# Air Quality Conformity Determination

For the New Castle County, Delaware Portion of the PA-NJ-MD-DE 8-hour Ozone Nonattainment Area & PA-NJ-DE Fine Particulate Matter ($PM_{2.5}$) Maintenance Area

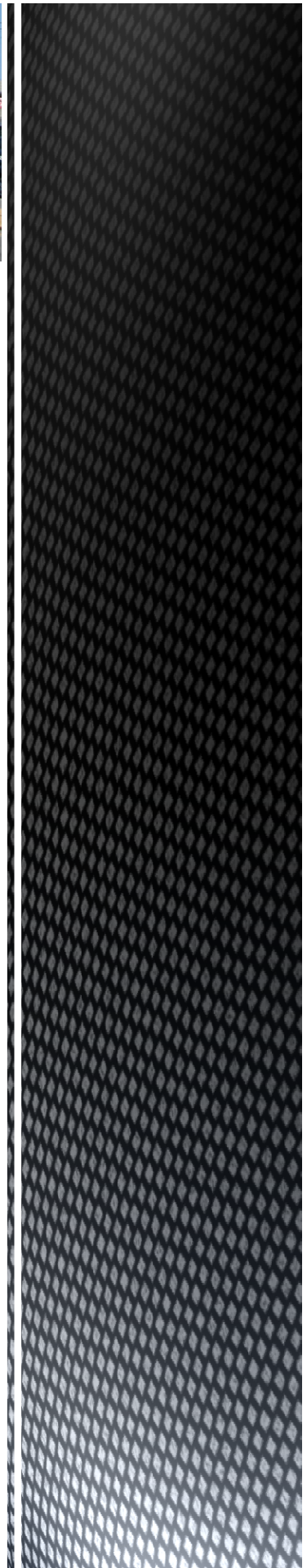FY2017–2020 Transportation Improvement Program And 2040 Regional Transportation Plan

September 2016

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# Introduction

This report demonstrates transportation conformity of the Wilmington Area Planning Council's (WILMAPCO) Amended Fiscal Year (FY) 2017-2020 Transportation Improvement Program (TIP) and Amended 2040 Regional Transportation Plan (RTP) for the New Castle County, Delaware portion of the PA-NJ-MD-DE 8-hour ozone and PA-NJ-DE fine particulate matter (PM2.5) nonattainment areas.

WILMAPCO is the Metropolitan Planning Organization (MPO) for New Castle County, Delaware and Cecil County, Maryland. It is designated by the governors of both states to plan for, coordinate, and program the many transportation investments in the region. Under federal law and regulation, all plans and programs that involve federal funds or are of regional significance must be reviewed and approved through WILMAPCO.

WILMAPCO is responsible for developing a Transportation Improvement Program (TIP) and a regional long-range transportation plan (RTP) in cooperation with the Maryland Department of Transportation (MDOT), the Delaware Department of Transportation (DelDOT) and affected transit operators. In accordance with federal planning requirements, a collaborative process has been developed wherein state, county and local governments and transportation providers are partners in the planning and programming process.

As the Federally-designated MPO for New Castle County, Delaware and Cecil County, Maryland, WILMAPCO is required by law to demonstrate that the RTP and TIP conform to the transportation emission budgets set forth in the Statewide Implementation Plan (SIP) for each state. If emissions generated from the projects programmed in the TIP and RTP are equal to or less than the emission budgets in the SIPs, then conformity has been demonstrated.

## *8-hour Ozone Background*

Ozone is an odorless, colorless, gas and is created by a reaction between nitrogen oxides (NOx) and volatile organic compounds (VOC) in the presence of sunlight. While ozone in the stratosphere forms a protective layer, shielding the earth from the sun's harmful rays, ground level ozone is a key contributor to smog. Motor vehicle exhaust, industrial emissions, gasoline vapors, chemical solvents, and natural sources all contribute to NOx and VOC emissions. Since ozone is formed in the presence of heat and sunlight, it is considered a summertime pollutant.
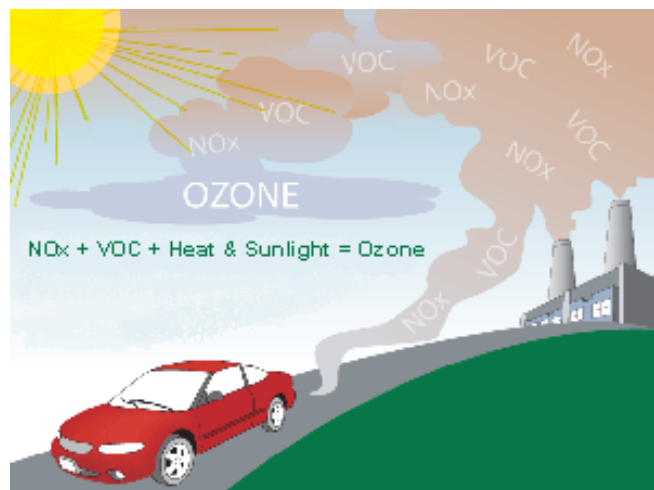
Ozone exposure is detrimental to public health.  Ozone can irritate lung airways and cause inflammation similar to sunburn. Other symptoms include wheezing, coughing, and pain when taking a deep breath and breathing difficulties during exercise or outdoor activities. People with respiratory problems, children and the elderly are most vulnerable, but even healthy people that are active outdoors can be affected when ozone levels are high. Even at very low levels, ground-level ozone triggers a variety of health problems including aggravated asthma, reduced lung capacity, and increased susceptibility to respiratory illnesses such as pneumonia and bronchitis.

In addition to adverse health effects, ground-level ozone also interferes with the ability of plants to produce and store food, which makes them more susceptible to disease, insects, other pollutants, and harsh weather. As a result, ground-level ozone negatively impacts both agricultural productivity and ecosystem stability.  Furthermore, ozone damages the leaves of trees and other plants, ruining the appearance of cities, national parks, and recreation areas.

### *8-Hour Ozone National Ambient Air Quality Standards*

On May 21, 2012, the Environmental Protection Agency (EPA) issued a final rule via the Federal Register (77 FR 30088) establishing initial air quality designations for the 2008 primary and secondary NAAQS for ozone.  The 2008 standard is set at an 8-hour average concentration of 0.075 ppm and retains the same general form and averaging time as the 0.080 ppm NAAQS set in 1997.  The effective date of the 2008 ozone standard designations was July 20, 2012.

