 

State of the Structures and Bridges Fiscal Year 2020

July 1, 2019 – June 30, 2020

Prepared By: Structure and Bridge Division,
Virginia Department of Transportation

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1 OVERVIEW

Mission of the Structure and Bridge Division

The Structure and Bridge Division will plan, design, inspect and rehabilitate bridges and structures for a surface transportation system that represents the highest standards of safety and quality. Stewardship, accountability, professionalism, and customer service will guide every action that we take and every decision that we make.

1.1 INTRODUCTION

This annual report summarizes the conditions of Virginia's bridges, large culverts and ancillary structures (signs, luminaires, traffic signals, high mast lights and camera poles). It also describes the bridge maintenance, construction, and inspection programs of the Virginia Department of Transportation (VDOT). The report reflects accomplishments for the 2020 Fiscal Year (referred to as FY2020), which ran from July 1, 2019 through June 30, 2020. Salient historical trends are also provided. All "current" data in this report reflect inventory and condition information as of July 1, 2020.

Data presented in this report provide information for the population of highway structures referred to as "Virginia Responsible Structures". This term refers to bridges and culverts carrying public traffic that are owned by the Virginia Department of Transportation (VDOT), localities (cities, towns and counties), other state agencies, or other legal entities of the Commonwealth of Virginia. These structures include bridges of any length and culverts with total opening in excess of 36 square feet. Temporarily closed structures are also included. Any use of the terms "structures" or "Virginia's structures" in this report refers to that population defined as "Virginia Responsible Structures" above unless specifically noted otherwise.

There are currently 21,195 structures in Virginia, and 19,612 of these are owned by VDOT. The remainder are owned by other legal entities, including localities, state agencies, and toll authorities. As shown in Figure 1-1, the majority of structures are on secondary routes. VDOT's control of secondary routes is due in large part to the Byrd Act of 1932, which transferred ownership of most county-owned secondary roads and bridges to the state. This is a departure from the practice in most states, where most secondary roads are under local jurisdiction. As a result, VDOT has the third largest number of highway structures in its state-owned inventory, behind Texas and North Carolina.

Since 2007, bridges have been designed and built using new standards and construction materials, resulting in anticipated service lives of 75 years. However, the vast majority (92.4%) of Virginia's bridges were built prior to 2007 and were designed with anticipated design service lives of 50 years. About 52.4% percent of structures are 50 years or older (11,107 of 21,195), meaning these structures have reached or exceeded their anticipated service lives.

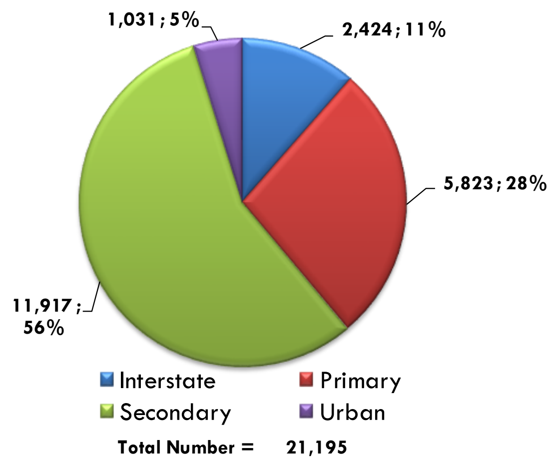


Figure 1-1- Distribution of Structures by Highway System

The aging of the bridge inventory is a national concern and the greatest challenge facing Virginia's highway structures. To provide some context for the problem, if Virginia were to replace all its 50-year service life bridges as they turned 70, the approximate total cost between now and the year 2070 (the next 50 years) would be $91 billion in 2020 dollars. However, if current funding remains constant over the same 50-year interval, only $19 billion will be available to address these bridges (combined maintenance and construction funds). This extraordinary gap between funding available and replacement need has caused Virginia to take a data-driven approach to the management of its structures.

A comprehensive study investigating the anticipated deterioration of Virginia's highway structures was performed in 2019. The study was initiated to develop the most effective long-term strategies for managing the bridge inventory, determine the best methods for measuring performance, establish acceptable levels of service, and estimate the amount of funding needed. The study found that at current levels of funding the bridge inventory would experience a slow, managed decline in condition but nonetheless sustain an acceptable level of service, but *only* if Virginia shifts its focus immediately to a preservation-first methodology. Alternatively, the study found that an additional $122M annually would be needed if this change in approach were not adopted. The study's findings, Comprehensive Review Pavements and Structures, were presented to Virginia's Commonwealth Transportation Board (CTB) at the September 2019 CTB meeting. In order to transition to a preservation-based philosophy, two major changes are necessary:

- Virginia's primary source of construction funding for existing bridges, the State of Good Repair program, needs to expand its eligibility requirements to allow work on bridges before they become structurally deficient. This will require a change to Code of Virginia Section § 33.2-369.
- The primary method for measuring bridge conditions should be changed from the percentage of structurally deficient bridges to the average general condition rating. This change included in the Agenda item #9 Resolution was adopted at the December 2019 CTB meeting.

Unless and until the relevant section of the Code of Virginia is changed, Virginia's bridge program will be underfunded by $122M annually (2019 dollars). However, until that change is made, VDOT is working within existing constrains to proactively manage the inventory to optimize bridge durability, safety, and value of funds invested by employing the following techniques:

- A bridge safety inspection program that exceeds the requirements of the Federal Highway Administration (FHWA), typically resulting in inspection intervals no greater than 2 years for bridges and 4 years for large culverts, with more frequent intervals for fracture critical and poor structures
- A maintenance program that uses a balanced approach to preserving, repairing, and rehabilitating structures
- A proactive program of practical, collaborative research that allows for early implementation of new and innovative techniques and durable materials
- A decentralized organizational structure allowing decisions to be made at the local/district level wherever possible
- Performance targets and quarterly reporting comparing results with targets

This report contains a variety of technical terms commonly used by bridge engineers, many of which are defined in Appendix A.

1.2 PERFORMANCE

In 2012, Virginia attained its long-standing goal by improving its inventory so that more than 92% of its structures were in good or fair condition. This led to the development of more ambitious targets in 2017, along with a concerted effort to further reduce the number of poor (also referred to as structurally deficient, or “SD”) structures. Table 1-1 shows the success of this effort, as Virginia has continued to reduce the number of poor (SD) structures in its inventory. Section 3 and Appendix D of this report provide detailed definitions of the “good”, “fair”, and “poor (SD)” condition designations that are assigned to bridges and large culverts.

Table 1-1 - Percentage of Structures by Count in Good or Fair Condition

District	Interstate	Primary	Secondary & Urban	NBI* Only	All Systems
1 Bristol	97.7%	97.7%	94.7%	95.0%	95.7%
2 Salem	99.0%	97.2%	97.3%	97.1%	97.4%
3 Lynchburg	N/A	98.0%	94.6%	95.8%	95.7%
4 Richmond	98.3%	95.8%	93.5%	94.4%	95.1%
5 Hampton Roads	99.8%	96.8%	94.9%	96.3%	96.7%
6 Fredericksburg	98.8%	91.7%	95.8%	94.0%	94.8%
7 Culpeper	100.0%	98.6%	95.2%	95.5%	96.5%
8 Staunton	100.0%	97.1%	96.3%	96.1%	97.0%
9 NOVA	99.7%	97.7%	98.4%	98.1%	98.4%
Statewide	99.2%	97.1%	95.7%	95.9%	96.5%

***** *NBI refers to structures in the National Bridge Inventory, which are more than 20 feet in length*

During FY2020, Virginia reduced the number of poor (SD) structures from 792 (3.7% of structures) to 743 (3.5%). This compares favorably with the nationwide results, as 7.5% of the bridges in the National Bridge Inventory (NBI) were poor (SD) as of December 2019 (the latest date for which data are available). Figure 1-2 shows the eleven year increase in number, percentage, and deck area of structures in fair and good condition (not structurally deficient). Figure 1-3 shows that the reduction in the number of structures in good and fair condition led to a commensurate increase in the number and percentage of fair structures.

Poor (SD) structures are not necessarily unsafe, but they have usually deteriorated to a state where they require significant repair, rehabilitation or, in many cases, replacement. Poor (SD) structures have one or more major components that are rated in poor condition in accordance with National Bridge Inspection Standards (NBIS).

Effective bridge management requires continued maintenance of structures in all conditions, not only poor (SD) structures. Preventive maintenance on bridges is more cost-effective than waiting to perform the extensive repairs required after advanced deterioration has occurred. Virginia's continued progress in reducing the number of poor (SD) structures has led to the development of new performance metrics that will lead to an emphasis on system preservation in addition to work on poor (SD) structures. Specifically, VDOT has added a goal for the average general condition rating (GCR) of its bridges. The GCR is a numerical assessment of condition, assigned by inspectors at each safety inspection on a 0 to 9 scale, where 0 represents failure and 9 is excellent. A GCR is assigned to each of a bridge's major components (deck, superstructure, or substructure) and a single culvert GCR rating is assigned to a large culvert in accordance with NBIS requirements.

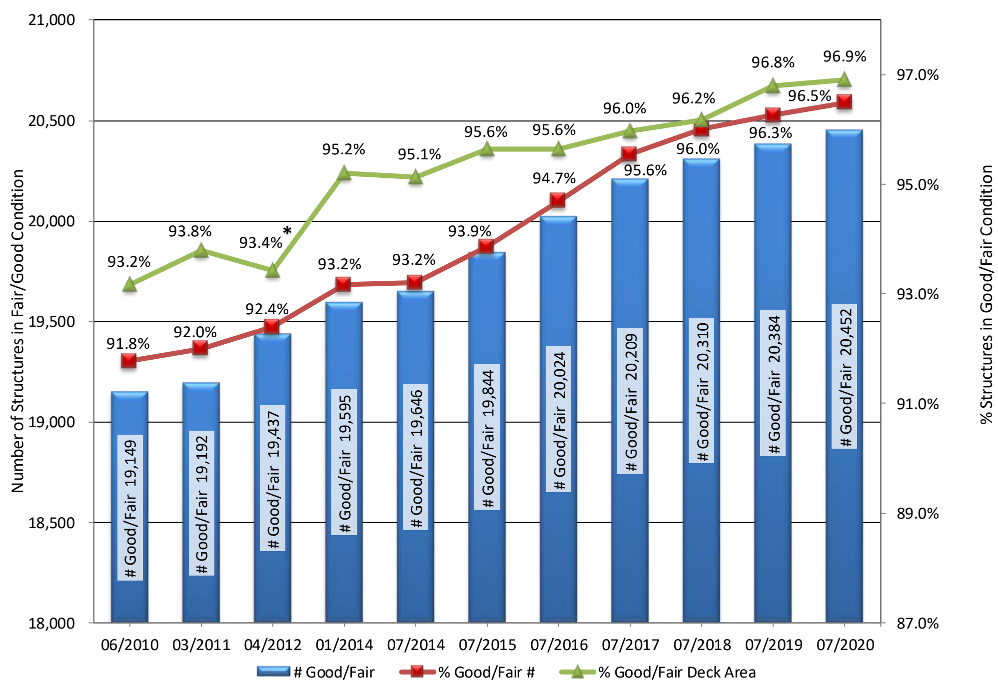


Figure 1-2- Multi-Year Trend of Structures in Good or Fair Condition by Count and Deck Area

** The decrease in the percentage of good/fair deck area on 04/2012 was caused by the deterioration of several large bridges during the preceding year. The subsequent increase in the percentage of good/fair deck area on 01/2014 was a result of repairs to bring them from poor to good/fair condition in the previous year.*

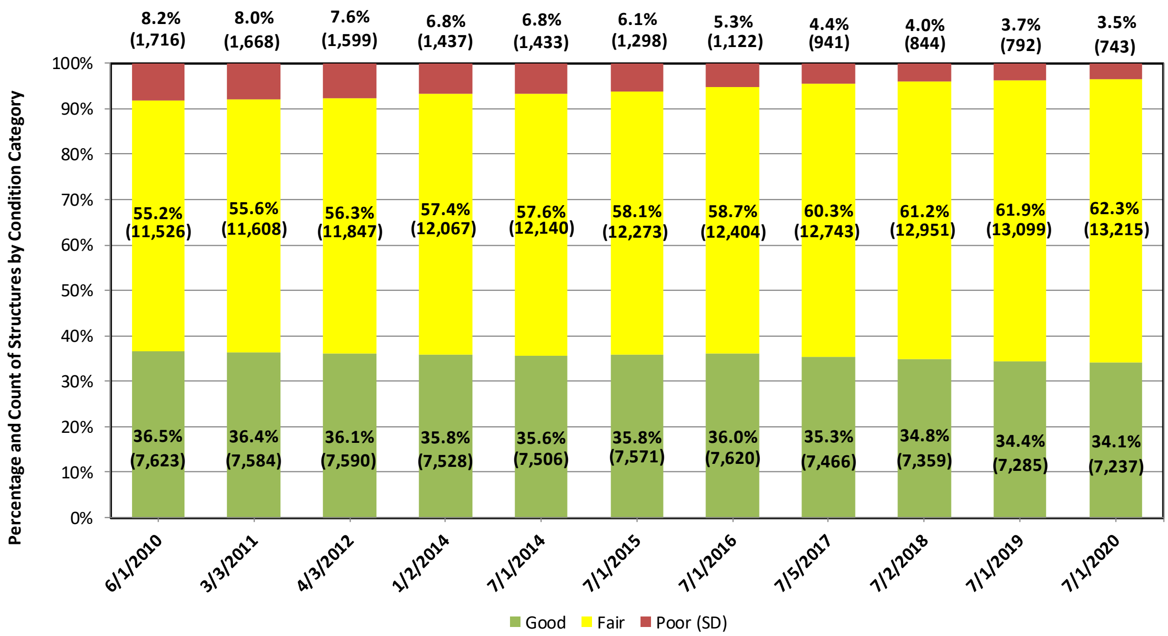


Figure 1-3- Multi-Year Trend of Structures in Good, Fair, and Poor (SD) Condition

VDOT is also responsible for the inventory, maintenance and inspection of five types of ancillary structures: signs, luminaires, signals, high mast lights, and camera poles. Their conditions are summarized in Table 1-2 for the 35,534 ancillary structures in the inventory. All information for ancillary structures is based on condition and inventory data at the end of FY2020. Ancillary structure data provided is only for structures that are owned by VDOT, as VDOT has very limited information on such structures that it does not own.

Table 1-2- Conditions of Ancillary Structures

Structure Type	Percentage of Primary Components in Good or Fair Condition		
	Foundation	Parapet	Superstructure
Signs	82.0%	85.5%	87.1%
Luminaires	76.9%	N/A	86.6%
Signals	74.7%	N/A	76.0%
High Mast Lights and Camera Poles	80.7%	N/A	94.6%

1.3 Inventory Addressed in Report

Data presented in this report provide condition and inventory information for all highway structures meeting the criteria for the population of structures referred to as “Virginia Responsible Structures” as defined in Section 1.1, which excludes permanently closed structures and structure types that are not relevant to reports on the condition of highway bridges, such as pedestrian bridges, scales, and ferry docks. Structures that are outside the control of the Commonwealth of Virginia, such as bridges and culverts owned by federal agencies or legal entities directly managed by a federal agency, are also excluded.

Figure 1-4 displays the distribution of Virginia's structures by owner.

- VDOT: owned by VDOT
- Localities: owned by counties, cities, and towns
- Other: owned by various legal entities, which includes state toll authorities (the Chesapeake Bay Bridge and Tunnel District), other state agencies such as the Department of Game and Inland Fisheries and State Parks, and other toll authorities (Richmond Metropolitan Authority, Dulles Greenway Toll, Globalvia (Pocahontas Parkway- Route 895)), and any border bridges for which Virginia has at least partial responsibility.

