



— 2020 STATUS REPORT —

REQUIRED UNDER THE  
MARYLAND COMMISSION ON  
CLIMATE CHANGE ACT

[§2-1305] MSAR 10683

— 2020 —

*The 2015 Maryland Commission on Climate Change (MCCC) Act required the MCCC and its participating agencies, including Maryland Department of Transportation (MDOT), to maintain a comprehensive action plan with 5-year benchmarks to achieve science-based reductions in Maryland's Greenhouse Gas (GHG) emissions. This 2020 status report meets the requirements of the MCCC Act (§2-1305) by sharing MDOT's recent and planned actions to continue to mitigate the impacts of climate change and reduce transportation sector greenhouse gas emissions.*

# Highlights

## CLIMATE CHANGE ADAPTATION AND RESILIENCE

MDOT continues to focus on enhancing the State's multimodal transportation infrastructure resilience as part of a comprehensive approach that includes understanding and assessing transportation system vulnerabilities, integrating climate adaptation and resilience into MDOT's business processes, and communicating potential risks and vulnerabilities to MDOT stakeholders and transportation system users.

- MDOT State Highway Administration's (MDOT SHA) Climate Change Vulnerability Viewer (CCVV) is being shared and leveraged across MDOT's Transportation Business Units (TBUs) for supporting vulnerability and risk assessments.
- Conducted multiple vulnerability assessments and implemented adaptation strategies to guide the making of resilient infrastructure investments with the partnership and involvement of various local, state, and federal partners.

## TRANSPORTATION TECHNOLOGY

As an emerging leader in implementing transportation technology, MDOT has been leading various initiatives including the Zero Emission Electric Vehicle Infrastructure Council (ZEEVIC), connected and automated vehicle (CAV) technology, and renewable energy initiatives.

- Total number of registered electric vehicles in Maryland stands at 25,700 by the end of June 30, 2020.
- MDOT is completing its Fleet Innovation Plan which will support the conversion of MDOT's light-duty and bus fleet to zero emission vehicles (ZEVs).

## CONGESTION MITIGATION

MDOT continues its holistic approach to congestion mitigation and improved travel and freight reliability through various initiatives including those under the Transportation Systems Management and Operations (TSMO) umbrella.

- In 2019, the Coordinated Highways Action Response Team (CHART) Program cleared 31,750 traffic incidents and assisted 39,500 motorists on Maryland highways saving drivers \$1.4 billion in delay and fuel costs by effective traffic incident management, traveler information, and emergency services.

## VMT REDUCTION

MDOT continues to invest in low-emissions travel modes (transit, bicycle, and pedestrian) and provides leadership under the Commuter Choice Maryland statewide travel demand management program.

- MDOT Maryland Transit Administration (MTA) continues its railcar replacement program, to replace 78 railcars at a total contract cost of \$400 million and enhancing safety components on the Metro SubwayLink system.
- MDOT MTA launched real-time tracking for MARC Train service in August 2020.

## INFRASTRUCTURE DESIGN

MDOT continues to emphasize the importance of reducing emissions impact using design principles including practical and innovative design.

- MDOT Transportation Secretary's Office (MDOT TSO) published design guidance for projects applying for MDOT Kim Lamphier Bicycle Program funding.
- Maryland Transportation Authority (MDTA) implemented permanent full-time all-electronic (cashless) tolling at all of its facilities across Maryland.

# The MDOT Approach

## THE 2020 STATE AGENCY REPORT

As a member of the MCCC, MDOT and other state agencies, elected officials, and experts are charged with advising the Governor and General Assembly “on ways to mitigate the causes of, prepare for, and adapt to the consequences of climate change.”

**Why is it required?** – As stipulated by the Greenhouse Gas Reduction Act reauthorization in 2016, state agencies are required to report to the Governor and General Assembly, in accordance with §2–1246 of the state government article, on the status of efforts to mitigate the causes of, prepare for, and adapt to the consequences of climate change, including future plans and recommendations for any legislation towards consideration by the General Assembly.

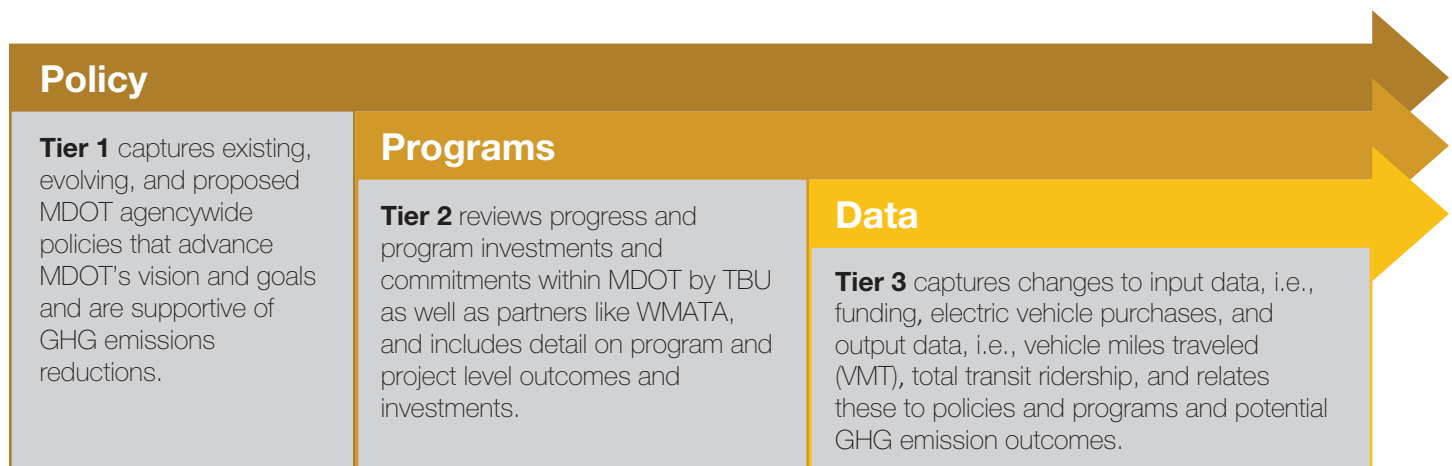
**Why does MDOT do it?** – Planning and analysis efforts included as part of MDOT’s support of the MCCC and the GGRA goals have also guided MDOT’s six-year capital program decisions (also known as the Consolidated Transportation Program, or CTP). Investments within the CTP increasingly are helping to decrease fuel consumption, reduce single occupant vehicle use, improve system efficiency, and prepare the transportation system to be resilient to the impacts of climate change.

**MDOT’s History** – Starting in 2008, MDOT has prepared regular reports and conducted analysis to determine the potential of the transportation sector to reduce GHG emissions. These reports have included priority actions for MDOT to implement to maintain a positive trend to meeting the GGRA 2020 and 2030 GHG emission goals. In 2015, MDOT started preparing annual agency reports detailing implementation successes and challenges.

**Where are we now?** – This report highlights recent and planned MDOT activities to fulfill the annual reporting requirement. During 2020, MDOT is also updating the MDOT 2020 GGRA Final Plan. The 2020 GGRA Final Plan will present current and forecasted trends and a diverse set of strategies that will position the transportation sector to meet the 40 percent reduction of 2006 emissions by 2030 (“40 by 30”) goal.

## THE MDOT REPORTING APPROACH

Since 2015, MDOT’s annual reports provide a review of recent, ongoing, and planned activities across three different tiers- policy, programs, and data. This State Agency Report draws from three sources of performance and budgetary/financial reporting systems - the Annual Attainment Report on Transportation System Performance (AR), the MDOT Excellerator, and the CTP – in addition to direct input from MDOT staff. This report presents a mix of information reflecting programs, conditions, and accomplishments prior to COVID-19, as well as ongoing activities during the pandemic.





## MISSION STATEMENT

*“The Maryland Department of Transportation is a customer-driven leader that delivers safe, sustainable, intelligent, and exceptional transportation solutions in order to connect our customers to life’s opportunities.”*

### MDOT MISSION, GOALS, AND INVESTMENTS

MDOT’s mission communicates the importance of a customer-driven transportation system.

**There are seven goals supporting MDOT’s mission as documented in the Maryland Transportation Plan (MTP).**

These goals also help move forward MDOT’s approach to adapt to and combat climate change, including:

- Delivery of the State’s transportation infrastructure program that conserves and enhances Maryland’s natural, historic and cultural resources,
- System preservation, safety and security, and quality of service goals that drive MDOT’s progress towards improving resilience and transitioning to a more efficient transportation system, and
- Commitment to multimodal accessibility and mobility for all transportation system users that helps mitigate congestion and shift travel to less emission intensive modes.

