# Air Quality Conformity Analysis Report

## Harrisburg Area Transportation Study 2019-2022 TIP and 2040 RTP

**National Ambient Air Quality Standards (NAAQS) Addressed:**

**The Harrisburg Area Transportation Study (HATS) portion of the:**

- ***Harrisburg–Lebanon–Carlisle-York, PA 2006 24-Hour $PM_{2.5}$ Maintenance Area***
- ***Harrisburg-Lebanon-Carlisle, PA 1997 8-Hour Ozone Maintenance Area***

**Prepared by:**

**The HATS and Pennsylvania Department of Transportation**

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**May 2018 (Draft)**

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# Overview

This report provides an analysis of the air quality implications of the Harrisburg Area Transportation Study (HATS) 2019-2022 Transportation Improvement Program (TIP) and 2040 Regional Transportation Plan (RTP). The analysis demonstrates transportation conformity under the 1997 8-hour ozone National Ambient Air Quality Standard (NAAQS) and the 2006 24-hour fine particulate ($PM_{2.5}$) NAAQS. The air quality conformity analysis reflects an assessment of the regionally significant, non-exempt transportation projects included in both the TIP and the RTP.

This document replaces the previously approved conformity demonstration of the TIP and RTP, and ensures that the findings meet all current criteria established by the U.S. Environmental Protection Agency (EPA) for the applicable NAAQS. A new conformity determination has been completed to provide a regional forecast of emissions based on planned air quality significant projects and the latest available planning assumptions.

## Background on Transportation Conformity

Transportation conformity is a way to ensure that federal funding and approval are awarded to transportation activities that are consistent with air quality goals. Under the Clean Air Act (CAA), transportation and air quality modeling procedures must be coordinated to ensure that the TIP and the RTP are consistent with the area's applicable State Implementation Plan (SIP). The SIP is a federally approved and enforceable plan by which each area identifies how it will attain and/or maintain the health-related primary and welfare-related secondary NAAQS.

In order to receive transportation funding and approvals from the Federal Highway Administration (FHWA) or the Federal Transit Administration (FTA), state and local transportation agencies must demonstrate that the plans, programs, or projects meet the transportation conformity requirements of the CAA as set forth in the transportation conformity rule. Under the transportation conformity rule, transportation plans are expected to conform to the applicable SIP in nonattainment or maintenance areas. The integration of transportation and air quality planning is intended to ensure that transportation plans, programs, and projects will not:

- Cause or contribute to any new violation of any applicable NAAQS.
- Increase the frequency or severity of any existing violation of any applicable NAAQS.
- Delay timely attainment of any applicable NAAQS, any required interim emissions reductions, or other NAAQS milestones.

The transportation conformity determination includes an assessment of future highway emissions for defined analysis years, including the end year of the RTP. Emissions are estimated using the latest available planning assumptions and available analytical tools, including EPA's latest approved on-highway mobile sources emissions model, the Motor Vehicle Emission Simulator (MOVES). The conformity determination provides a tabulation of the analysis results for applicable precursor pollutants, showing that the required conformity test was met for each analysis year.

### Report Contents

This document includes a summary of the methodology and data assumptions used for the conformity analysis. As shown in **Exhibit 1**, attachments containing additional detail have been provided with the document. In addition, modeling input and output files have been reviewed by the Environmental Protection Agency (EPA) Region III and the Pennsylvania Department of Environmental Protection (DEP).

**EXHIBIT 1: SUMMARY OF ATTACHMENTS**

| Attachment | Title | Description |
|---|---|---|
| **A** | Project List | Provides a list of regionally significant highway projects that have been updated or added to the TIP and RTP. |
| **B** | Detailed Emission Results | Provides a detailed summary of emissions by roadway type, source type and emission process. |
| **C** | MOVES Sample Run Specification | Provides example of MOVES data importer (XML) and run specification (MRS) files. |

## National Ambient Air Quality Standard Designations

The CAA requires the EPA to set NAAQS for pollutants considered harmful to public health and the environment. A nonattainment area is any area that does not meet the primary or secondary NAAQS. Once a nonattainment area meets the standards and additional redesignation requirements in the CAA [Section 107(d)(3)(E)], EPA will designate the area as a maintenance area.

The HATS MPO area is included within the *Harrisburg-Lebanon-Carlisle, PA* maintenance area under the 1997 8-hour ozone NAAQS and the *Harrisburg-Lebanon-Carlisle-York, PA* maintenance area under the 2006 24-Hour $PM_{2.5}$ NAAQS. Only Cumberland and Dauphin counties are included in the 2006 24-hour $PM_{2.5}$ NAAQS maintenance area. All counties in the Harrisburg region are in attainment for the 2012 annual $PM_{2.5}$ and 2008 8-hour ozone NAAQS. Transportation conformity requires nonattainment and maintenance areas to demonstrate that all future transportation projects will not prevent an area from reaching its air quality attainment goals.

### Final Particulate Matter

Fine particulate matter ($PM_{2.5}$) can be emitted directly into the atmosphere (sources include exhaust and dust from brake and tire wear) or formed in the atmosphere by combinations of precursor pollutants (secondary formation). Sulfates and nitrates are two types of pollutants that contribute to secondary formation. Sulfate emissions are a result of power plant and industry emissions, while nitrate emissions result from automobiles, power plants, and other combustion sources. Scientific studies have shown a significant correlation between exposure to fine particulates and severe health issues such as heart disease, lung disease, and premature death.

The pollutants that could be analyzed in the conformity analysis are: [1] direct $PM_{2.5}$ emissions (tail pipe emissions, brake and tire wear), [2] re-entrained road dust, and [3] precursors nitrogen oxides ($NO_X$), volatile organic compounds (VOC), sulfur oxides ($SO_X$) and ammonia ($NH_3$). The EPA has ruled that until the EPA or DEP find that other precursor pollutants are significant contributors, and a SIP revision is approved stating such findings, direct $PM_{2.5}$ emissions and NOx are the only pollutants that must be analyzed for transportation conformity (40 CFR 93.119(f)(8)–(10)).

***1997 Annual $PM_{2.5}$ and 2006 24-hour $PM_{2.5}$ Standards***

The EPA published the 1997 annual $PM_{2.5}$ NAAQS on July 18, 1997, (62 FR 38652), with an effective date of September 16, 1997. An area is in nonattainment of this standard if the 3-year average of the annual mean $PM_{2.5}$ concentrations (for designated monitoring sites within an area) exceed 15.0 micrograms per cubic meter ($\mu g/m^3$). Cumberland and Dauphin counties were designated as part of the Harrisburg-Lebanon-Carlisle nonattainment area under the 1997 annual $PM_{2.5}$ NAAQS, effective April 5, 2005 (70 FR 944).

The EPA published the 2006 24-hour $PM_{2.5}$ NAAQS on October 17, 2006, (71 FR 61144), with an effective date of December 18, 2006. The rulemaking strengthened the 1997 24-hour standard of 65 $\mu g/m^3$ (62 FR 38652) to 35 $\mu g/m^3$ and retained the 1997 annual $PM_{2.5}$ NAAQS of 15 $\mu g/m^3$. An area is in nonattainment of the 2006 24-hour $PM_{2.5}$ NAAQS if the $98^{th}$ percentile of the annual 24-hour concentrations, averaged over three years, is greater than 35 $\mu g/m^3$. Cumberland and Dauphin counties were designated as part of the Harrisburg-Lebanon-Carlisle-York nonattainment area under the 2006 24-hour $PM_{2.5}$ NAAQS, effective December 14, 2009 (74 FR 58688).

A redesignation request and maintenance plan applicable to both the 1997 annual and 2006 24-hour $PM_{2.5}$ NAAQS was approved by EPA and effective December 8, 2014 (79 FR 72522). As a result, both Dauphin and Cumberland counties are now classified as attainment for these NAAQS. However, both counties must continue to demonstrate conformity during the maintenance plan time period. The maintenance plan includes 2017 and 2025 $PM_{2.5}$ and NOx mobile vehicle emission budgets (MVEBs) for transportation conformity purposes.

Since the last conformity determination was completed, EPA took final action on the "*Fine Particulate Matter National Ambient Air Quality Standards: State Implementation Plan Requirements*" rule on August 24, 2016 (81 FR 58010 effective on October 24, 2016). In that rulemaking, EPA finalized the option that revokes the 1997 primary annual $PM_{2.5}$ NAAQS in areas that have always been designated as attainment and in maintenance of that NAAQS. After revocation, areas no longer have to expend resources on CAA air quality planning and conformity determination requirements associated with the 1997 annual $PM_{2.5}$ NAAQS.

***2012 Annual $PM_{2.5}$ Standard***

The EPA published the 2012 annual $PM_{2.5}$ NAAQS on January 15, 2013, (78 FR 3086), with an effective date of March 18, 2013. The EPA revised the annual $PM_{2.5}$ NAAQS by strengthening the standard from 15 $\mu g/m^3$

to 12 µg/$m^3$. An area is in nonattainment of this standard if the 3-year average of the annual mean $PM_{2.5}$ concentrations for designated monitoring sites in an area is greater than 12.0 µg/$m^3$. On December 18, 2014, EPA issued final designations for the standard that were revised on April 7, 2015 (80 FR 18535). The Harrisburg region was designated in attainment of the standard.

## Ozone

Ozone is formed by chemical reactions occurring under specific atmospheric conditions. Precursor pollutants that contribute to the formation of ozone include VOC and $NO_X$, both of which are components of vehicle exhaust. VOCs may also be produced through the evaporation of vehicle fuel, as well as by displacement of vapors in the gas tank during refueling. By controlling VOC and $NO_X$ emissions, ozone formation can be mitigated.

### *1997 and 2008 8-hour Ozone NAAQS*

The EPA published the 1997 8-hour ozone NAAQS on July, 18, 1997, (62 FR 38856), with an effective date of September 16, 1997. An area was in nonattainment of the 1997 8-hour ozone NAAQS if the 3-year average of the individual fourth highest air quality monitor readings, averaged over 8 hours throughout the day, exceeded the NAAQS of 0.08 parts per million (ppm). On May 21, 2013, the EPA published a rule revoking the 1997 8-hour ozone NAAQS, for the purposes of transportation conformity, effective one year after the effective date of the 2008 8-hour ozone NAAQS area designations (77 FR 30160). As of July 20, 2013, the Harrisburg region no longer needs to demonstrate conformity to the 1997 8-hour ozone NAAQS. However, future SIP revisions must address EPA's anti-backsliding requirements.

The EPA published the 2008 8-hour Ozone NAAQS on March 27, 2008, (73 FR 16436), with an effective date of May 27, 2008. EPA revised the ozone NAAQS by strengthening the standard to 0.075 ppm. Thus, an area is in nonattainment of the 2008 8-hour ozone NAAQS if the 3-year average of the individual fourth highest air quality monitor readings, averaged over 8 hours throughout the day, exceeds the NAAQS of 0.075 ppm. The Harrisburg region was designated as an attainment area under the 2008 8-hour ozone NAAQS, effective July 20, 2012 (77 FR 30088). As a result, transportation conformity is not currently required for the standard.

On February 16, 2018 the D.C. Circuit reached a decision in *South Coast Air Quality Management District v. EPA*, Case No. 15-1115. In that decision, the court vacated major portions of the final rule that established procedures for transitioning from the 1997 ozone NAAQS to the stricter 2008 ozone NAAQS. While the implications of this ruling are being decided, this conformity determination addresses transportation conformity to the 1997 8-hour ozone NAAQS.

### *2015 8-hour Ozone NAAQS*

In October 2015, based on its review of the air quality criteria for ozone and related photochemical oxidants, the EPA revised the primary and secondary NAAQS for ozone to provide requisite protection of public health and welfare, respectively (80 FR 65292). The EPA revised the levels of both standards to 0.070 ppm, and retained their indicators, forms (fourth-highest daily maximum, averaged across three

consecutive years) and averaging times (eight hours). Under the Clean Air Act, the EPA administrator is required to make all attainment designations within two years after a final rule revising the NAAQS is published. However, the deadline for EPA to issue designations for the 2015 NAAQS for ozone passed on October 1, 2017. Once designations are final, transportation conformity would be required within 12 months for any areas designated nonattainment under the standard.

## Interagency Consultation

As required by the federal transportation conformity rule, the conformity process includes a significant level of cooperative interaction among federal, state, and local agencies. For this air quality conformity analysis, interagency consultation was conducted as required by the Pennsylvania Conformity SIP. This included conference call(s) or meeting(s) of the Pennsylvania Transportation-Air Quality Work Group (including the Pennsylvania Department of Transportation (PennDOT), DEP, EPA, FHWA, FTA and representatives from larger MPOs within the state).

Meeting and conference calls were conducted on October 4, 2017; January 25, 2018 and April 11, 2018 to review all input planning assumptions, methodologies and analysis years.

## Analysis Methodology and Data

This transportation conformity analysis was conducted using EPA's MOVES model. MOVES is an upgrade to EPA's modeling tools and replaces MOBILE6.2 as the official model for estimating emissions from highway vehicles for SIP emission inventories and transportation conformity (75 FR 9411), effective March 2, 2010. MOVES2014a has been used for this conformity determination and is the latest approved model version for SIP and transportation conformity purposes (79 FR 60343).

Planning assumptions are updated following EPA and FHWA joint guidance (EPA420-B-08-901) that clarifies the implementation of the latest planning assumption requirements in 40 CFR 92.110. This analysis utilizes the latest available traffic, vehicle fleet and environmental data to estimate regional highway emissions. Pennsylvania updates state-level planning assumptions on a 3-year cycle and this information is integrated into the conformity analyses.

The analysis methodology and data inputs for this analysis were developed through interagency consultation and used available EPA guidance documents that included:

- *Policy Guidance on the Use of MOVES2014 for State Implementation Plan Development, Transportation Conformity, and Other Purposes*, US EPA Office of Air and Radiation, EPA-420-B-14-008, July 2014.
- *MOVES2014 and MOVES2014a Technical Guidance: Using MOVES to Prepare Emission Inventories in State Implementation Plans and Transportation Conformity.* US EPA Office of Air and Radiation, and Office of Transportation and Air Quality, EPA-420-B-15-093, November 2015.

- *MOVES2014a User Guide*, US EPA Office of Transportation and Air Quality, EPA-420-B-15-095, November 2015.

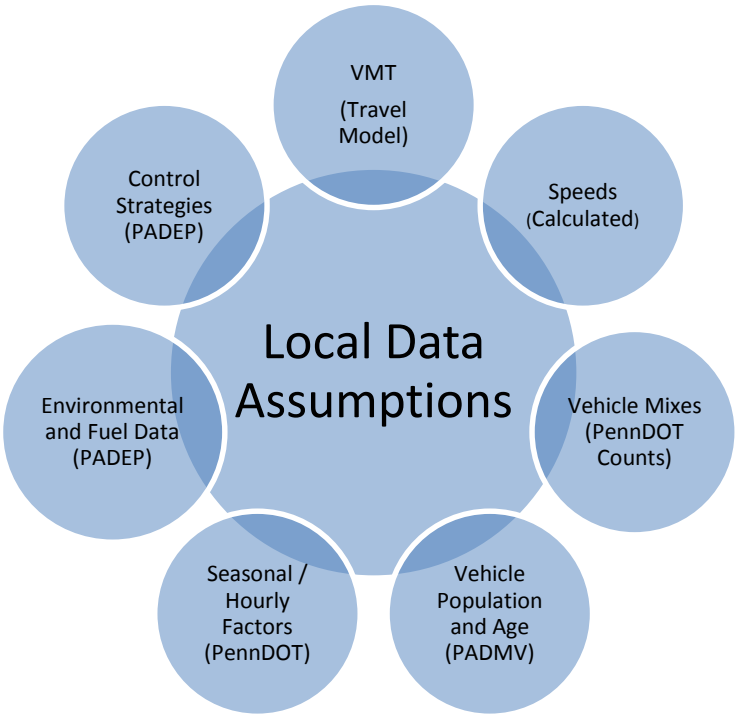
A mix of local and national default (internal to MOVES) data are used in the analysis. As illustrated in **Exhibit 2**, local data has been used for data items that have a significant impact on emissions, including: vehicle miles of travel (VMT), vehicle population, congested speeds, and vehicle type mix, as well as environmental and fuel assumptions. Local data inputs to the analysis process reflect the latest available planning assumptions using information obtained from PennDOT, DEP and other local/national sources.

