

Conformity Determination of the 2020-2023 Transportation Improvement Program and *Maximize2045*

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Bernard C. “Jack” Young, Chair of the Baltimore Regional Transportation Board

Todd Lang, Director of Transportation Planning
Baltimore Metropolitan Council

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Metropolitan Planning Organization for the Baltimore Region

Baltimore Metropolitan Council
1500 Whetstone Way, Suite 300
Baltimore, Maryland 21230

Baltimore Regional Transportation Board

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INTRODUCTION

The transportation conformity process is required under the Clean Air Act to ensure that transportation planning and air quality planning processes within a state are coordinated. Emissions from mobile sources are amongst the most significant contributors to ozone pollution. Because of this, the transportation conformity process is a critical element of the region's and the State's efforts to address environmental issues.

This report documents the demonstration of transportation conformity of the 2020-2023 Transportation Improvement Program (TIP) and the amended *Maximize 2045*, the long range transportation plan for the Baltimore region (the Plan), to address conformity to the 8-hour ozone National Ambient Air Quality Standard (NAAQS). Under the Clean Air Act Amendments of 1990, areas designated as nonattainment for a NAAQS are required to review their current transportation plans and programs to ensure conformity with the applicable state air quality implementation plan. Since the passage of the CAAA, EPA released a final rule on November 24, 1993 outlining methods for nonattainment areas to conduct conformity analyses of plans and programs. EPA has amended the final rule (the Conformity Rule) on a number of occasions, with the most recent occurring in April 2012.

The conformity analysis documented here was conducted through a quantitative and qualitative review of the projects in the Plan and TIP. The conformity determination process ensures that long-range transportation plans and short-term programs contribute to air quality improvement objectives delineated in the State Implementation Plan. In determining conformity, MPO officials estimate the future emissions produced by the planned transportation system. These emission projections are then compared with the emission levels established in the State Implementation Plan.

This conformity determination is undertaken by the Baltimore Regional Transportation Board (BRTB), in its capacity as the Metropolitan Planning Organization for the Baltimore metropolitan area. The BRTB, assisted by the Baltimore Metropolitan Council and in conjunction with the Maryland Departments of the Environment and Transportation, conducted a comprehensive analysis of conformity of the Plan and the TIP for the Baltimore region. The approach used for this conformity determination was developed in concert with the Conformity Rule.

CURRENT ATTAINMENT STATUS FOR NAAQS

Eight-hour Ozone Standard

The Baltimore region is designated as “marginal” nonattainment for the 2015 8-hour ozone standard. The standard is 0.070 parts per million (ppm). This designation became effective August 3, 2018. The region had one year to perform a conformity determination for this NAAQS. This requirement was met on time in 2018.

Earlier, in 2012, the region was designated as “moderate” nonattainment for the 2008 8-hour ozone NAAQS. At the time, under this rule the Baltimore region was designated the only “moderate” ozone nonattainment area for the 2008 8-hour ozone standard in the East. The Baltimore region’s attainment date for the 2008 Ozone NAAQS was July 20, 2018. The EPA has proposed that the Baltimore region has met the NAAQS by the attainment date, but this has not been finalized.

The Baltimore region is a “serious” nonattainment area for the 1997 ozone standard.¹

Mobile source emissions are amongst the most significant local contributors to the Baltimore area’s ozone problem. The most current approved/adequate ozone motor vehicle emissions budgets are used in the transportation conformity process. This conformity determination demonstrates conformity to the 1997 ozone NAAQS, the 2008 ozone NAAQS, and the 2015 ozone NAAQS using the 2012 8-hour ozone Reasonable Further Progress (RFP) SIP budget. The 8-hour ozone RFP SIP was prepared by the Maryland Department of the Environment (MDE) and contains motor vehicle emissions budgets for volatile organic compounds (VOC) and nitrogen oxides (NO_x). The RFP budgets were determined by U.S. EPA as adequate for use in conformity determinations, as published in the Federal Register on February 22, 2016.

The design value for the Baltimore region is 75 ppb as of the end of the 2018 ozone season, indicating that it is currently meeting the 2008 NAAQS.

¹ In 2015, the US EPA issued a final rule revoking the 1997 ozone NAAQS. (80 FR 12264) However, a February 2018 court ruling reinstated the 1997 ozone NAAQS conformity requirement.

