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2024 CONGESTION MANAGEMENT PROCESS (CMP) TECHNICAL REPORT DRAFT

November 2024

National Capital Region
Transportation Planning Board

CONGESTION MANAGEMENT PROCESS (CMP) TECHNICAL REPORT
Prepared on behalf of the Transportation Planning Board Technical Committee
November 1, 2024

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The National Capital Region Transportation Planning Board (TPB) is the federally designated metropolitan planning organization (MPO) for metropolitan Washington. It is responsible for developing and carrying out a continuing, cooperative, and comprehensive transportation planning process in the metropolitan area. Members of the TPB include representatives of the transportation agencies of the states of Maryland and Virginia and the District of Columbia, 24 local governments, the Washington Metropolitan Area Transit Authority, the Maryland and Virginia General Assemblies, and nonvoting members from the Metropolitan Washington Airports Authority and federal agencies. The TPB is staffed by the Department of Transportation Planning at the Metropolitan Washington Council of Governments (COG).

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CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS AND ACRONYMS

AADT	Annual Average Daily Traffic
ACS	American Communities Survey
ART	Arlington Transit
ATIS	Advanced Traveler Information Systems
ATM	Active Traffic Management
ATRI	American Transportation Research Institute
AVL	Automatic Vehicle Location
BRAC	Base Closure and Realignment Commission
BWI	Baltimore/Washington International Thurgood Marshall Airport
CAFE	Corporate Average Fuel Economy
CAV	Connected and Autonomous Vehicle(s)
CATT	Center For Advanced Transportation Technology
CCTV	Closed-Circuit Television
CHART	Coordinated Highway Action Response Team
CLRP	Constrained Long-Range Plan
CLV	Critical Lane Volume
CMP	Congestion Management Process
CMS	Congestion Management System
CNG	Compressed Natural Gas
CO	Carbon Monoxide
COC	Commuter Operations Center
CUE	City-University-Energysaver
DASH	Driving Alexandrians Safely Home
DCA	Ronald Reagan Washington National Airport
DMS	Dynamic Message Signs
DOT	Department of Transportation
MPSTOC	McConnell Public Safety and Transportation Operations Center
MTA	Maryland Transit Administration
MWAA	Metropolitan Washington Airports Authority
MWCOG	Metropolitan Washington Council of Governments
MWRITSA	Metropolitan Washington Regional Intelligent Transportation Systems Architecture
NCHRP	National Cooperative Highway Research Program
NCR	National Capital Region
NEPA	National Environmental Policy Act
NGA	National Geospatial Agency
NHS	National Highway System
NOx	Nitrogen Oxides
NPMRDS	National Performance Management Research Data Set
NPRM	Notice of Proposed Rulemaking
NTOC	National Transportation Operations Coalition
NVRC	Northern Virginia Regional Commission
NVTC	Northern Virginia Transportation Commission
PBPP	Performance-Based Planning and Programming
PM	Particulate Matter
PRTC	Potomac and Rappahannock Transportation Commission
PSTOC	Public Safety Transportation Operations Center
PTI	Planning Time Index
RITIS	Regional Integrated Transportation Information System
RFC	Region Forward Coalition
RTPP	Regional Transportation Priorities Plan
SAFETEA-LU	Safe Accountable Flexible Efficient Transportation Equity Act - A Legacy for the Users
SIP	State Implementation Plans

EPC	Emergency Planning Council
FAF	Freight Analysis Framework
FHWA	Federal Highway Administration
FSCPPE	Federal State Cooperative Program for Population Estimates
GHG	Greenhouse Gas Emissions
GPS	Geographic Positioning System
GRH	Guaranteed Ride Home
HOT	High Occupancy/Toll
HOV	High Occupancy Vehicle
HPMS	Highway Performance Monitoring System
IAD	Washington Dulles International Airport
ICC	Inter-County Connector
ICM	Integrated Corridor Management
IMR	Incident Management and Response
IS	Interstate System
ITS	Intelligent Transportation Systems
IVR	Interactive Voice Response
LATR	Local Area Transportation Review
LAUS	Local Area Unemployment Statistics
LOS	Level of Service
MAP-21	Moving Ahead for Progress in the 21st Century Act
MARC	Maryland Area Rail Commuter
MAROps	Mid-Atlantic Rail Operations
MATOC	Metropolitan Area Transportation Operations Coordination
MATOps	Mid-Atlantic Truck Operations
MDSHA	Maryland State Highway Administration
MNCPPC	Maryland – National Capital Park and Planning Commission
MOITS	Management, Operations, and Intelligent Transportation Systems
MPO	Metropolitan Planning Organization
SOC	State of the Commute Survey
SOV	Single Occupancy Vehicle
SRTS	Safe Routes to Schools
TARS	Travelers Advisory Radio System
TAZ	Traffic Analysis Zone
TCSP	Transportation, Community and System Preservation
TDM	Transportation Demand Management
TE	Transportation Enhancements
TERM	Transportation Emission Reduction Measure
TIGER	Transportation Investment Generating Economic Recovery
TIP	Transportation Improvement Program
TLC	Transportation/Land Use Connections
TMA	Transportation Management Area
TMC	Traffic Management Center; Traffic Message Channel
TOC	Transportation Operations Center
TOD	Transit-Oriented Development
TPB	Transportation Planning Board
TTI	Travel Time Index
TTID	Transportation Technology Innovation and Demonstration
UPT	Unlinked Passenger Trip
VDRPT	Virginia Department of Rail and Public Transportation
VHD	Vehicle Hours of Delay
VHT	Vehicle Hours of Travel
VMT	Vehicle Miles of Travel
VOC	Volatile Organic Compound
VPL	Variably Priced Lane
VPP	Vehicle Probe Project
VRE	Virginia Railway Express
WMATA	Washington Metropolitan Area Transit Authority

EXECUTIVE SUMMARY

Background

A Congestion Management Process (CMP) has been a requirement since the 2005 Safe Accountable Flexible Efficient Transportation Equity Act - A Legacy for Users (SAFETEA-LU) federal legislation. The requirement for a CMP continued under subsequent federal transportation laws including the Moving Ahead for Progress in the 21st Century Act (MAP-21, 2012) and the Fixing America's Surface Transportation (FAST) Act (2015).

The Infrastructure Investment and Jobs Act, also known as the Bipartisan Infrastructure Law (IIJA/BIL), was signed into law by President Biden on November 15, 2021. The IIJA/BIL itself and subsequent rulemaking were silent on the topic of the CMP. This report proceeds with the understanding that previous federal requirements as updated under the FAST Act remain in place.

This CMP Technical Report serves as a background document to the official CMP within Visualize 2050, providing detailed information on data, strategies, and regional programs involved in congestion management. This 2024 CMP Technical Report is an updated version of the previously published CMP Technical Reports (2008-2022).

Components of the CMP

The National Capital Region's Congestion Management Process has four components as described in Visualize 2050:

- Monitor and evaluate transportation system performance
- Define and analyze strategies
- Compile project-specific congestion management information
- Implement strategies and assess

This report documents and provides technical details of the four components of the CMP. It compiles information from a wide range of metropolitan transportation planning activities, as well as providing some additional CMP specific analyses, particularly travel time reliability and non-recurring congestion analyses.

Congestion on Highways

REGIONAL CONGESTION TRENDS, 2010-2023

The analysis of regional congestion trends from 2010 to 2023 highlights significant fluctuations in traffic congestion, notably influenced by the COVID-19 pandemic. The congestion intensity, measured by the Travel Time Index (TTI)[1] from a traveler's perspective, decreased during the pandemic, reaching a historic low TTI of 1.17 in 2020. Although the TTI rebounded in 2023, it remained below pre-pandemic levels. As shown in Figure E-1, Interstates exhibit higher TTI values

[1] Travel Time Index (TTI) is an indicator of the intensity of congestion, calculated as the ratio of actual experienced travel time to free flow travel time. A travel time index of 1.00 implies free flow travel without any delays, while a travel time index of 1.30 means one has to spend 30% more time to finish a trip compared to free flow travel.

than other road types, emphasizing the need for effective traffic management. Further details on the Travel Time Index are available in Section 2.2.1.1.

The spatial extent of congestion, measured by Percent of Congested Miles[2] from a system perspective, varied (Figure E-2) similar to the TTI. All highway categories experienced a significant decrease in congestion in 2020, likely due to the impacts of COVID-19, with reductions ranging from 84% to 95% compared to 2019. However, congestion levels rebounded swiftly, particularly on Interstates. By 2023, the percentage of congested miles on Interstates during AM peak periods reached 20%, a 400% increase from the pandemic low of 4% in 2020. Despite the temporary pandemic-related decline, the long-term trend indicates a general increase in the percentage of congested miles, especially on Interstates. Additional details on the Percent of Congested Miles can be found in Section 2.2.1.3.

Figure E-1: Annual Average Travel Time Index by Highway Category: Total AM and PM Peaks

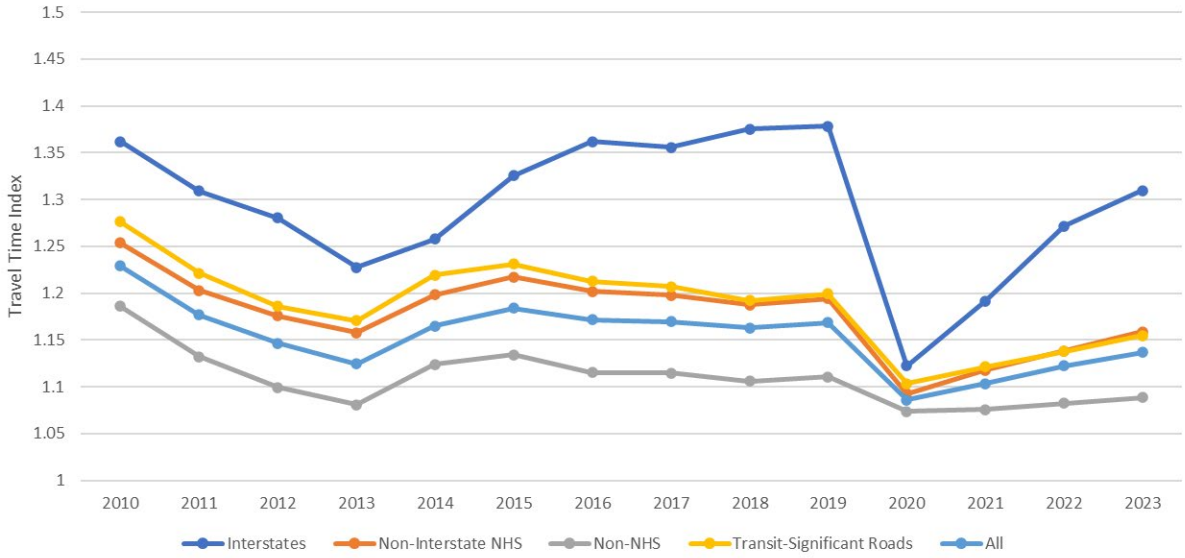
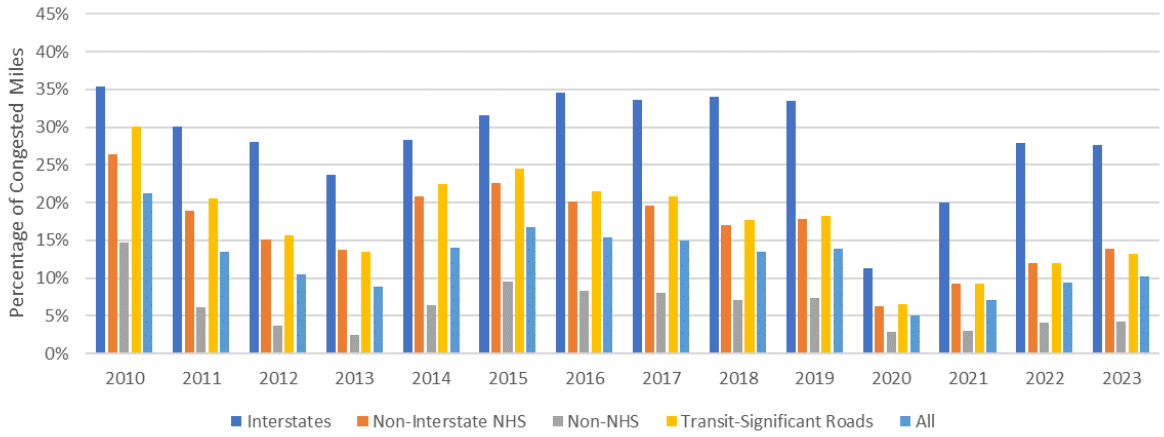


Figure E-2: Annual Average Percent of Congested Miles by Highway Category: Total AM and PM Peaks



[2] Percent of Congested (Directional) Miles is a system-wide measure that captures the spatial extent of congestion. Congestion is defined if actual travel time is 30% longer than the free-flow travel time[2], i.e., Travel Time Index > 1.3, based on recommendations made by the National Transportation Operations Coalition in 2005.

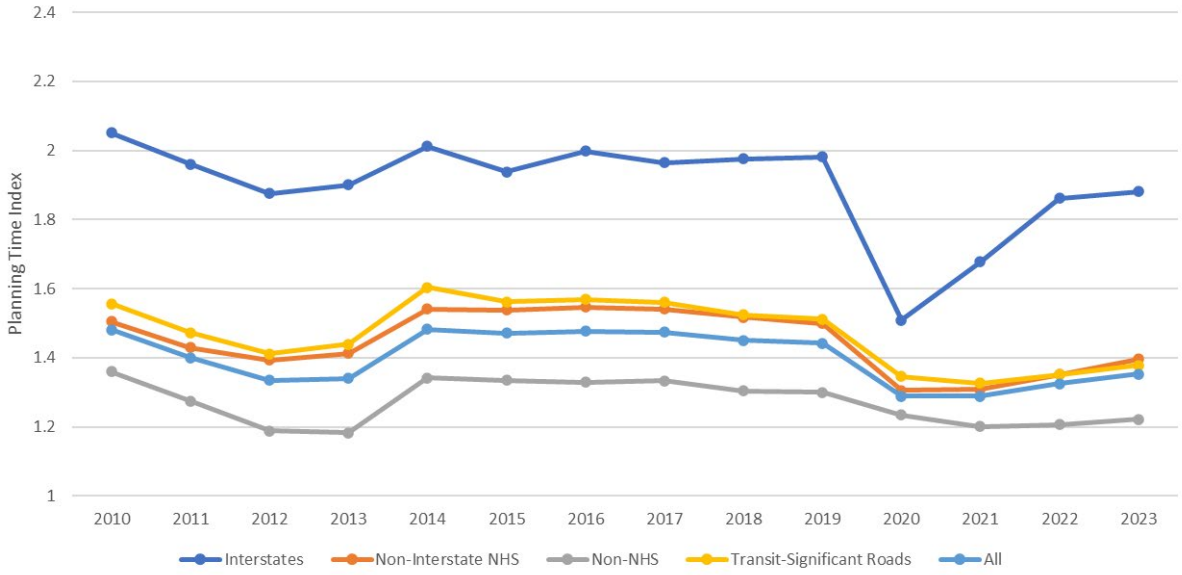
REGIONAL TRAVEL TIME RELIABILITY TRENDS, 2010-2023

Travelers in the Washington region should expect significantly longer journey times during peak periods. To ensure on-time arrivals, it is advisable to double the estimated free-flow travel time, especially on the regional Interstates. This estimate accounts for all directions of travel, but those traveling in the direction of heaviest traffic may need to allocate even more time.

In line with broader traffic congestion trends, Interstates have consistently demonstrated lower travel time reliability compared to other road types. As measured by the Planning Time Index (PTI), Interstates have consistently had a higher PTI than other highway categories, both during AM and PM peak periods. On average, the PTI for Interstates is approximately 23% higher than the overall average (Figure E-3).

Since the pandemic in 2020, the reliability of Interstate travel has worsened at a faster pace than other road types. This trend is evident in both AM and PM peak periods. The PTI for Interstates has increased by approximately 23% during AM peak periods and by 27% during PM peak periods between 2020 and 2023. Further details on the Travel Time Index are available in Section 2.2.1.2.

Figure E-3: Annual Average Planning Time Index by Highway Category: Total AM and PM Peaks

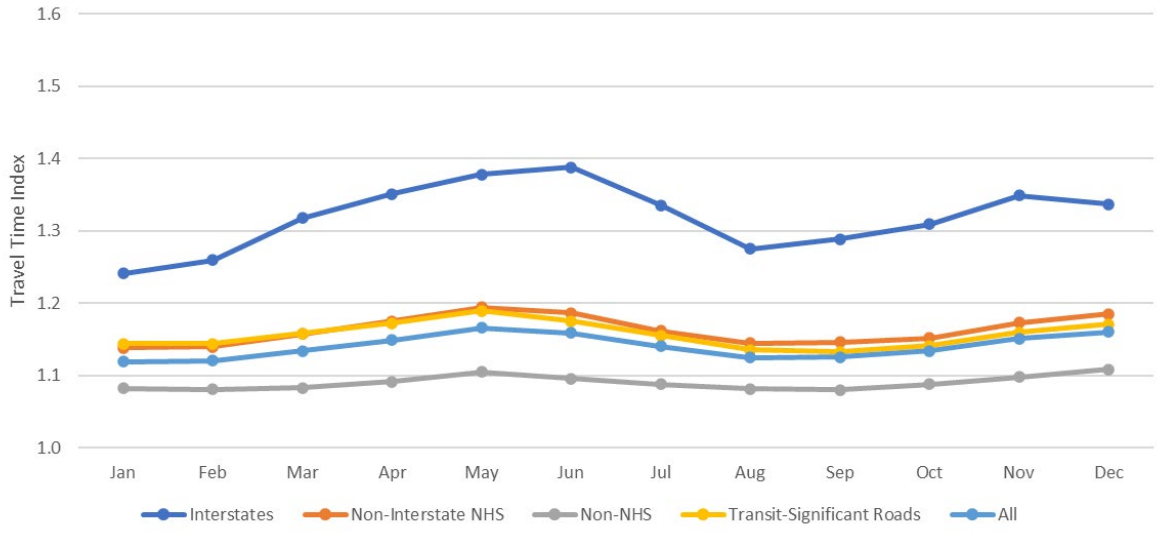


CONGESTION MONTHLY VARIATION

As depicted in Figure E-4 for 2023, traffic congestion fluctuates seasonally, with the Interstates experiencing the most significant monthly variations. Transit-Significant Roads, Non-Interstate NHS, and Non-NHS roads follow in terms of congestion variability.

During PM peak hours in 2023, Interstate TTI (Travel Time Index) exhibited a 22.1% difference between its highest (May - 1.49) and lowest (August - 1.16) values. In contrast, Non-NHS roads saw a 13.5% difference (May - 1.26 vs. August - 1.09). This indicates that Interstate travel times are more subject to seasonal fluctuations than those on other road types. The monthly variation of congestion is discussed in greater detail in Section 2.2.1.4.

Figure E-4: 2023 Monthly Variation of Congestion: Total AM and PM Peaks

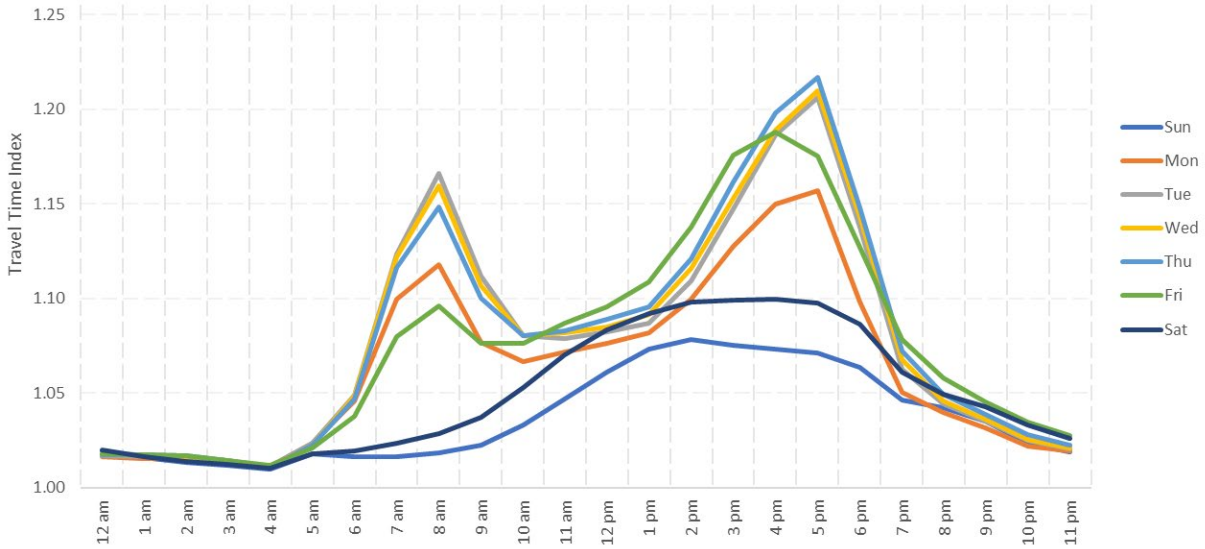


CONGESTION DAY OF WEEK VARIATION

Congestion also fluctuates throughout the week (Figure E-5). Weekends exhibited the least traffic, with Sunday recording even less congestion than Saturday and lacking distinct morning and afternoon peaks. Saturday displayed a distinctive pattern with slightly elevated midday traffic compared to Monday and Tuesday.

Weekday morning and afternoon rush hours on Tuesday, Wednesday, and Thursday witnessed substantial increases in TTI. For example, the TTI on Tuesday at 8 AM reached 1.17 compared to near free-flow conditions of 1.02 overnight, and at 5 PM, it reached 1.21. These levels are comparable to those seen before the COVID-19 pandemic, indicating a robust return to pre-pandemic traffic patterns during peak hours. For more information on the congestion variation in a typical week of 2023, see Section 2.2.1.5.

Figure E-5: Time of Day and Day of Week Variation of Congestion in 2023



TOP BOTTLENECKS

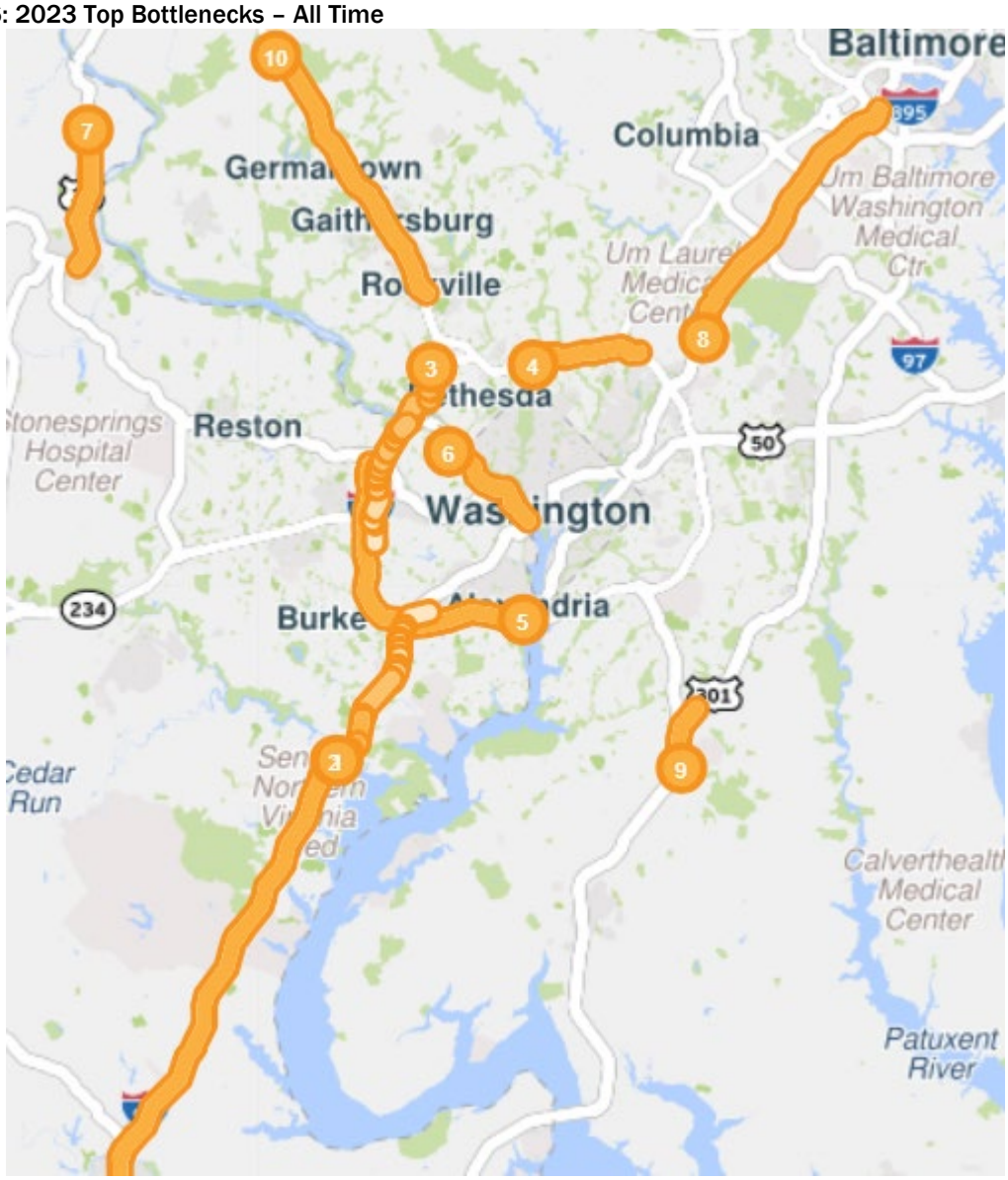
This report presents "all-time", i.e. 24/7/365, top bottlenecks by taking advantage of the Bottleneck Ranking tool in the University of Maryland's Regional Integrated Transportation Information System (RITIS) Probe Data Analytics (PDA) Suite. A measure of "Base Impact", defined within the PDA Suite as the sum of queue lengths over the duration, was used to rank the bottlenecks for this report. The "all-time" top bottlenecks in 2023 are summarized in Table E-1 and mapped in Figure E-6.

For 2023, I-95 South at VA-123/Exit 160 remained the region's most severe bottleneck (as it was in 2021 and in prior years), but the severity of congestion at this location decreased substantially compared to 2021. The average duration in 2023 (6 hours and 32 minutes) was almost 2 hours less compared to 2021 (8 hours and 9 minutes), representing a reduction of nearly 27%. The average maximum length for the bottleneck has decreased from 4.01 miles in 2021 to 3.19 miles in 2023, a decrease of approximately 20.4%. These measures suggest successful improvement efforts in this corridor. A more comprehensive discussion of the 2023 top ten bottlenecks is provided in Section 2.2.1.6.

Table E-1: 2023 Top Bottlenecks – All Time

Rank	Location	Average duration	Average max length (miles)	Total duration	Impact factor
1	I-95 S @ VA-123/EXIT 160	6 h 32 m	3.19	99 d 12 h 37 m	358,921
2	I-95 N @ VA-123/EXIT 160	4 h 17 m	3.89	65 d 7 h 21 m	348,300
3	I-495 CW @ I-270 SPUR	2 h	6.97	30 d 11 h 11 m	311,793
4	I-495 CCW @ MD-97/GEORGIA AVE/EXIT 31	3 h 45 m	3.13	57 d 1 h 35 m	265,032
5	I-495 CCW @ US-1/EXIT 1	3 h 8 m	3.52	47 d 16 h 53 m	251,152
6	GW PKY N @ VA-123/CHAIN BRIDGE RD	2 h 39 m	4.11	40 d 11 h 7 m	239,625
7	US-15 N @ STUMPTOWN RD/LUCKETTS RD	1 h 26 m	7.23	21 d 23 h 26 m	220,696
8	Baltimore–Washington Parkway S @ POWDER MILL RD	2 h 26 m	4.62	37 d 42 m	217,495
9	US-301 S @ MCKENDREE RD/CEDARVILLE RD	4 h 30 m	2.23	68 d 15 h 49 m	217,102
10	I-270 N @ MD-109/EXIT 22	2 h 8 m	5.09	32 d 14 h 5 m	214,980

Figure E-6: 2023 Top Bottlenecks – All Time



MAJOR FREEWAY COMMUTE ROUTES

Beyond the regional performance metrics outlined above, this report delves into corridor-specific analyses, focusing on 18 major freeway commute routes identified between key interchanges and points of interest. Utilizing the PDA Suite's 'Performance Charts' tool, we analyzed travel times along these routes during peak periods (Tuesdays, Wednesdays, and Thursdays) for 2010 and 2021-2023 (detailed in Section 2.2.1.7 and Appendix C).

Upon comparing travel times between 2013 and 2023, corridors were identified that have experienced improvements, deterioration, or remained relatively unchanged. The analysis conducted reveals a general trend of increased travel times across most routes during both morning and evening peak hours. However, several corridors have shown signs of improvement, with reduced travel times in 2023 compared to 2013. These insights provide valuable information for traffic management and planning efforts. For a more comprehensive exploration of traffic trends, please refer to Section 2.1.2 and Appendix D.

Congestion on Transit and Other Systems

The CMP Technical Report provides a detailed analysis of congestion's interrelationship with various issues and transportation modes, drawing from a diverse range of contemporary and historical sources. Chapter 2 provides in-depth coverage of these topics. Key findings, particularly those derived from recent research, are summarized below.

TRANSIT

The National Capital Region's transit system is a complex network comprising multiple modes, including Metrorail, commuter rail, and various bus operations. A primary concern is the persistent congestion that occurs within this system.

Roadway congestion often adversely impacts bus transit operations. Key chokepoints, particularly those situated on the Washington Metropolitan Area Transit Authority's (WMATA) Priority Corridor Network and Transit-Significant Roads (as identified by the TPB's Regional Public Transportation Subcommittee, see Section 2.3.1.1 for more information), frequently bottleneck bus transit. Addressing roadway congestion directly benefits bus operations by reducing passenger delays, lowering operational costs, enhancing reliability, and increasing ridership.

Congestion can also arise within the transit system itself. When demand for bus, rail, and train services exceeds capacity, overcrowding becomes a concern. Metrorail stations often experience peak-hour congestion, and certain transit centers, such as Union Station, are prone to crowding. Station congestion is typically attributed to design limitations, circulation constraints, and increasing ridership. As indicated in Metro's strategic plan, Momentum[3], crowded conditions during peak periods are likely to intensify without expanding the rail fleet.

MANAGED LANES FACILITIES

Several High-Occupancy Vehicle (HOV) facilities in the region have been reconstructed to High-Occupancy Toll (HOT) lanes. These lanes allow eligible vehicles, such as carpools or buses, to continue using the facility at no cost. However, single-occupant vehicles can also utilize these lanes by paying a variable toll that adjusts based on traffic congestion levels.

[3] WMATA, Strategic Plan 2013-2025, https://www.wmata.com/initiatives/strategic-plans/upload/momentum-full.pdf

PARK-AND-RIDE FACILITIES

There are over 160,000 parking spaces at nearly 400 Park & Ride lots throughout the Washington/Baltimore Metropolitan areas where commuters can conveniently bike, walk or drive to and join up with carpools/vanpools or gain access to public transit. According to the region's Commuter Connections program: two thirds of Park & Ride Lots have bus or rail service available; parking is free at 89% of the Park & Ride Lots; and more than 25% of Park & Ride Lots have bicycle parking facilities.

AIRPORT ACCESS

The transportation linkage between airports and local activities is a critical component of the transportation system. The Washington region has two major airports – Ronald Reagan Washington National Airport (DCA) in Arlington, VA, and Washington Dulles International Airport (IAD) in Loudoun County, VA. The region is also served by the nearby Baltimore/Washington International Thurgood Marshall Airport (BWI). According to the most recent TPB Air Passenger Survey the majority (over 90%) of those traveling to the region's airports does so via the highway network (i.e. personal cars, rental cars, taxis, buses). Therefore, understanding ground airport access is important to congestion management.

FREIGHT

The National Capital Region has a responsive freight system to support the vitality of economy and quality of life. This region features a consumer and service-based economy and approximately 73% of freight by weight moving into, out of and within the region is transported by truck[4]. In addition, the TPB calculates a Truck Travel Time Reliability Index (TTTRI) as part of federal Performance-Based Planning and Programming reporting requirements (see Section 4.1.2).

Future Congestion

The constrained element of Visualize 2045, the Metropolitan Washington region's long-range transportation plan, included all regionally significant transportation projects and programs planned in the Metropolitan Washington region over the next 25-30 years. The TPB produces a performance analysis of every long-range plan, which examines trends and assesses future levels of congestion as well as other performance measures. The performance analysis of the constrained element of Visualize 2045 provided an overall assessment of the anticipated impacts and an indication of future levels of congestion relevant to the CMP.[5]

Based upon the outlook of growth in the region, the plan performance analysis examined travel demand model data to identify where congestion is expected to occur now and in the future. It looked at criteria that may affect congestion, such as changes in population, employment, transit trips, auto trips, number of lane miles, and congested lane miles. The analysis broke down lane miles of congestion by examining the total share of congested lane miles, a comparison with no-build alternative scenario, additional indicators of delay, and, generally, where the most lane miles of congestion may be found in 2045.

The region was forecast to be home to 23% more residents and 26% more jobs in 2045. Towards accommodating that growth, 42% more lane miles of roadway and 27% more high-capacity transit miles were planned to be constructed. The total number of trips per day taken was expected to

[4] National Capital Region Freight Plan Update – 2023, https://www.mwcog.org/documents/2023/07/19/national-capital-region-freight-plan-freight/

[5] TPB, Visualize 2045 Long-Range Transportation Plan (2022 Update). https://visualize2045.org/plan-update/approved-2022-plan/

increase by 17%, and transit, walk, and bike trips were expected to increase at a faster rate than single driver trips. The overall amount of driving (Vehicle Miles Traveled or VMT) was expected to increase by 15%. This was slightly less than forecast population growth, which means that VMT per capita was expected to decline by 3%. The increase in demand on the roadways was forecast to outpace the increase in supply, leading to a significant increase in congestion.

National Comparison of the Washington Region's Congestion

The Washington metropolitan area is consistently ranked among the most congested regions in the United States. According to independent congestion analyses conducted by INRIX[6], Texas A&M Transportation Institute[7], and TomTom[8], the region's traffic patterns significantly contribute to travel time delays. According to INRIX, Washington was ranked 8th nationally in 2023 for annual average hours wasted in traffic. The Texas A&M Transportation Institute reported that Washington had the 4th highest Annual Person-Hours of Delay per Commuter among 15 very large urban areas. Meanwhile, TomTom ranked the region 14th based on average travel time per 6 miles. For additional details of the Washington region's congestion relative to other major cities, please refer to Section 2.5.

Congestion Management Strategies

The CMP has been playing an important role in developing strategies, including strategies in association with capacity-expanding projects, to combat congestion or mitigate the impact of congestion. Visualize 2045 and TPB member agencies have pursued many alternatives to capacity increases, with considerations of these strategies informed by the CMP. In accordance with R18-2021[9], the TPB and Fredericksburg Area MPO (FAMPO) maintain coordinated, cooperative, and continuing planning processes, particularly regarding the CMP that FAMPO oversees[10] for the northern portion of Stafford County, which is part of the Washington, DC-MD-VA Urbanized Area (UZA), in compliance with applicable federal laws and regulations. Implemented or continuing strategies include demand management strategies and operational management strategies, as shown in Figure E-7. It should be noted that although strategies are divided into two categories for reporting purposes in this document, demand management and operational management strategies should be designed and implemented to work in cooperation.

[6] INRIX, Inc., Traffic Scorecard, http://inrix.com/scorecard/

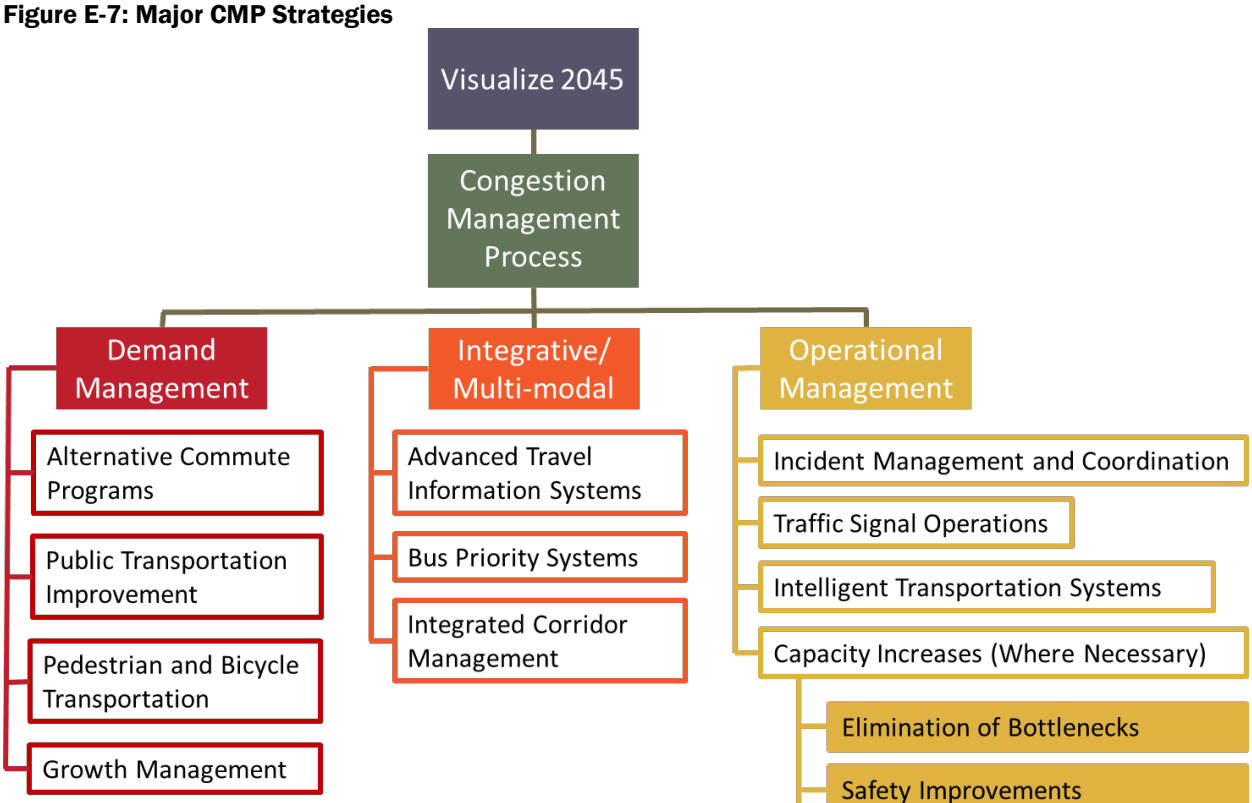
[7] Texas A&M Transportation Institute, 2023 Urban Mobility Report, https://mobility.tamu.edu/umr/

[8] TomTom, Traffic Index, https://www.tomtom.com/en_gb/trafficindex/list

[9] R18-2021 - Resolution to approve the 2021 TPB-Fredericksburg Area MPO Memorandum of Understanding, https://www.mwcog.org/documents/2021/05/21/r18-2021---resolution-to-approve-the-2021-tpb-fredericksburg-area-mpo-memorandum-of-understanding-/

[10] FAMPO, Congestion Management Process, https://fampo.gwregion.org/congestion-management-process/

Figure E-7: Major CMP Strategies



Note: There are synergies between demand management and operational management strategies, such real-time traveler information on ridesharing opportunities responsive to a real-time traffic incident or situation.

DEMAND MANAGEMENT STRATEGIES

Demand Management aims at influencing travelers' behavior for the purpose of redistributing or reducing travel demand. Examples of TPB's demand management strategies include:

- Commuter Connections Program – Including strategies such as Telework, Employer Outreach, Guaranteed Ride Home, Live Near Your Work, Carpooling, Vanpooling, Ridematching Services, Car Free Day, and Bike To Work Day.
- Promotion of local travel demand management – Local demand management strategies are documented in the main body of the CMP Technical Report.
- Public transportation improvements – The Washington region continues to support a robust transit system as a major alternative to driving alone.
- Pedestrian and bicycle transportation enhancements as promoted and tracked through the Bicycle and Pedestrian Planning program – The number of bicycle and pedestrian facilities in the region has increased in recent years; the regional bikesharing program, Capital Bikeshare has more than 5,000 bikes available at 600 stations across six jurisdictions:

Washington, DC; Arlington, VA; Alexandria, VA; Montgomery County, MD; Prince George's County, MD; Fairfax County, VA; and the City of Falls Church, VA.

- Car sharing - Local governments work with private companies to make the region's car sharing market viable.
- Land use strategies – Including those promoted by the Transportation-Land Use Connections (TLC) Program.

OPERATIONAL MANAGEMENT STRATEGIES

Operational management focuses on improvements made to the existing transportation system to keep it functioning effectively. Examples of TPB's operational management strategies include:

- Managed Lanes Facilities, which can include high-occupancy vehicle facilities (such as on US-50 and the Dulles Toll Road) and variably-priced facilities (such as on I-66 and I-495).

- Incident Management – The region's state DOTs all pursue strategies for managing their transportation systems, including operation of 24/7 traffic management centers, roadway monitoring, service patrols, and communications interconnections among personnel, centers and systems.

- Regional Transportation Operations Coordination – Notably, the Metropolitan Transportation Operations Coordination (MATOC) program, whose development the TPB helped shepherd, uses real-time transportation systems monitoring and information sharing to help mitigate the impacts of non-recurring congestion.

- Intelligent Transportation Systems are considered, particularly through the TPB's Systems Performance, Operations, and Technology Subcommittee. Examples include traffic signal optimization, adaptive traffic signal systems, safety service patrols, drone technology for accident reconstruction and traveler information.

INTEGRATED/MULTI-MODAL STRATEGIES

While there is often overlap in demand management and operational management strategies, for example, real-time traveler information on ridesharing opportunities responsive to a real-time traffic incident or situation, there are projects in the region that fully integrate demand and operational management strategies.

- Advanced Traveler Information Systems – Travelers have more ways than ever for obtaining trip planning information such as traffic, incidents, real-time transit arrivals, and emergency information. The prevalence of internet capable mobile devices and social media provide new means of communication between travelers and operators.

- Bus priority systems are sensors used to detect approaching transit vehicles and alter signal timings to improve transit performance. This is important because improved transit performance, including more reliable arrival times for buses, makes public transit a more appealing option for travelers. Bus priority systems have been installed on key bus corridors across the region, helping to offset the impact of traffic congestion on bus speeds.

- Integrated Corridor Management - MDOT and VDOT have instituted ICM efforts in major corridors.

- Both the VDOT and the MDOT utilize performance-data-driven project programming prioritization processes that consider, in part, congestion management impacts of proposed projects.

- DOTs, transit agencies, private transportation providers, and other third parties have developed mobile versions of websites and mobile applications (apps) to make it easier for travelers to receive information on their devices.

- Transportation agencies in the region have adopted social media as a means of sharing information with a large segment of the public. Instead of providing information only on a central website that the user has to visit, social media provides a way to deliver that information to users through a forum to which they already subscribe, such as Twitter which was one of the most popular social media sites for the transportation sector.

ADDITIONAL SYSTEM CAPACITY

Federal law and regulations list capacity increases as another possible component of operational management strategies, for consideration in cases of elimination of bottlenecks, safety improvements and/or traffic operational improvements. These capacity increase projects were documented in Visualize 2045.

The region has an emphasis on demand and operational management strategies, such as transit improvements, the Commuter Connections program, instead of or in conjunction with system capacity increases.

Assessment of Congestion Management Strategies

ASSESSMENT OF IMPLEMENTED STRATEGIES

The TPB assesses the implemented congestion management strategies in a variety of ways. Many strategies have specific assessments and the overall effectiveness of all strategies is repeatedly evaluated by congestion monitoring and analysis.

Specific assessments (of individual or several strategies):

- A variety of surveys within the Commuter Connections Program are regularly conducted to provide firsthand data inputs for the assessments, including the Guaranteed Ride Home Customer Satisfaction Survey, Commuter Connections Applicant Placement Rate Survey, State of the Commute Survey, Employee Commute Surveys, Carshare Survey, Vanpool Driver Survey, Employer Telework Assistance Follow-up Survey, and the Bike-to-Work Day Participant Survey.

- Public transportation improvements, pedestrian and bicycle transportation improvements, and land use strategies are assessed in Regional Household Travel Surveys, and Regional Travel Trends Reports.

Overall assessments (of all implemented strategies):

a) The Eastern Transportation Coalition probe-vehicle-based traffic monitoring data.

b) National Performance Management Research Data Set (NPMRDS).

c) Maryland, Virginia and the District of Columbia's Highway Performance Monitoring Systems (HPMS).

ASSESSMENT OF POTENTIAL STRATEGIES THROUGH SCENARIO PLANNING

The TPB has conducted scenario planning studies over the years. The three most recent scenario studies are the Long Range Plan Task Force Report which identified seven initiatives for inclusion in Visualize 2045; the Multi-sector Working Group (2015) identified projects in the transportation and land use sector with the aim of reducing greenhouse gases; and the TPB Climate Change Mitigation Study of 2021 which included three "top-down" scenarios and 10 "bottom-up" scenarios exploring single and combination pathways to reduce on-road, transportation-sector greenhouse gas emissions.

The TPB has also undertaken the Transportation/Land Use Connections (TLC) Program. The TLC Program addresses the "how to" challenges related to improving transportation/land-use coordination and realizing an alternative future for the region, through providing both direct technical assistance and information about best practices and model projects.

Compiling Project-Specific Congestion Management Information

Pursuant to Federal regulations, the TPB encourages consideration and inclusion of congestion management strategies in all Single Occupancy Vehicle (SOV) capacity-increasing projects. To ensure that individual transportation projects contribute positively to regional congestion management efforts, the TPB utilizes a CMP Documentation Form[11] (see Appendix F) to assess that the planning of federally funded single-occupancy vehicle (SOV) projects has included considerations of CMP strategy alternatives and integrate such components where feasible. In the Technical Inputs Solicitation for the update to Visualize 2050 and the TIP, for any project to undergo construction activities within the first four years (by 2029) and is providing a significant increase to SOV capacity, it must be documented that the implementing agency considered all appropriate systems and demand management alternatives to the SOV capacity. This ensures that project planning considered strategies that reduce overall traffic demand, alongside potential capacity enhancements.

The dedicated CMP Documentation Form includes a specific set of questions related to SOV congestion management. Any project with construction activities planned by 2029 aiming to significantly increase a highway's single-occupancy vehicle capacity must answer these questions to be considered for inclusion within the Visualize 2050 plan and the FY26-29 TIP. By requiring this documentation, the CMP ensures that high-capacity SOV projects are carefully evaluated and, whenever possible, integrated with strategies that manage overall traffic demand.

Key Findings of the 2024 CMP Technical Report

1. Congestion – While the COVID-19 pandemic significantly reduced congestion, with the Travel Time Index (TTI) reaching a historic low of 1.17 in 2020, congestion rebounded in 2023, but

[11] *The CMP Documentation Form is currently a portion of the online system member agencies use to enter project information into TPB's Technical Inputs Solicitation.*

to levels still below pre-pandemic norms (e.g., Interstates TTI of 1.41 in 2023 versus 1.48 in 2019).

2. Reliability – Travel time reliability improved during the pandemic due to reduced congestion but has since reverted to pre-pandemic levels (Section 2.2.1.2).

3. Bottlenecks – Bottleneck locations have shifted somewhat since 2019, though many persistent hotspots remain, with I-95 southbound between US-1 and VA-123 continuing to be the region's most congested segment. (Section 2.2.1.6).

4. Travel Demand Management – Travel demand management strategies, including the Commuter Connections program, remain crucial for congestion mitigation. The region's robust transit system is a key alternative to single-occupancy vehicles (Section 3.2.1).

5. Walking and Bicycling – Walking and bicycling continue to grow in the region in part due to increasing connectivity in the bicycle and pedestrian network (Sections 3.2.4 and 3.2.5).

6. Variably Priced Lanes (VPLs) - VPLs provide additional options to travelers in the region. Facilities include 95Express, 395Express, 495Express, I-66, and Maryland Route 200 (Intercounty Connector (ICC)) (Section 3.3.2).

7. Regional Transportation Operations Coordination – The Metropolitan Washington Area Transportation Operations Coordination (MATOC) continues to play an important role in coordination and communicating incident information during both typical travel days and special events such as severe weather and construction work (Section 3.3.3.4).

8. Real-time travel information – The increasing availability of technology to monitor, detect, and evaluate travel conditions allows operators to make changes to the transportation network through active travel demand management, traffic signal optimization, and integrative corridor management. For travelers, real-time traffic and transit information are available from a number of sources though mobile applications and mobile versions of websites. Social media provides a mutually beneficial direct connection between transportation providers and users. Mobile applications related to non-auto modes, such as transit and bikesharing, allow travelers to be flexible with their mode choices (Section 3.4.6).

9. COVID-19 Pandemic Impacts – 2023 saw a mix of travel trends coming out of the pandemic, with A.M. peak congestion remaining lower but P.M. peak congestion matching pre-pandemic conditions. (Sections 2.2.1.1 and 2.2.1.2; Section 2.2.3; Section 2.3).

Recommendations for the Congestion Management Process

The 2024 CMP Technical Report delineates the evolution of the Congestion Management Process in the Washington region. The report underscores several pivotal recommendations for prospective enhancements.

1. **Continue the Commuter Connections program.** The Commuter Connections program is a fundamental strategy for demand management in the National Capital Region, offering benefits from a regional perspective. It contributes to the reduction of trips, vehicle miles of travel, transportation emissions, and enhances air quality.

2. **Continue and enhance the MATOC program and support agency/jurisdictional transportation management activities.** The MATOC program/activities are key strategies of operational management in the National Capital Region. Recent enhancements have including efforts on severe weather mobilization and incident coordination. Future enhancements of the MATOC program should be considered when appropriate to expand the function and participation of the program.

3. **Continue to coordinate PBPP with the CMP.** Performance measurement and analysis are integral components of both requirements and can be achieved synergistically.

4. **Continue to encourage integration of operations management and travel demand management components of congestion management for more efficient use of the existing transportation network.** State DOTs should persist in exploring ATM strategies along congested freeways and actively manage arterials along freeways. Collaboration among transportation agencies and stakeholders is encouraged along congested corridors.

5. **Pursue sufficient investment in the existing transportation system, which is important for addressing congestion.** Prioritizing maintenance for the existing transportation system, as advocated in TPB's Regional Transportation Priorities Plan, is crucial to congestion management.

6. **Continue variable pricing and other management strategies in conjunction with capacity increasing projects.** Variably priced lanes (VPLs) offer an option for travelers to circumvent congestion and provide an effective congestion management strategy for agencies.

7. **Continue to encourage transit in the Washington region and explore transit priority strategies.** The transit system serves as a significant alternative to solo driving, maximizing the utility of existing infrastructure. Local jurisdictions should collaborate with transit agencies to explore transit priority strategies.

8. **Encourage implementation of congestion management for major construction projects.** Past successes, such as the 495 NEXT and Transform 66 projects, underscore the effectiveness of construction project-related congestion management.

9. **Continue to encourage access to non-auto travel modes.** The success of the Capital Bikeshare program and the decrease in automobile registrations in the District of Columbia indicate a shift towards non-automobile transportation in urban areas.

10. **Continue and enhance providing real-time, historical, and multimodal traveler information.** Sharing travel/incident information and partnering with private sector providers of travel and navigation information can help travelers avoid congestion and delays.

11. **Encourage implementation of projects, programs, and processes that support the TPB Priority Strategies.** In February 2023, the TPB approved Priority Strategies to guide the development of Visualize 2050. As a continuation of the seven Aspirational Initiatives endorsed in 2018, the TPB noted that these fourteen total Priority Strategies, if funded, enacted, and supported, would have the potential to significantly improve the region's transportation system performance compared to current plans and programs.

12. **Encourage connectivity within and between Regional Activity Centers.** The recent refinement of the Regional Activity Centers map, adopted in 2013, helps coordinate transportation and land use planning for future growth.

13. **Continue and enhance the regional congestion monitoring program with multiple data sources.** There is a wealth of sources, both public and private sector, for data related to congestion which have their individual strengths and shortcomings. Private sector probe-based monitoring provides unprecedented spatial and temporal coverage on roadways, but still needs to be supplemented with data from other sources including data on traffic volumes and traffic engineering considerations. There should be continual review of the quality and availability of data provided by different sources and the structuring of a monitoring program in a way that is adaptable for potential future changes in data reporting and/or data sources.

14. **Undertake enhanced analysis of available data to understand congestion trends and impacts.** Regional understanding of the equity impacts of congestion as well as long-term trends would be improved with new and additional analyses.

15. **Monitor trends in freight, specifically truck travel.** Interrelationships between freight movement and congestion differ from interrelationships between passenger travel and congestion.

16. **Participate in collaborative planning connected and automated vehicle readiness.** These emerging technologies will dramatically alter future transportation planning. Standards and interoperability are critical issues and should be addressed through extensive collaboration with a variety of stakeholders.

17. **Monitor impacts of and interactions with shared mobility services.** Transportation Network Companies (TNCs) continue to have an evolving impact on a variety of aspects of congestion management, mode share, and transportation overall, but data for regional analysis remain scarce. Regulating agencies are encouraged to arrange for TNC data to be collected and shared with the TPB and other official transportation planning and operating entities, to enable analysis of impacts.

18. **Encourage Traffic Incident Management (TIM).** COG's 2018 creation of its Traffic Incident Management Enhancement (TIME) initiative highlighted the importance of TIM within congestion management.

1. INTRODUCTION

1.1 Need for a CMP Technical Report

This report presents a technical review of the Congestion Management Process (CMP), as addressed by the National Capital Region Transportation Planning Board (TPB) at the Metropolitan Washington Council of Governments (COG).

The Fixing America's Surface Transportation (FAST) Act, signed into law by President Obama on December 4, 2015, continued the requirement for the use of the CMP in Transportation Management Areas (TMA) that was first stipulated in SAFETEA-LU and maintained in the MAP-21 legislation.

The Infrastructure Investment and Jobs Act, also known as the Bipartisan Infrastructure Law (IIJA/BIL), was signed into law by President Biden on November 15, 2021. The IIJA/BIL itself and subsequent rulemaking were silent on the topic of the CMP. This report proceeds with the understanding that previous federal requirements as updated under the FAST Act remain in place.

The CMP is similar to the previous requirements for a Congestion Management System (CMS) introduced in the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). The change in name and acronym from CMS to CMP was intended to place a greater emphasis on the planning process and environmental review process, while maintaining and developing effective management and operation strategies. Federal regulations state that metropolitan transportation planning areas with a population of 200,000 or more, designated as a TMA, are required to have a CMP. Long-range transportation plans developed after July 1, 2007, must contain a CMP component. Additionally, in metropolitan planning areas classified as non-attainment for Ozone and Carbon Monoxide (CO) under the Clean Air Act, no single-occupant vehicle (SOV) capacity-expanding project can receive federal funds unless it shows that the CMP has been considered.

Federal regulations state that:

"The transportation planning process … shall address congestion management through a process that provides for safe and effective integrated management and operation of the multimodal transportation system, based on a cooperatively developed and implemented metropolitan-wide strategy, of new and existing transportation facilities…
…through the use of travel demand reduction …, job access projects, and operational management strategies."[12]

Additionally, a previous federal certification of the TPB planning process, dated March 2006, addressed CMS/CMP as related to the region's long-range transportation plan, then known as the Constrained Long Range Plan or CLRP[13], with the following recommendation:

> *The TPB should develop a comprehensive description of a regional Congestion Management System to demonstrate its application at critical stages of the metropolitan planning*

[12] "Statewide and Nonmetropolitan Transportation Planning; Metropolitan Transportation Planning; Final Rule," *Federal Register*, Vol. 81, No. 103, May 27, 2016, § 450.322 (a) page 34152 – emphasis added.

[13] Prior to 2018, the TPB's long-range transportation plans were known by the name Constrained Long-Range Plan, or CLRP. TPB published a successor to the CLRP in 2018, expanding the plan and naming it Visualize 2045; the term "CLRP" is no longer used. Henceforth the CMP Technical Report will use the terminology of either Visualize 2045, when referring to the specific 2018 document, Visualize 2050 when referring to the upcoming plan or to the National Capital Region Transportation Plan for more general references. The label CLRP will not be used, except for historical references and quotes.

process, including the development of the CLRP, TIP, and the development of major projects and policies.

The description should be part of the next update to the CLRP or a stand-alone document that is completed in one year from the issuance of this report. The description can build on key elements in place, including monitoring and evaluating alternatives to new capacity (such as for the Mixing Bowl Springfield Exchange and the Woodrow Wilson Bridge) and the range of congestion-related strategies (such as the Commuter Connections Program).[14]

The Congestion Management Process is intended to operate within or in conjunction with the planning process, which is the focal point for consideration of other factors, such as equity, safety, Clean Air Act requirements, transit, funding, land use scenarios, and non-motorized alternatives. The planning process also leads to decisions on which projects are programmed and implemented. The CMP provides important information to decision-makers, such as the TPB, who consider transportation planning in our region.

This report is a step in the CMP, which is an ongoing activity. Just as there are many causes of congestion, there are also many solutions. While this report documents the region's recent CMP activities, the concept of addressing congestion and meeting regional goals will continue to be an integral part of the metropolitan planning process.

1.2 The Institutional Context of the CMP in the Washington Region

The National Capital Region Transportation Planning Board (TPB) at the Metropolitan Washington Council of Governments (COG) is the federally designated Metropolitan Planning Organization (MPO) for the region. The TPB is responsible for creating long-range transportation plans and Transportation Improvement Programs (TIPs) for the region, encompassing the District of Columbia, parts of the State of Maryland, and the Commonwealth of Virginia. The TPB comprises representatives from state, county, local government agencies, the Washington Metropolitan Area Transit Authority (WMATA), non-voting members of the Metropolitan Washington Airports Authority, and federal agencies.

The TPB is guided by a standing Technical Committee for transportation. This committee supervises the details of transportation planning and engineering studies necessary to support the region's transportation decision-making process. It has several standing subcommittees focusing on specific aspects of the transportation planning process, including aviation, bicycle and pedestrian planning, regional public transportation planning, travel forecasting, transportation safety, freight planning, and systems performance, operations, and technology[15].

The TPB Technical Committee serves as the oversight committee for the CMP, guiding long-range plan activity and overseeing the interaction of the various subcommittees. The Technical Committee is further advised by several standing subcommittees with expertise in specific aspects of the CMP, such as the Systems Performance, Operations, and Technology Subcommittee, the Commuter Connections Subcommittee, and the Travel Forecasting Subcommittee.

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[14] *Transportation Planning Certification Summary Report* (March 16, 2006). Prepared by Federal Highway Administration and Federal Transit Administration. Page 10. http://www.mwcog.org/uploads/committee-documents/tVpXVls20060405140322.pdf

[15] As of July 2016, under the auspices of the FY2017 Unified Planning Work Program (UPWP), the former Management, Operations, and Intelligent Transportation Systems (MOITS) Technical Subcommittee was renamed the Systems Performance, Operations, and Technology Subcommittee (SPOTS), reflecting a focus on both existing and emerging topics.

The original CMS/CMP activities in the region were directed by a CMS Task Force, established in the mid-1990s. Congestion Management System reports were produced in FY 1995 and FY 1996. Subsequently, a decision was made to integrate congestion management information into the region's long-range transportation plan, rather than maintaining a separate document, to ensure continuity between the CMS and the long-range plan. Over the years, the CMS/CMP process has involved data collection and analysis, compiling information from implementing agencies associated with projects submitted to the long-range plan and TIP, and considering management and operations strategies under the TPB Technical Committee and its relevant subcommittees. Following the 2006 federal certification review of the TPB's planning process, the 2008 CMP Technical Report marked a return to the practice of creating a separate congestion management document.

The 2010 CMP Technical Report was the first to incorporate the Vehicle Probe Project (VPP)/INRIX data[16] and develop new performance measures. The 2012 CMP Technical Report used even more third-party data, including expanded VPP/INRIX data, and traffic volume information from the Transportation Technology Innovation and Demonstration (TTID) Program of the FHWA. The 2014 CMP Technical Report included updates or initiatives occurring between mid-2012 to mid-2014 and adjusted itself to meet MAP-21 requirements. The 2016 and 2018 CMP Technical Reports summarized the region's travel trends, including congestion up to the end of 2015 and 2017 respectively, and congestion management strategies up to mid-2016 and 2018 respectively. The elements of the CMP were incorporated into Visualize 2045, the region's long-range plan, using the 2018 Technical Report as a resource document. The 2020 and 2022 CMP Technical Reports continued with similar structures and analyses. The 2020 report provided information considered in the development of the 2022 update to Visualize 2045. The 2022 report added examination of the impacts of the COVID-19 pandemic. The current 2024 CMP Technical Report summarizes the region's travel trends, including congestion up to the end of 2023, and congestion management strategies. Section 1.5 provides a summary of the highlights of the 2024 Report.

1.3 Coverage Area of the CMP

The Washington region CMP covers the TPB Planning Area (
Figure 1-1). As of July 1, 2024, the planning area under the jurisdiction of the TPB includes the District of Columbia and its surrounding territories. In Maryland, the jurisdictions within the planning area comprise Charles County, Frederick County, Montgomery County, and Prince George's County, along with the cities and towns located within these counties. In Virginia, the planning area extends to include Alexandria, Arlington County, the City of Fairfax, Fairfax County, Falls Church, Loudoun County, the Cities of Manassas and Manassas Park, and Prince William County.

[16] From the Eastern Transportation Coalition (formerly I-95 Corridor Coalition), https://tetcoalition.org/projects/vpp-marketplace/

Figure 1-1 TPB Planning Area

1.4 Components of the CMP

The Congestion Management Process (CMP) in the National Capital Region is composed of the following four integral components, each of which is fully integrated into the long-range transportation plan:

1. **Monitoring and Evaluating Transportation System Performance.** This component encompasses the TPB's efforts to analyze congestion using emerging data sources, such as the Vehicle Probe Project (VPP) data and analysis tools, the regional transportation data clearinghouse, and special studies.

2. **Defining and Analyzing Strategies.** This component involves the TPB Technical Committee, subcommittees, and staff identifying existing and potential strategies. The TPB considers a variety of demand management and operational management strategies.

3. **Compiling Project-Specific Congestion Management Information.** In accordance with Federal regulations, the TPB advocates for the consideration and inclusion of congestion management strategies in all Single Occupancy Vehicle (SOV) capacity-increasing projects. This involves compiling and analyzing information in the CMP documentation forms, which are part of the TPB's Technical Inputs Solicitation process. These forms are submitted by regional agencies during the development of the long-range transportation plan.

4. **Implementing Strategies.** This component focuses on the TPB's efforts to compile information on strategies that have been implemented, particularly on a regional level. Feedback from the process is beneficial for updating the CMP and considering additional strategies and technical methods.

1.5 Highlights of the 2024 Update of the CMP Technical Report

The 2024 CMP Technical Report is an enhancement of the congestion facts and analyses presented in the 2022 report. It continues to provide comprehensive and updated documentation of the congestion management strategies considered and implemented in the National Capital Region. Updates have been made throughout the 2024 edition. Key updates include:

- **New Analyses.** The 2024 CMP Technical Report includes new sections that provide more detailed information on various aspects of congestion in the National Capital Region, including:
    - *Key External Influences on NCR's Congestion (Section 2.1.1):* This section provides an interpretative analysis of the external factors influencing weekday Interstate traffic congestion within the National Capital Region (NCR), as gauged by the travel time index (TTI). Analysis of data from 2010-2022 suggests that employment, population, and gasoline prices have a moderate to minor impact on TTI.

    - *Long-Term Travel Time Trends on NCR Corridors (Section 2.1.2 and Appendix D):* Section 2.1.2 describes an analysis of travel time trends on the 18 major commute corridors in the region during the morning and evening peak hours. It compares travel times in 2013 to those in 2023, highlighting corridors that have improved, worsened, or remained unchanged, with more details found in Appendix D.

- **Updated CMP and Performance-Based Planning and Programming Data (Chapter 2).** The Federal Highway Administration (FHWA) requires State Departments of Transportation (DOTs) and Metropolitan Planning Organizations (MPOs) to report on the performance of the Interstate and non-Interstate National Highway System (NHS), manage freight movement on the Interstate system, and monitor traffic congestion and on-road mobile source emissions for the Congestion Mitigation and Air Quality Improvement (CMAQ) Program. TPB continues to comply and report performance measures and targets as required, coordinating with the CMP as necessary. The latest available information has been included in this report:
    - Percent of reliable person-miles traveled on the Interstate.
    - Percent of reliable person-miles traveled on the non-Interstate NHS.
    - Truck Travel Time Reliability Index for Interstates.
    - Annual hours of peak hour excessive delay per capita.
- **Periodic updates.** Since the release of the 2022 CMP Technical Report, a variety of planning and program periodic updates and outside data sources have been released. This current report uses these updates to provide the most up-to-date information for the CMP. Some critical updates include, but are not limited to:
    - Round 10 Cooperative Forecasts of the region's demographics (Section 2.1)
    - 2023 Transportation Emissions Reductions (TERMs) Analysis Report (Section 3.2.1 and Appendix E)
- **How Results of the CMP Are Integrated into the National Capital Region Transportation Plan (Chapter 5):** This section has been updated and expanded to better describe the CMP as a component of the region's planning ecosystem, shaping the strategies and, ultimately, the projects, programs, and policies encapsulated in National Capital Region Transportation Plans. New sections of Chapter 5 include the Role of Key Planning Agencies, Public Engagement, and Equity Considerations.

2. STATE OF CONGESTION

2.1 Regional Travel Trends

The Washington region's recent travel trends paint a picture of shifting dynamics impacted by population growth, employment fluctuations, and the COVID-19 pandemic. While population increased steadily between 2010 and 2022 (Figure 2-1)[17], employment saw fluctuations with a peak in 2019 before dropping slightly in 2020 and recovering in 2021-22.

The weekday vehicle miles traveled (VMT) per capita, as reported by the Regional Transportation Data Clearinghouse, saw an uptick of 6% from 2014 to 2017, plateaued through 2018, and then rose slightly in 2019. However, the COVID-19 pandemic led to a significant 20% reduction in 2020. Interestingly, there was a rebound in 2021 with VMT rising to levels closer to the pre-pandemic era.

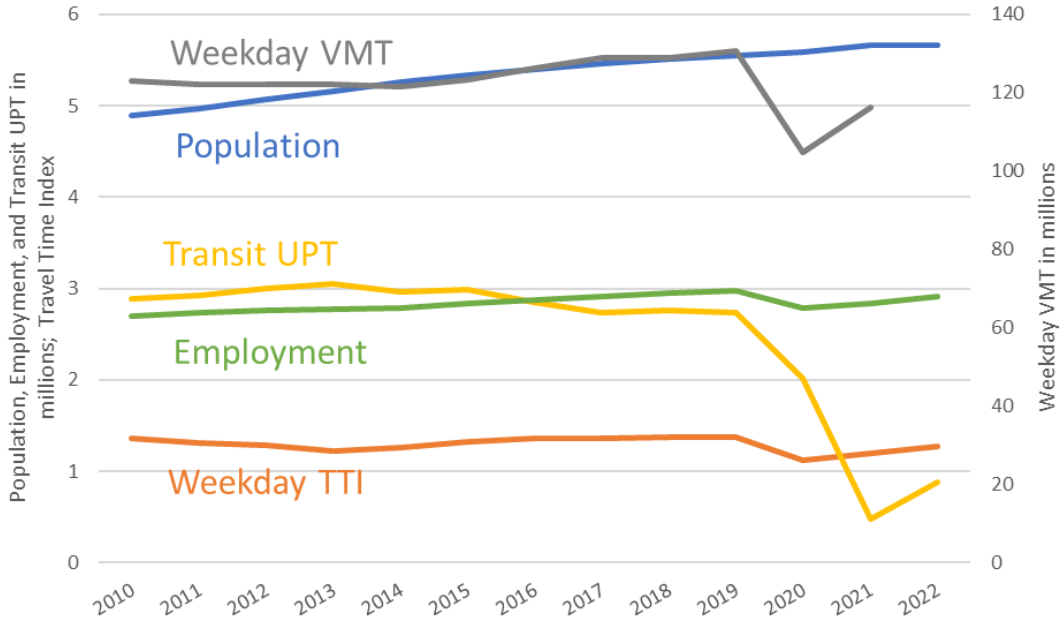
The Weekday Travel Time Index (TTI), a measure of peak period congestion on the area's Interstates, showed a minor decrease from 2010 to 2013, followed by an increase in 2014. The TTI remained stable until the onset of the COVID-19 pandemic in early 2020, which led to a notable 21% decrease. Since 2021, the TTI has been on a recovery trajectory, with a marginal increase observed in 2022.

Transit ridership during weekdays, encompassing Metrorail, Metrobus, local transit, and commuter rail, has been on a downward trend since 2013. The impact of COVID-19 further exacerbated this decline with a 26% drop from 2019 to 2020. Although ridership continued to decrease in 2021, signs of recovery were evident in 2022.

Keeping these regional trends in perspective, the subsequent sections of this chapter will delve into the specifics of highway congestion, transit systems, and other travel monitoring activities. A comparative analysis of the Washington region's congestion at a national level, along with a forecast of future congestion as per the long-range transportation plan, will be presented towards the end of this chapter.

[17] Data Sources: Population – U.S. Census Bureau, Annual Estimates of the Resident Population; Transit Unlinked Passenger Trips (UPT) - The National Transit Database (NTD) in selected Reporting Year (RY usually equals July-June fiscal year); Employment – U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages; Weekday VMT – National Capital Region Transportation Planning Board, Regional Transportation Data Clearinghouse; Weekday Transit Trips – National Capital Region Transportation Planning Board, Regional Transportation Data Clearinghouse; Weekday Travel Time Index (TTI) – This Report.

Figure 2-1 Population, Employment, Weekday VMT and Transit Ridership, and Peak Period Travel Time Index in the TPB Planning Area



2.1.1 KEY EXTERNAL INFLUENCES ON NCR'S CONGESTION

This section provides an interpretative analysis of the external factors influencing weekday Interstate traffic congestion within the National Capital Region (NCR), as gauged by the travel time index (TTI). Our preliminary data from 2010-2022 suggests that employment, population, and gasoline prices have a moderate to minor impact on TTI.

- Employment[18] Trends: The data reveals a moderate positive correlation (0.37) between employment and TTI, suggesting that work commutes notably contribute to traffic congestion. The coefficient of determination (R^2) is 0.14, indicating that employment in the NCR explains about 14% of the variation in TTI. This underscores the importance of promoting alternative commuting options such as carpooling, public transportation, and flexible work arrangements.

- Population[19] Growth: Interestingly, the data shows a weak negative correlation (-0.24) between population and TTI. The R^2 is 0.06, meaning that population in the NCR explains about 6% of the variation in TTI. This counterintuitive finding could be attributed to several factors:

    - The NCR's development patterns, where growth is concentrated in areas with efficient road infrastructure or good public transportation, could alleviate congestion.

    - Changes in travel behavior due to technological advancements, such as online shopping and telecommuting, might be reducing travel demand despite population growth.

[18] State and County Employment and Wages, https://www.bls.gov/data/home.htm

[19] U.S. Census Bureau. American Community Survey 5-Year Data (2009-2022) products, https://www.census.gov/data/developers/data-sets/acs-5year.html

    - Data limitations, as TTI might not fully capture localized congestion, potentially obscuring the relationship with population density in specific areas.

- Gasoline Prices[20]: The data indicates a weak negative correlation (-0.21) between gasoline prices and TTI, suggesting that higher gas prices might reduce travel demand as individuals opt for more fuel-efficient alternatives or telecommuting. The R^2 is 0.04, indicating that gasoline prices in the NCR explain about 4% of the variation in TTI. However, this relationship is not absolute and could be influenced by other factors such as income levels, public transportation availability, and job accessibility. Further research is recommended to better understand the complex dynamics between fuel prices and congestion.

2.1.2 LONG-TERM TRAVEL TIME TRENDS ON NCR CORRIDORS

This section analyzes travel time trends on the 18 major commute corridors in the region during the morning and evening peak hours. It compares travel times in 2013 to those in 2023, highlighting corridors that have improved, worsened, or remained unchanged. The direction of commute trips changes reversely in these two peaks. Therefore, the analysis focuses on the direction with the heavier traffic volume during each peak period. More details of the peak hours' travel time could be found in Appendix D.

Morning Peak (8:00 AM - 9:00 AM): The average travel time across all corridors during the morning peak hour in 2023 increased by 6% compared to 2013. However, the trend varied significantly across corridors. Some corridors, like VA-267 eastbound between VA-28 and VA-123, and I-66 eastbound between VA-28 and I-495, experienced improvements with travel times decreasing by 22% and 28% respectively. Conversely, travel times on the inner loop of I-495 between I-66 and I-270, and the inner loop of I-495 between I-95 and I-66, increased by 35% and 47% respectively.

Evening Peak (5:00 PM - 6:00 PM): The evening peak hour saw a more substantial increase in average travel time compared to the morning peak, with a 21% rise in 2023 compared to 2013. Like the morning peak, individual corridors exhibited a mix of trends. I-66 westbound between VA-28 and I-495 saw a significant improvement with a 45% decrease in travel time. However, several corridors experienced substantial increases, particularly the outer loop of I-495 between I-95 and I-66, with a remarkable 76% increase.

Key Takeaways:

- Traffic congestion has worsened on average during both morning and evening peak hours compared to 2013.

- The impact varies significantly across corridors, with some experiencing improvements and others significant slowdowns.

- Commuter behavior may have shifted, with a larger increase in congestion observed during the evening peak hour potentially reflecting a change in work schedules or trip patterns.

In conclusion, the traffic trends show that the travel time on most corridors has increased from 2013 to 2023 during both the morning and evening peak hours. However, some corridors have seen

[20] U.S. Energy Information Administration (EIA), All Grades Retail Prices for Gasoline, https://www.eia.gov/dnav/pet/pet_pri_gnd_a_epm0_pte_dpgal_a.htm

improvements, with reduced travel times in 2023 compared to 2013. This analysis provides valuable insights into the traffic conditions on these corridors, which can be useful for planning and managing traffic flow.

2.2 Congestion on Highways

The Federal Highway Administration of the U.S. Department of Transportation has established a set of performance metrics [82 FR 5970][21] for state departments of transportation (DOTs) and metropolitan planning organizations (MPOs) to be used as required by the Moving Ahead for Progress in the 21st Century Act (MAP-21) and the Fixing America's Surface Transportation (FAST) Act to assess performance of the National Highway System, Freight Movement on the Interstate System, and the Congestion Mitigation and Air Quality Improvement (CMAQ) Program, effective May 20, 2017 [82 FR 22879].

The final rule, which became effective on May 20, 2017, established the following four performance measures relevant to the CMP, including:

- percentage of reliable person-miles traveled on the Interstate.
- percentage of reliable person-miles traveled on the non-Interstate NHS.
- percentage of Interstate system mileage providing for reliable truck travel time (Truck Travel Time Reliability Index)
- annual hours of peak-hour excessive delay per capita.

While the four performance measures established by the Federal Highway Administration provide a comprehensive assessment of transportation system performance, the Travel Time Index (TTI) and Planning Time Index (PTI) are particularly relevant to the National Capital Region (NCR) due to the region's unique transportation challenges.

The NCR is home to a large population and a dense network of roads and highways, making it a prime target for congestion and travel time delays. The TTI effectively captures the severity of congestion in the region by comparing travel times during peak periods to free-flow travel times. This metric allows transportation planners to identify areas where congestion is most prevalent and prioritize mitigation efforts.

The PTI, on the other hand, focuses on the predictability of travel times, which is crucial for commuters and businesses in the NCR. By measuring the variation in travel times from day to day, the PTI highlights the impact of unexpected events, such as accidents, road closures, and weather conditions, on travel reliability. This information is essential for travelers to make informed decisions about their transportation choices.

In addition to their relevance to the NCR's specific transportation challenges, the TTI and PTI are also well-established and widely used metrics, allowing for comparison with other regions and tracking performance trends over time. This makes them valuable tools for transportation planners and policymakers in the NCR to evaluate the effectiveness of their congestion mitigation strategies and inform future investments in transportation infrastructure. In this report, we will utilize data provided

[21] Federal Register, Vol. 82. No. 11, January 18, 2017.

by the Eastern Transportation Coalition Vehicle Probe Project (VPP) to analyze the TTI and PTI across various facilities in the NCR.

2.2.1 TRAFFIC MONITORING WITH THE EASTERN TRANSPORTATION COALITION VEHICLE PROBE PROJECT (VPP)

Since 2010[22], the Eastern Transportation Coalition (TETC), formerly known as the I-95 Corridor Coalition, has been instrumental in monitoring traffic conditions on major roadways in the Metropolitan Washington area. This groundbreaking initiative[23], spearheaded by TETC in collaboration with the University of Maryland and private sector data vendors, has provided Coalition members with comprehensive and continuous real-time and historical traffic information[24]. The VPP's primary objective is to gather travel times and speeds on freeways and arterials using probe technology. While GPS data from vehicles is the primary source, other data sources, such as sensors, may also be utilized.

As an affiliate member of the coalition, the TPB was granted gratis access to the historical archive data in 2009. Data from vendor INRIX has been made available to the TPB. The INRIX system fuses data from various sources to present a comprehensive picture of traffic, including vehicle speed and travel time at 5-minute granularity for each road segment.

As of January 11, 2024, the VPP/INRIX data covers approximately 6,967 directional miles of roads in the TPB Planning Area (Figure 2-2), including 550 miles of the Interstate System, 2,450 miles of Non-Interstate NHS, and 3,800 miles of Non-NHS; if categorized by freeway/arterial, this coverage includes around 800 miles of freeways and around 6,000 miles of arterials.

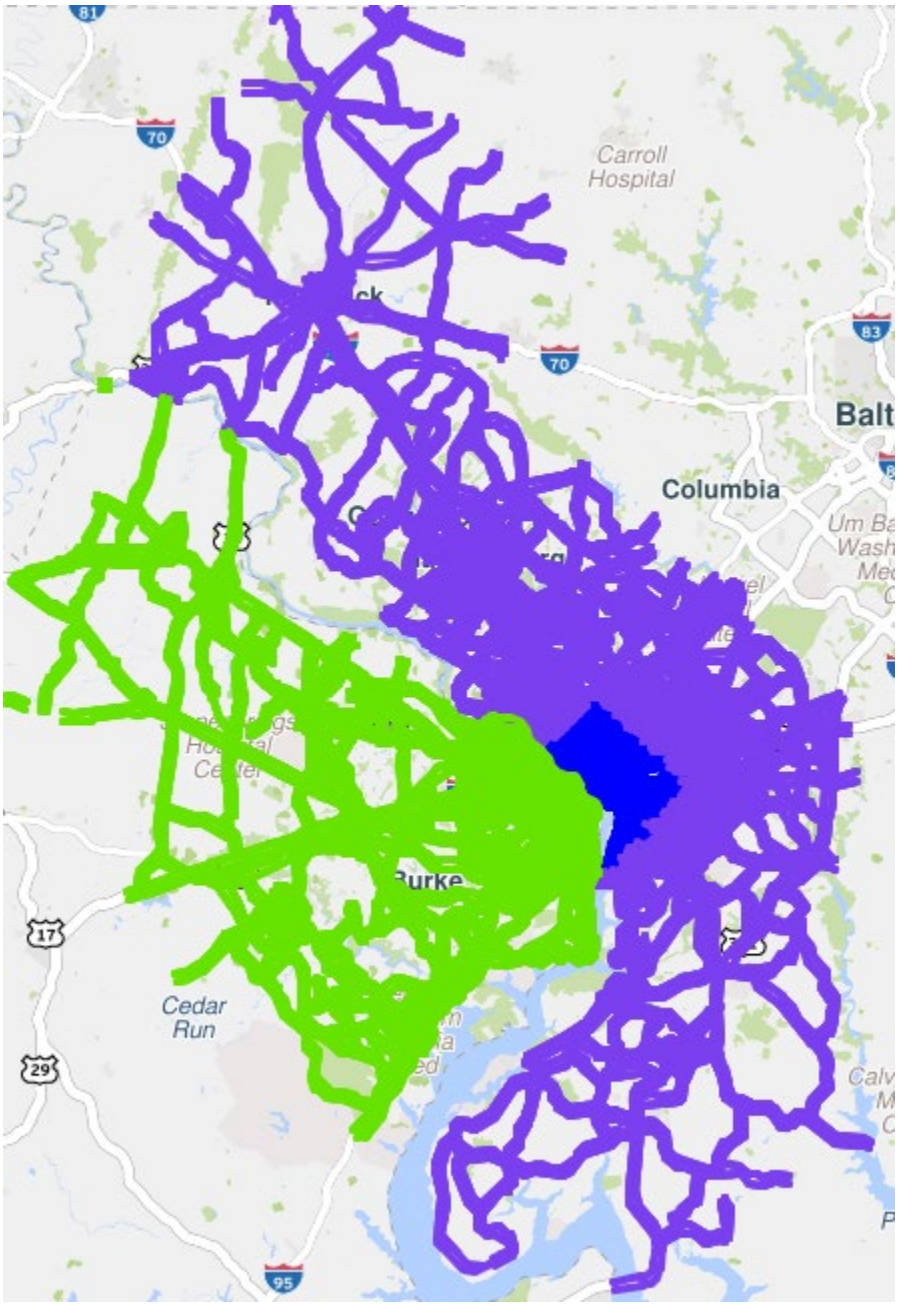
This VPP/INRIX data source has become the TPB's major source of traffic monitoring for both freeways and arterials in the Washington region, transforming the way by which highway congestion and travel time reliability are analyzed and presented.

[22] Data for some roadways are available back to July 1, 2008.

[23] The Eastern Transportation Coalition (formerly the I-95 Corridor Coalition), https://tetcoalition.org/projects/vpp-marketplace/

[24] In 2014, the VPP data contract was re-competed by the I-95 Corridor Coalition; HERE and TomTom joined INRIX as data providers. As of this report, among those vendors, only data from INRIX has been made available gratis to TPB.

Figure 2-2 The Eastern Transportation Vehicle Probe Project/INRIX Data Coverage in the Washington Region



(Screenshot captured on the VPP Suite developed by the CATT Lab of University of Maryland.)

2.2.1.1 Travel Time Index

Travel Time Index (TTI) is an indicator of the intensity of congestion, calculated as the ratio of actual experienced travel time to free flow travel time. A travel time index of 1.00 implies free flow travel without any delays, while a travel time index of 1.30 means one has to spend 30% more time to finish a trip compared to free flow travel.

The annual average Travel Time Index on monitored roadways in the TPB Planning Area is shown below. Figure 2-3 is the average TTI of total AM Peak (6:00-10:00 am) and PM Peak (3:00-7:00 pm) on all weekdays in a year, Federal holidays excluded, Figure 2-4 is the TTI for the AM Peak, and Figure 2-5 is the TTI for the PM Peak. The TTI is reported by the following five highway categories:

i. Interstate System, about 550 directional miles.

ii. Non-Interstate NHS, about 2,450 directional miles. The NHS designation used in this report was defined on October 1, 2012. The MAP-21 NHS includes all principal arterials[25].

iii. Non-NHS, about 3,800 directional miles. This category includes minor arterials covered by the VPP/INRIX data.

iv. Transit-Significant Roads[26], about 950 directional miles. This category consists of road segments with at least 6 buses in the AM Peak Hour (equivalent to one bus in either direction every 10 minutes) and the total length is about 1,400 directional miles in the TPB planning area, but only 950 miles of which are covered by the VPP monitoring. This category could include Interstate, Non-Interstate NHS and Non-NHS by definition.

v. All Roads, about 6,831 directional miles. This is the set of all roads covered by the VPP/INRIX data in the TPB Planning Area.

Observations from examining the regional annual average TTI for recent years include:

- While the COVID-19 pandemic significantly reduced congestion, with the Travel Time Index (TTO) reaching a historic low of 1.17 in 2020, congestion rebounded in 2023, but to levels still below pre-pandemic norms (e.g. Interstates TTI of 1.41 in 2023 versus 1.48 in 2019).

- Data consistently shows higher TTI during evening peak hours compared to morning across all years and road types. This suggests that evening commutes are more congested, a factor to consider when planning travel times.

- Interstates, the backbone of our national transportation system, consistently show higher TTI compared to other road types. This highlights the critical role of Interstates in our daily travel and the need for effective traffic management strategies.

- Roads significant for transit traffic also experience considerable congestion, with TTI values higher than average roads but lower than Interstates. This points to the importance of these roads for transit and the need for their efficient management.

[25] FHWA, National Highway System, http://www.fhwa.dot.gov/planning/national_highway_system/nhs_maps/

[26] Pu, W. National Capital Region Congestion Report, 1st Quarter 2015, p.11-12. https://www.mwcog.org/file.aspx?D=lhCuCwV1tlyW641B%2bg%2b4SF%2bN6k9XjI4cbRqIHxnFodA%3d&A=Z7cxzRwPfUbEVw2pIDS3kvWdOO5DkTrGjfVIJNmt8XE%3d

2023 weekday (Monday through Friday) peak hour (8:00-9:00 am; 5:00-6:00 pm) Travel Time Index on the Interstate System and other monitored roads were visualized by the "Trend Map" tool of the TETC Probe Data Analytics (PDA) Suite Developed by the CATT Lab of the University of Maryland[27], as provided in Appendix A.

Figure 2-3 Annual Average Travel Time Index by Highway Category: Total AM and PM Peaks

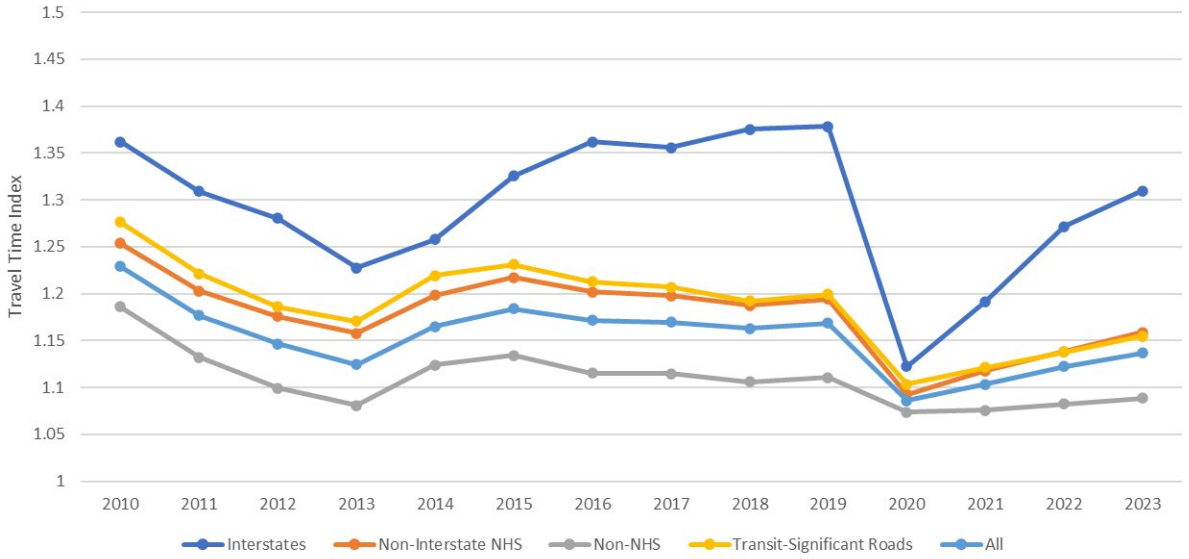
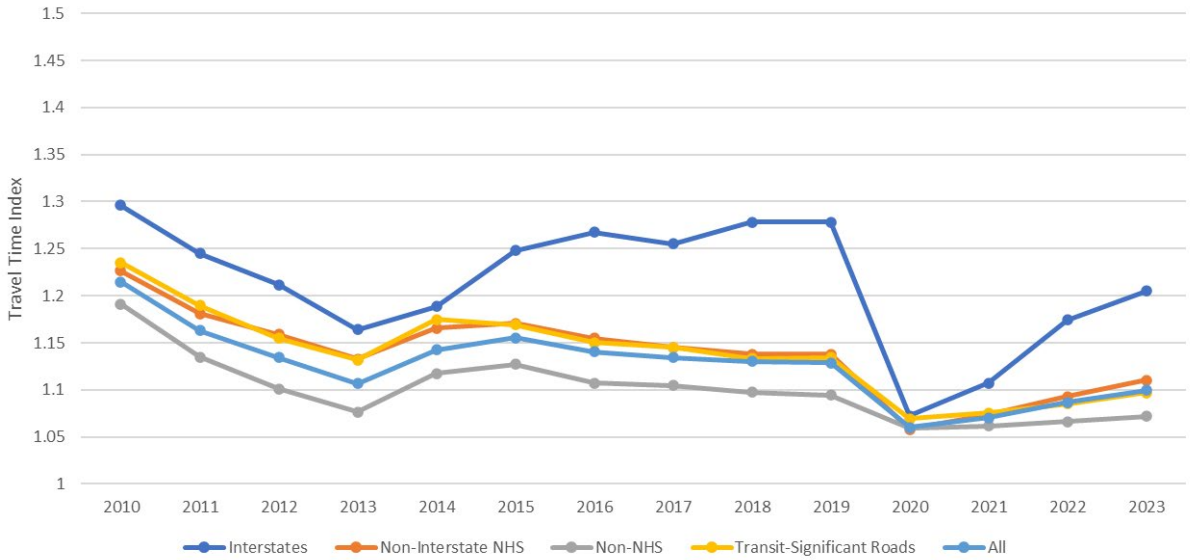
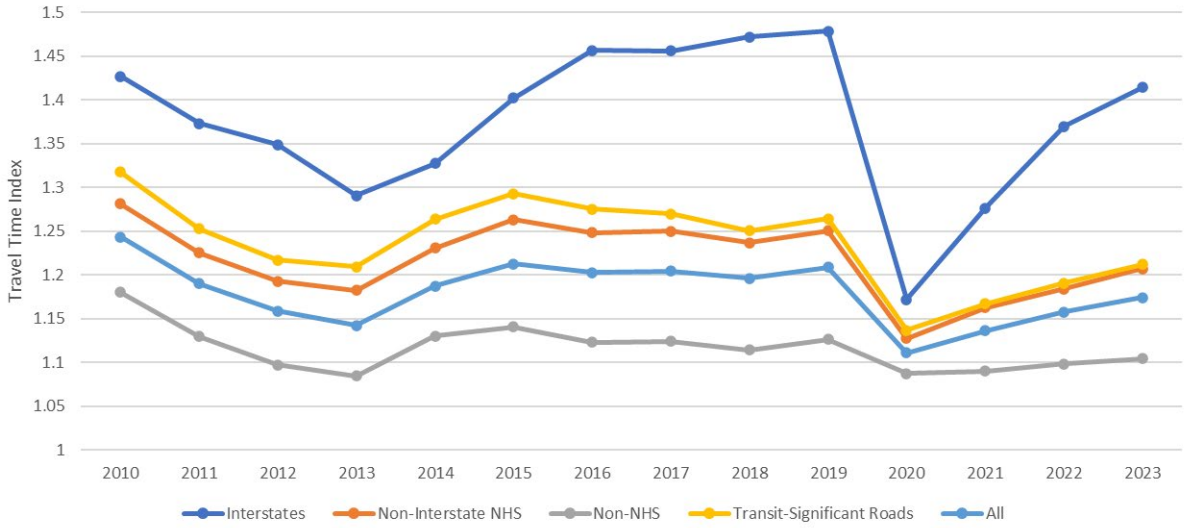


Figure 2-4 Annual Average Travel Time Index by Highway Category: AM Peak



[27] Center for Advanced Transportation Technology Laboratory (CATT Lab), University of Maryland, Vehicle Probe Project Suite, http://www.catt.umd.edu/research/vehicle-probe.

Figure 2-5 Annual Average Travel Time Index by Highway Category: PM Peak



2.2.1.2 Planning Time Index

To most travelers, everyday congestion, particularly peak period congestion, is common and they often adjust their schedules or plan extra time to allow for the expected delays; what troubles travelers most are unexpected or much-worse-than-expected delays, which can be caused by incidents, inclement weather, work zones, and the like. Travelers thus want travel time reliability - a consistency or dependability in travel times, as measured from day to day or across different times of day[28] - to avoid being late.

To quantify travel time reliability (or unreliability), this report adopts Planning Time Index (PTI), the ratio of 95th percentile travel time over free flow travel time. It expresses the extra time a traveler should budget in addition to free flow travel time in order to arrive on time 95 percent of the time. The difference between 95th percentile travel time and free flow travel time is called Planning Time. For example, a 30-minute free flow travel with a Planning Time Index of 2.00 requires 60 minutes in budget to ensure on-time arrival, and thus the Planning Time is 30 minutes.

The annual Planning Time Index on monitored roadways in the TPB Planning Area is shown below. Figure 2-6 is the average PTI of total AM Peak (6:00-10:00 am) and PM Peak (3:00-7:00 pm) on all weekdays in a year, Federal holidays excluded. Figure 2-7 is the PTI for the AM Peak, and Figure 2-8 is the PTI for the PM Peak. The PTI is reported by the five highway categories described above in the Travel Time Index section.

Observations from examining the regional annual average PTI for recent years include:

- The PTI during PM peak periods was consistently higher than during AM peak periods across all categories of roadways. This indicates that travel time was less reliable during PM peak periods. The average increase from AM to PM across all years and categories is approximately 22%.

- The PTI for Interstates was consistently higher than for other categories of highways, indicating that Interstates were less reliable, regardless of whether it was during AM or PM

[28] Federal Highway Administration, *Travel Time Reliability Measures*, http://ops.fhwa.dot.gov/perf_measurement/reliability_measures/index.htm

peak periods. The average PTI for Interstates was approximately 23% higher than the average PTI for all roads during the same periods.

- The PTI for Interstates has been increasing more rapidly than for other categories of roadways in the three years following the pandemic in 2020. This trend is observed for both AM and PM peak periods. The PTI for Interstates increased by approximately 23% from 2020 to 2023 during AM peak periods, and by approximately 27% during PM peak periods.

- The PM peak PTI has been increasing since 2022 and is approaching the pre-pandemic level (prior to 2020). The PTI for PM peak periods in 2023 is only about 3% lower than the pre-pandemic level in 2019.

- Despite some increase, the AM peak PTI in 2023 remains significantly lower than the pre-pandemic level. The PTI for AM peak periods in 2023 is approximately 8% lower than the pre-pandemic level in 2019.

The 2023 weekday (Monday through Friday) peak hour (8:00-9:00 am; 5:00-6:00 pm) Planning Time Index on the Interstate System and other monitored roads were visualized by the "Trend Map" tool in the VPP Suite, as provided in Appendix B.