The methodology used for this analysis is consistent with the methodology used to develop SIP inventories. This includes the use of custom post-processing software (PPSUITE) to calculate hourly speeds and prepare key traffic input files to the MOVES emission model.

PPSUITE consists of a set of programs that perform the following functions:

- Analyzes highway operating conditions.
- Calculates highway speeds.
- Compiles VMT and vehicle type mix data.
- Prepares MOVES runs and processes MOVES outputs.

**EXHIBIT 2: LOCAL DATA INPUTS USED FOR CONFORMITY RUNS**

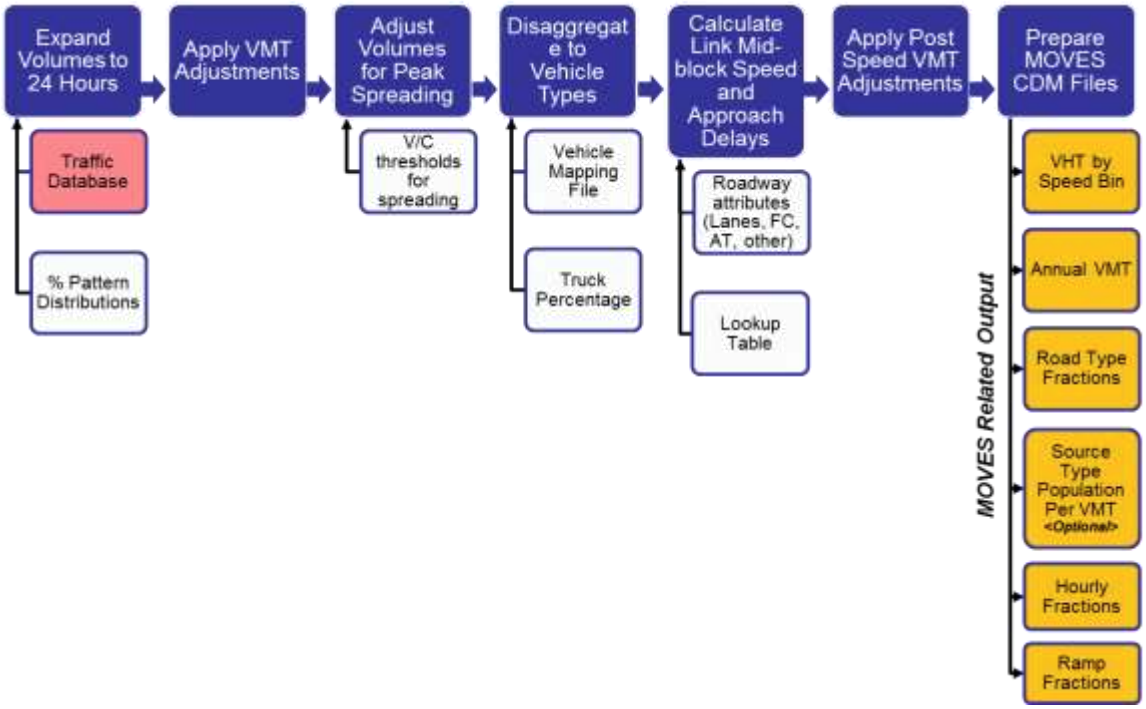



PPSUITE is a widely used and accepted tool for estimating speeds and processing emissions rates. The PPSUITE tool has been used for developing on-highway mobile source inventories in SIP revisions, control

strategy analyses, and conformity analyses in other states. The software was developed to utilize accepted transportation engineering methodologies. The PPSUITE process is integral to producing traffic-related input files to the MOVES emission model. **Exhibit 3** summarizes the key functions of PPSUITE within the emission calculation process. Other MOVES input files are prepared externally to the PPSUITE software, including vehicle population, vehicle age, environmental and fuel input files.

The CENTRAL software is also used in this analysis. CENTRAL is a menu-driven software platform that executes the PPSUITE and MOVES processes in batch mode. The CENTRAL software allows users to execute runs for a variety of input options and integrates custom MYSQL steps into the process. CENTRAL provides important quality control and assurance steps, including file naming and storage automation.

**EXHIBIT 3: EMISSION CALCULATION PROCESS**




## Key MOVES Input Data

A large number of inputs to MOVES are needed to fully account for the numerous vehicle and environmental parameters that affect emissions. These inputs include traffic flow characteristics, vehicle descriptions, fuel parameters, I/M program parameters and environmental variables. MOVES includes a default national database of meteorology, vehicle fleet, vehicle activity, fuel and emission control program data for every county; EPA, however, cannot certify that the default data is the most current or best available information for any specific area. As a result, local data, where available, is recommended for

use when conducting a regional conformity analysis. A mix of local and default data is used for this analysis. These data items are discussed in the following sections.

**Roadway Data**

The roadway data input to emissions calculations for this conformity analysis is based on information from the region's updated travel demand forecasting model. The travel demand model estimates roadway volumes based on input demographic forecasts and expected changes to the transportation roadway network.

The travel demand model follows the basic "four-step" travel demand forecasting process and utilizes the Cube Voyager (TPPlus) software platform. The updated model consists of 947 Traffic Analysis Zones (TAZ's), approximately 14,400 links, and approximately 11,000 nodes. The network contains attributes such as distance, number of lanes, area type, facility type, free flow speed, capacity of the lane, and location of traffic signals.

The model was validated to 2010 conditions. Using the projected traffic volume data from the model, conditions were evaluated for all applicable future analysis years. All significant air quality projects from the TIP and RTP were coded into the travel demand model.

Transit data was also generated as part of the travel demand model. Existing fixed transit routes and their associated attributes (i.e., stops, headways, fares, speeds) are included within a transit subroutine. Ridership estimates generated by this subroutine are fed back into the model stream as part of the overall network processing.

Traffic forecasts were projected based on the socioeconomic and land use data projections developed by HATS and included in the 2040 RTP. This data includes total population, household population, total employment, and school enrollment. **Exhibit 4** summarizes the socioeconomic data for the base year and horizon years of the RTP. Socioeconomic data for other analysis years were forecast using interpolation.

**EXHIBIT 4: SOCIOECONOMIC GROWTH ASSUMPTIONS TO THE TRAVEL MODEL**

| County | Year | Population | Household | Total Employment |
|---|---|---|---|---|
| Cumberland | 2010 | 235,406 | 93,943 | 126,388 |
| | 2040 | 280,507 | 112,704 | 152,710 |
| Dauphin | 2010 | 268,100 | 110,435 | 178,190 |
| | 2040 | 296,765 | 122,433 | 215,251 |
| Perry | 2010 | 45,969 | 17,903 | 8,769 |
| | 2040 | 50,197 | 19,565 | 10,598 |

The travel model network and assigned traffic volumes are processed by PPSUITE to prepare the traffic inputs needed to run the MOVES emission model. The following information is extracted from the model for emission calculations:

- Lanes
- Roadway capacity
- Distance
- Daily traffic volume
- Type of area abutting the roadway (e.g. urban, suburban, rural, etc.)
- Type of roadway facility (e.g. interstate, arterial, collector, local, etc.)

**Other Supporting Traffic Data**

Other traffic data is used to adjust and disaggregate traffic volumes. Key sources used in these processes include the following:

- *Highway Performance Monitoring System (HPMS VMT)*: According to EPA guidance, baseline inventory VMT computed from the regional travel demand model must be adjusted to be consistent with HPMS VMT totals. The VMT contained in the HPMS reports are considered to represent average annual daily traffic (AADT), an average of all days in the year, including weekends and holidays. Adjustment factors were calculated as part of the model's validation process. These factors are used to adjust locally modeled roadway data VMT to be consistent with the reported HPMS totals, and are applied to all county and facility group combinations within the region. These adjustments are important to account for local roadway VMT not represented within the regional travel demand model.
- *Seasonal Factors*: The traffic volumes estimated from the regional travel demand model are adjusted to summer or average monthly conditions (as needed for annual processing), using seasonal adjustment factors prepared by PennDOT's BPR in their annual traffic data report published on the BPR website (http://www.dot.state.pa.us/ Search: Research and Planning) The seasonal factors are also used to develop MOVES daily and monthly VMT fraction files, allowing MOVES to determine the portion of annual VMT that occurs in each month of the year.
- *Hourly Patterns*: Speeds and emissions vary considerably depending on the time of day. In order to produce accurate emission estimates, it is important to estimate the pattern by which roadway volume varies by breaking the data down into hourly increments. Pattern data is in the form of a percentage of the daily volumes for each hour. Distributions are provided for all the counties within the region and by each facility type grouping. The hourly pattern data has been developed from 24-hour vehicle count data compiled by PennDOT's BPR, using the process identified in PennDOT's annual traffic data report. The same factors are also used to develop the MOVES hourly fraction file.

**Vehicle Class**

Emission rates within MOVES also vary significantly by vehicle type. MOVES produces emission rates for thirteen MOVES vehicle source input types. VMT, however, is input to MOVES by six HPMS vehicle groups (note that passenger cars and light trucks are grouped for input to MOVES2014). **Exhibit 5** summarizes the distinction between each classification scheme.

**EXHIBIT 5: MOVES SOURCE TYPES AND HPMS VEHICLE GROUPS**

| SOURCE TYPES | | HPMS Class Groups | |
|---|---|---|---|
| 11 | Motorcycle | 10 | Motorcycle |
| 21 | Passenger Car | 25 | Passenger Car |
| 31 | Passenger Truck | 25 | Passenger/Light Truck |
| 32 | Light Commercial Truck | 40 | Buses |
| 41 | Intercity Bus | 50 | Single Unit Trucks |
| 42 | Transit Bus | 60 | Combination Trucks |
| 43 | School bus | | |
| 51 | Refuse Truck | | |
| 52 | Single Unit Short-haul Truck | | |
| 53 | Single Unit Long-haul Truck | | |
| 54 | Motor Home | | |
| 61 | Combination Short-haul Truck | | |
| 62 | Combination Long-haul Truck | | |

The emissions estimation process includes a method to disaggregate the traffic volumes to the thirteen source types and then to recombine the estimates to the six HPMS vehicle classes. Vehicle type pattern data is used by PPSUITE to distribute the hourly roadway segment volumes among the thirteen MOVES source types. Similar to the 24-hour pattern data, this data contains percentage splits to each source type for every hour of the day. The vehicle type pattern data is developed from several sources of information:

- PennDOT truck percentages from the RMS database.
- Hourly distributions for trucks and total traffic compiled by PennDOT's BPR.
- Transit data from PennDOT and the National Transit Database Transit Profiles (https://www.ntdprogram.gov).
- School bus registration data from PennDOT's Bureau of Motor Vehicles Registration Database.

Vehicle type percentages are also input into the capacity analysis section of PPSUITE to adjust the speeds in response to truck volume. Larger trucks take up more roadway space compared to an equal number of cars and light trucks, which is accounted for in the speed estimation process by adjusting capacity using information from the Transportation Research Board's fifth edition of the *Highway Capacity Manual*. (http://hcm.trb.org/).

**Vehicle Ages**

Vehicle age distributions are input to MOVES for each of the thirteen source types. These distributions reflect the percentage of the vehicle fleet falling under each vehicle model year (MY), to a maximum age of 31 years. The vehicle age distributions were prepared from the most recently available registration download from PennDOT's Bureau of Motor Vehicles Registration Database. Due to data limitations, information for light duty vehicles (including source types 11, 21, 31 and 32) was used as local data for MOVES inputs, while heavy-duty vehicles (including source types 41, 42, 43, 51, 52, 53, 54, 61, and 62) used the internal MOVES national default data. The registration data download is based on MOBILE6.2 vehicle categories. The data was converted to source types using the EPA convertor spreadsheets provided with the MOVES emission model.

**Vehicle Population**

The vehicle population information, including the number and age of vehicles, impacts forecasted start and evaporative emissions within MOVES. Similar to vehicle ages, MOVES requires vehicle populations for each of the thirteen source type categories. County vehicle registration data was used to estimate vehicle population for light-duty vehicles, transit buses, and school buses. Other heavy-duty vehicle population values were based on VMT for each source type using the vehicle mix and pattern data discussed previously. PPSUITE automatically applies MOVES default ratios of VMT and source type population (e.g. the number of miles per vehicle by source type) to the local VMT estimates to produce vehicle population.

For the preparation of source type population for other required conformity analysis years, base values were adjusted using forecast population and household data for the area. Growth rates were limited so as to not exceed the VMT growth assumptions.

**Meteorology Data**

Average monthly minimum temperatures, maximum temperatures, and humidity values are consistent with the regional State Implementation Plan (SIP) modeling conducted by DEP. The data was obtained from WeatherBank, Inc. EPA's MOBILE6.2-MOVES meteorological data convertor spreadsheet (http://www.epa.gov/oms/models/moves/tools.htm) was used to prepare the hourly temperature inputs needed for the MOVES model, based on the available data.

**Fuel Parameters**

The MOVES default fuel formulation and fuel supply data were reviewed and updated based on available local volumetric fuel property information. The gasohol market penetration and Reid Vapor Pressure (RVP) values were updated, but MOVES default data was used for the remaining parameters. Key assumptions include:

- 10.0 RVP used for summer months [Local data].
- 10% ethanol used throughout the year [MOVES defaults].

**I/M Program Parameters**

The inspection maintenance (I/M) program inputs to the MOVES model are based on previous and current programs within each county (all PA I/M programs are based on county boundaries). All analysis years include Pennsylvania's statewide I/M program. The default I/M program parameters included in MOVES were examined for each county and necessary changes were made to the default parameters to match the actual local program.

The I/M program requirements vary by region (five regions) and include on-board diagnostics (OBD) technology that uses the vehicle's computer for model years 1996 and newer to identify potential engine and exhaust system problems that could affect emissions. The program, named PAOBDII, is implemented by region as follows:

- *Philadelphia Region* - Bucks, Chester, Delaware, Montgomery and Philadelphia Counties
  [Includes tailpipe exhaust testing using ASM2015 or equipment for pre-1996 vehicles up to 25 years old]
- *Pittsburgh Region* - Allegheny, Beaver, Washington and Westmoreland Counties.
  [Includes tailpipe exhaust testing using PA 97 equipment for pre-1996 vehicles up to 25 years old]
- *South Central and Lehigh Valley Region* - Berks, Cumberland, Dauphin, Lancaster, Lebanon, Lehigh, Northampton and York Counties.
  [Gas cap and visual inspection only]
- *North Region* - Blair, Cambria, Centre, Erie, Lackawanna, Luzerne, Lycoming, and Mercer Counties.
  [Gas cap and visual inspection only]
- *Other 42 Counties* – Includes the remaining 42 counties not included above.
  [Visual inspection only]

**Other Vehicle Technology and Control Strategy Data**

Current federal vehicle emissions control and fuel programs are incorporated into the MOVES software. These include the National Program standards covering vehicles MY2012-MY2025. Modifications of default emission rates are required to reflect the early implementation of the National Low Emission Vehicle (NLEV) Program in Pennsylvania. To reflect these impacts, EPA has released instructions and input files that can be used to model these impacts.

The Pennsylvania Clean Vehicles (PCV) Program, adopted in 1998, incorporated the California Low Emission Vehicle Regulations (CA LEV) by reference. The PCV Program allowed automakers to comply with the NLEV program as an alternative to this Pennsylvania program until MY2006. Beginning with MY2008, all "new" passenger cars and light-duty trucks with a gross vehicle weight rating (GVWR) of 8,500 pounds or less sold/leased and titled in Pennsylvania must be certified by the California Air Resources Board (CARB) or be certified for sale in all 50 states. For this program, a "new" vehicle is a qualified vehicle with an odometer reading less than 7,500 miles. DEP and PennDOT both work with the public, including manufacturers, vehicle dealers and consumers, to ensure that vehicles sold and purchased in Pennsylvania or vehicles purchased from other states by Pennsylvania residents comply with the requirements of the PCV Program, in order to be titled in Pennsylvania. Additionally, PennDOT ensures that paperwork for

title and registration includes proof of CARB- or 50-state emission certification or that the vehicle owner qualifies for an exemption to the requirements, as listed on PennDOT's MV-9 form and in the PCV Program regulation. When necessary, information from PennDOT's title and registration process may be used to audit vehicle title transactions to determine program compliance.

