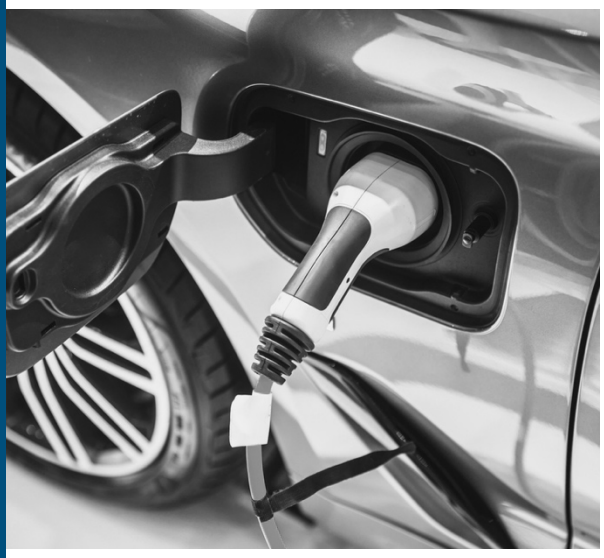
VISUALIZE 2050



Visualize 2050 Planning and Programming Process

Air Quality Conformity Analysis

Part 3 of 27

National Capital Region
Transportation Planning Board

December 2025

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OVERVIEW OF AIR QUALITY CONFORMITY

Air Quality Conformity is a requirement of the Federal Clean Air Act and its Amendments (CAAA) to ensure that metropolitan transportation plans (MTPs) and transportation improvement programs (TIPs) are consistent with air quality goals and that progress is made toward achieving and maintaining federal national ambient air quality standards (NAAQS). A conformity determination is undertaken to forecast on-road mobile source emissions from an area's transportation system, and the analysis must demonstrate that these emissions are within limits outlined in state air quality implementation plans (SIPs) to help ensure that the NAAQS are attained and maintained. As the region is currently designated as a non-attainment area for ozone, to fulfill these federal requirements, an air quality conformity analysis was undertaken for ozone precursors, nitrogen oxides (NOx) and volatile organic compounds (VOCs).

TPB'S ROLE AND KEY STAFF

The air quality conformity analysis for the metropolitan Washington region is the responsibility of the National Capital Region Transportation Planning Board (TPB). The TPB staff involved, their titles, and their roles are found in Table 3.1. At the beginning of the conformity cycle, the TPB approves the Air Quality Conformity Scope of Work and transportation project inputs, allowing the technical analysis to begin. The TPB staff then completes the technical analysis, including developing highway and transit networks encompassing all regionally significant projects in the plan, travel demand forecasting for six analysis years, and motor vehicle emissions estimates for those six forecast years. At the end of the conformity cycle, the TPB approves the conformity analysis concurrently with the approval of the MTP and TIP. The TPB transmits the air quality conformity report, the Plan document, and the TIP document to the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) who coordinate with the U.S. Environmental Protection Agency (EPA) for federal review and approval. TPB also shares the conformity report with the Calvert-Saint Mary's Metropolitan Planning Organization (C-SMMPO) and the Fredericksburg Area Planning Organization (FAMPO) as per agreements between the TPB and those organizations.

TABLE 3.1: KEY STAFF

TPB Staff	Title	Role
Kanti Srikanth	Executive Director	Director for the Transportation Planning Board (TPB)
Mark Moran	Program Director, Travel Forecasting and Emissions Analysis	Contributor
Andrew Austin	Transportation Planner IV	Contributor
Laura Bachle	Transportation Planner	Contributor
William Bacon	Transportation Engineer III	Contributor

TABLE 3.1 CONTINUED: KEY STAFF

TPB Staff	Title	Role
Rachel Beyerle	Transportation Communications Manager	Contributor
Jamie Bufkin	Transportation Planner II	Contributor
Anant Choudhary	Transportation Engineer IV	Contributor
Robert d'Abadie	Transportation Engineer IV	Contributor
Nazneen Ferdous	Transportation Engineer IV	Contributor
Charlene Howard	Manager, Planning Data Resources	Contributor
Sunil Kumar	Principal Environmental Engineer	Contributor
Ray Ngo	Principal Transportation Engineer	Contributor
Wanda Owens	Senior Transportation Engineer	Contributor
Jinchul (JC) Park	Principal Transportation Engineer	Contributor
Jane Posey	Contractor	Contributor
Eric Randall	Principal Engineer/Program Manager	Contributor
Renee Ritchey	GIS Analyst I	Contributor
Ho Jun (Daniel) Son	Senior Transportation Engineer	Contributor
Dusan Vuksan	Principal Engineer/Program Manager	Contributor
Feng Xie	Principal Engineer/Program Manager	Contributor
Jian (Jim) Yin	Principal Transportation Engineer	Contributor

Role of TPB Subcommittees

The state and local departments of transportation (DOTs) provide project inputs to the MTP. The TPB Technical Committee (TPB Tech) and the Metropolitan Washington Air Quality Committee (MWAQ) Technical Advisory Committee (MWAQC TAC), which is a subcommittee of MWAQC, both reviewed project inputs and the conformity scope of work before the TPB approved those at the beginning of the conformity cycle. MWAQC TAC members provide some inputs to the U.S. EPA's mobile emissions estimation tool, Motor Vehicle Emissions Simulator (MOVES) model, which is required for use in conformity analyses. TPB Tech and MWAQC TAC review the conformity analysis results and confirm that the analysis meets all federal requirements. MWAQC reviews the analysis and provides formal comments, a copy of which is included in the full conformity report.

