VDOT
Virginia Department of Transportation

BIENNIAL REPORT

2020-2022

LETTER FROM THE COMMISSIONER OF HIGHWAYS

December 2022

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

I am pleased to submit the Commissioner of Highways Biennial Report for 2022. The 2022 Biennial Report covers accomplishments from 2020 through 2022.

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 (see Appendix A – Statutory Requirements), 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 you have any question, or need any additional information, please do not hesitate to contact me.

Sincerely,

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

VDOT
Virginia Department of Transportation

THE VIRGINIA DEPARTMENT OF TRANSPORTATION

With a topography ranging from mountain ranges, piedmont farmlands, to the Chesapeake Bay and Virginia Beach shores, VDOT manages the third-largest state-maintained highway system in the country. VDOT's goal is to keep Virginians, visitors and goods moving safely, efficiently, and seamlessly for work and play. With a $7.6B annual budget and a team of 7,500, VDOT is responsible for designing, building, maintaining, and operating the state's nearly 58,000 miles of roadway, 21,000 bridges and structures, six tunnels and three ferry systems.

With the onset of the pandemic and economic challenges, VDOT remained flexible and agile. VDOT's actions are reflected in several examples throughout this report but include our ability to use VDOT's robust statewide traffic count program and traffic operations centers to assess traffic volumes during the pandemic and expedite construction and maintenance work on some of the Commonwealth's busiest roadways.

The following is a summary of some of the incredible projects that our teams at VDOT have accomplished or progressed since 2020.

The completion of the **I-64 Widening Segment Phase 3** in York County includes the culmination of widening 21 miles of interstate along the Virginia Peninsula. The pavement design included the use of more than 500,000 tons of reclaimed asphalt pavement and recycled concrete aggregate in the foundation layers, making Segment 3 the largest project in the U.S., and the second largest in the world to use recycled material.

The **Hampton Roads Bridge Tunnel Expansion Project** is the largest highway construction project in Virginia's history and features the construction of two new bored tunnels. The centerpiece of the tunneling is the Tunnel Boring Machine (TBM). The TBM was recently manufactured in Germany and will be used to excavate and construct the new tunnels. The tunnel boring machine is 46 feet tall and 430 feet in length.

In October 2021, VDOT announced the completion of the southbound I-95 **Rappahannock River Crossing Project,** a $132M investment to unlock gridlock in the Fredericksburg area. The project doubles capacity on the most heavily traveled section of interstate in the region, which carries 150,000 vehicles daily. The project was completed "on time" and "on budget".

The **Chatham Bridge Rehabilitation,** a $23M project, opened to traffic in October 2021. Around 16,000 vehicles a day travel on the Chatham Bridge, which links the City of Fredericksburg and Stafford County. One of the bridge's new features is a nearly 10-foot-wide shared use path, replacing narrow, deteriorating 4-foot-wide sidewalks that existed on the bridge before the project.

A comprehensive agreement was executed to construct the final phase of the $207M **Corridor Q Project** in Buchanan County. The completion of the final phase of Corridor Q construction in Virginia will significantly reduce regional travel times between the communities of Southwest Virginia and neighboring Kentucky and enable safer and more efficient transportation options while creating opportunities for economic growth in the region. The bridge will be 175 feet tall, making it the second tallest bridge in Virginia.

The **I-81 Corridor Improvement Program** includes innovative targeted improvements that will have a substantial effect on the safety and reliability of critical portions of our nation's infrastructure. One of the projects adds a third lane northbound and southbound for about five miles of I-81, between mile markers 136 and 141. Other projects in the **I-81 Corridor Improvement Program** include replacing six bridges, and widening two others, and making interchange improvements at exit 137.

Through the combined efforts of VDOT employees, consultants and partners, we connect Virginia.

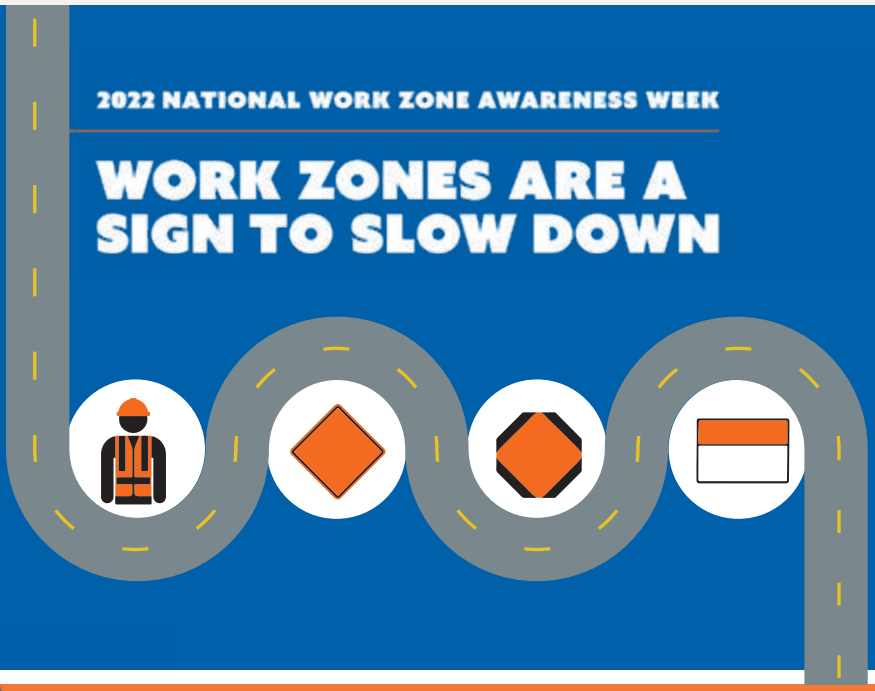
CONTENTS

SAFETY FOCUS

There is nothing more crucial to VDOT than maintaining the safety of those who work and travel on Virginia roads. Despite all the challenges over the past two years to include the pandemic, supply chain issues, and work force vacancies the VDOT team has adapted safely and quickly to keep Virginia moving. Safety is the foundation for the efficient and effective operation of the state's transportation network, connecting people, goods, and services. We are particularly proud of the dedication of our people to safety and enormously pleased that their dedication is recognized by others.

National Work Zone Awareness Week

The National Work Zone Awareness Week[1] 2022 kickoff event was hosted by VDOT and held near the Hampton Roads Bridge-Tunnel Expansion Project in Virginia. The kickoff event was live streamed by VDOT for all to watch. National Work Zone Awareness Week, was started by VDOT. In 1997 a group of VDOT employees in southwestern Virginia first launched a week dedicated to raising awareness of work zone safety among district employees.



National Safety Award

In February 2022, the American Traffic Safety Services Association (ATSSA) named Ginger Quinn, VDOT Salem District Area Work Zone Coordinator, the winner of its National Safety Award.[2] The award recognizes a significant contribution to the safety of our nation's highways. Ginger's four decades of service to Virginia have included assisting in the development of VDOT work zone safety practices.

"Ginger has always advocated for the highest standard in work zone safety and has been the driving force in many of our advanced work zone safety requirements in Virginia due to her passion for safety for all."

—VDOT Work Zone Safety Program Manager David Rush

DELIVERING A SAFE AND EFFICIENT TRANSPORTATION SYSTEM

Measures taken in the past two years reflect VDOT's continuing commitment to a strategic approach that values data-driven decision-making and innovation. Work has included addressing locations of recurring congestion, as well as improved traffic management along interstate corridors to combat the delays and frustration caused by non-recurring, congestion-creating incidents. We continue to work toward improved safety and zero deaths on VDOT's transportation system.

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

Programs and actions such as those described throughout this report flow directly from VDOT's mission of operating and maintaining a safe and efficient transportation system for all users and its commitment to a Transportation Systems Management and Operations (TSMO) approach. The focus on traffic operations was reinforced through organizational changes (see Page 25). At the same time, VDOT aligns programs among partner agencies to enhance operations through improved coordination and shared resources. Recurring congestion – traffic volumes too high for the capacity of the roadway – remains a focus in our growing state. Non-recurring congestion – crashes, other incidents, work zones, and weather events – is the focus of innovative and effective ways to improve response. Mobility data regarding the operating condition of state highways and the average duration of incidents are included in Appendix B.

VDOT provides the Commonwealth with a comprehensive and responsive transportation system serving the needs of residents, businesses, and visitors – all while keeping safety at the forefront.

Combating Recurring Congestion

Improved traffic management and low-cost improvements can optimize existing roadway capacity, limiting the need for additional capacity to only the most critical locations. VDOT's approach to addressing recurring congestion includes advancing multimodal solutions, and looking at other modes to serve growing travel demand.

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

In addition, VDOT is utilizing Travel Demand Management (TDM) strategies that encourage use of alternative modes through improved services and amenities and real-time traveler information to enable informed decisions about mode, route, and time of travel.