The impacts of this program are modeled for all analysis years beyond 2008 using the same instructions and tools downloaded for the early NLEV analysis. EPA provided input files to reflect state programs similar to the CAL LEV program. Modifications to those files were made to reflect a 2008 program start date for Pennsylvania.

## Analysis Process Details

The previous sections have summarized the input data used for computing speeds and emission rates for this conformity analysis. This section explains how PPSUITE and MOVES use that input data to produce emission estimates. **Exhibit 6** provides a more detailed overview of the PPSUITE analysis procedure using the available traffic data information described in the previous sections.

### VMT Preparation

Producing an emissions inventory with PPSUITE requires a process of disaggregation and aggregation. Data is available and used on a very detailed scale – individual roadway segments for each of the 24 hours of the day. This data needs to be processed individually to determine the distribution of vehicle hours of travel (VHT) by speed and then aggregated by vehicle class to determine the input VMT to the MOVES emission model. Key steps in the preparation of VMT include:

- *Assemble VMT* - The regional travel demand model contains the roadway segments, distances and travel volumes needed to estimate VMT. PPSUITE processes each segment by simply multiplying the assigned travel volume by the distance to obtain VMT.
- *Apply Seasonal Adjustments* – PPSUITE adjusts the traffic volumes to the appropriate analysis season using an average monthly day to support annual $PM_{2.5}$ analyses. These traffic volumes are assembled by PPSUITE and extrapolated over the course of a year to produce the annual VMT file input to MOVES.
- *Disaggregate to Hours* - After seasonal adjustments are applied, the traffic volumes are distributed to each hour of the day. This allows for more accurate speed calculations (effects of congested hours) and allows PPSUITE to prepare the hourly VMT and speeds for input to MOVES.
- *Peak Spreading* - After distributing the daily volumes to each hour of the day, PPSUITE identifies hours that are unreasonably congested. For those hours, PPSUITE then spreads a portion of the volume to other hours within the same peak period, thereby approximating the "peak spreading" that normally occurs in such over-capacity conditions. This process also helps prevent hours with unreasonably congested speeds from disproportionately impacting emission calculations.
- *Disaggregation to Vehicle Types* - EPA requires VMT estimates to be prepared by the six HPMS vehicle groups, reflecting specific local characteristics. As described in the previous section, the hourly

volumes are disaggregated into thirteen MOVES source types based on data from PennDOT and NTD, in combination with MOVES defaults. The thirteen MOVES source types are then recombined into six HPMS vehicle classes.

- *Apply HPMS VMT Adjustments* - Volumes must also be adjusted to account for differences with the HPMS VMT totals, as described in previous sections. VMT adjustment factors are provided as inputs to PPSUITE and are applied to each of the roadway segment volumes. VMT adjustment factors are also applied to runs for future years.

**Speed Estimation**

Emissions for many pollutants (including VOC and NOx) vary significantly with travel speed. VOC emissions generally decrease as speed increases, while $NO_X$ emissions decrease at low speeds and increases at higher speeds, as illustrated in **Exhibit 7**. Because emissions are so sensitive to speed changes, EPA recommends special attention be given to developing reasonable and consistent speed estimates. EPA also recommends that VMT be disaggregated into subsets that have roughly equal speeds, with separate emission factors for each subset. At a minimum, speeds should be estimated separately by road type.

The computational framework used for this analysis meets and exceeds the recommendation above relating to speed estimates. Speeds are individually calculated for each roadway segment and hour. Rather than accumulating the roadway segments into a particular road type and calculating an average speed, each individual link hourly speed is represented in the MOVES vehicle hours of travel (VHT) by a speed bin file. This MOVES input file allows the specification of a distribution of hourly speeds. For example, if 5% of a county's arterial VHT operates at 5 mph during the AM peak hour and the remaining 95% operates at 65 mph, this can be represented in the MOVES speed input file. For the roadway vehicle emissions calculations, speed distributions are input to MOVES by road type and source type for each hour of the day.

To calculate speeds, PPSUITE first obtains initial capacities (i.e., how much volume the roadway can serve before heavy congestion) and free-flow speeds (speeds assuming no congestion) a speed/capacity lookup table. As described previously, this data contains default roadway information indexed by the area and facility type codes. For areas with known characteristics, values can be directly coded to the database and the speed/capacity default values can be overridden. For most areas where known information is unavailable, the speed/capacity lookup tables provide valuable default information regarding speeds, capacities, signal characteristics, and other capacity adjustment information used for calculating congested delays and speeds. The result of this process is an estimated average travel time for each hour of the day for each highway segment. The average travel time multiplied by traffic volume produces vehicle hours of travel (VHT).

## EXHIBIT 6: PPSUITE SPEED/EMISSION ESTIMATION PROCEDURE

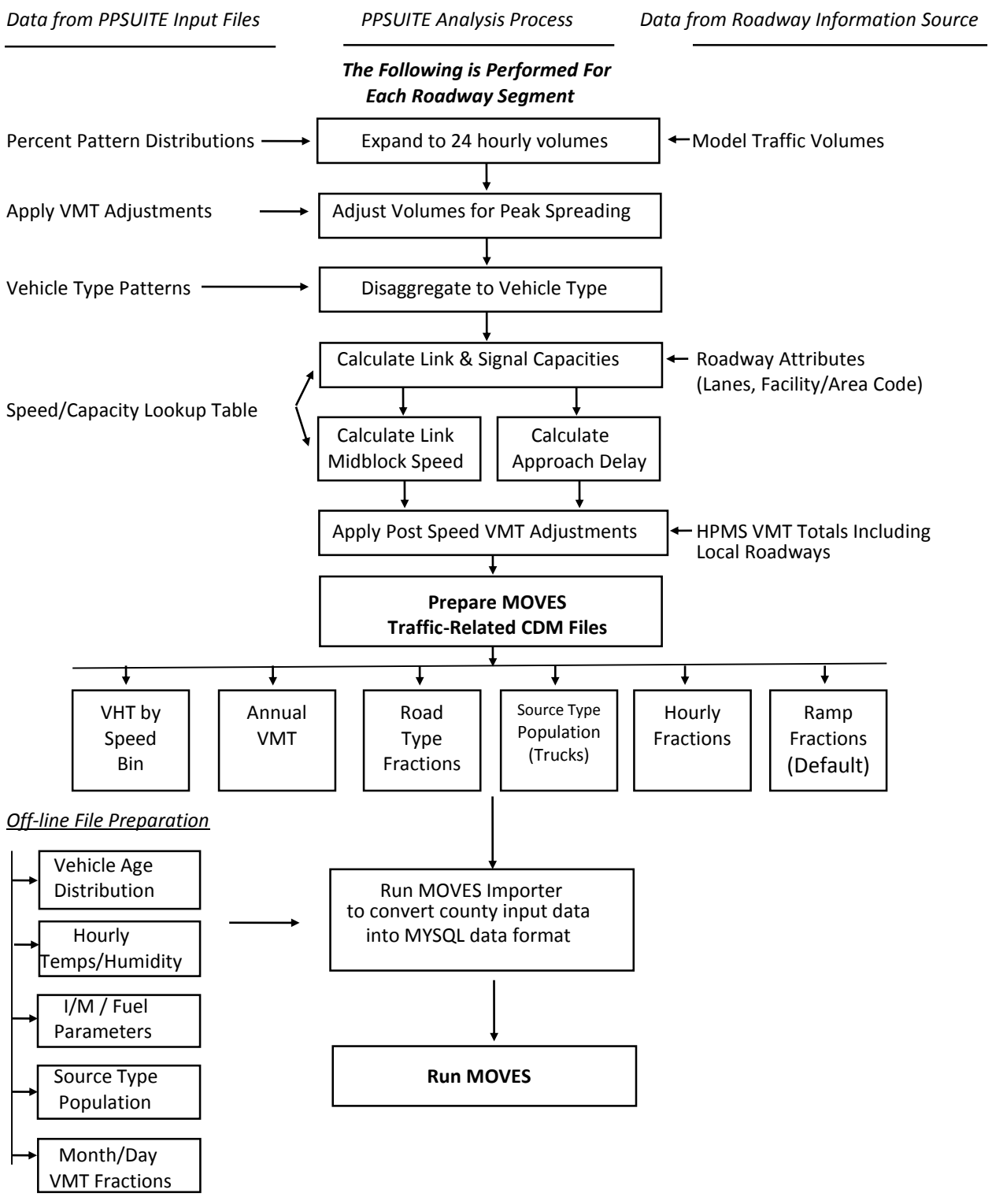
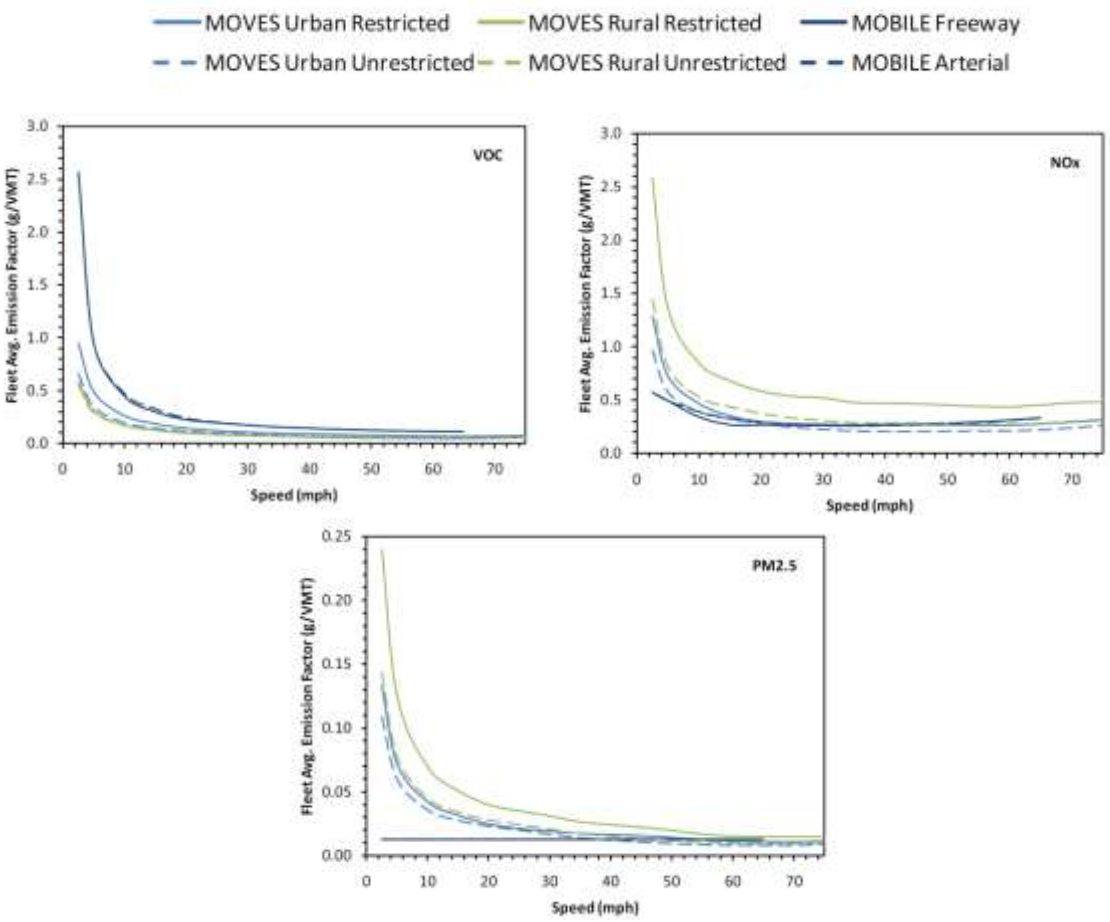


**EXHIBIT 7: EMISSION FACTOR VS. SPEED VARIANCES (VOC, NOX, AND $PM_{2.5}$)**




*Source: Figure 3 from Implications of the MOVES2010 Model on Mobile Source Emission Estimates, Air & Waste Management Association, July 2010.*

**Developing the MOVES Traffic Input Files**

The PPSUITE software is responsible for producing the following MOVES input files during any analysis run:

- VMT by HPMS vehicle class.
- VHT by speed bin.
- Road type distributions.
- Hourly VMT fractions.
- Ramp fractions.

These files are text formatted files with a *.csv extension. The files are provided as inputs within the MOVES County Data Manager (CDM) and are described below:

- *VMT Input File*: VMT is the primary traffic input affecting emission results. The roadway segment distances and traffic volumes are used to prepare estimates of VMT. PPSUITE performs these calculations and outputs the MOVES annual VMT input file to the County Data Manager (CDM). The annual VMT is computed by multiplying the RMS or travel model roadway adjusted VMT by 365 days (366 days in a leap year).
- *VHT by Speed Bin File*: As described in the previous section, the PPSUITE software prepares the MOVES VHT by speed bin file, which summarizes the distribution of speeds across all links into each of the 16 MOVES speed bins for each hour of the day by road type. This robust process is consistent with the methods and recommendations provided in EPA's technical guidance for the MOVES2014 model (http://www.epa.gov/otaq/models/moves/) and ensures that MOVES emission rates are used to the fullest extent.
- *Road Type Distributions*: Within MOVES, typical drive cycles and associated operating conditions vary by roadway type. MOVES defines five different roadway types as follows:

  1 Off-Network.
  2 Rural Restricted Access.
  3 Rural Unrestricted Access.
  4 Urban Restricted Access.
  5 Urban Unrestricted Access.

  For this analysis, the MOVES road type distribution file is automatically generated by PPSUITE using defined equivalencies. The off-network road type includes emissions from vehicle starts, extended idling, and evaporative emissions. Off-network activity in MOVES is primarily determined by the Source Type Population input.
- *Ramp Fractions*: Since ramps are not directly represented within the regional travel demand model, the assumption is that 8% of total Freeway VHT is Ramp VHT, consistent with EPA's technical guidance.

**MOVES Runs**

After computing speeds and aggregating VMT and VHT, PPSUITE prepares traffic-related inputs needed to run EPA's MOVES software. Additional required MOVES inputs are prepared externally from the processing software and include temperatures, I/M program parameters, fuel characteristics, vehicle fleet age distributions, and source type population. The MOVES county importer is run in batch mode. This program converts all data files into the MYSQL format used by the MOVES model. At that point, a MOVES run specification file (*.mrs) is created which specifies options and key data locations for the run. The MOVES run is then executed in batch mode. A summary of key MOVES run specification settings is shown in **Exhibit 8**. MOVES can be executed using either an inventory or rate-based approach. For this analysis, MOVES is applied using the inventory-based approach. Using this approach, actual VMT and population are provided as inputs to the model; MOVES is responsible for producing the total emissions for the region.

### EXHIBIT 8: MOVES RUN SPECIFICATION FILE PARAMETER SETTINGS

| Parameter | Setting |
|---|---|
| **MOVES Version** | MOVES2014a |
| **MOVES Default Database Version** | MOVESDB20161117 |
| **Scale** | COUNTY |
| **Analysis Mode** | Inventory |
| **Time Span** | **Annual Runs:**<br>Single MOVES run with 12-month inputs including all days and hours<br>**July Weekday Runs:**<br>July month, Weekday, 24 hours |
| **Input Time Aggregation** | Hour |
| **Geographic Selection** | County [FIPS] |
| **Vehicle Selection** | All source types<br>Gasoline, Diesel, CNG, E85 |
| **Road Type** | All road types including off-network |
| **Pollutants and Processes** | All $PM_{2.5}$ categories, VOC, $NO_X$ |
| **Database selection** | Early NLEV database<br>PA-Specific CAL LEV program database |
| **General Output** | Units:<br>Emission = grams; Distance = miles;<br>Time = hours; Energy = Million BTU |
| **Output Emissions** | Time = Month, Emissions by Process ID, Source Type and Road Type |

## Conformity Analysis Results

Transportation conformity analyses of the current TIP and RTP have been completed for the Harrisburg area. The analyses were performed according to the requirements of the Federal transportation conformity rule at 40 CFR Part 93, Subpart A. The analyses utilized the methodologies, assumptions and data as presented in previous sections. Interagency consultation has been used to determine applicable emission models, analysis years and emission tests.