Areas across the United States that have failed to meet the standards outlined above have been designated as nonattainment areas and, as a result, are subject to transportation conformity. Transportation conformity requires nonattainment and maintenance areas to demonstrate that all future transportation projects will not hinder the area from reaching and maintaining its attainment goals. In particular, the projects will not:

- *Cause or contribute to new air quality violations*
- *Worsen existing violations*
- *Delay timely attainment of the relevant NAAQS*

The PA-NJ-MD-DE area is classified as a marginal nonattainment area, resulting in an attainment date of December 31, 2015.  It is made up of 16 counties spanning the states of Pennsylvania, New Jersey, Maryland and Delaware.  The counties of Sussex and Kent in Delaware will no longer be included in the PA-NJ-MD-DE nonattainment area under the 2008 standard.

In October 2015, EPA lowered the standard to 0.70 ppm. Nonattainment area designations are expected next year.

## PM2.5 Background

Fine particulate matter (PM2.5 hereafter) is a mixture of microscopic solids and liquid droplets suspended in the air, where the size of the particles is less than 2.5 µm (or about one-thirtieth the diameter of a human hair). Fine particles can be emitted directly (such as smoke from a fire, or as a component of automobile exhaust) or be formed indirectly in the air from power plant, industrial and mobile source emissions of gases such as sulfur dioxide and nitrogen oxides.

HUMAN HAIR
50-70 µm
(microns) in diameter

PM2.5
Combustion particles, organic
compounds, metals, etc.
< 2.5 µm (microns) in diameter

PM10
Dust, pollen, mold, etc.
<10 µm (microns) in diameter

90 µm (microns) in diameter
FINE BEACH SAND

Image courtesy of the U.S. EPA

The health effects associated with exposure to fine particles are significant. Scientific studies have shown significant associations between elevated fine particle levels and premature death. Effects associated with fine particle exposure include aggravation of respiratory and cardiovascular disease (as indicated by increased hospital admissions, emergency room visits, absences from school or work, and restricted activity days), lung disease, decreased lung function, asthma attacks, and certain cardiovascular problems such as heart attacks and cardiac arrhythmia. While fine particles are unhealthy for anyone to breathe, people with heart or lung disease, asthmatics, older adults, and children are especially at risk.

## PM2.5 National Ambient Air Quality Standards

In July 1997, the EPA issued NAAQS for PM2.5, designed to protect the public from exposure to PM2.5 at levels that may cause health problems. That standard included two elements:

1) An annual standard set at 15 µg/m$^3$, based on a three-year average of the annual mean PM2.5 concentrations, and

2) A 24-hour standard of 65 µg/m$^3$, based on a three-year average of the 98$^{th}$ percentile of 24-hour concentrations.

Areas need to meet both standards to be considered in attainment of PM2.5 NAAQS[1].

On April 5, 2005, EPA designations under the PM2.5 NAAQS became effective, under which the region consisting of New Castle County in Delaware, Bucks, Chester, Delaware, Montgomery, and Philadelphia counties in Pennsylvania, and Burlington, Camden and Gloucester counties in New Jersey were collectively designated as a nonattainment area. This region is known as the Philadelphia-Wilmington, PA-NJ-DE PM2.5 Nonattainment Area.

In December 2006, the EPA revised the 24-hour standard from 65 µg/m$^3$ to 35 µg/m$^3$. Three years later, in December 2009, the EPA designated the Philadelphia-Wilmington, PA-NJ-DE PM2.5 Nonattainment Area in nonattainment for the 24-hour standard. The October 2011 PM2.5 SIP's PM2.5 emission budget, calculated using the MOVES model, was found adequate for conformity purposes by EPA in December 2013.

On August 5, 2014, the EPA approved Delaware's request to redesignate to attainment the Delaware portion of the Philadelphia-Wilmington, PA-NJ-DE PM2.5 Nonattainment Area for both the 1997 annual and the 2006 24-hour PM2.5 standards. The EPA simultaneously approved the New Castle County PM2.5 Maintenance Plan, which requires conformity analyses using motor vehicle emission budgets associated with the 1997 annual in the 2006 24-hour PM2.5 standards. The effective date of this final rule was September 4, 2014.

### Status of the Amended 2040 RTP and Amended FY 2017-2020 TIP

As the regional transportation-planning agency for Cecil County, Maryland and New Castle County, Delaware, WILMAPCO is charged with authoring a long-range transportation plan with at least a 20-year planning horizon. The RTP presents recommendations for enhanced transportation efficiency and functionality, including the construction of new facilities, improved connectivity to multiple travel modes, and the enhancement of existing highway, transit, and bicycle/pedestrian facilities. Transportation projects that address challenges faced by the region are identified in this plan and placed in the four-year TIP that corresponds to that project's development timetable.

The 2015 Update to the 2040 RTP and the Amended Fiscal Year (FY) 2017 – 2020 TIP were created by the WILMAPCO staff and member agencies. The RTP and present conformity analysis were adopted by the WILMAPCO Council in January 2015. The Amended FY 2017 TIP is set for Council adoption in September 2016.

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[1] Meeting the PM2.5 standards nationwide is estimated to prevent at least 15,000 premature deaths; 75,000 cases of chronic bronchitis; 10,000 hospital admissions for respiratory and cardiovascular disease; hundreds of thousands of occurrences of aggravated asthma; and 3.1 million days when people miss work because they are suffering from symptoms related to particle pollution exposure.

## Interagency Consultation

As required by the federal transportation conformity rule (40 CFR 93.105) the conformity process includes cooperative interaction among the federal, state and local agencies. Interagency consultation requirements include coordination with the local county representatives, the MPO and representatives from both state and federal agencies including:

- WILMAPCO
- Maryland Department of the Environment (MDE)
- Maryland Department of Transportation (MDOT)
- Delaware Transit Corporation (DTC)
- Delaware Department of Transportation (DelDOT)
- Delaware Department of Natural Resources and Environmental Control (DNREC)
- Cecil County
- New Castle County
- Federal Highway Administration (FHWA)
- Environmental Protection Agency (EPA)
- Federal Transit Administration (FTA)

As part of the interagency consultation, the Technical Advisory Committee (TAC) and Air Quality Subcommittee (AQS) groups met and collaborated in order to achieve the following goals related to the transportation conformity process:

- Determine planning assumptions
- Develop a definitive list of future year projects to be analyzed
- Develop a format for presenting determination
- Develop and standardize the public participation process

Meeting minutes and notes are available at the following webpages:
- http://www.wilmapco.org/aqs/
- http://www.wilmapco.org/tac/

## Determine Planning Assumptions

*Ozone*

The emissions resulting from the implementation of regionally significant transportation projects (those which do not qualify as exempt under 40 CFR 93.126 and 127) will be compared to the Delaware Department of Natural Resources and the Environmental Control's (DNREC) Motor Vehicle Emissions Budget (MVEB).

