National Capital Region **Transportation Plan**

Chapter 6

VISUALIZE 2050

National Capital Region
Transportation Planning Board

Approved December 17, 2025

Chapter 6:
2050 System & Performance

The substantial investments planned for the region's multimodal transportation system through 2050 will feature new elements—many of which will help address current transportation performance challenges highlighted in Chapter 3. This chapter will explore each mode of the 2050 transportation system, the system's anticipated performance, as measured through extensive travel demand model analysis from 2025 (Today) to 2050, and how transportation agencies are applying TPB's priority strategies.

As in Chapter 5, some of the region's planned projects are highlighted in this chapter to showcase the implementation of strategies, and the full listing can be found on the visualize2050.org website. As shown in the future system performance analysis, the characteristics of the region's existing transportation system, including the level of service experienced, the increased demand on the system due to the forecast increase in people and jobs, and the impact of regionally significant transportation projects planned to be implemented drive what is expected from the region's transportation system in 2050.

Future Transportation Network

The region's future transportation network in 2050 will feature new elements for all modes and travelers, such as 530 miles of new roadway and 100 miles and 99 stations of High-Capacity Transit (HCT). The **Future Transportation System** map displays all mappable, programmed investments scheduled for construction in the short term (through FY 2029) and those reasonably anticipated in the long term (through FY 2050).[1]

Based on the 2020 Census, the National Capital Region is the 6th largest metropolitan area in the U.S.[2] Between 2025 and 2050, it is predicted that 1.2 million more people and 800,000 more jobs will be added to the region, a 21 and 24 percent increase, respectively, indicating that most of the anticipated number of people and jobs in 2050 are already present in 2025.

robpegoraro/Flickr

1 National Capital Region Transportation Planning Board (2025). Visualize 2050: Future Transportation System. [Interactive Map]. **https://www.mwcog.org/V50FutureTransportationMap**

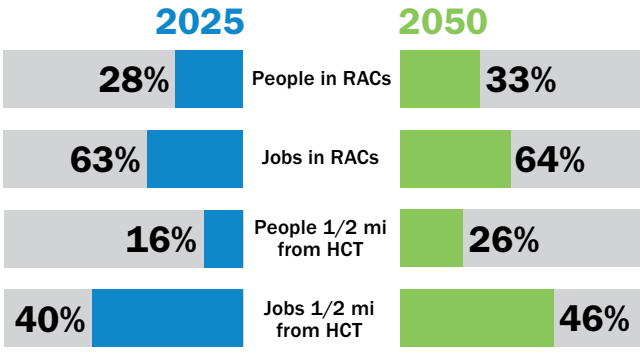
2 Rosenberg, Matt (June 7, 2024). *Which Metropolitan Areas in the United States Have the Largest Populations?* **https://www.thoughtco.com/largest-metropolitan-areas-1435135**

PRIORITY STRATEGY:
Bring jobs and housing closer together by focusing growth and adding housing units in Regional Activity Centers and near High-Capacity Transit stations.

The priority strategy to bring jobs and housing closer together is aimed at providing options for people to travel and reducing the need for automobile travel, particularly in single-occupant vehicles (SOV). This is a proven strategy to improve mobility, accessibility, and conserve natural resources.

As housing and jobs are projected to grow, they will be located closer together. This is a result of local zoning and development policies that emphasize Regional Activity Centers (RACs) and areas close to HCT stations. Transportation investments further reinforce these priorities by focusing on existing RACs, transit, and non-motorized travel, aligning with the TPB priority strategy to promote land use patterns that make the best use of the network.

Figure 6.1: Percent of People and Jobs in Regional Activity Centers and near High-Capacity Transit, Today and 2050



Visualize 2050 advances this strategy in several ways, including by designing streets that accommodate multiple travel modes and support more intensive land uses, filling in gaps in pedestrian/bicycle facilities, and investing in safety and access improvements near HCT stations. Figure 6.1 shows the anticipated impacts of targeted development and growth in RACs and HCT stations.

Roadways

By 2050, capacity changes to the region's transportation system will result in 530 new lane miles of roadway. These capacity projects will take the form of newly constructed roads, extended roads, or added general-purpose, electronic toll, or High-Occupancy Toll (HOT) lanes along existing routes.

The number of additional roadway lane miles, by type, is summarized in Table 6.1 and visualized regionwide in the **Future Roadway Network** map.[3] The changes to roadway capacity fulfill local comprehensive or state transportation plans, and improve motor vehicle access to daily needs. Although automobiles make the most use of roadways, the multimodal nature of the region is evident in new roadway projects, which increasingly include infrastructure for buses, cyclists, and pedestrians.

In the region's core, particularly Washington, DC, and other dense RACs, safety and mobility challenges are sometimes addressed by repurposing existing roadway space to accommodate a wider range of transportation modes. In contrast, the outer suburbs of Maryland and Virginia have more flexibility to expand the roadway network through widening, extensions, or new construction. However, these areas are also increasingly pursuing alternatives to roadway expansion, including multimodal and demand management strategies.

3 National Capital Region Transportation Planning Board (2025). *Future Roadway Map*. **http://www.mwcog.org/V50FutureRoadwayMap**

Table 6.1: Roadway Facilities added to the Transportation System

Roadway Type	Today Lane Miles	2050 Lane Miles	Change in Lane Miles (~% Change)
Freeways/ Expressways	3,824	4,115	291 (+8%)
General Purpose Electronic Toll Roads	*190*	*195*	*5 (+3%)*
HOV Only	*39*	*29*	*-10 (-26%)*
HOT3+	*255*	*336*	*81 (+32%)*
Arterials	13,300	13,539	239 (+2%)
Total	**17,124**	**17,654**	**530 (+3%)**

Many planned roadway projects will incorporate multimodal elements supporting alternative travel modes while also improving conditions for drivers. For example, in Tysons, VA, the *Boone Boulevard Extension: Chain Bridge Road (VA 123) to Ashgrove Lane* (CE3150), will add 1.1 miles of new roadway through existing commercial areas. This extension will provide more direct and convenient access between multiple commercial destinations, reducing the need to travel along Leesburg Pike (VA 7), which experiences congestion. The project will also enhance connectivity for non-motorized travelers by incorporating bicycle and pedestrian facilities. As part of the Tysons Grid of Streets, the extension will contribute to a finer street network with shorter block lengths, supporting a more walkable and accessible urban environment.[4]

At intersections and interchanges, many reconfigurations and traffic light system upgrades will be made to optimize traffic flow and add safety features. In Prince George's County the *I-95/I-495 Interchange at Medical Center Drive Interchange Improvements* (CE3854-T11578) will manage traffic through a diverging diamond to reduce conflict points between vehicles, improve traffic operations, support future development, and improve pedestrian and bicycle connectivity with new shared-use paths.

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Washington, DC, is rolling out a comprehensive traffic operations program (CE1151-T3216) aimed at improving vehicle and pedestrian mobility through strategic modifications to traffic signals, channelization, signage, and pavement markings. Emergency responders will also benefit from the region's evolving traffic signal system, which will increasingly incorporate smart signals capable of communicating directly with their vehicles to improve response times and safety. All these efforts will calibrate intersections and traffic management systems with the changing travel patterns from roadway improvements.

PRIORITY STRATEGY: Expand the express highway network, with rapid transit, and allow carpool/vanpool to ride free.

This strategy to expand the express highway network aims to advance several goals, including providing more options for travel, reducing congestion, incentivizing ride sharing, and expanding opportunities for rapid and reliable bus travel. The region's HOT lanes, or express lanes, are designed to provide an average minimum travel speed of 45 miles per hour, offering travelers a

4 Fairfax County (2022). *Transportation – Transforming the Existing System*. **https://www.fairfaxcounty.gov/tysons/transportation-transforming-existing-system**

faster and more reliable option for a fee. By diverting vehicles from the general purposes lanes, HOT lanes help facilitate less congested travel on those lanes. They also encourage carpooling and transit use, as buses and vehicles with three or more people can use them free of charge.