**Emission Tests**

A SIP maintenance plan for the *Harrisburg-Lebanon-Carlisle, PA* nonattainment area was approved on July 25, 2007 (72 FR 40749) under the 1997 8-hour ozone NAAQS. The SIP established separate MVEBs for the HATS MPO region including Cumberland, Dauphin and Perry counties. The ozone conformity analysis has been conducted to evaluate emissions in comparison to the applicable ozone MVEBs as summarized in **Exhibit 9**.

**EXHIBIT 9: 8-HOUR OZONE MOTOR VEHICLE EMISSION BUDGETS**

| County / Pollutant | 2009 Budget (kg/day) | 2018 Budget (kg/day) |
|---|---|---|
| **VOC** | 23,014 | 16,136 |
| **$NO_X$** | 41,917 | 18,409 |

On December 8, 2014 EPA approved the Commonwealth of Pennsylvania's request to redesignate the *Harrisburg-Lebanon-Carlisle, PA* and *Harrisburg-Lebanon-Carlisle-York, PA* nonattainment areas to attainment for the 1997 annual and 2006 24-hour $PM_{2.5}$ NAAQS. As a result, both Dauphin and Cumberland counties are now classified as attainment for these NAAQS. However, both counties must continue to demonstrate conformity during the maintenance plan time period. The MVEBs provided in the maintenance plans for the HATS MPO region (Cumberland and Dauphin counties) are summarized in **Exhibit 10**.

**EXHIBIT 10: ANNUAL $PM_{2.5}$ MOTOR VEHICLE EMISSION BUDGETS**

| County / Pollutant | 2017 Budget (tons/year) | 2025 Budget (tons/year) |
|---|---|---|
| **$PM_{2.5}$** | 365 | 275 |
| **NOx** | 10,287 | 7,024 |

**Analysis Years**

Section 93.119(g) of the Federal Transportation Conformity Regulations requires that emissions analyses be conducted for specific analysis years as follows:

- A near-term year, one to five years in the future.
- The last year of the RTP's forecast period.
- Attainment year of the standard if within timeframe of TIP and RTP.
- An intermediate year or years such that if there are two years in which analysis is performed, the two analysis years are no more than ten years apart.

All analysis years were determined through the interagency consultation process. **Exhibit 11** provides the analysis years used for this conformity analysis.

**EXHIBIT 11: TRANSPORTATION CONFORMITY ANALYSIS YEARS**

| Analysis Year | Description |
|---|---|
| 2022 | Interim Year – *Last Year of TIP* |
| 2025 | Budget Year |
| 2035 | Interim Year |
| 2040 | Last Year of LRTP |

**Components of the $PM_{2.5}$ Regional Emissions Analysis**

$PM_{2.5}$ can be the result of either direct or indirect emissions. Direct transportation emissions can be the result of brake or tire-wear, particulates in exhaust emissions, or dust raised by on-road vehicles or construction equipment. Possible indirect transportation related emissions of $PM_{2.5}$ include: $NH_3$, $NO_X$, $SO_X$, and VOC. The EPA has ruled that regional analysis of direct $PM_{2.5}$ emissions must include both exhaust and brake/tire-wear emissions. EPA's current regulations specify that road dust should be included in the regional analysis of direct $PM_{2.5}$ emissions only if the EPA or the state air agency have found it to be a significant contributor to the region's nonattainment. Neither the EPA nor the state air agency has determined road dust to be a significant contributor in the nonattainment area for this conformity determination.

Until a SIP revision is approved proving that $NO_X$ is insignificant, EPA's current regulations state that indirect $PM_{2.5}$ emissions must be analyzed for $NO_X$. Conversely, VOC, $SO_X$ and $NH_3$ must be analyzed only if the state(s) or the EPA determines one or more of these pollutants significant. Therefore, $NO_X$ is the only indirect $PM_{2.5}$ component analyzed for the nonattainment area in this conformity determination.

**Regionally Significant Highway Projects**

For the purposes of conformity analysis, model highway networks are created for each analysis year. For the horizon years, regionally significant projects from the TIP and RTP were coded onto the networks. Detailed assessments were only performed for those new projects which may have a significant effect on emissions in accordance with 40 CFR Parts 51 and 93. Only those projects which would increase capacity or significantly impact vehicular speeds were considered. Projects such as common bridge replacements and roadway restoration projects, which constitute the majority of the TIP and RTP list, have been excluded from consideration since they are considered exempt under 40 CFR 93.126-127. A list of significant highway projects is shown in **Attachment A**.

**Analysis Results**

An emissions analysis has been completed for the 1997 8-hour ozone NAAQS and the 2006 24-hour $PM_{2.5}$ NAAQS. Forecast years have been estimated using the procedures and assumptions provide in this conformity report. A detailed emission summary is also provided in **Attachment B**. Example MOVES importer (XML) and run specification (MRS) files are provided in **Attachment C**.

1997 Ozone NAAQS

**Exhibit 12** summarizes the HATS MPO area (Cumberland, Dauphin and Perry counties) ozone emission results for a summer weekday in each analysis year. All years are lower than the applicable conformity budgets established in the regional maintenance plan for the 1997 ozone NAAQS.

**EXHIBIT 12: OZONE EMISSION ANALYSIS RESULTS AND CONFORMITY TEST**
(Summer Weekday)

| Pollutant | *2018 BUDGET (kg/day)* | *2022 (kg/day)* | *2025 (kg/day)* | *2035 (kg/day)* | *2040 (kg/day)* |
|---|---|---|---|---|---|
| *VOC* | ***16,136*** | *7,561* | *6,053* | *3,862* | *3,601* |
| *$NO_X$* | ***18,409*** | *15,366* | *12,289* | *8,265* | *8,324* |
| Conformity Result | | **Pass** | **Pass** | **Pass** | **Pass** |

2006 $PM_{2.5}$ NAAQS

**Exhibit 13** summarizes the Harrisburg region annual $PM_{2.5}$ and $NO_X$ emissions. Emissions are compared against the available 2017 and 2025 SIP MVEBs listed in **Exhibit 9**. The results illustrate that projected emissions are below the applicable MVEBs.

**Exhibit 13: ANNUAL $PM_{2.5}$ EMISSION ANALYSIS RESULTS AND CONFORMITY TEST**
(Annual)

| Pollutant | *2022 (tons/year)* | *2025 (tons/year)* | *2035 (tons/year)* | *2040 (tons/year)* |
|---|---|---|---|---|
| *$PM_{2.5}$* | *188* | *158* | *106* | *104* |
| *$NO_X$* | *5,821* | *4,693* | *3,237* | *3,272* |
| *MVEB - $PM_{2.5}$* | ***365*** | ***275*** | ***275*** | ***275*** |
| *MVEB - $NO_X$* | ***10,287*** | ***7,024*** | ***7,024*** | ***7,024*** |
| Conformity Result | **Pass** | **Pass** | **Pass** | **Pass** |

# Conformity Determination

**Financial Constraint**

The planning regulations, Sections 450.322(b)(11) and 450.324(e), require the transportation plan to be financially constrained while the existing transportation system is being adequately operated and maintained. Only projects for which construction and operating funds are reasonably expected to be available are included. HATS, in conjunction with PennDOT, FHWA and FTA, has developed an estimate of the cost to maintain and operate existing roads, bridges and transit systems in the Harrisburg area and have compared the cost with the estimated revenues and maintenance needs of the new roads over the same period. The TIP and RTP have been determined to be financially constrained.

**Public Participation**

The TIP and RTP have undergone the public participation requirements as well as the comment and response requirements according to the procedures established in compliance with 23 CFR part 450, the HATS Public Participation Plan, and Pennsylvania's Conformity SIP. The draft document was made available for a 30-day public review and comment beginning on May 7, 2018 and a public meeting on May 23, 2018.

**Conformity Statement**

The conformity rule requires that the TIP and RTP conform to the applicable SIP(s) and be adopted by the MPO/RPO before any federal agency may approve, accept, or fund projects. Conformity is determined by applying criteria outlined in the transportation conformity regulations to the analysis.

The TIP and RTP for the Harrisburg area are found to conform to the applicable air quality SIP(s) or EPA conformity requirements. This finding of conformity positively reflects on the efforts of the HATS and its partners in meeting the regional air quality goals, while maintaining and building an effective transportation system.

# Resources

**MOVES Model**

Modeling Page within EPA's Office of Mobile Sources Website contains a downloadable model, MOVES users guide and other information. See (http://www.epa.gov/omswww/models.htm)

*Policy Guidance on the Use of MOVES2014 for State Implementation Plan Development, Transportation Conformity, and Other Purposes*, US EPA Office of Air and Radiation, EPA-420-B-14-008, July 2014.

*MOVES2014 and MOVES2014a Technical Guidance: Using MOVES to Prepare Emission Inventories in State Implementation Plans and Transportation Conformity.* US EPA Office of Air and Radiation, and Office of Transportation and Air Quality, EPA-420-B-15-093, November 2015.

*MOVES2014a User Guide, US EPA Office of Transportation and Air Quality, EPA-420-B-15-095, November 2015.*

**Traffic Engineering**

*Highway Capacity Manual, fifth edition (HCM2010),* Transportation Research Board, presents current knowledge and techniques for analyzing the transportation system.

*Traffic Data Collection and Factor Development Report, 2008 Data,* Pennsylvania Department of Transportation, Bureau of Planning and Research.

# Highway Vehicle Emissions Analysis Glossary

**AADT:** Average Annual Daily Traffic, average of ALL days.

**CAA:** Clean Air Act as amended.

**CARB:** California Air Resources Board.

**CFR**: Code of Federal Regulations.

**County Data Manager (CDM):** User interface developed to simplify importing specific local data for a single county or a user-defined custom domain without requiring direct interaction with the underlying MySQL database in the MOVES emission model.

**Emission rate or factor:** Expresses the amount of pollution emitted per unit of activity. For highway vehicles, this is usually expressed in grams of pollutant emitted per mile driven.

**FC:** Functional code. Applied to road segments to identify their type (freeway, local, etc.).

**FHWA:** Federal Highway Administration.

**FR:** Federal Register.

**FTA:** Federal Transit Administration.

**Growth factor:** Factor used to convert volumes to future years.

**HPMS:** Highway Performance Monitoring System.

**I/M:** Vehicle emissions inspection/maintenance programs are required in certain areas of the country. The programs ensure that vehicle emission controls are in good working order throughout the life of the vehicle. The programs require vehicles to be tested for emissions. Most vehicles that do not pass must be repaired.

**MOVES:** Motor Vehicle Emission Simulator. The latest model EPA has developed to estimate emissions from highway vehicles.

**MVEB:** motor vehicle emissions budget.

**Pattern data:** Extrapolations of traffic patterns (such as how traffic volume on road segment types varies by time of day, or what kinds of vehicles tend to use a road segment type) from segments with observed data to similar segments.

**PPSUITE:** Post-Processor for Air Quality. A set of programs that estimate speeds and prepares MOVES inputs and processes MOVES outputs.

**Road Type:** Functional code, applied in data management to road segments to identify their type (rural/urban highways, rural/urban arterials, etc.).

**RMS:** Roadway Management System.

**Source Type:** One of thirteen vehicle types used in MOVES modeling.

**VHT:** Vehicle hours traveled.

**VMT:** Vehicle miles traveled. In modeling terms, it is the simulated traffic volumes multiplied by link length.

# ATTACHMENT A

## Project List

The following TIP and RTP AQ significant highway projects are included in this analysis. They include:

**Cumberland County**

1. *Gettysburg Road Realignment (FFY2019-22 TIP)* – Realign 800 feet of Gettysburg Road and create a new intersection at Wesley Drive, remove a portion of Gettysburg Road to reduce flooding in Lower Allen Township.
2. *Creekview Road Interchange (FFY2019-22 TIP)* - Interchange improvements at Creekview Road intersection with PA 581 in Hampden Township, Cumberland County.
3. *Rossmoyne Roundabout (FFY2019-22 TIP)* - Installation of a roundabout at the intersection of Lisburn Road and Rossmoyne Road, in Lower Allen Township, Cumberland County.
4. *Carlisle Borough Projects (FFY2019-22 TIP)* – Tiger Grant for Carlisle Borough to improve local street connections with the installation of roundabouts on Fairground Avenue, Hanover Street and Carlisle Springs Road.
5. *Interstate 81 Exit 29 (RTP 2040)* – Reconstruct interchange to 6 lanes, relocate Hershey Road, and install traffic signals at ramps in Shippensburg Township.
6. *Route 34 (Holly Pike) (SR 3004) and Marsh Drive (T-479); (RTP 2040)* – Signalize intersection and/or add turning lanes in South Middleton Township.
7. *Hummel Avenue/State Street/17th Street Intersections (RTP 2040)* – Upgrade signal intersections at Hummel Ave. (SR 2014) at 18th St. (SR 2033); Hummel Ave. (SR 2014 and SR 2016) at 17th St. (SR 2014); State St. (SR 2014) at 17th St. (SR 2014 and 2016) in Lower Allen Township.
8. *Sporting Hill Road Center Turn Lane (RTP 2040)* – Install continuous center turning lane on Sporting Hill Road between Carlisle Pike and Trindle Road in Hampden Township.
9. *Gettysburg Road Intersection Signalization (RTP 2040)* – Upgrade existing signalized intersection at Slate Hill Road/Locust Street (SR 2025) and Gettysburg Road including potential turning lanes; install new traffic signal at St. Johns Road (SR 2029) and Gettysburg Road in Lower Allen Township.
10. *Route 944 Left Turn Lanes (RTP 2040)* – Install 3 left turn lanes at Deer Lane, Rich Valley and Route 144 intersections along Route 944 in Silver Spring Township.
11. *Wertzville Road Center Turn Lane (RTP 2040)* – Resurface, widen structure and shoulders, and add center turn lane on Wertzville Road in East Pennsboro Township.
12. *Lower Allen Drive Extension (RTP 2040)* – Extend Lower Allen Drive between Hartzdale Drive and Lisburn Drive in Lower Allen Township.
13. *Lisburn Road Intersection Improvements (RTP 2040)* - Add capacity (turning lanes) at 3 intersections: Lisburn Road (SR 2031) at Carlisle Road (SR 2018); Lisburn Road (SR 2031) at Creek Road (SR 2033); Lisburn Road (SR 2031 and SR 2017) at Spanglers Mill Road (SR 2031) in Lower Allen Township.
14. *Trindle Road Widening (RTP 2040)* – Widen to 4 lanes (two lanes in each direction) from Camp Hill to Sporting Hill Road in Hampden Township.
15. *US 15 / Rossmoyne Rd / Wesley Dr Interchange Improvements (RTP 2040)* – Upgrade existing signalized intersections and improve intersection alignments in Lower Allen Township.
16. *US 15 / Slate Hill Road Interchange Ramp Relocation (RTP 2040)* – Relocate northbound off ramp, add turnings lanes & signalize intersections at interchange in Lower Allen Township.

17. *I-81 / SR 114 interchange (RTP 2040)* – Add turning lanes and other capacity improvements at interchange intersections in Silver Spring Township.
18. *Wertzville Road Widening (RTP 2040)* – Widen Wertzville Road from Valley Road to East Penn Drive in Hampden Township.

