VDOT
Virginia Department of Transportation

BIENNIAL REPORT

2020

VDOT AT A GLANCE

9 DISTRICTS

PAVEMENTS STATEWIDE
129,047
lane miles

STRUCTURES STATEWIDE
21,173

3rd Largest
State-maintained Highway System in the U.S.

Safety is not just a slogan, it is our focus.

10
PERFORMANCE METRICS for delivery of routine maintenance

25
SPECIAL STRUCTURES STATEWIDE INCLUDING:

7 Tunnels

8 Movable Bridges

10 Complex Structures

8.5 Million
VA POPULATION

Ranked #1
BY CNBC AS THE 2019 TOP STATE FOR BUSINESS

~7,800
VDOT EMPLOYEES

~40% OF VDOT'S LEADERSHIP TEAM ARE WOMEN

31 RESIDENCIES,
194 AREA HEADQUARTERS
Keeping the system operational and safe

5 REGIONAL TRAFFIC OPERATIONS CENTERS,
Over 60 SAFETY SERVICE PATROL ROUTES
Helping maintain the flow of people and goods

Letter from the COMMISSIONER OF HIGHWAYS

January 22, 2021

Governor Northam, Members of the General Assembly, and Members of the Commonwealth Transportation Board:

I am pleased to submit the Commissioner of Highways Biennial Report for 2020.

Section 33.2-232 of the *Code of Virginia* directs the Commissioner of Highways to provide the Governor, the General Assembly and the Commonwealth Transportation Board a biennial report.

To meet the requirements of the legislation, I am submitting this report, which includes the information required and explains the basis for investment in the surface transportation network maintained by the Virginia Department of Transportation.

If anyone has any questions, or needs any additional information, please do not hesitate to contact me.

Sincerely,

Stephen C. Brich, P.E.
Commissioner of Highways

CONTENTS

SAFETY FOCUSED

Americans have all faced challenges presented by the COVID-19 pandemic and have had to work together to address those challenges. Likewise, VDOT has responded to and implemented measures to address COVID-19.

FLEXIBILITY THROUGH THE PANDEMIC

- Using variable message signs to reinforce the commitments that Virginians have made.
- Following safe practices for VDOT workers and contractors constructing and maintaining our roadways.
- Partnering with the DMV to use 10 Virginia highway weigh stations as temporary rest areas for those delivering food and essential supplies.
- Increasing cleaning of Safety Rest Areas.
- Requiring face masks and social distancing in all work environments.
- Encouraging telework for all employees who are able.
- Leveraging technology and using alternatives to in-person meetings.

USING REDUCED TRAFFIC VOLUMES TO EXPEDITE CONSTRUCTION ACTIVITIES

BENEFITS FOR VIRGINIANS

- Provided faster construction delivery that reduced costs and disruption.
- Improved safety for the traveling public, VDOT workers, and industry partners.

VDOT has a robust statewide traffic count program. With the onset of the pandemic, VDOT monitored the changes in traffic volumes using traffic count stations and operations centers. By the middle of April 2020, traffic volumes across the Commonwealth plummeted by as much as 64% for all vehicles, while truck traffic for the same timeframe dropped to 30% lower than the previous year as presented to the Board in June 2020. With traffic volumes reduced, VDOT was able to expedite construction and maintenance work on some of the Commonwealth's busiest roadways. This included undertaking more work during daylight hours and extending work hours to improve efficiency.

DELIVERING A SAFE AND EFFICIENT TRANSPORTATION SYSTEM

The core of VDOT's mission is to operate and maintain a safe and efficient transportation system for all users. These objectives are delivered through a forward thinking, strategic approach that values data-driven decision making and innovation.

[REQUIREMENT 4]
A description of transportation systems management and operations

VDOT uses performance management to continually assess and improve its core operational programs while incorporating innovations into its processes and programs to improve efficiency. In the Operations arena, VDOT embraces TSMO - Transportation Systems Management and Operations – as the key to delivering the most efficient system possible. TSMO also aims to align programs among partner agencies to enhance operations through improved coordination and shared resources facilitating the delivery of seamless transportation services. This approach enables VDOT to keep Virginia moving in a safe, reliable and cost effective manner and to improve the quality of life of the traveling public.

In both the previous two fiscal years, approximately 60% of congestion on Virginia's freeways was recurring congestion – volumes too high for the capacity of the roadway and the remainder of the congestion was non-recurring causes which includes crashes, other incidents, work zones and weather events. A similar situation exists on arterials, with national studies indicating that 5% of congestion is attributed to poor signal timing, 55% caused by non-recurring congestion and the remaining 40% by bottlenecks.[1,2]

VDOT targets these specific sources of congestion through holistic management of our arterial networks and corridors, innovative technology deployments and continual improvement of our core program areas. Combining this focus with an unrelenting pursuit of safety enables VDOT to provide the best transportation system possible to the Commonwealth.

We Keep Virginia MOVING

Combating Recurring Congestion

[REQUIREMENT 6] Actions to improve highway operations within the Commonwealth

Building new roads and increasing capacity is only one way VDOT reduces recurring congestion. Through an active TSMO Program, VDOT optimizes the available roadway capacity which can eliminate or delay the need for a capital improvement project by several years.

ARTERIAL MANAGEMENT

Effective arterial management is critical to keeping Virginia moving safely and efficiently. Traffic signals are a key operational component of the arterial system. With over 3,100 VDOT operated signals across the state, improved operations can make major impacts.

VDOT is at an exciting juncture as it transitions to a real-time, proactive signal and arterial management program that will provide all Virginia road users decreased delays, increased throughput, improved safety, access to real-time arterial information and reduced emissions. VDOT will be able to quickly adapt to changing demand with these upgrades providing greater travel time reliability to the public even during incidents, special events or unexpected changes in demand. The signal and arterial management program is comprised of four main improvement initiatives (**Figure 1**) to upgrade VDOT's statewide signal system technology.

FIGURE 1 | **Improvement Initiatives in VDOT Statewide Signal System Technology Upgrade**

COMMUNICATIONS UPGRADES

Facilitating the connection between on-street hardware and office systems

70%
COMPLETE TO DATE
2022
COMPLETION YEAR

ADVANCED TRAFFIC SIGNAL TECHNOLOGY

Improving control, security and preparing for connected and autonomous vehicles

75%
COMPLETE TO DATE
2022
COMPLETION YEAR

AUTOMATED TRAFFIC SIGNAL PERFORMANCE METRICS

Providing VDOT with individual real-time intersection performance metrics

5%
COMPLETE TO DATE
2022
COMPLETION YEAR

CENTRAL SIGNAL SYSTEM

Facilitating remote control of all of VDOT's traffic signals to allow operation as a system

30%
COMPLETE TO DATE
2021
COMPLETION YEAR

BENEFITS FOR VIRGINIANS

These technologies will facilitate sustained optimized signal operations. VDOT projects an **annual user and environmental benefits of over $225 million** across the statewide system through:

- 11 million hours of reduced delay
- 450 million fewer vehicle stops
- 14 million gallons of reduced fuel consumption
- Over 1,400 metric tons of emissions reduced

Further validation of these benefits at a sample of 160 intersections where these technologies have been deployed show **multiple measurable benefits:**

- Travel time reductions of 18-67%
- Reduction in stops of 8-76%
- Reductions in crashes of 20% and of injury crashes by 29% annually

These investments are leveraging on-going funding through multiple sources including the Highway Maintenance and Operations Program (HMOP) funds, Innovation and Technology Transportation Fund (ITTF), Highway Safety Improvement Program (HSIP) funds, fiber resource sharing and the Interstate Operations and Enhancement Program funds. In addition to providing immediate benefits today, these investments improve our readiness for tomorrow's connected and autonomous vehicle environment.

REGIONAL MULTI-MODAL MOBILITY PROGRAM (RM3P)[3]

The RM3P incorporates Integrated Corridor Management (ICM) concepts across a large geographic area. ICM focuses on using or integrating the capacity of all parallel arterial and interstate highways and modes of travel to manage recurring and non-recurring congestion events. The RM3P effort combines multiple ICM corridors to form a regional strategy. VDOT has partnered with the Virginia Department of Rail and Public Transportation and the Northern Virginia Transportation Authority to implement one of the nation's first unified, regional, predictive, transportation programs.

BENEFITS FOR VIRGINIANS

When the new system is operational in 2022, Northern Virginia commuters can expect:

- Optimized transportation system performance through improved efficiency of agency responses to travel disruptions.
- Enhanced travel time reliability.
- More informed, on-demand, multi-modal trip choices for travelers.

The RM3P effort is using innovative strategies to combine multimodal data sources in a data-exchange platform. This data will then be used in Virginia's first Artificial Intelligence (AI) based decision support system to assist in managing traffic events. This system will ultimately enable travelers to make decisions with the complete knowledge of all modal options which are especially useful when major incidents occur. RM3P will also help local, regional, and state agencies work together more quickly and effectively to resolve disruptions that slow travelers.

In 2019, this project received funding through the ITTF; in 2020, VDOT was awarded a $4.3 million Federal Highway Administration grant to expand the RM3P program into the Fredericksburg District. Success in the Northern Virginia area will lead to expansion in other areas of the state.

CORRIDOR IMPROVEMENT PROGRAMS

[REQUIREMENT 8]
☑ The status of the Interstate Operations and Enhancement Program

Through a data-driven, holistic process, opportunities have been identified along Virginia's busiest corridors to provide **faster, safer, and more reliable travel.** By deploying a wide range of innovative and core operations strategies, VDOT is providing an integrated solution to reduce congestion.

VDOT has completed the evaluation of both I-81 and I-95 and is near completion of I-64/664. VDOT is planning to complete Corridor Studies for I-77, I-85, and I-295 in early 2021.

Chapters 1230 and 1275 of the 2020 Acts of Assembly enacted section 33.2-372 of the *Code of Virginia*, establishing the Interstate Operations and Enhancement Program. Per the code, the Board must establish the Interstate Operations and Enhancement Program to improve the safety, reliability and travel flow along interstate highway corridors in the Commonwealth. The estimated revenues for the program were presented to the Board in March 2020.[4] All Interstate Operations and Enhancement Program requirements to include allocation of revenues, current and projected performance and anticipated benefits will be included in future reports.