On the region's interstates, drivers will be able to make use of over 85 new lane-miles of HOT lanes. The use of high-occupancy vehicle (HOV) and HOT lanes in 2050 includes the following policies:

- In Maryland, the HOV facility on U.S. 50 will remain HOV 2+ through 2050
- In Maryland, the HOV facility on I-270 will convert from HOV 2+ to HOT 3+ when the express lanes project is implemented
- In Virginia, I-66, I-95, I-395, and I-495 are all HOT 3+
- In Virginia, all HOV-only facilities will be HOV 2+

The new HOT facilities will continue to support buses by allowing them to travel for free. In Virginia and Maryland, the *I-495 Express Lanes Northern Extension Transit Operation Services: Tysons to Bethesda* (T13640) will provide funds to support the operation of the express bus service between Tysons, VA, and Bethesda, MD. The Fairfax Connector and Omniride/PRTC will continue to travel for free on the express lanes to provide faster and more reliable travel.

Freight truck drivers will be able to bypass peak hour traffic delays by using the express lanes along I-495 in Fairfax County and I-95 from Fredericksburg to Prince William County. The *I-495 Express Lanes Truck Access* project (CE3812-CE3813), spanning from the American Legion Bridge to the I-95/I-395 Interchange, will provide the necessary infrastructure upgrades to enable this access.

The remaining HOV facilities that will be HOV 2+ will continue to promote carpooling by providing dedicated lanes for vehicles with two or more people. Efforts such as these help the region achieve reliability and affordable and convenient multimodal options by implementing its priority strategy to expand the express highway network where carpools and vanpools ride for free and transit use is encouraged in express lanes.

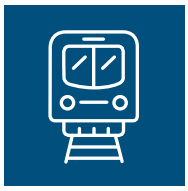
Numerous bridges tie the roadway network together and connect DC, MD, and VA. By 2050, many aging bridges will undergo a range of reconstruction and maintenance efforts to restore structural integrity. New bridges and underpasses will be built to improve multimodal connectivity such as the two planned overpasses in Reston, VA, across Dulles Toll Road (VA 267) which will create new and improved connections for drivers, cyclists, and pedestrians *Soapstone Drive New Overpass over Dulles Toll Road (VA 267): Sunrise Valley Drive to Sunset Hills Drive*, T6583, and *South Lakes Drive New Overpass over Dulles Toll Road (VA26): Sunrise Valley Drive to Sunset Hills Road*, (CE3451).

Cristina Finch/COG

PRIORITY STRATEGY: Develop and implement an electric vehicle charging network to support the expansion of EVs.

Driving will remain the dominant mode of travel in the region, with the number of registered light–duty vehicles projected to grow from 3.9 million to over 4.9 million by 2045, according to the TPB's Regional Electric Vehicle Infrastructure Implementation (REVII) Strategy.[5] As vehicle ownership grows, the fleet of vehicles may also become less gasoline dependent as alternative fuel, hybrid, and electric vehicles gain in popularity and account for a larger share within the region's vehicle fleet.

The number of registered electric vehicles increased by over 250 percent in the region between 2020 and 2023, making it the fastest growing vehicle category.[6] Based on these EV-adoption trends, the REVII Strategy projected that over 74,000 more publicly available chargers may be needed by 2045 beyond the 1,586 publicly available chargers in place in late-2023, with possibly over 100,000 additional chargers needed under a high EV adoption scenario.[7] To support this shift to EVs, dedicated funding from programs like the *National Electric Vehicle Infrastructure Deployment Program (NEVI)* (T13601-T11622) will help expand the regional network of publicly available EV charging stations.



Railways

By 2050, the region's passenger rail system will expand upon the existing 304 network miles with 18 new track miles. Beyond the physical expansion, the 2050 rail transit system will also feature operational enhancements designed to modernize and improve daily transit performance, helping to implement the priority strategy to move more people on Metrorail. Table 6.2, the **Future Railway and Bus Transit Network** map, and the ***List of New HCT Stations (2050)*** showcase the transit capacity changes that will serve the region by 2050.[8]

Table 6.2: Railway Transit added to the Transportation System

High-Capacity Rail Transit	Today	2050	New
Metrorail Stations	98	98	0
Commuter Rail Stations	38	39	1
Streetcar/Light Rail Stations	8	34	26
Total Stations	**144**	**171**	**27**
Metrorail Miles	129	129	0
Commuter Rail Miles	173	173	0
Streetcar/Light Rail Miles	2	20	18
Total Miles	**304**	**322**	**18**

PRIORITY STRATEGY: Move more people on Metrorail with more frequent services, longer trains, and expanded stations that are accessible by nonmotorized modes.

5 ICF. *Regional Electric Vehicle Infrastructure Implementation Strategy*. Prepared for the National Capital Region Transportation Planning Board and the Metropolitan Washington Council of Governments, August 2024. **https://www.mwcog.org/documents/2024/09/04/regional-electric-vehicle-infrastructure-implementation-revii-strategy-climate--energy-climate-change-electric-vehicles/**

6 National Capital Region Transportation Planning Board Technical Committee (October 4, 2024). *Agenda Item 9: 2023 Vehicle Registration Data*. **https://www.mwcog.org/events/2024/10/4/tpb-technical-committee/**

7 Increased levels of EV adoption are represented in the Visualize 2050 technical analysis by using the EPA's assumptions that over 40 percent of light-duty vehicles sold after 2030 will be electric. These assumptions are reflected in the EPA's MOVES4 model default inputs that are based on the federal regulations and recent trends.

8 National Capital Region Transportation Planning Board (2025). *Future Railway and Bus Transit Network Map*. **http://www.mwcog.org/V50FutureTransitMap**

BeyondDC/Flickr

The most significant rail expansion will come from the *Purple Line Light Rail Transitway: Bethesda Metro Station to New Carrollton Metro Station* (CE3645-T2795), which will span 16 miles. This transformative project will provide faster, more direct, and more reliable east-west transit service for RACs in Prince George's and Montgomery Counties. Featuring 21 stations along a semi-circular route, the fixed-guideway system plans to run every 7.5 minutes during peak periods, operating in both mixed traffic and dedicated lanes to serve parts of the region that have long been disconnected from the existing rail network.[9] Moving more people on Metrorail will also be easier as the Purple Line will provide new, seamless connections to Metro's Red, Green, and Orange lines, as well as MARC, Amtrak, and local and regional bus services, allowing residents in six RACs including Silver Spring, Takoma/Langley Crossroads, and the University of Maryland to access many destinations without a car.

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Several planned upgrades to Metrorail station entrances will make access easier, safer, and more direct for riders. At Bethesda Station, a long-awaited second entrance at Elm Street will provide a smooth connection between the Purple Line and Metrorail (T5560). Ballston-MU Station will gain a new western mezzanine entrance with an underground passageway, fare gates, escalators, elevators, and an attendant kiosk (CE3633). In Crystal City, a new eastern mezzanine entrance will improve access from Crystal Drive, the VRE station, and the northbound Transitway (T6670). A new pedestrian and bicycle tunnel under Georgia Avenue will offer safer, more direct access to Forest Glen Station (T5649). At the Van Dorn Station, a new multimodal bridge over the freight railroad tracks and Eisenhower Avenue will connect buses, bicyclists, and pedestrians from South Pickett Street directly to the station entrance (CE3284).

Travelers on Virginia Railway Express (VRE) and MARC commuter trains will see improved and expanded service. On the VRE, a bottleneck in Alexandria will be addressed by adding new tracks that will separate freight and passenger trains, improving freight operations while also increasing capacity and efficiency for VRE and Amtrak northbound travel into Washington, DC. Further south on the Fredericksburg Line between Lorton and Springfield, an additional track will also remove conflicts with freight trains while also increasing train speeds through curves. To complement these upgrades, *VRE Fredericksburg and Manassas Lines Service Improvements* (CE2832) will increase weekday peak-period, peak-direction service frequency to 20-minute headways, introduce limited reverse-peak and midday weekday trains, and launch new weekend service.

9 Maryland Department of Transportation (2024). *Purple Line Project Overview*. **https://www.purplelinemd.com/overview/**

Jeff Morfit/Flickr

Similarly, MARC is advancing a series of capital projects including mainline track expansions to support the potential for future run-through service into Northern Virginia, increased weekday and weekend service, and strategic enhancements to storage and maintenance facilities—enabling the deployment of longer trains for expanded seating capacity. These commuter train service enhancements will improve access to Metro and make commuter trains a more appealing option for both daily commuting and weekend travel.

