2021 STATUS REPORT

Required under the Maryland Commission on Climate Change Act (§2-1305) MSAR 10683

MDOT
MARYLAND DEPARTMENT
OF TRANSPORTATION

Highlights

Climate Change Adaptation and Resilience

The Maryland Department of Transportation (MDOT) continues to enhance 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 collaboration and outreach within MDOT Transportation Business Units (TBUs), partners, stakeholders, and the public.

- The MDOT State Highway Administration (SHA) completed a final draft of the MDOT SHA Climate Resilience Strategy which identifies opportunities and strategies for integrating vulnerability assessment results and climate risk analyses into existing asset management systems and processes.

Office of Climate Change Resilience and Adaptation

Established June 2021

- In late June 2021, the MDOT Secretary established the Office of Climate Change Resilience and Adaptation (OCCRA). OCCRA is responsible for establishing a cohesive, proactive, and coordinated response to the impacts of climate change across transportation systems, with consideration of state and federal climate change initiatives and opportunities to support the State of Maryland transportation climate-change-related activities and projects.

Transportation Technology

As an emerging leader in implementing transportation technologies, MDOT leads various initiatives including the Zero Emission Electric Vehicle Infrastructure Council (ZEEVIC) and the Connected and Automated Vehicle (CAV) Working Group.

Just Under

40,000
registered electric vehicles (EV) in Maryland by the end of October 2021

42%
increase from the previous year

Oct. 2020 **Oct. 2021**
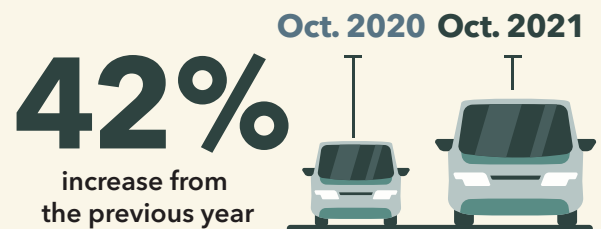
- The total number of registered electric vehicles (EV) in Maryland stands at just under 40,000 at the end of October 2021, a 42 percent increase from the previous October.

- The MDOT finalized the MDOT Maryland Transit Administration (MTA) Zero Emission Fleet Transition Study. The plan provides final recommendations and next steps for MDOT MTA to transition 50 percent of buses to zero emissions by 2030 and 95 percent by 2045.

ZERO EMISSIONS BUSES

50% BY 2030

95% BY 2045
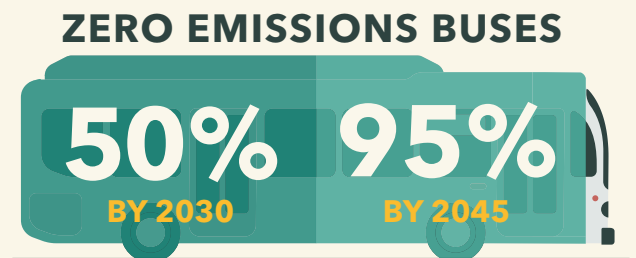
Congestion Mitigation

The MDOT continues efforts to mitigate congestion and improve travel and freight reliability through holistic initiatives, including those under the Transportation Systems Management and Operations (TSMO) umbrella.

- The Coordinated Highways Action Response Team (CHART) is a joint program of MDOT SHA, Maryland State Police (MSP), and Maryland Transportation Authority (MDTA) that assists motorists 24 hours a day, seven days a week, in the Baltimore, Washington, D.C., and Frederick metropolitan areas. In CY 2020, CHART handled 27,000 events, including incident responses, assistance with disabled vehicles, and traffic management operations for special and weather-related events. This saved drivers $1.08 billion in delay costs and reduced travel delays by 32.8 million vehicle-hours.

In 2020, CHART responded to 27,000 traffic incidents

- As of October 2021, all of MDTA toll facilities are all-electronic (cashless).

Saved drivers $1.08 BILLION in delay and fuel costs

**travel delays reduced by 32.8 million vehicle-hours**

VMT Reduction

The MDOT continues to manage and implement programs and initiatives that reduce vehicle miles traveled (VMT) by employing strategies to shift trips to low-emission modes of travel, increase vehicle occupancies, or reduce the number or distance of trips required.

- Commuter Choice Maryland, the transportation demand management (TDM) program, offers a Commuter Calculator to show the cost savings of switching to alternatives to single-occupant-vehicle travel. Additionally, the Employer Partner Program recognizes organizations participating in the Maryland Commuter Tax Credit.

- MDOT promotes Transit Oriented Development (TOD) to support utilization of transit and land development patterns that maximize the efficient use of transportation infrastructure.

- MDOT continued investments in active transportation with grants awarded to 42 bicycle and pedestrian projects across the state and a second year of the Walktoberinitiative.

Infrastructure Design

The MDOT continues to emphasize the importance of reducing emissions through design principles including practical, innovative, and nature-based design.

- MDOT MTA released TOD design guidelines as a resource for local jurisdictions, developers, and communities. Recommendations address a range of station types, whether they are located in a densely populated downtown, or in a small town or rural setting.

- An innovative public-private partnership involving MDOT – called the high-performance pond partnership demonstration project (HP3) – benefits the Chesapeake Bay through advanced stormwater control technology.
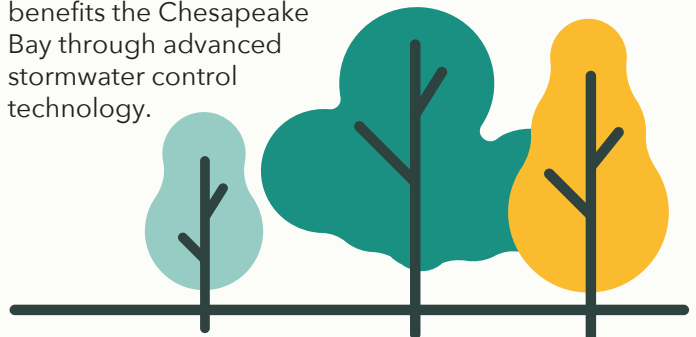
The MDOT Approach

The 2021 State Agency Report

As a member of the Maryland Commission on Climate Change (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 Maryland's Greenhouse Gas Reduction Act (GGRA) 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 for 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 guide MDOT's six-year capital program decisions (also known as the Consolidated 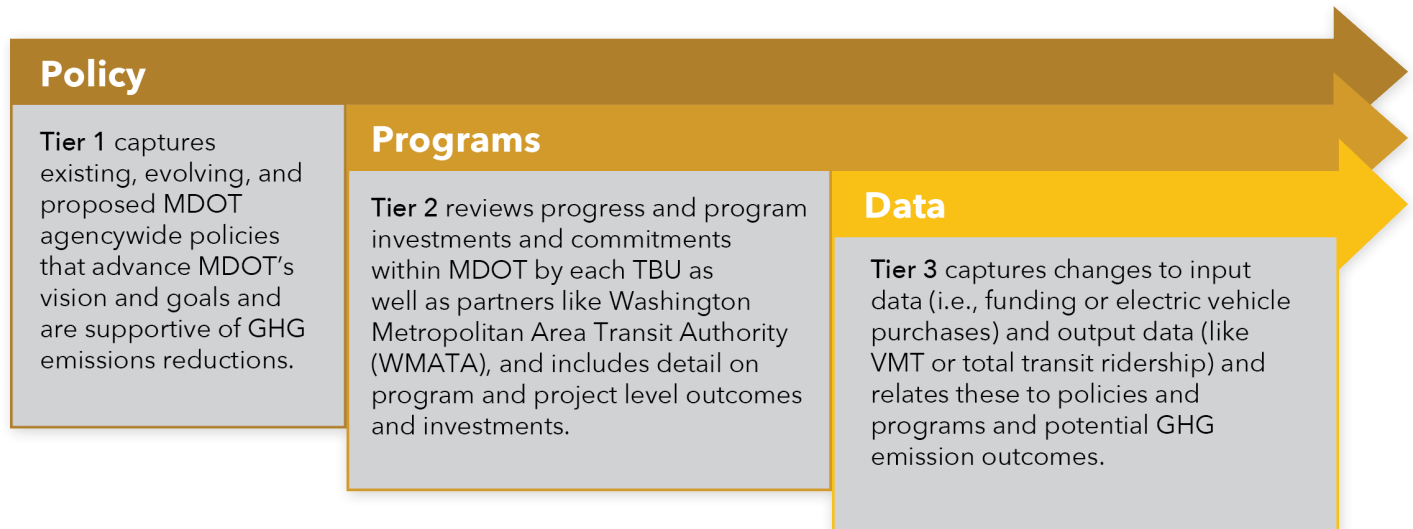Transportation Program, or CTP). Investments within the CTP help to decrease fuel consumption, reduce single occupant vehicle use, improve system efficiency, and prepare the transportation system to be resilient to the impacts of climate change.

MDOT's history. Starting in 2008, MDOT has prepared regular reports and conducted analysis to determine the potential of the transportation sector to reduce greenhouse gas (GHG) emissions. These reports have included priority actions for MDOT to implement to maintain a positive trend toward 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 completed the MDOT GGRA Plan, a component of Maryland's 2030 GGRA Plan. The MDOT GGRA Plan presented trends and a diverse set of strategies to 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 planning, performance, and budgetary/financial reporting systems: (1) the 2040 Maryland Transportation Plan (MTP), (2) the CTP, and (3) the Annual Attainment Report on Transportation System Performance (AR), 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.