I-81 CORRIDOR IMPROVEMENTS

In 2019, VDOT presented the General Assembly with the I-81 Corridor Improvement Plan.[5] Support for the plan was confirmed through dedicated funding sources for projects identified as priorities and funding became available in July 2019. VDOT aggressively implemented recommendations to expedite travel improvements to the traveling public. On July 1, 2019 three new Safety Service Patrol Routes were deployed, followed by 8 curve warning systems, and 51 cameras within the next 6 months. Capital Projects are in different phases, 16 in planning, 32 in design and 8 are complete. Arterial improvements along parallel roadways are currently under design and will support infrastructure on both the VDOT and Locality systems.[6] A statewide Towing Recovery Incentive Program (TRIP) contract has been advertised to provide an additional incident management strategy. The benefits to the public have been immediate. Future operations and roadway projects will continue to reduce delays and improve safety to create a more reliable regional travel network.

BENEFITS FOR VIRGINIANS

I-81 benefits in the first 5 months as of November 2019:[7]

- Incident clearance time has reduced by 7 minutes.
- Incident and emergency response times have reduced by 4 minutes.
- Vehicle hours of delay have reduced by 100,000 equating to $3.8 million in time saved by motorists not waiting in traffic.

I-95 CORRIDOR IMPROVEMENT PLAN

In 2019, the Secretary of Transportation and the Board requested the entire length of I-95 be considered in the I-95 Corridor Improvement Plan. I-95 is a key artery of the state carrying almost $200 billion of goods every year with many transit options as well—Metrorail, Commuter/Express Bus, and Amtrak.[8] With 21,000 crashes in the last four years and annual person hours of delay exceeding 1.2 million at some locations, a data driven analysis was used to identify a suite of improvements aimed at providing a faster, safer and more reliable travel experience to all users. Operational improvements that offer high return on investment and are fastest to implement are recommended for early implementation. The plan adopted by the Board in January 2020 includes cameras, message signs, three new safety service patrol routes, and towing programs. The study also recommended active traffic management strategies including variable speed limits, ramp metering, and work zone technologies. Funding was approved to allow initial operational improvements to begin in July 2020 and the advanced systems are under development with fall 2021 planned for earliest deployment.

BENEFITS FOR VIRGINIANS[9]

- It is anticipated that the initial investment in the towing program will **reduce incident clearance by 27 min per incident.**
- Safety service patrols investments will **reduce incident duration by 17%.**
- Variable speed limits are anticipated to **reduce crashes by 8% and increase vehicle throughput by 5%.**
- Ramp metering may **reduce travel times as much as 22%** at targeted locations.

Two unique operational projects identified in the I-95 Corridor Improvement Plan include:

VARIABLE SPEED LIMITS (VSL)

VSL systems enable proactive management of the traffic. By adjusting speed limits at intervals along the corridor, vehicles move steadily and stop and go traffic is prevented leading to shorter travel times and more reliable trips. VSL also serves to alert drivers of upcoming situations and are proven to reduce congestion-related crashes. Planning and project development is underway for a pilot VSL system for northbound I-95 near Fredericksburg; deployment is scheduled for fall 2021.

RAMP METERING

Ramp metering regulates the flow of traffic entering a freeway to ease traffic congestion on the mainline. Ramp metering has been successfully implemented in the Commonwealth on several corridor segments in Northern Virginia (I-395 and I-66) and a system is currently under development for I-95 also in the Northern Virginia District, with a current installation planned for 2024.

Combating Non-Recurring Congestion

Core to VDOT's TSMO program is the everyday work of our Traffic Operations Centers (TOCs) and the many operational strategies they deploy to minimize the impacts of non-recurring congestion. By managing incidents and their impacts, providing accurate, real time traveler information; managing work zones and fostering strong relationships with our partners, the TOCs improve safety and reliability throughout the highway network.

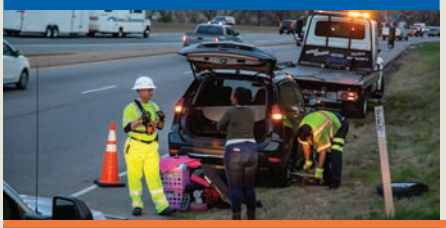
INCIDENT MANAGEMENT

Effective Incident Management requires the quick detection of all things impeding traffic, immediate deployment of the right response, the dissemination of real time traffic management and route detours when needed. Mobility data regarding the operating condition of state highways and the average duration of incidents are included in Appendix C.

CCTV CAMERAS

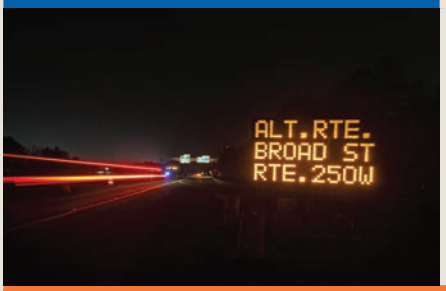
By the end of 2021, VDOT will install more than 150 additional CCTV cameras. These cameras are used to detect incidents and provide visual verification and situational awareness for the TOC.

SAFETY SERVICE PATROLS (SSP)



SSP Route expansion has occurred on I-66, I-81, I-95, and Virginia Route 28 and has extended hours on existing routes. Eighteen routes now operate 24/7. **Incident durations can be reduced 17% when a safety service patrol program is available.** Reducing the duration of incidents can prevent secondary crashes from occurring in the traffic backups caused by the original event.

DETOUR PLANS



VDOT has implemented a standard detour plan template to address VDOT and public safety agency priorities when an incident detour is necessary. A standard, statewide template shortens the time to implement a detour for all responders and jurisdictions, improving the traffic flow through the affected area. VDOT will be expanding the detour plans to cover all corridors.

TOWING RECOVERY INCENTIVE PROGRAM (TRIP)

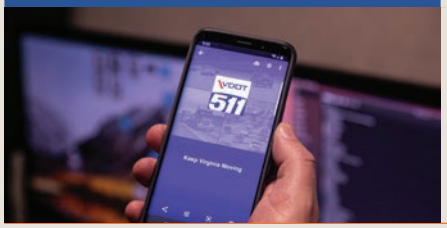
VDOT's Corridor studies verified a need to expand towing and recovery operations for faster incident response. This program will provide incentives to towing and recovery firms to clear complex incidents faster. TRIP benefits emergency responders and the traveling public by facilitating the quick clearance of large commercial vehicle incidents, resulting in a reduction of congestion and secondary incidents. **TRIP can reduce the length of complex incidents by 22%.**[10] After a successful pilot completed in 2019 this program is now being expanded across the Commonwealth.

TRAVELER INFORMATION

DYNAMIC MESSAGE SIGNS (DMS)

During 2020 and 2021, VDOT plans to install or upgrade more than 40 dynamic message signs along the I-81, I-95 and I-64 corridors. The message signs provide real time travel information to motorists contributing to the proactive management of traffic and incidents. The addition of DMS in combination with CCTV on the I-95 corridor alone is expected to provide more than $3.50 in safety, mobility and environmental benefits for every $1 invested.

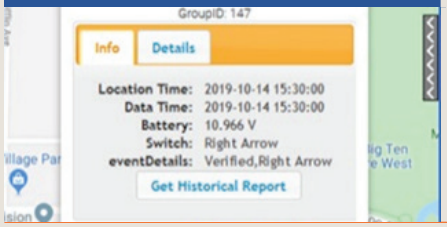
ENHANCED 511



VDOT plans to replace its current 511 service with a new and more powerful tool in early 2022. The new service will include "geo-fencing" technology that will allow VDOT to send targeted information along specific corridors to alert motorists of adverse traffic conditions along their route. By providing relevant, real time information to drivers, VDOT can improve safety and trip reliability.

WORK ZONE MANAGEMENT

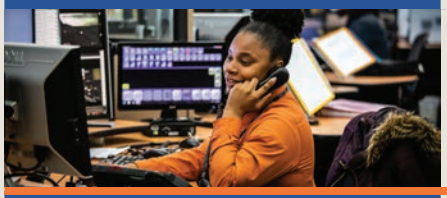
ADVANCED WORK ZONE TECHNOLOGIES



Advanced technologies for work zone management provide the VDOT TOC the ability to actively manage and inform the public of work zones along corridors. Not only are work zones a cause of delay, they experience higher rates of incidents. By providing accurate and timely information including end of queue warning, safety is improved and drivers can choose alternate travel options resulting in more reliable travel times.

PARTNERSHIPS WITH PUBLIC SAFETY RESOURCES

INTEGRATION OF PUBLIC SAFETY RESOURCES



The new Joint State Operations Center (JSOC) was completed in 2019. This Richmond facility co-locates VDOT and Virginia State Police in one building for improved coordination resulting in better service delivered to the public.

TRAFFIC INCIDENT MANAGEMENT (TIM) PROGRAMS

VDOT continues to partner with state and local law enforcement agencies and private sector towing and recovery services **to clear traffic incidents safely and efficiently.** A 2019 study of this program identified a **62 minute reduction in the average clearance time.**

Innovative Safety Program

VDOT continues to make highway safety its top priority, focusing on the strategy outlined in the Strategic Highway Safety Plan (SHSP).[11] The SHSP includes infrastructure focus areas to address road departure, intersection, and pedestrian and bicycle crashes as well as to improve crash data and analysis methods. The plan is implemented through a blend of funding sources, including state and federal funds, such as the federally funded HSIP.

SYSTEMIC SAFETY IMPROVEMENT PLAN

BENEFITS FOR VIRGINIANS

When completed in the coming years, the systemic plan is expected to:

Save over 60 lives and 1100 injuries every year.

VDOT is currently implementing its first Systemic Safety Implementation Plan[12] that was approved by the Board in late 2019 and has something to benefit each of the SHSP infrastructure focus areas. The systemic plan will install eight proven safety countermeasures across Virginia on road locations that meet the defined criteria. The eight improvements include traffic signal backplates, flashing yellow arrows, pedestrian crossings at signals, curve delineation, and improvements at unsignalized intersections, in addition to installing rumble strips (centerline and edge line) and pavement shoulder wedge (safety edge) when roads are resurfaced.

Program Delivery

Over recent years, VDOT has embraced data driven decision making by investing in tools, data, processes and human resources to transform our data into information. An asset management approach is used to distribute HMOP and performance measures and return on investment analysis determines the optimum operational strategies to deploy. VDOT efficiently leverages the funding sources available to provide a safe and reliable transportation network throughout the Commonwealth.