**Dauphin County**

1. *I-83 East Shore Section 1 (FFY2019-22 TIP)* – Add lanes and rehabilitate bridges on I-81 from Interstate 81/Interstate 83 junction to just south of SR 3020 (Union Deposit Road) in Lower Paxton Township.
2. *Eisenhower Interchange (FFY2019-22 TIP)* – Interchange reconstruction, lane additions, and bridge rehabilitations on the Eisenhower Interchange: I-83, I-283, and US 322 in Swatara and Lower Paxton Townships.
3. *I-83 East Shore Section 3 (FFY2019-22 TIP)* – Widen and reconstruct I-83 from the Susquehanna River to SR 3013 (29th Street) in Harrisburg City and Swatara Township.
4. *Derry Street Safety Improvements (FFY2019-22 TIP)* – Corridor Safety Improvements including new advisory signs, pavement markings, traffic signal upgrades at multiple intersections, potential construction of turning lanes and other safety improvements on SR 3012 (Derry Street) from South 14th Street to SR 3017 (61st Street) in Harrisburg City, Paxtang Borough and Swatara Township, Dauphin County.
5. *US 322 Ramp Extensions (FFY2019-22 TIP)* - Construct approximately one-half mile of ramp extensions both eastbound and westbound on US Route 322 to connect the Waltonville Road exit (SR 2005) with the Route 322/422/39 interchange (Hersheypark Drive) in Derry Township and Hummelstown Borough, Dauphin County.
6. *Upper Dauphin Park & Ride (FFY2019-22 TIP)* – New Park and Ride lot facility.
7. *US 322 Governor Road from University Drive to Fishburn Road (RTP 2040)* – Upgrade traffic signals at multiple intersections in Derry Township.
8. *Walnut Street and Progress Avenue (RTP 2040)* – Add turning lanes in all directions at intersection in Susquehanna Township.
9. *US 422, US 322 and PA 39 Interchange (RTP 2040)* – Add capacity at intersections including US 322/US 422/SR39 Interchange and the split interchange of US 322 and Waltonville Road/Quarry Road & Hummelstown/Middletown Road in Derry Township.
10. *Linglestown Road and Progress Avenue (RTP 2040)* – Add turning lanes on approaches to intersection in Susquehanna Township.
11. *Linglestown Road between Route 322 and Crooked Hill Road (RTP 2040)* – There are four (4) lanes on Linglestown road between Progress Avenue and Crooked Hill Road as well as at the Route 322 Interchange. For the rest of the corridor there are only two through lanes. Increase to 4 through lanes on Linglestown Road between Route 322 and Crooked Hill Road in Susquehanna Township.
12. *Airport Connector Access (RTP 2040)* – Extend Meade Avenue to the north and east to intersect Stoner Drive, creating a new half-interchange with the Airport Connector in Lower Swatara Township.

**Perry County**

1. *PA 34 & PA 850 Intersection (FFY2019-2022 TIP)* – The project consists of improvements to better the safety of the intersection and to improve flow of traffic, either by signalizing the intersection or constructing a roundabout.
2. *Millerstown Park and Ride (FFY2019-2022 TIP)* – Contruct a park and ride lot in Millerstown along State Route 1015 (Market Street) in Greenwood Township, Perry County.
3. *Shermansdale Park and Ride (FFY2019-2022 TIP)* – Construct a park and ride lot in Shermansdale near the intersection of PA 34 (Spring Road) and PA 850 (Valley Road) in Carroll Township, Perry County.
4. *Route 34 Turning Lanes (RTP 2040)* - Multiple turning lanes are proposed in this corridor to alleviate some of the traffuc congestion by allowing turning vehicles to exit the flow of traffic.

**Transit**

1. *Capital Area Transit (CAT) Bus Rapid Transit (BRT) Signal (FFY2019-22 TIP)* – Signal upgrades to accommodate Bus Rapid Technology preemption in the City of Harrisburg.

# ATTACHMENT B

## Detailed Emission Results

# Detailed Emission Results for Daily Ozone Analysis

## 2022 Daily Ozone by Road Type

| County | Road Type | Summer Daily VMT | Speed (mph) | Emissoins (Tons/Day) | |
|---|---|---|---|---|---|
| | | | | VOC | NOx |
| Cumberland | Off-Network | N/A | N/A | 2.80 | 3.25 |
| | Rural Restricted | 2,060,090 | 61.8 | 0.20 | 1.69 |
| | Rural UnRestricted | 1,567,902 | 34.2 | 0.17 | 0.54 |
| | Urban Restricted | 3,091,657 | 53.8 | 0.30 | 1.97 |
| | Urban UnRestricted | 2,656,846 | 26.5 | 0.35 | 1.07 |
| | *Subtotal* | *9,376,495* | | *3.82* | *8.52* |
| Dauphin | Off-Network | N/A | N/A | 2.85 | 2.19 |
| | Rural Restricted | 975,251 | 34.6 | 0.13 | 0.87 |
| | Rural UnRestricted | 2,346,265 | 42.0 | 0.24 | 1.18 |
| | Urban Restricted | 3,268,161 | 55.8 | 0.31 | 2.11 |
| | Urban UnRestricted | 2,948,704 | 33.1 | 0.33 | 1.16 |
| | *Subtotal* | *9,538,382* | | *3.86* | *7.50* |
| Perry | Off-Network | N/A | N/A | 0.50 | 0.22 |
| | Rural Restricted | 2,693 | 28.5 | 0.00 | 0.00 |
| | Rural UnRestricted | 1,327,597 | 46.3 | 0.12 | 0.61 |
| | Urban Restricted | 1,158 | 24.4 | 0.00 | 0.00 |
| | Urban UnRestricted | 182,933 | 15.1 | 0.04 | 0.08 |
| | *Subtotal* | *1,514,381* | | *0.66* | *0.91* |
| Off-Model Project Emission Benefits | | | | 0.00 | 0.00 |
| **Region Total** | | **20,429,258** | | **8.33** | **16.94** |
| | | | **(Kg/Day)** | **7,561** | **15,366** |

## 2025 Daily Ozone by Road Type

| County | Road Type | Summer Daily VMT | Speed (mph) | Emissoins (Tons/Day) | |
|---|---|---|---|---|---|
| | | | | VOC | NOx |
| Cumberland | Off-Network | N/A | N/A | 2.32 | 3.08 |
| | Rural Restricted | 2,203,459 | 61.8 | 0.15 | 1.30 |
| | Rural UnRestricted | 1,630,617 | 33.6 | 0.13 | 0.38 |
| | Urban Restricted | 3,247,116 | 53.6 | 0.23 | 1.49 |
| | Urban UnRestricted | 2,743,286 | 25.7 | 0.26 | 0.76 |
| | *Subtotal* | *9,824,478* | | *3.09* | *7.01* |
| Dauphin | Off-Network | N/A | N/A | 2.30 | 1.92 |
| | Rural Restricted | 1,038,222 | 31.8 | 0.10 | 0.68 |
| | Rural UnRestricted | 2,397,010 | 41.3 | 0.17 | 0.86 |
| | Urban Restricted | 3,398,584 | 55.7 | 0.23 | 1.59 |
| | Urban UnRestricted | 3,005,711 | 32.9 | 0.24 | 0.81 |
| | *Subtotal* | *9,839,526* | | *3.05* | *5.86* |
| Perry | Off-Network | N/A | N/A | 0.41 | 0.17 |
| | Rural Restricted | 2,750 | 28.4 | 0.00 | 0.00 |
| | Rural UnRestricted | 1,361,260 | 46.3 | 0.09 | 0.44 |
| | Urban Restricted | 1,183 | 24.4 | 0.00 | 0.00 |
| | Urban UnRestricted | 190,274 | 14.1 | 0.03 | 0.06 |
| | *Subtotal* | *1,555,466* | | *0.53* | *0.67* |
| Off-Model Project Emission Benefits | | | | 0.00 | 0.00 |
| **Region Total** | | **21,219,471** | | **6.67** | **13.55** |
| | | | **(Kg/Day)** | **6,053** | **12,289** |

**2035 Daily Ozone by Road Type**

| County | Road Type | Summer Daily VMT | Speed (mph) | Emissoins (Tons/Day) | |
|---|---|---|---|---|---|
| | | | | VOC | NOx |
| Cumberland | Off-Network | N/A | N/A | 1.53 | 2.92 |
| | Rural Restricted | 2,624,639 | 61.9 | 0.09 | 0.77 |
| | Rural UnRestricted | 1,866,497 | 31.5 | 0.09 | 0.18 |
| | Urban Restricted | 3,703,869 | 51.0 | 0.14 | 0.84 |
| | Urban UnRestricted | 3,053,853 | 23.3 | 0.19 | 0.37 |
| | *Subtotal* | *11,248,858* | | *2.05* | *5.08* |
| Dauphin | Off-Network | N/A | N/A | 1.39 | 1.52 |
| | Rural Restricted | 1,193,815 | 20.7 | 0.09 | 0.46 |
| | Rural UnRestricted | 2,563,938 | 39.1 | 0.11 | 0.45 |
| | Urban Restricted | 3,812,797 | 54.0 | 0.14 | 0.90 |
| | Urban UnRestricted | 3,212,267 | 32.4 | 0.15 | 0.37 |
| | *Subtotal* | *10,782,817* | | *1.89* | *3.70* |
| Perry | Off-Network | N/A | N/A | 0.24 | 0.07 |
| | Rural Restricted | 2,922 | 28.4 | 0.00 | 0.00 |
| | Rural UnRestricted | 1,456,848 | 46.3 | 0.05 | 0.22 |
| | Urban Restricted | 1,268 | 24.3 | 0.00 | 0.00 |
| | Urban UnRestricted | 205,712 | 12.1 | 0.02 | 0.03 |
| | *Subtotal* | *1,666,750* | | *0.32* | *0.33* |
| Off-Model Project Emission Benefits | | | | 0.00 | 0.00 |
| **Region Total** | | **23,698,426** | | **4.26** | **9.11** |
| | | | **(Kg/Day)** | **3,862** | **8,265** |

**2040 Daily Ozone by Road Type**

| County | Road Type | Summer Daily VMT | Speed (mph) | Emissoins (Tons/Day) | |
|---|---|---|---|---|---|
| | | | | VOC | NOx |
| Cumberland | Off-Network | N/A | N/A | 1.43 | 3.06 |
| | Rural Restricted | 2,792,630 | 61.9 | 0.09 | 0.76 |
| | Rural UnRestricted | 2,006,081 | 30.3 | 0.09 | 0.17 |
| | Urban Restricted | 3,922,330 | 47.5 | 0.14 | 0.83 |
| | Urban UnRestricted | 3,194,191 | 22.1 | 0.19 | 0.34 |
| | *Subtotal* | *11,915,232* | | *1.94* | *5.16* |
| Dauphin | Off-Network | N/A | N/A | 1.25 | 1.55 |
| | Rural Restricted | 1,277,681 | 16.5 | 0.11 | 0.51 |
| | Rural UnRestricted | 2,642,360 | 37.8 | 0.11 | 0.43 |
| | Urban Restricted | 4,049,432 | 55.5 | 0.13 | 0.88 |
| | Urban UnRestricted | 3,305,438 | 32.2 | 0.14 | 0.33 |
| | *Subtotal* | *11,274,911* | | *1.74* | *3.70* |
| Perry | Off-Network | N/A | N/A | 0.22 | 0.06 |
| | Rural Restricted | 2,985 | 28.3 | 0.00 | 0.00 |
| | Rural UnRestricted | 1,499,936 | 46.4 | 0.05 | 0.21 |
| | Urban Restricted | 1,283 | 24.3 | 0.00 | 0.00 |
| | Urban UnRestricted | 212,342 | 11.3 | 0.02 | 0.04 |
| | *Subtotal* | *1,716,547* | | *0.29* | *0.31* |
| Off-Model Project Emission Benefits | | | | 0.00 | 0.00 |
| **Region Total** | | **24,906,690** | | **3.97** | **9.18** |
| | | | **(Kg/Day)** | **3,601** | **8,324** |

**2022 Daily Ozone by Source Type**

| County | Source Type | Summer Daily VMT | Emissoins (Tons/Day) | |
|---|---|---|---|---|
| | | | VOC | NOx |
| Cumberland | Motorcycle | 56,278 | 0.14 | 0.04 |
| | Passenger Car | 4,442,221 | 0.88 | 0.61 |
| | Passenger Truck | 2,878,516 | 1.68 | 1.90 |
| | Light Commercial Truck | 729,889 | 0.41 | 0.50 |
| | Intercity Bus | 2,304 | 0.00 | 0.01 |
| | Transit Bus | 9,827 | 0.00 | 0.04 |
| | School Bus | 3,872 | 0.00 | 0.01 |
| | Refuse Truck | 21,290 | 0.00 | 0.05 |
| | Single Unit Short-haul Truck | 440,384 | 0.13 | 0.54 |
| | Single Unit Long-haul Truck | 24,169 | 0.01 | 0.03 |
| | Motor Home | 16,784 | 0.02 | 0.03 |
| | Combination Short-haul Truck | 170,151 | 0.02 | 0.44 |
| | Combination Long-haul Truck | 580,808 | 0.52 | 4.31 |
| | *Subtotal* | *9,376,495* | *3.82* | *8.52* |
| Dauphin | Motorcycle | 57,412 | 0.14 | 0.04 |
| | Passenger Car | 4,531,746 | 0.96 | 0.64 |
| | Passenger Truck | 2,936,541 | 1.81 | 1.97 |
| | Light Commercial Truck | 744,566 | 0.45 | 0.52 |
| | Intercity Bus | 1,579 | 0.00 | 0.01 |
| | Transit Bus | 16,931 | 0.01 | 0.07 |
| | School Bus | 2,957 | 0.00 | 0.01 |
| | Refuse Truck | 21,167 | 0.00 | 0.05 |
| | Single Unit Short-haul Truck | 437,983 | 0.14 | 0.55 |
| | Single Unit Long-haul Truck | 24,002 | 0.01 | 0.03 |
| | Motor Home | 16,693 | 0.02 | 0.03 |
| | Combination Short-haul Truck | 169,158 | 0.02 | 0.44 |
| | Combination Long-haul Truck | 577,646 | 0.30 | 3.15 |
| | *Subtotal* | *9,536,382* | *3.86* | *7.50* |
| Perry | Motorcycle | 9,501 | 0.03 | 0.01 |
| | Passenger Car | 747,820 | 0.19 | 0.11 |
| | Passenger Truck | 487,698 | 0.33 | 0.32 |
| | Light Commercial Truck | 123,571 | 0.08 | 0.09 |
| | Intercity Bus | 154 | 0.00 | 0.00 |
| | Transit Bus | 5,453 | 0.00 | 0.02 |
| | School Bus | 6,141 | 0.00 | 0.02 |
| | Refuse Truck | 2,276 | 0.00 | 0.01 |
| | Single Unit Short-haul Truck | 47,102 | 0.01 | 0.06 |
| | Single Unit Long-haul Truck | 2,573 | 0.00 | 0.00 |
| | Motor Home | 1,793 | 0.00 | 0.00 |
| | Combination Short-haul Truck | 18,171 | 0.00 | 0.05 |
| | Combination Long-haul Truck | 62,127 | 0.01 | 0.23 |
| | *Subtotal* | *1,514,381* | *0.66* | *0.91* |
| Off-Model Project Emission Benefits | | | 0.00 | 0.00 |
| **Region Total** | | **20,429,258 (Kg/Day)** | **8.33 7,561** | **16.94 15,366** |