STRATEGICALLY TARGETED AFFORDABLE ROADWAY SOLUTIONS (STARS)

VDOT's Strategically Targeted Affordable Roadway Solutions (STARS)[3] program looks at ways to improve traffic safety and mobility on roads and intersections throughout the Commonwealth.

Studies conducted under the program use a performance-based approach to offer targeted improvements, considering measures such as optimized traffic signal timing and operations, "innovative" intersections, access management, and pedestrian and bicycle facilities. As part of the effort, online surveys of local residents and roadway users ask for input on issues such as how often and why people use the specific roadway and corridor, the level of congestion in those areas and when it happens, challenges in accessibility in those areas, pedestrian and bicycling issues, and safety concerns. The surveys also ask respondents to prioritize their primary concerns in the study area. An example of a recently conducted study within the STARS program is the Route 1 Corridor Study for the City of Fredericksburg.[4]

The study developed recommendations to improve the efficiency and safety of the Route 1 corridor (see **Figure 1**) from the Falmouth Bridge to Route 3. Proposed improvements for multiple locations on Route 1 have been developed.

FIGURE 1 | **Fredericksburg Route 1 STARS Study Location**

CUSTOMER SERVICE INNOVATIONS: IMPLEMENTING INNOVATIVE RM3P PROGRAM

The Regional Multimodal Mobility Program (RM3P)[5] promotes the collaborative use of real-time data in Northern Virginia and Metropolitan Fredericksburg to provide tools for travelers to make informed travel choices. It also enables transportation operators to implement multimodal responses to manage incidents. One important element of the RM3P is the Artificial Intelligence-Based Decision Support System (AI-DSS) which will help predict the impact of disruptions to the transportation network and provide coordinated response options to agencies. This automated tool for operators will use travel data to monitor emerging conditions and recommend plans for coordinated, multi-agency responses to congestion, incidents, and events.

The RM3P program is funded by the Innovation and Technology Transportation Fund (ITTF) as well as a federal Advanced Transportation and Congestion Management Technologies Deployment Program grant and the I-95 Corridor Improvement Program.

RM3P has recently advanced the following customer service initiatives, among others:

Multimodal Mobility Enhancement via Dynamic Incentivization,[6] providing the public with options and incentives offered by regional agencies and third-party providers when making their travel choices in response to real-time travel conditions.

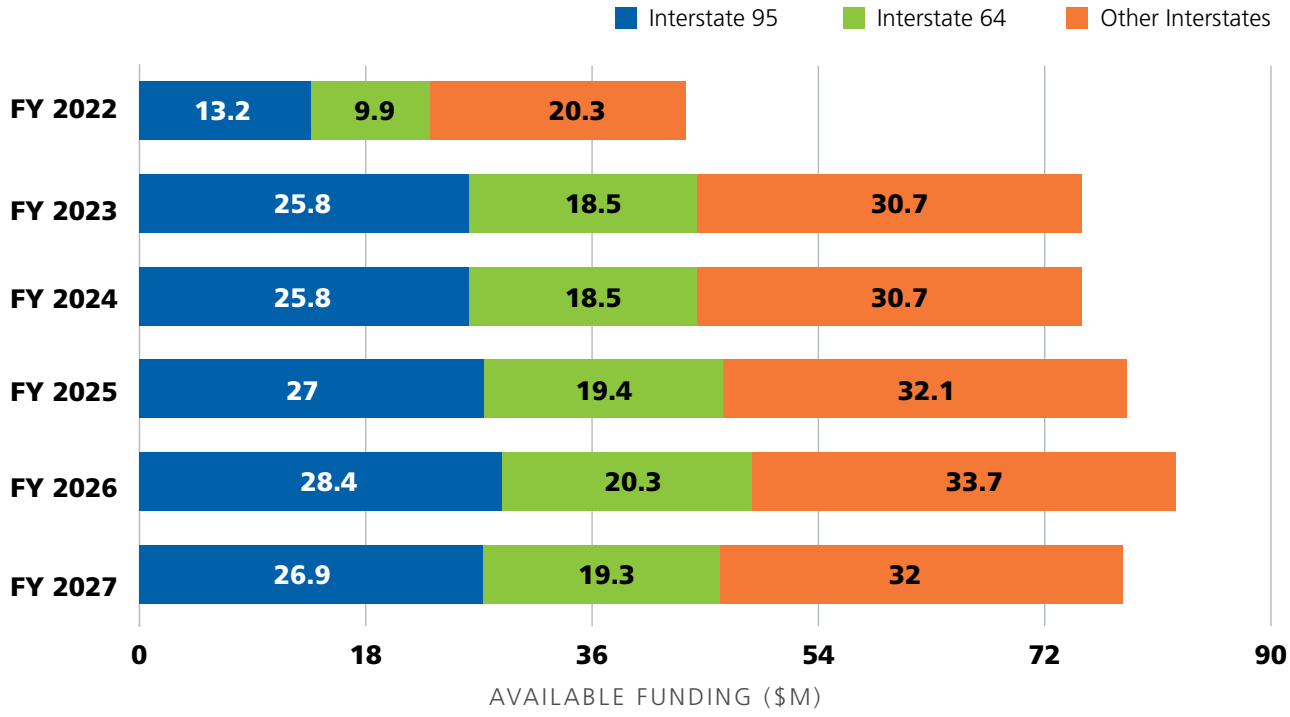
Artificial Intelligence Commuter Parking Systems,[7] developing a real-time, app-based parking availability information system that provides reliable information about commuting options and parking space availability at lots serving bus, vanpool, and carpool commuters.

CORRIDOR IMPROVEMENT PROGRAMS

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

Planning, public engagement, and implementation on VDOT's corridor improvement programs continue to advance. This program includes integrated strategies that deploy a wide range of innovative and core operational improvements to reduce congestion and provide faster, safer, and more reliable travel along the Commonwealth's interstate corridors. The new Interstate Operations and Enhancement Program (IOEP) is funding key operations, transportation demand management, and highway capital improvements. In June 2021, the Commonwealth Transportation Board (the Board) adopted a policy regarding the allocation process for the program, including funding for operational improvements.[8] The policy also set the process to identify and prioritize recommended projects. **Figure 2** identifies the available program funding through the IOEP. Interstate 81 is not reflected in the chart below as the Interstate 81 Corridor Improvement Plan (which was also completed at the direction of the Board) preceded the adoption of the IOEP.[9]

FIGURE 2 | **Interstate Operations and Enhancement Program - Available Funding (as of October 2021)**[10]



Note: Other Interstate Improvement programs include Interstates 77, 85, 295 and 66.

Under the Corridor Improvement Programs, operations improvements are funded first, such as the VDOT Safety Service Patrol and towing program (discussed later in the document). Remaining funds are used for multimodal and highway capital improvements. These projects are prioritized, according to the IOEP policy, in consideration of their contribution to:

- **Congestion** – Reduction in peak period delay
- **Safety** – Reduction in fatal and injury crashes
- **Accessibility** – Increase in access to jobs

The Board approved and adopted the Interstates 95 and 64 corridor improvement plans in September 2021 consistent with the IOEP policy.[11] Performance issues in the corridors were identified and validated through public engagement.

Both the I-95 and I-64 Corridor Improvement Plans follow the IOEP policy of first using a performance-based analysis to identify congestion, safety, and accessibility needs, and then applying a step-wise approach to targeted improvements, looking at operations first, then transportation demand management, and ultimately highway capital improvements. VDOT also applied this strategy to develop Corridor studies for Interstates 66 (mile marker 0-48), 77, 85, and 295. Recommended solutions have been prioritized for these corridors for implementation.

I-95 VARIABLE SPEED LIMITS

BENEFITS FOR VIRGINIANS[12]

Variable speed limit deployments indicate that they can:

- Reduce crashes up to 8%.
- Increase vehicle throughput up to 5%.

One example of a targeted operational improvement resulting from the **I-95 Corridor Improvement Plan** was the implementation of a variable speed limit system. Crashes and congestion are frequent in the 15-mile segment of I-95 from north of the Ladysmith exit in Caroline County to State Route 3 in Fredericksburg. To help improve traffic flow and safety, an early action item was the installation of a system in the summer of 2022. Variable speed limit changes are based on real-time traffic flow information. Slowing traffic down before traffic flow deteriorates or gradually slowing traffic as it approaches congestion will help to reduce the risk of crashes and stop-and-go travel conditions. The $10M project includes regulatory variable speed limit signs with dynamic messaging to inform drivers of the reduced speed limit when vehicle detectors pick up traffic speed and volume data that indicate high levels of congestion are imminent. Vehicle detectors installed along I-95 use radar to collect traffic speed and volume data, which is fed into a software program. The program uses an algorithm to recognize when speed limits should be lowered, such as when traffic volumes are heavy and speeds are high. The program then assigns incrementally lower speeds to harmonize traffic flow and reduce the risk of crashes and congestion.[13] Once traffic flow is back to normal, the posted speed limit will return to the maximum speed allowed.