INNOVATION AND TECHNOLOGY TRANSPORTATION FUND

While VDOT operations is funded with different resources (e.g., HMOP), the ITTF was established by Section 33.2-1531 of the *Code of Virginia* to provide funding specifically for the purpose of piloting programs and initiatives pertaining to high-tech infrastructure improvements with a focus on:

- Reducing congestion
- Improving mobility
- Improving safety
- Providing up-to-date travel data
- Improving emergency response

In October 2019, the Board approved a list of 13 projects (with a total value of $67.8 million) for the use of ITTF funds for Fiscal Years 2020–2024.[13] The ITTF was leveraged to assist in funding a portion of the following the initiatives described above:

- The I-95 Variable Speed Limit project. The project will be financed using funds from ITTF and the I-95 Corridor Improvement program (Interstate Operations Enhancement Fund).
- Communications upgrades
- RM3P

As operational programs are piloted to include some of the ones described in this section; the HMOP is typically the resource to maintain these efforts and others as piloted projects are approved for implementation and institutionalized. In the world of operations, a project will end, but the program continues indefinitely. The program requires continuous investment. If technology becomes obsolete, reliability, efficiency and safety may be compromised.

CYBERSECURITY

In Virginia, roadway operations and traffic control services are provided by using advanced technology solutions integrated within routine operational functions. Technology solutions include sophisticated edge devices, a mesh of telecommunication networks, and a complex set of control systems, such as the statewide traffic signal system, operated with our five TOCs. Proliferation of digital assets, connecting to cloud and mobile services, and increasing reliance on data driven operations has propelled the need for cybersecurity improvements and technology hardening.

VDOT has adopted a comprehensive approach to improving cybersecurity supporting transportation operations. This approach ensures tools and systems are resilient, processes are streamlined, and people are trained. VDOT is in phase three of a three-phase journey to improve its cybersecurity:

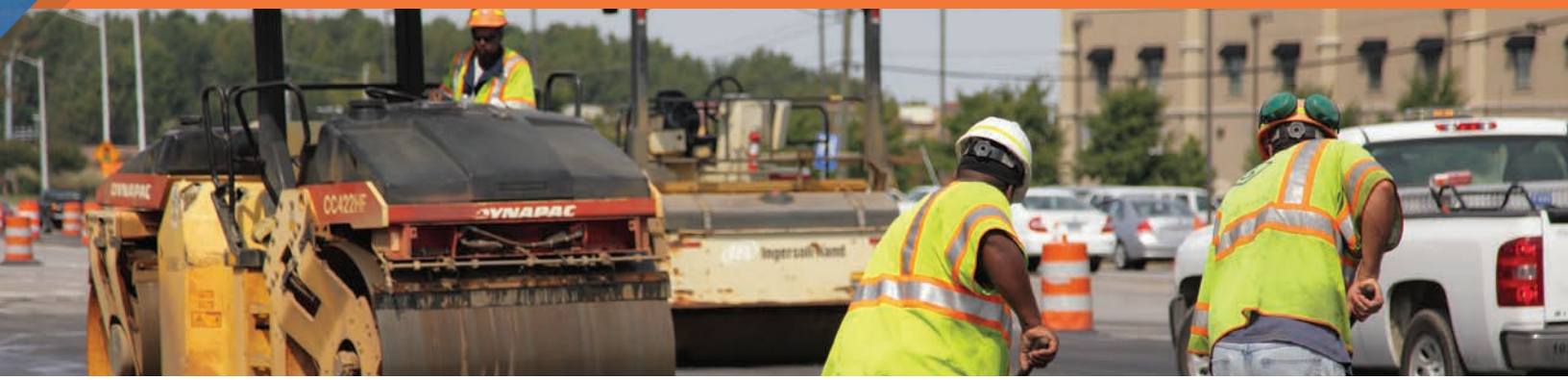
2018
VDOT completed a comprehensive assessment of the operations technology environment.

2019
VDOT completed the design of a defense-in-depth secure operating environment.

2020 and 2021
VDOT is implementing solutions and services to translate the design into operational reality.

VDOT'S FUTURE: MAINTAINING INFRASTRUCTURE WHILE ENSURING TRANSPARENCY AND FOCUS ON BUSINESS ACUMEN

Along with safety and operations, maintenance of the transportation network is at the forefront of VDOT's investment decisions. VDOT is committed to assessing the maintenance investment needs and establishing goals to keep infrastructure and facilities in good repair.



Maintenance and Operations Comprehensive Review

In 2019, VDOT conducted a Comprehensive Review of the Commonwealth's investment in transportation assets funded by VDOT's Maintenance and Operations and State of Good Repair Programs. The Comprehensive Review entailed the development of an investment strategy to achieve long-term sustainable performance targets for pavements, bridges, and special structures and to satisfy the requirements of the Robert O. Norris Bridge and Special Structures Fund legislation (2019 Acts of Assembly, Enactment 2 of Chapters 83 and 349, as amended).

As a result of the Comprehensive Review, in December 2019, the Board:[14]

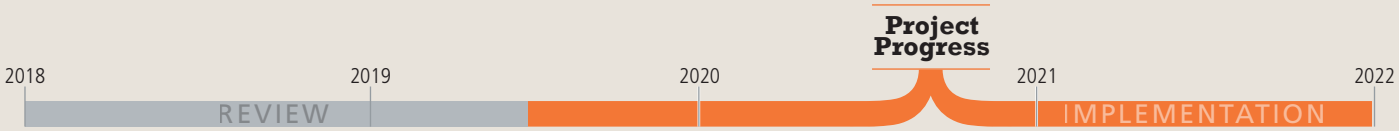
- Adopted new performance targets for pavements.
- Adopted new performance measures and targets for structures.
- Supported development of a special structures health index and risk-based prioritization of projects.
- Required an Annual Report that summarizes planned and actual achievement of performance targets.
- Approved the 2019 Comprehensive Review report.

MAINTENANCE AND OPERATIONS COMPREHENSIVE REVIEW[15]

Aligned with the Commissioner of Highway's vision to ensure VDOT is business-focused, VDOT conducted a comprehensive review of the Commonwealth's investment in transportation assets funded by VDOT's Maintenance and Operations and State of Good Repair Programs (*2019 Maintenance and Operations Comprehensive Review* Report - "Comprehensive Review")

BENEFITS FOR VIRGINIANS

- Saves up to $145M annually while meeting all statewide performance measures.
- Equips the Commonwealth with a sustainable, 20-year investment strategy for highway pavements, and 50-year investment strategies for bridges and Special Structures.
- Establishes VDOT accountability through an annual reporting requirement for pavements, bridges, special structures and routine maintenance to measure actual performance against planned results.



Maintenance Needs and the Highway Maintenance and Operating Fund (HMOF)

[REQUIREMENT 1]
☑ The methodology for the allocation of funds from the HMOF

The methodology used to determine maintenance needs is part of VDOT's continuous cycle of asset management that begins with assessing asset inventory and condition and ends with performance monitoring, as illustrated in **Figure 2**.

Annually, VDOT uses condition assessments for pavements and bridges to develop a cost estimate for repairing or replacing these assets. VDOT refers to these costs as needs. This condition assessment is described and reported in the State of the Structures and Bridges[16] and the State of the Pavement[17] reports.

VDOT collects, compiles, analyzes, and reviews the pavement condition data to report the optimized needs at a system and district level. VDOT's pavement program selects specific projects based on highest priority needs and optimizes timing of projects through a data-driven pavement management system.

VDOT uses bridge management software to store bridge condition and inventory data for each structure and to program, schedule, and track bridge and structure inspections. The data collected during visual inspections allow VDOT to use a proactive approach to determine maintenance needs. Preventive maintenance and timely repairs avoid and slow deterioration, which, if not undertaken, can lead to greater rehabilitation or replacement costs.

FIGURE 2 | VDOT's Asset Management Cycle

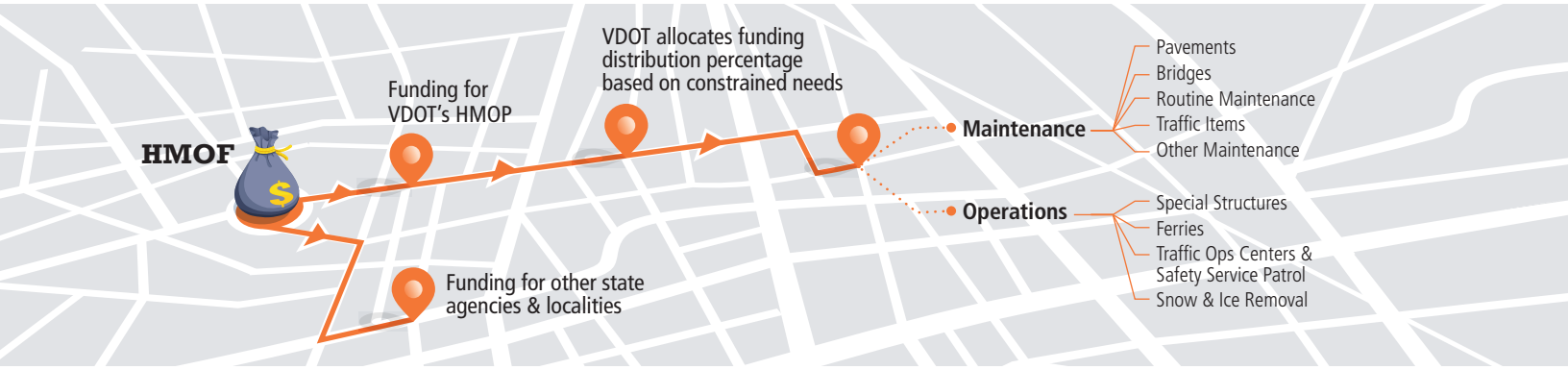
Using this approach allows VDOT to evaluate or assess pavement and bridge repair costs or needs in sequential steps, as illustrated in **Figure 3**.

FIGURE 3 | **Methodology for Assessing Annual Pavement and Bridge Maintenance Needs**

The costs to maintain and operate VDOT's other essential assets and services are determined based on engineering principles, industry-recognized best practices, or historical expenditures.

Localities and other state agencies receive payments from the HMOF. The method used to compute the amount each locality is paid is established by statute. Funds from the HMOF support VDOT's Highway Maintenance and Operations Program (HMOP) for the agency's maintenance, operations, and services. Once VDOT receives the HMOP distribution, funding is allocated statewide based on the needs assessments. This process is shown in **Figure 4**.