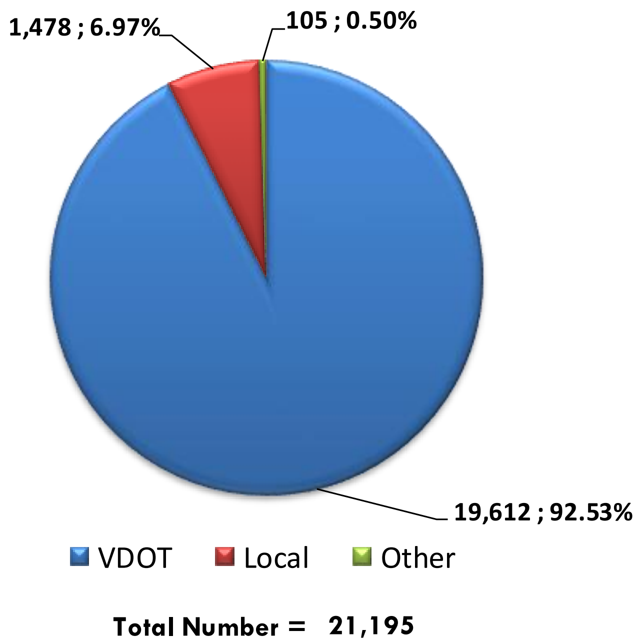


Figure 1-4- Distribution of Structures by Owner

"Virginia Responsible Structures" include the following structures carrying public vehicular traffic:

- All NBI structures for which Virginia must report condition data to FHWA. These include bridges and large culverts greater than 20 feet in length.
- Non-NBI structures. These include bridges less than or equal to 20 feet in length and large culverts less than 20 feet in length with openings in excess of 36 square feet.
- Bridges that span between Virginia and an adjacent state (border bridges)

While the maintenance of structures is generally the responsibility of their owners, FHWA holds VDOT responsible for the inspection of all NBI bridges that are not controlled by the Federal Government, regardless of ownership. VDOT chooses to also inspect and maintain non-NBI structures (less than or equal to 20') through its Structure and Bridge Division.

2 INVENTORY

2.1 STRUCTURES

Structures can be grouped into several categories. Tables in this section provide an overview of their number, type, size, and category. Some terms and abbreviations used in the tables are defined below:

- NBI - Structures in the National Bridge Inventory (greater than 20')
- NHS – Structures on the National Highway System
- I - Structures carrying Interstate Highway System traffic
- P - Structures carrying Primary Highway System traffic
- S - Structures carrying Secondary Highway System traffic
- U - Structures carrying Urban Highway System traffic

Table 2-1- Number of Structures

	Number of Structures by District, Highway System and Category											
	NBI				NBI on NHS				All Structures			
District	I	P	S&U	Total	I	P	S&U	Total	I	P	S&U	Total
1 Bristol	164	525	1,320	2,009	163	173	1	337	216	954	2,222	3,392
2 Salem	138	461	1,239	1,838	137	233	4	374	209	829	2,041	3,079
3 Lynchburg	0	409	926	1,335	0	217	1	218	0	660	1,413	2,073
4 Richmond	364	580	1,029	1,973	362	363	24	749	520	784	1,302	2,606
5 H. Roads*	380	381	671	1,432	375	237	82	694	461	465	807	1,733
6 F'burg*	45	177	327	549	45	112	7	164	80	254	496	830
7 Culpeper	84	245	715	1,044	83	95	4	182	120	495	1,093	1,708
8 Staunton	253	453	1,159	1,865	250	153	2	405	431	824	2,236	3,491
9 NOVA*	295	412	860	1,567	292	330	31	653	387	558	1,338	2,283
Total	1,723	3,643	8,246	13,612	1,707	1,913	156	3,776	2,424	5,823	12,948	21,195

**Note: Tables in this report use the abbreviations "H.Roads" for Hampton Roads, "F'burg" for Fredericksburg, and NOVA for Northern Virginia. These abbreviations are necessary to allow a clearer presentation of data.*

The "All Structures" category in Table 2-1 and Table 2-2 includes both NBI and non-NBI structures. Note that the definition of an NBI structure is different than the definition of structures on the National Highway System (NHS), so not all structures on the NHS are in the NBI, nor are all NBI structures on the NHS. Virginia also maintains a large inventory of smaller culverts that are not included in the inventory of the Structure and Bridge Division because their total opening size is less than 36 square feet. These smaller structures have separate maintenance and inspection cycles and are not addressed in this report.

Table 2-2- Deck Area of Structures

District	Area of Structures by District, Highway System and Category (Millions of Square Feet)											
	NBI				NBI on NHS				All Structures			
	I	P	S&U	Total	I	P	S&U	Total	I	P	S&U	Total
1 Bristol	1.5	3.3	2.4	7.2	1.5	1.5	0.0	3.0	1.6	3.6	2.7	7.8
2 Salem	1.3	4.1	3.0	8.3	1.3	2.4	0.0	3.7	1.3	4.2	3.2	8.8
3 Lynchburg	0.0	3.9	2.4	6.3	0.0	2.5	0.0	2.5	0.0	4.0	2.6	6.6
4 Richmond	5.9	8.9	4.4	19.2	5.8	7.0	0.4	13.2	6.1	9.1	4.5	19.7
5 H. Roads	10.9	15.3	4.1	30.2	10.8	12.6	1.6	25.0	11.0	15.3	4.1	30.4
6 F'burg	0.4	2.9	1.1	4.5	0.4	2.0	0.1	2.6	0.4	3.0	1.2	4.6
7 Culpeper	0.8	1.4	1.6	3.7	0.8	0.7	0.0	1.6	0.8	1.5	1.7	4.0
8 Staunton	2.5	3.2	2.9	8.5	2.5	1.6	0.0	4.1	2.6	3.4	3.2	9.2
9 NOVA	8.1	6.0	5.5	19.6	8.0	5.2	0.5	13.7	8.2	6.1	5.8	20.1
Total	31.3	49.0	27.4	107.7	31.2	35.6	2.7	69.4	32.0	50.1	29.0	111.2

2.2 Inventory Changes from Previous Years

Some of the charts in the report provide multi-year trends for various performance metrics. Inventory numbers provided in this report for the years 2010 and 2011 may vary slightly from numbers provided in previous editions of this report. These differences are primarily due to a change in the reporting period. Reports from 2007 through 2011 were based on a calendar year (January 1 through December 31), whereas subsequent reports were based on the fiscal year (July 1 through June 30). This change was made to align the reporting period of the State of the Structures and Bridges Report with the fiscal year and with reports developed by other VDOT divisions.

Other factors causing differences between this report and previous editions of the State of the Structures and Bridges Report include:

- **Buchanan County Bridges Added to Inventory:** In Fiscal Year 2012 Virginia added to its inventory 144 existing structures from Buchanan County in the Bristol District. Buchanan County retains responsibility for these bridges.
- **Change in Highway System Designation of Buchanan County Bridges:** In Fiscal Year 2013 the system designation of the recently added bridges from Buchanan County was changed from Secondary to Urban.
- **Norfolk Southern Railway Agreement:** In Fiscal Year 2014, VDOT transferred the ownership and maintenance responsibility for 15 railroad bridges to the Norfolk Southern Railway (NS). The agreement also caused the transfer of ownership and maintenance responsibility of 31 highway bridges crossing the NS railroad from NS to VDOT.
- **NHS:** In 2015, VDOT redefined the particular routes that constitute Virginia's portion of the NHS, which resulted in the removal and/or addition of certain structures from inclusion on the National Highway System. This redesignation

effort was performed in accordance with FHWA requirements. The historic data used for the tables and charts have been updated to reflect the current NHS designation.

- **Areas for all Structures:** Prior to 2018, areas for culverts were computed by multiplying barrel length by the culvert width. Starting with the 2018 report, bridge and culvert areas have been calculated using the FHWA Computation Procedure for the Bridge Condition Measures (FHWA-HI-18-023), which uses a slightly different methodology.

2.3 Age of Structures

The aging of the bridge inventory is a significant concern, because the vast majority of Virginia's structures (92.4%) were designed with an anticipated 50-year service life, and 52.4% of our structures are over 50 years old.

Figure 2-1, Figure 2-2, and Figure 2-3 provide data on the ages of Virginia's structures.

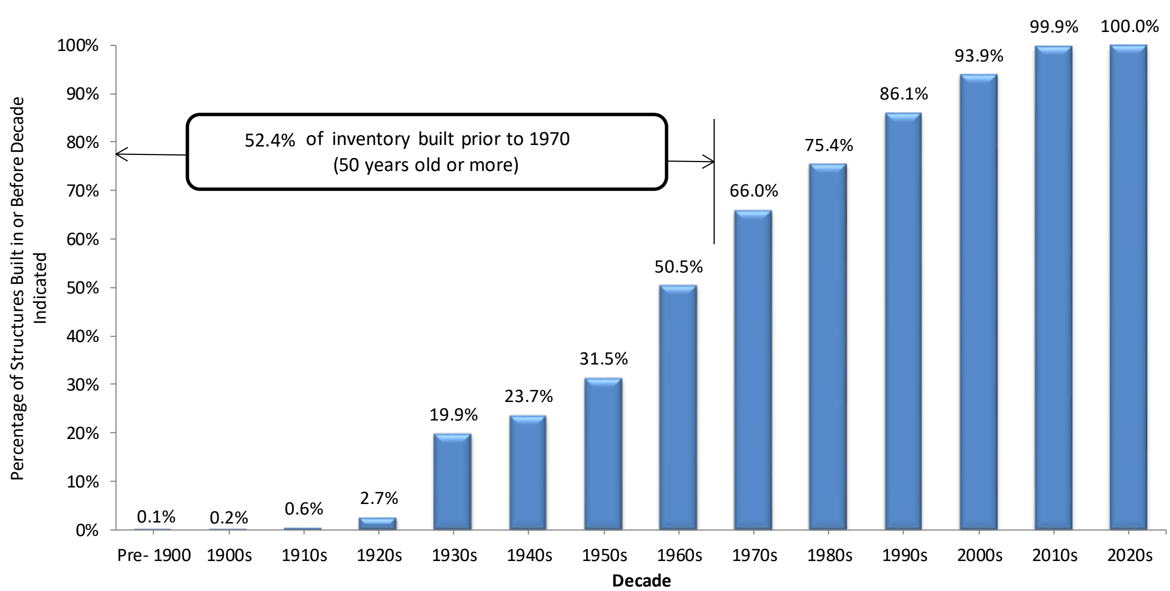


Figure 2-1- Cumulative Age Distribution of Structures by Decade

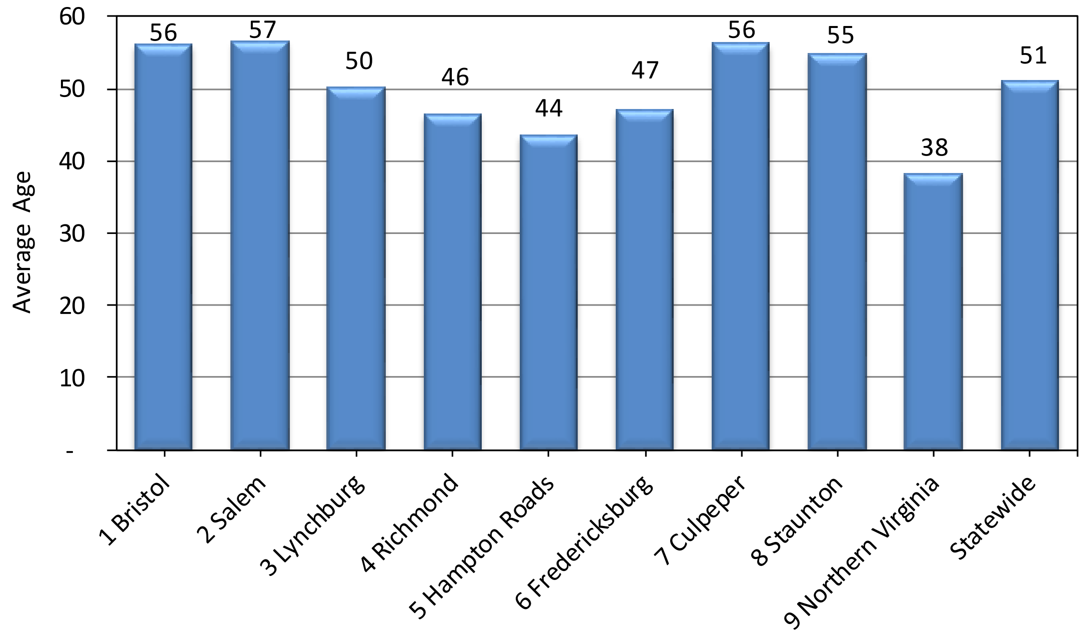


Figure 2-2- Average Age of Structures by District

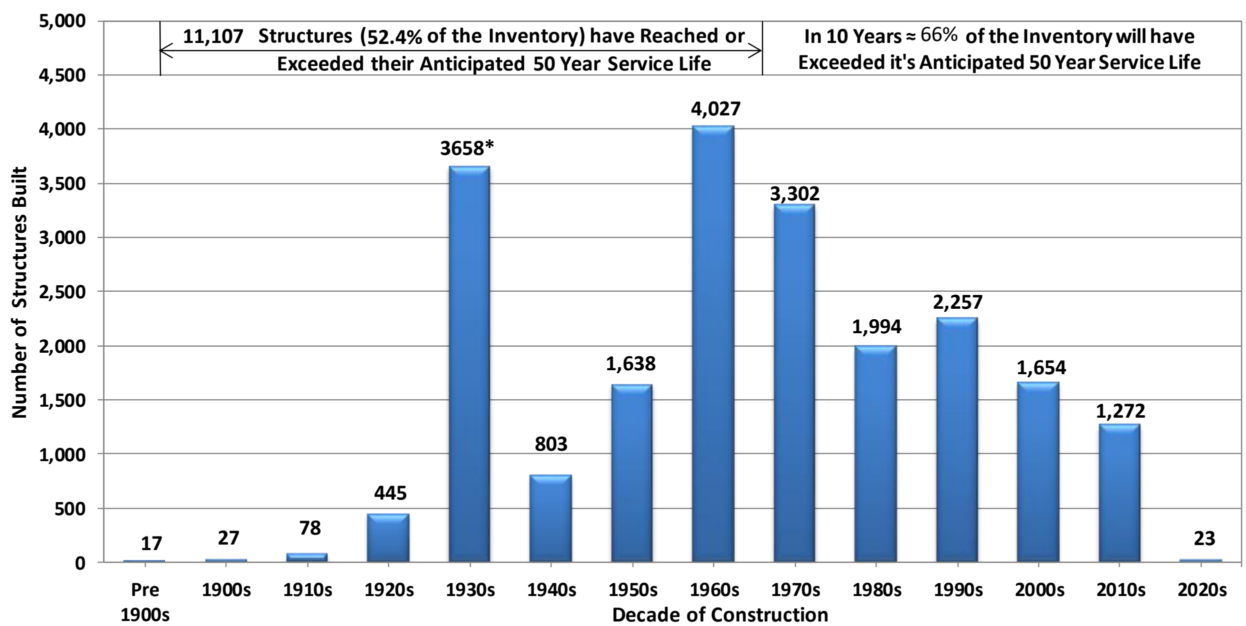


Figure 2-3- Number of Structures Built by Decade

**A large number of county structures with unknown construction dates were added to the VDOT inventory during this period. Structures with unknown construction dates have been assumed to have year built in 1932.*

2.4 CATEGORIES OF STRUCTURES

Virginia has divided the inventory into structure categories to better understand their needs and rates of deterioration. Figure 2-4 through Figure 2-9 provide inventory and condition data for 14 different categories of structures, showing the number of structures in "good", "fair", and "poor (SD)" conditions in each category. These categories describe types of materials and structural system employed. As the charts show, the performance and durability vary considerably between categories, as concrete culverts provide the greatest durability, while timber deck bridges, T-beams, and large metal culverts demonstrate the least favorable performance.