Complementing the additional rail capacity and service improvements are many planned upgrades inside and around rail stations. Lighting upgrades for better visibility, upgraded security and communication systems, accessibility improvements to the platforms, and enhanced wayfinding will all contribute to a better experience for rail transit users. *New Carrollton Station Improvements* (T13654) will go above and beyond with an upgraded train hall for the existing MARC, Metrorail, and Amtrak services, while also incorporating connections to local and intercity bus services and the Purple Line light rail. Outside of New Carrollton Station, new sidewalks, bike lanes, lights, signalization, and traffic calming improvements on Garden City Drive will create a more welcoming space for all riders.

Altogether, by 2050, residents and visitors in the region will have a more robust rail transit network that offers new travel options to key destinations, more frequent service, and enhanced station amenities.

Bus Transit

The bus network that hundreds of thousands rely on will gain nearly 80 lane miles of bus rapid transit (BRT) and 90 BRT stations, as shown in Table 6.3, on the **Future Railway and Bus Transit Network** map, and in the ***List of New HCT Stations (2050)*** online. This BRT network expansion will be accomplished by repurposing space and adding transitways along existing roadways. The 2050 BRT system will allow more buses to operate outside of general traffic where possible, reducing their reliance on roadway conditions and improving reliability along key corridors.

Table 6.3: Bus Rapid Transit added to the Transportation System

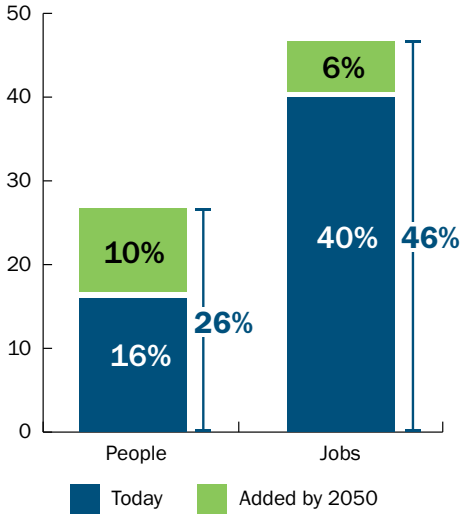
	Today	2050	New
Bus Rapid Transit Service Miles	14	93	79
Bus Rapid Transit Bus Stations	28	118	90

PRIORITY STRATEGY: Increase frequency and capacity of transit by expanding bus rapid transit (BRT) and transitways across the region to provide more service to more people, especially in corridors with high demand.

A range of other upgrades like transit signal priority for existing routes, queue jumps at targeted congested intersections, expansion of all-door boarding, optimization of bus routes and bus stop locations, and dedicated lanes or peak-hour bus lanes on existing routes are all on the docket and will help to make bus travel a more viable option for many people. With a larger BRT system and the growth in population and jobs, the share of people and jobs within 1/2 mile of HCT stations will increase by 10

percent and six percent respectively, between Today and 2050 (see Figure 6.2).

Figure 6.2: Share of People and Jobs 1/2 mile from High-Capacity Transit stations, Today and 2050



The region's priority strategy to increase the frequency and capacity of transit by expanding BRT and transitways across the region will be advanced with the new BRT lane miles. One such project is the *Richmond Highway (US 1) New BRT: Huntington Metrorail Station to Fort Belvoir* (T13563-T6680) in Fairfax County. About 90 percent of the 7.4-mile route will have dedicated bus lanes have dedicated bus lanes, helping Richmond Highway BRT - The One buses avoid traffic and stay on schedule as they transport riders between the Yellow Metro Line, residential communities, and Fort Belvoir. The BRT will also use long, 60-foot electric buses that are quiet, environmentally friendly, and can transport more people than a general lane of cars, expanding overall transportation capacity in the corridor. Pedestrian improvements will also be weaved into the project so that accessing transit will be easier and safer.

In Montgomery County, the Veirs Mill Road (MD 586) corridor will be transformed with *New BRT Expansion from Montgomery College, Rockville to Wheaton Metro Station* (CE3103). Running along one of the county's busiest bus transit corridors, this seven-mile BRT route will upgrade the existing bus corridor with pre-payment stations for faster boarding, real-time transit information, dedicated lanes, queue jumps, and transit signal priority at key intersections. Building further upon Montgomery County's BRT system, the *MD 355 New BRT Expansion from East-West Highway (MD 410) to Clarksburg Road* (CE3856) will feature median-running dedicated bus lanes where feasible, offering faster, more reliable service between downtown Bethesda, North Bethesda, Rockville, and Gaithersburg. Similar BRT projects, along with the continual refinement of service plans and routes by transit agencies, will significantly enhance bus travel times and overall reliability for the thousands of residents and visitors that depend on buses to get around.

PRIORITY STRATEGY: Reduce travel times on all public transportation bus services with faster bus service for existing users, regardless of the type of bus or corridor.

In addition to major BRT projects, the region will benefit from a spectrum of smaller-scale improvements, non-infrastructure upgrades, and fleet replacements. One example is along Georgia Avenue NW in Washington, DC, where bus speeds have steadily declined since 2020.[10] In response,

BeyondDC/Flickr

10 District Department of Transportation (2023). *Georgia Avenue NW Bus Priority.* **https://buspriority.ddot.dc.gov/pages/georgiaavenw**

the *Georgia Avenue NW Capacity Reduction for New Bus Lanes: Eastern Avenue to Barry Place NW* project (T13591) will introduce bus lanes, install bus bulbs to streamline boarding without leaving the travel lane, and relocate and rebalance bus stops, all designed to reduce delays and improve operational efficiency along the heavily used corridor. While waiting for the bus, riders will more frequently see modernized stops with real-time arrival information, more comfortable seating, and better lighting.

Commuter buses traveling to and from areas within and beyond the region will spend less time in interstate traffic due to the use of existing and future HOV and HOT lanes. These lanes, available to public buses free of charge, will offer faster, more reliable service with shorter travel times and fewer delays. Leveraging existing routes and tools available in this way will help the region implement its priority strategy to reduce travel times on all public transportation bus services with faster bus service for existing users, regardless of the type of bus or corridor. Having more bus services that are less dependent on private automobile traffic conditions will allow travelers to be more confident of bus arrival times and spend less time in traffic.

Transportation services designed to serve individuals with transportation disadvantages will continue to have support from the TPB and transportation agencies through the region's program for *Enhanced Mobility of Seniors and Individuals with Disabilities* (T6366). In some cases, technological advancements in mobility help address the needs of these community members. In other cases, providing more resources to existing mobility services will enable more reliable and widespread coverage.

PRIORITY STRATEGY:
Convert vehicles to clean fuels: 50 percent of new light-duty vehicles, 30 percent of medium and heavy-duty trucks sold, and 50 percent of all buses on the road.

Bus technology and power sources will continue to evolve. As aging diesel fleets are phased out, local transit agencies will replace them with electric buses, supported by new charging infrastructure. In Virginia, DASH will replace 13 end-of-life buses with battery electric models (T6331), powered by 13 depot chargers, three megawatts of electric utility service, and an on-route opportunity charger (T13618-T13569). Fairfax County will deploy 21 articulated electric buses to serve riders on the new Richmond Highway (US 1) "The One" BRT route (T13563-T6680). In Maryland, 14 of Montgomery County's Ride On diesel buses with be replaced with electric ones, along with 13 new hydrogen fuel cell electric buses (T6616) to add to its fleet to support the many planned BRT routes. Dedicated funding will also be invested into bringing EV chargers for buses across the region. Fleet and infrastructure upgrades such as these will advance the region's priority strategies to convert vehicles to clean vehicles and to develop and implement an electric vehicle charging network.

Between 2025 and 2050, the region's bus network will continue to advance into a modern, next-generation transit system that operates with greater independence from automobile traffic. Riders along the new BRT corridors can expect better reliability with shorter waiting times and more consistent arrival schedules. As investments in bus priority are focused along major corridors, where populations and employment are projected to increase, a positive feedback loop is expected to emerge; improved service will attract more riders, fueling continued demand for further investment in BRT.