The ozone emissions budgets of record were developed by DNREC using the MOBILE6b model for 2009. The following budgets were used:

- VOC: 9.89 tons/summer day
- NOx: 19.23 tons/summer day

The EPA regulations, as outlined in the Final Transportation Conformity Rule, Section 93.118, require that emissions analyses for the following years:

- Attainment year
- A near-term year, one-to-five years in the future
- The last year of the RTP's forecast period
- An intermediate year or years such that analyses years are no more than ten years apart.

The following three analysis years were chosen for the ozone analysis:

- 2020 (near-term year)
- 2030 (interim year to keep analysis years less than ten years apart)
- 2040 (WILMAPCO Plan horizon year)

As discussed above, ozone formation is a direct result of VOC and NOx emissions reacting with each other in the presence of sunlight. The EPA has ruled that both precursor emissions, VOC and NOx, must be included in a regional analysis of 8-hour ozone for transportation conformity.

## *PM2.5*

PM2.5 can result from both direct and indirect sources. Gasoline and diesel on-road vehicles emit both direct PM2.5 and other gases that react in the air to form PM2.5. Transportation-related direct PM2.5 emissions can result from particles in exhaust fumes, from brake and tire wear, from road dust kicked up by vehicles, and from highway and transit construction. Transportation-related indirect PM2.5 emissions can result from one or more of several exhaust components, including nitrogen oxides (NOx), volatile organic compounds (VOCs), sulfur oxides (SOx), and ammonia ($NH_3$).

For the regional analysis of direct PM2.5 emissions, the EPA has ruled that both exhaust and brake/tire wear must be included. However, EPA has ruled that regional emissions analyses for direct PM2.5 should include road dust only if road dust is found to be a significant contributor to PM2.5 by either the EPA Regional Administrator or a state air agency. For this nonattainment area, neither of the EPA Regional Administrators nor any of the three state air agencies have found that road dust is a significant PM2.5 contributor. EPA has also ruled that regional direct PM2.5 analyses need only include fugitive dust from construction of transportation projects if the SIP identifies these emissions as significant contributors to the regional PM2.5 problem. The current submitted PM2.5 SIP has not deemed construction-related dust as a contributor to the regional PM2.5 problem.

Thus, the only components of direct PM2.5 emissions to be considered in the nonattainment area are tailpipe exhaust and brake/tire wear.

For the regional analysis of indirect PM2.5 emissions (also called PM2.5 precursors), the EPA has identified four potential transportation-related PM2.5 precursors: NOx, VOCs, SOx, and $NH_3$. The current PM2.5 SIP does not identify any precursors identified other than NOx as a significant contributor of PM2.5 emissions in New Castle County.

The following PM2.5 pollutants and precursors were tested:

- Direct PM2.5 source: tailpipe exhaust, brake and tire wear
- PM2.5 Precursor: NOx

The PM2.5 emissions budget of record were developed by DNREC using the MOVES model (described later) for 2012. The following budgets were used:

- Direct PM2.5 2012 budget: 199.0 tons/year (0.545 tons/day)
- Indirect (NOx) PM2.5 2012 budget: 6,273 tons/year (17.19 tons/day)

EPA regulations require that emissions analysis be conducted for specific analysis years. Section 93.119(g) of the *Final Rule* states that these analysis years must include a near-term year (one-to-five years in the future), the last year of the long range plan, and an intermediate year or years such that analysis years are no more than 10 years apart. Additionally, the 2015 analysis year meets a conformity requirement to test conformity for the attainment year.

The following analysis years were chosen for the PM2.5 analysis:

- 2020 (near-term year)
- 2030 (interim year to keep analysis years less than ten years apart)
- 2040 (WILMAPCO Plan horizon year)

## Travel Demand Modeling Methodology

The air quality analysis conducted for the Amended FY 2017-2020 TIP and Amended 2040 RTP used a series of computer-based modeling techniques. These techniques are consistent with methods WILMAPCO and DelDOT have used in conducting air quality analyses required by the CAA amendments, and are similar to those used by other state and regional transportation agencies in preparing air quality analyses. They are also consistent with the modeling procedures WILMAPCO and DelDOT have used assisting in the preparation of various SIP documents with the Delaware Department of Natural Resources and Environmental Control (DNREC).

*Travel Demand Modeling*

A travel demand model for Delaware, including New Castle County, is maintained by DelDOT. The model applies a variety of data regarding roadway network conditions, vehicular travel patterns, automobile ownership, and the location of population and employment sites. The model follows a five-step process of trip generation, distribution, mode split, assignment, and feedback that is commonly used throughout the transportation planning industry. The model components were processed through the CUBE Voyager software package. The primary products of the model used in the air quality analysis were estimated volumes and average speeds for each segment or "link" of the roadway system.

The modeling process developed for the Amended FY 2017-2020 TIP and this update of the 2040 RTP used a 2012 base year network validated against DelDOT traffic counts for 2012. Model networks were developed for the years 2020, 2030, and 2040 for New Castle County. Networks included major capacity improvement projects that are expected to be in place and open to service during these years. The types of projects tested included: roadway upgrades (such as new or improved shoulders), highway widening (one lane or more), and new construction.

Demographic projections, including employment, households, and population, were developed for each of the analysis years through the WILMAPCO Data & Demographic Subcommittee. These forecasts were recommended by the Technical Advisory Committee (TAC) and were adopted by the WILMAPCO Council in July 2014.

Travel estimates were developed for this conformity analysis using a so-called "five-step travel demand" modeling process. The approach includes trip generation, trip distribution, mode split, assignment, and feedback. This type of process is required by Federal air quality conformity regulations, and is a set of planning tools commonly used among MPOs and State DOTs.

The travel demand modeling process uses two sets of primary input data. The first is socio-economic data for Traffic Analysis Zones (TAZ) for the New Castle County MPO region. Since the modeling process maintained for WILMAPCO by the Delaware DOT (Division of Planning) uses a single, integrated model of the Delaware/Maryland portion of the Delmarva Peninsula, WILMAPCO staff have developed a subcommittee process to estimate and manage demographic data for the TAZ in New Castle County. This demographic data generally consists of:

1) Population
2) Dwelling Units
3) Total Employment by Place of Work
4) Employment by Job Sector, by Place of Work
5) Total Employed Persons (Employment by Place of Residence)
6) Average Income
7) Income Quartiles
8) Average Vehicle Ownership

9) Vehicle Ownership Quartiles

For each TAZ, data for each of these items was obtained from the most recent census and updated as needed to the base year of the long range plan. For this conformity analysis, that means data from the 2010 Census was used with other locally obtained information to develop a set of TAZ estimates for 2012. Employment by place of work is not a product of the US Census, but the WILMAPCO Demographics and Data Subcommittee used a series of local, county, and state-agency data sources to develop and achieve consensus on TAZ-based employment locations. The MPO subcommittee also developed demographic forecasts for each TAZ, for the horizon years of 2020, 2030, and 2040.