ROLE OF KEY PLANNING AGENCIES

Several agencies listed in Table 3.2 are involved in the conformity process. After the TPB approves the air quality conformity analysis, the TPB staff transmits the conformity report and the MOVES model input/output/MOVES control files (a.k.a. run specification files or runspec files), the MTP document, and the TIP document to the FHWA and the FTA for their review and approval. The FHWA shares the documents and the MOVES files with the EPA. The EPA reviews the conformity analysis and confirms that the analysis meets federal requirements.

TABLE 3.2: KEY PLANNING AGENCIES

Planning Agency	Role
FHWA	Reviews and approves the conformity analysis, Plan, and TIP
FTA	Reviews and approves the conformity analysis, Plan, and TIP
EPA	Reviews and concurs that the conformity determination meets Clean Air Act (CAA) requirements
State and local DOTs	Provide project inputs
MWAQC/MWAQC TAC	Reviews via consultation and provides some MOVES model inputs

PUBLIC ENGAGEMENT

All three public engagement opportunities during the Visualize 2050 development process were applicable to the air quality conformity process. From February to November of 2023, a public consultation period was held seeking input on projects in the current Visualize 2045 that were being re-examined for inclusion in the Visualize 2050 plan. The public provided 962 comments on existing projects and an additional 133 comments on new ones. Comments were forwarded to the responsible agencies for consideration and response, leading to agencies developing a final list of project inputs for Visualize 2050. Once the regionally-significant-for-air-quality (RSAQ) project list was complete, a second public comment period was held from March 1 to March 30, 2024, to

gather further input. Of the 893 responses received, 110 comments directly addressed issues related to the air quality conformity process.

As per the EPA conformity guidance, a 30-day public review period for the final air quality conformity documentation will be taking place in fall 2025. In addition to the final comment period, the draft analysis and documentation was shared with the following Metropolitan Washington Council of Governments (COG) and TPB committees (committee meetings are open to the public) and in the TPB consultation mailout:

- Metropolitan Washington Air Quality Committee (MWAQC)
- MWAQC Technical Committee
- TPB
- TPB Technical Committee
- TPB Community Advisory Committee
  TPB Access for All Advisory Committee

NATIONAL AMBIENT AIR QUALITY STANDARDS & MOBILE EMISSIONS BUDGETS

The federal CAAA requires the establishment of Air Quality Standards for certain airborne pollutants. The U.S. EPA currently regulates six air pollutants, known as criteria pollutants:

- Carbon monoxide (CO),
- lead (PB),
- ground-level ozone (O_3),
- nitrogen dioxide (NO_2),
- particulate matter (PM), and
- sulfur dioxide (SO_2).

Areas in the United States that exceed these standards are identified and designated as non-attainment areas. Non-attainment areas are required to develop and implement plans to attain the federal standards. These implementation plans include limits on the amount of certain criteria pollutants the transportation sector can emit. These limits are referred to as Motor Vehicle Emissions Budgets (MVEBs).

Air quality conformity is a process designed to ensure that activities funded by federal transportation programs are consistent with the air quality goals outlined in the implementation plans for non-attainment areas. The conformity requirements for transportation are found in Section 176(c) of the Clean Air Act (42 USC § 7506(c)). The EPA regulations to implement the conformity requirements are found at 40 CFR Part 93. The Metropolitan Washington, DC (DC-MD-VA) region has conformity requirements for one pollutant, ground-level ozone (O_3).

2008 Ozone Standard and Maintenance Plan Budgets

In 2012, the EPA designated the Metropolitan Washington, DC (DC-MD-VA) region as being in "marginal" non-attainment for the 2008 Ozone Standard. With only a marginal designation, EPA regulations do not require the development of new MVEBs. Instead, as per EPA regulations, conformity analyses for the region's MTP and TIP were demonstrated to previously approved MVEBs from the older 1997 Ozone Standard.

In 2015, the region attained the 2008 Ozone Standard, based on the readings from ambient air quality monitors. The MWAQC developed a Redesignation Request and Maintenance Plan, which the state air agencies submitted to the EPA in early 2018. The 2008 Ozone Maintenance Plan included MVEBs for VOC and NO_X. In August 2018, the EPA found these mobile emissions budgets adequate for use in the region's air quality conformity analyses.

The MVEBs were subsequently updated in September 2023,[1] and after submission by the state departments of the environment, the EPA granted an adequacy finding on October 4, 2024. The MVEBs were developed using the then-current version of the EPA Motor Vehicle Emissions Simulator, MOVES3.0.4. VOC and NO_X emissions budgets were established for three specific periods: the attainment year for the 2008 ozone NAAQS (2014), an intermediate year (2025), and the final year (2030) of the Maintenance Plan. The mobile emission ozone budgets include a 20 percent safety margin for both VOC and NO_X, with the final MVEBs shown in Table 3.3 below.