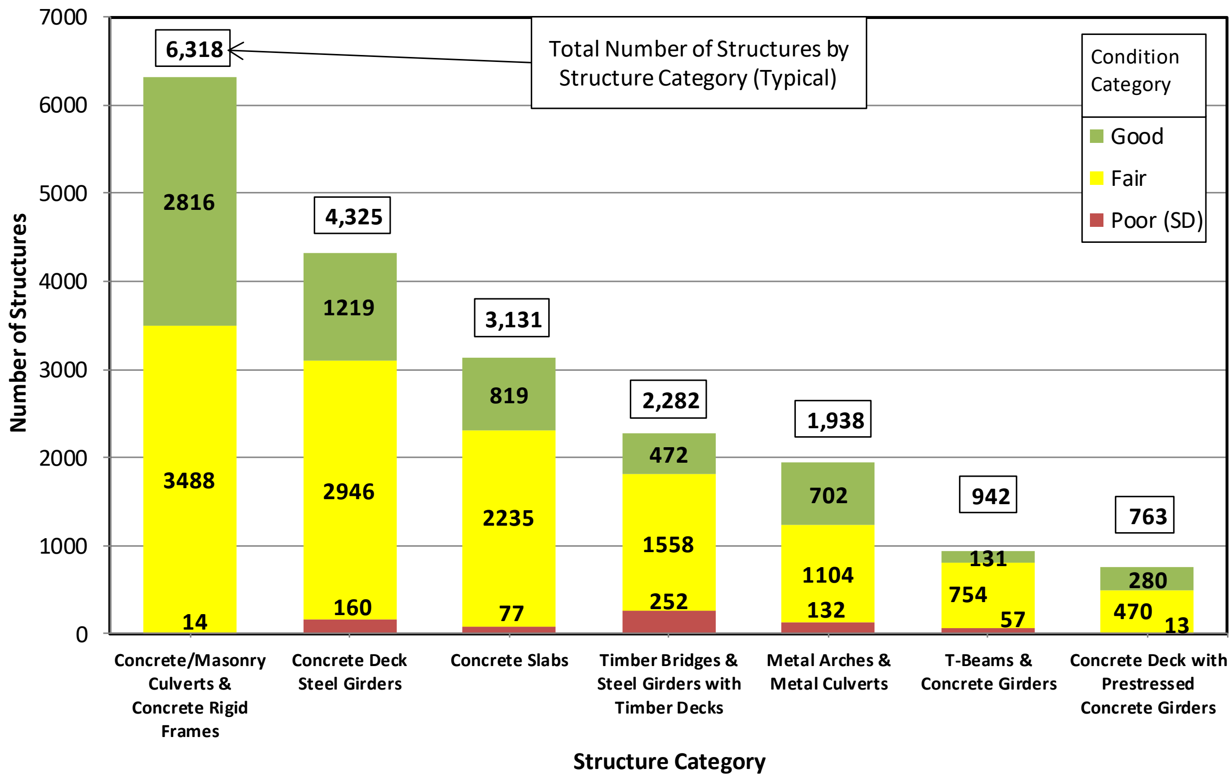


Figure 2-4- Count and Condition Data for Most Common Structure Categories (All Structures)

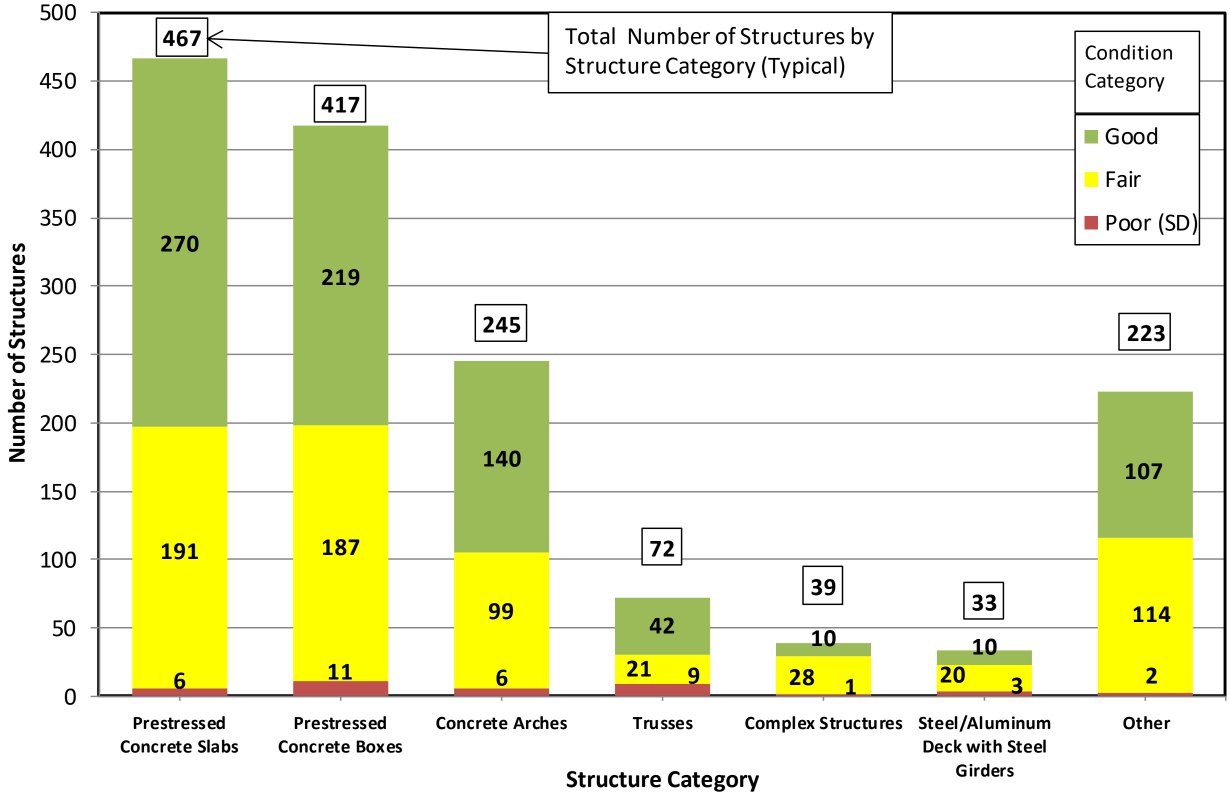


Figure 2-5- Count and Condition Data for Less Common Structure Categories (All Structures)

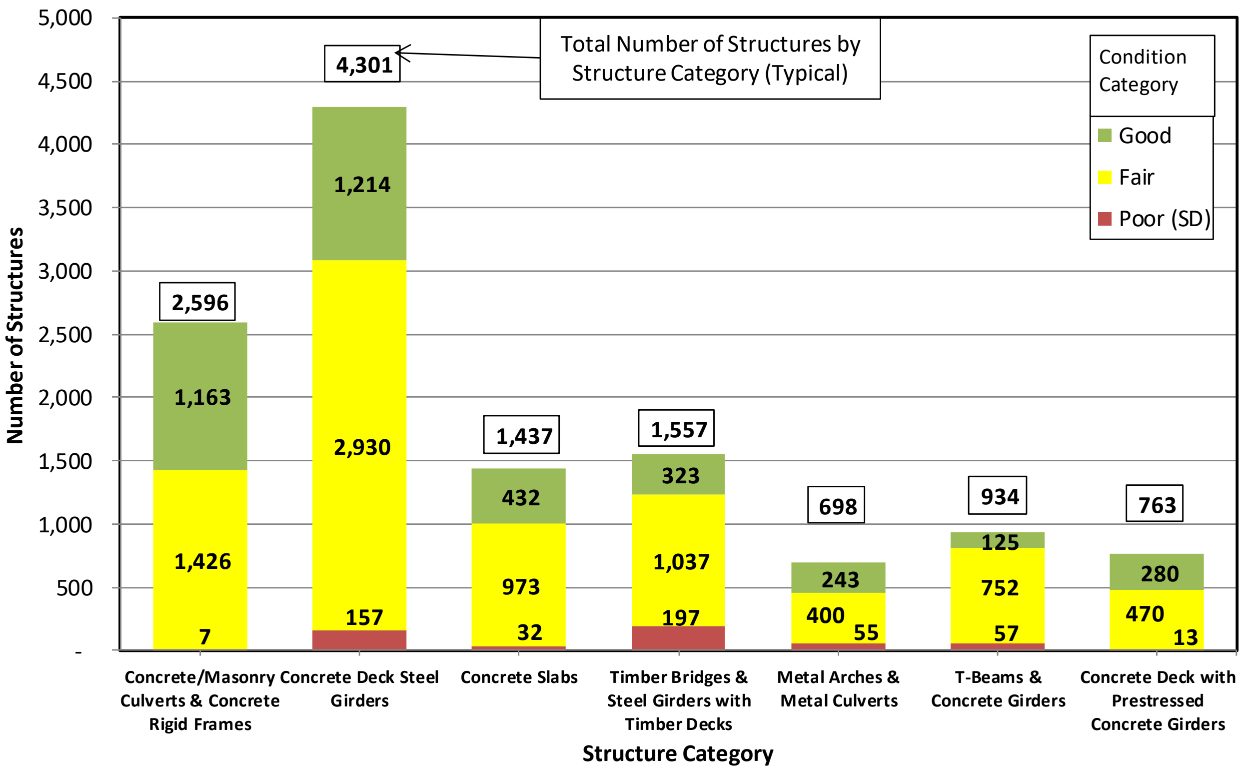


Figure 2-6- Count and Condition Data for Most Common Structure Categories (NBI Structures)

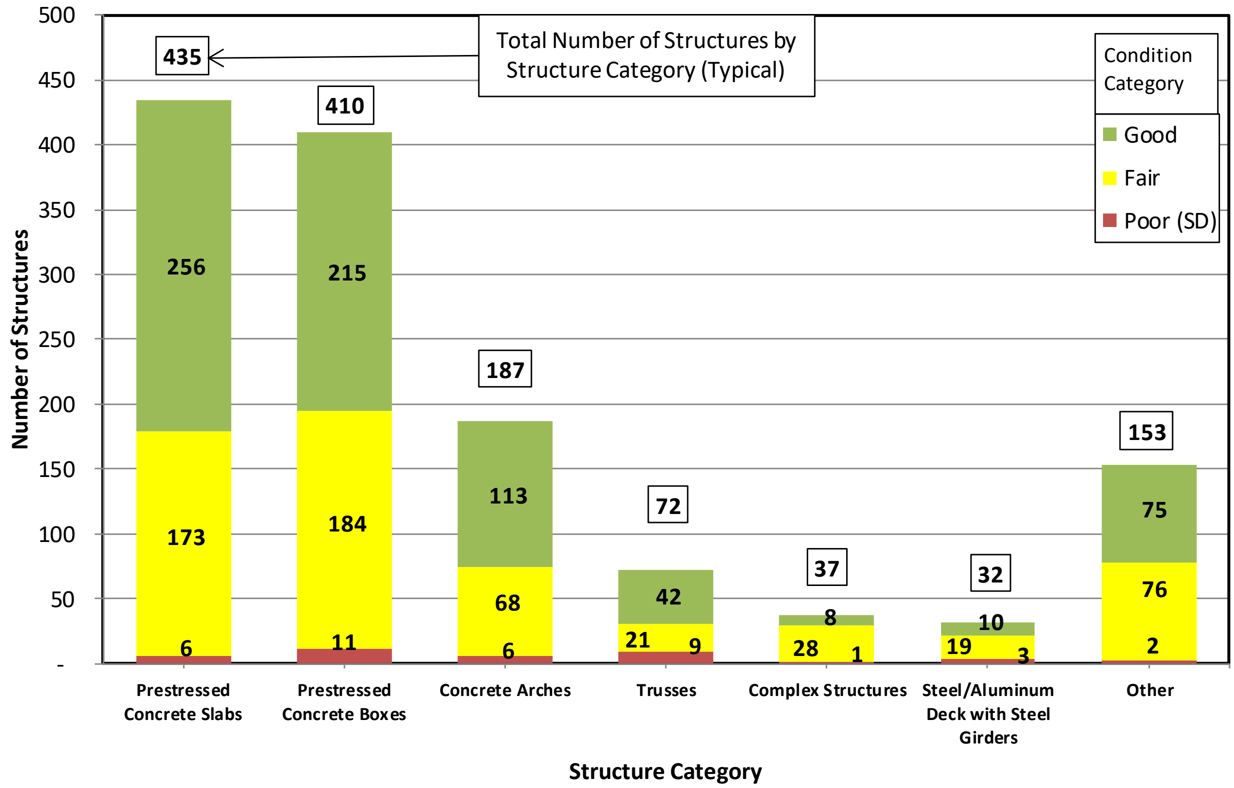


Figure 2-7- Count and Condition Data for Less Common Structures Categories (NBI Structures)

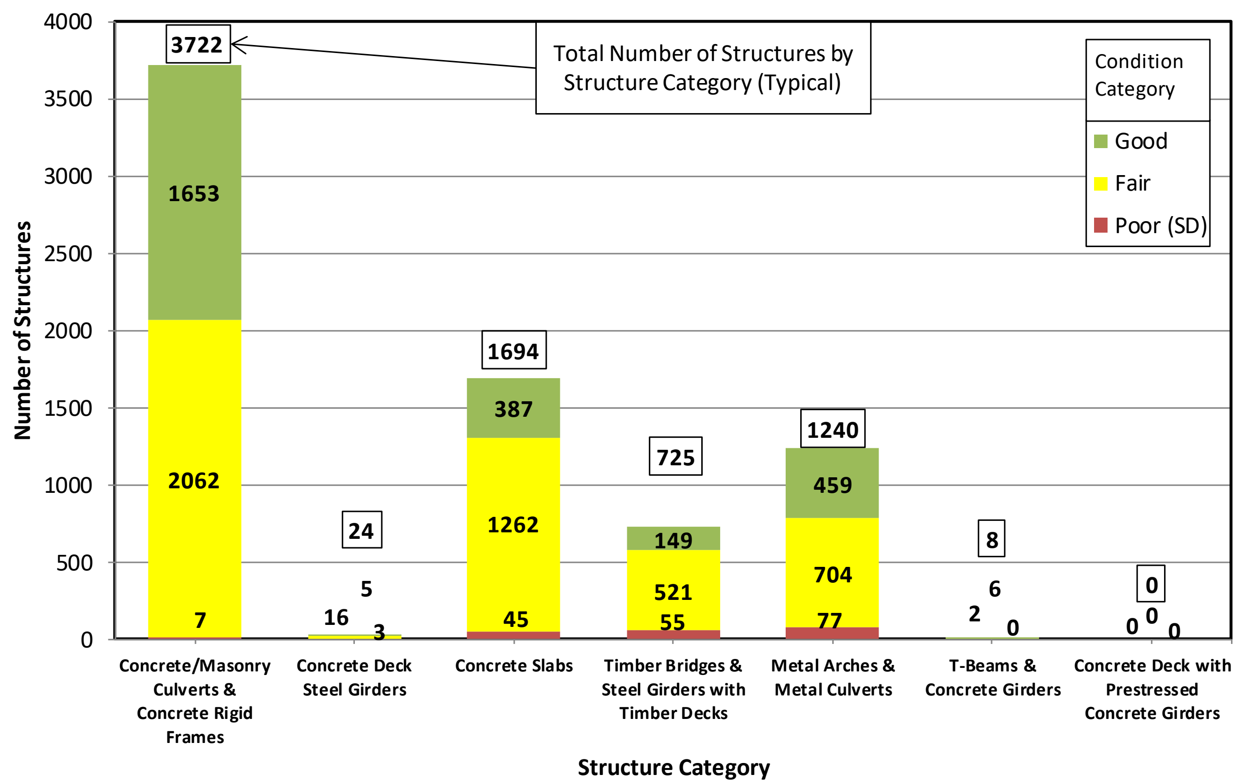


Figure 2-8- Count and Condition Data for Most Common Structure Categories (Non-NBI Structures)

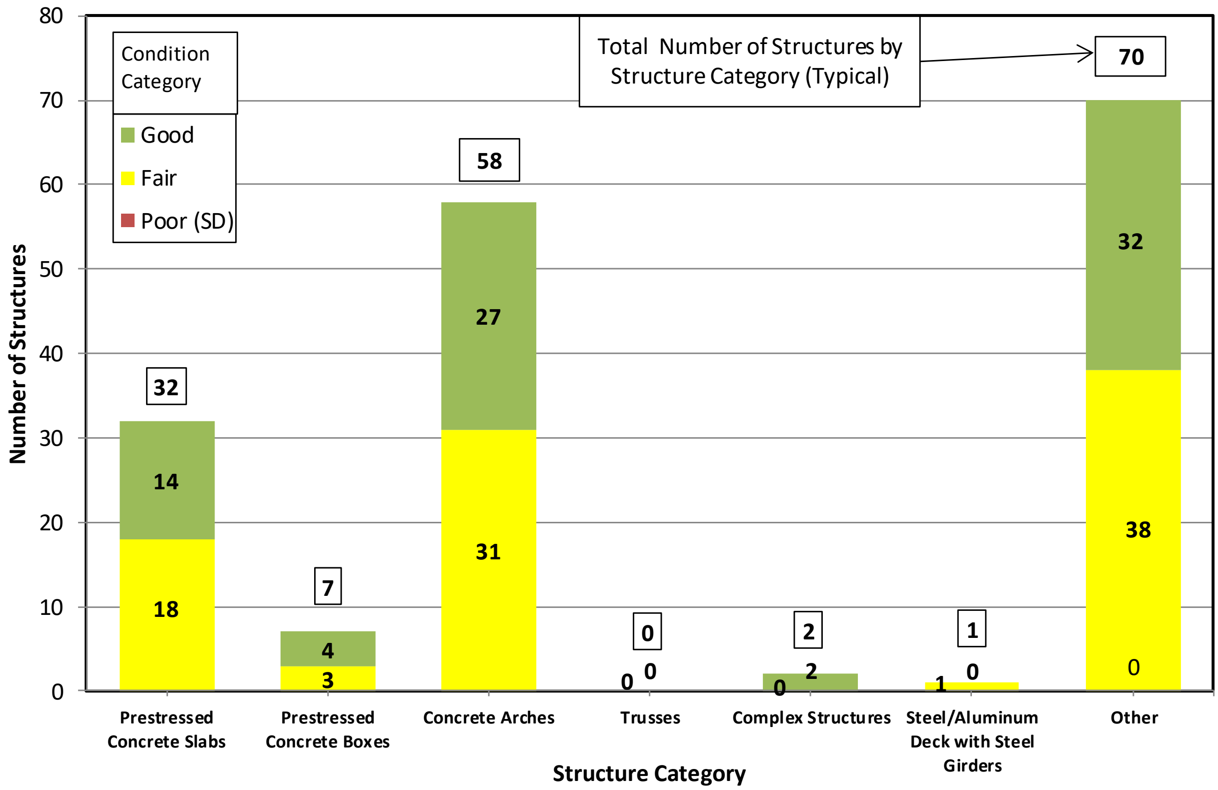


Figure 2-9- Count and Condition Data for Less Common Structure Categories (Non-NBI Structures)

VDOT has also identified a group of "Special Structures" with characteristics that warrant additional consideration for maintenance, repair and funding. Special Structures include tunnels, movable bridges, and large, complex fixed-span structures. They are considered "special" due to their complexity, maintenance and operations cost, level of risk, and importance. Determination of importance is based on factors including potential long detours, high traffic, economic significance (shipping and vehicular), and access to vital facilities, including military facilities and ports.