The second primary travel model input is the so-called "travel network" representation of New Castle County roadways and streets. The network file stores the following data for each street segment:

1) Functional Class (or road type)
2) Number of Lanes
3) Lane Capacity
4) Posted Speed
5) Operating Speed
6) Average Peak Period Capacity (Lanes X Lane Capacity)

The current set of DelDOT/MPO travel demand models is typical of advanced TAZ-based travel models in use in the United States. DelDOT staff (with assistance from Whitman, Requardt and Associates, an engineering consulting firm) estimated these models using data from the 1997 – 2011 Delaware Travel Monitoring Survey (DTMS). The current TAZ-based models are referred to as "aggregate demand models" because they are applied at an aggregate, zonal level with extensive market segmentation.

DTMS data for 2012 - 2015 has not been analyzed at this time and is therefore not yet a part of the DelDOT/MPO travel model process.

The trip generation models include a precursor step, which disaggregates TAZ-based household data using workers per household, persons per household, and vehicles per household data from US Census PUMS, then applies cross classification-based trip generation rates to estimate productions and attractions for each TAZ, for several trip purposes including:

1) Home-Based Work (HBW)
2) Home-Based Local Shopping (HBLS)
3) Home-Based Regional Shopping (HBRS)
4) Home-Based Other (HBO)
5) Non-Home Based (NHB)
6) Journey-to-Work (JTW)
7) Journey-at-Work (JAW)
8) Trucks

The trip distribution models are standard gravity model formulations using trip length frequencies for each trip purpose based on analysis of the entire 1997 – 2011 DTMS dataset.

The mode choice model used by DelDOT and the MPOs is a nested logic choice format. Non-motorized trips (separate modes for bicycle and walk) are included as an option in certain sets of model runs that are based on tax-parcel TAZ geography. Non-motorized trips are not currently modeled in the TAZ-based regional modeling process used for county-based conformity analyses.

The trip assignment procedures use network capacity-constrained equilibrium methods, which emphasize average weekday peak period congestion levels to allocate roadway volumes and speeds by time period of day. Four peak period times are used: AM, Midday, PM, and Offpeak. The process uses customized speed-flow delay curves representing freeway, arterial, collector, and local speeds separately.

The model process methods, as required by conformity regulations, incorporate full feedback from trip assignment back through trip distribution. The travel model was run in the CUBE Voyager software package (Version 6.1.0 of the software dated May 2, 2013) under license from the vendor, Citilabs (http://www.citilabs.com/).

*Summary*

The modeling process for this conformity analysis used a 2012 base year network validated against DelDOT traffic counts for 2012. Model networks were developed for 2020, 2030, and 2040 for New Castle County and for the Delaware/Maryland peninsula counties within the DelDOT/MPO "Peninsula Travel Model". Modeled transportation projects are listed in Table 1. The types of projects tested were corridor improvements, highway widening, and new roadway construction. Each project was added to the network in the year when the improvement was completed. Socioeconomic projects such as population, employment, and household size were developed for the same planning horizon years.

**Table 1: Cecil and New Castle Counties' Regionally Significant Projects**

| Row | Project | County | List | Model Year |
|---|---|---|---|---|
| 1 | MD 213: Frenchtown Road to US 40 (two to four lane divided highway) | Cecil | Aspiration | 2040 |
| 2 | I-95: Susquehanna River to DE Line (add a lane in each direction, plus bridge expansion | Cecil | Constrained | 2040 |
| 3 | MD 272: US 40 to Lums Rd.  (two to four lane divided highway) | Cecil | Constrained | 2040 |
| 4 | I-95/SR 222 Interchange (two to four lanes on the SR 222 bridge) | Cecil | Constrained | 2040 |
| 5 | MD 222: US 40 to MD 276 (multilane reconstruction) | Cecil | Constrained | 2040 |
| 6 | US 301: MD State Line to SR 1 (new four lane expressway) | NCC | Constrained | 2020 |
| 7 | Christina River Bridge (new bridge) | NCC | Constrained | 2020 |
| 8 | SR 72, McCoy Road to SR 71 (two to four lanes) | NCC | Constrained | 2030 |
| 9 | Road A / SR 7 Improvements (new lane in each direction) | NCC | Constrained | 2030 |
| 10 | SR 299, SR 1 to Catherine Street (widening) | NCC | Constrained | 2030 |
| 11 | Elkton Road, Maryland State Line to Casho Mill Road (widening) | NCC | Constrained | 2030 |
| 12 | SR 141/I-95 Interchange (expansion) | NCC | Constrained | 2030 |
| 13 | US 301: Spur (new two lane road) | NCC | Constrained | 2030 |
| 14 | US 40/SR 896 (grade separated intersection) | NCC | Constrained | 2030 |
| 15 | SR 1: Tybouts Corner to Roth Bridge (widening) | NCC | Constrained | 2030 |
| 16 | SR 896/I-95 Interchange (expansion) | NCC | Constrained | 2030 |
| 17 | SR 896/Bethel Church Road Interchange (expansion) | NCC | Constrained | 2030 |
| 18 | US 40 Widening: Salem Church Road to Walther Road | NCC | Constrained | 2030 |
| 19 | SR 1: Tybouts Corner to SR 273 (four to six lanes) | NCC | Constrained | 2030 |
| 20 | SR 4 (Christina Parkway): SR 2 to SR 896 (widening entire lengh 2 to 4 lanes) | NCC | Constrained | 2030 |
| 21 | Tyler McConnell Bridge, SR141: Montchanin Road to Alapocas Road (bridge expansion | NCC | Constrained | 2040 |
| 22 | I-295 Improvements Eastbound at SR 141 (add third lane) | NCC | Aspiration | 2040 |

## *Emission Factor Estimate*

EPA's Office of Transportation and Air Quality (OTAQ) developed the **MO**tor **V**ehicle **E**mission **S**imulator (MOVES) modeling software. Initial draft versions of the software were released in 2009. This is the required modeling software used in regional or countywide air quality analyses including transportation conformity analyses.  The software replaces the previous EPA tool which was called MOBILE6.2.  The MOVES software is required for use in conformity analyses after March 2013.

MOVES estimates emissions for mobile sources covering a broad range of mobile source pollutants and allows multiple scale analysis.  The MOVES software produces estimates of emissions from cars, trucks and motorcycles.

Figure 3 presents an overview of the process used to generate travel model and emissions model data for this conformity analysis.  The travel model software, CUBE Voyager, was arranged by DelDOT staff with consultant assistance to include the DNREC spreadsheet "MOVES inventory method" process for estimating mobile source emissions in New

Castle County. Essentially, DNREC staff developed an Excel-based application of the MOVES inventory method for estimating mobile source emissions. That process was incorporated, step-by-step, into the CUBE Voyager software so that conformity analysis process is based directly on the DNREC application of the MOVES inventory method. A series of quality-control checks were performed by DelDOT and the consulting firm staff ensuring the CUBE-model generated emissions data accurately replicated the DNREC spreadsheet method.