I-81 CORRIDOR IMPROVEMENTS

Design and the public involvement process progressed on the first local project funded under the $2B Interstate 81 Corridor Improvement Program.[14] The proposed $33M project is to widen a portion of the interstate near the Bristol/Washington County line.[15]

In addition, 30 new digital message signs were installed and activated along the corridor. The signs provide motorists immediate information about traffic incidents, congestion, work zones, and inclement weather such as heavy fog. Additionally, acceleration and deceleration lane extension projects have been completed in Washington County, Pulaski County, Shenandoah County, Frederick County, Wythe County, Wytheville and Abingdon.[16]

The I-81 Corridor Operations Expansion Program, a component of the overall I-81 Corridor Improvement Program, was recognized by the Southeastern Association of State Highway and Transportation Officials (SASHTO) regional competition in late 2020 as the winning project in the Operations Excellence – Small Project category for implementing operational solutions to improve reliability and safety along the corridor.

INNOVATION AND TECHNOLOGY TRANSPORTATION FUND (ITTF)

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

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

The ITTF is separate from the VDOT operations funding provided from the Highway Maintenance and Operations Program (HMOP). As innovative projects and operational programs are piloted using the ITTF, they are eligible for HMOP funding once they are approved for implementation and institutionalized. While an ITTF funded project may end its implementation, the project continues with on-going maintenance costs. The program requires continuous investment. If technology becomes obsolete, reliability, efficiency, and safety may be compromised.

There are 40 projects currently funded with the ITTF that were approved by the Board, these 40 projects have a total value of approximately $125M.[17] The ITTF was leveraged to assist in funding a portion of the I-95 Variable Speed Limit and RM3P projects.

Another project included within the 2022 program is Tunnel Speed Management (Guide Lights) for the Monitor Merrimac Bridge Tunnel. This technology addresses the phenomenon of reduced speed on inclines. These "Pace" lights will provide visual cues of appropriate speeds. This project will address the ITTF focus on congestion, safety, and improved traveler information.

Combating Non-Recurring Congestion

Operational strategies can minimize the impacts of non-recurring congestion on the traveling public. This customer-focused work is led by VDOT's five traffic operations centers (TOCs) maximizes system reliability, maintains system access, and promotes safe travel. Examples of operational strategies include monitoring traffic and travel conditions; dispatching personnel to respond to and manage incidents and events; providing accurate, real time traveler information; managing work zones; and fostering strong relationships with our partners. The TOCs use technology and Intelligent Transportation Systems to keep Virginia moving. VDOT team members are piloting new ideas and transferring successful examples to other parts of the Commonwealth. They step in to help each other across the state when needed to address incidents affecting the traveling public.

INCIDENT MANAGEMENT

VDOT is an emergency response organization, responding to any event that impacts the transportation system. Our incident management personnel, area headquarters, residencies, and Safety Service Patrols are on the front lines of the operations program. They lead our incident response, clear active incidents, remove fallen trees, repair washed out roadways, and help people in trouble on our system. Each year VDOT faces, responds to, and learns from these events. The planning, fine-tuning, and preparation for incidents is a continual focus for VDOT.

SAFETY SERVICE PATROL (SSP)

Safety Service Patrol (SSP)[18] includes over 170 vehicles, covers over 887 Interstate miles statewide, and is an integral part of VDOT's safety program. SSP primary goals are:

- Detecting incidents and disruptions in traffic
- Minimizing incident duration
- Clearing obstructions and debris from the roadway
- Establishing temporary traffic control for emergency responders and providing scene assistance as needed as per the Move it Law.[19] This includes serving in the capacity of VDOT on-scene field commander as part of the command structure at the scene and providing incident and congestion management functions until relieved
- Additionally, and where applicable, support reversible roadway and high-occupancy vehicle gate operations to ensure safe and incident-free lane change functions

INCIDENT MANAGEMENT COORDINATORS

VDOT has implemented a program to hire Incident Management Coordinators (IMCs) with over 30 IMCs across the state within regions, districts, and residencies. The role of the IMC is to:

- Plan, execute, and continually review incident and emergency operations
- Respond to major incidents on Virginia's highways to address safe and efficient incident mitigation
- Coordinate VDOT resources and implement safe procedures to clear the scene while also allowing for continued traffic flow to *"Keep Virginia Moving"*

The IMC represents VDOT collaborating with other public service agencies, first responders, and stakeholders to coordinate scene and lane clearance to restore traffic flow quickly.

VEHICLE RED LIGHT INITIATIVE

The 2022 Acts of General Assembly amended the Code of Virginia (§46.2-1029.2 and §46.2-1030), allowing Safety Service Patrol vehicles and vehicles of incident management coordinators the ability to use red lights to respond to traffic incidents. Timely response and quick incident clearance are critical to promoting safe and reliable travel. Long incidents contribute to secondary crashes. Therefore, the ability to respond to an incident quickly is essential to clearing the incident faster and reducing delay, and the possibility of secondary crashes. Improving roadway clearance time also reduces the cost of congestion as vehicle hours of delay will decrease.

I-81 TOWING AND RECOVERY INCENTIVE PROGRAM (TRIP)

BENEFITS FOR VIRGINIANS

- Tow response times reduced from 2-18% along the corridor; roadway clearance times reduced 10-12%[20].
- Reduced risk of secondary crashes.

Another I-81 corridor improvement project taking off in 2021 was Virginia's Towing and Recovery Incentive Program (TRIP)[21]. Supported by VDOT, Virginia State Police, and members of the Virginia Statewide Traffic Incident Management Committee, TRIP is an incentive program where VDOT partners with heavy-duty towing and recovery companies to standardize the response to commercial vehicle crashes. Mountainous terrain along I-81 contributes to the highest incident-related delay among interstates in Virginia. TRIP facilitates safe and quick clearance of incidents with improved towing standards, procedures, and training. It reduces lost-time costs, improves reliability, and lessens the risk of secondary crashes that happen during backups.

Innovative Safety Program

VDOT examines every aspect of where and how safety can be improved for the traveling public and VDOT's own employees. In 2022, the Board adopted a new Highway Safety Investment Strategy. VDOT delivered the 2022 update of the Strategic Highway Safety Plan (SHSP).[22] VDOT continues to partner with others to identify potentially promising future technologies to improve work zone safety.

VDOT SAFETY PROGRAM BEHAVIORAL AND INFRASTRUCTURE INVESTMENT PLAN

The VDOT safety program investment plan[23] continues a focus on behavioral education and measures to address speed, as well as distracted/alcohol/drugged/unrestrained driving. In addition, VDOT is implementing a prioritized approach to infrastructure investments. This work has initially focused on VDOT systemic safety projects to improve safety by installing lower-cost, high-return countermeasures at many locations on the road network that have similar risk factors. In Virginia, these countermeasures are expected to be up to nine times more effective at reducing fatalities and serious injuries per dollar spent as compared to spot improvement projects. Many of these projects are being delivered ahead of the original schedule. Progress is shown in **Figure 3**. On completion of this work the focus is to shift towards local undivided two-lane road systemic safety projects where over 17,500 crashes happen annually on over 32,800 lane lines and looking forward (indicatively 2026 / 2027) to fund crucial spot improvement projects with higher return on investments.[24]

FIGURE 3 | **VDOT progress in delivery of systemic safety improvements (November 2021).**

2022-2026 STRATEGIC HIGHWAY SAFETY PLAN

VDOT's 2022-2026 Strategic Highway Safety Plan (SHSP)[25] is the latest update to Virginia's highway safety planning efforts, ongoing since 2006. It describes how the Commonwealth will address infrastructure and behavioral safety. Since 2014, traffic fatalities have increased in Virginia, climbing to 968 in 2021.[26] The updated SHSP represents a coordinated effort by VDOT, Virginia Departments of Motor Vehicles (DMV), Health (VDH), and Education (VDOE), the Virginia State Police (VSP), and other state, regional, and local partners. The goal is to plan and implement traffic safety improvement initiatives for each SHSP emphasis area. To make progress towards the plan's vision (Towards Zero Deaths) and mission, the Board adopted Aspirational Safety Performance Goals (June 2022[27]) that are consistent with the goals in the SHSP. Priority strategies aligned with the guiding principles are to:

- Implement road improvements that ensure human mistakes and vulnerabilities do not result in serious injuries or fatalities
- Adopt an approach that considers risk when prioritizing locations for safety improvements and programs
- Recognize road safety as a public health issue and establish policies and programs that promote safe behavior and reduce crash severity outcomes
- Develop and implement programs that provide education and awareness to high-risk road users
- Implement innovative solutions and utilize current and emerging technologies

The plan was developed in consultation with federal, state, regional, and local stakeholders who represent the 4 E's of safety – engineering, enforcement, education, and emergency response and medical services.