A 50 Year Plan was finalized in Spring, 2020 using a life-cycle approach for each Special Structure that VDOT maintains and operates. The plan is required by §33.2-1532 of the Code of Virginia, known as the *Robert O. Norris Bridge and Statewide Special Structure Fund*, for the maintenance and replacement of Special Structures.

The 50 Year Plan used a multi-objective formula to prioritize and select maintenance and improvement projects for the Special Structures. The three Special Structures under concession agreements – the Pocahontas Parkway and Elizabeth River Tunnels (Midtown and Downtown) – will not be included in the plan until the concession agreements end, in years 2105 and 2069, respectively.

The 50 Year Plan identified a funding gap between current spending levels for Special Structures – $50 million per year (average over fiscal years 2016 through 2019) – and that required for asset management investment. Funding for the prioritized list of projects is provided through VDOT's Maintenance and Operation Fund as well as the Robert O. Norris Special Structures Fund. Due to the economic downturn associated with the COVID-19 pandemic, funding for the first year of the 50 Year Plan has been postponed until Fiscal Year 2022. A list of the Special Structures is provided in **Table 2-3**.

Table 2-3- VDOT's Special Structures

	STRUCTURE NAME	ROUTE CARRIED	DISTRICT
MOVABLE BRIDGES	Benjamin Harrison Bridge	Rt. 156	Richmond
	Chincoteague Bridge	Rt. 175	Hampton Roads
	High Rise Bridge	I-64	Hampton Roads
	Berkley Bridge	I-264	Hampton Roads
	Coleman Bridge	Rt. 17	Hampton Roads
	James River Bridge	Rt. 17	Hampton Roads
	Eltham Bridge	Rt. 30/33	Fredericksburg
	Gwynn Island Bridge	Rt. 223	Fredericksburg
TUNNELS	Big Walker Mountain Tunnel (twin bore)	I-77	Bristol
	East River Mountain Tunnel (twin bore)	I-77	Bristol
	Hampton Roads Bridge Tunnels (HRBT) – 2 Tunnels	I-64	Hampton Roads
	Monitor Merrimac Memorial Bridge Tunnel (MMMBT)	I-664	Hampton Roads
	Elizabeth River Midtown Tunnels – 2 Tunnels	Rt. 58	Hampton Roads
	Elizabeth River Downtown Tunnels – 2 Tunnels	I-264	Hampton Roads
	Rosslyn Tunnel	I-66	Northern Virginia
COMPLEX STRUCTURES	460 Connector Bridges	Rt. 460	Bristol
	Smart Road Bridge	Smart Rd.	Salem
	Varina-Enon Bridge	I-295	Richmond
	Pocahontas Parkway over James River	Rt. 895	Richmond
	HRBT Approach Bridges	I-64	Hampton Roads
	I-64 over Willoughby Bay	I-64	Hampton Roads
	MMMBT Approach Bridges	I-664	Hampton Roads
	James River Bridge Approach Spans	Rt. 17	Hampton Roads
	High Rise Bridge Approach Spans	I-64	Hampton Roads
	Norris Bridge	Rt. 3	Fredericksburg

2.5 Ancillary Structures

VDOT is responsible for the inventory, inspection, and maintenance of 35,534 ancillary structures. VDOT's inventory includes five types of ancillary structures, two of which are further divided into subcategories:

1. High mast lighting structures
2. Camera pole structures
3. Signal structures
    a. Span wires
    b. Cantilever
    c. Overhead span
4. Luminaires
5. Sign structures
    a. Overhead
    b. Cantilever
    c. Butterfly
    d. Bridge-parapet mounted

Figure 2-10 and Figure 2-11 indicate the distribution of the ancillary structures by district and type.

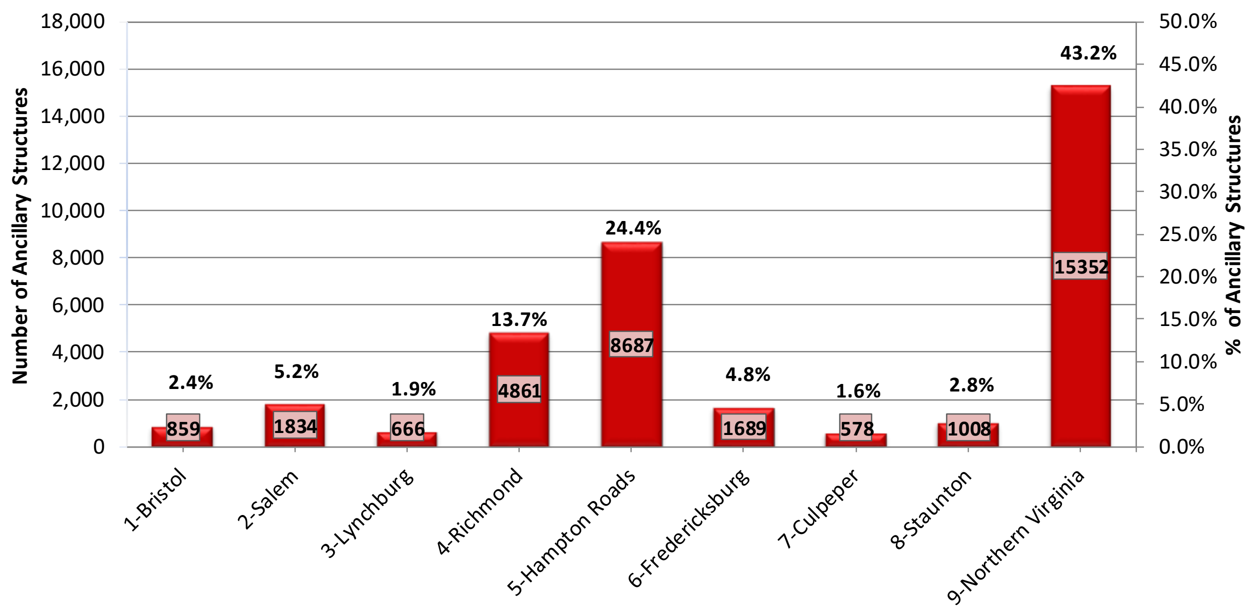


Figure 2-10- Distribution of Ancillary Structures by District

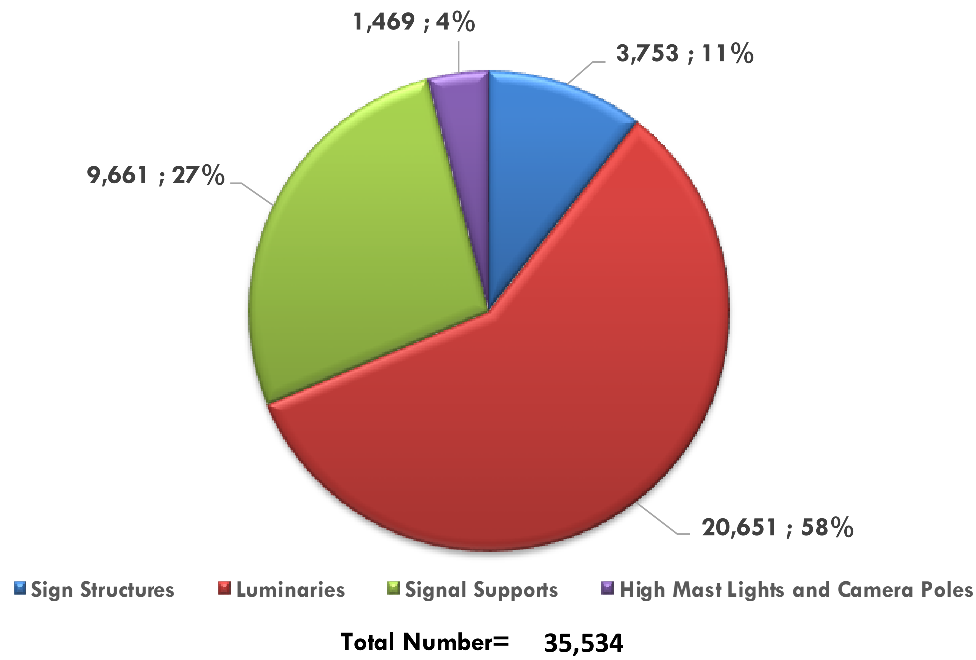


Figure 2-11- Distribution of Ancillary Structures by Type

3 CONDITION

3.1 CONDITION CATEGORIES (GOOD, FAIR, AND POOR (SD) STRUCTURES)

A functional system preservation program extends the service life of structures. This requires a balanced approach, wherein work is performed on structures in all condition categories (good, fair, and poor (SD)). In order to provide an easily-understood organizational system, structures are placed in one of these three condition categories based on the minimum general condition rating (GCR) of each structure.

The GCR is a numerical rating of the primary components of each structure, assigned during regular safety inspections. Definitions of GCRs are provided in FHWA's *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges* and in Appendix D of this report. Measured on a 0-9 scale, with 0 representing a failed component and 9 representing excellent condition, a GCR is assigned to each bridge's deck, superstructure, and substructure components at each inspection. Large culverts receive a single GCR. The structures are inspected in accordance with federal criteria and VDOT's current Instructional and Informational Memorandum IIM-S&B-27. The minimum GCR for each bridge or large culvert is used to define its condition category. Definitions of the three condition categories are shown in Table 3-1.

Table 3-1- Condition Categories for Structures

Condition Category	Category Definition
Good Structures	Minimum GCR ≥ 7
Fair Structures	Minimum GCR = 5 or 6
Poor (SD) Structures	Minimum GCR ≤ 4

The condition category definitions in Table 3-1 were formally established by FHWA in 2017. Prior to the federal adoption of condition category definitions, VDOT used slightly different definitions. Versions of the State of the Structures and Bridges Report published prior to 2018 defined fair structures as those with a minimum GCR equal to 5 and good structures as those with a minimum GCR equal to 6 or greater.

3.2 PERFORMANCE GOALS

3.2.1 General

Performance measurement is an essential tool for asset owners seeking to make the best use of limited funds. A sound performance measurement program requires extensive study of current and anticipated conditions to identify metrics that are meaningful, actionable, and practical to measure.

Virginia has been using performance measures for over a decade, but with the adoption of the FAST Act, FHWA also began requiring states to use a system to track bridge conditions, establish performance targets, and report results for NBI structures on the NHS. Virginia honors the federal requirements, tracking and reporting bridge conditions in accordance with established guidelines. However, Virginia also recognizes that the particular challenges presented by our inventory and environment require a set of performance measures targeted to Virginia's asset management needs. Accordingly, Virginia has two sets of performance targets: state and federal.

3.2.2 State Performance Management Measures

In December 2019, Virginia's Commonwealth Transportation Board passed a resolution to establish new state performance measures, shifting the focus in Virginia from replacement of poor (SD) structures to the preservation of the current inventory. These performance measures were developed with the goal of sustaining the bridge inventory to an acceptable level of service through the year 2070. Accordingly, the performance targets are based on what can be sustained over 50 years, allowing a slow, managed decline of general condition ratings but maintaining the inventory to an acceptable condition through a focus on preservation activities and the incorporation of new technologies. The Agenda item #9 Resolution adopted at the December 2019 CTB meeting established the following performance measures and targets for bridge conditions:

- Average general condition rating (GCR) weighted by Importance Factor (IF) $\geq$ 5.6 (50 year goal – near term targets will be adjusted accordingly to meet this goal in 2070)
- Percentage of structures by count in good and fair condition
    - Interstate $\geq$ 97%
    - Primary $\geq$ 93%
    - Secondary/Urban $\geq$ 90%
- No weight-restricted structures on the interstate system

The Importance Factor (IF) is a unitless measurement of the relative importance of each structure to the overall highway network. It was developed through a cooperative effort with the Virginia Transportation Research Council and uses objectively-measured data such as traffic and detour length to calculate an importance value for each structure. Figure 3-1, which provides multi-year trends of average GCRs weighted by IF, shows a steady rate of deterioration for all highway systems except the secondary/urban. Figure 3-2 provides average GCR weighted by IF for each district.