Figure 2-6 Annual Average Planning Time Index by Highway Category: Total AM and PM Peaks

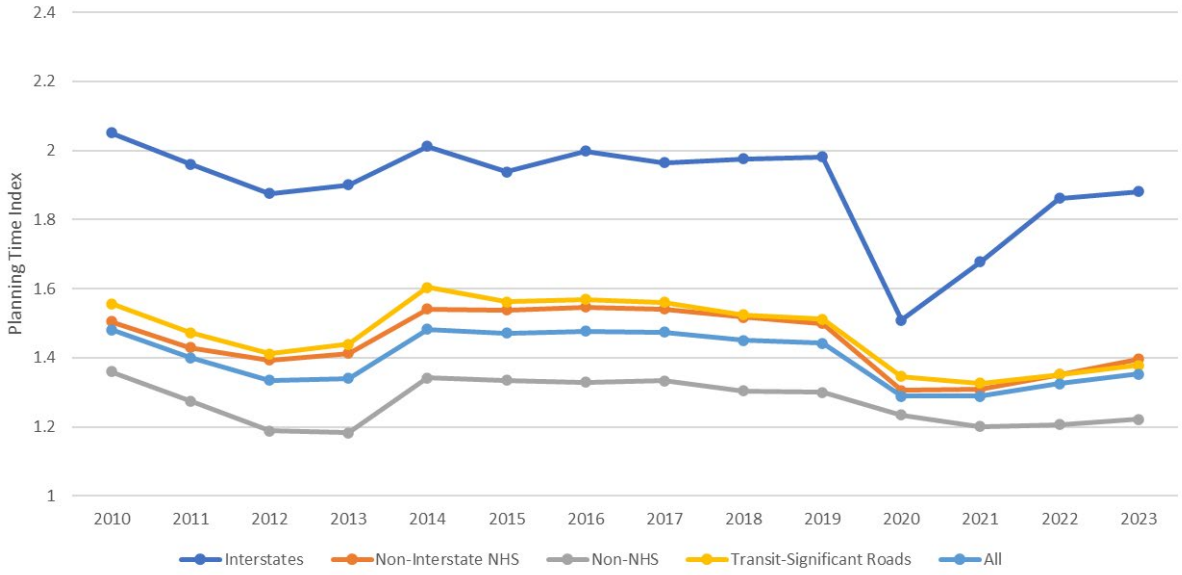


Figure 2-7 Annual Average Planning Time Index by Highway Category: AM Peak

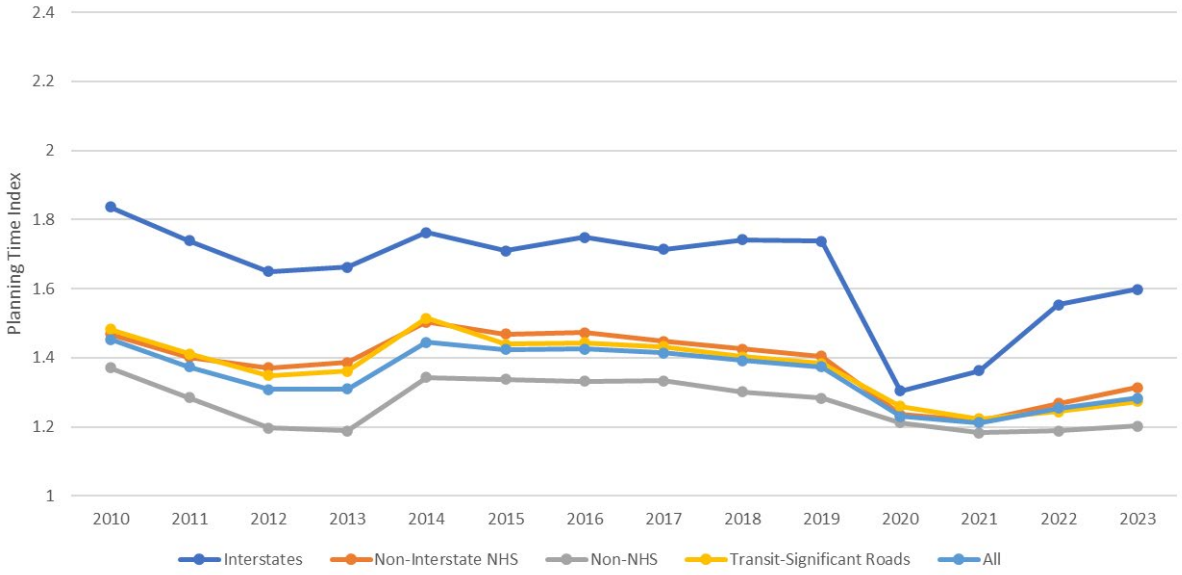
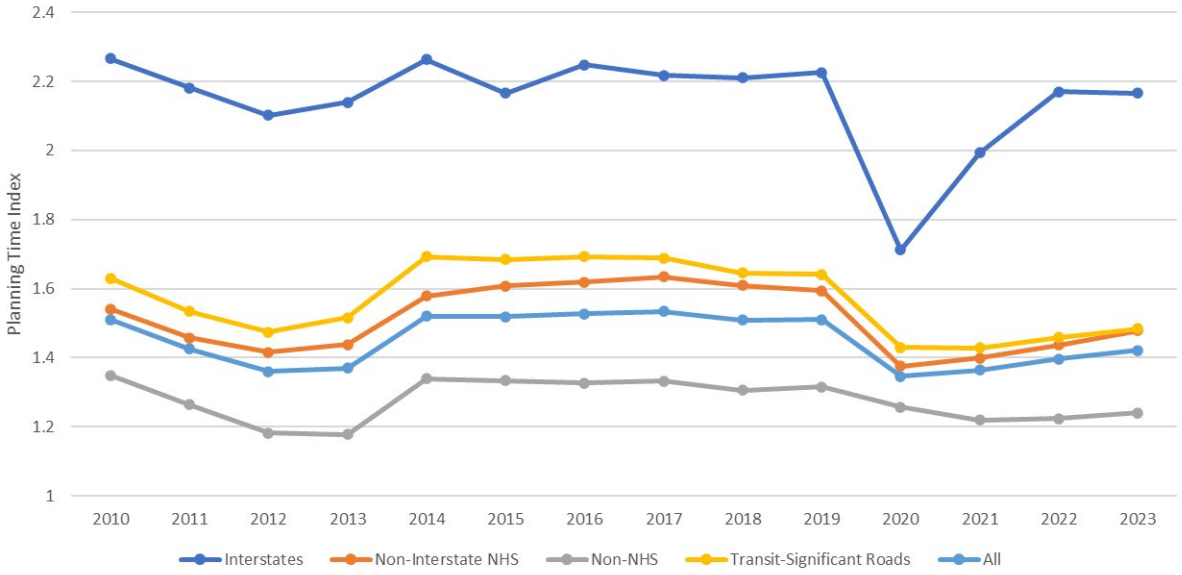


Figure 2-8 Annual Average Planning Time Index by Highway Category: PM Peak



2.2.1.3 Percent of Congested Miles

Percent of Congested (Directional) Miles is a system-wide measure that captures the spatial extent of congestion. According to the National Transportation Operations Coalition, if actual travel time is 30% longer than the free-flow travel time, i.e., Travel Time Index > 1.3, congestion is defined.[29]

The annual average Percent of Congested Miles on monitored roadways in the TPB Planning Area is shown below. Figure 2-9 is the average percentage of both AM Peak (6:00-10:00 am) and PM Peak (3:00-7:00 pm) on all weekdays in a year, Federal holidays excluded, Figure 2-10 is the percentage for the AM Peak, and Figure 2-11 is the percentage for the PM Peak. The percentage is reported by five highway categories as described earlier.

Observations from examining the Percent of Congested Miles for 2010-2021 include:

- All highway categories witnessed a significant decrease in congestion in 2020 (likely due to COVID-19 impacts). This decrease ranged from 84% to 95% compared to 2019. However, congestion levels rebounded quickly, especially on Interstates. By 2023, the percentage of congested miles on Interstates during AM peak periods reached 20%, a 400% increase from the pandemic low (4% in 2020).

- Regardless of the period (AM or PM peak), Interstates consistently had a higher percentage of congested miles compared to other categories of roadways. This trend persisted even after the pandemic.

- While percentage of congested miles increased on all highway categories after the pandemic, the rise was steeper for Interstates during PM peak periods. From 2020 to 2023, PM congestion on Interstates grew by 89% (19% in 2020 to 36% in 2023), compared to a 60% increase for all highway categories combined (8% in 2020 to 14% in 2023).

- Regardless of the year or highway category, congestion levels were consistently higher during PM peak periods compared to AM peak periods. The difference ranged from 5% to 20% across the data, suggesting a heavier traffic burden in the evenings.

- Despite the temporary drop in 2020 due to the pandemic, the long-term trend shows a general increase in the percentage of congested miles, particularly on Interstates. This suggests a growing issue with traffic congestion on these major highways.

[29] National Transportation Operations Coalition, National Transportation Operations Coalition (NTOC) Performance Measures Initiative, 2005. https://www.transportationops.org/publications/performance-measurement-initiative-final-report

Figure 2-9 Annual Average Percent of Congested Miles by Highway Category: Total AM and PM Peaks

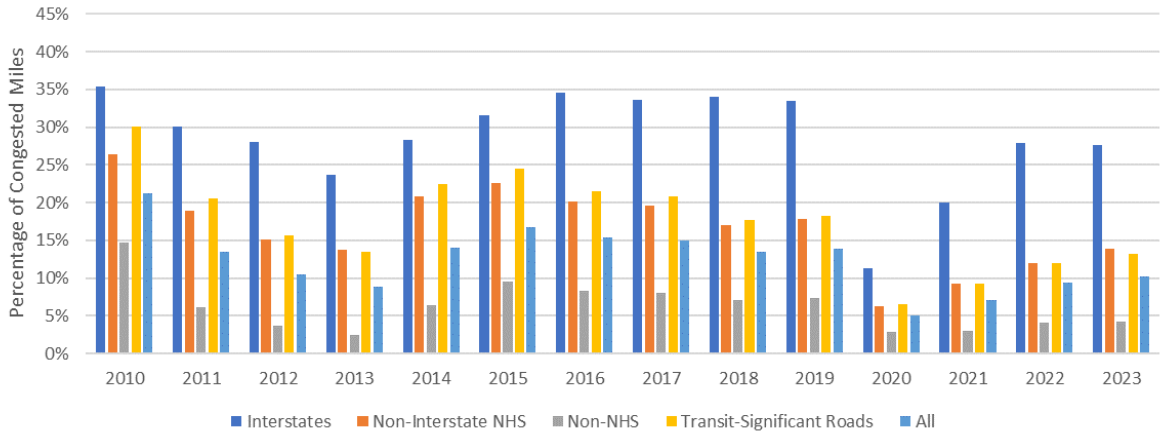


Figure 2-10 Annual Average Percent of Congested Miles by Highway Category: AM Peak

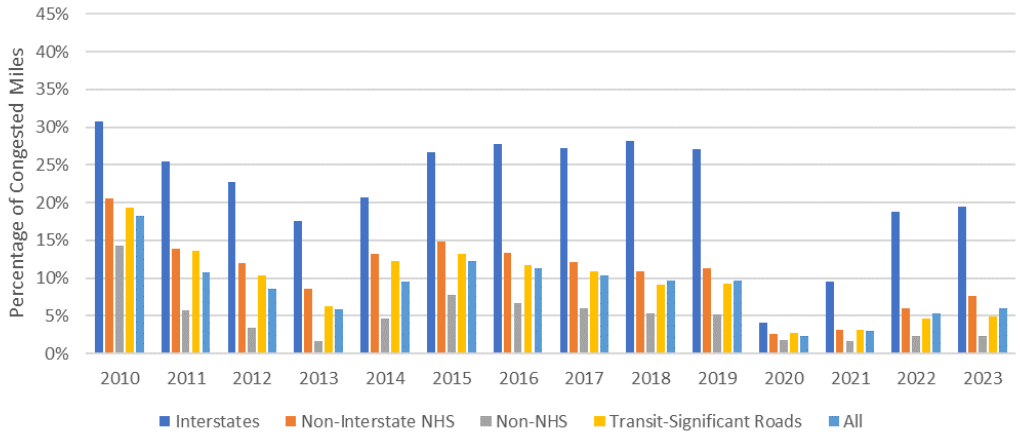
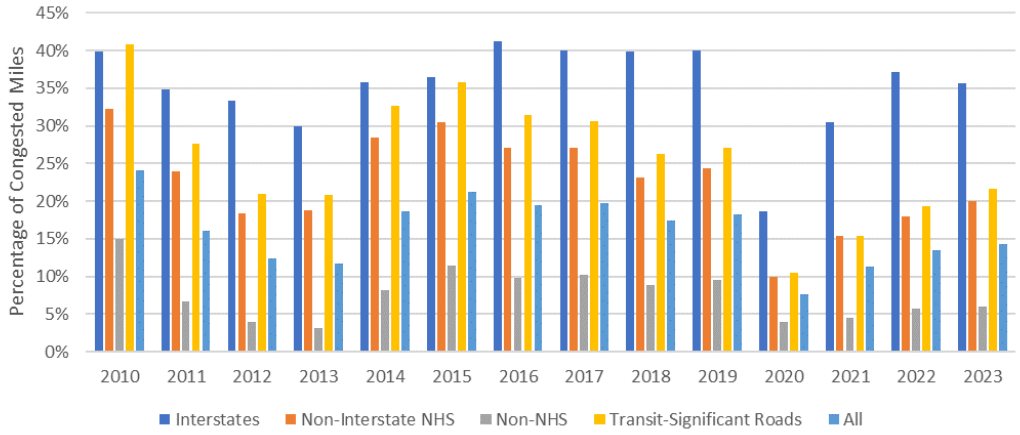


Figure 2-11 Annual Average Percent of Congested Miles by Highway Category: PM Peak



2.2.1.4 Congestion Monthly Variation in 2023

Congestion varies from month to month within a year, as shown in Figure 2-12 (total AM and PM peaks), Figure 2-13 (AM Peak), and Figure 2-14 (PM Peak). Monthly variation of congestion in 2023 had the following characteristics in the Washington region:

- When considering all road categories together, the TTI values in the PM peak table are consistently higher than those in the AM peak table. For example, the overall TTI in December is 1.49 during PM peak and 1.18 during AM peak, reflecting a difference of 0.31. This translates to a percentage change of about 26.3%. This observation aligns with the general trend of heavier traffic during afternoon or evening hours.

- The TTI for Interstates fluctuates more throughout the year compared to other categories. In 2023, the difference between the highest (May - 1.49) and lowest (August - 1.16) TTI for Interstates during PM peak is 0.33. This represents a percentage change of about 22.1%. In contrast, the difference for Non-NHS roads is only 0.17 (May - 1.26 vs. August - 1.09) during PM peak, translating to a 13.5% change. This suggests that Interstate travel times are more sensitive to seasonal or monthly factors compared to other road types.

- Traffic congestion on Interstate highways in 2023 was worse during peak periods, especially in the afternoons or evenings, compared to mornings. For instance, in April, the TTI for Interstates was 17.7% higher during the PM peak period (1.46) compared to the AM peak period (1.24). This signifies a significant increase in travel time during evening rush hour on these highways.

Figure 2-12 Monthly Variation of Congestion in 2023: Total AM and PM Peaks

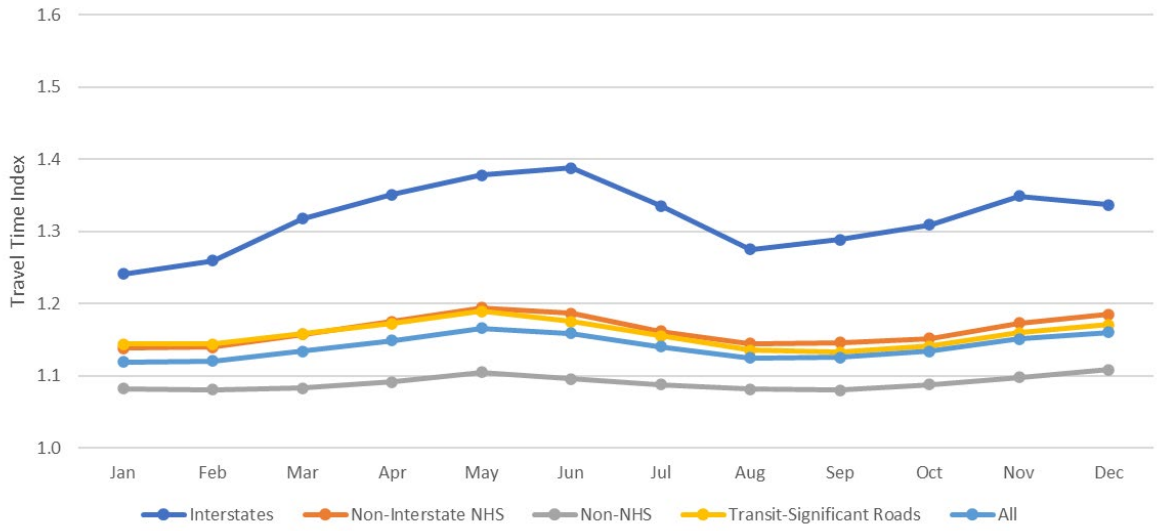


Figure 2-13 Monthly Variation of Congestion in 2023: AM Peak

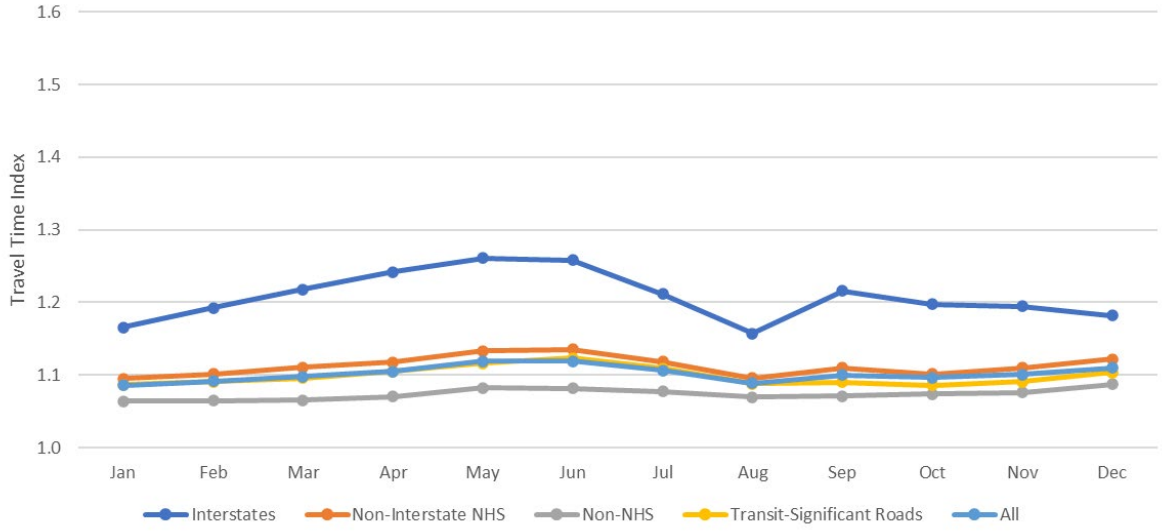
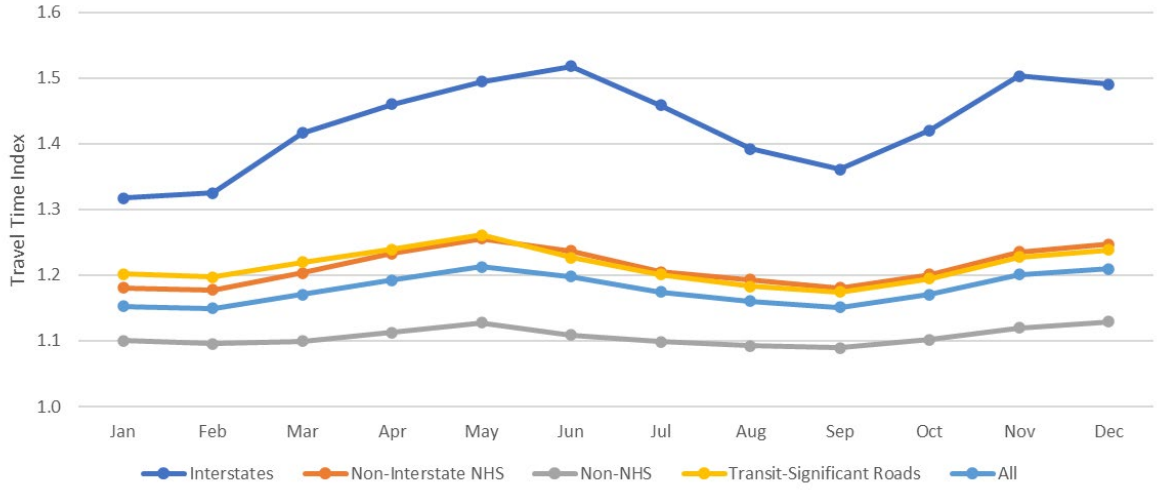


Figure 2-14 Monthly Variation of Congestion in 2023: PM Peak



2.2.1.5 Congestion Time of Day, Day of Week Variation in 2023

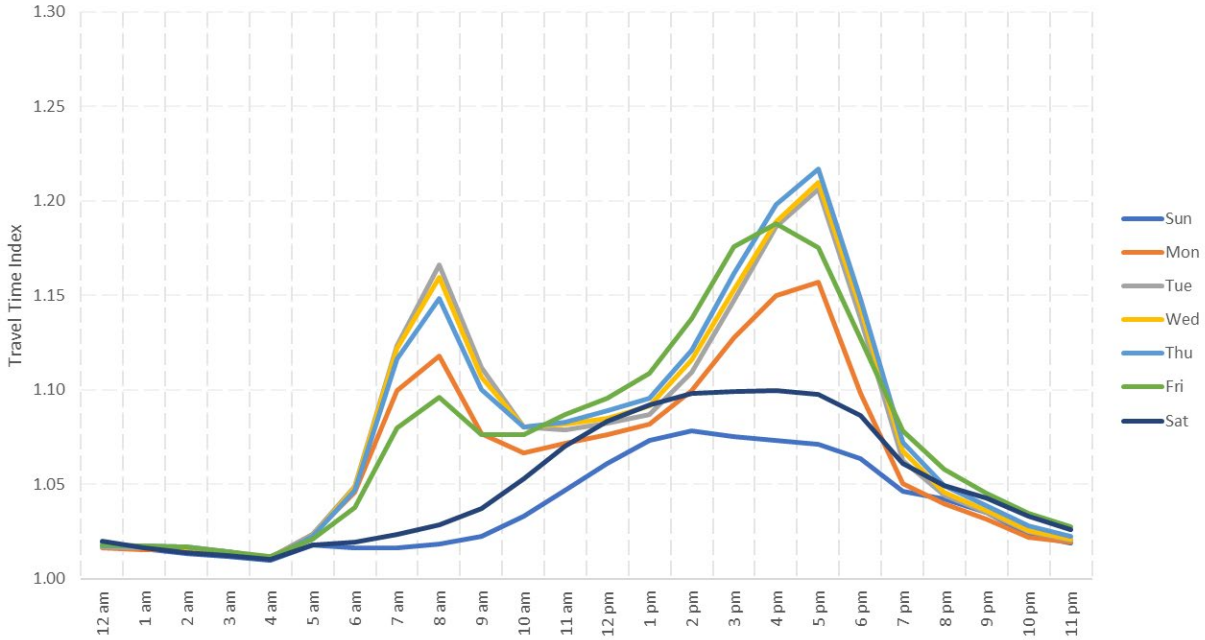
Congestion also varies within a week, as shown in Figure 2-15. The day of week variation of congestion in the Washington region in 2023 had the following trends. Note that these trends are a summary of all the 6,831 directional miles of roads in the region; different areas, highway facilities and routes may vary differently.

- Weekday morning and afternoon rush hours on Tuesday, Wednesday, and Thursday witnessed substantial increases in TTI. For example, the TTI on Tuesday at 8 AM reached 1.17 compared to near free-flow conditions of 1.02 overnight, and at 5 PM, it reached 1.21. These levels are comparable to those observed before the COVID-19 pandemic. This suggests a strong return to pre-pandemic traffic patterns during peak hours.

- The most congested PM peak hour shifted from Friday to Thursday in 2023. Additionally, Tuesday and Wednesday PM commutes had higher TTI than Friday. This is a new pattern compared to previous years, where Friday evenings typically had the worst congestion.

- Figure 2-15 reveals a significant difference in traffic patterns between weekdays and weekends. Weekend days had the lowest traffic in the week, and Sunday was even lower than Saturday with no pronounced AM and PM peaks. Saturday has a unique pattern with slightly higher midday traffic compared to those on Monday and Tuesday.

Figure 2-15 Time of Day and Day of Week Variation of Congestion in 2023



2.2.1.6 Top Bottlenecks

This report presents "all-time", i.e. 24/7/365, top bottlenecks by taking advantage of Bottleneck Ranking tool in the Probe Data Analytics Suite of the Regional Integrated Transportation Information System (RITIS) provided by the University of Maryland CATT Lab. To be consistent with the ranking method in National Capital Congestion Reports since 2019, a measure of "Base Impact" in the tool was chosen to rank the bottlenecks for this report. According to RITIS, the "Base Impact" measure was defined as the sum of queue lengths over the duration. The "all-time" top bottlenecks in 2023 are summarized in Table 2-1 and mapped in Figure 2-16.

It is worth noting that the bottleneck ranking method for this report is different from those in editions of the CMP Technical Report prior to the 2022 report. Travel Time Index (TTI) – an indicator of the intensity of congestion and the ratio of actual travel time to free flow travel time – and Annual Average Daily Traffic volume (AADT) were used as the essential factors in ranking the bottlenecks in the previous reports. While the methods are similar but different, use caution in comparing bottlenecks of this report to those reported in those previous editions.

Key takeaways from the 2023 top bottlenecks:

- Significant Improvement on I-95 South: There is a substantial decrease in congestion on the #1 bottleneck, i.e. I-95 South at VA-123/Exit 160. The average duration in 2023 (6 hours and 32 minutes) is almost 2 hours less compared to 2021 (8 hours and 9 minutes), representing a reduction of nearly 27%. The average max length for the location has decreased from 4.01 miles in 2021 to 3.19 miles in 2023, a decrease of approximately 20.4%. These measures suggest successful improvement efforts in this corridor.

- Persistent Bottleneck on US-301 South: US-301 South at McKendree Rd/Cedarville Rd has consistently ranked high (6th in 2021 and 9th in 2023) with minimal change in average duration (around 1 hour reduction). This suggests a need for further investigation and targeted improvement strategies for this specific bottleneck.

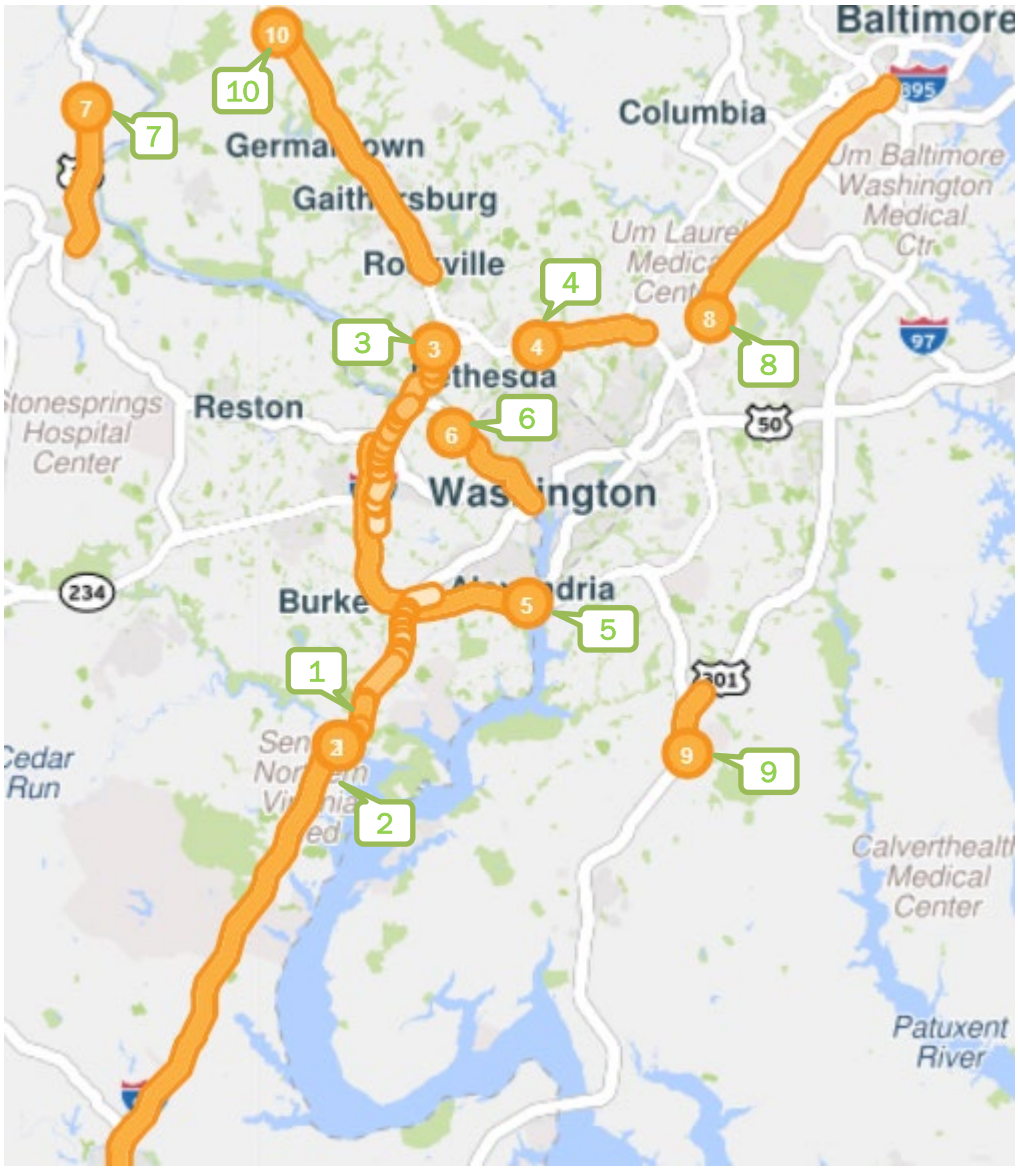
- Shifting Bottlenecks on I-495: While I-495 remained congested in both years, the ranking of specific bottlenecks within I-495 has changed. In 2021, I-495 CW at I-270 Spur was the 7th worst bottleneck, while in 2023, it became the 3rd worst bottleneck. In addition to that, two other locations in I-495 were ranked #4 and #5 top bottlenecks in 2023. This indicates a potential congestion shift within the I-495 corridor.

- Emerging Bottlenecks: Several bottlenecks that were not present in the top 10 of 2021 (like I-495 counter-clockwise, GW Parkway north, and US-15 north) appeared in 2023. This highlights the need for continuous monitoring and proactive measures to address potential congestion issues before they become major bottlenecks.

Table 2-1 2023 Top Bottlenecks – All Time

Rank	Location	Average duration	Average max length (miles)	Total duration	Impact factor
1	I-95 S @ VA-123/EXIT 160	6 h 32 m	3.19	99 d 12 h 37 m	358,921
2	I-95 N @ VA-123/EXIT 160	4 h 17 m	3.89	65 d 7 h 21 m	348,300
3	I-495 CW @ I-270 SPUR	2 h	6.97	30 d 11 h 11 m	311,793
4	I-495 CCW @ MD-97/GEORGIA AVE/EXIT 31	3 h 45 m	3.13	57 d 1 h 35 m	265,032
5	I-495 CCW @ US-1/EXIT 1	3 h 8 m	3.52	47 d 16 h 53 m	251,152
6	GW PKY N @ VA-123/CHAIN BRIDGE RD	2 h 39 m	4.11	40 d 11 h 7 m	239,625
7	US-15 N @ STUMPTOWN RD/LUCKETTS RD	1 h 26 m	7.23	21 d 23 h 26 m	220,696
8	Baltimore–Washington Parkway S @ POWDER MILL RD	2 h 26 m	4.62	37 d 42 m	217,495
9	US-301 S @ MCKENDREE RD/CEDARVILLE RD	4 h 30 m	2.23	68 d 15 h 49 m	217,102
10	I-270 N @ MD-109/EXIT 22	2 h 8 m	5.09	32 d 14 h 5 m	214,980

Figure 2-16 2023 Top Bottlenecks – All Time



2.2.1.7 Travel Times along Major Freeway Commute Routes

In addition to the overall regional summaries based on performance metrics, this report also includes a detailed analysis specific to individual routes or corridors. A total of 18 major freeway commute routes have been defined between significant interchanges or points of interest, as outlined in Table 2-2 and Figure 2-17.

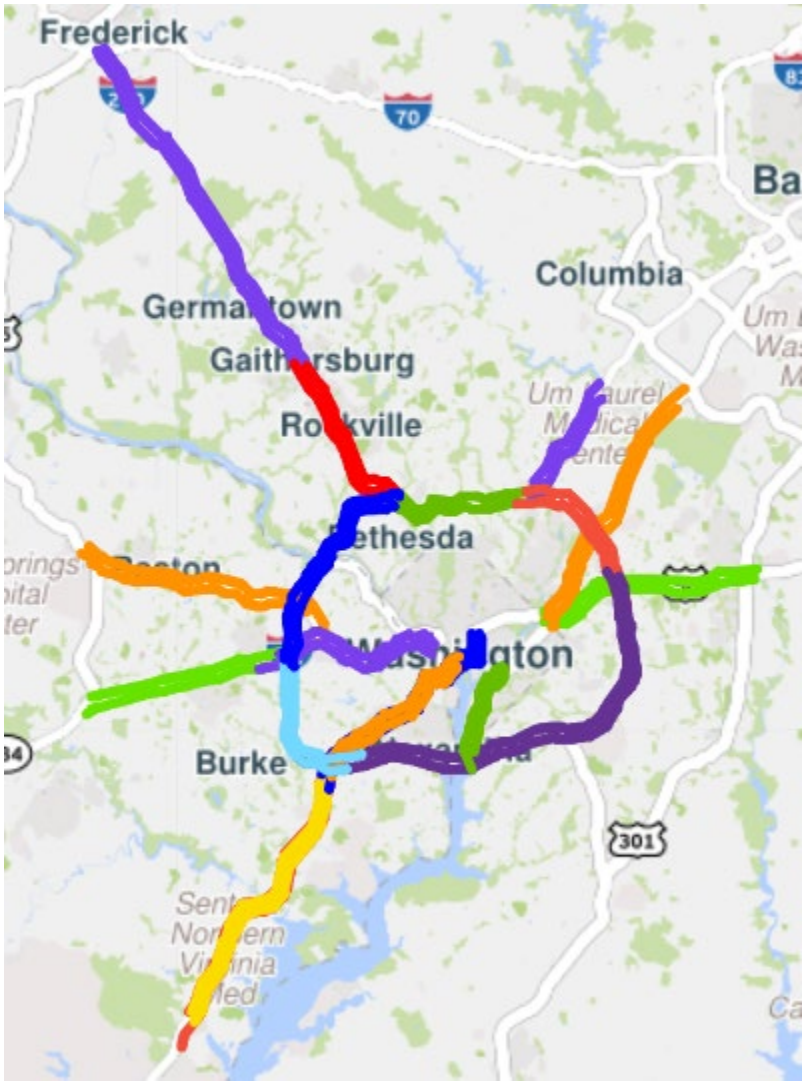
For each of these 18 routes, travel times in both directions were plotted using the 'Performance Charts' tool from the VPP Suite. The data covers Tuesdays, Wednesdays, and Thursdays for the years 2013 and 2021-2023. Figure 2-18 (one example) and Appendix C (all 18 corridors) provide visual representations of these travel times. Additionally, Table 2-3 and Table 2-4 present travel times during the AM Peak Hour (8:00-9:00 am) and PM Peak Hour (5:00-6:00 pm), including planning times at the 95th percentile.

However, it is important to note that the methodology used for analyzing major commute routes calculates route travel time as instantaneous travel time, rather than *experienced travel time*. Instantaneous travel time assumes that prevailing traffic conditions remain constant, resulting in the sum of all segment travel times. Experienced travel time may differ significantly from this sum, especially during unstable traffic conditions. This limitation in the methodology warrants future improvements.

Table 2-2 Major Freeway Commute Routes

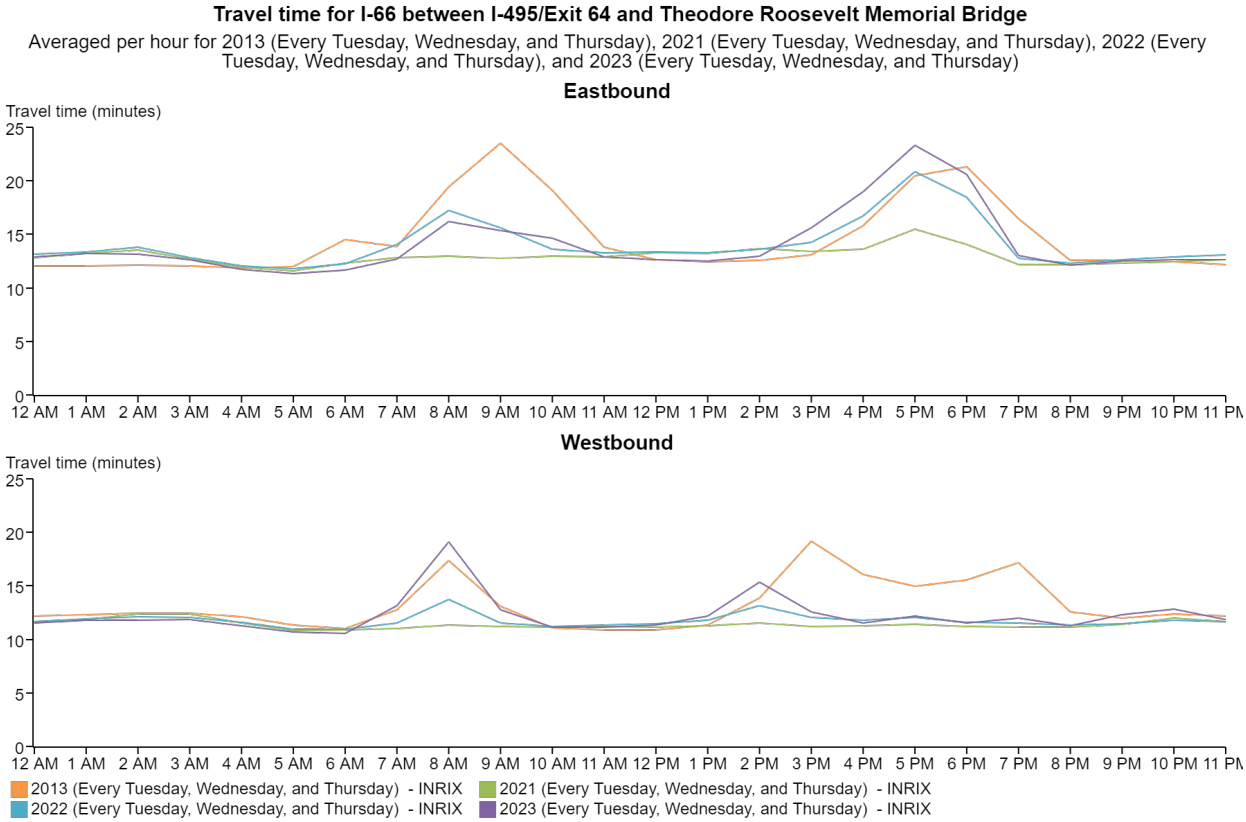
Route Code	Description
C1	I-270 between I-370/Sam Eig Hwy/Exit 9 and I-70/US-40
C2	I-270 between I-370/Sam Eig Hwy/Exit 9 and I-495/MD-355
C3	VA-267 between VA-28/Exit 9a and VA-123/Exit 19
C4	I-66 between VA-28/Exit 53 and I-495/Exit 64
C5	I-66 between I-495/Exit 64 and Theodore Roosevelt Memorial Bridge
C6	I-95 between VA-234/Exit 152 and Franconia Rd/Exit 169
C7	I-95 HOV between VA-234/Exit 152 and Franconia Rd/Exit 169
C8	I-395 between I-95 and H St
C9	I-395 HOV between I-95 and US-1
C10	US-50 between MD-295/Kenilworth Ave and US-301/Exit 13
C11	Balt-Wash Pkwy between US-50/MD-201/Kenilworth Ave and MD-198
C12	I-95 between I-495/Exit 27-25 and MD-198/Exit 33
C13	I-495 between I-270/Exit 35 and I-95/Exit 27
C14	I-495 between I-95/Exit 27 and US-50/Exit 19
C15	I-495 between US-50/Exit 19 and I-95/I-395/Exit 57
C16	I-495 between I-95/I-395/Exit 57 and I-66/Exit 9
C17	I-495 between I-66/Exit 9 and I-270/Exit 35
C18	I-295 between I-495 and 11th St. Bridge

Figure 2-17 Major Freeway Commute Routes



(Screenshot was captured from pda.ritis.org in Feb 2024)

Figure 2-18 Sample of Travel Times along Major Freeway Commute Routes



NOTE: Travel time: time it will take to drive along the stretch of road (Distance traveled / Speed)

Here is a breakdown of key takeaways from the travel time data on major freeway commute routes during morning (AM, Table 2-3) and evening (PM, Table 2-4) peak hours:

- **Mixed Commute Picture in 2023**: Commute times in 2023 show a varied trend compared to 2022. Some routes enjoyed significant improvements (e.g., I-66 EB from VA-28 to I-495 in AM peak hour seeing a 32% decrease). Conversely, others experienced increases (e.g., I-495 IL from I-66/Exit9 to I-270/Exit35 in AM peak hour with a 37% increase). This highlights the need for targeted strategies to address congestion hotspots.

- **Improvement on I-66 Commute**: Both AM and PM peak hours on I-66 (EB in AM and WB in PM) routes show promise for improvement. They witnessed travel time decreases compared to 2022, with the most significant on I-66 WB from I-495 to VA-28 (41% decrease during the PM peak hour). This suggests the effectiveness of implemented traffic management strategies on this corridor.

- **Importance of Considering Variability**: The data focuses on average travel times, but the "Reliable (95th percentile)" figures reveal significant variations. This suggests that occasional heavy traffic can significantly increase travel times beyond the average. A deeper understanding could be gained by analyzing the complete distribution of travel times.

- **Stabilization After Pandemic Disruptions**: While improvements have been made since 2013, changes in travel times from 2021 to 2023 are generally modest. This suggests a potential stabilization of traffic patterns following disruptions caused by the pandemic. Routes like I-95

NB from VA-234 to Exit 169 and I-495 IL from I-270/Exit35 to I-95/Exit 27 show minimal changes compared to 2021, indicating a return to pre-pandemic baseline congestion levels on these routes.

Table 2-3 Travel Time on Major Freeway Commute Routes in AM Peak Hour (8:00-9:00 am)

Route	Length (miles)	Average Travel Time in AM Peak Hour 8:00-9:00 am (min)				Reliable (95th) Travel Time* in AM Peak Hour 8:00-9:00 am (min)				2023 Changes in Average Travel Time in AM Peak Hour (min)			2023 Changes in 95th Travel Time in AM Peak Hour (min)		
		2013	2021	2022	2023	2013	2021	2022	2023	vs. 2013	vs. 2021	vs. 2022	vs. 2013	vs. 2021	vs. 2022
C1: I-270 SB from I-70 to I-370	24	35	32	35	36	64	57	66	59	1	4	1	-5	2	-8
C2: I-270 SB from I-370 to I-495	11	20	12	15	16	38	18	30	29	-4	4	1	-10	11	-1
C3: VA-267 EB from VA-28 to VA-123	14	19	14	15	15	39	15	20	18	-4	1	0	-20	3	-1
C4: I-66 EB from VA-28 to I-495	13	21	20	22	15	36	38	39	22	-6	-5	-7	-14	-16	-17
C5: I-66 EB from I-495 to TR Bridge	12	18	13	16	15	35	15	25	26	-3	3	-1	-9	12	1
C6: I-95 NB from VA-234 to Exit 169	19	28	25	27	26	62	42	47	46	-2	1	-1	-16	4	-1
C7: I-95 NB HOV from VA-234 to Exit 169	18	16	15	15	15	20	15	15	16	-1	1	0	-4	0	0
C8: I-395 NB from I-95 to H St.	14	33	26	36	40	74	47	65	67	6	14	3	-7	20	2
C9: I-395 NB HOV from I-495 to US-1	11	11	10	11	13	22	11	16	20	2	3	2	-1	9	4
C10: US-50 WB from US-301 to MD-295	13	21	16	20	20	34	26	34	36	-1	4	0	2	10	2
C11: Balt-Wash Pkwy SB from MD-198 to US-50	16	25	21	26	28	47	39	50	51	3	7	2	4	12	1
C12: I-95 SB from MD-198 to I-495	8	9	9	10	11	18	14	18	18	2	2	1	0	4	0
C13: I-495 IL from I-270/Exit35 to I-95/Exit 27	10	12	12	13	13	18	18	21	21	1	1	0	3	3	0
C14: I-495 IL from I-95/Exit 27 to US-50/Exit19	9	11	13	14	15	13	21	24	25	5	3	1	12	4	2
C15: I-495 IL from US-50/Exit19 to I-95/Exit57	28	33	31	40	41	56	47	70	67	8	10	1	11	20	-3
C16: I-495 IL from I-95/Exit57 to I-66/Exit9	10	13	14	17	19	20	19	26	29	6	5	2	9	9	3
C17: I-495 IL from I-66/Exit9 to I-270/Exit35	14	19	14	19	26	34	18	35	39	7	11	7	5	21	5
C13: I-495 OL from I-95/Exit27 to I-270/Exit35	10	29	22	29	29	49	38	48	46	0	7	0	-4	8	-3
C14: I-495 OL from US-50/Exit19 to I-95	10	14	11	14	14	24	20	26	25	0	3	0	1	5	-1
C15: I-495 OL from I-95/Exit57 to US-50/Exit19	29	28	30	33	36	42	40	53	58	8	6	3	16	18	5
C16: I-495 OL from I-66/Exit9 to I-95/Exit57	10	10	10	10	10	10	11	11	13	1	0	0	3	2	2
C17: I-495 OL from I-270/Exit35 to I-66/Exit9	13	14	15	19	22	18	23	32	36	8	7	3	18	13	5
C18: I-295 NB from I-495 to 11th St. Bridge.	6	15	11	15	17	33	25	35	32	2	6	2	-1	7	-3

* The majority (95%) of trips spent equal to or less than the reliable (95th) travel time on the specified route. On average, a traveler could successfully complete the travel on the specified route within the reliable travel time during 19 out of 20 trips (only 1 trip could exceed the reliable travel time).

Table 2-4 Travel Time on Major Freeway Commute Routes in PM Peak Hour (5:00-6:00 pm)

Route	Length (miles)	Average Travel Time in PM Peak Hour 5:00-6:00 pm (min)				Reliable (95th) Travel Time* in PM Peak Hour 5:00-6:00 pm (min)				2023 Changes in Average Travel Time in PM Peak Hour			2023 Changes in 95th Travel Time in PM Peak Hour (min)		
		2013	2021	2022	2023	2013	2021	2022	2023	vs. 2013	vs. 2021	vs. 2022	vs. 2013	vs. 2021	vs. 2022
C1: I-270 NB from I-370 to I-70	24	34	34	37	38	62	57	62	59	3	4	1	-3	3	-3
C2: I-270 NB from I-495 to I-370	10	16	12	14	16	30	22	27	27	0	4	1	-3	5	0
C3: VA-267 WB from I-66 to VA-28	17	18	16	16	16	27	17	18	17	-2	0	0	-10	0	-1
C4: I-66 WB from I-495 to VA-28	13	31	24	24	17	57	55	51	25	-14	-7	-7	-32	-30	-26
C5: I-66 WB from TR Bridge to I-495	11	14	11	11	11	24	12	14	15	-3	1	0	-8	3	1
C6: I-95 SB from Exit 169 to VA-234	17	44	33	34	33	96	55	56	54	-11	0	-1	-43	-1	-2
C7: I-95 SB HOV from Exit 169 to VA-234	17	18	15	15	15	28	16	16	16	-3	0	0	-12	0	0
C8: I-395 SB from H St. to I-95	14	26	25	32	36	44	47	60	63	11	11	4	19	16	3
C9: I-395 SB HOV from US-1 to I-495	11	8	10	10	10	10	11	12	12	2	0	0	2	1	0
C10: US-50 E8 from MD-295 to US-301	13	16	14	15	16	22	18	20	20	0	1	0	-2	1	0
C11: Balt-Wash Pkwy NB from US-50 to MD-198	15	29	27	30	32	56	48	54	58	4	5	3	2	10	3
C12: I-95 NB from I-495 to MD-198	8	9	8	8	8	18	11	13	15	0	1	1	-3	4	2
C13: I-495 IL from I-270/Exit35 to I-95/Exit 27	10	18	23	27	29	42	41	49	48	11	6	2	6	7	-1
C14: I-495 IL from I-95/Exit 27 to US-50/Exit19	9	17	15	17	19	33	26	31	33	2	5	2	-1	6	1
C15: I-495 IL from US-50/Exit19 to I-95/Exit57	28	26	34	37	40	33	53	60	65	14	5	2	32	12	5
C16: I-495 IL from I-95/Exit57 to I-66/Exit9	10	10	10	10	11	12	12	13	12	0	0	0	0	1	0
C17: I-495 IL from I-66/Exit9 to I-270/Exit35	14	40	31	39	44	80	60	73	75	4	13	5	-5	14	1
C13: I-495 OL from I-95/Exit27 to I-270/Exit35	10	13	13	13	13	27	22	20	20	-1	0	0	-7	-1	1
C14: I-495 OL from US-50/Exit19 to I-95/Exit57	10	15	16	18	19	27	26	30	29	5	3	1	2	4	0
C15: I-495 OL from I-95/Exit57 to US-50/Exit19	29	34	46	54	58	70	88	97	101	24	12	5	31	12	3
C16: I-495 OL from I-66/Exit9 to I-95/Exit57	10	12	16	19	21	18	26	29	33	9	5	3	15	7	4
C17: I-495 OL from I-270/Exit35 to I-66/Exit9	13	20	22	29	34	36	48	57	60	14	11	5	24	13	3
C18: I-295 SB from 11th St. Bridge. to I-495	7	13	13	18	22	23	28	35	35	9	9	4	12	7	0

* The majority (95%) of trips spent equal to or less than the reliable (95th) travel time on the specified route. On average, a traveler could successfully complete the travel on the specified route within the reliable travel time during 19 out of 20 trips (only 1 trip could exceed the reliable travel time).

2.2.1.8 Congestion on Arterials

Congestion Characteristics on Arterials

Arterial highways, defined as interrupted flow roadways, differ from freeways due to their multiple ingress and egress points, intersections, fewer lanes, and lower speeds. These characteristics lead to unique congestion patterns. The TPB conducted Arterial Floating Car Travel Time Studies from 2000 – 2011 on selected NHS arterial highways in the region, providing valuable insights into arterial congestion:

- Competing demands of traveler mobility and accessibility to adjacent land uses affect arterial operations.
- Growth and development can rapidly worsen congestion at specific locations.
- Intersections and driveways can cause slow-downs and backups along arterials.
- Arterials often experience spillover from freeways.
- Traffic engineering improvements can help soften the impacts of growth.

These findings are crucial for the current effort on arterial travel time monitoring. The congestion characteristics vary based on the urban form surrounding the arterial, classified as Inner Core, Inner Suburbs, and Outer Suburbs arterials.

In the Inner Core, pedestrian and transit access to densely populated land uses are a major focus. Traffic speeds must ensure pedestrian safety. The flow of traffic is frequently interrupted by a higher concentration of signaled intersections and driveways/alleyways.

Inner Suburbs arterials have characteristics combined from that of the inner core and outer suburban arterials. Signalized intersections have capacity limitations, especially when there are high percentages of turning movements at those intersections. Traffic from both nearby offices and residences can cause congestion. And, again, pedestrian safety must be ensured.

Outer Suburbs arterials have their own unique characteristics. New development in the outer suburbs may quickly overwhelm the capacities of what were until recently lightly traveled rural roads. Because commute distances in the outer suburbs tend to be longer, peaking characteristics of traffic are much sharper. Pedestrian and bicyclist accommodations are often lacking.

Congestion management strategies that can help manage congestion on these arterials include operational management strategies such as optimized traffic signal timing, traffic engineering improvements, and demand management strategies such as robust transit services, employer outreach of alternative commute programs, as well as improved pedestrian and bicycle facilities. These lessons learned from past studies are being applied to the current effort on arterial travel time monitoring.

Congestion on Selected NHS Arterials

Leveraging the RITIS VPP/INRIX data, the TPB has incorporated this third-party probe-based data for monitoring arterial travel times. This data source has facilitated a more comprehensive analysis of travel patterns on arterials, including the reliability of travel times. Appendices A and B offer the

Travel Time Index and Planning Time Index during peak hours for most of the region's NHS arterials and other roadways monitored by probe data for 2023.

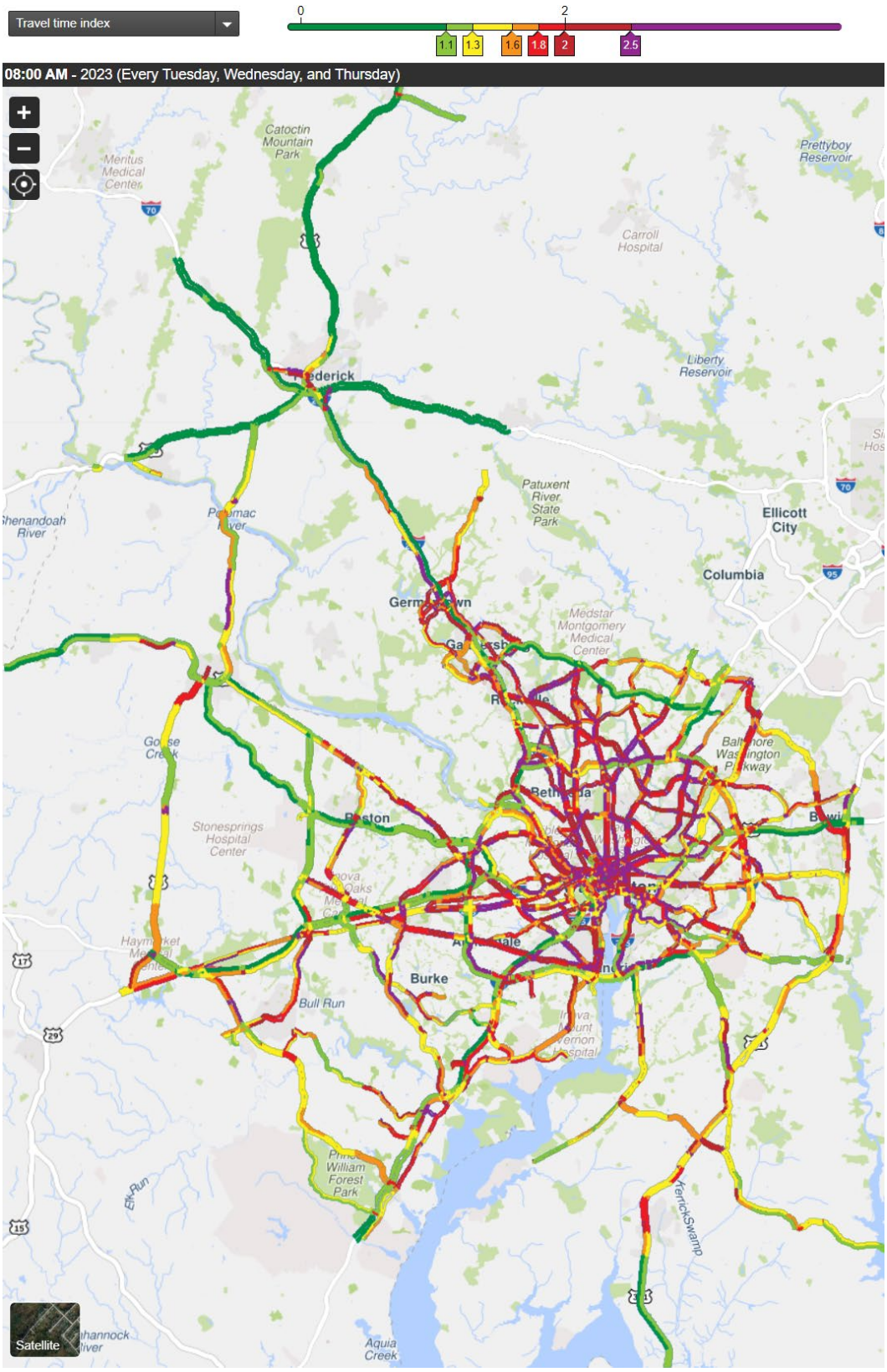
Beyond the regional summaries and congestion maps on arterials previously presented in this chapter, this report also explores travel times on study routes based on historical floating car surveys. This encompasses 58 routes that have been examined in past studies, as detailed in Table 2-5. The Travel Time Index for these studied routes and other NHS arterials during mid-week peak hours (8:00-9:00 am and 5:00-6:00 pm on Tuesdays, Wednesdays, and Thursdays) are illustrated in Figure 2-19 and Figure 2-20.

Table 2-5 Arterial Travel Time Study Routes

State	Route	From/To	To/From	Length (miles)
DC	14th St	Independence Ave	K St	1.0
DC	16th St	K St	Eastern Ave	6.1
DC	17th St	Pennsylvania Ave	Independence Ave	0.5
DC	7th St/Georgia Ave Sec. 1	Independence Ave	New Hampshire Ave	2.8
DC	7th St/Georgia Ave Sec. 2	New Hampshire Ave	Eastern Ave	3.5
DC	Canal Rd/M St	30th St	Chain Bridge	3.7
DC	Connecticut Ave	K St	Nebraska Ave	4.0
DC	Constitution Ave	Louisiana Ave	14th St NE	1.5
DC	H St	Pennsylvania Ave	14th St NW	0.6
DC	Independence Ave	17th St	2nd St SE	1.9
DC	K St/New York Ave	21st St NW	Bladensburg Rd	4.2
DC	L St	Pennsylvania Ave	14th St NW	1.1
DC	Military Rd	Connecticut Ave	Georgia Ave	2.5
DC	Pennsylvania Ave	Constitution Ave	15th St NW	0.8
DC	Rhode Island Ave	7th St	Eastern Ave	3.5
DC	South Dakota Ave	Bladensburg Rd	Riggs Rd	3.0
DC	US 50	17th St	T. R. Bridge	0.9
DC	US 29	M St	Whitehurst Fwy	0.5
DC	Wisconsin Ave	M St	Western Ave	4.1
MD	MD 117	Muddy Branch Rd	Clarksburg Rd	6.8
MD	MD 193	Colesville Rd	Adelphi Rd	4.6
MD	MD 198	MD 650	Old Gunpowder Rd	5.2
MD	MD 210	Southern Ave	Livingston Rd	10.5
MD	MD 355 Sec. 1	MD 124	MD 547	10.1
MD	MD 355 Sec. 2	MD 547	Western Ave	5.3
MD	MD 4	Southern Ave	Dower house Rd	7.0
MD	MD 450	US 301	B. W. Pkwy	12.1
MD	MD 586	MD 28	MD 193	5.0
MD	MD 193	US 29	MD 185	4.2
MD	MD 28	Veirs Mill Rd	New Hampshire Ave	9.0
MD	MD 5	Suitland Pkwy	Accokeek Rd	12.2
MD	MD 97 Sec. 1	Eastern Ave	University Blvd	4.2

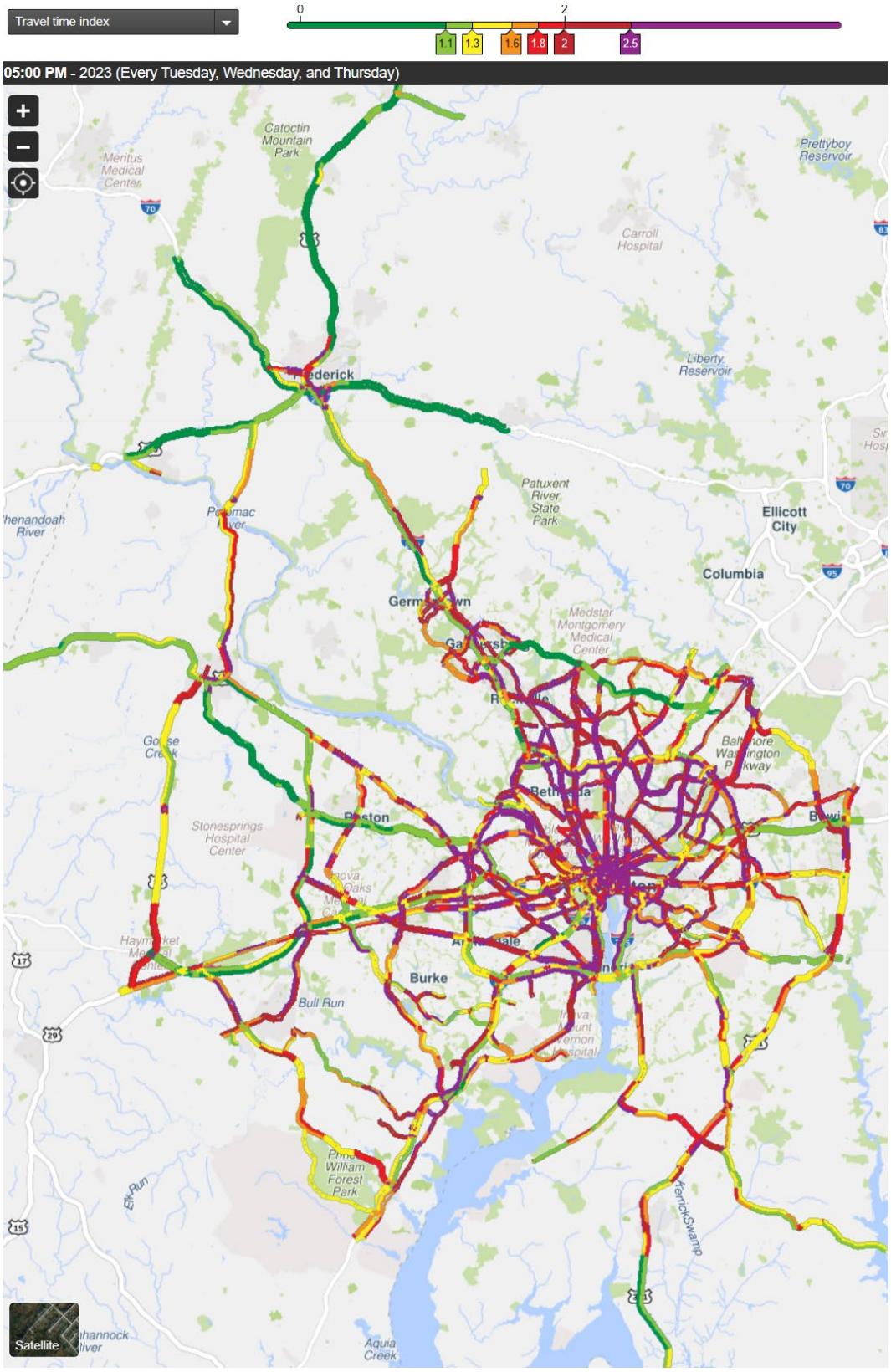
MD	MD 97 Sec. 2	University Blvd	MD 28	5.3
MD	Randolph Rd	MD 355	Columbia Pike	9.1
MD	US 1 Sec. 1	MD 198	MD 193	8.1
MD	US 1 Sec. 2	MD 193	Eastern Ave	5.3
MD	US 29	East-West Hwy	Fairland Rd	7.1
VA	US 15	VA 7	Lovettsville Rd	12.6
VA	US 50 Sec. 1	VA 28	Nutley St	13.4
VA	US 50 Sec. 2	Nutley St	Fort Myer Dr	12.3
VA	US 1	15th St	VA 123	20.0
VA	US 29 Sec. 1	G.W. Pkwy	Gallows Rd	9.0
VA	US 29 Sec. 2	Gallows Rd	VA 236	8.8
VA	US 29 Sec. 3	VA 236	Bull Run PO Rd	7.5
VA	VA 120	I 395	Chain Bridge	8.3
VA	VA 123 Sec. 1	VA 193	VA 7	5.8
VA	VA 123 Sec. 2	VA 7	VA 236	7.1
VA	VA 123 Sec. 3	VA 236	US 1	14.8
VA	VA 234 Sec. 1	US 1	Hoadley Rd	10.2
VA	VA 234 Sec. 2	Hoadley Rd	US 29	13.2
VA	VA 28 Sec. 1	Wellington Road	Compton Rd	7.0
VA	VA 28 Sec. 2	Compton Rd	VA 7	17.0
VA	VA 7 Sec. 1	Braddock Rd	Gallows Rd	9.5
VA	VA 7 Sec. 2	Gallows Rd	VA 193	10.0
VA	VA 7 Sec. 3	VA 193	VA 28	8.0
VA	VA 286 Sec. 1	Sunrise Valley	US 50	6.2
VA	VA 286 Sec. 2	US 50	Rolling Rd	20.0
VA	Wilson Blvd	Roosevelt Blvd	Fort Myer Dr	4.7
	Total			402.7

Figure 2-19 Travel Time Index on Selected NHS Arterials during 8:00-9:00 am on Middle Weekdays in 2023



Note: Congestion levels are categorized by the value of TTI: TTI = 1.0: Free flow

Figure 2-20 Travel Time Index on Selected NHS Arterials during 5:00-6:00 pm on Middle Weekdays in 2023



Note: Congestion levels are categorized by the value of TTI: TTI = 1.0: Free flow

Mitigating Arterial Congestion
Expanding arterial capacity to alleviate congestion is often unfeasible, given that many arterials are already operating at full capacity with developments on both sides. Nonetheless, solutions could be found in demand management and operational management strategies. Introducing express buses or other forms of public transportation along an arterial could reduce the volume of cars on the road. Enhancements for pedestrians and cyclists, such as the establishment of a new bike facility along the arterial, can offer alternative travel options. Operational enhancements could involve the addition of turn lanes to minimize intersection back-ups, or the creation of extra lanes. Optimizing traffic signal timing is also crucial to ensure smooth vehicle movement at intersections.

2.2.1.9 Quarterly National Capital Region Congestion Report

Motivated by the dashboard initiatives of various agencies and jurisdictions across the country, and propelled by MAP-21, FAST, and the availability of probe-based traffic speed data from the Eastern Transportation Coalition Vehicle Probe Project, the National Capital Region Congestion Report is produced quarterly. This report leverages the rich data and analytical tools available to provide customized, easily communicated, and regularly updated performance measures of traffic congestion and travel time reliability for the Transportation Planning Board (TPB) Planning Area.

The aim of this endeavor is to provide a summary of the region's congestion, TPB programs and those of its member jurisdictions that could influence congestion, and reliability and non-recurring congestion due to recent incidents or occurrences, in conjunction with appropriate congestion management strategies.

The quarterly report encompasses an analysis of congestion and travel time reliability, a list of the top 10 bottlenecks for the quarter, congestion maps, a quarterly spotlight on significant event(s) and their transportation impacts during that quarter, and information on the background and methodology. The report can be accessed at www.mwcog.org/congestion. A screenshot of the congestion page of the 4th Quarter 2023 Report is shown in Figure 2-21.

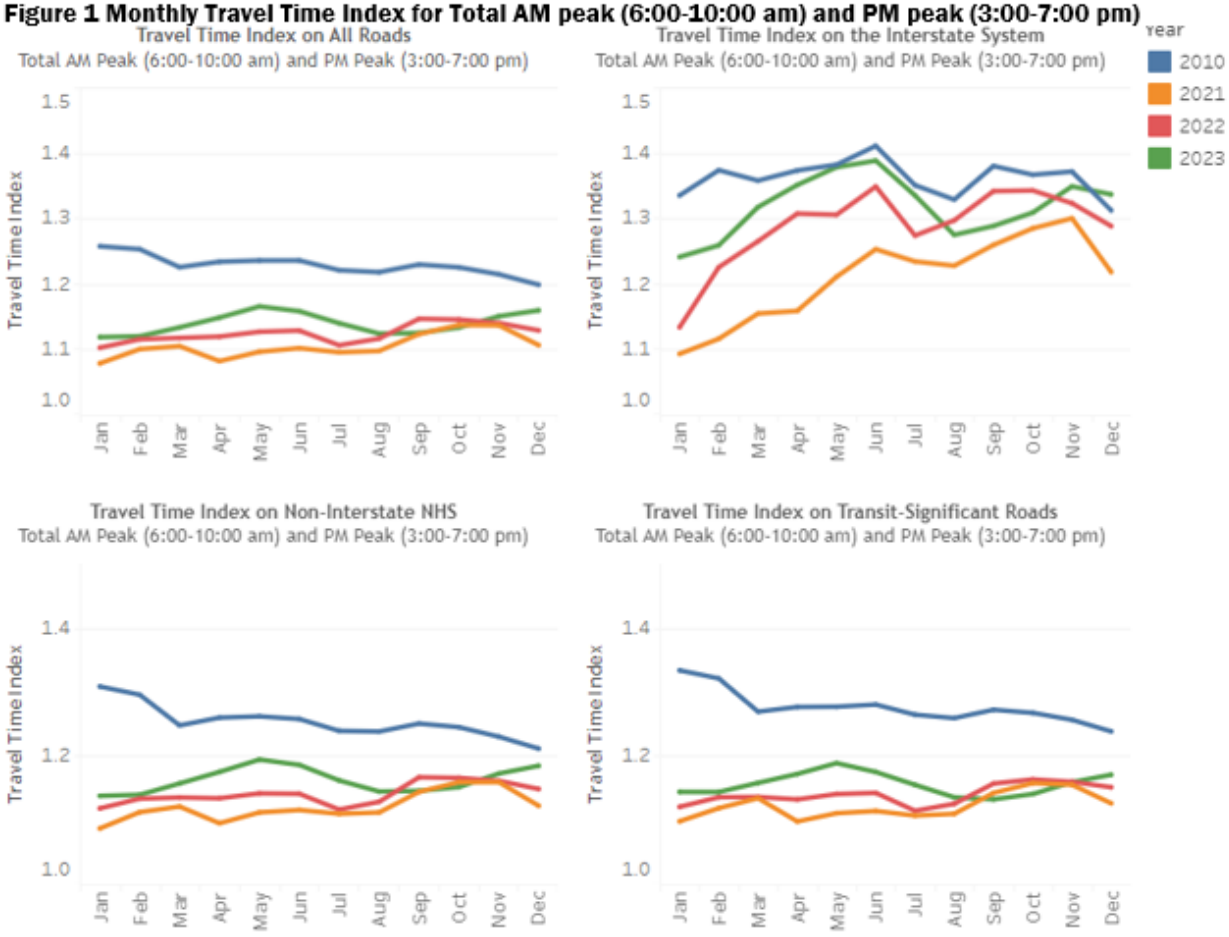
Figure 2-21 National Capital Region Congestion Report Example (the Congestion Page)

CONGESTION – TRAVEL TIME INDEX (TTI)

Interstate System			**Non-Interstate NHS[3]**		
TTI 4th Quarter 2023:	**1.33**	↑1.0% or 0.01[1]	TTI 4th Quarter 2023:	**1.17**	↑1.0% or 0.01
TTI Trailing 4 Quarters:	**1.32**	↑2.4% or 0.03[2]	TTI Trailing 4 Quarters:	**1.16**	↑1.9% or 0.02
Transit-Significant[4]			**All Roads**		
TTI 4th Quarter 2023:	**1.16**	↓0.1% or -0.00	TTI 4th Quarter 2023:	**1.15**	↑0.8% or 0.01
TTI Trailing 4 Quarters:	**1.16**	↑1.4% or 0.02	TTI Trailing 4 Quarters:	**1.14**	↑1.3% or 0.02

[1] Compared to 4th Quarter 2022; [2]Compared to one year earlier;[3] NHS: National Highway System; [4] See "Background" section.

Figure 1 Monthly Travel Time Index for Total AM peak (6:00-10:00 am) and PM peak (3:00-7:00 pm)



Source: TPB

> ***Travel Time Index*** *(TTI), defined as the ratio of actual travel time to free-flow travel time, measures the intensity of congestion. The higher the index, the more congested traffic conditions it represents, e.g., TTI = 1.00 means free flow conditions, while TTI = 1.30 indicates the actual travel time is 30% longer than the free-flow travel time.*

2.2.2 AIRPORT GROUND ACCESS TRAVEL TIME STUDIES

Studies of travel time to the three major airports[30] that serve the Washington and Baltimore metropolitan areas have been conducted for many years as part of the Continuous Airport Systems Planning (CASP) work program.

The most recent study was completed in 2017 and digital copies are available upon request. The study used vehicle probe data from 2014/2015[31] which were compared with data from 2011/2012[32] for purposes of computing changes in congestion and travel times to the airports. This was the first study of airport ground access that used vehicle probe data from INRIX, obtained through Center for Advanced Transportation Technology Laboratory at the University of Maryland in College Park.

Previous studies were completed in 1988, 1994, 2003 and 2011, all using a smaller network of airport access routes, with data collection performed using in-the-field floating car methodology.

Unlike many studies involving vehicle probe data performed by COG/TPB, the 2017 report placed significant emphasis on monitoring of the highways system on weekends and holidays, since so much air travel takes place during those times.

This report also included sections of the highway system well beyond the TPB planning area, including the Baltimore, Maryland and Fredericksburg, Virginia regions, as well as Hagerstown and Easton in Maryland; Front Royal and Winchester in Virginia; and Gettysburg and York in Pennsylvania. Highway routes between the three airports were also evaluated.

Future CMP Technical Reports are anticipated to include results from an updated ground access travel time study using a similar methodology. This update will provide airport ground access data for three analysis periods: (1) spring 2019 (pre-pandemic period); (2) spring 2020 (peak pandemic period); and (3) spring 2023 (post-pandemic).

2.2.3 FREIGHT MOVEMENT AND CONGESTION

In addition to congestion's impacts on person movement, congestion in and around major urban areas significantly impacts freight movements. While other modes are not generally affected to the degree that trucks are by surface transportation congestion, the metropolitan Washington region is subject to freight rail bottlenecks in addition to roadway congestion.

Congestion on the region’s highways and arterials slows freight deliveries which impacts both shippers and consumers. Shippers continually adjust their operations in response to congested conditions. Longer term impacts of increased congestion to freight-dependent industries include:

- A shrinking of the delivery area that one driver and vehicle can serve on one shift, causing firms to add smaller and more numerous trucks to their fleets to better serve their customers;

[30] Baltimore/Washington International Thurgood Marshall Airport (BWI), Linthicum, Maryland; Ronald Reagan Washington National Airport (DCA), Arlington, Virginia; Washington Dulles International Airport (IAD), Chantilly, Virginia.

[31] September 1, 2014 through August 31, 2015

[32] September 1, 2011 through August 31, 2012

- A decrease in the size of the area that can be served from any given distribution facility, impacting the size, number, and dispersion of distribution facilities in the region;

- A decrease in delivery reliability, causing firms to increase "on hand" or "just in case" inventory, thereby eroding the economic efficiencies associated with just-in-time inventory systems; and

- An increase in shipper operating costs (time and fuel) which are eventually passed on to consumers.

According to TPB analysis of FHWA Freight Analysis Framework data (FAF), approximately 339 million tons of goods worth over $583 billion were transported to, from, within, and through the National Capital Region in 2020. Approximately 72 percent of this freight movement (by weight) was by truck. Both recurring and non-recurring congestion increase truck travel and planning time, which add to shipping and inventory holding costs. Trucks also contribute to congestion due to their size and operating characteristics. Because of their importance to the regional and national economy and the way that trucks affect, and are affected by, roadway congestion, freight movement is an important element of regional and local transportation and land use planning efforts.

Employment in the professional and business services, trade and transportation, federal government, and state and local government sectors drives the economy of the metropolitan Washington region. Because of the service-based nature of metropolitan Washington's economy, this region is primarily a consumer rather than a producer of goods. Consumers depend upon trucks to deliver needed goods. This demand puts pressure on the regional surface transportation system as trucks maneuver across the transportation network and attempt to make their deliveries on time.

Both national and regional freight forecasts predict significant growth in freight tonnage and value across most transportation modes. Trucks are more flexible than trains, ships, or airplanes; operate on a broader transportation network; and are usually required to haul goods shipped by other modes to their final destination. Because of these features, trucks are projected to capture much of the forecasted growth in freight demand. According to TPB analysis of the Federal Highway Administration's Freight Analysis Framework, the volume of freight tonnage transported by truck is forecasted to grow by 62 percent by 2050.

The rise in e-commerce has exacerbated congestion in urban areas of metropolitan Washington and throughout much of the world. Over the last decade, e-commerce has grown approximately 15 percent annually[33] and will likely become increasingly prevalent going forward. Growth in e-commerce means growth in the overall number of truck trips which contributes to congestion because trucks account for 12 percent of the cost of congestion in urban areas.[34] Urban congestion is exacerbated when increasing numbers of trucks compete for limited urban curbside space, forcing many of them to block travel lanes, bicycle lanes, and alleys.

The American Transportation Research Institute (ATRI) ranked congestion in the Washington, DC metropolitan area as eighth in the nation in terms of its contribution to increased operating costs for the trucking industry (see Table 2-6). Compared to ATRI's previous ranking using 2016 data, the Washington DC metropolitan area dropped two places despite experiencing a 14.6 percent increase in congestion cost.

[33] Calculated based on data from the U.S. Census Bureau

[34] Texas A&M Transportation Institute 2021 Urban Mobility Report

Table 2-6 –Top Ten Metropolitan Areas by Total Cost of Congestion (2021)

Rank	Metropolitan Area	Cost to the Trucking Industry (millions of dollars)
1	New York City Metro	5,491.4
2	Miami Metro	2,618.2
3	Chicago Metro	2,570.5
4	Philadelphia Metro	2,101.9
5	Los Angeles Metro	1,804.9
6	Dallas Metro	1,795.6
7	Houston Metro	1,633.8
8	**Washington DC Metro**	**1,613.8**
9	Nashville Metro	1,440.8
10	Atlanta Metro	1,393.4

Source: ATRI, *Cost of Congestion to the Trucking Industry: 2023 Update*

The COVID-19 pandemic temporarily reduced traffic congestion by 60-75 percent in urban areas during March, April, and May 2020 due to the implementation of "lockdown" policies.[35] As a result of the decreased congestion, freight trucks traveled at higher speeds and were able to reduce delivery delays in urban areas during this period.[36] Truck delays returned in 2021, however, as work-from-home requirements started to lift and commuters began returning to offices for work.[37] In the National Capital Region, annual vehicle miles traveled (VMT) increased by 10.9 percent between 2020 and 2021, from 366.60 (in 100 million VMT) to 406.47 (in 100 million VMT). Annual VMT figures for 2021 still represent approximately 89 percent of pre-pandemic VMT levels.

A Panama Canal Expansion completed in 2016 has also fueled increased truck traffic. Much larger "Post-Panamax" ships from Asia are now able to serve East Coast ports, including the port facilities in Baltimore and the Hampton Roads, Virginia area. Container traffic between Asia and the United States is now able to use both West Coast and East Coast ports thus reducing the demand for long hauls from the West Coast and increasing demand for regional hauls from East Coast ports.

The TPB supports freight planning in the National Capital Region through various initiatives, including participation in regional and national freight groups, publication of a Freight Plan, and a Freight Subcommittee which was established in 2008. The Freight Subcommittee provides a forum for discussion of freight issues and concerns within the metropolitan Washington Region and gives freight stakeholders the opportunity to share concerns and information with the TPB and other decision-makers.

2.2.4 TRAFFIC SIGNALS

2.2.4.1 Traffic Signal Timing

Delays occurring at signalized intersections are understood to account for a significant portion of overall arterial and urban street delays. Improving traffic signal timing has been identified as a TPB priority area. The TPB conducted surveys of the status of the region's signal optimization in 2005[38],

[35] Id.

[36] Id.

[37] ATRI, *Cost of Congestion to the Trucking Industry: 2023 Update*

[38] Andrew J. Meese, *Briefing on the Implementation of Traffic Signal Optimization in the Region*, a presentation to the TPB on November 10, 2005. http://www.mwcog.org/uploads/committee-documents/tVtXWlY20051110144208.pdf

2009[39], and 2013[40], and 2017. This survey has now been discontinued, as signal technology has advanced, and optimization happens on an ongoing basis and moved away from the three-to-five-year cycles of the past.

In 2016, DDOT completed a citywide signal optimization project initiated in 2012, enhancing the District's entire traffic signal network of more than 1,650 signals. The central goal of the optimization project is to make DC traffic signals safer and friendlier for pedestrians, improve bus running times, and reduce traffic congestion and vehicular traffic emissions.

Under the TPB's Transportation Investments Generating Economic Recovery (TIGER) grant for Priority Bus Transit in the National Capital Region, in 2015 and 2016 WMATA, City of Alexandria and DDOT implemented Transit Signal Priority (TSP) at intersections along VA-7 (Leesburg Pike), the Van Dorn-Pentagon corridor, and in the District of Columbia.

On the VA-7 corridor, 25 TSP signals were installed in locations in Fairfax County, the City of Alexandria, and the City of Falls Church. A WMATA fleet of 8 Metrobuses was equipped with the onboard equipment and the project began operation in June 2015. The DDOT TSP Project was implemented at 195 locations throughout the District and began operation in December 2016. Onboard bus equipment was installed by WMATA on 116 Metrobuses. The City of Alexandria implemented TSP at nine locations along the Van Dorn-Pentagon corridor in July 2016. WMATA installed onboard equipment on eight Metrobuses for this project.

2.2.4.2 Traffic Signal Power Back-Up

Traffic signal power back-up systems are critical in the event of an emergency, particularly if the event involves a lack of power. Since late 2011, the TPB's Traffic Signal Subcommittee has conducted seven regional surveys on traffic signals power back-up systems[41]. The most recent survey was conducted by the spring of 2018 covering systems as of December 31, 2017 and found that about 33% of the region's 5,900+ signals are already equipped with battery-based power back-up systems, and 70% are equipped with generator-ready back-up systems (most battery-based systems also have generator-ready features). These power back-up systems can improve the resiliency of the transportation network. Like the Traffic Signal Timing Survey, with no recent change in trends, the Power Back-up survey has been discontinued. Staff will continue to keep abreast of traffic signal technology in the region.

2.2.5 SAFETY AND CONGESTION

2.2.5.1 Overview

The correlation between highway safety and congestion is complex. On one hand, there is a positive correlation between traffic crashes and congestion. Crashes, as well as road construction and repair

[39] Edward D. Jones, *Status Report on Traffic Signal Optimization in the Washington Region*, a presentation to the TPB on March 11, 2009. http://www.mwcog.org/uploads/committee-documents/bV5cXFhc20090312161527.pdf

[40] Ling Li, *Briefing on Traffic Signal Timing/Optimization in the Washington Region*, a presentation to the TPB on February 19, 2014. http://www.mwcog.org/uploads/committee-documents/al1ZXFpb20140212133426.pdf

[41] Andrew Burke, *2018 Signal Surveys, Power Backup and Signal Optimization*, a presentation to the TPB's Systems Performance, Operations, and Technology Subcommittee on June 7, 2018.

activities, disabled vehicles, inclement weather, and/or special events contribute to non-recurring congestion. Sources indicate that approximately half of total congestion is non-recurring[42].

Engineering and operational management activities can mitigate congestion and improve safety. Many transportation agencies in the region employ active incident management programs to quickly respond to incidents, reduce their duration, and thereby lessen the likelihood of secondary crashes[43] resulting from traffic backups. These programs are further integrated into the Metropolitan Area Transportation Operations Coordination (MATOC) program[44], which provides day-to-day, real-time multi-agency coordination and information sharing on transportation systems conditions in the National Capital Region.

The TPB addresses transportation safety through the following programs and activities:

- The ***Transportation Improvement Program (TIP)*** helps the TPB reduce fatal and serious injury crashes on the regions roadways and because crashes are one of the causes of non-recurring congestion, a reduction in these crashes therefore helps to reduce overall congestion. The TIP includes funding under the Highway Safety Improvement Program for priority HSIP projects as programmed by the three states. Examples of HSIP programmed projects include impact attenuators, guardrails, upgrading traffic signal devices, work zone safety reviews, and improved signs and markings. The three states have processes for inclusion of safety-related projects as identified in their Strategic Highway Safety Plans and other state plans and documents. Safety improvements are also included within projects funded with non-HSIP funds and through other state and federal sources, such as the Transportation Alternatives Program Block Grants, including Safe Routes to School grants, and roadway maintenance projects, all of which will provide benefits that contribute to improved safety performance.

- The TPB's ***Transportation Safety Subcommittee***[45] serves as a forum for public- and private-sector safety stakeholders to exchange information on best practices in transportation safety planning. The subcommittee periodically compiles and reviews regional highway safety data, shares this data among member jurisdictions, monitors regional performance on the federally-required regional highway safety performance measures, and advises the Technical Committee and the Transportation Planning Board (TPB) on regional highway safety issues and on the various federal requirements for MPOs to follow related to transportation safety.

- The ***Street Smart Pedestrian and Bicycle Safety*** campaign is an annual region-wide education effort to raise public awareness on pedestrian and bicycle safety[46]. The campaign, uses radio, newspaper, and transit advertising, public awareness efforts, and engages law enforcement to change driver, pedestrian, and bicyclist behavior in an effort to reduce nonmotorist fatalities and serious injuries.

Incorporating Travel-Time Reliability into the Congestion Management Process (CMP): A Primer – Figure 1, Federal Highway Administration: https://ops.fhwa.dot.gov/publications/fhwahop14034/ch1.htm .

[43] crashes due to congestion created by an earlier crash or incident or to drivers distracted by the previous incident scene

[44] See www.matoc.org for more information.

[45] a subcommittee of the TPB Technical Committee

[46] http://www.bestreetsmart.net/

- The ***Regional Roadway Safety Program*** is a TPB technical assistance program that provides consultant services to member jurisdictions or agencies to assist with planning or preliminary engineering projects addressing roadway safety concerns.

2.2.5.2 Safety Trends in the National Capital Region

The TPB Transportation Safety Subcommittee compiles, summarizes, and reports on safety performance measures at the regional level. It is reasonable to infer that increasing numbers of fatal and serious injury crashes could also result in increasing non-recurring congestion associated with crashes. Note that the statistics for 2022 referenced below are preliminary. State figures are being used pending the availability of updated information from the National Highway Traffic Safety Administration's (NHTSA) Fatality Analysis Reporting System (FARS).

- After plateauing for much of the first part of this decade, the number of highway fatalities has been on an increasing trend since 2015. In 2022, 382[47] people were killed on the National Capital Region's roadways, an increase of approximately five percent over 2021 levels. Traffic fatalities and serious injuries were notably high among nonmotorists (pedestrians and bicyclists), which increased by roughly 23 percent in 2022. While the causes for the fatality increase is still being investigated, research indicates that individuals involved in crashes during the pandemic engaged in riskier and more aggressive driving behavior, such as speeding, failure to wear seat belts and driving under the influence of alcohol or other drugs.[48] These behaviors continued in the pandemic's aftermath, explaining some of the increases in traffic fatalities.[49]

- The fatality rate per 100 million VMT for the National Capital Region increased from 0.67 in 2018 to 0.94 in 2022.

2.2.5.3 Performance Based Planning and Programming – Highway Safety Targets

Federal regulations require Metropolitan Planning Organizations (like the TPB) to track five highway safety performance measures and set targets for each of them every year. The five performance measures, along with proscribed data sources, are described in Table 2-7 below. These safety performance measures are applicable to all public roads regardless of ownership or functional classification.

[47] Fatality counts reflect fatalities that meet the federal criteria for traffic fatalities.

[48] USDOT NHTSA, Examination of the Traffic Safety Environment During the Second Quarter of 2020

[49] USDOT NHTSA, Overview of Motor Vehicle Traffic Crashes in 2021

Table 2-7 Highway Safety Performance Measures Summary

Performance Measure	Description	Data Source
Number of Fatalities *(5 year rolling average)*	Total number of fatalities during a calendar year	FARS[1]
Rate of Fatalities per 100 million VMT *(5 year rolling average)*	Ratio of total fatalities to VMT	FARS and HPMS[2] (or MPO estimate)
Number of Serious Injuries *(5 year rolling average)*	Total number of serious injuries during a calendar year	State reported serious injury data
Rate of Serious Injuries per 100 million VMT *(5 year rolling average)*	Ratio of total serious injuries to VMT	State reported serious injury data and HPMS
Number of Non-Motorized Fatalities and Serious Injuries *(5 year rolling average)*	Total number of fatalities and serious injuries during a calendar year	FARS and State serious injury data

[1] FARS: Fatality Analysis Reporting System
[2] HPMS: Highway Performance Monitoring System

While these safety performance measures are not specifically related to congestion, the fatalities and serious injuries resulting from congestion-related crashes are part of the overall regional safety picture and will have an impact on whether or not the National Capital Region meets its highway safety targets.

The TPB has set targets for each of these performance measures every year beginning in January 2018.

2.3 Congestion on Transit Systems

2.3.1 IMPACTS OF HIGHWAY CONGESTION ON TRANSIT SYSTEMS

2.3.1.1 Transit-Significant Roads

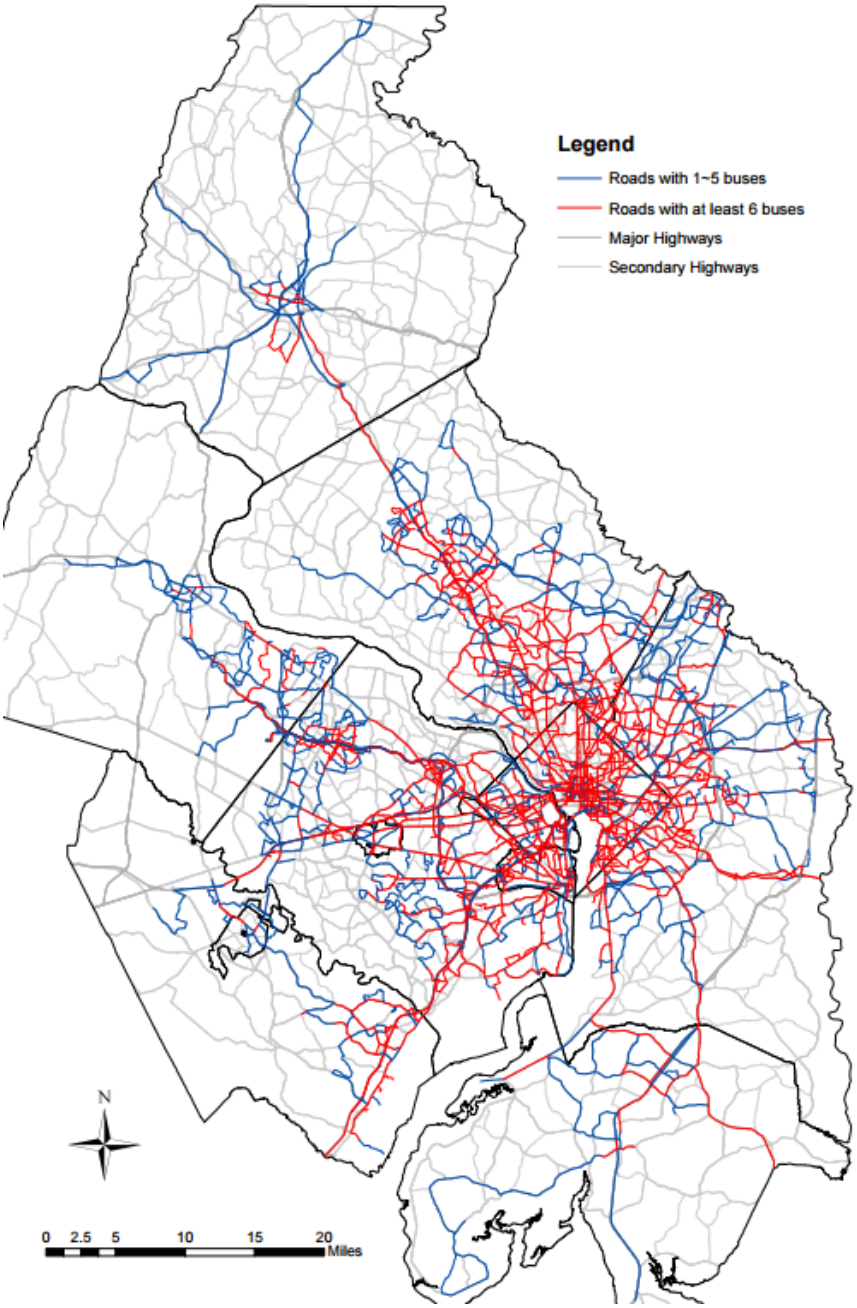
Frequently, highway congestion in a region has repercussions on transit systems. Transit operations tend to concentrate in areas with high-density land uses, where traffic congestion is expected. Bus schedules are typically designed to account for and adapt to highway congestion whenever possible. However, there are instances when congestion becomes unpredictable, affecting not only the timing of individual buses but also the entire bus system and other connected transit systems (such as commuter rail).

To monitor the varying congestion conditions between overall regional traffic and transit-significant routes, the TPB identified a Transit-Significant Road Network in 2014[50]. This network's performance is now tracked in the quarterly National Capital Region Congestion Report and the CMP Technical Report as a distinct highway category.

[50] Wenjing Pu, Update on "Transit-Significant Highway Network" Identification, Presentation to the Regional Public Transportation Subcommittee, November 25, 2014. http://www.mwcog.org/uploads/committee-documents/al1XXV1Z20141125094736.pdf

Road segments with at least six buses during the morning peak hour (equivalent to one bus in either direction every ten minutes) are classified as “transit-significant”. By this criterion, the region has a total of 1,397 miles of transit-significant road segments, as depicted in Figure 2-22.

Figure 2-22 Transit-Significant Roads in the TPB Planning Area

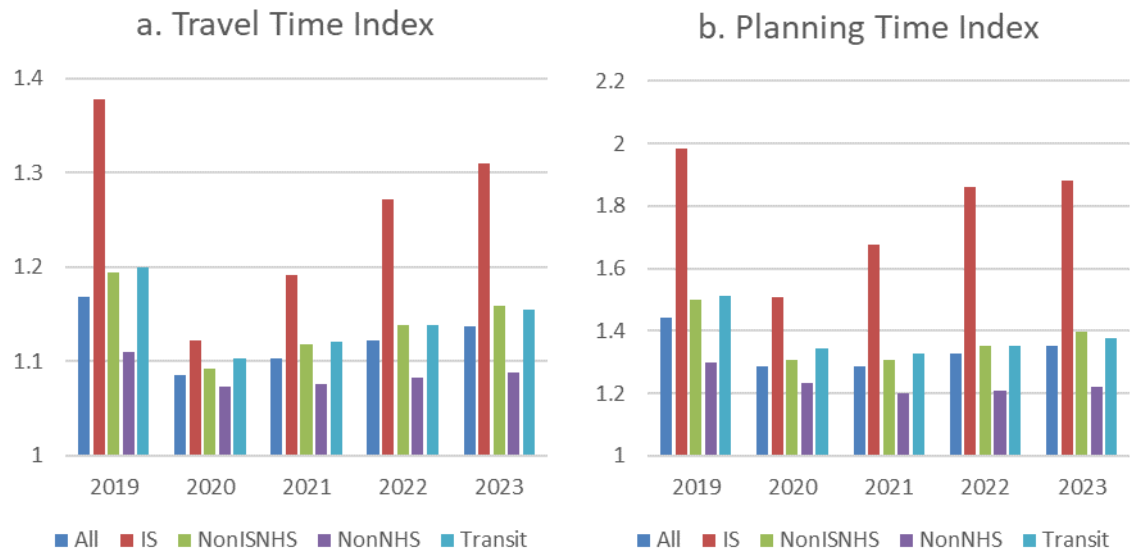


In general, performance analyses indicate that Transit-Significant Roads are both more congested and more responsive to changes compared to the regional average for all roads. However, they tend to be less congested than the region's Interstate highways.

The transit network historically experienced higher congestion than the overall road network during peak periods (6:00-10:00 AM and 3:00-7:00 PM) as measured by the annual average Travel Time Index (TTI). This difference was around 3 to 5 percent worse between 2010 and 2016. However, the gap has narrowed in recent years, dropping to 1 to 2 percent since the COVID-19 pandemic began in 2020, as shown in Figure 2-23a or in Figure 2-23a. Although the transit network's TTI remains higher, it does not necessarily indicate lower efficiency. Public transit, like buses, can efficiently

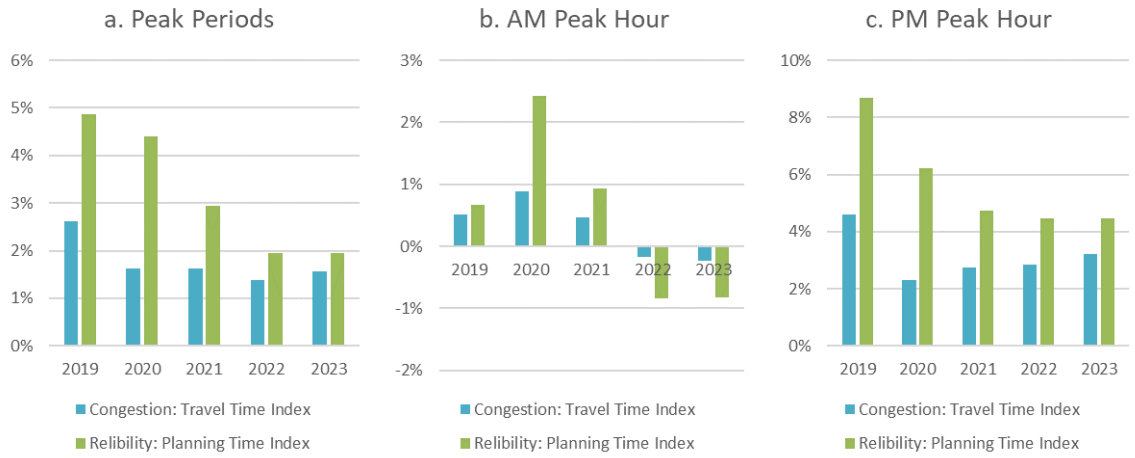
move a larger number of people compared to individual cars, even in congested conditions. A higher TTI for the transit network might simply reflect its role in carrying a significant volume of passengers, particularly during peak hours.

Figure 2-23 Peak Period Travel Time Index and Planning Time Index of Transit-Significant Roads



The difference in congestion between the transit network and the regional average was more pronounced during PM peak hour, with over 2 percent difference, compared to the AM peak hour's less than 1 percent divergence (Figure 2-24 b. and c.).

Figure 2-24 Percentage Change for Transit-Significant Roads Compared to All Roads

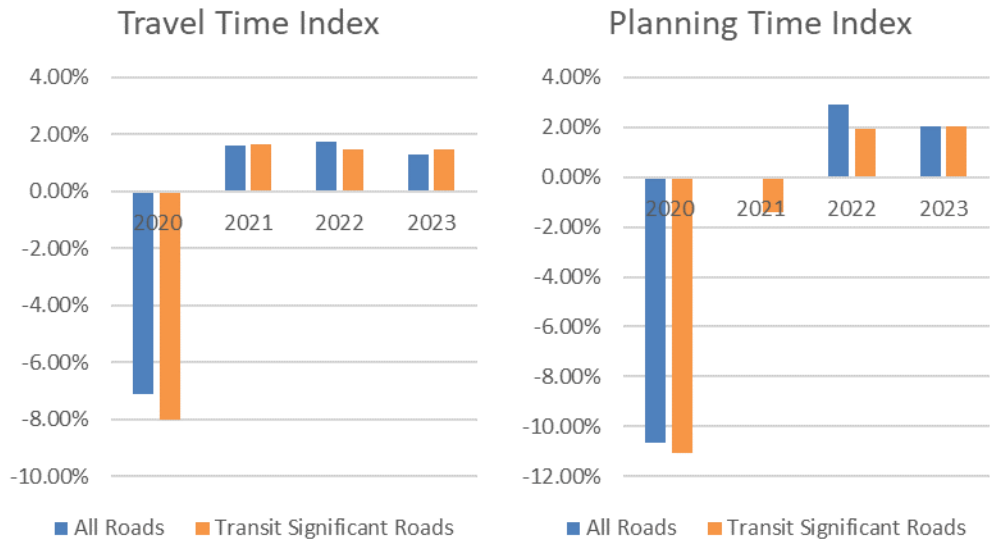


Travel time reliability on the transit network has been steadily improving over the past five years. This is measured by the Planning Time Index (PTI), and the gap between the transit network and the regional average has narrowed significantly (Figure 2-24a). It went from nearly a 5% difference to less than 2%. The trend is particularly strong during peak afternoon hours (PM peak). As shown in Figure 2-24c, the PTI for the transit network in the PM peak has become much closer to the regional average. In fact, the transit network was even more reliable than all roads in the region during morning peak hours (AM peak) for 2022 and 2023. The PTI difference was less than 1% in those

years. For PM peak hours only, 2023 saw a slight increase in PTI compared to 2022, but it remained very close.

Historically, the performance of the Transit-Significant Network has tracked closely with the regional average. However, in recent years, year-to-year changes in the Transit-Significant Network's performance have been even slightly less volatile than those of the regional average (Figure 2-25) in the recent three years. Notably, the PTI for all roads showed almost no change between 2020 and 2021, while the Transit-Significant Network observed an improvement of about 2% during the same period.