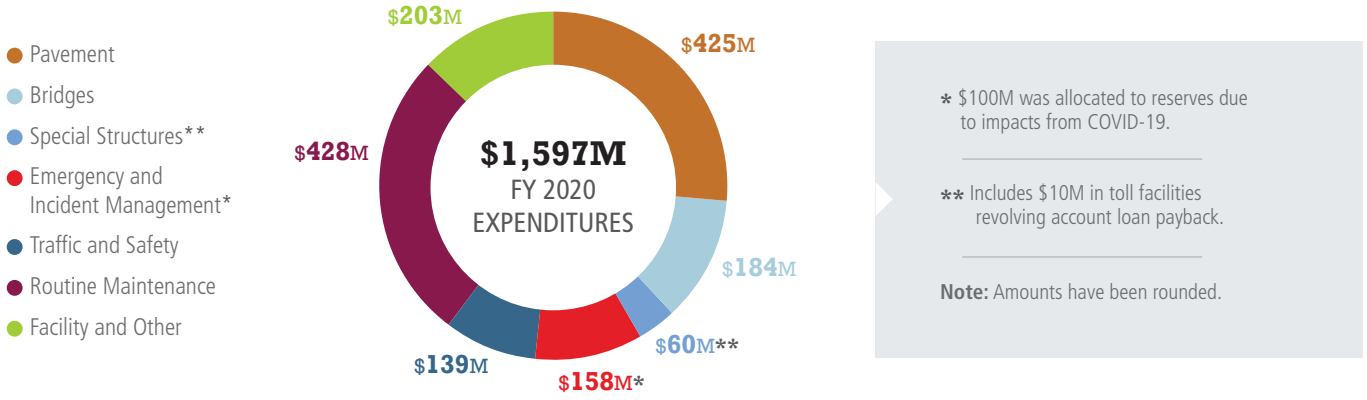
FIGURE 4 | **HMOF Funding Allocation Methodology**



VDOT employees and contractors execute the HMOP, which includes the activities (assets and services) listed in **Figure 5**. The needs assessments are used to distribute the HMOP budget in the beginning of a fiscal year then expended throughout the year. The FY 2020 expenditure by district and activity is provided in Appendix B. The FY 2020 budget and expenditures were in effect and underway prior to the implementation of the Comprehensive Review.

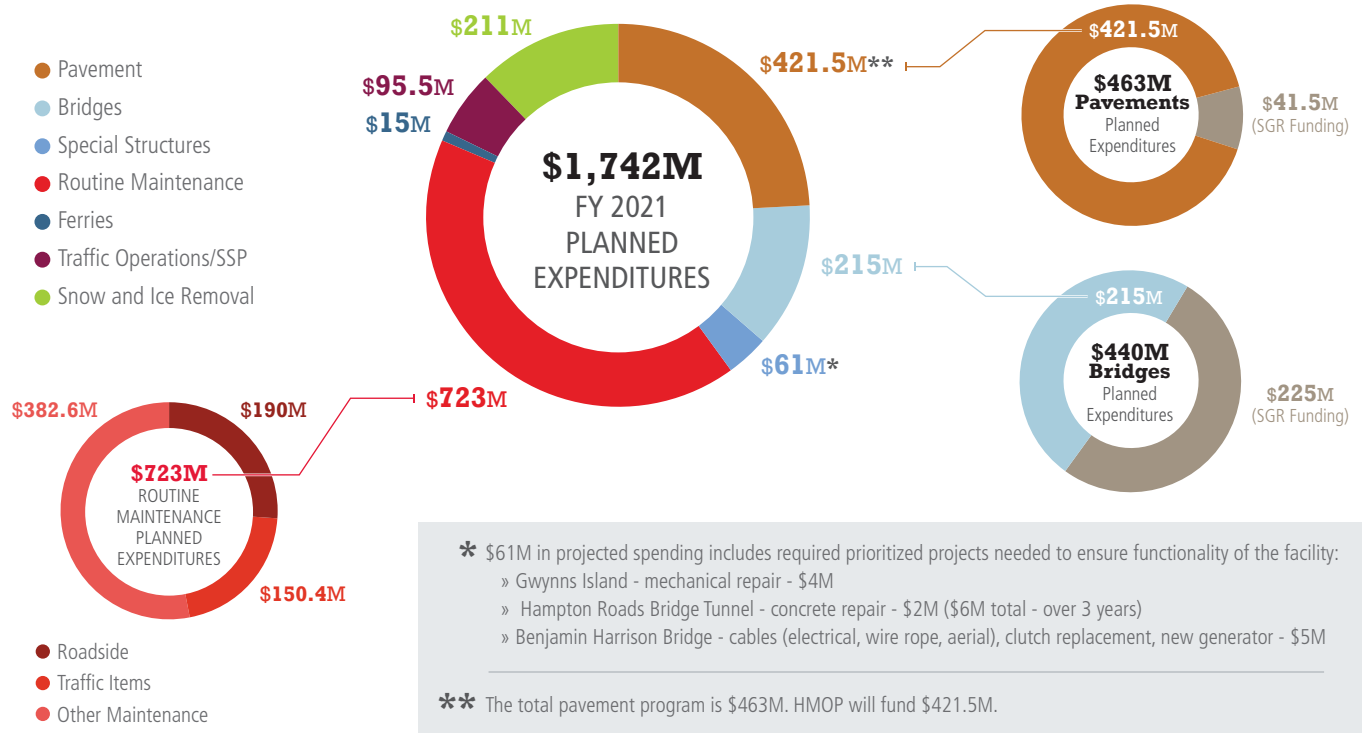
[REQUIREMENT 3] Expenditures from the Highway Maintenance and Operations Program

FIGURE 5 | HMOP - FY 2020 Expenditures



Based on the Comprehensive Review, the FY 2021 HMOP planned expenditures are shown in **Figure 6** along with a breakdown of the other investments for pavements and bridges. The activities listed reflect those identified through the Comprehensive Review. In the next biennial report, a clarification for special structures will be provided as well. The FY 2021 Planned expenditure by district and activity is provided in Appendix B.

FIGURE 6 | HMOP - FY 2021 Planned Expenditures



State of Good Repair Program

[REQUIREMENT 2]
☑ The methodology for the allocation of funds for the state of good repair

The Board approved a process to prioritize needs for the State of Good Repair Program with the goal of preserving and extending the service life of Virginia's complex roadway system. The Board's Prioritized Process Methodology provides details on the needs (projects) prioritization and the approved allocation processes for the State of Good Repair Program funds.[18]

Under the State of Good Repair Program, all nine VDOT construction districts receive funding, with no district receiving less than 5.5% or more than 17.5% of the State of Good Repair Program funds each year. However, the Board can approve an exception that waives the funding cap in order to provide funds for an urgent pavement or bridge need (project) resulting from extraordinary circumstances. On March 21, 2019, the Board approved a waiver of the State of Good Repair Program funding cap for the I-64 Hampton Roads Bridge-Tunnel Expansion Project and South Island Trestle Bridge Replacement Work. This waiver will increase the share of State of Good Repair Program funds for the Hampton Roads District in FY 2025 and FY 2026. An explanation and rationale for the waiver of the funding cap as provided for in subsection B of § 33.2-369 can be found in the presentation made to the Board on March 20, 2019.[19]

[REQUIREMENT 5]
☑ A listing of prioritized pavement and bridge needs

A list of prioritized pavement and bridge needs (projects) based on the priority ranking system developed by the Board is available on VDOT's external site - Six-Year Improvement Program reports and State of Good Repair Program site.[20]

EXAMPLE PROJECTS

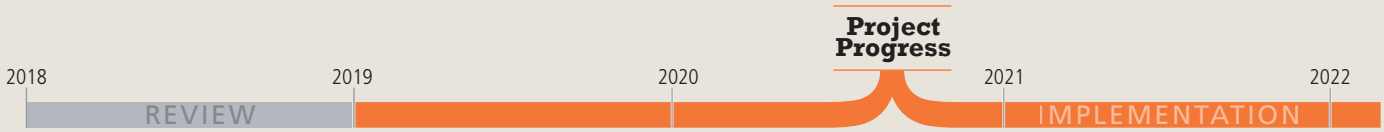
The Chatham Bridge Rehabilitation and the Hampton Roads Bridge-Tunnel project are both examples of VDOT utilizing combined resources such as the Maintenance and Operations and State of Good Repair Programs along with other sources to deliver improved mobility outcomes.

CHATHAM BRIDGE REHABILITATION

BENEFITS FOR VIRGINIANS[21]

- Remove current weight limit.
- Include a dedicated path for pedestrians and bicyclists.
- Accelerate project delivery by 9 months.
- Improve bridge condition with a smoother ride for travelers.

A bridge at this location was originally built in 1796 and was damaged by floods on four different occasions. The existing bridge was constructed in 1941 and carries approximately 16,000 vehicles a day. Major maintenance work is underway on the bridge and is an example of combining resources as it is funded with multiple resources to include VDOT and locality State of Good Repair Program funds and for the maintenance components of the project HMOP funds. When work is complete, the project will make it safer and easier for motorists, pedestrians, and cyclists to cross the structure. The bridge currently has a weight posting that prevents heavier-weight emergency service vehicles and some commercial delivery trucks from crossing the river.