Policy

Tier 1 captures existing, evolving, and proposed MDOT agencywide policies that advance MDOT's vision and goals and are supportive of GHG emissions reductions.

Programs

Tier 2 reviews progress and program investments and commitments within MDOT by each TBU as well as partners like Washington Metropolitan Area Transit Authority (WMATA), and includes detail on program and project level outcomes and investments.

Data

Tier 3 captures changes to input data (i.e., funding or electric vehicle purchases) and output data (like VMT or total transit ridership) and relates these to policies and programs and potential GHG emission outcomes.

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

MDOT Mission, Goals, and Investments

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

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."

There are seven goals supporting MDOT's mission as documented in the Maryland Transportation Plan.

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, helping to mitigate congestion and shift travel to less emission intensive modes.

The MDOT 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.

PLAN

2040 Maryland Transportation Plan
(January 2019)

The MTP establishes a 20-year vision for multimodal transportation in Maryland that outlines the states's transportation policies and priorities and helps guide statewide investment decisions for all modes of transportation.

INVEST

Maryland Consolidated Transportation Program
(FY 2021-2026)

The CTP is MDOT's fiscally constrained six-year capital budget for all State transportation projects. MDOT works with residents, businesses, local jurisdictions and local and state elected officials to include projects in the CTP.

EVALUATE

2021 Annual Attainment Report
On Transportation System Performance

The annual Attainment Report (AR) 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 the US Environmental Protection Agency (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 four percent.** GHG emissions from on-road transportation is primarily a product of two trends: VMT, and the efficiency (miles per gallon) of the fleet.

Vehicle miles traveled: As a proxy for increased economic activity, the movement of people and goods seems to be on the rise in Maryland. Total annual statewide VMT steadily increased in line with population growth from 2014 through 2019. VMT in Maryland dropped nearly 16 percent in 2020 due to the COVID-19 pandemic compared to 2019, largely in response to limits on in-person gatherings, and calls for reduced travel. The 2021 VMT data and estimates show that travel continues to gradually rebound, although total annual VMT is still anticipated to be 10 percent below 2019 levels.

Annual VMT and VMT Per Capita

Annual VMT (Millions)

Annual VMT Per Capita
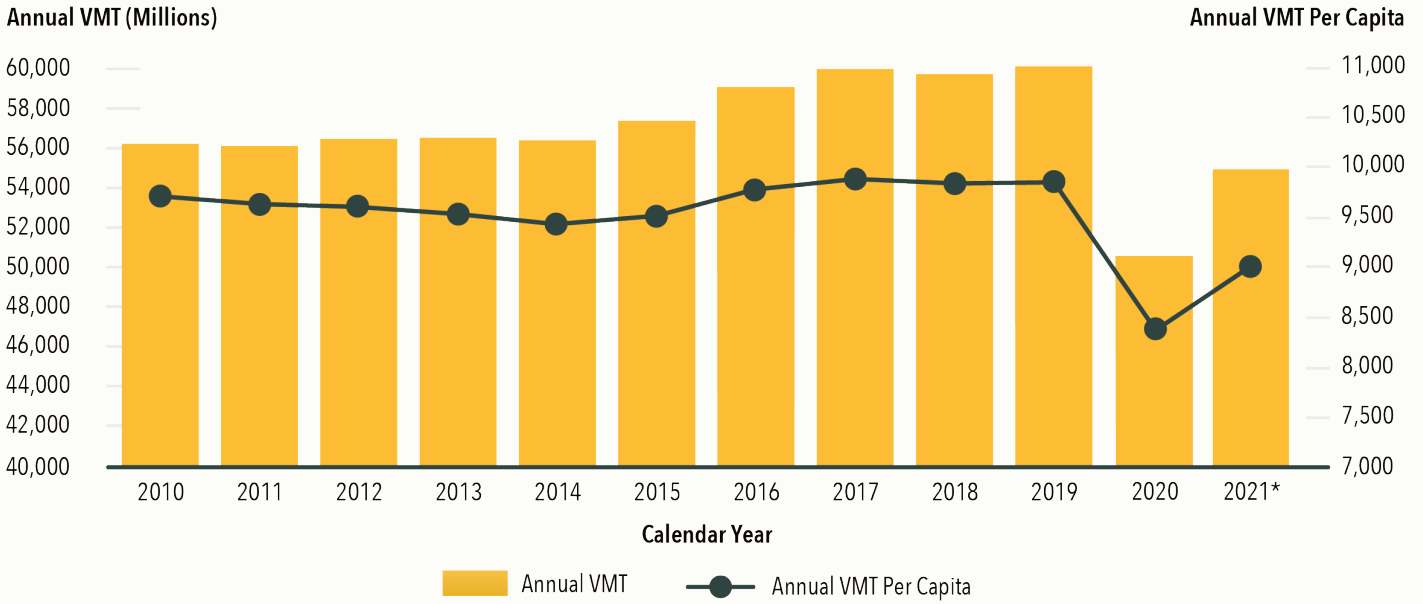

*December 2021 data is estimated

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. EVs are a growing share of the fleet – as of October 31, 2021, there are just under 40,000 registered EVs in Maryland – a 42 percent increase from the previous October.

The combination of these trends and other factors results in a decline in GHG emissions from on-road transportation during the last decade. There were significant emissions decreases in 2020 driven

Total GHG Emissions

by reduced travel during the earlier period of the pandemic. However, when looking at 2020 and 2021 as part of a longer trend, there has been a 16 percent reduction in GHG emissions from 2017 to 2021 and a 23 percent reduction in GHG emissions from 2006 to 2021. Longer-term changes to travel behavior as a result of the pandemic are still being studied and considered, including commuting and freight movement as people and industries adapt to disruptions.
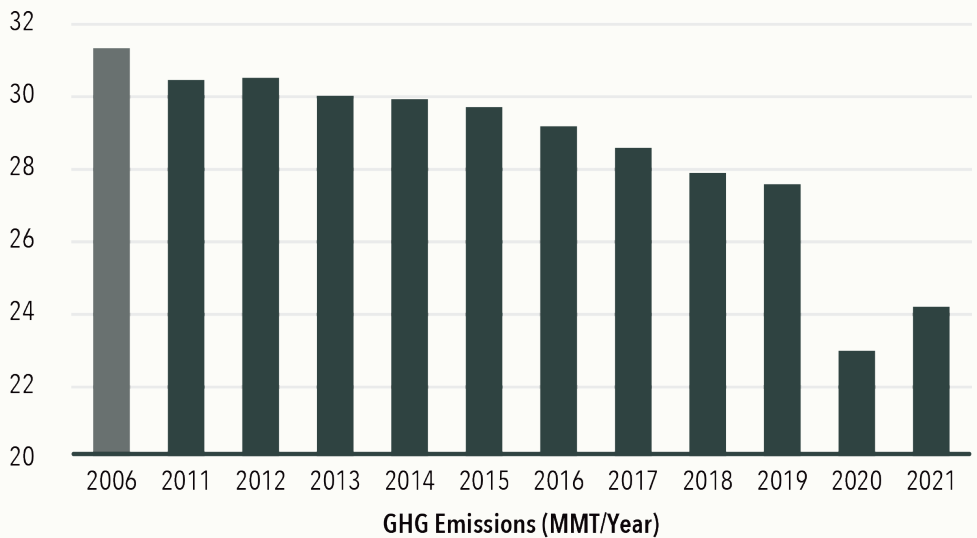
MDOT's Climate Change Commitment

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.
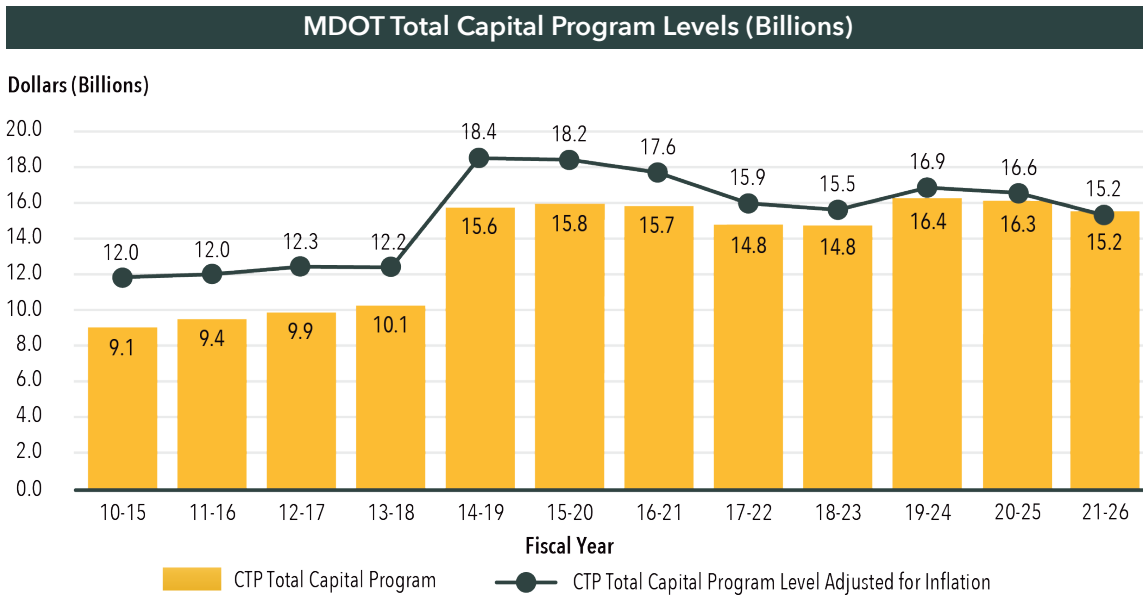
Within the FY 2021–2026 CTP, 65 percent (approximately $8.01 billion) of Maryland's $12.39 billion six-year major capital program are investments that will reduce GHG emissions through 2030 and beyond. This share excludes spending by the MDTA and minor capital programs, such as system preservation and maintenance activities.
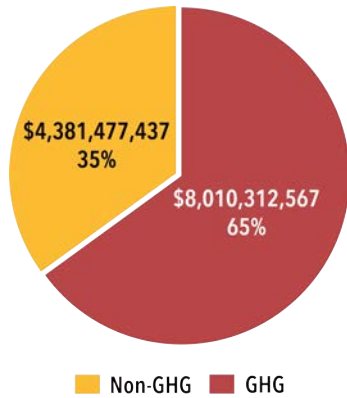
When looking at the entire capital program, the total share is 51 percent. This incorporates both major and minor capital, which includes MDOT and MDTA asset preservation and maintenance activities.