Figure 2-25 Congestion and Reliability Year-to-Year Changes of Transit-Significant Roads



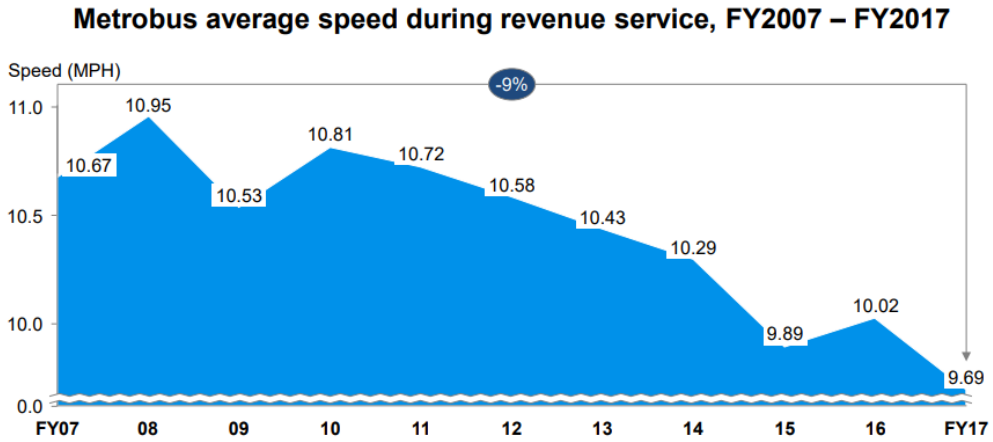
2.3.1.2 Bus Travel Speeds

Another way to assess the impacts of highway congestion on transit is to directly investigate bus travel speed along roads carrying both buses and other vehicles. Bus transit service is affected by travel speed, with slow speeds impacting customers as well as the efficiency of bus scheduling. The traffic congestion that contributes to slow travel speeds is also associated with reduced reliability as travel times increase in variability. Slow bus travel speeds are commonly found in the downtown as well as in dense activity centers elsewhere.

WMATA Metrobus operates through downtown DC and to most major activity centers in the region. According to research done for the Bus Transformation Project study, over the ten years between 2007 and 2017 Metrobus experienced decelerating bus speeds of 9% or 1 mph.[51] Besides the impact on travel, this slowdown also added to operational costs.

[51] "The Bus System and its Riders Today", p. 153. October 2018. http://bustransformationproject.com/wp-content/uploads/2019/01/20190118-Bus-System-Today_FINAL.pdf

Figure 2-26 Decline in Metrobus Speed, 2007 to 2017



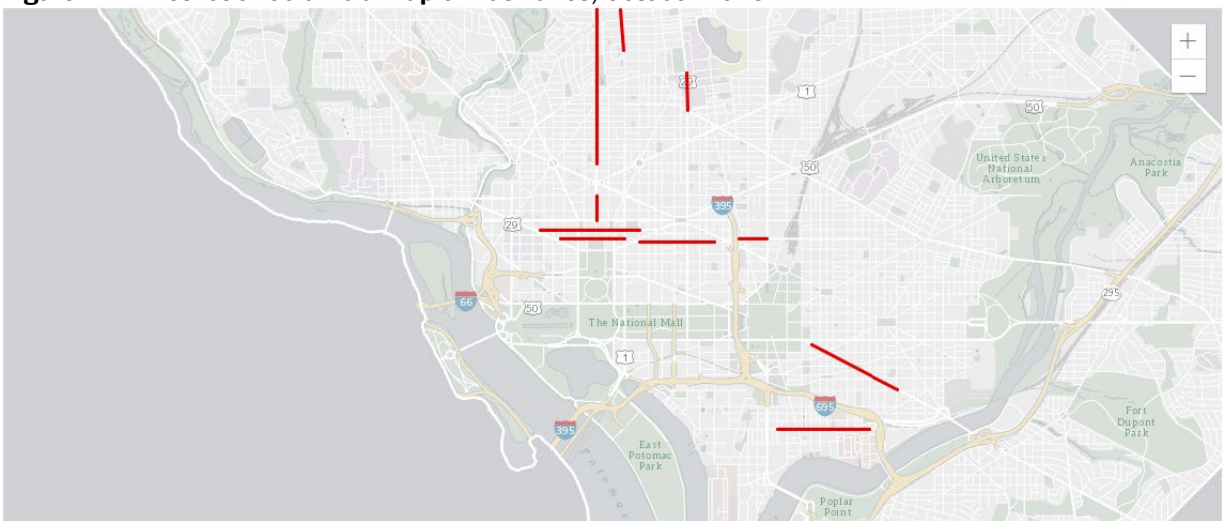
Source: National Transit Database, WMATA FY19 budget book.

The District of Columbia has been the most active jurisdiction in the region in implementing bus lanes, several projects were catalyzed by the pandemic. Bus lanes speed up bus service and enhance reliability. With dedicated lanes, buses no longer need to change travel lanes or wait behind other traffic. These lanes allow bus operators to pull up directly next to the curb, allowing for safe boarding. These lanes and the bus stop design make our streets safer and boarding efficient and safe. Bus lanes in the District include 16th Street and 14th Street NW, the H and I NW Bus Lanes, M Street SE, MLK Avenue, Pennsylvania Ave SE, and Minnesota Avenue. Other bus lanes in the region include the barrier separated Potomac Yard and Crystal City Transitways in Alexandria and Arlington used by the Metroway BRT and bus shoulder lanes on US-29 used by the Montgomery County Flash BRT. Recently, Montgomery County's dedicated bus lane pilot project on MD-193 (University Boulevard), between Amherst Avenue and Dennis Avenue, was completed with functional operation beginning in February 2024; during a 12-18 month pilot period, the county was to evaluate bus lane operations, improvements in passenger travel times, service reliability, customer experience, and motorist compliance.[52]

A new initiative in late 2023 is the Clear Lanes Project, a joint effort between WMATA and the District Department of Transportation (DDOT) that aims to improve bus travel times and enhance bus stop safety by using camera technology to identify illegally parked and stopped vehicles in dedicated bus lanes. WMATA has installed cameras on 140 buses, on 31 routes that run along bus only lanes in the District. The cameras will capture violators and then wirelessly transmit the encrypted videos and photos directly to the DDOT for review and enforcement. Results of this initiative should be available once operations have been underway for a sufficient amount of time, with improvements in bus speeds anticipated.

[52] https://www.montgomerycountymd.gov/DOT/Projects/buspriority/university.html

Figure 2-27 District of Columbia Map of Bus Lanes, October 2023[53]



2.3.1.3 Connections to Transit

The impact of highway congestion on transit systems can also be assessed by identifying and analyzing the key linkages between transit and other modes. In 2018 Metro conducted a Bus Survey throughout our region. This survey that found about 6% of the region's bus trips accessed the bus via autos or other vehicles (e.g., taxies, vanpools, carpools) and 14% transferred from other buses. These passengers were subjected to the impact of highway congestion if it occurs on pertinent routes.

In August 2016, WMATA published the Metrorail Station Investment Strategy Summary Report[54]. The report states

> "Improving bicycle and pedestrian access to Metrorail stations helps stabilize rail ridership and reduce growth in public subsidy to Metro. In late 2014, as Metro's Planning office began to study the relationship between ridership and station walk access, staff developed walksheds for each Metrorail station, identifying the actual walkable area relative to a ½ mile "as the crow flies" distance using network analysis in GIS. With help from researchers at the University of Maryland, staff has been able to calculate the number of riders walking to Metro that can be expected when jobs and housing are connected [in] the walkshed. The exact numbers vary by station, but, on average, for every ten households connected to the station, Metro sees about seven weekday Metrorail trips."

In short, improved transit accessibility will attract travelers to the transit system, reducing the demand on the highway network.

2.3.2 CONGESTION WITHIN TRANSIT FACILITIES OR SYSTEMS

Congestion can also be an issue within transit. If the demand for rail and buses is high and the capacity cannot keep up with that demand, then transit becomes too crowded. Just as incidents can cause non-recurring impacts on roadways, the same can occur on transit facilities. Even a minor bus or train incident can cause back-ups and delays.

[53] https://buspriority.ddot.dc.gov/pages/buslanes

[54] https://planitmetro.com/uploads/MISIS_Report_August_2016.pdf

Congestion can not only result on transit vehicles themselves, but on station platforms and immediately around stations. Union Station in the District of Columbia is a station that accommodates Metrorail, Metrobus, DC Circulator buses, Maryland Area Rail Commuter (MARC) trains, Virginia Railway Express (VRE) trains, and AMTRAK. With these various transit options, Union Station has become a primary connection point for commuters/visitors, and the busiest station in the Metrorail system, with nearly 60,000 passengers entering and exiting daily pre-pandemic.

The CMP recognizes the impacts of congestion within the region's transit systems. As the region's population grows and "going green" trends advance, projections are that there will be more commuter and residents looking to transit options instead of driving. While increase in transit use is overall a positive trend, it is important that the impacts of transit congestion throughout the region be evaluated and mitigated.

Congestion management will benefit from continuing efforts to encourage transit use in the Washington region and explore transit priority strategies. The transit system in the Washington region serves as a major alternative to driving alone, and is an important means of providing more mobility utilizing current infrastructure. Coordination with appropriate committees and transit agencies to address related data and performance measure issues helps further support the CMP.

2.4 Congestion Monitoring and Data Consolidation Activities

2.4.1 HOUSEHOLD TRAVEL SURVEYS

The TPB conducts regional household travel surveys in the Washington region and adjacent areas to collect detailed demographic and travel information from a randomly selected and representative sample of households. The survey has been conducted approximately every ten years since 1968. It is the primary source of observed data used to estimate, calibrate, and validate the regional travel demand model, which is used for travel forecasting and air quality conformity analysis of the region's long-range transportation plan. The household travel survey data are also used to analyze travel trends and for other key program activities.

The most recent large-scale regional household travel survey conducted by the TPB is the 2017/2018 Regional Travel Survey (RTS), which surveyed 15,976 households in the TPB modeled area from October 2017 through December 2018. The survey consisted of two parts: 1) a recruitment questionnaire (Part 1) and; 2) a one-day travel diary (Part 2). Households were recruited through mailed invitation letters and reminder postcards. Households were offered a participation incentive of a gift card or donation to complete the web-based (with a telephone option) survey. The RTS covered 22 major jurisdictions and 111 geographic strata consisting of Census Public Use Microdata Areas (PUMAs) and COG-defined Regional Activity Centers. TPB coordinated with the Baltimore Metropolitan Council (BMC) on its sample plan for the Maryland Travel Survey, which was conducted concurrently. The RTS also included an outreach effort to increase Hispanic/Latino survey participation.

The RTS consists of multiple data files including the Household File, Person File, Vehicle File, and Trip File. A public use version of these data files were released and made available to the public upon request. More details on the RTS sample plan and data file structure can be found in the RTS Technical Documentation, posted on the Regional Transportation Data Clearinghouse (RTDC)[55]. The

[55] https://rtdc-mwcog.opendata.arcgis.com/documents/mwcog::regional-travel-survey-rts-technical-documentation/explore

results of the 2017/2018 RTS were released in a series of presentations. Additionally, TPB staff prepared tabulations that provide insights on travel patterns in the region. The RTDC RTS Tabulations[55] are an online resource for the RTS data to be used by practitioners, researchers, and other stakeholders. In addition, staff conducted in-depth analysis and developed a series of responses to thought-provoking questions offered by regional stakeholders.

As a follow-on activity to the RTS, TPB conducted the 7-Day RTS Follow-On Smartphone Panel Survey (SPS) which sampled a panel of respondents from the RTS, focusing on Regional Activity Centers. The primary objectives of the SPS were to evaluate the effectiveness of the smartphone app-based survey methodology, to assess the quality of the data collected from a smartphone-app based survey, and to determine the feasibility of smartphone surveys for future survey efforts by COG/TPB. TPB staff performed a comprehensive review of the data files and all data items contained in those files. Data editing and imputation were performed, followed by trip logic and consistency checks which were completed in December 2021. After the data processing was completed, TPB staff conducted an evaluation to assess the effectiveness of the smartphone app-based survey methodology. As part of the SPS evaluation, user comments providing feedback on the survey experience were reviewed and analyzed. Key findings from the SPS evaluation were released in a series of presentations and documented in a memo[56].

TPB staff conducted an extensive literature review in 2021 and 2022 to examine how pandemic travel trends were being captured by travel surveys conducted by MPOs, universities and federal/state governments, measuring the impacts of COVID-19 on transportation and travel behavior in U.S. states and metropolitan areas. TPB staff developed a reference list of surveys focused on COVID-19 and collected relevant resources, summarized the type of surveys, and identified the top five surveys representing best practices in survey design and methodology. One survey was conducted by a private firm, two surveys were conducted by teams of university researchers, and two surveys were conducted by MPOs. These surveys focused on trends in teleworking and work from home, travel mode, and grocery shopping and delivery services from the spring of 2020 through the end of 2021. The findings from the literature review were shared in a series of presentations and in a memo[57].

In light of rapid changes in travel patterns and behavior in recent years and as the region emerges out of the pandemic, it is expected that travel in the Washington region will continue to evolve. Furthermore, conducting surveys has become more expensive while survey participation rates have been declining, which prompted TPB staff to consider their approach for conducting future household travel surveys. In the fall of 2022, TPB staff conducted interviews with peer MPOs across the country to learn about their methods and approaches for conducting household travel surveys. Based on these interviews, the MPOs interviewed were pursuing the following options: 1) conducting or preparing for more frequent and smaller sample size household travel surveys; 2) participating in and purchasing add-on samples through the Federal Highway Administration (FHWA) Next Generation National Household Travel Survey (NextGen NHTS) program; or 3) planning to conduct a large scale household travel survey once a decade. Most MPOs were pursuing the first two options.

TPB staff considered their approach for conducting future household travel surveys, based on whether these surveys are state of the practice and embrace the latest survey methods and data collection technology such as using smartphone apps and utilizing passive data collection. Another key consideration was whether the survey methods would yield statistically valid and representative results. Given the challenges of conducting surveys, it is important that the survey methods help

[56] https://www.mwcog.org/file.aspx?&A=3qOny7II1xH3JN0A2Qr6kpuV7RzTTLbivjnvHTcwYAg%3d

[57] https://www.mwcog.org/file.aspx?&A=jKYs5l%2fXOys4cVSEh06SAAtzAupMtrQA6WH4Bvjy4h0%3d

improve response rates and reduce respondent burden, while maintaining cost effectiveness. For the Washington region in particular, it was important to consider the following: 1) future household travel surveys would sufficiently capture travel patterns and behavior that are unique to this diverse region; 2) the data would provide critical input for developing regional travel demand models and forecasts; 3) the appropriate frequency for conducting future household travel surveys. Based on these criteria and a review of survey best practices, TPB staff shared recommendations for conducting future household travel surveys in a series of presentations in 2023. The next steps include developing a scope of work, procuring a survey contractor, conducting a survey pretest, and conducting full scale data collection, currently projected for 2025.

2.4.2 SPECIAL SURVEYS AND STUDIES

The TPB and its member agencies undertake special studies or data collection efforts, on both one-time and recurring bases. Examples include compiling data to form a regional travel trends report, as well as monitoring transit usage.

2.4.2.1 Surveys of Bus Travel in the Region

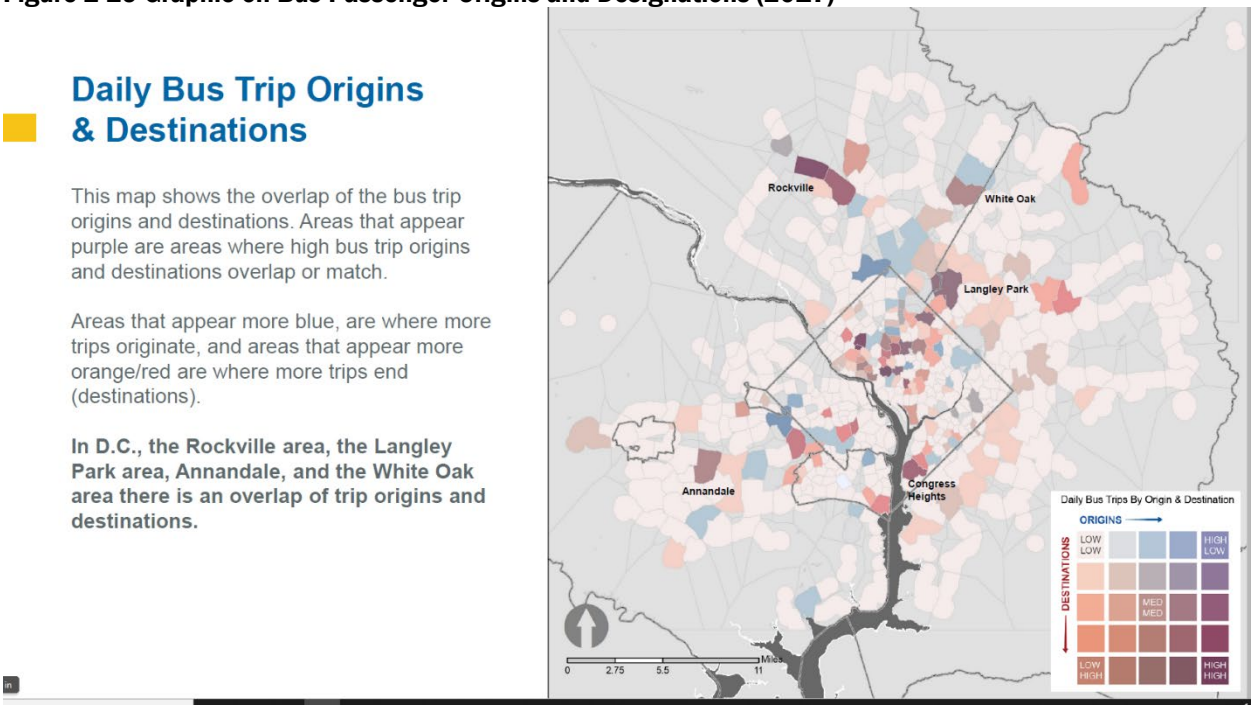
Periodically, the region's bus systems conduct surveys of their passengers. In the past, these surveys were focused on travel patterns, including origin, destination, time of day, and route and mode choice. Increased technology capability has led to a change in survey focus, with more emphasis on meeting Federal Transit Administration civil rights requirements. Instead, smart card and passenger counting data are harvested to determine travel patterns, often with greater detail for the purposes of specific projects and plans. Therefore, WMATA and other agencies have moved to conducting their own surveys to meet agency purposes. While greater data is collected on a more frequent basis, the bus surveys no longer provide a regionally comprehensive reference. The following table lists the dates of the last travel surveys conducted by local bus systems in the region.

Figure 2-28 Date of Most Recent Transit Travel Survey – by Agency (Collected 2024).

Last Agency-Wide Survey	
Agency	**Year**
City of Alexandria (DASH)	2023
Charles County (VanGO)	2019
City of Fairfax (CUE)	2019
Fairfax County (Connector)	2019
Frederick County (Frederick Transit)	2019
Loudoun County (LCT)	2014
MDOT (MTA Commuter)	2023
Montgomery County (Ride On)	2019
Prince George's County (TheBus)	2024
Prince William County (OmniRide)	2019
WMATA - (Metrobus)	2018

The Bus Transformation Project reviewed origins and destinations of bus riders for the WMATA Compact region using 2017 data. The following graphic shows areas where, origins, destinations, and both were clustered.

Figure 2-29 Graphic on Bus Passenger Origins and Designations (2017) [58]



2.4.2.2 Regional Travel Trends Report

The TPB receives periodic updates regarding regional travel trends. The most recent large-scale briefing occurred in 2018, which was documented in an online report[59]. The rate and spatial pattern of population growth, combined with employer sites and other major attractions, are key to the underlying changes in travel trends. The metropolitan Washington region has seen a fast increase in growth over the last several decades, along with major changes in how and why people travel. This is important to congestion management, in that it is important in understanding why congestion may be occurring in particular areas. In addition, travel trends can help predict, and prepare for, future congestion.

In the 2018 Travel Trends report, key travel trends findings and factors included:

- Population in the region increased by 16% between 2007 and 2017.
- Regional weekday vehicle miles traveled (VMT) increased steadily between 2000 and 2008, but decreased in 2009 and has remained relatively flat since then.
- Metrorail ridership increased steadily between 2001 when it recorded 607,000 weekday trips to 2010 when it recorded 748,000 weekday trips. Since then, Metrorail ridership decreased substantially through 2017 when it recorded 613,000 weekday trips, which resembled 2001-2002 ridership levels.

[58] Page 69. Bus Transformation Project: The Bus System Today. Final Report, January 2019.

http://bustransformationproject.com/wp-content/uploads/2019/01/20190118-Bus-System-Today_FINAL.pdf

[59] https://gs.mwcog.org/webmaps/tpb/traveltrends/.

- Although minor shifts are occurring, the predominant mode of commute travel in the region continued to be single occupant vehicles, accounting for 65% of all commute travel, and the next-highest mode is transit, which accounts for 15%.

- The share of commuters teleworking, at least occasionally, increased from 11% in 2001 to 32% in 2016. The 2019 State of the Commute Survey[60] revealed that this share had increased to 35% by 2019.

During the COVID-19 pandemic period, the region experienced significant variations in regional travel. This included significant reductions in daily travel in the earlier stage of the pandemic period when many worksites shut down and employers offered large-scale teleworking. Reductions in work travel were also caused, in part, by significant job losses that occurred as a result of the pandemic. By late 2021, much of the job losses as well as regional travel had largely recovered to near pre-pandemic conditions. TPB staff made periodic presentations on the multisectoral impacts of the pandemic on the region, including regional travel, for example, the update provided to the TPB Technical Committee at its October 2021 meeting[61]. In addition to these periodic briefings, staff also posted monthly "COVID-19 Travel Monitoring Snapshots," which provided monthly updates of key regional travel indicators observed during the pandemic period[62].

As of this writing, TPB staff are in the process of acquiring location-based datasets from commercial vendors. These data, commonly referred to as "Big Data," track personal travel movements using data obtained and aggregated from millions of mobile phones and other devices/vehicles that produce location-based data. These data can be used to derive insights into travel in the region.

2.4.3 THE REGIONAL TRANSPORTATION DATA CLEARINGHOUSE

The Regional Transportation Data Clearinghouse (RTDC)[63] is the online resource for transportation data, maps and applications from the National Capital Region Transportation Planning Board (TPB). Over the years, TPB staff has collected transportation data from various sources, primarily member jurisdictions, state agencies, and transit authorities. These data have been processed, packaged, organized and presented here in an open format to improve access and data sharing between TPB members and other users in the region. The datasets in the RTDC are regularly used internally by TPB staff as well as by jurisdictional members and the general public. The data are available publicly for all -- TPB staff, TPB member agency staff and other interested parties to access, download, customize, and visualize.

The RTDC content is organized and maintained on ArcGIS Online and is a part of TPB's organizational account. This flexible platform allows TPB staff to easily share its spatial and non-spatial data resources, and provides for integration of data, maps, applications, and documents in a single location. In addition to downloadable data, the RTDC also contains TPB reports and documents as well as links to related content produced by TPB members and other agencies (such as USDOT).

Datasets in the RTDC represent various transportation modes (highway, transit, bicycle, aviation) and include a selection of available modes and operators within the metropolitan Washington region. Count-related datasets are some of the most utilized data types in the RTDC. These count data span

[60] https://www.mwcog.org/newsroom/2019/09/24/three-big-takeaways-from-the-2019-state-of-the-commute-survey/

[61] https://www.mwcog.org/file.aspx?&A=RPzEQG2VFv%2fkThRVpddQizfwogkMzN2IhliHjmzKY%2fs%3d

[62] https://www.mwcog.org/documents/2021/09/27/covid-19-travel-monitoring-snapshot-traffic-monitoring/

[63] https://rtdc-mwcog.opendata.arcgis.com/

all types of modes, including highway, transit and active transportation and cover several years' worth of data. Components of the CMP are informed by data from the RTDC, include the regional context of overall travel trends (Section 2.1), and a summary of regional Household Travel Surveys (Section 2.4.1).

While the bulk of data in the RTDC are related to transportation networks and assets, the RTDC also includes several datasets focused on land use and demographics. COG's Cooperative Forecast of population, households and employment is another example is also downloaded regularly by regional planners, demographers and travel modelers and forecasters. These forecasts are provided at the transportation analysis zone (TAZ) level and include the most current adopted forecast as well as previous rounds.

Users can search for data by keyword or category and can also choose to show all available datasets. Each RTDC dataset has its own content page with metadata, a link to download data, and a summary of dataset attributes. Many of these datasets are available as both spatial and tabular data and can be used in conjunction with various software. Current 'core' RTDC datasets such as traffic and transit counts and the Cooperative Forecast data are routinely updated as new data become available. Additionally, new content is added periodically, based on data availability, user requests and/or other means of discovery.

One of the goals of the RTDC is to provide transportation analysts, planners, and the general public with as much publicly available regional transportation-related data as possible. Aside from being a warehouse for regional data, the RTDC includes a Regional GIS Resources[64] page that provides access to several TPB member jurisdictions' online spatial data. Users can also browse data from other MPOs, regional bodies and the federal government using the links provided. TPB staff have included these additional resources and tools to make it easier for users to find related data.

The RTDC is a continuously evolving product—dataset and functionality requests are appreciated and are considered.

2.4.4 OTHER CONGESTION MONITORING AND DATA CONSOLIDATION ACTIVITIES

In addition to the activities mentioned above, TPB is also procuring Streetlight data for the national capital region as part of its ongoing efforts to monitor and improve traffic congestion. Streetlight data provides valuable insights into travel patterns and congestion levels, including information on traffic speeds, volumes, and vehicle miles traveled (VMT), which can be used to monitor congestion and identify areas for improvement. By consolidating this data with other transportation data sources, the TPB plans to develop a more comprehensive understanding of traffic patterns in the region and to inform future transportation planning decisions.

By consolidating this data with other transportation data sources, including Replica and Teralytics data, the TPB plans to develop a more comprehensive understanding of traffic patterns in the region. Replica and Teralytics data can provide additional details on specific trip characteristics, such as origin, destination, mode of travel, and trip purpose. This comprehensive view will inform future transportation planning decisions, allowing the TPB to target congestion hotspots, improve travel efficiency, and make the transportation network more responsive to the needs of the region.

[64] https://rtdc-mwcog.opendata.arcgis.com/pages/resources

2.5 National Comparison of the Washington Region's Congestion

INRIX, Inc., an independent live traffic information provider based on GPS units equipped on smartphones, in-vehicle devices, and commercial fleets, released an *INRIX Traffic Scorecard*[65] for the largest 100 metropolitan areas in the U.S. The Texas A&M Transportation Institute (TTI) released its 2023 Urban Mobility Report (UMR)[66] leveraging crowdsourced data from INRIX on urban streets and highways, supplemented by highway inventory data from the Federal Highway Administration's database. The navigation device firm TomTom also released an online TomTom Traffic Index[67].

These three national or international reports use different performance measures and underlying methodologies, which greatly impacts the rankings of cities (Table 2-8). The Washington region ranked No. 8, No. 4, and No. 14 in the latest rankings published by INRIX, TTI and TomTom, respectively. From a traveler's perspective, these rankings translate into real-world experiences on the road. According to the 2023 TomTom Traffic Index, Washington drivers experience an average travel time of 18 minutes per 6 miles, placing it 14th out of the listed metro areas. This suggests that traffic flow in Washington is generally better than in 13 of the other major cities included in the index.

Table 2-8 National Comparison of the Washington Region's Congestion

INRIX Traffic Scorecard (2022 data)			TTI Urban Mobility Report (2022 data)			TomTom Traffic Index (2023 data)		
Hours Lost in Congestion			Annual Person-Hours of Delay per Commuter			Average Travel Time per 6 Miles (Metro Area)		
Metro Area	**Value**	**Rank**	**Urban Area**	**Hours**	**Rank**	**Metro Area**	**Minutes**	**Rank**
Chicago	155	1	Los Angeles	122	1	New York	21	1
Boston	134	2	San Francisco	109	2	Honolulu	21	2
New York	117	3	New York	92	3	McAllen	20	3
Philadelphia	114	4	**Washington**	**85**	**4**	San Francisco	20	4
Miami	105	5	Atlanta	82	5	Los Angeles	20	5
San Francisco	97	6	Seattle	82	5	Philadelphia	19	6
Los Angeles	95	7	Miami	79	7	Seattle	19	7
Washington	**83**	**8**	Boston	73	8	Miami	19	8
Houston	74	9	Chicago	72	9	Chicago	19	9
Atlanta	74	10	Houston	69	10	**Washington**	**18**	**14**

2.6 Performance Analysis of Visualize 2045

Visualize 2045, the Metropolitan Washington region's latest long-range transportation plan, approved in June 2022, includes all regionally significant transportation projects and programs planned in the Metropolitan Washington region over the next twenty-plus years. For every long-range transportation plan, the TPB produces a performance analysis that examines trends and assesses future levels of congestion. This performance analysis provides an overall assessment of the anticipated impacts and an indication of future levels of congestion relevant to the CMP.[68]

[65] INRIX, Inc., Traffic Scorecard, http://inrix.com/scorecard/

[66] Texas A&M Transportation Institute, 2023 Urban Mobility Report, https://mobility.tamu.edu/umr/

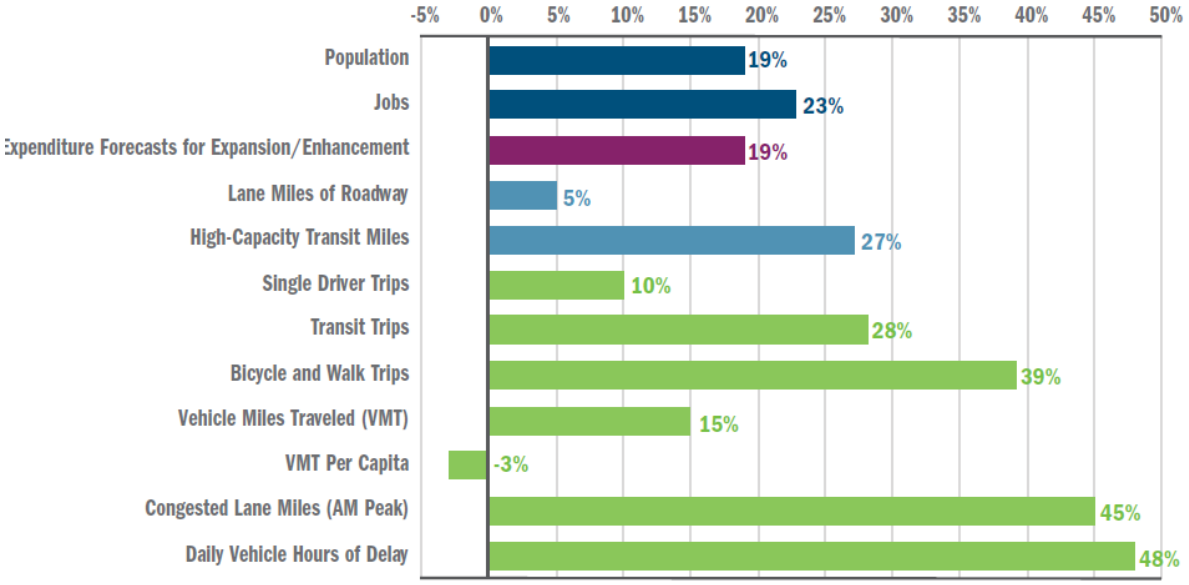
[67] TomTom, Traffic Index Ranking 2023, https://www.tomtom.com/traffic-index/united-states-of-america-country-traffic/

[68] TPB, Visualize 2045 Documentation, June 2018. https://visualize2045.org/plan-update/approved-2022-plan/

The plan performance analyzes the outlook of growth in the region and forecasts future congestion. The Visualize 2045 plan used 2023 as the base model year referenced as 'Today' in charts, and 2045 as the out year. The plan performance analysis examines travel demand model data to identify where congestion is expected to occur now and in the future. It looks at criteria that may affect congestion, such as changes in population, employment, transit trips, auto trips, number of lane miles, and congested lane miles. The analysis breaks down lane miles of congestion by examining the total share of congested lane miles, a comparison with a no-build alternative scenario, and additional indicators of delay.

Between 2023 to 2045, the region is forecast to be home to 19 percent more residents and 23 percent more jobs in 2045 (Figure 2-30). To accommodate that growth, 5 percent more lane miles of roadway and 27 percent more high-capacity transit miles are planned to be constructed. The total number of trips taken is expected to increase by 18 percent, and transit, walk, and bike trips are expected to increase at a faster rate than single driver trips. The overall amount of driving (Vehicle Miles Traveled or VMT) is expected to increase by 15 percent. This is less than forecast population growth, which means that VMT per capita is expected to decline by 3 percent. The increase in demand on the roadways is forecast to outpace the increase in supply, leading to a significant increase in congestion.

Figure 2-30 Visualize 2045 Performance Analysis Summary



Congested lane miles in the AM peak hour are projected to increase by 45 percent in 2045 compared to 2023, meaning that 746 lane miles of roadway which were not congested in 2023 will be congested in 2045. The share of lane miles congested in comparison to all the lane miles of roadway in our region helps tell another part of the story: during the AM peak hour, 10 percent of lane miles in the region were congested in 2023 and 13 percent are projected to be congested in 2045. While roadway capacity is expanding, the region's travel demand, due to growth in population and employment, will further congest a small set of the region's most used roadways.

The amount of driving in the region, measured as VMT, is expected to grow over the next 25 years, but at a slightly lower rate than population growth. As a result, residents of the region are likely to be driving fewer miles per person in 2045 than they do today. Even though regional population is expected to increase by nearly 19 percent, on average, driving per person in the region, including residents, freight, and all other travel, is forecast to increase by 15 percent, resulting in a nearly

three percent decline in vehicle miles traveled per capita (Figure 2 – 31). When examining vehicle miles traveled by isolating the analysis to only residents of the region, vehicle miles traveled per capita declined by an even greater amount of 6 percent (Figure 2 – 32). These findings suggest that travel behavior in the region does respond to changes to the land use and transportation infrastructure environment, particularly that of the region's residents. These can include people making shorter trips due to jobs and housing being in closer proximity, using non-auto-based modes more often as more infrastructure is built, and changes to travel behavior due to the impact of congestion and delay.

Highway congestion is forecast to get worse in the coming decades, though moderated by the projects in Visualize 2045. Total daily vehicle hours of delay, which represents time spent in traffic in congested conditions, are forecast to increase by nearly 48 percent (Figure 2 – 30). A similar measure, average vehicle delay per trip, shows an increase of delay of nearly one minute and fifteen seconds or nearly 31 percent. In both metrics, by building the projects in Visualize 2045, congestion and delay are predicted to be at lower levels than if not built. Congestion and delay would have increased by nearly 80 percent and 58 percent in 2045 if projects were not built, respectively.

Figure 2-32 Vehicle Miles of Travel: Total and Per Capita

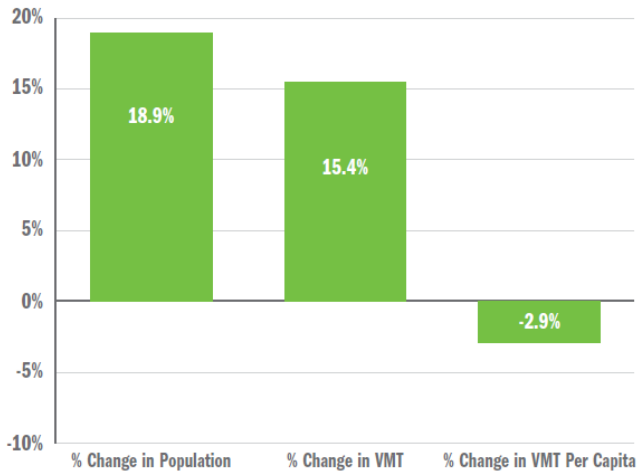
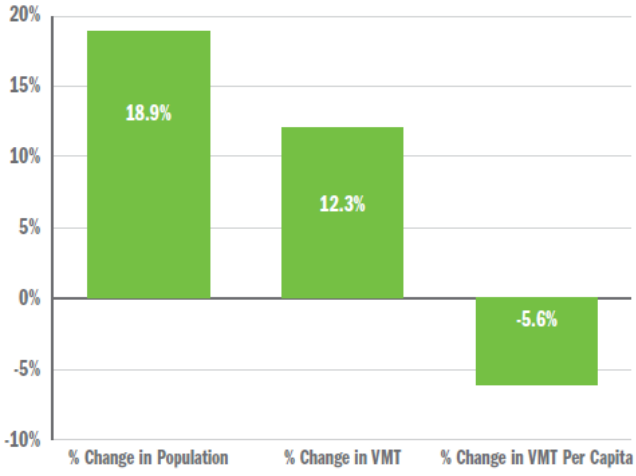


Figure 2-31 Resident Vehicle Miles of Travel: Total and Per Capita



The geographic distribution of changes in job access during a 45-minute commute in the morning is not forecasted to be equally shared in the region. The region's core, western suburbs, and northern suburbs are forecast to experience a moderate to significant gain in job access. Forecasts identify moderate to significant declines in accessibility by auto on the eastern side of the region and areas inside the Capital Beltway (Figure 2 – 33). Two factors are likely to contribute: The anticipated increase in congestion and delay decreasing accessibility to parts of the region by car and the additional jobs expected in this region between today and 2045 being located largely in the western part of the region, increasing accessibility for areas near those jobs but likely reducing access to those beyond a 45-minute commute. The average number of jobs that are accessible within a 45-minute AM peak commute by automobile is expected to increase by 1.2 percent between 2023 and 2045.

Analyzing transit performance, through the number of jobs accessible during a 45-minute morning commute, the region is expected to see gains, and many smaller parts of the region will experience moderate gains. By 2045, the average number of jobs accessible within a 45-minute transit commute will increase from 414,000 to 553,000, a nearly 34 percent increase. Examining the

geographic distribution of these changes shows that most places that currently have access to transit will experience increases in job access, and parts of the region where new transit projects are planned are also forecasted to gain access to additional jobs (Figure 2 –34). These gains are likely linked to the forecast increase in jobs near existing transit stations and the expansion of higher quality transit service to more areas of the region, particularly Activity Centers and High-Capacity Transit station areas.

Figure 2-33 Change in Access to Jobs by Automobile, 2023-2045

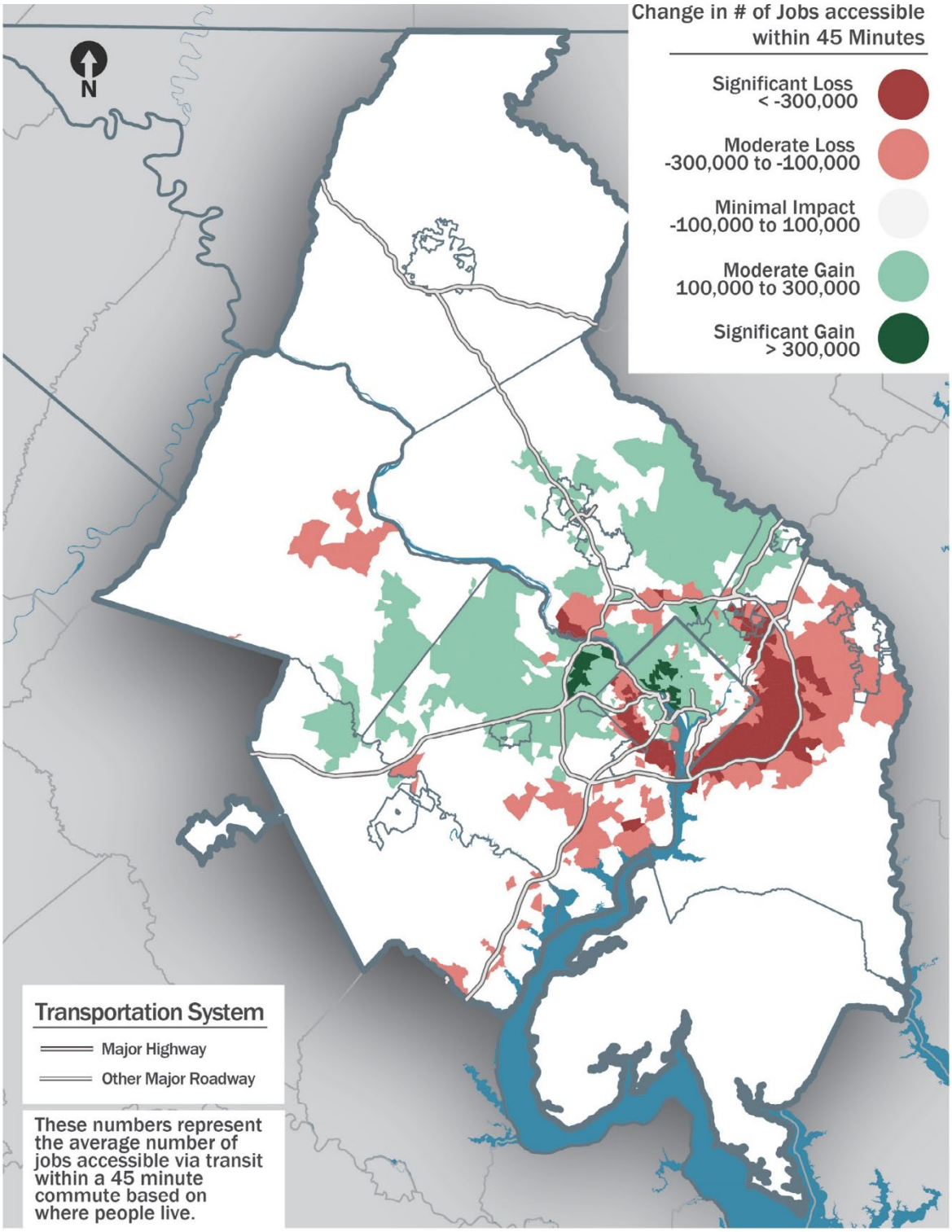
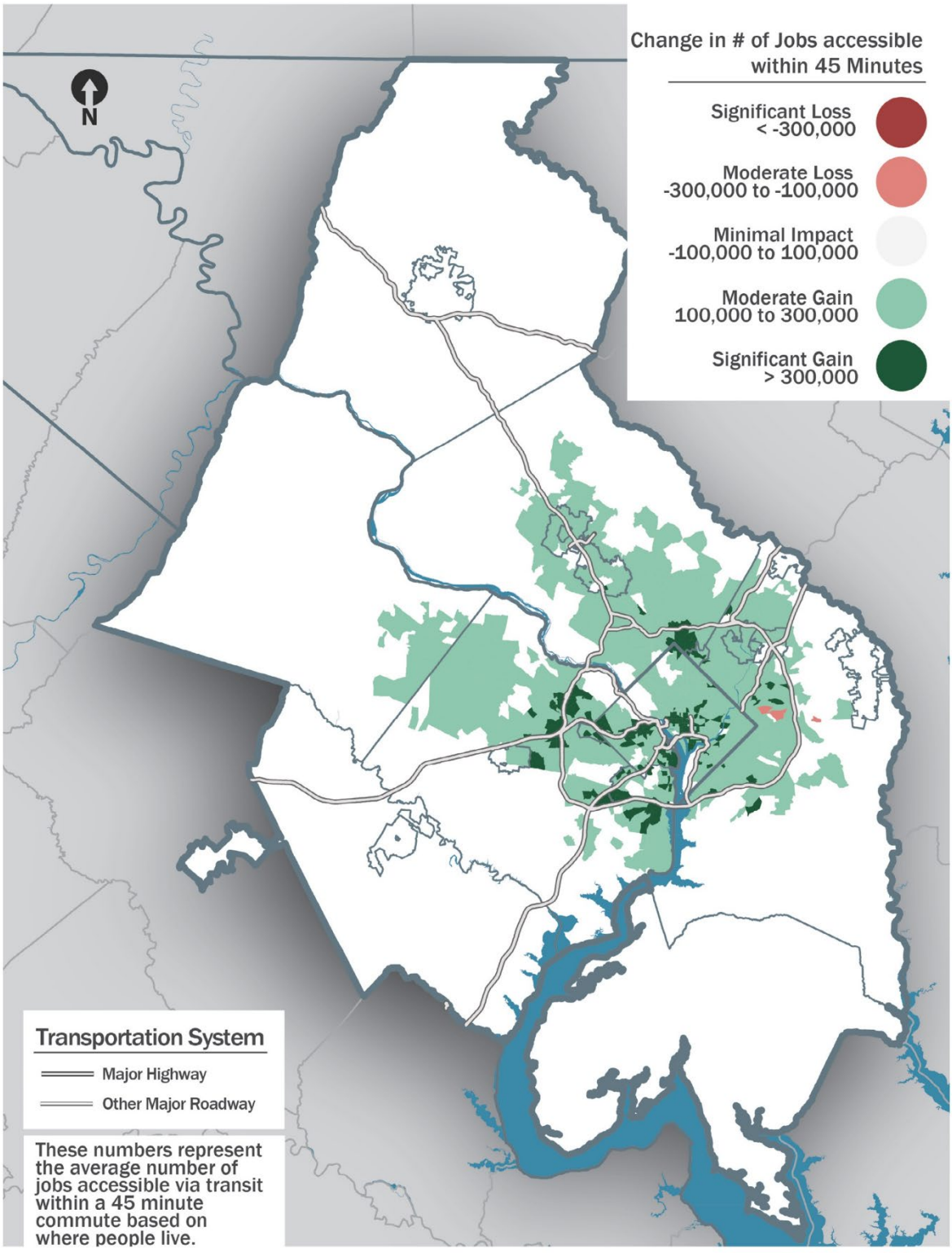


Figure 2-34 Change in Access to Jobs by Transit, 2023-2045

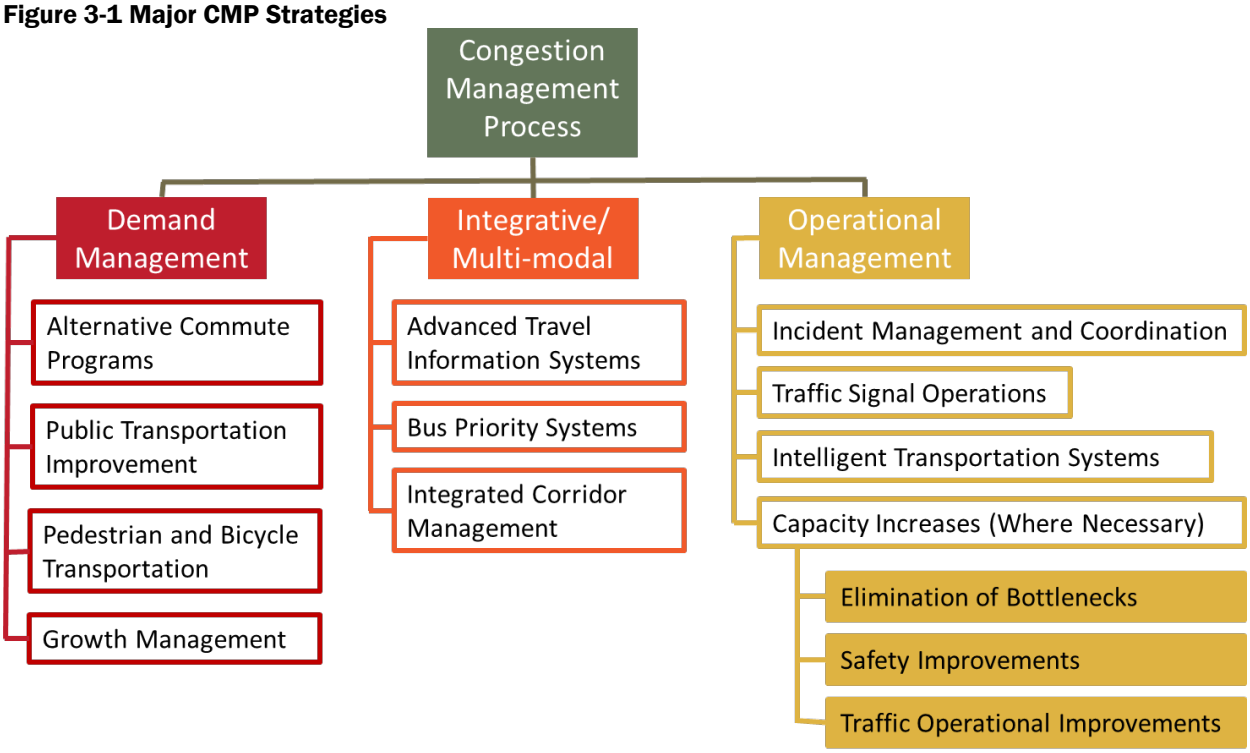


3. CONSIDERATION AND IMPLEMENTATION OF CONGESTION MANAGEMENT STRATEGIES

3.1 Overview of Congestion Management Strategies

Congestion Management Strategies generally can be divided into two types – Demand Management strategies and Operational, or Supply Management strategies. For purposes of this report, a third category, Integrative/Multi-modal, was added to better reflect the integration of demand and operation management in different projects in the region. Figure 3-1 shows examples of congestion management strategies.[69]

Figure 3-1 Major CMP Strategies



Note: There are synergies between strategies categorized as demand management or operational management strategies, such as real-time traveler information on ridesharing opportunities responsive to a real-time traffic incident or situation.

Demand Management is aimed at reducing the demand for travel and influencing travelers' behavior; either overall or by targeted modes. Demand Management strategies can include carpooling, vanpooling, telework programs that allow people to work from home to reduce the amount of cars on the road, and living near your work as a means of reducing commute travel.

Supply or operational management, on the other hand, is managing and making better use of the existing transportation network in order to meet the region's transportation goals and ultimately reduce congestion. Example supply management strategies are High-Occupancy Vehicle (HOV) lanes, variably priced lanes, and traffic management.

[69] The anticipated successor plan to Visualize 2045, Visualize 2050, was under development as of the publication of this 2024 CMP Technical Report. Therefore, this report will refer to the currently adopted metropolitan long-range transportation plan, which is Visualize 2045.

Often strategies categorized as either demand management or operational management have components of the other. There are strategies in place in the region that take that combination a step further and integrate demand and operational management strategies into larger projects. In this report, these strategies have been categorized as Integrative/Multi-modal strategies. Examples of these strategies include advanced traveler information systems and integrated corridor management.

These strategies, and how they are implemented throughout the Washington region, are explained in further detail below.

3.2 Demand Management Strategies

3.2.1 COMMUTER CONNECTIONS PROGRAM

Commuter Connections is a regional network, coordinated by COG/TPB, which provides commuter information and commuting assistance services to those living and working in the Washington, DC region. This program has been in existence since the 1970's under different names and has implemented a number of demand management strategies in the region. The Commuter Connections program is designed to inform commuters of the availability and benefits of alternatives to driving alone, and to assist them in finding alternatives to fit their commuting needs. The program is funded by the District of Columbia, Maryland, and Virginia Departments of Transportation, as well as the U.S. Department of Transportation, and all services are provided free to the public and employers. Continuing the Commuter Connections Program is one of the key recommendations of the 2024 CMP Technical Report.

Commuter Connections evaluates the impacts of their programs through the Commuter Connections Transportation Demand Management Evaluation Project. The evaluation process allows for both on-going estimation of program effectiveness and for annual and triennial evaluations. The most recent Transportation Demand Management (TDM) Analysis Report covered FY2021-2023.[70]

Both qualitative and quantitative types of performance measures are included in the evaluation process to assess effectiveness. First, measures reflecting commuters' and users' awareness, participation, utilization, and satisfaction with the program, and their attitudes related to transportation options are used to track recognition, output, and service quality. Some of the important performance measures are:

- Vehicle trips reduced
- Vehicle miles of travel (VMT) reduced
- Emissions reduced: Nitrogen Oxides (NOx), Volatile Organic Compounds (VOC), Particulate Matter (PM2.5), PM 2.5 pre-cursor NOx, and CO_2 emissions (Greenhouse Gas Emissions - GHG)

[70] *Transportation Demand Management (TDM Analysis Report FY 2021-2023*, November 21, 2023. https://www.commuterconnections.org/wp-content/uploads/2021-2023-TDM-Analysis-Evaluation-Report-Final-Draft-112123.pdf

Particularly of interest to congestion management is the impact on vehicle trips reduced, vehicle miles of travel (VMT) reduced, and cost effectiveness. Appendix D shows the summary of results for individual Commuter Connections TDM program elements (i.e., how many daily vehicle trips were reduced and the daily VMT reduced compared to the goals set by Commuter Connections).

Commuter Connections also operates the Commuter Operations Center (COC), providing direct commute assistance services, such as carpool and vanpool matching through telephone and internet assistance to commuters. The Commuter Operations Center also provides transit, bicycling, park and ride lot, and telecommuting information to commuters in the region.

In addition, a variety of surveys (the following lists a subset of them) are conducted by Commuter Connections to follow-up with program applicants and assess user satisfaction on its TDM programs. These surveys provide data used to estimate program impacts. Some of the surveys, such as the Applicant Placement survey and Guaranteed Ride Home (GRH) Survey, also provide information used by Commuter Connections staff to fine tune program operations and policies.

Commuter Connections Applicant Placement Rate Survey – Since May 1997 Commuter Connections has conducted commuter applicant placement surveys to assess the effectiveness of the Commuter Operations Center and other program components such as commuter incentives. The surveys assess users' perceptions of and satisfaction with the services provided.

GRH Applicant Survey – Commuters who register with the GRH program or use a one-time exception trip will be surveyed to establish how the availability and use of GRH influenced their decision to use an alternative mode and to maintain that mode. Satisfaction with GRH services also will be polled.

State of the Commute Survey (SOC) – The SOC survey, a random sample survey of employed adults in the Washington metropolitan region, serves several purposes. First, it establishes trends in commuting behavior, such as commute mode and distance, and awareness and attitudes about commuting, and awareness and use of transportation services, such as HOV/Express toll lanes and public transportation, available to commuters in the region.

Employee Commute Surveys – Some employers conduct baseline surveys of employees' commute patterns, before they develop commuter assistance programs and follow-up surveys after the programs are in place.

Employer Telework Assistance Follow-up Survey – Sent to employers that received telework assistance from Commuter Connections to determine if and how they used the information they received.

Bike-to-Work Day Participant Survey – A survey among registered participants in the Bike-to-Work Day event is undertaken to assess travel behavior before and after the Bike-to-Work Day, as well as commute distance and travel on non-bike days.

Car Free Day Participant Survey - A survey among registered participants in the Car Free Day event is undertaken to assess travel behavior before and after the Car Free Day, as well as commute distance and travel.

'Pool Rewards Participant Survey -- A survey among registered participants in the 'Pool Rewards program undertaken to assess travel behavior before and after program participation.

Vanpool Driver Survey – a survey that collects data on van ownership and operation, vanpool use and travel patterns, availability and use of vanpool assistance and support services, and issues of potential concern to vanpool drivers.

Transportation Demand Management (TDM) Evaluation – With the introduction of Clean Air Act Amendments in the 1990's reducing vehicle emissions became important in the region. Analysis

showed that enhancing existing and introducing new demand management strategies will have a two-fold impact; reducing congestion and at the same time reducing emissions and clearing the air of ozone causing pollutants. These programs were adopted by the TPB and were originally called Transportation Emissions Reduction Measures (TERMs) and the regional programs were implemented through the Commuter Connections Program, in concert with program partners to meet air quality conformity and federal clean air mandates. Initially, Commuter Connections provided transportation emission reduction measure benefits for inclusion in the air quality conformity determination, which was approved by the TPB as part of the annual update of the Long Range Plan and Transportation Improvement Program. However, for the past decade or more the TPB has not required the use of the program's air quality impacts in the conformity analyses. In addition, Commuter Connections transportation impacts from its various programs may be needed to meet Performance Based Planning and Programming (PBPP) regional targets. Commuter Connections sets goals on TDM programs that impact commute trips, and evaluates the programs to determine the impact they are having on reducing congestion and vehicle emissions. These TDM programs include:

Guaranteed Ride Home (GRH) – Eliminates a barrier to use of alternative modes by providing free rides home in the event of an unexpected personal emergency or unscheduled overtime to commuters who use alternative modes.

Employer Outreach – Provides regional outreach services to encourage large, private-sector and non-profit employers voluntarily to implement commuter assistance strategies that will contribute to reducing vehicle trips to worksites, including the efforts of jurisdiction sales representatives to foster new and expanded trip reduction programs.

Mass Marketing – Involves a large-scale, comprehensive media campaign to inform the region's commuters of services available from Commuter Connections as one way to address commuters' frustration about the commute. Projects associated with this program include a regional Bike to Work Day event, Car free day event, and the 'Pool Rewards, CarpoolNow, Flextime Rewards, and incenTrip incentive programs.

Both the TDM program evaluation and associated surveys are keys to assessing the impact these programs have on congestion management and air quality. Following is a more detailed analysis on the above programs and other Commuter Connections demand management strategies in the region.

3.2.1.1 Telework

Teleworking, or telecommuting, can be described as a means of using telecommunications and information technology to replace work-related travel. This can be done by working at one's home, or at a designated telework center one or more days a week. There are designated telework and co-working centers throughout the region, in the District, Maryland, and Virginia. Phones, tablets, wireless communications, and computers make teleworking an easy alternative to getting in a car and driving long distances to an office. Teleworking has shown to boost the quality of life, have economic benefits, reduce air pollution, and ease traffic congestion.

The TPB adopted Resolution R10-2019 in December 2018 as part of the Visualize 2045 aspirational initiatives and one of the initiatives included the development of policy templates for small and mid-size employers to adopt and develop flextime and telework programs at their worksites. In FY2020 the telework materials on the Commuter Connections website were re-vamped and telework policy templates were developed and deployed along with other alternative work hours information. A new

teleworking landing page was created on the Commuter Connections website to host the new materials. The landing page also includes select information from teleworking sections located in both the Commuters and Employers menus. Sample agreements and policy templates were uploaded to the website. Updated FAQs, best practices for teleworking, and updated information on alternative work schedules were also posted. These materials were all released just prior to the pandemic and have been helpful for employers who did not have policies or programs in place.

Telework is a TDM program evaluated by Commuter Connections. Telework Outreach is a resource service to help employers, commuters, and program partners initiate telework programs. In evaluating teleworking, several travel changes need to be assessed, including: trip reduction due to teleworking, the mode on non-telework days, and mode and travel distance to telework/co-working centers.

Telework impacts are primarily estimated from the State of the Commute survey (SOC) and by surveys conducted of employers directly requesting information from Commuter Connections. The 2022 State of the Commute Technical Report[71] concluded the following regarding teleworking:

- The percentage of workers who telework exploded between 2019 and 2022, in response to the pandemic. Two-thirds (66%) of regional commuters said they teleworked at least occasionally. In 2022, 2.14 million regional workers teleworked at least occasionally. This represented a near doubling of regional teleworkers. The 66% telework percentage represents a near doubling of the 2019 percentage of 35%. Telework incidence grew in every demographic and occupational segment.

- Even with the dramatic telework increase in 2022, the survey showed that an additional 9% of all commuters "could and would" telework if given the opportunity (295,000 workers). These respondents said they did not telework but could perform some or all their job responsibilities at a location away from the main workplace and they would like to telework. In fact, many of these workers did occasionally work remotely, although they did not consider it as "telework;" 73% said they worked from home all day during their regular work hours as least one day in the past year and 27% worked from home at least one day per month. But they worked from home infrequently; on average just 13.5 days per year or about 0.27 days per week.

- The average telework frequency also rose between 2019 and 2022. Nearly four in ten teleworkers were teleworking all their workdays in 2022 and 32% teleworked three or four days per week. When averaged across all teleworkers, this resulted in an average of 3.37 telework days, nearly a tripling of the average 1.2 days per week frequency in 2019.

- When the average 3.37 days per week telework frequency for teleworkers and the 0.27 days per week work-at-home frequency of non-teleworkers are applied across the region, it equates to approximately 1,455,700 regional workers teleworking/working at home on a typical workday, or about 44% of all regional workers. Assuming two commute trips per day, these workers eliminate nearly three million work trips each workday.

3.2.1.2 Employer Outreach

[71] *Commuter Connections State of the Commute Survey 2022 Technical Survey Report*. Prepared for Metropolitan Washington Council of Governments. Prepared by: LDA Consulting in conjunction with: WBA Research September 20, 2022.

https://www.mwcog.org/file.aspx?&A=1UIeGbmEEi5Qj3Y6rsCwj4s%2f1ZLV6nSSNl%2bOPxUkChc%3d

Employer Outreach is aimed at increasing the number of private and non-profit employers implementing worksite commuter assistance programs, and is ultimately designed to encourage employees of client employers to shift from driving alone to alternative modes.

In this program, jurisdiction-based sales representatives contact employers, educate them about the benefits commuter assistance programs offer to employers, employees, and the region and assist them to develop, implement, and monitor worksite commuter assistance programs.

The *TDM Analysis Report for FY 2021-2023* estimated the impacts of employer outreach. The following are some noteworthy statistics from that report:

- There were 2,166 employers participating in the Commuter Connections Employer Outreach program that represented 512,945 employees.

- The impacts from the Employer Outreach program included an estimated 69,093 daily vehicle trips and 1.2 million miles of VMT.

3.2.1.3 Carpooling, Vanpooling, Ridesharing and other Commuter Resources

Commuter Connections provides information on carpooling, vanpooling, and Ridesharing. These alternative commute methods reduce the amount of single occupant vehicles (SOVs) on the road, which is important to congestion management.

Carpooling is two or more people traveling together in one vehicle, on a continuing basis.

Vanpooling is when a group of individuals (usually long-distance commuters) travel together by van, which is sometimes provided by employers. There are typically three kinds of vanpool arrangements:

Owner-operated vans — An individual leases or purchases a van and operates the van independently. Riders generally meet at a central location and pay the owner a set monthly fee.

Third-party vans — A vanpool "vendor" leases the vanpool vehicle for a monthly fee that includes the vehicle operating cost, insurance, and maintenance. The vendor can contract directly with one or more employees. The monthly lease fee is paid by the group of riders.

Employer-provided vans — The employer (or a group of employers) buys or leases vans for employees' commute use. The employer organizes the vanpool riders and insures and maintains the vehicles. The employer may charge a fee to ride in the van or subsidize the service.

'Pool Rewards - 'Pool Rewards is a special incentive program available through Commuter Connections designed to encourage current drive alone commuters to start ridesharing in the Washington Metropolitan region. Commuters who currently drive alone to work may be eligible for a cash payment through 'Pool Rewards when they start or join a new carpool. If eligible, each carpool member can earn $2 per day ($1 each way) for each day they carpool to work over a consecutive 90-day period. The maximum incentive for the 90-day trial period is $130. Carpools may consist of two or more people. For commuters who drive alone to work and can get between seven and fifteen people together to form a vanpool, they may qualify for a $200 monthly 'Pool Rewards subsidy for the new vanpool. [72]

[72] https://www.commuterconnections.org/pool-rewards/

CarpoolNow - CarpoolNow is a dynamic rideshare mobile application that both drivers and riders can use anytime to find and schedule rides to and from work and is available through Commuter Connections. Drivers will receive an incentive payment for picking up a passenger using the mobile application so long as a portion of the trip occurs in the Washington DC Metropolitan region. Drivers using the mobile app who give riders a lift to work in the non-attainment region are eligible to receive up to $10 per trip as an incentive for using the app. The maximum incentive a driver using the app can receive is $600 per calendar year.

Flextime Rewards - The Flextime Rewards program will pay registered commuters through Commuter Connections' incenTrip mobile app an $8 incentive each time they avoid notoriously congested corridors in the Washington D.C. region. It's a simple way to reward commuters that have flextime available through their employers to help reduce traffic congestion during peak hour travel periods. Participants are encouraged to first check with their employer to confirm that flextime is allowable at their worksite, they can then register to the program through Commuter Connections*. Once the commuter has joined* the program, they will be asked to select an eligible corridor that is part of their commute. Corridors currently eligible for the Flextime Rewards cash incentive include:

- I-95 North and South at VA-123/Exit 160
- BW Parkway North at Powder Mill Road
- US-301 South at McKendree Road/Cedarville Road
- I-495 Inner Loop at the I-270 spur
- DC-295 heading southbound at East Capitol Street

If the commuter does not use any of these corridors for commuting purposes, they can still sign up to receive daily congestion notifications to avoid wasting time sitting in traffic. Once registration is complete, the commuter will begin to receive email notifications if higher-than-average traffic congestion is projected along their commute corridor(s). These emails contain suggested alternative departure times that may help avoid congestion. Those that use the defined Flextime Rewards cash-eligible corridors will receive the program incentive once a trip is logged. If a commuter elects to delay their trip, they'll need to use the Commuter Connections mobile app to record the flextime trip.

incenTrip Mobile Application - The incenTrip[73] mobile app was jointly developed through the TPB's Commuter Connections program and the University of Maryland through federal grants from the USDOT and USDOE. incenTrip motivates commuters to use more efficient and cleaner methods of transportation and features include the multi-modal transportation choices available from a commuter's origin to their destination, the best times to travel, and provides reward points through Commuter Connections for use of cleaner and greener forms of travel such as bikes, buses, trains, walking, and ridesharing. incenTrip even rewards for driving alone in an Eco-friendly manner.

The idea behind incenTrip is to embrace the use of technology on a personalized level to reduce traffic congestion, tailpipe emissions, and improve energy efficiencies. The gamification and rewards aspects use innovative behavioral economics to help increase demand for alternatives to Single Occupant Vehicles and more fuel-efficient driving. By leveraging incenTrip as a tool to help prompt

[73] A new app name and other changes for incenTrip users were anticipated for fall 2024.

behavior change, the Commuter Connections is actively working to better achieve the broad range of transportation goals embedded in the TPB's adopted Vision 2045 aspirational initiatives. The app allows commuters to plan trips with the best travel modes, departure times, and routes that save time, cost, and fuel, based on person-level traffic prediction and real-time data feeds. With artificial intelligence, the incenTrip learns the users travel patterns and habits, and constantly seeks to improve the experience without requiring commuters to do the heavy lifting by searching for better options; steps that many are not willing to take.

Drivers can also earn rewards points and save money through incenTrip. Of all the multi-modal transportation methods the incenTrip app identifies, the fewest rewards points earned are for driving alone. So, while drivers are rewarded for improved eco-driving habits and delaying trips to avoid above-the-norm congestion, more rewards points are given for non-SOV travel such as transit use, carpooling, bicycling and walking . Reward points earned through the app can be redeemed for $10, $20, or $50 in cash, up to $600 per commuter per calendar year through Commuter Connections. The incenTrip app takes the carrot approach to maximize transportation system efficiencies. incenTrip is available through the Apple or Android store for downloading and use.

Ridematching Services enables commuters to find other individuals that share the same commute route and can carpool/vanpool together. This provides carpooling options for people who may not know of someone to carpool with, thus broadening the carpooling options.

3.2.1.4 Bike To Work Day

Each May thousands of area commuters participate in Bike to Work Day, sponsored by Commuter Connections and the Washington Area Bicyclist Association.[74] The TPB has a Bike to Work Day Steering Committee which coordinates the event each year.

Bike to Work Day encourages commuters to try bicycling to work as an alternative to solo driving. The program attracted over 12,700 bicyclists in 2022[75].

Biking and other nontraditional modes are expanded upon in Section 3.2.4.

3.2.1.5 Car Free Day

Each year, Commuter Connections implements a regional Car Free Day[76] campaign that encourages residents to leave their cars behind or to take alternative forms of transportation such as public transit, carpools, vanpools, telework, bicycling or walking.

Car Free Day was first held in FY 2009. In 2022, evaluation results showed that there were over 4,000 individuals that pledged to go "car-free" for this event. In addition, participants pledged to reduce 43,901 vehicle miles of travel as a result of participation in this event. This event is held on September 22nd each year and is in tandem with the World Car Free Day event. A marketing campaign along with public outreach efforts will be developed to coincide with this worldwide celebrated event.

[74] http://www.biketoworkmetrodc.org

[75] https://www.commuterconnections.org/wp-content/uploads/BTWD-2019-FINAL-Event-Report-012120.pdf

[76] http://www.carfreemetrodc.org/

3.2.2 LOCAL AND OTHER TRANSPORTATION DEMAND MANAGEMENT AND TRAFFIC MANAGEMENT ACTIVITIES

Local agencies and organizations, including local governments and Transportation Management Areas (TMAs), actively promote alternative commute methods and other demand management strategies. For specific details on ongoing demand management strategies in the Washington region, refer to Table 3-1.

Table 3-1 Ongoing State Local Jurisdictional Transportation Demand Management (TDM) Strategies

Geography	Location	Local Jurisdiction / Organization	Strategy Name	Operational or Demand Mngt. Strategy	Project/Program Name	Description	Website
Region-wide	Region- wide	WMATA	Public Transportation Improvements	Demand	Metrobus transit	Public bus service is available throughout the region. Connects to other modes: Metrorail, commuter rail, park-and-ride lots, etc.	https://wmata.com/service/bus/
Region-wide	Region- wide	WMATA	Public Transportation Improvements	Demand	Metrorail transit	Public rail services DC, MD, and VA. Connects to commuter rail, Metrobus and local bus systems.	https://wmata.com/service/rail/
Region-wide	Region- wide	WMATA	Park-and-ride lot improvements	Demand	Metrorail station park-and-ride lots	Parking offered at 42 Metrorail stations.	https://www.wmata.com/service/parking/
State/Multi-jurisdictional	Maryland State-wide	MDOT	Pedestrian, Bicycle, and Multimodal Improvements	Demand	Maryland Bicycle and Pedestrian Advisory Committee (MBPAC)	Provides information on biking and walking to State government agencies. Master Plan guides bike/ped planning in the State.	https://www.mdot.maryland.gov/tso/pages/index.aspx?PageId=140
State/Multi-jurisdictional	Maryland State-wide	MDOT	Telecommuting	Demand	MDOT's Telework Partnership with Employers/Telework Baltimore.com program	Offers free teleworking consulting services to Maryland employers. Promotes teleworking.	https://dbm.maryland.gov/employees/pages/telework/teleworkhome.aspx
State/Multi-jurisdictional	Maryland State-wide	MTA	Employer outreach / mass marketing	Demand	MDOT's Commuter Choice Maryland	Reaches out to Maryland employers and offers incentives to implement a commuter program.	https://mdot.maryland.gov/tso/pages/index.aspx?pageid=30

Geography	Location	Local Jurisdiction / Organization	Strategy Name	Operational or Demand Mngt. Strategy	Project/Program Name	Description	Website
State/Multi-jurisdictional	Maryland State-wide	MTA	Public Transportation Improvements	Demand	MDOT's MARC train	Maryland MTA Public commuter rail serving Montgomery County, Prince William County, Frederick County, and into DC.	https://www.mta.maryland.gov/about
State/Multi-jurisdictional	Maryland State-wide	MTA	Public Transportation Improvements	Demand	Local bus	Maryland MTA Public bus service throughout Maryland, primarily around the Baltimore-DC area.	https://www.mta.maryland.gov/about
State/Multi-jurisdictional	Maryland State-wide	MTA	Public Transportation Improvements	Demand	Commuter Bus	Maryland MTA Commuter bus service in Maryland and DC's inner-ring suburbs.	https://www.mta.maryland.gov/about
State/Multi-jurisdictional	District- wide	DDOT	Pedestrian, Bicycle and Multimodal Improvements	Demand	Bicycle and Pedestrian Programs	Committed to providing safe and convenient bicycle and pedestrian access throughout the City.	https://ddot.dc.gov/page/bicycles-and-pedestrians
State/Multi-jurisdictional	District of Columbia, Arlington County, City of Alexandria, Montgomery County	Partnership of DDOT, Arlington County, City of Alexandria, Montgomery County (Fairfax County – coming soon)	Bicycle Programs	Demand	Capital Bikeshare	A bike sharing program to encourage the use of bicycles.	https://capitalbikeshare.com/

Geography	Location	Local Jurisdiction / Organization	Strategy Name	Operational or Demand Mngt. Strategy	Project/Program Name	Description	Website
State/Multi-jurisdictional	District- wide	DDOT	Carsharing Programs	Demand	On-Street Carsharing Program	A network of vehicles offered for rent to the public. Allows mobility of a car without owning one.	https://ddot.dc.gov/page/street-carsharing-program
State/Multi-jurisdictional	District- wide	DDOT	Public Transportation Improvements	Demand	DDOT Mass transit	DDOT helps coordinate mass transit with agencies and WMATA.	https://ddot.dc.gov/page/mass-transit-district-columbia
State/Multi-jurisdictional	District- wide	DDOT	District TDM Program	Demand	goDCgo	goDCgo is an initiative of DDOT that is designed to help reduce congestion and improve air quality in the District through the promotion of sustainable transportation modes.	https://godcgo.com/
State/Multi-jurisdictional	Downtown DC	Partnership of DDOT, WMATA, and DC Surface Transit	Public Transportation Improvements	Demand	DC Circulator	A public bus system serving the District.	https://www.dccirculator.com/
State/Multi-jurisdictional	Virginia-statewide	VDRPT, VDOT	Telecommuting	Demand	Telework!VA	Primary resource for Virginia's employers to start a telework program in VA, promotes teleworking.	https://www.dhrm.virginia.gov/teleworking
State/Multi-jurisdictional	Northern Virginia	VDOT	Variably Priced HOT Lanes	Demand/ Operational	495 Express Lanes	High occupancy toll (HOT) lanes that use congestion pricing to manage congestion on the Beltway in Virginia	https://expresslanes.com/

Geography	Location	Local Jurisdiction / Organization	Strategy Name	Operational or Demand Mngt. Strategy	Project/Program Name	Description	Website
State/Multi-jurisdictional	Northern Virginia	VDOT	Variably Priced HOT Lanes	Demand/ Operational	95 Express Lanes	Construction of high occupancy toll (HOT) lanes that use congestion pricing to manage congestion on the Beltway in Virginia	https://expresslanes.com
State/Multi-jurisdictional	Northern Virginia	VDOT	Variably Priced HOT Lanes	Demand/ Operational	395 Express Lanes	Construction of high occupancy toll (HOT) lanes that use congestion pricing to manage congestion on the Beltway in Virginia	https://expresslanes.com
State/Multi-jurisdictional	Northern Virginia	VDOT and VDRPT	Transportation Demand Management Program	Demand/ operational	Virginia Megaprojects Regional, Dulles Rail, and 495 and 95 Express Lanes TMP's	Various targeted TDM and transit improvements to mitigate impacts and delays caused by construction of large-scale projects in Northern Virginia	https://www.virginiadot.org/projects/northern%20virginia/default.asp
State/Multi-jurisdictional	Fairfax and Loudoun Co. VA	VDRPT and MWAA	Public Transportation Improvements	Demand	Dulles Corridor Metrorail Project	In cooperation with WMATA and local governments. Construct an extension of Metrorail to Dulles Airport	https://www.mwaa.com/business/dulles-corridor-metrorail
State/Multi-jurisdictional	Virginia Statewide	VDRPT and AMTRAK	Public Outreach	Demand	AMTRAK Virginia	Promotes AMTRAK passenger rail service in Virginia	https://www.amtrak.com/virginia/home

Geography	Location	Local Jurisdiction / Organization	Strategy Name	Operational or Demand Mngt. Strategy	Project/Program Name	Description	Website
State/Multi-jurisdictional	Virginia Statewide	VDOT	Traffic Management	Operational	I-66 ATM	Promote safety and congestion management	https://vtrc.virginia.gov/media/vtrc/vtrc-pdf/vtrc-pdf/19-R7.pdf
State/Multi-jurisdictional	Virginia Statewide	VDOT	TDM and Traffic management	Operational	I-95 ICM	Promote safety and congestion management	None
State/Multi-jurisdictional	Loudoun, Fairfax, Arlington, and Prince William Counties	Northern Virginia Transportation Authority	Public Transportation Improvements	Demand	NVTA's TransAction Regional Transportation Plan	Identifies a number of public transits, travel demand management, and other improvements, including new park-and-ride lots throughout Northern VA.	https://nvtatransaction.org/
State/Multi-jurisdictional	Loudoun, Fairfax, Arlington, and Prince William Counties	Northern Virginia Transportation Authority	Alternative Commute Programs	Demand	NVTA's Mission of the Authority	Responsibilities include a general oversight of regional congestion mitigation, including carpooling, vanpooling, and other commute programs	https://thenovaauthority.org/planning/long-range-transportation/
State/Multi-jurisdictional	Northern VA and the District of Columbia	VRE	Public Transportation Improvements	Demand	Virginia Railway Express (VRE) Train	Commuter rail serving Northern VA and two stations in the District. Connects to local transit.	https://www.vre.org/

Geography	Location	Local Jurisdiction / Organization	Strategy Name	Operational or Demand Mngt. Strategy	Project/Program Name	Description	Website
State/Multi-jurisdictional	Prince William Co., Manassas, Manassas Park, and several locations in VA & DC	PRTC	Public Transportation Improvements	Demand	Potomac and Rappahannock Transportation Commission's (PRTC) OmniRide	Commuter and local bus services along I-95 and I-66 corridor and within Prince William Co., Manassas, and Manassas Park, and to several locations in VA & DC, including Metrorail stations.	https://omniride.com/about/
State/Multi-jurisdictional	Prince William Co. and Manassas	PRTC	Ride matching Services	Demand	PRTC's OmniRide Ridesharing	A free ride matching service for carpooler and vanpoolers originating in Prince William Co., Manassas, and Manassas Park.	https://omniride.com/ridesharing/
State/Multi-jurisdictional	Fairfax, Loudoun, and Prince William Counties	VDOT/NOVA	Park-and-Ride Lots	Demand/ operational	Commuter Park-and-Ride lots	Provides and maintains numerous free park-and-ride lots	https://www.virginiadot.org/travel/parkride/home.asp
State/Multi-jurisdictional	Fairfax, Loudoun, and Prince William Counties	VDOT/NOVA	Bicycle Lockers	Demand/ operational	Bicycle Locker Rental Program	Provides reserved bicycle lockers at several Park-and- Ride lots for an annual rental fee	https://www.vdot.virginia.gov/travel-traffic/bike-ped/#ParkandRidebikelockers2
State/Multi-jurisdictional	Northern Virginia	PRTC in cooperation with NVTC and GWRC	Vanpool Programs	Demand	Vanpool Alliance	Organizes private vanpool providers for NTD reporting. Provides support, ride matching, and general marketing for vanpools in the region.	https://vanpoolalliance.org/

Geography	Location	Local Jurisdiction / Organization	Strategy Name	Operational or Demand Mngt. Strategy	Project/Program Name	Description	Website
State/Multi-jurisdictional	Prince William Co., Manassas, and Manassas Park	PRTC	Employer Outreach	Demand	Omni Smart Commute	Provides outreach and support to area employers seeking to implement employee commute assistance programs.	https://omniride.com/service/
State/Local	NOVA	VDOT/Local	Bike Lanes	Demand	Road Diet	Improve safety and mobility	https://www.vdot.virginia.gov/doing-business/technical-guidance-and-support/transportation-and-mobility-planning/bicycle-and-pedestrian-accommodations/
County	Throughout Montgomery County	Montgomery County, MD	Park-&-Ride lots: Provision, maintenance & improvements	Demand	Montgomery County Park-and-Ride Lots	Provide park-and-ride lot information in the County.	https://www.montgomerycountymd.gov/DOT-Transit/routesandschedules/brochures/parklots.html
County	Throughout Montgomery County	Montgomery County, MD	Public Transportation	Demand	Ride On (local bus)	Provides public bus service in Montgomery County. Connects to Metrorail and Metrobus	https://www.montgomerycountymd.gov/DOT/ride.html
County	Throughout Montgomery County MD	MCDOT/ Commuter Services Section	Alternative Commute Programs	Demand	MCDOT TDM Programs & Services - available throughout the County	Provides information on alternative commute options: carpooling, biking, employer incentives, all other TDM services & strategies	https://www.montgomerycountymd.gov/dot-dir/CommTravelOptions.html

Geography	Location	Local Jurisdiction / Organization	Strategy Name	Operational or Demand Mngt. Strategy	Project/Program Name	Description	Website
County	Throughout Montgomery County MD	MCDOT/ Commuter Services Section & other offices within MCDOT; M- NCPPC	Growth Management	Demand	TDM for Development Review	Coordinates TDM strategies required in new developments	https://www.montgomerycountymd.gov/commute
County	Throughout Montgomery County MD	MCDOT/ Commuter Services Section & Traffic Engineering Div./Bikeways	Alternative Commute Programs – Bicycling	Demand	Bicycling Resources	Bike/transit maps for County and individual service areas. Bike resources	https://www.montgomerycountymd.gov/DOT-DIR/commuter/bikewalk/index.html
County	Throughout Montgomery County MD	MCDOT/ Commuter Services Section	Telework Incentive Program	Demand	Telework Resources	Laptops and consulting services available to employers exploring or adopting telework	https://www.montgomerycountymd.gov/DOT-DIR/commuter/telework/index.html
County	Throughout Prince George's County	Prince George's County Dept. of Public Works and Trans.	Alternative Commute Programs	Demand	Prince George's County Ride Smart Commuter Solutions	Provides information on commuter services available in Prince George's County and works with employers to establish workplace commuter benefits programs.	https://ridesmartsolutions.com/
County	Throughout Prince George's County	Prince George's County Dept. of Public Works and Trans.	Park-and-ride lot improvements	Demand	Prince George's County Park-and-Ride Lots	There are a number of free park-and- ride lots available in Prince George's County.	https://www.princegeorgescountymd.gov/1134/Park-Ride

Geography	Location	Local Jurisdiction / Organization	Strategy Name	Operational or Demand Mngt. Strategy	Project/Program Name	Description	Website
County	Throughout Prince George's County	Prince George's County Dept. of Public Works and Transport.	Improving accessibility to multimodal options	Demand	Prince George's County Call-A-Bus and PGC Link	Bus service available to all residents of Prince George's County who are not served by existing bus or rail; PGC Link offers on-demand service in specific zones not well served by fixed-route service.	https://www.princegeorgescountymd.gov/1138/Call-a-Bus and https://www.princegeorgescountymd.gov/departments-offices/public-works-transportation/thebus/microtransit-pgc-link
County	Throughout Frederick County	Frederick County, MD	Public Transportation Improvements	Demand	TransIT Services of Frederick County	Public bus and paratransit services.	https://frederickcountymd.gov/105/TransIT
County	Throughout Frederick County	Frederick County, MD	Alternative Commute Programs	Demand	TransIT Rideshare (a program within TransIT Services of Frederick County)	TransIT offers information on alternative commute options including commuter connections, regional transit and vanpools.	https://www.frederickcountymd.gov/208/Commuter-Services-Regional-Transportatio
County	Throughout Frederick County	Frederick County, MD	Alternative Commute Programs	Demand	Employer Connection (a program of TransIT Services of Frederick County)	Help business and employees find best transportation solutions	https://frederickcountymd.gov/105/TransIT
County	Throughout Frederick County	Frederick County, MD	Alternative Commute Programs	Demand	Frederick County Rideshare and Employer Outreach	Provides information on alternative commute programs, and local and regional public transit. Work with Employers to develop commute strategies at their locations.	https://www.frederickcountymd.gov/208/Commuter-Services-Regional-Transportatio
County	Throughout Frederick County	Frederick County, MD	Alternative Commute Programs	Demand	Taxi Access Program	TAP is available to County TransIT-plus program users as a way to supplement their transportation options.	https://www.frederickcountymd.gov/6483/Taxi-Access-Program

Geography	Location	Local Jurisdiction / Organization	Strategy Name	Operational or Demand Mngt. Strategy	Project/Program Name	Description	Website
County	Throughout Fairfax County	Fairfax County, VA	Public Transportation Improvements	Demand	Fairfax Connector (local bus)	Public bus system in Fairfax County. Connects to Metrorail and bus.	https://www.fairfaxcounty.gov/connector/
County	Throughout Fairfax County	Fairfax County, VA	Alternative Commute Programs	Demand	Fairfax County Commuter Services Program	Provides information on alternative commute programs, and helps business and employees find best transportation solutions	https://www.fairfaxcounty.gov/transportation/commuter-services
County	Throughout Fairfax County	Fairfax County, VA	Alternative Commute Programs	Demand	Active Transportation Program	A comprehensive bicycle initiative and program committed to making Fairfax County bicycle and pedestrian friendly	https://www.fairfaxcounty.gov/transportation/bike-walk
County	Throughout Fairfax County	Fairfax County, VA	Employer Awards	Demand	Fairfax County Best Workplaces for Commuters Awards	National & local recognition awards for Fairfax County employers who have established level 3 or 4 TDM programs	https://www.fairfaxcounty.gov/transportation/bike-walk
County	Throughout Fairfax County	Fairfax County, VA	Transit	Demand	Fairfax Transit	Study countywide transit needs	https://www.fairfaxcounty.gov/transportation/sites/transportation/files/assets/documents/pdf/transportation%20projects,%20studies%20and%20plans/countywide%20transit%20network%20study/finalreport.pdf
County	Throughout Arlington County	Arlington County, VA	Public Transportation Improvements	Demand	Arlington Transit (ART)	Public bus service in Arlington. Connects to Metrorail and bus.	https://www.arlingtontransit.com
County	Throughout Arlington County	Arlington County, VA	Alternative Commute Programs	Demand	Arlington County Commuter Services	Provides information on alternative commute programs, and public transit.	https://www.commuterpage.com/about/arlington-county-commuter-services

Geography	Location	Local Jurisdiction / Organization	Strategy Name	Operational or Demand Mngt. Strategy	Project/Program Name	Description	Website
County	Throughout Arlington County	Arlington County, VA	Pedestrian, Bicycle and Multimodal Improvements	Demand	Arlington's BikeArlington	Initiative to encourage more people to bike often.	https://www.bikearlington.com/
County	Throughout Arlington County	Arlington County, VA	Alternative Commute Programs	Demand	Arlington's Car-Free Diet	Promotes alternative commute methods.	https://www.carfreediet.com
County	Throughout Arlington County	Arlington County, VA	Promote Alternate Modes	Demand	WALKArlington	Promotes walking as an alternative mode.	https://www.walkarlington.com/
County	Throughout Arlington County	Arlington County, VA	Alternative Commute Programs	Demand	Arlington County's CommuterPage.com	Provides information on transportation options in Arlington and the DC area.	https://www.commuterpage.com
County	Throughout Arlington County	Arlington County, VA	Growth Management	Demand	Arlington County's TDM Management for Site Plan Development	Coordinates site plan development (proposed land use) with commuter and transit services.	https://www.commuterpage.com/about/benefits-of-tdm
Throughout Loudoun and from Loudoun to DC	Loudoun County, VA	Public Transportation Improvements	Commuter Bus Service	Demand	Loudoun County Commuter Bus Service	Commuter bus service from Loudoun Co. to Crystal City, the Pentagon, Rosslyn and Washington, D.C.	https://www.loudoun.gov/221/Commuter-Bus
County	Throughout Loudoun County	Loudoun County, VA	Park-and-ride lot improvements	Demand	Loudoun's Free Park-and-Ride lots	Free park-and-ride lots are available throughout the County.	https://www.loudoun.gov/242/Park-Ride-Lots
County	Throughout Loudoun County	Loudoun County, VA	Alternative Commute Programs	Demand	Loudoun's Commuting options	Provides information on alternative commute programs and transit options.	https://www.loudoun.gov/4146/Commuter-Services

Geography	Location	Local Jurisdiction / Organization	Strategy Name	Operational or Demand Mngt. Strategy	Project/Program Name	Description	Website
County	Throughout Loudoun County	Loudoun County, VA	Employer Outreach/ Services	Demand	Loudoun's Employer Services	Helps businesses identify commuting solutions for employees in Loudoun County	https://www.loudoun.gov/283/Employer-Services
County	Throughout Southern Loudoun and in Northern Loudoun to Purcellville	Virginia Regional Transit (in cooperation with Loudoun Co.)	Local Fixed Route Bus Service	Demand	Loudoun County	Public bus service within Loudoun County.	https://www.loudoun.gov/283/Employer-Services
City	The length of College Park, MD	City of College Park, MD	Pedestrian, Bicycle and Multimodal Improvements	Demand	College Park Trolley Trail	Trail is to run the length of the City of College Park, in the old trolley right-of-way.	https://collegeparkmd.gov/trails
City	Throughout Greenbelt	City of Greenbelt, MD	Public Transportation Improvements	Demand	Greenbelt Connection	A local bus in Greenbelt; runs upon request.	https://greenbeltmd.gov/government/departments-con-t/public-works/greenbelt-connection
City	Throughout City of Frederick	City of Frederick, MD	Pedestrian, Bicycle and Multimodal Improvements	Demand	Frederick Shared use paths	Promotes the use of and creates new shared use paths.	https://www.cityoffrederick.com/232/Transportation
City	Throughout Alexandria	City of Alexandria, VA	Alternative Commute Programs	Demand	GO Alex	Promotes use of alternative modes.	https://www.alexandriava.gov/GOAlex

Geography	Location	Local Jurisdiction / Organization	Strategy Name	Operational or Demand Mngt. Strategy	Project/Program Name	Description	Website
City	Throughout Alexandria	City of Alexandria, VA	Public Transportation Improvements	Demand	Alexandria DASH	Local bus system. Connects to Metrobus and Metrorail, VRE, and other local bus systems.	https://www.dashbus.com/
City	Throughout Alexandria	City of Alexandria, VA	Growth Management	Demand	Transportation Management Plans for Site Plan Developments	Coordinates site plan development (proposed land uses) with commuter and transit services.	https://www.alexandriava.gov/transportation-planning/transportation-management-plans
City	Throughout Alexandria	City of Alexandria, VA	Improving accessibility to multimodal options	Demand	Alexandria Transit Store	Provides resources and retail transactions for multimodal travel	https://www.alexandriava.gov/TransitStore
City	Throughout City of Fairfax	City of Fairfax, VA	Public Transportation Improvements	Demand	City of Fairfax's CUE	Public bus service within City of Fairfax. Also connects to Vienna Metrorail station.	https://www.fairfaxva.gov/government/public-works/transportation-division/current-transportation-projects/cue-access-and-technology-improvements
Local / Corridor-based	Along the corridor between Baltimore and DC	BWI Business Partnership	Alternative Commute Programs	Demand	BWI Business Partnership Commuter Resources	Provides information on commuter programs available to the BWI area.	https://bwipartner.org/?option=com_content&amp%3Btask=view&amp%3Bid=21&amp%3BItemid=59
Local / Corridor-based	Downtown Bethesda Transportation Management District (TMD)	MCDOT/ Commuter Services Section with contractor: Bethesda Transportation Solutions (BTS)	Alternative Commute Programs	Demand	Bethesda TMD	Provides information on alternative commute options: carpooling, biking, employer incentives	https://www.bethesdatransit.org
Local / Corridor-based	Downtown Bethesda Transportation Management District (TMD)	MCDOT with contractor: Bethesda Urban Partnership (BUP)	Public Transportation Improvements	Demand	Bethesda Circulator	Downtown Bethesda Circulator Bus	https://www.bethesda.org/bethesda/bethesda-circulator

Geography	Location	Local Jurisdiction / Organization	Strategy Name	Operational or Demand Mngt. Strategy	Project/Program Name	Description	Website
Local / Corridor-based	North Bethesda TMD	MCDOT/ Commuter Services Section with contractor: North Bethesda Transportation Center	Alternative Commute Programs	Demand	N. Bethesda TMD	Provides information on alternative commute options: carpooling, biking, employer incentives	https://www.nbtc.org
Local / Corridor-based	Friendship Heights TMD	MCDOT/ Commuter Services Section (CSS)	Alternative Commute Programs	Demand	Friendship Heights TMD	Provides information on alternative commute options: carpooling, biking, employer incentives	https://www.montgomerycountymd.gov/DOT-DIR/commuter/tmd/index.html#FHTMDAC
Local / Corridor-based	Silver Spring TMD	MCDOT/ Commuter Services Section (CSS)	Alternative Commute Programs	Demand	Silver Spring TMD	Provides information on alternative commute options: carpooling, biking, employer incentives	https://www.montgomerycountymd.gov/DOT-DIR/commuter/tmd/index.html#GSG-TMD
Local / Corridor-based	Greater Shady Grove TMD	MCDOT/ Commuter Services Section (CSS)	Alternative Commute Programs	Demand	Greater Shady Grove TMD	Provides information on alternative commute options: carpooling, biking, employer incentives	https://www.montgomerycountymd.gov/DOT-DIR/commuter/tmd/index.html#GSG-TMD
Local/Corridor-based	Downtown Bethesda TMD	MCDOT/ Commuter Services Section (CSS)	Alternative Commute Programs	Demand	Downtown Bethesda TMD	Provides information on alternative commute options: carpooling, biking, employer incentives	https://www.montgomerycountymd.gov/DOT-DIR/commuter/tmd/index.html#GSG-TMD
Local/Corridor-based	North Bethesda TMD	MCDOT/ Commuter Services Section (CSS)	Alternative Commute Programs	Demand	North Bethesda TMD	Provides information on alternative commute options: carpooling, biking, employer incentives	https://www.montgomerycountymd.gov/DOT-DIR/commuter/tmd/index.html#GSG-TMD

Geography	Location	Local Jurisdiction / Organization	Strategy Name	Operational or Demand Mngt. Strategy	Project/Program Name	Description	Website
Local/Corridor-based	White Oak TMD	MCDOT/ Commuter Services Section (CSS)	Alternative Commute Programs	Demand	White Oak TMD	Provides information on alternative commute options: carpooling, biking, employer incentives	https://www.montgomerycountymd.gov/DOT-DIR/commuter/tmd/index.html#GSG-TMD
Local / Corridor-based	Loudoun, Fairfax, and Prince William Counties	Dulles Area Transportation Association (DATA)	Alternative Commute Programs	Demand	DATA Commuter Resources	Advocates for alternative commute programs, transit needs, and transit-oriented development.	https://www.datatrans.org/
Local / Corridor-based	Reston	LINK	Alternative Commute Programs	Demand	Reston's LINK Commuter Resources	Provides information on carpooling, vanpooling, and regional bus schedules.	https://linkrtc.org/
Local / Corridor-based	Tyson's Corner area	Tyson's Transportation Association (TYTRAN)	Alternative Commute Programs	Demand	TYTRAN's Commuter Resources	Provides information on carpooling, vanpooling, park- and-ride lots, and telework locations.	https://tysonsva.org/experience/how-to-get-here
Local / Corridor-based	Northern VA - Loudoun, Fairfax, Prince William	Northern Virginia Transportation Commission (NVTC)	Public Transportation Improvements	Demand	NVTC Programs	NVTC has innovative programs supporting transit	https://www.novatransit.org/programs/
Local / Corridor-based	Eastern Arlington's Potomac Yard neighborhood	Full Access Solutions in Transportation (FAST) for Potomac Yard	Growth Management	Demand	Non-profit, developer-initiated FAST	Aims at reducing single- occupant trips to the growing Potomac Yard area. Promotes transit, biking, walking. Offers discounted Metrobus shuttle.	https://fastpotomacyard.com/

3.2.3 TRANSIT SYSTEMS

Transit systems can improve the operation of existing roadways and systems by carrying more passengers than a single-occupant vehicle. They can also be considered demand management strategies in that they can influence a person's traveling behavior and convince them to leave their car at home. Many of the transit systems in the region are operated by transit agencies or local government agencies, including:

- *Alexandria DASH*, the local bus service in Alexandria, Virginia.
- *Arlington Transit (ART)*, the local bus service in Arlington County, Virginia.
- *Bethesda Circulator*, a downtown Bethesda bus service.
- *City-University Energysaver (CUE)*, the local bus service in City of Fairfax, Virginia.
- *DC Circulator* bus, serving downtown District of Columbia.
- *Fairfax Connector*, the local bus service in Fairfax County, Virginia.
- *Frederick County TransIT*, the local bus service in Frederick County, Maryland.
- *Greenbelt Connection*, bus serving Greenbelt upon request.
- *Loudoun County Transit* operates local and commuter bus services in the County, with commuter services between the County and West Falls Church Metro, Rosslyn, the Pentagon, and Washington, D.C.
- *Maryland Transit Administration (MTA) MARC* train commuter rail, serving the District of Columbia and Maryland, as well as West Virginia.
- *Montgomery County Ride On*, the local bus service in Montgomery County, Maryland.
- *MTA Commuter Bus* operates contracted bus services throughout the Maryland suburbs including service from Howard, Anne Arundel, Queen Anne's, and Charles Counties to locations in Washington, D.C., Montgomery County, and Prince George's County.
- *Potomac and Rappahannock Transportation Commission (PRTC)*, providing *OmniRide* commuter and local bus services throughout Prince William County, Manassas, and Manassas Park with commuter services to several Metrorail stations, the Pentagon, Crystal City, Rosslyn/Ballston, downtown Washington, D.C., Capitol Hill, and the Washington Navy Yard.
- *Prince George's County Call-A-Bus*, serving those in Prince George's County not served by existing bus or rail.
- *Prince George's County TheBus*, the local bus service in Prince George's County, Maryland.
- *Regional Transportation Agency (RTA) of Central Maryland*, a public transportation service providing fixed route and paratransit services within Howard County, Anne Arundel County, Northern Prince George's County and the City of Laurel.
- *Virginia Railway Express (VRE)* commuter rail serving Virginia and District of Columbia.
- *Virginia Regional Transit* (in cooperation with Loudoun County Transit), a bus service that operates into Loudoun County, Virginia.
- *Washington Metropolitan Area Transit Authority (WMATA) Metrobus*, serving the entire Washington metropolitan area.
- *Washington Metropolitan Area Transit Authority (WMATA) Metrorail*, serving the entire Washington metropolitan area.

While these transit systems are individually very important strategies, it is important to note that they work together to form an entire transit network important to the congestion management system. They work well with other strategies as well, such as VPLs and HOV lanes. In addition, with the help of Intelligent Transportation System (ITS) technologies, Advanced Traveler Information Systems and providing buses with bicycle racks, transit can be even more appealing to travelers.

The 2017/2018 regional household travel survey revealed that the regional commuting transit modal share increased from 15.1% in 1994 to 19.8%. This increase reflects the positive effect of the region's longstanding efforts to promote transit usage. However, overall daily transit modal share has been essentially static, at 5.5% in 1994 and 5.6% in 2017/2018[77]. Post-pandemic, transit mode share has decreased, but has not reached a consistent level with ridership slowly recovering.