HAMPTON ROADS BRIDGE-TUNNEL EXPANSION PROJECT AND SOUTH ISLAND BRIDGE REPLACEMENT WORK

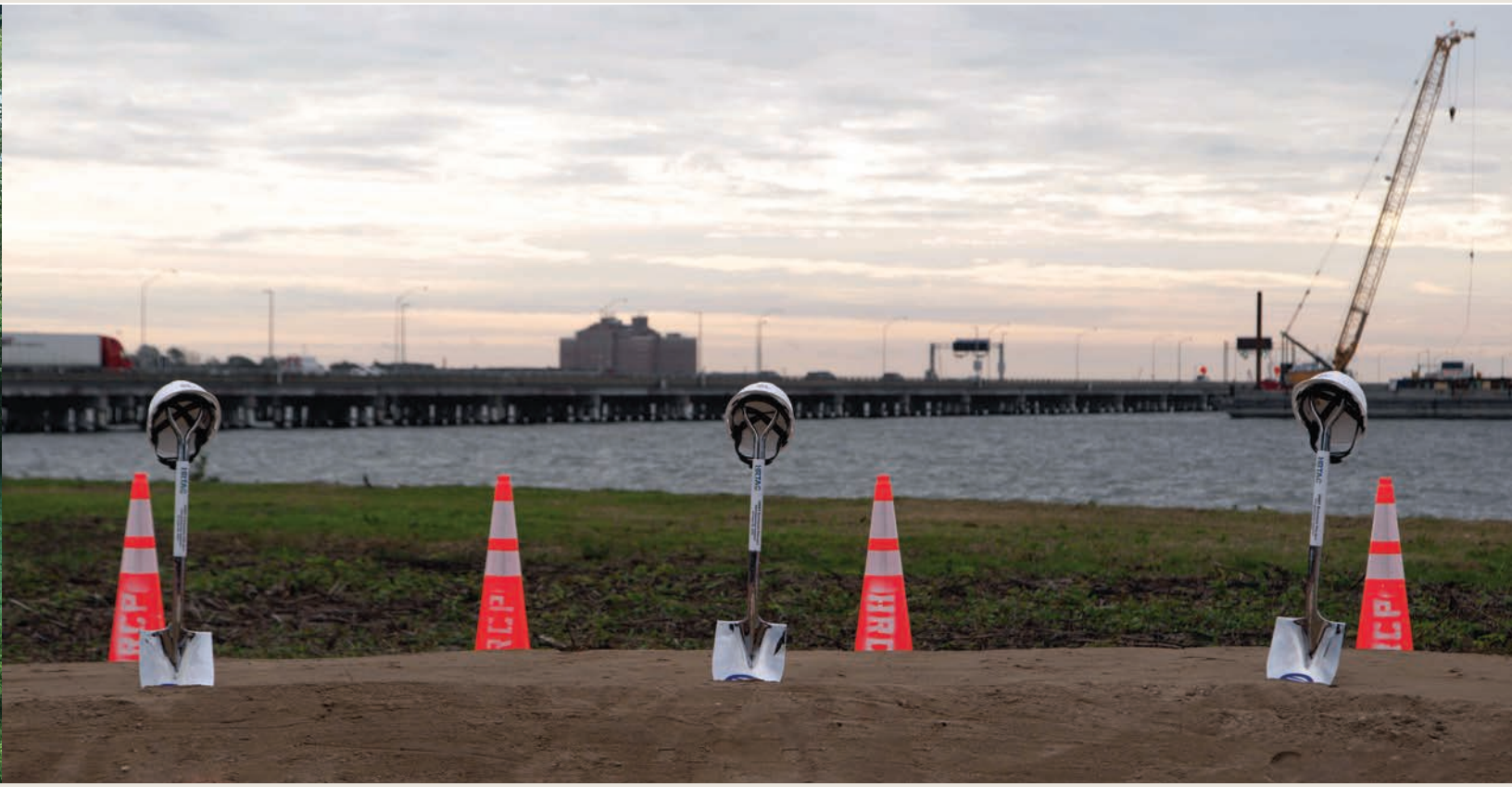
BENEFITS FOR VIRGINIANS

- Relieve congestion on the most congested corridors in the region.
- Increase capacity, increases safety, and improves travel time reliability.
- Bring in more than $4.6B in investment.[22]
- Create 28,000 jobs over the life of the project.

VDOT has started the largest construction project in Virginia's history. The Hampton Roads Bridge-Tunnel Expansion Project will build twin two-lane bored tunnels west of the existing eastbound tunnel and widen four-lane approach sections in Hampton and Norfolk to six lanes, as well as provide two part-time drivable shoulder lanes for use during peak travel (two lanes in each direction will be free general-purpose lanes). The total project cost is estimated at $3.8B, making it one of the largest infrastructure projects in the country.

To undertake this work, VDOT will utilize the State of Good Repair Program and contributions from Hampton Roads Transportation Accountability Commission, HMOP, and other Smart Scale funds.

In addition VDOT is undertaking trestle replacement work now to reduce traffic impacts and provide significant economies of scale, resulting in savings of $280M over stand-alone replacement.



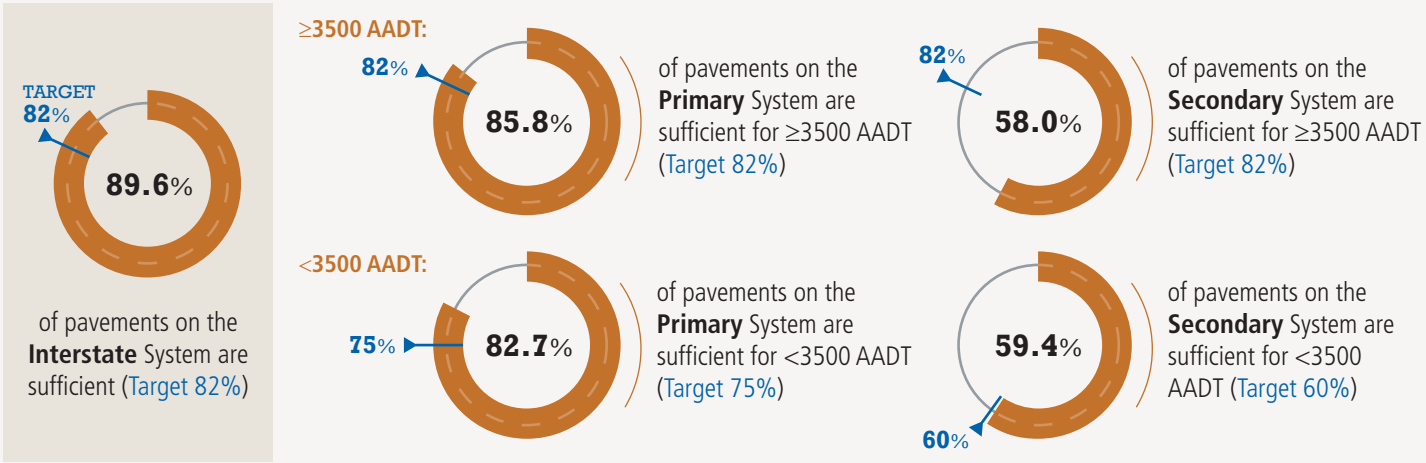
Pavement, Structures, and Routine Maintenance – New Performance Targets Progression

Where current performance exceeds or is below new targets, VDOT will adjust the condition of those systems over several years to enable the new performance level to be reached and sustained.

PAVEMENTS

Performance against targets agreed through the Comprehensive Review are shown in **Figure 7.**

FIGURE 7 | **Pavement Performance (as of July 2020) – Targets vs. Actual**



AADT – Annual Average Daily Traffic

STRUCTURES

For structures, the shift in performance will include a preservation "first" focus to allow VDOT to recover and stabilize the condition of all structures across the Commonwealth. **Figures 8** presents current bridge condition performance.

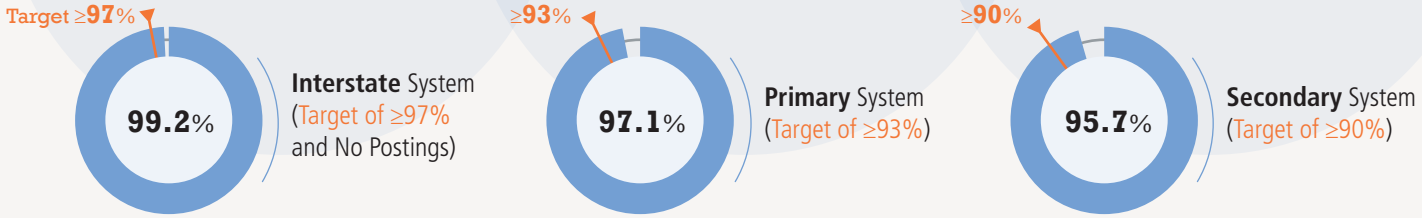
FIGURE 8 | **Structure Performance (as of July 2020) – Targets vs. Actual**

Average Weighted General Condition Rating (GCR July 2020) against a long-term goal of maintaining ≥ 5.6:

LONG-TERM GOAL OF MAINTAINING ≥ 5.6

6.08	6.19	6.26
INTERSTATE SYSTEM	PRIMARY SYSTEM	SECONDARY SYSTEM

Pecentage of non-poor (sufficient) structures:



ROUTINE MAINTENANCE

The routine maintenance performance measures were presented to the Board in October 2019 as an informational tool.[23] VDOT's "back to basics approach" will enable VDOT to refocus and allow district teams to proactively plan work and create efficiencies with the systematic method.

Special Structures

[REQUIREMENT 7] The Use of Funds in the Special Structure Fund

In 2019, VDOT developed the Special Structures 50-Year Long Term Plan for each special structure across the Commonwealth. This process included prioritizing those projects that are most critical to the safety and operations of these facilities. **Figure 9** identifies some of the high priority projects that will be the focus of the Special Structures Fund,[24] with expected availability in FY 2022, to maintain operation and enhance safety for the movement of people and goods. While the Special Structure Fund will not receive funding in FY 2021, VDOT's HMOP will provide at least $50M on an annual basis and for FY 2021 is estimated to fund over $60M as some facilities' projects must begin to prevent failure. Once the Special Structure Fund receives funding, future biennial reports will include a summary on the use of the funds.