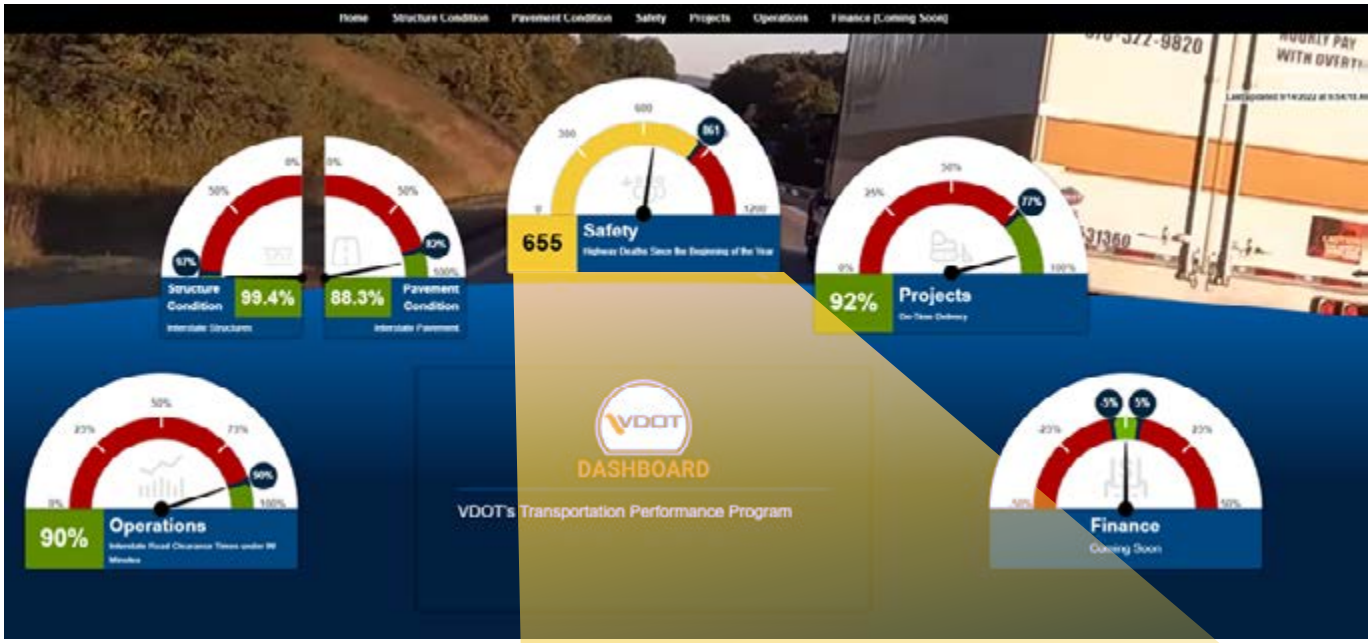
2022-2026 STRATEGIC HIGHWAY SAFETY PLAN EMPHASIS AREAS

Program Delivery

VDOT's mission is to "Keep Virginia Moving" with program delivery as one of the objectives. The VDOT dashboard, ensures transparency, accountability, open communications, and maintains focus. The dashboard (see **Figure 4**) measures:

- projects on-time and on-budget
- condition of pavement and bridge assets
- operational clearance times and
- safety incidents

FIGURE 4 | **VDOT Transportation Performance Program Dashboard (September 2022).**



VDOT has instilled the on-time and on-budget in our everyday approach to projects reflected in the Six-Year Improvement Program and VDOT's Maintenance and Operations Program. To preserve the condition of existing assets, in 2019 VDOT reviewed the Maintenance and Operations Program to ensure that assets such as pavements and bridges have a long-term sustainable performance (over 20 years) along with the understanding of the investments required to achieve performance goals, the 2019 Maintenance and Operations Program Comprehensive Review or "Comprehensive Review".

VDOT'S FUTURE: MAINTAINING INFRASTRUCTURE WHILE ENSURING TRANSPARENCY AND LONG-TERM SUSTAINABILITY

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

Maintenance and Operations Comprehensive Review

Following the 2019 Maintenance and Operations Comprehensive Review Report[28] ("Comprehensive Review") of pavements, bridges, routine maintenance, and special structures, VDOT has continued to report annually to the CTB on the approved investment strategies to achieve long-term sustainable performance targets. VDOT continues to assess other areas in the Maintenance and Operations Program areas where a long-term strategic approach is applicable.

Infrastructure Investment and Jobs Act (IIJA)

In November 2021, the IIJA was signed into law. VDOT worked closely with the Federal Highway Administration (FHWA) to ensure that Virginia was well positioned to utilize newly available funding. This positioning enabled VDOT to program projects for the first year within 2 months of when the IIJA was signed into law and have projects for the remaining 4 years approved by June 30, 2022. This program includes $575M for bridges over the next 5 years[29] that will allow VDOT to:

- Extend the life of over 500 bridges
- For VDOT bridges, focus the expenditure on the preservation of interstates and high-volume primary roads
- For locally owned bridges, focus expenditure on bridges in poor condition

This approach aligns with the findings of the Comprehensive Review, which has positioned VDOT to invest these additional funds in the areas of greatest identified need while delivering a sustainable long-term outcome.

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 5**.

Annually, VDOT uses condition assessments for pavements and bridges to develop a cost estimate for repairing or replacing these assets. VDOT refers to these monetary costs as needs. This condition assessment is described in two reports: State of the Structures and Bridges[30] and State of the Pavement.[31]

FIGURE 5 | VDOT's Asset Management Cycle

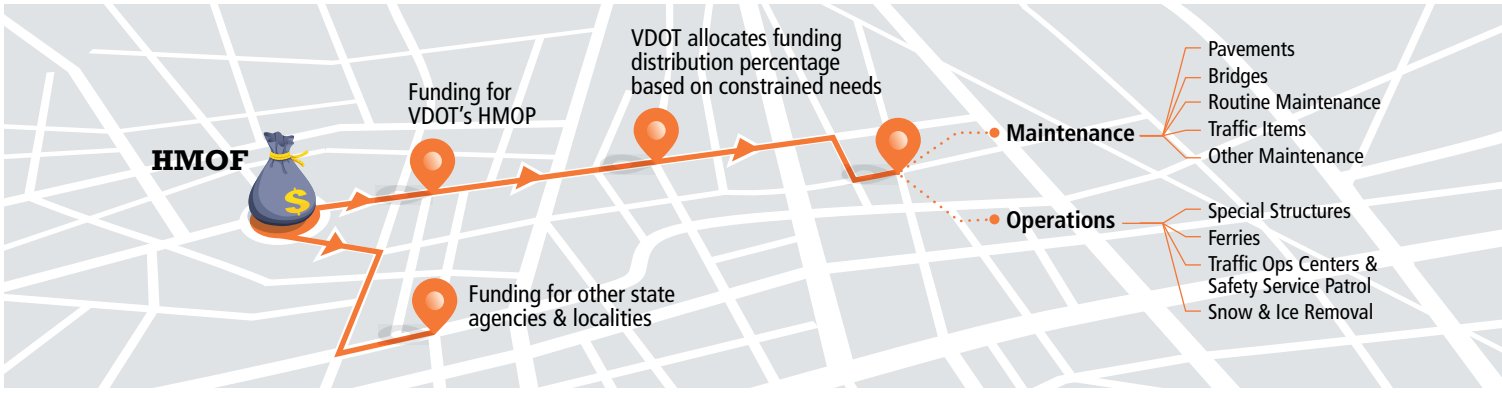
VDOT collects, compiles, analyzes, and reviews pavement condition data to report the optimized needs at a system and district level. VDOT's pavement program selects specific projects based on highest priority needs and optimizes timing of projects through a data-driven pavement management system.

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

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. In 2022, VDOT, like other Virginia consumers, is faced with the impacts of high gas prices and inflation, and the increased costs came during the paving season. Accordingly, the Board authorized a set-aside of $129M to cover possible increases in maintenance costs that were forecasted for the rest of the year.

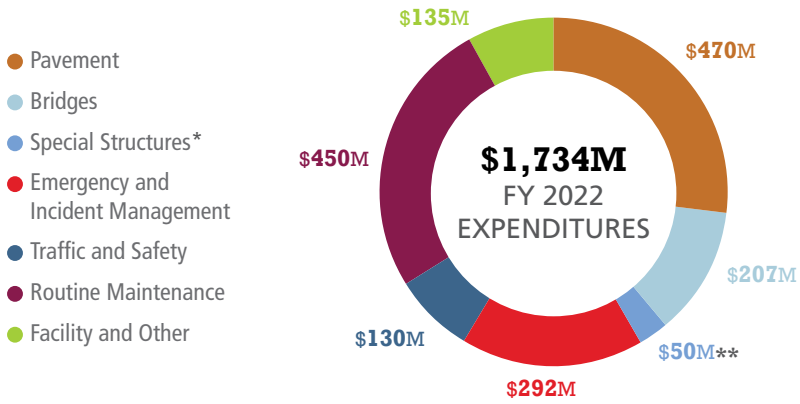
Funds from the HMOF support VDOT's Highway Maintenance and Operations Program (HMOP) for the agency's maintenance, operations, and services. Localities and other state agencies also receive payments directly from the HMOF. The method used to compute the amount each locality is paid is established by statute. The overall HMOP allocation process is shown in **Figure 6**.