MDOT’s integrated approach includes – plan, invest, and evaluate. Each aspect of this approach is presented through the State Report on Transportation (SRT), which is comprised of three documents.

## MTP GOALS

- 
Ensure a Safe, Secure, and Resilient Transportation System
- 
Facilitate Economic Opportunity and Reduce Congestion in Maryland Through Strategic System Expansion
- 
Maintain a High Standard and Modernize Maryland’s Multimodal Transportation System
- 
Improve the Quality and Efficiency of the Transportation System to Enhance the Customer Experience
- 
Ensure Environmental Protection and Sensitivity
- 
Promote Fiscal Responsibility
- 
Provide Better Transportation Choices and Connections

<b>Plan</b>	MTP	Updated every 5 years	The MTP establishes a 20-year vision for multi-modal transportation in Maryland that outlines the State’s transportation policies and priorities and helps guide Statewide investment decisions for all modes of transportation.
<b>Invest</b>	CTP	Updated Annually	MDOT’s fiscally constrained 6-year capital budget for all State transportation projects. MDOT works with residents, businesses, local jurisdictions, and local and state elected officials to include projects into the CTP.
<b>Evaluate</b>	AR	Updated Annually	Provides an overview of the transportation system, investment strategies, and mobility and accessibility outcomes. MDOT assesses progress toward achieving its overarching goals by aligning performance measures and data with each MTP goal area and objective.



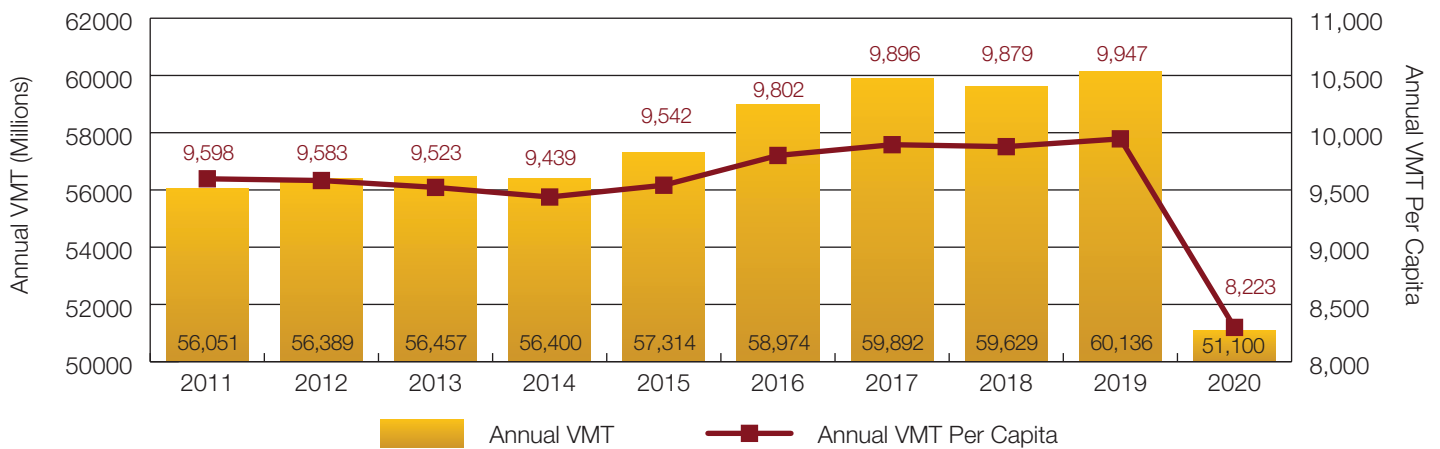
## GHG EMISSIONS FROM TRANSPORTATION

The National Emissions Inventory (NEI) is developed by US EPA through consultation with state agencies every three years. **The current inventory, developed for 2017, shows that on-road transportation is the single largest GHG emissions generator in Maryland, representing 36 percent of total state GHG emissions.**

**Off-road (aviation, marine, rail) represents another 4 percent.** GHG emission from on-road transportation is primarily a product of two trends – vehicle miles traveled (VMT) and the efficiency (miles per gallon) of the fleet.

**Vehicle miles traveled:** Statewide VMT has been steadily increasing in Maryland since 2014, with over 60 billion vehicle miles traveled in 2019. VMT growth has been consistent with population growth as VMT per capita has remained stable. While population increase is expected to create additional demand for the State’s transportation systems, VMT in Maryland dropped dramatically in 2020 due to the COVID-19 pandemic. MDOT continues to monitor traffic volumes on a weekly basis and the trends have stabilized since July. Based on estimates from these trends, annual VMT is expected to drop roughly to an estimated 51.1 billion VMT statewide. While MDOT anticipates that VMT will rebound back to 2019 levels over the next five years, there is uncertainty regarding the exact timeline and speed of the recovery.

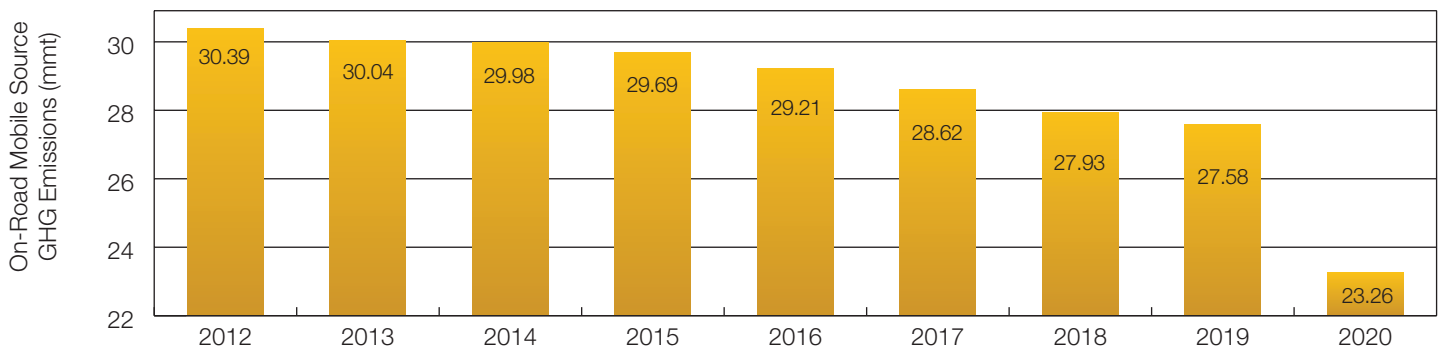
**Annual VMT and VMT Per Capita**



**On-road vehicle fleet:** Efficiency of the on-road vehicle fleet continues to improve, as older vehicles are replaced with newer vehicles that meet more stringent GHG emission standards. Electric vehicles (EVs) are a growing share of the fleet- at the end of 2019, there were over 23,000 EVs registered in Maryland, more than double the total in 2017.

The combination of these trends, in addition to other factors, result in a decline in GHG emissions from on-road transportation over the last decade. This downward trend has continued since 2014 even as VMT has grown by a total 6.5 percent.

**On-Road Mobile Source GHG Emissions**



# MDOT's Climate Change Commitment

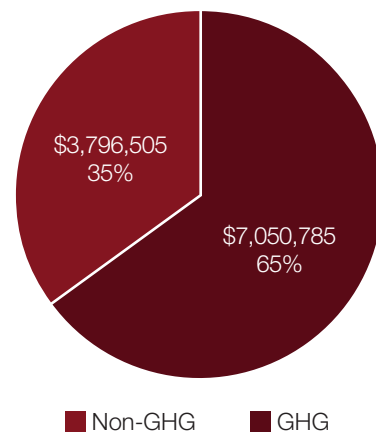
As a means to understanding the overall commitment to reducing GHG emissions and minimizing climate change impacts, MDOT tracks the total share of CTP funding dedicated to projects that will help Maryland meet its climate change goals.

**Within the FY 2020–2025 CTP, 65 percent (approximately \$7.05 billion) of Maryland's \$10.85 billion six-year major capital program are investments that will reduce GHG emissions through 2030 and beyond.** This share excludes spending by the MDTA, and minor capital programs such as system preservation and maintenance activities.