Travel model link volumes are summed to countywide totals. Adjustment factors are then used to account for seasonal traffic variations and alignment of Delaware-based Vehicle Miles Traveled (VMT) estimates with the federally-required Highway Performance Management System (HPMS). HPMS data are used to standardize the Delaware specific VMT data as required by the EPA so that direct comparisons can be made among different years and modeling scenarios.

**Figure 1: Overview of Travel Model – Emission Model Process for Conformity**
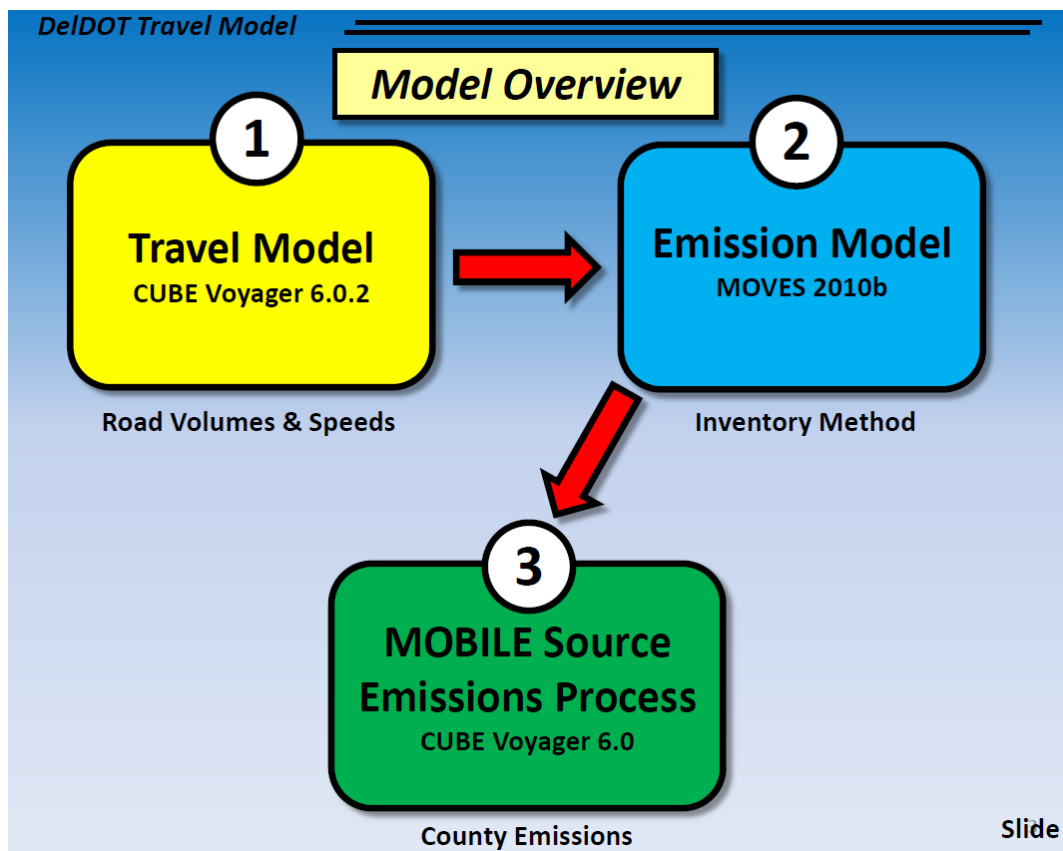
*Mobile Source Emissions Estimates*

The estimates of emissions for New Castle County are generated jointly by DelDOT and DNREC. The model post-processor takes data produced by CUBE Voyager model output for New Castle County and adjusts it for input into the MOVES mobile emissions process noted above. This process links the estimated roadway speeds and volumes generated by the travel demand model with emission trends derived from MOVES. The product of this process is countywide emission estimates presented in this document.

The VMT and emissions data for New Castle County were adjusted to be compatible with the data contained in the current SIPs. The adjustments represent factors to account for seasonal traffic variations and to align the travel demand estimates with DelDOT's and the HPMS traffic level reporting system. These data were used to standardize the Delaware specific VMT data as required by the EPA so that direct comparisons can be made among different years and modeling scenarios.

## Analysis Results

The results of the motor vehicle emissions budget tests are presented below in Tables 2 and 3 and 4. Table 2 presents the results of the budget tests for ozone emissions. Tables 3 and 4 present the results of the baseline and budget tests for PM2.5 emissions. All baselines and budget tests pass, which demonstrates conformity.

**Table 2: Ozone (VOC & NOx) Emissions Test Results – MVEB Test (tons/summer day)**

| VOC (tpsd) | 2020 | 2030 | 2040 |
|---|---|---|---|
| Emissions | 4.81 | 4.00 | 4.11 |
| 2009 Budget | 9.89 | 9.89 | 9.89 |
| Result | Pass | Pass | Pass |

| NOx (tpsd) | 2020 | 2030 | 2040 |
|---|---|---|---|
| Emissions | 9.57 | 7.10 | 7.25 |
| 2009 Budget | 19.23 | 19.23 | 19.23 |
| Result | Pass | Pass | Pass |

**Table 3: Annual PM2.5 Emissions Test Results – MVEB Test (tons/day)**

| Direct PM2.5 (tpy) | 2020 | 2030 | 2040 |
|---|---|---|---|
| Emissions | 131.2 | 113.8 | 118.8 |
| 2012 Budget | 199.0 | 199.0 | 199.0 |
| Result | Pass | Pass | Pass |

| Indirect (NOx) PM2.5 (tpy) | 2020 | 2030 | 2040 |
|---|---|---|---|
| Emissions | 3,514 | 2,624 | 2,674 |
| 2012 Budget | 6,273 | 6,273 | 6,273 |
| Result | Pass | Pass | Pass |

**Table 4: Daily PM2.5 Emissions Test Results – MVEB Test (tons/day)**

| Direct PM2.5 (tpd) | 2020 | 2030 | 2040 |
|---|---|---|---|
| Emissions | 0.304 | 0.254 | 0.265 |
| 2012 Budget | 0.545 | 0.545 | 0.545 |
| Result | Pass | Pass | Pass |

| Indirect (NOx) PM2.5 (tpd) | 2020 | 2030 | 2040 |
|---|---|---|---|
| Emissions | 9.63 | 7.19 | 7.33 |
| 2012 Budget | 17.19 | 17.19 | 17.19 |
| Result | Pass | Pass | Pass |

*Description of 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 include traffic flow characteristics, vehicle descriptions, fuel parameters, inspection/maintenance (I/M) program parameters, and environmental variables. MOVES includes a default national database of meteorology, vehicle fleet, vehicle activity, fuel, and emissions control program data for every county; but EPA cannot certify that the default data is the most current or best available information for any specific area. As a result, local data is recommended for use when completing a regional conformity analysis. Local data sources are used for all inputs that have a significant impact on calculated emission rates.
These data items are discussed in the following sections.