**2025 Daily Ozone by Source Type**

| County | Source Type | Summer Daily VMT | Emissoins (Tons/Day) | |
|---|---|---|---|---|
| | | | VOC | NOx |
| Cumberland | Motorcycle | 58,698 | 0.14 | 0.04 |
| | Passenger Car | 4,633,245 | 0.78 | 0.47 |
| | Passenger Truck | 3,002,257 | 1.24 | 1.28 |
| | Light Commercial Truck | 761,299 | 0.31 | 0.35 |
| | Intercity Bus | 2,611 | 0.00 | 0.01 |
| | Transit Bus | 10,530 | 0.00 | 0.03 |
| | School Bus | 4,112 | 0.00 | 0.01 |
| | Refuse Truck | 22,963 | 0.00 | 0.04 |
| | Single Unit Short-haul Truck | 474,882 | 0.10 | 0.44 |
| | Single Unit Long-haul Truck | 26,034 | 0.00 | 0.02 |
| | Motor Home | 18,098 | 0.01 | 0.03 |
| | Combination Short-haul Truck | 183,469 | 0.01 | 0.34 |
| | Combination Long-haul Truck | 626,281 | 0.49 | 3.95 |
| | *Subtotal* | *9,824,478* | *3.09* | *7.01* |
| Dauphin | Motorcycle | 58,882 | 0.14 | 0.04 |
| | Passenger Car | 4,647,795 | 0.84 | 0.49 |
| | Passenger Truck | 3,011,707 | 1.32 | 1.30 |
| | Light Commercial Truck | 763,665 | 0.33 | 0.35 |
| | Intercity Bus | 1,756 | 0.00 | 0.01 |
| | Transit Bus | 18,077 | 0.00 | 0.05 |
| | School Bus | 3,146 | 0.00 | 0.01 |
| | Refuse Truck | 22,656 | 0.00 | 0.04 |
| | Single Unit Short-haul Truck | 468,854 | 0.10 | 0.44 |
| | Single Unit Long-haul Truck | 25,692 | 0.00 | 0.03 |
| | Motor Home | 17,867 | 0.01 | 0.03 |
| | Combination Short-haul Truck | 181,125 | 0.02 | 0.34 |
| | Combination Long-haul Truck | 618,305 | 0.27 | 2.73 |
| | *Subtotal* | *9,839,526* | *3.05* | *5.86* |
| Perry | Motorcycle | 9,711 | 0.03 | 0.01 |
| | Passenger Car | 764,357 | 0.17 | 0.09 |
| | Passenger Truck | 498,474 | 0.24 | 0.22 |
| | Light Commercial Truck | 126,323 | 0.06 | 0.06 |
| | Intercity Bus | 212 | 0.00 | 0.00 |
| | Transit Bus | 5,849 | 0.00 | 0.02 |
| | School Bus | 6,537 | 0.00 | 0.01 |
| | Refuse Truck | 2,455 | 0.00 | 0.00 |
| | Single Unit Short-haul Truck | 50,564 | 0.01 | 0.05 |
| | Single Unit Long-haul Truck | 2,791 | 0.00 | 0.00 |
| | Motor Home | 1,929 | 0.00 | 0.00 |
| | Combination Short-haul Truck | 19,527 | 0.00 | 0.04 |
| | Combination Long-haul Truck | 66,739 | 0.01 | 0.18 |
| | *Subtotal* | *1,555,466* | *0.53* | *0.67* |
| Off-Model Project Emission Benefits | | | 0.00 | 0.00 |
| **Region Total** | | **21,219,471 (Kg/Day)** | **6.67 6,053** | **13.55 12,289** |

**2035 Daily Ozone by Source Type**

| County | Source Type | Summer Daily VMT | Emissoins (Tons/Day) | |
|---|---|---|---|---|
| | | | VOC | NOx |
| Cumberland | Motorcycle | 66,682 | 0.14 | 0.04 |
| | Passenger Car | 5,263,493 | 0.53 | 0.26 |
| | Passenger Truck | 3,410,664 | 0.67 | 0.43 |
| | Light Commercial Truck | 864,829 | 0.16 | 0.12 |
| | Intercity Bus | 3,367 | 0.00 | 0.00 |
| | Transit Bus | 12,588 | 0.00 | 0.02 |
| | School Bus | 4,750 | 0.00 | 0.00 |
| | Refuse Truck | 27,568 | 0.00 | 0.03 |
| | Single Unit Short-haul Truck | 570,000 | 0.06 | 0.34 |
| | Single Unit Long-haul Truck | 31,246 | 0.00 | 0.02 |
| | Motor Home | 21,724 | 0.01 | 0.01 |
| | Combination Short-haul Truck | 220,152 | 0.01 | 0.26 |
| | Combination Long-haul Truck | 751,796 | 0.46 | 3.54 |
| | *Subtotal* | *11,248,858* | *2.05* | *5.08* |
| Dauphin | Motorcycle | 63,735 | 0.14 | 0.04 |
| | Passenger Car | 5,030,834 | 0.55 | 0.25 |
| | Passenger Truck | 3,259,941 | 0.70 | 0.42 |
| | Light Commercial Truck | 826,617 | 0.17 | 0.12 |
| | Intercity Bus | 2,280 | 0.00 | 0.00 |
| | Transit Bus | 21,239 | 0.00 | 0.03 |
| | School Bus | 3,573 | 0.00 | 0.00 |
| | Refuse Truck | 26,766 | 0.00 | 0.03 |
| | Single Unit Short-haul Truck | 553,145 | 0.07 | 0.35 |
| | Single Unit Long-haul Truck | 30,345 | 0.00 | 0.02 |
| | Motor Home | 21,080 | 0.01 | 0.01 |
| | Combination Short-haul Truck | 213,720 | 0.01 | 0.27 |
| | Combination Long-haul Truck | 729,540 | 0.23 | 2.14 |
| | *Subtotal* | *10,782,817* | *1.89* | *3.70* |
| Perry | Motorcycle | 10,278 | 0.03 | 0.01 |
| | Passenger Car | 808,941 | 0.11 | 0.04 |
| | Passenger Truck | 527,583 | 0.13 | 0.07 |
| | Light Commercial Truck | 133,699 | 0.03 | 0.02 |
| | Intercity Bus | 227 | 0.00 | 0.00 |
| | Transit Bus | 7,093 | 0.00 | 0.01 |
| | School Bus | 7,678 | 0.00 | 0.01 |
| | Refuse Truck | 2,892 | 0.00 | 0.00 |
| | Single Unit Short-haul Truck | 60,163 | 0.01 | 0.04 |
| | Single Unit Long-haul Truck | 3,316 | 0.00 | 0.00 |
| | Motor Home | 2,291 | 0.00 | 0.00 |
| | Combination Short-haul Truck | 23,225 | 0.00 | 0.03 |
| | Combination Long-haul Truck | 79,362 | 0.00 | 0.10 |
| | *Subtotal* | *1,666,750* | *0.32* | *0.33* |
| Off-Model Project Emission Benefits | | | 0.00 | 0.00 |
| **Region Total** | | **23,698,426 (Kg/Day)** | **4.26 3,862** | **9.11 8,265** |

**2040 Daily Ozone by Source Type**

| County | Source Type | Summer Daily VMT | Emissoins (Tons/Day) | |
|---|---|---|---|---|
| | | | VOC | NOx |
| Cumberland | Motorcycle | 70,397 | 0.15 | 0.05 |
| | Passenger Car | 5,556,723 | 0.48 | 0.23 |
| | Passenger Truck | 3,600,663 | 0.59 | 0.32 |
| | Light Commercial Truck | 913,027 | 0.14 | 0.09 |
| | Intercity Bus | 3,790 | 0.00 | 0.00 |
| | Transit Bus | 13,501 | 0.00 | 0.02 |
| | School Bus | 5,075 | 0.00 | 0.00 |
| | Refuse Truck | 29,767 | 0.00 | 0.04 |
| | Single Unit Short-haul Truck | 615,507 | 0.07 | 0.36 |
| | Single Unit Long-haul Truck | 33,754 | 0.00 | 0.02 |
| | Motor Home | 23,461 | 0.01 | 0.01 |
| | Combination Short-haul Truck | 237,771 | 0.01 | 0.28 |
| | Combination Long-haul Truck | 811,796 | 0.48 | 3.74 |
| | *Subtotal* | *11,915,232* | *1.94* | *5.16* |
| Dauphin | Motorcycle | 66,346 | 0.15 | 0.04 |
| | Passenger Car | 5,236,915 | 0.50 | 0.22 |
| | Passenger Truck | 3,393,480 | 0.60 | 0.31 |
| | Light Commercial Truck | 860,459 | 0.15 | 0.09 |
| | Intercity Bus | 2,537 | 0.00 | 0.00 |
| | Transit Bus | 22,701 | 0.00 | 0.03 |
| | School Bus | 3,790 | 0.00 | 0.00 |
| | Refuse Truck | 28,665 | 0.00 | 0.04 |
| | Single Unit Short-haul Truck | 593,275 | 0.07 | 0.38 |
| | Single Unit Long-haul Truck | 32,530 | 0.00 | 0.02 |
| | Motor Home | 22,609 | 0.01 | 0.01 |
| | Combination Short-haul Truck | 229,155 | 0.01 | 0.29 |
| | Combination Long-haul Truck | 782,449 | 0.24 | 2.26 |
| | *Subtotal* | *11,274,911* | *1.74* | *3.70* |
| Perry | Motorcycle | 10,519 | 0.03 | 0.01 |
| | Passenger Car | 827,973 | 0.10 | 0.04 |
| | Passenger Truck | 539,988 | 0.12 | 0.05 |
| | Light Commercial Truck | 136,826 | 0.03 | 0.01 |
| | Intercity Bus | 292 | 0.00 | 0.00 |
| | Transit Bus | 7,669 | 0.00 | 0.01 |
| | School Bus | 8,233 | 0.00 | 0.01 |
| | Refuse Truck | 3,125 | 0.00 | 0.00 |
| | Single Unit Short-haul Truck | 65,025 | 0.01 | 0.04 |
| | Single Unit Long-haul Truck | 3,566 | 0.00 | 0.00 |
| | Motor Home | 2,480 | 0.00 | 0.00 |
| | Combination Short-haul Truck | 25,165 | 0.00 | 0.03 |
| | Combination Long-haul Truck | 85,687 | 0.00 | 0.11 |
| | *Subtotal* | *1,716,547* | *0.29* | *0.31* |
| Off-Model Project Emission Benefits | | | 0.00 | 0.00 |
| **Region Total** | | **24,906,690 (Kg/Day)** | **3.97 3,601** | **9.18 8,324** |

**2022 Daily Ozone by Emission Process**

| County | Emission Process | Emissoins (Tons/Day) | |
|---|---|---|---|
| | | VOC | NOx |
| Cumberland | Running Exhaust | 0.70 | 5.27 |
| | Start Exhaust | 1.31 | 1.08 |
| | Brakewear | 0.00 | 0.00 |
| | Tirewear | 0.00 | 0.00 |
| | Evap Permeation | 0.27 | 0.00 |
| | Evap Fuel Vapor Venting | 0.59 | 0.00 |
| | Evap Fuel Leaks | 0.50 | 0.00 |
| | Crankcase Running Exhaust | 0.01 | 0.00 |
| | Crankcase Start Exhaust | 0.02 | 0.00 |
| | Crankcase Extended Idle Exhaust | 0.01 | 0.00 |
| | Extended Idle Exhaust | 0.39 | 2.09 |
| | Auxiliary Power Exhaust | 0.02 | 0.08 |
| | *Subtotal* | *3.82* | *8.52* |
| Dauphin | Running Exhaust | 0.71 | 5.31 |
| | Start Exhaust | 1.46 | 1.20 |
| | Brakewear | 0.00 | 0.00 |
| | Tirewear | 0.00 | 0.00 |
| | Evap Permeation | 0.30 | 0.00 |
| | Evap Fuel Vapor Venting | 0.64 | 0.00 |
| | Evap Fuel Leaks | 0.53 | 0.00 |
| | Crankcase Running Exhaust | 0.01 | 0.00 |
| | Crankcase Start Exhaust | 0.02 | 0.00 |
| | Crankcase Extended Idle Exhaust | 0.00 | 0.00 |
| | Extended Idle Exhaust | 0.18 | 0.95 |
| | Auxiliary Power Exhaust | 0.01 | 0.04 |
| | *Subtotal* | *3.86* | *7.50* |
| Perry | Running Exhaust | 0.10 | 0.69 |
| | Start Exhaust | 0.27 | 0.22 |
| | Brakewear | 0.00 | 0.00 |
| | Tirewear | 0.00 | 0.00 |
| | Evap Permeation | 0.06 | 0.00 |
| | Evap Fuel Vapor Venting | 0.12 | 0.00 |
| | Evap Fuel Leaks | 0.10 | 0.00 |
| | Crankcase Running Exhaust | 0.00 | 0.00 |
| | Crankcase Start Exhaust | 0.00 | 0.00 |
| | Crankcase Extended Idle Exhaust | 0.00 | 0.00 |
| | Extended Idle Exhaust | 0.00 | 0.00 |
| | Auxiliary Power Exhaust | 0.00 | 0.00 |
| | *Subtotal* | *0.66* | *0.91* |
| Off-Model Project Emission Benefits | | 0.00 | 0.00 |
| **Region Total** | | **8.33** | **16.94** |
| | **(Kg/Day)** | **7,561** | **15,366** |

**2025 Daily Ozone by Emission Process**

| County | Emission Process | Emissoins (Tons/Day) | |
|---|---|---|---|
| | | VOC | NOx |
| Cumberland | Running Exhaust | 0.48 | 3.93 |
| | Start Exhaust | 0.98 | 0.82 |
| | Brakewear | 0.00 | 0.00 |
| | Tirewear | 0.00 | 0.00 |
| | Evap Permeation | 0.19 | 0.00 |
| | Evap Fuel Vapor Venting | 0.49 | 0.00 |
| | Evap Fuel Leaks | 0.51 | 0.00 |
| | Crankcase Running Exhaust | 0.01 | 0.00 |
| | Crankcase Start Exhaust | 0.01 | 0.00 |
| | Crankcase Extended Idle Exhaust | 0.00 | 0.00 |
| | Extended Idle Exhaust | 0.38 | 2.17 |
| | Auxiliary Power Exhaust | 0.03 | 0.10 |
| | *Subtotal* | *3.09* | *7.01* |
| Dauphin | Running Exhaust | 0.48 | 3.94 |
| | Start Exhaust | 1.08 | 0.89 |
| | Brakewear | 0.00 | 0.00 |
| | Tirewear | 0.00 | 0.00 |
| | Evap Permeation | 0.21 | 0.00 |
| | Evap Fuel Vapor Venting | 0.53 | 0.00 |
| | Evap Fuel Leaks | 0.54 | 0.00 |
| | Crankcase Running Exhaust | 0.01 | 0.00 |
| | Crankcase Start Exhaust | 0.01 | 0.00 |
| | Crankcase Extended Idle Exhaust | 0.00 | 0.00 |
| | Extended Idle Exhaust | 0.17 | 0.99 |
| | Auxiliary Power Exhaust | 0.01 | 0.04 |
| | *Subtotal* | *3.05* | *5.86* |
| Perry | Running Exhaust | 0.07 | 0.51 |
| | Start Exhaust | 0.21 | 0.17 |
| | Brakewear | 0.00 | 0.00 |
| | Tirewear | 0.00 | 0.00 |
| | Evap Permeation | 0.04 | 0.00 |
| | Evap Fuel Vapor Venting | 0.10 | 0.00 |
| | Evap Fuel Leaks | 0.10 | 0.00 |
| | Crankcase Running Exhaust | 0.00 | 0.00 |
| | Crankcase Start Exhaust | 0.00 | 0.00 |
| | Crankcase Extended Idle Exhaust | 0.00 | 0.00 |
| | Extended Idle Exhaust | 0.00 | 0.00 |
| | Auxiliary Power Exhaust | 0.00 | 0.00 |
| | *Subtotal* | *0.53* | *0.67* |
| Off-Model Project Emission Benefits | | 0.00 | 0.00 |
| **Region Total** | | **6.67** | **13.55** |
| | **(Kg/Day)** | **6,053** | **12,289** |