TABLE 3.3: MOBILE EMISSIONS BUDGETS

Year	VOC On-Road Emissions (tpd*)	NO_X On-Road Emissions (tpd)
Attainment Year 2014 Emissions & Budget	61.25	136.84
2025 Predicted Emissions without Safety Margin	27.92	46.52
2025 Safety Margin	5.58	9.30
Intermediate Year 2025 Emissions & Budget	33.50	55.82
2030 Predicted Emissions without Safety Margin	21.75	34.26
2030 Safety Margin	4.35	6.85
Final Year 2030 Emissions & Budget	26.10	41.11

*tpd = short tons per day. One short ton equals 2,000 pounds.

2015 Ozone Standard

In 2015, the EPA promulgated new and more stringent NAAQS for ozone. Effective August 3, 2018, the EPA designated the Metropolitan Washington, DC-MD-VA non-attainment area as "marginal" non-attainment for the 2015 Ozone NAAQS. Marginal non-attainment areas have three years from the date of designation to achieve the standard, and accordingly, the region was assigned an attainment date of August 3, 2021. As the attainment date fell in the middle of the region's ozone season (March 1 - October 31), the NAAQS had to be demonstrated by the end of the 2020 ozone season. The region did not achieve the 2015 ozone NAAQS by the original deadline, and the non-

[1] Prepared by the Metropolitan Washington Council of Governments for the District Department of the Environment, the Maryland Department of the Environment, and the Virginia Department of Environmental Quality on behalf of the Metropolitan Washington Air Quality Committee (September 27, 2023). *State Implementation Plan Revision: Motor Vehicle Emission Budget Revisions Based on:* Metropolitan Washington Council of Governments (September 27, 2023). *MOVES3 Model Washington DC-MD-VA 2008 Ozone NAAQS Maintenance Plan*. https://www.mwcog.org/documents/2023/09/27/washington-dc-md-va-2008-ozone-naaqs-maintenance-plan-update-air-quality-air-quality-conformity-ozone/

attainment area was redesignated as a "moderate" non-attainment area, effective November 7, 2022,[2] with a new attainment date of August 3, 2024. The region achieved the 2015 ozone NAAQS by the end of the 2021 ozone season and in all subsequent seasons, based on regional ambient air quality monitor data. The region subsequently requested that the EPA approve the area's request for a "Clean Data Determination" (CDD) based on the air monitor data, which was published on April 4, 2025, and took effect on May 5, 2025.[3]

According to provisions in the conformity regulations, conformity analyses for the region's MTP and TIP are demonstrated using the approved (or "found adequate for conformity purposes") MVEBs from the older 2008 Ozone Standard.[4] When the TPB approved the Visualize 2050 conformity analysis, MVEBs associated with the 2015 Ozone Standard had not yet been federally approved. The emissions from the Visualize 2050 plan and FY 2026-2029 TIP adhere to the current 2008 Ozone NAAQS MVEBs.

Budget Setting Versus Conformity

An air quality conformity analysis is conducted to formally demonstrate that projected motor vehicle emissions associated with the MTP and TIP are less than or equal to the MVEBs for each analysis year. The conformity regulations require using the "latest planning assumptions," meaning that each conformity analysis must incorporate the most up-to-date planning inputs and technical methods available at the beginning of the process. Therefore, the inputs used in regional air quality conformity analyses change with time. Mobile emissions budgets in air quality plans are established based on analyses incorporating the "latest planning assumptions" when the air quality plan is developed, with the mobile emissions budgets generally being updated infrequently.

Changes to the inputs used in air quality conformity analyses are not limited to transportation projects. They include other assumptions such as vehicle fleet mix and demographics. Such changes to inputs in conformity analyses relative to inputs used to establish mobile emissions budgets will inevitably yield mobile emissions estimate differences that are not strictly attributable to the transportation plan itself. Additionally, the models used to estimate future travel and emissions change, as does the data the models use, yielding mobile emissions estimate differences not simply attributable to the projects in the transportation plan.

Anticipating such situations, federal air quality conformity regulations allow air quality attainment and maintenance plans to provide a "safety margin" while establishing MVEBs. Accordingly, the DC-MD-VA 2008 Ozone updated Maintenance Plan emissions budgets include a 20 percent buffer to address the uncertainty introduced when inconsistent assumptions are used between budget-setting and the conformity analysis.

Table 3.4 lists the contrasting assumptions used in the mobile emissions budget development and in the current air quality conformity analysis (of the Visualize 2050 plan and FY 2026-2029 TIP). Details related to these inputs are discussed in the next section of this report.

