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# CONFORMITY DETERMINATION OF MAXIMIZE2040 AND THE AMENDED 2016-2019 TRANSPORTATION IMPROVEMENT PROGRAM

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*Prepared by the Baltimore Regional Transportation Board*





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**November 2015**

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Produced under the auspices of the Baltimore Regional Transportation  
Board, the Metropolitan Planning Organization for the Baltimore Region

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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 amended 2016-2019 Transportation Improvement Program (TIP) and *Maximize 2040*, 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), the annual fine particulate matter (PM<sub>2.5</sub>) NAAQS and the carbon monoxide (CO) 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 issued by U.S. EPA on November 24, 1993 (58 FR 62187) and subsequent amendments.

## CURRENT ATTAINMENT STATUS FOR NAAQS

### Eight-hour Ozone Standard

The Baltimore region has been designated by the EPA as not attaining either the 1997 or the 2008 8-hour ozone NAAQS. On April 15, 2004, EPA designated the Baltimore region as nonattainment for the 1997 8-hour ozone standard which became effective on June 15, 2004. Then on June 12, 2007, the Maryland Department of the Environment (MDE) submitted the Baltimore Nonattainment Area 8-hour Ozone SIP to U.S. EPA. On January 15, 2009, EPA sent a letter to MDE stating that EPA finds the budgets in the 2008 Reasonable Further Progress Plan (for the 1997 standard) submittal for the Baltimore 8-hour nonattainment area adequate for transportation conformity purposes. The Federal Register notice was published on March 27, 2009. On February 1, 2012, EPA determined that the Baltimore region did not attain the 1997 8-hour ozone standard by the June 15, 2011 attainment date. As a result, the region was reclassified as “serious” nonattainment for the 1997 8-hour ozone NAAQS.

On July 20, 2012, a final EPA rule designating nonattainment areas for the 2008 8-hour ozone NAAQS became effective. Under this rule the Baltimore region was designated the only “moderate” ozone nonattainment area for the 2008 8-hour ozone standard in the East.

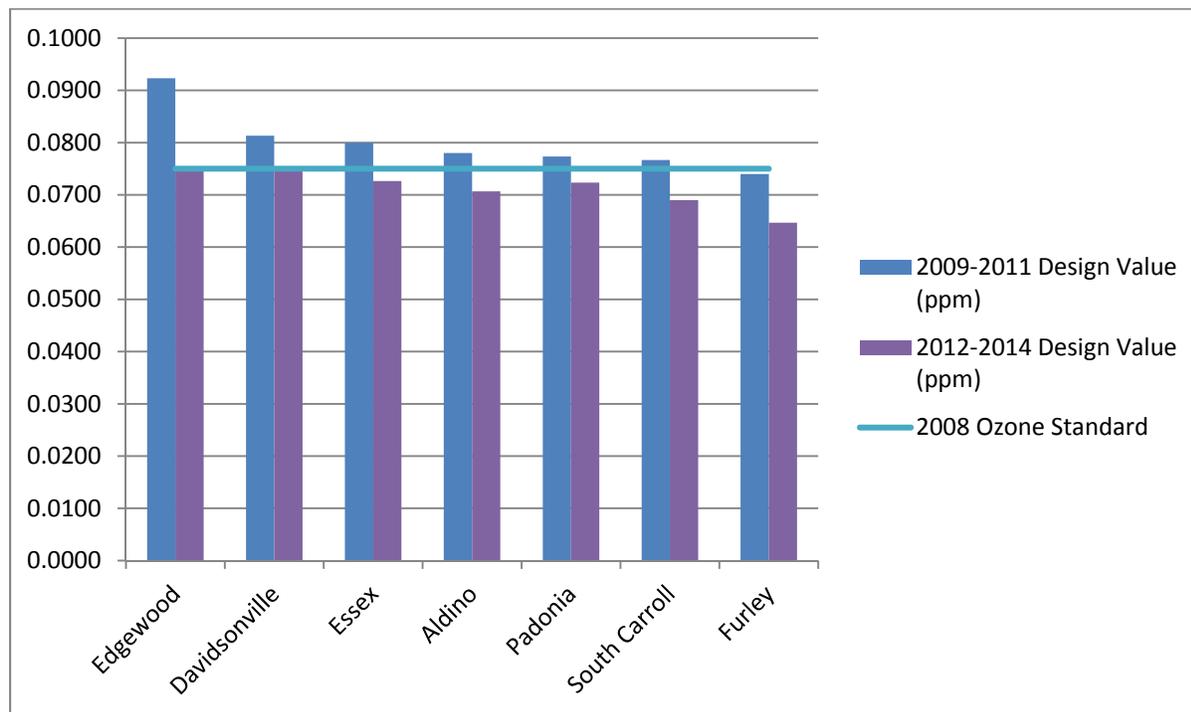
Currently, the Baltimore region is a "moderate" ozone nonattainment area for the 2008 8-hour ozone standard and is a former serious nonattainment area for the 1997 ozone standard.<sup>1</sup> The most current approved/adequate ozone budgets are used in the transportation conformity process.