**2035 Daily Ozone by Emission Process**

| County | Emission Process | Emissoins (Tons/Day) | |
|---|---|---|---|
| | | VOC | NOx |
| Cumberland | Running Exhaust | 0.23 | 2.16 |
| | Start Exhaust | 0.39 | 0.35 |
| | Brakewear | 0.00 | 0.00 |
| | Tirewear | 0.00 | 0.00 |
| | Evap Permeation | 0.08 | 0.00 |
| | Evap Fuel Vapor Venting | 0.38 | 0.00 |
| | Evap Fuel Leaks | 0.54 | 0.00 |
| | Crankcase Running Exhaust | 0.00 | 0.00 |
| | Crankcase Start Exhaust | 0.01 | 0.00 |
| | Crankcase Extended Idle Exhaust | 0.00 | 0.00 |
| | Extended Idle Exhaust | 0.38 | 2.43 |
| | Auxiliary Power Exhaust | 0.04 | 0.14 |
| | *Subtotal* | *2.05* | *5.08* |
| Dauphin | Running Exhaust | 0.23 | 2.18 |
| | Start Exhaust | 0.42 | 0.37 |
| | Brakewear | 0.00 | 0.00 |
| | Tirewear | 0.00 | 0.00 |
| | Evap Permeation | 0.08 | 0.00 |
| | Evap Fuel Vapor Venting | 0.40 | 0.00 |
| | Evap Fuel Leaks | 0.55 | 0.00 |
| | Crankcase Running Exhaust | 0.00 | 0.00 |
| | Crankcase Start Exhaust | 0.01 | 0.00 |
| | Crankcase Extended Idle Exhaust | 0.00 | 0.00 |
| | Extended Idle Exhaust | 0.17 | 1.09 |
| | Auxiliary Power Exhaust | 0.02 | 0.06 |
| | *Subtotal* | *1.89* | *3.70* |
| Perry | Running Exhaust | 0.03 | 0.26 |
| | Start Exhaust | 0.08 | 0.07 |
| | Brakewear | 0.00 | 0.00 |
| | Tirewear | 0.00 | 0.00 |
| | Evap Permeation | 0.02 | 0.00 |
| | Evap Fuel Vapor Venting | 0.08 | 0.00 |
| | Evap Fuel Leaks | 0.10 | 0.00 |
| | Crankcase Running Exhaust | 0.00 | 0.00 |
| | Crankcase Start Exhaust | 0.00 | 0.00 |
| | Crankcase Extended Idle Exhaust | 0.00 | 0.00 |
| | Extended Idle Exhaust | 0.00 | 0.00 |
| | Auxiliary Power Exhaust | 0.00 | 0.00 |
| | *Subtotal* | *0.32* | *0.33* |
| Off-Model Project Emission Benefits | | 0.00 | 0.00 |
| **Region Total** | | **4.26** | **9.11** |
| | **(Kg/Day)** | **3,862** | **8,265** |

**2040 Daily Ozone by Emission Process**

| County | Emission Process | Emissoins (Tons/Day) | |
|---|---|---|---|
| | | VOC | NOx |
| Cumberland | Running Exhaust | 0.21 | 2.11 |
| | Start Exhaust | 0.31 | 0.30 |
| | Brakewear | 0.00 | 0.00 |
| | Tirewear | 0.00 | 0.00 |
| | Evap Permeation | 0.06 | 0.00 |
| | Evap Fuel Vapor Venting | 0.37 | 0.00 |
| | Evap Fuel Leaks | 0.53 | 0.00 |
| | Crankcase Running Exhaust | 0.00 | 0.00 |
| | Crankcase Start Exhaust | 0.00 | 0.00 |
| | Crankcase Extended Idle Exhaust | 0.00 | 0.00 |
| | Extended Idle Exhaust | 0.41 | 2.61 |
| | Auxiliary Power Exhaust | 0.04 | 0.15 |
| | *Subtotal* | *1.94* | *5.16* |
| Dauphin | Running Exhaust | 0.22 | 2.15 |
| | Start Exhaust | 0.33 | 0.31 |
| | Brakewear | 0.00 | 0.00 |
| | Tirewear | 0.00 | 0.00 |
| | Evap Permeation | 0.07 | 0.00 |
| | Evap Fuel Vapor Venting | 0.38 | 0.00 |
| | Evap Fuel Leaks | 0.54 | 0.00 |
| | Crankcase Running Exhaust | 0.00 | 0.00 |
| | Crankcase Start Exhaust | 0.00 | 0.00 |
| | Crankcase Extended Idle Exhaust | 0.00 | 0.00 |
| | Extended Idle Exhaust | 0.18 | 1.17 |
| | Auxiliary Power Exhaust | 0.02 | 0.07 |
| | *Subtotal* | *1.74* | *3.70* |
| Perry | Running Exhaust | 0.03 | 0.25 |
| | Start Exhaust | 0.07 | 0.06 |
| | Brakewear | 0.00 | 0.00 |
| | Tirewear | 0.00 | 0.00 |
| | Evap Permeation | 0.01 | 0.00 |
| | Evap Fuel Vapor Venting | 0.08 | 0.00 |
| | Evap Fuel Leaks | 0.10 | 0.00 |
| | Crankcase Running Exhaust | 0.00 | 0.00 |
| | Crankcase Start Exhaust | 0.00 | 0.00 |
| | Crankcase Extended Idle Exhaust | 0.00 | 0.00 |
| | Extended Idle Exhaust | 0.00 | 0.00 |
| | Auxiliary Power Exhaust | 0.00 | 0.00 |
| | *Subtotal* | *0.29* | *0.31* |
| Off-Model Project Emission Benefits | | 0.00 | 0.00 |
| **Region Total** | | **3.97** | **9.18** |
| | **(Kg/Day)** | **3,601** | **8,324** |

# Detailed Emission Results for Annual $PM_{2.5}$ Analysis

**2022 Annual $PM_{2.5}$ by Road Type**

| County | Road Type | Annual VMT | Speed (mph) | Emissoins (Tons/Year) | |
|---|---|---|---|---|---|
| | | | | NOx | $PM_{2.5}$ |
| Cumberland | Off-Network | N/A | N/A | 1,205.14 | 16.89 |
| | Rural Restricted | 663,699,070 | 61.9 | 615.73 | 21.52 |
| | Rural UnRestricted | 506,782,672 | 34.1 | 194.70 | 9.69 |
| | Urban Restricted | 984,415,309 | 56.5 | 702.91 | 26.57 |
| | Urban UnRestricted | 867,796,363 | 28.8 | 378.08 | 20.54 |
| | *Subtotal* | *3,022,693,415* | | *3,096.55* | *95.21* |
| Dauphin | Off-Network | N/A | N/A | 814.99 | 13.71 |
| | Rural Restricted | 314,170,424 | 39.6 | 307.14 | 12.67 |
| | Rural UnRestricted | 766,512,563 | 43.1 | 429.53 | 18.06 |
| | Urban Restricted | 1,040,621,988 | 57.5 | 753.97 | 27.90 |
| | Urban UnRestricted | 963,747,127 | 33.5 | 419.08 | 20.84 |
| | *Subtotal* | *3,085,052,103* | | *2,724.72* | *93.19* |
| Off-Model Project Emission Benefits | | | | 0.00 | 0.00 |
| **Region Total** | | **6,107,745,518** | | **5,821.27** | **188.40** |
| | | | **(Kg/Year)** | **5,280,968** | **170,912** |

**2025 Annual $PM_{2.5}$ by Road Type**

| County | Road Type | Annual VMT | Speed (mph) | Emissoins (Tons/Year) | |
|---|---|---|---|---|---|
| | | | | NOx | $PM_{2.5}$ |
| Cumberland | Off-Network | N/A | N/A | 1,147.51 | 14.71 |
| | Rural Restricted | 709,882,562 | 61.9 | 475.18 | 17.31 |
| | Rural UnRestricted | 527,056,249 | 33.5 | 137.10 | 8.64 |
| | Urban Restricted | 1,033,921,003 | 56.5 | 531.00 | 21.65 |
| | Urban UnRestricted | 896,095,990 | 28.2 | 267.68 | 18.10 |
| | *Subtotal* | *3,166,955,805* | | *2,558.47* | *80.42* |
| Dauphin | Off-Network | N/A | N/A | 724.36 | 11.91 |
| | Rural Restricted | 334,455,506 | 39.3 | 237.46 | 10.35 |
| | Rural UnRestricted | 783,034,741 | 42.6 | 312.77 | 15.01 |
| | Urban Restricted | 1,082,149,211 | 57.6 | 567.46 | 22.55 |
| | Urban UnRestricted | 982,396,861 | 33.4 | 292.01 | 17.77 |
| | *Subtotal* | *3,182,036,318* | | *2,134.06* | *77.60* |
| Off-Model Project Emission Benefits | | | | 0.00 | 0.00 |
| **Region Total** | | **6,348,992,123** | | **4,692.53** | **158.02** |
| | | | **(Kg/Year)** | **4,256,995** | **143,352** |

**2035 Annual $PM_{2.5}$ by Road Type**

| County | Road Type | Annual VMT | Speed (mph) | Emissoins (Tons/Year) | |
|---|---|---|---|---|---|
| | | | | NOx | $PM_{2.5}$ |
| Cumberland | Off-Network | N/A | N/A | 1,102.87 | 9.83 |
| | Rural Restricted | 845,574,583 | 62.0 | 281.81 | 10.23 |
| | Rural UnRestricted | 603,189,678 | 31.4 | 65.93 | 7.05 |
| | Urban Restricted | 1,179,346,792 | 56.2 | 299.76 | 13.17 |
| | Urban UnRestricted | 997,652,523 | 26.1 | 129.20 | 14.34 |
| | *Subtotal* | *3,625,763,576* | | *1,879.57* | *54.61* |
| Dauphin | Off-Network | N/A | N/A | 590.52 | 7.57 |
| | Rural Restricted | 384,583,334 | 30.8 | 147.47 | 7.70 |
| | Rural UnRestricted | 837,424,959 | 40.9 | 163.51 | 10.00 |
| | Urban Restricted | 1,214,041,742 | 57.2 | 320.88 | 13.56 |
| | Urban UnRestricted | 1,050,166,039 | 33.0 | 134.55 | 12.79 |
| | *Subtotal* | *3,486,216,073* | | *1,356.93* | *51.62* |
| Off-Model Project Emission Benefits | | | | 0.00 | 0.00 |
| **Region Total** | | **7,111,979,649** | | **3,236.50** | **106.23** |
| | | | **(Kg/Year)** | **2,936,105** | **96,373** |

**2040 Annual $PM_{2.5}$ by Road Type**

| County | Road Type | Annual VMT | Speed (mph) | Emissoins (Tons/Year) | |
|---|---|---|---|---|---|
| | | | | NOx | $PM_{2.5}$ |
| Cumberland | Off-Network | N/A | N/A | 1,158.34 | 8.85 |
| | Rural Restricted | 902,177,275 | 62.1 | 279.79 | 10.00 |
| | Rural UnRestricted | 649,966,761 | 30.2 | 63.22 | 7.27 |
| | Urban Restricted | 1,252,338,723 | 55.8 | 294.24 | 12.86 |
| | Urban UnRestricted | 1,046,464,442 | 24.9 | 120.37 | 14.52 |
| | *Subtotal* | *3,850,947,200* | | *1,915.97* | *53.50* |
| Dauphin | Off-Network | N/A | N/A | 605.25 | 6.30 |
| | Rural Restricted | 412,731,770 | 25.7 | 156.33 | 9.04 |
| | Rural UnRestricted | 865,357,527 | 39.8 | 156.92 | 9.87 |
| | Urban Restricted | 1,292,923,475 | 57.3 | 315.87 | 13.16 |
| | Urban UnRestricted | 1,083,642,709 | 32.9 | 121.74 | 12.38 |
| | *Subtotal* | *3,654,655,481* | | *1,356.11* | *50.75* |
| Off-Model Project Emission Benefits | | | | 0.00 | 0.00 |
| **Region Total** | | **7,505,602,682** | | **3,272.08** | **104.24** |
| | | | **(Kg/Year)** | **2,968,378** | **94,569** |

**2022 Annual PM2.5 by Source Type**

| County | Source Type | Annual VMT | Emissoins (Tons/Year) | |
|---|---|---|---|---|
| | | | NOx | $PM_{2.5}$ |
| Cumberland | Motorcycle | 18,152,884 | 14.93 | 0.57 |
| | Passenger Car | 1,432,868,300 | 232.52 | 15.74 |
| | Passenger Truck | 928,484,200 | 678.09 | 19.13 |
| | Light Commercial Truck | 235,430,700 | 177.90 | 5.17 |
| | Intercity Bus | 659,569 | 4.45 | 0.18 |
| | Transit Bus | 3,214,912 | 14.66 | 0.32 |
| | School Bus | 1,266,926 | 4.77 | 0.25 |
| | Refuse Truck | 6,827,670 | 19.79 | 0.75 |
| | Single Unit Short-haul Truck | 141,450,675 | 189.89 | 8.45 |
| | Single Unit Long-haul Truck | 7,760,137 | 10.73 | 0.49 |
| | Motor Home | 5,390,943 | 11.98 | 0.56 |
| | Combination Short-haul Truck | 54,656,903 | 158.89 | 5.52 |
| | Combination Long-haul Truck | 186,529,596 | 1,577.95 | 38.07 |
| | *Subtotal* | *3,022,693,415* | *3,096.55* | *95.21* |
| Dauphin | Motorcycle | 18,583,941 | 15.71 | 0.56 |
| | Passenger Car | 1,466,895,930 | 245.44 | 15.59 |
| | Passenger Truck | 950,538,650 | 706.66 | 18.99 |
| | Light Commercial Truck | 241,011,110 | 185.63 | 5.16 |
| | Intercity Bus | 448,937 | 3.03 | 0.13 |
| | Transit Bus | 5,501,100 | 24.52 | 0.58 |
| | School Bus | 960,812 | 3.54 | 0.20 |
| | Refuse Truck | 6,805,550 | 19.89 | 0.80 |
| | Single Unit Short-haul Truck | 140,929,460 | 191.67 | 8.64 |
| | Single Unit Long-haul Truck | 7,719,677 | 10.87 | 0.51 |
| | Motor Home | 5,371,490 | 11.83 | 0.54 |
| | Combination Short-haul Truck | 54,433,766 | 159.05 | 5.85 |
| | Combination Long-haul Truck | 185,851,680 | 1,146.89 | 35.65 |
| | *Subtotal* | *3,085,052,103* | *2,724.72* | *93.19* |
| Off-Model Project Emission Benefits | | | 0.00 | 0.00 |
| **Region Total** | | **6,107,745,518 (Kg/Year)** | **5,821.27 5,280,968** | **188.40 170,912** |

**2025 Annual $PM_{2.5}$ by Source Type**

| County | Source Type | Annual VMT | Emissoins (Tons/Year) | |
|---|---|---|---|---|
| | | | NOx | $PM_{2.5}$ |
| Cumberland | Motorcycle | 18,933,001 | 15.46 | 0.59 |
| | Passenger Car | 1,494,448,200 | 186.44 | 15.07 |
| | Passenger Truck | 968,374,900 | 458.62 | 17.45 |
| | Light Commercial Truck | 245,556,030 | 123.06 | 4.64 |
| | Intercity Bus | 756,106 | 3.73 | 0.15 |
| | Transit Bus | 3,442,226 | 11.37 | 0.26 |
| | School Bus | 1,344,187 | 3.78 | 0.19 |
| | Refuse Truck | 7,372,968 | 15.19 | 0.55 |
| | Single Unit Short-haul Truck | 152,508,339 | 153.39 | 6.66 |
| | Single Unit Long-haul Truck | 8,358,723 | 8.75 | 0.38 |
| | Motor Home | 5,813,399 | 9.63 | 0.46 |
| | Combination Short-haul Truck | 58,902,738 | 124.41 | 4.17 |
| | Combination Long-haul Truck | 201,144,988 | 1,444.64 | 29.86 |
| | *Subtotal* | *3,166,955,805* | *2,558.47* | *80.42* |
| Dauphin | Motorcycle | 19,058,073 | 15.98 | 0.56 |
| | Passenger Car | 1,504,321,370 | 194.21 | 14.66 |
| | Passenger Truck | 974,779,360 | 471.42 | 17.00 |
| | Light Commercial Truck | 247,170,410 | 126.64 | 4.55 |
| | Intercity Bus | 503,095 | 2.49 | 0.10 |
| | Transit Bus | 5,870,944 | 18.95 | 0.47 |
| | School Bus | 1,021,636 | 2.81 | 0.15 |
| | Refuse Truck | 7,282,977 | 15.17 | 0.58 |
| | Single Unit Short-haul Truck | 150,827,050 | 153.94 | 6.74 |
| | Single Unit Long-haul Truck | 8,275,156 | 8.86 | 0.40 |
| | Motor Home | 5,747,721 | 9.46 | 0.44 |
| | Combination Short-haul Truck | 58,280,235 | 124.05 | 4.42 |
| | Combination Long-haul Truck | 198,898,290 | 990.08 | 27.52 |
| | *Subtotal* | *3,182,036,318* | *2,134.06* | *77.60* |
| Off-Model Project Emission Benefits | | | 0.00 | 0.00 |
| **Region Total** | | **6,348,992,123** | **4,692.53** | **158.02** |
| | | **(Kg/Year)** | **4,256,995** | **143,352** |