Pedestrians, Bicyclists, & Micromobility

Active transportation and micromobility daily trips are possible for people in the region because of the region's concerted investment to improve safety and accessibility for pedestrians, bicyclists, and micromobility users. By 2050, non-motorized travel will be better supported across the region through expanded, and more integrated, bicycle and pedestrian infrastructure.

Throughout the region's communities, all applicable investments in Visualize 2050 will include a range of bicycle and/or pedestrian accommodations. The region's ongoing commitment to building safe pedestrian and bicyclist accommodations will further strengthen the active and micromobility transportation networks. The **Future Pedestrian, Bicyclist, and Micromobility Network** map shows investments through 2050 that will include bicycle or pedestrian accommodations.[11]

Online Resource

Because the region is motivated to address non-motorized user safety and access concerns, agencies are implementing bicycle and pedestrian features such as shared-use paths, bike lanes, more visible crossings, or other amenities into all types of projects, including roadway redesign and widening projects. Many projects will incorporate access to new off-road trails or fill gaps between existing trails. With these changes, the ability for people to walk, bike, or use micromobility to reach daily destinations will become easier and safer while also providing public health benefits.

In Prince George's County, safety concerns for pedestrians along Marlboro Pike have inspired a new vision for 4.5 miles of the corridor to gain widened sidewalks, more visible crosswalks, new landscaping, and potential modifications to driveways (T13604). In Arlington, a segment of George Mason Drive surrounded by schools, homes, parks, and commercial areas will be rebuilt into a safer, multimodal corridor with enhanced bicycle and pedestrian crossings at intersections, a separated multiuse trail, and narrowed travel lanes designed to reduce traffic speeds (CE3884).

BeyondDC/Flickr

PRIORITY STRATEGY: Improve walk and bike access to transit, especially within TPB identified High-Capacity Transit station areas, through the application of Complete Streets and Green Streets policies.

Many projects will strategically make walking and bike access to transit easier. With an expected 26 percent of people and 46 percent of jobs to be within a half-mile of an HCT station, there is a substantial opportunity to make improvements to encourage even more people to choose Metrorail, commuter rail, BRT, or streetcar.

A critical gap between Bethesda, Chevy Chase, and Silver Spring in Montgomery County, for instance, will be filled with the *Capital Crescent Trail: Elm Street to Chevy Chase Lake Terrace and Silver Spring Transit Depot to Silver Spring Metro Station* (CE3122-T6015) to provide safer and more direct access to the Bethesda and Silver Spring Metro Stations, as well as to several future Purple Line Stations. The corridor connecting the Largo, Garrett Morgan Boulevard, Addison Road/Seat Pleasant, and Capitol Heights Metro stations in Prince George's County will be transformed from a car-centric throughfare into a more balanced, multimodal corridor, featuring a range of bicycle and pedestrian access improvements at, and between, each station (T13605). A *New Pedestrian Bridge over I-395: Quantrell Avenue to Landmark Mall* (CE3768) will overcome the highway barrier separating nearby neighborhoods from the future Landmark Transit Center (CE3071), a planned

11 National Capital Region Transportation Planning Board (2025). *Future Bicycle and Pedestrian Map*. **http://www.mwcog.org/V50FutureBikePedMap**

hub that will serve as a transfer point between two BRT routes. When walking or biking to transit is safe and convenient, the value of existing transit investments is maximized as transit becomes a more practical and appealing option for more people.

PRIORITY STRATEGY: Complete the National Capital Trail Network to create an extensive web of trails that provide walk and bicycle access to jobs and other activities by connecting communities across the region to Activity Centers.

New trails on the National Capital Trail Network (NCTN) will help create a more robust and connected off-road bicycle/pedestrian system. Most likely, other trail projects, both on and off the NCTN, will be identified as part of project groupings and ongoing programs, beyond the discrete projects submitted by agencies for this plan.

From 2020 to 2023, the region added mileage to the NCTN at a rate of 27 miles per year. If this rate continues, the trail network as currently envisioned will be almost complete by 2050.

The *Anacostia River Waterfront Reconstruction: Poplar Point to Kenilworth Park* (CE1589) will mend disconnections between neighborhoods that are separated by DC 295 and provide new, comfortable access to trails and parks for residents. A new one-mile trail, the Silver Spring Green Trail, will run from Fenton Street to the Sligo Creek Trail to provide direct connection to the Silver Spring Transit Center Purple Line Station by way of the Metropolitan Branch Trail and the future extension of the Capital Crescent Trail. As community members gain access to these safe and interconnected networks by 2050, the opportunity for improved physical and mental health increases as more people have access to active commuting and recreational options.

Even some rail and interstate projects, like *I-495/I-270Y (West Spur)/I-270 Express Toll Lanes Widening: I-370 to George Washington Memorial Parkway* (CE3863) and the *New Long Bridge over the Potomac River* (T6727) will create new trail connections strengthening multimodal links between DC, MD, and VA.

Between Today and 2050, the transportation network will become larger, more interconnected, and more multimodal than ever before with an expanded roadway and transit system and a strengthened pedestrian, bicycle, and micromobility network. These investments, guided by priority strategies, will not only change how people and goods move, but will also influence where growth occurs and how

Joe Flood/Flickr

communities function. As the transportation network grows and evolves, its ability to deliver safe, reliable, and sustainable travel will depend on how well it performs for everyone who relies on it. The following section examines this performance, looking closely at how the future system is expected to impact access, congestion, and the environment.

2050 System Performance

The future system performance analysis of Visualize 2050 considers how well the anticipated transportation system will accommodate 2025 and forecasted 2050 travel demand and address mobility and accessibility challenges. Future expectations for the region's transportation network will be shaped by the characteristics of the existing transportation system and the prevailing land use and development patterns, increased demand on the system associated with projected growth in population, employment, changes in land use and development patterns, combined with the influence of regionally significant transportation projects. Without the investments included in Visualize 2050, auto congestion and delays are expected to rise, and accessibility is expected to worsen which is further explained in the following sections.

As the size of the population and workforce continue to grow, travel demand across all modes of transportation is expected to rise. While Visualize 2050 includes some capacity expansion and more options on modes with more reliable travel times (such as rail, BRT, walk and bike, and HOV and HOT lanes), the existing highway and transit systems will need to absorb most of this increased demand. Despite advancements in technology and shifts in travel behavior to more non-single occupancy vehicle (non-SOV) travel and shorter trips, congestion and delay are still projected to worsen on highways, leading to declines in timely auto access to destinations. For transit, population and job growth near HCT stations, along with new transit services, leads to improved job access by transit in the year 2050.

DID YOU KNOW?

TPB's analysis of future system performance uses output from the TPB's Travel Demand Model (Gen2/Version 2.4), which forecasts where, when, and how people will travel around the region in the coming decades. To make its predictions, the model relies on the latest regional population and job growth forecasts from the COG Round 10.0 Cooperative Forecasts, information on existing travel patterns from the TPB's Regional Travel Survey, and the planned future transportation system.

Access

Investments in the roadway network, rail and bus transit system, and bicycle and pedestrian infrastructure will reshape how people can reach their destinations. The expansion of BRT routes is expected to enable more people to travel efficiently by bus, while enhancements to both on- and off-road bicycle and pedestrian facilities will expand opportunities for active transportation. However, the impact of these improvements will vary widely depending on local land use characteristics and where future housing and job growth is concentrated. As a result, the changes in access brought by Visualize 2050 investments will not be experienced uniformly across urban, suburban, and rural zones. This section presents findings from the accessibility analysis of the TPB's Travel Demand Model (see callout for more info).

MODE SHARE FOR ALL TRIP AND WORK TRIP ACCESS

The share of trips in this region—for accessing both work and non-work places—taken on non-SOV modes such as high occupancy auto of two passengers or more, bicycle and pedestrian travel, and transit trips increases at rates greater than single occupancy vehicle trips by 2050 (see Figure 6.3 and Figure 6.4). For all trip purposes, rates of growth in non-SOV trips lead to more than 62 percent of trips by 2050

compared to 59 percent Today (see Figure 6.3). This is a similar trend for work trips, where 43 percent of commute trips will be taken on non-SOV modes by 2050 compared to 40 percent Today. SOV travel, however, will continue to be the predominant way the region's commuters travel to work (see Figure 6.4).