MAXIMIZE 2045 – THE BALTIMORE REGION’S LONG RANGE TRANSPORTATION PLAN

Maximize 2045 is the financially constrained long range transportation plan for the Baltimore region, and is scheduled for approval by the BRTB, the region’s federally-designated MPO, on July 23, 2019.

The new short range transportation improvement program (TIP) for FY 2020-2023, is also planned for approval concurrent with the Plan and the conformity determination. This conformity determination shows conformity of the 2020-2023 TIP and *Maximize 2045* long range transportation plan.

CONFORMITY STATEMENT

The conformity rule, as it applies to the Baltimore nonattainment area, requires the Plan and TIP to conform to the motor vehicle emissions budgets established in the SIP. The applicable SIP for this Conformity Determination of *Maximize 2045* and the 2020-2023 TIP is the 2012 8-hour ozone Reasonable Further Progress (RFP) SIP budget for the Baltimore region (motor vehicle emission budgets determined adequate by EPA on February 22, 2016). Appendix A contains a matrix, which provides responses to all of EPA’s criteria as applicable to this conformity determination.

The results of the conformity analysis for the Baltimore nonattainment area indicate that the projected mobile source emissions are below the most recent approved/ adequate motor vehicle emission budgets for the established analysis years of 2020, 2030, 2040, and 2045. Therefore, it is the conclusion of the Baltimore Regional Transportation Board, in its capacity as the Metropolitan Planning Organization for the Baltimore region, that *Maximize 2045* and the 2020-2023 Transportation Improvement Program are found to be in conformity with the requirements of the Clean Air Act Amendments of 1990 and the relevant sections of the Final Transportation Conformity Regulations 40 CFR Part 93.

INTERAGENCY CONSULTATION

Under Section 93.105 of the Conformity Rule, each State Implementation Plan revision must include procedures for interagency consultation before making conformity determinations, and also procedures to be undertaken by air quality agencies and transportation agencies before developing applicable implementation plans. On January 9, 2007, after public review and comment, Maryland state regulations codifying the interagency consultation process (26.11.26) were updated to reflect transportation conformity regulations for the 8-hour ozone and PM_{2.5} NAAQS, the changes to the Conformity Rule, as well as incorporation of existing federal guidance that is consistent with a U.S. Court of Appeals decision.

For the Baltimore region, the BRTB established the Interagency Consultation Group to carry out the consultation process and provide recommendations on air quality topics. Final

procedures for consultation were prepared and formally endorsed by consultation members (TSC Resolution 96-12). Final consultation procedures were developed through a cooperative effort involving the BRTB staff, MDOT and MDE staffs, as well as U.S. EPA and Federal Highway Administration representatives. These procedures provide the framework that the BRTB follows in making conformity determinations.

The ICG meets formally to discuss and recommend appropriate procedures for determining conformity of the Plan and TIP. These meetings are critical to the findings reported in this document, as well as to the development of the consultation procedures that will govern future conformity determinations. ICG meetings provide an additional forum for public participation and input to the process, including comments on technical methodologies. Meetings are advertised on the Internet. Agendas, meeting minutes and necessary materials are emailed to interested parties.

Table 1. ICG Meetings Specifically Addressing this Conformity Analysis

February 6, 2019	Review and approval of methodology/assumptions
March 18, 2019	Review and approval of conformity status of projects
May 1, 2019	ICG approves conformity determination regional emissions analysis results.
July 9, 2019	ICG and Technical Committee recommendation for BRTB approval of conformity determination.

Please see Appendix B for more information on the Interagency Consultation Process related to this conformity determination. Decisions relating to the exempt/non-exempt status of projects are available in Appendix C.

CONFORMITY PROCESS

Test Method

One of the first steps in the conformity determination process is to determine which test method to use – whether an interim emissions test or a budget test, and what the applicable budgets are. Through interagency consultation, it was determined that the budget test would be used to address the ozone NAAQS.