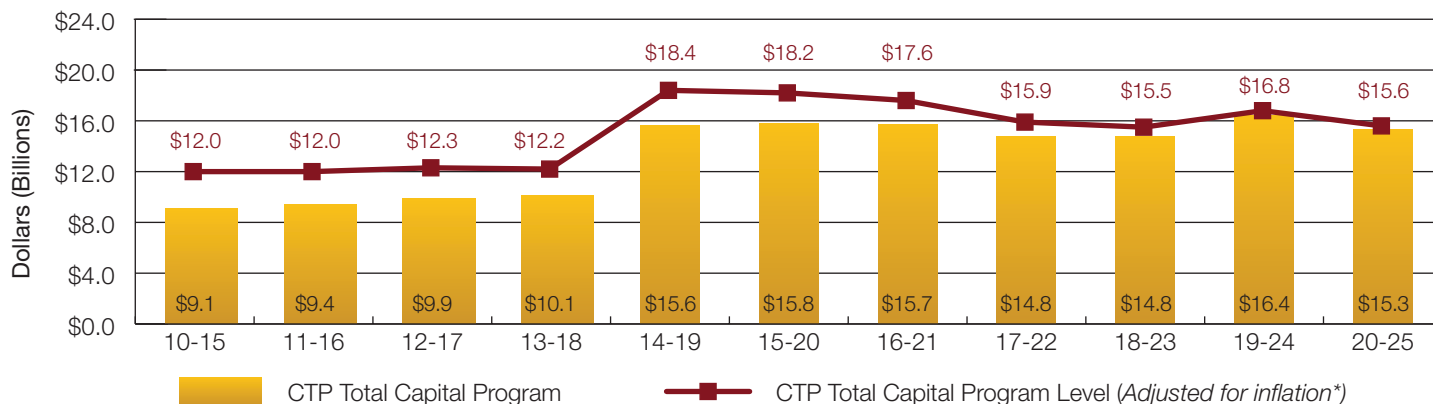
**When looking at the entire capital program, both major and minor, which includes MDOT and MDTA asset preservation and maintenance activities, the total share is 46 percent.**

**The 35 percent of major capital investments and the 54 percent of all capital investments not considered GHG beneficial are primarily associated with spending that enhances customer service across MDOT's TBUs and preserves and maintains Maryland's multimodal transportation system.** These investments are critical to meeting MDOT's responsibilities to its customers and for keeping the system in a state of good repair. Many of the system preservation activities, such as bridge rehabilitation, stormwater management, and pavement preservation also promote a more resilient transportation system, particularly to severe weather events – which is a priority objective of the MCCC.

Total MDOT capital program levels have remained stable over the past seven iterations of the CTP. During this time period, the commitment to GHG beneficial projects has increased, with the current estimate of 65 percent for the 2020 – 2025 CTP representing the highest estimated share to date (increasing from 63 percent in the 2019 – 2024 CTP). This increase includes new and increased funding to support the MDOT MTA and Washington Metropolitan Area Transit Authority (WMATA), priority investments addressing roadway bottlenecks and transit on-time performance, and continued support to expanding safe and accessible bicycle and pedestrian networks.



MDOT Total Capital Program Levels (Billions)



\* The inflation adjusted amounts are calculated using the Construction Cost Index, which measures the average change in construction costs.

*The economic challenges and uncertainty surrounding the COVID-19 global pandemic have impacted virtually all MDOT operations and revenues. In response, MDOT has reduced its revenue projections. Estimated State revenues for the Draft 2021 to 2026 CTP are \$2.6 billion less than the estimates for the FY2020 – FY2025 CTP (reducing total projected capital spending by almost 18 percent).*

# Collaboration

MDOT recognizes that collaboration is critical as Maryland works toward our goals of accelerating zero emission vehicle deployment, reducing VMT, and mitigating GHG. In 2020 MDOT, MDE, and MEA continued to work with transportation planning and programming partners and stakeholders, including transit providers, metropolitan planning organizations, local jurisdictions, academia, advocacy groups, communities, and other states on key programs and policies to reduce transportation GHG emissions.

## ZERO EMISSION ELECTRIC VEHICLE INFRASTRUCTURE COUNCIL (ZEEVIC)

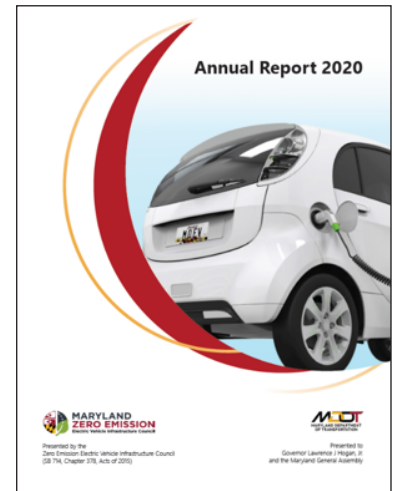
Since 2011, as the agency responsible for chairing ZEEVIC, MDOT has played a leading role in the adoption of zero emission vehicles (ZEV) and the deployment of ZEV infrastructure. MDOT continues to work with MDE and MEA in developing policies and strategies to foster electric vehicle market expansion in Maryland, for both passenger cars and trucks, as well as medium-and heavy-duty vehicles.

**In 2019 and 2020, MDOT supported 26 unique events connecting with over 8,000 people to share information and resources regarding electric vehicle ownership and incentives in Maryland.**

Throughout 2020, MDOT, MDE and MEA turned their focus toward informational webinars with stakeholders and communities. This included four ZEV outreach webinars in October, focused on connecting with local government partners, and two medium and heavy-duty ZEV truck webinars in November. Nearly 250 participants joined these webinars, providing feedback on opportunities and challenges for ZEV expansion.

**Webinar participants ranked incentives for vehicle purchases and procurement for local governments as the top priorities.**

In 2020, under MDOT’s leadership, ZEEVIC created a handout for outreach to legislators and related audiences, refurbished the MarylandEV.org website, and launched the MarylandEV social media campaign (#MarylandEV) which reached over 400,000 Marylanders. The 2020 Annual Report provides more details into 2020 accomplishments and goals.



## COMMUTER CHOICE MARYLAND

Starting in 2018, MDOT has worked with a diverse group of partners, including metropolitan planning organizations, local economic development offices, locally operated transit systems, and other public and private stakeholders to set a new strategic direction for the Commuter Choice Maryland Program.

Goals	Implementation Actions
<b>Goal 1:</b> Make transportation choices easy to understand and access.	<b>Commuter Choice Maryland Website updates</b>
<b>Goal 2:</b> Enhance the awareness, availability, and use of complementary statewide employer TDM services that support non-SOV drive alone commuting options, teleworking, and flexible work schedules by employers across Maryland at the places Marylanders work.	<b>Events and outreach opportunities</b> – 54 total events since 2018 engaging over 21,000 people <b>Commuter calculator</b> – Helps encourage commuters who are thinking about an alternative commute
<b>Goal 3:</b> Increase statewide ridesharing support, and services, and use statewide.	<b>MDOT MTA Rideshare Assistance Grant</b> – Developed a tool and process to provide state-wide employer assistance for the Baltimore region
<b>Goal 4:</b> Maximize the reach and effectiveness of TDM services through collaboration and innovation.	MDOT created the <b>Commuter Choice Maryland Workgroup</b> to collaborate, engage, and support all the TDM projects that every business unit is implementing or planning to implement.

# Climate Change Adaptation and Resilience

## MDOT COMMITMENT AND ROLE

MDOT continues to develop a comprehensive approach for reducing transportation asset climate change vulnerabilities and optimizing resiliency planning and implementation. MDOT’s activities are helping to adapt to the potential impacts of a changing climate through planning, maintenance, management, and response. MDOT’s approach focuses on enhancing multimodal transportation infrastructure resilience through best practices to mitigate impacts, respond to transportation disruptions, and recover to normal operations. MDOT is making steady progress through working in close coordination with key stakeholders and system users in the areas of information sharing and outreach.

## 2019 AND 2020 ACCOMPLISHMENTS

MDOT TSO is continuing efforts to update the statewide Adaptation Plan led by the MCCC- Adaptation and Resiliency Work Group to develop a framework for guiding and prioritizing actions over the next ten years, specifically in vulnerable and under-served communities.

Each MDOT TBU is also leading actions to improve transportation network resiliency to climate change. In broad terms, MDOT’s TBUs accomplishments can be categorized by three connected focus areas shown to the right.