Due to the timing of this current conformity determination, it demonstrates conformity to the 2008 ozone NAAQS, demonstrated through the 8-hour ozone Reasonable Further Progress (RFP) SIP motor vehicle emissions budgets (for the 1997 standard), which were determined by U.S. EPA as adequate for use in conformity determinations, as published in the Federal Register on March 27, 2009. 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<sub>x</sub>).

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<sup>1</sup> On February 13, 2015, the US EPA issued a final rule that addresses implementation requirements for the 2008 NAAQS for ground-level ozone. The rule was effective on April 6, 2015. In this final rule, the US EPA revoked the 1997 ozone standard for all purposes, including transportation conformity. (80 FR 12264)

**Figure 1. Baltimore Region Ozone Monitors: Ambient Air Quality 8-Hour Ozone Design Values, (2009 to 2011) and (2012 to 2014)**



Mobile source emissions are among the most significant local contributors to the Baltimore area's ozone problem. The Baltimore region's attainment date for the 2008 Ozone NAAQS is July 20, 2018.

The CAAA and the Conformity Rule at 40 CFR 93.102(d) provide a one-year grace period from the effective date of designations before transportation conformity applies in newly-designated nonattainment areas for a specific NAAQS. Transportation conformity for the 2008 ozone NAAQS applied one year after the effective date of nonattainment designations for this NAAQS (i.e., July 20, 2013). Conformity to the 2008 ozone NAAQS was demonstrated for the first time in the May 2013 *Conformity Determination of Plan It 2035 and the 2012-2015 Transportation Improvement Program: Addendum to Address the 2008 Ozone Standard*, approved by FHWA and FTA on July 10, 2013.

### Annual PM<sub>2.5</sub> Standard

The Baltimore region was designated as nonattainment for the 1997 annual PM<sub>2.5</sub> standard on December 17, 2004 and the designation became effective April 5, 2005. "Fine particles" come from many different sources, including industrial and residential combustion as well as vehicle exhaust. Fine particle pollution is linked to short-term health effects such as increased hospital admissions and emergency department visits for heart attacks, strokes and asthma attacks, and serious long-term health effects, including development of lung

disease and premature mortality. People who are at highest risk for being affected by particle pollution are those with heart or lung disease, children (whose lungs are still developing), and the elderly.

Since this time, federal, state and local controls and programs have been successful at reducing emissions of PM<sub>2.5</sub> and its precursors. The controls that were key in helping the Baltimore region get clean air quality monitoring data for PM<sub>2.5</sub> include the Maryland Healthy Air Act, the national fuel/engine standards (and vehicle fleet turnover), national power plant rules, and Maryland's aggressive suite of regulations that reduce NO<sub>x</sub> emissions.

In 2013, the Maryland Department of the Environment (MDE) submitted the *Baltimore Nonattainment Area PM<sub>2.5</sub> Redesignation Request* and the *Baltimore Nonattainment Area PM<sub>2.5</sub> Maintenance State Implementation Plan (SIP)*. This SIP demonstrates how the area will remain compliant with the PM<sub>2.5</sub> NAAQS and includes motor vehicle emission budgets. On December 16, 2014, the U.S. EPA finalized its decision to redesignate the Baltimore region attainment for the fine particulate matter NAAQS. The Baltimore region is now in a "maintenance" phase for the PM 2.5 NAAQS. They approved the PM<sub>2.5</sub> maintenance SIP, including the motor vehicle emission budgets. Conformity to the annual PM<sub>2.5</sub> NAAQS is demonstrated here using the PM<sub>2.5</sub> maintenance SIP budgets, which are the most current approved/adequate budgets available. The regional emissions analysis was performed for the annual standard, using a monthly modeling approach.