By 2050, more people will take auto trips together than by themselves.

NADTC

While transit and walk/bicycle travel will increase, automobiles will continue to be the dominant travel mode into 2050. Seventy-eight percent of all trips will be in personal automobiles of which 38 percent will be made in SOV, and 40 percent will be taken using high-occupancy vehicles of two passengers or more. This 78 percent of automobile trips in 2050 is a decrease from 81 percent Today (see Figure 6.3). Over this period, the growth rate of HOV trips is slightly greater than that of SOV trips, indicating that more trips will be taken with multiple passengers per car (see Figure 6.3).

Figure 6.3: Mode Share for All Trips, Today to 2050

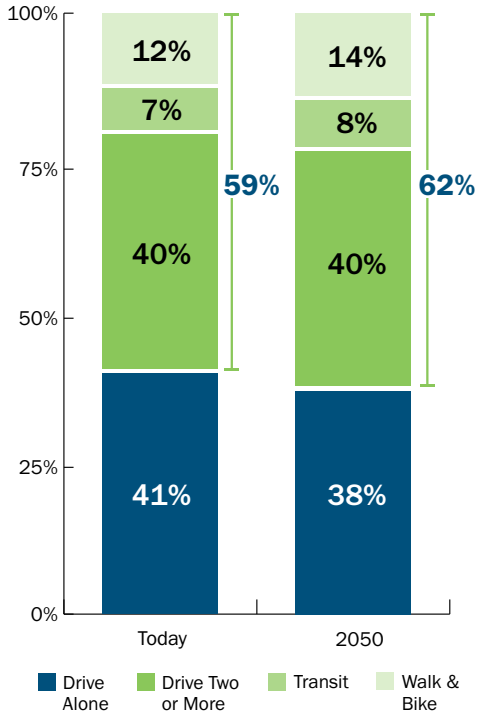
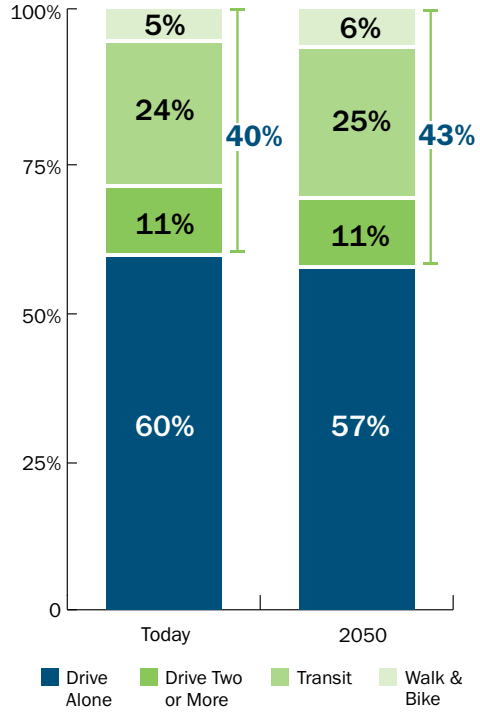


Figure 6.4: Mode Share for Work Trips, Today to 2050



MODE ANALYSIS BY GEOGRAPHY FOR ALL TRIPS AND WORK TRIP ACCESS

While some general trends can be observed across the region, such as higher number of trips on transit for work access than other trip purposes and carpooling trips being more common for non-work trips, travel mode distribution and number of trips in 2050 vary across the region. These are influenced by differences in land use and access to transportation infrastructure. Geographic analysis areas help to understand how the different land use patterns relate to proximity and access to HCT stations and RACs. Table 6.4 lists the number of RACs and HCT stations in each geographic area, while Figure 6.5 illustrates the projected share of all trips in 2050 across the geographic analysis areas.

TPB GEOGRAPHIC ANALYSIS AREAS

Regional Core: City of Alexandria, Arlington County, District of Columbia

Inner Suburbs: City of Bowie, City of College Park, Fairfax County, City of Fairfax, City of Falls Church, City of Gaithersburg, City of Greenbelt, City of Laurel, Montgomery County, Prince George's County, City of Rockville, City of Takoma Park

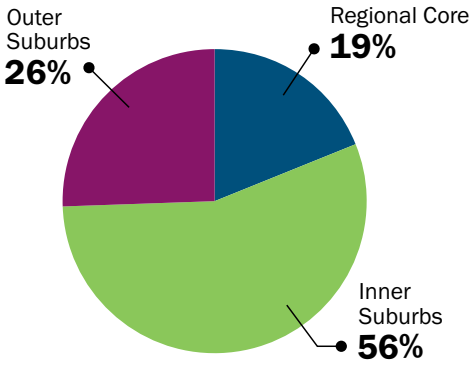
Outer Suburbs: Charles County, Frederick County, City of Frederick, Loudoun County, City of Manassas, City of Manassas Park, Prince William County

In the Regional Core, residents benefit from dense, mixed-use development, many HCT stations, and a broad range of travel options. Non-recreational walk and bicycle trips are typically over short distances, and the proximity and mixed-use nature of land use in the region's core is most supportive of such travel. In the Inner Suburbs, more dispersed land use patterns and scattered RACs create uneven, and often less convenient, access to non-driving modes. Farther out in the Outer Suburbs, low-density development, fewer RACs, and limited access to HCT stations further car dependency.

Table 6.4: Number of RACs and HCT stations by Geography

TPB Geographic Analysis Area	#RACs	#HCT stations Today	#HCT stations 2050
Regional Core	45	83	103
Inner Suburbs	78	75	170
Outer Suburbs	22	13	15

Figure 6.5: Percent of All Trips in 2050 by Geography



Regional Core

Transit, walking, and biking are highly accessible in the Regional Core, where dense, mixed land uses of the region's historic center—particularly in transects categorized as urban core, urban center, and general urban zones—make these modes easy and convenient (Figure 6.6, see Chapter 4, Land Use and Development Patterns for more information on transect categories). As a result, the Regional Core is projected to continue to have the highest share of transit, walking, and biking trips for all trip types as well as for only work trips among the geographic analysis areas (Figures 6.9 and 6.10).

For all trips in the Regional Core, travel is estimated to be evenly split—50 percent by driving (SOV and HOV) and 50 percent by alternative modes (transit/walking/biking). When looking specifically at work trips, transit use becomes even more prominent, as more than half of work trips are projected to be made by transit, one-third by driving, and the remaining 17 percent by walking or biking.

Figure 6.6: Regional Core Land Use Patterns

Inner Suburbs

With an expected 47 percent of all jobs and 54 percent of all residents in 2050, most trips in 2050, 56 percent, are projected to originate from the Inner Suburbs (Figure 6.5). This area includes a mix of transects defined as urban center zones, general urban zones, and sub-urban zones (Figure 6.7). RACs and HCT in the Inner Suburbs are primarily located within the denser, mixed-use urban center and general urban zones. These denser nodes play an important role in supporting travel options to connect, concentrate, and circulate movement.

This variation in land use is reflected in differences in mode choice access (Figures 6.9 and 6.10). While only seven percent of all trip types in the Inner Suburbs are expected to be made by transit, work trips by transit make up 24 percent of travel. Conversely, community members are about three times more likely to walk or bike for all trip types than for commuting. Carpooling is also more common for work trips in the Inner Suburbs compared to the Regional Core, six times the share of mode choice in comparison, highlighting the unique travel patterns shaped by the area's land use and transit accessibility.