FIGURE 6 | **HMOF Funding Allocation Methodology**



VDOT employees and contractors execute the HMOP, which includes the activities (assets and services) listed in **Figure 7**. The needs assessments are used to distribute the HMOP budget in the beginning of a fiscal year for use throughout the year. The FY 2022 expenditure by district and activity is provided in Appendix C.

FIGURE 7 | **HMOP - FY 2022 Expenditures**



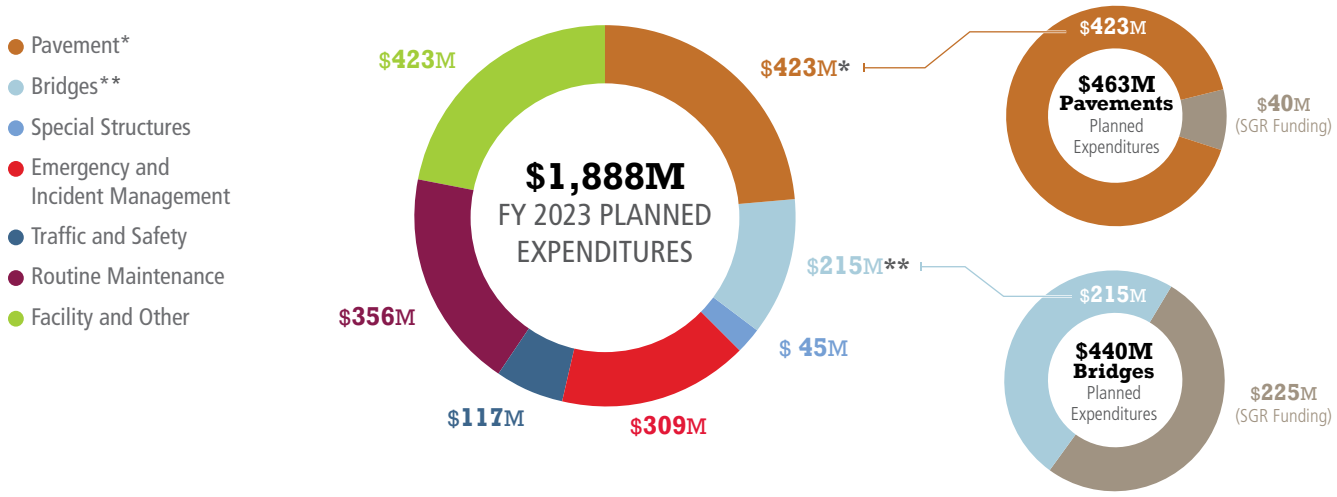
* Special Structures receives funds for operations and routine maintenance (average $50M)

Note: Amounts have been rounded.

The FY 2023 HMOP planned expenditures are shown in **Figure 8** along with a breakdown of the other investments for pavements and bridges. The Special Structure expenditures reflects the dedicated HMOP amounts (average of $50M annually) for the operations and routine maintenance of the facilities discussed later in this report. The expenditures and activities listed reflect those identified through the Comprehensive Review.

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

FIGURE 8 | **HMOP - FY 2023 Planned Expenditures**



* VDOT reviewing the need for additional funds due to current economic factors.

** IIJA amounts are not reflected.

State of Good Repair Program

Under the State of Good Repair Program, all nine VDOT construction districts receive funding each year. 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 roadway system with dedicated funds for pavements and bridges. The Board's Prioritized Process Methodology provides details on the monetary needs (projects) prioritization and the approved allocation processes for the State of Good Repair Program funds and a link may be found in the endnotes later in this report.[32, 33]

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

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

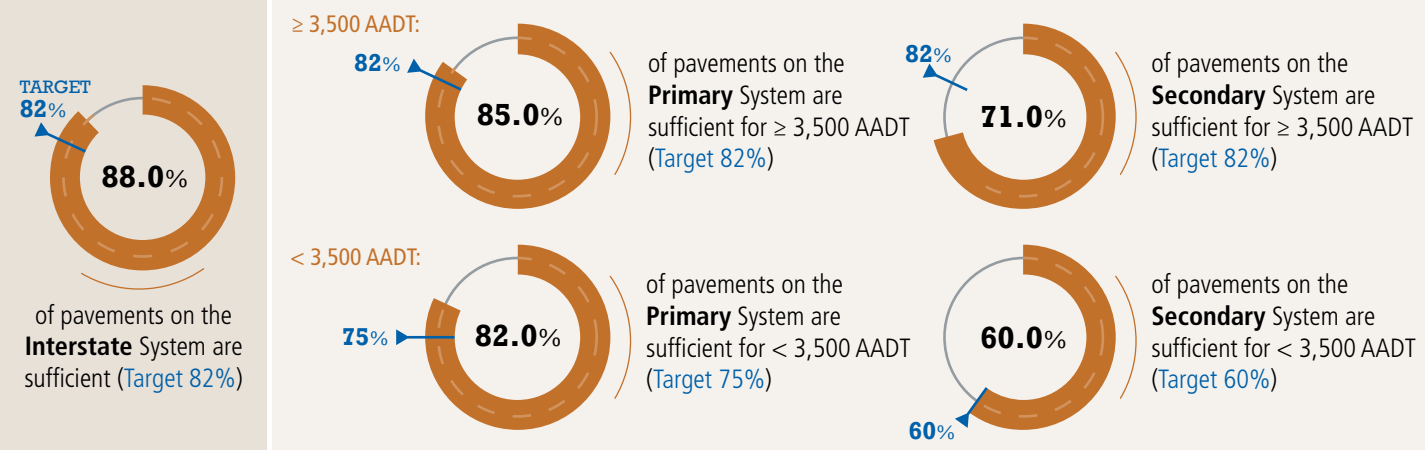
Pavements, Structures, and Routine Maintenance – Performance Progression

VDOT has continued to make progress in moving towards performance goals set through the Comprehensive Review.

PAVEMENTS

Pavement performance against targets is shown in **Figure 9**.

FIGURE 9 | 2022 Pavement Performance – Targets vs. Actual[34]



AADT – Annual Average Daily Traffic

STRUCTURES

For structures, a shift to a "preservation approach," allows VDOT to create sustainable performance of structures across the Commonwealth. **Figure 10** presents current structure condition performance.

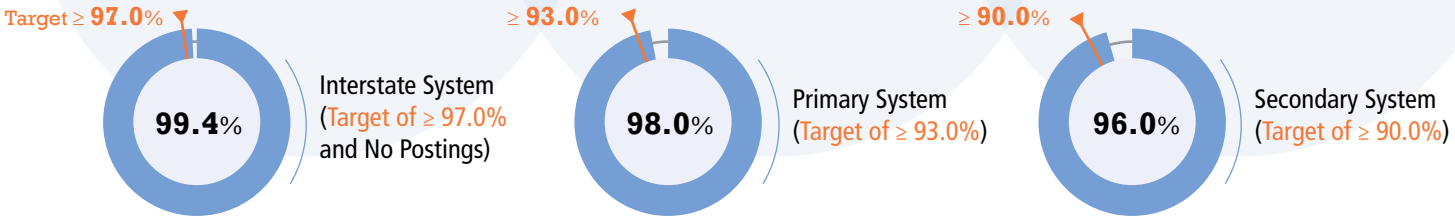
FIGURE 10 | 2022 Structure Performance – Targets vs. Actual[35]

Average Weighted General Condition Rating (GCR July 2022) against a long-term goal of maintaining ≥ :