According to the “Transportation Conformity Guidance for 2008 Ozone Nonattainment Areas,” if 1997 8-hour ozone budgets are available for each analysis year in a conformity determination for the 2008 8-hour ozone NAAQS, an area would use 1997 ozone budgets that are established for that year or the most recent prior year. On February 22, 2016, EPA determined the motor vehicle emissions budgets in the Baltimore 1997 8-hour Ozone Standard RFP SIP for 2012 to be adequate for use in conformity determinations. The conformity testing for the 2008 ozone NAAQS was performed using these budgets for VOCs

and NO_x. The conformity determination for the 1997 ozone NAAQS and the 2015 ozone NAAQS also uses these budgets for VOCs and NO_x.

Selection of Horizon Years

In order to perform the technical analysis for the Plan and TIP, four horizon years were chosen through interagency consultation in order to analyze emission results. The date of full implementation of the long range transportation plan, 2045, is a required model year. The other three horizon years are 2020, 2030, and 2040 test scenarios set so that there are no more than 10 years between horizon years. The years of analysis shown in Table 2 have been determined in keeping with federal requirements.

Table 2. Horizon Years

Year	Analysis Required	Ozone Test
2020	Yes – intermediate year	Budget Test – RFP budget for 2012 for the 1997 ozone standard
2030	Yes – intermediate year	Budget Test – RFP budget for 2012 for the 1997 ozone standard
2040	Yes – intermediate year	Budget Test – RFP budget for 2012 for the 1997 ozone standard
2045	Yes – last year of transportation plan	Budget Test – RFP budget for 2012 for the 1997 ozone standard

Emission Analysis Software

The EPA-developed MOVES 2014a motor vehicle emissions model, in combination with PPSuite, was used to assist the analysis of emissions of volatile organic compounds and oxides of nitrogen resulting from onroad mobile sources in the Baltimore region. PPSuite is a software package used to pre-format and post-format data to and from MOVES 2014a.

Staff of the BMC Transportation Planning Division applies the travel forecasting model to horizon year scenarios to assess highway and transit system travel and speed impacts of implementing the region's proposed transportation plan (Plan) and program (TIP). Upon completion of travel forecasting, MDE uses the MOVES 2014a computer model to estimate the emission effects of the projected transportation system usage and performance characteristics.

Identification of Exempt and Regionally Significant Projects

All projects from *Maximize2045* and the 2020-2023 TIP were reviewed and categorized as either “exempt” or “non-exempt.” Projects that are exempt from the conformity requirement may proceed forward even if there is no conforming plan and TIP. Exempt projects are identified in §93.126 and §93.127 of the Conformity Rule. Exempt projects in the TIP generally include projects with neutral or de minimis emissions impacts such as road rehabilitation and

resurfacing, streetscape improvements, bridge replacements and bicycle and pedestrian facilities.

Non-exempt projects are not exempt from the requirement to determine conformity. Non-exempt, regionally significant projects are included in the regional emissions analysis. According to §93.101 of the Conformity Rule, regionally significant projects are non-exempt transportation projects that are “on a facility which serves regional transportation needs (such as access to and from the area outside of the region, major activity centers in the region, major planned developments such as new retail malls, sports complexes, etc., or transportation terminals as well as most terminals themselves) and would normally be included in the modeling of a metropolitan area's transportation network, including, at a minimum, all principal arterial highways and all fixed guideway transit facilities that offer an alternative to regional highway travel.” According to §93.122 of the Conformity Rule, non-exempt, non-regionally significant projects are not required to be modeled explicitly, but VMT must be estimated according to reasonable professional practice.

TCM Statement

The current SIP does not include any Transportation Control Measures. Therefore, neither the budgets nor the conformity analysis reflect Transportation Control Measures. The region continues to program and implement emission reduction measures in many areas including commuter assistance activities, bicycle/pedestrian activities, park-and-ride lots, public transit, management and operations projects, preferential parking management, and clean vehicles, fuels and technologies. Appendix I provides descriptions of some of the emission reducing activities in the region.

PUBLIC INVOLVEMENT

The BRTB adopted an updated Public Participation Plan in June 2018. The new plan updates information detailed in a previous version based on [Fixing America's Surface Transportation \(FAST\) Act](#), a federal law that authorizes transportation funding to address such things as new technologies and a review of the most effective public involvement practices. The plan was created in coordination with the Public Advisory Committee and other stakeholders. The public involvement procedures provide a framework and methodology for involving the public in all metropolitan planning activities. The draft Public Participation Plan is available online at www.baltometro.org.