### **Carbon Monoxide Standard**

In 1995, the Baltimore City Central Business District (CBD) which had formerly not been attaining the CO NAAQS, was redesignated as attaining the CO NAAQS. The Baltimore region is now in "maintenance" with respect to the CO NAAQS standard. CO is a colorless, odorless gas that most often results from incomplete combustion of a fossil fuel. Exposure to unhealthy levels of CO reduces oxygen delivery to the body's organs and tissues. There has not been a violation of the standard from 1988 to the present.

This document demonstrates conformity of the 2016-2019 TIP and *Maximize 2040* to the most current approved/ adequate CO budget contained in the 2003 Carbon Monoxide Maintenance Plan for the Baltimore Attainment Area. This is the second of two CO maintenance plans developed for the Baltimore attainment area. The planning horizon for this second maintenance plan continues through December 15, 2015.

### ***Maximize 2040* – the Baltimore Region's Long Range Transportation Plan**

*Maximize 2040* is the financially constrained long range transportation plan for the Baltimore region, and is being approved by the BRTB, the region's federally-designated

MPO at the same time as this conformity determination. The short range transportation improvement program (TIP) for FY 2016-2019, was previously approved by the BRTB on July 28, 2015 and is being amended concurrent with adoption of *Maximize 2040*. The new long range transportation plan, *Maximize 2040*, further improves upon the transportation projects included in the TIP, but adding improvements for the next 21 years (2020 to 2040). This conformity determination shows conformity of the new long range transportation plan and the amended 2016-2019 TIP.

## **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 SIPs for this Conformity Determination of *Maximize 2040* and the 2016-2019 TIP are the *2008 Reasonable Further Progress (RFP) Plan for the Baltimore 8-hour Ozone Nonattainment Area* (motor vehicle emission budgets determined adequate on March 27, 2009), the *Maintenance Plan for the Baltimore Carbon Monoxide Attainment Area (2003)*, and the *Baltimore Nonattainment Area PM<sub>2.5</sub> Maintenance SIP* approved by US EPA in 2014. 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 2017, 2025, 2035, and 2040. 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 2040* and the 2016-2019 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<sub>2.5</sub> 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 2. ICG Meetings Specifically Addressing this Conformity Analysis**

July 1, 2015	Review and approval of methodology/assumptions
July 1, 2015	Review and approval of conformity status of projects
August 25, 2015	ICG approves conformity determination regional emissions analysis results.
November 4, 2015	ICG 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, the PM2.5, and the CO 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 March 27, 2009, EPA determined the motor vehicle emissions budgets in the 1997 standard 8-hour Ozone RFP SIP for the Baltimore region 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<sub>x</sub>.

The motor vehicle emission budget test was also used to show conformity to the *Maintenance Plan for the Baltimore Carbon Monoxide Attainment Area (2003)*, and the *Baltimore Nonattainment Area PM2.5 Maintenance SIP* approved by US EPA in 2014.

### 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 first modeled horizon year is 2017, the last full ozone season prior to the attainment date for the 2008 ozone NAAQS, for moderate nonattainment areas. The second two horizon years are 2025 and 2035, test scenarios set so that there are no more than 10 years between horizon years. The fourth horizon year is 2040, the date of full implementation of the Plan. The years of analysis shown in Table 3 have been determined in keeping with federal requirements.

**Table 3. Horizon Years**

Year	Analysis Required	Ozone Test	CO Test	PM2.5 Test
2017	Yes – effective attainment year of 2008 ozone NAAQS for moderate NAA’s	Budget Test – RFP budget for 2008, from the 1997 ozone standard	Budget Test - 2003 CO Maintenance Plan	Budget Test - Interim Maintenance Budget, PM2.5 Maintenance SIP
2025	Yes – intermediate year	Budget Test – RFP budget for 2008, from the 1997 ozone standard	Budget Test - 2003 CO Maintenance Plan	Budget Test – Out Year Maintenance Budget, PM2.5 Maintenance SIP
2035	Yes – intermediate year	Budget Test – RFP budget for 2008, from the 1997 ozone standard	Budget Test - 2003 CO Maintenance Plan	Budget Test – Out Year Maintenance Budget, PM2.5 Maintenance SIP
2040	Yes – last year of transportation plan	Budget Test – RFP budget for 2008, from the 1997 ozone standard	Budget Test - 2003 CO Maintenance Plan	Budget Test – Out Year Maintenance Budget, PM2.5 Maintenance SIP

## **Emission Analysis Software**

The EPA-developed MOVES 2014 motor vehicle emissions model, in combination with PPSuite, was used to assist the analysis of emissions of volatile organic compounds, oxides of nitrogen, carbon monoxide, and direct fine particulate matter, 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 2014.