LONG-TERM GOAL OF MAINTAINING ≥ 5.6

6.30	6.20	6.50
INTERSTATE SYSTEM	PRIMARY SYSTEM	SECONDARY SYSTEM

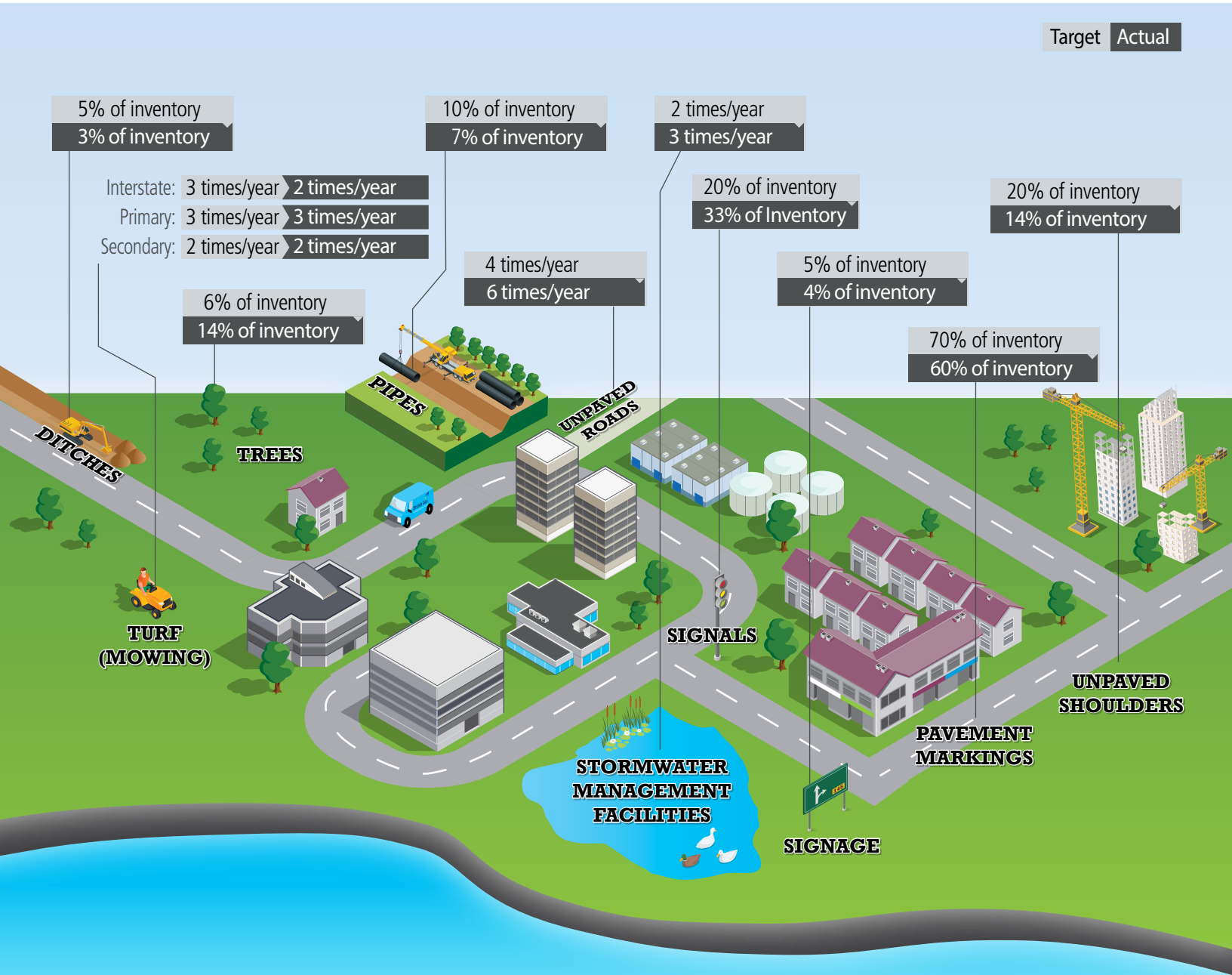
Pecentage of non-poor (sufficient) structures:



Routine Maintenance

The routine maintenance performance measures were presented to the Board in October 2019 (**Figure 11**) as an informational tool. VDOT's "back to basics approach" will enable VDOT to refocus and allow district teams to proactively plan work and create efficiencies with a systematic method.

FIGURE 11 | 2022 Routine Maintenance Performance – Targets vs. Actual[36]



In 2022 VDOT has identified four key maintenance activities for which an increased focus is proposed moving forward. With these activities VDOT is to increase the level of effort to ensure that national best practice standards are achieved. The four maintenance activities and the benefits to be achieved include:

▪ **Unpaved shoulders** ▪ **Ditches** ▪ **Pipes**	Each of these activities will extend the life of pavements. Reducing the likelihood of standing water in the pavement foundations.
▪ **Trees**	Trimming trees will reduce the impact on the traveling public and cost to VDOT from debris cleanup following emergency weather events (e.g., ice storms, and hurricanes).

Special Structures

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

VDOT has Special Structures that include tunnels, movable bridges, and large, complex fixed-span structures (**Figure 12**). They are considered "special" due to their complexity, maintenance and operations cost, level of risk, and economic importance. The Board approved the Special Structure 50-Year Long Term Plan[37] in October 2021[38] with a plan to update annually. In June 2021 (FY 2022), the Board approved the Special Structure Fund allocations ($60M) to projects reflected in the 50-Year Long Term Plan. This Special Structure Fund allocations increased to $80M in FY 2023 with an inflationary factor each fiscal year after FY 2023. Work on projects to prevent the highest risk of failure has begun in 2022 and planning for future year projects is continuing.

FIGURE 12 | VDOT Special Structures and High Priority Special Structure Fund 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

SPECIAL STRUCTURES HEALTH INDEX

The Special Structures health index will measure the relative condition of structures and their internal 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.

In development of the Special Structures health index VDOT has undertaken considerable outreach with the AASHTO T-8 Movable Bridges and T-20 Tunnels technical committees and other DOTs. Examples of a health index for these types of structures has not been found.

The Special Structures health index will guide better investment decisions that will enable VDOT to deliver safer and more efficient outcomes.

GWYNN'S ISLAND BRIDGE

In 2022 a project commenced to undertake critical repair/replacement of the mechanical equipment for the Gwynn's Island Bridge. This work will prevent failures that have occurred multiple times per year, stranding vehicular or maritime traffic. This $11M project is currently in the fabrication stage, that started in 2022. In the winter of 2022/2023, the bridge will be closed to maritime traffic and VDOT has been in continuous communication with the commercial fisherman and U.S. Coast Guard to enable alternative arrangements to be made during this time. Project completion is expected in spring/summer 2023.[39]

VDOT ORGANIZATION INSIGHT

The vision driving how VDOT executes its mission includes the principles of transparency and innovation – a focus that includes operating our system more efficiently, maintaining our assets, maintaining a highly trained workforce, ensuring a sustainable pipeline of projects, and, of course, safety. The vision has inspired many collective accomplishments in recent years that reflect our investment in tools, data, processes, and our people (see examples Figure 13.)

FIGURE 13 | **VDOT People, Process and Tools Initiatives**

INVESTING IN OUR EMPLOYEES[40]

Investing in our people is important to VDOT. In May 2022, VDOT bridge maintenance teams from Staunton and Lynchburg districts gathered for hands-on training in specialized welding techniques. After several weeks of instruction and practice, the trainees underwent rigorous testing in vertical and overhead welding. Certification is required to weld on a bridge and the testing that one has to pass to receive the certification is difficult. However, having VDOT team members trained and certified helps with welding projects in our shop plus in the field welding on bridges. The cooperation and teamwork demonstrated between districts allowed them to fill an entire class – and share their knowledge in the process.

BUSINESS[41]

In May 2022, VDOT launched the DocuSign ePen solution for use by our team and partners. DocuSign ePen is an electronic signature service that helps streamline our workflows and make doing business with VDOT simple and easy. As a part of this solution, VDOT established a DocuSign Center of Excellence, which assists in converting paper forms that require signatures into DocuSign forms. Since the launch in the spring of 2022, over 200 forms have been processed using ePen. Half of the forms were completed within one hour and 90% were completed within 24 hours – allowing VDOT to begin collaboration with our external business partners faster than ever before.

INNOVATION

VDOT is continuously implementing innovative safety, mobility, and maintenance approaches.[42] Safety innovation is featured beginning on page 10. Further details on material and equipment improvements are included on page 24. Mobility initiatives are featured throughout this section, including the Regional Multimodal Mobility Program (RM3P) on page 3.

RESEARCH AND DEVELOPMENT TOWARD NEW METHODS AND MORE RESILIENT AND LONG-LASTING MATERIALS

VDOT has a long-standing commitment to the research and development of Virginia's transportation system, exploring new ideas and technologies that might help make travel safer, improve traffic flow, improve efficiency and lower costs, and provide longer-lasting materials and more resilient infrastructure (see examples in **Figure 14**). One avenue of research and development is through the Virginia Transportation Research Council, VDOT's Research Division, which undertakes studies on behalf of VDOT.

FIGURE 14 | **Innovations in Materials and Equipment**

RECYCLED PLASTIC PAVEMENT

The Research Council is assessing the use of recycled plastic materials in pavements[43], evaluating their constructability and performance compared with VDOT's typical asphalt control mixes. The technique has been tested on a mile-long stretch of Old Stage Road in Chester. Using plastic in roadways is one way to make use of the 76 percent of plastic waste that would otherwise end up in a landfill. As noted earlier in this document VDOT utilized more than 500,000 tons of recycled asphalt in the pavement for the I-64 Widening Segment Phase III project.