There is a 30(+) day public comment period on the Draft Conformity Determination, beginning in early May 2019. This public comment period meets the transportation conformity public participation requirements in 93.105 (e) of the Conformity Rule, which states that reasonable public access be provided to technical and policy information at the beginning of the public comment period and prior to taking formal action on a conformity determination for all transportation plans and TIPs. There are opportunities for the public to comment in person on the Draft Conformity Determination during several meetings listed below.

- May 1, 2019 Interagency Consultation Group – ICG addresses emission results
- June 6, 2019 Public Advisory Committee – review and comment opportunity on the Conformity Determination, TIP, and *Maximize 2045*
- June 26, 2019 BRTB Meeting – public participation opportunity
- July 10, 2019 Joint Interagency Consultation Group/ Technical Committee Meeting – the ICG and TC address the Conformity Determination, TIP, and *Maximize 2045*
- July 24, 2018 BRTB Meeting – BRTB addresses the Conformity Determination, TIP, and *Maximize 2045*

The Conformity Determination and its appendices were made available at www.baltometro.org throughout the public comment period. The document was available online and in printed format at the Regional Information Center, located at the Baltimore Metropolitan Council.

FISCAL CONSTRAINT

The FAST Act and its predecessors have required regional transportation plans to be fiscally constrained. That is, the total estimated costs of projects and programs cannot exceed forecasted revenue levels.

For *Maximize2045*, the BRTB, in consultation with the Maryland Department of Transportation, has forecasted the amount of revenues from federal, state, local, and private sources the region reasonably expects will be available for the 22-year period from 2024-2045.

Forecasted Revenues

Consistent with MDOT assumptions, the BRTB has assumed that 40.3% of statewide revenues (federal + state + private funds) will be available for the Baltimore region for the 2024-2045 period. Shown below are revenues (from federal, state, local, and private sources) expected to be available for the 2024-2045 period, broken down by type of investment:

<i>System operations:</i>	<i>\$36.749 billion</i>
<i>System preservation:</i>	<i>\$16.270 billion</i>
<i>Major capital projects:</i>	<i>\$12.162 billion</i>
<i>Total revenues:</i>	<i>\$65.181 billion</i>

Fiscal Constraint: Forecasted Revenues vs. Major Capital Project Costs

Listed below are the forecasted revenues and total estimated year of expenditure costs for major capital projects for the 2024-2034 and 2035-2045 periods. This comparison demonstrates that the region expects to have sufficient funds to pay for the projects in *Maximize2045* in the time periods in which the region expects the projects to be implemented.

<i>Forecasted Revenues, 2024-2034:</i>	<i>\$3,209,000,000</i>
<i>Estimated YOE Costs, 2024-2034:</i>	<i>\$3,194,000,000</i>
<i>Forecasted Revenues, 2035-2045:</i>	<i>\$8,953,000,000</i>
<i>Estimated YOE Costs, 2035-2045:</i>	<i>\$8,861,000,000</i>

The main resource used to determine the funding anticipated to be available for implementing the projects in *Maximize2045* is the document titled *Financially Constrained Long Range Plan, Year 2017 to 2045 Update for the Baltimore Metropolitan Area*, prepared by the Maryland Department of Transportation. This document is included in the Appendices.

LATEST PLANNING ASSUMPTIONS

Socioeconomic Data

Estimates of travel on horizon year networks are based on the completed Round 9 Cooperative Forecasts. These forecasts were endorsed by the BRTB at their June 26, 2018 meeting. The Cooperative Forecasting Group, responsible for the development of regional socioeconomic projections that are used in travel demand forecasting, meets bimonthly to discuss modifications and to set the groundwork for future estimates of land use activity. These agreed-upon regional forecasts represent a planning scenario created to extend through 2045. The Cooperative Forecasting Group member's provide Transportation Analysis Zone (TAZ) horizon year (2015 – 2045 in 5 year increments) forecasts of the number of households, total population, and total employment. The BMC staff using federal and other administration databases supplement the TAZ horizon year forecasts with group quarter population, median household income, household workers and employment by retail, office, industrial, and other. Appendix D displays jurisdictional totals for the major socioeconomic data.