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[2] U.S. Environmental Protection Agency (October 7, 2022). *Determinations of Attainment by the Attainment Date, Extensions of the Attainment Date, and Reclassification of Areas Classified as Marginal for the 2015 Ozone National Ambient Air Quality Standards (87 FR 60897).* https://www.federalregister.gov/documents/2022/10/07/2022-20460/determinations-of-attainment-by-the-attainment-date-extensions-of-the-attainment-date-andf

[3] U.S. Environmental Protection Agency (April 4, 2025). *Air Plan Approval; District of Columbia, Maryland, Virginia; Determination of Attainment by the Attainment Date and Clean Data Determination for the Washington, DC-MD-VA Nonattainment Area for the 2015 Ozone National Ambient Air Quality Standards (90 FR 1473).* https://www.federalregister.gov/documents/2025/04/04/2025-05913/air-plan-approval-district-of-columbia-maryland-virginia-determination-of-attainment-by-the

[4] U.S. Environmental Protection Agency (April 2021). *Transportation Conformity Regulations as of April 2012; EPA-420-B-12-013.* https://nepis.epa.gov/Exe/ZyPDF.cgi/P100E7CS.PDF?Dockey=P100E7CS.PDF

TABLE 3.4: INPUT ASSUMPTIONS

Input	SIP Revision Mobile Emissions Budgets	Visualize 2050 Conformity Emissions
Cooperative Forecasts	Round 9.2	Round 10.0
Vehicle Fleet	2020 VIN*	2023 VIN
Travel Demand Model	Gen2/Ver. 2.4	Gen2/Ver. 2.4.6
Project Inputs	2022 Update to Visualize 2045	Visualize 2050
Mobile Emissions Model	MOVES3.0.4	MOVES4.0.1

* Vehicle registration data is also known as Vehicle Identification Number (VIN) data.

WORK ACTIVITIES & TECHNICAL INPUTS

The TPB approved the Scope of Work and project submissions for Visualize 2050 and the FY 2026-2029 TIP air quality conformity analysis on May 15, 2024. The air quality conformity Scope of Work is included as Appendix A of the full conformity report available online at www.visualize2050.org/plan-resources.

Key technical planning assumptions and methods include:

- New zone-level forecasts for land activity: Round 10.0 of the Cooperative Forecasts.
- New vehicle registration data (also known as VIN data): December 2023 (DC/MD/VA)
- New transportation projects and updates to existing projects
- New EPA MOVES4.0.1 Mobile Emissions Model
- New TPB Gen2/Version 2.4.6 Travel Demand Model

Mobile emissions inventories were developed for ozone-season VOC and NO_X for six forecast years (2025, 2026, 2030, 2040, 2045, and 2050). These inventories address a primary conformity requirement to demonstrate that emissions associated with the plan and TIP do not exceed the EPA-approved mobile emissions budgets. Figure 3.1 depicts the geographic areas for travel demand modeling and emissions reporting.[5]

Vehicle Registration Data

TPB staff have analyzed motor vehicle fleet inventory information on a regular basis since 2005. This information is used to understand the vehicle-type composition and vehicle-age distributions, which are important determinants of mobile emissions. Periodic inventory reviews enable staff to refresh mobile emissions modeling inputs with the latest available information. The current data are from December 2023. TPB staff analyzed the 2023 vehicle registration data, and the analysis was reviewed by the TPB Tech and MWAQC-TAC in October 2024.