The 35 percent of major capital investments and the 49 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 Maryland Commission on Climate Change (MCCC).

The commitment to GHG-beneficial projects has increased during the last eight iterations of the CTP, with the current estimate of 65 percent for the FY 2021 – 2026 CTP representing the same share as the FY 2020 – 2025 CTP, which was the highest estimated share to date (increasing from 63 percent in the FY 2019 – 2024 CTP). This shows sustained support for MDOT MTA and WMATA, prioritizing investments addressing roadway bottlenecks and transit on-time performance, and expanding safe and accessible bicycle and pedestrian networks. This is all while the total CTP budget was reduced by more than $1 billion in the FY 2021 – 2026 CTP due to funding decreases associated with economic impacts of the pandemic.

Pie chart: $4,381,477,437 35% Non-GHG; $8,010,312,567 65% GHG

MDOT Total Capital Program Levels (Billions)

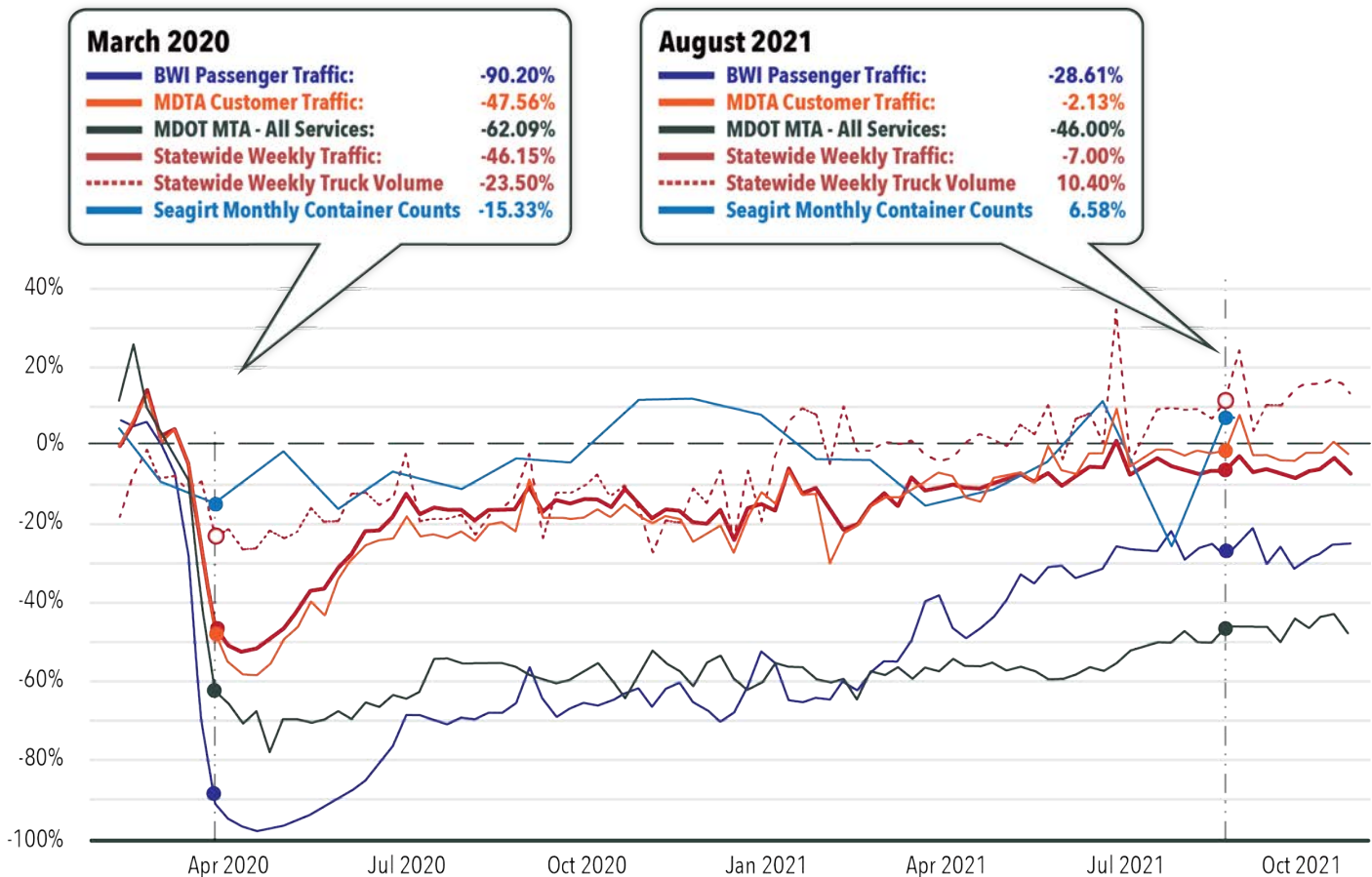| Fiscal Year	CTP Total Capital Program	CTP Total Capital Program Level Adjusted for Inflation
10-15	9.1	12.0
11-16	9.4	12.0
12-17	9.9	12.3
13-18	10.1	12.2
14-19	15.6	18.4
15-20	15.8	18.2
16-21	15.7	17.6
17-22	14.8	15.9
18-23	14.8	15.5
19-24	16.4	16.9
20-25	16.3	16.6
21-26	15.2	15.2

Rebounding from COVID-19

The MDOT Blueprint

As Maryland recovers from the impacts of the pandemic, the MDOT Blueprint consolidates all of MDOT's strategic plans for the future and focuses on seamless connections and smart collaborations to ensure that MDOT's transportation system will be an "integrated, smart, cleaner, and more autonomous and connected transportation system." These collaborations focus on: Sustainability and Resiliency, Asset Management, Customer Service, Technology and Innovation, and Economic Growth. MDOT is improving the movement of goods and services and connecting people to the places where they live, work, and play.

Maryland's pandemic-related State of Emergency ended July 1, 2021. Since then, Marylanders have been returning to travel across modes in numbers approaching pre-pandemic levels. However, not all economic indicators are positive trends for reducing emissions, given the need to decouple economic growth from emissions growth. The figure below shows pick up for a range of travel activity metrics from their low points in March 2020 to August 2021.

MDOT-Wide Services Percent Change Compared to 2019

March 2020

BWI Passenger Traffic:	-90.20%
MDTA Customer Traffic:	-47.56%
MDOT MTA - All Services:	-62.09%
Statewide Weekly Traffic:	-46.15%
Statewide Weekly Truck Volume	-23.50%
Seagirt Monthly Container Counts	-15.33%