IMPROVED LOW-COST PAVEMENT TREATMENTS

A comparative evaluation of the application of chip seal (Richmond) or microsurfacing (Hampton Roads) treatments using current VDOT standards versus AASHTO's newly proposed, provisional standards. The research will determine if the provisional changes return any initial benefits to VDOT.[44] Another pavement study is aimed at developing testing standards to evaluate the rutting performance of asphalt mixtures.[45]

SOLAR LIGHTING

A "bright" idea for using solar lighting[46] came from the Bristol District's first Innovation Lab in 2021. Employees from Bristol's Facilities Division have installed new solar light poles at two salt storage facilities for the Abingdon Residency to assist with night operations and save costs. The solar pole investment will be paid off in four years. In undertaking research prior to the decision to go solar, a Bristol employee learned that the imported solar poles could be purchased directly from a local Virginia company.

EXTENDING BRIDGE LIFE

The Research Council is examining the use of fiber-reinforced concrete for repair of the ends of corroded steel beams.[47] It is also looking at the development of standardized tests for the use of different elasticized expanded polystyrene (EPS) materials to address potential settlement at the approaches to integral (jointless) bridges.[48]

INNOVATIVE MAINTENANCE

The Staunton District Equipment division works with dealers and manufacturers to evaluate innovative products[49] on real-life maintenance tasks with the goal of helping employees be safer and more productive. One example is a remote-controlled mower that is roughly the size and weight of a small sedan, but with a low center of gravity and steel tracks. The mower maintains stability on steep slopes, avoiding the risk of slips and falls.

COMMONWEALTH'S TRAFFIC OPERATIONS ADVANCEMENTS

Through organizational realignment, VDOT recognizes Traffic Operations as one of the agency's core functions along with Construction and Maintenance. VDOT is harnessing the power and benefits of increasingly sophisticated and interconnected technologies – ranging from variable speed limit signs, statewide advanced traffic signal systems, automated incident detection cameras, and digital message boards (see Figure 15) – to improve safety and traffic operations. Enhanced security solutions were deployed to reduce the risk of cyber-attacks. VDOT links these devices and solutions with multiple cloud-based data centers and thousands of miles of fiber networks to prepare for even more advanced technologies on the horizon.

FIGURE 15 | Traffic Operations Technology Enabling Roadway Operations

VDOT reorganized central functions to establish a new Transportation Systems Strategy Office, an Operations Technology Division and a Traffic Operations Division.[50] A dedicated position has been established at each District – District Traffic Operations Director. These actions ensure that traffic operations remain customer-focused and service oriented. At the same time, VDOT is increasing the use of data science and robotic process automations to support agency personnel in traffic and congestion management.

The newly formed Operations Technology Division will provide statewide leadership with focused and dedicated attention to consistent systems and solutions, to support field operations, and to strengthen the linkage of these efforts with the districts. The organization realignment will enhance the ability of the VDOT team to address recurring congestion, non-recurring congestion, and road safety.

STRENGTHENING PARTNERSHIPS WITH THE PRIVATE SECTOR, LOCALITIES AND REGIONAL AUTHORITIES

VDOT collaborates with businesses and local agencies to assure the most effective, efficient, and responsive delivery of transportation system improvements and services. Work by contractors providing specialized technical expertise is performed under VDOT direction. VDOT assesses which jobs can be completed in-house and which need to be contracted out to ensure the appropriate team accomplishes the work.

Partnerships with Localities

VDOT is working with localities to improve safety on local roadways; to improve traffic flow and provide new pedestrian and bicycle paths and features; develop multimodal transportation services; and provide new design tools and options for intersections and interchanges. Localities are vital to the delivery of Virginia's transportation system projects. VDOT's dedicated Local Assistance Division partners with localities to support the achievement of overall goals and objectives for Virginia's transportation network.

2022 marked the 10th anniversary of the Local Programs Workshop.[51] This workshop focuses on providing an overview of local programs, which will provide training for program management and project development. The Workshop brings together local government, VDOT, and private sector staff to discuss the delivery of the local transportation program.

Another effort on which VDOT will collaborate with localities is related to roadway assessments. The 2022 Acts of General Assembly Chapter 2 (FY 2023 and FY 2024) Item 456 G requires VDOT to conduct an evaluation of the condition of city streets for entities receiving city street payments. The evaluation will include pavements and bridges on city-maintained streets throughout the Commonwealth to include (i) conditions; (ii) current city street payment formula distribution; (iii) partnership opportunities and (iv) recommendations on revisions to formula. The evaluation is due no later than December 1, 2023. The assessment will be consistent with VDOT's 2019 Maintenance and Operations Program Comprehensive Review.

VDOT partners with regional authorities established throughout the Commonwealth, in particular the Northern Virginia Transportation Authority (2002); the Hampton Roads Transportation Accountability Commission (2014); and the Central Virginia Transportation Authority (CVTA,2020). The common attributes for these authorities are a regional focus; regional revenue; tolling authority (for some entities) and the ability to issue debt (for some entities). Membership includes elected representatives from the localities as well as the Commissioner of Highways and the DRPT Director; and they are authorized to employ a chief and staff. VDOT is a collaborative partner with the authorities. Sample projects include:

- The Route 28 widening project – Northern Virginia Transportation Authority[52, 53]
- The Hampton Roads Bridge Tunnel – Hampton Roads Transportation Accountability Commission[54]
- The Fall Line Trail Project - Central Virginia Transportation Authority[55]

VIRGINIA TRAILS NETWORK CONTINUES TO EXPAND

In February of 2022, VDOT completed improvements to bridges along the Jamestown leg of the Virginia Capital Trail (VCT).[56] In 2022 VDOT has reached an agreement with the CVTA on the administration and funding for the Fall Line Trail. Named for its unique geography along the trail corridor, the Fall Line denotes the area where the Piedmont plateau and Atlantic Coastal Plain meet, resulting in a number of rapids and waterfalls. This trail will be a 43-mile multi-use path that travels through Chesterfield, Hanover and Henrico counties, as well as Colonial Heights, Petersburg, Richmond, and Ashland. The first section is already open in Ashland and other sections are under design.

Partnerships with Private Sector

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

VDOT has a long history partnering 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 membership in associations. More than 60 percent of the HMOP expenditures are delivered in partnership with the private sector.

In 2021, VDOT's strong partnership with the private sector was put to the test when its largest interstate maintenance contractor went out of business. With the contractor literally disappearing overnight, VDOT maintenance and operations teams partnered with sub-contractors to provide continuity. This included immediately setting up teams to maintain the Interstate, manage and operate bridges, and manage rest areas. This response was a great example of VDOT's relationship with companies and individuals in the private sector and a can-do approach in response to change.

Public Private Partnership (P3)

Virginia continues its leadership in the use of P3 projects to accelerate project delivery and strengthen the state's economy and workforce. Having embarked on innovative financing through the use of the P3 delivery model as far back as 1992, the Commonwealth has recently been recognized for its achievements in delivering the I-95 Express Lanes Fredericksburg Extension, the I-495-Express Lanes Northern Extension, and the Coalfields Expressway.

VDOT WINS TWO MAJOR AWARDS FOR P3 PROJECTS

The industry publication P3 Bulletin named VDOT and Virginia's Office of Public-Private Partnerships as Public Sector Procurer of the Year (2020).[57] The award recognizes outstanding achievement in public-private partnerships throughout the Americas. The program has delivered significant roadway solutions for Virginia motorists. The projects have injected billions of dollars into Virginia's economy, supported tens of thousands of jobs, and offered unique solutions.

The Virginia Office of Public-Private Partnerships also received the 2022 StateScoop Award for State IT Innovation of the Year for developing the Strategic Contract Management System (SCMS). StateScoop gathers top leaders from across government, academia and the technology industry to discuss ways technology can improve government, and to exchange best practices and identify ways to achieve common goals. The SCMS was built to better manage the multi-billion dollar and long-term P3 contracts. The application is first-of-its-kind in state government. It was built via Low Code-No Code, built with visual tools and model-driven process instead of the traditional code-based programming application, and is fully scalable to fit the needs of the future.[58]

TRANSFORM 66 – OUTSIDE THE BELTWAY

BENEFITS FOR VIRGINIANS

- 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 paths.
- Improve interchanges to enhance safety and reduce congestion.

A Forbes magazine review late last year cited Virginia's success in bringing large infrastructure projects to completion on time and without cost overruns.[59] The piece called VDOT's Express Lanes on Interstate 66 project "an example of a multimodal successful project" and a model for other projects seeking funding under the new federal Infrastructure Investment and Jobs Act. Noting that it took three years to develop the partnership, requiring coordination with localities and different interest groups, the review went on to praise VDOT for bringing everyone together and structuring an agreement that recognized equitable risk allocation.

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. The project is on schedule to be completed in December 2022.