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 2014 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 *Maximize2040* and the 2016-2019 TIP and 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. It also includes a longer listing of data collected from tracking the status of “emission-friendly” projects in the region.

## **PUBLIC INVOLVEMENT**

The BRTB approved a new public participation plan in September 2014. This 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 Public Participation Plan is available online at [www.baltometro.org](http://www.baltometro.org).

There was a 45-day public comment period on the Draft Conformity Determination, beginning September 1, 2015. 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 were opportunities for the public to comment in person on the Draft Conformity Determination during several meetings listed below.

- August 25, 2015 Interagency Consultation Group – results presented with support to release for public review
- November 3, 2015 Technical Committee – recommends BRTB approval of the Conformity Determination, *Maximize2040*, and the Amended 2016-2019 TIP
- November 4, 2015 Interagency Consultation Group – Review of any public comments and then BRTB approval recommended for the Conformity Determination
- November 4, 2015 Public Advisory Committee – review and comment opportunity on the Conformity Determination, *Maximize2040*, and the Amended 2016-2019 TIP
- November 24, 2015 BRTB Meeting – approval of the Conformity Determination, *Maximize2040*, and the Amended 2016-2019 TIP

The Conformity Determination and its appendices were made available at [www.baltometro.org](http://www.baltometro.org) throughout the public comment period. Public meetings were held in

each member jurisdiction. The document was available online and in printed format at the Regional Information Center, located at the Baltimore Metropolitan Council.

## **FISCAL CONSTRAINT**

Federal transportation legislation requires regional long-range plans include a list of the transportation investments planned to commence during the next 20 to 25 years. This federal legislation also mandates that the long-range transportation plan be financially constrained. That is, the estimated cost of the capital investments in the Plan must not exceed the revenues reasonably projected to become available.

The February 2007 Metropolitan Planning Regulations require that existing and proposed revenues cover all forecasted capital, operating, and maintenance costs identified in the Plan. To comply with this rule, the BRTB must identify all sources of anticipated revenue available in support of its investment decisions. Further, the planning regulations require that, as of December 2007, revenue and cost estimates in the Plan must use an inflation rate to reflect “year of expenditure” dollars. This rate must be based on reasonable financial principles and information, developed cooperatively by the MPO and the state. For the federal and state inputs to *Maximize2040*, the BRTB has relied on revenue projections generated by the Maryland Department of Transportation (MDOT). The Department’s Office of Finance and Office of Planning work closely to develop the financial forecast that the BRTB subsequently reviews and endorses.

MDOT, working closely with its financial consultants, has over several years and numerous plans established a consistent and reliable methodology to forecast the funding necessary to support plans generally, and *Maximize2040* specifically. The process uses generally accepted principles, assumptions, and historic spending levels to identify realistically anticipated revenues and expenditures, over a 25- to 30-year horizon.

The forecast developed by MDOT and submitted to the BRTB was adopted in October 2014 to provide an understanding of the funding available as the Preferred Alternative was being developed. Recently, the Governor of Maryland withdrew sponsorship of the proposed Red Line Light Rail project. There was insufficient time for MDOT to prepare a new forecast that eliminated the New Starts category. The documentation for *Maximize2040*, Appendix E: Revenues and Cost Estimates, includes the original information (page E-9) followed by a revised forecast edited by BMC staff (page E-10) that estimates a lower level of funding. Therefore, *Maximize2040* identifies \$12,411,000,000 in anticipated investments for the expansion category and \$15,590,000,000 in forecasted revenues.