Figure 6.7: Inner Suburbs Land Use Patterns

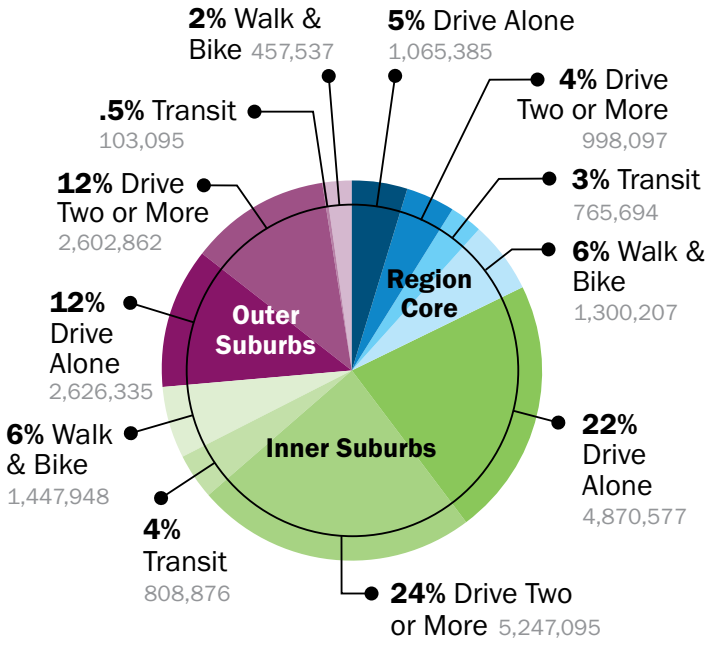
Outer Suburbs

Transects defined as sub-urban, rural, and natural zones, with lower-density RACs and HCT stations largely characterize the fabric of the Outer Suburbs (Figure 6.8). Here, most of the travel will be dominated by single-occupant and carpool auto-based travel (Figures 6.9 and 6.10). Auto-based commute trips from here are greater than all commute trips combined from the Regional Core.

In the Outer Suburbs, only one half of one percent of all trips are projected to be made by transit, underscoring the limited availability and feasibility of transit services common in areas with lower density. Despite this, the share of work trips made by transit is projected to be four times higher than that of all trips, highlighting the relative importance for job-related travel. Walking and biking are expected to account for two percent of all trips, which is four times higher than their estimated share of work trips.

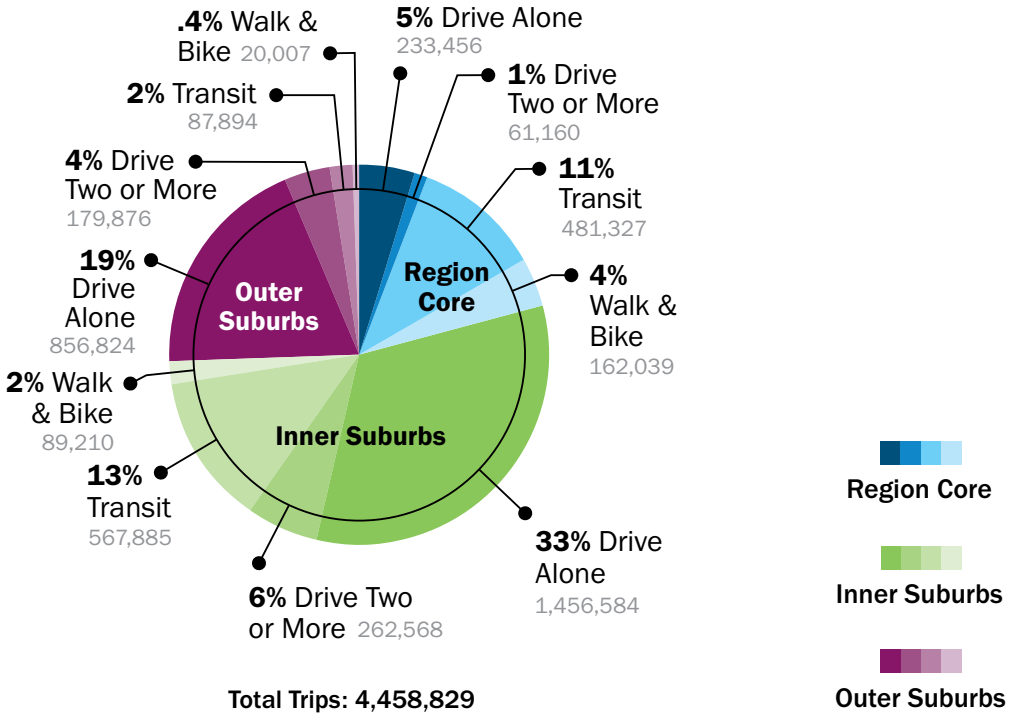
Figure 6.8: Outer Suburbs Land Use Patterns

Figure 6.9: All Trips by Mode and Geography, 2050



Total Trips: 22,293,708

Figure 6.10: Work Trips by Mode and Geography, 2050



Total Trips: 4,458,829

ACCESS TO JOBS BY AUTO AND TRANSIT

Analyzing roadway performance through the number of jobs accessible by auto and transit during a 45-minute morning commute, the region as-a-whole will see a decline in access by auto and an increase by transit by 2050. This shift from Today to 2050 is shown on the **Current and Future Accessibility to Jobs** map.

Access to jobs by auto declines by five percent below the 2025 level of nearly 1.06 million jobs accessible (see Figure 6.11). Forecasted growth in people and jobs contributes to increased demand on the region's roadway network, thus increasing congestion and delay, resulting in some residents no longer being able to reach certain jobs within the 45-minute commute travel shed. However, without the investments proposed in Visualize 2050, average regional job accessibility by automobile would decline by 11 percent (or more than 110,000 jobs). This contrast highlights the critical role of Visualize 2050 in preserving timely job access by auto.

Figure 6.11: Change in Access to Jobs by Auto, Today to 2050

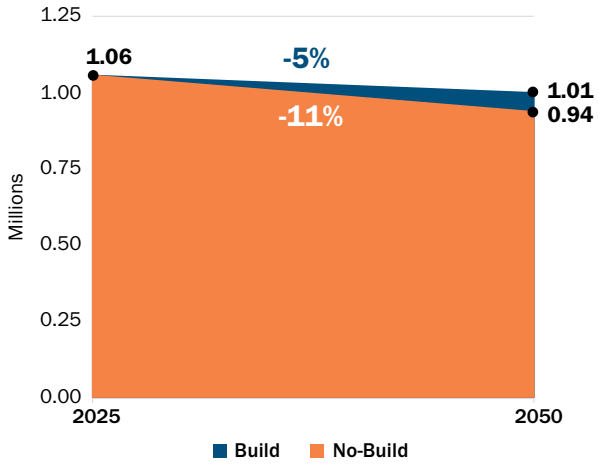
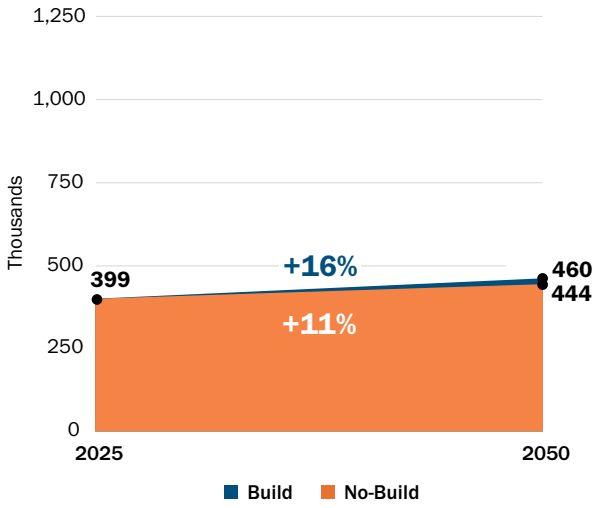


Figure 6.12: Change in Access to Jobs by Transit, Today to 2050



The change in job access by auto will not be felt evenly across the region as illustrated in the **Current and Future Accessibility to Jobs** map. Communities in the region's core, western suburbs, and northern suburbs are projected to experience moderate to significant improvements in job accessibility by auto. In contrast, areas in the eastern part of the region and within the Capital Beltway will likely face moderate to significant declines. These disparities are likely driven by worsening congestion and delays, which will increase the time it takes to access certain areas by car. Additionally, as seen in the online map, job growth is expected to be concentrated in the western part of the region, meaning residents there will have easier access to employment opportunities, while people living in the east will face longer distances and travel times to reach new job centers.

Access to jobs by transit is expected to grow between Today and 2050 (see Figure 6.12). With additional HCT services planned for the region and forecasts expecting more people and jobs close to those transit services, the analysis finds a 16 percent increase in jobs accessible by transit during a 45-minute morning commute, increasing

by almost 62,000 jobs by 2050. A closer look at the geographic distribution of these changes reveals that most areas already served by transit will experience increased job access. Additionally, parts of the region where new transit projects are planned are forecasted to gain even greater access to employment opportunities. These advancements highlight not only the region's commitment to transit investment, but also its evolving urban landscape, with population and employment centers becoming more concentrated around HCT stations.