These actions include best practices and investments that adapt transportation assets to climate change impacts and actions, including multi-agency coordination, that can improve overall transportation network resiliency. The TBUs are at different stages of mainstreaming resilience due to the time required to implement systemic organizational changes and undertake system-wide vulnerability and risk assessments. Some TBUs are still planning and others are already implementing adaptation measures.



2020 Key Project Highlights	
<p>MDOT SHA conducted a Climate Risk and Resiliency Pilot Study on MD 450 (Defense Highway) in Anne Arundel County along US 50. The pilot assessed and prioritized the state-owned roadway network and shared criticality information through the MDOT SHA CCVV. The study also prioritized critical hydraulic asset treatments in the MD 450 corridor by analyzing assets, threats, vulnerability, and consequences within a Risk and Resiliency for Highways framework.</p>	
<p>MDOT MTA Environmental Planning Division (EPD) updated the Vulnerability Plan developed in 2016. The outcome developed a mapping tool to depict the vulnerability of MDOT MTA assets to the effects of climate change stressors. MDOT MTA is also developing an Adaptation and Resiliency Toolbox (ART) to assist engineers, planners, and maintenance personnel with adaptation strategies to reduce the risk and increase the resiliency of vulnerable assets.</p>	
<p>MDOT Maryland Port Administration (MDOT MPA) completed a study to determine the best approach for mitigating flooding at Dundalk Marine Terminal. When completed the project will protect all 575-acres of the terminal and its valuable cargo. In September 2020, this \$36 million project was awarded a \$10 million Better Utilizing Investments to Leverage Development (BUILD) Grant by the U.S. Department of Transportation (USDOT).</p>	

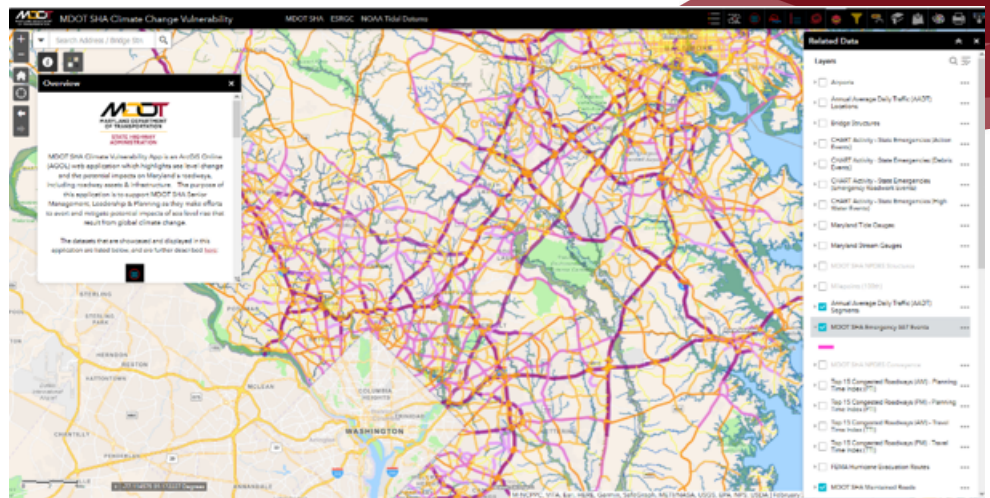




## Understanding and assessing transportation system vulnerabilities

MDOT's TBUs have been undertaking and completing vulnerability and risk assessments and associated plans to assess and analyze the impacts of climate change on statewide transportation infrastructure.

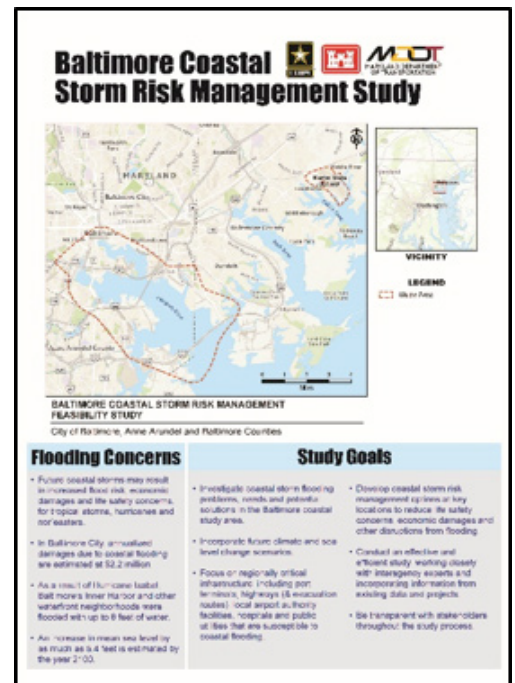
- MDOT SHA's CCVV is a key visual and analytical resource that is routinely updated with new data and assessment information to support planning and project development activity.
- MDTA is considering the effects of climate change for the Chesapeake Bay Crossing Study: Tier 1 National Environmental Policy Act (NEPA), by performing a comparative analysis of the total amount of land area susceptible to sea level rise in each of the three Corridor Alternatives Retained for Analysis.
- The MDOT MTA Environmental Planning Division (EPD) updated MDOT MTA's Climate Change Vulnerability Assessment with the latest projections for sea level rise, flood events, and hurricane storm surge.



## Integrating climate adaptation and resilience into MDOT's business processes

The results of vulnerability and risk assessments are being incorporated into MDOT's business processes in order to adapt and manage climate risk and integrate the knowledge into agency decision-making. Some major examples of MDOT's TBUs undertaking this integration during 2019 and 2020 are:

- MDOT SHA is implementing procedures to track and document repeat catastrophic failure of a critical highway or bridge infrastructure during emergency declared events in the CCVV to meet federal requirements in 23 CFR 667. MDOT SHA is also developing risk-based asset management plan for its 14 critical asset classes and over 75 asset types.
- MDTA is screening projects for vulnerability to flooding, storm surge, precipitation, temperature, and sea level rise risk.
- MDOT MTA is incorporating the resiliency analysis outcome into the Asset Management practices in the agency. This includes developing a toolbox to provide a menu of short-term and low-investment solutions to address and protect the identified high-risk locations.
- MDOT Maryland Aviation Administration (MDOT MAA) provided technical documentation, economic impact cost analysis, and arranged site visits at Martin State Airport which helped inform the approved Project Management Plan for the Baltimore Coastal Storm Risk Management Study.
- MDOT MPA completed redevelopment of the Fairfield Marine Terminal (FMT) Wet Basin and South Locust Point Fruit Slip as part of a federally funded port enhancement project, creating new, elevated cargo space while enhancing storm water management and filtration.



FMT Wet Basin During Construction, Underground Storm Water Management System, January 17, 2019.



## Communicating potential risks and vulnerabilities to MDOT stakeholders and transportation system users

MDOT TBUs were asked to identify their top five extreme weather-related concerns, including consideration for vulnerability of the area, frequency of recurrence, and magnitude of impact as it pertains to transportation infrastructure. MDOT's TBUs are collaborating with MDOT TSO to explore how climate resilience can be incorporated into transportation network vulnerability and risk assessment, asset management, and engineering policy frameworks. MDOT SHA is showcasing its CCVV data and tools available to MDOT TSO and all TBUs and will offer online assistance as a webinar to local and state agencies in utilization of the available information.

MDOT hired a Senior Manager for Climate Risk Management and Resilience at MDOT TSO, to coordinate climate change vulnerability assessment and resiliency planning agency-wide, support climate change adaptation, and engage various partners and stakeholders on improving Maryland transportation system resilience. MDOT participated in a multi-agency subgroup within the Coast Smart Council with a focus on updating the existing Coast Smart Construction Program document. The 2020 Coast Smart Program document updates were necessary to bring the program document in line with the Coast Smart statute.

MDOT TSO, in partnership with the Maryland Department of Natural Resources (DNR) and the U.S. Army Corps of Engineers (Baltimore District) continued to make progress on the Baltimore Coastal Storm Risk Management Study, including conducting an open house on September 23, 2019 at Maryland Department of the Environment (MDE).

### STRATEGIES UNDER DEVELOPMENT

Opportunities for ongoing planning and implementation rely on the significant progress already made by each of MDOT's TBUs and expansion of these resources to support planning and investment decisions across multiple agencies, including other state and local partners.