## The Consequences of Financial Constraint

Growing needs and less funding, added to the requirement that long-range plans be financially constrained, have forced the BRTB to evaluate and program projects based on verifiable revenue projections. As a result, some projects that jurisdictions have deemed to be critical and necessary were programmed in later planning years of *Maximize2040*. Or, they were moved to the list of illustrative projects (i.e., projects that are ready to proceed but lack a reasonable assurance that funds for them will be available during the time period covered by *Maximize2040*).

In some cases, projects not able to be funded with federal funds can tap state, local, or other funding sources that may become available.

## LATEST PLANNING ASSUMPTIONS

### Socioeconomic Data

Estimates of travel on horizon year networks are based on the completed Round 8A Cooperative Forecasts. These forecasts were endorsed by the BRTB at their June 24, 2014 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 2040. The forecasts estimate the number of households, population, labor force, retail employment, non-retail employment, and median household income by transportation analysis zone for 2015, 2020, 2025, 2030, 2035 and 2040. Appendix D displays jurisdictional totals for the major socioeconomic data. Data from 2010 is also included.

### Transit Systems

Recently, the Red Line 14.1-mile east-west light rail transit line was removed from the planned transportation network, in line with its removal from the planning process.

Additionally, the representative transit network was revised reflecting the current routes, alignments and operating conditions within the region's simulation tools. The following changes were incorporated into the analysis to determine federal transportation conformity.

- Route 26 – Adds service to Amazon and Dundalk Marine Terminal replacing an East side Route 20 branch
- Route 31 – Connecting Canton and Dundalk replacing Route 11 and 20 East side service
- Route 11 – Truncated to run between Towson and the Inner Harbor
- Route 20 – Truncated to run between the Centers for Medicare and Medicaid and Baltimore City Hall

## Transit Operating Assumptions

Horizon year transit networks consist of the existing transit system plus expansion and new service proposed in the Plan and TIP. All horizon transit networks consist of existing service provided by the MTA along with local transit service provided in the Cities of Baltimore and Annapolis and Carroll, Harford, Anne Arundel, and Howard counties. Transit operating assumptions were updated to reflect the initial transit fare of \$1.70. Transit ridership projections are provided in Table 4.

**Table 4. Average Weekday Transit Ridership Projections**

	2017	2025	2035	2040
Home-Based Work	121,700	123,300	127,500	135,100
Home-Based Shop	42,500	43,000	43,500	43,200
Home-Based Other	61,700	64,400	68,100	73,100
Home-Based School	22,700	25,400	26,300	26,600
Non-Home Based Journey to/from Work	14,900	15,900	16,900	17,000
Non-Home Based Journey at Work	500	500	600	600
Non-Home Based Other	25,500	26,300	27,400	27,600
<b>Total</b>	<b>289,500</b>	<b>298,800</b>	<b>310,300</b>	<b>323,200</b>

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

## Electronic Toll Lanes

The Maryland Transportation Authority has constructed additional capacity on I-95 north of Baltimore. Users of the added capacity, regardless of occupancy or vehicle type, electronically pay a per-mile toll. There are seven new tolled miles on I-95 between I-895 and just north of MD 43. There are two northbound and two southbound express toll lanes, which use both EZ Pass tolling and video tolling. Rates for 2-axles vehicles vary between 10 and 25 cents per mile using EZ Pass, and are higher with video tolling. Rates for larger vehicles are higher. (More information can be found at [www.mdt.maryland.gov](http://www.mdt.maryland.gov).)

Within the travel demand model, the effects of this toll cost are reflected in trip distribution, mode choice and route assignment. The toll cost is 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 links is based on the travel time to traverse the link, 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 (2017, 2025, 2035, and 2040) 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 member's 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 2014 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. Significant changes have been made to the regional travel demand models providing more reliable future year travel simulations. With these changes, the model is better positioned to analyze and produce conformity results. The latest model update is documented and is available upon request (BMC, *Baltimore Region Travel Demand Model Version 4.4 – Model Validation for 2010 Base Year*). 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 2017, 2025, 2035, and 2040 resulting from projects in the 2016-2019 TIP and *Maximize2040*.