August 2021

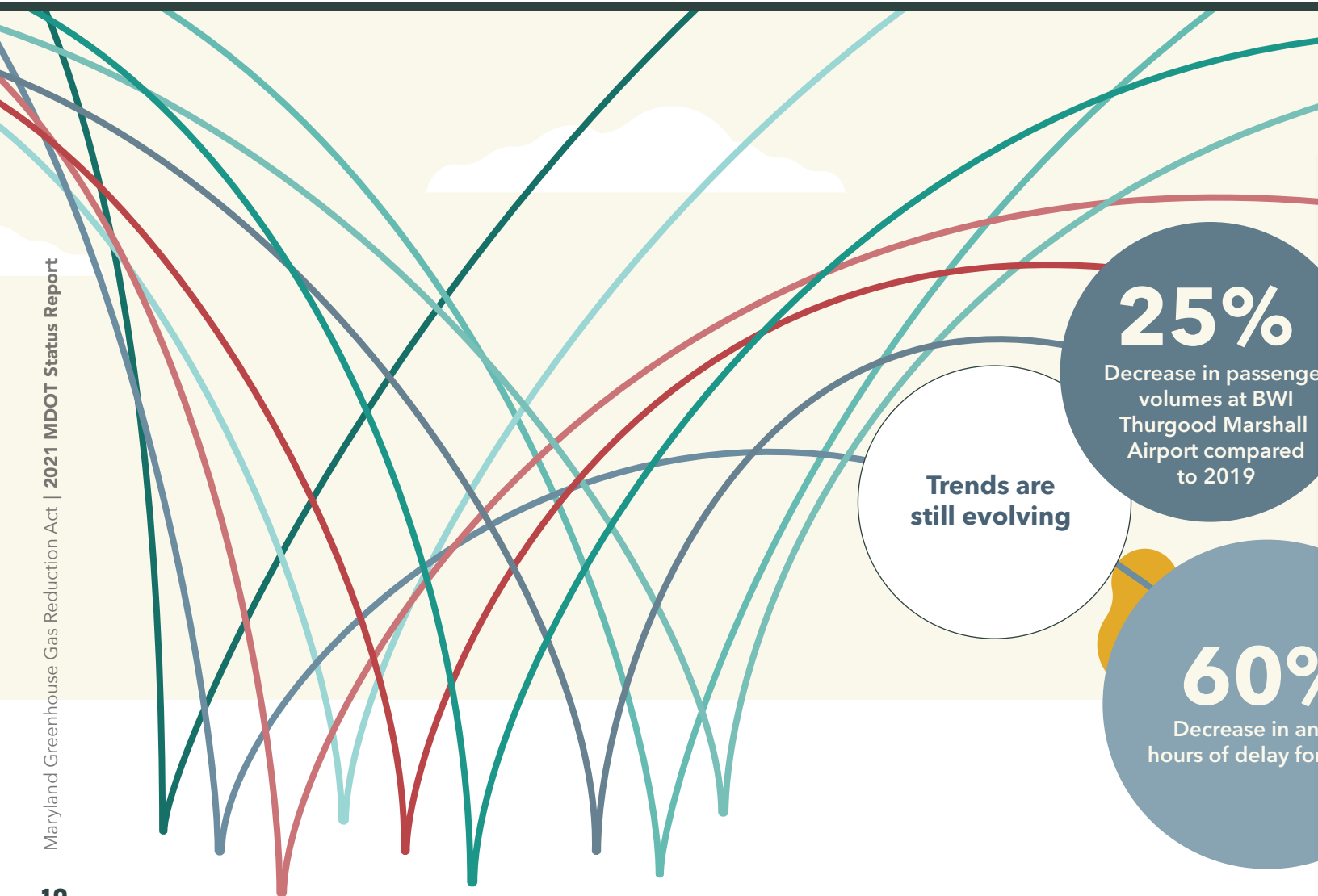|	
BWI Passenger Traffic:	-28.61%
MDTA Customer Traffic:	-2.13%
MDOT MTA - All Services:	-46.00%
Statewide Weekly Traffic:	-7.00%
Statewide Weekly Truck Volume	10.40%
Seagirt Monthly Container Counts	6.58%

Source: MDOT

Rebounding From COVID-19

The MDOT is positioning itself to embrace the opportunities and meet the challenges posed by the pandemic, and emerge out of it stronger and more agile in responding to transportation needs. MDOT's Blueprint for transportation solutions is designed to create meaningful benefits regardless of the funding situation. The themes are:

- Sustainability and Resiliency
- Asset Management
- Customer Service
- Technology and Innovation
- Economic Growth

These themes express the systemic nature of the MDOT Blueprint. The themes are consistent with achieving Maryland's climate change goals through streamlined policy and program implementation. MDOT will continue making data-driven investment decisions to support sustainability and resiliency. Asset management will be guided by system preservation policies, tools, and data. The MDOT Blueprint dives deeply into the needs of Marylanders to inform methods of delivery to customers. MDOT will leverage emerging technology and innovation to build upon operational efficiencies. New policies will align sustainability, economic growth, and transportation funding under more innovative models.

25%
Decrease in passenger volumes at BWI Thurgood Marshall Airport compared to 2019

Trends are still evolving

60%
Decrease in an hours of delay for

2,800
EV charger outlets installed in Maryland

6.9%
Projected increase in weekday ridership across MDOT MTA services in 2021 compared to 2020

65%
Of workers who would prefer to telework two or more days a week

Some aspects of the rebound have been encouraging for low-emissions economic growth

43%
Of MDOT Motor Vehicle Administration transactions are online

12%
Increase in Port of Baltimore volumes from August 2020 to August 2021

Other aspects, despite their economic benefits, have contributed to increased emissions

89,514
Average daily traffic in July on the Bay Bridge, a 1% increase in traffic compared to 2019

13%
Increase in truck volumes above pre-pandemic levels by September 2021

...nual ...r trucks
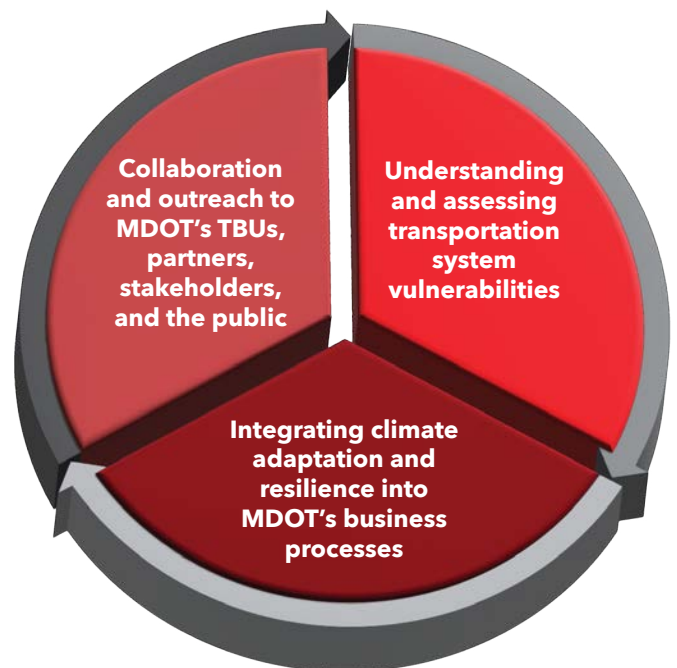
Climate Change Adaptation and Resilience

MDOT Commitment and Role

The MDOT continues to develop and implement a comprehensive approach for enhancing resiliency and mitigating risks and vulnerabilities, while improving agency response through planning, maintenance, management, and communications. 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 in close coordination among the TBUs, other agency partners, key stakeholders, and system users in the areas of information sharing and outreach.

2020 and 2021 Accomplishments

The MDOT contributed to an interagency effort to revise the Adaptation and Resilience Strategic Framework for 2020-2023, ensuring that Maryland transportation goals, strategies, and activities were reflected in sections on critical infrastructure, water, public health, environmental justice, local governments activities, working lands, and ecosystems. Each MDOT TBU is also leading actions to improve transportation infrastructure resiliency to climate change. In broad terms, MDOT accomplishments can be categorized by the three connected focus areas shown to the right.

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 in the assessment and earlier stages of planning, while others are already implementing adaptation measures and mainstreaming resilience planning.

Collaboration and outreach to MDOT's TBUs, partners, stakeholders, and the public

Understanding and assessing transportation system vulnerabilities

Integrating climate adaptation and resilience into MDOT's business processes

Understanding and assessing transportation system vulnerabilities

The MDOT 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.

The MDOT conducted a preliminary evaluation of extreme weather risks across its TBUs. A consistently identified risk was flooding associated with sea level rise and storm surge (in coastal areas) and extreme rain events in nontidal areas. Flooding and increased stormwater discharge was identified as contributing to increased risk of erosion, impacting stormwater drainage assets and embankments.

The MDOT SHA completed the Final Draft of the Climate Resilience Strategy document to identify opportunities and strategies for integrating vulnerability assessment results and climate risk analyses into existing asset management systems and processes. This includes opportunities for integration in planning, design, and maintenance and operations.

2021 KEY ACCOMPLISHMENTS

In late June 2021, the Secretary of Transportation established OCCRA within The Secretary's Office (TSO), responsible for establishing a cohesive, proactive, and coordinated response to the impacts of climate change across transportation systems. OCCRA oversees or supports four broad-scope priorities, including:

- Working in collaboration within MDOT and with local, state, and federal agencies to promote integrated climate actions.
- Implementing MDOT climate change mitigation and resiliency initiatives, including vulnerability and risk assessments, GHG reduction strategies, renewable energy portfolio expansion, and innovative systems deployment.
- Tracking climate change-related performance metrics to demonstrate progress towards achieving transportation-specific climate change goals.
- Communicating MDOT accomplishments in mitigating the causes of climate change, as well as preparing for and adapting to its consequences.

The MDOT SHA advanced strategic climate and extreme weather risk and resiliency concepts by drafting the MDOT SHA Climate Resilience Strategy on behalf of seven MDOT SHA offices of Planning, Design, and Maintenance and Operations.

As a follow up to the MDOT SHA Climate Risk and Resiliency Pilot Study on MD 450 (Defense Highway) in Anne Arundel County along US 50, MDOT SHA asset managers, the Office of Planning and Preliminary Engineering (OPPE), and the Asset Management Office (AMO) coordinated to develop a geographic information system (GIS)-based methodology to determine the criticality of the roadway network. The assessment was based on weighting five different variables, such as annual average daily traffic and a social vulnerability index, and visualized using GIS.

The MDOT MTA continued development of the Adaptation and Resiliency Toolbox (ARToolbox) designed to aid implementating adaptation measures at sites previously identified as priority locations in their Climate Change Vulnerability Assessment (2016, re-evaluated in 2019-2020). Adaptation measures are categorized as long-term, mid-term, and short-term solutions. The intent of the ARToolbox is to provide a central repository for all efforts leading to the successful implementation of adaptation and resilience measures that may be applied at various MDOT MTA assets. In addition, the toolbox will provide a comprehensive database of potential adaptation measures that can be implemented at the asset level, assisting designers, planners, engineers, and maintenance staff with the resources needed to establish a proactive approach to a changing climate.

The 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.

⤧ 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 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 2020 and 2021 are listed below:

The MDOT SHA partnered with the Maryland Department of Planning to standardize comment responses and background information on climate resilience for local document reviews (local, comprehensive, and master plans) and worked with partners to develop a methodology for applying the Criticality Criterion they developed for their infrastructure and visualized using GIS software.