- MDOT SHA is looking to refine its data analysis and modeling around central elements of vulnerability assessments and expanding it statewide. Increasing capabilities within the CCVV to efficiently utilize data from the One Maryland One Centerline Program is also an important ongoing effort to collaborate with stakeholders.
- MDOT MTA will update their vulnerability assessment, while developing and implementing mitigation or adaptation measures and associated cost estimates of potential improvements at MDOT MTA locations identified as at high- or very high-risk to transit services. Another planned effort is completing the integration of climate change vulnerability data and resiliency analysis into the agency's Environmental and Sustainability Management System (ESMS), Asset Management Plan, and system preservation program.

**Top 5 Weather-Related Hazards**

- 1 EXTREME WEATHER**
- 2 WINTER STORMS**  
(snow and ice)
- 3 EXTREME TEMPERATURE**  
(heat and cold)
- 4 HIGH WINDS**  
(gusts 100 mph+, derechos, hurricanes, tornadoes)
- 5 FLOODING**  
(frequent, or deficit drainage)

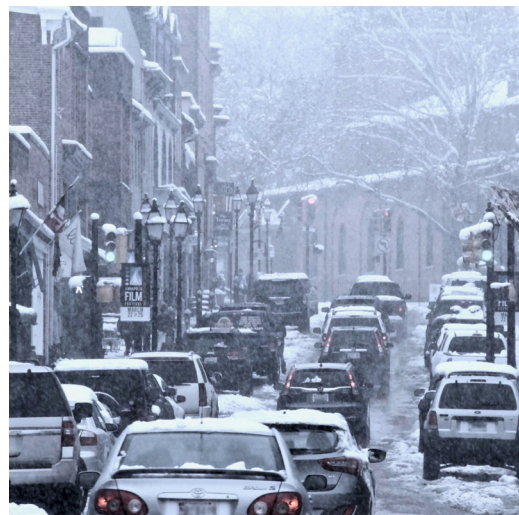


- MDOT MPA is exploring the use of technology, geospatial, and engineering tools to help estimate climate-related risks, vulnerabilities, and costs. MDOT MPA is also adding a focus on cybersecurity and IT infrastructure resilience to its resilience strategy.
- MDOT TSO is leading several initiatives and funding opportunities including:
  - A Pooled Fund Solicitation to update precipitation frequency estimates for Delaware, Maryland, North Carolina, and Virginia.
  - A Federal Emergency Management Agency (FEMA) Building Resilient Infrastructure and Communities (BRIC) proposal concept to Maryland Emergency Management Agency (MEMA) entitled, *Maryland Resiliency Partnership*.
  - A joint funding agreement with the U.S. Geological Survey to continue to provide funding for 16 continuously monitored stream gauges that will continue to support development/reevaluation/ updating of the regression equations that are a basis of our hydrology studies.
  - A proposal concept to a request from the American Association of State Highway and Transportation Officials (AASHTO) Committee on Transportation System Security and Resilience (CTSSR), entitled, *Identifying, Understanding, and Managing Risks from Multiple Interacting Crisis and Cascading Failures in the Context of Improving Transportation System Resilience*.

## RISKS AND OPPORTUNITIES

MDOT is seeking to elevate and champion climate resilience across the agency. Challenges include:

- Identifying and incorporating key points of entry for climate resilience in MDOT asset management, planning, policy, and operations across diverse transportation modes and services;
- Defining climate and extreme weather hazards with diverse characteristics seamlessly across different time and space-scales to provide uniform guidance for TBUs;
- Synchronizing short-term operational and long-term planning to accommodate life-cycle considerations, and more rapid degradation of systems from accelerating climate change and extreme weather impacts;
- Identifying critical vulnerabilities across transportation and other interdependent systems, such as, electric grid, telecommunications, water supply, and stormwater.



The increased cost of adaptation is unknown for many projects at this time; however, the vulnerability assessments are ongoing and provide data for the determination of adaptation needs. While infrastructure adaptation may increase costs, it could also increase the life span, improve reliability, and reduce maintenance requirements for the infrastructure. It is important to consider and quantify all benefits now and in the future.

MDOT is thoughtfully approaching the challenges of evaluating and changing current practices. Utilization of new technologies and procedures need to be evaluated and considered in construction, engineering, planning, and operations and maintenance that can reduce potential impacts from extreme weather events and sea level rise. New procedures may also include the use of natural or nature-based features that can provide the benefit of coastal resiliency while also providing carbon sequestration benefits.

MDOT has been pursuing federal funding opportunities for climate resilience including, National Oceanic and Atmospheric Administration (NOAA) Climate Office Adaptation Sciences (AdSci) Program: Advancing Climate Adaptation and Coastal Community Resilience; NOAA Effects of Sea Level Rise Program Coastal Resilience and Surface Transportation Resilience opportunities; and FEMA Building Resilient Infrastructure and Communities (BRIC) Program.



# Greenhouse Gas Mitigation Matrix

MDOT works with federal, state, regional, local, and private partners to plan, invest, and operate the multimodal transportation network in Maryland to meet the goals of the MTP while also sustaining GHG emission reductions. Strategies to reduce transportation GHG emissions fall into four categories.



**Technology** – Adopting policy and regulations while also piloting and incentivizing new vehicle technologies keeps Maryland’s place as one of the best marketplaces in the United States for electric vehicles. Maryland’s

leadership in implementing the ZEV Memorandum of Understanding (MOU) will continue to increase overall fleet efficiency across multiple modes and vehicle types. New vehicle technologies, including electric vehicles, could reduce average annual CO2 emission from each vehicle by 34 percent (or 1.5 metric tons (MT)) through 2030.



**Travel Choice** – Mitigating the growth in VMT relative to population growth is critical. The strategies to change traveler behavior are complex, with success contingent on other decisions like land use. As the fleet becomes

more efficient, VMT strategies are also less effective at reducing GHGs. Eliminating rail bottlenecks, like the Howard Street Tunnel, can also support increased movement of good by rail rather than truck, which is more efficient on an emissions per ton moved basis.

**Technology** – Consuming less fossil fuel per mile traveled through vehicle and fuel technologies

**Travel Choice** – Offering alternatives to the most carbon intensive modes, like driving alone

**Where Do Greenhouse Gas Emission Reductions in the Transportation Sector Come From?**

**Travel Efficiency** – Reducing congested and unreliable travel, which leads to more efficient travel and less emissions

**Infrastructure Design** – Opportunities for clean energy use while also ensuring design that is resilient to climate change impacts



**Travel Efficiency** – Reducing inefficient travel associated with congestion or poor reliability is a primary focus of MDOT, both through how it manages and operates the multimodal transportation system,

but also where it strategically expands the system to address bottlenecks. For example, a car operating at 25 mph emits 25 percent more CO2 per mile than a car operating at 50 mph.



**Infrastructure Design** –

MDOT’s TBUs have been developing and implementing design changes to agency business processes that have mitigated and in some cases have had positive impacts on the environment.

Contractors also are competing to install, operate, and maintain solar systems on MDOT properties, resulting in reductions in energy use.



# Transportation Technology

Transportation technologies represent the most significant opportunity to reduce GHG emissions from the transportation sector. Accelerating progress in on-road vehicle technology, fuels, and intelligent transportation systems (ITS), which improve system efficiency, is having a measurable impact on major travel indicators and GHG emissions. New, low-carbon vehicle technologies and fuels are becoming more reliable and decreasing in cost, helping to broaden their market share.

## MDOT COMMITMENT AND ROLE

Maryland is taking a proactive role in promoting the adoption of on-road technologies that can have life-saving benefits as well as GHG benefits. In addition to chairing the Zero Emission Electric Vehicle Infrastructure Council (ZEEVIC), MDOT also leads a workgroup dedicated to ensuring that connected and automated vehicle (CAV) technology is deployed safely and thoughtfully on Maryland's roads.