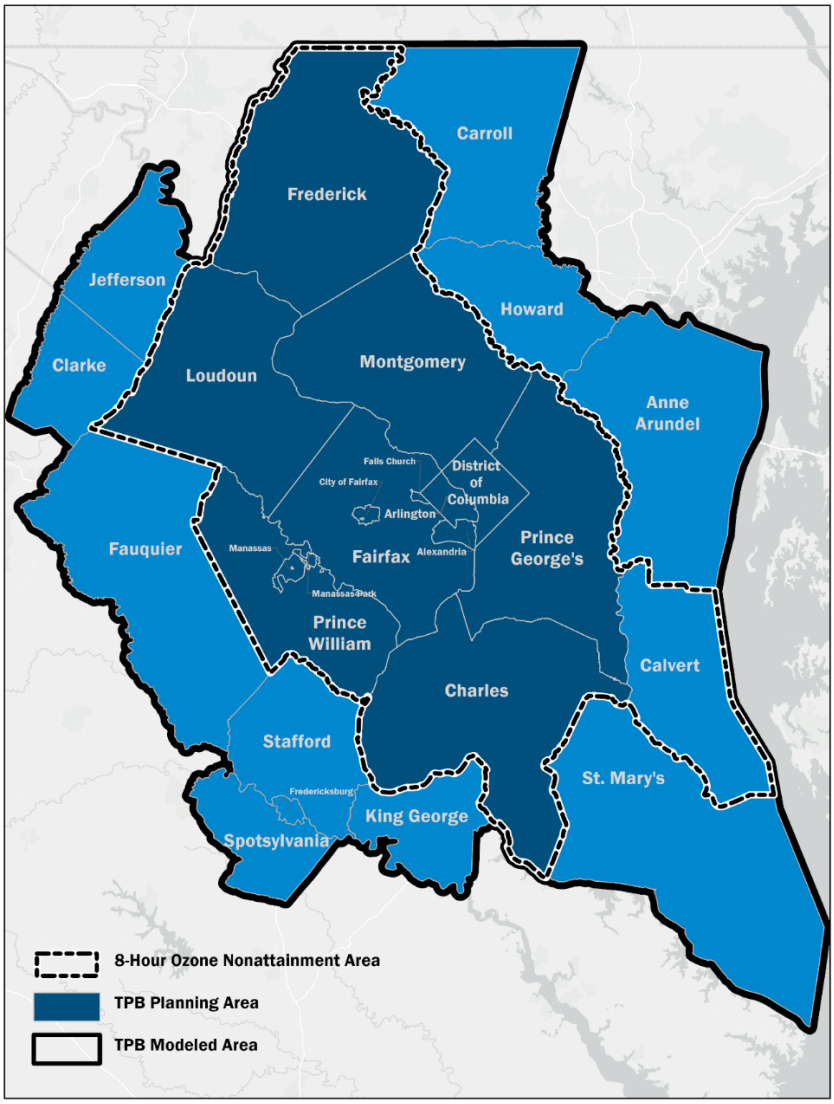
Cooperative Forecasts

The COG Board approved, on June 14, 2023, the draft Round 10.0 Cooperative Forecasts for use in the air quality conformity analysis of the Visualize 2050 plan and FY 2026-2029 TIP. In addition

[5] The TPB Modeled Area includes one county in West Virginia (Jefferson Co.), but the TPB Member Area does not include West Virginia.

to forecasts from the TPB Planning Area, the Round 10.0 Cooperative Forecasts include the Baltimore Metropolitan Council's (BMC) Round 10 (endorsed July 15, 2022); the George Washington Regional Commission (GWRC)/Fredericksburg Area Metropolitan Planning Organization's (FAMPO) 2050 Socioeconomic Data Projections (revised May 2023); and the Maryland Department of Planning's Historical and Projected Total Population for Calvert and St. Mary's Counties (December 2022). TPB staff revised the employment definition adjustment factors to ensure a consistent definition of employment across all jurisdictions in the modeled area.[6] The Round 10.0 data, summarized in Figure 3.2, were used for the air quality conformity analysis of the Visualize 2050 plan.

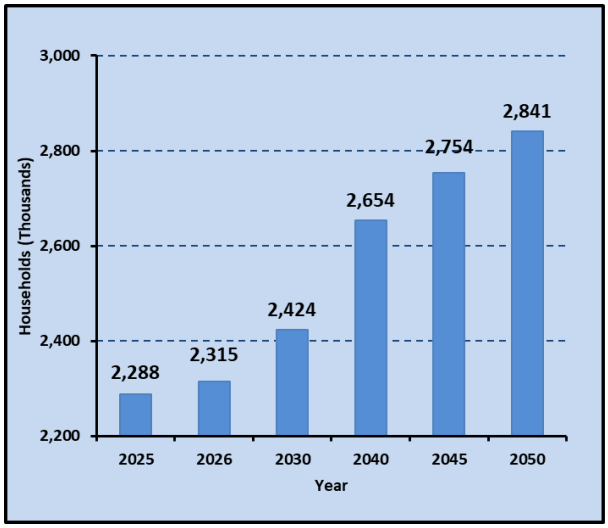
FIGURE 3.1: TPB MODEL AREA, TPB PLANNING AREA, AND 8-HOUR OZONE NON-ATTAINMENT AREA



[6] McCall, Nicole. Memorandum to Mark Moran, Dusan Vuksan, Jun Xie, Jane Posey, and Timothy Canan (June 22, 2023). "*Travel Model Employment Definition Adjustment Factors for Round 10.*"

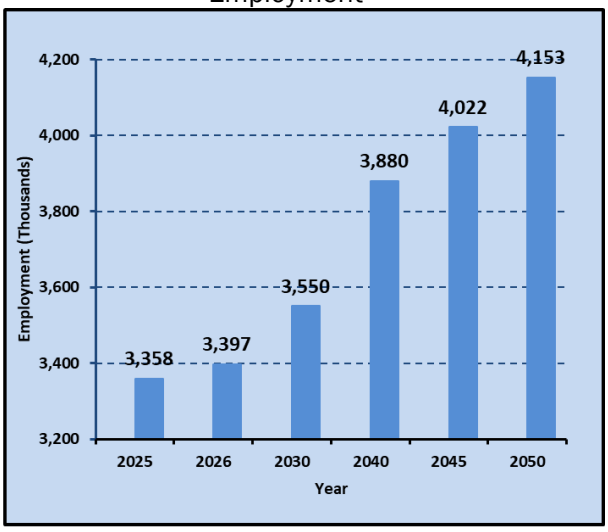
FIGURE 3.2: ROUND 10.0 COOPERATIVE FORECASTS, HOUSEHOLDS AND EMPLOYMENT, IN THE NON-ATTAINMENT AREA

Households



NOTE: Values are for the Non-Attainment Area

Employment*



NOTE: Values are for the Non-Attainment Area
*Includes Employment Definition Adjustment

Figure 3.3 and Table 3.5 show the characteristics of the region's vehicle fleet through time. The exhibits indicate that the fleet is continuing to grow overall. Starting in 2020, the population of light-duty vehicles (automobiles/motorcycles) began to decline while the population of light-duty trucks (sport utility vehicles, or SUVs) grew, becoming the largest portion of the vehicle fleet in 2023. Also, the average vehicle age increased across all categories in 2020 and 2023.