**2035 Annual $PM_{2.5}$ by Source Type**

| County | Source Type | Annual VMT | Emissoins (Tons/Year) | |
|---|---|---|---|---|
| | | | NOx | $PM_{2.5}$ |
| Cumberland | Motorcycle | 21,507,169 | 17.40 | 0.65 |
| | Passenger Car | 1,697,638,200 | 112.60 | 12.55 |
| | Passenger Truck | 1,100,044,300 | 163.44 | 13.11 |
| | Light Commercial Truck | 278,933,700 | 45.13 | 3.37 |
| | Intercity Bus | 971,399 | 1.48 | 0.05 |
| | Transit Bus | 4,122,810 | 5.82 | 0.14 |
| | School Bus | 1,555,863 | 1.65 | 0.05 |
| | Refuse Truck | 8,849,578 | 11.92 | 0.38 |
| | Single Unit Short-haul Truck | 183,035,455 | 118.95 | 5.20 |
| | Single Unit Long-haul Truck | 10,030,684 | 7.02 | 0.27 |
| | Motor Home | 6,975,947 | 5.29 | 0.25 |
| | Combination Short-haul Truck | 70,702,599 | 95.29 | 2.78 |
| | Combination Long-haul Truck | 241,395,872 | 1,293.58 | 15.81 |
| | *Subtotal* | *3,625,763,576* | *1,879.57* | *54.61* |
| Dauphin | Motorcycle | 20,625,445 | 17.02 | 0.59 |
| | Passenger Car | 1,628,030,800 | 113.32 | 11.63 |
| | Passenger Truck | 1,054,951,100 | 161.15 | 12.27 |
| | Light Commercial Truck | 267,501,950 | 44.72 | 3.17 |
| | Intercity Bus | 651,245 | 1.02 | 0.04 |
| | Transit Bus | 6,907,830 | 9.77 | 0.27 |
| | School Bus | 1,162,145 | 1.26 | 0.05 |
| | Refuse Truck | 8,601,853 | 11.91 | 0.42 |
| | Single Unit Short-haul Truck | 177,891,560 | 119.34 | 5.30 |
| | Single Unit Long-haul Truck | 9,763,271 | 7.17 | 0.29 |
| | Motor Home | 6,779,205 | 5.20 | 0.24 |
| | Combination Short-haul Truck | 68,726,779 | 95.08 | 3.07 |
| | Combination Long-haul Truck | 234,622,890 | 769.98 | 14.29 |
| | *Subtotal* | *3,486,216,073* | *1,356.93* | *51.62* |
| Off-Model Project Emission Benefits | | | 0.00 | 0.00 |
| **Region Total** | | **7,111,979,649 (Kg/Year)** | **3,236.50 2,936,105** | **106.23 96,373** |

**2040 Annual $PM_{2.5}$ by Source Type**

| County | Source Type | Annual VMT | Emissoins (Tons/Year) | |
|---|---|---|---|---|
| | | | NOx | $PM_{2.5}$ |
| Cumberland | Motorcycle | 22,767,057 | 18.49 | 0.69 |
| | Passenger Car | 1,797,083,400 | 102.87 | 11.96 |
| | Passenger Truck | 1,164,480,100 | 127.13 | 11.76 |
| | Light Commercial Truck | 295,279,500 | 35.33 | 3.09 |
| | Intercity Bus | 1,085,517 | 1.36 | 0.04 |
| | Transit Bus | 4,446,513 | 5.85 | 0.14 |
| | School Bus | 1,671,314 | 1.52 | 0.04 |
| | Refuse Truck | 9,572,348 | 12.77 | 0.41 |
| | Single Unit Short-haul Truck | 198,197,421 | 126.26 | 5.61 |
| | Single Unit Long-haul Truck | 10,866,102 | 7.47 | 0.29 |
| | Motor Home | 7,554,351 | 5.27 | 0.26 |
| | Combination Short-haul Truck | 76,569,130 | 101.03 | 2.95 |
| | Combination Long-haul Truck | 261,374,448 | 1,370.61 | 16.24 |
| | *Subtotal* | *3,850,947,200* | *1,915.97* | *53.50* |
| Dauphin | Motorcycle | 21,525,748 | 17.82 | 0.62 |
| | Passenger Car | 1,699,098,200 | 102.20 | 10.89 |
| | Passenger Truck | 1,101,002,360 | 124.05 | 10.79 |
| | Light Commercial Truck | 279,172,910 | 34.65 | 2.84 |
| | Intercity Bus | 733,577 | 0.95 | 0.03 |
| | Transit Bus | 7,405,222 | 9.94 | 0.29 |
| | School Bus | 1,236,472 | 1.18 | 0.04 |
| | Refuse Truck | 9,236,923 | 12.81 | 0.47 |
| | Single Unit Short-haul Truck | 191,301,820 | 127.40 | 5.84 |
| | Single Unit Long-haul Truck | 10,479,702 | 7.68 | 0.32 |
| | Motor Home | 7,291,894 | 5.20 | 0.25 |
| | Combination Short-haul Truck | 73,901,014 | 101.19 | 3.36 |
| | Combination Long-haul Truck | 252,269,640 | 811.04 | 15.00 |
| | *Subtotal* | *3,654,655,481* | *1,356.11* | *50.75* |
| Off-Model Project Emission Benefits | | | 0.00 | 0.00 |
| **Region Total** | | **7,505,602,682** | **3,272.08** | **104.24** |
| | | **(Kg/Year)** | **2,968,378** | **94,569** |

**2022 Annual $PM_{2.5}$ by Emission Process**

| County | Emission Process | ProcessID | Emissoins (Tons/Year) | |
|---|---|---|---|---|
| | | | NOx | $PM_{2.5}$ |
| Cumberland | Running Exhaust | 1 | 1,890.73 | 53.81 |
| | Start Exhaust | 2 | 406.62 | 9.06 |
| | Brakewear | 9 | 0.00 | 11.37 |
| | Tirewear | 10 | 0.00 | 5.26 |
| | Evap Permeation | 11 | 0.00 | 0.00 |
| | Evap Fuel Vapor Venting | 12 | 0.00 | 0.00 |
| | Evap Fuel Leaks | 13 | 0.00 | 0.00 |
| | Crankcase Running Exhaust | 15 | 0.68 | 7.88 |
| | Crankcase Start Exhaust | 16 | 0.02 | 0.10 |
| | Crankcase Extended Idle Exhaust | 17 | 0.18 | 1.23 |
| | Extended Idle Exhaust | 90 | 769.65 | 4.83 |
| | Auxiliary Power Exhaust | 91 | 28.67 | 1.67 |
| | *Subtotal* | | *3,096.55* | *95.21* |
| Dauphin | Running Exhaust | 1 | 1,909.04 | 53.89 |
| | Start Exhaust | 2 | 452.14 | 10.10 |
| | Brakewear | 9 | 0.00 | 11.56 |
| | Tirewear | 10 | 0.00 | 5.37 |
| | Evap Permeation | 11 | 0.00 | 0.00 |
| | Evap Fuel Vapor Venting | 12 | 0.00 | 0.00 |
| | Evap Fuel Leaks | 13 | 0.00 | 0.00 |
| | Crankcase Running Exhaust | 15 | 0.68 | 8.66 |
| | Crankcase Start Exhaust | 16 | 0.02 | 0.11 |
| | Crankcase Extended Idle Exhaust | 17 | 0.08 | 0.56 |
| | Extended Idle Exhaust | 90 | 349.72 | 2.19 |
| | Auxiliary Power Exhaust | 91 | 13.03 | 0.76 |
| | *Subtotal* | | *2,724.72* | *93.19* |
| Off-Model Project Emission Benefits | | | 0.00 | 0.00 |
| **Region Total** | | | **5,821.27** | **188.40** |
| | **(Kg/Year)** | | **5,280,968** | **170,912** |

**2025 Annual $PM_{2.5}$ by Emission Process**

| County | Emission Process | ProcessID | Emissoins (Tons/Year) | |
|---|---|---|---|---|
| | | | NOx | $PM_{2.5}$ |
| Cumberland | Running Exhaust | 1 | 1,410.54 | 41.75 |
| | Start Exhaust | 2 | 314.79 | 7.98 |
| | Brakewear | 9 | 0.00 | 12.06 |
| | Tirewear | 10 | 0.00 | 5.53 |
| | Evap Permeation | 11 | 0.00 | 0.00 |
| | Evap Fuel Vapor Venting | 12 | 0.00 | 0.00 |
| | Evap Fuel Leaks | 13 | 0.00 | 0.00 |
| | Crankcase Running Exhaust | 15 | 0.42 | 6.36 |
| | Crankcase Start Exhaust | 16 | 0.01 | 0.09 |
| | Crankcase Extended Idle Exhaust | 17 | 0.12 | 1.02 |
| | Extended Idle Exhaust | 90 | 797.08 | 3.56 |
| | Auxiliary Power Exhaust | 91 | 35.50 | 2.06 |
| | *Subtotal* | | *2,558.47* | *80.42* |
| Dauphin | Running Exhaust | 1 | 1,409.29 | 41.19 |
| | Start Exhaust | 2 | 346.15 | 8.80 |
| | Brakewear | 9 | 0.00 | 12.07 |
| | Tirewear | 10 | 0.00 | 5.57 |
| | Evap Permeation | 11 | 0.00 | 0.00 |
| | Evap Fuel Vapor Venting | 12 | 0.00 | 0.00 |
| | Evap Fuel Leaks | 13 | 0.00 | 0.00 |
| | Crankcase Running Exhaust | 15 | 0.42 | 6.85 |
| | Crankcase Start Exhaust | 16 | 0.02 | 0.10 |
| | Crankcase Extended Idle Exhaust | 17 | 0.06 | 0.46 |
| | Extended Idle Exhaust | 90 | 362.02 | 1.61 |
| | Auxiliary Power Exhaust | 91 | 16.12 | 0.94 |
| | *Subtotal* | | *2,134.06* | *77.60* |
| Off-Model Project Emission Benefits | | | 0.00 | 0.00 |
| **Region Total** | | | **4,692.53** | **158.02** |
| | **(Kg/Year)** | | **4,256,995** | **143,352** |

**2035 Annual $PM_{2.5}$ by Emission Process**

| County | Emission Process | ProcessID | Emissoins (Tons/Year) | |
|---|---|---|---|---|
| | | | NOx | $PM_{2.5}$ |
| Cumberland | Running Exhaust | 1 | 776.68 | 19.69 |
| | Start Exhaust | 2 | 156.62 | 4.96 |
| | Brakewear | 9 | 0.00 | 14.45 |
| | Tirewear | 10 | 0.00 | 6.40 |
| | Evap Permeation | 11 | 0.00 | 0.00 |
| | Evap Fuel Vapor Venting | 12 | 0.00 | 0.00 |
| | Evap Fuel Leaks | 13 | 0.00 | 0.00 |
| | Crankcase Running Exhaust | 15 | 0.02 | 4.24 |
| | Crankcase Start Exhaust | 16 | 0.01 | 0.06 |
| | Crankcase Extended Idle Exhaust | 17 | 0.01 | 0.65 |
| | Extended Idle Exhaust | 90 | 894.67 | 1.16 |
| | Auxiliary Power Exhaust | 91 | 51.56 | 3.00 |
| | *Subtotal* | | *1,879.57* | *54.61* |
| Dauphin | Running Exhaust | 1 | 766.39 | 18.64 |
| | Start Exhaust | 2 | 168.32 | 5.36 |
| | Brakewear | 9 | 0.00 | 14.76 |
| | Tirewear | 10 | 0.00 | 6.26 |
| | Evap Permeation | 11 | 0.00 | 0.00 |
| | Evap Fuel Vapor Venting | 12 | 0.00 | 0.00 |
| | Evap Fuel Leaks | 13 | 0.00 | 0.00 |
| | Crankcase Running Exhaust | 15 | 0.02 | 4.40 |
| | Crankcase Start Exhaust | 16 | 0.01 | 0.06 |
| | Crankcase Extended Idle Exhaust | 17 | 0.00 | 0.29 |
| | Extended Idle Exhaust | 90 | 399.18 | 0.52 |
| | Auxiliary Power Exhaust | 91 | 23.01 | 1.34 |
| | *Subtotal* | | *1,356.93* | *51.62* |
| Off-Model Project Emission Benefits | | | 0.00 | 0.00 |
| **Region Total** | | | **3,236.50** | **106.23** |
| | **(Kg/Year)** | | **2,936,105** | **96,373** |

**2040 Annual $PM_{2.5}$ by Emission Process**

| County | Emission Process | ProcessID | Emissoins (Tons/Year) | |
|---|---|---|---|---|
| | | | NOx | $PM_{2.5}$ |
| Cumberland | Running Exhaust | 1 | 757.62 | 17.50 |
| | Start Exhaust | 2 | 141.38 | 3.74 |
| | Brakewear | 9 | 0.00 | 15.86 |
| | Tirewear | 10 | 0.00 | 6.84 |
| | Evap Permeation | 11 | 0.00 | 0.00 |
| | Evap Fuel Vapor Venting | 12 | 0.00 | 0.00 |
| | Evap Fuel Leaks | 13 | 0.00 | 0.00 |
| | Crankcase Running Exhaust | 15 | 0.01 | 4.44 |
| | Crankcase Start Exhaust | 16 | 0.01 | 0.05 |
| | Crankcase Extended Idle Exhaust | 17 | 0.00 | 0.67 |
| | Extended Idle Exhaust | 90 | 960.44 | 1.10 |
| | Auxiliary Power Exhaust | 91 | 56.51 | 3.28 |
| | *Subtotal* | | *1,915.97* | *53.50* |
| Dauphin | Running Exhaust | 1 | 750.86 | 16.53 |
| | Start Exhaust | 2 | 149.72 | 3.99 |
| | Brakewear | 9 | 0.00 | 16.68 |
| | Tirewear | 10 | 0.00 | 6.63 |
| | Evap Permeation | 11 | 0.00 | 0.00 |
| | Evap Fuel Vapor Venting | 12 | 0.00 | 0.00 |
| | Evap Fuel Leaks | 13 | 0.00 | 0.00 |
| | Crankcase Running Exhaust | 15 | 0.01 | 4.61 |
| | Crankcase Start Exhaust | 16 | 0.01 | 0.05 |
| | Crankcase Extended Idle Exhaust | 17 | 0.00 | 0.30 |
| | Extended Idle Exhaust | 90 | 430.21 | 0.49 |
| | Auxiliary Power Exhaust | 91 | 25.31 | 1.47 |
| | *Subtotal* | | *1,356.11* | *50.75* |
| Off-Model Project Emission Benefits | | | 0.00 | 0.00 |
| **Region Total** | | | **3,272.08** | **104.24** |
| | **(Kg/Year)** | | **2,968,378** | **94,569** |

# ATTACHMENT C

## Sample MOVES Data Importer (XML) Input File
## and
## Run Specification (MRS) Input File

**(Sample for 2022 Annual Runs)**

## MOVES County Data Manager Importer File – Annual Run (MOVESIMPORTER.XML)

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## MOVES Run Specification File – Annual Run (MOVESRUN.MRS)

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Exhaust"/>
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