3.2.3.1 Significant Transit Construction and Capacity Increases

The second phase of Metrorail's Silver Line with service to Dulles Airport opened in November 2022. The Potomac Yard Metrorail station in Alexandria, Virginia was opened in May 2023. Beyond these two projects no further Metrorail expansion is funded.

The Purple Line light rail line in Maryland continues in construction, with an anticipated opening date in 2027. This circumferential high capacity transit line, connecting four branches of the Metrorail system, is the most significant planned transit capacity project in the region.

DDOT is still evaluating a planned extension of the H Street NE Streetcar to the Benning Road Metrorail station. DDOT had also worked on engineering for the K Street NW Transitway, which long-term could be converted to streetcar operation though the plan currently calls for it to be built as a busway. However, planning for the Transitway was suspended in 2023.

Other significant public transportation projects include the planned expansion of commuter rail services for Northern Virginia. These are part of a wider statewide rail effort in Virginia, the Transforming Rail Initiative.[78] Fundamental to this effort is the construction of a second span to the Long Bridge railroad bridge across the Potomac River. The Long Bridge project will add two tracks for commuter and intercity rail, and the state also plans to construct a fourth track from the bridge south on land right-of-way purchased from CSX. Eventually, this would enable frequent commuter rail service in Virginia, as well as potentially through running service from Maryland via the District of Columbia into Northern Virginia.

In Maryland there are also plans for commuter rail expansion, as detailed in the MARC Cornerstone Plan.[79] However, beyond short-term investments in state of good repair much of this plan has not been programmed for funding.

Section 3.4.2 discusses technology-related transit projects such as bus priority systems.

3.2.3.2 Future Transit Planning

While there are no current projects for expanding the WMATA Metrorail network, there are several studies and plans examining possible expansion, including a Blue Orange Silver (BOS) study by WMATA to add capacity through the downtown core. In addition, there have been several conceptual studies which included looking at extending the Yellow Line to Hybla Valley in Fairfax County, Virginia, extending Metrorail to Prince William County, Virginia[80] and extending Metrorail to Germantown,

[77] A presentation of the 2017/2018 Regional Travel Survey, January 20, 2021. https://www.mwcog.org/file.aspx?D=Dw%2fgnMYLOCdyKXzDtqFr5zupoggDaIxTusmHeFT279s%3d&A=1jtAjBORzA7h3tDBYvudqLXCbQeynNuAP7ySU4tLGKI%3d

[78] https://transformingrailva.com/

[79] https://s3.amazonaws.com/mta-website-staging/mta-website-staging/files/Transit%20Projects/Cornerstone/MCP_MARC.pdf

[80] http://www.drpt.virginia.gov/transit/springfield-to-quantico/

Maryland. Any projects are at least a decade in the future though and there is no current funding for advancing these projects past planning.

3.2.3.3 University Transit Systems

Many area universities have their own transit systems for students, faculty, staff, and in some cases, visitors. These shuttle systems increase transit options for the university community and help reduce congestion on campus roads. Two examples of university transit systems are the Shuttle-UM system at the University of Maryland, College Park and the Mason Shuttle at George Mason University. The Shuttle-UM system is one of the nation's largest University transit services[81] with a fleet of over 75 vehicles, including hybrid and clean diesel vehicles, and a ridership of about 3.3 million during FY 2019.[82] Mason Shuttles has five routes including connections to the Vienna Metrorail Station and the Burke VRE station. Both universities provide riders with real-time bus arrival information.

3.2.4 PEDESTRIAN AND BICYCLE TRANSPORTATION

Walking and bicycling are garnering attention as having positive environmental and health benefits. As a part of the region's transportation network, these activities impact congestion management as well. There are a number of things the Washington region is doing to enhance the area of bicycle and pedestrian transportation to encourage non-motorized transportation.

- The TPB adopted Visualize 2045, the region's long range transportation plan, in October 2018. Two of the seven "aspirational" initiatives in Visualize 2045, "Improve Walk and Bike Access to Transit" and "Complete the National Capital Trail" relate to enhancing walk and bike access.

- In July 2020, the TPB passed a resolution adopting the National Capital Trail Network, a regional trails plan.[83] The National Capital Trail Network will provide a continuous pedestrian and bicycle network of over 1,400 miles of trails and other low-stress facilities, of which over 600 miles already exist and almost 800 miles are planned.

- Projects that help complete the TPB's Aspirational Initiatives, such as by improving walk and bike connections to transit, or completing the National Capital Trail Network, are prioritized for funding through the TPB's Transportation-Land Use Connections, Transit within Reach, Roadway Safety, and Transportation Alternatives programs.[84]

- The TPB adopted an updated "Bicycle and Pedestrian Plan for the National Capital Region" in May 2022,[85] with a revised plan anticipated in 2026. Both the TPB and COG recognize the congestion reduction benefits of bicycling and walking.

- Most of the area's local governments have adopted bicycle, pedestrian, and/or trail plans and/or policies. Bicycle or pedestrian coordinators and trail planners are now found at most levels of government.

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[81] http://www.transportation.umd.edu/shuttle.html

[82] https://storymaps.arcgis.com/collections/34ff45a10d0c459488e6ebe053293b6b

[83] https://www.mwcog.org/events/2020/7/22/transportation-planning-board/

[84] https://www.mwcog.org/transportation/programs/

[85] https://www.mwcog.org/documents/bicycle-and-pedestrian-plan/

- On May 16, 2012, the TPB approved the "Complete Streets Policy for the National Capital Region" which is a directive to all of the TPB member jurisdictions to ensure safe and adequate accommodation, in all phases of project planning, development, and operations, of all users of the transportation network in a manner appropriate to the function and context of the relevant facility.[86]

- Most of the region's transit agencies have bike racks on their buses. WMATA allows bikes on rail at all times.[87]

- Full-size and collapsible/folding bicycles are permitted on all MARC trains on all three lines - Penn Line, Camden Line, and Brunswick Line. Non-collapsible bikes may only be transported on railcars with bike racks, indicated by green lights on the exterior of the car.[88]

- Full-size and collapsible bicycles are allowed on all VRE trains. Full-size bicycles must be secured to the south end bench seats using a bungee cord attached to the seat frame eyelet.[89]

- WMATA has eight secure Bike & Ride facilities at historically high bike-to-rail stations, including:
    - College Park-U of Md
    - East Falls Church
    - Grosvenor-Strathmore
    - Herndon
    - Innovation Center
    - Potomac Yard
    - Vienna
    - Wiehle-Reston East

  Capacity is up to 100 bikes per location, with space for expansion to meet future demand.

- A number of local governments require bicycle parking, as well as provide free on-street racks. DC requires bike parking in all buildings that offer car parking.

- In accordance with federal guidance and state policies, pedestrian and bicycle facilities are increasingly being provided as part of larger transportation projects. A number of local jurisdictions have implemented transit-oriented developments (TODs) and other walkable communities.

- VDOT has included in its secondary street acceptance requirements the mandate that streets built by private developers connect with adjacent streets and future developments in a manner that enhances pedestrian and bicycle access, and that adds to the capacity of the transportation system. Residential streets may be narrower and incorporate traffic calming features.

- Employers are investing in bike facilities at work sites, and developers are including paths in new construction.

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[86] http://www.mwcog.org/uploads/committee-documents/mV1dXl9e20120510092939.pdf

[87] https://www.wmata.com/service/bikes/

[88] https://www.mta.maryland.gov/bike

[89] http://www.vre.org/service/rider/policies/

- Specific bicycle/pedestrian campaigns encourage biking/walking, such as WALKArlington, GoAlex, and GoDCGo.

- Thanks in part to the TPB's policies, plans, and grant programs, bicycle and pedestrian plans and projects are now widespread throughout the Washington region. For example, DC has built over 100 miles of bike lanes since 2001. Beginning in 2009, DDOT began installing protected bike lanes, also known as Cycle Tracks or separated bike lanes. As of the end of 2021, there were 24 miles of Protected Bike Lane facilities in the District. Research shows that protected bike lanes significantly improve the safety of bicyclists and increase safety for pedestrians and drivers.

- Other jurisdictions are following the District's example, adding bike lanes and trails. Maps of existing bike facilities can be found at dcbikemap.com and at BikeArlington.com.

- More and better online bike and walk routing resources have also become available. Google Maps offers both walk and bike routing features. Other bike routing resources for the Washington region include dcbikemap.com and Map My Ride,

Results

- Better bike and walk infrastructure have led to more bicycling and walking. The 2017-2018 COG household travel survey shows that bicycle commuting in the DC metropolitan area has nearly tripled since the 2007-2008 household travel survey, from 0.9% to 2.8%, while walk commutes jumped from 2.2% to 3.1%. Drive alone trips fell sharply.

- Growth in bicycling and walking is concentrated in the urban core jurisdictions that have done the most to enhance facilities and increase densities around transit. The urban core (DC. Arlington, and Alexandria) saw bike commuting triple, from 2.4% to 8.9%. Walking increased from 7.2% to 8.7%, and transit ridership increased.[90]

- The inner suburbs also tripled their bike commute share, from a base of 0.5% to 1.5%.

Potential for the Future

Bicycling and walking have an even greater potential to grow as modes of transportation. Many trips taken by automobile could potentially be taken by bicycle. This is especially true in areas such as Activity Centers where a number of trips are more easily switched from motorized transportation to walking. Many people who live far from their jobs, but closer to transit or a carpool location could walk or bike to transit or the carpool instead of driving. When considering the following statistics, switching from a motor vehicle or bicycling or walking is feasible[91]:

- The median work trip length for solo drivers in the TPB Planning area is 9.3 miles.

- Twenty-five percent of commute trips are less than 4.8 miles, a distance most people can cover by bicycle.

- The median auto driver trip (for all purposes) is only 4.3 miles, and 25% of all auto driver trips are less than 1.7 miles.

[91] https://www.mwcog.org/documents/2020/01/21/regional-travel-survey-presentations-regional-travel-survey-tpb-travel-surveys/

- Auto passenger trips, often children being taken to school, are even shorter, with a median trip distance of 3.1 miles, and 25% of trips less than 1.3 miles.

Supporting bicycle and pedestrian planning is important to congestion management. Each additional person walking or biking for a trip is one less person on the road, thus easing congestion. Pedestrian and bicycle facility planning is something that will continue to be considered in the realm of congestion management, not only as a stand-alone area, but in conjunction with transit projects and land use planning.

Bikesharing

Capital Bikeshare opened in September 2010 with 1,100 bikes at 110 stations. The public-private partnership has since expanded, with more than 5,000 bikes available at 600 stations across seven jurisdictions: Washington, DC; Arlington, VA; Alexandria, VA; Montgomery County, MD; Prince George's County, MD; Fairfax County, VA; and the City of Falls Church, VA. Falls Church, VA.128F The Capital Bikeshare smartphone app allows users to see bicycle and dock availability.

Capital Bikeshare has ~1,000 ebikes that can dock in station or be locked at public bike racks for a $2 fee. DDOT plans on adding another 2,000 ebikes over the next few years.

All members pay an extra $0.10/min for E-bikes, and non-members pay an extra $0.15/ebike unlock. E-bikes can go up to 20 mph, allowing faster trips, especially in hilly areas. E-bikes in DC average 4.7 trips per bike per day.[92] A $25 fee is applied for parking outside the service area.

The results of a survey of Capital Bikeshare members conducted in 2016 provided information on travel changes made in response to Capital Bikeshare availability. According to the survey report, bikeshare provides an additional transportation option to members to make trips that they may not have made in the past because it was too far to walk. More than half of Capital Bikeshare members do not have access to a car or personal vehicle. The survey found that bikeshare plays a role in multimodal transportation. When asked about their travel, seven in ten (71%) of respondents used Capital Bikeshare at least occasionally to access a bus, Metrorail, or commuter rail; 18% used bikeshare six or more times per month for this purpose. The availability of bikeshare allows its members to switch trips to bike from other modes.

Capital Bikeshare makes survey and anonymized trip data available to the public.[93]

3.2.5 DOCKLESS MICROMOBILITY

The term ‘dockless’ originally referred to bikeshare programs that allowed people to pick up and drop off a rented bicycle at any place away from a designated docking station within a certain jurisdiction. In a short time (since mid-2018), however, dockless bikes have since been replaced with electric scooters and e-bikes. They are typically rented using a smartphone app. Dockless bikes, e-scooters, and e-bikes are collectively referred to as “dockless micromobility” vehicles.

[92] Dockless Bike and Scooter Share - Transportation - Events | Metropolitan Washington Council of Governments (mwcog.org)

[93] System Data | Capital Bikeshare

On a national, and local level, dockless bikes are being displaced by dockless e-scooters, while station-based bikes are growing slowly. With the withdrawal of venture capital, fares for e-bike systems have been increasing significantly, which has slowed growth of this mode. Shared E-scooter ridership as of FY 2022 in DC was lower than in 2019.

Table 3-2 Dockless Micromobility Services in the Washington Region (As of April 2023)

Jurisdiction	E-Scooters And E-Bikes Permitted	Service Area	Number of Operators
District of Columbia	20,000	All	7
Alexandria	2000	All	5
Arlington	3000	All	8
City of Fairfax	750	All	3
Fairfax County	300 per operator	All	2
Loudoun County	1000	Within 3 miles of Metrorail	None yet
City of Manassas	N/A	All	None yet
University of Maryland College Park	400	All	1
Montgomery County	1500	Rockville & Silver Spring	3

Dockless e-scooter trips are mostly replacing ride-hailing and personal vehicle trips, rather than transit or walk trips. In Alexandria, when asked "If there were no scooters in the City, how would you have taken most of these trips?", almost 70% of users (980) responded that they would have either used a personal vehicle, used a rideshare app (such as Uber or Lyft), or taken a taxi as one of their top two choices.[94]

Regional Dockless Workshops

TPB hosts a series of regional workshops on dockless electric scooter and bicycle sharing. Representatives from member jurisdictions present on their programs, to an audience of planners, consultants, public officials, and members of the general public.

These multi-purpose workshops provide a forum for staff from various agencies in the region, working or exploring dockless services within their jurisdictions, to hear about the experience and approaches taken by agencies currently providing these services. The workshops are also a forum for all agency staffs to hear from the various stakeholders, including members of the public, about their expectations from and opportunities for improving these services.

Documents from the workshops are posted on the Bicycle and Pedestrian Subcommittee website.[95]

[94] *Alexandria Dockless Mobility Pilot Evaluation,* page 31. City of Alexandria, November 2019.

[95] https://www.mwcog.org/events/2022/?F_committee=22.

Conclusions

- Shared Dockless E-Scooters and E-Bikes are likely to be a part of the transportation scene for the immediate future. Established permit programs are being renewed, and additional jurisdictions have pilot programs under development.

- E-scooters serve short trips in urban areas, replacing walking, driving, and taxi/ride-hailing trips. They often provide a last-mile solution of access to transit.

Scooter Corral. Photo Credit: DDOT

- Major concerns with e-scooters include dangers to pedestrians from sidewalk-riding, rider safety, and obstruction of the sidewalk by improperly parked vehicles.

- Covid-19 slowed deployment of new dockless micromobility programs, and many e-scooter companies modified or reduced operations.

- Loss of venture capital funding for the industry has increased fares and slowed growth.

3.2.6 CAR SHARING AND RIDE HAILING

Car sharing is short-term car rental, often by the hour. Using smartphone apps and unstaffed parking spaces, it makes renting a car fast and convenient. This supports residents, especially in densely populated urban environments, who make only occasional use of a vehicle.

Car share companies follow one of two basic models. The first has designated parking spaces for each vehicle, and the vehicle must be returned to that location at the end of the rental. The second, has a home area defined where users can park the vehicle in any legal public parking space at the end of the rental, allowing for one-way or point-to-point trips.

The point-to-point model has come under competitive pressure from ride hailing and from shared e-scooters, which serve the same kind of short trips within the city, often for a lower price. The round-trip model has proven more stable.[96]

Ride-hailing car services, such as Uber and Lyft (also called transportation network companies or TNCs), operate much like a taxi service. However, these app-based services are often cheaper and easier to use, more reliable, and more secure than traditional street-hailed taxicabs. Ride hailing has grown rapidly, especially in the urban core.[97] In Washington, DC (in the pre-Covid period) ride-hailing was reported to account for 7% of VMT, versus 2% for the region as a whole.[98]

Ride hail users own fewer cars, use more shared modes, and spend less on transportation overall than their neighbors. However, in many locations ride hailing appears to be more a substitute for

[96] https://dcist.com/story/20/03/03/the-future-of-carsharing-in-d-c-now-that-car2go-has-gone/

[97] "Ride-hailing, travel behaviour and sustainable mobility: an international review" Alejandro Tirachini, November 2019.

https://link.springer.com/article/10.1007/s11116-019-10070-2

[98] https://www.bloomberg.com/news/articles/2019-08-05/uber-and-lyft-admit-they-re-making-traffic-worse

transit than a complement, resulting in increased motorized traffic and congestion. Operating characteristics of ride hailing, such as driving without a passenger, and stopping in the travel lane to load and unload, have also been shown to increase congestion.[99] Improved curbside management may mitigate some of these issues.

Major ride-hailing companies acknowledge that they have contributed to congestion in the urban core, and support congestion pricing so long as it is applied to all private motorized users.[100]

Covid-19 was devastating for the ride hail business.[101] Recovery has been complicated by a shortage of drivers, which has led to increased wait times and fares.[102]

3.2.7 LAND USE STRATEGIES IN THE WASHINGTON REGION

The relationship of land use and transportation often has an important influence on a person's willingness to commute by transit, ridesharing, bicycling, or walking; modes other than driving alone. The TPB and its staff collaborate with COG's Department of Community Planning and Services (DCPS) staff to support regional land-use and transportation coordination. Through staff support, local jurisdictions are provided with opportunities to inform the TPB about market conditions, real estate development, land-use plans, and growth forecasts for employment, population, and households. Staff also coordinates closely with the National Capital Planning Commission (NCPC) and General Services Administration (GSA) in planning for the optimal locations for federal facilities throughout the National Capital Region. At the policy level, the TPB, COG Board, and Region Forward Coalition work to develop long-range regional planning goals and to integrate planning policies around land-use, transportation, housing, and the environment.

3.2.7.1 Cooperative Forecasts

The Cooperative Forecasts are the official employment, population and household projections for COG member local governments, based on common assumptions about future growth. The Forecasts are widely used as technical inputs for local and regional planning and to guide capital investment decisions. The forecasts are based on national economic trends, local demographic factors, and are closely coordinated with regional travel forecasts.

The Cooperative Forecasting program is a multi-stage, "top-down/bottom-up" technical process led by COG's Planning Directors Technical Advisory Committee (PDTAC) and its Cooperative Forecasting and Data Subcommittee (CFDS). The top-down aspect of the program produces regional econometric forecast totals for the region. Econometric totals, developed using data from S&P Global, comprise forecasts of employment, population, and households for the metropolitan Washington region based on national economic trends. Concurrently, for the bottom-up aspect, local government planners develop short-term benchmark projections (5 to 10 years) based upon current development activity (rezonings, construction and permitting, etc.) and long-term benchmark forecasts (15 to 25 years) guided by local comprehensive, land use, and small area plans. COG staff, PDTAC members and CFDS members work to reconcile the regional econometric totals and local jurisdictional benchmark

[99] "The New Automobility: Lyft, Uber and the Future of American Cities" Schaller Consulting, July 25, 2018. http://www.schallerconsult.com/rideservices/automobility.pdf

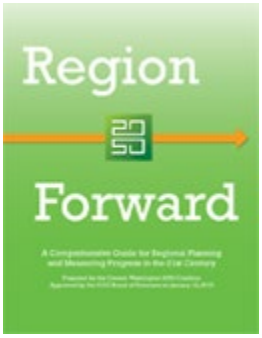
[100] https://medium.com/sharing-the-ride-with-lyft/the-new-frontier-congestion-pricing-in-america-ba99c3721c98

[101] https://www.theverge.com/2021/2/11/22277043/uber-lyft-earnings-q4-2020-profit-loss-covid

[102] https://www.theverge.com/2021/4/7/22371850/uber-lyft-driver-shortage-covid-bonus-stimulus

projections. COG staff also coordinates with adjacent MPOs (the Baltimore Metropolitan Council, the Fredericksburg Area MPO, and other jurisdictions within the TPB "Modeled Area" footprint to obtain similar growth assumptions for those areas. If there is a major change in planned transportation facilities (such as an addition or removal of a planned major facility) the Cooperative Forecasts are updated to reflect this change. COG's Cooperative Forecasting program is a strong, well-established processes that helps ensure that regional transportation planning and land use planning are well-coordinated in the Washington metropolitan area. The current available forecasts for the region are the Round 10.0Cooperative Forecasts, adopted by the COG Board in 2023.

3.2.7.2 Region Forward and Regional Activity Centers



Region Forward is a vision for a more accessible, sustainable, prosperous, and livable National Capital Region. It was developed by the Greater Washington 2050 Coalition, a group of public, private, and civic leaders convened by COG in 2008 to help the region meet future challenges such as significant population growth by 2050, maintaining aging infrastructure, growing more sustainably, and ensuring equitable consideration of all residents in future prosperity.

The Region Forward Compact seeks effective coordination of land use and transportation planning resulting in an integration of land use, transportation, environmental, and energy decisions. Specifically in the transportation sector, Region Forward:

- Seeks a broad range of public and private transportation choices for our Region, which maximizes accessibility and affordability to everyone and minimizes reliance upon single occupancy use of the automobile.

- Seeks a transportation system that maximizes community connectivity and walkability, and minimizes ecological harm to the Region and world beyond.[103]

First called for by the TPB in the 1998 "Vision Plan," Regional Activity Centers are a framework used to coordinate transportation and land use planning in specific areas in the Washington region experiencing and anticipating growth. Concentrating residential and commercial development in dense, mixed-use Activity Centers is a strategy that the TPB has encouraged jurisdictions throughout the region to pursue to reduce the reliance on people driving alone for their daily needs. The Activity Centers include existing urban centers, priority development areas, transit hubs, suburban town centers, and traditional towns throughout the region. Connecting Activity Centers with high-capacity transit[104] options and making it easier for people to move around within these areas can also help reduce reliance on driving alone which is key to congestion management.

The first map of Regional Activity Centers was adopted in 2002 through the oversight of COG's PDTAC, and has undergone two subsequent updates. Regional Activity Centers are based upon current local comprehensive plans and zoning. The most recent map of Activity Centers was adopted by the COG Board in January 2013.[105] The development of the 2013 map used more targeted and

[103] https://www.mwcog.org/regionforward/

[104] High-capacity transit includes Metrorail, commuter rail, light rail, streetcar, and bus rapid transit.

[105] Regional Activity Centers Map, January 2013

http://www.mwcog.org/uploads/pub-documents/oV5cXVc20130813171550.pdf

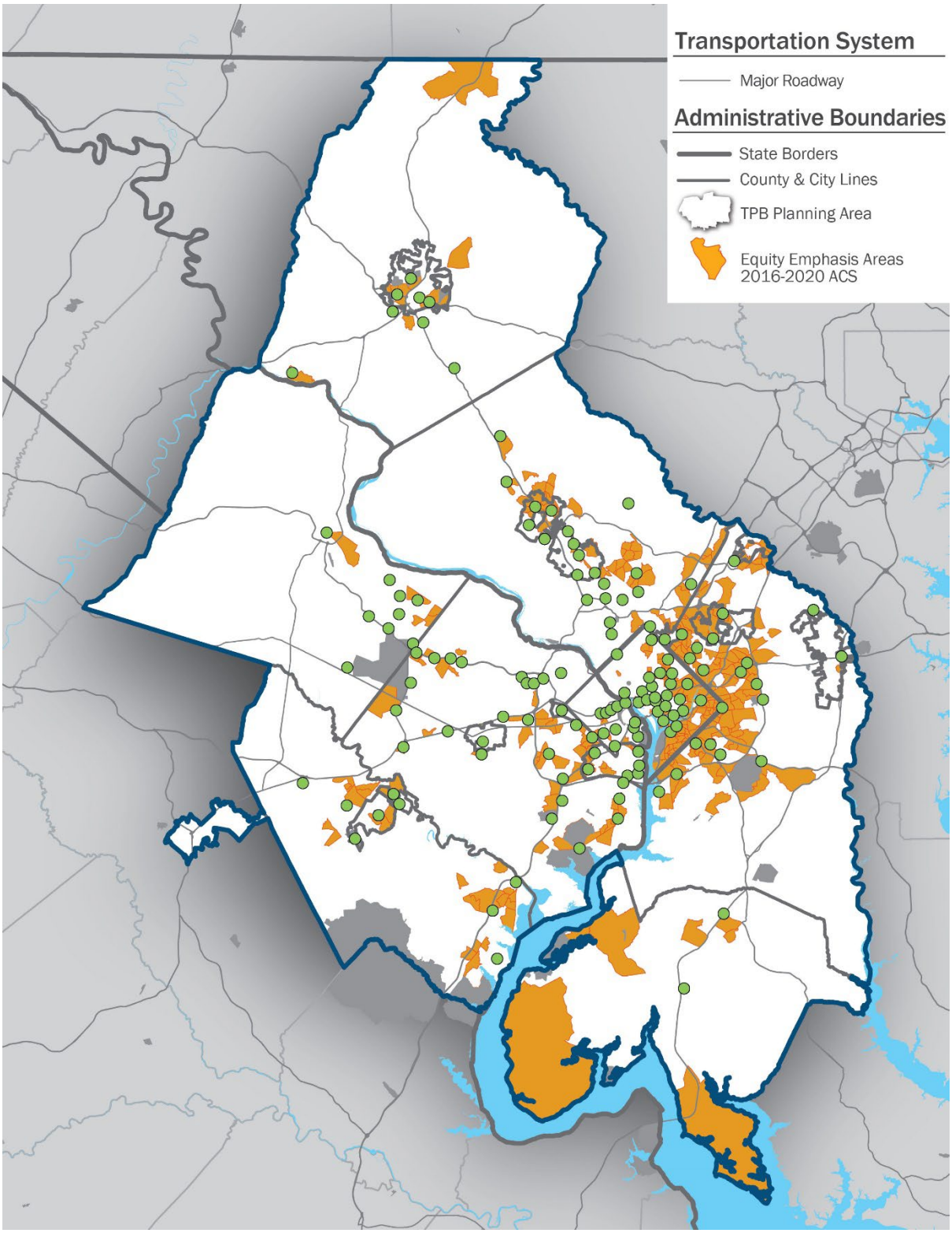
specific criteria than in previous versions (2003, 2007) to designate 141 Activity Centers (Figure 3-2). The criteria are a mix of 'core' or required local planning goals or attributes, and a mix of several additional measures.[106] Following adoption of the Round 10.0 Cooperative Forecasts, the region's planning directors are expected to update the Activity Centers map as part of the work program of COG's PDTAC.

According to the Round 9.2 Cooperative Forecasts, 33 percent of the region's households are within Activity Centers, and 65 percent of jobs are located within them. In the future, growth will be even more concentrated in Activity Centers[107]. By 2045, 39 percent of the region's households and 67 percent of the region's jobs will be located in Activity Centers. Regarding growth, 62 percent of all new households and 74 percent of all new jobs will be located in Activity Centers between 2020 and 2045.

[106] https://www.mwcog.org/documents/2023/11/03/cooperative-forecasts-employment-population-and-household-forecasts-by-transportation-analysis-zone-cooperative-forecast-demographics-housing-population/?DocumentId=11760&pg=2.

[107] This analysis was based on Cooperative Forecast Round 9.2; as of this writing, no similar analysis was available for the recently adopted Cooperative Forecast 10.0.

Figure 3-2 2013 Regional Activity Center Map



3.2.7.3 Aspirational Initiative to "bring Jobs and Housing Closer Together"

The Aspirational Element of *Visualize 2045*, the TPB's regional long-range transportation plan, calls for moving people and jobs closer together, further emphasizing the desire for coordinated mixed use development in areas served by transit. Through this initiative, the TPB is calling upon regional leaders to promote policies encouraging more housing in general and more housing near transit and in Activity Centers. The TPB has prioritized growth around high-capacity transit stations. A recent analysis by the TPB determined that additional housing in the region would improve transportation system performance, particularly if those units were strategically located in Activity Centers and near High-Capacity Transit Stations. Learn more about planning for focused growth around high capacity transit stations at: https://www.mwcog.org/maps/map-listing/high-capacity-transit-hct-station-areas/

To address the regional housing shortfall and affordability challenges documented in COG's report, the Future of Housing in Greater Washington, in September 2019, the COG Board of Directors approved three Housing Targets:

1. The Region needs 320,000 housing units in the next 10 years – 75,000 more than currently anticipated;

2. At least 75 percent of all new housing – or 240,000 total units – should be located in Activity Centers or near High Capacity Transit; and

3. At least 75 percent of new housing should be affordable to low and middle-income households.

In October 2021, the COG Board took action on two resolutions to optimize land use around High-Capacity Transit Station Areas and elevate Equity Emphasis Areas throughout all of COG's planning activities. HCTs are the locations around Metrorail, commuter rail, light rail, bus rapid transit, and streetcar stations that are in place or will be by 2030. By optimizing land use around these station areas, enhancing transportation connections, and creating transit-oriented communities, the region can accommodate future growth and also ensure quality places where all residents can thrive.

The TPB and COG are responding to the day-to-day challenges of people who are struggling with high costs of housing and transportation by focusing on more housing, including more affordable housing options, in places where people will have better access to transit, biking and walking.

3.2.7.4 Transportation-Land Use Connection (TLC) Program

The TPB's Transportation/Land Use Connections (TLC) program helps local jurisdictions work through the challenges of integrating transportation and land use planning to create vibrant communities. TLC is designed to support local planning and design projects as well as share success stories and proven tools with governments and agencies across the region.

Since 2007, the TPB has worked with its member jurisdictions on the three components of the TLC Program: TLC Technical Assistance, the Peer Exchange Network (TLC PeerX), and the Transportation Alternatives Set Aside (TA Set Aside).

The TLC program allows for flexibility to study a wide variety of transportation – land use issues. Some projects are more demand management focused, focusing on pedestrian improvements,

growth management, and transit-oriented development. Other projects address operational issues, including pedestrian safety improvements and roadway design. The goals among each may be different, but each project is applicable to congestion management.

3.2.7.5 Transit Within Reach (TWR) Technical Assistance Program

The Transit Within Reach Program funds design and preliminary engineering projects to help improve bike and walk connections to existing high-capacity transit stations or stations that will be open to riders by 2030. The program places emphasis on projects that improve access in TPB Transit Access Focus Areas (TAFAs), which have been identified as prime locations for small capital improvements—such as sidewalks, trails, crosswalks— that will make it safer and easier to walk or bike to train stations and bus stops.

3.2.7.6 Local Jurisdictional Land Use Planning Activities

Following are some of the major examples of activities going on at the local level that are important to congestion management. Activities range from having a strong comprehensive plan that guides local development, to the implementation of projects that include transportation options and pedestrian and bicycle facilities. Examples of local jurisdictional recent or ongoing planning activities (please note: this is not a comprehensive list) include:

- Silver Spring Downtown and Adjacent Communities Plan[108]
- Prince George's County Zoning Rewrite142F[109]
- Loudoun County 2019 Comprehensive Plan[110]
- Alexandria Old Town North Urban Design Standards & Guidelines[111]
- Prince William County Small Area Plans[112]
- Fairfax County Embark Richmond Highway[113]

3.3 Operational Management Strategies

3.3.1 MANAGED LANES/FACILITIES/SYSTEMS

[108] https://montgomeryplanning.org/planning/communities/downcounty/silver-spring/silver-spring-downtown-plan/

[109] https://montgomeryplanning.org/planning/communities/downcounty/silver-spring/silver-spring-downtown-plan/

[110] https://www.loudoun.gov/4957/Loudoun-County-2019-Comprehensive-Plan

[111]https://www.alexandriava.gov/planning/info/default.aspx?id=86032

[112] https://www.pwcva.gov/department/planning-office/small-area-plans; http://eservice.pwcgov.org/planning/documents/NorthWoodbridgeSAP/NorthWoodbridgeSAP_DRAFT.pdf

[113] https://www.fairfaxcounty.gov/planning-development/embark-richmond-highway/about

Managed lanes have their origin in the Washington Area with the I-95 Busway/Shirley Express[114] project of the early 1970's. These lanes were converted to allow car-pools and vanpools (initially HOV-4 then HOV-3), and the network was expanded to include a new section of I-66 (HOV restricted in peak-flow directions between I-495 and the Rosslyn area of Arlington County), VA-267 (Dulles Toll Road), I-270 and U.S. 50 in Prince George's County.

Since 2010, several of these former HOV corridors have been converted to HOV/Toll lanes, including in the I-395, I-95, and I-66 corridors. New managed lanes were added to I-495 in Fairfax County, and an entirely new priced highway, MD-200, was constructed and opened to traffic in Montgomery County and Prince George's County in Maryland[115]. Expansion of HOV/toll lanes to other areas/corridors in the future has been discussed.

3.3.1.1 High-Occupancy Vehicle (HOV), High-Occupancy Vehicle/Toll and Variable Tolling Overview

High Occupancy Vehicle (HOV) lanes are defined as roadways or roadway segments that are restricted to use by vehicles (cars, buses, vanpools) carrying the driver and one or more additional passengers.

HOV facilities offer several advantages over conventional lanes and roads. They increase the number of persons per motor vehicle using a highway over conventional (non-HOV) roadways, they preserve the person-moving capacity of a lane or roadway as demands for transportation capacity increase and enhance bus transit operations. All advantages are important to effectively managing the operations of existing and new capacity on roadways.

However, HOV facilities can also be considered demand management strategies as well, providing predictable travel times even during peak periods of high demand for highway capacity. HOV lanes can help influence travelers' behavior and provide them with additional choices of how, or if, to travel a certain route.

High-Occupancy Vehicle/Toll lanes are an adaptation of HOV lanes and allow vehicles not meeting the HOV requirement to use the faster lanes in exchange for electronic payment of a toll, usually variable according to demand or sometimes time-of-day.

Variable-pricing of road capacity can be used with HOV lanes or alone to manage traffic and demand so that traffic is flowing freely, even in peak demand times, as on MD-200.

The TPB has had active interest in variably priced lanes (VPLs) since June 2003 when the TPB, together with the Federal Highway Administration and the Maryland, Virginia, and District Departments of Transportation, sponsored a successful one-day conference on value pricing in the Washington region. After the conference, in Fall 2003, the TPB created a Task Force on Value Pricing to further examine and consider the subject. Under a grant from the Federal Highway Administration's Value Pricing Program, the TPB Value Pricing Task Force evaluated a regional network of variably priced lanes in the region producing a final report in February 2008.

Currently there are six HOV or HOV/Toll or variable toll facilities in the Washington region on highways functionally classified as freeways:

[114] Now 395Express and 95Express HOV/Toll lanes.

[115] Differing from the Virginia examples cited, MD-200 does not exempt HOVs from tolls (though tolls charged vary according to anticipated demand on the highway).

- I-95/I-395 in the Northern Virginia counties of Stafford, Prince William, Fairfax and Arlington and the City of Alexandria (HOV/Toll[116]).

- I-66 in the counties of Fairfax and Arlington inside I-495 (HOV/Toll (eastbound AM and Westbound PM - peak commute hours only) between I-495 and US-29 at Rosslyn).

- Dulles Connector Road (east end of Dulles Toll Road between VA-123 and I-66) operates as part of I-66 inside the Beltway.

- I-66 in the counties of Prince William and Fairfax (new separated lanes (2 each direction) between US-29 at Gainesville and I-495).

- Virginia Route 267 (Dulles Toll Road) in Fairfax County (concurrent-flow HOV).

- I-270 and the I-270 Spur in Montgomery County, Maryland (concurrent-flow HOV).

- U.S. 50 (John Hanson Highway) in Prince George's County, Maryland (concurrent-flow HOV).

- MD-200 (InterCounty Connector) in Montgomery County and Prince George's County, Maryland (variable-priced tolling). and

- I-495 between Springfield and a point north of the VA-267 (Dulles Toll Road) interchange (HOV/Toll).

3.3.1.2 I-95/I-395

Managed lanes have their origin in the Washington area with the I-95 Busway/Shirley Express reversible lane project which began operation in 1969 and continued into the 1970's, running from the D.C. approaches to the 14th Street Bridge to a point south of VA-644 (Franconia Road) in the Springfield area of Fairfax County, Virginia. These reversible lanes were eventually converted to allow car-pools and vanpools (initially HOV-4 then HOV-3), and the lanes were extended south to VA-234 at Dumfries, Prince William County in the 1990's. In 2014 the reversible lanes from the southern terminus (at VA-610 in Garrisonville, Stafford County, an extension from VA-234) to a point north of VA-648 (Edsall Road) at Turkeycock Run on I-395 were converted from HOV-3 to the 95Express HOV/toll lanes, with vehicles not meeting the HOV-3 requirement permitted to use them in exchange for payment of tolls (HOV-3 vehicles may use them at no charge if equipped with E-ZPass Flex transponder set appropriately). North of Turkeycock Run, on I-395, the HOV-3 operation remained unchanged at the time of the conversion to 95Express. In 2019 the 95Express HOV/toll operation was extended north from Turkeycock Run along I-395 and called 395Express to the Virginia shoreline of the Potomac River, with the same operating characteristics as the original 95Express lanes. The combined length of the 95Express and 395Express managed lanes is currently about 37 miles.

A ten-mile southern extension of 95Express from VA-610 at Garrisonville to near U.S. 17 in southern Stafford County was completed in 2023.

[116] Toll (by E-ZPass Transponder) or free passage from HOV-3 with E-ZPass Flex transponder.

3.3.1.3 I-66

In 1982, the network was expanded to include a new section of I-66 (all lanes HOV restricted (initially HOV-4 now HOV-3 or toll) in peak-flow directions between I-495 and U.S. 29 in the Rosslyn area of Arlington County).

This section of I-66, about 9.5 miles in length, was converted to HOV/Toll operation in December 2017 (currently HOV-3 traffic may use the lanes at no charge with an E-ZPass Flex transponder).

In 1994, the I-66 HOV lanes were extended west beyond I-495 as single concurrent-flow HOV lanes, initially to U.S. 50 near Fair Oaks and eventually west to U.S. 15 at Haymarket. A project to convert the concurrent-flow HOV lanes to two lanes each way separate (from conventional lanes) HOV/toll lanes as part of the Transform 66 Outside the Beltway Project from I-495 to U.S. 29 at Gainesville delivered about 22.5 miles of managed lanes.
I-66 outside I-495 now has two separated HOV/Toll roadways (mostly two lanes each direction) open to traffic in November 2022 which replaced the former concurrent-flow HOV lanes.

3.3.1.4 I-270

I-270 was the first Interstate in Maryland to have HOV lanes. All HOV lanes in Maryland are currently HOV-2. The first section of I-270 HOV was opened in 1993 along northbound lanes (P.M.) from the I-495/MD-355 interchange to the I-270 Spur. By 1999, the P.M. HOV system had expanded to include HOV lanes along I-270 Spur (about 2 miles) and along I-270 as far north as MD-121 (about 18.2 miles). Southbound the A.M. HOV system runs from the I-370 interchange to a point south of MD-187 (about 8.8 miles) and along the I-270 Spur (also about 2 miles). Conversion of the I-270 corridor HOV lanes to HOV/Toll lanes has been considered.

3.3.1.5 VA-267 (Dulles Toll Road)

Concurrent-flow HOV lanes began operation in December 1998 in peak-flow directions (eastbound in A.M. and westbound in P.M.) and are little changed since opening except at the far eastern connection to I-66. These HOV-2 lanes provide a direct connection to the HOV/Toll (in peak hours) section of I-66 (eastbound in A.M. and westbound in P.M.) but there is a gap in the HOV lanes between the main toll barrier at VA-684 (Spring Hill Road) and east of VA-123 (Dolley Madison Boulevard). The western terminus of the HOV lanes is between VA-657 and VA-28. HOV traffic is not granted an exception from tolls, but approved buses may use the un-tolled Dulles Airport Access Road (otherwise reserved for airport users only – violators can be stopped and ticketed by police) through restricted and gated ramps east of VA-674 (Hunter Mill Road). The distance from the western terminus of the VA-267 HOV lanes to I-66 (includes a section between VA-7 and VA-123 without marked HOV lanes) is about 14.5 miles.

3.3.1.6 U.S. 50 in Prince George's County

HOV lanes have been open along U.S. 50 between U.S. 301/MD-3 and I-95/I-495 since October 2002, about 9 miles. Unlike other HOV lanes in the region, HOV restrictions are in effect 24 hours per day and 7 days per week in both directions.

3.3.1.7 MD-200 in Montgomery County and Prince George's County

The Intercounty Connector (MD 200) – a 6-lane, 18-mile east-west highway in Montgomery County and Prince George's County Maryland that runs between I-370 at Shady Grove and U.S. 1 (Baltimore

Avenue) in Beltsville. Most of the facility, from I-370 to I-95 was open by November 2011 and the road was fully open by 2014. Toll rates vary by time of day. MDOT/MTA operates bus routes on the ICC, including Gaithersburg to BWI Business District, Columbia to Bethesda, and Frederick to College Park. Montgomery County Ride-On provides service between Shady Grove and Glenmont. There is no HOV requirement to use MD-200 and discounts for HOV traffic are not offered.

3.3.1.8 I-495 in Fairfax County

There were never HOV lanes on this section of I-495. The roadway was widened to add 4 new HOV/Toll lanes (called 495Express) consisting of about 11 miles of managed lanes opened to traffic in November 2012. As with the I-95/I-395 lanes, HOV-3 traffic may use the lanes at no charge. PRTC OmniRide provides express bus service using these lanes between Woodbridge in eastern Prince William County and the Tysons employment area.

Extension of these lanes north across the Potomac River via the American Legion Bridge into Montgomery County, Maryland has been considered.

3.3.2 TRAFFIC MANAGEMENT

The topic of Traffic Management, including Incident Management and Intelligent Transportation Systems (ITS) is considered under the Systems Performance, Operations, and Technology Planning program and Subcommittee (SPOTS). SPOTS advises the TPB on management and operations matters and provides a regional forum for coordination among TPB member agencies and other stakeholders on these topics.

Investments in operations-oriented strategies have time and again shown good benefit-cost ratios and best enable transportation agencies (for both highways and transit) to provide effective incident management and good customer service, through operations centers and staffs, motorist/safety service patrols, traffic signal timing improvements, and supporting technologies. Particularly, intersection improvements (signalization timing / geometrics) can provide cost efficient congestion reduction. Also, the Metropolitan Area Transportation Operations Coordination (MATOC) program, comprising DDOT, MDOT, VDOT, WMATA, and TPB, is a regional program to enhance the availability of real-time transportation information and strengthen coordination among transportation agencies.

3.3.2.1 Active Traffic Management (ATM)

As defined by FHWA, active traffic management is the "ability to dynamically manage recurrent and non-recurrent congestion based on prevailing and predicted traffic conditions." [117]

- VDOT's I-66 Active Traffic Management Project from the District of Columbia to Gainesville in Prince William County was brought online on September 16, 2015. ATM components in the corridor included expanded use of shoulder lanes, lane control signals, expanded camera and dynamic message sign coverage, and upgrades to the ramp metering system. VDOT's I-66 Active Traffic Management Project was removed from service in 2019 in conjunction with the managed lane upgrade to the I-66 facility.[118]

[117] http://ops.fhwa.dot.gov/atdm/approaches/atm.htm (Accessed June 7, 2016)

[118] Exclusive: I-66 toll construction to take down 2-year old high-tech traffic management system - WTOP News.

- MDOT launched the I-270 Innovative Congestion Management (ICM) project, featuring ramp metering. In 2021 through 2023, ramp metering was established at about 45 ramps along the I-270 corridor in Frederick and Montgomery Counties.[119]

- Montgomery County has an ATM system which includes strategies such a vehicle detection, video and aerial monitoring, and information outreach including broadcast media, internet, variable message signs, and Travelers Advisory Radio System (TARS). Future strategies will include variable speed limit signs, monitoring parking and weather/pavement sensors, and in-vehicle paging services.[120]

3.3.2.2 Incident Management

A significant portion of congestion is associated with incidents such as crashes, disabled vehicles, and traffic associated with special events. If an incident disrupts traffic, it is important for congestion that normal flow resumes quickly.

Many successful incident management activities are part of the robust activities undertaken by the Washington region's transportation agencies. The region's state DOTs all pursue strategies for managing their transportation systems, including operation of 24/7 traffic management centers, roadway monitoring, service patrols, and communications interconnections among personnel and systems. All three focus on getting timely word out to the media and public on incidents. Local-level agencies also play an important role in transportation management, particularly on local roads and traffic signal timing.

Specific state-wide and regional incident management strategies include:

- ***Imaging / video for traffic monitoring and detection*** – help detect incidents and allow emergency vehicles to arrive quickly. Also helps travelers negotiate around incidents.
    - State and local DOTs have cameras for traffic monitoring and detection throughout the region. The Regional Integrated Transportation Information System (RITIS) provides a platform for participating agencies to share real-time data feeds and other pertinent information related to real-time situational awareness and incident management.[121]

- ***Service patrols*** – These specially equipped motor vehicles and trained staff help in clearing incidents off a roadway and navigating traffic safely around an incident. DDOT, MDOT, and VDOT all provide such service patrols on major roadways. The Maryland Transportation Authority provides safety patrols for its roads in the Washington region (MD-200 and US-301 crossing the Potomac River at the Nice Middleton Bridge).

- ***Road Weather Management*** – Can take the forms of information dissemination, response and treatment, monitoring, prediction, and traffic control.
    - All three state DOTs implement road weather management systems that disseminate information, treat roadways, and monitor conditions, especially during winter snow and ice events.

    .
- ***Traffic Management Centers (TMCs)*** – These centers collect and analyze traffic data, then disseminate data to the public. Data collection includes CCTVs, cameras, and detectors.

[119] https://www.roads.maryland.gov/mdotsha/pages/pressreleasedetails.aspx?newsId=3984&PageId=818

[120] http://www.montgomerycountymd.gov/DOT-TMC/ATMS/gettmc.html (Accessed April 30, 2016)

[121] http://i95coalition.org/projects/regional-integrated-transportation-information-system-ritis/

- All three state DOTs have TMCs:
  - *VDOT's McConnell Public Safety Transportation Operation Center (MPSTOC)* operates the Northern Region Transportation Operations Center (TOC) and Signal System. The TOC monitors traffic and incidents by using cameras and other information-gathering mechanisms to better manage day-to-day traffic flow and large incidents.
  - *DDOT's Transportation Management Center* gathers and disseminates information to the public using a network of cameras and other devices.
  - *MDOT's Coordinated Highway Action Response Team (CHART)* collects traffic data, disseminates information to the public, and provides emergency motorist assistance.

- ***Curve Speed Warning Systems*** - use roadside detectors and electronic warning signs to warn drivers, typically those in commercial trucks and other heavy vehicles, of potentially dangerous speeds in approach to curves on highways, with the intention of preventing incidents.
  - Curve speed warning systems have been used on the Capital Beltway.

- ***Work Zone Management*** - uses traffic workers, signs, and temporary road blockers to direct and control traffic during construction activities.
  - All three state DOTs have work zone management programs to temporarily implement traffic management and direct traffic. The goal is to reduce incidents by controlling the flow, speed, and direction of traffic.

- ***Automated Truck Rollover Systems*** - detectors deployed on ramps to warn truck drivers if they are about to exceed their rollover threshold, thus helping to reduce incidents.
  - Automated truck rollover systems, similar to the curve speed warning systems, were implemented at the same locations on the Capital Beltway in Virginia and Maryland. This was in response to a high number of truck rollovers on the Beltway in the 1980's.

- ***Maryland State Police Traffic Incident Management Unit*** – in 2021 the MSP created their new TIM units to respond to incidents in the state of Maryland. The unit in our region is mostly tasked with responding to incidents on the I-495 Beltway. More information regarding the success of the effectiveness of this unit will be included in the next CMP update when there are results to report.

Studies have shown the impact incident management activities have on reducing congestion, in particular reducing duration of incidents and reducing chances for secondary incidents. An example of this type of study is the yearly analysis of impacts of the Coordinated Highway Action Response Team (CHART) on incident management in Maryland. The focus of the report is to gauge effectiveness of CHART's availability to detect and manage incidents on major freeways and highways.

The *Performance Evaluation and Benefit Analysis for CHART*[122] includes statistics and analysis such as:

- Distribution of incidents and disabled vehicles
    - By day and time
    - By road and location
    - By lane blockage type
    - By blockage duration
    - By nature of incident (accident, disabled vehicle, etc.)
- Comparison of current year's data with that of previous years
- Benefits from CHART's incident management
    - Assistance to drivers
    - Potential reduction in secondary incidents
    - Estimated benefits due to efficient removal of stationary vehicles
    - Direct benefits to highway users

Analysis and studies such as those conducted by CHART indicate that incident management activities do have a positive impact on congestion. Each minute of reduced duration of incidents, for example, reduces the chances of secondary incidents and has a concomitant reduction in the severity and duration of non-recurring congestion.

Continuing enhancement of and investment in incident management activities will support congestion management.

Traffic Incident Management Enhancement (TIME) Task Force

In January 2018, the Metropolitan Washington Council of Governments (COG) Board of Directors, tasked COG with identifying recommendations and actions to enhance traffic incident management in the region. TPB and COG Department of Homeland Security and Public Safety (DHSPS) staff convened a multi-disciplinary task force of transportation, law enforcement, fire and emergency medical services subject matter experts. The Traffic Incident Management Enhancement (TIME) Task Force met seven times from February to October and hosted a May 22 regional workshop with expanded participation.

Traffic Incident Management (TIM) encompasses a wide range of topics. Staff's review of national literature and initiatives found dozens of notable TIM strategies and practices in place.
Although many of these initiatives are already being pursued in the region, there were many other new, innovative practices to consider. The region's high traffic volumes and continually growing population and economy mean the area's roadway system has little spare capacity to absorb traffic incidents when they do occur.

The TIME Task Force forwarded the COG board seven items that were approved in a resolution. The seven approved items are as follows:

1. Update regional agreements and improve consistency of TIM laws and policies. COG should lead an effort to develop a transportation incident management mutual aid operations plan. Jurisdictions should review and update, as necessary, their laws to ensure the concepts of "move over," "move it," and "hold harmless" are included consistently.

[122] http://chartinput.umd.edu/.

2. Coordinate regional annual TIM self-assessments. Convene state and local transportation agencies, public safety agencies, and private sector TIM stakeholders annually for a regional Traffic Incident Management Self-Assessment.

3. Encourage and coordinate TIM trainings to promote best practices. Member agencies should require those who have a role in responding to traffic incidents to attend TIM trainings, particularly through the Federal Highway Administration's National TIM Responder Training Program. COG should share information with its members about available TIM training opportunities and host its own regional sessions.

4. Launch outreach initiatives that better engage the public and officials on TIM. Identify funding for and develop a regional public outreach campaign that promotes educational messages on moving over for sirens, slowing down near incident scenes, and other TIM-related driver safety messages. Elected officials should also request periodic briefings from transportation and public safety agencies on TIM-related activities and data to inform future decision-making.

5. Create a regional TIM program. Identify resources to create and sustain a regional program and stakeholder committee that can coordinate training and exercises, compile and review data, track emerging technologies, and promote best practices. Practitioners are eager to collaborate but must be given a forum.

6. Designate transportation incident responders as emergency responders regionwide. As has been done in Maryland, jurisdictions must review and update legislation and policies to ensure transportation emergency responders can get to incident scenes quickly, using flashing lights and audible sirens.

7. Expand roadway service patrols to federal parkways and other critical major roads not currently covered. Convene the federal government, District, Maryland, and Virginia public safety agencies, and state and local jurisdictions to negotiate an agreement allowing for the funding and deployment of roadway service patrols on federal parkways and other key highways.

TPB Staff along with DHSPS staff have continued to work together to incorporate TIM into the respective work programs where appropriate. Most TIM work is currently housed in the Transportation Emergency Preparedness (Regional Emergency Support Function 1/R-ESF 1) Committee since many of the region's TIM practitioners are also members of the committee.

3.3.2.3 Traffic Signal Operations

Traffic Signal Timing

There are at least 21 different agencies that have ownership and/or maintenance responsibilities for the approximately 5,900 signals on public roads in the region. The most recent TPB survey of these agencies (2018) found that an estimated 73% of the eligible traffic signals had been retimed within the past three years, which is a generally accepted guideline. The signals in the region use a variety of retiming methods including computer optimization, engineering judgment, and active management.[123]

[123] http://www.mwcog.org/uploads/committee-documents/al1ZXFpb20140212133426.pdf

DDOT undertook a comprehensive 5-year plan to improve the flow of traffic in the region, including signal timing, and impacts all 1600 traffic signals in the District of Columbia.[124] The project was completed in 2016 and funding secured to continue another round of signal timing optimization. For example, in Anacostia, one of the completed areas, DDOT reported a 13% network-wide travel time savings over all peak periods, a 34% reduction in delays, and a 23% reduction in stops. In the downtown area, DDOT reported travel time savings for motorized vehicles during all periods and reduced stopping for bicycles in the Pennsylvania Avenue separated bike lanes.[125]

Advanced Traffic Signal Systems

Advanced Traffic Signal Systems are used for coordination of traffic signal operations in a jurisdiction, or between jurisdictions using detectors to monitor real-time traffic conditions. This is important to congestion, as it reduces delay and improves travel time. It can include active traffic signal management – where traffic signals are managed through a control center, where technicians adjust the length of signal phases based on prevailing traffic conditions – or adaptive signal control – in which the controller automatically adjusts the timing of signals to accommodate changing traffic patterns.

- VDOT actively optimizes traffic signal timing plans and launched a signal/arterial traffic management control center located adjacent to the MPSTOC operating floor to proactively manage the arterial traffic.

- The City of Alexandria has implemented an adaptive traffic signal control system along Duke Street. The system can adapt to real-time traffic situations by changing cycle lengths as traffic flows change while keeping the corridor synchronized.

Traffic Signal Timing During Incidents

Traffic signal timing plans adjust traffic signals during an incident, during inclement weather, or to improve transit performance. The overall objective is to reduce backups at traffic signals and to increase the level of service.

3.3.2.4 Regional Operations Coordination

Metropolitan Area Transportation Operations Coordination (MATOC)

The Metropolitan Area Transportation Operations Coordination (MATOC) Program is a coordinated partnership between transportation agencies in D.C., Maryland, and Virginia that aims to improve safety and mobility in the region through information sharing, planning, and coordination. Current agencies include the District of Columbia, Maryland, and Virginia Departments of Transportation along with County and City transportation departments and transit providers like WMATA and other local providers. For example, a review of the MATOC program showed that coordination between the MATOC family of agencies during a bus crash on I-66 resulted in a savings of over $382,000 for area commuters. This savings was a result of decreased emissions, fuel consumption and lost time. [126]

[126] www.matoc.org

A benefit-cost study of the MATOC program was undertaken and the results were based on three incidents that were handled by MATOC. The benefit-cost study looked at travelers "modified trips" - trips made later, on another route, by another mode, or not made due to regionally significant incidents. Benefits were estimated from reduced delay, fuel consumption, emissions (including greenhouse gases), and secondary incidents. Three case studies were conducted, two for freeway incidents and one for arterial incident. The study found an overall benefit/cost ratio conservatively estimated at 10 to 1. A summary report of this study called the MATOC Benefit Cost Analysis dated June 2010 is available. MATOC also maintains a public use website called Traffic View which can be accessed at https://matoc.org/travel-info/ which uses the RITIS traffic information to inform the public about regional traffic incidents and roadway conditions.

MATOC has undertaken several initiatives. The Severe Weather Mobilization Coordination Effort began during the winter of 2012-2013. This effort has led to "the development of consistent terminology to describe roadway and transit conditions throughout the region, protocols for sharing weather information from different agency-specific sources and detection systems, testing of coordinated messaging systems, and better ways to advise the overall regional winter storm decision-making process." [127] MATOC's Regional Construction and Work Zone Coordination effort was initiated in 2014 to develop a framework for regional coordination around major construction projects as well as regional work zone-related lane closures and special events. In the Spring of 2016, MATOC hosted its first Regional Traffic Incident Management (TIM) Conference to bring together its partner Departments of Transportation and area first responders to highlight, discuss, and demonstrate advancements in TIM best practices, technologies, and policies affecting agencies and jurisdictions in and around the National Capital Region. MATOC followed up with its June 2018 Regional Traffic Incident Management Tabletop Exercise to bring together its partner transportation agencies and first responders to evaluate and discuss communications and coordination efforts. The MATOC program is committed to hosting similar regional TIM related events in the future to support its member Departments of Transportation and their regional partners.

3.3.2.5 Intelligent Transportation Systems (ITS)

ITS strategies can be defined as electronic technologies and communication devices aimed at monitoring traffic flow, detecting incidents, and providing information to the public and emergency systems on what is happening on our roadways and transit communities. Much of what is done with ITS helps in reducing non-recurring and incident-related congestion.

- ***Electronic Payment Systems*** - These systems can make transit use more convenient by allowing a user to pay for bus, rail, park-and-ride lots, and other transit services with one card. Convenience an appealing factor and helps increase transit ridership and transfers among different transit modes.
    - SmarTrip cards are used for rail and bus fares (both WMATA and local buses) and for WMATA parking facilities. WMATA discontinued use of paper farecards on March 6, 2016.[128]
    - The region's roadway toll agencies are part of the E-ZPass consortium electronic payment system. The ICC and the 495 and 95 Express Lanes are E-ZPass-only facilities (no toll booths).
    - TransIT (Frederick County) released phone app for payment of TransIT fares.[129].

[128] http://www.wmata.com/fares/paperless.cfm

[129] https://frederickcountymd.gov/5906/Mobile-App

- ***Freeway Ramp Metering*** - Traffic signals on freeway ramps that alternate between red and green to control the flow of vehicles entering the freeway. This prevents incidents that may occur from vehicles entering the freeway too quickly and prevents a backup of traffic on the on-ramp.
    - Ramp meters are used inside the Capital Beltway (I-495) in Virginia on I-66 and I-395, as well as on I-270 in Maryland.

- ***Automated Enforcement (e.g., red light cameras)*** - Still or video cameras that monitor things such as speed, ramp metering, and the running of red lights, to name a few. Any help provided preventing non-recurring and incident related congestion will bolster safety.
    - In the Washington region, the legal ability to deploy these systems is in place in the District of Columbia, Maryland, and Virginia.

- ***Reversible Lanes*** - Traffic sensors and lane control signs reverse the flow of traffic and allow travel in the peak direction during rush hours. This is important to alleviating congestion that may occur in one direction during a peak hour. Examples of reversible lanes include Rock Creek Parkway in the District and Colesville Rd./US29 in Maryland.

3.3.2.6 Connected and Autonomous Vehicles

The shift from today's automobiles to connected and autonomous vehicles (CAVs) is anticipated to have broad and significant impacts on various facets of mobility and society, such as traffic safety; personal and freight mobility; changing models of vehicle ownership and use; public transit services; and where people choose to live and travel. Given the sheer number of factors that will influence CAV deployment, much uncertainty surrounds how CAVs will function on the highways and local roads and in our communities. However, CAVs are likely to impact regional transportation planning goals, priorities, and activities in significant ways.

In 2021, TPB received an expert consulting firm white paper[130] to assist in planning for CAVs on the region's transportation system. Specifically, it looked to inform regional conversations on CAVs and TPB's role related to this topic by examining:

- Areas where TPB goals, policies, and activities may substantially interact with CAVs.

- Potential CAV deployment impacts (issues, challenges, opportunities) as they relate to corresponding jurisdictional authorities and roles (primary, secondary, collaborative).

- Opportunities to enhance CAV considerations within TPB's planning products/activities including processes for developing regional CAV principles.

CAVs may impact transportation management and operations in the future, on a variety of factors such as traffic flow and data availability. However, the exact nature and timing of these impacts remains uncertain. TPB will monitor this topic and any impacts on the CMP.

3.4 Integrative/Multi-Modal Strategies

3.4.1 ADVANCED TRAVELER INFORMATION SYSTEMS (ATIS)

[130] https://www.mwcog.org/file.aspx?&A=7WMjEy2ZhM8YzERTQVVII3PKAQ0m42ApjSq%2fGenZ2N0%3d.

ATIS are technology-driven platforms that collect and deliver transportation data in real-time or near-real-time to travelers, enabling them to make informed decisions before or during their journeys. The widespread use of smartphones and other mobile internet-capable devices has significantly increased the accessibility of real-time information for travelers. Modern ATIS platforms function as data aggregators, seamlessly integrating information from a variety of sources to provide a comprehensive picture of the transportation landscape. Key data contributors include:

- Department of Transportation (DOT) agencies: Traffic flow sensors, incident reports, construction updates, roadway conditions, and even transit schedules.

- Connected vehicle (CV) applications: Real-time traffic speeds, crash locations, and hazard reports sourced from anonymized user data from apps like Waze.

This public-private data exchange fosters a collaborative environment that enhances the accuracy and comprehensiveness of ATIS. In recent years, the integration of public and private sector data has further enriched these systems. For instance, many departments of transportation including the U.S. Department of Transportation (DOT), DDOT, MDOT, and VDOT now collaborate with Waze, a popular navigation app, through the Waze for Cities program[131]. This partnership allows the DOT to receive and curate both user-reported and auto-generated data from Waze, covering the entire United States. This data exchange has significantly improved the accuracy and comprehensiveness of the information available to travelers. Some ATIS in the TPB region include:

- The District of Columbia makes traffic information, including live traffic cameras, traffic alerts, and street closures, available on the DDOT website.

- WMATA provides real-time transit information (both bus and rail) on the web and on informational screens in the Metrorail stations.

- Real-time bus information is available for many of the region's bus systems (including Montgomery, Arlington, and Prince George's Counties and the City of Fairfax).

- Maryland provides live traffic information on traffic and incidents via the CHART website[132].

- Virginia operates under a statewide 511 system via telephone, internet[133], and mobile app.

- The MATOC website has links to all three state's traffic information. In addition, Traffic View on the Traveler Information webpage[134] aggregates traveler information including incidents, traffic camera feeds, construction activity and schedules, and variable message sign information for the region.

- Dynamic Message Signs (DMS) are used throughout the region including permanently installed signs on freeways and portable signs used on both freeways and arterials.

3.4.2 BUS PRIORITY SYSTEMS

[131] Waze for Cities, https://www.waze.com/wazeforcities

[132] MDOT, Traveler Information, https://chart.maryland.gov/TravelerInformation/GetTravelerInformation

[133] VDOT, Virginia Traffic Information, http://www.511virginia.org/

[134] MATOC, Traveler Information, https://matoc.org/travel-info/

Bus priority systems are sensors used to detect approaching transit vehicles and alter signal timings to improve transit performance. For example, some systems extend the duration of green signals for public transportation vehicles when necessary. This is important because improved transit performance, including more reliable arrival times for buses, makes public transit a more appealing option for travelers. Bus priority systems have been installed on key bus corridors across the region, helping to offset the impact of traffic congestion on bus speeds.

3.4.3 REGIONAL ITS ARCHITECTURE

The Metropolitan Washington Regional Intelligent Transportation Systems Architecture (MWRITSA)[135], developed by the TPB, serves as a comprehensive regional ITS framework. It outlines a roadmap for future ITS development, defines and validates ITS operations of regional significance, and ensures compliance with federal and state standards. By promoting knowledge sharing and fostering system integration, the architecture enhances technical interoperability across the region. The MWRITSA goes beyond merely describing existing transportation technology systems; it serves as a valuable tool for identifying project responsibilities and applicable standards. It also informs business cases for state and federal ITS investments in transportation improvement programs and other initiatives. The three DOTs have collaborated extensively to ensure consistency among their regional ITS architectures. The Regional Architecture is subject to periodic updates to reflect ongoing changes in the region.[136]

3.4.4 INTEGRATED CORRIDOR MANAGEMENT (ICM)

New technologies and concepts have been tested nationally or internationally to integrate operations to manage total corridor capacity including freeways, arterials, bus, rail, and parking systems. The purposes of the initiative include identifying innovative technologies to facilitate multi-modal local, regional, and national corridor travel, and identifying tools to provide information to travelers related to travel times and parking.

- A Regional Multimodal Mobility Program (RM3P) in Northern Virginia is managed by the Virginia Department of Transportation (VDOT) in partnership with the Virginia Department of Rail and Public Transportation (DRPT) and the Northern Virginia Transportation Authority (NVTA).[137] This is a data-driven program built on integrated corridor management activities (ICM) already underway in NOVA.[138]. Aspects include:
    - Enhanced Commuter Parking Data
    - Mobility as a Service (MaaS)
    - Dynamic Service Gap Dashboard
    - AI-Based Decision Support System with Prediction
    - Data-Driven Tool to Incentivize Customer Mode and Route Choice.

- MDOT/SHA I-270 Innovative Congestion Management Project – MDOT's FY 2020-2025 Consolidated Transportation Program (CTP) includes the $131 million I-270 Innovative Congestion Management (ICM) project to implement a series of roadway and technology-based improvements on I-270. The I-270 ICM project included the first deployment of ramp

[135] The Metropolitan Washington Regional Intelligent Transportation Systems Architecture. http://www.mwcog.org/itsarch/Home.htm

[136] http://www.mwcog.org/itsarch/

[137] See presentation V in this document: https://thenovaauthority.org/wp-content/uploads/2019/07/Authority-Meeting-Packet-7-11-2019.pdf

[138] https://ops.fhwa.dot.gov/fastact/atcmtd/2017/applications/virginiadot/project.htm

metering in Maryland, so extensive coordination was required within the agency, with the public, and with other agencies.[139] The project is currently 85% complete and is expected to be completed in fall 2024.[140]

3.4.5 EVALUATING SIGNIFICANT TRANSPORTATION PROJECTS

Both the Virginia Department of Transportation and the Maryland Department of Transportation utilize performance-data-driven project programming prioritization processes that consider, in part, congestion management impacts of proposed projects.

Virginia's SMART SCALE (§33.2-214.1) is the method of scoring planned transportation projects included in VTrans (Virginia's Transportation Plan). SMART SCALE stands for System for the Management and Allocation of Resources for Transportation, and the key factors used in evaluating a project's merits: improvements to Safety, Congestion reduction, Accessibility, Land use, Economic development and the Environment.[141] Virginia uses this process to prioritize transportation projects in the state's transportation budget for certain funding categories. Each cycle is on a biennial schedule. There are five steps to the process used to rate projects: Determination of Eligibility for Program Funding, Project Application, Project Screening, Evaluation/Scoring, and Prioritization and Programming. As implied in SCALE, transportation projects are scored and prioritized using several metrics: Safety, Congestion Mitigation, Accessibility, Environmental Quality, Economic Development, and Land Use. Once projects are scored and prioritized, the Commonwealth Transportation Board (CTB) selects the projects that will receive funding, advised by the scoring.

Maryland's Chapter 30 Scoring Model is a project–based scoring system for proposed major transportation projects using goals and measures established under Transportation Article 2-103.7(c), for potential inclusion in the Maryland Department of Transportation's Consolidated Transportation Program (CTP). The law, as amended in 2017, defines a "major transportation project" as a highway or transit capacity project that exceeds $5,000,000 in cost, and excludes any projects solely intended for system preservation. The Chapter 30 scoring model evaluates projects across nine goals and twenty-three measures established in statute, using project data, modeling analysis, and qualitative questionnaires. A project application process has been established requiring county and municipalities to request major transportation projects to ensure the necessary project information and priorities is provided to conduct the scoring. Counties and municipalities submit projects via a web portal, in an annual process with submissions due March 1 of each year. One of the key evaluation criteria of the Chapter 30 Scoring Model is "reducing congestion and commute times".[142]

3.4.6 MOBILE DEVICES AND SOCIAL MEDIA

3.4.6.1 Mobile Devices

The increasing number of people with mobile internet-capable devices, such as smartphones and tablets, combined with the availability of real-time travel data, is changing the way travelers receive information and make decisions on their choice of mode, route, and/or departure time. Most travelers now carry a mobile device with maps and GPS allowing for information to be tailored to

[139] https://transportationops.org/case-studies/i-270-innovative-congestion-management-icm-ramp-metering

[140] https://mdot-sha-i270-i70-to-i495-inno-cong-mgmt-mo0695172-maryland.hub.arcgis.com/

[141] Commonwealth Transportation Board SMART SCALE page, http://www.ctb.virginia.gov/planning/smart_scale/default.asp.

[142] Maryland Department of Transportation Chapter 30 information page, https://mdot.maryland.gov/tso/pages/Index.aspx?PageId=83.

their location. DOTs, transit agencies, private transportation providers, and other third parties have developed mobile versions of websites and mobile applications (apps) to make it easier for travelers to receive information on their devices.

- WMATA provides real-time rail arrivals on the mobile version of its website and now gives a year-end review of users transit usage from throughout the year using the smart card number associated with the riders account.

- Many bus operators make real-time arrival information and/or static schedules available on their mobile websites and/or make data available to third party websites and applications. NextBus is one of the most popular bus information apps.

- MARC provides real time incident and delay alerts through text, and email to commuters. The MARCTracker website provides live GPS train locations.

- Capital Bikeshare, carshare, and ridehailing (Uber, Lyft) companies have mobile apps which allow users to make travel decision on the spot.

- Traffic information, based on data sources such as INRIX, is available through a number of apps (INRIX, Google Maps, and WAZE being among some of the most popular. See Section 3.4.6.2 for more information about WAZE.)

- Wireless Emergency Alerts (WEA) are sent by authorized government alerting authorities. These alerts can contain information that is valuable to the traveling public such as extreme weather warnings and local emergencies requiring evacuation or other immediate action.[143]

- Commuter Connections has developed a mobile version of its website and mobile apps for a number of services. See Section 3.2.1.3.

Safety while using the devices while traveling remains a concern; all three states have laws against distracted driving and texting while driving.

3.4.6.2 Social Media

The traveling public is now oriented toward the use of social media for many aspects of their lives. The social media landscape is constantly evolving and it is causing the transportation sector to rethink its model for providing information. Transportation agencies in the region have adopted social media as a means of sharing information with a large segment of the public. Instead of providing information only on a central website that the user has to visit, social media provides a way to deliver that information to users through a forum to which they already subscribe, such as Twitter which was one of the most popular social media sites for the transportation sector. However, due to decisions that Twitter management has made in regarding posting rules many public agencies have pulled back from using Twitter and no clear replacement has emerged as a viable alternative at this time. In addition, social media can provide a means for agencies to receive information from users in order to better manage the system and most operations centers monitor social media as well as their normal sources of information like video and radio.

[143] https://www.weather.gov/wrn/wea

- MDOT, VDOT[144], DDOT, and many other transportation agencies use X (formerly Twitter) to share information.

- Local police departments user X to provide preliminary information and updates on active incidents.

- WMATA uses different X accounts to share general information, Metrorail information, Metrobus information, and crime prevention tips. Supplemental two-way customer support has been provided on the Metrorail and Metrobus feeds.[145]

- WAZE[146] is a community-based traffic and navigation app. WAZE goes beyond other apps that provide traffic data by providing a crowdsourcing component. Users can passively contribute to providing traffic information by having the mobile app open while driving. They can also contribute by sharing information about incidents and other travel conditions.

- MATOC users its own X account to provide updates on incidents. MATOC follows other social media feeds (including police departments, local jurisdictions, transit agencies, news organizations, etc.) and crowdsourcing websites like WAZE to obtain more timely and accurate information about incidents. Due to changes made by X the app is not as useful as in the past for gaining real time information but is still monitored.

3.5 TPB Priority Strategies and the CMP

In February 2023, the TPB approved Priority Strategies to guide the development of Visualize 2050.[147] As a continuation of the seven Aspirational Initiatives endorsed in 2018,[148] the TPB noted that these fourteen total Priority Strategies, if funded, enacted, and supported, would have the potential to significantly improve the region's transportation system performance compared to current plans and programs. The fourteen Priority Strategies are:

- Bring Jobs and Housing Closer Together
- Expand Bus Rapid Transit and Transitways
- Move More People on Metrorail and commuter rail
- Provide More Telecommuting and Other Options for Commuting
- Expand Express Highway Network
- Improve Walk and Bike Access to Transit
- Complete the National Capital Trail Network
- Apply Best Practices to Maintain Bridges, Pavement, and Transit Assets
- Apply Safety Strategies to Design and Operate Safer Infrastructure
- Reduce Travel Times on all Public Transportation Bus Services
- Implement Transportation System Management Operations Measures
- Apply Effective Technologies that Advance TPB's Goals
- Convert Vehicles to Clean Fuels
- Develop and Implement an Electric Vehicle Charging Network

[144] https://www.vdot.virginia.gov/news-events/social-media/.

[145] https://www.wmata.com/service/bus/bus_youtube_facebook_metroalerts.cfm

[146] https://www.waze.com/about (Accessed July 10, 2024).

[147] https://visualize2045.org/wp-content/uploads/2023/01/TPB-Policy-Framework-Booklet.pdf

[148] https://www.mwcog.org/documents/2019/09/20/visualize-2045-aspirational-initiatives-visualize-2045/

The following sections offer more insights and interpretation on the Priority Strategies, although it should be noted that the CMP Technical Report may not provide comprehensive technical information for all these strategies.

3.5.1 BRING JOBS AND HOUSING CLOSER TOGETHER

The region's 141 Activity Centers (adopted in 2013) are intended to be walkable places for concentrated housing and job growth. If more housing and jobs were placed in the region's Activity Centers, it would facilitate walking, bicycling, or taking public transit in lieu of driving. Local planning efforts should encourage housing and job growth close to High-Capacity Transit stations that have available space nearby for new construction. More housing close to High-Capacity Transit and in Activity Centers lets more people walk to work and transit. That means there would be fewer cars on the region's roads, reducing congestion and making driving more reliable for those who commute by car. For more information, see Section 3.2.7.3.

3.5.2 EXPAND BUS RAPID TRANSIT AND TRANSITWAYS

Bus-rapid transit (BRT) in the region provides high-quality transit services that approach the speed of rail, but at a fraction of the cost to build. Express bus, streetcar, and light rail systems should be available for more people in more places throughout the region. Streetcar and light rail routes provide targeted connections within the regionwide system, serving high-density locations, promoting economic development, and offering viable alternatives to driving. These transit systems are important congestion management strategies because they provide people with an option to not drive. Places with high activity density and high roadway congestion are more likely to see the greatest use of BRT.

In June 2022, the TPB approved a major update to Visualize 2045 that includes the expansion of bus rapid transit (BRT) and transitways, improving access to non-SOV mode options that can help reduce vehicle-miles travelled, congested lane miles, and improve travel times.[149] According to the plan, with additional projects planned for BRT and rail expansion, more than one-half of jobs and one-quarter of residents will be close to High-Capacity Transit Station Areas and 67 percent of jobs and 35 percent of residents will be in Activity Centers, the region's priority areas for growth, by 2045.

Beyond the BRT expansion listed in the 2045 plan, transportation agencies in the region continue to look for new BRT opportunities with multiple studies ongoing. Continued BRT expansion would provide another option for people to travel instead of driving thus helping the region manage traffic congestion.

3.5.3 MOVE MORE PEOPLE ON METRORAIL AND COMMUTER RAIL

Moving More People on Metrorail and Commuter Rail was also identified as a TPB Priority Strategy, including expanding the number of trains and expanding stations. However, post-pandemic travel behaviors suggest a decline in transit use as teleworking and flexible work schedules have shifted how and when people commute and conduct non-work travel. The region continues to support and promote Metrorail and Commuter Rail travel as an effective option for travel that helps reduce congestion. Further, by expanding the capacity on Metrorail and the region's commuter rails, more

[149] https://www.mwcog.org/newsroom/2022/06/15/tpb-approves-update-to-visualize-2045-long-range-transportation-plan

people will have the option to choose to take rail over driving, thus diverting trips that would otherwise contribute to roadway congestion.

3.5.4 PROVIDE MORE TELECOMMUTING AND OTHER OPTIONS FOR COMMUTING

This strategy aims to expand programs to increase the number of people who telework, find carpools, or use transit. Although this strategy predated COVID-19, the pandemic caused the region to enter into an almost maximum possible telework situation during 2020. As of early 2024, teleworking continues to be significantly higher than pre-pandemic though more people are commuting into workplaces than at the height of the pandemic. These telecommuting programs can be implemented by employers, government programs, or both. This remains a priority strategy for the region to manage congestion recognizing that full-time telework has its drawbacks and hybrid situations provide the most balance. See Section 3.2.1 for more information.

3.5.5 EXPAND EXPRESS HIGHWAY NETWORK

Managed lanes added to existing highways throughout the region would allow toll-paying customers to avoid congestion because of dynamic pricing. Such pricing would enable the lanes to maintain a set travel speed since toll rates increase during the most congested times of day. Higher tolls reduce demand on the express lanes, keeping traffic in those lanes free-flowing. Toll lanes are the most likely way that the region will be able to generate revenue for new projects in our growing region, even as we seek to reduce our dependence on driving alone.

If included in their user policy, managed lanes encourage carpooling by being toll-free for vehicles with a certain minimum number of occupants, and provide opportunities for transit via networks of express buses that can travel in those lanes, connecting people and destinations throughout the region. Revenues generated from the tolls can be used to operate the extensive regional network of bus services. For more information, see Section 3.3.1.

3.5.6 IMPROVE WALK AND BIKE ACCESS TO TRANSIT

The region seeks to improve walk and bike access to transit stations, especially High-Capacity Transit stations. Often, there are barriers in the way, such as a lack of safe sidewalks or crosswalks, or a major road that cannot be crossed potentially requiring a longer travel distance. To improve access to transit for walkers and bicyclists, TPB member agencies apply Complete Streets and Green Streets policies to build or repair sidewalks, install crosswalks and crossing signals, and construct new trails so that walking or biking to transit is comfortable and convenient.

In July 2020, the TPB adopted Resolution R4-2021 to approve a regional list of Transit Access Focus Areas (TAFAs).[150] The TAFAs work is rooted in the Improve Walk and Bike Access to Transit Priority Strategy. Based on this direction, TPB staff launched the Transit Within Reach Program[151] which prioritized locations with the greatest need for improvements, such as sidewalks, trails, and crosswalks, that will make it safer and easier to walk or bike to train stations and bus stops. This program funds design and preliminary engineering projects to help improve bike and walk connections to existing high-capacity transit stations or stations that will be open to riders by 2030. The list approved in July 2020 identified 49 TAFAs in 17 jurisdictions around the region. Improving

[150] https://www.mwcog.org/maps/map-listing/tafa/.

[151] https://www.mwcog.org/transportation/programs/transit-within-reach-program

walk and bike access to transit helps transit better fulfill its ridership potential and could take vehicles off the road.

This priority strategy relates to congestion because as more people have walking and biking access to transit, more people will gain transit as a viable option for transportation. Trail connections that are less than one mile and simple roadway pedestrian safety treatments can result in significant improvements in direct access and perception of safety.

3.5.7 COMPLETE THE NATIONAL CAPITAL TRAIL NETWORK

Originally in July 2020, with a February 2024 update, the Transportation Planning Board approved the National Capital Trail Network[152], a 1,500-mile, continuous network of existing and planned long-distance, off-street trails, serving the entire region.

The built portions of the network provide healthy, low-stress access to adjacent destinations and reliable bike and pedestrian transportation options for people of all ages and abilities. As the network grows, more people will have access to an off-road, continuous trail that will make walking/biking to destinations across jurisdictions more viable. This will then give people the option to walk or bike, rather than drive, where possible, thus diverting trips from roads to walking and biking. See Section 3.2.4 for more information.

3.5.8 APPLY BEST PRACTICES TO MAINTAIN BRIDGES, PAVEMENT, AND TRANSIT ASSETS

A well-maintained transportation system is the foundation for economic growth and avoids greater costs that come with reconstruction. To maintain the transportation system assets in the region, best practices including routine inspections, securing funding for maintenance, and replacing transit assets that have exceeded their useful lives should be applied by agencies. The network will be in a good state of repair because of proactive maintenance practices, making the system more reliable and less prone to congestion due to unforeseen roadway and transit maintenance needs.[153]

3.5.9 APPLY SAFETY STRATEGIES TO DESIGN AND OPERATE SAFER INFRASTRUCTURE

Since 2019, the region has experienced an increase in the rate of roadway safety injuries and fatalities. A major contributing factor to these incidents is the roadway designs, which influence behaviors. Through coordinated applications of best practices, such as aligning roadway design with design speed, proper separation between bicyclists and motorists, and implementing design interventions that change behaviors, the region can anticipate less crashes, more lives saved, and a more appealing mode of travel. Improved safety increases travel reliability due to fewer incidents that cause non-recurring congestion. For more information, see Section 2.2.5.

[152] https://www.mwcog.org/assets/1/28/07220202_-_Item_11_-_NCTN.pdf and https://www.mwcog.org/maps/map-listing/national-capital-trail-network/

[153] For more information, see https://www.mwcog.org/transportation/planning-areas/performance-based-planning-and-programming/pbpp/.

3.5.10 REDUCE TRAVEL TIMES ON ALL PUBLIC TRANSPORTATION BUS SERVICES

The bus services in the region are essential assets for everyday travel for thousands of residents. Despite having a widespread network, there is an opportunity to improve the travel times to make bus services more reliable and viable. Coordinated efforts such as increasing headways, investing in bus priority and bus rapid transit (BRT) infrastructure, route simplification, and a regionwide off-board fare collection system can make this possible. As travel times on all public transportation bus services improve, the region's bus services have the potential to replace more single occupant vehicle (SOV) trips, thus helping to manage roadway congestion. For detailed information on performance measures of Transit-Significant Roads, refer to Section 2.3.1.

3.5.11 IMPLEMENT TRANSPORTATION SYSTEM MANAGEMENT OPERATIONS MEASURES

Transportation System Management and Operations (TSMO) is a set of coordinated, cross-jurisdictional strategies that focus on operational improvements that can maintain and even restore the performance of the existing transportation system before extra capacity is considered. Through TSMO measures, the region can maximize its transportation system by using solutions that can be quickly implemented at relatively low costs. Regional collaboration on work zone management, traffic incident management, traffic signal coordination, congestion pricing, and road weather management are just a few examples of TSMO strategies that can more efficiently use resources, reduce congestion, and improve system reliability. For more information on Transportation Systems Management and Operations, see Section 3.3.

3.5.12 APPLY EFFECTIVE TECHNOLOGIES THAT ADVANCE TPB'S GOALS

This priority strategy looks to advance the application of current and evolving technology (particularly computer and communications technology) to transportation systems, and the careful integration of system functions, to provide efficient and effective solutions to multimodal transportation problems. While the application of technology was always a major emphasis area for improving capacity and efficiency of transportation systems, and in effect help reduce congestion, it can also apply to transportation system management and operations. See Section 3.4 for some examples.

3.5.13 CONVERT VEHICLES TO CLEAN FUELS

To advance the TPB's vision for reduced greenhouse gas emissions, the conversion of combustion engine vehicles to clean fuel vehicles is necessary. By 2050, the TPB strives for 50% of new light-duty vehicles sold, 30% of medium and heavy-duty trucks sold, and 50% of all buses on the road to be converted to clean fuels.[154] From this transition, the region will see improved air quality, reduced respiratory illnesses that are linked to vehicular emissions, and reduction in noise pollution that comes from combustion vehicles. This priority strategy is aimed at environmental benefits and in the conversion to cleaner fuels, infrastructure supporting those vehicles should be designed to not cause added travel delays and roadway congestion.

[154] For more information on clean fuels, see https://www.mwcog.org/environment/planning-areas/climate-and-energy/clean-fuel-vehicles/.

3.5.14 DEVELOP AND IMPLEMENT AN ELECTRIC VEHICLE CHARGING NETWORK

As the region strives to reduce greenhouse gas emissions, transitioning from combustion engine vehicles to clean fuels, such as electric vehicles (EVs), will require a comprehensive EV charging network. Strategized policies that increase the availability of charging stations and strengthen the region's grid capacity will help to make EV car ownership more feasible, while also improving regional air quality. The EV charging network should be designed to not cause added travel delays and roadway congestion. COG has undertaken a number of EV-related activities on behalf of the region, supporting this TPB goal.[155]

3.6 Additional System Capacity

3.6.1 DOCUMENTATION OF CONGESTION MANAGEMENT FOR ADDITIONAL SYSTEM CAPACITY

Federal regulations state that any project proposing an increase in Single-Occupant Vehicle Capacity should show that congestion management strategies have been considered. The specific language from the Federal Rule states that Transportation Management Areas (TMAs) shall provide for:

"an appropriate analysis of reasonable (including multimodal) travel demand reduction and operational management strategies for the corridor in which a project that will result in a significant increase in SOVs is proposed to be advanced with Federal Funds. If the analysis demonstrates that travel demand reduction and operational management strategies cannot fully satisfy the need for additional capacity in the corridor, and additional SOV capacity is warranted, then the congestion management process shall identify all reasonable strategies to managed the SOV facility safely and effectively."

In the Washington region, the TPB is ensuring that all proposed SOV capacity increasing projects (except those which are exempt) show that congestion management strategies have been considered to effectively manage the additional capacity. This is being done with agencies completing a "CMP Documentation Form" when submitting a proposal for projects in the National Capital Region Transportation Plan and Transportation Improvement Program (TIP).

The TPB collects from project sponsors a CMP Documentation Form for projects that require them. The requirement is that SOV capacity-increasing projects are only supposed to be implemented if non-SOV-capacity strategies were also considered. The forms document that such consideration has occurred.

The TPB also compiles information pertinent to specific projects in its CMP documentation process form.[156] These forms provide documentation that the planning of federally-funded SOV projects has included considerations of CMP strategy alternatives, and integrate such components where feasible. In the "Technical Inputs Solicitation" for the update to the National Capital Region Transportation Plan and the Transportation Improvement Program, for any project providing a significant increase to SOV capacity, it must be documented that the implementing agency considered all appropriate systems and demand management alternatives to the SOV capacity. A

[155] https://www.mwcog.org/about-us/cog-board-and-priorities/ev-clearinghouse/.

[156] TPB now has set up an online project information portal for member agencies to submit project information, a portion of which compiles Congestion Management Process information, in lieu of the paper or word processing "forms" used in past years.

special set of SOV congestion management documentation questions must be answered for any project to be included in the Plan or TIP that significantly increases the single occupant vehicle carrying capacity of a highway. For more information, see Appendix F.

3.6.2 WHERE ADDITIONAL SYSTEM CAPACITY IS NEEDED AND HOW THE ADDITIONAL SYSTEM CAPACITY WILL BE MANAGED EFFICIENTLY

The National Capital Region Transportation Plan, updated regularly, identifies where major roadway capacity expansions are planned. The TPB, through the long-range transportation plan, asks that congestion management strategies be considered for these capacity increases. In the Washington region, all proposed SOV capacity increasing projects (except those which are exempt), show that congestion management strategies have been considered to effectively manage the additional capacity. These types of strategies could be of demand or operational management, or both, as outlined in this report. Many of these strategies are considered before any capacity-increasing project is adopted.

The National Capital Region Transportation Plan, through the CMP, strongly encourages consideration and implementation of strategies such as the following to manage both existing and future additional roadway capacity:

- Transportation Demand Management (TDM) strategies, such as Commuter Connections programs.
- Traffic Operational Improvements
- Public Transportation Improvements
- Intelligent Transportation Systems technologies
- Combinations of the above strategies.

Roadway capacity increases may be needed in specific locations for a number of reasons including bottleneck removal, safety improvements, economic development, and other reasons. Managing this capacity through the CMP is key.

3.7 Project-Related Congestion Management

There have been examples in the Washington region of successfully implemented project-related congestion management for major construction projects. Strategies include providing incentives for commuters to give up driving alone and try transit, carpooling, vanpooling, and other alternatives, disseminating more information about construction projects and congestion, improving alternative routes, providing fire and rescue equipment and staff for emergency services along with additional police services, adding additional spaces to park-and-ride lots, providing additional shuttle bus services, etc.

Some successful examples of past projects implementing project-related congestion management during construction include the Woodrow Wilson Bridge project, the I-95/I-495 Springfield Interchange project, the DDOT South Capitol Street and 11th Street Bridge projects, and Northern Virginia Megaprojects.

Current projects that include project related congestion management include:

I-495 EXPRESS LANES NORTHERN EXTENSION (495 NEXT)

The I-495 Express Lanes Northern Extension (495 NEXT) project is a public-private partnership between the Commonwealth of Virginia and Transurban that involves extending the 495 Express Lanes north by two-and-a-half miles from the Dulles Corridor to the George Washington Memorial Parkway interchanges near the American Legion Bridge.

Congestion management strategies implemented for this project can be found on the Transportation Management Plan page of the project

TRANSFORM 66

As part of the Transform 66 projects (both Inside and Outside of the Beltway) VDOT, DRPT, and the Northern Virginia Transportation Commission (NVTC) partnered to create the Commuter Choice Program using toll revenues from the I-66 and I-95/395 express lanes to support ongoing transportation projects in the region to help reduce congestion.

4. STUDIES OF CONGESTION MANAGEMENT STRATEGIES

Congestion management strategies are a critical component of the CMP, and this chapter delves into the performance measures adopted by the TPB and its subcommittees, evaluating the effectiveness of demand and operational management strategies. Several noteworthy studies of these strategies are also presented as illustrative examples.

4.1 Review of Performance Measures

4.1.1 INTRODUCTION TO PERFORMANCE MEASURES

A performance measure, or indicator, is a means to gauge and understand the usage of a transportation facility, or the characteristics of particular travelers and their trips. The performance measure/indicator may refer to a particular location or "link" of the transportation system.

Performance measures can be either quantitative or qualitative. It may refer to the experience of a traveler on a trip between a particular origin and a particular destination. It may summarize all trips or trip makers between a particular origin and destination pair. Or, it may describe the operation of one mode of transportation versus another.

Federal regulations[157] state that the CMP should include:

"Definition of congestion management objectives and performance measures to assess the extent of congestion and support the evaluation of the effectiveness of congestion reduction and mobility enhancement strategies for the movement of people and goods."

The fields of transportation planning have typically used mode-specific performance measures or indicators to gauge conditions on the system. These include motor-vehicle specific performance measures such as traffic volumes, capacities, and level-of-service.

The TPB adopted a set of performance measures in the 1994 Congestion Management System (CMS) Work Plan. Since then, there has been an evolution towards more traveler-oriented metrics in conveying congestion and related information to the general public. Some of the measures are leveraged by emerging highway performance monitoring activities such as the Eastern Transportation Corridor Coalition Vehicle Probe Project that provides probe-based continuous monitoring.

In the Final Rule on "National Performance Management Measures; Assessing Performance of the National Highway System, Freight Movement on the Interstate System, and Congestion Mitigation and Air Quality Improvement Program" which became effective on May 20, 2017 [82 FR 22879][158], FHWA established a set of performance measures for State departments of transportation (State DOTs) and Metropolitan Planning Organizations (MPOs) to use as required by the Moving Ahead for Progress in the 21st Century Act (MAP-21) and the Fixing America's Surface Transportation (FAST) Act.

[157] Federal Register, Vol. 81, No.103, May 27, 2016.

[158] Docket No. FHWA-2013-0054, RIN 2125-AF54, Federal Register - Vol. 82, No. 11, Pg. 5970 - January 18, 2017: https://www.gpo.gov/fdsys/pkg/FR-2017-01-18/pdf/2017-00681.pdf.

The highway system performance measures are used by State DOTs and MPOs to assess the performance of the Interstate and non-Interstate National Highway System (NHS) for the purpose of carrying out the National Highway Performance Program (NHPP); to assess freight movement on the Interstate System; and to assess traffic congestion and on-road mobile source emissions for the purpose of carrying out the Congestion Mitigation and Air Quality Improvement (CMAQ) Program.

In accordance with the federal performance measurement requirements, targets for the highway system performance measures are set for a four-year or quadrennial period: the initial period was for 2018 through 2021, the second period is for 2022-2025. All highway travel targets are set for calendar years, with the exception of on-road mobile source emissions reductions achieved by CMAQ projects which are set for federal fiscal years. In addition to four-year targets, targets are also set for the mid-point of the period, or the two year mark, at which time the four-year targets can also be revised.[159] In developing its two-year and four-year projections and setting targets, the TPB coordinates with the three State DOTs. With regard to the forecasting and setting of the targets that apply to the urbanized area and the air quality maintenance area, the TPB has taken the lead in projecting future performance and setting targets in coordination with the DOTs. The TPB also contributes to the State DOT Performance Reports that are due to FHWA every two years.

Information on the 2022-2025 quadrennial targets, and on actual performance versus the 2018-2021 quadrennial targets, can be found in the Visualize 2045 Appendix D: PBPP System Performance Report (Revised January 2023).

4.1.2 MAP-21/FAST ACT PERFORMANCE MEASURES

The MAP-21 and FAST Acts transformed the Federal-aid highway program by establishing new requirements for performance management to ensure the most efficient investment of Federal transportation funds. Performance management increases the accountability and transparency of the Federal-aid highway program and provides a framework to support improved investment decision-making through a focus on performance outcomes for key national transportation goals. State DOTs and MPOs will be expected to use the information and data generated as a result of these regulations to inform their transportation planning and programming decisions.

Performance measures in four areas, relevant to the congestion management process, were defined in the final rule on "National Performance Management Measures; Assessing Performance of the National Highway System, Freight Movement on the Interstate System, and Congestion Mitigation and Air Quality Improvement Program" are summarized in Table 4-1, including:

- percent of reliable person-miles traveled on the Interstate.
- percent of reliable person-miles traveled on the non-Interstate NHS.
- percentage of Interstate system mileage providing for reliable truck travel time (Truck Travel Time Reliability Index)
- annual hours of peak hour excessive delay per capita

TPB, in conjunction with state DOTs, works to analyze these measures and set associated targets.

[159] In January 2024, the USDOT issued a Notice of Proposed Rulemaking on National Performance Management Measures that, if finalized, would adjust some PBPP deadlines and related requirements. See: https://www.federalregister.gov/documents/2024/01/25/2024-00373/national-performance-management-measures-extenuating-circumstances-highway-performance-monitoring#citation-4-p4862.

Table 4-1 Performance Measures in the final rule on "National Performance Management Measures; Assessing Performance of the National Highway System, Freight Movement on the Interstate System, and Congestion Mitigation and Air Quality Improvement Program

Areas	Measures	Metrics	Equations	Thresholds	Time Periods (in a Calendar Year)	Geographic Areas	Data	Target Scope
Performance of the Interstate	Percent of the Interstate System providing for Reliable Travel	Level of Travel Time Reliability (LOTTR)	80th TT / 50th TT	Reliable: LOTTR < 1.50	6:00 am-10:00 am, M-F 10:00 am-4:00 pm, M-F 4:00 pm-8:00 pm, M-F 6:00 am-8:00 pm, S-S	Interstate	1) Travel Time Data Set; 2) Reporting segments	Statewide target; MPO-wide target
	Percent of the Interstate System where peak hour travel times meet expectations	Peak Hour Travel Time Ratio (PHTTR)	Longest PHTT / Desired PHTT in that hour the longest PHTT occurred	Meet expectation: PHTTR < 1.50	Could be any one of the 6 peak hours: 6:00 am-9:00 am, 4:00 pm-7:00pm in non-Federal holiday weekdays	Interstate in urbanized area with population over 1 million	1) Travel Time Data Set; 2) Reporting segments; 3) Desired Peak Period Travel Time	A single urbanized area target
Performance of the Non-Interstate NHS	Percent of the non-Interstate NHS providing for Reliable Travel	Level of Travel Time Reliability (LOTTR)	80th TT / 50th TT	Reliable: LOTTR < 1.50	6:00 am-10:00 am, M-F 10:00 am-4:00 pm, M-F 4:00 pm-8:00 pm, M-F 6:00 am-8:00 pm, S-S	Non-Interstate NHS	1) Travel Time Data Set; 2) Reporting segments	Statewide target; MPO-wide target
	Percent of the non-Interstate NHS where peak hour travel times meet expectations	Peak Hour Travel Time Ratio (PHTTR)	Longest PHTT / Desired PHTT in that hour the longest PHTT occurred	Meet expectation: PHTTR < 1.50	Could be any one of the 6 peak hours: 6:00 am-9:00 am, 4:00 pm-7:00pm in non-Federal holiday weekdays	Non-Interstate NHS in urbanized area with population over 1 million	1) Travel Time Data Set; 2) Reporting segments; 3) Desired Peak Period Travel Time	A single urbanized area target
Freight movement on the Interstate System	Percent of the Interstate System Mileage providing for Reliable Truck Travel Time	Truck Travel Time Reliability	95th Truck TT / 50th Truck TT	Reliable: Annual Average Truck Travel Time Reliability < 1.50	24/7/365	Interstate	1) Travel Time Data Set; 2) Reporting segments	Statewide target; MPO-wide target
	Percent of the Interstate System Mileage Uncongested	Average Truck Speed	Arithmetic mean of Truck Speeds **(leading to inconsistency between average speed and average travel time)**	Uncongested: Truck Speed > 50 mph	24/7/365	Interstate	1) Travel Time Data Set; 2) Reporting segments	Statewide target; MPO-wide target
Traffic Congestion	Annual Hours of Excessive Delay per Capita	Vehicle-hours of delay per capita	Delay * volume	Delay occurs if speed < 35 mph on Interstate (FC1), freeways and expressways (FC2); and < 15 mph on principal arterials (FC3) and all other NHS	24/7/365	NHS in nonattainment or maintenance urbanized area with population over 1 million	1) Travel Time Data Set; 2) Reporting segments; 3) **Hourly traffic volume**	A single urbanized area target

4.1.3 TRAVELER-ORIENTED CMP PERFORMANCE MEASURES

Since the TPB development of the CMP performance measures in 1994 (see Section 4.1.4), there has been an evolution towards more traveler-oriented metrics in conveying congestion and related information to the general public. Some of the measures are leveraged by emerging highway performance monitoring activities such as the Eastern Transportation Corridor Coalition's Vehicle Probe Project that provides probe-based continuous monitoring. Earlier in this report, the following four measures were used, with the first two quantifying congestion and the latter two travel time reliability. The 2010 Strategic Plan for the Management, Operations and Intelligent Transportation Systems (MOITS) Program[160] adopted Travel Time Index, Buffer Time Index and Planning Time Index as three regional indices of travel conditions and traveler's experience.