Transit Systems and Operating Assumptions

The Baltimore Metropolitan Council maintains a Trip-Based Model (TBM) for the Baltimore metropolitan area which includes Anne Arundel County, Baltimore City, Baltimore County, Carroll County, Harford County, Howard County and the urbanized portion of Queen Anne's County. The TBM is composed of three major inputs: 1) demographic data files, 2) transportation networks and 3) household travel behavior/choices estimated from an analysis of the 2008 Household Travel Survey. The transit network includes all bus and rail transit service for the Baltimore region. This includes the following service providers and a description of their operations:

- **Baltimore Link / Maryland Transit Administration (MTA)**
 - Modes: Metro-SubwayLink, Light RailLink, Commuter Rail (MARC), CityLink (bus), LocalLink (bus), Express BusLink (bus), & Commuter Bus
 - Serves: Anne Arundel County, Baltimore City, Baltimore County, Harford County, Howard County & Queen Anne's County
 - Number of Bus Routes: 73
 - Map: [MTA System Map](#)
- **Regional Transportation Agency (RTA)**
 - Modes: Local Bus
 - Serves: Anne Arundel County & Howard County
 - Number of Bus Routes: 16
 - Map: [RTA System Map](#)
- **Trailblazer / Carroll Transit**
 - Modes: Local Bus
 - Serves: Carroll County
 - Number of Bus Routes: 4
 - Route Information: [Trailblazer Routes](#)
- **Harford Transit**
 - Modes: Local Bus
 - Serves: Harford County
 - Number of Bus Routes: 11
 - Map: [LINK System Map](#)
- **Annapolis Transit**
 - Modes: Local Bus
 - Serves: Anne Arundel County
 - Number of Bus Routes: 7
 - Map: [Annapolis Transit System Map](#)

Transit Projects

BMC staff reviews each providers' periodic changes to their service and incorporates those changes into the TBM's transit network. BMC models transit networks for a base year (2012) and air quality conformity horizon years of 2020, 2030, 2040 and 2045. These networks include transit projects found in the Transportation Improvement Program (TIP) and the long-range plan (*Maximize 2045*). The following projects change the transit service for the region in the future:

- **MTA Commuter Bus Service (Harford County)** – Additional MTA Commuter Bus Service from Harford County to downtown Baltimore and Harbor East. Includes connections with Harford Transit. A *Maximize 2045* project, scheduled for completion in 2030.
- **BWI Bus Rapid Transit (BRT)** – new BRT service between Dorsey MARC station and BWI Light Rail Station (with stops at Arundel Mills Mall and BWI Consolidated Rental Car Facility). A *Maximize 2045* project, scheduled for completion in 2040.
- **US 1 Bus Rapid Transit (BRT)** – new BRT service between Dorsey MARC station and College Park MARC/Metro/Light Rail (future Purple Line) along US 1 (with stops in Laurel MARC station and Laurel). A *Maximize 2045* project, scheduled for completion in 2040.
- **US 29 Bus Rapid Transit (BRT)** – new BRT service between Ellicott City and MD 198 in Montgomery County along US 29 (with stops in downtown Columbia). A *Maximize 2045* project, scheduled for completion in 2040.
- **US 50 Bus Rapid Transit (BRT)** – new BRT service between New Carrollton MARC/Metro station and Parole along US 50. A *Maximize 2045* project, scheduled for completion in 2045.

Transit Modeling Results

BMC used the TBM to test conformity for the years 2020, 2030, 2040 and 2045. The following are the transit ridership results (see Table 3).

Table 3. Average Weekday Transit Ridership Projections

	2020	2030	2040	2045
Home-Based Work	116,066	109,211	109,567	111,445
Home-Based Shop	44,670	45,834	46,497	46,645
Home-Based Other	65,055	66,518	71,243	72,134
Home-Based School	24,899	24,685	23,974	25,092
Non-Home Based Journey to/from Work	14,512	14,314	14,512	14,623
Non-Home Based Journey at Work	505	505	513	522
Non-Home Based Other	26,043	26,884	27,462	27,739
Total	291,752	287,953	293,769	298,201

For an overview of transit services in the region, reference Appendix I for more information.