*Roadway Data*

The emission calculation process uses key traffic data from the regional travel demand model to estimate regional Vehicle Miles Traveled (VMT) and speeds. This data includes

individual roadway traffic volumes and physical roadway descriptive characteristics including area type, facility type, lanes, distances, capacity, and free-flow speeds. Travel demand model runs are produced for future analysis years and include the impact of regionally significant transportation projects. The model provides a key resource for estimating the impact of population and employment growth on roadway volumes and calculating the diversions due to transportation projects.

VMT was determined for each roadway class/setting by multiplying the length of road by the number of vehicles using the road per day. Additional adjustments to VMT included: seasonal adjustment factors reflecting traffic variation within the spring, summer, fall, and winter months (derived from permanent count station monitoring), and, Highway Performance Monitoring System (HPMS) adjustments used to align annual VMT estimates with HPMS reported totals for the base year.

Speed data was calculated for each highway segment and hour of the day, based on roadway capacity, traffic volume, and other physical roadway features (e.g. traffic signals). Thus, the travel demand model provided VMT according to the speed bins required by the MOVES software, thereby accounting for certain physical highway conditions and congestion caused by traffic volume. A speed bin is essentially an increment of speed range; for example: "VMT for the 30-35 mph range". For future horizon years, congestion (and thereby speed) can be affected by traffic growth and changes in physical conditions due to planned transportation improvements and other projects assumed to be "in-service" in horizon years.

*Vehicle Class Data*
Emission rates within MOVES vary significantly by vehicle type. The MOVES model produces emissions and rates by thirteen MOVES vehicle source types. However, VMT is input into MOVES by six HPMS vehicle groups.

For this emissions analysis, vehicle type pattern data was developed for New Castle County by functional class based on DelDOT classification counts and internal MOBILE6.2 and MOVES defaults. This follows procedures used for previous conformity analyses for WILMAPCO. The vehicle groups from the count data were expanded to the 28 MOBILE6.2 weight-based vehicle types and then, using procedures provided in EPA MOVES technical guidance the MOBILE6.2 vehicle classes were mapped to the MOVES source type and HPMS class groups.

The impact of trucks on traffic flow is accounted for within the travel demand modeling process. A heavy truck weight factor is used by functional class to adjust the rates at which increasing numbers of vehicles (congestion) cause average traveling speeds to drop. This effect generally is due to larger trucks taking up more roadway space than a given number of cars and also tend to have slower average traveling speeds than cars for most functional classes. The final loaded speeds from the travel model (used to define which speed bin a given road segment's VMT is placed in) reflect this truck adjustment.

*Vehicle Age*
Vehicle age distributions were input to MOVES for the county by the thirteen source types. The age distributions reflect the percentage of vehicles for each model year in the fleet up to 31 years old. The vehicle age distributions were prepared by DNREC DAQ based on information obtained from DMV registration data.

The age distributions for this conformity analysis were based on 2012 DMV registration data. In the late summer of 2012, DNREC DAQ staff transformed DMV raw data for a July 1, 2012 summary of vehicle age data into MOBILE6.2-16 composite vehicle type system using a spreadsheet method.

The MOVES model input age distributions were produced by DelDOT's travel demand and air quality modeling consulting firm utilizing the available EPA MS-Excel-based vehicle registration converter tool. This tool assisted in converting the MOBILE6.2-16 based data from DNREC DAQ into the MOVES source type categories.

*Vehicle Population Data*
Vehicle fleet information such as the number and age of vehicles has an impact on the forecasted start and evaporative emissions within MOVES. The MOVES model requires the number of vehicles (called "vehicle population") to be defined for each of the thirteen source type categories, for each year emissions estimates are needed including future horizon years. This data was prepared and provided by DelDOT's travel demand and air quality modeling consulting firm using a spreadsheet.

For the analysis years 2020, 2030, and 2040, the vehicle populations were estimated for New Castle County by developing a growth factor based on the projected increase in total countywide vehicles from 2012 to each horizon year. WILMAPCO staff and the Data and Demographics subcommittee use 2010 Census-based data for vehicles per person and vehicles per household (for each traffic analysis zone) to develop TAZ-based estimates of future year vehicles. To generate future year vehicle populations needed for MOVES (for each horizon year), the TAZ based estimates (again, for each horizon year) were summed and averaged to a countywide growth factor that was then applied to the 2012 age distribution data described above.

*Environmental and Fuel Data*
Information on environmental, fuel, vehicle technology, and other control strategy assumptions were determined based on a review of MOVES2010b default information by DNREC DAQ.

*Fuel Data:* DNREC DAQ used the fuel formulation and supply data that has been assigned to New Castle County, Delaware by the EPA in the MOVES model. The EPA obtains data on all fuel shipments from the refineries in the Delaware area and develops the formulations based on these data. Data inputs include fields such as: ethanol content, sulfur content, aromatic content, benzene content, olefin content, and Methyl Ter-Butyl Ether (MTBE) volume.

*Meteorological Data:* Evaporative emissions are influenced significantly by the temperatures of the surrounding air. DNREC DAQ used the default ozone analysis temperature and humidity values that exist in the MOVES model. These values are presented as month-by-month, hourly data sets for New Castle County.


*Other Vehicle Technology and Control Strategy Data*
The MOVES2010b default I/M data was reviewed and updated by DNREC DAQ for New Castle County. The current I/M program known as the Vehicle Emission Inspection Program (VEIP) was utilized for these analysis runs and is described below.

*DE Vehicle Emission Inspection Program:* This program tests the following gasoline-powered and diesel-powered vehicles: model year 1968 and newer light duty passenger cars, as well as 1970 and newer light duty trucks up to 8,500 pounds. The test is done biennially and on change of ownership. There is a five-year grace period for new vehicles. In New Castle County, 1996 and newer light duty vehicles subject to the regulation receive an On-board Diagnostics (OBD) II test. Model year 1968-1980 vehicles subject to the regulation receive an idle test; those of model year 1981-1995 receive a two-speed idle test. In addition, model year 1975-1995 vehicles receive a tank and cap pressure test. Finally, all 1975 and newer light duty vehicles in New Castle County subject to this regulation receive a visual inspection of the catalytic converter. The compliance factors reflect the fail and waiver rates observed in the program, combined with an assumed 96% compliance rate for vehicles showing up for testing.