## Procedures for Determining Regional Transportation-Related Emissions

The Baltimore region is using EPA's MOVES 2014 model for regional emissions analyses. A commercially-available software package (entitled Central) was used to manage the process of connecting output from the travel model to the MOVES 2014 model used to estimate 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 completing the importation of local planning assumptions, the MOVES emissions model is used to generate gram per mile emission factors which are applied to the imported 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 totals 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, due to persistent air quality issues in the Baltimore region, 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 2010 travel demand model validation. The 2010 HPMS adjustment factors used are provided in Appendix F. The 2010 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 2010 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 2010 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 2010. 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 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 *User Guide for MOVES 2014* 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 2014 emissions model are reviewed and validated with the latest information on environmental conditions and MOVES 2014 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 2016-2019 TIP and *Maximize2040*, as shown in Tables 5, 6, 7, 8, and 9 below, demonstrate that emissions are below levels necessary to demonstrate conformity to the 2008 8-hour ozone standard, the annual fine particulate matter standard and the carbon monoxide standard.

- Average summer weekday emissions of VOCs and NO<sub>x</sub> resulting from the region’s transportation network in 2017, 2025, 2035, and 2040 are below the most recent approved/ adequate SIP budgets.
- Average winter weekday emissions of CO resulting from the region’s transportation network in 2017, 2025, 2035, and 2040 are below the most recent approved/ adequate SIP budgets.
- Yearly emissions of direct PM<sub>2.5</sub> and NO<sub>x</sub> resulting from the region’s transportation network in 2017, 2025, 2035, and 2040 are below the most recent approved/ adequate SIP budgets.

**Table 5. VOC Emissions Test Results** (average summer weekday, tons/day)

	2017	2025	2035	2040
<b>Total Emissions Modeled</b>	26.5	18.2	12.0	11.6
<b>2008 Conformity Budget<sup>1</sup></b>	41.2	41.2	41.2	41.2
<b>Conformity Result</b>	<b>Pass</b>	<b>Pass</b>	<b>Pass</b>	<b>Pass</b>

<sup>1</sup> 8-hour ozone SIP Reasonable Further Progress Budgets (Determined “adequate” as published on March 27, 2009.)

**Table 6. Weekday NO<sub>x</sub> Emissions Test Results** (average summer weekday, tons/day)

	2017	2025	2035	2040
<b>Total Emissions Modeled</b>	50.7	25.9	18.2	18.2
<b>2008 Conformity Budget<sup>1</sup></b>	106.8	106.8	106.8	106.8
<b>Conformity Result</b>	<b>Pass</b>	<b>Pass</b>	<b>Pass</b>	<b>Pass</b>

<sup>1</sup> 8-hour ozone SIP Reasonable Further Progress Budgets (Determined “adequate” as published on March 27, 2009.)

**Table 7. CO Emissions Test Results** (average winter weekday, tons/day)

	<b>2017</b>	<b>2025</b>	<b>2035</b>	<b>2040</b>
<b>Total Emissions Modeled</b>	381.0	271.1	197.1	194.9
<b>Conformity Budget<sup>2</sup></b>	1689.8	1689.8	1689.8	1689.8
<b>Conformity Result</b>	<b>Pass</b>	<b>Pass</b>	<b>Pass</b>	<b>Pass</b>

<sup>2</sup> Carbon Monoxide Maintenance Plan for the Baltimore Attainment Area (December 15, 2003.)

**Table 8. Annual NOx Emissions Test Results** (tons/year)

	<b>2017</b>	<b>2025</b>	<b>2035</b>	<b>2040</b>
<b>Total Emissions Modeled</b>	19,294	10,002	7,742	7,344
<b>Conformity Budget<sup>3</sup></b>	29,892.01	21,594.96	21,594.96	21,594.96
<b>Conformity Result</b>	<b>Pass</b>	<b>Pass</b>	<b>Pass</b>	<b>Pass</b>

<sup>3</sup> Baltimore Nonattainment Area PM2.5 Maintenance State Implementation Plan (Approved December 2014.)

**Table 9. Annual Direct PM2.5 Emissions Test Results** (tons/year)

	<b>2017</b>	<b>2025</b>	<b>2035</b>	<b>2040</b>
<b>Total Emissions Modeled</b>	887	538	448	441
<b>Conformity Budget<sup>3</sup></b>	1,218.60	1,051.39	1,051.39	1,051.39
<b>Conformity Result</b>	<b>Pass</b>	<b>Pass</b>	<b>Pass</b>	<b>Pass</b>

<sup>3</sup> Baltimore Nonattainment Area PM2.5 Maintenance State Implementation Plan (Approved December 2014.)