Toll Facilities

The Baltimore region currently has five toll facilities, including three harbor crossings, one managed lane facility, and the Chesapeake Bay crossing. The harbor crossings are traditional toll facilities with a toll plaza, which handles cash and electronic toll transactions. The passenger car toll for the harbor crossings is \$4.00 for cash transactions, \$3.00 for Maryland EZ Pass users or \$1.40 for commuter plan users. For additional tolling information on the harbor crossings, including truck tolls, see:

http://www.mdt.maryland.gov/Toll_Rates/harbor_crossings_rates.html

The harbor crossings include:

- I-95, Fort McHenry Tunnel
- I-895, Baltimore Harbor Tunnel
- I-695, Frances Scott Key Bridge

The managed lane facility, known as Express Toll Lanes (ETL), is on I-95 north of Baltimore. It connects I-95 and I-895 at the eastern city line to MD 43, White Marsh Boulevard and I-95 north, a distance of eight miles. A connection to I-695, Baltimore Beltway is planned for 2025 as part of *Maximize2045*. The ETL's are tolled at a per-mile rate, which amounts to \$2.54 peak / \$2.19 off-peak for video toll users and \$1.54 peak / \$1.19 off-peak for electronic toll users. For more information on the ETL toll rates see:

http://www.mdt.maryland.gov/ETL/Toll_Rate_Schedule.html

The Bay Bridge (US 50/301) toll for passenger cars is \$4.00 for cash transactions, \$2.50 for Maryland EZ Pass users, \$2.00 for shoppers, or \$1.40 for commuter plan users.

Within the travel demand model, the effects of tolls are reflected in trip distribution, mode choice and route assignment. The tolls are converted to travel time using \$14.00 an hour as the value of time and is added to the ETLs calculated travel time based on the travel speed. The travel cost (time) is fed into trip distribution. During mode choice, the dollar cost of traveling on the ETL is calculated and added to the auto operating cost for the utility of single occupant vehicle (SOV) and shared ride. Route choice travel time for all roads is based on the travel time to traverse the road section, including the toll time where applicable. The assignment algorithm chooses the path that minimizes travel time. During periods of high congestion, the ETLs become the preferred choice over the general purpose lanes due to their time (cost) savings.

Selection of Network Facilities

A series of computerized highway and transit networks was prepared and tested for each modeled horizon year (2020, 2030, 2040, and 2045) under the Plan and TIP implementation scenario. The implementation scenario is the future transportation system that will result from the goals and policies proposed in the Plan and TIP in given horizon years. Criteria for inclusion of highway and transit improvements in the implementation scenario were reviewed by the ICG, including representatives from MDOT and MDE. As described above, the ICG members discuss which projects in the Plan and TIP, as well as regionally significant projects, are exempt from the regional emission analysis.

Additionally, BRTB member jurisdictions provided highway and transit project specifications for all regionally significant non-federally funded highway and transit projects that have committed funding sources and could reasonably be expected to be completed by the appropriate analysis year.

The following were included:

- All in-place regionally significant highway and transit facilities, services, and activities;
- Completion of all regionally significant projects (including facilities, services, and activities) included in the proposed Plan and TIP;
- Completion of all expected regionally significant non-FHWA/FTA highway and transit projects that have clear funding sources and commitments leading toward their implementation and completion by the analysis year.

TECHNICAL METHODOLOGY

The regional emissions analysis used to demonstrate conformity utilizes both the BMC staff-supported four-step travel demand forecasting model, in addition to the EPA MOVES 2014a model and the PPSuite model. The travel demand forecasting model incorporates economic and demographic data to assist in simulating the transportation modeling process: trip generation, trip distribution, mode choice, and trip assignment. Updates are made to the regional travel demand model, providing more reliable future year travel simulations. With these changes, the model is better positioned to analyze and produce conformity results. The latest significant model update is documented and is available upon request (BMC, *Baltimore Region Travel Demand Model Version 4.4 – Model Validation for 2010 Base Year*).² The introduction of this report is included in Appendix E of this conformity report.

Representative highway and transit networks and trip tables were developed to correspond with conditions expected in the horizon years of 2020, 2030, 2040, and 2045 resulting from projects in the 2020-2023 TIP and *Maximize 2045*.

² In 2018-2019, the model had a minor update, in which it was validated to the 2012 base year. This is referenced as Model Version 4.4c.