*Federal Programs:* Current federal vehicle emissions control and fuel programs are incorporated into the MOVES2010b software. These include the National Program standards covering model year vehicles through 2016. Modifications of default emission rates are required to reflect the implementation of the National Low Emission Vehicle Program (NLEV) program in Delaware. To reflect these impacts, EPA has released instructions and input files that can be used to model these impacts. This inventory utilized the August 2010 version of the files: (http://www.epa.gov/oms/models/moves/tools.htm).


*State Vehicle Technology Program:*
*DE Clean Car Program:* Under the Delaware Low Emission Vehicle Program, 7 DE Admin Code 1140, which was revised December 2013, Delaware required manufacturers of 2014 model year vehicles to comply with Non-Methane Organic Gas (NMOG) emission requirements and California Low Emission Vehicle (LEV II) phase-in requirements. The regulation also requires manufacturers of 2015 and subsequent model year vehicles to comply with NMOG plus NOx emission requirements, as well as California LEV III phase-in requirements. Zero emission vehicles are currently not required by this regulation. California adopted the Low-Emission Vehicle regulation entitled LEV III (third generation low emission vehicle standards) in March 2012. These amendments create more stringent emission standards for new motor vehicles. These new standards will be phased-in over the 2015-2025 model years.

The impacts of this program were modeled for all analysis years using EPA's guidance document, *Instructions for Using LEV and NLEV Inputs for MOVES, EPA-420-B-10-003, January 2010*. EPA provided input files to reflect the CAL LEVII program with the standard phase-in schedules for new emission standards. Modifications to those schedules were done per EPA's instructions, to reflect a later start for the State of Delaware beginning with vehicle model year 2014.

## Amended 2040 RTP and Amended FY 2017-2020 TIP 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.  WILMAPCO has developed an estimate of the cost to maintain and operate existing roads and bridges in the MPO area and has compared that with the estimated revenues and maintenance needs of the new roads. As shown in the RTP, WILMAPCO has found that the projected revenues are sufficient to cover the costs; therefore, satisfying the financial constraint requirement.

### *Public Participation*

This conformity document has undergone the public participation requirements set forth in the Final Conformity Rule, and Final Statewide / Metropolitan Planning Rule. The draft analysis was made available for public review and comment beginning on July 25, 2016, and ending on September 6, 2016. The public review and comment period was announced using the following outlets:

- Notices in the Delaware News Journal and Cecil Whig
- WILMAPCO website ([www.wilmapco.org](www.wilmapco.org))
- WILMAPCO E-NEWS (monthly electronic newsletter)
- WILMAPCO Transporter (quarterly newsletter)
- Public Workshop on August 31, 2016, at the Newark Library in Newark, Delaware

The documentation of the observed 30-day public comment period can be found in Appendix G of the TIP.

# Appendices

## Appendix A

## Conformity Question Checklist

## Table A-1: Conformity Questions Matrix

| SECTION OF 40 CFR PART 93 | CRITERIA | YES / NO | COMMENTS |
|---|---|---|---|
| *GENERAL CRITERIA APPLICABLE TO BOTH PLAN AND TIP* | | | |
| 93.11 | Are the conformity determinations based upon the latest planning assumptions ? | Yes | The conformity determination uses the most recent available information including recent demographics and vehicle registration. |
| | **(a)** Is the conformity determination, with respect to all other applicable criteria in §§93.111 - 93.119, based upon the most recent planning assumptions in force at the time of the conformity determination? | Yes | Population, housing and land use data inputs for the Travel Demand Model were updated in July 2014. Vehicle fleet data for 2012 was utilized in the conformity determination. |
| | **(b)** Are the assumptions derived from the estimates of current and future population, employment, travel, and congestion most recently developed by the MPO or other designated agency? Is the conformity determination based upon the latest assumptions about current and future background concentrations? | Yes | Transportation demand end emissions modeling assumptions are developed by the DE Dept of Transportation in conjunction with WILMAPCO and other local, state and federal representatives as part of the consultation process. Standard procedures for projecting future demographics are outlined in the Plan. |
| | **(c)** Are any changes in the transit operating policies (including fares and service levels) and assumed transit ridership discussed in the determination?<br>**(d)** The conformity determination must include reasonable assumptions about transit service and increases in transit fares and road and bridge tolls over time. | Yes | Reasonable assumptions have been made with regard to transit fares and operating policies (fare and service levels). Changes to transit policy and tolling may occur during the duration of the Plan. However, these cannot be predicted. Therefore, the model assumes they will remain constant during the life of the Plan. |

| SECTION OF 40 CFR PART 93 | CRITERIA | YES / NO | COMMENTS |
|---|---|---|---|
| | **(f)** Key assumptions shall be specified and included in the draft documents and supporting materials used for the interagency and public consultation required by §93.105. | Yes | Key planning assumptions are included and explained in the conformity determination document and agreed upon by all participating parties through the interagency consultation process. The conformity document has been made available for public review for the required 30 day period. |
| 93.111 | Is the conformity determination based upon the latest emissions model? | Yes | EPA's latest emission model, MOVES, was used for this conformity analysis. |
| | Did the MPO make the conformity determination according to the consultation procedures of the conformity rule or the state's conformity SIP? | | WILMAPCO conducted the conformity determination in accordance with the consultation procedures of the conformity rule. |
| **TRANSPORTATION PLAN** | | | |
| 93.106(a) (1) | Are the Horizon Years correct? | Yes | Analysis horizon years included 2020, 2030 and 2040. These represent the appropriate horizon years for the 8-hour ozone and PM2.5 NAAQS conformity determination. |
| 93.106(a) (2)(i) | Does the plan quantify and document the demographic and employment factors influencing transportation demand? | Yes | Socioeconomic data including population, retail and non retail employment and number of households are included in the body of the conformity document |
| 93.106(a) (2)(ii) | Is the highway and transit system adequately described in terms of the regionally significant additions or modifications to the existing transportation network which the transportation plan envisions to be operational in the horizon years? | Yes | The regional modifications to the highway and transit systems are documented within the conformity determination report and included in the emissions analysis. |
| 93.108 | Is the Transportation Plan Fiscally Constrained? | Yes | The transportation plan is in complete agreement with the State's FY 2017 to 2022 Capital Improvement Plan. |
| 93.113(b) | Are TCMs being implemented in a timely manner? | N/A | There are no TCMs included in the Plan. |
| 93.118 | For Areas with SIP Budgets:Is the Transportation Plan, TIP or Project consistent with the motor vehicle emissions budget(s) in the applicable SIP? | Yes | Emission totals calculated for each analysis years were tested against the 2009 SIP budgets for ozone and the 2012 PM2.5 budget. |