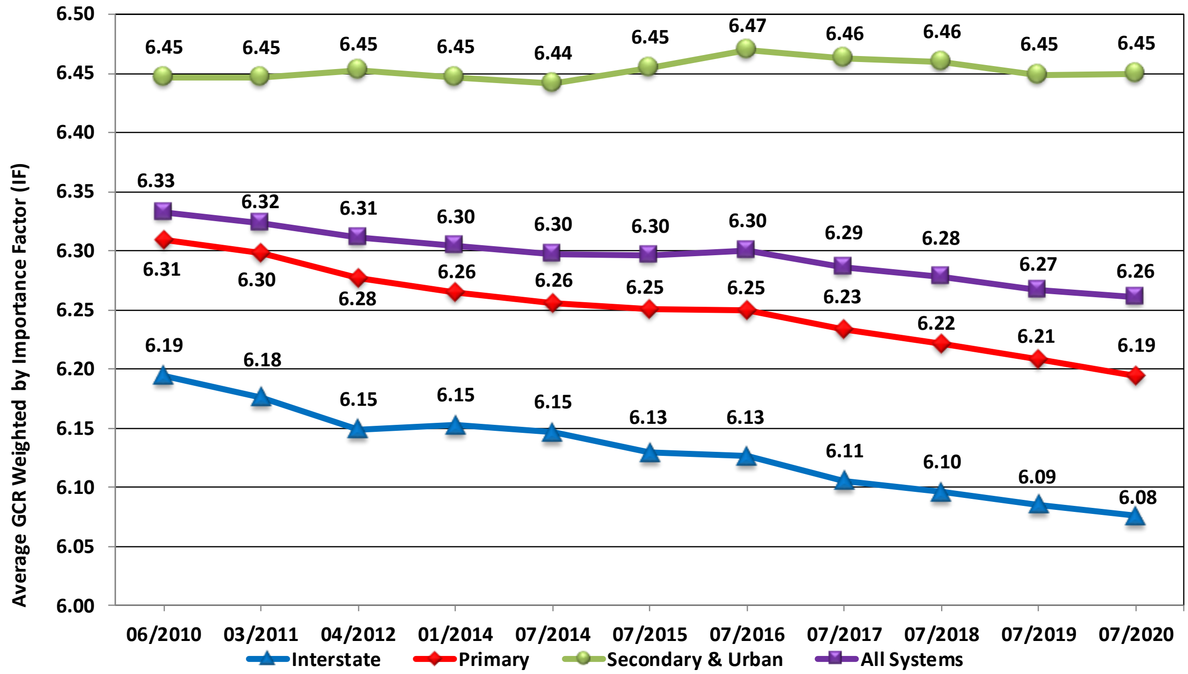


Figure 3-1- Multi-Year Trend of Average GCR Weighted by Importance Factor by Highway System

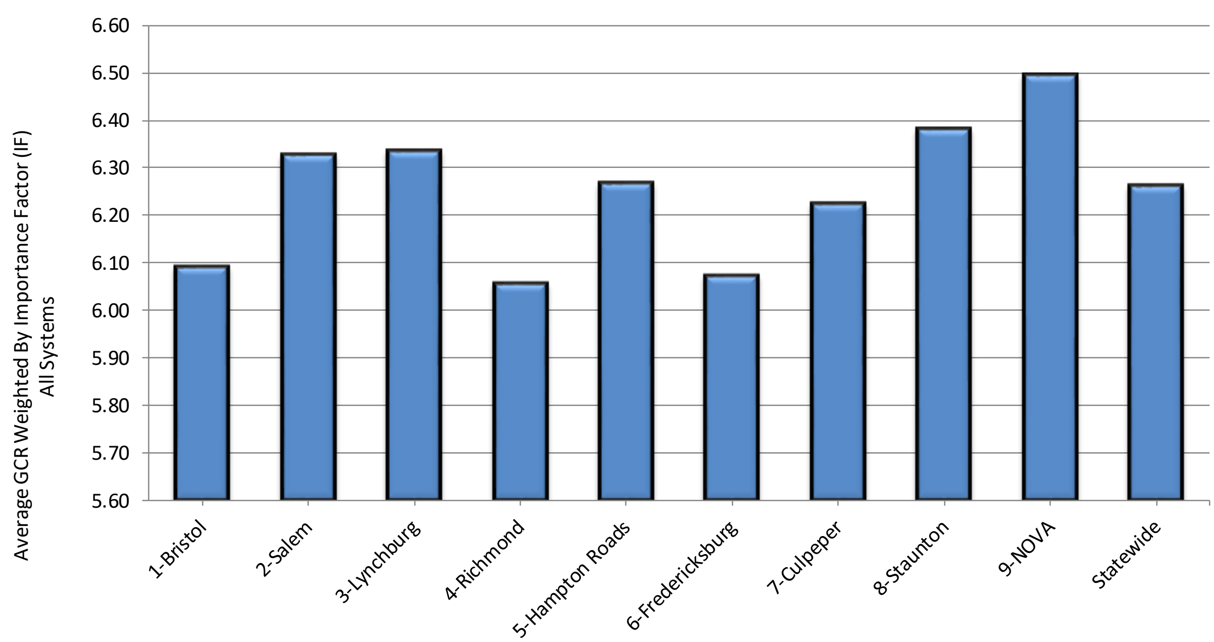


Figure 3-2- Average GCR Weighted by Importance Factor by District

The statewide goals established for the minimum percentage of structures in good and fair condition on each of the three highway systems are provided in Table 3-2, along with the current statewide performance. Figure 3-3 provides eleven-year trends showing the percentage of structures in good and fair condition for each highway system. There are currently no interstate structures that are posted for weight restriction.

Table 3-2- Virginia's Targets for Percentage of Structures by Count in Good or Fair Condition

Highway System	Current Target	Current Statewide Performance
Interstate	97.0%	99.2%
Primary	93.0%	97.1%
Secondary and Urban	90.0%	95.7%
All Systems Combined	N/A	96.5%

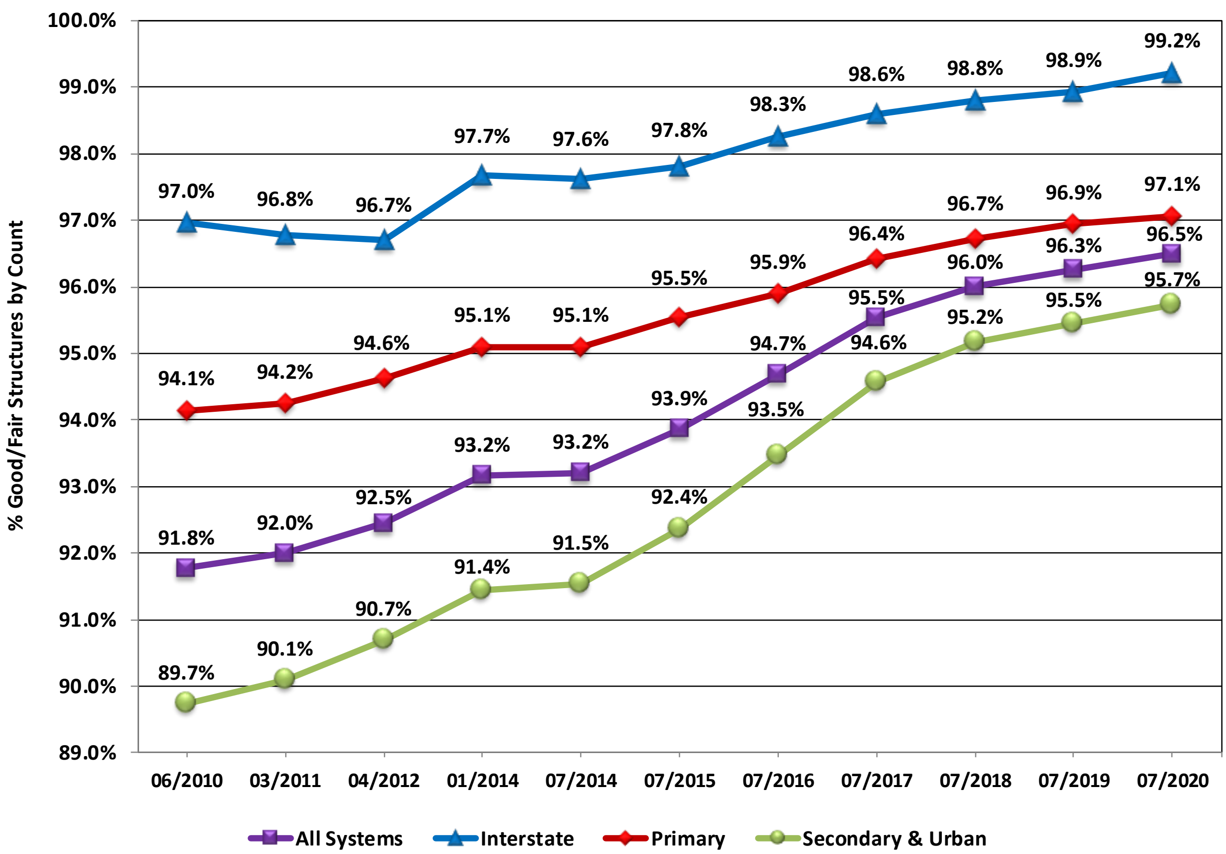


Figure 3-3- Multi-Year Trend of Percentage of Structures in Good or Fair Condition Statewide

3.2.3 Virginia's Best Practices/Recommended Targets for System Sustainability

Chapter 32, Part 2, of VDOT's *Manual of the Structure and Bridge Division* establishes best practices for bridge preservation and recommended targets for system sustainability. The targets indicated in Chapter 32 are directed toward subject matter experts and are intended as a guide that will help stewards of the bridge inventory maintain conditions and reach the more general goals established by Virginia's Commonwealth Transportation Board. These best practice goals are:

- Maintain 90% of expansion joints in a Condition State of 1
- Eliminate 2% of the deck expansion joints in each district in each fiscal year
- Perform maintenance activities on at least 6% of the number of structures with a minimum GCR of 5 in each district in each fiscal year
- Perform maintenance activities on at least 2% of the number of structures with a minimum GCR of 6 in each district in each fiscal year
- Meet established targets for poor (SD) bridges on each highway system (see previous discussions)

These recommended targets were determined using an analysis of the annual transition of VDOT's structures from one condition category to another. Recognizing that the bridge maintenance program requires a balanced approach, where the maintenance needs of structures in each of the three condition categories are regularly addressed, the analysis sought to establish thresholds that would achieve the goal of maintaining the average GCR of the existing inventory over time. There is no unique solution for these goals (various combinations of thresholds for good, fair and poor could achieve the desired result of maintaining the average GCR).

Prior to establishing the actual thresholds, the transition study was performed to determine the number of structures whose minimum GCR either improves or deteriorates in any particular year. The initial study focused on the transition between 2009 and 2010, and the results of the study were used to establish a baseline and develop achievable goals for each condition category.

The study determined that system sustainability could be achieved with the goals that are now in Chapter 32. Furthermore, the Chapter 32 system sustainability goals above were deemed to be reasonably attainable with existing staff. However, the funding required to meet these goals remains significantly higher than the funding provided.

The numbers of the most recent year-to-year transitions are displayed in Figure 3-4, which depicts the number of structures that transitioned from one condition category to another or moved up or down within a condition category. For example, the figure shows that during FY2020, 268 structures fell from "good" to "fair" condition, and 104 structures were improved from "fair" to "good" condition.

Virginia performs an annual analysis to determine and report on the monetary needs for each of its assets. The financial needs for any particular asset are defined as the amount of funding required to reach stated performance goals, which have been established to maintain and improve the condition of Virginia's bridges.

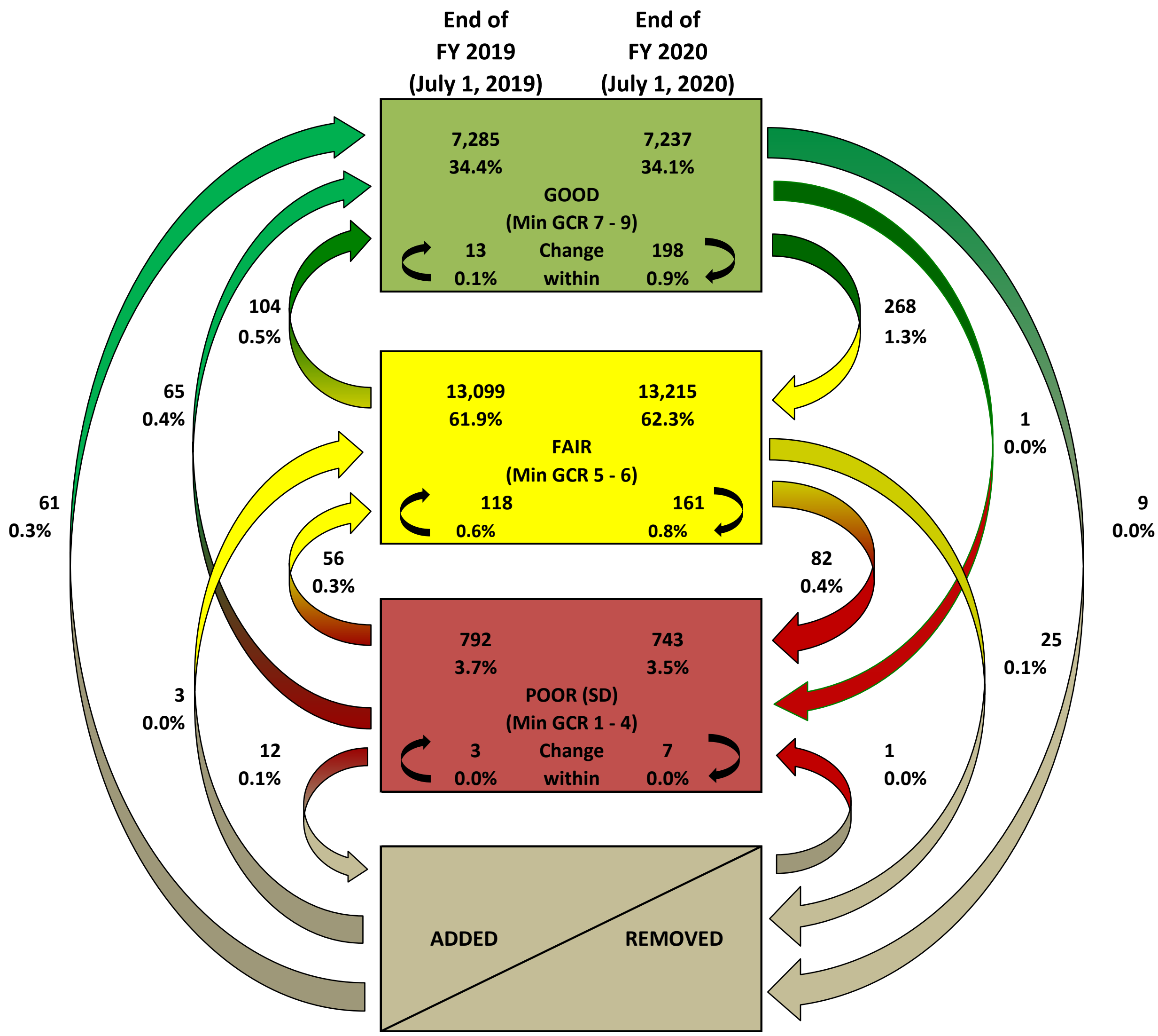


Figure 3-4- Annual Transitions between Good/Fair/Poor (SD) from End of FY 2019 to End of FY 2020

Note: Percentages for transitions between condition categories are based on the total number of structures in the inventory. For example, the 56 structures that were improved from "poor (SD)" to fair represents 0.3% of the total inventory.

3.2.4 Federal Performance Management Measures

The 2012 federal transportation bill known as "Moving Ahead for Progress in the 21st Century" (MAP-21) requires states to develop Transportation Asset Management Plans (TAMPs), which provide information about highway assets and associated management strategies. TAMPs are required to establish performance targets for NBI structures on the NHS and to report progress toward those targets. Performance measures and targets pertain to all NBI bridges on the NHS, irrespective of owner, including on- and off-ramps and bridges that cross a state border.

Federal Performance Management Measures for Poor (SD) and Good Structures: MAP-21 established the specific requirements for poor (SD) and good bridges below. No more than 10% of the deck area of NBI structures on the NHS may be poor (SD)

1. Each state must establish 2-year and 4-year goals for the percentage of deck area of NBI bridges on the NHS in poor (SD) condition
2. Each state must establish 2-year and 4-year goals for the percentage of deck area of NBI bridges on the NHS in good condition

Table 3-3 shows Virginia's 2-year and 4-year targets, along with actual performance for good and poor (SD) deck area.

Table 3-3- Virginia's Status with FHWA's Required Performance Targets

Percentage of Deck Area of NBI Bridges on the National Highway System				
Condition	**Virginia's 2-Year Target 2019**	**Virginia's 4-Year Target 2021**	**Federal Limit**	**Current Status**
Good	33.5%	30.5%	-	32.1%
Poor (SD)	3.5%	3.0%	10.0%	2.3%

Notes:

a. The 2021 performance target for good deck area has been adjusted to align with predicted performance.
b. Data used by FHWA for the performance targets represent data as of the end of the referenced year although reported early in the following year including the ongoing changes over that period. The actual performance information is not usually finalized until the latter part of the following year. An example is as follows: the two-year 2019 target uses data reported to FHWA on March 15, 2020, and FHWA publishes the data in December of 2020.
c. Data relating to federal performance management includes federally-owned and federally-managed bridges which are not included in data used in this report.
d. As a result of bullets 'b' and 'c' above, there are small differences between the federal performance management condition data and other data reported herein including the current status in Table 3-3.

While the federal performance management targets apply statewide, irrespective of highway system or district, Table 3-4 is provided as supplemental information to show how performance varies between districts and highway systems.