FIGURE 9 | **Special Structures - High Priority Projects**

❶ Big Walker and ❷ East River Mountain Tunnels
- Supervisory Control and Data Acquisition (SCADA) system installation
- Control system upgrade
- Fan rehabilitation
- Fire standpipe installation

❶ Rosslyn Tunnel
- Ceiling tile removal

❶ Gwynn's Island Bridge
- Mechanical and structural repairs*

❷ Robert O. Norris Bridge
- Deck joint rehabilitation

❶ Varina-Enon Bridge
- Structural repairs

❷ Benjamin Harrison Bridge
- Generator and Lifting Cable Replacement*

❶ George P. Coleman Bridge
- Balance wheel track

❷ James River Bridge
- Replace drive system

❸ High Rise Bridge
- Grid deck replacement

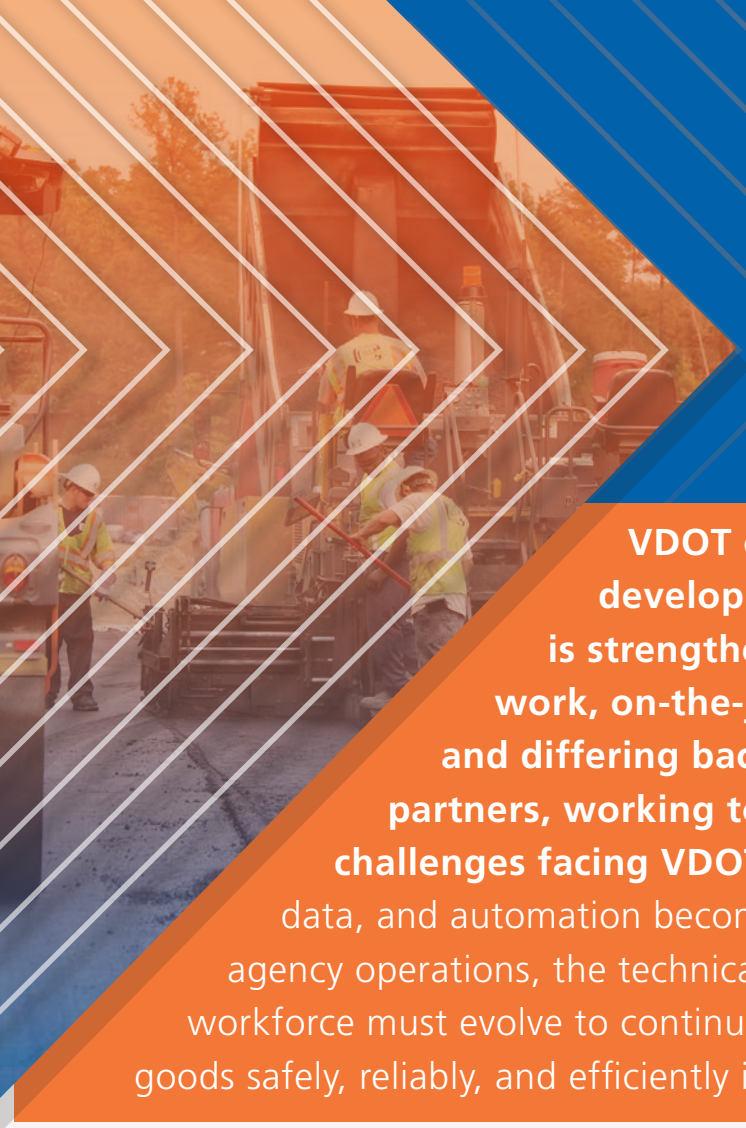
❹ Hampton Roads Bridge-Tunnel
- Structural repairs and ventilation fan overhauls*

❺ Monitor-Merrimac Memorial Bridge Tunnel
- Communications Sytem Upgrade and Ventilation System Upgrade

*Due to the critical functionality risks that exists, these projects are to be progressed in FY 2021 utilizing HMOP funding.

SPECIAL STRUCTURES HEALTH INDEX

The Special Structures health index will measure the relative condition of structures and their systems (i.e. mechanical, electrical, operational, and structural). After the development and implementation of the index, VDOT intends to use it as a performance measure to guide decision making on Special Structure projects and enable VDOT to optimize long-term life-cycle actions. In development of the Special Structures health index, VDOT will consider the condition, age, functional/operational performance, safety and importance of each component and its contributions to the overall structure. This Special Structures health index will build on the previously developed health index for conventional bridges and position VDOT at the forefront of those developing new ways to measure and manage assets. The Special Structures health index will guide better investment decisions that will enable VDOT to deliver safer and more efficient outcomes.



TRANSFORMATIONAL LEADERS GUIDING LONG-TERM SUSTAINABILITY

VDOT continues to identify new ways to develop its highly trained workforce. VDOT is strengthened by its diversity—our breadth of work, on-the-job training, educational experiences and differing backgrounds combine to make us better partners, working together to solve transportation challenges facing VDOT today and tomorrow. As technology, data, and automation become more prevalent throughout transportation agency operations, the technical and behavioral competencies of VDOT's workforce must evolve to continue to find new ways to move people and goods safely, reliably, and efficiently in the future.

Not all future challenges will be technological. As demonstrated over the last 10 years, transportation agencies have had to become more strategic to meet infrastructure and stakeholder demands with constrained resources. Having to operate more like a private business requires a strengthened knowledge base, including sharpened analytical, financial, and management skills and an adaptive culture that can implement the latest best practices on an ongoing basis.

VDOT OF TOMORROW

BENEFITS FOR VIRGINIANS

Equip the Commonwealth with an agency prepared to meet new challenges of the future.

VDOT of Tomorrow is a strategic initiative to ensure that the agency is well-positioned to overcome the challenges of today as well as those it will face in the future. Benchmarking against companies known for their innovation and adaptability like Booze Allen, Amazon, Google, Uber, and Anthem, VDOT is undergoing an organizational transformation through several strategic initiatives to prepare for the future. Some of the focus includes: (1) Prepare People, (2) Empower Innovation, and (3) Modernize Methods, the strategic initiatives will enhance technological fluency across the agency, automate processes using robotics, retool employees to perform higher-level tasks, and bring together VDOT and its partners through information technology and innovation strategies.

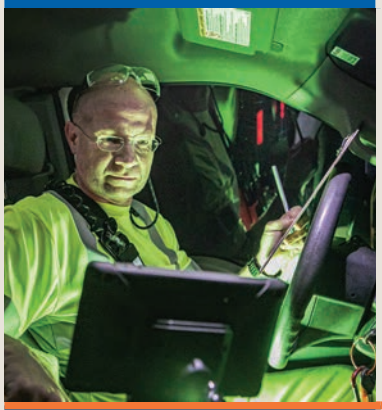
VDOT of Tomorrow Strategic Initiatives Currently Underway

PREPARE OUR PEOPLE

Develop VDOT workforce to ensure skills are gained and scope is covered to deliver the future work through training, mentoring, and building capabilities:

- Two-way mentoring
- Interactive field-based learning
- Building future skills through technology fluency
- Cyber-risk awareness through education

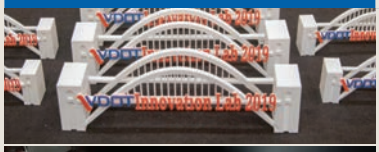
MODERNIZE OUR METHODS



Update processes and procedures to increase productivity, improve career development opportunities, and update recruitment and retention strategies to ensure VDOT is hiring and keeping the best people to deliver its programs.

- Promote innovation to drive a strategic and coordinated approach across VDOT
- Information Technology Strategy (agency-wide)
- Robotic processes to automate repetitive tasks for greater efficiency
- Data Science Center of Excellence to discover new insights
- Future workplace strategy to support recruitment and retention

EMPOWER INNOVATION



Create and amplify a culture of innovation by encouraging the workforce to challenge the norm; create and adapt to new ideas; and work safer, faster, and better in all locations and sectors of work. Recent innovation examples include:

SIMULATOR TRAINING

Offering trainees a virtual experience of operating loaders, motor graders, and forklifts.

VIRTUAL REALITY CITIZEN EXPERIENCE

Providing the public with the ability to virtually drive[25] the proposed roundabouts on Route 122 and Route 636 in Franklin County.

STRENGTHENING PARTNERSHIPS WITH THE PRIVATE SECTOR AND LOCALITIES

VDOT is organized to ensure collaboration with the private sector. From the operation and maintenance of existing assets and building projects procured under the traditional design, bid, build process to public-private partnership models, consultant services, or joined associations, VDOT has a long history partnering with the private sector. Most of VDOT's work is outsourced to utilize specialized technical expertise under VDOT direction. VDOT assesses which jobs can be completed in-house and which need to be outsourced to ensure the appropriate team accomplishes the work.

Further examples of VDOT's partnerships are briefly discussed below.

[REQUIREMENT 9]
A review of collaboration with the private sector

Highway Maintenance and Operations Program

More than 60% of the HMOP expenditures are delivered by the private sector, including interstate maintenance work and the maintenance of Safety Rest Areas.

VDOT regularly partners with the engineering consultant community on major initiatives. For example, VDOT and experts from five different consultant firms partnered to undertake the Comprehensive Review.

FIBER OPTIC RESOURCE SHARING PROGRAM[26, 27]

Since its inception in 1998, VDOT's Fiber Optic Resource Sharing program has allowed communications providers to install fiber infrastructure in VDOT's limited-access rights-of-way. In return, VDOT has received more than 4,700 miles of fiber routes to support transportation operations across the Commonwealth.

BENEFITS FOR VIRGINIANS

- Eliminate costly leased communications circuits, saving $3,600 to $6,000 annually per traffic camera.
- Improve internet feeds for rural communities along routes.

Over the last few years, VDOT has secured new agreements with Facebook and Amazon (among others) to build fiber optic lines along Virginia's highways. Through FY 2019 and FY 2020, VDOT received access to more than 1,100 miles of fiber optic cables and free access to conduits and network co-location sites. In this same period, VDOT also received more than $2.5M in revenue from the fiber optic service providers.

WAZE APP PARTNERSHIP[28]

Since 2016, VDOT has been in a data-sharing partnership with WAZE to exchange information like road closures, incidents, and major traffic events to provide increased real-time information to highway users across Virginia. In continuing this partnership, VDOT suggested that WAZE create the option to better highlight snow on the road within the app.

BENEFITS FOR VIRGINIANS

- Prepares Virginia drivers for hazardous winter weather conditions.
- Enables VDOT to incorporate more comprehensive information into planning for winter operations.

Thanks to VDOT's suggestion, WAZE users globally will now be able to report an unplowed road and will be kept informed when approaching a road that other drivers have already identified as unplowed. VDOT plans to monitor incoming reports to determine how best to incorporate these new data into future operations.

Locally Administered Program

VDOT continues to strengthen its locally administered program (LAP). Localities are an important part of delivering Virginia's transportation system. They are responsible for over 52% of the projects in the SYIP by number and 23% by value. VDOT has clarified roles and responsibilities of VDOT and the localities administering transportation projects in the 2020 update of the LAP Manual and developed the Locally Administered Projects Qualification Program for localities administering federal projects. Developed by VDOT's Local Assistance Division, the Locally Administered Projects Qualification provides a consistent method of determining a locality's readiness to administer federal projects. Since online classes began in August 2019, 82 localities[29] have successfully completed the program and achieved the "qualified" status.