FIGURE 3.3: HISTORICAL GROWTH IN VEHICLE POPULATION BY VEHICLE TYPE

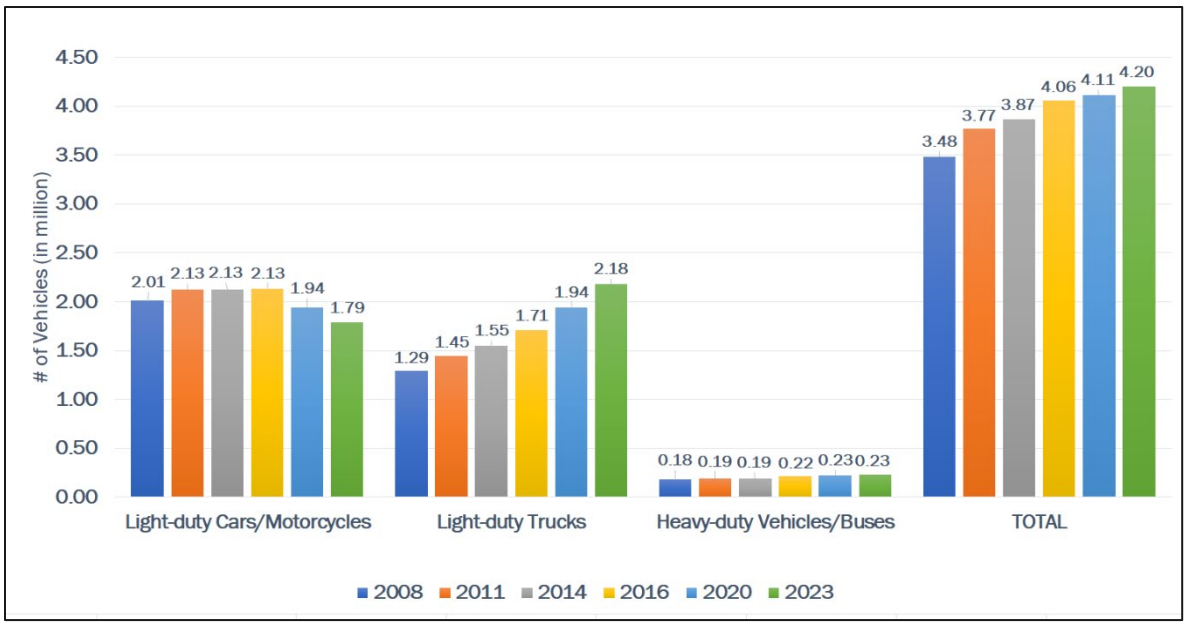


TABLE 3.5: AVERAGE AGE (IN YEARS) OF REGIONAL VEHICLE FLEET BY VIN YEAR

Year	Light-duty Cars/Motorcycles	Light-duty Trucks	Heavy-duty Vehicles/Buses	All Vehicle Types
2008	8.51	7.53	9.21	8.18
2011	9.25	8.55	10.56	9.05
2014	9.62	9.09	11.3	9.49
2016	9.32	8.68	11.29	9.16
2020	10.05	8.74	11.51	9.51
2023	11.04	8.87	12.07	9.97

Transportation Project Inputs

Member agencies submitted regionally significant projects for the air quality conformity analysis by December 2023. In May 2024, the TPB approved all but one project, the I-495 Southside Express Lanes (SEL) project, which was deferred for further consideration and action until October 2025. As a result, the TPB conducted two sets of analysis using the original project inputs approved in May 2024 and a second analysis with the SEL project. The TPB ultimately decided to defer the inclusion of the I-495 SEL project in Visualize 2050. As a result, the conformity analysis without the I-495 SEL project is reported on in the full conformity report in alignment with the TPB's October 2025 vote on the SEL project. Appendix B of the full conformity report contains the transportation projects that are included in the final Visualize 2050 conformity analysis. Project changes from the previous conformity analysis for the 2022 update to Visualize 2045 are identified in the table.

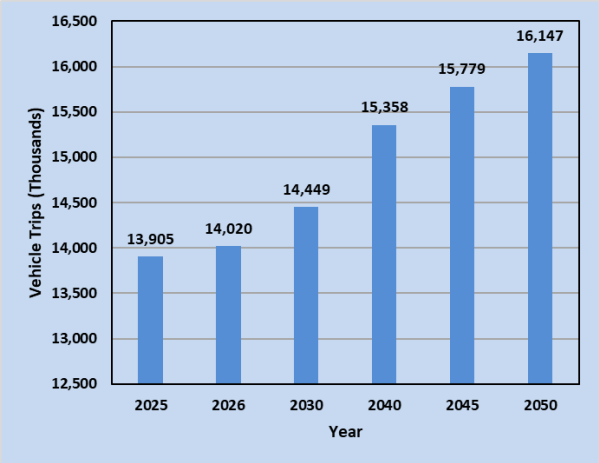
Travel Modeling

Travel demand forecasts were developed for each of the analysis years using the most recent version of the Gen2 Travel Demand Model. Changes between the version of the model used to set the mobile emissions budgets (Gen2/Ver. 2.4) and the version of the model used for this conformity analysis (Gen2/Ver. 2.4.6) were minimal, although changes in land use model inputs (Round 10.0 Cooperative Forecasts) and transportation networks from the "Zero-Based Budgeting" process in Visualize 2050 are estimated to have a more significant impact on results. Figure 3.4 shows the average weekday vehicle and transit trips through time for each conformity analysis year for the non-attainment area. Figure 3.5 shows Vehicle Miles Traveled (VMT) for the non-attainment area for each conformity analysis year.