4.1.3.1 Travel Time Index (TTI)

TTI is defined as the ratio of actual travel time to free-flow travel time, measures the intensity of congestion. The higher the index, the more congested traffic conditions it represents, e.g., TTI = 1.00 means free flow conditions, while TTI = 1.30 indicates the actual travel time is 30% longer than the free-flow travel time. For more information, please refer to Travel Time Reliability: Making It There On Time, All The Time[161], a report published by the Federal Highway Administration and produced by the Texas Transportation Institute with Cambridge Systematics, Inc. This report uses the following method to calculate TTI:

1) Download INRIX 5-minute raw data from the RITIS Probe Data Analytics Suite website (https://pda.ritis.org/suite/).

2) Aggregate the raw data to monthly average data by day of the week and hour of the day. Harmonic Mean was used to average the speeds and reference speeds (Harmonic Mean is only used here; other averages used are all Arithmetic Mean). For each segment (TMC), the monthly data have 168 observations (7 days in a week * 24 hours a day) in a month.

3) Calculate TTI = reference speed / speed in the monthly data. If TTI < 1 then make TTI = 1. If constraint TTI >= 1 was not imposed, some congestion could be cancelled by conditions with TTI < 1.

4) Calculate regional average TTI for the Interstate system, non-Interstate NHS, non-NHS, and all roads for AM peak (6:00-10:00 am) and PM Peak (3:00-7:00 pm) respectively, using segment length as the weight.

5) Calculate the average TTI of the AM Peak and PM Peak to obtain an overall congestion indicator.

4.1.3.2 Planning Time Index (PTI)

PTI is defined as the ratio of 95th percentile travel time to free flow travel time, measures travel time reliability. The higher the index, the less reliable traffic conditions it represents, e.g., PTI = 1.30 means a traveler has to budget 30% longer than the uncongested travel time to arrive on time 95% of the times (i.e., 19 out of 20 trips), while TTI = 1.60 indicates that one has to budget 60% longer than the uncongested travel time to arrive on time most of the times. For more information, please

[160] COG/TPB, http://www1.mwcog.org/transportation/activities/operations/plan/MOITS-Strategic-Plan-Executive-Summary-2010-06-16.pdf

[161] https://ops.fhwa.dot.gov/publications/tt_reliability/ttr_report.htm

refer to Travel Time Reliability: Making It There On Time, All The Time[162], a report published by the Federal Highway Administration and produced by the Texas Transportation Institute with Cambridge Systematics, Inc. This report uses the following method to calculate PTI:

1) Calculate TTI = reference speed / speed in the monthly data obtained in step 2 of the above TTI methodology. Do not impose constraint TTI >= 1, since the purpose of this calculation is to rank the TTIs to find the 95th percentile, not to average the TTIs.

2) Calculate monthly average PTI: including sorting the data obtained in step 1 by segment, peak period, and month, finding the 95th percentile TTI and this TTI is PTI by definition, and averaging the PTIs using segment length as the weight to get regional summaries (for the Interstate system, non-Interstate NHS, non-NHS, and all roads for AM peak (6:00-10:00 am) and PM Peak (3:00-7:00 pm) respectively).

3) Calculate yearly average PTI: including sorting the data obtained in step 1 by segment and peak period, finding the 95th percentile TTI and this TTI is PTI by definition, and averaging the PTIs using segment length as the weight to get regional summaries.

4) Calculate the average PTI of the AM Peak and PM Peak to obtain an overall travel time reliability indicator.

4.2 Review of Congestion Management Strategies

4.2.1 INTRODUCTION

Federal regulations state that the CMP should include:

"Identification and evaluation of the anticipated performance and expected benefits of appropriate congestion management strategies that will contribute to the more effective use and improved safety of existing and future transportation systems based on the established performance measures. The following categories of strategies, or combinations of strategies, are some examples of what should be appropriately considered for each area:

(i) Demand Management measures, including growth management and congestion pricing;
(ii) Traffic operational improvements;
(iii) Public transportation improvements;
(iv) ITS technologies as related to the regional ITS architecture; and
(v) Where, necessary, additional system capacity."[163]

To address this point, strategy lists have been developed as a way of categorizing congestion management strategies and characterizing the current impact, or potential impact, these strategies have throughout our region.

[162] https://ops.fhwa.dot.gov/publications/tt_reliability/ttr_report.htm

[163] §450.322(d), Metropolitan Transportation Planning, Final Rule, Federal Register, May 27, 2016 – emphasis added.

These lists are modeled after the longstanding Transportation Emission Reduction Measure (TERM) process for air quality in the region. The TERM list was formed as a way of developing additional plan and program elements which could be utilized to mitigate emission increases.

Similarly, lists have been developed for strategies under consideration for Congestion Management. At this time the effort is proposed to be qualitative, as the congestion information is not tied to one specific location. In addition, some strategies are regional while others are local , and a qualitative effort better characterizes the impact they have on the region as a whole.

The following section contains background and summary information of how the Strategy Lists were developed.

4.2.2 DESCRIPTIONS OF STRATEGIES

The general characteristics of strategies are provided in Table 4-2 and Table 4-3; one for operational management strategies (those strategies contributing to a more effective use of existing systems) and one for demand management strategies (those that influence travel behavior). The qualitative criteria across the top of the lists, and the methodology used to categorize each strategy as “some impact (x)”, “significant impact (xx)”, and “high impact (xxx)” are the same for both tables. The separate tables are simply for the purpose of distinguishing the two types of strategies. A more detailed review of the strategies is provided in Appendix F.

Table 4- 2 Congestion Management Process (CMP) Demand Management Strategies Criteria

1. Low (x)
2. Medium (xx)
3. High (xxx)

		QUALITATIVE CRITERIA									
		Congestion Related				Others					
STRATEGY		Reduces Overall Congestion	Reduces Incident-related Congestion	Supports/Promotes Multi-modal Transportation	Regional Applicability	Local Applicability	Existing Level of Deployment	Ease of Implementation	Cost	Cost Effectiveness	Enhance Existing Programs
C.5.0	***Alternative Commute Programs***										
C.5.1	Carpooling	xxx	x	x	xxx	xxx	xxx	xx	x	xxx	xxx
C.5.2	Ridematching Services	xxx	x	x	xxx	xxx	xxx	xx	x	xxx	xxx
C.5.3	Vanpooling	xxx	x	x	xxx	xx	xx	xx	x	xxx	xxx
C.5.4	Telecommuting	xx	x	x	xxx	xx	xx	xxx	x	xx	xxx
C.5.5	Promote Alternate Modes	xx	x	xxx	xxx	xxx	xxx	xxx	x	xx	xxx
C.5.6	Compressed/Flexible Workweeks	xx	x	x	xxx	xxx	xxx	xxx	x	x	xx
C.5.7	Employer Outreach/Mass Marketing	xx	x	xxx	xxx	xxx	xx	xx	xx	xx	xxx
C.5.8	Parking Cash-out	xx	x	xxx	x	xxx	x	x	xxx	xx	xx
C.5.9	Alternative Commute Subsidy Program	xx	x	xxx	xxx	xx	xx	x	x	xxx	xxx
C.5.10	App-based Incentives (e.g. incenTrip)	xx	xxx	xxx	xxx	xx	xx	xx	x	xxx	xxx
C.6.0	***Managed Facilities***										
C.6.1	High-Occupancy Vehicle (HOV) Facilities	xx	x	xxx	xxx	xx	xx	xx	xxx	xxx	xxx
C.6.2	Variably Priced Lanes (VPL)	xxx	x	xx	xxx	xx	xx	xx	xxx	xxx	xx
C.6.3	Cordon Pricing	xxx	x	xxx	xxx	xx	x	x	xx	xxx	xx
C.7.0	***Public Transportation Improvements***										
C.7.1	Electronic Payment Systems	xx	x	xxx	xx	xx	xxx	xx	xx	xxx	xx
C.7.2	Improvements/Added Capacity to Regional Rail and Bus Transit	xx	xx	xxx	xx	xxx	xx	x	xxx	xxx	xx
C.7.3	Improving Accessibility to Multi-modal Options	xx	x	xxx	xx	xxx	xx	xx	xx	xx	xxx
C.7.4	Park-and-Ride Lot Improvements	xx	x	xx	xx	xx	xx	xx	xx	xx	xx
C.7.5	Carsharing Programs	xx	x	xxx	xxx	xxx	xx	xxx	xx	xx	xxx
C.8.0	***Pedestrian, bicycle, and multi-modal improvements***										
C.8.1	Improve Pedestrian Facilities	xx	x	xxx	xx	xxx	xx	xx	xx	xx	xxx
C.8.2	Creation of New Bicycle and Pedestrian Facilities	xx	x	xxx	xxx	xxx	xx	xx	xx	xx	xxx
C.8.3	Addition of Bicycle Racks at Public Transit Stations/Stops	x	x	xx	xxx	xxx	xx	xxx	x	x	xxx
C.8.4	Bikesharing/Micromobility Programs	xx	x	xxx	xxx	xxx	xx	xxx	xx	xx	xxx
C.9.0	***Growth Management***										
C.9.1	Coordination of Regional Activity Centers	xx	x	xxx	xxx	xxx	xx	x	xxx	xxx	xx
C.9.2	Implementation of TLC program (i.e. Coordination of Transportation and Land Use with Local Gov'ts)	xx	x	xxx	xxx	xxx	xx	xxx	x	xxx	xxx
C.9.3	"Live Near Your Work" Program	xx	x	xx	xxx	xx	x	xx	xx	x	xx

Table 4- 3 Congestion Management Process (CMP) Operational Management Strategies Criteria

1. Low (x)
2. Medium (xx)
3. High (xxx)

		QUALITATIVE CRITERIA									
		Congestion Related				Others					
STRATEGY		Reduces Overall Congestion	Reduces Incident-related Congestion	Supports/Promotes Multi-modal Transportation	Regional Applicability	Local Applicability	Existing Level of Deployment	Ease of Implementation	Cost	Cost Effectiveness	Enhance Existing Programs
C.1.0	***Incident Mngt./Non-recurring***										
C.1.1	Imaging/Video for Surveillance and Detection	xx	xxx	xx	xxx	xxx	xx	xx	xx	xxx	xxx
C.1.2	Service Patrols	xx	xxx	x	xxx	xxx	xx	xxx	xx	xxx	xxx
C.1.3	Emergency Management Systems	x	xx	x	xx	xxx	xxx	xx	xxx	xxx	xxx
C.1.4	Emergency Vehicle Preemption	x	xx	x	x	xxx	xx	xx	xx	x	xx
C.1.5	Road Weather Management	x	xxx	x	xxx	xxx	xx	xx	xx	xx	xx
C.1.6	Traffic Management Centers	xx	xxx	xx	xxx	xx	xx	xx	xx	xxx	xxx
C.1.7	Curve Speed Warning System	xx	xx	x	x	xx	x	xx	xx	xx	x
C.1.8	Work Zone Management	xx	xxx	x	xx	xxx	xx	xx	xx	xx	xx
C.1.9	Automated Truck Rollover Systems	x	xx	x	x	xx	xx	xx	xx	xx	xx
C.1.10	Regional Incident Coordination	xxx	xxx	x	xxx	xx	xxx	xx	x	xxx	xxx
C.2.0	***ITS Technologies***										
C.2.1	Advanced Traffic Signal Systems	xxx	xx	xx	xxx	xxx	xx	xx	xxx	xxx	xxx
C.2.2	Electronic Payment Systems	xxx	x	xx	xxx	xx	xx	xx	xx	xxx	xx
C.2.3	Freeway Ramp Metering	xx	x	x	xx	xx	xx	xx	xx	xx	xx
C.2.4	Bus Priority Systems	x	x	xxx	xxx	xxx	x	xx	xxx	xx	xx
C.2.5	Lane Management (e.g. Variable Speed Limits)	xx	xx	x	xx	xxx	x	xx	xx	xx	xx
C.2.6	Automated Enforcement (e.g. Red Light Cameras)	x	x	x	x	xxx	xx	xx	xx	xx	xx
C.2.7	Traffic Signal Timing	xxx	x	xx	xxx	xxx	xx	xxx	x	xxx	xxx
C.2.8	Reversible Lanes	xx	x	x	xx	xxx	x	x	xx	xx	xx
C.2.9	Parking Management Systems	xx	x	xx	xx	xxx	x	x	xxx	xx	xx
C.2.10	Dynamic Routing/Scheduling	xx	x	xx	xxx	xxx	x	x	xxx	xx	xx
C.2.11	Service Coordination and Fleet Mngt. (e.g. Buses and Trains Sharing Real-time Information)	xx	x	xxx	xxx	xxx	xx	x	xx	xx	xx
C.2.12	Probe Traffic Monitoring	xx	xxx	x	xxx	xx	xxx	xxx	x	xxx	xxx
C.3.0	***Advanced Traveler Information Systems***										
C.3.1	Traffic Information Systems (e.g. 511)	xx	xxx	xx	xxx	x	xx	xx	xxx	xx	xxx
C.3.2	Variable Message Signs (VMS)	xx	xxx	xx	xx	xxx	xx	xx	xx	xxx	xxx
C.3.3	Highway Advisory Radio (HAR)	x	xx	x	xx	xxx	xx	xxx	xx	x	xx
C.3.4	Transit Information Systems	xx	xx	xxx	xx	xxx	xx	x	xx	xx	xxx
C.3.5	Information Sharing with Private Sector Apps	xx	xxx	x	xxx	xxx	xx	xx	x	xxx	xx
C.4.0	***Traffic Engineering Improvements***										
C.4.1	Safety Improvements	x	xxx	x	x	xxx	xx	xxx	x	xxx	xxx
C.4.2	Turn Lanes	xx	x	x	x	xxx	xx	xx	xx	xx	x
C.4.3	Roundabouts	x	xx	x	x	xxx	x	x	x	xx	xx

4.3 Examples of Strategies Studies

4.3.1 ANALYSIS OF TRANSPORTATION EMISSIONS REDUCTION MEASURES (TERMS)

4.3.1.1 Overview

Transportation Emission Reduction Measures (TERMs) are strategies or actions employed to offset increases in nitrogen oxide (NOx) and volatile organic compound (VOC) emissions from mobile sources. The TPB first adopted TERMs in FY 1995.

The Clean Air Act Amendments of 1990 (CAAA) and SAFETEA-LU require metropolitan planning organizations and DOTs to perform air quality analyses, to ensure that the transportation plan and program conform to mobile emission budget established in the State Implementation Plans (SIP). Consequently MPOs and DOTs are required to identify TERMs that would provide emission-reduction benefits and other measures intended to modify motor vehicle use.

Selection of the TERMs requires quantitative as well as qualitative assessment. The quantitative assessment includes specific information on the benefits, costs, and expected air-quality benefits. Qualitative criteria includes ranking based on the subjective criteria's such as ease of implementation, how to implement, and synergy with other measures.

The effects of TERMs on GHG reduction in the Washington region were analyzed in the "What Would It Take" Scenario Study (see Section 4.3.3).

4.3.1.2 Findings and Applications to Congestion Management

Most TERMs were intended to reduce either the number of vehicle trips (VT), vehicle miles traveled (VMT), or both. These strategies may include ridesharing and telecommuting programs, improved transit and bicycling facilities, clean fuel vehicle programs or other possible actions. These TERMs were not only important to offsetting increases in NOx and VOC, but many are important in congestion management by reducing trips and miles of travel.

The Washington region has adopted and implemented several TERMs with the sole aim of reducing emissions, such as the addition of clean diesel bus service, taxicabs with Compressed Natural Gas (CNG) cabs, and CNG buses. However, many TERMs also have an impact on congestion management. Examples of some of these congestion-mitigating TERMs that have been implemented included upgrading traffic signal systems, telecommuting programs, park-and-ride lots, and pedestrian facilities.

4.3.2 SCENARIO PLANNING

4.3.2.1 "CLRP Aspirations" Scenario

Presented in 2013, the "CLRP Aspirations" scenario was an integrated future land use and transportation scenario for building on the key results of previous TPB scenario studies. It included concentrated land use growth in Regional Activity Centers, a regional network of variably priced lanes, and a high quality bus rapid transit network operating on the VPL network for the current planning horizon year 2040. Relative to the 2012 CLRP baseline for 2040, the full CLRP Aspirations Scenario showed increases in trips of all modes (auto person trips, transit trips, and non-motorized trips) due to the increase in population, both auto and transit capacity, and shifts in land use that

enable more non-motorized trips. The Scenario showed a slight decrease in VMT, a decrease in VMT per capita, and a significant decrease in regional vehicle-hours of delay.[164]

4.3.2.2 "What Would It Take?" Scenario

Completed in May 2010, the "What Would It Take?" scenario started with the adopted COG non-sector specific goals for reducing mobile source greenhouse gas emissions for 2030 and beyond. It assesses how such goals might be achieved in the transportation sector through different combinations of interventions that include increasing fuel efficiency, reducing the carbon-intensity of fuel, and improving travel efficiency. The study found that:

- Strategies analyzed to date do not achieve regional goals of reducing greenhouse gas emissions, and additional strategies can and should be analyzed.
- Goals are difficult to meet and will require emission reductions in all three categories: Vehicle efficiency (CAFE improvement), alternative fuel (cellulosic ethanol), and travel efficiency (strategies aimed at reducing VMT, congestion, and delays).
- While major reductions can come from federal energy policies, local governments can make significant reductions quickly.
- Some strategies may not have major greenhouse gas (GHG) reduction potential, but have multiple benefits worth exploring through benefit-cost analysis (e.g. the MATOC program).

The study also recommended nine potential local actions that can be implemented quickly to reduce GHG.

4.3.2.3. Multi-Sector Working Group

This group comprised senior staff from transportation, planning, and environment sectors of COG member agencies including state departments of transportation. A consultant studied effective strategies to reduce greenhouse gases from the transportation, land use and built environment sectors. Many of the strategies studied had the added benefit of reducing vehicle trips and vehicle miles of travel affecting congestion positively. This was a study under the direction of the COG Board of Directors and the January 2016 Technical Report on Multi-Sector Approach to Reducing Greenhouse Gas Emissions in the Metropolitan Washington Region was published.[165]

4.3.2.4. Long-Range Plan Task Force

In 2016 and 2017, TPB formed this task force to identify a limited set of regionally significant projects, programs, and policies above and beyond what is in the region's current long-range transportation plan. The Task Force and supporting consultants identified and analyzed a number of long-range planning strategies, many of which could address congestion. Following the Task Force's work, Seven Endorsed Initiatives were included in Visualize 2045 planning.[166]

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[165] https://www.mwcog.org/documents/2016/08/01/multi-sector-approach-to-reducing-greenhouse-gas-emissions-in-the-metropolitan-washington-region-final-technical-report/

[166] http://mwcog.maps.arcgis.com/apps/Cascade/index.html?appid=debc2550777b4cc2bae2364c7712a151

4.3.2.5. Climate Change Mitigation Study

The TPB Climate Change Mitigation Study of 2021[167] (CCMS) was a scenario study whose goal was to identify potential pathways for the region to reduce on-road, transportation sector greenhouse gas emissions to meet COG's regional greenhouse gas (GHG) reduction goals associated with 2030 and 2050. The analysis phase of the study included three "top-down" scenarios and 10 "bottom-up" scenarios that explore single and combination pathways to reduce on-road, transportation-sector greenhouse gas emissions. Among scenarios analyzed were strategies that could also have congestion management benefits, including:

- *Mode Shift and Travel Behavior (MSTB):* Strategies to reduce motor vehicle travel, typically measured as vehicle miles of travel, by shifting travel from driving alone to more efficient modes, such as transit, ridesharing, bicycling, and walking; reducing vehicle trip lengths, such as through land use strategies; or reducing trip-making entirely, such as through telework.

- *Transportation Systems Management and Operations (TSMO):* Strategies to optimize the efficiency of travel by reducing vehicle travel delay and/or encourage more eco-friendly driving patterns.

The study estimated reduction of vehicle miles of travel from combinations of analyzed strategies, and brought strategies and scenarios once again to the attention of member agencies.

4.3.3 MATOC BENEFIT-COST ANALYSIS

The Metropolitan Area Transportation Operations Coordination (MATOC) Program is a joint program of VDOT, MDOT, DDOT, WMATA and TPB. It aims to provide real-time situational awareness of transportation operations in the National Capital Region (NCR), especially during emergencies and other incidents with significant impacts on travelers and on the transportation systems of the region.

A benefit-cost study has been carried out to quantify the effectiveness of this program which shows a $ 10 benefit for every $ 1 spent on the program.

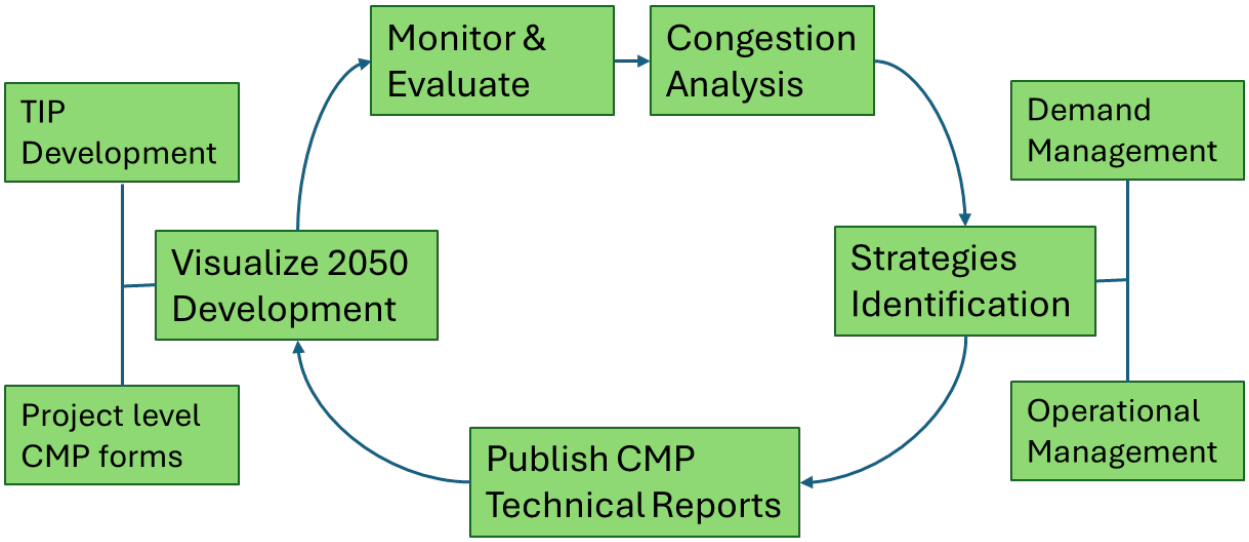
[167] https://www.mwcog.org/tpb-climate-change-mitigation-study-of-2021/.

5. HOW RESULTS OF THE CMP ARE INTEGRATED INTO THE NATIONAL CAPITAL REGION TRANSPORTATION PLAN

The TPB maintains a robust Congestion Management Process (CMP) to address traffic congestion in the National Capital Region. The CMP aligns with federal transportation planning requirements outlined in Titles 23 and 49 of the U.S. Code and associated regulations. Visualize 2050 directly addresses this mandate by incorporating projects, programs, and policies that target both travel demand reduction and operational management strategies within the region. The CMP serves as a vital framework within Visualize 2050.

A pivotal mandate from USC Title 23 requires that the transportation planning process "…shall address congestion management through a process that provides for effective management and operation… utilizing travel demand reduction and operational management strategies." The CMP is not a siloed entity but a core component of the planning ecosystem, shaping the strategies and, ultimately, the projects, programs, and policies encapsulated in Visualize 2050 through the ongoing process informed by previous National Capital Region Transportation Plan (NCRTP) updates, see Figure 5-1.

Figure 5-8 National Capital Region Transportation Plan Development and the CMP



The CMP relies on a systematic approach to monitor the performance of the National Capital Region's transportation system, identify areas of congestion, and evaluate the effectiveness of various strategies to alleviate traffic congestion. It operates through a continuous cycle of data collection, analysis, and action. By monitoring key performance measures, the TPB and its regional partners gain a clear understanding of how the National Capital Region's transportation system is functioning. This data becomes the foundation for developing targeted strategies and initiatives to reduce congestion. These strategies fall into two main categories: demand management and operational management.

Demand management strategies *aim to reduce the overall number of vehicles on the road, particularly single-occupancy vehicles during peak travel times. This can be achieved through initiatives like promoting carpooling, ridesharing, telecommuting, and encouraging greater use of public transportation and alternative modes like bicycling and walking.*

Operational management strategies *focus on optimizing the efficiency of the existing transportation system. This includes proactive measures like incident management, leveraging technological advancements for traffic signal operations, and exploring capacity improvements where necessary.*

The strength of the CMP lies in its collaborative nature. The TPB Technical Committee, along with subcommittees focused on Systems Performance, Operations & Technology, and Commuter Connections, the TPB's transportation demand management program, actively engage with staff to coordinate, inform, and refine CMP activities. Additionally, the TPB's Commuter Connections program plays a vital role in implementing impactful demand management strategies, helping to shift travel behavior towards more sustainable and efficient options.

By fostering collaboration across agencies and stakeholders, the CMP ensures a comprehensive and data-driven approach to tackling congestion. This introduction sets the stage for the following sections, which will delve deeper into the core elements of the CMP as they apply to the development of Visualize 2050, the roles of key players, and the importance of public engagement in shaping a more efficient and equitable transportation future for the region.

5.1 Components of the CMP to Be Integrated in Visualize 2050

There are four major components of the CMP to be integrated in Visualize 2050, including:

- Monitoring and evaluating transportation system performance
- Defining and analyzing strategies
- Compiling project-specific congestion management information
- Implementing and assessing strategies

See Table 5-1 for an overview of the CMP products and resources associated with each component of the CMP, also described in the following sections.

Table 5-2: Visualize 2050 CMP Components

Component	TPB Role	CMP Documentation
1. *Monitoring and evaluating transportation system performance*	The TPB monitored the performance of the region's transportation system and identified and evaluated the benefits that various congestion management strategies may have.	The TPB travel monitoring activities associated with the CMP were communicated to inform decision makers on the region's congestion through numerous documents, graphics and text compiled on the TPB website including an ongoing series of reports: National Capital Region Congestion Report[168].
2. *Defining and analyzing strategies*	Leveraging accurate and reliable data, the TPB and regional partners collaboratively established priority strategies to alleviate congestion. These strategies encompassed both demand management, aiming to influence travel behavior, and operational management, focusing on optimizing the efficiency of the transportation system.	The TPB's congestion management strategies can be found online at: Major CMP Strategies[169]. The TPB's Congestion Management Technical Report provides updated congestion information and congestion management strategies on the region's transportation systems. The 2022 CMP Technical Report most directly influenced project inputs submitted in 2023 and 2024 for inclusion in Visualize 2050.
3. *Compiling project-specific congestion management information*	The TPB collects from project sponsors a CMP Documentation Form for projects that will be programmed with construction funds in the FY 26-29 TIP and are on certain regional roadways. The requirement is that SOV capacity-increasing projects are only supposed to be implemented if non-SOV-capacity strategies were also considered. The form documents from project sponsors that such consideration has occurred.	Through the TPB's 2023 Technical Inputs Solicitation for projects, sponsors indicated whether the need for their project stems from recurring or non-recurring congestion. Additionally, they specified if the project involves capacity expansion and, if so, which exemption criteria apply. Further details are available in the form provided in Appendix E of the 2022 CMP Technical Report[170].
4. *Implementing strategies*	The TPB manages the Commuter Connections program to promote and implement regional demand management. TPB members implement the strategies and submit projects, programs, and policies to the TPB for inclusion in the NCRTP and TIP.	TPB members and Commuter Connections submitted projects, programs, and policies that reflect the CMP strategies for inclusion in the Visualize 2050 and the FY26-29 TIP.

[168] https://www.mwcog.org/congestion/

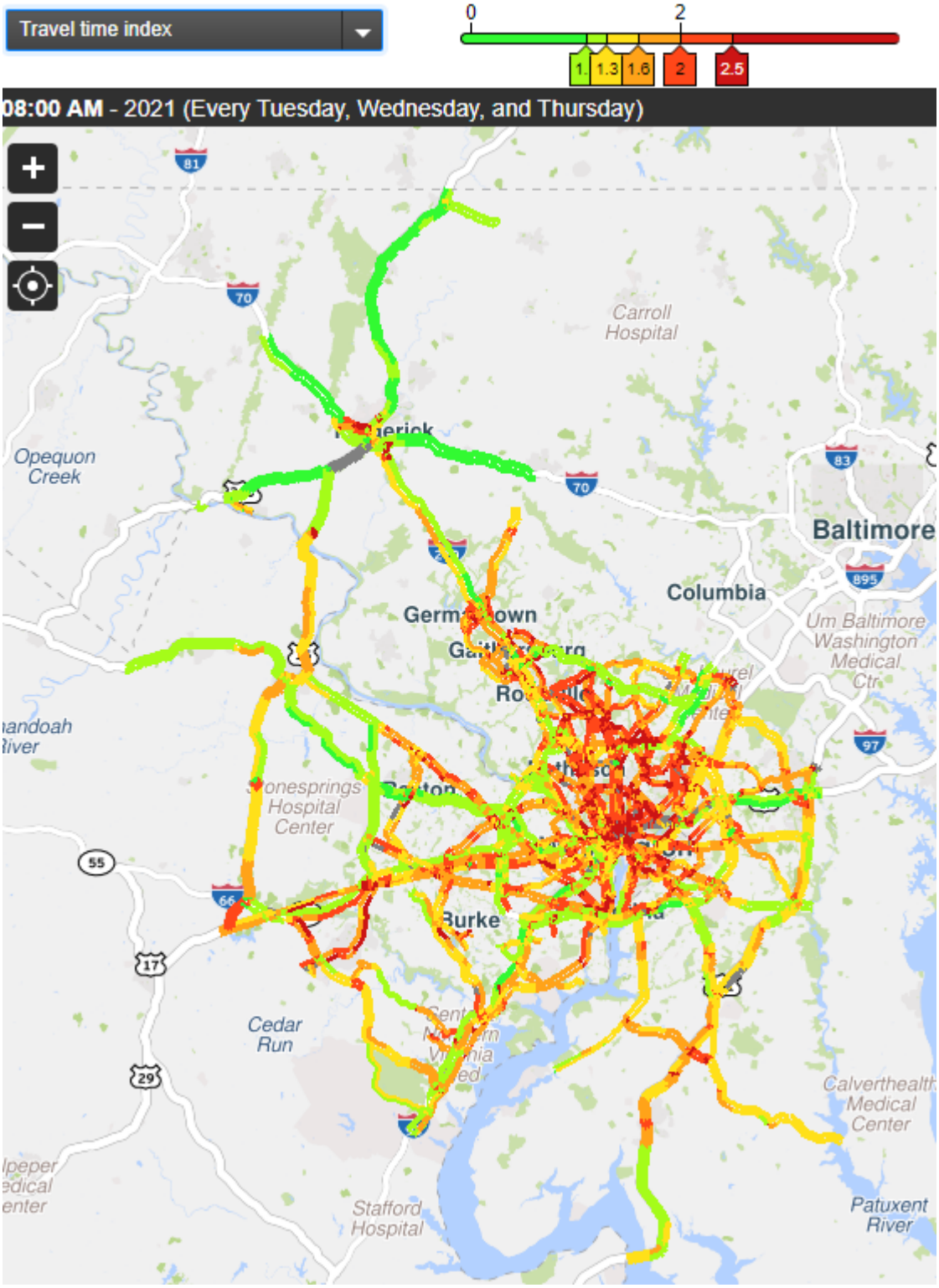
[169] https://www.mwcog.org/transportation/planning-areas/management-operations-and-safety/cmp/strategies/

[170] https://www.mwcog.org/documents/2022/07/08/congestion-management-process-cmp-technical-report-congestion-management-process/

5.2 Monitoring and Evaluating Transportation System Performance

In monitoring and evaluating transportation system performance, the TPB leverages vehicle probe data (see Figure 5-2 as an example) to support both the CMP and travel demand forecast model calibration, complementing operating agencies' own information, and illustrating locations of existing congestion. Travel demand modeling forecasts, in turn, provide information on future congestion locations. This provides an overall picture of current and future congestion in the region and helps set the stage for agencies to consider and implement CMP strategies, including those integrated into capacity-increasing roadway projects informing Visualize 2050 development.

Figure 5-9 Example CMP Congestion Summary Using Travel Time Index on Selected NHS Arterials during 8:00-9:00 am on Middle Weekdays in 2021



For planned or programmed projects, cross-referencing the locations of planned or programmed improvements with the locations of congestion helps guide decision makers to prioritize areas for

current and future projects and associated CMP strategies. For example, Table 5-2 shows that most of the region's top roadway bottlenecks (2019) also had projects submitted for inclusion in Visualize 2045 in their vicinities.

Table 5-3: Comparison of Top Ten Bottleneck Locations (2019) and Visualize 2045 (2020 Amendment) Projects

Rank (2019)	Bottleneck Location	Visualize 2045 Projects/ Studies in Vicinity
1	I-95 SB between US 1 (Exit 161) & VA 123	Multiple Projects
2	I-495 IL between VA 267 & GW Pkwy.	Multiple Projects
3	I-495 IL between Wisconsin Ave. & Connecticut Ave.	One Project
4	I-395 NB between Eads St. & 14th St. Bridge	Multiple Projects
5	DC 295 NB between 11th St. Bridge & Pennsylvania Ave.	Multiple Projects
6	I-495 OL east of US 1 (Richmond Hwy.)	Multiple Projects
7	US 301 NB vicinity of Old Indian Head Rd./Rosaryville Rd.	No Projects
8	I-495 OL vicinity of University Blvd.	No Projects
9	I-495 OL between Telegraph Rd. & US 1 (Richmond Hwy.)	Multiple Projects
10	VA 28 SB vicinity of Westfields Blvd.	One Project

Sources: 2020 Congestion Management Process Technical Report (bottlenecks), and 2020 Visualize 2045 Update Air Quality Conformity determination (technical inputs/projects). IL = Inner Loop; OL = Outer Loop.

The CMP goes beyond simply identifying congestion; it actively encourages the implementation of effective strategies. The NCR places a strong emphasis on non-capital-intensive congestion management strategies, particularly those championed by the TPB's Commuter Connections program (demand management) and the TPB's Systems Performance, Operations, and Technology program (operational management). Notably, the Metropolitan Area Transportation Operations Coordination (MATOC) Program serves as a key example of an operational management strategy focused on improving traffic incident coordination, aiming to avoid incident-related, nonrecurring congestion. Overall, these non-capital-intensive congestion management strategies are of a nature that they may not be directly evident in capital project listings in the National Capital Region Transportation Plan.

5.3 Defining and Analyzing Strategies

The CMP component of Visualize 2050 defines and analyzes potential congestion management strategies. These strategies encompass both demand management (e.g., ridesharing, public transit use) and operational management (e.g., traffic signal timing) approaches, ensuring a comprehensive strategy for tackling the challenge.

- Demand Management: This approach focuses on reducing the overall number of vehicles on the road during peak travel times. Examples include promoting carpooling, ridesharing, telecommuting, bicycling, and walking infrastructure improvements – all aimed at encouraging a shift towards more sustainable and efficient modes of transportation.

- Operational Management: This category focuses on optimizing the efficiency of the existing transportation system. Strategies include proactive measures like incident management, leveraging technological advancements for traffic signal timing, and exploring capacity improvements where necessary.

Through its Technical Committee and various subcommittees, including the Systems Performance, Operations, and Technology Subcommittee and the Travel Forecasting Subcommittee, the TPB facilitated a collaborative review process. This process considered both the locations experiencing the most severe congestion and the potential effectiveness of various strategies in those specific areas when developing Visualize 2050 project inputs.

This Congestion Management Process Technical Report serves as a valuable resource for this strategic analysis which typically takes place within state and local planning and project development. This report provides not only technical details about potential strategies but also keeps stakeholders informed with updated congestion information and the latest congestion management strategies being considered for implementation on the region's transportation systems. Furthermore, this report details the ongoing process of integrating the CMP and congestion-related projects into the update of Visualize 2050. This ensures that the most up-to-date data and analysis are reflected in the National Capital Region Transportation Plan.

5.4 Compiling Project-Specific Congestion Management Information

To ensure that individual transportation projects contribute positively to regional congestion management efforts, the TPB utilizes a CMP Documentation Form[171] (see Appendix F) to assess that the planning of federally funded single-occupancy vehicle (SOV) projects has included considerations of CMP strategy alternatives and integrate such components where feasible. In the Technical Inputs Solicitation for the update to Visualize 2050 and the TIP, for any project to undergo construction activities within the first four years (by 2029) and is providing a significant increase to SOV capacity, it must be documented that the implementing agency considered all appropriate systems and demand management alternatives to the SOV capacity. This ensures that project planning considered strategies that reduce overall traffic demand, alongside potential capacity enhancements.

The dedicated CMP Documentation Form includes a specific set of questions related to SOV congestion management. Any project with construction activities planned by 2029 aiming to significantly increase a highway's single-occupancy vehicle capacity must answer these questions to be considered for inclusion within the Visualize 2050 plan and the FY26-29 TIP. By requiring this documentation, the CMP ensures that high-capacity SOV projects are carefully evaluated and, whenever possible, integrated with strategies that manage overall traffic demand.

[171] *The CMP Documentation Form is currently a portion of the online system member agencies use to enter project information into TPB's Technical Inputs Solicitation.*

5.5 Implementing and Assessing Strategies

The selection of fiscally constrained projects within Visualize 2050 and the FY 2026-29 TIP is informed by the CMP analysis and reporting. The CMP's strategies are propelled forward through the deliberations and consensus-building efforts of the TPB committees, notably with the TPB's endorsement of Priority Strategies as part of its Synthesize Policy Framework.[172] The region places a strong emphasis on non-capital congestion strategies, as evidenced by the Commuter Connections program's demand management activities and the operational management strategies studied by the Systems Performance, Operations, and Technology Subcommittee. Regular assessments of these programs by Commuter Connections staff, coupled with the TPB's ongoing travel monitoring and studies, provide valuable feedback that shapes future transportation planning cycles.

The CMP documents the region's consideration and adoption of congestion management strategies as viable alternatives to SOV capacity expansion. Both demand management and operational management strategies are actively supported, including those integral to the Commuter Connections and Metropolitan Area Transportation Operations Coordination (MATOC) programs. National Capital Region Transportation Plans reflect the TPB's commitment to these strategies over time.

5.5.1 Demand Management in Visualize 2050

Visualize 2050 is anticipated to be strategically designed to shape traveler behavior, aiming to redistribute or mitigate travel demand. The integration of established demand management strategies not only augments the efficiency of the transportation network but also prepares it for future demands.

Within the scope of the region's transportation infrastructure planning, Visualize 2050 is anticipated to incorporate a suite of demand management strategies, including, alternative commuting options, managed facilities like high-occupancy vehicle (HOV) lanes and dynamically priced high-occupancy toll (HOT) lanes, enhancements to public transit, and upgrades to pedestrian and bicycling infrastructure, alongside growth management strategies that coordinate transportation with land use initiatives.

The cornerstone of the region's demand management approach is the comprehensive TPB Commuter Connections program, which fosters a diverse array of alternatives to travel by SOVs. This includes promoting ridesharing, public transportation, bicycling, telecommuting, and residential proximity to workplaces. Commuter Connections reflects these Transportation Demand Management (TDM) efforts through employer engagement, promotional activities, and programs such as the regional Guaranteed Ride Home program.

The commitment of Visualize 2050 to TDM is anticipated to be further manifested in its robust support for public transit and a holistic multimodal strategy. The expansion and preservation of

[172] https://visualize2045.org/wp-content/uploads/2023/01/TPB-Policy-Framework-Booklet.pdf

transit's share in regional travel is pivotal to the successful management of congestion in the National Capital Region, aligning with the broader objectives of regional transportation planning.

5.5.2 Operational Management in Visualize 2050

Visualize 2050's vision statement is anticipated to articulate a commitment to leveraging cutting-edge technology to enhance the efficiency of the system. A pivotal element of the CMP is the identification and implementation of operational management strategies that bolster the effective utilization and safety of both current and prospective transportation frameworks.

These strategies encompass a range of programs and technologies, including incident management initiatives, Intelligent Transportation Systems (ITS) technologies, Advanced Traveler Information Systems, and advancements in traffic engineering. While many of these strategies represent ongoing efforts by member agencies, they are integral to the CMP, even when they serve as complementary components of broader capital projects.

A cornerstone of the region's operational management is the Metropolitan Area Transportation Operations Coordination (MATOC) Program. Established in 2009, MATOC has been instrumental in real-time surveillance of transportation system conditions, issuing timely alerts to member agencies responsible for system operations. This proactive approach plays a vital role in diminishing the repercussions of incidents on regional traffic congestion.

5.5.3 Capacity Increases in Visualize 2050 and Their CMP Components

Under federal law and regulations, capacity enhancements are recognized as a vital aspect of operational management strategies. These enhancements are particularly pertinent in scenarios such as:

- Alleviating Bottlenecks: Implementing modest capacity increases at pivotal congestion points can significantly mitigate traffic issues extending well beyond the immediate area.

- Safety Enhancements: Addressing safety concerns, especially at locations with high crash rates, can contribute to reducing non-recurring congestion related to these safety issues.

- Operational Traffic Enhancements: This includes the expansion or extension of turning lanes and the strategic redesign of intersections to improve traffic flow while upholding safety standards.

These strategic considerations are integral to the CMP Documentation Form[171] within the Visualize 2050 framework and are also reflected in projects ready for programming in the TIP.

Congestion management is ongoing. CMP Technical Reports will continue to reflect on the most current version of Visualize and inform future updates of the National Capital Region Transportation Plan while providing information for stakeholder consideration as they evaluate strategies to address congestion concerns throughout the National Capital Region.

5.6 Role of Key Planning Agencies

The success of the CMP is associated with the strong culture of collaboration among key planning agencies within the National Capital Region. In accordance with R18-2021[173], the TPB and Fredericksburg Area MPO (FAMPO) maintain coordinated, cooperative, and continuing planning processes, particularly regarding the congestion management process that FAMPO oversees[174] for the northern portion of Stafford County, which is part of the Washington, DC-MD-VA Urbanized Area (UZA), in compliance with applicable federal laws and regulations. In addition to FAMPO, the following agencies bring diverse expertise and resources to the table driving effective congestion management strategies.

5.6.1 Federal Partners

Certain federal agencies, such as the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA), provide technical assistance and funding that support the development and implementation of the CMP. Their involvement ensures alignment with national transportation goals and leverages federal resources for regional congestion reduction efforts.

5.6.2 State Agencies

State agencies, including the District Department of Transportation (DDOT), the Maryland Department of Transportation (MDOT) and the Virginia Department of Transportation (VDOT), manage and maintain a significant portion of the region's transportation infrastructure, including major highways, bridges, and tunnels. Their participation in the CMP ensures that congestion management strategies are effectively integrated with ongoing infrastructure projects and maintenance activities.

The DOTs play a large role analyzing congestion on major corridors in their state and determining the best strategies to manage or improve congestion. As part of the zero-based budgeting exercise in 2023, state agencies reviewed the projects originally included in Visualize 2045 for alignment with TPB's goal on reliability. Following their review, state agencies submitted projects to the TPB for consideration in Visualize 2050. The project descriptions and data collected on each project explain how each agency anticipates the investment will help the region's congestion challenges.

5.6.3 Local Jurisdictions

Local jurisdictions play a critical role in implementing many congestion management strategies, particularly those focused on demand management. This includes initiatives like promoting carpooling, encouraging bicycling and walking infrastructure, and supporting public transit ridership.

Through ongoing communication, data sharing, and collaborative planning, these key agencies work together to ensure the CMP addresses congestion in a comprehensive and coordinated manner. Regular meetings, joint task forces, and technical committees facilitate this collaboration, fostering a shared understanding of regional challenges and the most effective solutions.

[173] R18-2021 - Resolution to approve the 2021 TPB-Fredericksburg Area MPO Memorandum of Understanding, https://www.mwcog.org/documents/2021/05/21/r18-2021---resolution-to-approve-the-2021-tpb-fredericksburg-area-mpo-memorandum-of-understanding-/

[174] FAMPO, Congestion Management Process, https://fampo.gwregion.org/congestion-management-process/

By harnessing the collective expertise and resources of these diverse stakeholders, the CMP empowers the National Capital Region to develop and implement a truly comprehensive approach to congestion management.

5.7 Public Engagement

The CMP incorporates public input, relying on the regularly scheduled public meetings and workshops hosted by the TPB, its Technical Committee, and various subcommittees, including those subcommittees focusing on components of the CMP including Systems Performance, Operations & Technology, Regional Public Transportation, Travel Forecasting, and Commuter Connections. Open and transparent communication is important for the CMP and is achieved by:

- Providing clear and concise updates on the CMP process: Regularly sharing information about ongoing activities, input received, and recommendations made.

- Providing opportunities for periodic review and feedback from TPB's Community Advisory Committee who provide valuable insights.

By the TPB's public engagement, prioritization of accessibility, and fostering of trust through transparency, the CMP achieves an inclusive and collaborative approach to congestion management in the National Capital Region.

During the development of Visualize 2050, key milestones for public comment during TPB meeting presentations have included the following opportunities:

- June 2022
    - 2022 CMP Technical Report published (informs Visualize 2050 development)
    - Presentation to TPB and Action on R19-2022 Resolution to Adopt Regional Congestion Mitigation and Air Quality Program Performance Measure Targets for 2022-2025
- May 2023
    - Presentation to TPB on CMP Update and Regional Bottlenecks Analysis

5.8 Equity Considerations

In July 2020, the TPB adopted Resolution R1-2021, "Resolution to Establish Equity as a Fundamental Value and Integral Part of All Transportation Planning Board's Work Activities". The resolution states in part, "the TPB believes equity is a fundamental value defined as the commitment to promote fairness and justice in the development and implementation of projects, programs and policies, achieved when all people are fully able to participate in the region's economic vitality, contribute to its readiness for the future, and connect to the region's assets and resources… TPB affirms that equity, as a foundational principle, will be woven throughout TPB's analyses, operations, procurement, programs, and priorities to ensure a more prosperous, accessible, livable, sustainable, and equitable future for all residents…". Through this resolution, the TPB has called for technical analyses that consider and strengthen equity. Equity considerations in the CMP have been addressed or are planned to be addressed in the following ways.

Equity considerations in the CMP have been addressed or are planned to be addressed in the following ways.

- Geographic analysis of CMP data through the TPB's established Equity Emphasis Areas: Equity Emphasis Areas (EEAs) are a COG/TPB regional planning concept to elevate equity and inform future growth and investment decisions. As of the 2022 update to Visualize

2045, 364 of the region's more than 1,300 Census tracts were identified as EEAs, meaning they have high concentrations of low-income individuals and/or traditionally disadvantaged racial and ethnic population groups. EEAs were originally developed by the Transportation Planning Board to analyze potential impacts of its long-range transportation plan but are now being applied more broadly across disciplines, such as health, housing, and climate.[175] The CMP is able to examine congested portions of the region's roadways vis-à-vis the locations of EEAs and their populations.

- Review relevant equity information available from other COG/TPB analyses: the regional Household Travel Survey conducted periodically by the TPB is a robust source of information on commuting and other travel by residents of the region. Future analysis of survey results may provide some insights into the equity impacts of congestion.

- Examine big data sources for availability and extent of equity aspects of traveler data: Emerging, private sector-provided big data sources may provide future insights into equity impacts of congestion. Big data relies on travelers in-vehicle and mobile devices to provide travel characteristics and locations. Privacy concerns mean that data are anonymized and limited, but potentially could complement public data sources.

In summary, TPB has considered equity in the congestion management process and continues to seek future opportunities for examining the equity impacts of congestion and congestion management. TPB reports these activities through biennial Congestion Management Process Technical Reports, which, in turn, are considered in the development of the next National Capital Region Transportation Plan.

[175] See https://www.mwcog.org/maps/map-listing/equity-emphasis-areas-eeas/.

6.0 CONCLUSIONS

The 2024 CMP Technical Report hereby concludes with a summary of key findings and important recommendations from throughout the report to improve the Congestion Management Process in the National Capital Region.

6.1 Key Findings of the 2024 CMP Technical Report

1. Congestion – While the COVID-19 pandemic significantly reduced congestion, with the Travel Time Index (TTI) reaching a historic low of 1.17 in 2020, congestion rebounded in 2023, but to levels still below pre-pandemic norms (e.g., Interstates TTI of 1.41 in 2023 versus 1.48 in 2019).

2. Reliability – Travel time reliability improved during the pandemic due to reduced congestion but has since reverted to pre-pandemic levels (Section 2.2.1.2).

3. Bottlenecks – Bottleneck locations have shifted somewhat since 2019, though many persistent hotspots remain, with I-95 southbound between US-1 and VA-123 continuing to be the region's most congested segment. (Section 2.2.1.6).

4. Travel Demand Management – Travel demand management strategies, including the Commuter Connections program, remain crucial for congestion mitigation. The region's robust transit system is a key alternative to single-occupancy vehicles (Section 3.2.1).

5. Walking and Bicycling – Walking and bicycling continue to grow in the region in part due to increasing connectivity in the bicycle and pedestrian network (Sections 3.2.4 and 3.2.5).

6. Variably Priced Lanes (VPLs) - VPLs provide additional options to travelers in the region. Facilities include 95Express, 395Express, 495Express, I-66, and Maryland Route 200 (Intercounty Connector (ICC)) (Section 3.3.2).

7. Regional Transportation Operations Coordination – The Metropolitan Washington Area Transportation Operations Coordination (MATOC) continues to play an important role in coordination and communicating incident information during both typical travel days and special events such as severe weather and construction work (Section 3.3.3.4).

8. Real-time travel information – The increasing availability of technology to monitor, detect, and evaluate travel conditions allows operators to make changes to the transportation network through active travel demand management, traffic signal optimization, and integrative corridor management. For travelers, real-time traffic and transit information are available from a number of sources though mobile applications and mobile versions of websites. Social media provides a mutually beneficial direct connection between transportation providers and users. Mobile applications related to non-auto modes, such as transit and bikesharing, allow travelers to be flexible with their mode choices (Section 3.4.6).

9. COVID-19 Pandemic Impacts – 2023 saw a mix of travel trends coming out of the pandemic, with A.M. peak congestion remaining lower but P.M. peak congestion matching pre-pandemic conditions. (Sections 2.2.1.1 and 2.2.1.2; Section 2.2.3; Section 2.3).

6.2 Recommendations for the Congestion Management Process

The 2024 CMP Technical Report delineates the evolution of the Congestion Management Process in the Washington region. The report underscores several pivotal recommendations for prospective enhancements.

1. **Continue the Commuter Connections program.** The Commuter Connections program is a fundamental strategy for demand management in the National Capital Region, offering benefits from a regional perspective. It contributes to the reduction of trips, vehicle miles of travel, transportation emissions, and enhances air quality.

2. **Continue and enhance the MATOC program and support agency/jurisdictional transportation management activities.** The MATOC program/activities are key strategies of operational management in the National Capital Region. Recent enhancements have including efforts on severe weather mobilization and incident coordination. Future enhancements of the MATOC program should be considered when appropriate to expand the function and participation of the program.

3. **Continue to coordinate PBPP with the CMP.** Performance measurement and analysis are integral components of both requirements and can be achieved synergistically.

4. **Continue to encourage integration of operations management and travel demand management components of congestion management for more efficient use of the existing transportation network.** State DOTs should persist in exploring ATM strategies along congested freeways and actively manage arterials along freeways. Collaboration among transportation agencies and stakeholders is encouraged along congested corridors.

5. **Pursue sufficient investment in the existing transportation system, which is important for addressing congestion.** Prioritizing maintenance for the existing transportation system, as advocated in TPB's Regional Transportation Priorities Plan, is crucial to congestion management.

6. **Continue variable pricing and other management strategies in conjunction with capacity increasing projects.** Variably priced lanes (VPLs) offer an option for travelers to circumvent congestion and provide an effective congestion management strategy for agencies.

7. **Continue to encourage transit in the Washington region and explore transit priority strategies.** The transit system serves as a significant alternative to solo driving, maximizing the utility of existing infrastructure. Local jurisdictions should collaborate with transit agencies to explore transit priority strategies.

8. **Encourage implementation of congestion management for major construction projects.** Past successes, such as the 495 NEXT and Transform 66 projects, underscore the effectiveness of construction project-related congestion management.

9. **Continue to encourage access to non-auto travel modes.** The success of the Capital Bikeshare program and the decrease in automobile registrations in the District of Columbia indicate a shift towards non-automobile transportation in urban areas.

10. **Continue and enhance providing real-time, historical, and multimodal traveler information.** Sharing travel/incident information and partnering with private sector providers of travel and navigation information can help travelers avoid congestion and delays.

11. **Encourage implementation of projects, programs, and processes that support the TPB Priority Strategies.** In February 2023, the TPB approved Priority Strategies to guide the development of Visualize 2050. As a continuation of the seven Aspirational Initiatives endorsed in 2018, the TPB noted that these fourteen total Priority Strategies, if funded, enacted, and supported, would have the potential to significantly improve the region's transportation system performance compared to current plans and programs.

12. **Encourage connectivity within and between Regional Activity Centers.** The recent refinement of the Regional Activity Centers map, adopted in 2013, helps coordinate transportation and land use planning for future growth.

13. **Continue and enhance the regional congestion monitoring program with multiple data sources.** There are a wealth of sources, both public and private sector, for data related to congestion which have their individual strengths and shortcomings. Private sector probe-based monitoring provides unprecedented spatial and temporal coverage on roadways, but still needs to be supplemented with data from other sources including data on traffic volumes and traffic engineering considerations. There should be continual review of the quality and availability of data provided by different sources and the structuring of a monitoring program in a way that is adaptable for potential future changes in data reporting and/or data sources.

14. **Undertake enhanced analysis of available data to understand congestion trends and impacts.** Regional understanding of the equity impacts of congestion as well as long-term trends would be improved with new and additional analyses.

15. **Monitor trends in freight, specifically truck travel.** Interrelationships between freight movement and congestion differ from interrelationships between passenger travel and congestion.

16. **Participate in collaborative planning connected and automated vehicle readiness.** These emerging technologies will dramatically alter future transportation planning. Standards and interoperability are critical issues and should be addressed through extensive collaboration with a variety of stakeholders.

17. **Monitor impacts of and interactions with shared mobility services.** Transportation Network Companies (TNCs) continue to have an evolving impact on a variety of aspects of congestion management, mode share, and transportation overall, but data for regional analysis remain scarce. Regulating agencies are encouraged to arrange for TNC data to be collected and shared with the TPB and other official transportation planning and operating entities, to enable analysis of impacts.

18. **Encourage Traffic Incident Management (TIM).** COG's 2018 creation of its Traffic Incident Management Enhancement (TIME) initiative highlighted the importance of TIM within congestion management.

APPENDICES

APPENDIX A – 2023 PEAK HOUR TRAVEL TIME INDEX

Note:

1. Calculations and visualizations were provided by the "Trend Map" tool of the Vehicle Probe Project Suite developed by the CATT Lab of the University of Maryland, https://pda.ritis.org/suite/.

2. Peak Hour: 8:00-9:00 am is the regional morning peak hour, and 5:00-6:00 pm is the regional afternoon peak hour, Monday through Friday.

3. Congestion levels are categorized by the value of Travel Time Index:
   TTI = 1.0: Free flow
   1.0<TTI<=1.3: Minimal
   1.3<TTI<=1.6: Minor
   1.6<TTI<=2.0: Moderate
   2.0<TTI<=2.5: Heavy
   2.5<TTI: Severe

Figure A1: Travel Time Index on the Interstates and Freeways during Weekday 8:00-9:00 am, 2023

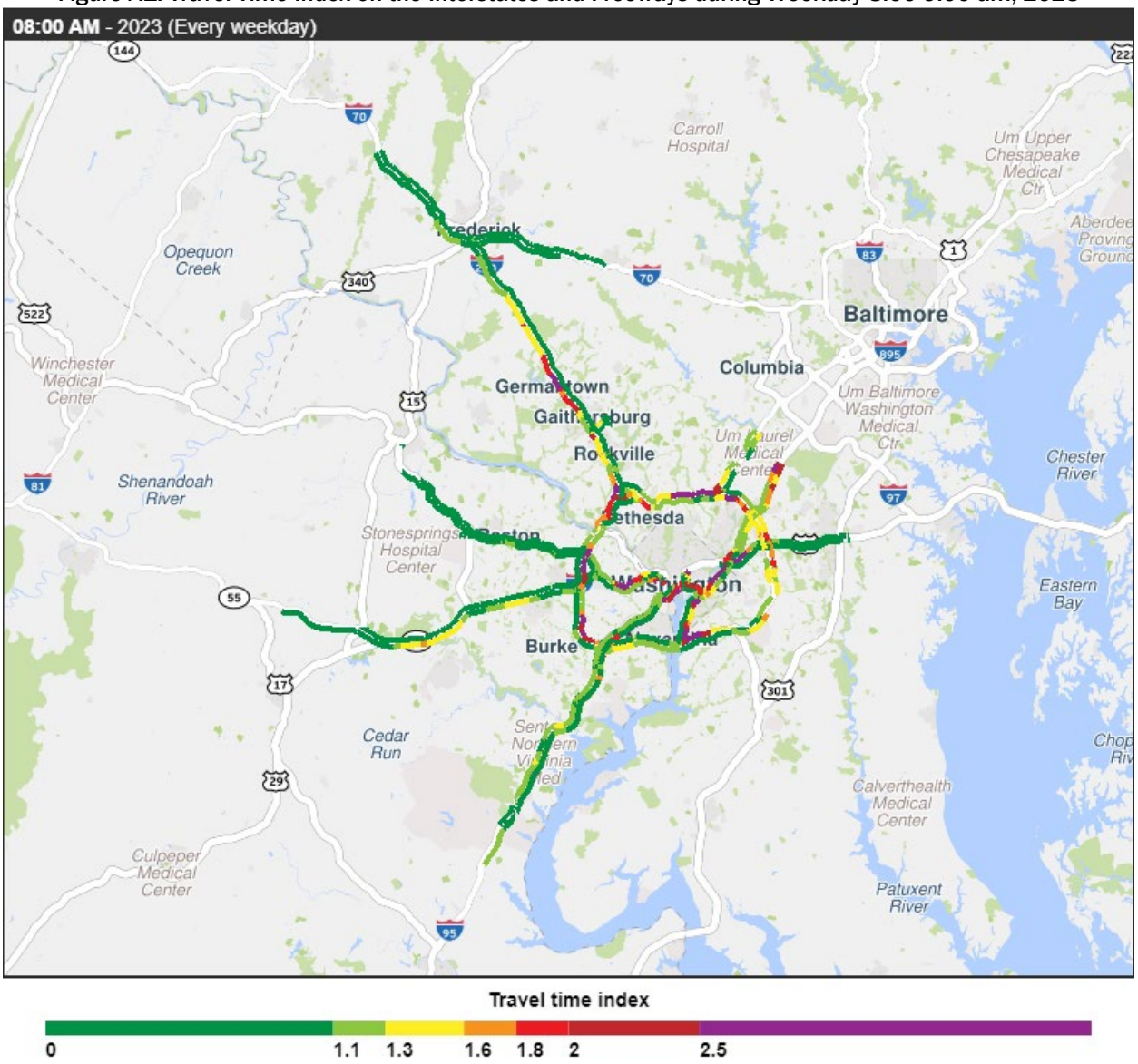


Figure A2: Travel Time Index on the Interstates and Freeways during Weekday 5:00-6:00 pm, 2023

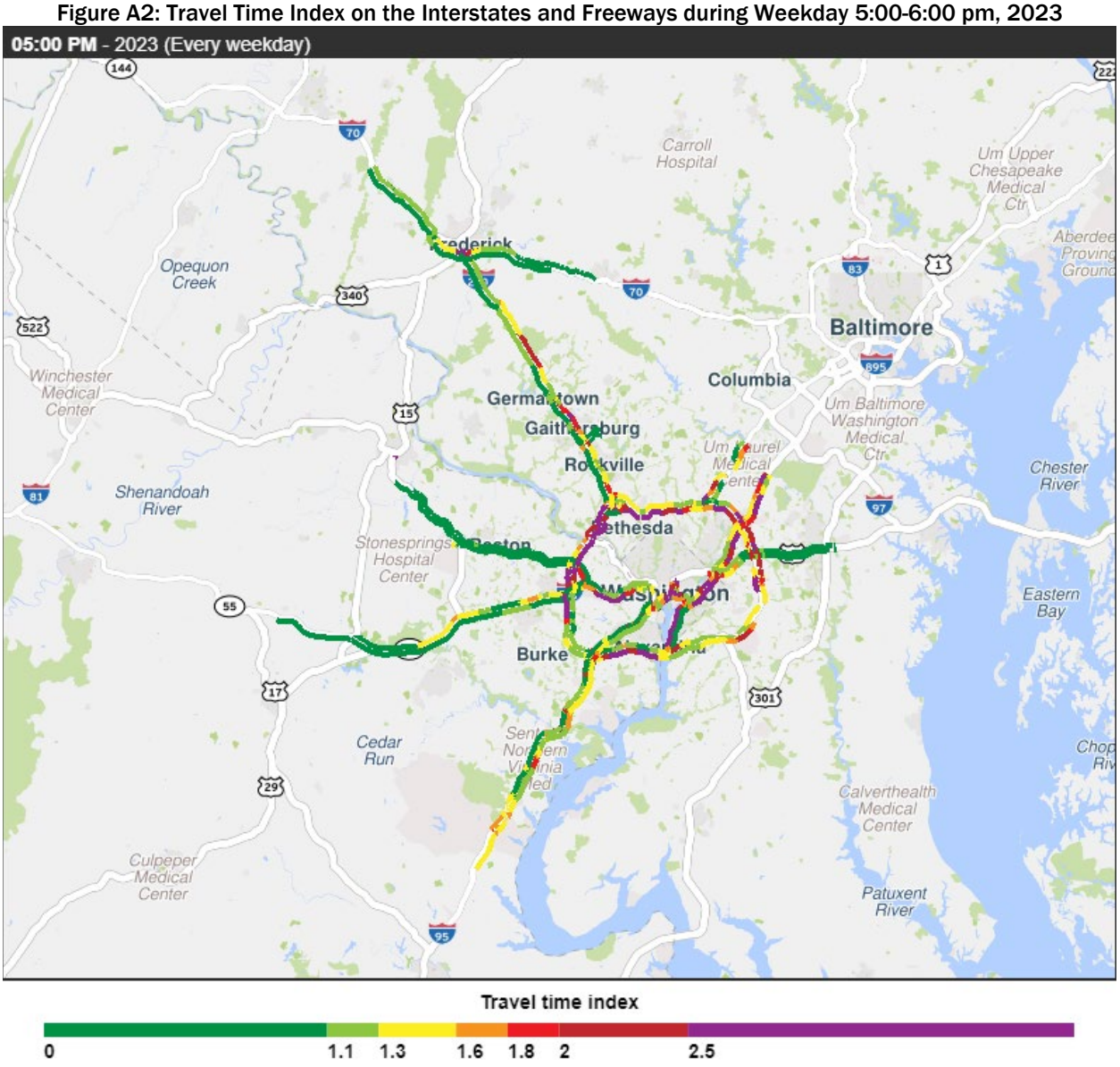


Figure A3: Travel Time Index in DC during Weekday 8:00-9:00 am, 2023

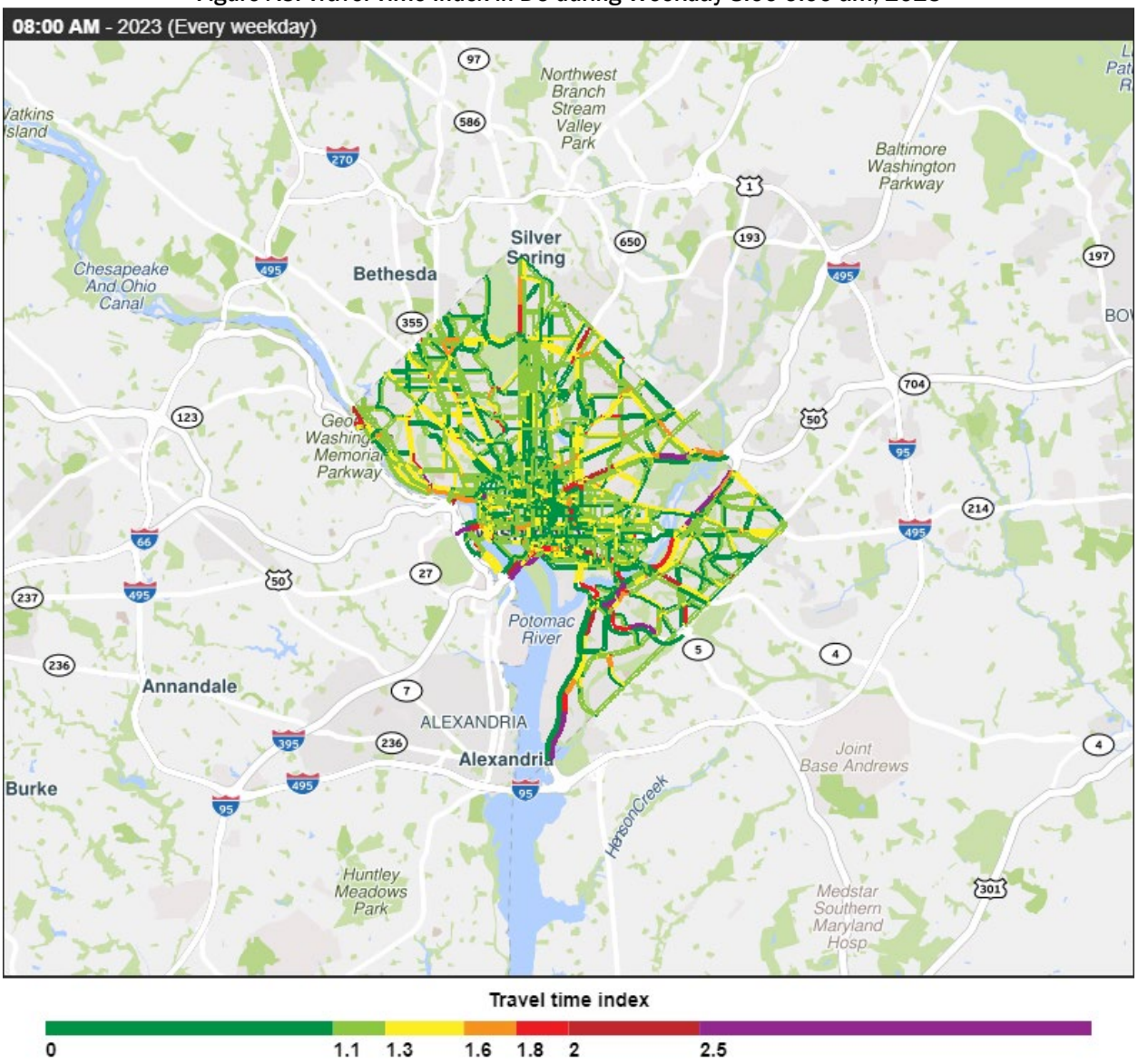


Figure A4: Travel Time Index in DC during Weekday 5:00-6:00 pm, 2023

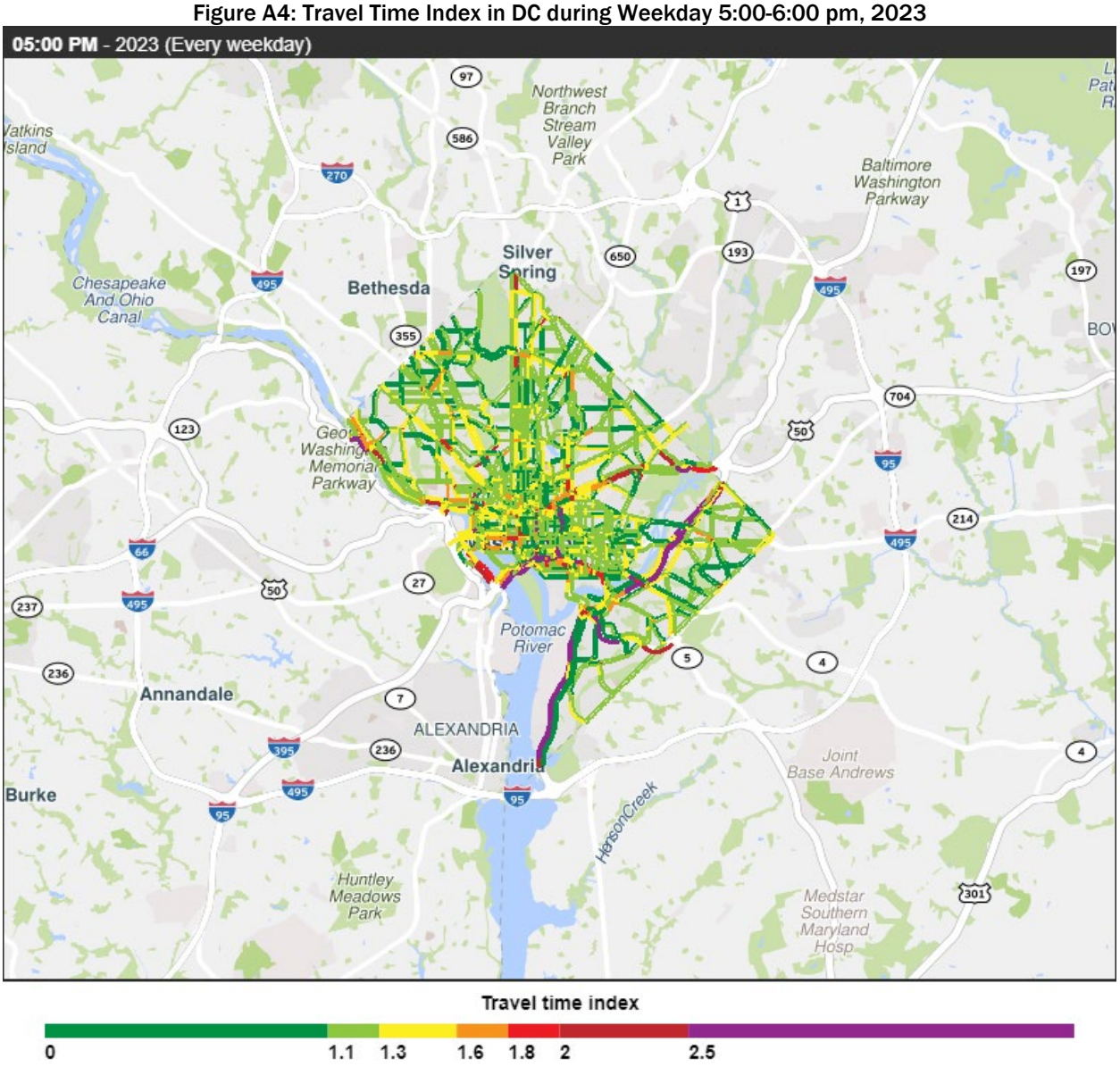


Figure A5: Travel Time Index in Frederick County, MD during Weekday 8:00-9:00 am, 2023

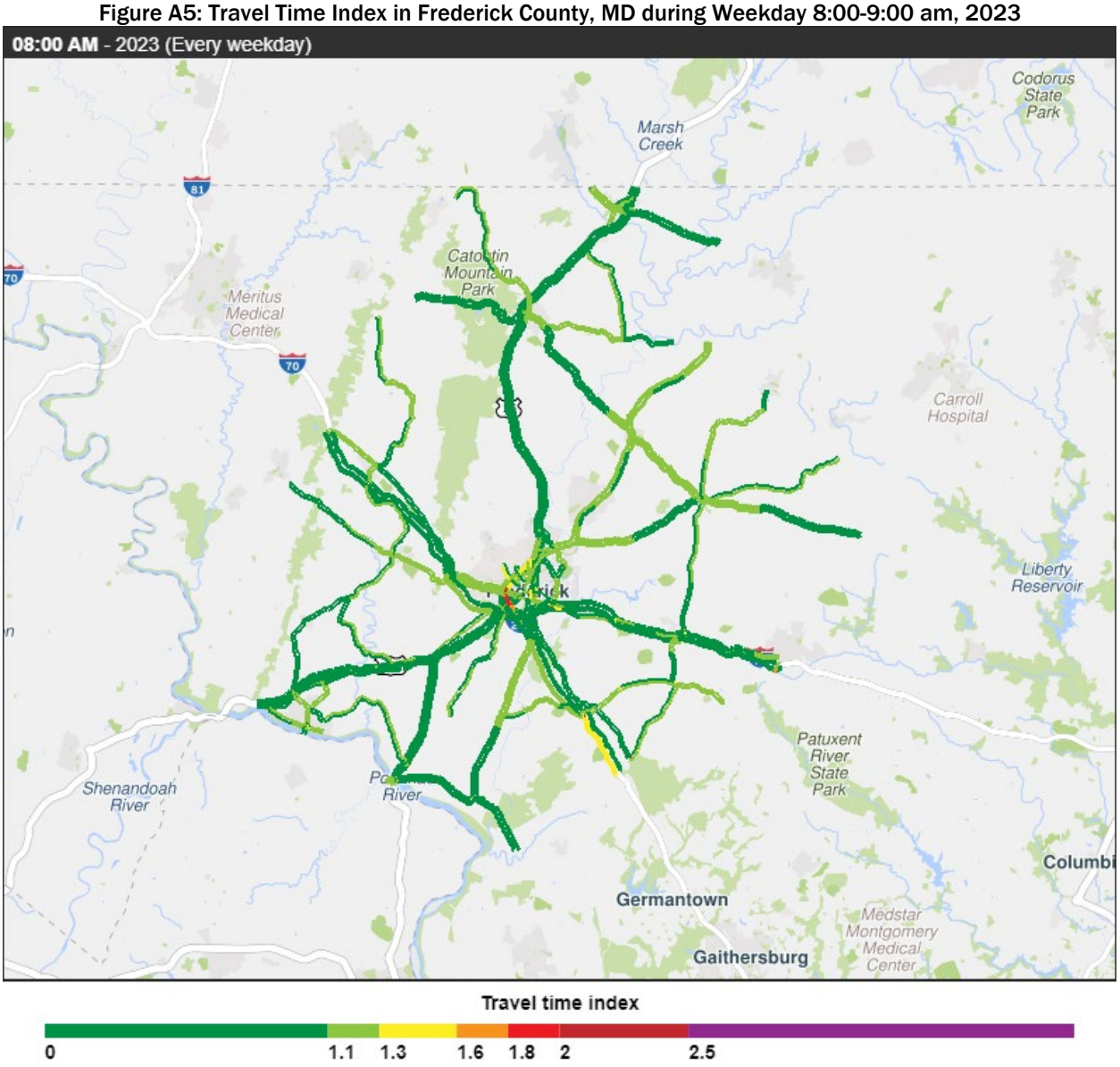


Figure A6: Travel Time Index in Frederick County, MD during Weekday 5:00-6:00 pm, 2023

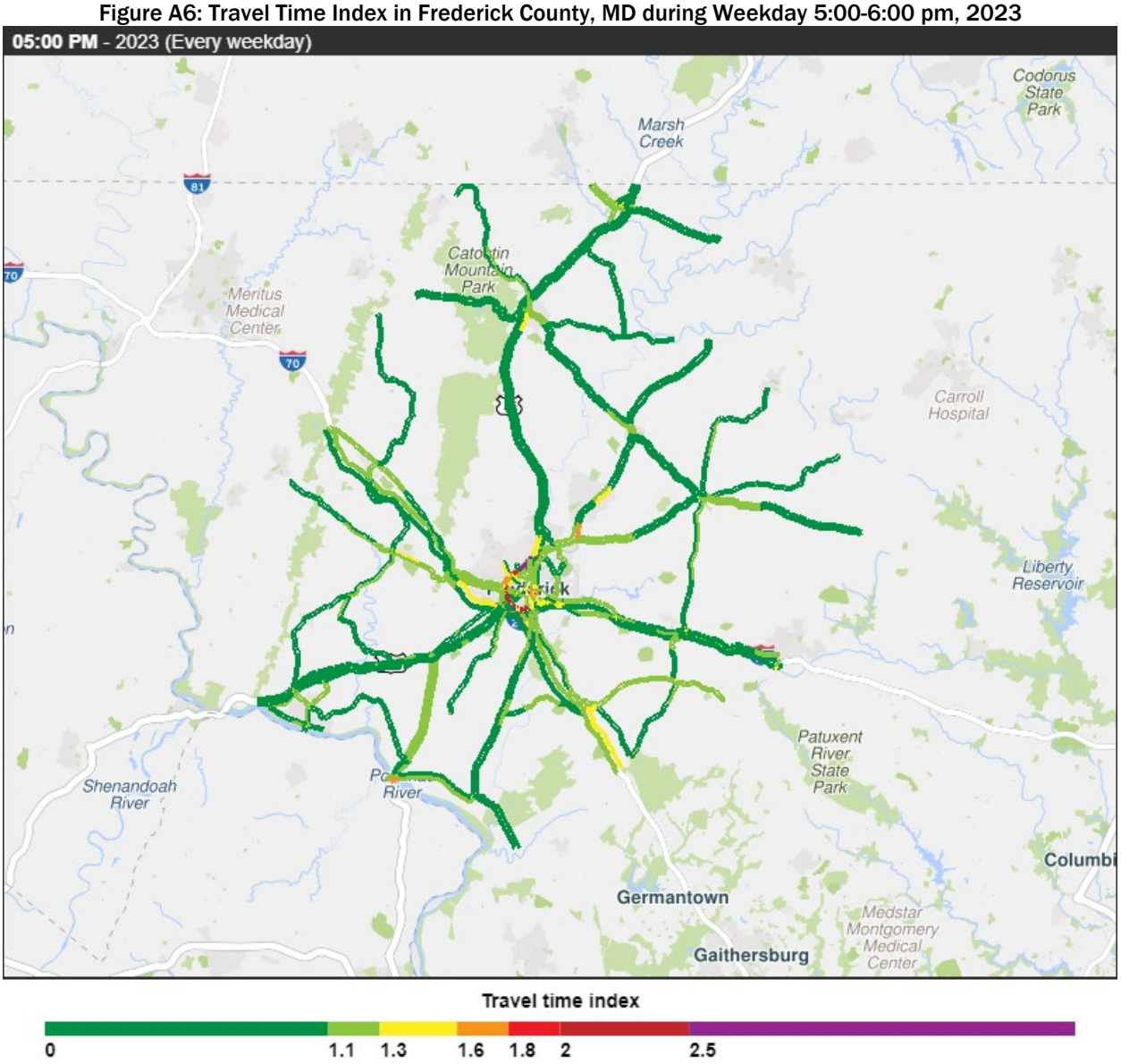


Figure A7: Travel Time Index in Montgomery County, MD during Weekday 8:00-9:00 am, 2023

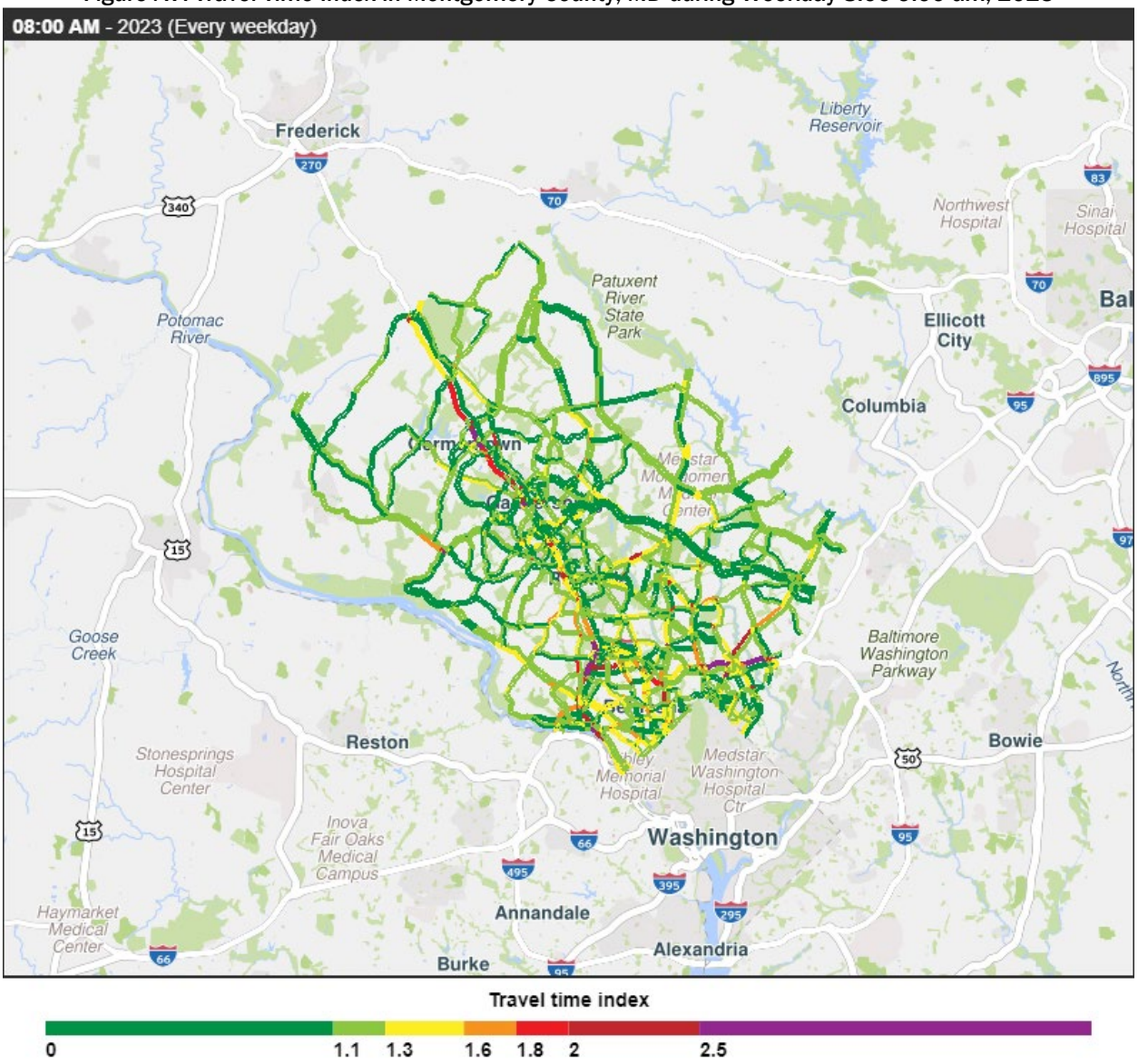


Figure A8: Travel Time Index in Montgomery County, MD during Weekday 5:00-6:00 pm, 2023

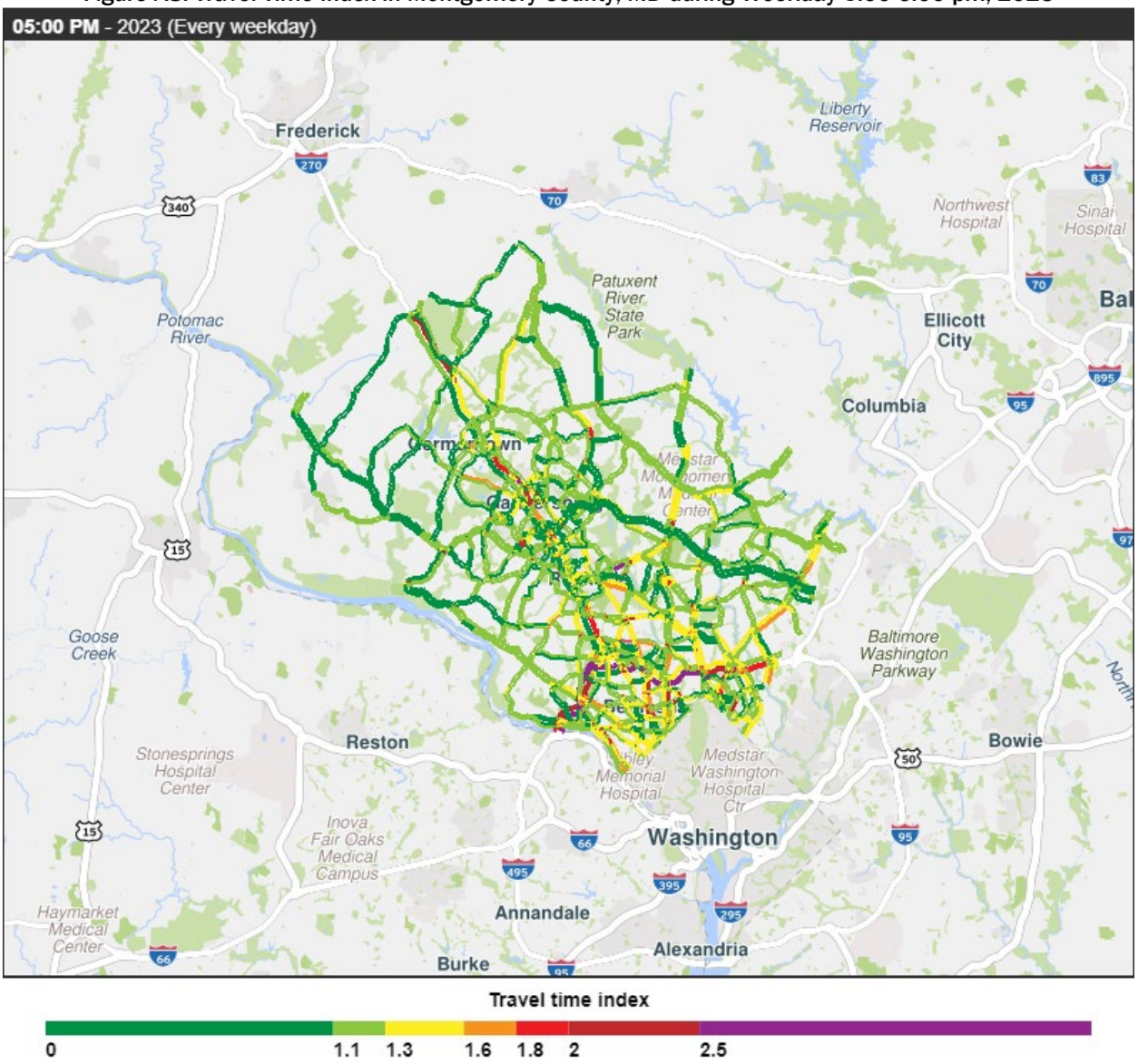


Figure A9: Travel Time Index in Prince George's County, MD during Weekday 8:00-9:00 am, 2023

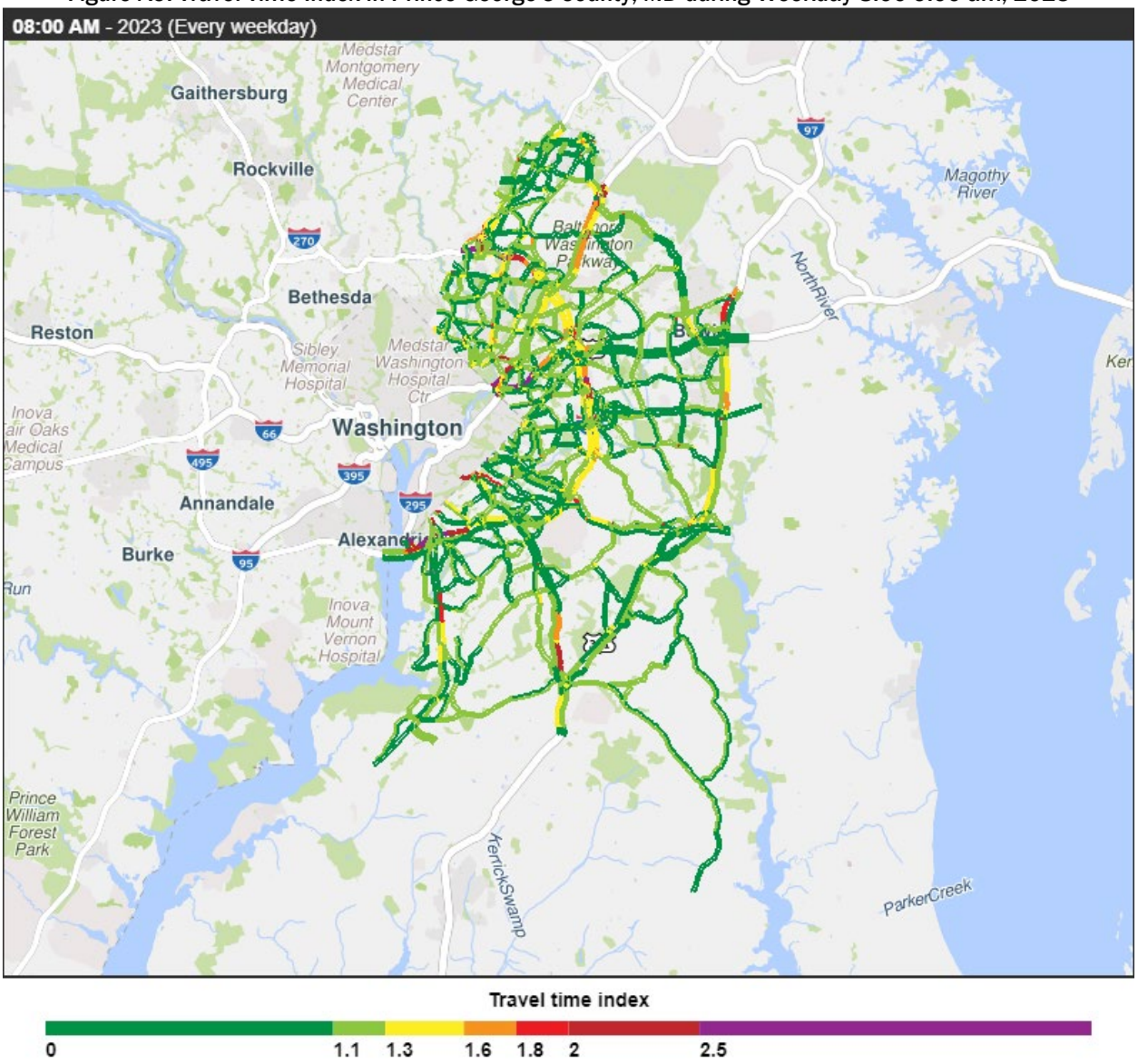


Figure A10: Travel Time Index in Prince George's County, MD during Weekday 5:00-6:00 pm, 2023

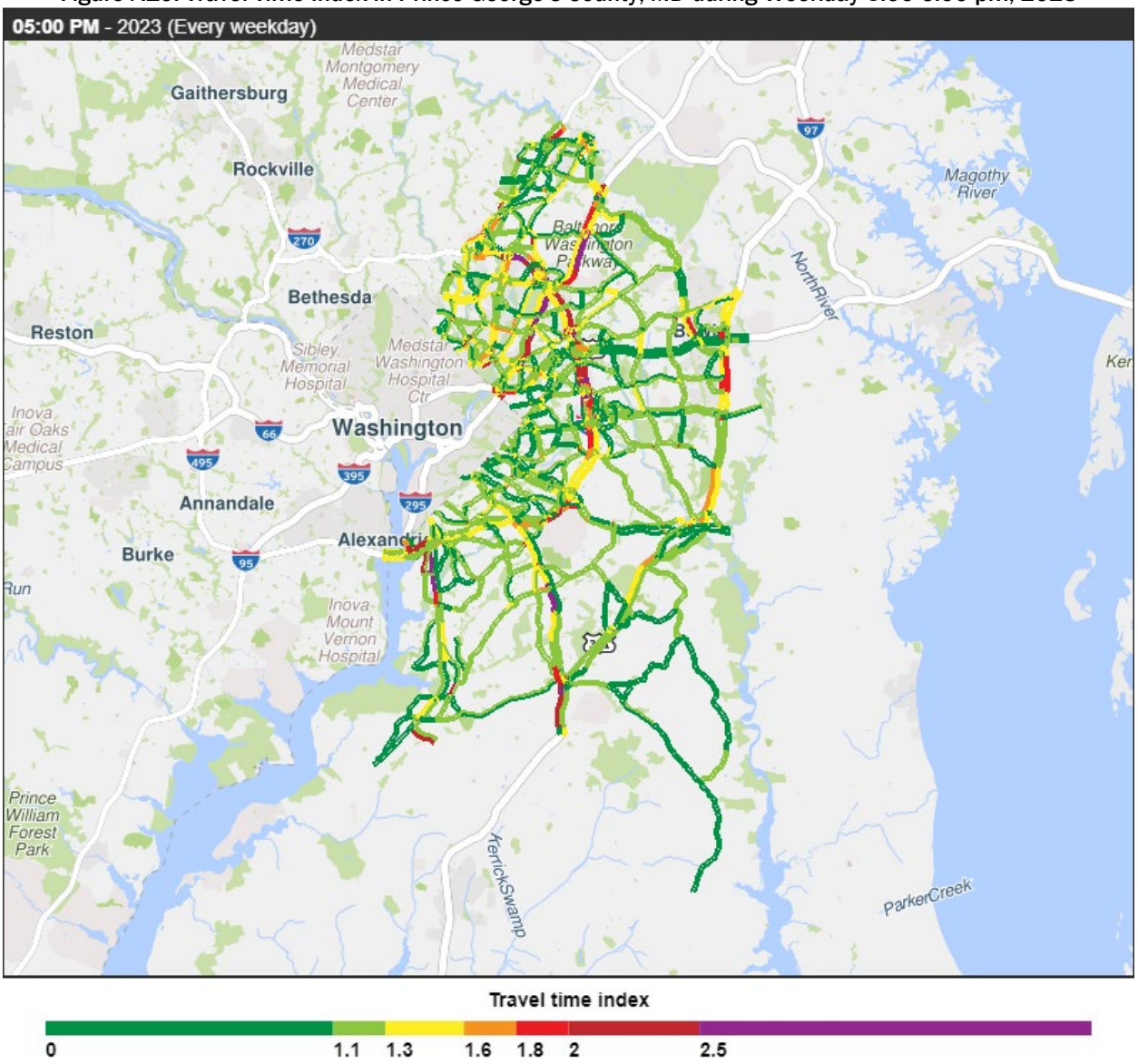


Figure A11: Travel Time Index in Charles County, MD during Weekday 8:00-9:00 am, 2023

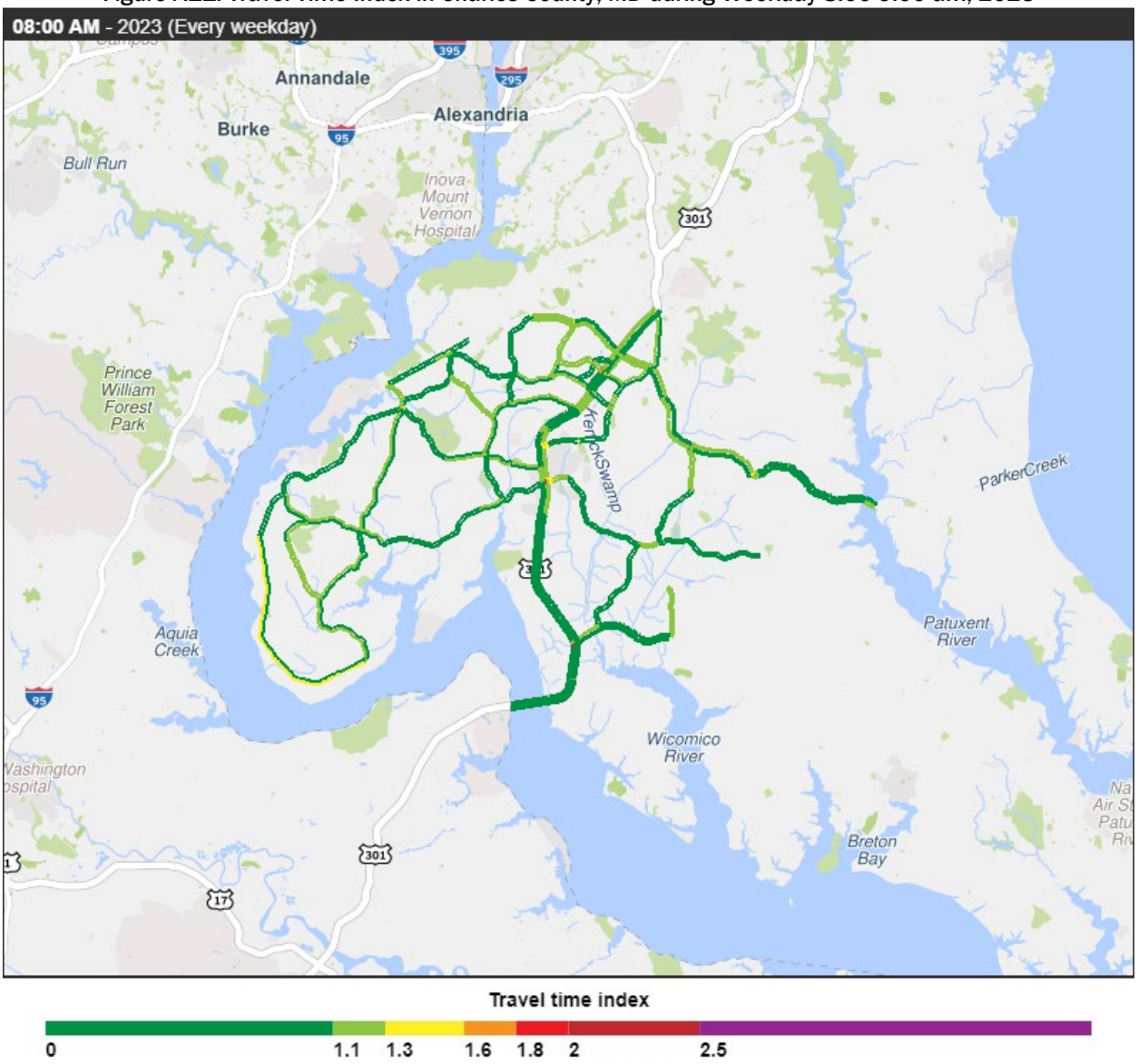


Figure A12: Travel Time Index in Charles County, MD during Weekday 5:00-6:00 pm, 2023