The MDTA is developing project review procedures for climate resiliency to address risks from sea level rise, storm surge, extreme precipitation, and extreme temperature. MDOT MVA is developing a risk profile to help identify, track, and prioritize risks that could affect its critical assets and impact its ability to provide services to its customers. This risk profile will integrate climate adaptation and resilience into MDOT MVA's assessment plan and business processes. MDOT MVA is in the initial stages of developing the formal risk profile and is expected to be completed in CY 2023.

The MDOT Maryland Ports Administration (MPA) received a $10 million federal grant to help protect the Dundalk Marine Terminal against severe weather, sea-level rise, and other potential climate change impacts. The funds from the U.S. Department of Transportation's BUILD transportation grant program will help advance MDOT MPA's $36.7 million Resiliency and Flood Mitigation Improvement project at the Marine Terminal.

✊ Collaboration & outreach to MDOT's TBUs, partners, stakeholders, and the public

The MDOT 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 developed a Climate Change Vulnerability Viewer (CCVV) instructional video to showcase the data and tools available to MDOT TSO, all TBUs, and other state and local climate risk and resilience partners and stakeholders. The video is posted to YouTube and the link is included in the CCVV. MDOT SHA also completed informational flood risk data documents for 15 Maryland counties impacted by coastal flooding. The two-page documents are integrated into the CCVV and will be available for each county as a resource for building resiliency to climate and extreme weather impacts. Additionally, MDOT SHA participated in the Governor proclaimed Maryland Flood Awareness Month April 2021, partnering with various state agencies to raise awareness about the many flood hazards faced by individuals and communities across the state.
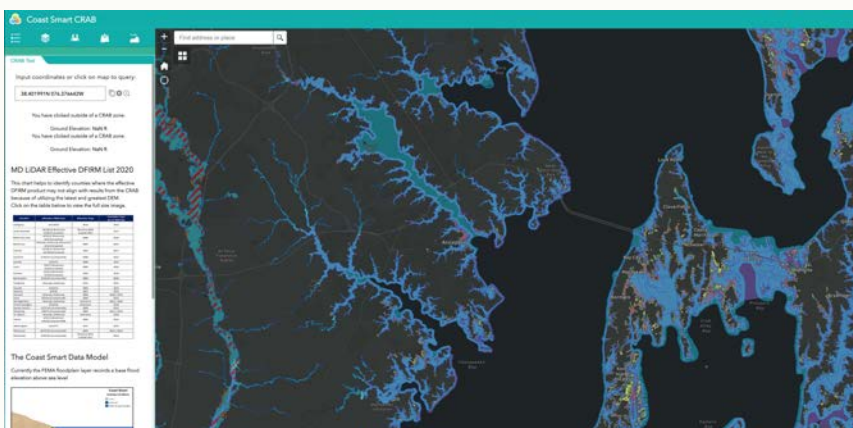
The MDOT TSO participated in a multi-agency effort to develop the Coast Smart Climate Ready Action Boundary (CS-CRAB) to identify and mitigate future flood risk to the state's existing infrastructure. The data developed (the CS-CRAB boundaries and CS-CRAB elevations) have been posted for all state agencies to utilize in planning, funding, design, and construction. The CS-CRAB has a public facing website to help communities and individuals be aware of the risk beyond the floodplain.

The MDOT SHA is participating with the Maryland Silver Jackets team and the Maryland Resiliency Partnership in collaboration with Maryland Department of the Environment (MDE), Maryland Department of Emergency Management (MDEM), Federal Emergency Management (FEMA), and Maryland Department of Natural Resources (DNR). MDOT SHA was also interviewed by the Environmental Systems Research Institute (ESRI), the supplier of geographic information system (GIS) software, for an article on MDOT's efforts toward making its transportation infrastructure more resilient. This case study was published on ESRI's website and highlights how MDOT utilized GIS technology to determine these infrastructure improvements.

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, management, and operational decisions across multiple agencies, including other state and local partners.

The MDOT SHA is looking to refine its data analysis and modeling around central elements of vulnerability assessment and expanding it statewide. Increasing capabilities within the CCVV to efficiently utilize data from the One Maryland One Centerline Program, such as develop story mapping, is also an important ongoing effort to collaborate with stakeholders. In FY 2022, MDOT SHA plans to develop an application to track maintenance inspection information on bridge and pavement assets in real-time to document repeat catastrophic failure of a critical highway or bridge infrastructure during emergency-declared events in the MDOT SHA CCVV to meet the 23 CFR 667 requirements to periodically evaluate facilities repeatedly requiring repair or reconstruction due to emergency events.

The MDOT SHA plans to collect flood-depth grid data and update current and future sea-level rise and associated flood modeling and coordinate with MDOT TSO to identify potential locations of alternative energy infrastructure installation on MDOT SHA properties in FY 2022.

The MDOT TSO is leading several initiatives and funding opportunities including:

In March 2021, MDOT sponsored a pooled fund study to update precipitation frequency estimates for Delaware, Maryland, North Carolina, and Virginia (NOAA Atlas 14 Volume 13), which was approved for funding by the Federal Highway Administration (FHWA). Work on the study began in October 2021. The Atlas 14 precipitation estimates are the standard for designing, building, and operating infrastructure to withstand the forces of heavy precipitation and floods.

In July 2021, the United States Army Corps of Engineers (USACE) received Congressional approval to reprogram federal funds ($1,450,000) towards completion of the Baltimore Coastal Storm Risk Management Study. This funding approval, along with MDOT funding, allowed work on this study to resume. The goal of the study is to reduce coastal flood risk at key locations to people, properties, infrastructure, and resources in the study area, considering future climate and sea level change scenarios.

The MDOT is currently updating its Strategic Asset Management Plan (SAMP) and have initiated work on a Critical Asset GIS Tool. MDOT's Asset Management Program currently requires annual reporting in July of critical asset inventories, condition scores, and criticality. The intended purpose of this GIS tool is to communicate MDOT's critical asset portfolio to senior leadership and stakeholders.

Risks and Opportunities

The MDOT is seeking to elevate and champion climate resilience across the agency. The main challenges include:

Leveraging the information from the SAMP and MDOT's Critical Asset GIS Tool to identify potential impacts to emergency response operations, utility interdependencies, water supply, stormwater, and the potential for cascading failures across the MDOT enterprise.

Providing uniform guidance for climate and extreme weather hazards to TBUs when their operations and resources are unique.

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.

Other challenges include:

- Dynamic modeling to provide a clearer picture of flooding and sedimentation impacts/risks.

- Aging infrastructure is a key risk as asset sensitivities increase vulnerabilities and require funding for maintaining assets in a state of good repair.

- Data and adaptive design guidance for design engineers to inform climate resilient design decisions.

- Funding to execute planned climate resiliency projects and initiatives and for long-term operation and maintenance. 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.

The 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 design, 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.

Greenhouse Gas Mitigation Matrix

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 EVs, 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 goods 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 that the design is environmentally friendly and resilient to climate 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, including nature-based design solutions. Contractors are also competing to install, operate, and maintain solar systems on MDOT properties, resulting in energy use reductions.

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) improves system efficiency and has a measurable impact on major travel indicators and GHG emissions. New, low-carbon vehicle technologies and fuels are becoming more reliable and less costly, 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 ZEEVIC, MDOT also leads a work group dedicated to ensuring that CAV technology is deployed safely and thoughtfully on Maryland's roads.

2020 and 2021 Accomplishments

Maryland continues to be a leader in Zero Emission Vehicles (ZEV) and ZEV infrastructure. In February 2021, Maryland was recognized by Plug-In America as a top 25 state for supporting EV drivers and was ranked as the fourth best state by the American Council for an Energy-Efficient Economy (ACEEE) for its policy and program efforts supporting electrification deployment. Highlights describing Maryland's leadership role are presented in the map (next page) and the points below, including:

- As of October 31, 2021, there are just under 40,000 registered EVs in Maryland – a 42 percent increase from the previous year.
- These vehicles are supported by a growing network of charging stations. In Maryland, there are more than 1,000 charging stations with more than 2,800 outlets, of which 18 percent are DC Fast chargers (DCFCs).
- With FHWA's designation of US 15 as an EV Alternative Fuel Corridor (AFC) in April 2021, Maryland now has a total of 22 EV AFCs.
- As part of FHWA's 2020 Corridor Refresh, I-795, MD 5/MD 235, and US 1 from Joppa to Bel Air were also redesignated from "Corridor Pending" to "Corridor Ready." Maryland now has over 800 miles of AFCs with a "Corridor Ready" designation.
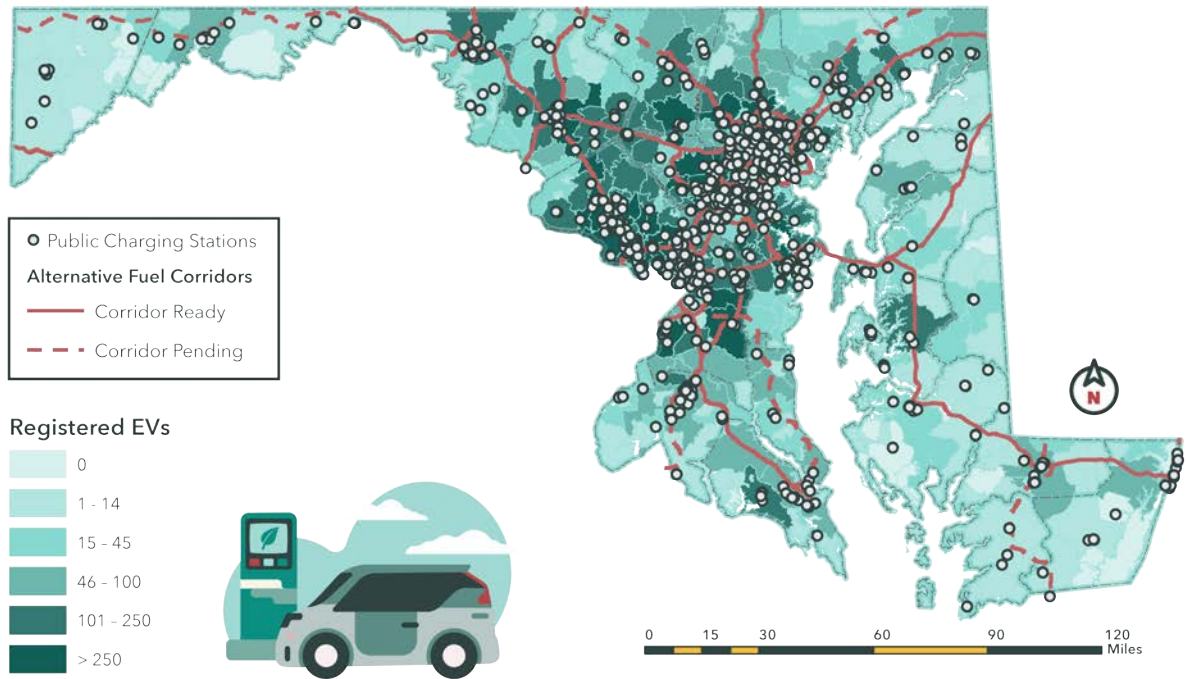
The MDOT is working to identify opportunities for charging infrastructure deployment across Maryland. In 2020, MDOT, in partnership with the Maryland Department of General Services, conducted the Maryland Workplace Charging Survey to identify opportunities for workplace charging at state facilities. MDOT was awarded

Volkswagon (VW) Mitigation funds to install 10 level-2 charging stations at two MDOT workplaces under MDE's Charge Ahead Grant Program. MDOT has also worked with the utilities to identify 24 sites for the charging station installation as part of the Public Service Commission (PSC) Pilot Program. Under this pilot, DCFC stations have been installed at three MDOT sites, including four DCFC stations at BWI Marshall Airport's cell phone lot and six DCFC at the airport's rideshare lot.

The MDOT continues to support the electrification and deployment of medium- and heavy-duty vehicles.

In November 2020, MDOT—in coordination with MDE and the Maryland Energy Administration (MEA)—hosted two webinars on the Medium- and Heavy-Duty Zero Emission Vehicle Memorandum of Understanding. In addition, MDOT finalized the MDOT MTA Zero Emission Fleet Transition Study. The plan provides final recommendations and next steps for MDOT MTA to transition to a 50 percent zero emission fleet by 2030 and a 95 percent zero emission fleet by 2045.

The MDOT supports fleet modernization efforts that will reduce energy use and lower GHG emissions from the transportation sector. MDOT MPA purchased a Chevy Bolt EV, the first compact EV in its fleet. Additionally, MDOT MTA and MDOT Maryland Aviation Administration (MDOT MAA) were both awarded VW Mitigation funds for the purchase of zero emission buses and shuttles. MDOT MTA also purchased new clean diesel buses as part of its five-year bus procurement that will replace 354 buses between 2020 to 2024, providing a potentially significant air quality impact by reducing particulate matter (PM) emissions.

MARYLAND

safe | efficient | equitable
and open for business.

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 December 2020, MDOT led the effort to finalize the CAV Vision and established an official Maryland CAV Strategic Framework. In June 2021, MDOT SHA completed the CAV Implementation Plan and MDOT, in coordination with Maryland Department of Planning, hosted three webinars for local government agencies and released the CAV Toolkit for Maryland Local Jurisdictions. The toolkit provides a list of recommended actions for local jurisdictions when considering CAV technologies.

Strategies Under Development

The 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. Evaluating these emerging technologies should include considering safety, congestion, and equity issues, such as public health, economic, and workforce impacts. The Statewide CAV Working Group is also currently looking into CAV-EV synergies. MDOT SHA funded a statewide public survey for FY 2022 to collect public input on accessible automated connected electric and shared mobility with a goal to generate scenarios to model in the Maryland Statewide Transportation Model. MDOT will continue to refine its estimation of GHG benefits due to congestion relief and fuel efficiency as a result of CAV adoption.

The MDOT will continue to review state fleet procurement procedures and practices as well as identify fleet vehicles eligible for conversion that will meet legislative purchase requirements and support MDOT's Fleet Innovation Plan. MDOT also will continue working with the TBUs to identify and install charging infrastructure at MDOT sites to support its fleet electrification efforts.

The MDOT continues to invest in fleet modernization measures. Work is underway to overhaul six Maryland Area Regional Commuter (MARC) GP39 diesel locomotives by replacing the head-end power engine with a modern microprocessor-controlled Caterpillar C18 engine, resulting in less idling and reduced energy consumption. MDOT MTA and MDOT MAA will participate in a ZEV pilot that will help inform future conversion plans for buses and shuttles with both agencies.

Risks and Opportunities

Maryland has made significant progress in EV adoption and electric vehicle supply equipment (EVSE) installation. To expand progress, the state should continue supportive policies and 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.

The MDOT is also working with the utilities, the PSC, and our state, local, and federal partners under Public Conference 44 (PC44) to ensure the strategic, sustainable, and reliable installation of EV charging infrastructure in Maryland. MDOT, in collaboration with ZEEVIC, will address barriers to EV adoption to ensure that charging is available to those who live in urban environments, multi-unit dwellings, or in homes governed by homeowner's associations.

The MDOT, in collaboration with ZEEVIC, continues to identify opportunities for fuel cell electric vehicles and infrastructure adoption and incorporation in the state.

While technologies offer the most significant GHG emissions reduction potential for the transportation sector, the true potential of GHG benefits will not be fully achieved until the fleet turns over with newer fuel efficient and GHG-beneficial vehicles. In addition, in August 2021, the EPA proposed to strengthen federal GHG emission standards for passenger cars and light trucks for model year 2023 through 2026. The more stringent standards can achieve additional GHG reduction benefits and improved fuel economy as the fleet continues to turnover.

Strategy Benefits

The 42 percent increase in registered EVs in Maryland since October 2020 equates to appoximately 11,600 additional EVs on Maryland roads and a 0.0324 MMT CO2e reduction in GHG emissions.

VMT and GHG emissions decreased dramatically in Maryland in 2020 and 2021 due to the COVID-19 global pandemic impacting travel behavior. As travel begins to rebound back to pre-pandemic levels, transportation technologies will continue to play a critical role in the reduction of GHG emissions.

Congestion Mitigation

MDOT Commitment and Role

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

The MDOT integrated approach to congestion mitigation is administered under the TSMO umbrella of programs at MDOT SHA. The agency's TSMO approach, and other TBU multimodal programs and projects, result in emission reductions by reducing delay to improve mobility, reliability, and safety for transportation system users. MDOT SHA's TSMO strategies leverage technology to optimize capacity that is limited by congestion.

Among the programs and initiatives targeting congestion mitigation, MDOT SHA's CHART program utilizes ITS technologies to enhance travel and address capacity inefficiencies reduce GHG emissions. MDOT's Traffic Relief Plan (TRP) is helping to reduce traffic congestion and improve commute times with technology and capacity improvements in the Baltimore and Washington DC areas.
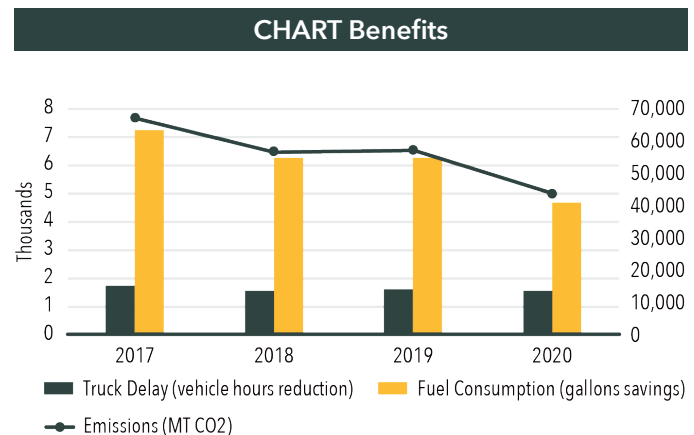

2020 and 2021 Accomplishments

In the last year, MDOT SHA's CHART program responded to approximately 27,000 traffic incidents and assisted 34,000 motorists on Maryland highways. These lower numbers are reflective of reduced VMT during the COVID-19 pandemic. CHART services in traffic incident management, traveler information, and emergency response saved drivers $1.08 billion in delay and fuel costs in CY 2020.

Under the TRP, MDOT SHA and FHWA published the updated I-495 and I-270 Managed Lanes Supplemental Draft Environmental Impact Statement (SDEIS) in October 2021. This federally required report details the environmental impacts and mitigation strategies associated with the proposed managed lane system on I-495 and I-270. The SDEIS comment period continued through November 30, 2021, and included two virtual public hearing sessions.