495 NEXT PROJECT: FINANCING SECURED AND CONSTRUCTION BEGUN

The construction on the I-495 Express Lanes Northern Extension ("495 NEXT") project began[60] in March 2022 and is expected to open in 2025. The project will extend the existing 495 Express Lanes north 2.5 miles from the current terminus near the I-495 and Dulles Access Road interchange to the vicinity of the of American Legion Bridge. Additionally, the Commonwealth of Virginia and toll road operator Transurban will be supporting the launch of new transit services and the construction of bicycle and pedestrian connections along the project corridor. Commercial and financial close was in October 2021 and in February 2022, respectively and all completed during the pandemic.

Appendix A – Statutory 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 addressed within this 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

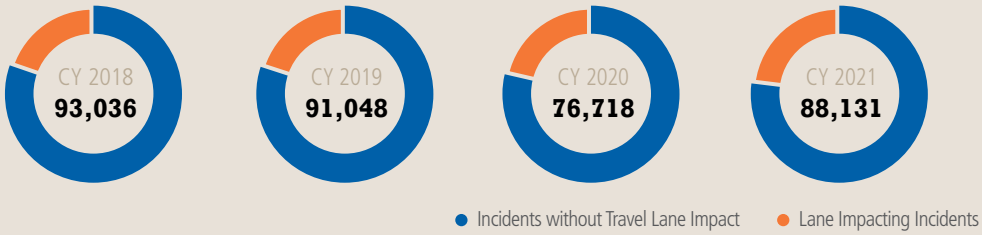
Appendix B –Mobility Performance Measures

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. Current performance on the other measures is shown in **Figure 16**.

FIGURE 16 | **Mobility Performance Outcomes**

INCIDENTS

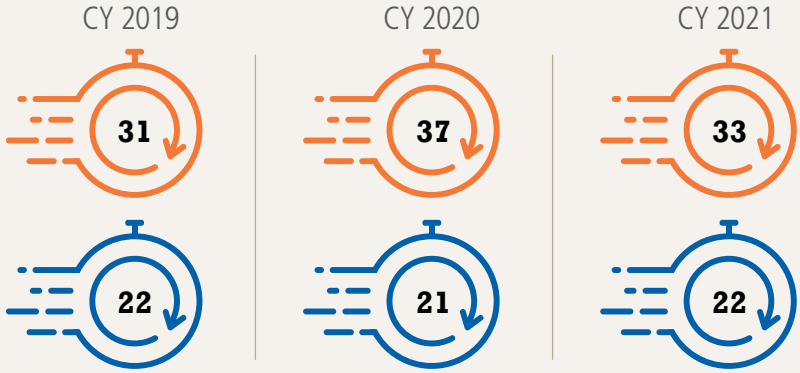
25% of the congestion on Virginia's interstate roadways occurs because of a traffic incident.



INCIDENT DURATION

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

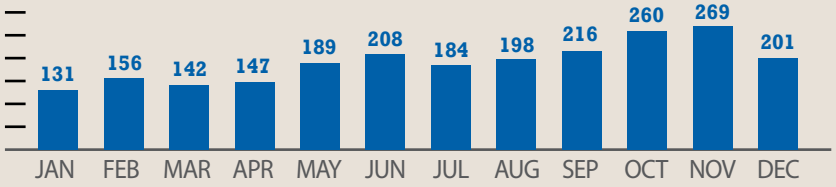
Scene Clearance Time* is defined as the median time from the start of the incident to when the last responder has left the scene and all lanes and shoulders are clear. A roadway's Scene Clearance Time includes times to address disabled vehicles on the shoulders and other simpler events that often result 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.

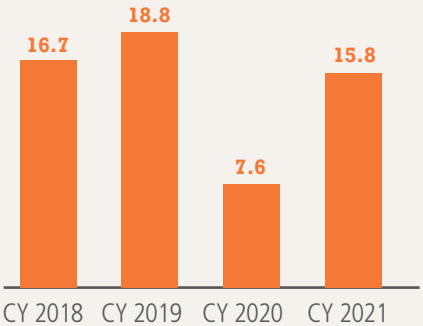


Number of Secondary Incidents	
CY 2018	**3,798**
CY 2019	**3,533**
CY 2020	**1,886**
CY 2021	**2,301**

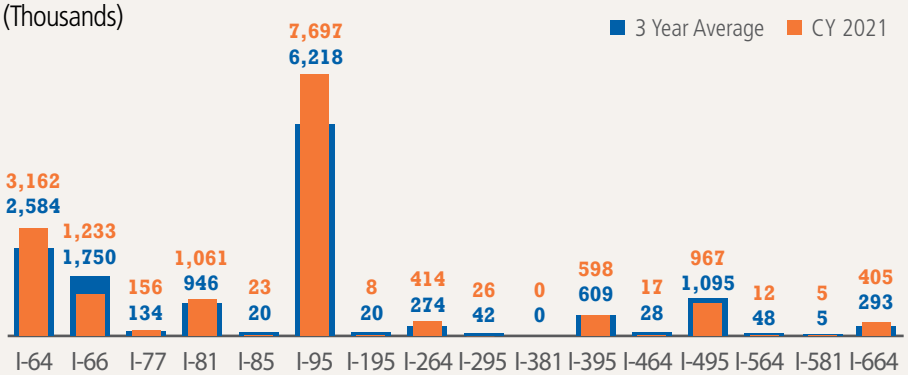
VEHICLE HOURS OF DELAY (VHD)

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.

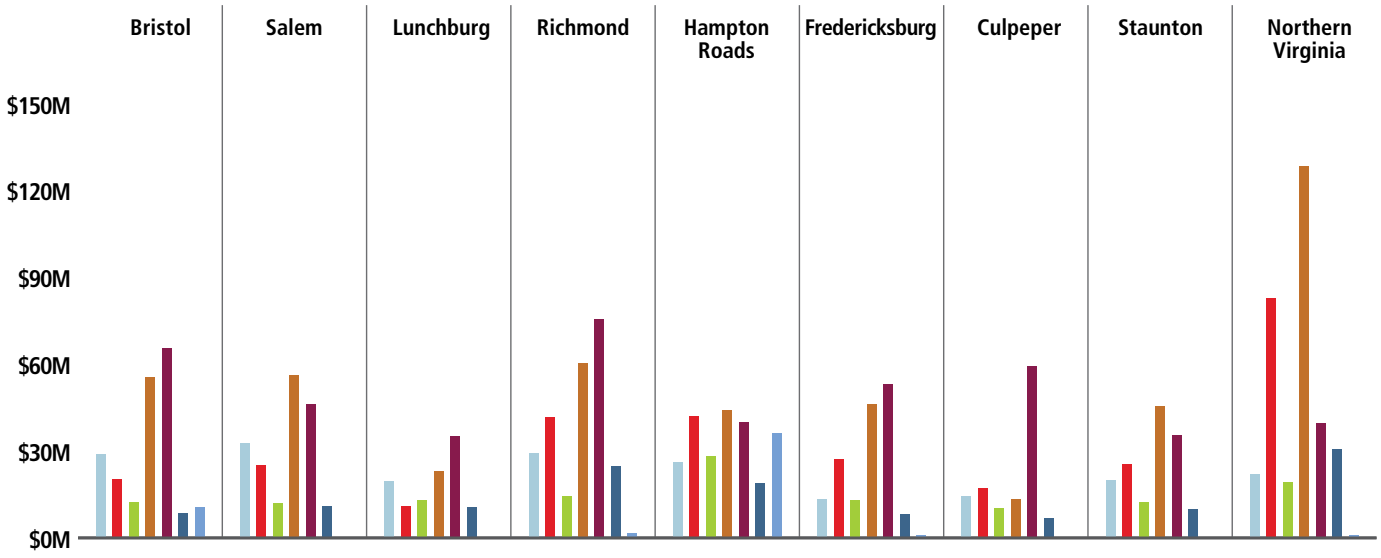
CY 2021 VHD by Year (Thousands)



CY 2021 VHD by Route (Thousands)



Appendix C – HMOP Expenditures by Asset Class and District



Category	Bristol	Salem	Lunchburg	Richmond	Hampton Roads	Fredericksburg	Culpeper	Staunton	Northern Virginia
Bridges	$29M	$33M	$20M	$29M	$26M	$13M	$14M	$20M	$22M
Emergency and Incident Management	$20M	$25M	$11M	$42M	$42M	$27M	$17M	$25M	$83M
Facility and Other	$12M	$12M	$13M	$14M	$28M	$13M	$10M	$12M	$19M
Pavement	$55M	$56M	$23M	$60M	$44M	$46M	$13M	$45M	$128M
Routine Maintenance	$65M	$46M	$35M	$76M	$40M	$53M	$59M	$35M	$40M
Traffic and Safety	$8M	$11M	$11M	$25M	$19M	$8M	$7M	$10M	$31M
Special Structures (VITAL)	$10M			$1M	$36M	$1M			$1M

ENDNOTES

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2 ATSSA announces winners of four national awards - ATSSA

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