# Appendix B

# Conformity Results
## Detailed VMT and Emissions
## By County
## By Functional Class
## By Analysis Year

# Table B-1: Detailed Emission Results

**New Castle County Annual PM2.5 and Nox Emission (Tons)**

| Month | 2020 | | | 2030 | | | 2040 | | |
|---|---|---|---|---|---|---|---|---|---|
| | VOC | NOx | PM25 | VOC | NOx | PM25 | VOC | NOx | PM25 |
| 1 | 166.30 | 314.69 | 14.80 | 119.68 | 236.96 | 13.27 | 117.84 | 240.96 | 13.84 |
| 2 | 152.51 | 290.11 | 13.15 | 108.77 | 216.35 | 11.69 | 110.38 | 221.76 | 12.26 |
| 3 | 149.46 | 313.34 | 12.59 | 116.47 | 235.58 | 11.12 | 116.94 | 239.76 | 11.61 |
| 4 | 139.22 | 301.15 | 10.49 | 114.03 | 224.23 | 9.04 | 116.05 | 228.20 | 9.44 |
| 5 | 137.37 | 302.04 | 9.99 | 114.24 | 225.50 | 8.49 | 116.77 | 229.74 | 8.86 |
| 6 | 138.07 | 270.42 | 8.47 | 115.00 | 200.50 | 7.04 | 117.91 | 204.59 | 7.34 |
| 7 | 144.86 | 270.78 | 8.57 | 120.41 | 200.58 | 7.11 | 123.45 | 204.73 | 7.41 |
| 8 | 141.57 | 288.61 | 8.98 | 118.07 | 214.18 | 7.48 | 121.06 | 218.55 | 7.80 |
| 9 | 130.43 | 264.74 | 8.26 | 108.97 | 196.13 | 6.90 | 111.64 | 199.82 | 7.19 |
| 10 | 133.96 | 280.64 | 9.74 | 110.17 | 210.02 | 8.39 | 112.08 | 213.63 | 8.75 |
| 11 | 141.20 | 294.68 | 11.71 | 110.35 | 221.26 | 10.32 | 110.88 | 225.07 | 10.78 |
| 12 | 163.54 | 323.18 | 14.48 | 120.43 | 242.73 | 12.94 | 119.38 | 246.91 | 13.50 |
| Total | 1738.50 | 3514.38 | 131.24 | 1376.60 | 2624.03 | 113.78 | 1394.39 | 2673.73 | 118.77 |

**New Castle County Summer Weekday Ozone & PM2.5 Emission (Tons)**

| Month | 2020 | | | 2030 | | | 2040 | | |
|---|---|---|---|---|---|---|---|---|---|
| | VOC | NOx | PM25 | VOC | NOx | PM25 | VOC | NOx | PM25 |
| 6 | 4.80 | 9.56 | 0.30 | 3.99 | 7.09 | 0.25 | 4.10 | 7.24 | 0.26 |
| 7 | 4.87 | 9.27 | 0.30 | 4.04 | 6.87 | 0.25 | 4.15 | 7.02 | 0.26 |
| 8 | 4.77 | 9.87 | 0.31 | 3.97 | 7.33 | 0.26 | 4.07 | 7.48 | 0.27 |
| Average | 4.813 | 9.568 | 0.304 | 4.002 | 7.096 | 0.254 | 4.106 | 7.248 | 0.265 |

## Table B-2: VMT by Vehicle Type

### New Castle County Annual VMT by Vehicle Type

| HPMSVTypeID | 2020 HPMS Annual VMT | 2030 HPMS Annual VMT | 2040 HPMS Annual VMT |
|---|---|---|---|
| Motorcycles | 42,709,270 | 46,330,590 | 49,265,158 |
| Passenger Cars | 2,644,656,130 | 2,868,896,538 | 3,050,611,777 |
| Other 2 axle-4 tire vehicles | 2,996,088,248 | 3,250,126,588 | 3,455,988,849 |
| Buses | 35,774,135 | 38,807,425 | 41,265,478 |
| Single Unit Trucks | 53,851,516 | 58,417,586 | 62,117,743 |
| Combination Trucks | 144,979,294 | 157,272,089 | 167,233,667 |
| Total | 5,918,058,594 | 6,419,850,816 | 6,826,482,672 |

## Table B-3: Vehicle Population

**New Castle County Vehicle Population**

| sourceTypeName | 2020 SourceType Population | 2030 SourceType Population | 2040 SourceType Population |
|---|---|---|---|
| Motorcycle | 13898 | 14514 | 14824 |
| Passenger Car | 246212 | 257118 | 262615 |
| Passenger Truck | 159865 | 166946 | 170516 |
| Light Commercial Truck | 52605 | 54935 | 56109 |
| Intercity Bus | 199 | 208 | 212 |
| Transit Bus | 596 | 623 | 636 |
| School Bus | 985 | 1029 | 1051 |
| Refuse Truck | 78 | 82 | 84 |
| Single Unit Short-haul Truck | 3183 | 3324 | 3396 |
| Single Unit Long-haul Truck | 224 | 234 | 239 |
| Motor Home | 390 | 407 | 416 |
| Combination Short-haul Truck | 1231 | 1286 | 1313 |
| Combination Long-haul Truck | 925 | 966 | 987 |

**Table B-4: VMT by Functional Classification**

**New Castle County Average Daily VMT by Functional Classification**

| Functional Class | 2020 HPMS Adjusted VMT | 2030 HPMS Adjusted VMT | 2040 HPMS Adjusted VMT |
|---|---|---|---|
| PA-rural | 1,475,198 | 1,672,544 | 1,841,440 |
| Minor Arterial-rural | 317,436 | 367,270 | 398,143 |
| Major collector-rural | 185,556 | 223,117 | 256,267 |
| Minor collector-rural | 62,345 | 77,680 | 90,661 |
| Local-rural | 268,753 | 339,365 | 384,538 |
| Interstate-urban | 3,658,500 | 3,956,280 | 4,263,386 |
| Freeway-urban | 820,731 | 905,974 | 963,259 |
| PA-urban | 4,054,670 | 4,338,158 | 4,559,499 |
| Minor Arterial-urban | 1,555,260 | 1,653,826 | 1,714,088 |
| Major collector-urban | 1,335,056 | 1,464,876 | 1,566,373 |
| Local-urban | 2,436,054 | 2,541,487 | 2,613,940 |
| **Total** | **16,169,559** | **17,540,577** | **18,651,594** |

# Appendix C

## Interagency Consultation

*For a collection of meeting notes, please visit:*

*wilmapco.org/aqs*

# Appendix D


# Public Participation Materials


*Please visit:*

*wilmapco.org/rtp*

*wilmapco.org/tip*

*wilmapco.org/aq*