With the MDTA's toll modernization plan and all-electronic tolling, drivers no longer stop to pay tolls, which reduces delays and forgoes the need for idling, thereby improving fuel efficiency. As of October 2021, all MDTA toll facilities are all-electronic (cashless).

CHART Benefits

Truck Delay (vehicle hours reduction) | Fuel Consumption (gallons savings) | Emissions (MT CO2)

Strategies Under Development

The 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. MDTA continues the I-95 Express Toll Lane (ETL) Northbound extension construction, which will reduce recurring congestion and improve air quality. Additionally, with innovative TSMO approaches, MDOT SHA and MDTA continue to enhance the customer experience with new technologies for safe, efficient, and reliable transportation mobility and operations.

The MDOT continues to study and estimate the emission reduction potential of CAVs and notes the GHG-beneficial effect of CAVs in the MDOT CAV Strategic Framework. The 2020 MDOT GGRA Plan estimated emissions benefits of CAVs through congestion reduction and fuel savings as a result of platooning, reduced crashes, and speed management. It also accounts for the increase in VMT due to new and additional CAVs and increased travel activity due to ease of travel. MDOT launched the statewide expansion of the incenTrip multimodal trip planning app in November 2021 as a congestion mitigation effort. The program aims to reduce traffic congestion in the weekday peak periods by encouraging Maryland travelers and employers to increase public transportation use, ridesharing (carpooling and vanpooling), walking, biking, teleworking, and alternative work schedules. Maryland travelers using the app will earn points, which can be redeemed for up to $600 in cash when they make decisions that will help reduce congestion.

Risks and Opportunities

Increasing demands on Maryland's transportation system due to dense development and economic activity, particularly in central Maryland, continue to result in reliability challenges. As a result, even relatively minor disruptions can lead to significant system-wide delay. Harnessing technology through the deployment of systems along roadways and in vehicles to reduce delays, clear traffic incidents more efficiently, and provide accurate and real-time traveler information continues to help transportation agencies and system users make better decisions to manage or avoid congestion.

The MDOT continues to keep track of research and evolving trends on sustainability impacts of CAVs including emission reductions and the potential to increase access and mobility of some population cohorts, while improving traffic flow optimization, enhancing safety, reliability, and potential economic transformation in freight and logistics sectors as a result of increased efficiency. MDOT will continue to educate and provide outreach on the sustainability and emission reductions potential of CAV adoption.

Strategy Benefits

Based on the performance evaluation and benefit analysis of CHART in 2020, the program is estimated to have helped reduce 43,372 MT in CO_2 emissions through reduced congestion. Total delay, fuel, and cost savings are also included in the table to the right.

The MDOT recognizes that delay and reliability affect freight movement and supply chain reliability, which can in turn impact economic development. MDOT tracks annual hours of delay experienced by truck operators on Maryland's highways. This delay dramatically decreased in 2020, as seen in the figure to the right, primarily due to the COVID-19 pandemic. MDOT leveraged the decrease in congestion by starting and completing projects that improve capacity and reliability.

CY 2020 CHART BENEFITS	
Delay (vehicle hours reduction)	1,490,000
Fuel Consumption (gallons savings)	4,700,000
Emission (MT CO2)	43,372
TOTAL COST SAVINGS ($)	$1,080,380,000

VMT Reduction

MDOT Commitment and Role

MDOT 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. 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 TBUs work together to advance bike and pedestrian friendly designs and policies to promote safety and respect of all transportation system users. The MDOT provides leadership in TDM practices through its Commuter Choice Maryland program and by continuing valuable partnerships with the Metropolitan Washington Council of Governments (MWCOG) Commuter Connections.

2020 and 2021 Accomplishments

The MDOT prioritizes efforts to support Maryland's transit system and the riders that use it. In August 2020, MDOT MTA completed the Shared Mobility Work Plan, which seeks to improve mobility throughout its fixed-route transit system. MDOT MTA also completed the Central Maryland Regional Transit Plan (RTP) in October 2020, which provides a 25-year vision for regional mobility and sets public transportation goals, including increasing transit ridership in the Baltimore Region. Additionally, in partnership with the Transit App, MDOT MTA is set to launch real-time tracking for Light RailLink and Metro Subway Link in late 2021, allowing for a better customer experience.

Walking and biking became increasingly popular in Maryland during the COVID-19 pandemic. In September 2021, Governor Hogan announced $16.8 million to advance 42 bicycle and pedestrian projects across Maryland. The package includes

$12.4 million in federal funding through the Transportation Alternatives Program (TAP), $1 million through the Recreational Trails Program (RTP), and nearly $3.4 million in state funding through MDOT's Kim Lamphier Bikeways Network Program. To assist local agencies in estimating bicycle infrastructure costs, MDOT also released a Bikeways project cost estimating tool for use with grant applications or other project planning purposes.

To focus on pedestrian issues, MDOT launched the second annual Walktober campaign, a month-long celebration, in partnership with various state agencies, county governments, and local and national non-profit organizations. Focusing on increasing safety, encouraging group walks, and visioning for a better walking environment, more than 150 individual events and programs took place.

Beginning June 1, 2021, full-size bicycles were welcome on all MARC trains. All scheduled trains feature at least one car with two bicycle racks. Additionally, MDOT MTA has expanded its bicycle policy to allow personally owned e-scooters and e-bikes on Local Bus, Light RailLink, Metro SubwayLink and MARC Train. Effective December 1, 2021, the new policy means customers can bring foldable e-scooters and e-bikes weighing less than 50 pounds onto transit modes that already make accommodations to carry collapsible and full-size bicycles. This reflects MDOT MTA's commitment to create a fully integrated transportation system for transit and bicycle users.

To improve assessments of bicycle infrastructure, MDOT is transitioning to a Level of Traffic Stress (LTS) metric for measuring bicycle accessibility on state roads. As part of developing this tool, an inventory of all on-road and shared-use paths accessible by bicycle was developed as a component of the One Maryland One Centerline geodatabase. LTS uses fewer metrics to more accurately reflect a person's comfort level while

biking between destinations. MDOT will continue to develop LTS-based analysis including intersection and bicycle network bike sheds.

The Commuter Choice Maryland Program launched the Commuter Calculator in July 2020 with the purpose of encouraging commuters who are thinking about an alternative commute to driving alone with estimation on fuel costs savings, vehicle maintenance cost savings, parking cost savings, emissions pollution reduction and GHG emissions reduction by switching to a non-single occupancy vehicle mode of travel.

The Commuter Choice Maryland Program has expanded its program offerings in the Employer Partner Program. Partners have access to complimentary guided support, assistance with a custom transportation plan and employee travel behavior survey, a featured success story, webinar spotlight, and access to employer assistance resources. Employer participation in the Maryland Commuter Tax Credit (now available on the Maryland OneStop Portal) for eligible expenses for vanpools, cash-in-lieu of parking, and company-sponsored Guaranteed Ride Home increased 240 percent from 2017 to 2019.

The Commuter Choice Maryland Employer Partner Program was launched in July 2021 to recognize these Maryland employers and organizations.

Strategies Under Development

Construction continues on a seven-mile dedicated bus lane on the North Avenue corridor in Baltimore, with completion anticipated at the end of 2021. Construction also continues on the Purple Line, linking Bethesda in Montgomery County to New Carrollton in Prince George's County. MDOT MTA has begun planning studies for two regional transit corridors identified in the Central Maryland RTP. In May 2021, MDOT released a request for proposal (RFP) for a TOD at the Reisterstown Plaza Metro Station and anticipates announcing awardees in winter 2021.

The MDOT continues to provide funding for the Transportation Emission Reduction Program for projects that reduce traffic congestion and provide emissions benefits. The program incorporates and expands proven strategies to reduce emissions and improve Maryland's air quality.

The MDOT SHA is continuing to work on the updated Complete Streets policy and anticipates the new policy—along with implementation details—to be finalized within the coming year. MDOT is continuing to work on creating safe and accessible bicycle facilities to support multimodal needs in coordination with MDOT SHA's Context Driven Guidelines.

Risks and Opportunities

The impact of the COVID-19 pandemic on transit ridership and the associated impacts on MDOT MTA revenues present a challenge that the TBU will face for the foreseeable future. Transit saw a 19 percent decline in ridership from FY 2018 (which included 2019) to FY 2020. This, in addition to other traffic volume declines, severely impacted revenue to the Transportation Trust Fund (TTF) and put many projects on hold. MDOT MTA weekday ridership is projected to increase by 6.9 percent in 2021 compared to 2020, however ridership levels still remain below pre-pandemic levels.

At the same time, MDOT MTA has an array of initiatives underway to improve environmental sustainability and reduce energy use and GHGs. Introducing 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.

As VMT rebounds from levels measured during 2020, Commuter Choice Maryland will play a vital role in ensuring that tools and resources are available to commuters and businesses to choose alternative modes to driving alone, integrate teleworking when possible, avoid travel during congested travel periods, and promote public health and quality of life. Pre-pandemic data from the MWCOG 2019 Report reveals that the share of commute trips made by driving alone fell nearly nine percentage points between 2007 and 2019. Use of transit and telework continued to increase. Several new modes, such as ride-hail, scooters, and bikeshare, joined traditional modes for commute travel. Even before the COVID-19 pandemic, the stage was set for increased work from home; these trends will likely be magnified in the post-COVID normal period. Telework remained a steady upward trend observed since 2007, with more than one million regional teleworkers in 2019. More recently, a 2021 University of Maryland survey found that 65 percent of respondents would prefer to telework two or more days a week post-COVID. Of those who did not telework, "the requirement of physical presence at work" (70 percent) was the predominant reason, pointing to requirements associated with essential workers. The Commuter Choice Program will balance resource offerings to employers and employees with this potentially new commuting pattern.