Public Private Partnership (P3)

Virginia P3 projects[30] have added billions of dollars into Virginia's economy and have supported tens of thousands of jobs. From new job creation to new business opportunities for Virginia contractors, the large scope of Virginia's P3 projects provides an enormous boost to local economies in Virginia.

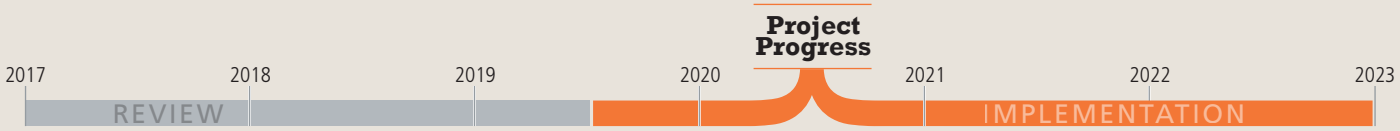
I-95 EXPRESS LANE EXTENSION (FREDEX)[31]

This project will extend the I-95 Express Lanes by approximately 10 miles south of Route 610 (Garrisonville Road) in Stafford County. The project will interface with and provide a direct connection to VDOT's Rappahannock River Crossing projects.

Project is on schedule for service commencement: October 2022.

BENEFITS FOR VIRGINIANS

- Create an estimated 9,000 jobs and $1B in economic activity during the project.
- Increase I-95 roadway capacity by 66% during rush hour periods.
- Provide new access points for faster and easier access to Quantico and the area's 28,000 workers.
- Expand travel choices by increasing the attractiveness and utility of ridesharing and transit usage, while also providing an option for single- and double-occupant vehicles to bypass congested conditions.



TRANSFORM 66 – OUTSIDE THE BELTWAY[32]

This project will modify nearly 23 miles of I-66, providing two express lanes alongside three regular lanes from I-495 to Route 29 in Gainesville, with dedicated express lane access points and space in the median reserved for future transit. In addition, the project will include 4,000 park-n-ride spaces, new and expanded bus service throughout the corridor, safety and operational improvements at key interchanges, auxiliary lanes between interchanges, and bicycle and pedestrian upgrades.

BENEFITS FOR VIRGINIANS

- Increase reliability of trips on I-66.
- Offer new and improved bus service and transit routes.
- Include new and expanded park and ride lots.
- Provide 11 miles of new bike and pedestrian trails.
- Improve interchanges to enhance safety and reduce congestion.

The I-66 Outside the beltway project is an example of VDOT acting collaboratively and creatively with the private sector to achieve major transportation improvements that benefit Virginia taxpayers.

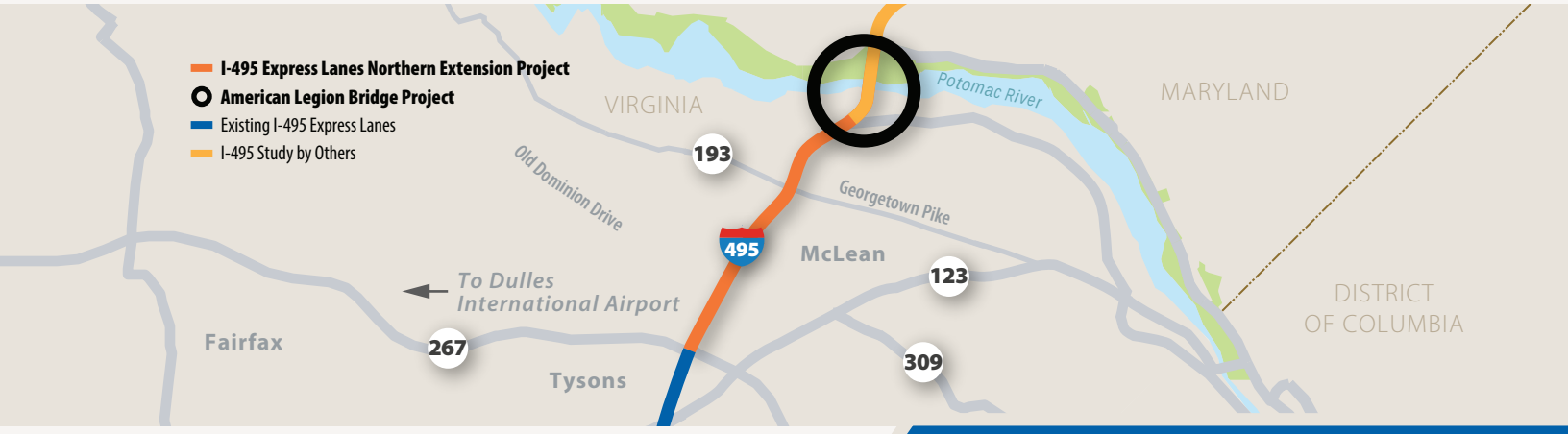
Project is on schedule for service commencement: December 2022.

495 NEXT[33]

BENEFITS FOR VIRGINIANS

- Reduce congestion and improve roadway safety
- Provide additional travel choices
- Improve travel reliability

I-495 Express Lanes Northern Extension Project ("495 NEXT" or "Project") is a 2.5-mile extension of the 495 Express Lanes north from the current terminus near the I-495 and Dulles Access Road interchange and to the vicinity of American Legion Bridge. 495 NEXT is being developed as an independent, stand-alone project that will be closely coordinated and compatible with plans for I-495 (Capital Beltway) in Maryland. The 495 NEXT study began in 2018 to help address one of the worst bottlenecks in the region and reduce cut-through traffic in local neighborhoods.



BI-STATE ACCORD TO ADDRESS THE AMERICAN LEGION BRIDGE[34]

BENEFITS FOR VIRGINIANS

- Cut commuting time in half for many travelers.
- Reduce congestion in regular lanes by 25%.
- Provide 40% more capacity on the bridge.
- Include bicycle and pedestrian paths across the Potomac

On November 12, 2019, Virginia's Governor Northam and Maryland's Governor Hogan announced a bi-state, bipartisan accord to create a new, unified Capital Beltway, replace the aging American Legion Bridge and relieving congestion at one of the country's worst traffic chokepoints.

The American Legion Bridge has been operating beyond its capacity for nearly four decades. Daily traffic has grown 390 percent since the bridge opened in 1962, with 235,000 vehicles using it daily. More than 40 percent of the region's population travels this segment of the Capital Beltway, and the region expects to grow by another 1.2 million people by 2040.

The project, being advanced by Maryland, will replace the existing lanes in each direction across the Potomac River and add two new Express Lanes in each direction for approximately three miles between the George Washington Memorial Parkway in Virginia to the vicinity of River Road in Maryland. New bicycle and pedestrian access will connect trails on both sides of the Potomac River. The project is being designed predominantly within the footprint of the existing bridge and right-of-way to minimize impact on travelers, the environment, and surrounding communities.

Appendix A – Statute Requirements

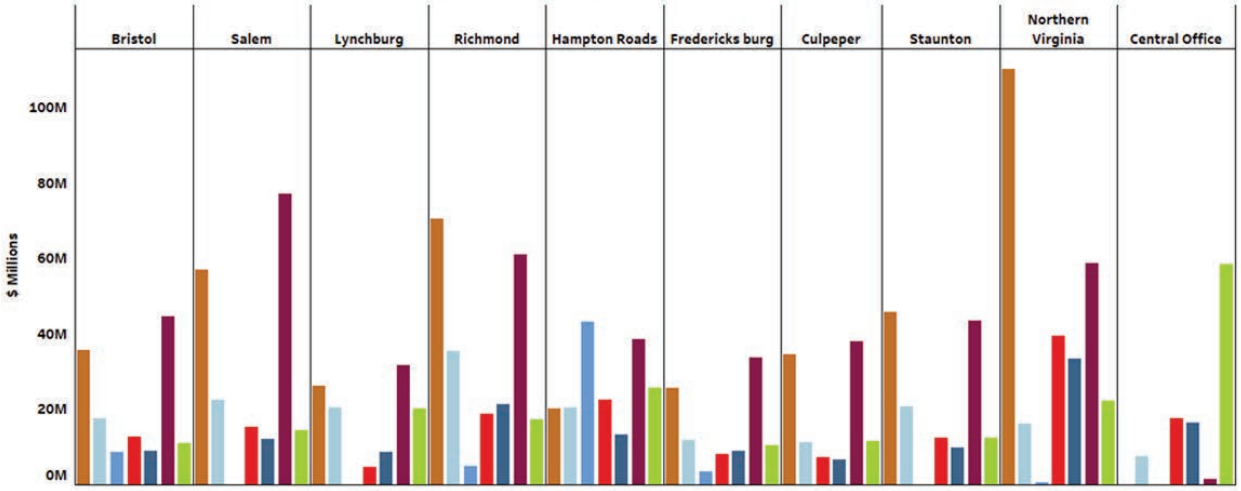
The Commissioner of Highways is required by the *Code of Virginia*, **33.2-232** to develop a Biennial Report. The Commonwealth Transportation Board (the Board) approved the report's minimum requirements on October 30, 2018.* The following table lays out where the requirements are within the report.