Table 3-4- Percentage of Deck Area of Poor (SD) NBI Structures on the NHS by District and Highway System

District	**Percentage of Poor (SD) Deck Area of NBI Bridges on NHS**			
	Interstate	**Primary**	**Secondary & Urban**	**All**
1 Bristol	3.6%	1.8%	100.0%	2.8%
2 Salem	5.8%	2.0%	0.0%	3.3%
3 Lynchburg	N/A	0.9%	0.0%	0.9%
4 Richmond	6.1%	2.6%	2.8%	4.1%
5 Hampton Roads	2.6%	1.0%	0.0%	1.6%
6 Fredericksburg	3.3%	6.6%	0.0%	5.7%
7 Culpeper	0.0%	6.9%	0.0%	3.1%
8 Staunton	0.0%	4.9%	0.0%	1.9%
9 NOVA	0.0%	2.9%	0.0%	1.1%
Statewide	**2.5%**	**2.3%**	**0.9%**	**2.3%**

Figure 3-5, Figure 3-6, Figure 3-7, and Figure 3-8 provide current and historic performance information regarding the area of NBI bridges on the NHS in good or poor (SD) condition.

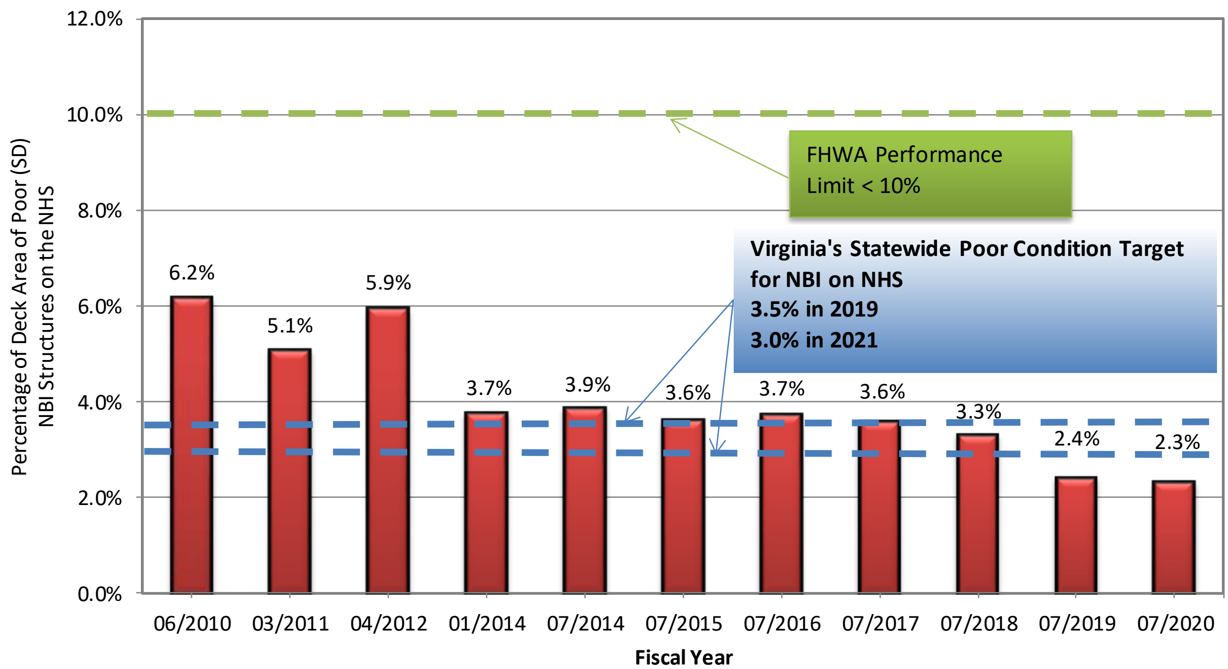


Figure 3-5- Multi-Year Performance History of Percentage of Deck Area of Poor (SD) NBI Structures on the NHS

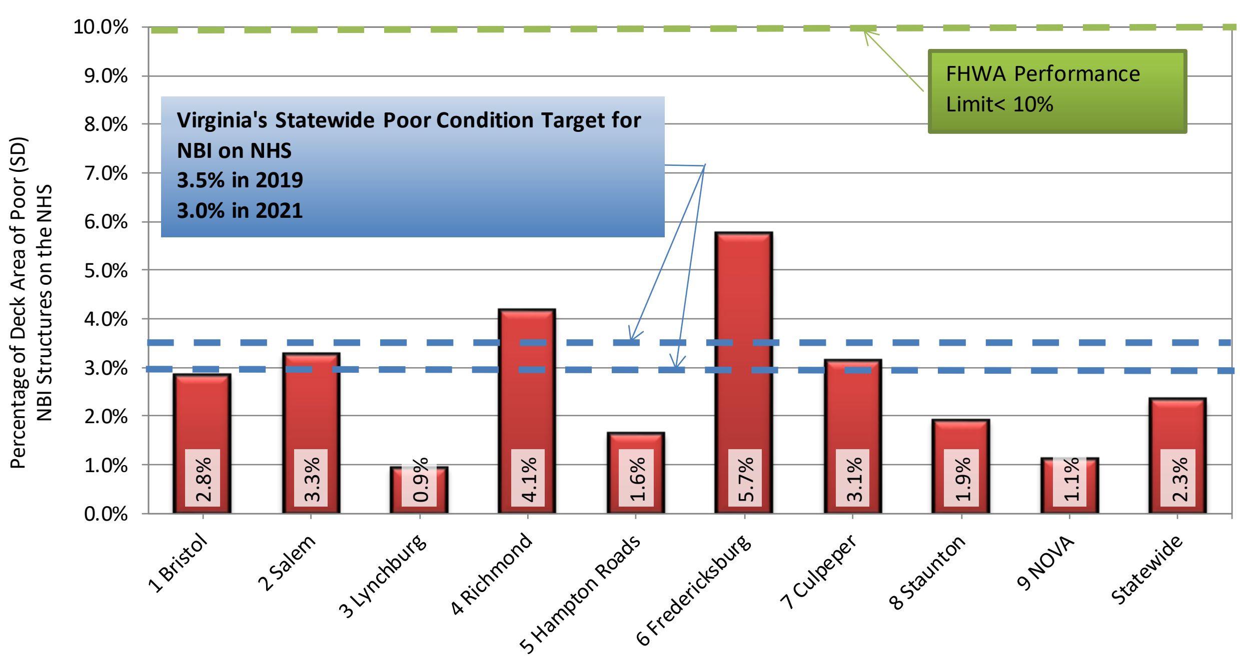


Figure 3-6- Percentage of Deck Area of Poor (SD) NBI Structures on the NHS by District

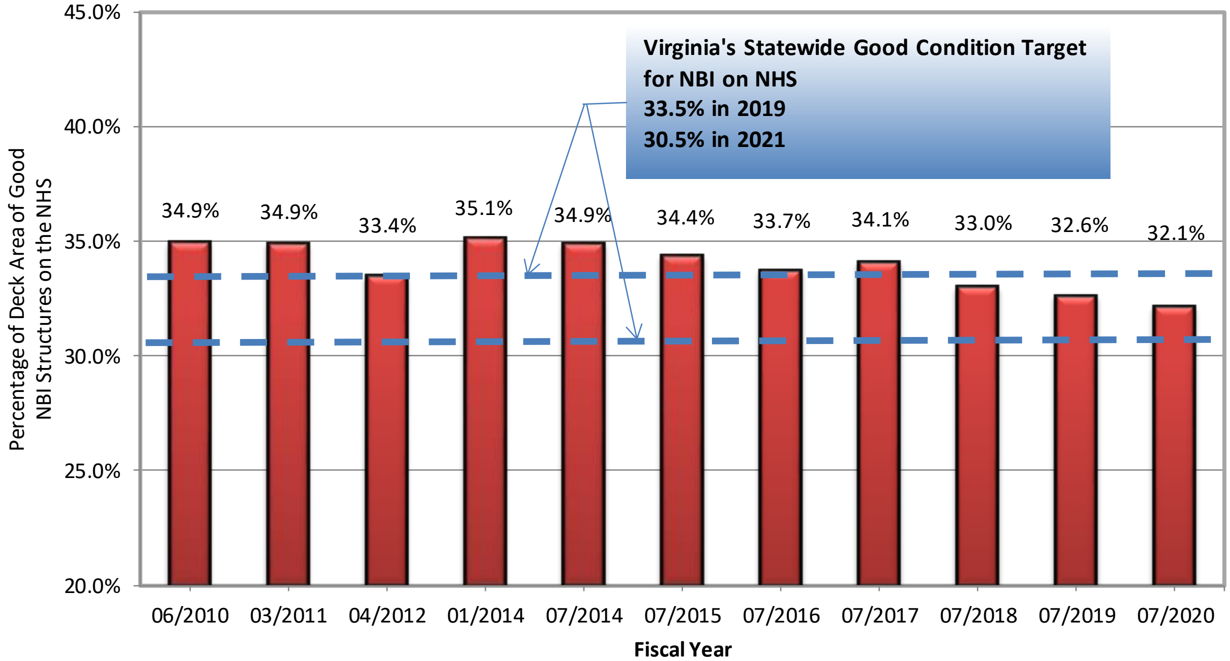


Figure 3-7- Multi-Year Performance History of Percentage of Deck Area of NBI Structures on the NHS in Good Condition

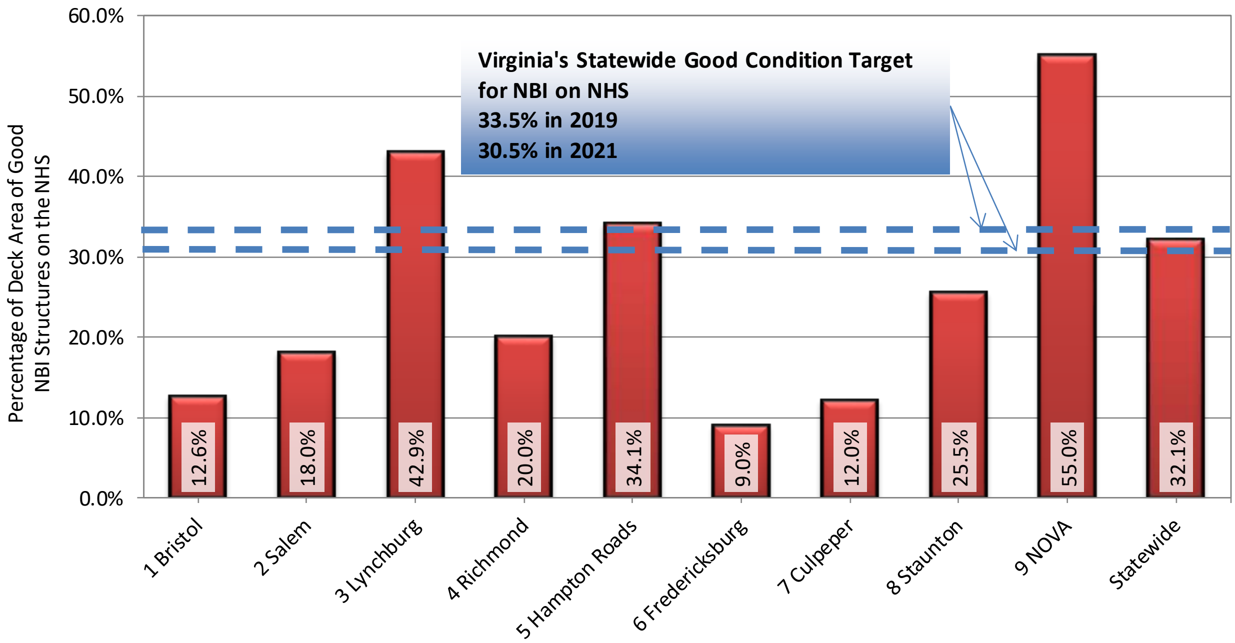


Figure 3-8- Percentage of Deck Area of NBI Structures on the NHS in Good Condition by District

3.3 CURRENT CONDITIONS - STRUCTURES

The following pages contain charts and tables providing information about the current conditions of Virginia's structures. The charts and tables detail the current state of Virginia's poor (SD) and weight-posted structures, as well as information about the percentage of good, fair, and poor structures. They are generally self-explanatory and are thus provided without narrative.

3.3.1 Percentage and Count of Poor (SD) Structures

- Figure 3-9 addresses poor (SD) Structures by count by district
- Figure 3-10 addresses poor (SD) NBI structures on the NHS by count
- Figure 3-11 through Figure 3-13 address poor (SD) structures by highway system and count

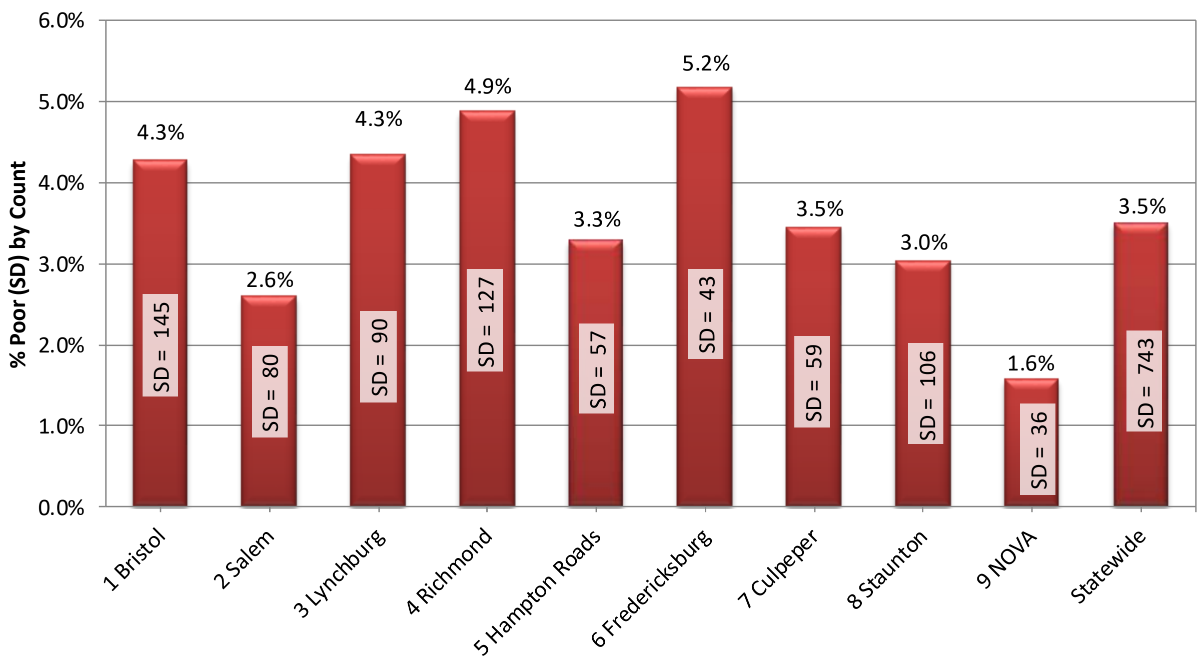


Figure 3-9- Percentage and Count of Poor (SD) Structures by District – All Systems

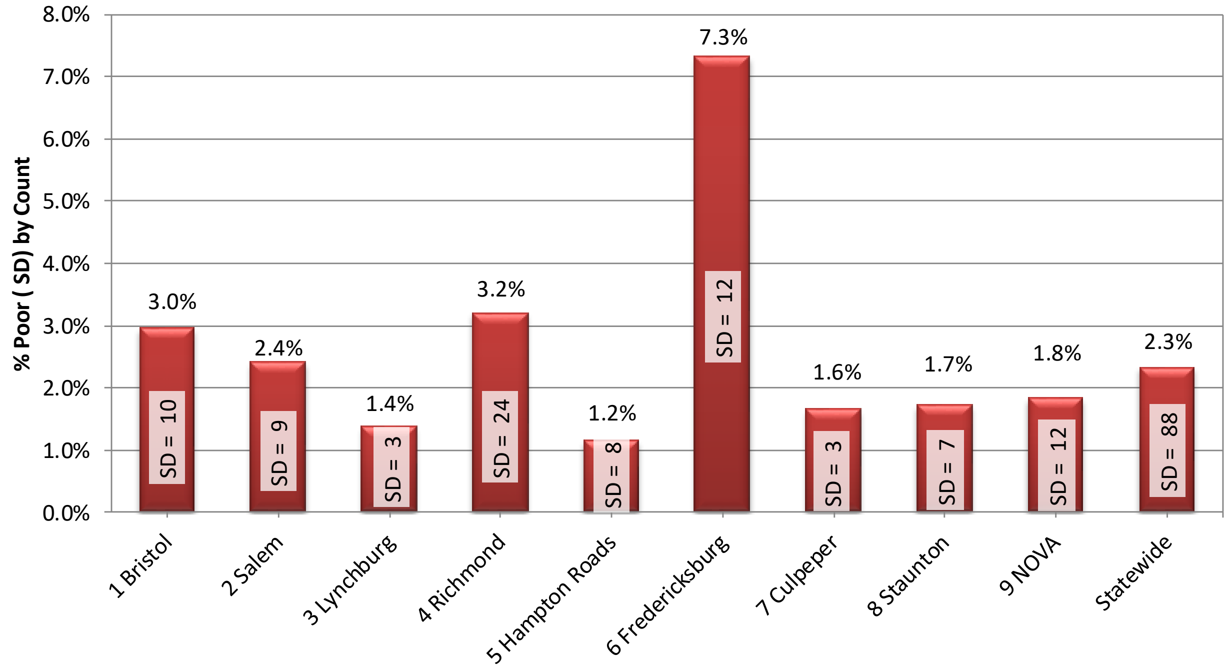


Figure 3-10- Percentage and Count of Poor (SD) NBI Structures on the NHS by District