Procedures for Determining Regional Transportation-Related Emissions

The Baltimore region is using EPA's MOVES 2014a model for regional emissions analyses. A commercially-available software package, *Central*, was used to manage the process of connecting output from the travel model to the MOVES 2014a model that estimates mobile emissions. The Central package takes travel demand model output and generates the needed MOVES transportation files and imports the information into the appropriate MOVES database. Other non-transportation databases (meteorological data, vehicle registration, motor fuel parameters and Inspection and Maintenance (IM)) are imported into the appropriate MOVES database. After importing local planning assumptions, the MOVES emissions model is used to generate gram per mile emission factors which are applied to the local travel activity. The process is completed by generating user-friendly summaries of the MOVES output emission databases.

The following general steps summarize the mobile emission estimation process:

- Output travel demand model estimates of daily-, a.m.- and p.m. peak-period link passenger vehicle and truck volumes;
- Convert travel demand model estimates of daily link total and truck volume to seasonal HPMS adjusted hourly estimates;
- Estimate link volume by vehicle class (motorcycle, 2 axle, bus, and 2 axle 6 tire and 3+ axles)
- Calculate new travel speed;
- Prepare MOVES transportation related files;
- Prepare MOVES non-transportation assumptions, environmental assumptions, control program specification files, fuel parameter, source type, population, and fleet age distribution;
- Execute MOVES, estimating mobile gram per mile composite emissions for each pollutant and by vehicle type; and
- Develop summaries showing estimated mobile source emissions by vehicle type for each pollutant and converted to tons per day.

The Conformity Rule contains transportation-related emissions determination procedures that must be implemented in nonattainment areas. The Baltimore region has maintained a process for a number of years that meets the modeling requirements under §93.122(b)(1)(i) through (vi) for designated severe ozone nonattainment areas. Since the revocation of the 1-hour ozone standard on June 15, 2005, the Baltimore region is no longer a severe nonattainment area for 1-hour ozone. As mentioned previously, the region is a designated moderate nonattainment area for the 2008 8-hour ozone standard. However, the region still follows the same procedures and meets the requirements of a severe nonattainment designation. BMC staff, on behalf of the BRTB, simulates travel demand associated with implementation of plans and programs. MDE is responsible for all non-transportation emissions model inputs.

Travel information within a database format (dBase) is used in exchanging link characteristics between the travel demand modeling software TP+ and PPSUITE. Estimated link volume is adjusted using jurisdiction Highway Performance Monitoring System (HPMS) factors and seasonal factors (1.04 percent for average summer weekday and 0.938 percent for average winter weekday) by facility type and area type. The HPMS factors are derived from the 2012 travel demand model. The 2012 HPMS adjustment factors used are provided in Appendix F. The 2012 HPMS factors are closer to one on the upper class facilities and are greater as the facility class decreases due to less representation of the highway network within the travel demand model. The travel model includes all interstates but only skeleton representation of the lower class facilities especially in the more developed jurisdictions. Factoring by the HPMS factors compensates for differences between simulated volume (from the travel model) and estimated observed volume. During the adjustment process, an estimate of local (off-network) VMT is made using the ratio of local to non-local 2012 HPMS estimates applied to the adjusted model estimates. These ratios are also shown in Appendix F. These three steps, as shown below, reconcile the travel demand model with 2012 estimated observed volume.

- Applying the HPMS factors;
- Applying the seasonal factors; and
- Estimating local VMT.

The HPMS and seasonal factors are also applied to horizon year estimates of VMT; thereby reconciling horizon year estimates with the ratio of unexplained volume in the base year 2012. This reconciliation ultimately allows the travel model to provide an estimate for all regional VMT.

Travel demand model outputs simulate volume in four time periods, while the MOVES model utilizes hourly inputs. Therefore, vehicle type pattern files are used to convert simulated period volume into hourly volume. The vehicle type pattern files are broken into four vehicle classes (motorcycle, 2-axle 4-tire, bus, and 2-axle 6-tire/3+ axle). These files are developed using two types of counts: observed counts taken hourly for all vehicles; and hourly classified counts (FHWA F-13 scheme), summarized by facility and area type (urban/rural). The counts are used to develop estimates of the share of the volume per hour. These estimates are applied against the simulated link time period volume (a.m. and p.m. peak, mid-day and overnight) by facility and area type.