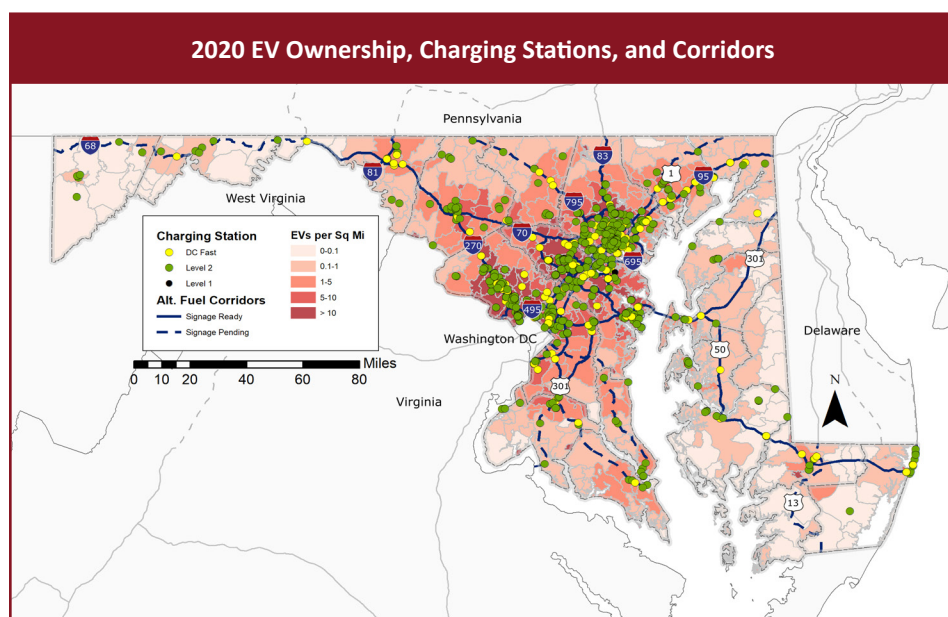
**MARYLAND**  
**ZERO EMISSION**  
Electric Vehicle Infrastructure Council

## 2019 AND 2020 ACCOMPLISHMENTS

Maryland is emerging as a national leader in CAV technology and is building on this progress by developing CAV strategic plans that document opportunities, challenges, priorities, strategies, and recommendations to help guide the State in planning and implementing CAV technology. In 2020, MDOT led the effort to finalize the CAV Vision and established an official Maryland CAV Strategic Framework.

Maryland continues to be a leader in the deployment of ZEV and ZEV infrastructure.

- As of June 30, 2020, there are over 25,700 registered electric vehicles in Maryland, representing a tripling of total EV registrations since 2017.
- These vehicles are supported by a growing network of charging stations – currently in Maryland there are 708 charging stations with 2,166 outlets of which 17.5 percent are DC Fast chargers.



In 2019, MDOT and ZEEVIC were awarded the Visionary Award by the Greater Washington Region Clean Cities Coalition (GWRCC) for their efforts to remove barriers to the early adoption of zero emission and electric vehicles. In June 2020, MD 295 was designated as an EV Charging Corridor and I-70's designation changed from "Corridor Pending" to "Corridor Ready". Maryland also signed onto the Multi-State Medium- and Heavy-Duty Zero Emission Vehicle Memorandum of Understanding that will help identify barriers to the electrification of medium- and heavy-duty vehicles and develop solutions to support their deployment.

## STRATEGIES UNDER DEVELOPMENT

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MDOT facilitates research and evaluation of the GHG emission reduction potential of vehicle and infrastructure technologies, including CAVs, EVs, and other ZEVs; transportation network companies/shared rides; and system operations. Evaluation of these emerging technologies should include consideration of safety, congestion, and equity issues including public health, economic, and workforce impacts.

MDOT will continue to review state fleet procurement procedures and practices and provide direction on procurement of EVs and other ZEVs, and associated charging/filling station installation guidance and targets through ZEEVIC's State Agency Working Group. MDOT will also complete the MDOT Fleet Innovation Plan which will support the conversion of MDOT's light-duty and bus fleet to ZEVs. The plan will establish a timeline for fleet replacement and identify ZEV fleet and infrastructure opportunities.

## RISKS AND OPPORTUNITIES

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Maryland has made significant progress in EV adoption and the installation of Electric Vehicle Supply Equipment (EVSE). To continue and expand progress, the State should continue investments in EV and EVSE incentives and ensure that adequate infrastructure is in place. Maryland is seeking opportunities to enhance EVSE availability through the National ZEV Investment Plan and the Maryland Volkswagen Mitigation Plan under the federal Volkswagen Settlement.

MDOT is also continuing to work with the utilities, the Public Service Commission (PSC), and our State, local, and federal partners under PC44 to ensure the strategic, sustainable, and reliable installation of EV charging infrastructure in Maryland. MDOT, in collaboration with ZEEVIC, will also continue to address barriers to EV acceptance to ensure that charging is available to those who live in urban environments, multi-unit dwellings, or in homes governed by homeowner's associations.

While technologies offer the most significant GHG emissions reduction potential for the transportation sector, the full potential of GHG benefits will not be fully achieved until the fleet turns over with newer fuel efficient and GHG-beneficial vehicles. In addition, The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rules for Model Years 2021-2026 Passenger Cars and Light Trucks Rule, if implemented as planned, could reduce potential GHG benefits as the fleet continues to turnover as a result of less stringent GHG emission standards.

## STRATEGY BENEFITS

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VMT slightly increased in Maryland in 2019 compared to 2018, but the on-road GHG emissions have continued to decrease, by 1.2 percent in 2019 from 2018, primarily due to transportation technologies.



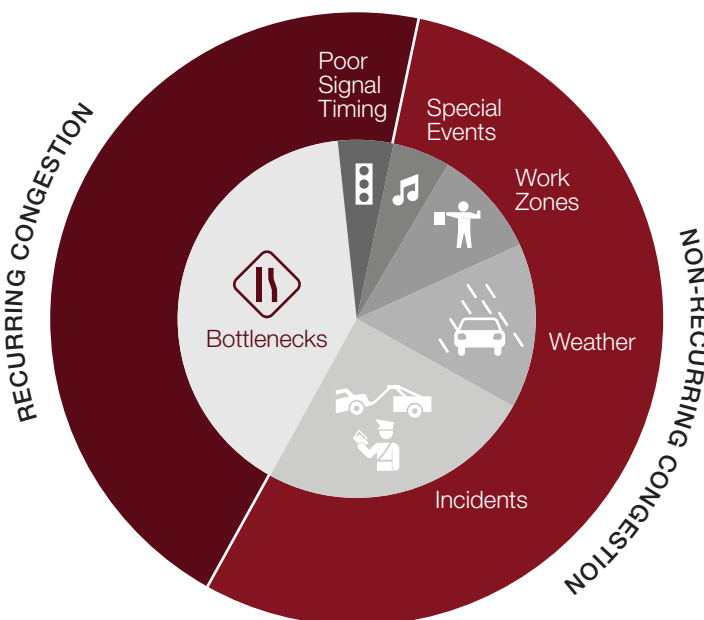
# Congestion Mitigation

## MDOT COMMITMENT AND ROLE

Traffic congestion can increase GHG emissions as a result of increased fuel use during vehicle idling and reduced engine efficiency at low speeds. Mitigating congestion not only reduces GHGs, but also helps improve air quality, reliability, and quality of life for Marylanders.

MDOT's integrated approach to congestion mitigation is administered under the Transportation Systems Management and Operations (TSMO) umbrella of programs at MDOT SHA. MDOT SHA's TSMO approach, and other TBU multimodal programs and projects, result in emission reductions by reducing delay, resulting in improved mobility, reliability, and safety for transportation system users. MDOT SHA's TSMO strategies leverage technology to optimize capacity that is limited by recurring and non-recurring congestion.

Among programs and initiatives targeting congestion mitigation, MDOT SHA's CHART program utilizes ITS technologies to enhance travel, reduce traffic congestion, and address capacity inefficiencies that contribute to GHG reductions. MDOT's Traffic Relief Plan (TRP) program, is helping to reduce traffic congestion and improve commute times, which are currently among the worst in the country, with technology and capacity improvements in the Baltimore and Washington, DC areas. MDTA's toll modernization plan and all-electronic tolling allows drivers to no longer stop to pay tolls, reducing delays and allowing for less idling and greater fuel efficiency.



## 2019 AND 2020 ACCOMPLISHMENTS



Last year, the CHART program continued delivering operational efficiency in clearing roadway incidents and delivering traveler benefits in the form of improved commute times for Maryland residents. In 2019, MDOT SHA's CHART Program cleared 31,750 traffic incidents and assisted 39,500 motorists on Maryland highways. These traffic incident management, traveler information, and emergency services saved drivers \$1.4 billion in delay and fuel costs in 2019.

Under the TRP program, MDOT SHA and Federal Highway Administration (FHWA) published the I-495 and I-270 Managed Lanes Study Draft Environmental Impact Statement in July of 2020, which is currently out for public review and comment. As of August of 2020, full-time all-electronic (cashless) tolling is permanent across Maryland, including at the John F. Kennedy Memorial Highway (I-95), Fort McHenry Tunnel (I-95), Baltimore Harbor Tunnel (I-895), and Nice/Middleton Bridge (US 301).