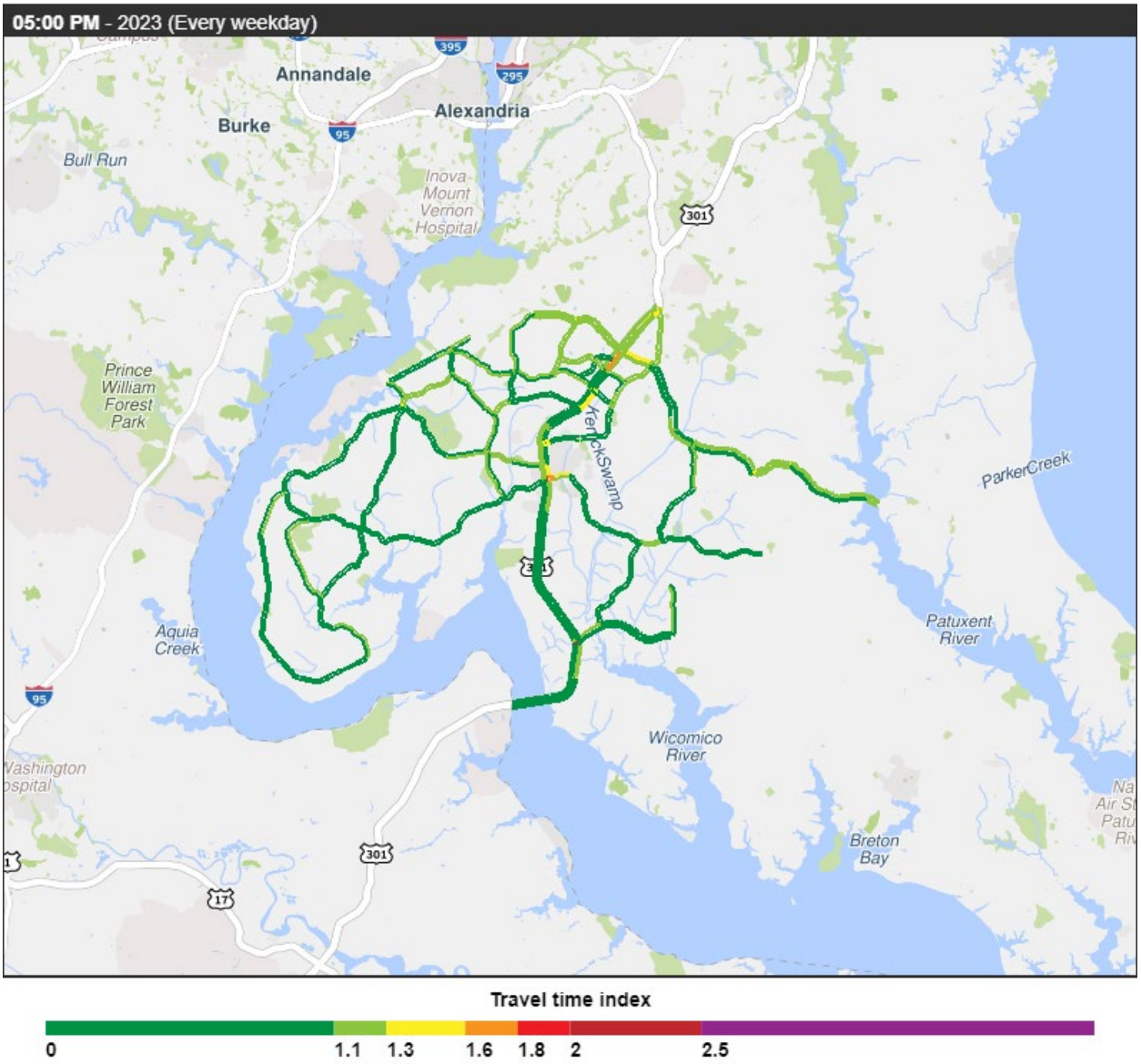


Figure A13: Travel Time Index in Loudoun County, VA during Weekday 8:00-9:00 am, 2023

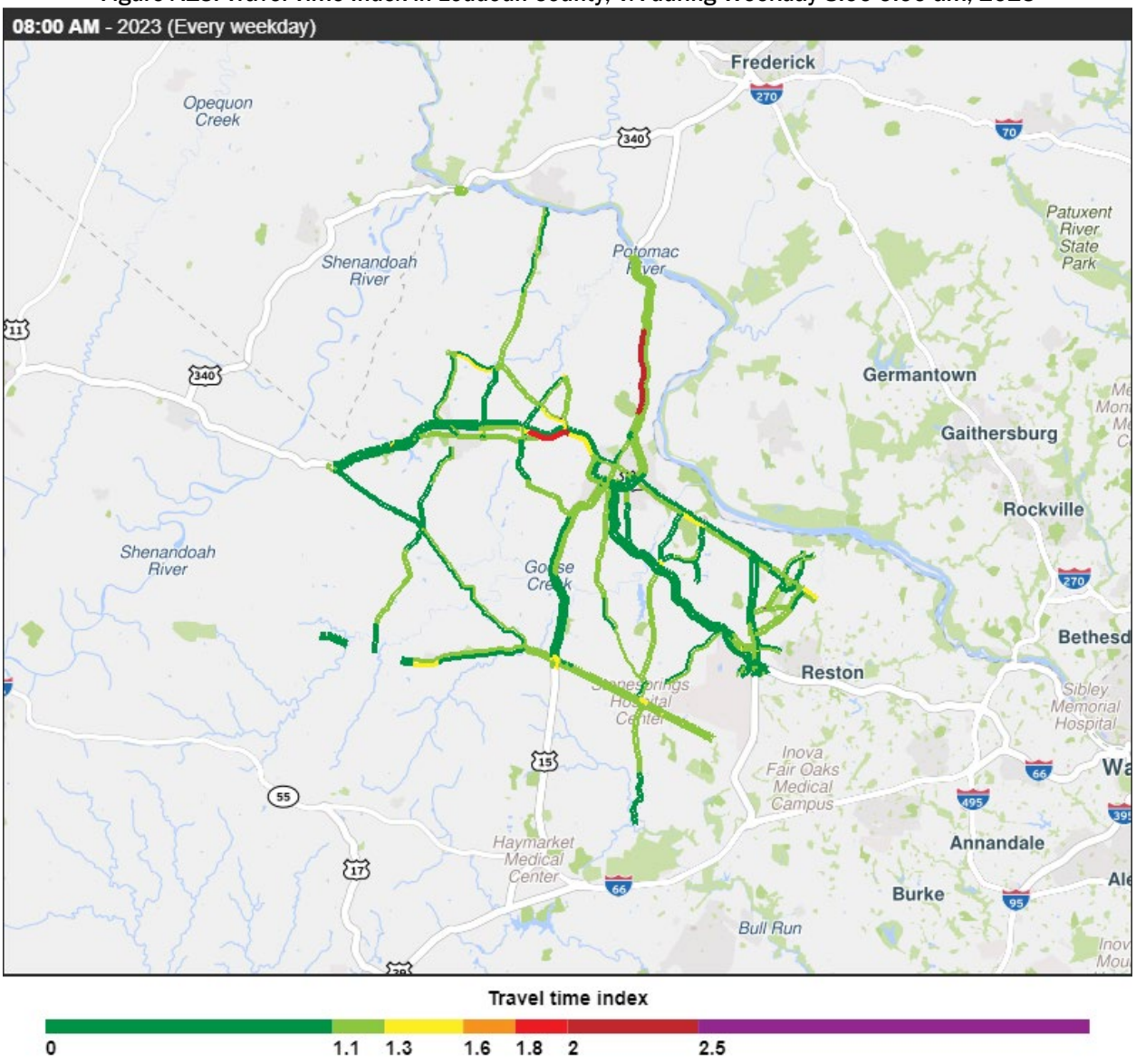


Figure A14: Travel Time Index in Loudoun County, VA during Weekday 5:00-6:00 pm, 2023

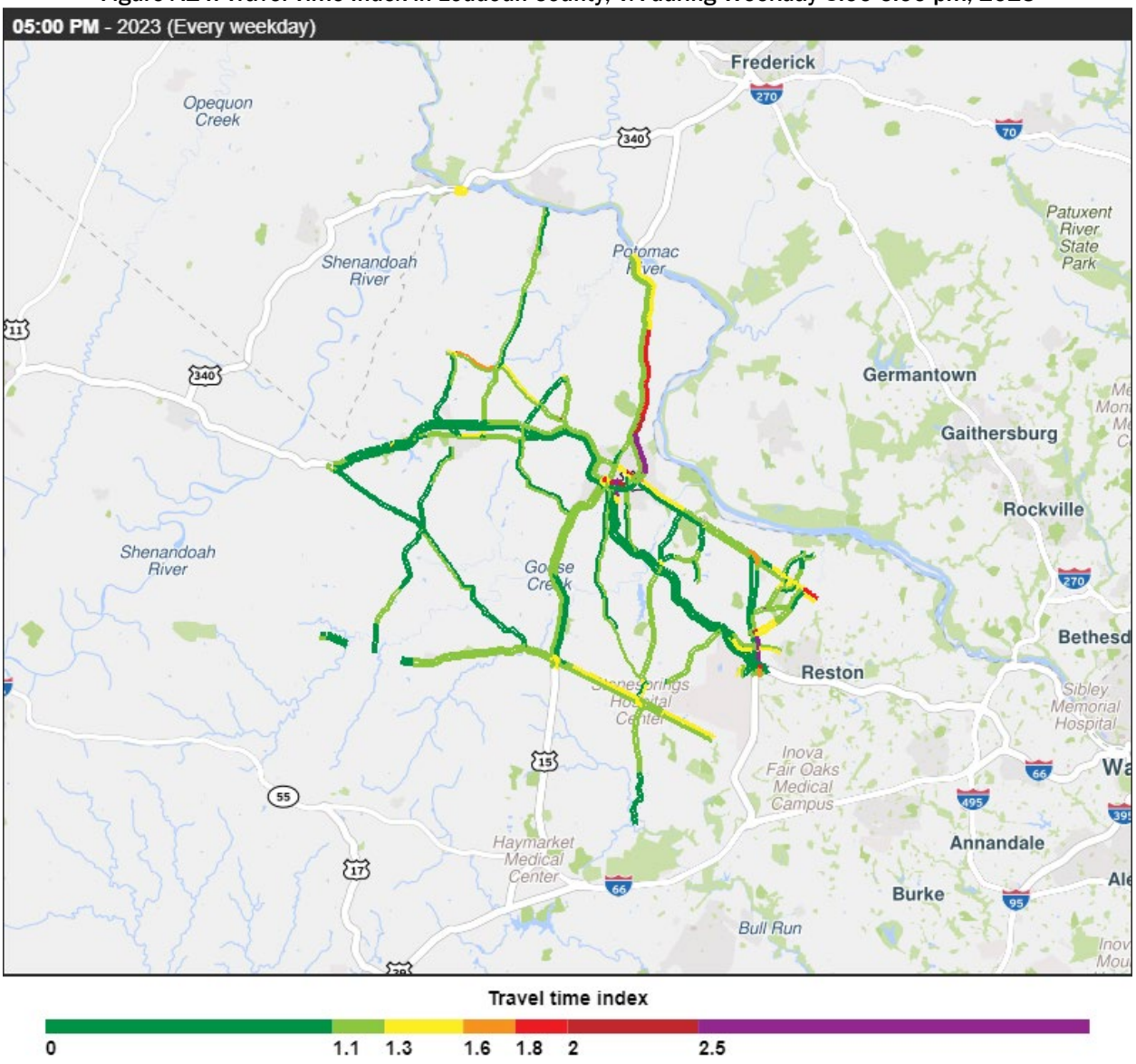


Figure A15: Travel Time Index in Fairfax, Prince William Counties and Cities of Fairfax, Manassas, and Manassas Park, VA during Weekday 8:00-9:00 am, 2023

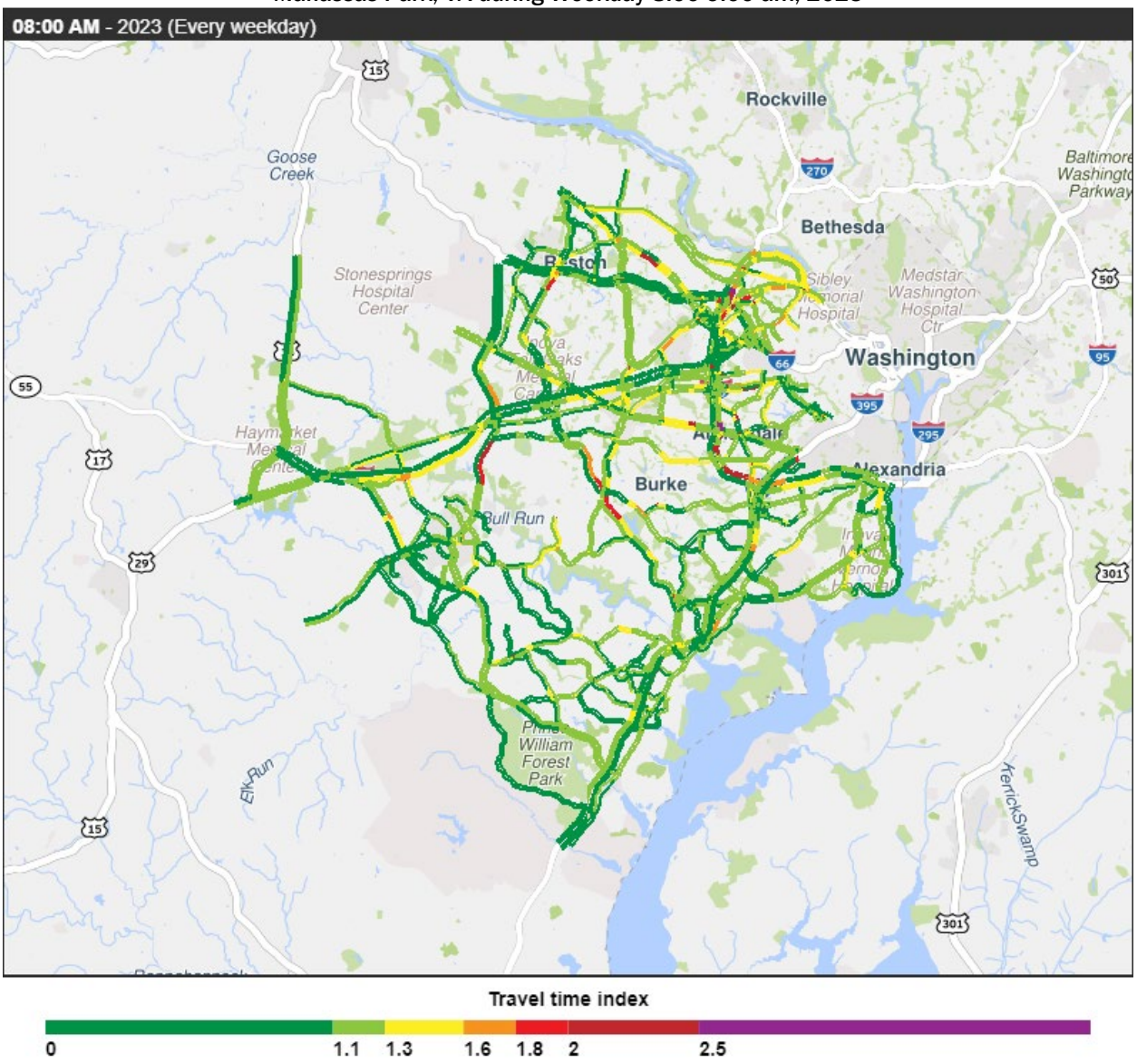


Figure A16: Travel Time Index in Fairfax, Prince William Counties and Cities of Fairfax, Manassas, and Manassas Park, VA during Weekday 5:00-6:00 pm, 2023

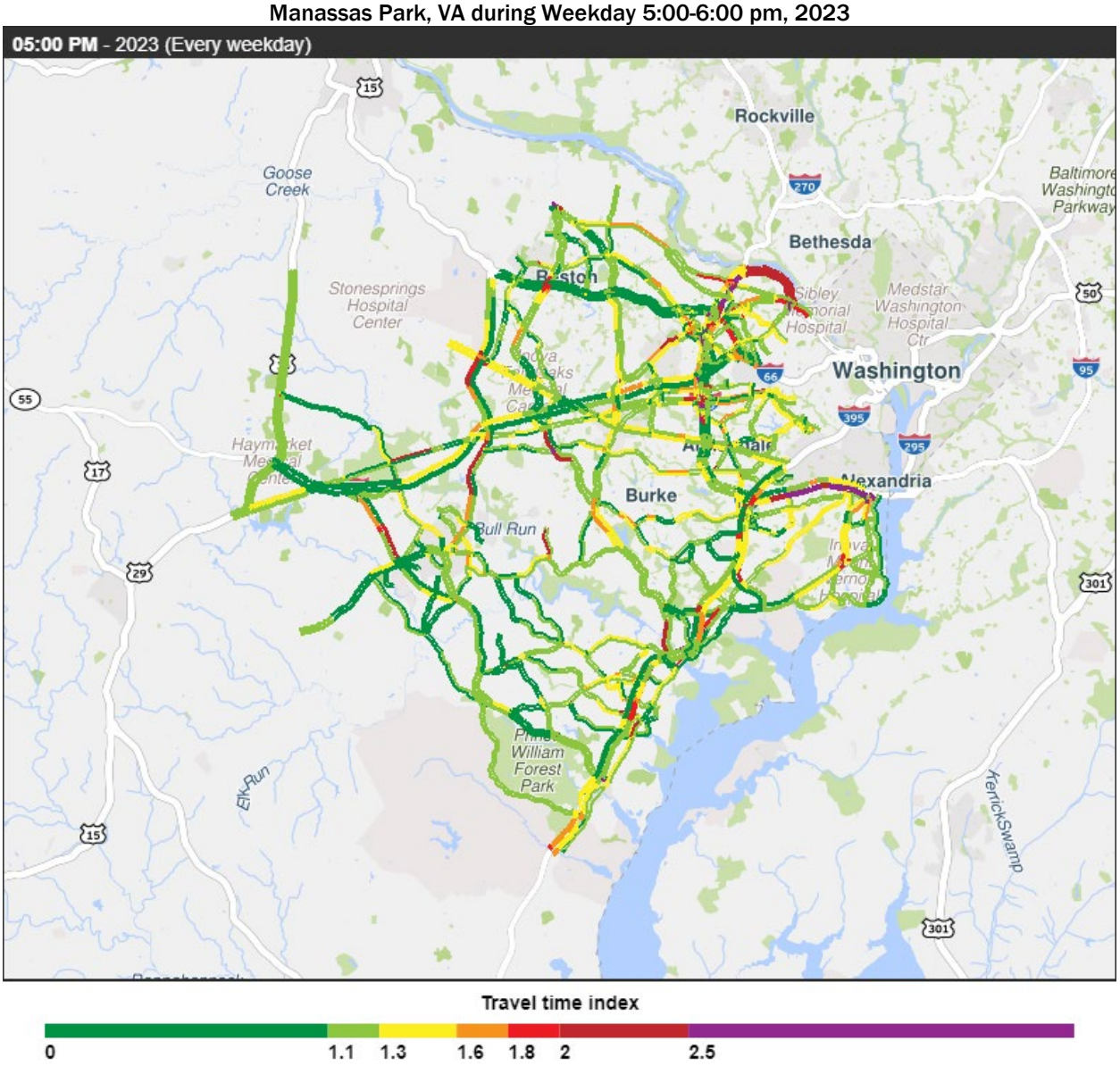


Figure A17: Travel Time Index in Cities of Alexandria, Arlington, and Falls Church, VA during Weekday 8:00-9:00 am, 2023

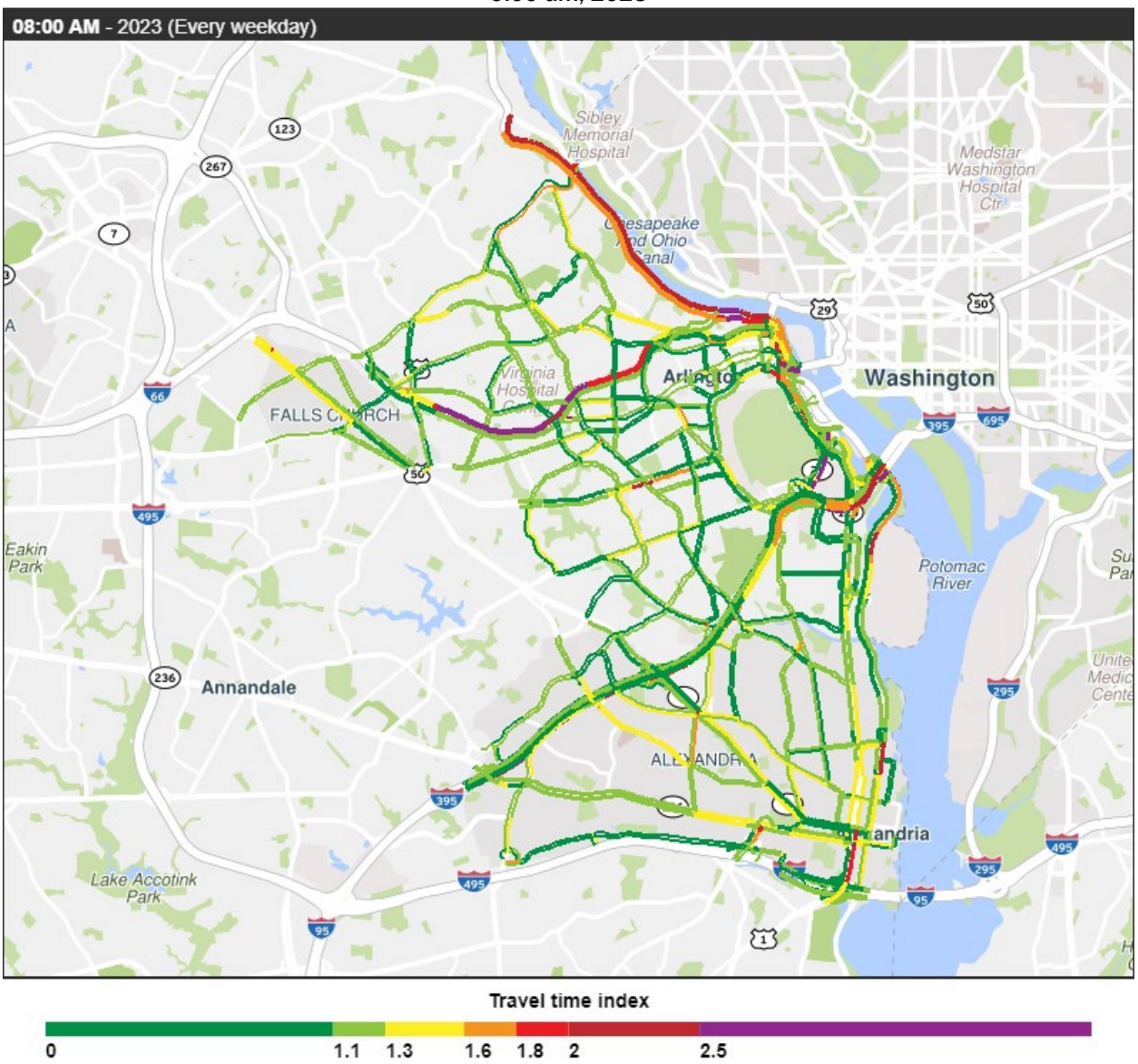
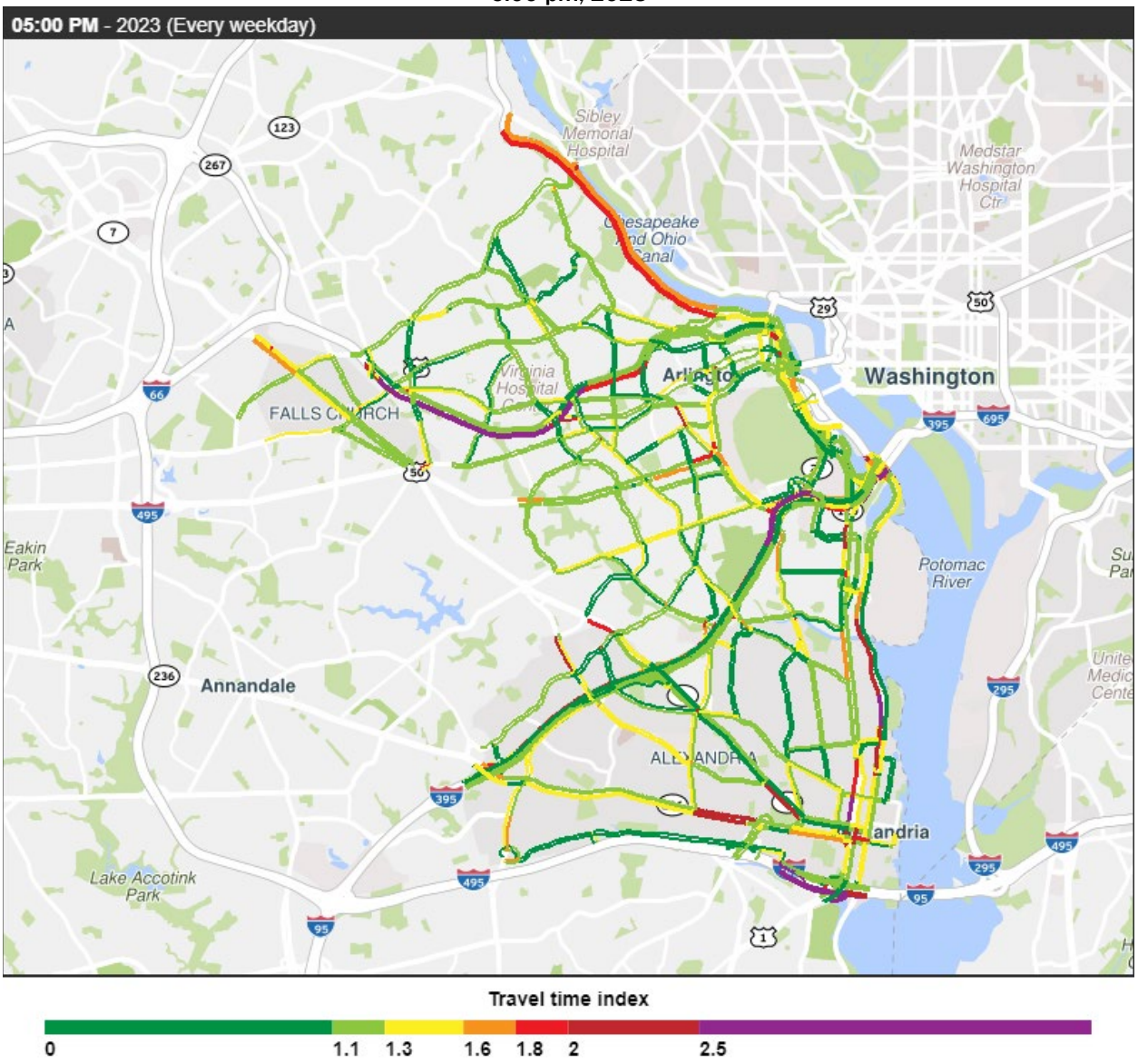


Figure A18: Travel Time Index in Cities of Alexandria, Arlington, and Falls Church, VA during Weekday 5:00-6:00 pm, 2023



APPENDIX B – 2023 PEAK HOUR PLANNING TIME INDEX

Note:

1. Calculations and visualizations were provided by the "Trend Map" tool of the Vehicle Probe Project Suite developed by the CATT Lab of the University of Maryland, https://pda.ritis.org/suite/.

2. Peak Hour: 8:00-9:00 am is the regional morning peak hour, and 5:00-6:00 pm is the regional afternoon peak hour, Monday through Friday.

Figure B1: Planning Time Index on the Interstates and Freeways during Weekday 8:00-9:00 am, 2023

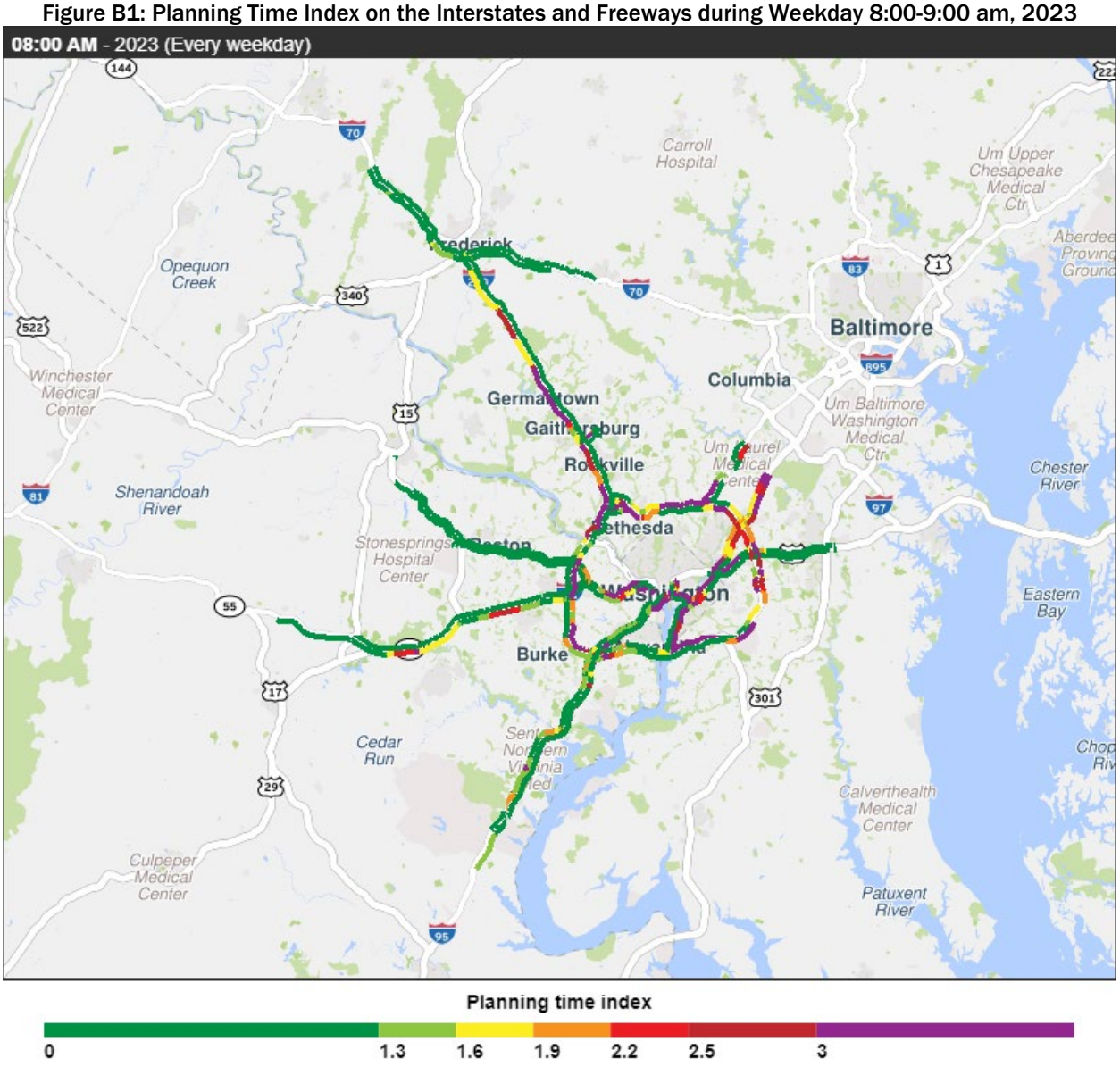


Figure B2: Planning Time Index on the Interstates and Freeways during Weekday 5:00-6:00 pm, 2023

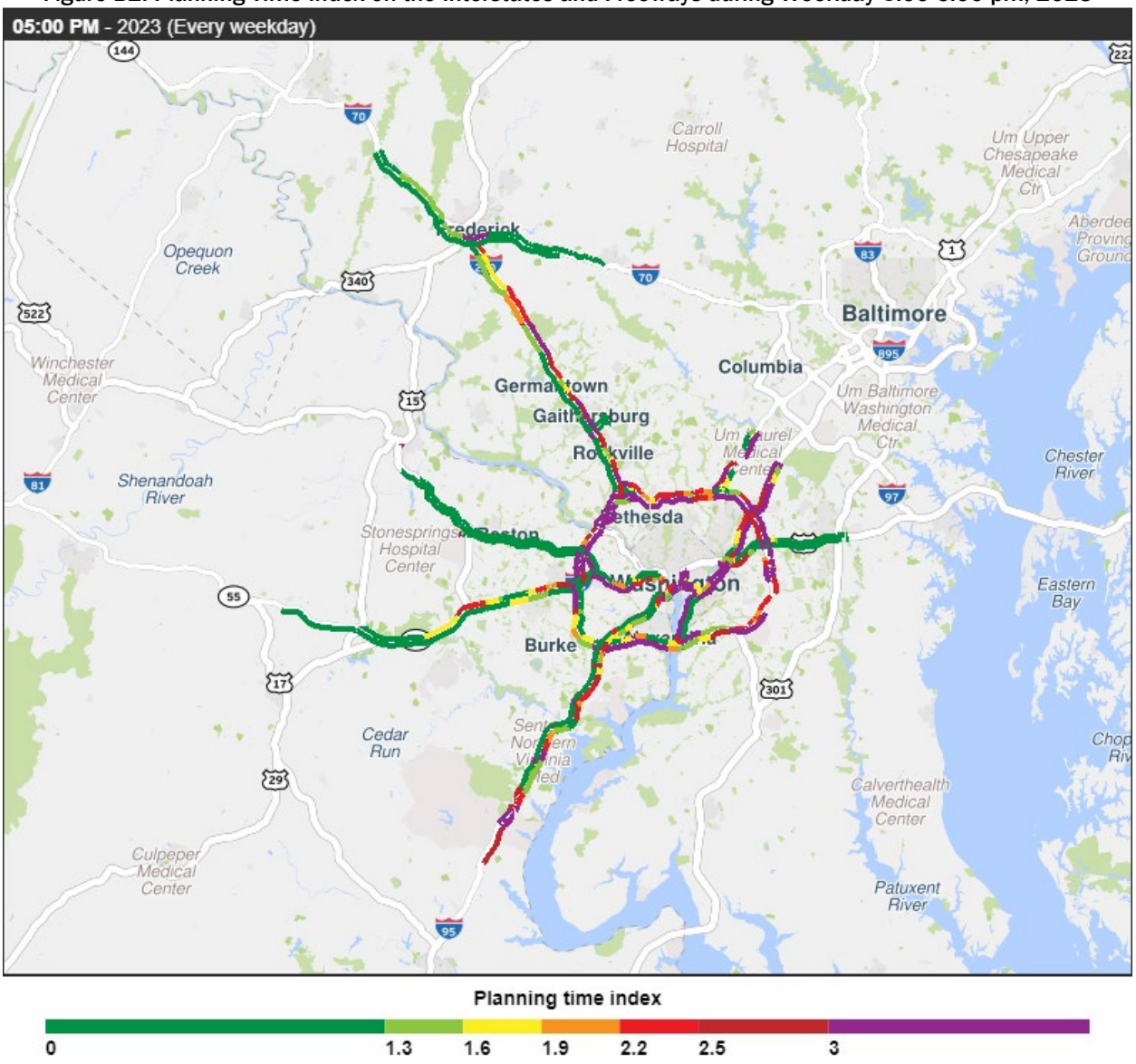


Figure B3: Planning Time Index in DC during Weekday 8:00-9:00 am, 2023

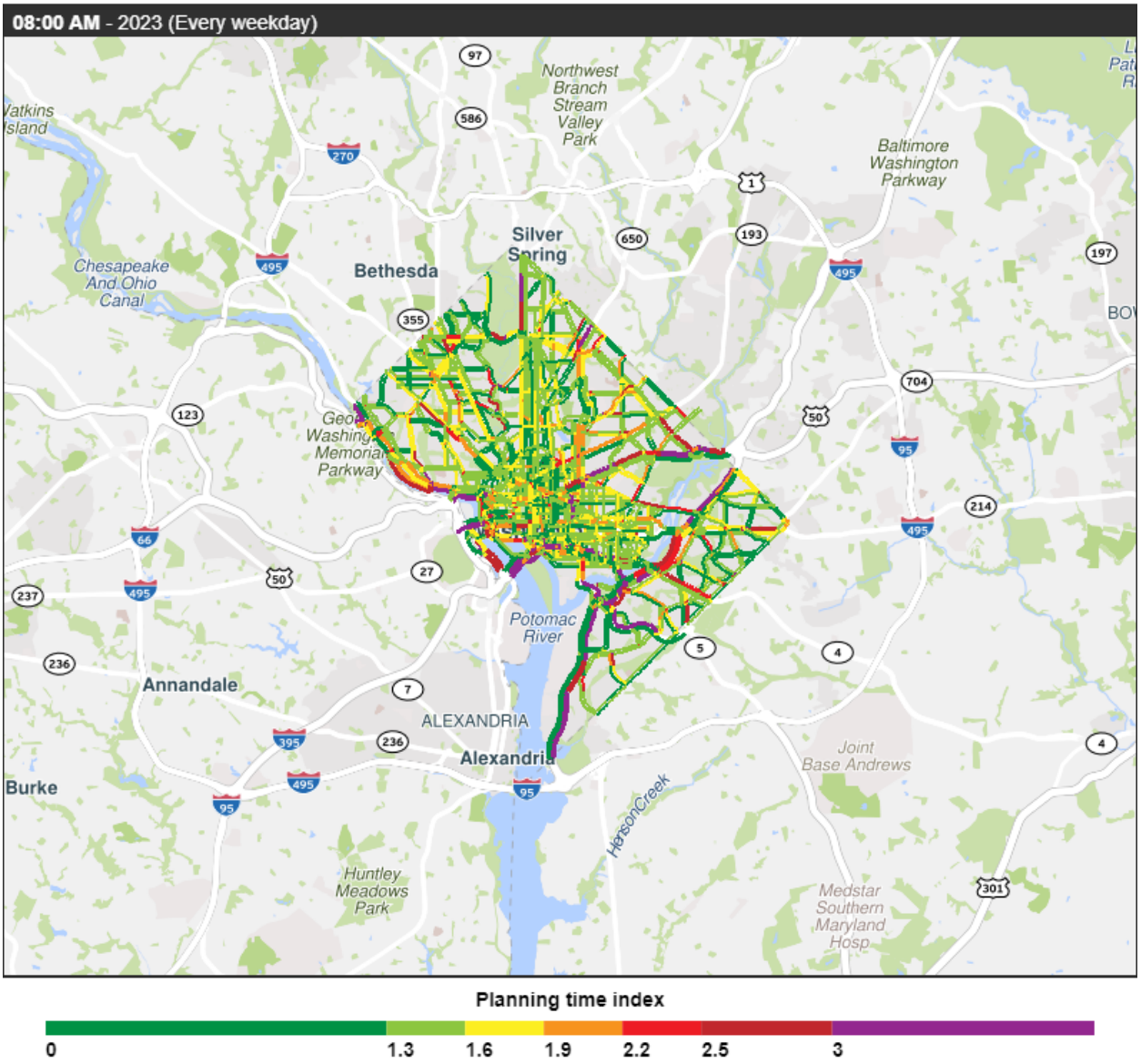


Figure B4: Planning Time Index in DC during Weekday 5:00-6:00 pm, 2023

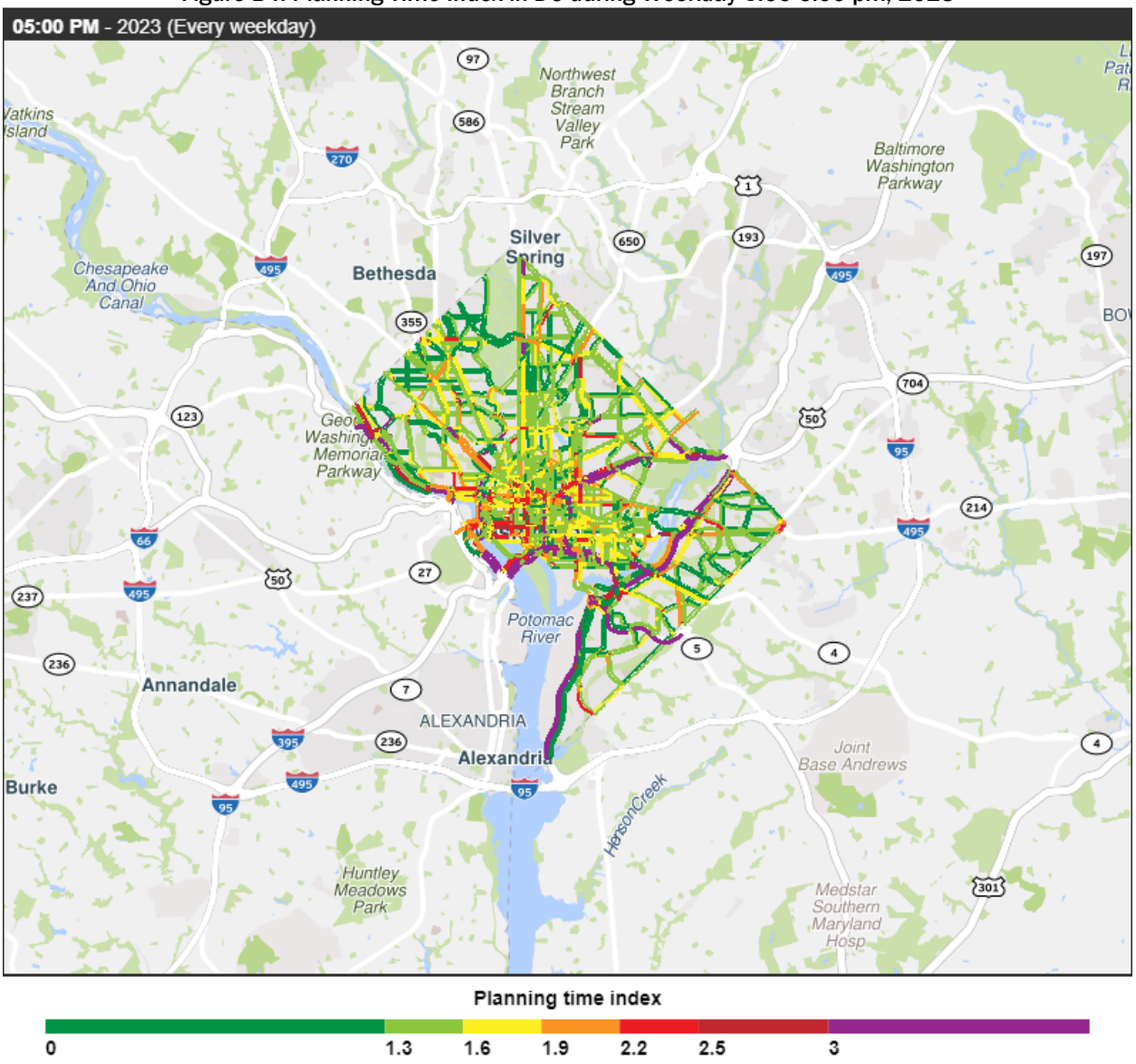


Figure B5: Planning Time in Frederick County, MD during Weekday 8:00-9:00 am, 2023

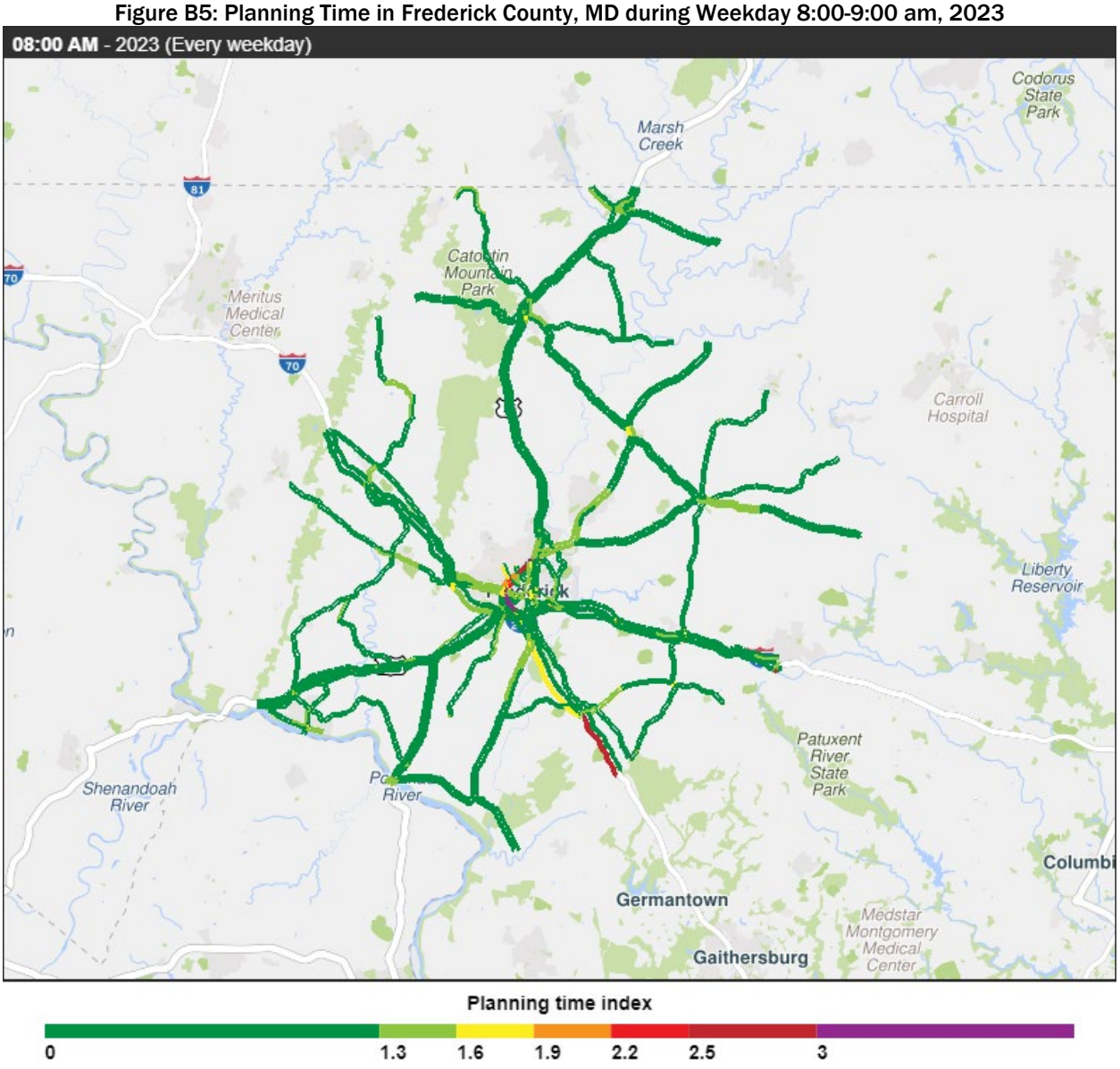


Figure B6: Planning Time Index in Frederick County, MD during Weekday 5:00-6:00 pm, 2023

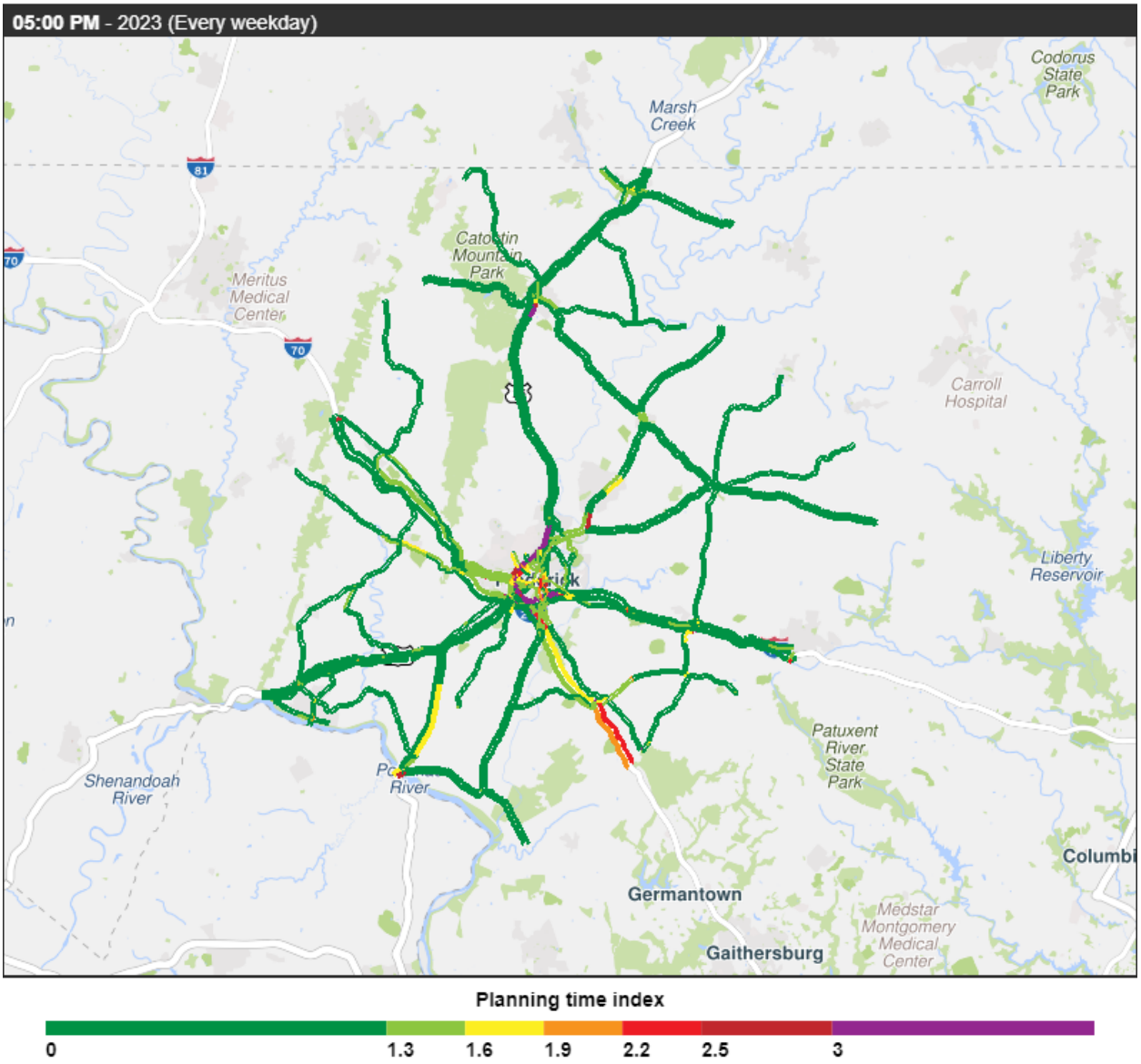


Figure B7: Planning Time Index in Montgomery County, MD during Weekday 8:00-9:00 am, 2023

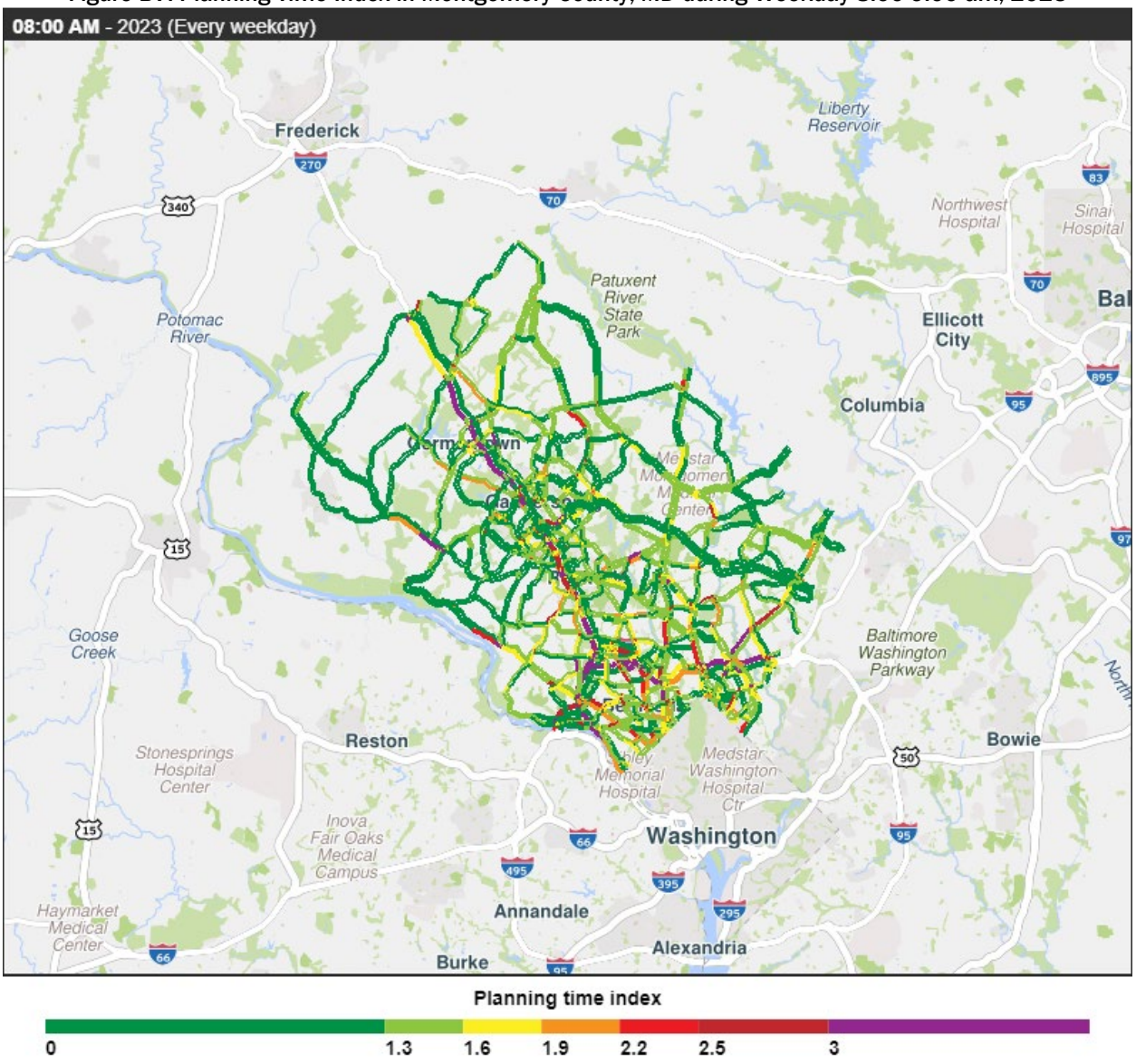


Figure B8: Planning Time Index in Montgomery County, MD during Weekday 5:00-6:00 pm, 2023

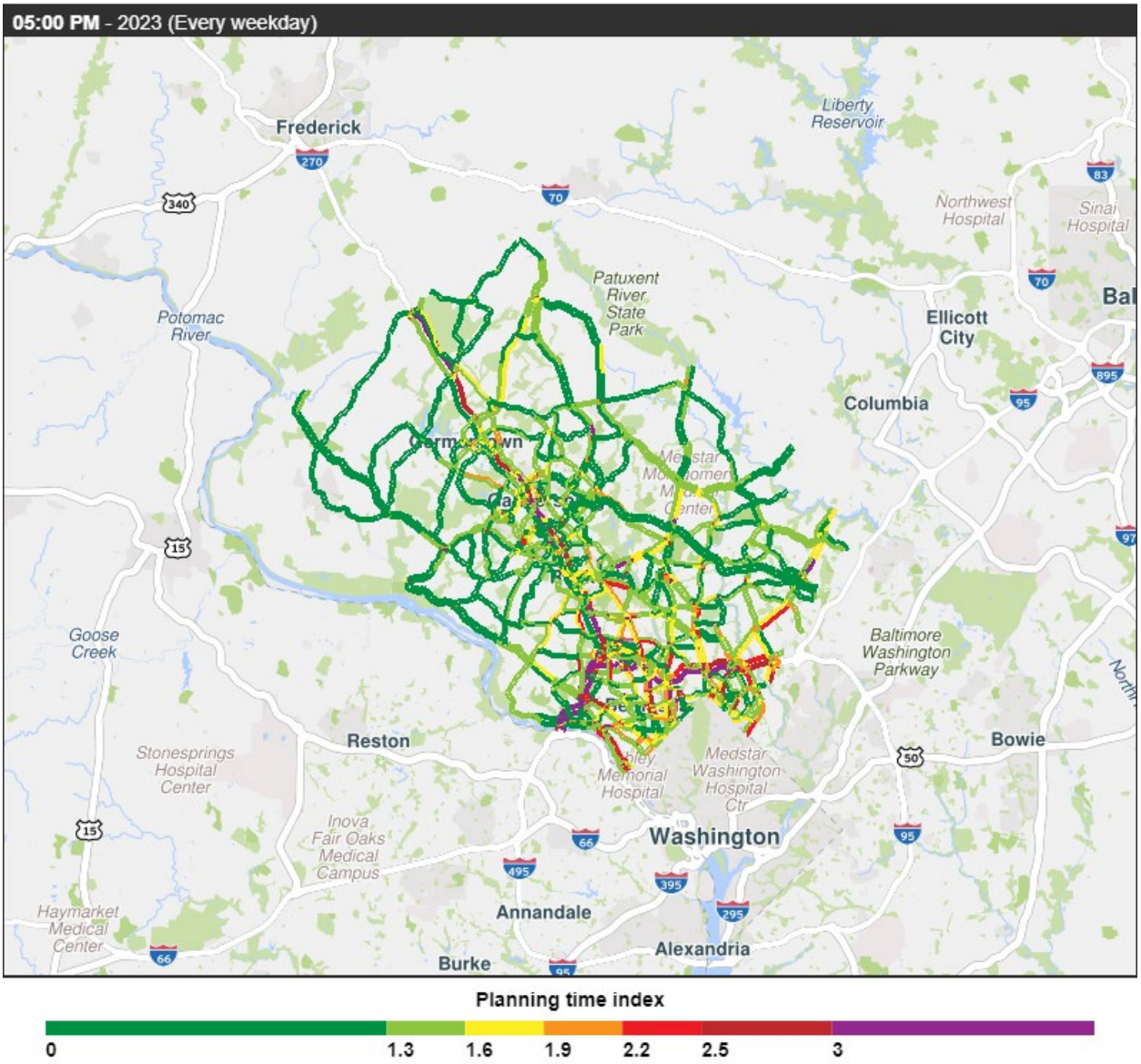


Figure B9: Planning Time Index in Prince George's County, MD during Weekday 8:00-9:00 am, 2023

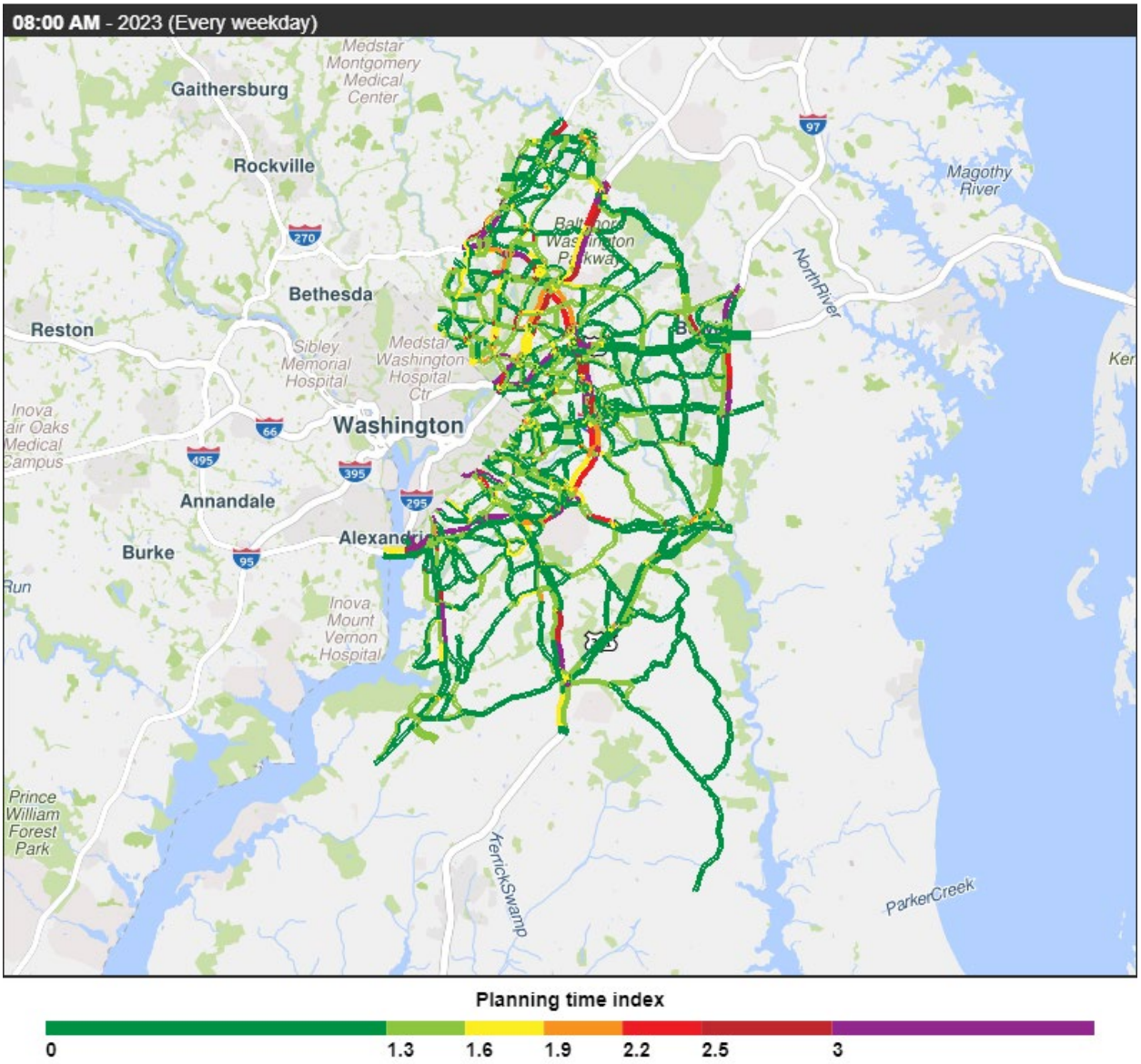


Figure B10: Planning Time Index in Prince George's County, MD during Weekday 5:00-6:00 pm, 2023

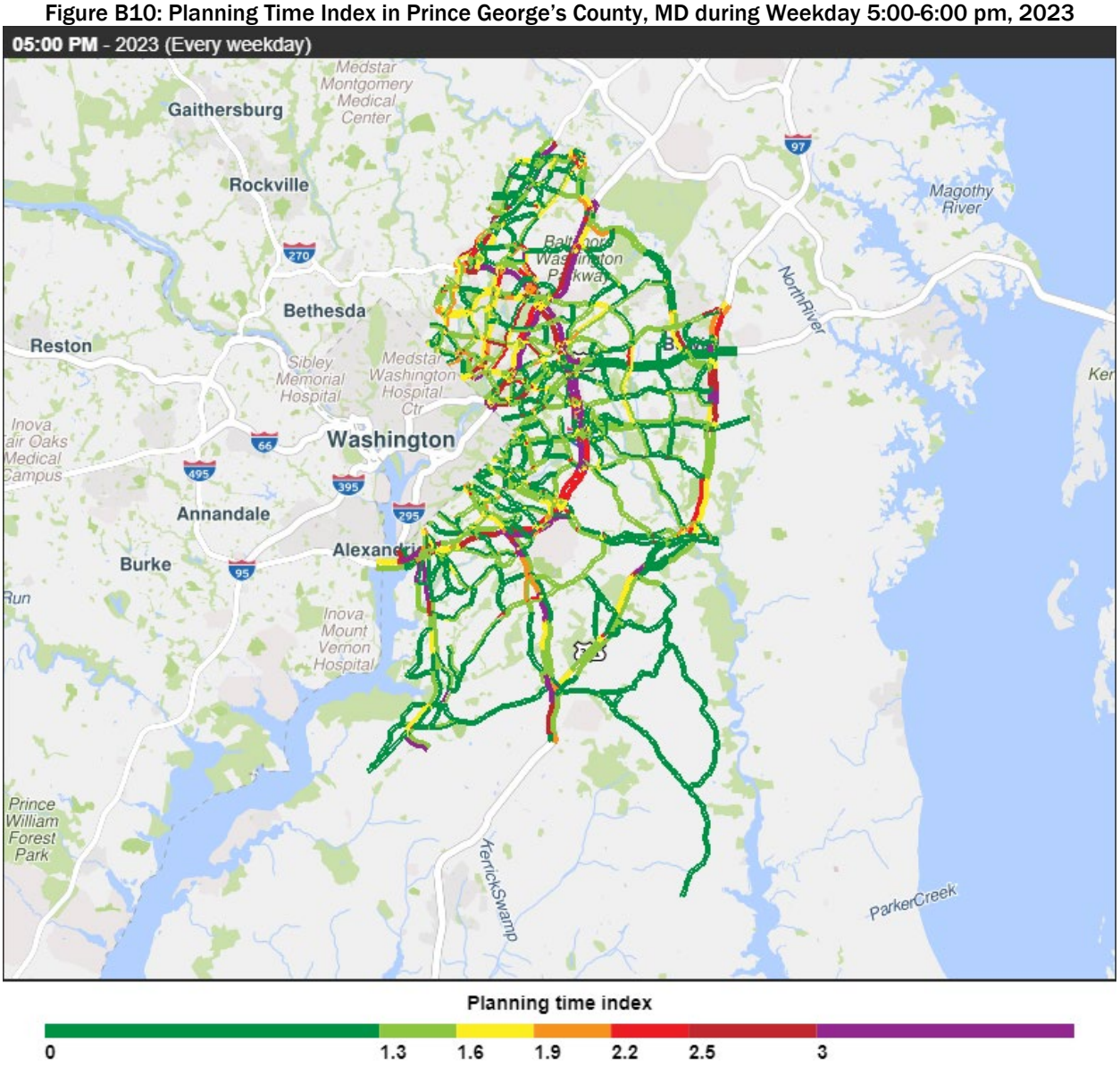


Figure B11: Planning Time Index in Charles County, MD during Weekday 8:00-9:00 am, 2023

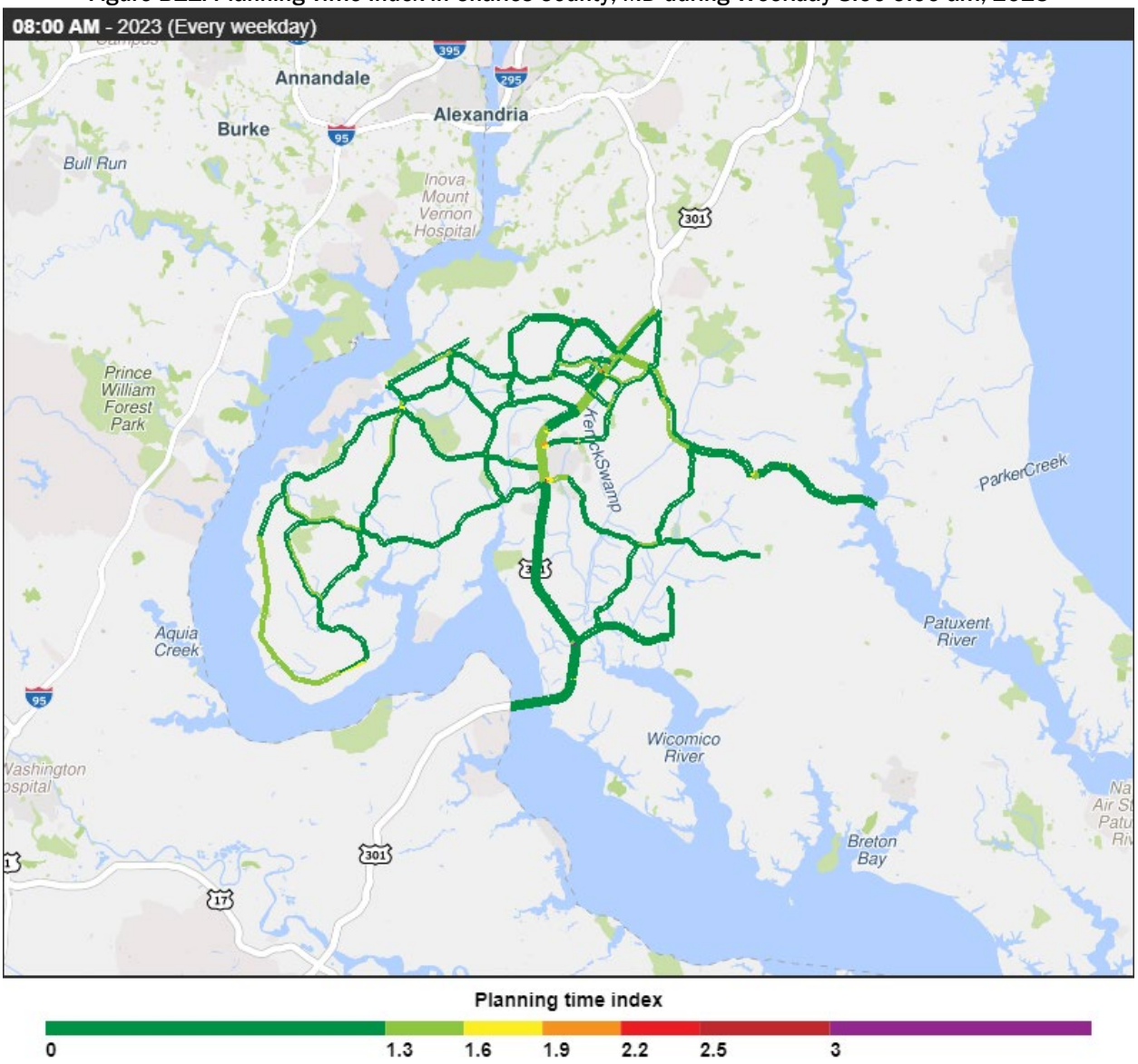


Figure B12: Planning Time Index in Prince Charles County, MD during Weekday 5:00-6:00 pm, 2023

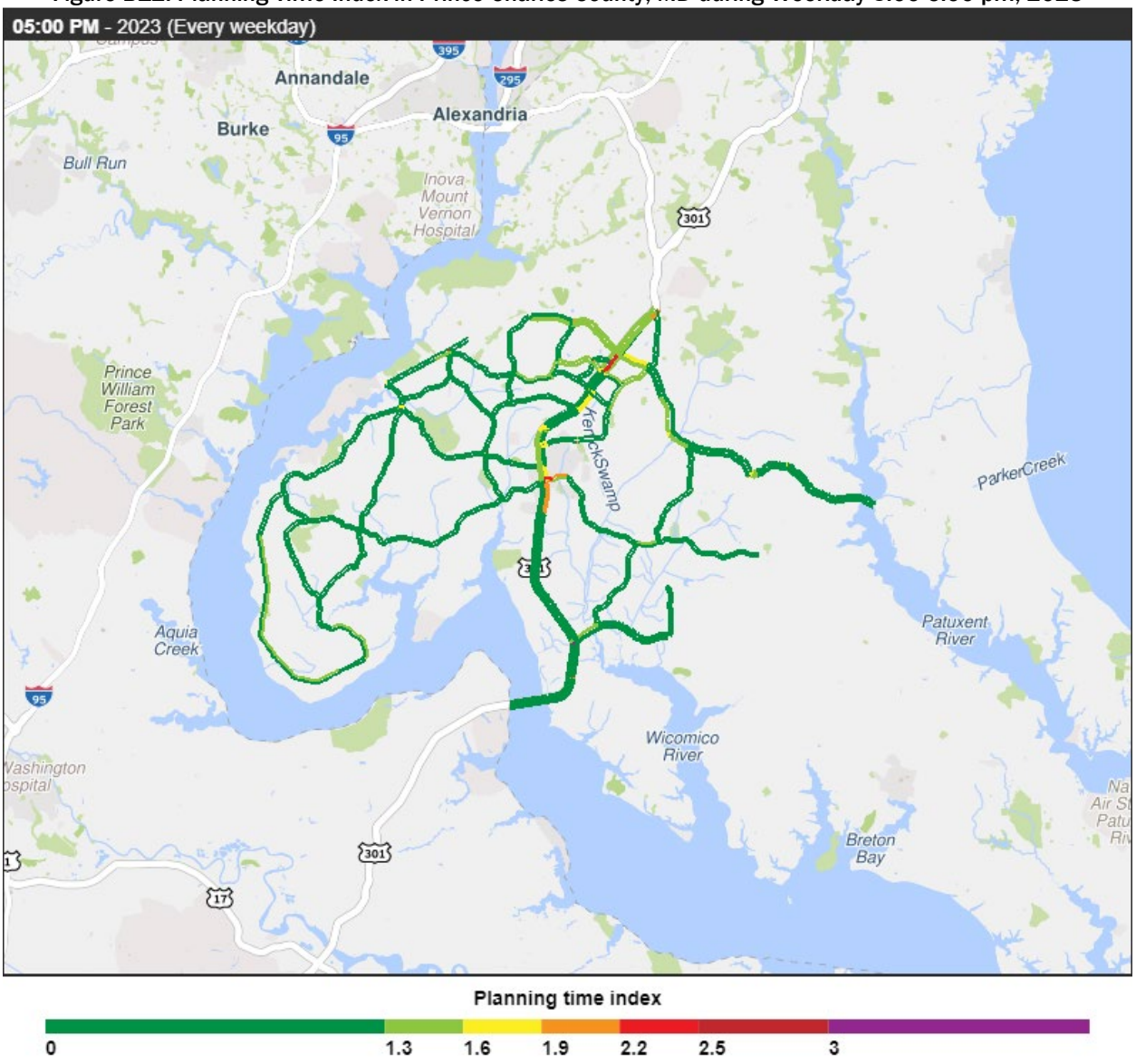


Figure B13: Planning Time Index in Loudoun County, VA during Weekday 8:00-9:00 am, 2023

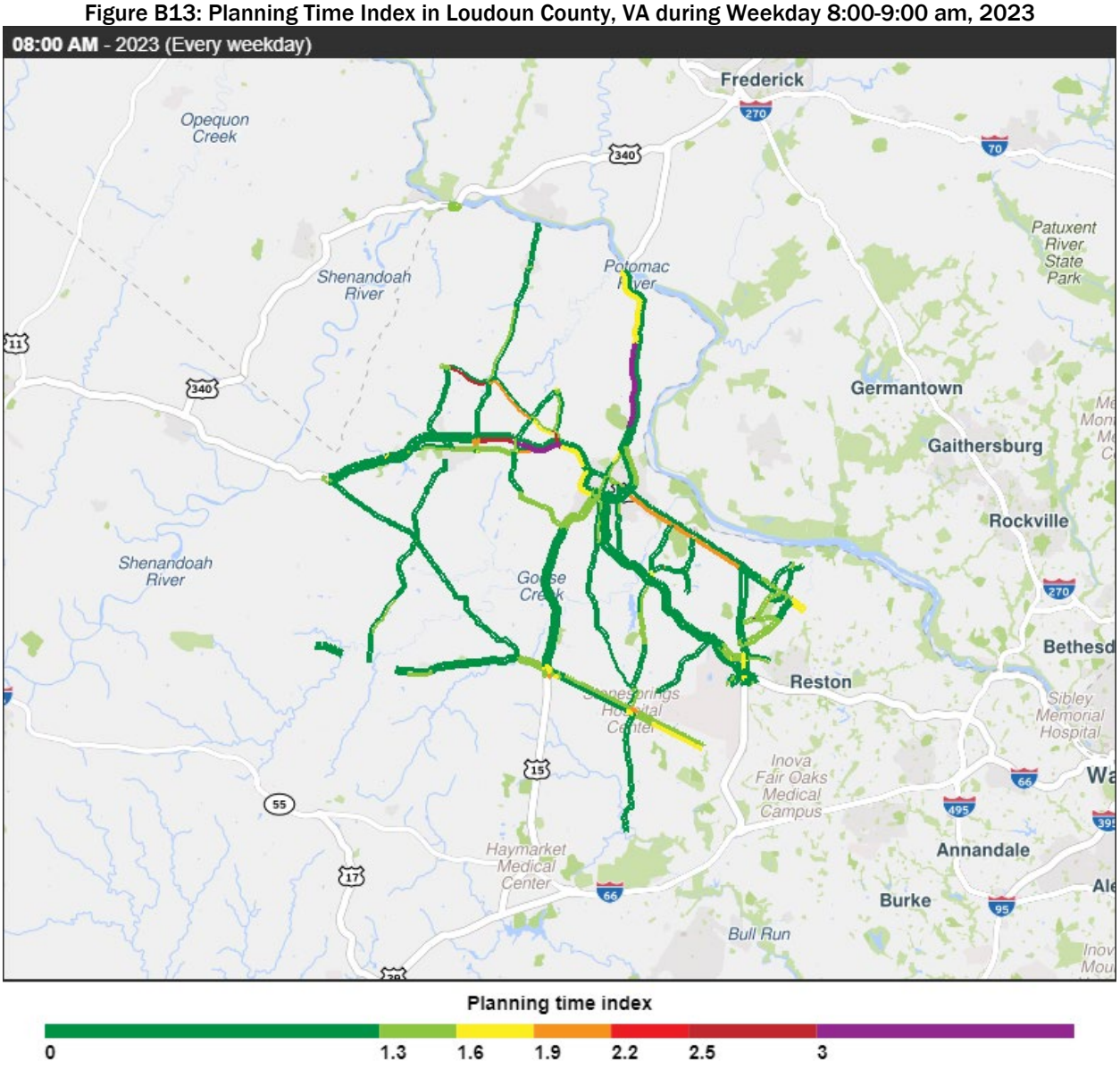


Figure B14: Planning Time Index in Loudoun County, VA during Weekday 5:00-6:00 pm, 2023

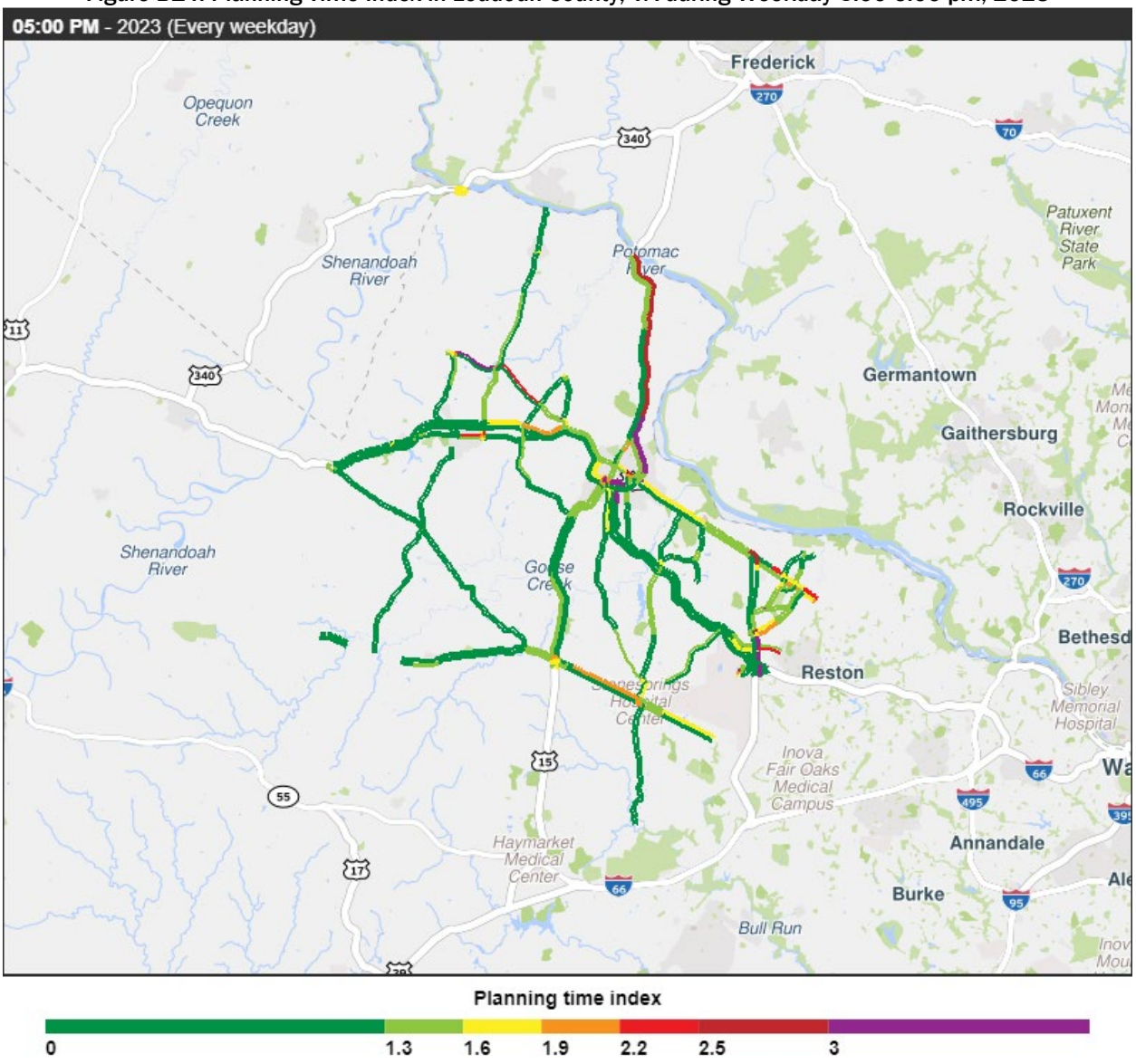


Figure B15: Planning Time Index in Fairfax, Prince William Counties and Cities of Fairfax, Manassas, and Manassas Park, VA during Weekday 8:00-9:00 am, 2023

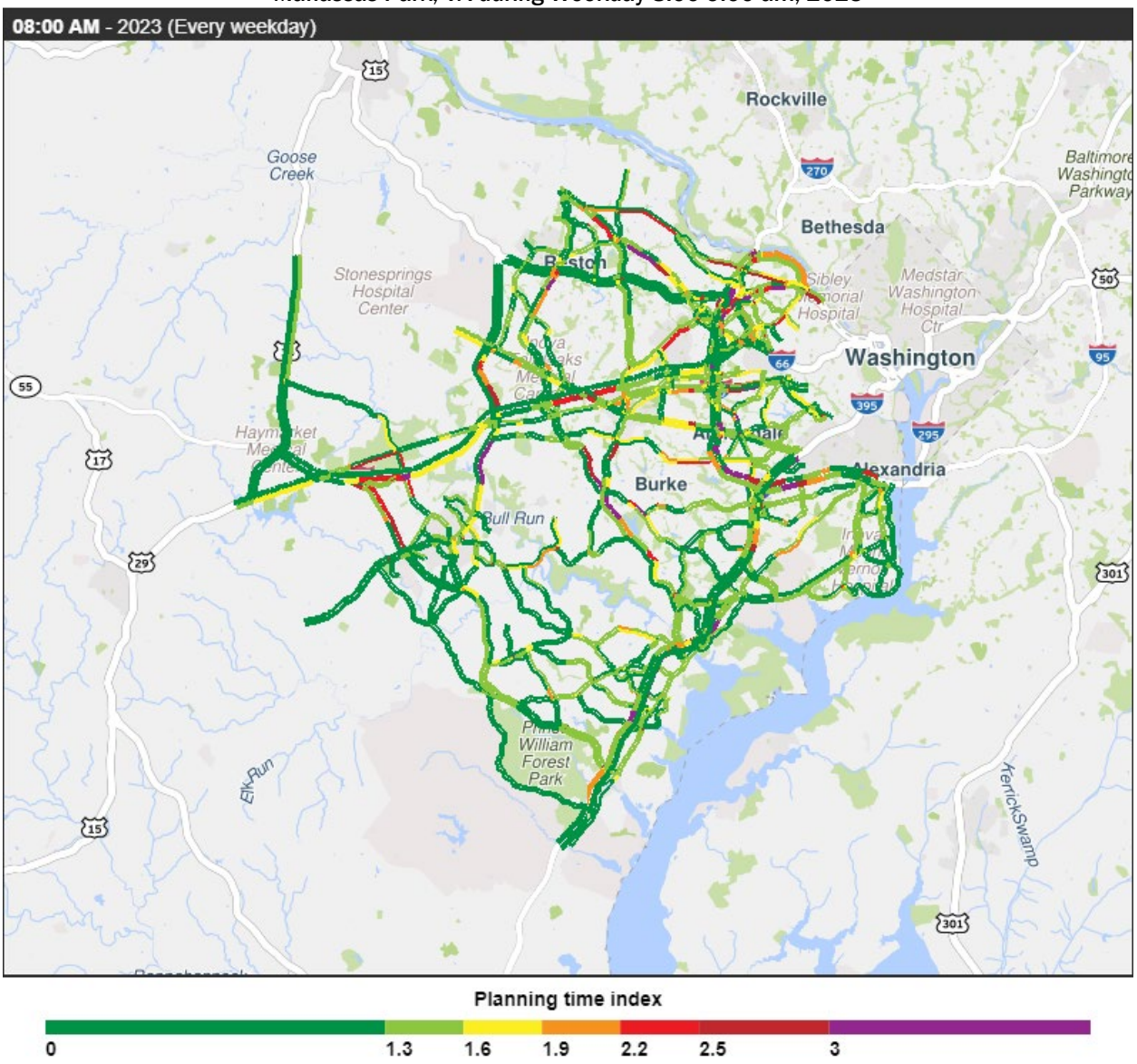


Figure B16: Planning Time Index in Fairfax, Prince William Counties and Cities of Fairfax, Manassas, and Manassas Park, VA during Weekday 5:00-6:00 pm, 2023

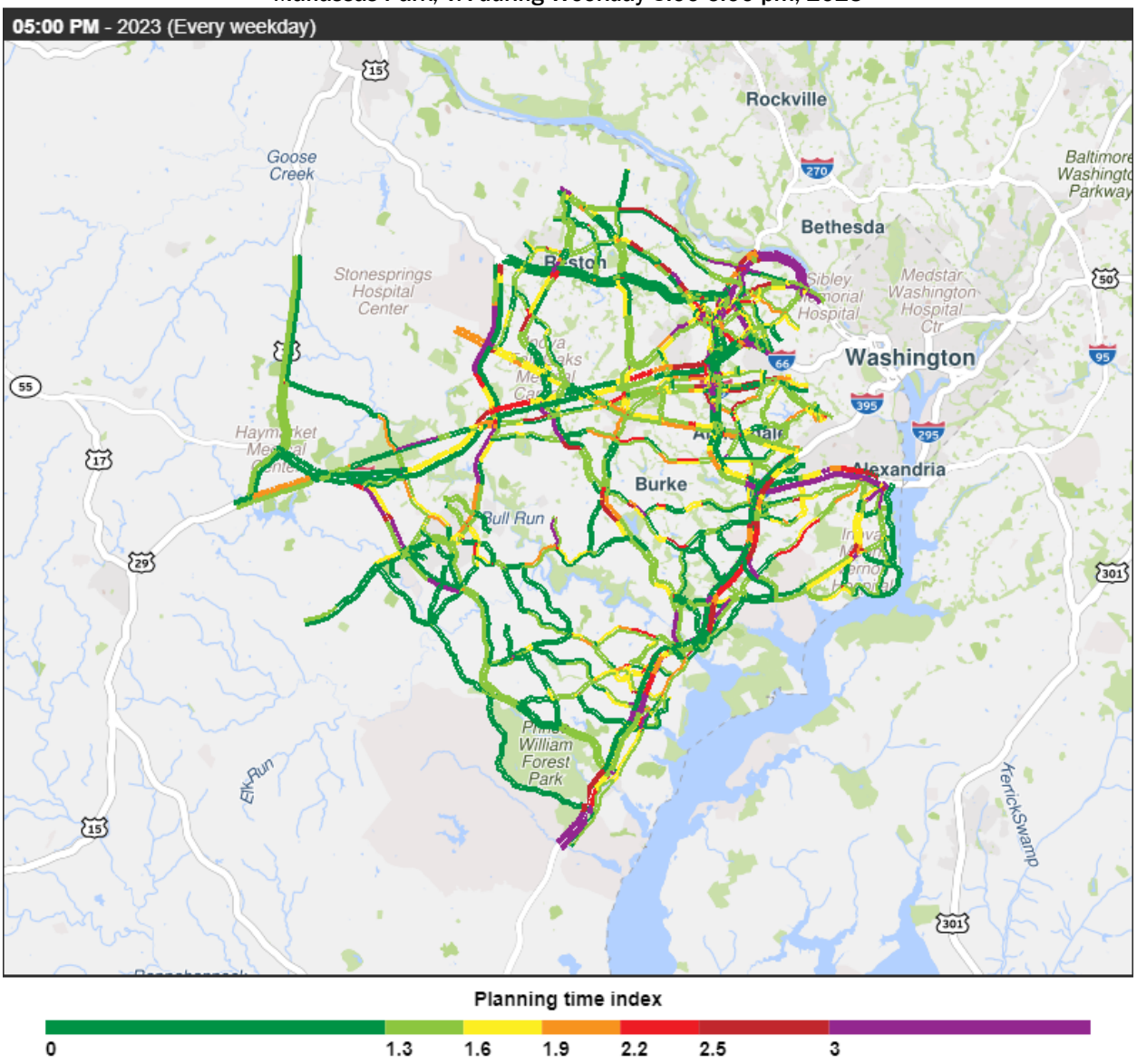


Figure B17: Planning Time Index in Cities of Alexandria, Arlington, and Falls Church, VA during Weekday 8:00-9:00 am, 2023

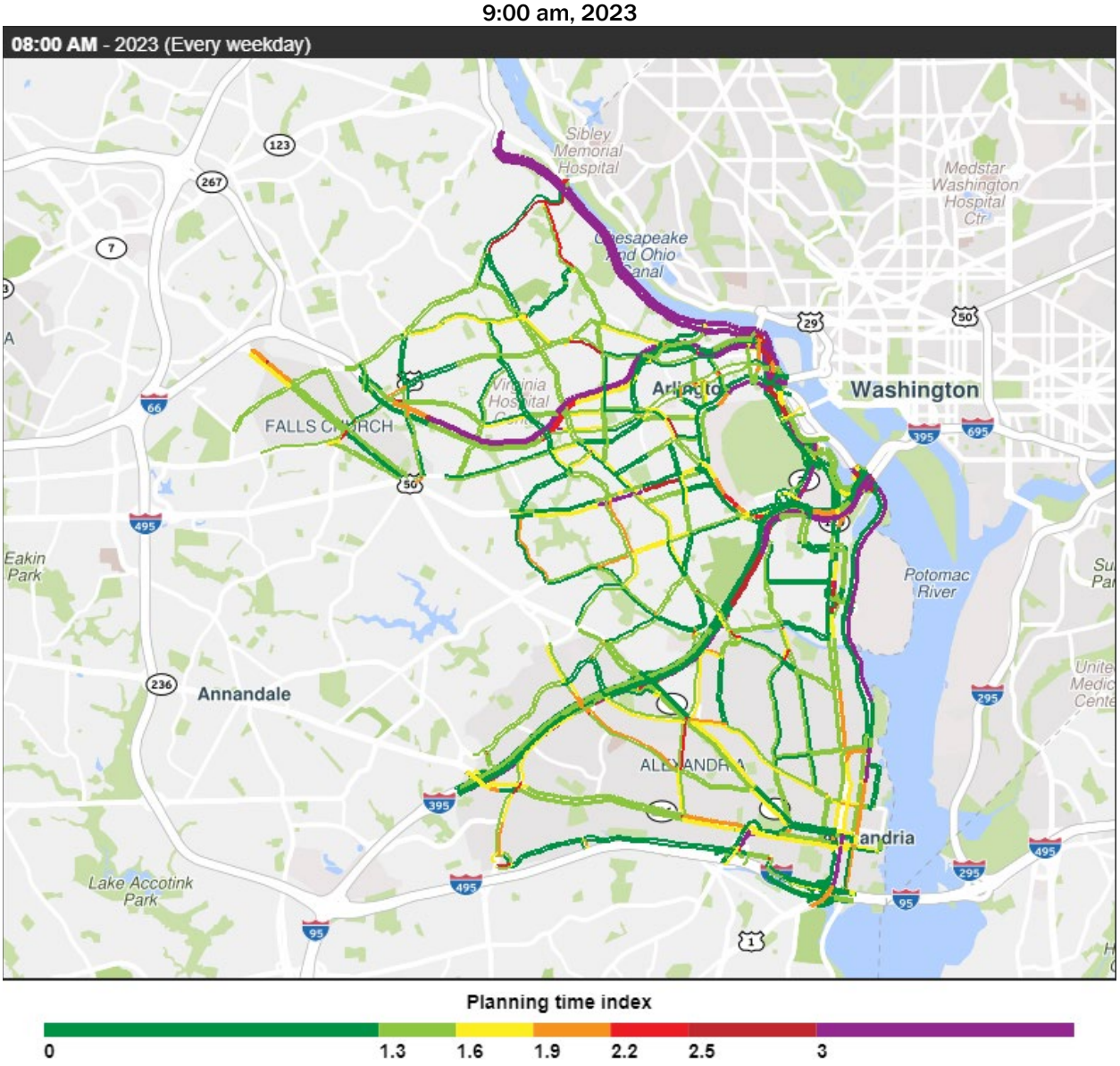
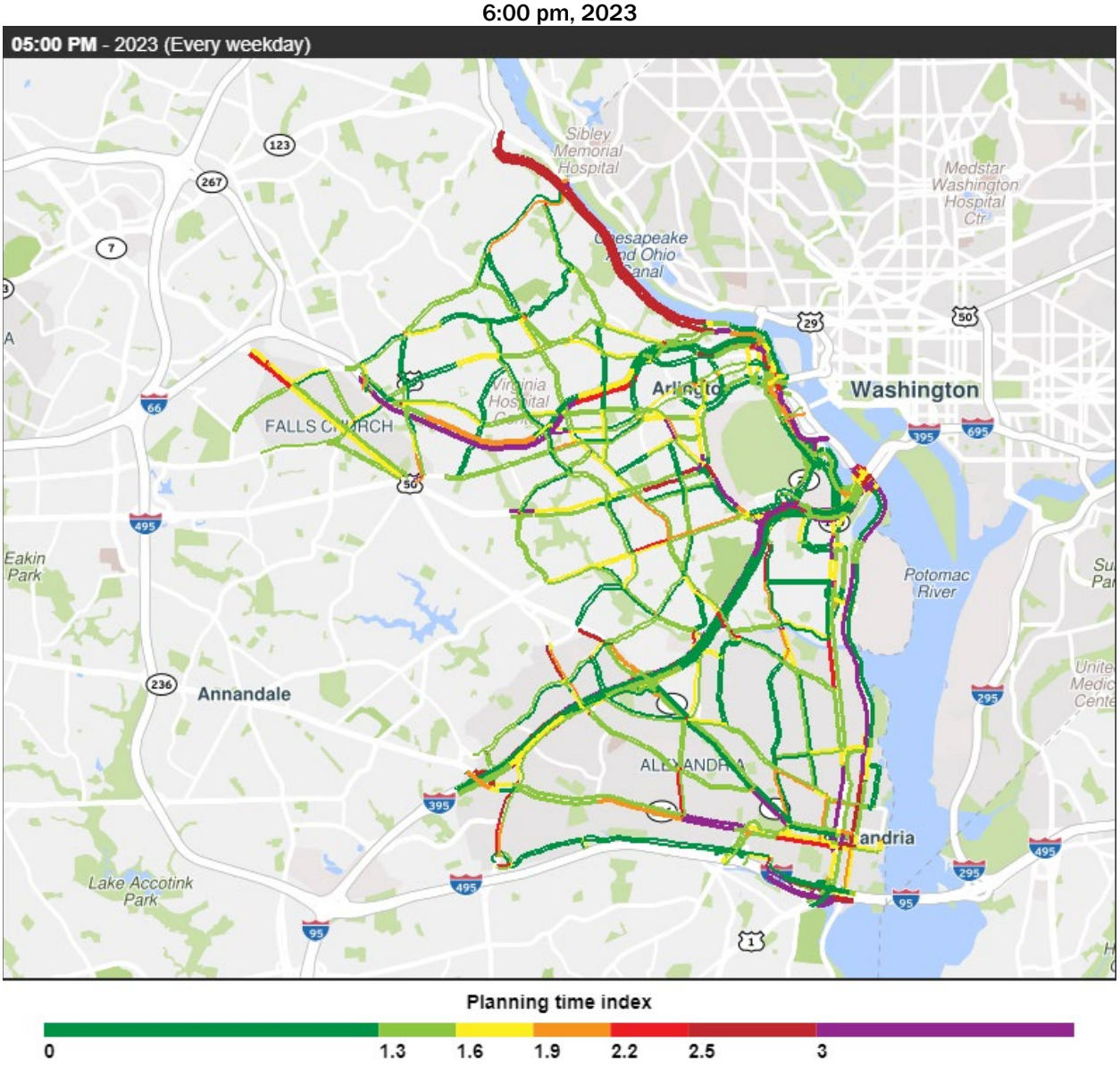


Figure B18: Planning Time Index in Cities of Alexandria, Arlington, and Falls Church, VA during Weekday 5:00-6:00 pm, 2023



APPENDIX C – 2013 AND 2021-2023 TRAVEL TIMES ALONG MAJOR FREEWAY COMMUTE CORRIDORS

Note:

1. Calculation and visualization were provided by the "Performance Charts" tool of the Vehicle Probe Project Suite developed by the CATT Lab of the University of Maryland, https://pda.ritis.org/suite/.