§ 33.2-232. Biennial report by the Commissioner of Highways. The Commissioner of Highways shall provide to the Governor, the General Assembly, and the Commonwealth Transportation Board, no later than November 1 of each even-numbered year, a report, the content of which shall be specified by the Board and shall contain, at a minimum:

* http://www.ctb.virginia.gov/resources/2018/oct/reso/15.pdf

Appendix B – HMOP Expenditures by Asset Class and District

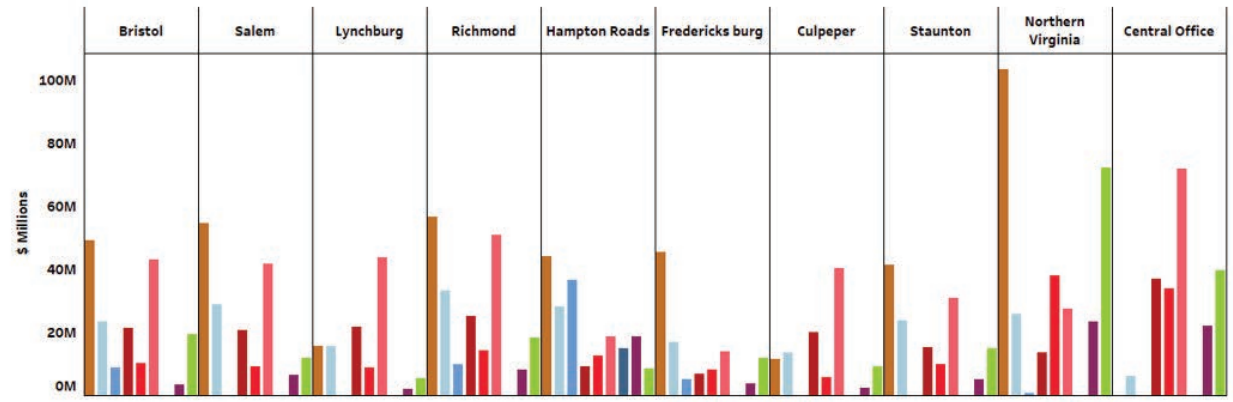
FY 2020 HMOP Expenditures by Asset Class and District (in millions)



Category	Bristol	Salem	Lynchburg	Richmond	Hampton Roads	Fredericksburg	Culpeper	Staunton	Northern Virginia	Central Office
Pavement	$35.7M	$56.8M	$26.0M	$70.5M	$20.3M	$25.6M	$34.5M	$45.8M	$110.0M	$0.0M
Bridges	$17.5M	$22.4M	$20.5M	$35.5M	$20.4M	$11.7M	$11.2M	$20.6M	$16.2M	$7.6M
Special Structures	$8.5M	$0.0M	$0.0M	$4.8M	$43.0M	$3.6M	$0.0M	$0.0M	$0.6M	$0.0M
Emergency and Incident Management*	$12.5M	$15.2M	$4.6M	$18.7M	$22.4M	$8.0M	$7.3M	$12.4M	$39.3M	$17.5M
Traffic and Safety	$8.8M	$12.0M	$8.7M	$21.2M	$13.3M	$8.9M	$6.5M	$9.7M	$33.3M	$16.3M
Routine Maintenance	$44.5M	$77.0M	$31.7M	$60.9M	$38.4M	$33.7M	$38.0M	$43.5M	$58.7M	$1.5M
Facility and Other	$11.0M	$14.2M	$20.0M	$17.2M	$25.6M	$10.5M	$11.5M	$12.3M	$22.2M	$58.3M

*In FY 2020 $100M of the allocation provided was set-aside to fund efforts outside of the HMOP due to impacts from COVID-19.

FY 2021 HMOP Projected Expenditures by Asset Class and District (in millions)



Category	Bristol	Salem	Lynchburg	Richmond	Hampton Roads	Fredericksburg	Culpeper	Staunton	Northern Virginia	Central Office
Pavements	$49.1M	$54.5M	$15.6M	$56.7M	$44.0M	$45.5M	$11.5M	$41.3M	$103.3M	$0.0M
Bridges	$23.4M	$28.7M	$15.5M	$33.3M	$28.2M	$17.0M	$13.4M	$23.6M	$25.7M	$6.2M
Special Structures	$8.9M	$0.0M	$0.0M	$9.7M	$36.7M	$5.1M	$0.0M	$0.0M	$0.6M	$0.0M
Roadside	$21.2M	$20.6M	$21.6M	$25.1M	$9.2M	$6.8M	$19.9M	$15.1M	$13.5M	$37.0M
Traffic Items	$10.3M	$9.1M	$8.7M	$14.3M	$12.6M	$8.3M	$5.6M	$9.7M	$37.9M	$33.9M
Other Maintenance	$43.1M	$41.8M	$43.8M	$50.9M	$18.7M	$13.9M	$40.5M	$30.7M	$27.5M	$71.7M
Ferries	$0.0M	$0.0M	$0.0M	$0.0M	$14.8M	$0.2M	$0.0M	$0.0M	$0.0M	$0.0M
Traffic Operations/SSP	$3.3M	$6.4M	$1.9M	$8.3M	$18.7M	$3.8M	$2.5M	$5.2M	$23.5M	$21.9M
Snow and Ice	$19.2M	$12.0M	$5.3M	$18.2M	$8.4M	$12.0M	$9.2M	$14.9M	$72.3M	$39.5M*

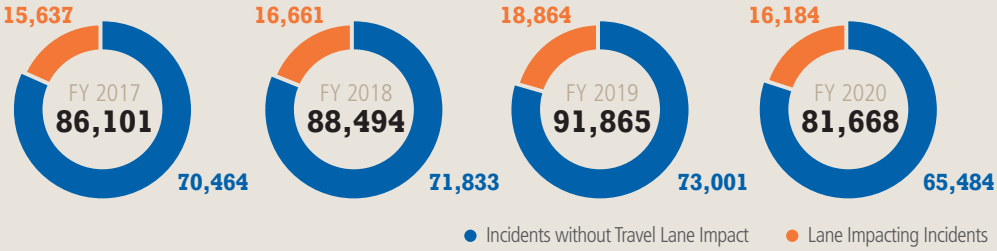
Appendix C –Mobility Performance Measures

VDOT uses performance metrics to measure highway operating conditions. Three regularly reported and reviewed metrics are vehicle hours of delay, incident duration, and travel time reliability. Travel time reliability measures the consistency or dependability in travel times, as measured from day-to-day and/or across different times of the day. Further information on travel time reliability can be found in the Office of Intermodal Planning and Investment Biennial Report.[35] Current performance on the other measures is shown in **Figure 10**.

FIGURE 10 | **Mobility Performance Outcomes**

INCIDENTS

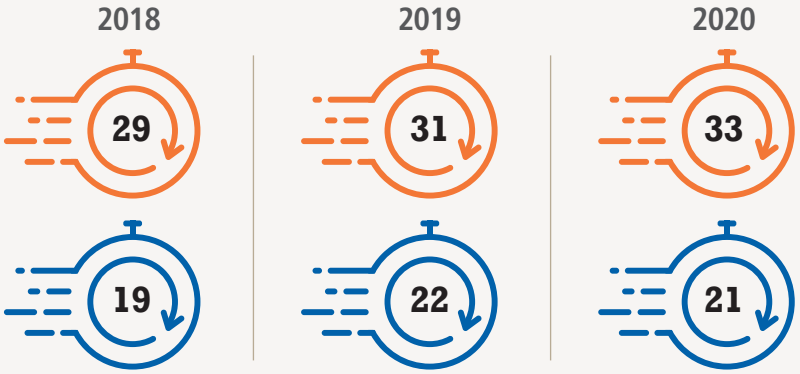
Half of the congestion on Virginia's roadways occurs because of a traffic incident. FY2020 experienced fewer incidents, reversing a trend of increases since 2017.



INCIDENT DURATION

Roadway Clearance Time* is defined as the time to clear an incident so that all travel lanes are available for traffic flow.

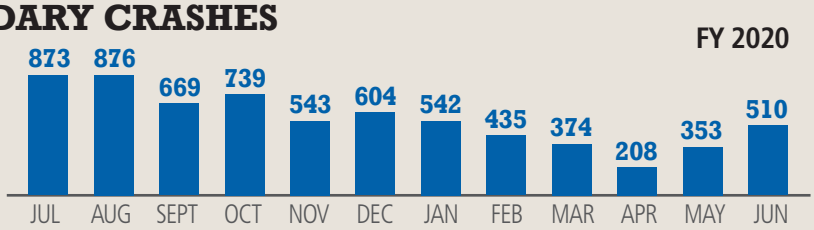
Scene Clearance Time* is defined as the time to when the last responder has left the scene and all lanes and shoulders are clear. A roadway's Scene Clearance Time includes times to address disabled vehicles on the shoulders and other simpler events that often result in a faster resolution than the Roadway Clearance Time.



*Data being displayed is in minutes

POTENTIAL SECONDARY CRASHES

Secondary Collisions are defined as the estimated number of crash incidents that are a result of another crash or disabled vehicle incident.

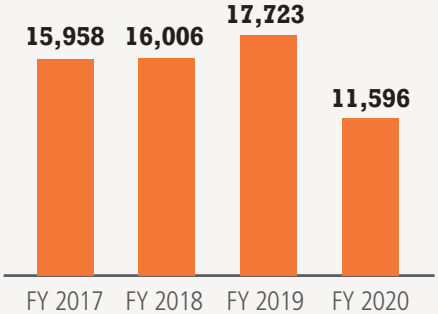


Number of Secondary Incidents	
FY18	8,172
FY19	8,962
FY20	6,726

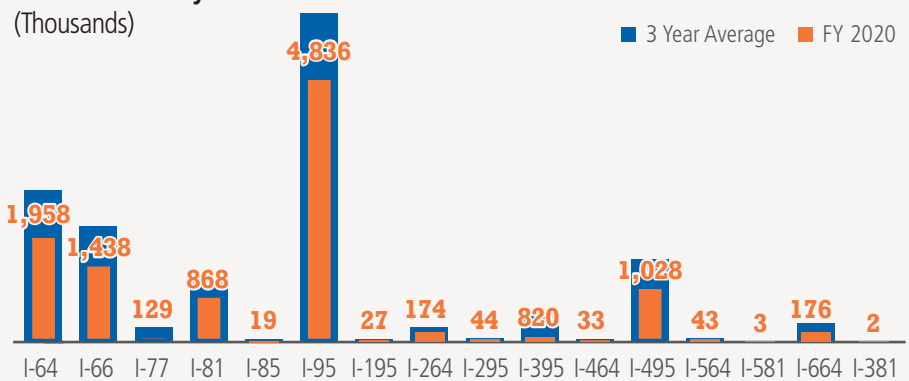
VEHICLE HOURS OF DELAY (VHD)

Vehicle hours of delay is a measure of the extra time that the public spends traveling because traffic is not moving at speeds close to the desired speed for drivers in low volume conditions without incidents or weather events. Delay is counted when the travel speeds are 20 miles per hour slower than usual free flow traffic.

FY 2020 VHD by Year (Thousands)



FY 2020 VHD by Route (Thousands)



ENDNOTES

1. http://www.virginiadot.org/business/resources/OperationsDivision/FY2020_Operations_Performance_Report.pdf
2. https://ops.fhwa.dot.gov/publications/fhwahop11034/ch1.htm
3. https://rm3pvirginia.org/
4. http://www.ctb.virginia.gov/resources/2020/march/pres/5_preliminary_fy_2021_–_2026_commonwealth_transportation_fund.pdf
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