## STRATEGIES UNDER DEVELOPMENT

MDOT is developing strategies to improve the efficiency of its roadways and transportation systems. With a focus on a connected and automated future, MDOT is taking a strategic System of Systems approach to developing active traffic management and integrated corridor management solutions. Additionally, with innovative TSMO approaches, MDOT SHA continues to enhance the customer experience with new technologies for safe, efficient, and reliable transportation mobility and operations.

## RISKS AND OPPORTUNITIES

Increasing demands on Maryland’s transportation system due to dense land-use and economic activity continue to pose reliability challenges manifesting in the form of significant system-wide effects caused by relatively minor disruptions. Congestion mitigation is one of the several areas where new technology has been harnessed through the deployment of infrastructure – both along the roadways and also increasingly in vehicles to reduce delays, clear traffic incidents more efficiently, and provide accurate and real-time traveler information.

## STRATEGY BENEFITS

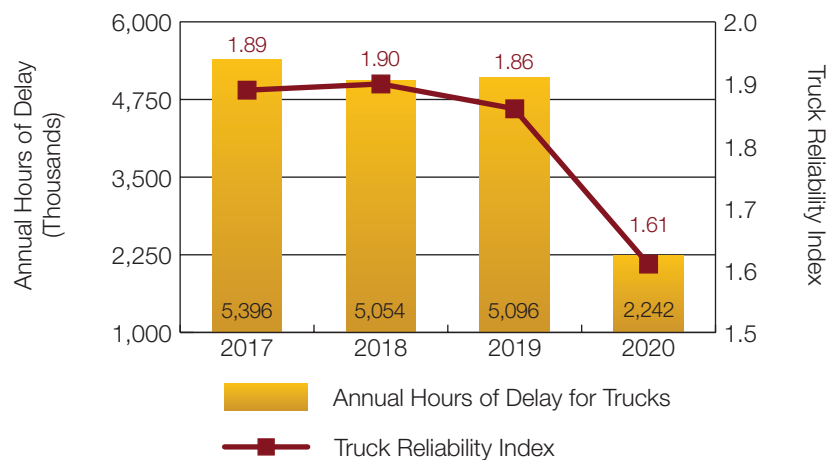
Based on the performance evaluation and benefit analysis of the CHART in 2019, the program is estimated to have resulted in a reduction 56,344 MT CO2 emissions through reduced congestion. Total delay, fuel, and cost savings are also included in the table to the right.

2019 CHART Benefits	
Delay (vehicle hours reduction)	1,550,000
Fuel Consumption (gallons savings)	6,160,000
Emissions (MT CO2)	56,344.93
Total Cost Savings (\$)	\$1,393,380,000

MDOT recognizes that delay and reliability affect freight movement and supply chain reliability, which has the potential to impact economic development. MDOT tracks annual hours of delay experienced by truck operators on Maryland’s highways. This delay has decreased from CY2017-2019 as seen in the chart below, showing annual hours of delay and truck reliability index. One of the reasons for this decrease is completion of 108 projects (including 21 major projects) in 2019 and other active projects on a continued basis which have improved capacity and reliability. Construction is often a major contributor to travel delay. Through traveler information and work zone best practices, MDOT is minimizing the impact that construction has on travel reliability.



**Annual Hours Of Delay For Trucks And Truck Travel Time Reliability Index**





# VMT Reduction

## MDOT COMMITMENT AND ROLE

MDOT invests in projects and programs that create options to help reduce VMT. For transit, there is an emphasis on improving service quality and reliability, better aligning transit service to demand, and improved transit information dissemination to customers. MDOT continues to work together to advance bike and pedestrian friendly designs and policies to promote safety and respect of all transportation system users. MDOT also supports transportation demand management programs, such as MDOT's Commuter Choice Maryland and Metropolitan Washington Council of Governments (MWCOC) Commuter Connections, that provide information and incentives for alternative modes, including telework.

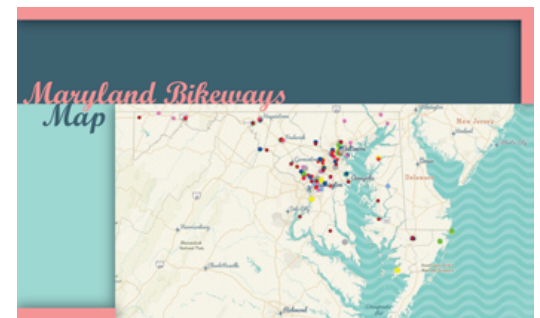


## 2019 AND 2020 ACCOMPLISHMENTS

MDOT and transit providers are currently engaged in a number of fleet modernization efforts, and it has reached a few key milestones in the past year for its transit operations. Ninety-four clean diesel buses (out of an order of 350 clean diesel buses) were delivered to MDOT MTA in FY2020. In October of 2020, Montgomery County launched its US-29 Bus Rapid Transit (BRT) service FLASH that will provide expedited transit service from Burtonsville to Silver Spring. Additionally, in partnership with the Transit App, MDOT MTA launched real-time tracking for MARC Train service in August 2020, allowing for a better transit user experience.



To continue its commitment toward bicycle and pedestrian programs, MDOT increased the funding levels for the MDOT Kim Lamphier Bikeways Network Program. In FY2021, MDOT awarded \$3.8 million to 19 projects for the design and construction of bicycle capital projects, and as part of this program published new design guidance. To focus on pedestrian issues, MDOT launched Walktober during the month of October, a month-long celebration of walking, focusing on increasing safety, encouraging group walks, and visioning for a better walking environment.



Commuter Choice Maryland continues to expand its activities, including a new focus on assisting employers and workers with the transition to telework due to the onset of the COVID-19 pandemic. Prior to the pandemic, Maryland's Commuter Choice program saw more than a doubling in employer participation from 2017 to 2019, with a correspondingly significant increase in employee participation as well. The Commuter Choice program expanded and enhanced the delivery of the Maryland Commuter Tax Credit through the Maryland OneStop Online Portal and updated marketing material to help communicate the benefits and how to claim the tax credit.

## STRATEGIES UNDER DEVELOPMENT

Construction began in 2019 on a 7-mile dedicated bus lane on the North Avenue corridor in Baltimore, with completion anticipated at the end of 2021. MDOT MTA is also continuing its railcar replacement program, with a \$400 million approved contract to replace 78 railcars and enhance safety components on the Metro SubwayLink system. The new railcars will be more reliable and more energy efficient, with the first train scheduled to enter service in 2021. MDOT MTA is also investing in other fleet modernization measures, including a 53-vehicle light rail vehicle fleet overhaul to be completed in 2022, as well as a \$54.2 million overhaul of MARC III passenger coaches, that will be complete in 2021.

In order to increase bicycle and pedestrian access to transit, MDOT MTA will continue working with Baltimore City to implement shared mobility corrals at 11 locations along North Avenue and at or adjacent to nearly every Metro, Light Rail, and MARC station in Baltimore City. MDOT SHA has been working to update the Complete Streets policy and anticipate the new policy along with implementation details to be finalized within the coming year. Policy implementation will be driven in large part by the recently adopted Context Driven Guidance published by MDOT SHA.

## RISKS AND OPPORTUNITIES

The impact of the COVID-19 pandemic on transit ridership, and the associated impacts on MDOT MTA revenues, presents a challenge that MDOT MTA will face in the foreseeable future. At the same time, MDOT MTA has underway an array of initiatives to improve environmental sustainability and reduce energy use and GHG emissions. The introduction of clean diesel and battery-electric buses, as well as studying the feasibility for a transition to a ZEV fleet, are opportunities to significantly reduce MDOT MTA's GHG emissions footprint.