Each link's hourly vehicle type volume is compared against the modification to the Bureau of Public Roads curve used in the travel demand model. As with the travel demand model, Passenger Car Equivalence is used for the estimated truck volume. Each hourly volume is also subject to peak spreading where individual hourly volumes that exceeds 30% of the maximum volume is spread to other hours within the peak period. The final estimate is a new travel time and speed estimated on each HPMS adjusted link volume considering peak spreading.

Standard MOVES input files of VMT by facility, VMT by hour, and VMT by speed bin are developed using information from the travel model and air quality post-processor. An exact description of the data estimated can be found in the MOVES 2014 User Guide developed by EPA. The fraction of VMT for each vehicle type is calculated from the HPMS adjusted link volume.

Central then assembles the MOVES information such as source type population for the Baltimore region, environmental conditions (such as temperature), control programs, and transportation information described in the above steps. National defaults are used for the more complex and data intensive inputs into MOVES. MOVES scripts are built for each area type (urban or rural) and facility type within each jurisdiction (only for the assembly of the transportation information, since neither environmental conditions nor control programs vary across the non-attainment area).

The assembled MOVES scripts are submitted to the MOVES software, which generates the database output (ASCII database) and the report. The output gives the gram per mile emission factors for each pollutant, for each of the vehicle types. The gram per mile factor is a composite factor based on the age distribution, transportation characteristics, environmental conditions, and control program applicable for that vehicle type.

The MOVES model generates a VMT fraction share for all vehicle types based on supplied information (registration data, diesel sales fractions, and mileage accumulation rates). This fraction share can be used to generate a composite emission factor that can be applied to the estimated VMT or can be used to convert regional VMT into an estimate of VMT for each vehicle type and then factored by the gram per mile emission factor for that particular vehicle. Both methods would produce the same estimate of VMT. The latter method is used in order to generate more specific reports about emissions and VMT for the region.

The final step is to accumulate the estimate of VMT and emissions for the various vehicle types and facility types.

Meteorological and Control Strategy Assumptions

In cooperation between BMC and MDE staff, assumptions used within the MOVES 2014a emissions model are reviewed and validated with the latest information on environmental conditions and MOVES 2014a commands representing control strategies and other policies.

The monthly analysis of mobile source emissions required the development of average hourly and monthly temperatures and humidity along with daily estimate of barometric pressure. The BWI weather reporting station observations were analyzed to develop the required input. Other monthly assumptions in fuel composition and volatility were estimated or used the MOVES default for that month.

The MOVES script for the Inspection and Maintenance program reflects the current test procedures in use at the various state inspection stations.

ANALYSIS RESULTS

The results of the emissions analysis of the 2020-2023 TIP and *Maximize 2045*, as shown in Tables 4 and 5 below, demonstrate that emissions are below levels necessary to demonstrate conformity to the 1997 8-hour ozone standard, the 2008 8-hour ozone standard, and the 2015 8-hour ozone standard.

Average summer weekday emissions of VOCs and NO_x resulting from the region's transportation network in 2020, 2030, 2040 and 2045 are below the most recent approved/adequate SIP budgets.

Table 4. VOC Emissions Test Results (average summer weekday, tons/day)

	2020	2030	2040	2045
Total Emissions Modeled	21.6	12.3	9.7	9.6
Conformity Budget¹	40.2	40.2	40.2	40.2
Conformity Result	Pass	Pass	Pass	Pass

¹ 2012, 8-hour ozone Reasonable Further Progress (RFP) SIP budget for the Baltimore region (motor vehicle emission budgets determined adequate by EPA on February 22, 2016)

Table 5. Weekday NO_x Emissions Test Results (average summer weekday, tons/day)

	2020	2030	2040	2045
Total Emissions Modeled	47.0	20.1	17.4	17.9
Conformity Budget¹	93.5	93.5	93.5	93.5
Conformity Result	Pass	Pass	Pass	Pass

¹ 2012, 8-hour ozone Reasonable Further Progress (RFP) SIP budget for the Baltimore region (motor vehicle emission budgets determined adequate by EPA on February 22, 2016)