Strategy Benefits

In 2020 and 2021, MDOT continued to make improvements to its bicycle network, following a 19 percent increase in directional miles of bicycle lanes between 2019 and 2021. Through its Bicycle Retrofit and Neighborhood Conservation programs, MDOT is investing in closing bicycle network gaps and improving bicycle access. These commitments help improve bicycle safety, access, and mobility.

These programs and initiatives advance the goals of mitigating VMT increase and reducing GHG emissions. The cumulative effect of these measurable, attainable, and timely actions across MDOT TBUs will have the lasting impact of reducing emissions.
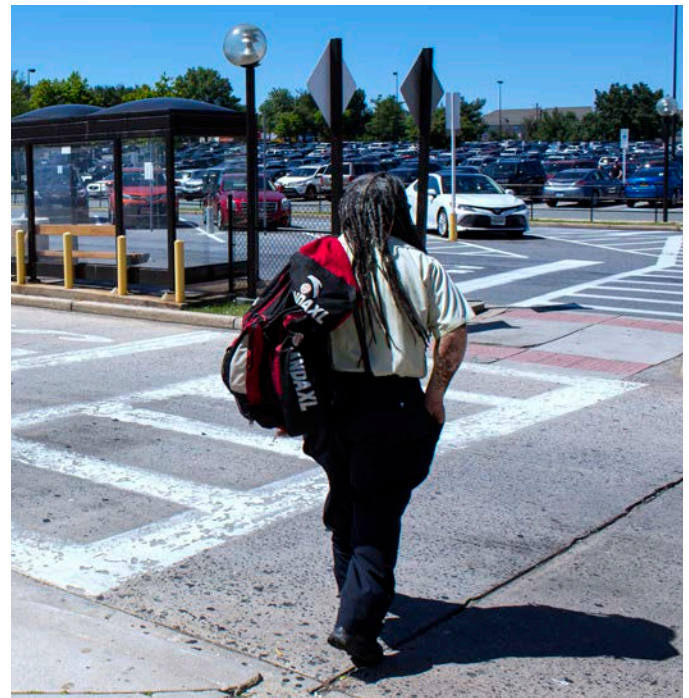
Infrastructure Design

MDOT Commitment and Role

The MDOT is establishing itself as a leader in developing innovative and environmentally friendly infrastructure design that results in a range of benefits, including reducing GHG emissions, minimizing climate impacts, and enhancing resilience to adverse impacts of climate change. MDOT continues to take steps to ensure that its assets and facilities are powered and designed to minimize their environmental impact. MDOT SHA and MDTA also incorporate Leadership in Energy and Environmental Design (LEED) principles into the design and construction of their facilities, saving water and energy, and reducing their emissions impact. MDOT takes steps—through programs such as Complete Streets—to ensure its infrastructure and roadways are designed to promote low-impact forms of travel.

Natural and Nature-Based Features (NNBF) design combines engineering with ecosystem and natural processes to reduce environmental impacts and adapt existing infrastructure to be more resilient. MDOT MPA and other TBUs are adopting innovative strategies, including fostering public-private partnerships to find solutions to stormwater management challenges and restoring ecosystems utilizing dredged materials.

2020 and 2021 Accomplishments

In January 2020, MDOT MTA published "Designing for Transit, Transit-Oriented Development Guidelines." The guidelines are a resource for local developers and communities considering development at or near a rail station. MDOT encourages transit-supportive design for all development near rail stations that includes quality spaces for walking and bicycling to and from transit. The TOD Design Guidelines has recommendations for various station types, whether they are located in a densely populated downtown or in a small town or rural setting. Shifting to TOD and encouraging transit use, walking, and bicycling are important to reducing single-occupancy vehicle use and GHG emissions.

The MDTA's full-time, all-electronic (cashless) tolling implementation at all facilities continues into FY 2022 with its Interim and Final Toll Plaza conversion projects that will remove toll booths and canopies and reduce the physical footprint (paved area) of the toll plazas. All-electronic tolling provides convenience for motorists, less engine idling for better fuel efficiency and reduced emissions, decreased congestion, and increased safety.

The MDOT MPA received a grant from the MEA's Resilient Maryland Program to complete a feasibility study that investigated microgrid options, including wind, solar, batteries, and fuel cells at the Dundalk Marine Terminal.

Additionally, MDOT MPA's electrical maintenance department installed new LED lighting inside four sheds at the Dundalk Marine Terminal in preparation for use by Port tenant BalTerm, which handles cargo for many of the world's largest forest product companies. The new lighting will result in an energy cost savings of more than $70,000 per year and is expected to remove 559 equivalent tons of CO2. This is equal to the emissions from the electricity used by 70 homes during the course of one year or the GHG emissions from 93 passenger cars per year.

Natural and Nature-Based Features

Before Smart Pond Installation

After Smart Pond Installation

High-Performance Pond Partnership: A unique public-private partnership involving MDOT has been established to provide reduced cost Total Maximum Daily Load (TMDL) water quality credits to the agency. Following Maryland Environmental Service (MES), vendor advertisement and procurement, OptiRTC, a developer and vendor of stormwater management technology, was contracted to provide up to 100 acres of TMDL credits at a set per-acre fee for a 20-year period. OptiRTC partnered with Walmart to retrofit existing Walmart-owned stormwater management (SWM) ponds with advanced technology that significantly reduces pollutant loads in stormwater runoff. This high-performance pond partnership demonstration project (HP3) serves as a national model for innovative SWM program delivery. This HP3 is the first of its kind implemented with a department of transportation and helps Maryland achieve greater environmental stewardship and multi-beneficial outcomes for communities. MDOT and MES will develop a white paper outlining the lessons learned from this project. It is anticipated this paper will be finalized by the end of 2021.

Poplar Island Expansion Complete: MDOT MPA and the US Army Corps of Engineers completed the Poplar Island Ecosystem Restoration Project lateral expansion, which will provide 575 additional acres for dredged material. This adds 28 million cubic yards of storage capacity and creates additional opportunities for wetland restoration, which encourages carbon sequestration, or the process of capturing and storing atmospheric carbon dioxide. This reduces the amount of carbon dioxide in the atmosphere and helps reduce emissions that drive climate change.

Strategies Under Development

Mid-Chesapeake Bay Island Ecosystem Restoration: Pre-Construction Engineering and Design 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. Implementation will create additional acreage of Bay Island wetlands, which will serve as important barrier islands providing shoreline protection to areas of Dorchester County.

The 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. The policy implementation will be driven in large part by the Context Driven Guide published by MDOT SHA.

Risks and Opportunities

Infrastructure design changes and evolution may span longer timeframes until their complete implementation. Additionally, it may be some time before realizing or accounting of the estimated resulting comprehensive benefits.

The MDOT continues active collaboration with private partners, such as the aforementioned HP3 project with Walmart, which has been a great opportunity to broaden the environmental benefits to more communities in Maryland. This has been recognized as a model replicated elsewhere in the Mid-Atlantic and across the nation.

Strategy Benefits

The MDOT SHA, in coordination with MDOT TSO, employs multiple forms of green infrastructure, which are part of LEED principles for new and old facilities. These green designs include daylighting, which works by harnessing natural light through roof skylights, geothermal heat exchange for heating and cooling buildings, and permeable walkways and roads.

The MDOT SHA exceeded its FY 2020 goal of treating 20 percent of its impervious surface not previously treated by stormwater management controls, with 35 percent treated through October 2020 and an anticipated 38 percent treated through June 2021. Best Management Practices (BMPs) include impervious surface elimination to pervious, new stormwater control structures, grass swales, stream restoration, tree planting, inlet cleaning, and more.

The MDOT promotes TOD as an approach to help increase transit ridership, support economic development, and maximize the efficient use of transportation infrastructure. TOD is widely known as a significant and effective land use and development strategy, but is particularly important in Maryland as a tool to help leverage transportation infrastructure investments, promote active and engaged communities, protect environmental and land resources, and support growth without adding traffic congestion. MDOT has partnered with many other state agencies to develop an interactive site, the State TOD Hub, that is a springboard for local jurisdictions, planners, elected officials, non-profit organizations, educational institutions, real estate professionals, and the general public who are interested in advancing TOD or TOD principles in their jurisdictions. See Maryland's map of 16 designated TOD sites. A recent example is the project at the Reisterstown Plaza Metro Station in Baltimore City. After a completed Phase I, that constructed the new Social Security Administration Building (SSA), Phase II is looking to develop approximately 25 acres of unimproved land and surfaced parking lots. MDOT has the Transit Station Area Profile Tool (TSAPT) to provide users socioeconomic, demographic, employment, and ridership data at station areas. MDOT is also seeking responses to a Request for Expressions of Interest (RFEI) from experienced respondents interested in transforming surface parking lots and unimproved land into a dynamic mixed-use Transit Oriented Development (TOD) project in the Elkridge area of Howard County. The approximately 21-acre site sits along US 100 (Exit 7) adjacent to the MARC Dorsey Train Station which averages 530 daily boardings.

According to Maryland Department of Planning, TOD residents use transit four to 10 times more, walk three to four times more, and bike one to two times more than those who live in other areas. Those who live, work and/or shop in TODs drive 20-40 percent less and reduce greenhouse gas emissions by 2.5 to 3.7 tons per year per household.

MDOT
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