2. There are 18 major commuter corridors defined in this report:

C1	I-270 between I-370/Sam Eig Hwy/Exit 9 and I-70/US-40
C2	I-270 between I-370/Sam Eig Hwy/Exit 9 and I-495/MD-355
C3	VA-267 between VA-28/Exit 9a and VA-123/Exit 19
C4	I-66 between VA-28/Exit 53 and I-495/Exit 64
C5	I-66 between I-495/Exit 64 and Theodore Roosevelt Memorial Bridge
C6	I-95 between VA-234/Exit 152 and Franconia Rd/Exit 169
C7	I-95 HOV between VA-234/Exit 152 and Franconia Rd/Exit 169
C8	I-395 between I-95 and H St
C9	I-395 HOV between I-95 and US-1
C10	US-50 between MD-295/Kenilworth Ave and US-301/Exit 13
C11	MD-295 between US-50/MD-201/Kenilworth Ave and MD-198
C12	I-95 between I-495/Exit 27-25 and MD-198/Exit 33
C13	I-495 between I-270/Exit 35 and I-95/Exit 27
C14	I-495 between I-95/Exit 27 and US-50/Exit 19
C15	I-495 between US-50/Exit 19 and I-95/I-395/Exit 57
C16	I-495 between I-95/I-395/Exit 57 and I-66/Exit 9
C17	I-495 between I-66/Exit 9 and I-270/Exit 35
C18	I-295 between I-495 and 11th St. Bridge

3. Travel times were drawn for only normal weekdays – Tuesdays, Wednesdays, and Thursdays.

Figure C1

Travel time for I-270 between I-370/Sam Eig Hwy/Exit 9 and I-70/US-40

Averaged per hour for 2013 (Every Tuesday, Wednesday, and Thursday), 2021 (Every Tuesday, Wednesday, and Thursday), 2022 (Every Tuesday, Wednesday, and Thursday), and 2023 (Every Tuesday, Wednesday, and Thursday)

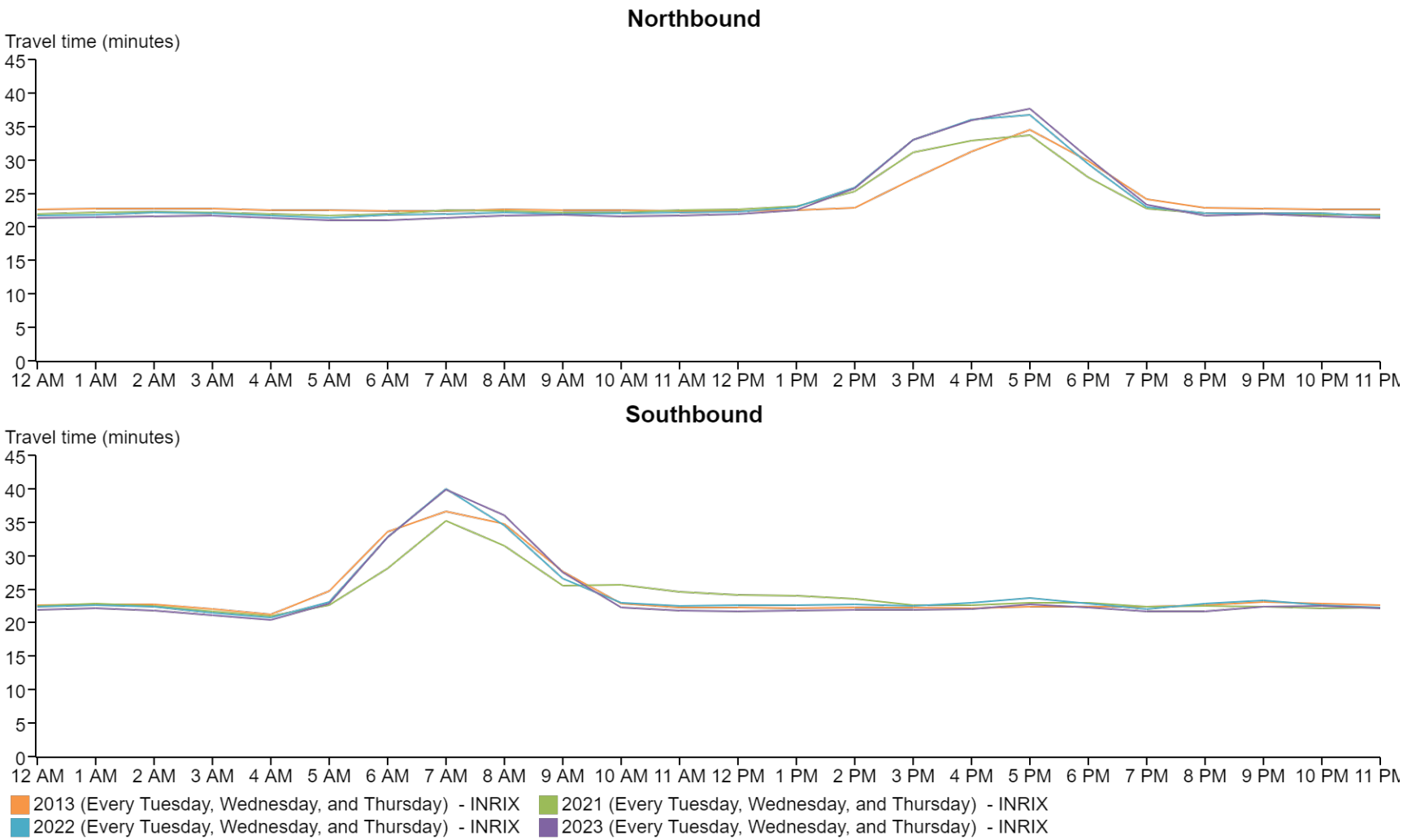


Figure C2

Travel time for I-270 between I-370/Sam Eig Hwy/Exit 9 and I-495/MD-355

Averaged per hour for 2013 (Every Tuesday, Wednesday, and Thursday), 2021 (Every Tuesday, Wednesday, and Thursday), 2022 (Every Tuesday, Wednesday, and Thursday), and 2023 (Every Tuesday, Wednesday, and Thursday)

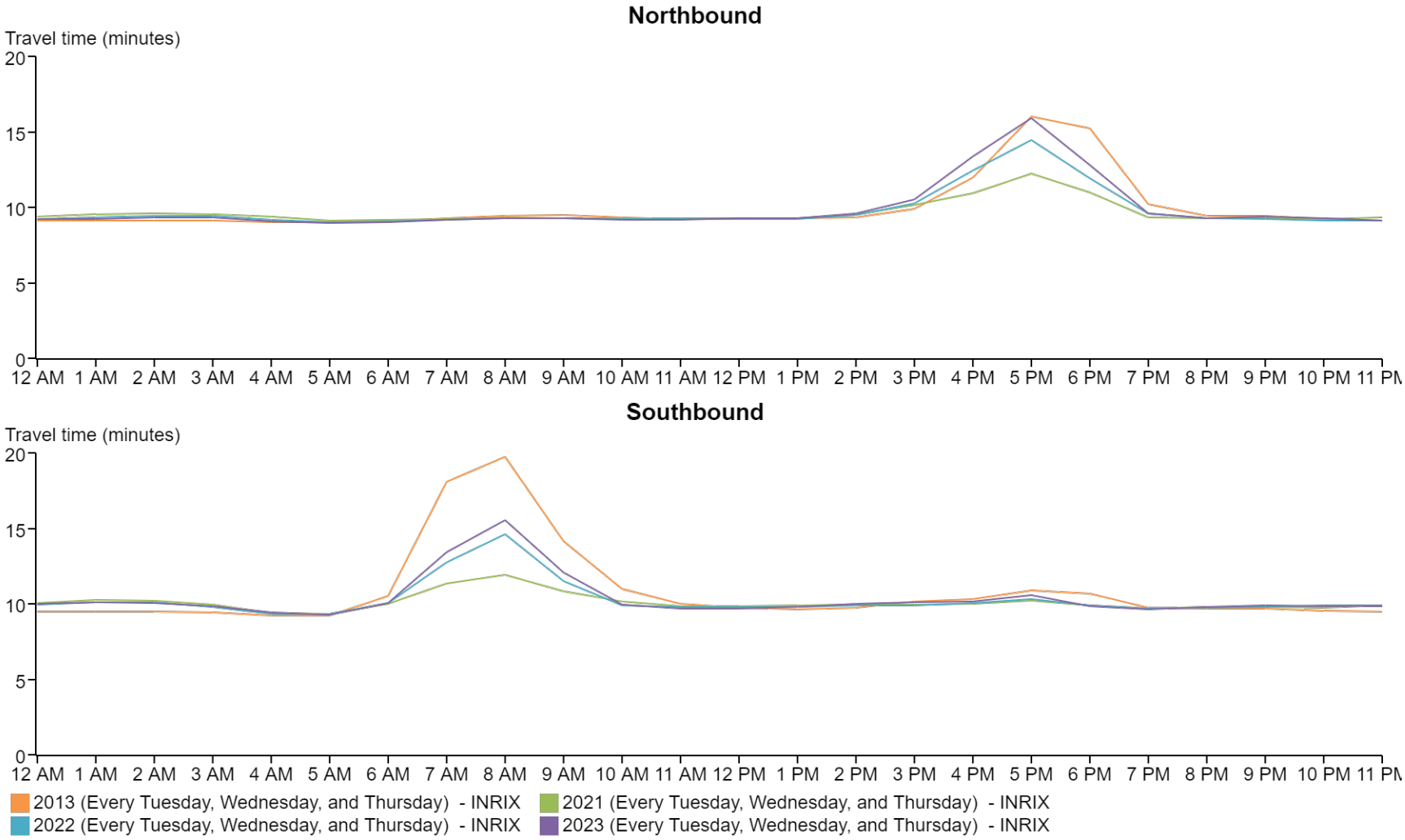


Figure C3

Travel time for VA-267 between VA-28/Exit 9A and VA-123/Exit 19

Averaged per hour for 2013 (Every Tuesday, Wednesday, and Thursday), 2021 (Every Tuesday, Wednesday, and Thursday), 2022 (Every Tuesday, Wednesday, and Thursday), and 2023 (Every Tuesday, Wednesday, and Thursday)

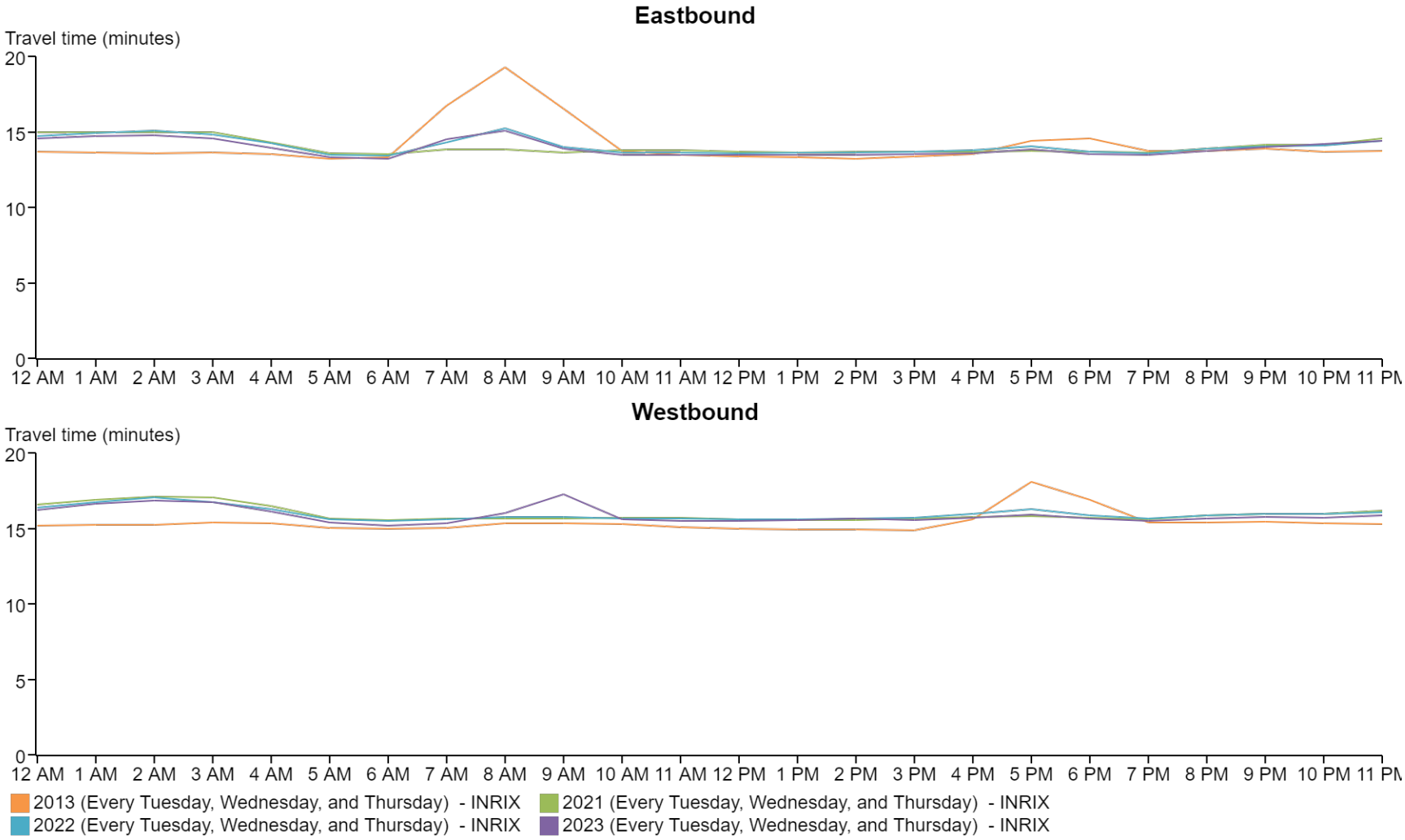


Figure C4

Travel time for I-66 between VA-28/Exit 53 and I-495/Exit 64

Averaged per hour for 2013 (Every Tuesday, Wednesday, and Thursday), 2021 (Every Tuesday, Wednesday, and Thursday), 2022 (Every Tuesday, Wednesday, and Thursday), and 2023 (Every Tuesday, Wednesday, and Thursday)

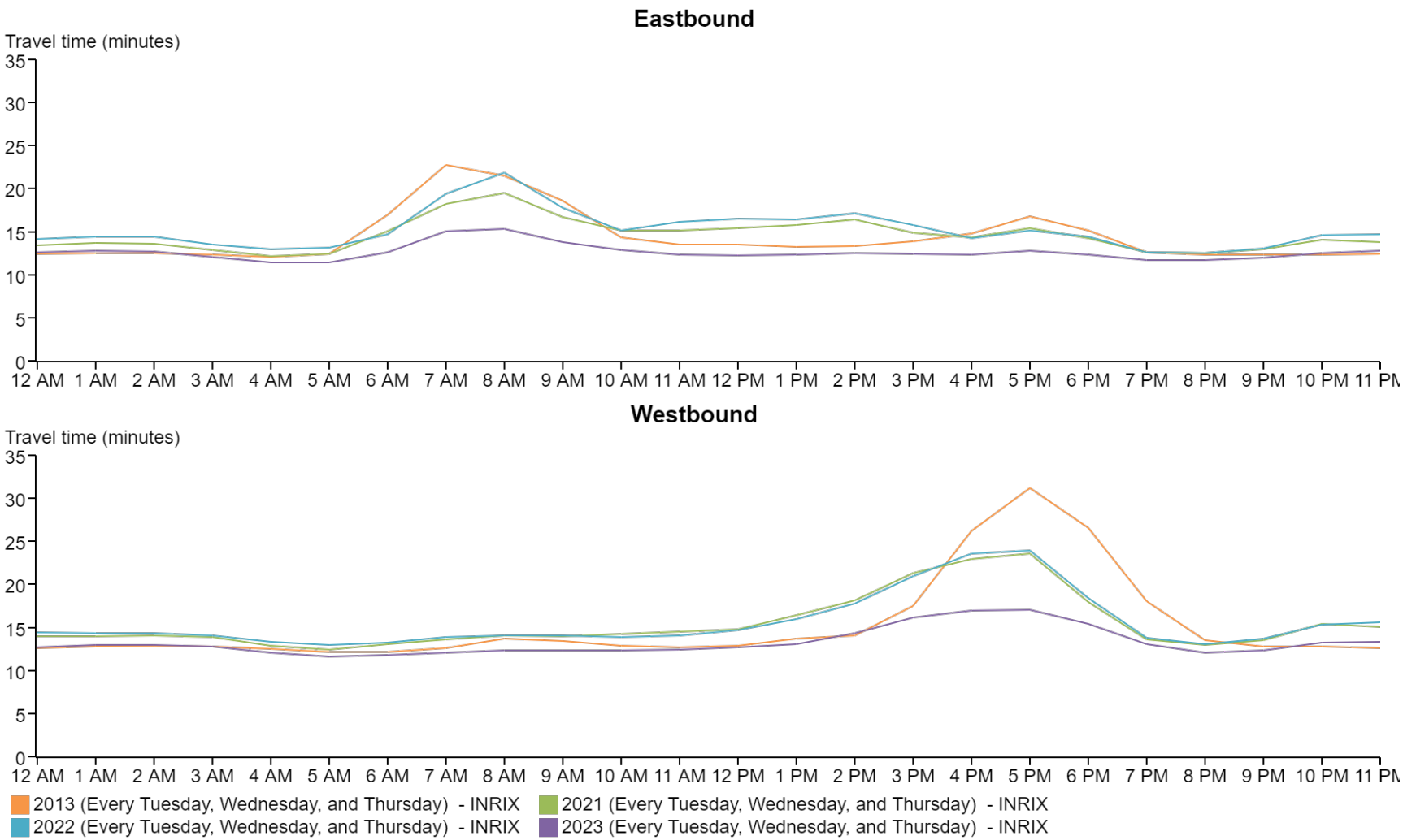


Figure C5

Travel time for I-66 between I-495/Exit 64 and Theodore Roosevelt Memorial Bridge

Averaged per hour for 2013 (Every Tuesday, Wednesday, and Thursday), 2021 (Every Tuesday, Wednesday, and Thursday), 2022 (Every Tuesday, Wednesday, and Thursday), and 2023 (Every Tuesday, Wednesday, and Thursday)

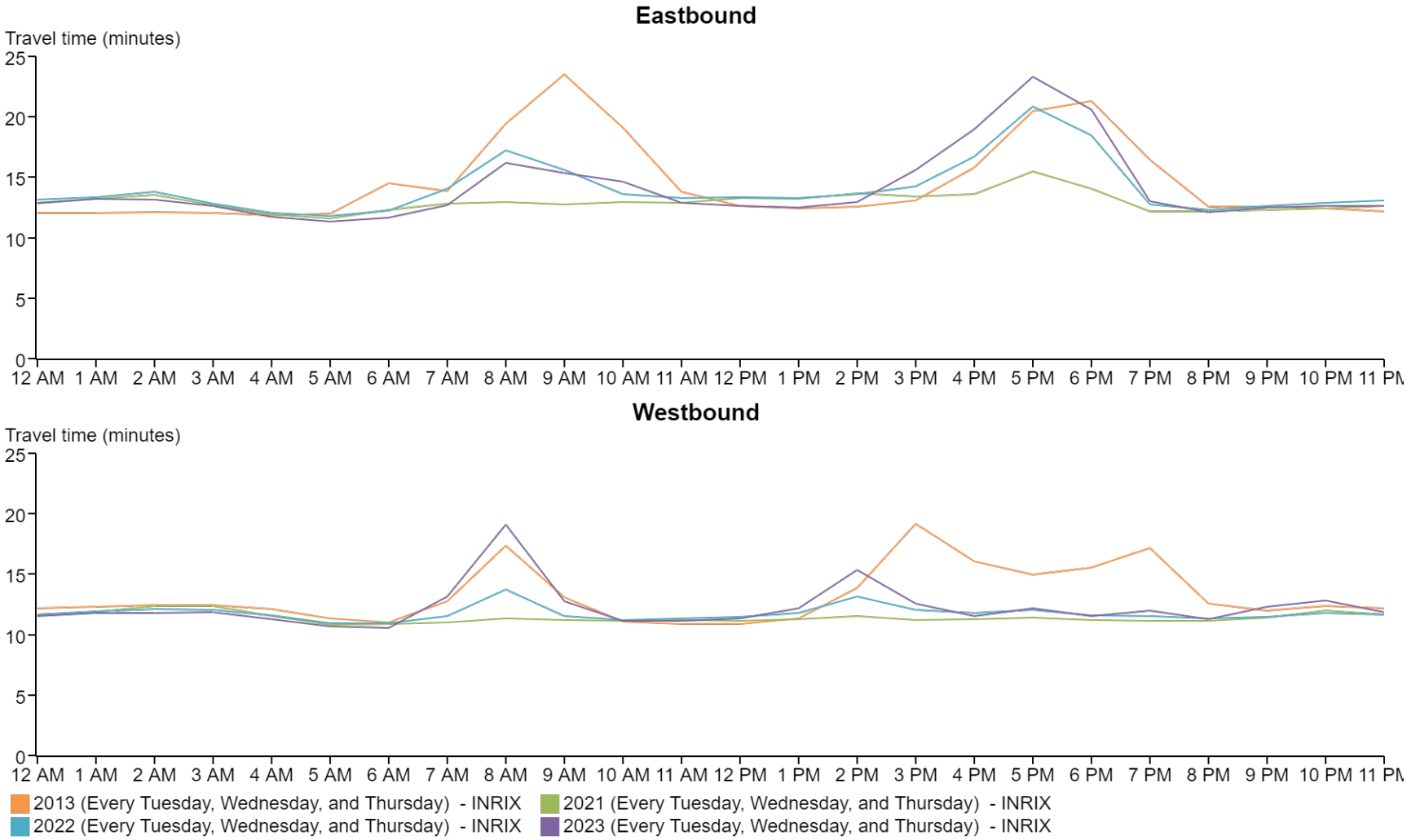


Figure C6

Travel time for I-95 between VA-234/Exit 152 and Franconia Rd/Exit 169

Averaged per hour for 2013 (Every Tuesday, Wednesday, and Thursday), 2021 (Every Tuesday, Wednesday, and Thursday), 2022 (Every Tuesday, Wednesday, and Thursday), and 2023 (Every Tuesday, Wednesday, and Thursday)

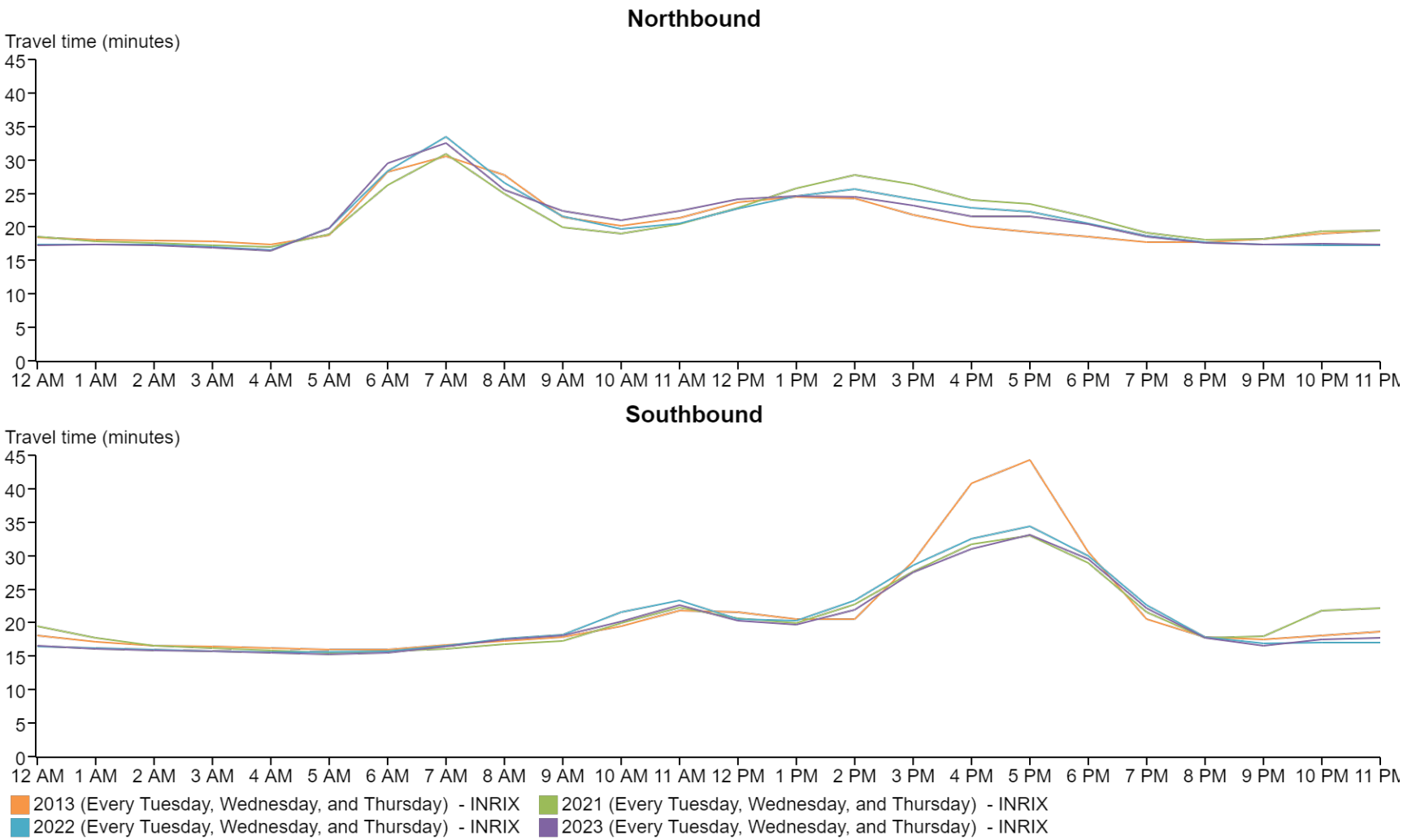


Figure C7

Travel time for I-95 (HOV) between VA-234/Exit 152 and Franconia Rd/Exit 169

Averaged per hour for 2013 (Every Tuesday, Wednesday, and Thursday), 2021 (Every Tuesday, Wednesday, and Thursday), 2022 (Every Tuesday, Wednesday, and Thursday), and 2023 (Every Tuesday, Wednesday, and Thursday)

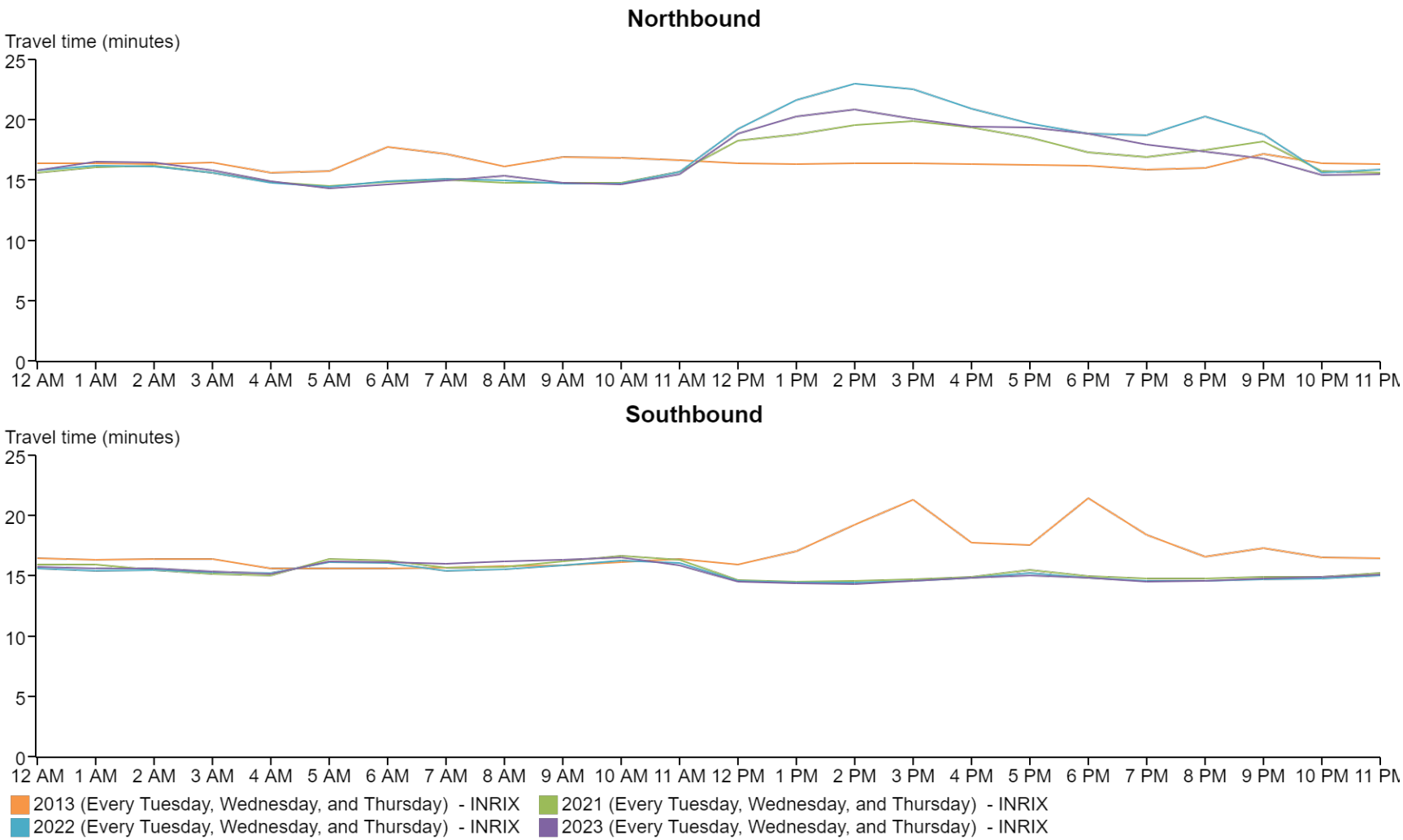


Figure C8

Travel time for I-395 between I-95/I-495 and H St

Averaged per hour for 2013 (Every Tuesday, Wednesday, and Thursday), 2021 (Every Tuesday, Wednesday, and Thursday), 2022 (Every Tuesday, Wednesday, and Thursday), and 2023 (Every Tuesday, Wednesday, and Thursday)

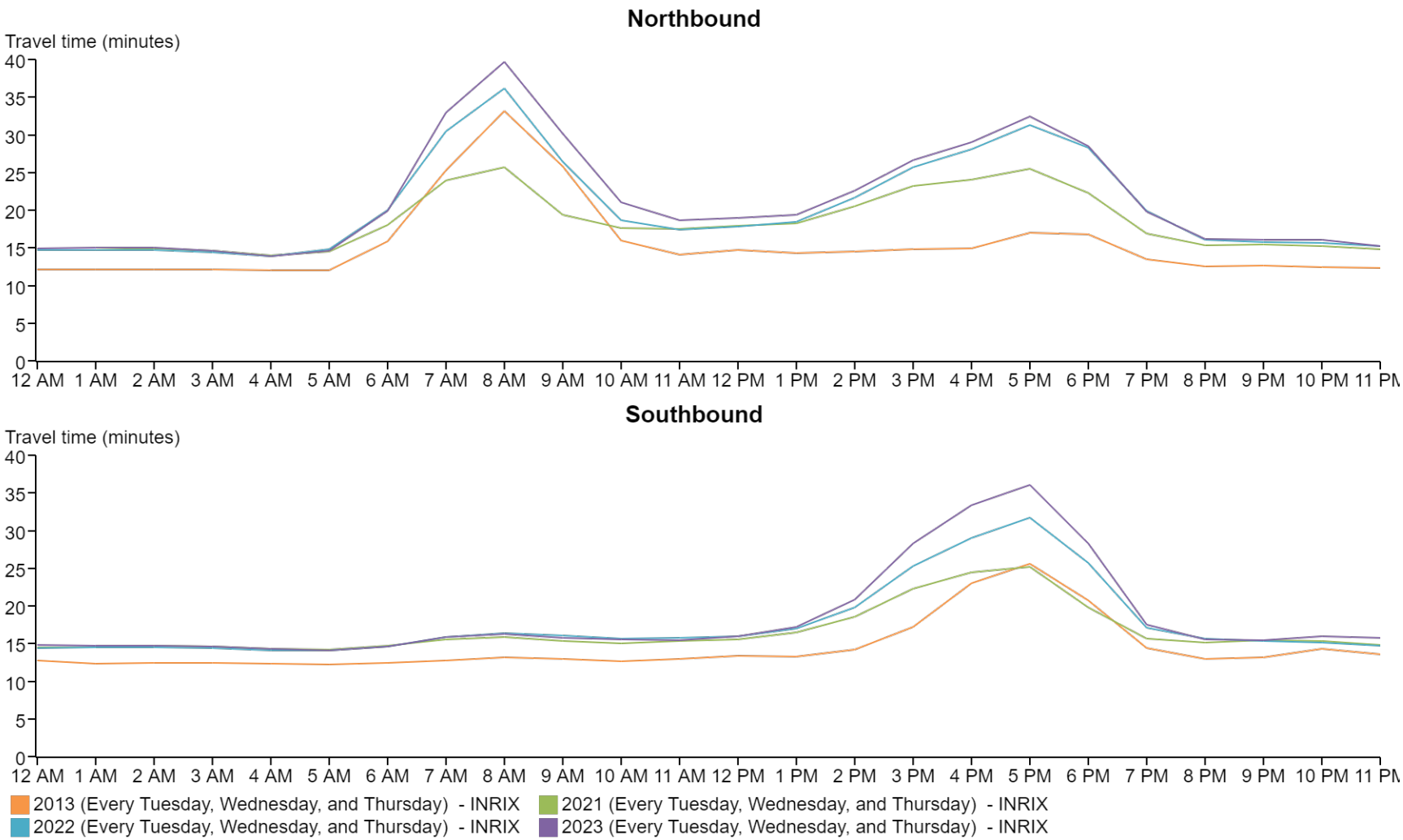


Figure C9

Travel time for I-395 (HOV) between I-495/I-95 and US-1

Averaged per hour for 2013 (Every Tuesday, Wednesday, and Thursday), 2021 (Every Tuesday, Wednesday, and Thursday), 2022 (Every Tuesday, Wednesday, and Thursday), and 2023 (Every Tuesday, Wednesday, and Thursday)

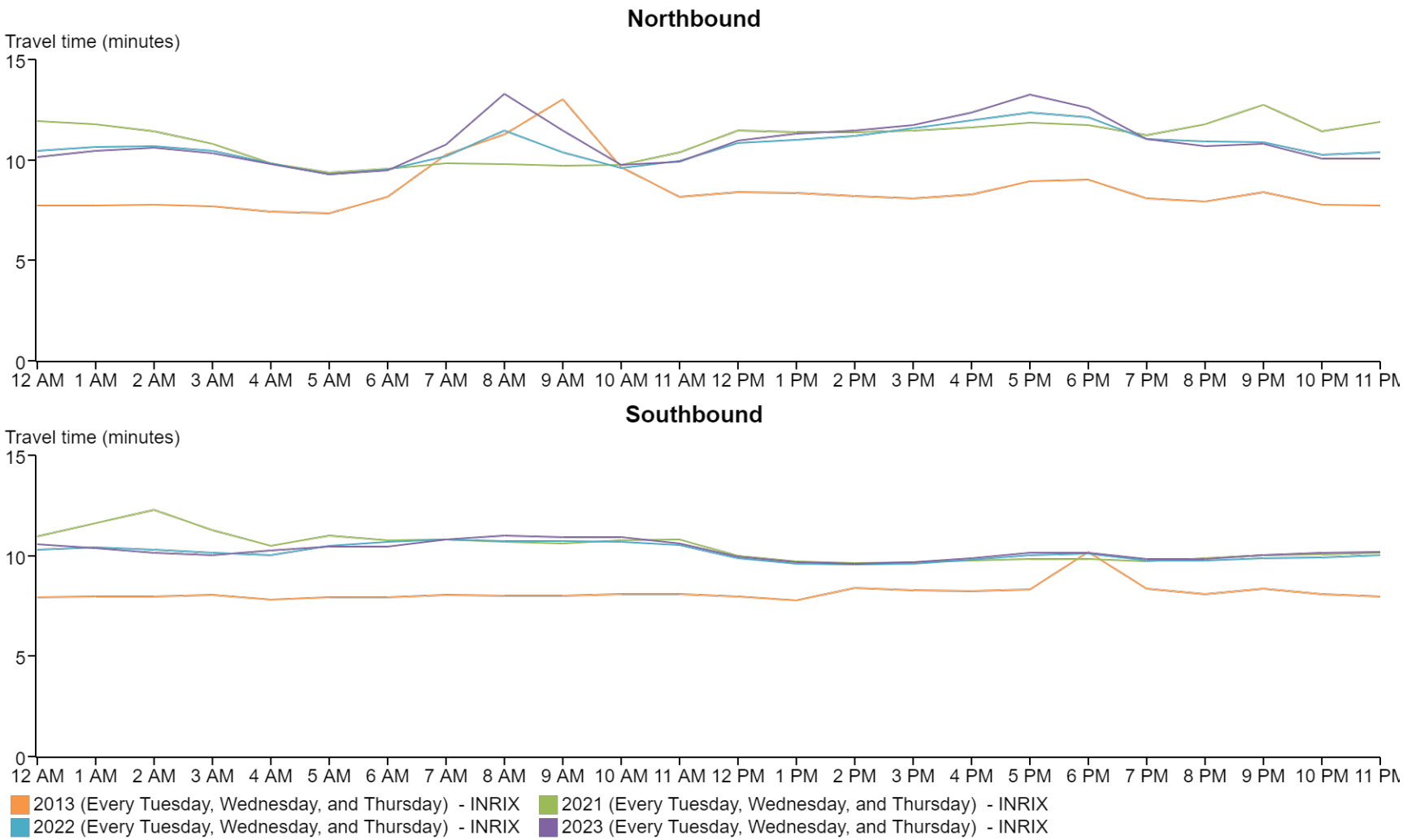


Figure C10

Travel time for US-50 between MD-295/Kenilworth Ave and US-301/Exit 13

Averaged per hour for 2013 (Every Tuesday, Wednesday, and Thursday), 2021 (Every Tuesday, Wednesday, and Thursday), 2022 (Every Tuesday, Wednesday, and Thursday), and 2023 (Every Tuesday, Wednesday, and Thursday)

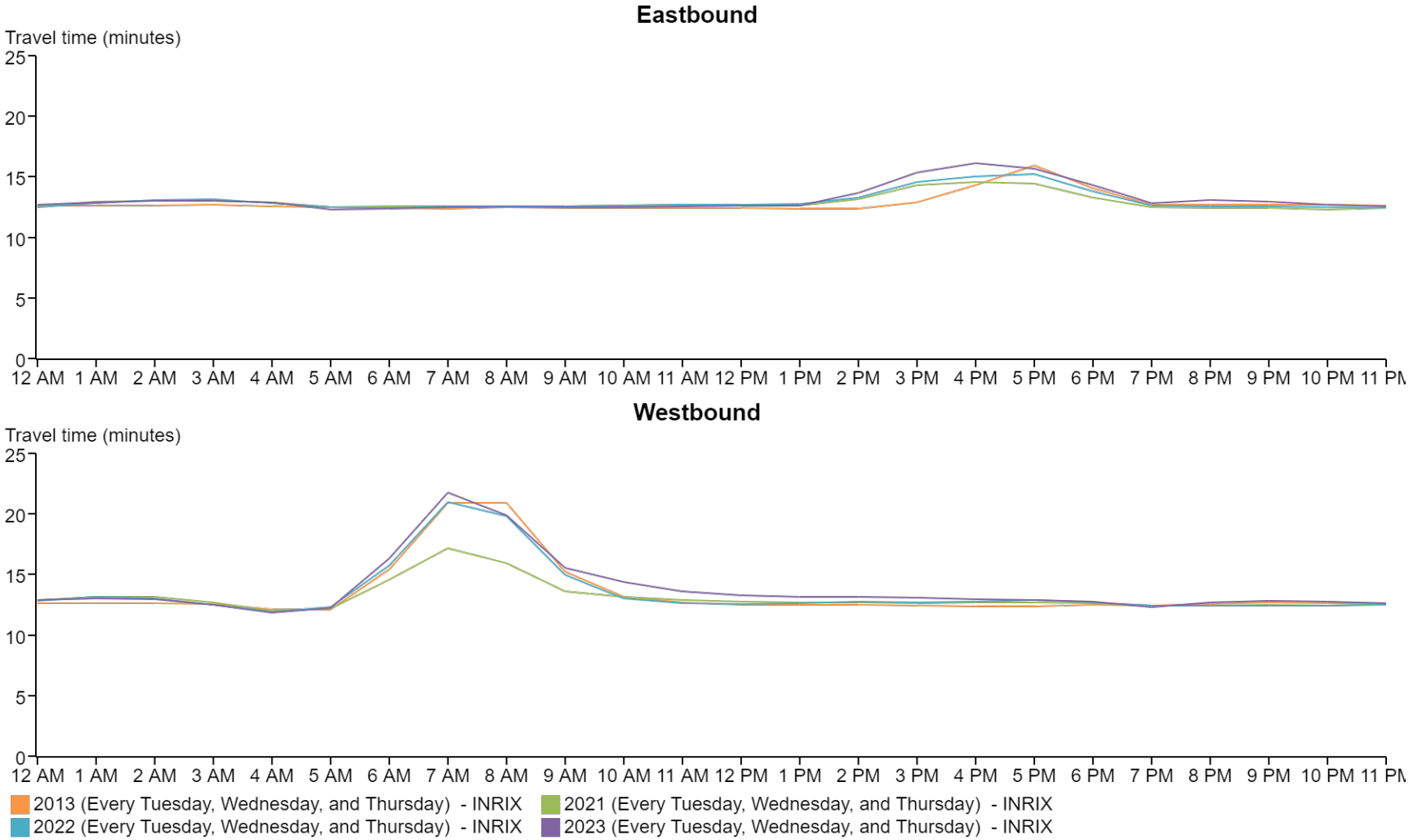


Figure C11

Travel time for MD-295 between US-50/MD-201/Kenilworth Ave and MD-198

Averaged per hour for 2013 (Every Tuesday, Wednesday, and Thursday), 2021 (Every Tuesday, Wednesday, and Thursday), 2022 (Every Tuesday, Wednesday, and Thursday), and 2023 (Every Tuesday, Wednesday, and Thursday)

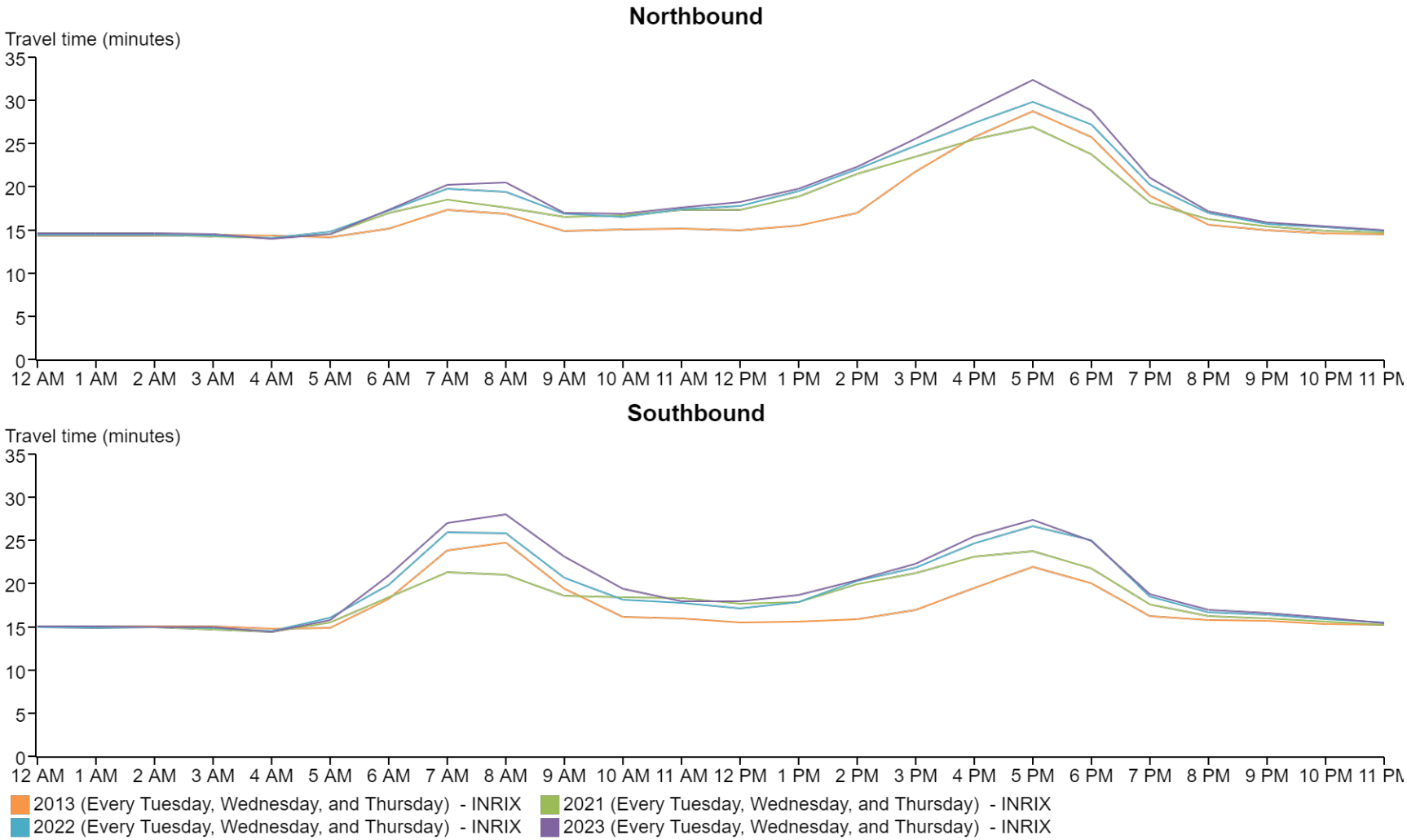


Figure C12

Travel time for I-95 between I-495/EXIT 27-25 and MD-198/Exit 33

Averaged per hour for 2013 (Every Tuesday, Wednesday, and Thursday), 2021 (Every Tuesday, Wednesday, and Thursday), 2022 (Every Tuesday, Wednesday, and Thursday), and 2023 (Every Tuesday, Wednesday, and Thursday)

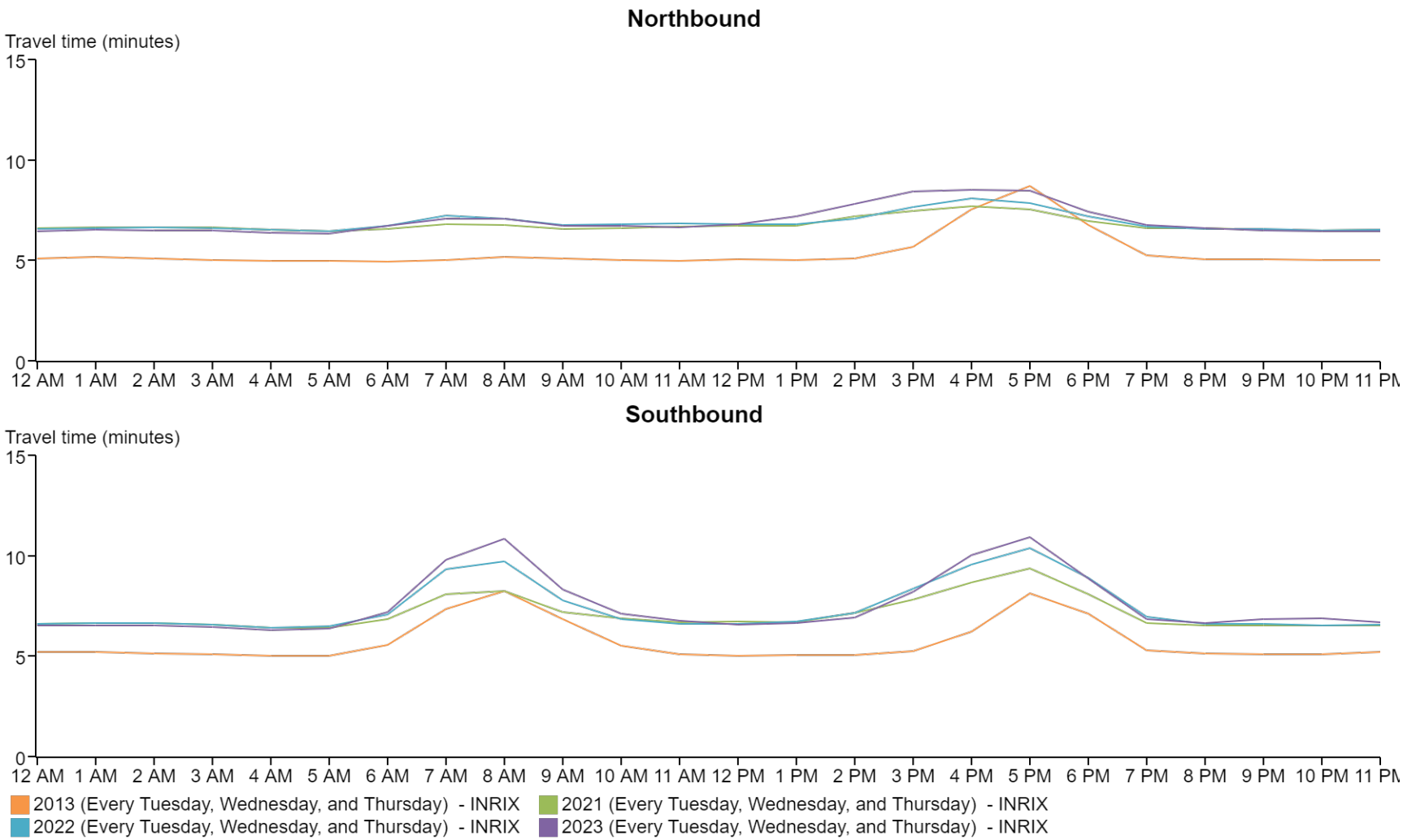


Figure C13

Travel time for I-495 between I-270/Exit 35 and Exit 27

Averaged per hour for 2013 (Every Tuesday, Wednesday, and Thursday), 2021 (Every Tuesday, Wednesday, and Thursday), 2022 (Every Tuesday, Wednesday, and Thursday), and 2023 (Every Tuesday, Wednesday, and Thursday)

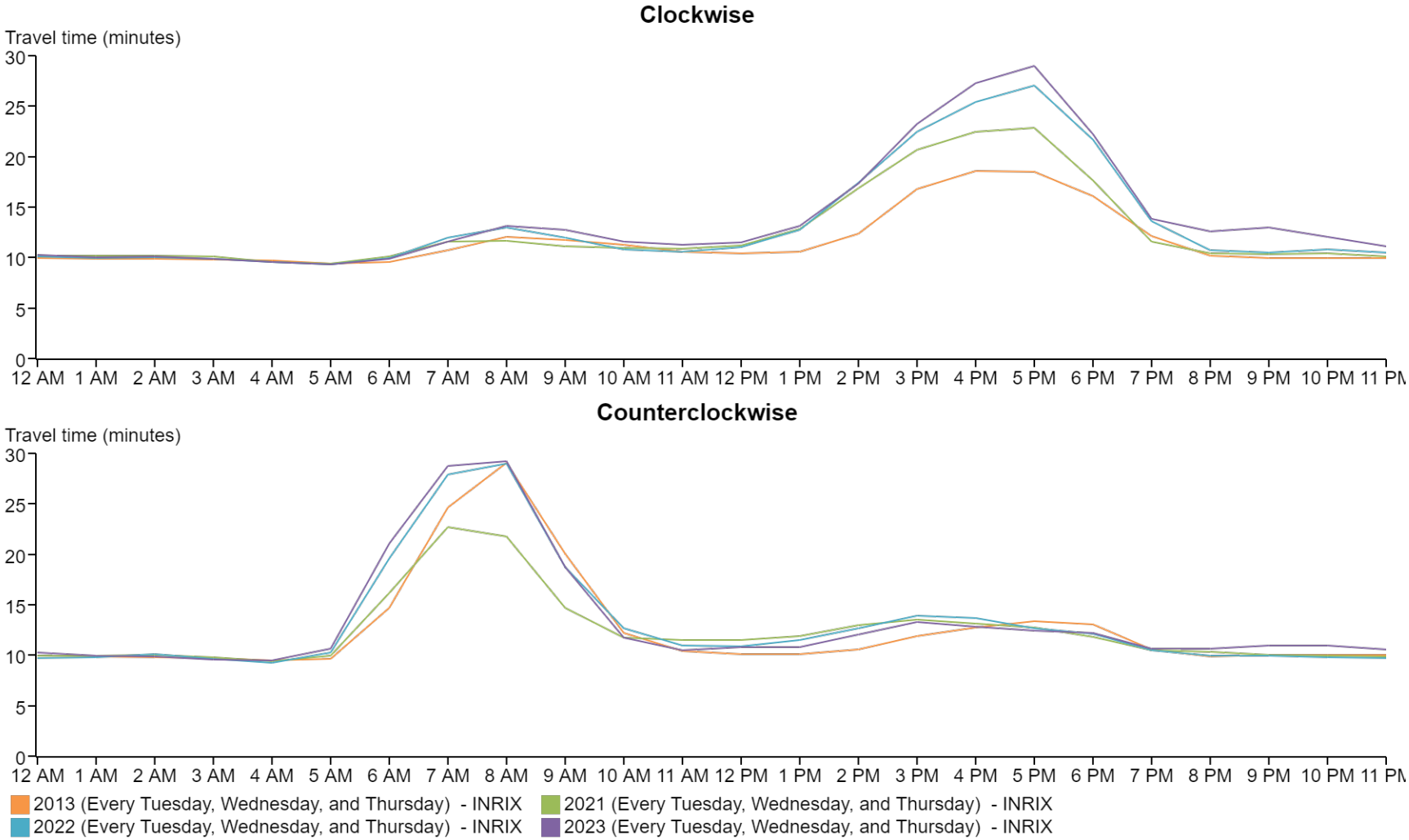


Figure C14

Travel time for I-495 between Exit 27 and US-50/Exit 19

Averaged per hour for 2013 (Every Tuesday, Wednesday, and Thursday), 2021 (Every Tuesday, Wednesday, and Thursday), 2022 (Every Tuesday, Wednesday, and Thursday), and 2023 (Every Tuesday, Wednesday, and Thursday)

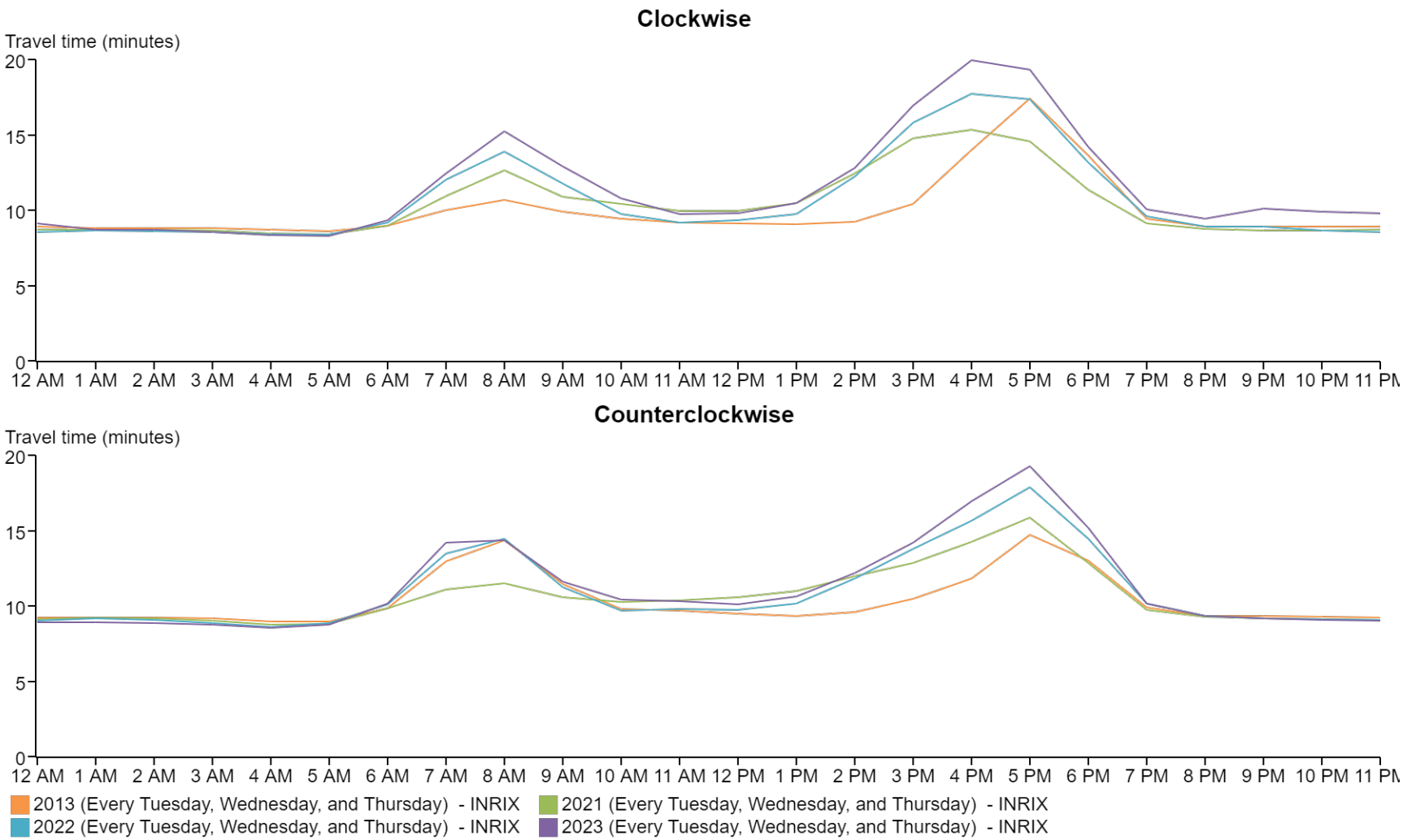


Figure C15

Travel time for I-495 between US-50/Exit 19 and I-95/I-395/Exit 57

Averaged per hour for 2013 (Every Tuesday, Wednesday, and Thursday), 2021 (Every Tuesday, Wednesday, and Thursday), 2022 (Every Tuesday, Wednesday, and Thursday), and 2023 (Every Tuesday, Wednesday, and Thursday)

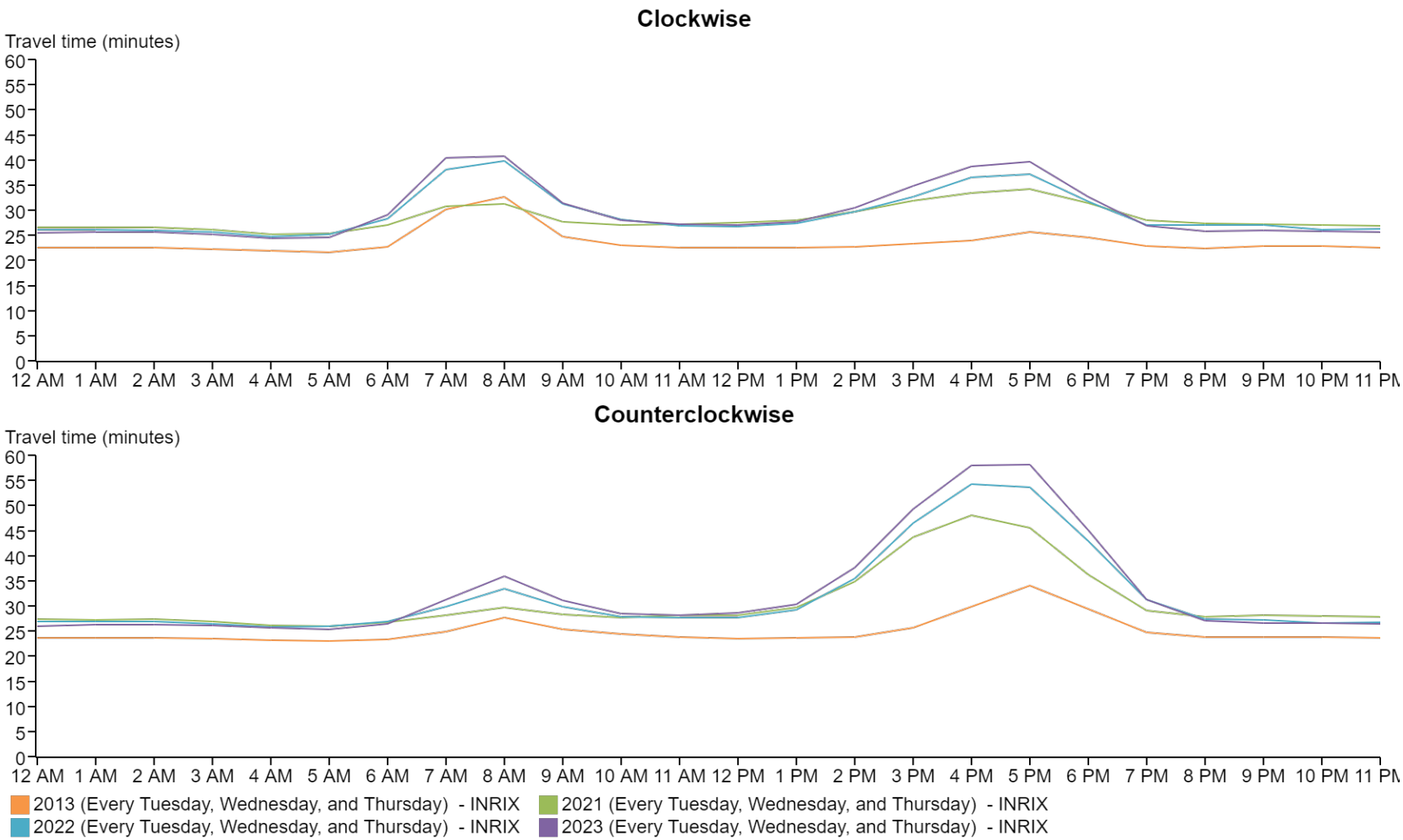


Figure C16

Travel time for I-495 between I-95/I-395/Exit 57 and I-66/Exit 9

Averaged per hour for 2013 (Every Tuesday, Wednesday, and Thursday), 2021 (Every Tuesday, Wednesday, and Thursday), 2022 (Every Tuesday, Wednesday, and Thursday), and 2023 (Every Tuesday, Wednesday, and Thursday)

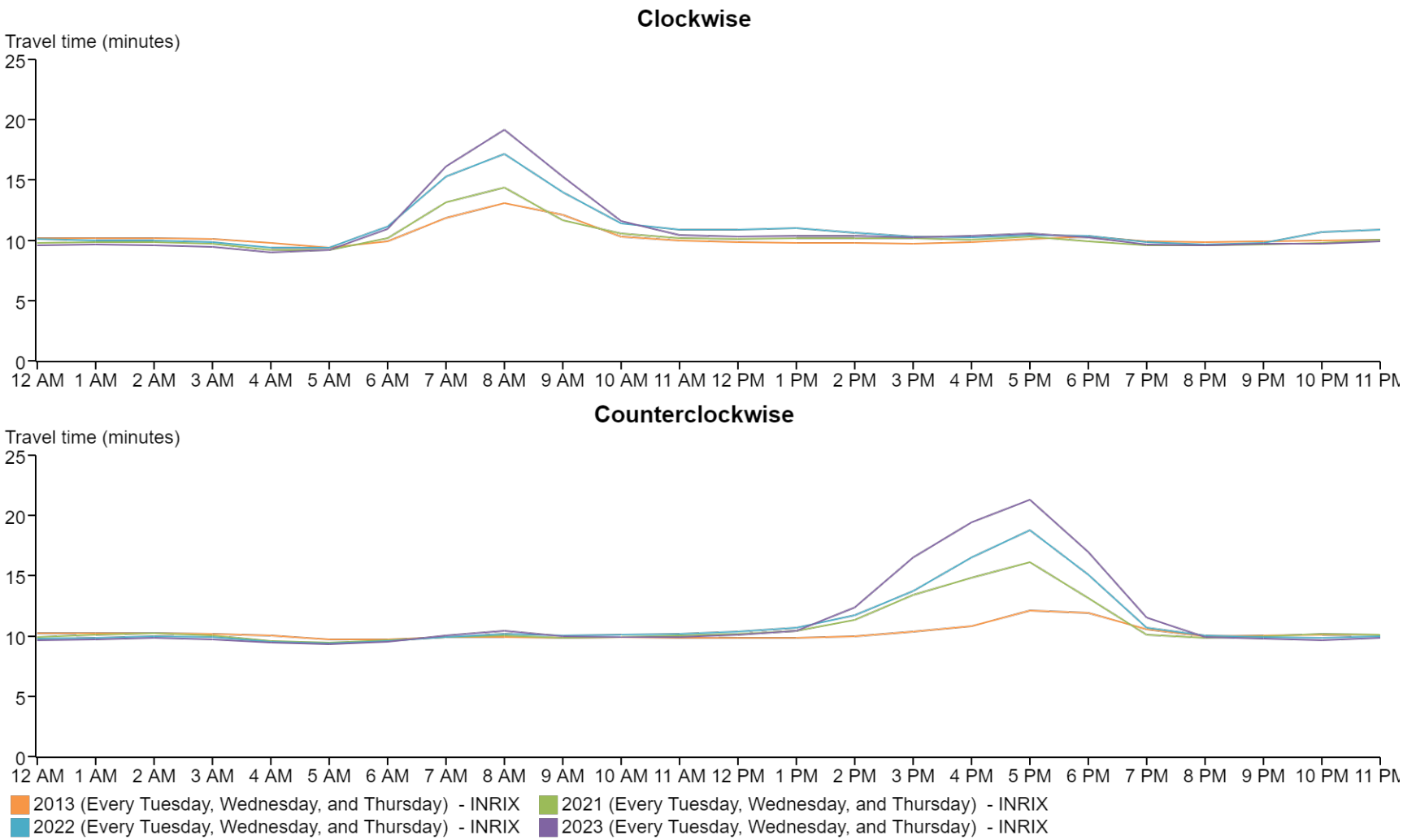


Figure C17

Travel time for I-495 between I-66/Exit 9 and I-270/Exit 35

Averaged per hour for 2013 (Every Tuesday, Wednesday, and Thursday), 2021 (Every Tuesday, Wednesday, and Thursday), 2022 (Every Tuesday, Wednesday, and Thursday), and 2023 (Every Tuesday, Wednesday, and Thursday)

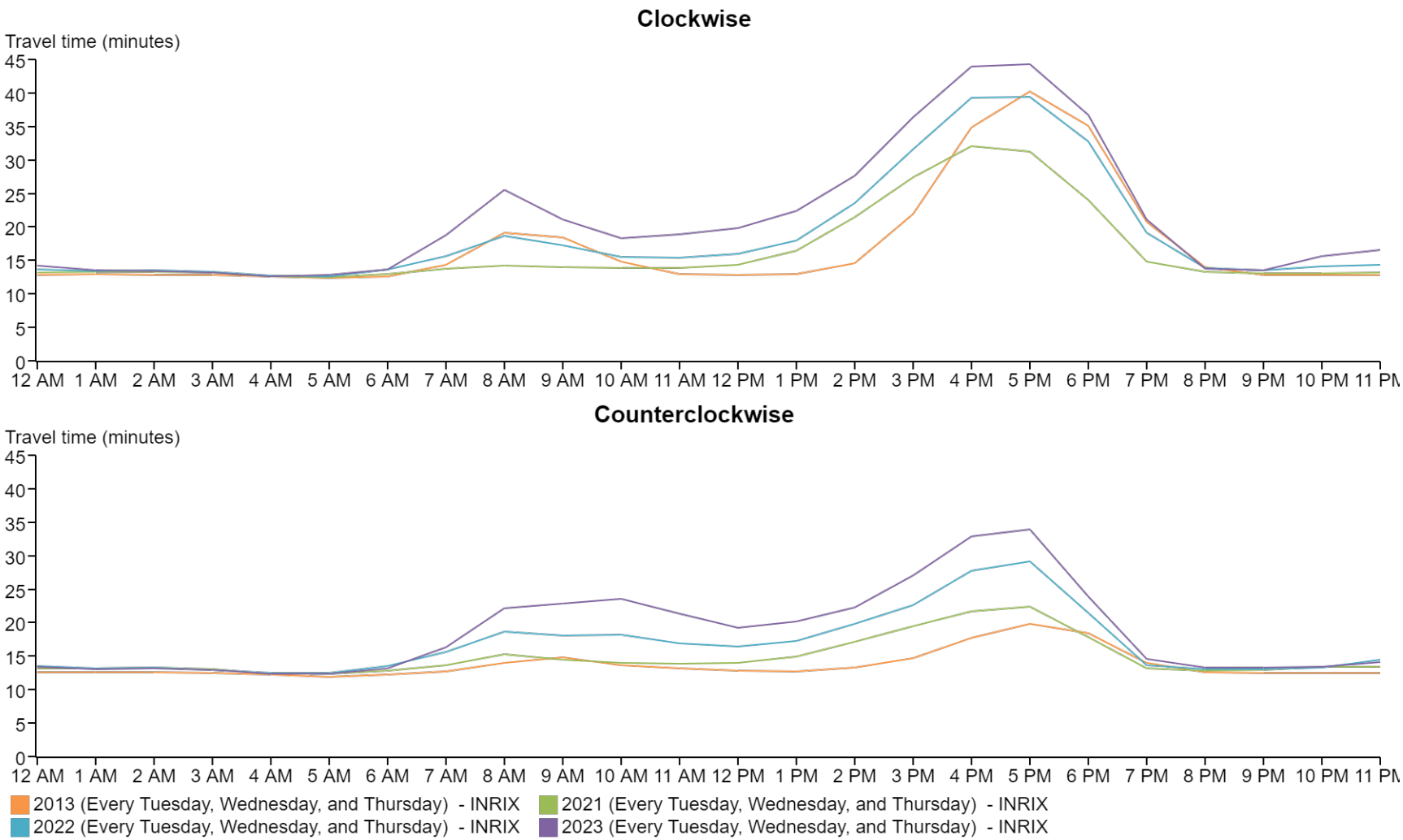
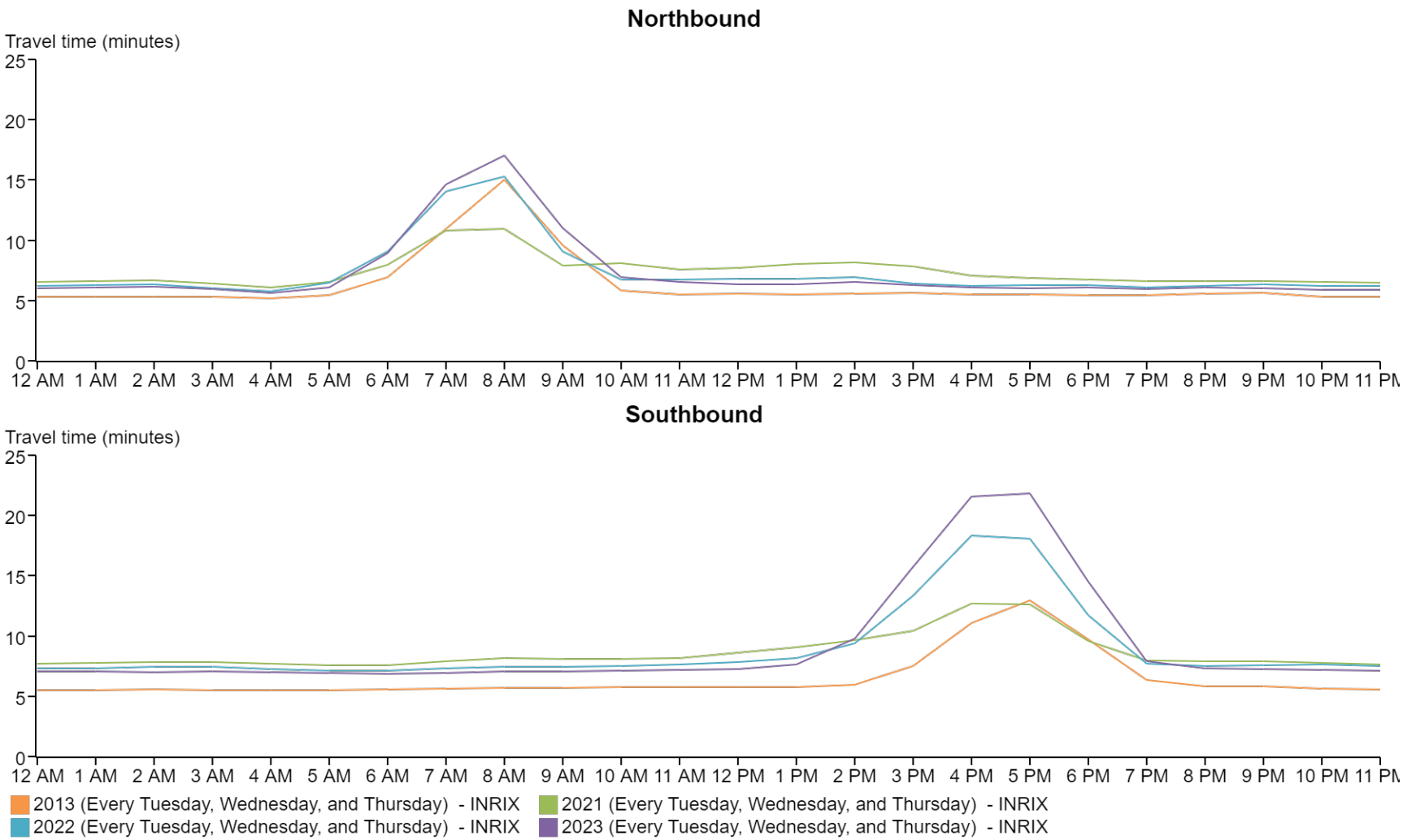


Figure C18

Travel time for I-295 between I-495/I-95/EXIT 2A-B and 11Th St. Bridge

Averaged per hour for 2013 (Every Tuesday, Wednesday, and Thursday), 2021 (Every Tuesday, Wednesday, and Thursday), 2022 (Every Tuesday, Wednesday, and Thursday), and 2023 (Every Tuesday, Wednesday, and Thursday)



APPENDIX D – PEAK HOURS TRAVEL TIME OVER YEARS ON MAJOR FREEWAY COMMUTE CORRIDORS

Note:

1. The hourly travel time data were provided by the "Trend Map" tool of the Vehicle Probe Project Suite developed by the CATT Lab of the University of Maryland, https://pda.ritis.org/suite/

2. For the purposes of this appendix, the morning peak hour is defined as 8:00 AM to 9:00 AM, and the evening peak hour is defined as 5:00 PM to 6:00 PM.

3. There are 18 major commuter corridors defined in this report:

C1	I-270 between I-370/Sam Eig Hwy/Exit 9 and I-70/US-40
C2	I-270 between I-370/Sam Eig Hwy/Exit 9 and I-495/MD-355
C3	VA-267 between VA-28/Exit 9a and VA-123/Exit 19
C4	I-66 between VA-28/Exit 53 and I-495/Exit 64
C5	I-66 between I-495/Exit 64 and Theodore Roosevelt Memorial Bridge
C6	I-95 between VA-234/Exit 152 and Franconia Rd/Exit 169
C7	I-95 HOV between VA-234/Exit 152 and Franconia Rd/Exit 169
C8	I-395 between I-95 and H St
C9	I-395 HOV between I-95 and US-1
C10	US-50 between MD-295/Kenilworth Ave and US-301/Exit 13
C11	MD-295 between US-50/MD-201/Kenilworth Ave and MD-198
C12	I-95 between I-495/Exit 27-25 and MD-198/Exit 33
C13	I-495 between I-270/Exit 35 and I-95/Exit 27
C14	I-495 between I-95/Exit 27 and US-50/Exit 19
C15	I-495 between US-50/Exit 19 and I-95/I-395/Exit 57
C16	I-495 between I-95/I-395/Exit 57 and I-66/Exit 9
C17	I-495 between I-66/Exit 9 and I-270/Exit 35
C18	I-295 between I-495 and 11th St. Bridge

Figure D1: I-270 between I-370/Sam Eig Hwy/Exit 9 and I-70/US-40

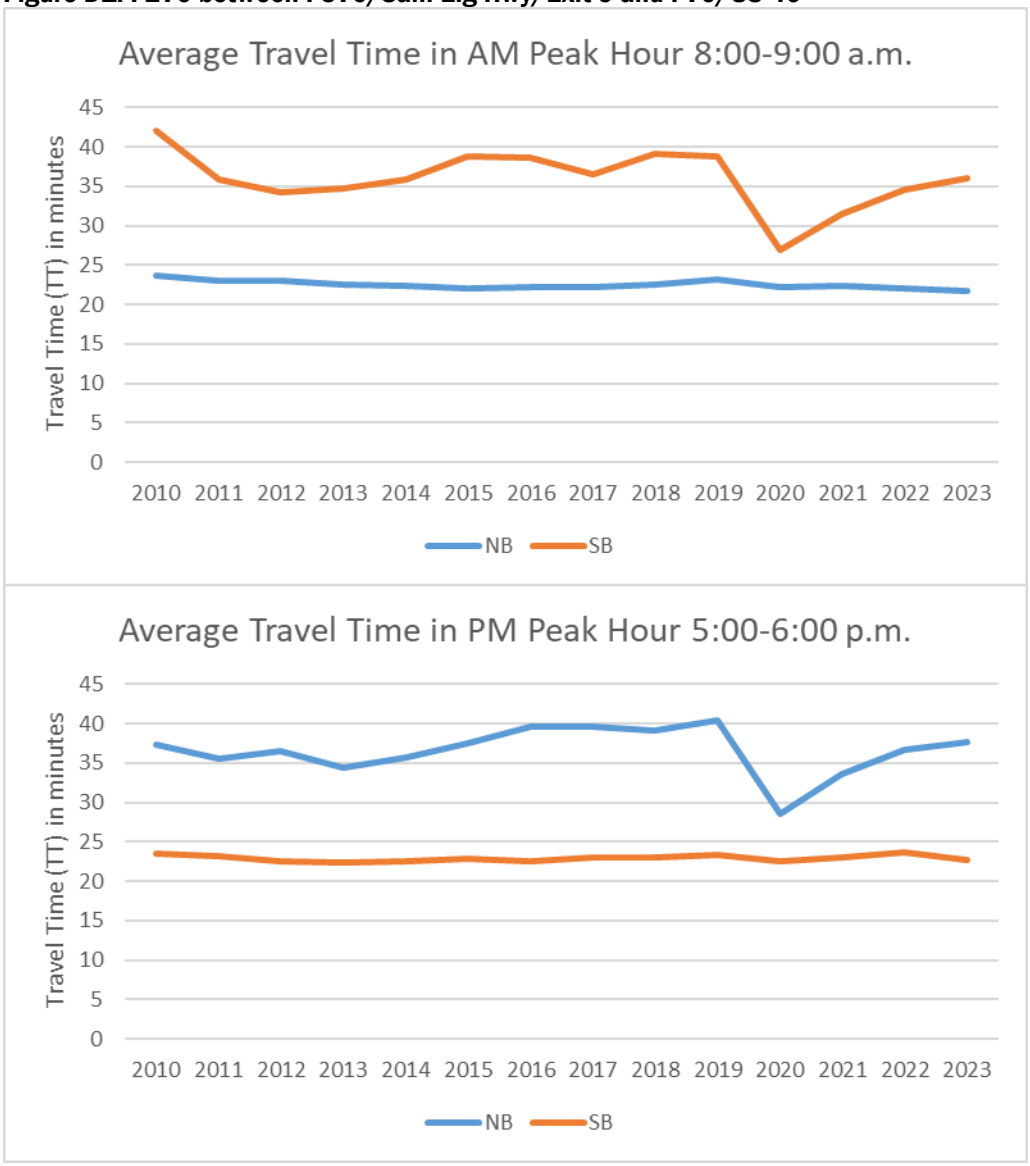
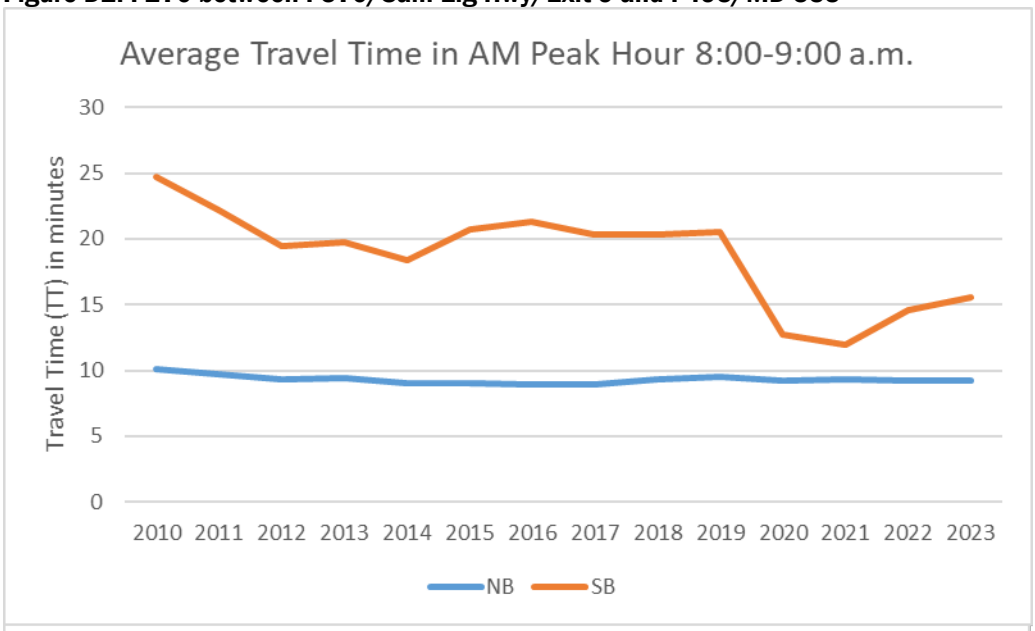


Figure D2: I-270 between I-370/Sam Eig Hwy/Exit 9 and I-495/MD-355



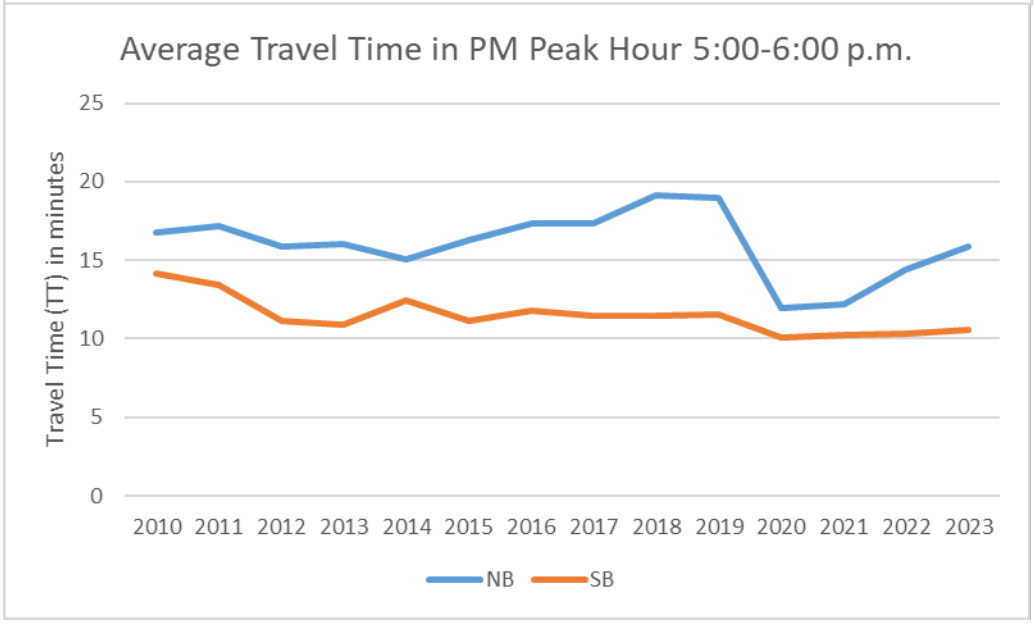
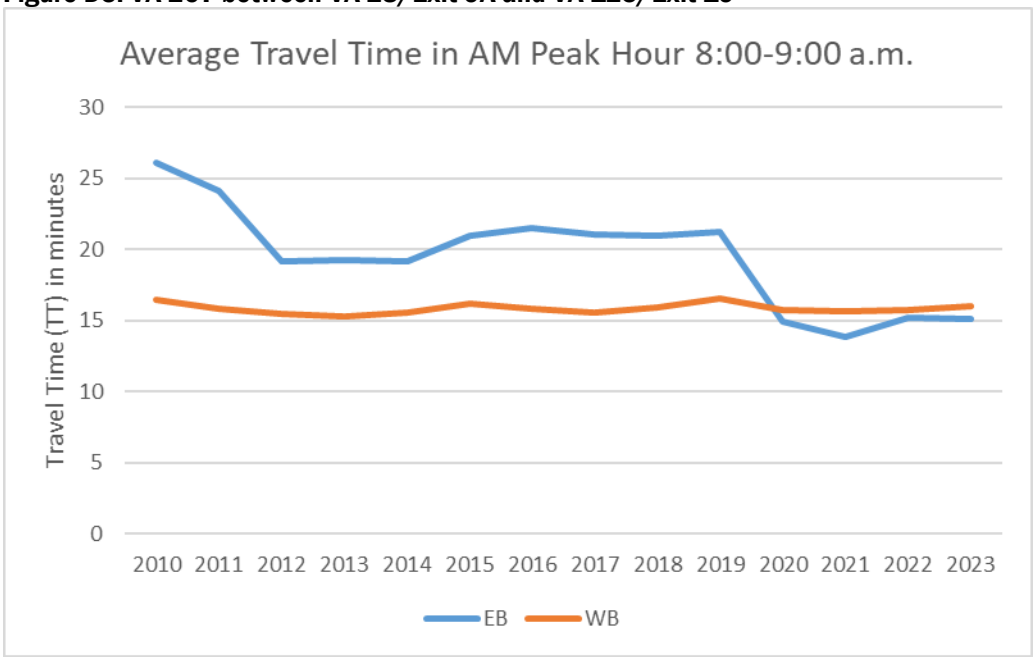


Figure D3: VA-267 between VA-28/Exit 9A and VA-123/Exit 19



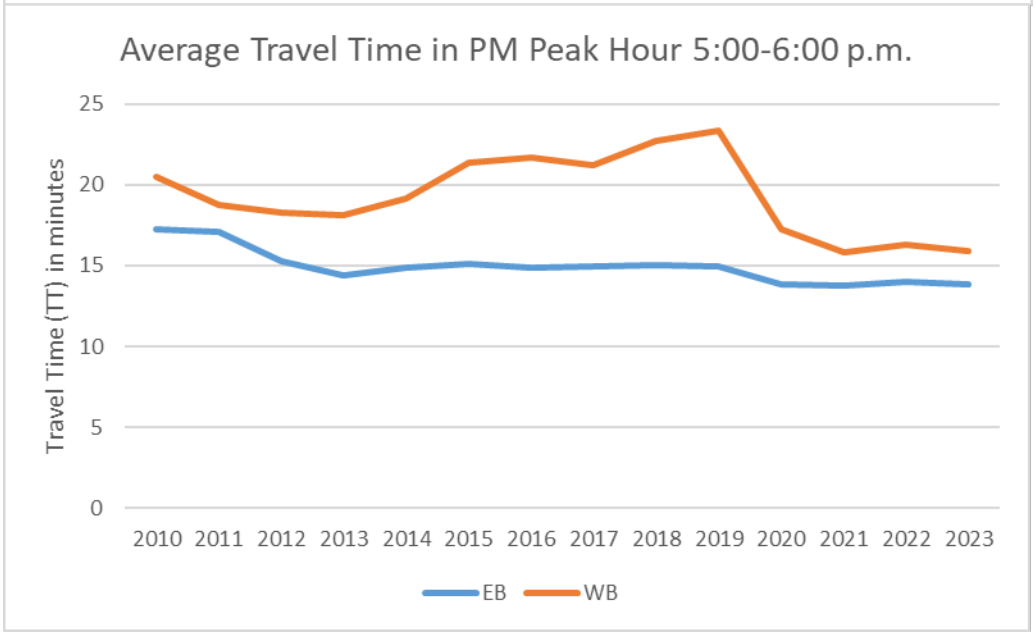


Figure D4: I-66 between VA-28/Exit 53 and I-495/Exit 64

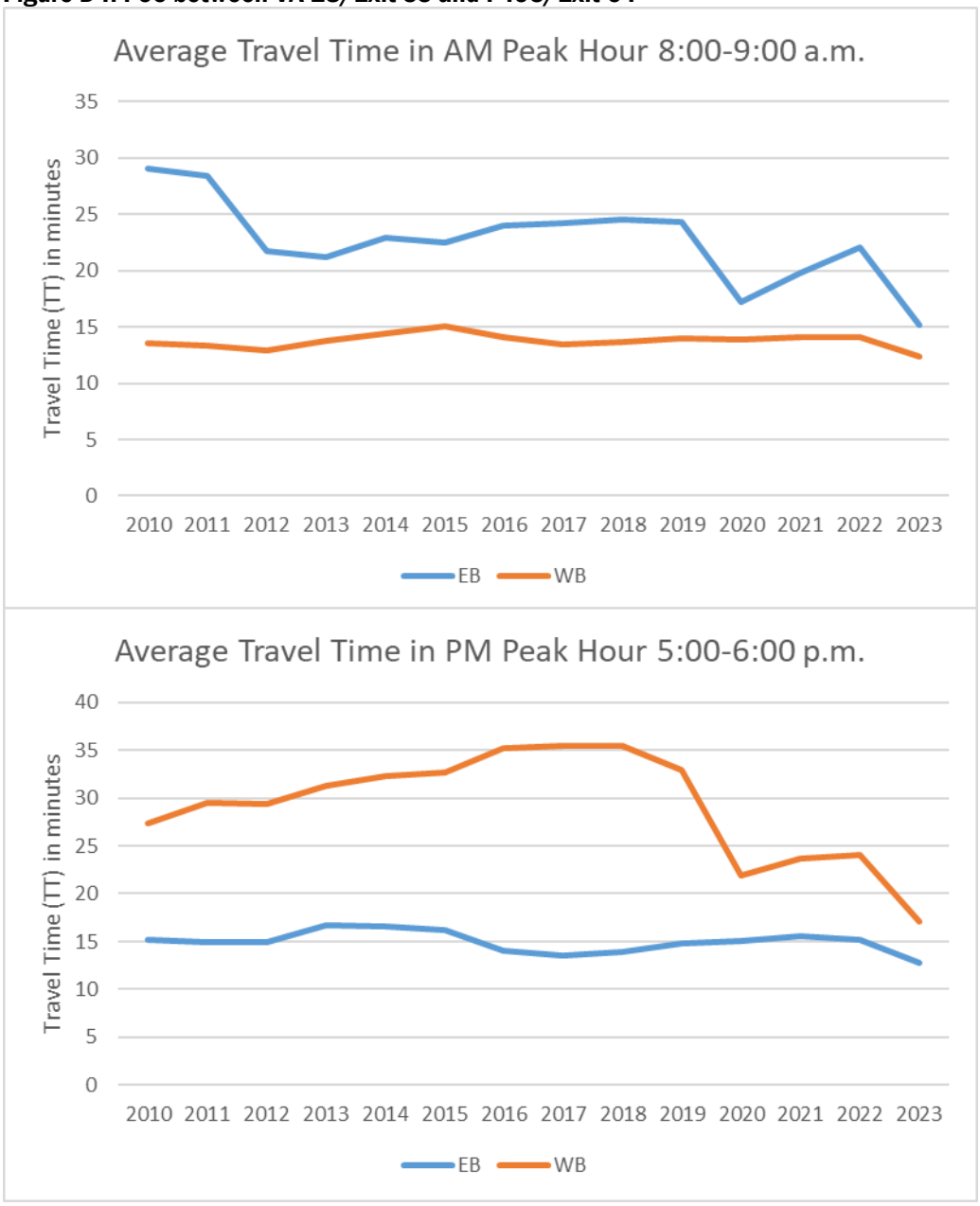


Figure D5: I-66 between I-495/Exit 64 and US-50/Arlington Memorial Bridge

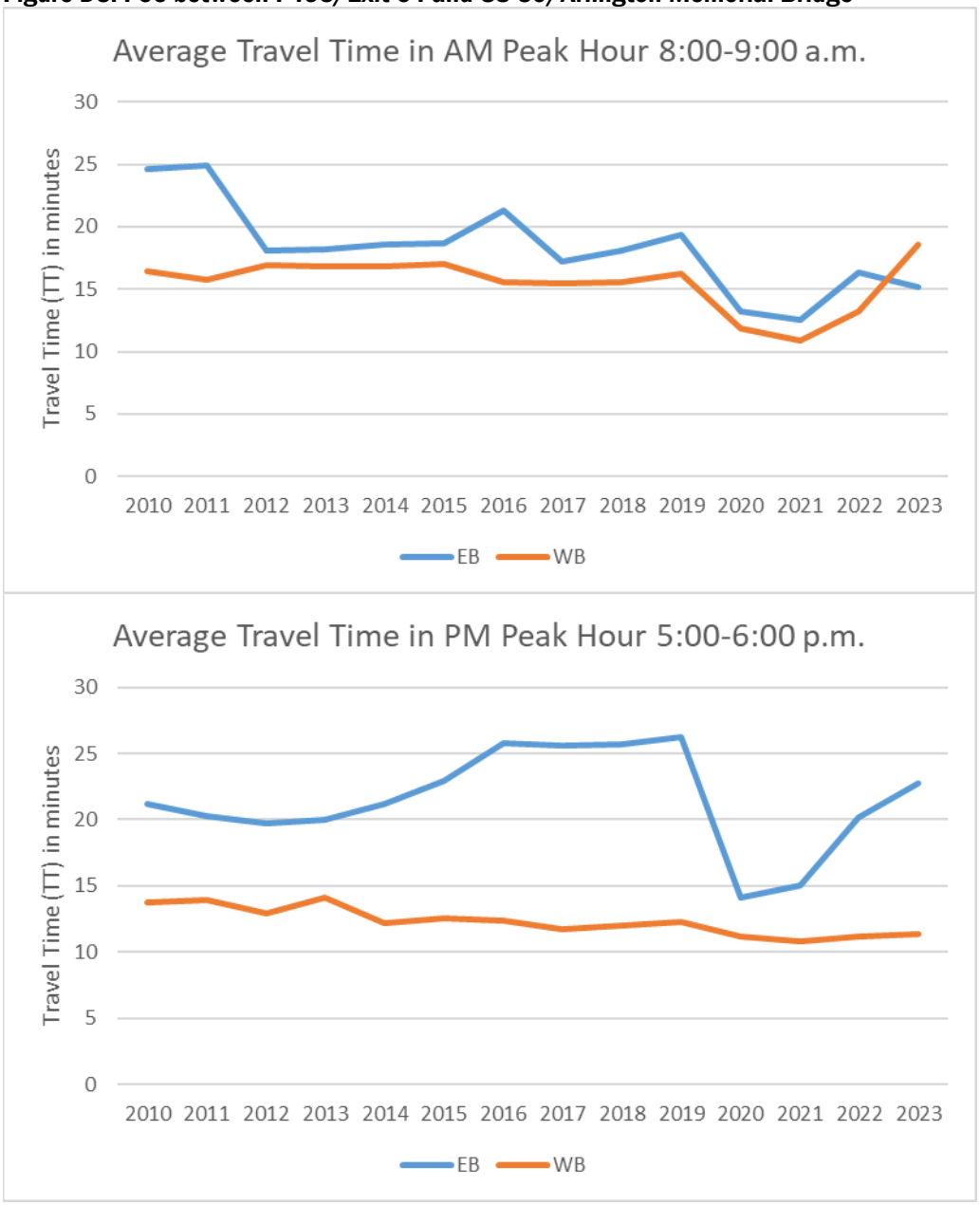


Figure D6: I-95 between VA-234/Exit 152 and VA-644/Franconia Rd/Exit 169

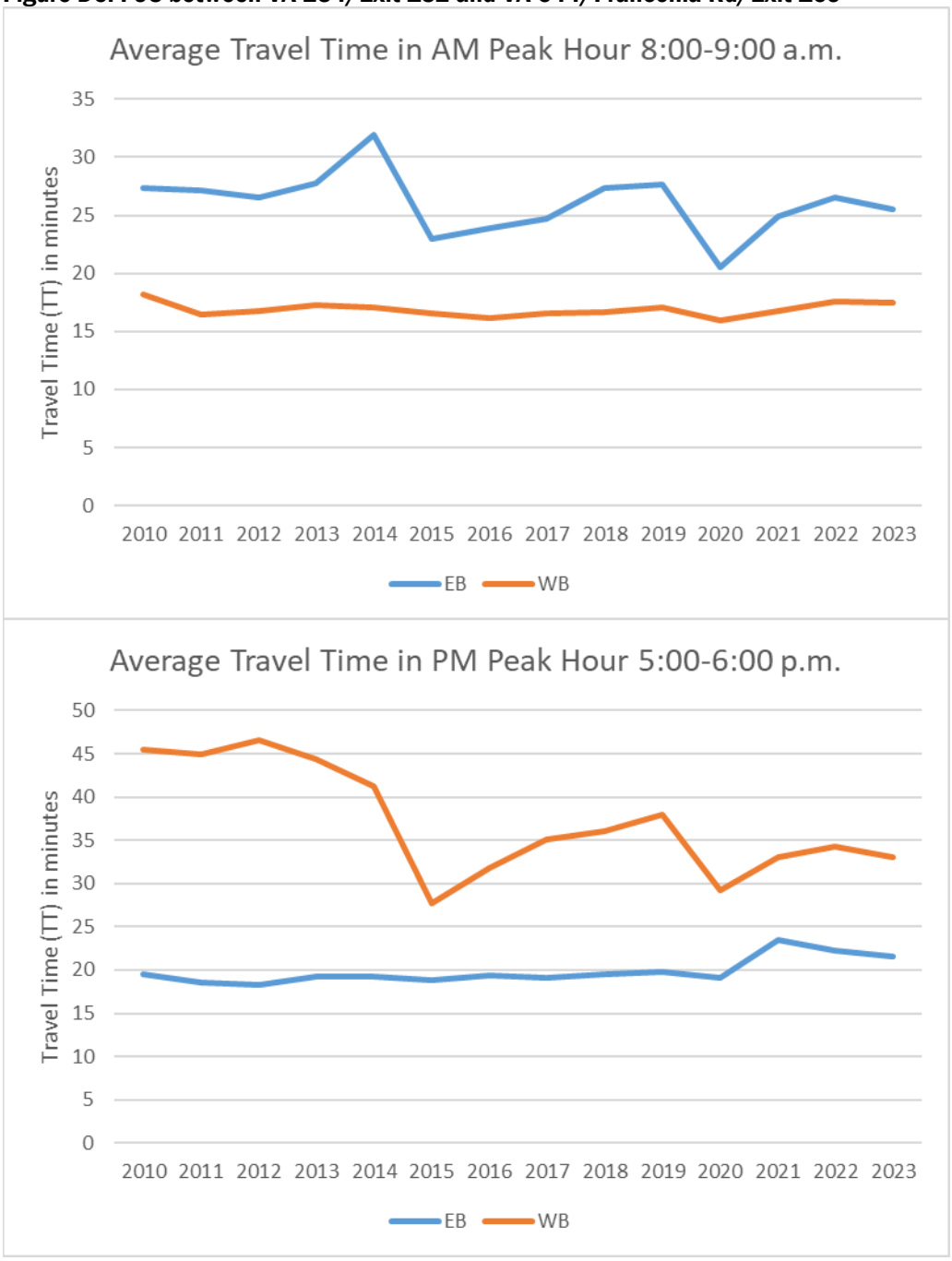
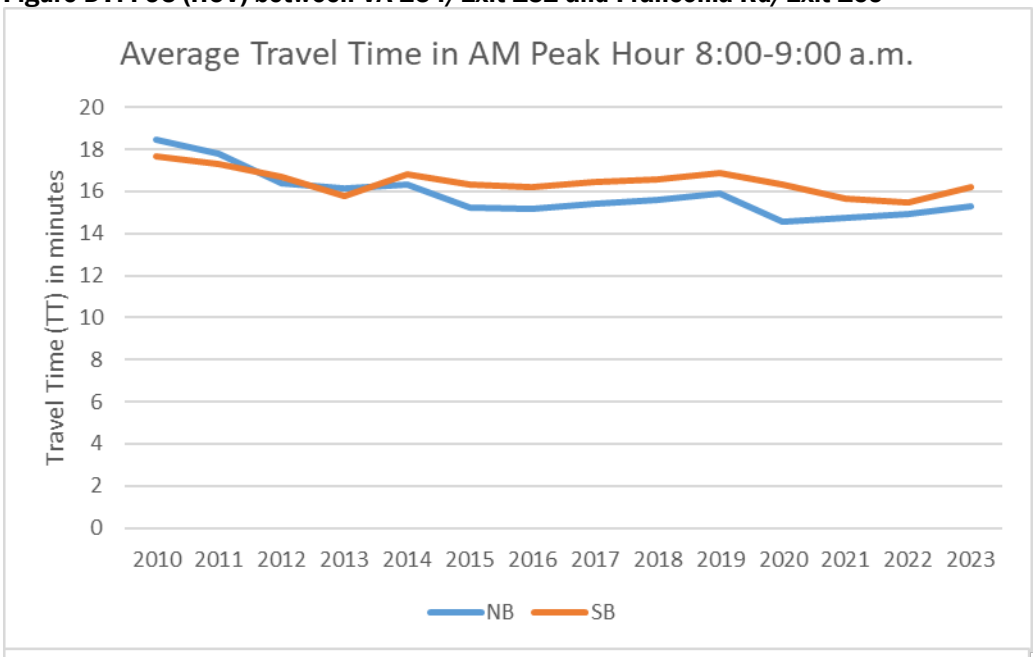