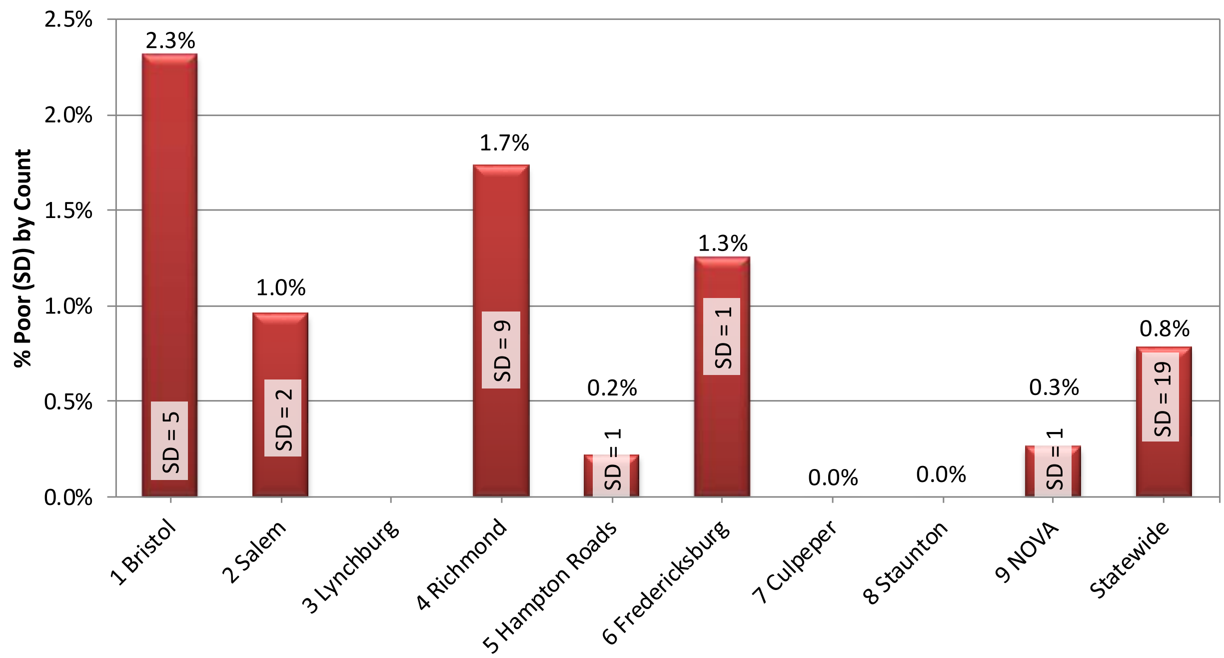


Figure 3-11- Percentage and Count of Poor (SD) Structures on Interstate System by District

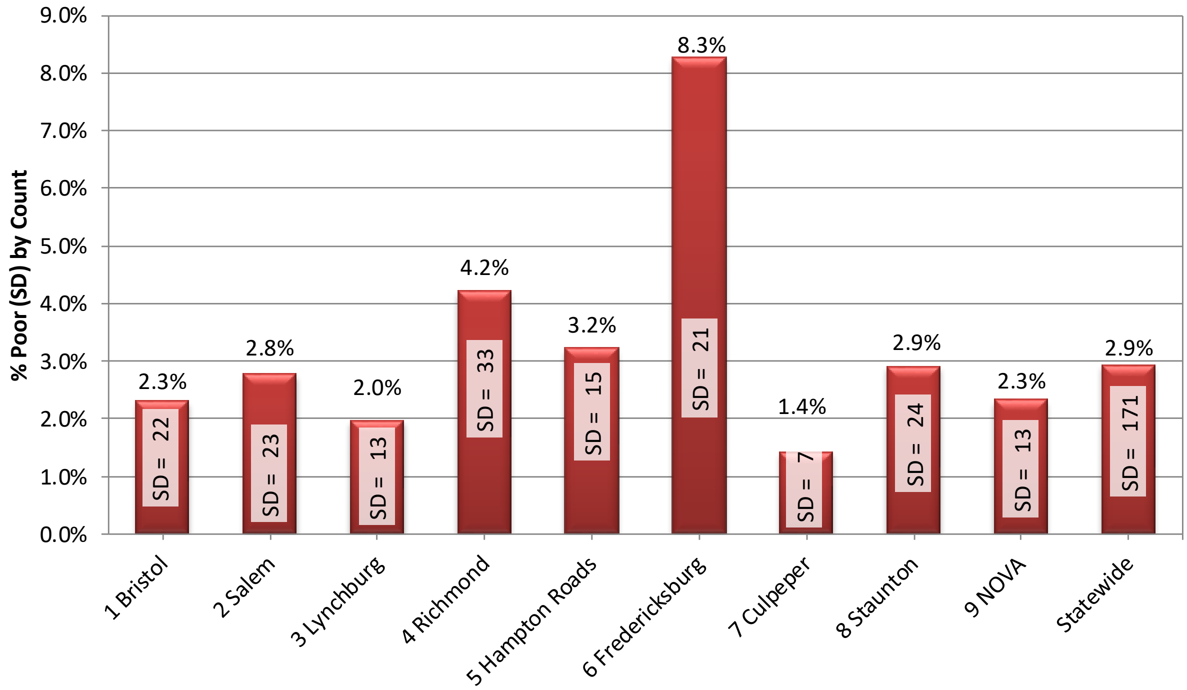


Figure 3-12- Percentage and Count of Poor (SD) Structures on Primary System by District

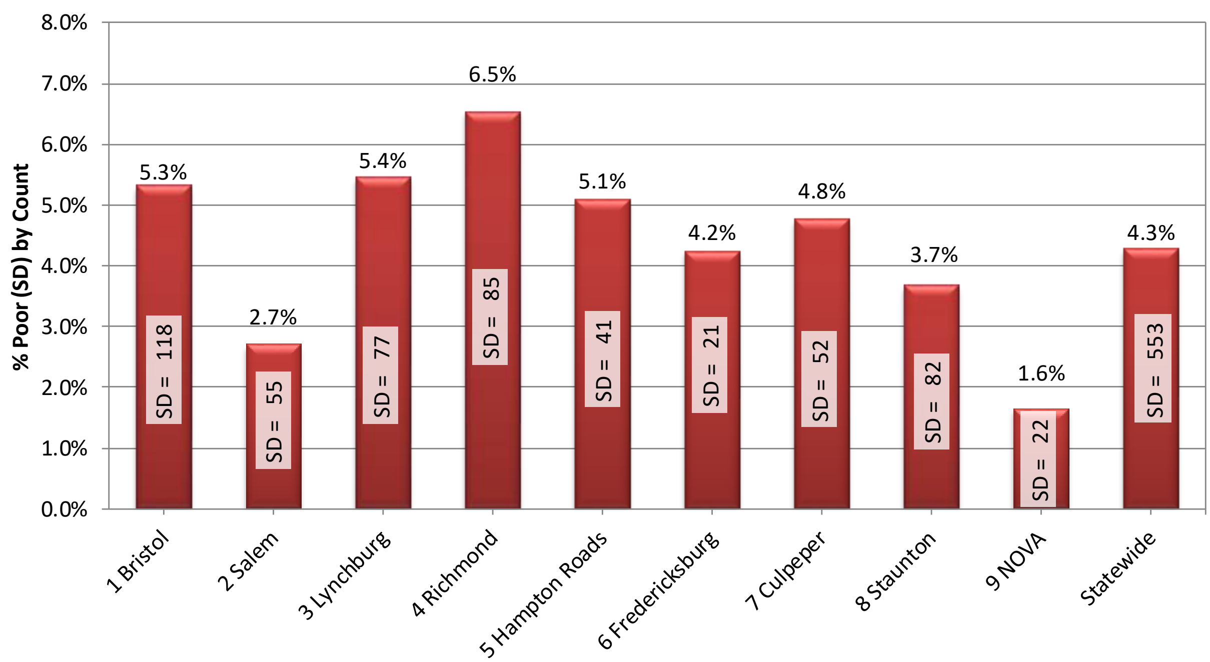


Figure 3-13**- Percentage and Count of Poor (SD) Structures on Secondary and Urban Systems by District**

3.3.2 Detailed Deck Area and Conditions of NBI Structures on the NHS

Figure 3-14 and Table 3-5 show the deck area of NBI structures on the NHS. Figure 3-15 and Table 3-6 show the poor (SD) deck area for NBI structures on the NHS. Figure 3-15 shows that the statewide total poor (SD) deck area is 1,611,107 square feet, which is well below the Federal (10%) limit of 6,944,495 square feet.

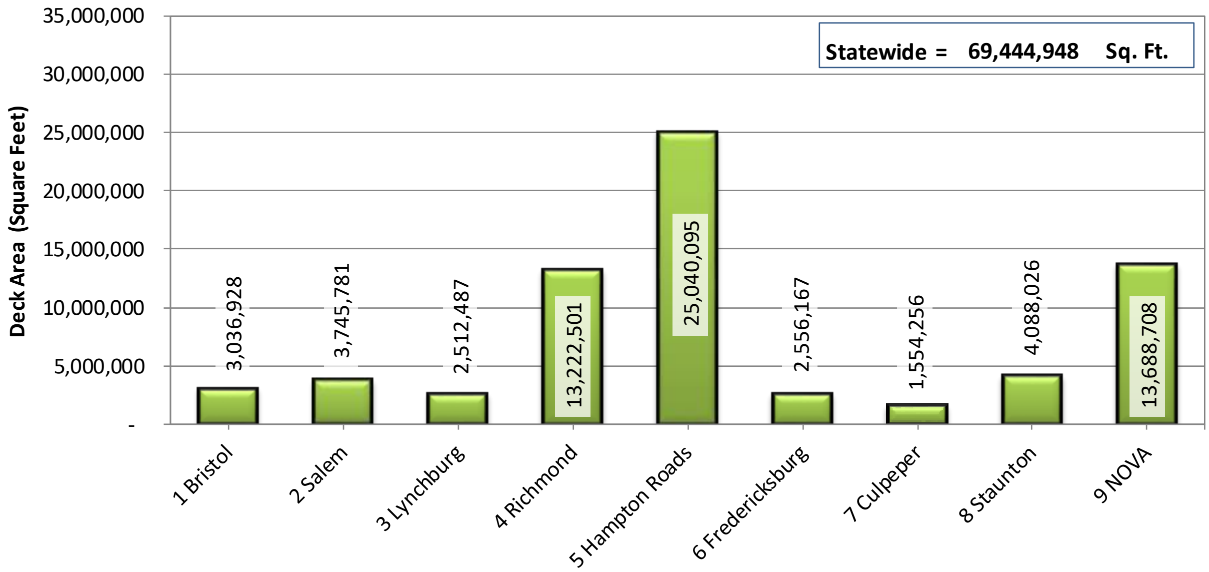


Figure 3-14- Deck Area of NBI Structures on NHS by District

Table 3-5- Deck Area of NBI Structures on NHS by District and Highway System

District	Deck Area of NBI Structures on NHS (Square Feet)			
	Interstate	Primary	Secondary & Urban	Total
1 Bristol	1,522,838	1,509,752	4,337	3,036,928
2 Salem	1,290,067	2,419,421	36,293	3,745,781
3 Lynchburg	0	2,507,590	4,896	2,512,487
4 Richmond	5,839,517	6,992,723	390,261	13,222,501
5 Hampton Roads	10,829,519	12,626,627	1,583,949	25,040,095
6 Fredericksburg	427,528	2,010,235	118,404	2,556,167
7 Culpeper	815,039	704,641	34,576	1,554,256
8 Staunton	2,495,031	1,571,757	21,238	4,088,026
9 NOVA	8,020,131	5,209,395	459,183	13,688,708
Statewide	**31,239,670**	**35,552,141**	**2,653,137**	**69,444,948**

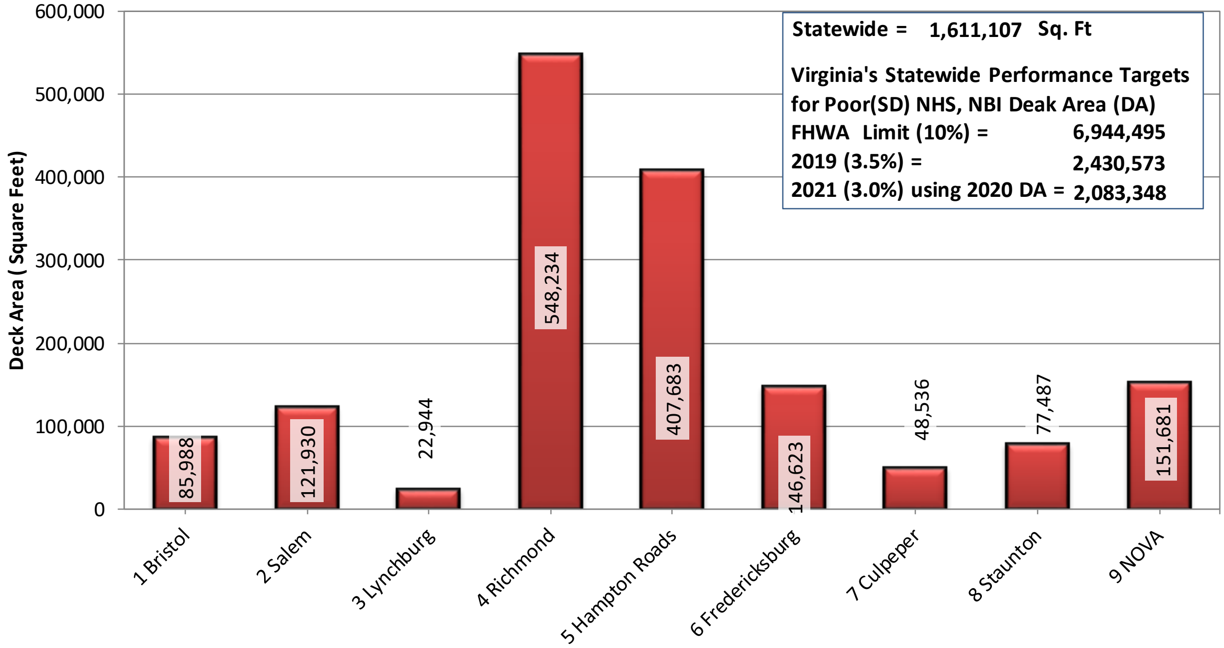


Figure 3-15- Deck Area of Poor (SD) NBI Structures on NHS by District

Table 3-6- Deck Area of Poor (SD) NBI Structures on NHS by District and Highway System

District	Area of Poor (SD) NBI Structures on NHS By Highway System (Square Feet)			
	Interstate	Primary	Secondary & Urban	Total
1 Bristol	54,100	27,551	4,337	85,988
2 Salem	74,220	47,710	0	121,930
3 Lynchburg	N/A	22,944	0	22,944
4 Richmond	355,407	181,947	10,880	548,234
5 Hampton Roads	282,900	124,783	0	407,683
6 Fredericksburg	14,001	132,622	0	146,623
7 Culpeper	0	48,536	0	48,536
8 Staunton	0	77,487	0	77,487
9 NOVA	1,100	150,581	0	151,681
Statewide	**781,728**	**814,161**	**15,217**	**1,611,107**

3.3.3 Condition Data by Deck Area

- Figure 3-16 and Table 3-7 address the deck area of all structures
- Figure 3-17 and Tables 3-8 and 3-9 address poor (SD) deck area
- Figure 3-18 and Table 3-10 address weight-posted deck area