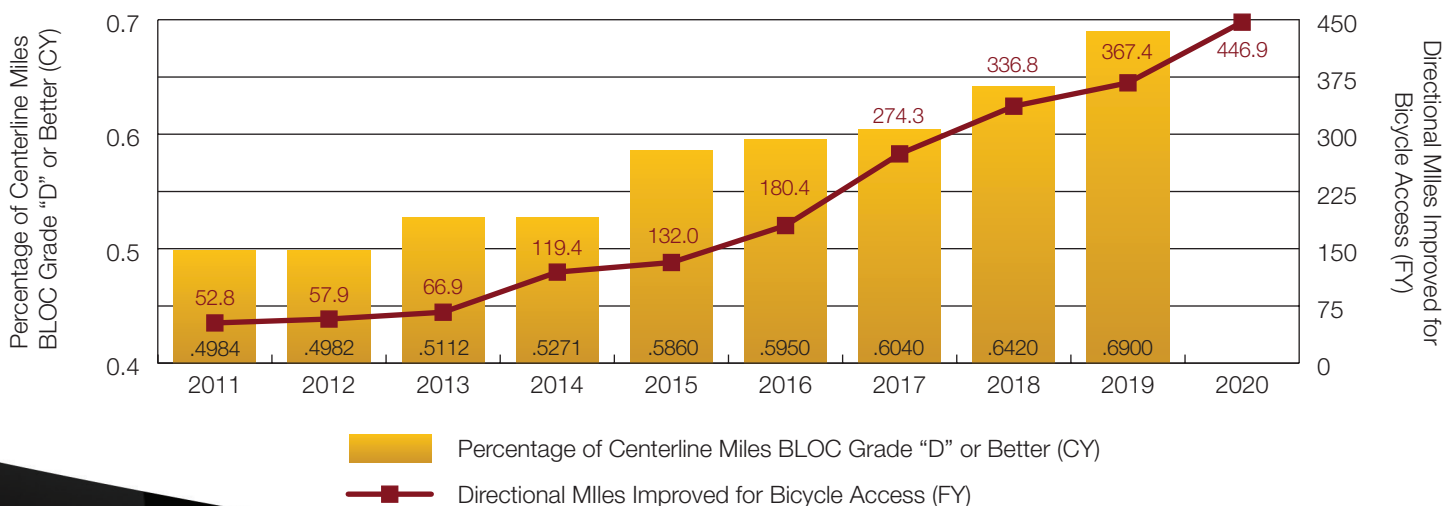
COVID-19 revenue impacts also may effect MDOT bicycle and pedestrian project scheduling and planning. During the COVID-19 pandemic, social distanced walking and biking were two activities Governor Hogan deemed allowable under pandemic restrictions. Governor Hogan also declared bike shops as essential businesses and allowed shops to remain open. With the increase in the number of bicycles on Maryland roadways and trails, more Marylanders are likely to support better walking and biking infrastructure. A number of bicycle/pedestrian projects (MDOT MTA's Patapsco Ave Phase I bridge, the Anne Arundel Co. BWI Trail extension, and a Baltimore Metropolitan Council (BMC) effort for the Patapsco Regional Greenway) will all be nearing 100 percent plans over the next year and ready for construction funding.

Within the Commuter Choice program and transportation demand management, there is now greater opportunity for collaboration on the various MDOT initiatives to help reduce congestion, improve air quality, and continue to provide an enhanced quality of life for all Marylanders. Commuter Choice Maryland rapidly adapted services and operations to serve the needs of Maryland businesses and workers including holding a 30-Day Telework Challenge campaign and a series of telework webinars which featured Maryland businesses sharing their telework best practices and lessons learned from operating remotely during the pandemic.

## STRATEGY BENEFITS

MDOT's programs and initiatives help reduce VMT and single occupant vehicle travel by shifting to less intensive emission modes of travel with increased investments in transit, cycling and walking, and transportation demand management. MDOT's programs reduce transportation-related GHG emissions. In 2019, MDOT continued to make improvements to its bicycle network, with a 9 percent increase in directional miles of bicycle lanes, and an increase from 64 to 69 percent of its roadway centerline miles with a BLOC grade of "D" or better. Additionally, MDOT's Commuter Choice program continued to improve its reach, with a 43 percent increase in the number of participating employees between 2018 and 2019, reaching a total of 1,260 employees in the program.

**Number Of Directional Miles Improved For Bicycle Access/Percentage Of State-Owned Roadway Centerline Miles With A Bicycle Level Of Comfort (Bloc) Grade "D" Or Better**



# Infrastructure Design

## MDOT COMMITMENT AND ROLE

MDOT continues to take steps to ensure that its assets and facilities are powered and designed to minimize their environmental impact. MDOT has continued to demonstrate leadership in renewable generation, with the agency issuing Master Service Agreements (MSAs) to six qualified contractors to design, construct, commission, finance, operate, and maintain photovoltaic (PV) energy facilities at MDOT locations throughout Maryland. MDOT SHA also incorporates Leadership in Energy and Environmental Design (LEED) principles into the design and construction of its facilities, saving water and energy, and reducing its emissions impact. Finally, MDOT takes steps, through programs such as Complete Streets, to ensure its infrastructure and roadways are designed in ways to promote low-impact forms of travel.



Practical Design places a greater emphasis on understanding a project's purpose and need beginning with planning and throughout design. Developing the MDOT purpose and need statement is the critical first step to ensure that the project is consistent with MDOT policy, which is to prioritize the needs of the State's transportation network as a whole above the wants of a single project.

## 2019 AND 2020 ACCOMPLISHMENTS

MDOT MAA is striving to meet the increasing traveler and employee demand for green infrastructure and has conducted a feasibility study to determine the number and type of EV charging stations needed at BWI Marshall Airport over the next 30 years. This study identified the extent of infrastructure upgrades needed to accommodate the different types of EV charging stations and provided key data and information that will guide the systematic addition of charging stations at MDOT MAA facilities.

Full-time all-electronic (cashless) tolling is now permanent at all MDTA facilities across Maryland, including at the John F. Kennedy Memorial Highway (I-95), Fort McHenry Tunnel (I-95), Baltimore Harbor Tunnel (I-895), and Nice/Middleton Bridge (US 301). The system provides convenience for motorists, less engine idling for better fuel efficiency and reduced emissions, decreased congestion, and increased safety.

Several organizations within the State of Maryland have already developed Task Order Request for Proposals, and numerous other organizations have contacted MDOT to inquire about how they can use the MDOT Master Solar Contract.

In the summer of 2019, MDOT SHA released the draft MDOT SHA Context Driven Guide, which is a planning and design resource offering practitioners guidelines centered on establishing safe and effective multi-modal transportation systems balancing access and mobility for all users.



MDOT TSO published design guidance for projects applying for MDOT Kim Lamphier Bicycle Program funding. Governor Hogan increased the FY2021 and FY2022 Bikeways program funding to \$3.8 million in honor of Kim Lamphier, a longtime bicycle advocate who succumbed to cancer in 2019.

MDOT SHA’s investment into a progressive design-build approach to improve reliability and reduce congestion in the I-270 corridor is an example of a project that will utilize innovative and technology focused approaches to manage congestion.

### STRATEGIES UNDER DEVELOPMENT

MDOT has been working to update the Complete Streets policy in response to legislation passed during the 2018 session, with new policy and implementation details to be finalized in the coming year. The policy implementation will be driven in large part by the recently adopted Context Driven Guidance published by MDOT SHA.

Pre-Construction Engineering and Design (PED) for the Mid-Chesapeake Bay Island Ecosystem Restoration Project is underway to restore two islands in the Chesapeake Bay with clean sediment removed from the Bay channels serving the Port of Baltimore.

### RISKS AND OPPORTUNITIES

Infrastructure design changes can have significant impacts, but there is also a lag time in realizing their benefits because the changes take long periods of time to implement.

### STRATEGY BENEFITS

The GHG benefit of MDOT’s existing renewable energy installations has increased by 10 percent over the last year and resulted in 15 MT of reductions.

Solar and Wind Technologies - Lifetime Totals (as of October 2019)				
	Capacity (kw)	Generation (kWh)	CO2 (lbs)	Install Date
MDOT MAA	505	5,205,852	15,741,911	Sep-11
MDTA	–	203,115	316,656	Apr-13
MDOT MPA (Cruise Terminal)	249.6	2,033,629	6,117,502	Aug-12
MDOT MPA (Shed 10)	505.44	2,630,000	7,947,059	Aug-12
MDOT MTA	535.39	4,611,924	13,938,123	Feb-12
<b>Total:</b>	<b>1795.43</b>	<b>14,684,520</b>	<b>44,061,252</b>	–

The RFP allows Maryland Counties, municipalities, instrumentalities of the State, other non-State of Maryland governments or government agencies, and not for profit 501 (c) (3) organizations within the State of Maryland to use MDOT’s Master Solar Contract to install PV systems on their properties. Several organizations within the State of Maryland have already developed Task Order Request for Proposals, and numerous other organizations have contacted MDOT to inquire about how they can use the contract.





MARYLAND DEPARTMENT  
OF TRANSPORTATION