Figure D7: I-95 (HOV) between VA-234/Exit 152 and Franconia Rd/Exit 169



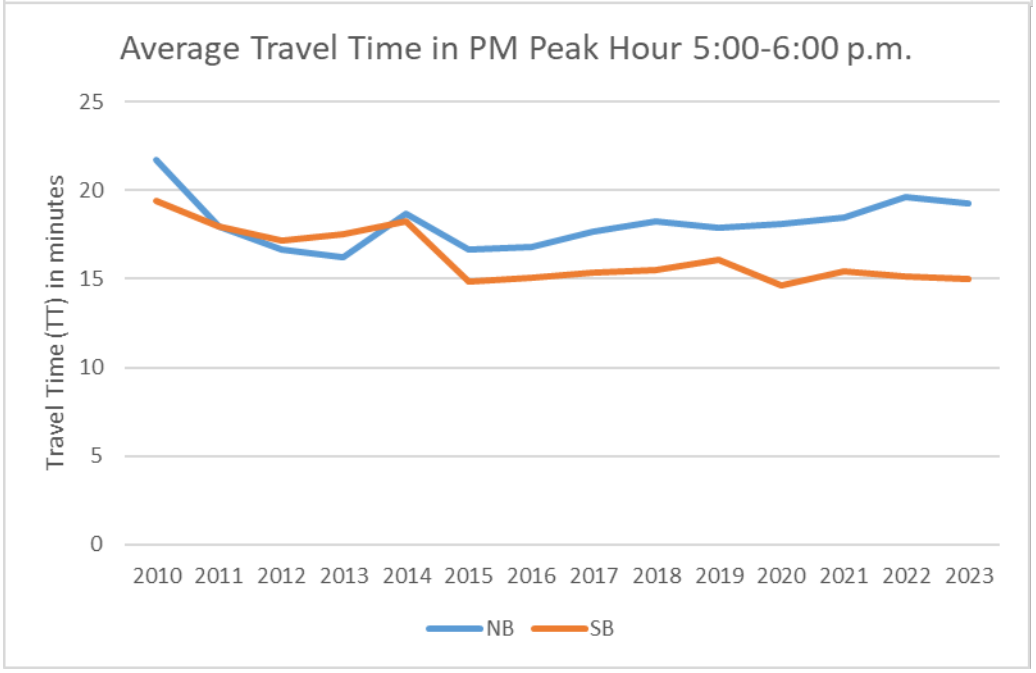
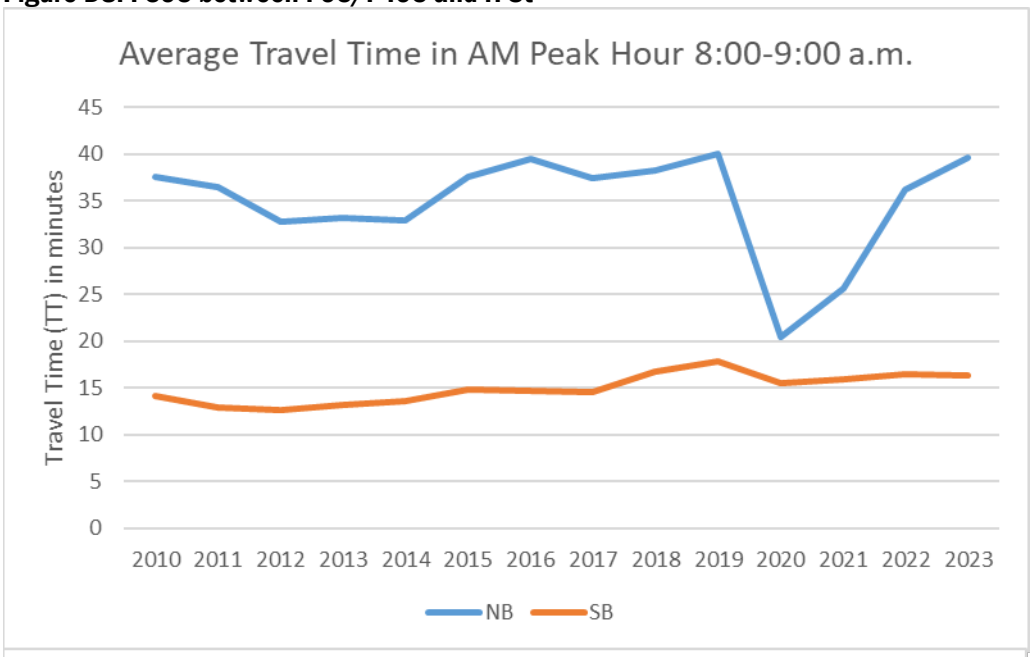


Figure D8: I-395 between I-95/I-495 and H St



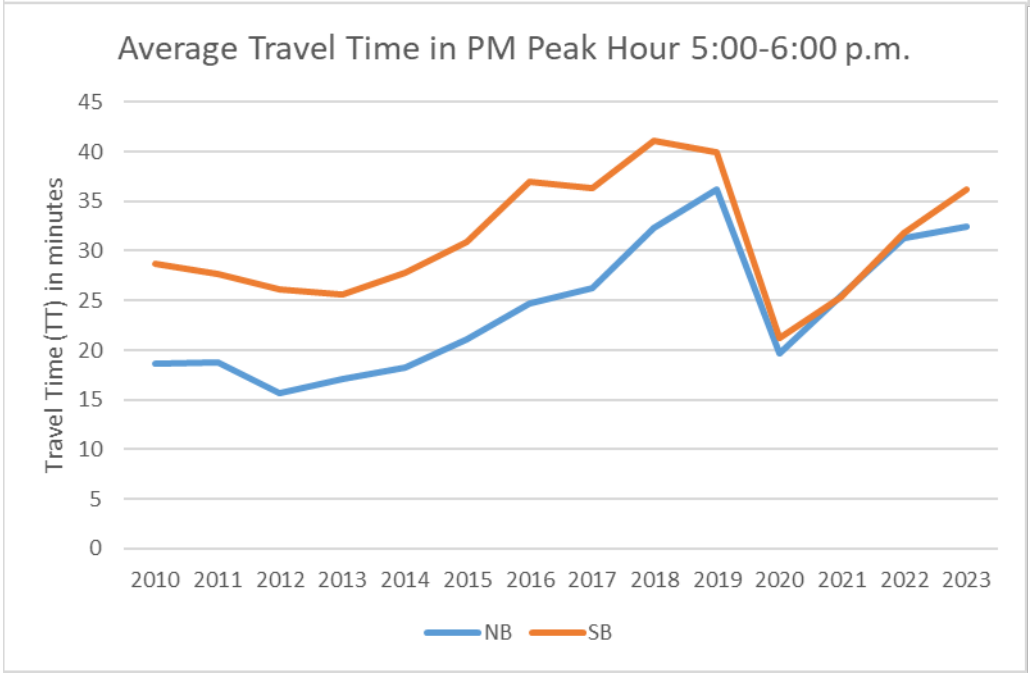
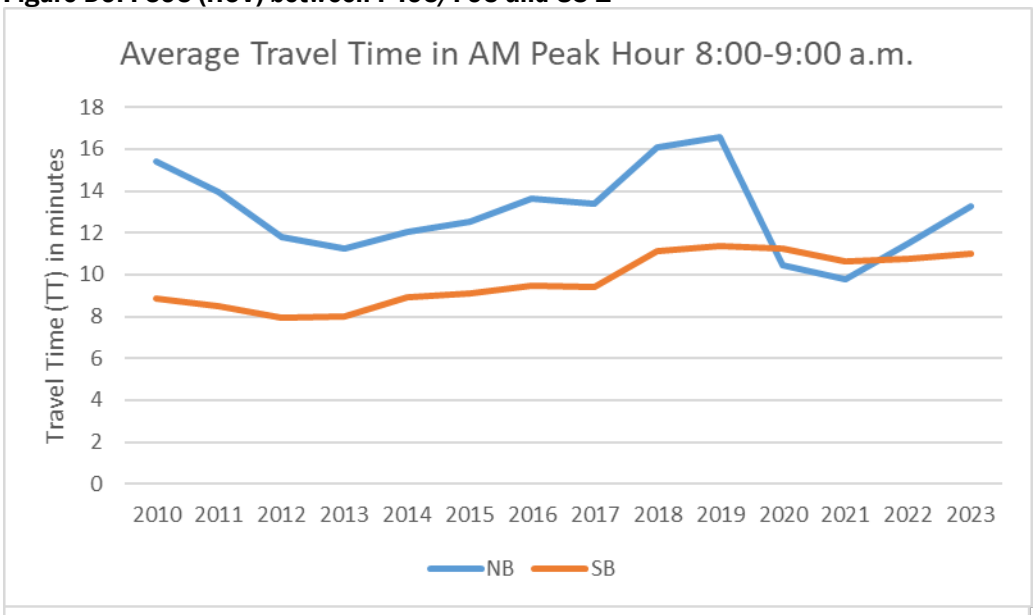


Figure D9: I-395 (HOV) between I-495/I-95 and US-1



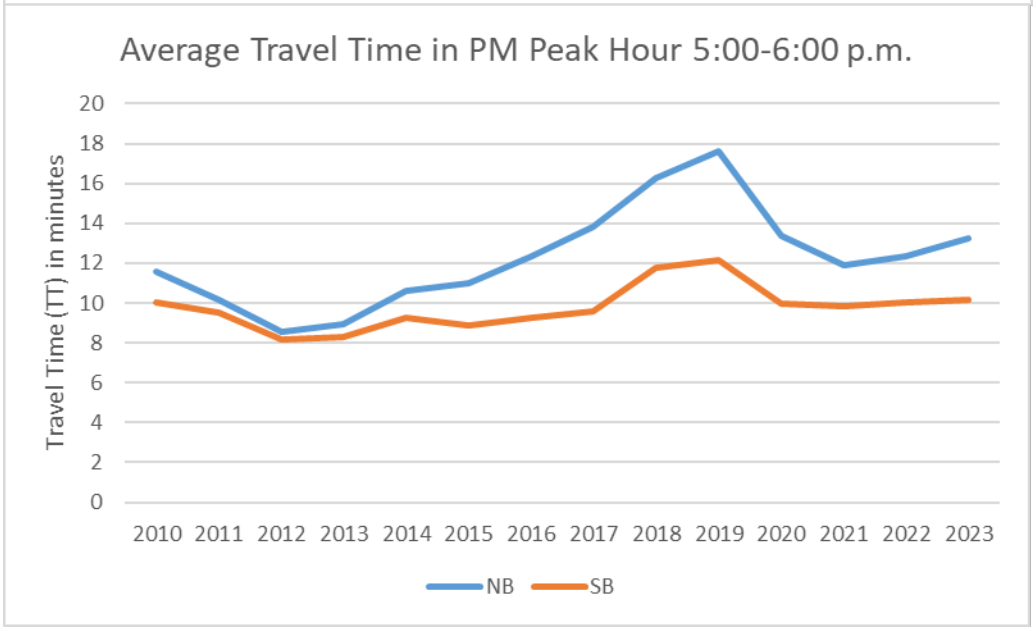


Figure D10: US-50 between US-301/Exit 13 and MD-295/Kenilworth Ave

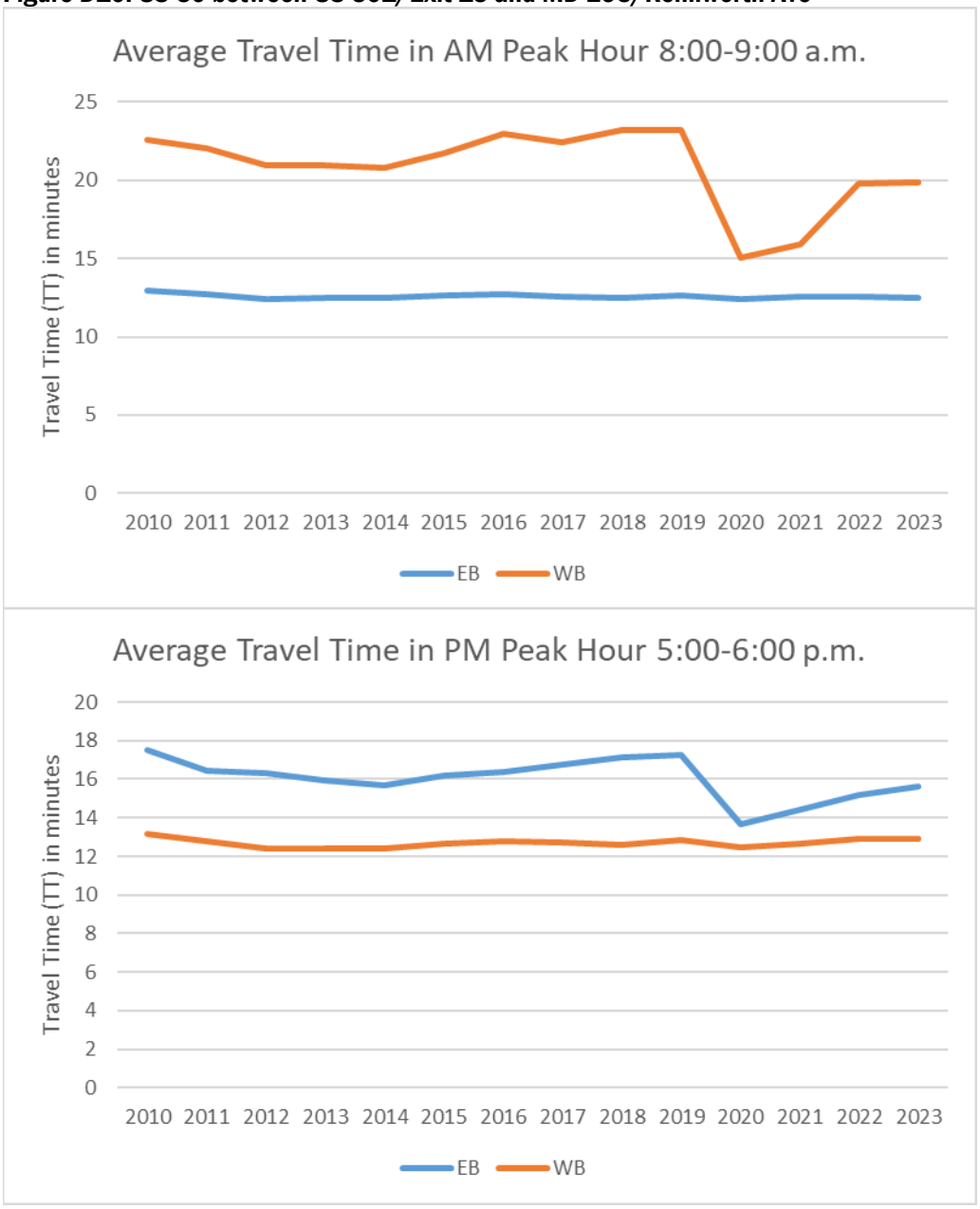


Figure D11: MD-295 between MD-198 and US-50/MD-201/Kenilworth Ave

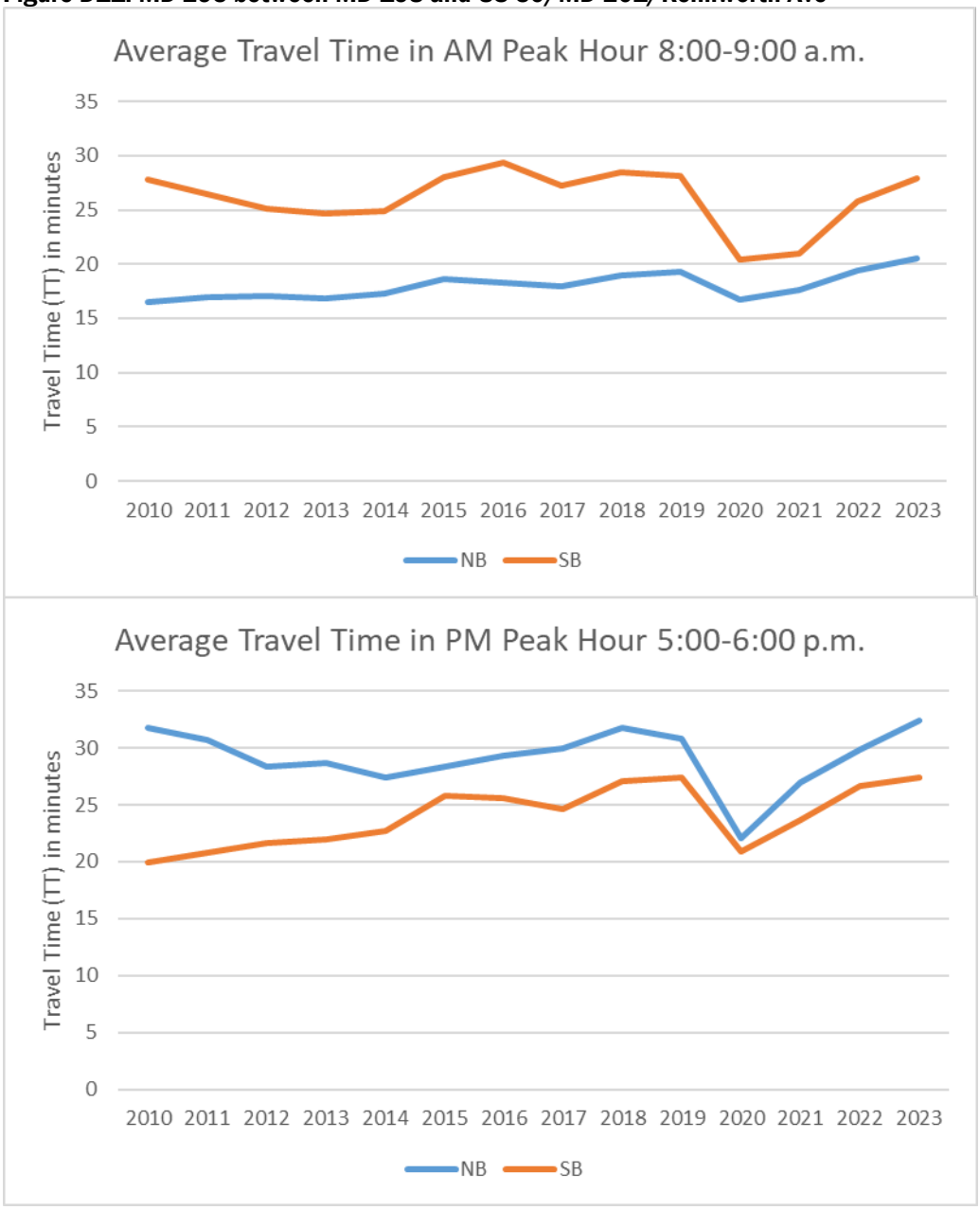
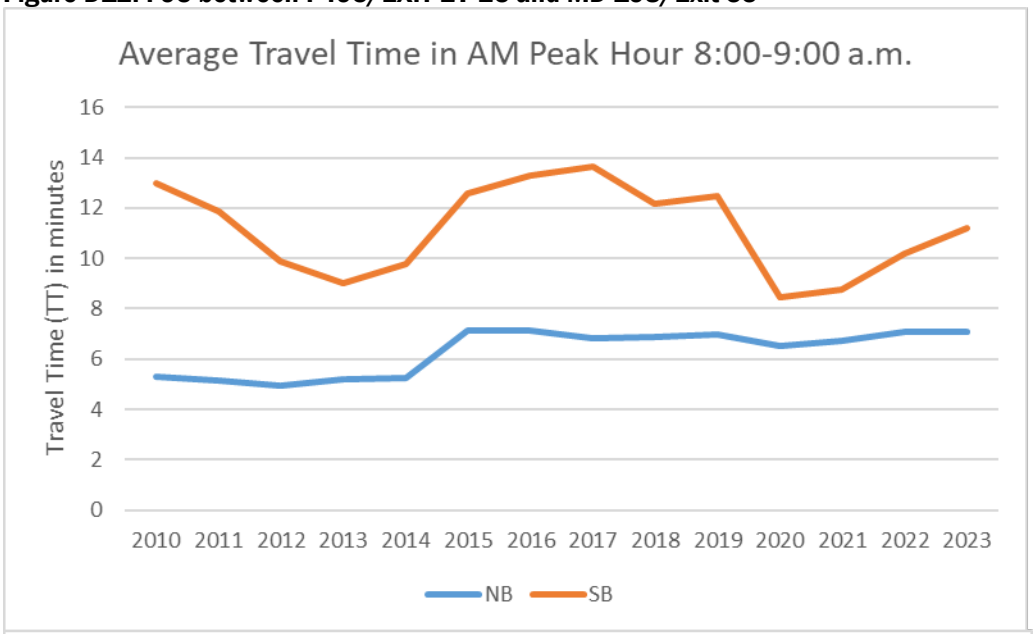


Figure D12: I-95 between I-495/EXIT 27-25 and MD-198/Exit 33



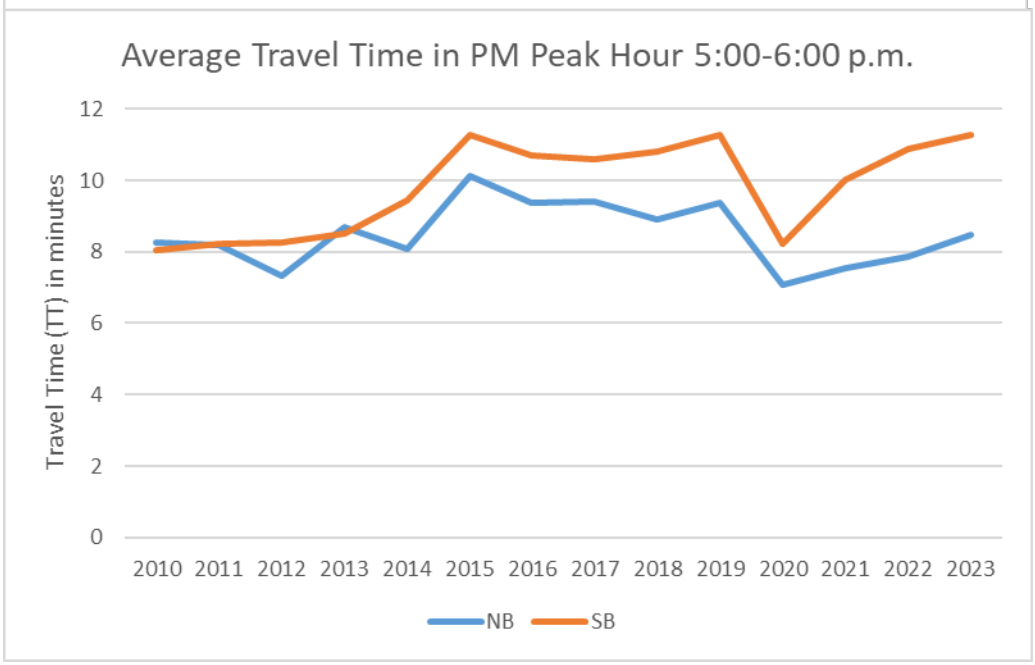


Figure D13: I-495 between I-270/Exit 35 and Exit 27

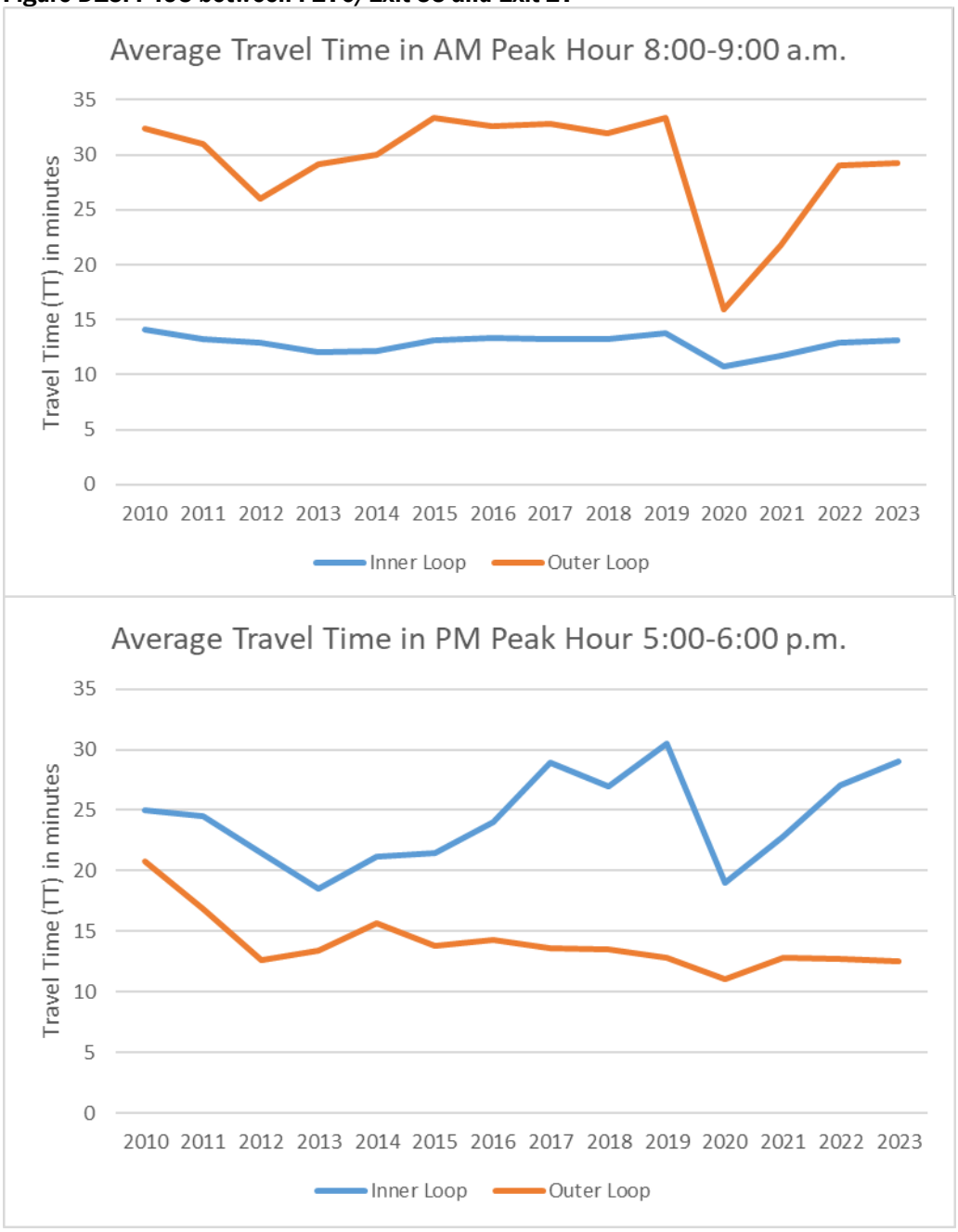


Figure D14: I-495 between Exit 27 and US-50/Exit 19

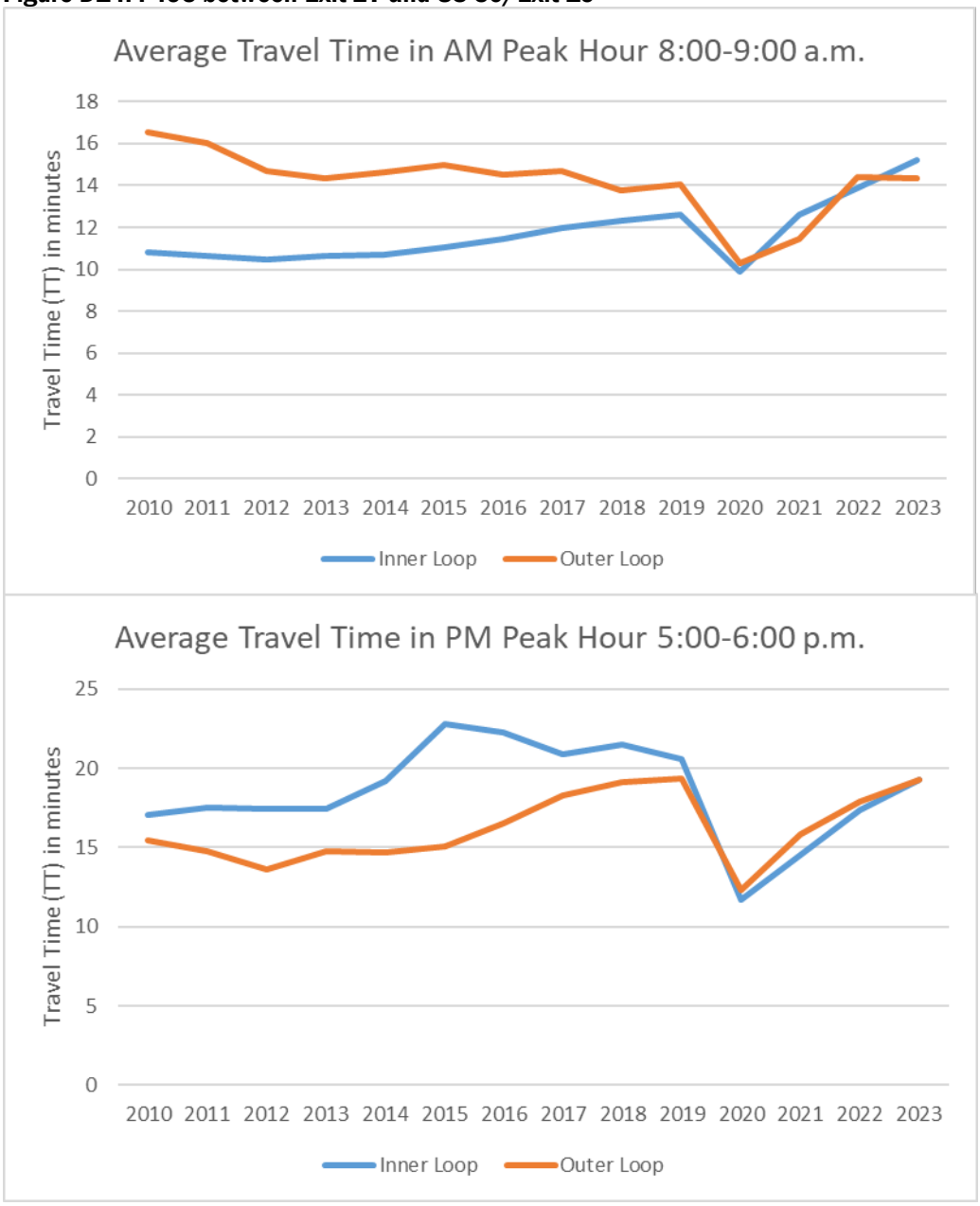


Figure D15: I-495 between US-50/Exit 19 and I-95/I-395/Exit 57

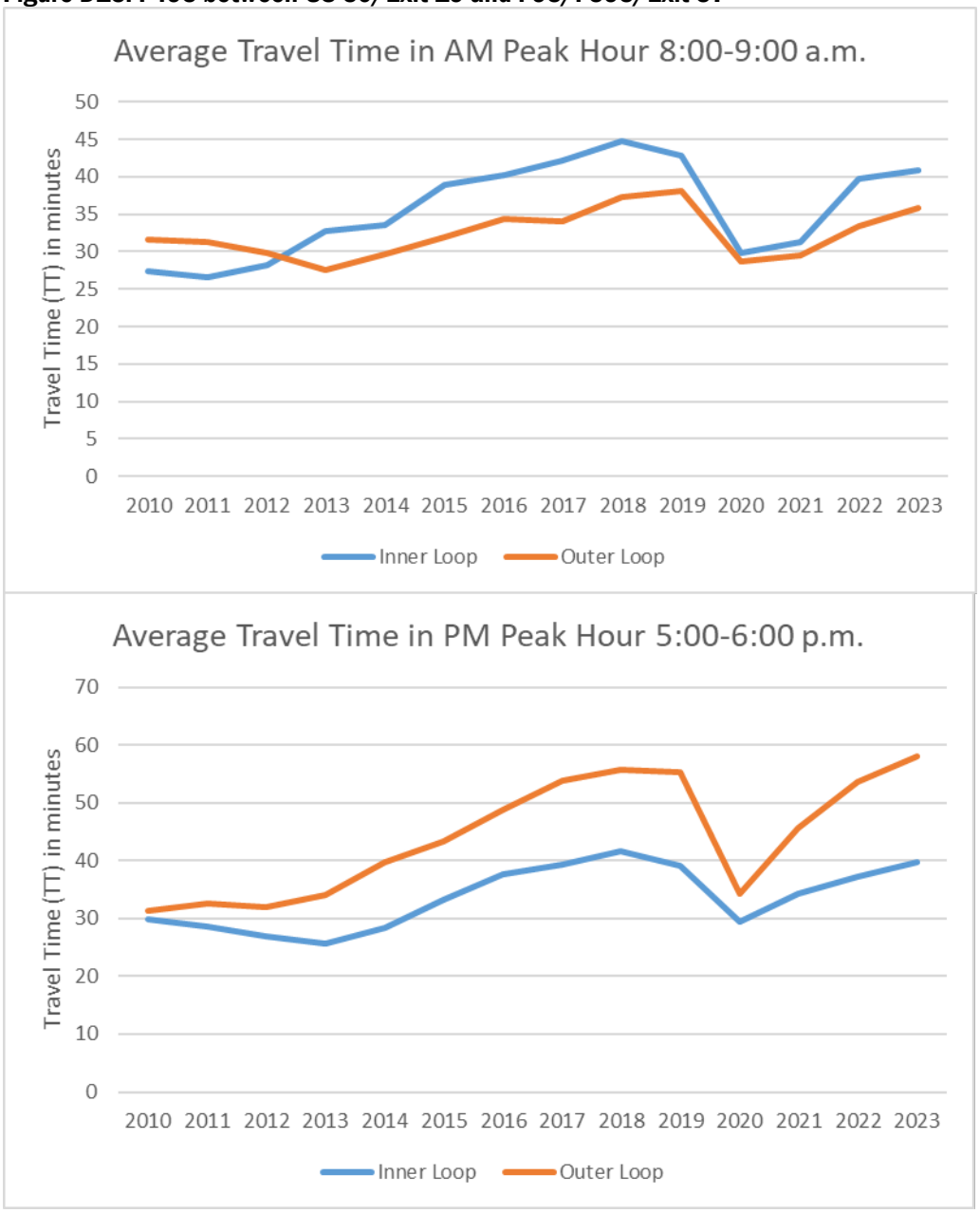
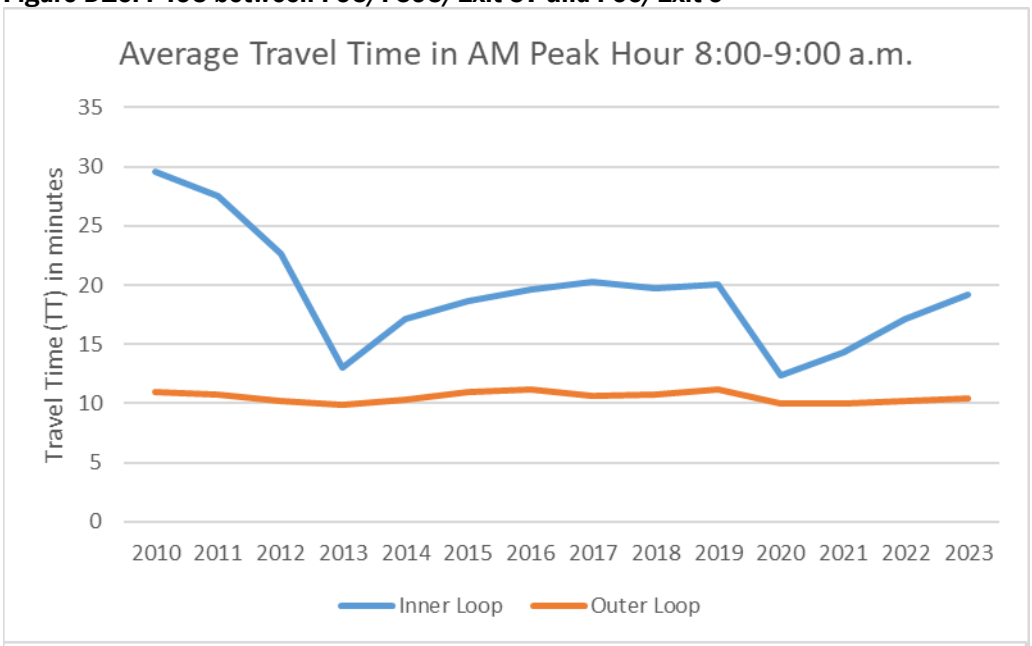


Figure D16: I-495 between I-95/I-395/Exit 57 and I-66/Exit 9



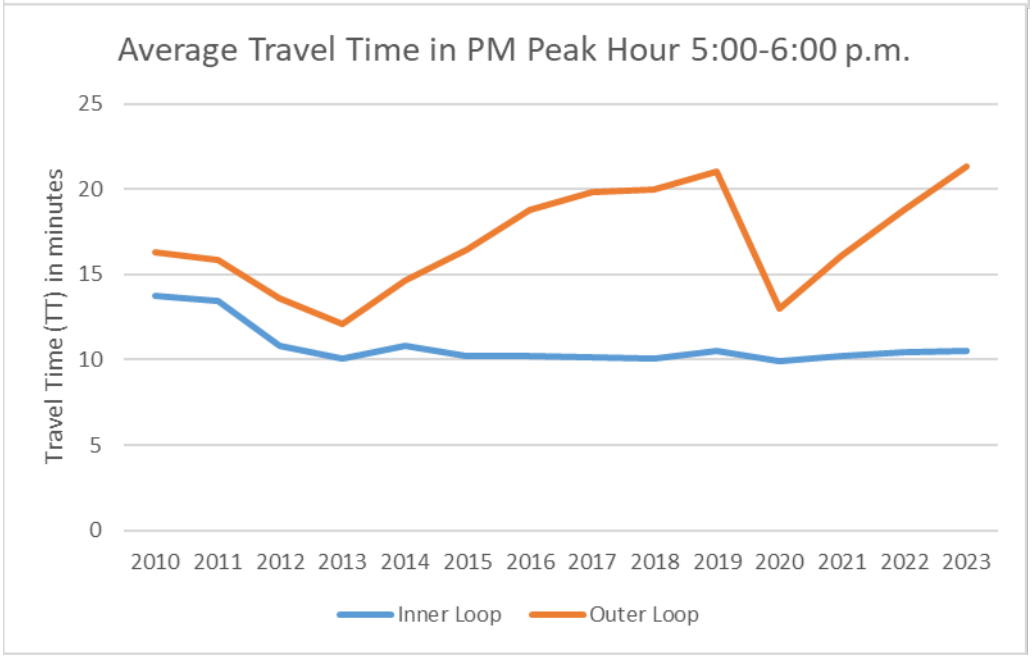
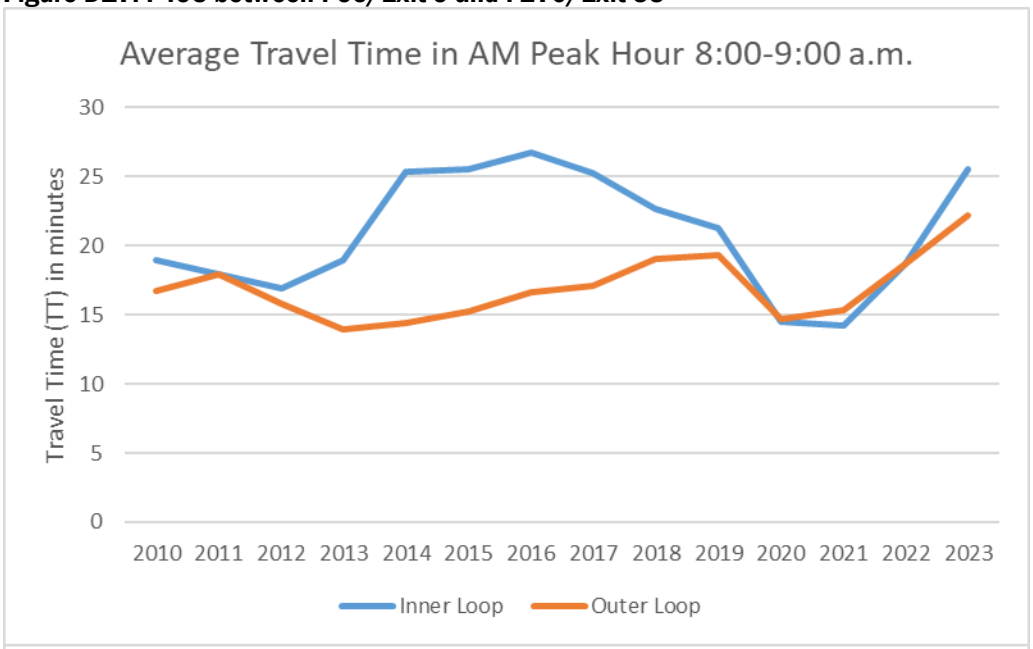


Figure D17: I-495 between I-66/Exit 9 and I-270/Exit 35



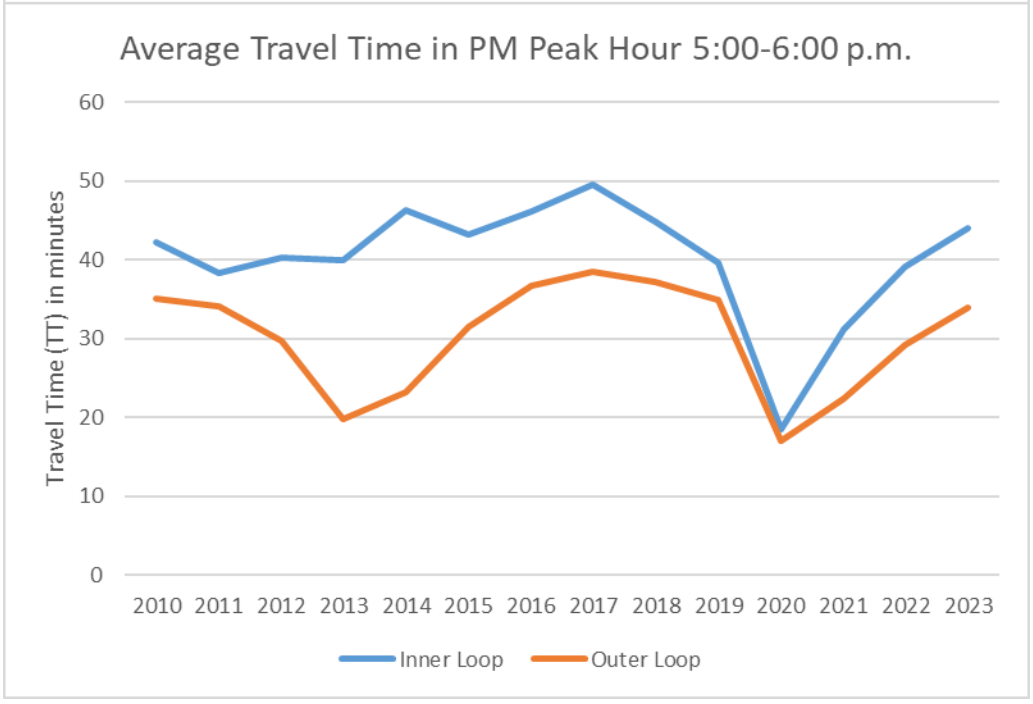
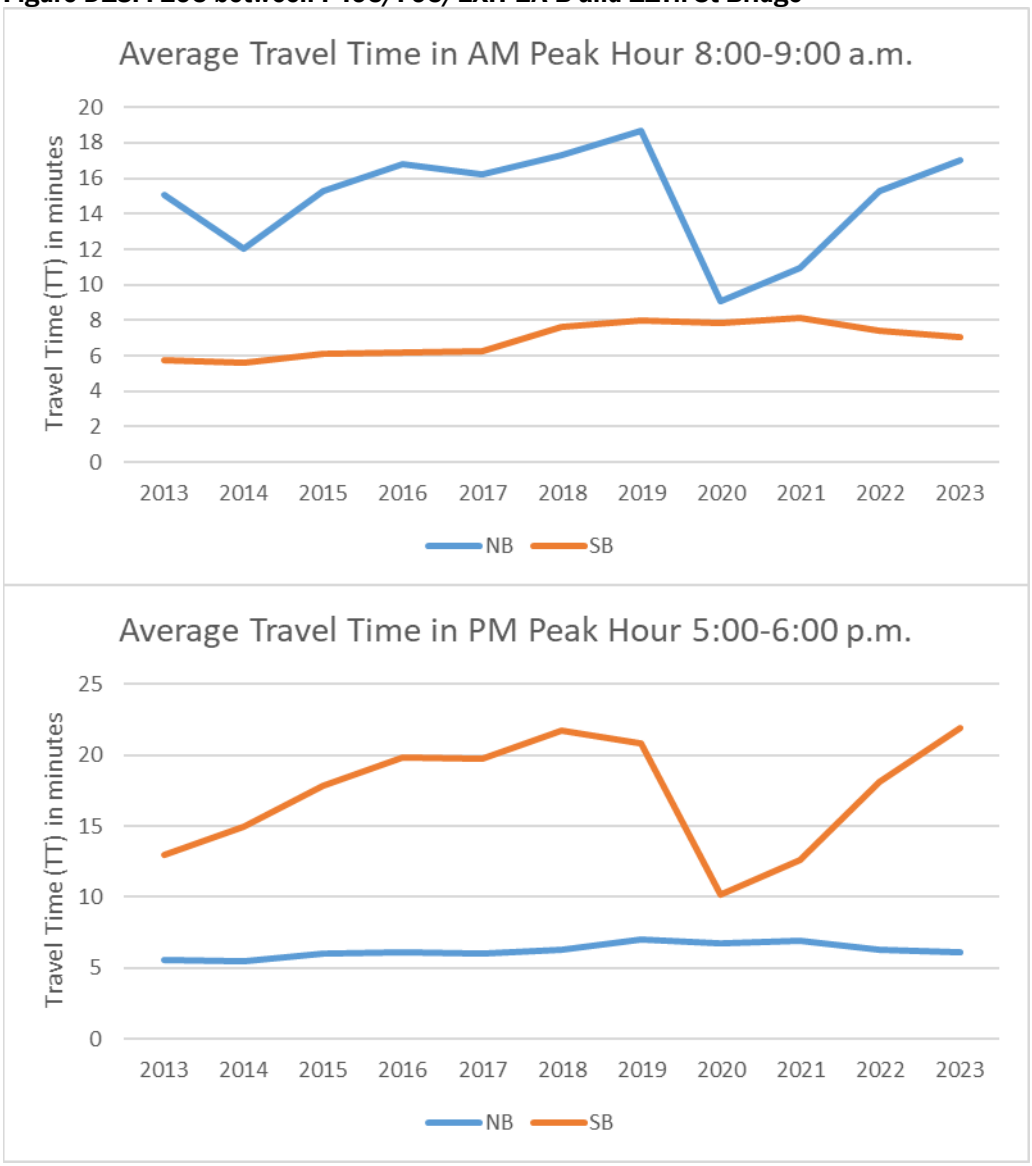


Figure D18: I-295 between I-495/I-95/EXIT 2A-B and 11Th St Bridge



APPENDIX E – SUMMARY OF TRANSPORTATION DEMAND MANAGEMENT (TDM) ANALYSIS REPORT FY 2021-2023[176]

In addition to air quality benefits, the evaluation results of the Commuter Connections TDM program elements show significant vehicle trips (VT) and vehicle miles traveled (VMT) reductions, contributing directly to congestion management in the region.

Background

This report presents the results of an evaluation of four Transportation Demand Management (TDM), measures implemented by the National Capital Region Transportation Planning Board's (TPB) Commuter Connections program at the Metropolitan Washington Council of Governments (COG) to support the Washington, DC metropolitan region's air quality conformity determination and congestion management process. This evaluation documents transportation and air quality impacts for the three-year evaluation period between July 1, 2020 and June 30, 2023, for the following:

- Maryland Telework – This program element provides information and assistance to Maryland commuters and employers to further in-home and telecenter-based telework programs.

- Guaranteed Ride Home – Eliminates a barrier to use of alternative modes by providing free rides home in the event of an unexpected personal emergency or unscheduled overtime to commuters who use alternative modes.

- Employer Outreach – Provides regional outreach services to encourage large, private-sector and non-profit employers voluntarily to implement commuter assistance strategies that will contribute to reducing vehicle trips to worksites, including the efforts of jurisdiction sales representatives to foster new and expanded trip reduction programs. The Employer Outreach for Bicycling program element also is part of this analysis.

- Mass Marketing – Involves a large-scale, comprehensive media campaign to inform the region's commuters of services available from Commuter Connections as one way to address commuters' frustration about the commute. Various special promotional events also are part of this program element.

COG's National Capital Transportation Planning Board (TPB), the designated Metropolitan Planning Organization (MPO) for the Washington, DC metropolitan region, adopted and continues to support these TDM program elements, among others, as part of the regional Transportation Improvement Program (TIP). The purpose of the Commuter Connections TDM programs is to help the region reduce emissions in support of air quality goals for the region and to meet federal requirements for the congestion management process. The Commuter Connections program is considered integral in regional travel demand management analysis.

COG/TPB's Commuter Connections program, which also operates an ongoing regional rideshare program, is the central administrator of the program measures noted above. Commuter Connections elected to include a vigorous evaluation element in the implementation plan for each of the adopted

[176] Nicholas Ramfos, Lori Diggins, Eric Schreffler and Phillip Winters, National Capital Region Transportation Planning Board (TPB) Commuter Connections Program 2021-2023 Transportation Demand Management (TDM) Analysis Report, November 21, 2023.

https://www.commuterconnections.org/wp-content/uploads/2021-2023-TDM-Analysis-Evaluation-Report-Final-Draft-112123.pdf

TDM program elements to develop information to guide sound decision-making about the measures. This report summarizes the results of the Commuter Connections TDM program element evaluation activities and presents the transportation and air quality impacts of both the program elements and the Commuter Operations Center (COC).

This evaluation is comprehensive for these programs; however, it should be noted that the evaluation is conservative in the sense that it includes credit only for impacts that can be reasonably documented with accepted measurement methods and tools. Many of the calculations use data from surveys that are subject to some statistical error, at rates common to such surveys.

A primary purpose of this evaluation was to develop meaningful information for regional transportation and air quality decision-makers, COG/TPB staff, COG/TPB program funding agencies, and state and local commute assistance program managers to guide sound decision-making about the Commuter Connections TDM program elements. The results of this evaluation will provide valuable information for regional air quality conformity and the region's congestion management process, to improve the structure and implementation procedures of the Commuter Connections TDM program elements themselves, and to refine future data collection methodologies and tools.

Summary of Commuter Connections TDM Program Impact Results

The objective of the evaluation is to estimate reductions in vehicle trips (VT), vehicle miles traveled (VMT), and tons of vehicle pollutants (Nitrogen Oxides (NOx), Volatile Organic Compounds (VOC), Particulate Matter (PM2.5), Particulate Matter NOx precursors (PM and NOx), and Carbon Dioxide (CO2)) resulting from implementation of each Commuter Connections TDM program element and compare the impacts against the goals established for the TDM program elements. The impact results for these measures are shown in Table A for each program element individually. Results for all Commuter Connections TDM program elements collectively and for the Commuter Operations Center (COC) are presented in Table B.

As shown in Table A, the four program elements fell about 17% short of the collective goal for vehicle trips reduced and 13% short of the goal for VMT reduced. The program elements did not reach the emission goals; the impact for NOx was 58% under the goal and VOC impact was 41% under the goal, but these deficits were due in part to reductions in the emission factors. The program goals were set in 2006, using 2006 emission factors. Goals for some program elements were re-set after the 2014 and 2017 TDM analyses were conducted but the emission factors used in the 2023 evaluation were considerably lower than the factors from past evaluations, reflecting a cleaner vehicle fleet.

When the COC results are added to the impacts of the four program elements impacts (Table B), the combined impact was 18% below the vehicle trips reduction goal and 20% under the goal for VMT reduced. The combined program element–COC program impact fell 61% short of the NOx goal and was 43% below the VOC goal. Again, the change in the emission factors affected the emission results.

Many factors enter the calculation of impacts, including participation in individual program elements as well as the current and previous commute patterns of program users. Explanations for individual program element results are presented in later sections of the report. But without question, commute disruptions related to the coronavirus pandemic were a significant factor in the overall impact results. As the coronavirus pandemic began, in spring 2020, stay-at-home directives were implemented throughout the Washington metropolitan region, closing many worksites and disrupting typical commutes. Many employees shifted to working from home all or most of their workdays.

Additionally, some employees became unemployed or changed jobs, and some who continued commuting to an outside work location changed their commute mode to minimize contact with other commuters.
Impacts of most Commuter Connections program elements are based on actual use of the programs and where shortfalls occurred against the vehicle trip and VMT reduction goals, they appear related to lower than expected commuter participation rates. For example, the number of commuters registered for Guaranteed Ride Home was just 18% of the goal for the program. The 14,501 commuters influenced or assisted by Mass Marketing were only 63% of the participation goal. And participation for the Commuter Operations Center was 56% of the goal for this service.

Commuter Connections' program enrollment was certainly affected by greater use of telework/work from home. But participation also could have been lower among commuters who continued to commute. While traffic began to resume in early 2021, traffic volumes and congestion are still below the pre-pandemic levels. This might have influenced some commuters who previously chose transit to avoid driving or to gain a time advantage through use of carpool lanes to shift to driving alone, reducing their need for Commute Connections' assistance with non-drive alone travel modes. The only program element that met individual goals for participation and travel impacts was Telework–Maryland Assistance. This program benefitted from the expanded use of telework as a pandemic emergency response and the interest of both employers and individual teleworkers in obtaining information that could be helpful in navigating new work from home requirements.

Additional details on the calculations for each Commuter Connections TDM program element and for the Commuter Operations Center are described in individual sections of this report. The reasons for the shortfalls from the goals also are discussed in the individual report sections.

Table A

Daily Impacts for Individual Program Elements (July 2020 – June 2023) and Comparison to Goals

TDM Program Element	Participation [1]	Daily Vehicle Trips Reduced	Daily VMT Reduced	Daily Tons NOx Reduced	Daily Tons VOC Reduced
Maryland Telework Assistance [2]					
2023 Goal	31,854	11,830	241,209	0.1220	0.0720
Impacts (7/20 – 6/23)	58,961	24,681	489,911	0.1072	0.0898
Net Credit or (Deficit)	**27,107**	**12,851**	**248,702**	**(0.0148)**	**0.0178**
Guaranteed Ride Home					
2023 Goal	18,496	6,296	177,568	0.0890	0.0480
Impacts (7/20 – 6/23)	3,308	2,013	52,201	0.0088	0.0054
Net Credit or (Deficit)	**(15,188)**	**(4,283)**	**(125,367)**	**(0.0802)**	**(0.0426)**
Employer Outreach – all employers participating [3]					
2023 Goal	2,031	90,776	1,533,161	0.6170	0.3850
Impacts (7/20 – 6/23)	2,166	69,498	1,247,480	0.2571	0.2056
Net Credit or (Deficit)	**135**	**(21,278)**	**(285,681)**	**(0.3599)**	**(0.1794)**
Employer Outreach – new / expanded employer services since July 2020 [3]					
2023 Goal	N/A	N/A	N/A	N/A	N/A
Impacts (7/20 – 6/23)	1,177	10,946	198,638	0.0408	0.0325
Net Credit or (Deficit)	N/A	N/A	N/A	N/A	N/A
Employer Outreach for Bicycling [3]					
2023 Goal	590	404	2,421	0.0016	0.0015
Impacts (7/20 – 6/23)	732	405	1,823	0.0007	0.0011
Net Credit or (Deficit)	**142**	**1**	**(598)**	**(0.0009)**	**(0.0004)**
Mass Marketing					
2023 Goal	23,168	10,809	181,932	0.0850	0.0250
Impacts (7/20 – 6/23)	14,501	3,588	65,820	0.0135	0.0108
Net Credit or (Deficit)	**(8,667)**	**(7,221)**	**(116,112)**	**(0.0715)**	**(0.0142)**
TDM Program Elements (all collectively)					
2023 Goal		119,711	2,133,870	0.9130	0.5300
Impacts (7/20 – 6/23)		99,780	1,855,412	0.3866	0.3116
Net Credit or (Deficit)		**(19,931)**	**(278,458)**	**(0.5264)**	**(0.2184)**

1) Participation refers to number of commuters participating, except for the Employer Outreach program element. For this element, participation equals the number of employers participating.

2) Maryland impacts represent portion of regional telework attributable to TW program activities in Maryland. Total telework credited for conformity is higher than reported for the program element.

3) Impacts for Employer Outreach - all employers participating includes impacts for Employer Outreach – new / expanded employer services since July 2020 and for Employer Outreach for Bicycling.

Table B
Combined Program Element and COC Impacts (July 2020 – June 2023) and Comparison to Goals

TDM Program Element	Participation	Daily Vehicle Trips Reduced	Daily VMT Reduced	Daily Tons NOx Reduced	Daily Tons VOC Reduced
Program Elements (all collectively)					
2023 Goal		119,711	2,133,870	0.9130	0.5300
Impacts (7/20 – 6/23)		99,780	1,855,412	0.3866	0.3116
Net Credit or (Deficit)		**(19,931)**	**(278,458)**	**(0.5264)**	**(0.2184)**
Commuter Operations Center – Basic Services					
2023 Goal	91,609	24,425	512,637	0.2410	0.1150
Impacts (7/20 – 6/23)	51,018	19,048	297,963	0.0676	0.0611
Net Credit or (Deficit)	**(40,591)**	**(5,377)**	**(214,674)**	**(0.1734)**	**(0.0539)**
Commuter Operations Center – Software Upgrades [1]					
2023 Goal	4,681	2,379	66,442	0.0280	0.0110
Impacts (7/20 – 6/23)	3,596	669	15,454	0.0030	0.0022
Net Credit or (Deficit)	**(1,085)**	**(1,710)**	**(50,988)**	**(0.0250)**	**(0.0088)**
All Program Elements plus COC					
2023 Goal		146,515	2,712,949	1.1820	0.6560
Impacts (7/20 – 6/23)		119,497	2,168,829	0.4572	0.3749
Net Credit or (Deficit)		**(27,018)**	**(544,120)**	**(0.7248)**	**(0.2811)**

1) Impacts for Commuter Operations Center – Software Upgrades are in addition to the impacts for the Commuter Operations Center – Basic Services. This project was previously part of the Integrated Rideshare program element.

Table C, on the following page, presents annual emission reduction results for PM 2.5, PM 2.5 pre-cursor NOx, and CO2 emissions (Greenhouse Gas Emissions - GHG) for each Commuter Connections TDM program element and for the COC. COG/TPB did not establish specific targets for these impacts for the Commuter Connections program elements. But COG has been measuring these impacts for other program elements, thus these results are provided.

As shown, the program elements collectively reduce 7.5 annual tons of PM 2.5, 150 annual tons of PM 2.5 pre-cursor NOx, and 218,000 annual tons of CO2 (greenhouse gas emissions). When the Commuter Operations Center is included, these emissions impacts rise to 8.8 annual tons of PM 2.5, 177 annual tons of PM 2.5 pre-cursor NOx, and more than 258,000 annual tons of CO2 (greenhouse gas emissions).

Table C
Annual CO2 Emission Impacts (July 2020 – June 2023) for Individual Program Element

TDM Program Element	Annual Tons CO2 Reduced
Maryland Telework Assistance [1]	48,460.3
Guaranteed Ride Home	4,529.5
Employer Outreach – all employers [2]	119,083.0
Employer Outreach – new/expanded employers [2]	18,963.0
Employer Outreach for Bicycling	198.3
Mass Marketing	6,223.6
Program Elements (all collectively)	**178,296.4**
Commuter Operations Center – basic services (not including Software Upgrades)	29,235.5
Commuter Operations Center – Software Upgrades	1,468.8
All Program Elements plus COC	**209,000.7**

1) Maryland impacts represent the portion of regional telework attributable to TW program activities in Maryland. Additional telework impacts from COG activities are assigned to Employer Outreach and the Commuter Operations Center. Total telework credited for conformity is higher than reported for the program element.

2) Impacts for new/expanded employer programs and Employer Outreach for Bicycling are included in the Employer Outreach – all employers figures.

Finally, Table D compares daily reductions in vehicle trips, VMT, NOx, and VOC from the 2023 TDM program element analysis (July 2020 through June 2023) to results of the 2020 analysis (July 2017 through June 2020). The impacts for Maryland Telework were higher in 2023 than in 2020 and the 2023 impacts for the Commuter Operation Center slightly exceeded those from the 2020 analysis. All other program elements experienced impact declines between 2020 and 2023, due in large part to drops in participation related to the coronavirus pandemic.

Table D
Impacts for Individual Program Elements 7/20– 6/23 Compared with 7/17 – 6/20

TDM Program Element	• Daily Vehicle Trips Reduced	• Daily VMT • Reduced	• Daily Tons NOx Reduced	• Daily Tons VOC Reduced
Maryland Telework Assistance				
July 2020 – June 2023	24,681	489,911	0.1072	0.0898
July 2017 – June 2020	13,636	308,001	0.0664	0.0522
Change [1)]	11,045	181,910	0.0408	0.0376
Guaranteed Ride Home				
July 2020 – June 2023	2,013	52,201	0.0088	0.0054
July 2017 – June 2020	5,200	147,371	0.0253	0.0154
Change [1)]	(3,187)	(95,170)	(0.0165)	(0.0100)
Employer Outreach – All services except Employer Outreach for Bicycling				
July 2020 – June 2023	69,093	1,245,657	0.2564	0.2045
July 2017 – June 2020	85,396	1,487,279	0.2987	0.2285
Change [1)]	(16,303)	(241,622)	(0.0423)	(0.0240)
Employer Outreach for Bicycling				
July 2020 – June 2023	405	1,823	0.0007	0.0011
July 2017 – June 2020	449	1,886	0.0008	0.0012
Change [1)]	(44)	(63)	(0.0001)	(0.0001)
Mass Marketing				
July 2020 – June 2023	3,588	65,820	0.0135	0.0108
July 2017 – June 2020	14,031	277,511	0.0554	0.0415
Change [1)]	(10,443)	(211,691)	(0.0419)	(0.0307)
All TDM Program Elements (Excluding Commuter Operations Center)				
July 2020 – June 2023	99,780	1,855,412	0.3866	0.3116
July 2017 – June 2020	119,249	2,231,875	0.4488	0.3407
Change [1)]	(19,469)	(376,463)	(0.0622)	(0.0291)
Commuter Operations Center (Basic Services + Software Upgrades)				
July 2020 – June 2023	19,717	313,417	0.0706	0.0633
July 2017 – June 2020	17,644	415,676	0.0802	0.0567
Change [1)]	2,073	(102,259)	(0.0096)	0.0066

1) Change in emissions is due in part to reduction in emission factors from 2020 to 2023.

APPENDIX F – CONTENT OF CMP DOCUMENTATION FORM[177]

1. Indicate whether the proposed project's location is subject to or benefits significantly from any of the following in-place congestion management strategies:

a. Metropolitan Washington Commuter Connections program (ridesharing, telecommuting, guaranteed ride home, employer programs)
b. A Transportation Management Association is in the vicinity
c. Channelized or grade-separated intersection(s) or roundabouts
d. Reversible, turning, acceleration/deceleration, or bypass lanes
e. High occupancy vehicle facilities or systems
f. Transit stop (rail or bus) within a 1/2 mile radius of the project location
g. Park-and-ride lot within a one-mile radius of the project location
h. Real-time surveillance/traffic device controlled by a traffic operations center
i. Motorist assistance/hazard clearance patrols
j. Interconnected/coordinated traffic signal system
k. Other in-place congestion management strategy or strategies (briefly describe below:)

2. List and briefly describe how the following categories of (additional) strategies were considered as full or partial alternatives to single-occupant vehicle capacity expansion in the study or proposal for the project.

a. Transportation demand management measures, including growth management and congestion pricing
b. Traffic operational improvements
c. Public transportation improvements
d. Intelligent Transportation Systems technologies
e. Other congestion management strategies
f. Combinations of the above strategies

3. Could congestion management alternatives fully eliminate or partially offset the need for the proposed increase in single-occupant vehicle capacity? Explain why or why not.

4. Describe all congestion management strategies that are going to be incorporated into the proposed highway project.

5. Describe the proposed funding and implementation schedule for the congestion management strategies to be incorporated into the proposed highway project. Also describe how the effectiveness of strategies implemented will be monitored and assessed after implementation.

[177] The CMP Documentation Form is currently a portion of the online system member agencies use to enter project information into TPB's Technical Inputs Solicitation.

APPENDIX G – REVIEW OF CONGESTION MANAGEMENT STRATEGIES

This appendix references the Table 4-2 and Table 4-3, which are repeated on the next two pages for convenience.

General Characteristics

Strategy Name and Number:

The strategies down the left-hand side of the lists were developed based on the types of strategies being pursued in the region and elsewhere, and could be considered for implementation in our region. Inclusion of any given strategy on the list does not imply endorsement, but rather is included on the list only for consideration and comparison purposes.

Each strategy has a number associated with it (C.1.0, C.1.1, etc.) to make it easier to find and discuss the strategies. The number is not in any way a ranking.

Those listed in bold italics are the strategy categories and underneath them are the specific strategies in that category.

Table G1: Congestion Management Process (CMP) Demand Management Strategies Criteria

1. Low (x)
2. Medium (xx)
3. High (xxx)

		QUALITATIVE CRITERIA									
		Congestion Related				Others					
STRATEGY		Reduces Overall Congestion	Reduces Incident-related Congestion	Supports/Promotes Multi-modal Transportation	Regional Applicability	Local Applicability	Existing Level of Deployment	Ease of Implementation	Cost	Cost Effectiveness	Enhance Existing Programs
C.5.0	***Alternative Commute Programs***										
C.5.1	Carpooling	xxx	x	x	xxx	xxx	xxx	xx	x	xxx	xxx
C.5.2	Ridematching Services	xxx	x	x	xxx	xxx	xxx	xx	x	xxx	xxx
C.5.3	Vanpooling	xxx	x	x	xxx	xx	xx	xx	x	xxx	xxx
C.5.4	Telecommuting	xx	x	x	xxx	xx	xx	xxx	x	xx	xxx
C.5.5	Promote Alternate Modes	xx	x	xxx	xxx	xxx	xxx	xxx	x	xx	xxx
C.5.6	Compressed/Flexible Workweeks	xx	x	x	xxx	xxx	xxx	xxx	x	x	xx
C.5.7	Employer Outreach/Mass Marketing	xx	x	xxx	xxx	xxx	xx	xx	xx	xx	xxx
C.5.8	Parking Cash-out	xx	x	xxx	x	xxx	x	x	xxx	xx	xx
C.5.9	Alternative Commute Subsidy Program	xx	x	xxx	xxx	xx	xx	x	x	xxx	xxx
C.5.10	App-based Incentives (e.g. incenTrip)	xx	xxx	xxx	xxx	xx	xx	xx	x	xxx	xxx
C.6.0	***Managed Facilities***										
C.6.1	High-Occupancy Vehicle (HOV) Facilities	xx	x	xxx	xxx	xx	xx	xx	xxx	xxx	xxx
C.6.2	Variably Priced Lanes (VPL)	xxx	x	xx	xxx	xx	xx	xx	xxx	xxx	xx
C.6.3	Cordon Pricing	xxx	x	xxx	xxx	xx	x	x	xx	xxx	xx
C.7.0	***Public Transportation Improvements***										
C.7.1	Electronic Payment Systems	xx	x	xxx	xx	xx	xxx	xx	xx	xxx	xx
C.7.2	Improvements/Added Capacity to Regional Rail and Bus Transit	xx	xx	xxx	xx	xxx	xx	x	xxx	xxx	xx
C.7.3	Improving Accessibility to Multi-modal Options	xx	x	xxx	xx	xxx	xx	xx	xx	xx	xxx
C.7.4	Park-and-Ride Lot Improvements	xx	x	xx	xx	xx	xx	xx	xx	xx	xx
C.7.5	Carsharing Programs	xx	x	xxx	xxx	xxx	xx	xxx	xx	xx	xxx
C.8.0	***Pedestrian, bicycle, and multi-modal improvements***										
C.8.1	Improve Pedestrian Facilities	xx	x	xxx	xx	xxx	xx	xx	xx	xx	xxx
C.8.2	Creation of New Bicycle and Pedestrian Facilities	xx	x	xxx	xxx	xxx	xx	xx	xx	xx	xxx
C.8.3	Addition of Bicycle Racks at Public Transit Stations/Stops	x	x	xx	xxx	xxx	xx	xxx	x	x	xxx
C.8.4	Bikesharing/Micromobility Programs	xx	x	xxx	xxx	xxx	xx	xxx	xx	xx	xxx
C.9.0	***Growth Management***										
C.9.1	Coordination of Regional Activity Centers	xx	x	xxx	xxx	xxx	xx	x	xxx	xxx	xx
C.9.2	Implementation of TLC program (i.e. Coordination of Transportation and Land Use with Local Gov'ts)	xx	x	xxx	xxx	xxx	xx	xxx	x	xxx	xxx
C.9.3	"Live Near Your Work" Program	xx	x	xx	xxx	xx	x	xx	xx	x	xx

Table G2: Congestion Management Process (CMP) Operational Management Strategies Criteria

1. Low (x)
2. Medium (xx)
3. High (xxx)

		QUALITATIVE CRITERIA									
		Congestion Related				Others					
STRATEGY		Reduces Overall Congestion	Reduces Incident-related Congestion	Supports/Promotes Multi-modal Transportation	Regional Applicability	Local Applicability	Existing Level of Deployment	Ease of Implementation	Cost	Cost Effectiveness	Enhance Existing Programs
C.1.0	***Incident Mngt./Non-recurring***										
C.1.1	Imaging/Video for Surveillance and Detection	xx	xxx	xx	xxx	xxx	xx	xx	xx	xxx	xxx
C.1.2	Service Patrols	xx	xxx	x	xxx	xxx	xx	xxx	xx	xxx	xxx
C.1.3	Emergency Management Systems	x	xx	x	xx	xxx	xxx	xx	xxx	xxx	xxx
C.1.4	Emergency Vehicle Preemption	x	xx	x	x	xxx	xx	xx	xx	x	xx
C.1.5	Road Weather Management	x	xxx	x	xxx	xxx	xx	xx	xx	xx	xx
C.1.6	Traffic Management Centers	xx	xxx	xx	xxx	xx	xx	xx	xx	xxx	xxx
C.1.7	Curve Speed Warning System	xx	xx	x	x	xx	x	xx	xx	xx	x
C.1.8	Work Zone Management	xx	xxx	x	xx	xxx	xx	xx	xx	xx	xx
C.1.9	Automated Truck Rollover Systems	x	xx	x	x	xx	xx	xx	xx	xx	xx
C.1.10	Regional Incident Coordination	xxx	xxx	x	xxx	xx	xxx	xx	x	xxx	xxx
C.2.0	***ITS Technologies***										
C.2.1	Advanced Traffic Signal Systems	xxx	xx	xx	xxx	xxx	xx	xx	xxx	xxx	xxx
C.2.2	Electronic Payment Systems	xxx	x	xx	xxx	xx	xx	xx	xx	xxx	xx
C.2.3	Freeway Ramp Metering	xx	x	x	xx	xx	xx	xx	xx	xx	xx
C.2.4	Bus Priority Systems	x	x	xxx	xxx	xxx	x	xx	xxx	xx	xx
C.2.5	Lane Management (e.g. Variable Speed Limits)	xx	xx	x	xx	xxx	x	xx	xx	xx	xx
C.2.6	Automated Enforcement (e.g. Red Light Cameras)	x	x	x	x	xxx	xx	xx	xx	xx	xx
C.2.7	Traffic Signal Timing	xxx	x	xx	xxx	xxx	xx	xxx	x	xxx	xxx
C.2.8	Reversible Lanes	xx	x	x	xx	xxx	x	x	xx	xx	xx
C.2.9	Parking Management Systems	xx	x	xx	xx	xxx	x	x	xxx	xx	xx
C.2.10	Dynamic Routing/Scheduling	xx	x	xx	xxx	xxx	x	x	xxx	xx	xx
C.2.11	Service Coordination and Fleet Mngt. (e.g. Buses and Trains Sharing Real-time Information)	xx	x	xxx	xxx	xxx	xx	x	xx	xx	xx
C.2.12	Probe Traffic Monitoring	xx	xxx	x	xxx	xx	xxx	xxx	x	xxx	xxx
C.3.0	***Advanced Traveler Information Systems***										
C.3.1	Traffic Information Systems (e.g. 511)	xx	xxx	xx	xxx	x	xx	xx	xxx	xx	xxx
C.3.2	Variable Message Signs (VMS)	xx	xxx	xx	xx	xxx	xx	xx	xx	xxx	xxx
C.3.3	Highway Advisory Radio (HAR)	x	xx	x	xx	xxx	xx	xxx	xx	x	xx
C.3.4	Transit Information Systems	xx	xx	xxx	xx	xxx	xx	x	xx	xx	xxx
C.3.5	Information Sharing with Private Sector Apps	xx	xxx	x	xxx	xxx	xx	xx	x	xxx	xx
C.4.0	***Traffic Engineering Improvements***										
C.4.1	Safety Improvements	x	xxx	x	x	xxx	xx	xxx	x	xxx	xxx
C.4.2	Turn Lanes	xx	x	x	x	xxx	xx	xx	xx	xx	x
C.4.3	Roundabouts	x	xx	x	x	xxx	x	x	x	xx	xx

Qualitative Criteria:

The qualitative criteria listed across the top of the lists are used to show what kind of impact strategies have on various areas. The first three criteria listed are all impacts on congestion. However, there are several other criteria that could be looked at to determine if a strategy should be considered. The following is a definition of each criterion, and the questions we may want to ask when giving each strategy a "high," "medium," or "low" indicator:

- ***Reduces Overall Congestion***
  - How much of an impact does a strategy have in reducing overall traffic congestion?
- ***Reduces Incident-related Congestion***
  - How much of an impact does a strategy have in reducing incidents and incident-related congestion?
- ***Support/Promotes Multi-modal Transportation***
  - Does this strategy play a particular role in supporting multi-modal transportation, such as the use of bus, rail, bicycling, or pedestrian facilities?
- ***Regional Applicability***
  - Is this the type of strategy that would be easier to implement at the regional level (e.g. alternative commute programs across the region)?
- ***Local Applicability***
  - Is this the type of strategy that would be easier to implement at the local level (e.g. Automated Enforcement, which depends greatly on the local laws and law enforcement)?
- ***Existing Level of Deployment***
  - Is this strategy implemented anywhere in the region now, and if so, to what extent?
- ***Ease of Implementation***
  - How easy is the strategy to implement? Not only in terms of complexity, but in also in terms of funding, and a local jurisdiction's unique programs and laws. Some strategies are more common and more promising, while others may be more difficult to implement.
- ***Cost***
  - How much does a strategy cost to implement?
- ***Cost Effectiveness***
  - How much does the value outweigh the cost (i.e. how high are the benefits)? This is different than the previous "cost" category. For example, carpooling may be indicated as low in terms of cost, because the cost is generally low to implement. However, carpooling may be indicated as high in terms of cost effectiveness, because the benefits and value gained in the region far outweigh the cost.
- ***Enhance Existing Programs***
  - How well does this strategy fit in with existing strategies in the region? Is it new and something that existing strategies would benefit from? This category, previously broken down into "DC," "MD," and "VA," was collapsed into one category. It was found that when trying to determine if a strategy enhanced existing programs, there was not much variation among the jurisdictions.

Some, Significant, and High Indicators:

Each strategy was given an indicator of "some impact (x)," "significant impact (xx)," or "high impact (xxx)," which was based on a similar nomenclature used in the TERM process. Each indicator was developed from the knowledge and research of what sorts of activities are going on in our region. By nature of various strategies, some will be evaluated with greater or lesser impacts (e.g. a strategy

may be listed as “low” for regional applicability but “high” for local applicability”). That being said, some strategies that are “low” in some categories may be of interest for other reasons.

To further explain and clarify the reason for these indicators, let’s walk through the indicators of one strategy, *C.8.1 – Improve Pedestrian Facilities*:

- Improving pedestrian facilities was thought to have a medium impact on reducing overall congestion in the region. Improving pedestrian facilities provides an alternative mode of transportation and takes some cars off the road.
- Its contribution to reducing incident-related congestion is limited; therefore it is indicated low in that category.
- Improving pedestrian facilities greatly support and promote multi-modal transportation, therefore indicated high.
- It is something that can be implemented region-wide, but is more likely to be applied more on a local level, given the unique programs and laws of jurisdictions (thus a medium indicator for regional applicability and a high indicator for local applicability).
- It has a fairly good existing level of deployment across the region (although given the high demand for pedestrian facilities in this region, some areas are lacking facilities).
- Ease of implementation for improving pedestrian facilities could be less expensive than building new roadways, and it could be easier to implement than ITS technologies. However, challenges such as local approval, and demand for these facilities, still remain. Indicator: medium.
- Cost is neither extremely low nor especially high, and it really depends on what type of pedestrian facility is being implemented. Cost effectiveness was indicated medium, as pedestrian facilities provide a good benefit for what it costs to implement them.
- Improvement of pedestrian facilities enhance existing programs. Pedestrian facilities support local growth management plans and provide access to transit options. Indicator: high.

Tying It All Together:

The strategy long lists are important to the regional CMP for several reasons:

- The lists outline various existing and potential strategies that could be considered for our region. As congestion is becoming and epidemic here and elsewhere, these strategies will serve as a point of reference to indicate what is being done in this region to address this.
- The “high,” “medium,” and “low” indicators characterize the impact strategies have. They provide a starting point for discussion show that there are various reasons why one may want to implement a strategy. While something may have a high cost, it may also have a high impact on reducing congestion and a high cost effectiveness.
- The lists address federal requirements, which state that the region should identify and evaluate anticipated performance and expected benefits of existing strategies.

As the region continues to grow these are just some of the strategies that could be considered for our region. Many strategies on these lists are ongoing and will continue to be implemented on a greater scale. For other strategies these lists may act as a starting point for future consideration. Regardless, congestion management strategies will be at the forefront of discussion as the Washington region continues to be a dynamic living and working environment.

Detailed Descriptions of Strategies

Following is a list of congestion management strategies listed in the Strategy Long Lists. The numbers correspond with the numbered strategies in the list.

Demand Management Strategies:

C.5.0 – Alternative Commute Programs – Provides travelers with options other than the single-occupant vehicle. These programs are aimed in reducing the amount of single-occupant vehicles are on our roadways.

- *C.5.1 – Carpooling*
    - Two or more people traveling together in one vehicle. This reduces the amount of vehicles on the road.
- *C.5.2 – Ridematching Services*
    - Enables commuters to find other individuals that share the same commute route and can carpool/vanpool together. This provides carpooling options for people who may not know of someone to carpool with, thus broadening the carpooling option.
- *C.5.3 – Vanpooling*
    - When a group of individuals (usually long-distance commuters) travel together by van, which is sometimes provided by employers. This reduces the amount of vehicles on the road, which is especially important for long-distance transportation modes.
- *C.5.4 – Telecommuting*
    - Workers either work from home or from a regional telecommute center for one or more days of the week. This reduces the amount of vehicles on the road, especially during rush hour when many commuters are going to work at once.
- *C.5.5 – Promote Alternate Modes*
    - Programs, such as Commuter Connections, or regional Transportation Management Areas (TMAs) provide information to the public on alternative commute programs. This gets the word out about commute options in the region, many who may not have considered alternative commute programs as an option before.
- *C.5.6 – Compressed/Flexible Workweeks*
    - Employees compressing their work week into a shorter number of days, which allows them to avoid commuting one or more days a week. This reduces the amount of vehicles on the road.
- *C.5.7 – Employer Outreach/Mass Marketing*
    - Organizations, such as Commuter Connections, providing information to employers on the benefits of alternative commute programs for their employees. This allows employers to see the benefits that alternative commute programs can have in their organization.
- *C.5.8 – Parking Cash-out*
    - Employers essentially pay their employees not to park at work. The employees receive compensation for the parking space they would have otherwise used if they did not walk, bike, take transit, etc. This encourages more people to leave their car at home in favor of another mode of transportation.
- *C.5.9 – Alternative Commute Subsidy Program*
    - Employers provide a transit subsidy to their employees, which encourages them to use public transit instead of driving to work. This reduces the amount of vehicles on the road.
- *C.5.10 – App-based Incentives (e.g., incenTrip)*

- Apps such as Commuter Connections' incenTrip combine information on multi-modal transportation choices available from a commuter's origin to their destination and the best times to travel, with gamification incentives to make tripmaking, trip timing, or mode choice changes that will be beneficial to congestion management.

C.6.0 – Managed Facilities – These facilities have restrictions for use of the roadways. In some cases, only those other than single-occupant vehicles can use the lane or roadway. In other cases, a fee is implemented for single-occupant vehicles. Still, in other case, a fee might be implemented for every car on the roadway entering a city. They all have a common goal of reducing the amount of single-occupant vehicles on the roadways and promoting other forms of transportation.

- *C.6.1 – High-Occupancy Vehicle (HOV) Facilities*
  - High Occupancy Vehicle (HOV) facilities typically are lanes reserved for vehicles with a driver and one or more passengers. This promotes the use of carpools, which can use a less-congested lane on the highway.
- *C.6.2- Variably Priced Lanes (VPL)*
  - Lanes which are typically used by carpoolers for free, while solo drivers pay tolls that change according to varying congestion levels. This encourages the use of carpooling, but also raises revenue for additional transportation projects that would reduce congestion.
- *C.6.3 – Cordon Pricing*
  - Cordon area congestion pricing is a fee paid by users to enter a restricted area in the city center. This is a way of promoting other alternative modes of transportation, while raising revenue for other transportation projects that would reduce congestion.

C.7.0 – Public Transportation Improvements – These improvements are done to the region's public transportation to ensure that it remains a safe and viable mode for travelers. Improvements can maintain the amount of users and attract new ones who never considered public transit as an option before.

- *C.7.1 – Electronic Payment Systems*
  - These systems can make transit use more convenient by allowing a user to pay for bus, rail, park-and-ride lots, and other transit services with one card. Convenience an appealing factor, and helps increase transit ridership and ridership between different transit modes.
- *C.7.2 – Improvements/Added Capacity to Regional Rail and Bus Transit*
  - Added capacity and improvements to rail and bus to help keep up with increasing demand on public transportation. This is important in keeping with the growing demand on public transportation as an alternative mode.
- *C.7.3 – Improving Accessibility to Multi-modal Options*
  - Ensuring that connections are provided to multi-modal options, such as bus, rail, and pedestrian and bicycle facilities. More connections makes it easier for people to access multi-modal options, thus increasing use.
- *C.7.4 – Park-and-Ride Lot Improvements*
  - Improvements to park-and-ride lots to keep up with increasing demand and growth in the region. Park-and-Ride lots allow people to access public transportation, who may not be able to access it from their home. Improvements to these lots can ensure that this growing need is met and that people can continue to have transit access.
- *C.7.5 – Carsharing Programs*
  - A convenient and cost-effective mobility option for those that typically do not have a need to own a car. This reduces the amount of cars on the road because generally

the car is only used when needed, and public transportation or other modes are used most of the time.

C.8.0 – Pedestrian, Bicycle, and Multi-modal Improvements – Maintaining and creating new pedestrian, bicycle, and multi-modal facilities is improvement in that it improves accessibility. If something is accessible by a walk or bike path, people are more likely to leave their car at home.

- *C.8.1- Improve Pedestrian Facilities*
    - Improvement and addition of new pedestrian and bicycle facilities to keep up with a growing demand and ensure safety for users. This ensures that those using these facilities will continue to do so, and that potential users will find pedestrian facilities more appealing and accessible.
- *C.8.2 – Creation of New Bicycle and Pedestrian Facilities*
    - Addition of new facilities to keep up with a growing demand and created new connections throughout the region. This will extend the option of bicycle and pedestrian lanes to those that may not already have access to it, as well as provide increased access to employment, recreation, retail, and housing in the region.
- *C.8.3 – Addition of Bicycle Racks at Public Transit Stations/Stops*
    - Allows people who bike to connect to other forms of transportation. This gives people another option for traveling other than a single-occupant vehicle.
- *C.8.4 – Bikesharing/Micromobility Programs*
    - Bicycles, electronic scooters, and other devices can be rented from locations close to popular origins and destinations. This provides convenient and cost-effective mobility options for when other options such as transit or driving are not available or convenient.

C.9.0 – Growth Management – Growth Management is the term used in the Federal Rule, but really this term pertains to ensuring the coordination of transportation and land use. In terms of Growth Management we are talking about making sure that everyone has the option to public transportation and alternative modes no matter where they live or work in the region.

- *C.9.1 – Coordination of Regional Activity Centers*
    - Help coordinate transportation and land use planning in specific areas in the Washington region experiencing and anticipating growth. Focusing growth in Regional Activity Centers is important to congestion management, where transportation options for those who live and work there can be provided.
- *C.9.2 – Implementation of TLC program (i.e. Coordination of Transportation and Land Use with Local Governments).*
    - Provides support and assistance to local governments in the Washington region as they implement their own strategies to improve coordination between transportation and land use. The idea is to provide public transit options to everyone in the region.
- *C.9.3 – "Live Near Your Work" Program*
    - Supporting the idea that locating jobs and housing closer together can provide alternative commuting options that may not have been options otherwise.

Operational Management Strategies:

C.1.0 - Incident Management./Non-recurring - This category of strategies are aimed at reducing non-recurring congestion; congestion caused primarily by incidents and events. Many of these incident management systems are aimed at clearing an incident so that traffic can resume its normal flow.

- *C.1.1 – Imaging/Video for Surveillance and Detection*

    - Cameras throughout our transportation system, on roadways, at intersections, and at transit stations. Help detect incidents quickly, help emergency response units arrive quickly and help travelers safely negotiate around incidents.
- *C.1.2 – Service Patrols*
    - Specially equipped motor vehicles and trained staff that help in clearing incidents off a roadway and navigating traffic safely around an incident.
- *C.1.3 – Emergency Management Systems (EMS)*
    - EMS notify, dispatch, and guide emergency responders to an incident. Aid in detecting, tracking, and clearing incidents.
- *C. 1.4 – Emergency Vehicle Preemption*
    - Signal preemption for emergency vehicles use sensors to detect and emergency vehicle and provide a green signal to the vehicle. This is important to incident management in that it allows for emergency vehicles to get to the scene of an incident and clear it so that traffic can resume its normal flow.
- *C.1.5 – Road Weather Management*
    - Can take the forms of information dissemination, response and treatment, surveillance monitoring, and prediction, and traffic control. Helps prevent incidents due to inclement weather (snow, ice).
- *C.1.6 – Traffic Management Centers (TMCs)*
    - Centers that collect and analyze traffic data and then disseminate data to the public. Data collection elements might include CCTVs, cameras, and loop detectors. Might relay information to the public through radio, TV, or the Internet. This is important to the public, as it allows them to get information about existing traffic conditions and plan their route and timing accordingly.
- *C.1.7 – Curve Speed Warning System*
    - GPS and digital devices on a highway that assess and detect the threat of vehicles moving toward a curve too quickly. This is important in preventing incidents and thus preventing non-recurring congestion.
- *C.1.8 – Work Zone Management*
    - Can take the form of traffic workers, signs, and temporary road blockers used to direct traffic during an incident or construction. The temporary implementation of traffic management or incident management capabilities can help direct the flow of traffic, keep traffic moving, and prevent additional incidents.
- *C.1.9 – Automated truck rollover systems*
    - Detectors deployed on ramps to warn trucks if they are about to exceed their rollover threshold. If the data concludes a truck's maximum safe speed is to be exceeded around a turn, then a message sign would flash, "TRUCKS REDUCE SPEED." This is important in preventing incidents caused by large trucks, and thus preventing non-recurring congestion.

C.2.0 – ITS Technologies – This category of strategies can be defined as electronic technologies and communication devices aimed at monitoring traffic flow, detecting incidents, and providing information to the public and emergency systems on what is happening on our roadways and transit communities. Much of what is done with ITS helps in reducing non-recurring and incident-related congestion, and works hand-in-hand with those strategies listed in the above category (C.1.0).

- *C.2.1 – Advanced Traffic Signal Systems*
    - The coordination of traffic signal operation in a jurisdiction, or between jurisdictions. This is important to congestion, as it reduces delay and improves travel times.
- *C.2.2 – Electronic Payment Systems*

    - These systems can make transit use more convenient by allowing a user to pay for bus, rail, park-and-ride lots, and other transit services with one card. Convenience an appealing factor, and helps increase transit ridership and transfers among different transit modes.
- *C.2.3 – Freeway Ramp Metering*
    - Traffic signals on freeway ramps that alternate between red and green to control the flow of vehicles entering the freeway. This prevents incidents that may occur from vehicles entering the freeway too quickly, and also prevents a backup of traffic on the on-ramp.
- *C.2.4 – Bus Priority Systems*
    - Bus priority systems are sensors used to detect approaching transit vehicles an alter signal timings to improve transit performance. For example, some systems extend the duration of green signals for public transportation vehicles when necessary. This is important because improved transit performance, including a more precisely predicted time for bus arrivals, makes public transit a more appealing option for travelers.
- *C.2.5 – Lane Management (e.g. Variable Speed Limits)*
    - Variable Speed Limits are sensors used to monitor prevailing weather or traffic conditions, and message signs posting enforceable speed limits. These systems can promote the most effective use of available capacity during emergency evacuations, incidents, construction, and a variety of other traffic and/or weather conditions.
- *C.2.6 – Automated Enforcement (e.g. red light cameras)*
    - Still or video cameras that monitor things such as speed, ramp metering, and the running of red lights, to name a few. They are important to preventing non-recurring and incident related congestion.
- *C.2.7 – Traffic Signal Timing*
    - Traffic signal timing plans adjust traffic signals during an incident, during inclement weather, or to improve transit performance. The overall objective is to reduce backups at traffic signals and to increase the level of service.
- *C.2.8 – Reversible Lanes*
    - Traffic sensors and lane control signs reverse the flow of traffic and allow travel in the peak direction during rush hours. This is important to alleviating congestion that may occur in one direction during a peak hour.
- *C.2.9 – Parking Management Systems*
    - Advanced parking management systems help people find parking spots quickly, thereby potentially reducing congestion in urban areas. Advanced parking management systems include elements from both traveler information systems and specialized parking management applications and technologies, including both detection and information sharing.
- *C.2.10 – Dynamic Routing/Scheduling*
    - Public transportation routing and scheduling can automatically detect a vehicle's location, and dispatching and reservation technologies can facilitate the flexibility of routing/scheduling. This is can help increase the timeliness of public transportation, keep transit on schedule, which in turn increases ridership.
- *C.2.11 – Service Coordination and Fleet Management (e.g. Buses and Trains Sharing Real-time Information*
    - Monitoring and communication technologies in a vehicle that facilitate the coordination of passenger transfers between vehicles or transit systems. This is important and appealing to passengers that use more than one type of transit.
- *C.2.12 – Probe Traffic Monitoring*

- Using individual vehicles in the traffic stream to measure the time it takes them to travel between two points and also to report abnormal traffic flow caused by incidents. Tracking could be done with the use of cellular phones, and in the future with the installation of a system in the vehicle which would send information to transportation operators. This is important to monitoring recurring and non-recurring congested locations, and travel time.

C.3.0 – Advanced Traveler Information Systems – Provide information to travelers which allow them to adjust the timing of their travels or the route that they take to avoid any incidents, construction, or weather problems.

- *C.3.1 – Traffic Information Systems (e.g. 511)*
  - A variety of applications for travelers to use either before their trip or en-route, such as 511 telephone systems, internet websites, pagers, cell phones, and radio, to obtain up-to-date traveler information. This helps travelers plan their timing and routes accordingly.
- *C.3.2 – Variable Message Signs (VMS)*
  - One way ITS operators can share traffic information with travelers is through a Variable Message Sign (VMS) along the roadway. Such signs could provide information on road closures, emergency messages, weather message, and construction. This helps travelers plan their timing and routes accordingly. These signs can also prevent incidents from occurring as they provide warnings about speed, weather, construction, etc.
- *C.3.3 – Highway Advisory Radio (HAR)*
  - Another way ITS operators can share traffic information with travelers is through Highway Advisory Radio (HAR). The radio can provide information on road closures, emergency messages, weather, and construction (such as the Woodrow Wilson Bridge Project). Travelers can plan their timing and route accordingly.
- *C.3.4 – Transit Information Systems*
  - Can provide up-to-date transit information, such as arrival times for bus and rail. The WMATA Metrorail display signs depicting arrival times for trains are examples of this. Having this type of information available can increase transit ridership, and can also allow riders to make decisions on what type of transit to use based on up-to-date information.
- *C.3.5 – Information Sharing with Private Sector Apps*
  - Widespread use of traffic/navigation smart phone apps among the traveling public has created opportunities for both obtaining and sharing traffic conditions or incident data. Roadway agencies can provide information feeds to such app operators, as well as entering into agreements with app operators to share real-time transportation information for mutual benefit.

C.4.0 – Traffic Engineering Improvements – Improvements implemented on roadways where congestion problems have occurred in the past or are anticipated to occur in the future. Some of these engineering improvements can be aimed at reducing incidents on a particularly dangerous section of roadway, while others may be attempting to relieve a choke-point or bottleneck.

- *C.4.1 – Safety Improvements*
  - Improvements done to increase safety and reduce incident-related congestion. Examples of some improvements include traffic calming devices, speed bumps, widening or narrowing a roadway, and textured pavement. These safety improvements can prevent incidents and non-recurring congestion resulting from incidents.
- *C.4.2 – Turn Lanes*

    - Might be implemented to reduce the queuing of cars waiting to make a right or left turn at an intersection, thus reducing congestion.
- *C.4.3 – Roundabouts*
    - Barriers placed in the middle of an intersection, creating a circle, and thus directing vehicles in the same direction. This can help reduce congestion by slowing the speed of cars on a street and/or preventing thru traffic on a neighborhood street.

APPENDIX H – PREVIOUS TRAVEL MONITORING ACTIVITIES AND STUDIES

In the CMP Technical Reports preceding the 2022 edition, a wealth of information was presented in a series of appendices, namely Appendix D and Appendices H-1 through H-7. This data was the outcome of various travel monitoring activities or studies spearheaded by the TPB or its affiliate organizations. The following six activities were previously conducted by field personnel under TPB's guidance:

- 2014 Performance of High-Occupancy Vehicle Facilities on Freeways in the Washington Region
- Freeway Aerial Photography Surveys
- Arterial Floating Car Travel Time Studies
- HOV Facility Studies
- Cordon Counts
- Park-and-Ride Facilities

However, these activities have not been continued or replicated by the TPB in recent years due to the evolution of programmatic needs and the advent of "big data" technologies such as vehicle probe data. The analyses based on vehicle probe data, detailed in Chapter 2 of this report, have effectively replaced the aerial photography and floating car activities.

The former Appendix H series also encompassed information on:

- Traffic Management Activities Associated with Defense Base Closure and Realignment Commission (BRAC) Actions
- Performance Measures in the 1994 CMS Work Plan

Given that the aforementioned information has not been updated in recent years and there is no anticipation of future updates, these appendices are not included as part of the current CMP Technical Report. However, the information they contained is still accessible in the 2020 CMP Technical Report available on the TPB website[178].

[178] https://www.mwcog.org/documents/2022/07/08/congestion-management-process-cmp-technical-report-congestion-management-process/

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