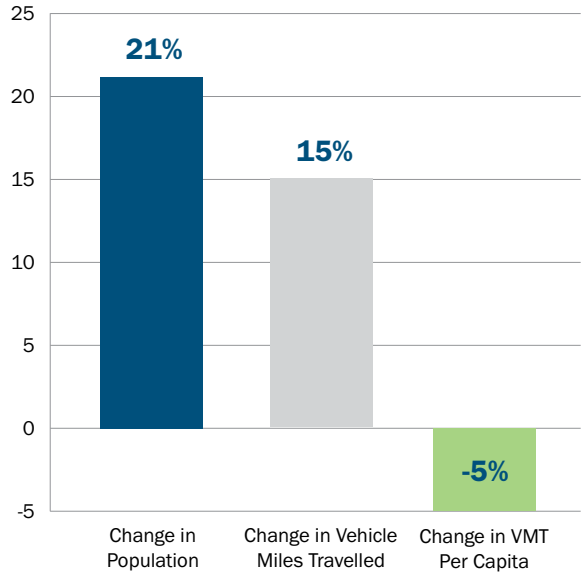
Congestion

Congestion is and will continue to be a recurring experience for people traveling along the region's roadways. Transportation planners across the region consider congestion when developing projects and aim to include features and infrastructure that help reduce it. Still, factors such as the location of population and job centers, varying growth patterns, unplanned emergencies, and the feasibility of alternative transportation options will continue to influence congestion levels in 2050. This section presents findings from the congestion analysis of the TPB's Travel Demand Model.

RESIDENT VEHICLE MILES TRAVELLED PER CAPITA BY AUTO

Even though congestion and delay are forecast to grow by 2050, residents of the region are expected to drive fewer miles per person, meeting a noted target in COG's Region Forward. The total vehicle miles traveled by all residents on a typical day in 2050 is forecast to grow less than the growth in population and vehicle miles traveled per person is expected to be five percent less than it is in 2025 (see Figure 6.13). These findings suggest that travel behavior in the region responds 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 closer, using non-auto-based modes more often as more transit/walk/bike infrastructure is built, and changing travel behavior due to the impact of congestion and delay.

Figure 6.13: Change in Resident Vehicle Miles Travelled Per Person, Today to 2050



CONGESTION AND DELAY BY AUTO

While many projects in Visualize 2050 aim to reduce congestion on the region's highway network, growing roadway demand will continue to strain an already overburdened system. Despite efforts to mitigate congestion, forecasts indicate worsening highway conditions in the coming decades. Total daily vehicle hours of delay (VHD), which represents time spent in traffic in congested conditions, is predicted to increase 70 percent, and average minutes of delay per trip is predicted to increase 46 percent, or from four minutes to nearly six minutes by 2050 (see Figures 6.14 and 6.15). By contrast, without the transportation projects in the plan, VHD is predicted to increase 85 percent, between 2025 and 2050, and the average minutes of delay per trip are predicted to increase 59 percent.

Capacity-adding roadway projects in Visualize 2050 are expected to provide short-run reductions in congestion. Over the long run, average traffic congestion levels in the areas where road capacity is increased are expected to remain about the same due to changes in people's travel behavior (pattern, choice of mode, etc.) resulting from the larger influence of employment and population growth forecasted

to occur in the region over the next 25 years, the assumed distribution of future jobs, housing, and future transit service levels, which will fuel increased demand on the region's highway network.

Figure 6.14: Change in Total Daily Vehicle Hours of Delay, Today to 2050

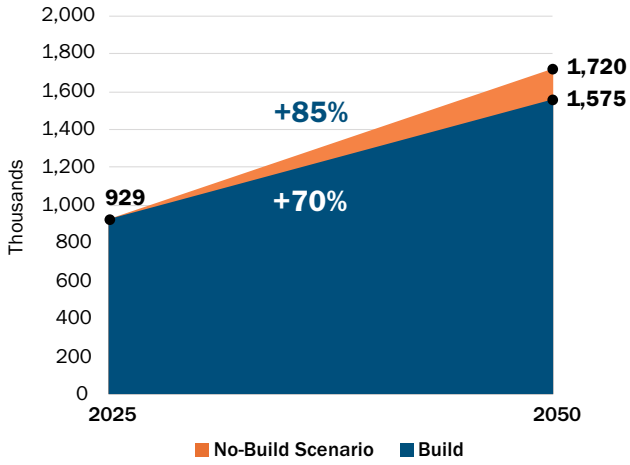
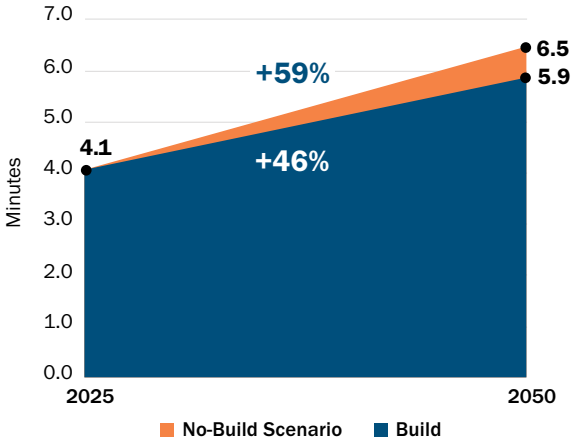


Figure 6.15: Change in Average Minutes of Delay Per Trip, Today to 2050



Environmental Forecasts

As discussed in Chapter 4, transportation projects have both direct and indirect environmental impacts. While it is impossible to predict all outcomes, TPB analyzes how millions of motor vehicles, which are continually subject to new standards for fuel consumption, emissions and advanced technologies, may influence air pollution/vehicle emissions. At the same time, designing the built environment to mostly prioritize vehicle movement and direct car access to land uses has fostered automobile dependency, driving higher fuel consumption and related emissions. All of this must now be considered in the context of a time where more frequent and more severe weather events and natural hazards can be expected. Certain elements of transportation projects can improve infrastructure's ability to withstand extreme heat, flooding, and winter storms. This section provides an overview of how the investments in Visualize 2050 may affect air quality and the region's resilience to natural hazards.