Mobile Emissions Inventories and Mobile Emissions Budgets

Estimated ozone-season emissions of VOC and NO_x (the pollutants that combine to form ground-level ozone) are shown in Figures 3.6 and 3.7. Also shown are the mobile emissions budgets (MVEBs) used to demonstrate conformity for the Visualize 2050 plan and FY 2026–2029 TIP. Emissions of both pollutants remain well below the MVEBs for all analysis years.

FIGURE 3.4: VEHICLE AND TRANSIT TRIPS IN THE NON-ATTAINMENT AREA



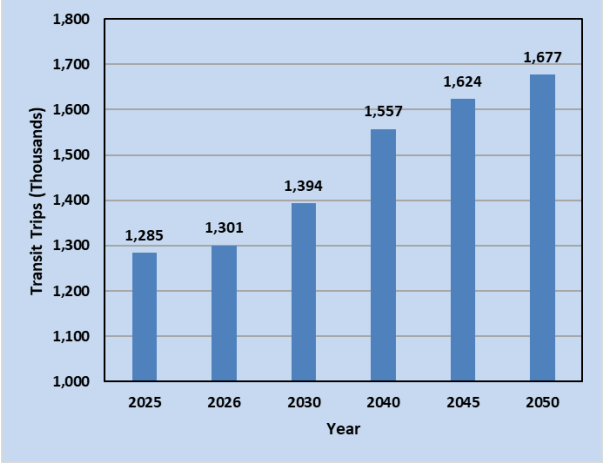


FIGURE 3.5: VEHICLE MILES TRAVELED IN THE NON-ATTAINMENT AREA (THOUSANDS)