Vehicle Emissions and Air Quality Conformity

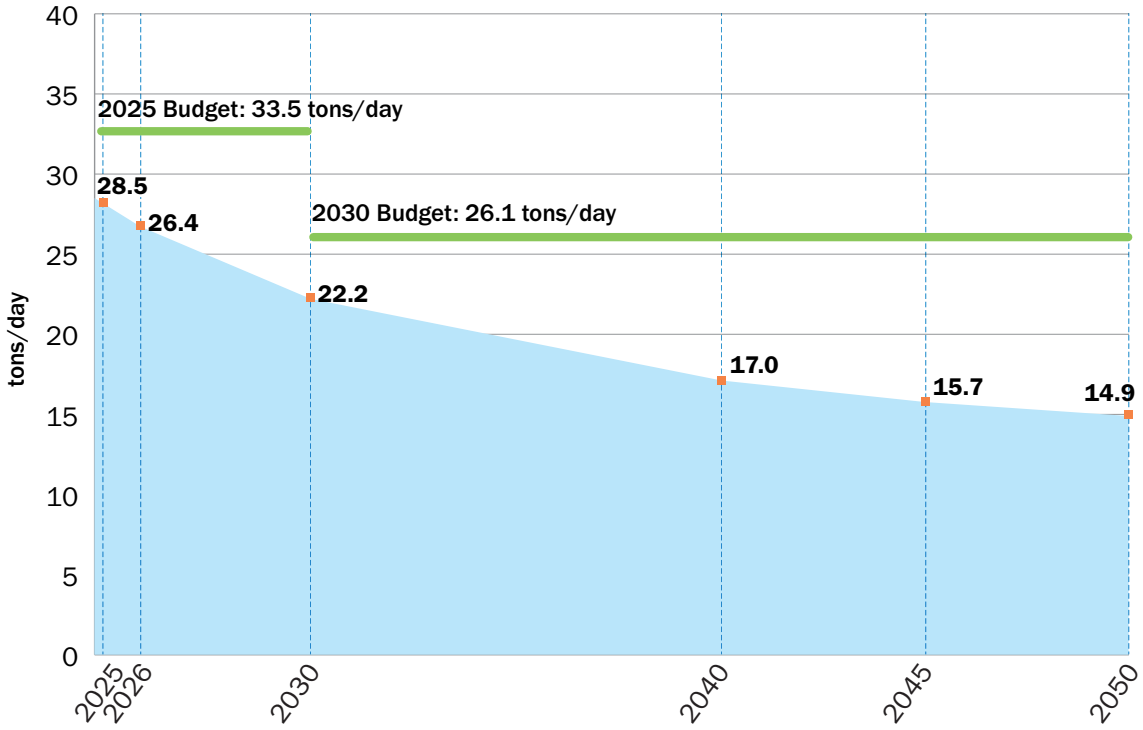
Visualize 2050 must comply with specific federal requirements to ensure it aligns with or "conforms" to the region's plan to achieve and maintain the national ambient air quality standards (NAAQS). This air quality plan is known as the State Implementation Plan (SIP). As part of the SIP, motor vehicle emission budgets (MVEBs) are established that limit the amount of mobile (on-road) vehicle emissions for specific pollutants. With ground-level ozone being the last remaining NAAQS of concern in the region, the pollutants that combine to form ozone, Volatile Organic Compounds (VOCs) and Nitrogen Oxides (NO_X), must fall below their MVEBs established in the SIP. This evaluation forms the basis for the air quality conformity analysis and report that must be completed and approved by the FHWA and FTA for Visualize 2050 itself to be approved.

The TPB's analysis shows Visualize 2050 meets air quality conformity requirements for Ozone.

To perform the air quality conformity analysis, projects deemed regionally significant for air quality (RSAQ) are input into the TPB's Travel Demand Forecasting Model, along with land use, population, jobs, and household forecasts. The resulting travel forecasts, along with other local non-transportation data, are combined and analyzed using the EPA's Motor Vehicle Emissions Simulator (MOVES) model. After additional processing of the results, estimates of the total motor vehicle emissions of VOC and NO_X for the entire region are developed. These total emissions are then compared to the MVEBs to verify that the Visualize 2050 plan conforms to the MVEB in the SIP. Full documentation of air quality conformity analysis can be found in the related report online at **visualize2050.org/plan-resources**.

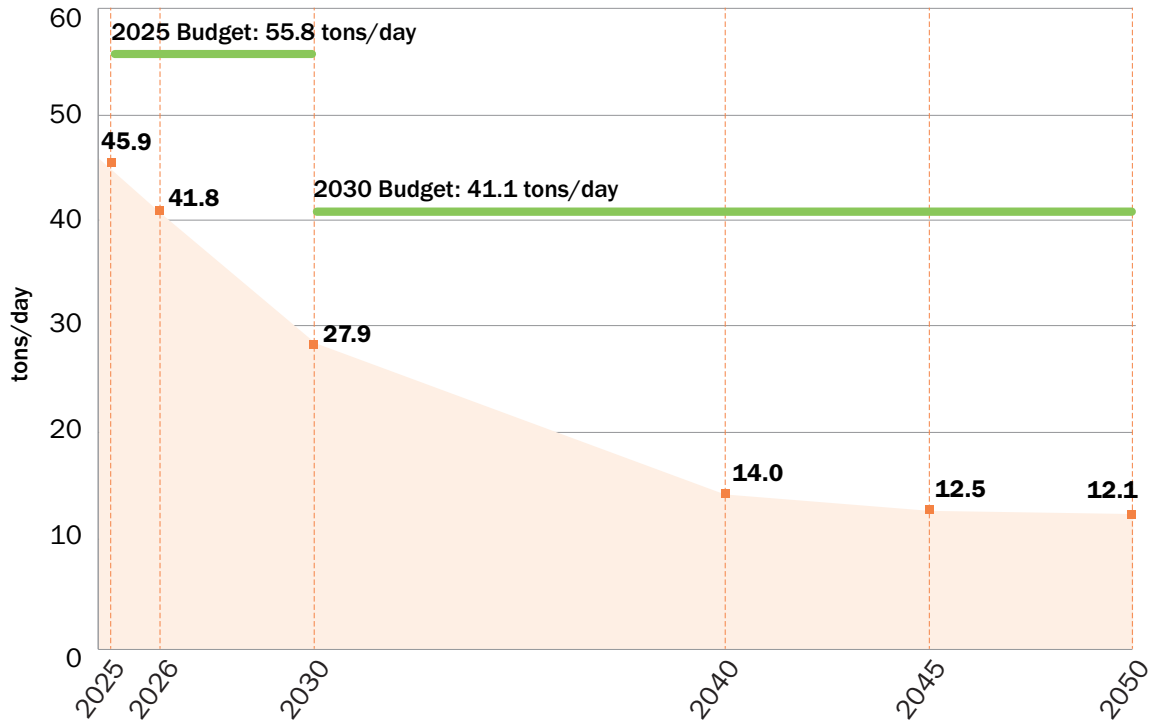
Despite rising travel demand, on-road vehicle emissions are expected to steadily decline through 2050 as electric and newer, cleaner, and more fuel-efficient cars and trucks replace older models in the region's vehicle fleet. Additionally, improvements in fuel formulations, shifts in development patterns, investments in transit and alternative travel options, and enhanced roadway operations will likely further contribute to emissions reductions. The TPB's analysis of air quality conformity confirmed that the total mobile emissions generated by the implementation of Visualize 2050 will fall below the MVEBs for VOCs and NO_X, demonstrating that the transportation plan conforms to the State Implementation Plan. This is illustrated in Figures 6.16 and 6.17, which also show the general downward trend in the total motor vehicle emissions from Today to 2050.

Figure 6.16: Visualize 2050 Air Quality Conformity Mobile Source Emissions and Mobile Emissions Budgets Ozone Season: Volatile Organic Compounds (VOC)



NOTE: The Mobile Emissions Budgets shown were developed as part of the Update to 2008 Ozone Standard Maintenance Plan. EPA found the budgets adequate for use in conformity with an effective date of October 4, 2024.

Figure 6.17: Visualize 2050 Air Quality Conformity Mobile Source Emissions and Mobile Emissions Budgets Ozone Season: Nitrogen Oxides (NO_X)



NOTE: The Mobile Emissions Budgets shown were developed as part of the Update to 2008 Ozone Standard Maintenance Plan. EPA found the budgets adequate for use in conformity with an effective date of October 4, 2024.

Pierre Gaunaurd/COG

Dan Reed/Greater Greater Washington

2050 System Resiliency

To understand how investments in Visualize 2050 might strengthen the region's resilience to extreme weather and natural hazards, TPB staff reviewed projects for resiliency components. The review found that many include features with the potential to improve the resilience of different transportation assets. Upgrades to bridges and roadways can potentially reduce negative impacts of flooding, while additions to transit and pedestrian infrastructure—such as pedestrian tunnels, covered walkways, bus shelters, and improved vegetated streetscapes—might offer protection from extreme heat. Ongoing restoration and maintenance of numerous bridges to ensure a state of good repair will enhance their structural integrity and resilience, enabling them to better withstand severe weather events.

The transition of buses and locomotives to zero-emission vehicles will help to reduce dependence on fossil fuels and help improve air quality. Additionally, targeted programs that fund the maintenance of critical drainage systems will make stormwater systems better prepared to handle water flow during heavy rainfall.

Piece by piece, these efforts have the potential to make the region's transportation system more resilient; however, significant challenges will remain—not only in the face of natural hazards, but across a range of issues.

When agencies develop projects, they often address more than one TPB goal. However, the challenges of limited funding, lengthy project development timelines, and the other hurdles of enhancing transportation in an already built-out region means implementation will continue to face many hurdles. The following chapter discusses key challenges that cannot be solved through Visualize 2050 alone and explains how the ongoing collaboration of TPB and its member agencies will continue to shape planning efforts to achieve regional goals.

VISUALIZE 2050

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