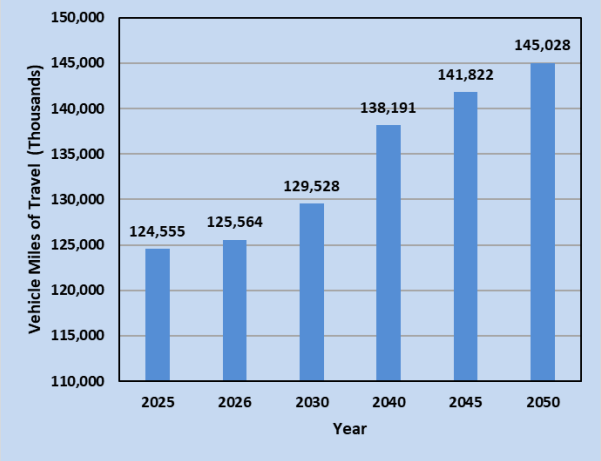


FIGURE 3.6: MOBILE SOURCE EMISSIONS AND MOBILE EMISSIONS BUDGETS, OZONE SEASON VOC

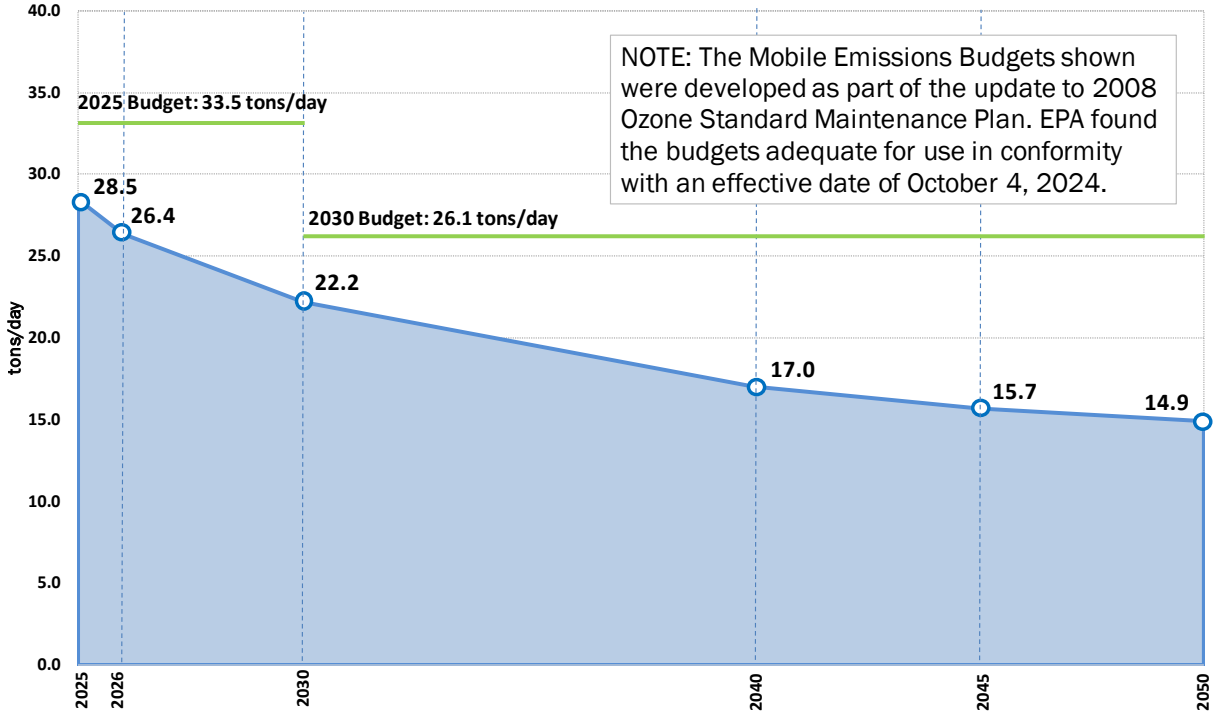
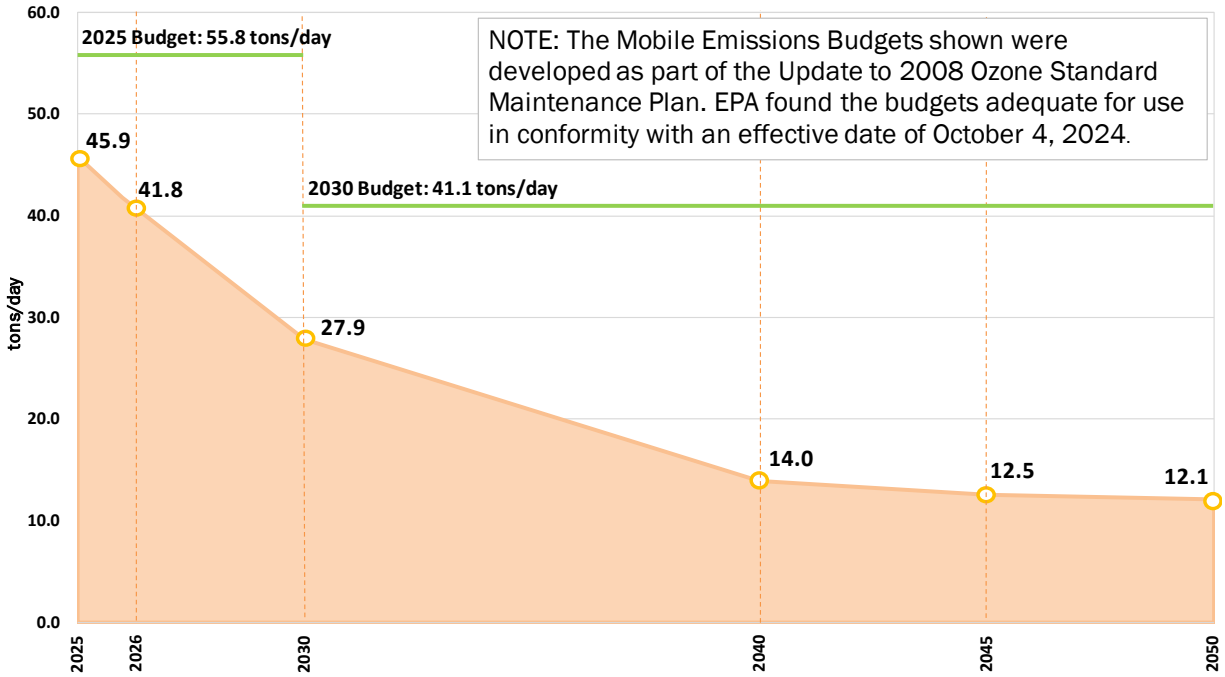


FIGURE 3.7: MOBILE SOURCE EMISSIONS AND MOBILE EMISSIONS BUDGETS, OZONE SEASON NO_X



Transportation Emission Reduction Measures

Transportation Emission Reduction Measures (TERMs) are strategies or actions that the TPB can employ to further reduce emissions from mobile sources. TERMs are generally intended to reduce the number of motor vehicle trips (VT), vehicle miles travelled (VMT), vehicle hours of travel (VHT), or a combination of any of these. These strategies may include ridesharing and telecommuting programs, improved transit and bicycling facilities, clean fuel vehicle programs, or other possible actions. These types of considerations, while not explicitly accounted for in the travel demand model, are intended to continue to reduce the emissions levels in the region.

In the Metropolitan Washington, DC (DC-MD-VA) air quality region, TERMs have not been needed to pass conformity for over ten years. During that time, TERMs' emissions benefits were calculated for reference purposes only. While TERMs are beneficial and continue to be included in the MTP, their associated emission reductions are minimal compared to the overall inventories. Calculating the transportation and emissions benefits of the TERMs is a time and resource-intensive task. Given these factors, a quantitative analysis of TERMs was not undertaken for the Visualize 2050 and FY 2026-2029 TIP air quality conformity analysis. The need for quantification and potential inclusion of the TERMs in emission inventories will be re-evaluated in future conformity determinations/plan updates.

SUMMARY

The air quality conformity work at the TPB provides critical information to confirm the region's future growth and transportation will result in on-road mobile source emissions that will be below levels needed to attain and maintain federal air quality standards. The TPB staff's air quality conformity analysis, as described, provide the basis for a determination, by the TPB, of conformity for the Visualize 2050 National Capital Region Transportation Plan and the FY 2026-2029 TIP. The findings are based on adherence to the region's current motor vehicle emissions budgets in the approved State Implementation Plan (SIP).