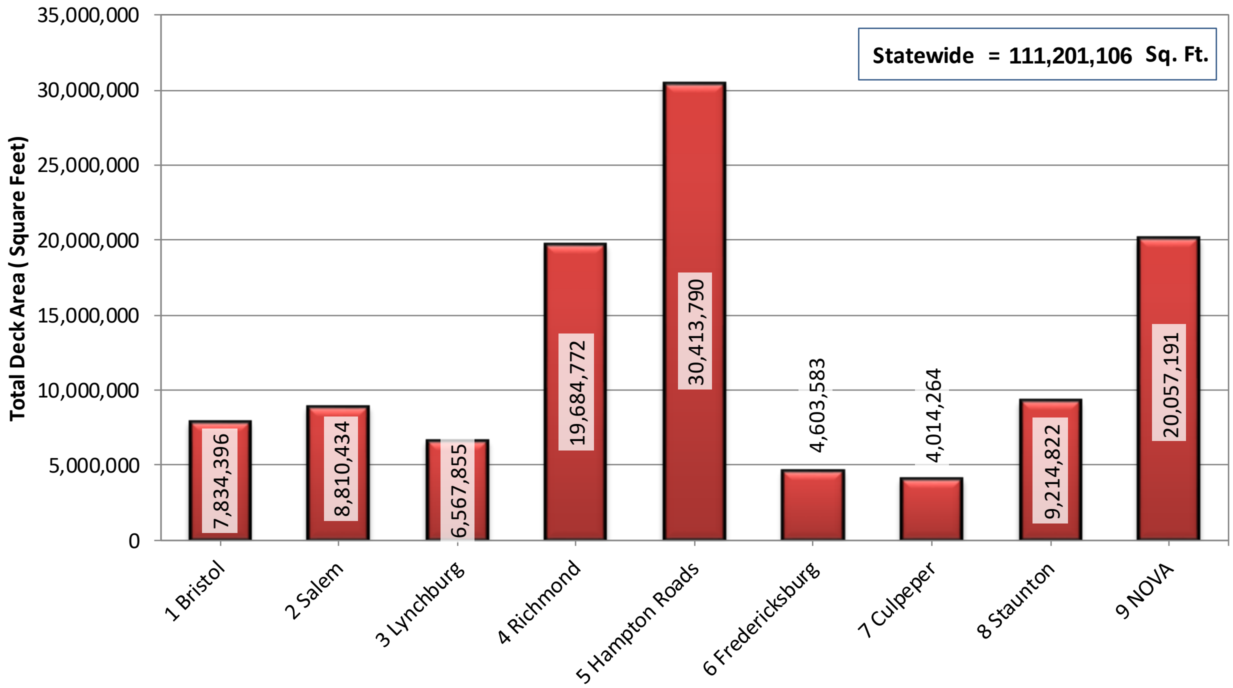


Figure 3-16- Total Deck Area of All Structures by District

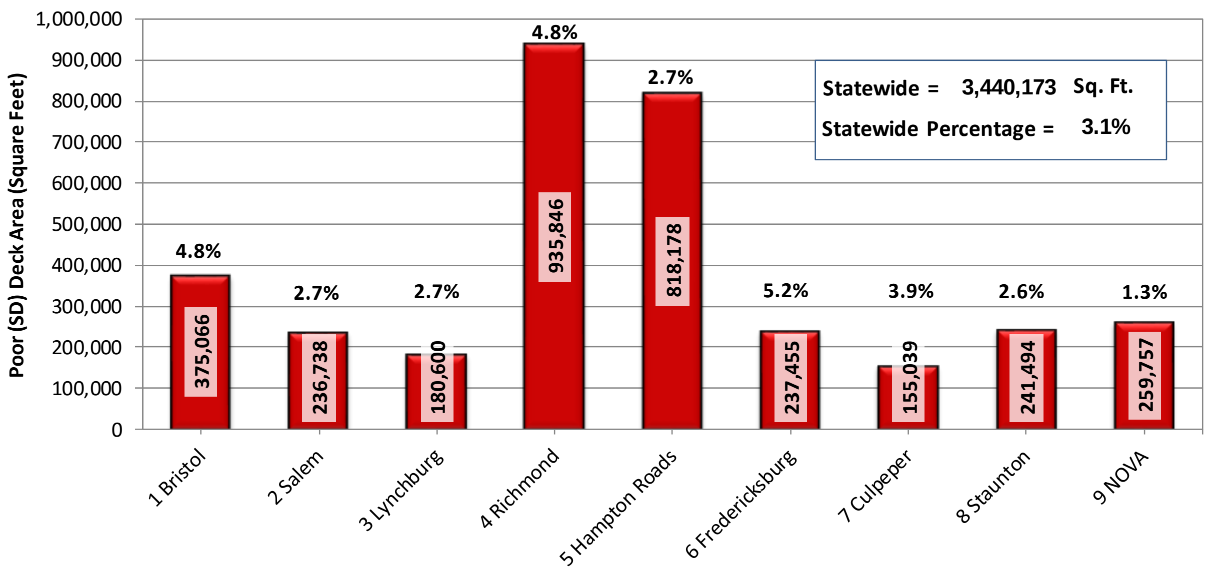


Figure 3-17- Deck Area of Poor (SD) Structures by District

Table 3-7- Deck Area of All Structures by District and Highway System

District	Area of All Structures (Sq. Ft.) By Highway System			
	Interstate	Primary	Secondary & Urban	Total
1 Bristol	1,591,472	3,552,723	2,690,201	7,834,396
2 Salem	1,342,828	4,234,465	3,233,140	8,810,434
3 Lynchburg	0	3,973,578	2,594,278	6,567,855
4 Richmond	6,067,765	9,093,649	4,523,358	19,684,772
5 Hampton Roads	10,950,201	15,330,374	4,133,215	30,413,790
6 Fredericksburg	447,392	2,957,214	1,198,977	4,603,583
7 Culpeper	836,739	1,505,490	1,672,035	4,014,264
8 Staunton	2,634,482	3,350,274	3,230,066	9,214,822
9 NOVA	8,162,983	6,131,284	5,762,924	20,057,191
Statewide	**32,033,863**	**50,129,049**	**29,038,194**	**111,201,106**

Table 3-8- Deck Area of Poor (SD) Structures by District and Highway System

District	Area of Poor (SD) Structures (Sq. Ft.) By Highway System			
	Interstate	Primary	Secondary & Urban	Total
1 Bristol	54,100	131,257	189,710	375,066
2 Salem	74,220	89,682	72,836	236,738
3 Lynchburg	N/A	68,436	112,164	180,600
4 Richmond	355,407	367,100	213,338	935,846
5 Hampton Roads	282,900	455,936	79,342	818,178
6 Fredericksburg	14,001	198,924	24,530	237,455
7 Culpeper	0	86,521	68,518	155,039
8 Staunton	0	126,380	115,114	241,494
9 NOVA	1,100	177,490	81,167	259,757
Statewide	**781,728**	**1,701,726**	**956,719**	**3,440,173**

Table 3-9- Percentage of Poor (SD) Condition Deck Area by District and Highway System

District	Percentage of Poor (SD) Deck Area			
	Interstate	Primary	Secondary & Urban	Total
1 Bristol	3.4%	3.7%	7.1%	4.8%
2 Salem	5.5%	2.1%	2.3%	2.7%
3 Lynchburg	N/A	1.7%	4.3%	2.7%
4 Richmond	5.9%	4.0%	4.7%	4.8%
5 Hampton Roads	2.6%	3.0%	1.9%	2.7%
6 Fredericksburg	3.1%	6.7%	2.0%	5.2%
7 Culpeper	0.0%	5.7%	4.1%	3.9%
8 Staunton	0.0%	3.8%	3.6%	2.6%
9 NOVA	0.0%	2.9%	1.4%	1.3%
Statewide	2.4%	3.4%	3.3%	3.1%

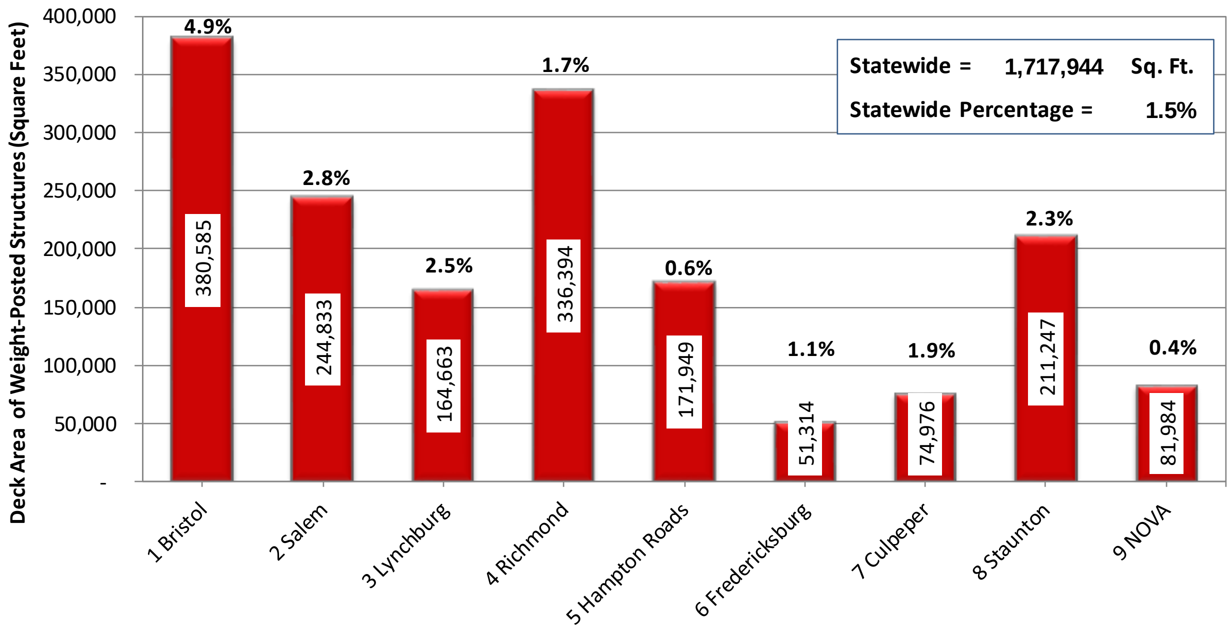


Figure 3-18- Deck Area of Weight-Posted Structures by District

Table 3-10- Deck Area of Weight-Posted Structures by District and Highway System

District	Deck Area of Weight-Posted Structures (Square Feet)			
	Interstate	Primary	Secondary & Urban	Grand Total
1 Bristol	0	111,217	269,367	380,585
2 Salem	0	24,070	220,762	244,833
3 Lynchburg	0	4,073	160,590	164,663
4 Richmond	0	107,889	228,504	336,394
5 Hampton Roads	0	82,940	89,009	171,949
6 Fredericksburg	0	20,980	30,334	51,314
7 Culpeper	0	924	74,052	74,976
8 Staunton	0	99,259	111,987	211,247
9 NOVA	0	998	80,986	81,984
Statewide	**0**	**452,352**	**1,265,591**	**1,717,944**

3.4 CURRENT CONDITIONS - ANCILLARY STRUCTURES

Conditions of ancillary structures are summarized in Table 3-11 and Figure 3-19. The condition ratings for ancillary structures have been limited to 5 ratings, which represents a change from previous years, where 10 ratings, correlating to the GCRs for bridges were coded. These five categories are good (7), fair (5), poor (4), critical (2), and failed condition (0). The major components that are rated are foundation, parapet mount (signs only) and superstructure. The overall structure receives a condition category rating that is the minimum component rating (superstructure, parapet mount, foundation).

Table 3-11- Percentage and Count of Ancillary Structures by Condition Category and Structure Type

Structure Type	Condition Categories (No. of Structures)				Condition Categories		
	Good	Fair	Poor	Total	Good	Fair	Poor
Signs	1,873	1,145	735	3,753	49.9%	30.5%	19.6%
Luminaires	7,326	6,903	6,422	20,651	35.5%	33.4%	31.1%
Traffic Signals	3,496	2,218	3,947	9,661	36.2%	23.0%	40.9%
High Mast Lights and Camera Poles	602	543	324	1,469	41.0%	37.0%	22.1%
Total	13,297	10,809	11,428	35,534	37.4%	30.4%	32.2%

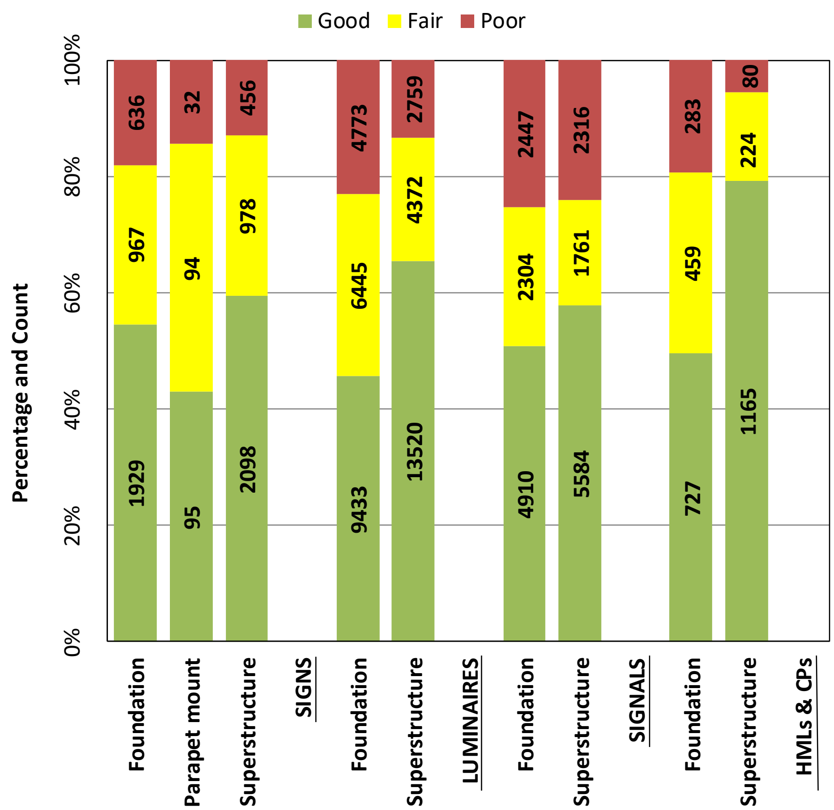


Figure 3-19- Percentage and Count of Ancillary Structures by Condition Category and Structure Type

Note: HMLs & CPs are High Mast Lights and Camera Poles

3.5 CONDITION TRENDS – GENERAL

Table 3-12 and Table 3-13 show the number of poor (SD) structures by district and the changes that occurred between the start and end of FY2020.

Table 3-12- Change in Number of Poor (SD) Structures

District	Number of Poor (SD) Structures		
	07/2019	07/2020	% Change
1 Bristol	156	145	-7.1%
2 Salem	91	80	-12.1%
3 Lynchburg	83	90	8.4%
4 Richmond	138	127	-8.0%
5 Hampton Roads	58	57	-1.7%
6 Fredericksburg	49	43	-12.2%
7 Culpeper	60	59	-1.7%
8 Staunton	115	106	-7.8%
9 NOVA	42	36	-14.3%
Statewide	**792**	**743**	**-6.2%**

Table 3-13- Number of Structures Improved from or Deteriorated into Poor Condition (SD)

District	Number of Poor Structures Improved	Number of Structures Deteriorated into Poor State	Net Change
1 Bristol	29	18	-11
2 Salem	19	8	-11
3 Lynchburg	17	24	7
4 Richmond	19	8	-11
5 Hampton Roads	8	7	-1
6 Fredericksburg	10	4	-6
7 Culpeper	8	7	-1
8 Staunton	15	6	-9
9 NOVA	8	2	-6
Statewide	**133**	**84**	**-49**

Note: Net change = Number of structures deteriorated to poor (SD) status – Number of poor (SD) structures restored or removed.

Figure 3-20 through Figure 3-23 provide the percentage and total number of poor (SD) structures for each of the Virginia Highway Systems for the last eleven years. The red lines indicate the percentage of structures by count that are poor (SD), green lines indicate the percentage of structures by deck area that are poor (SD), and the blue bars show the number of poor (SD) structures.

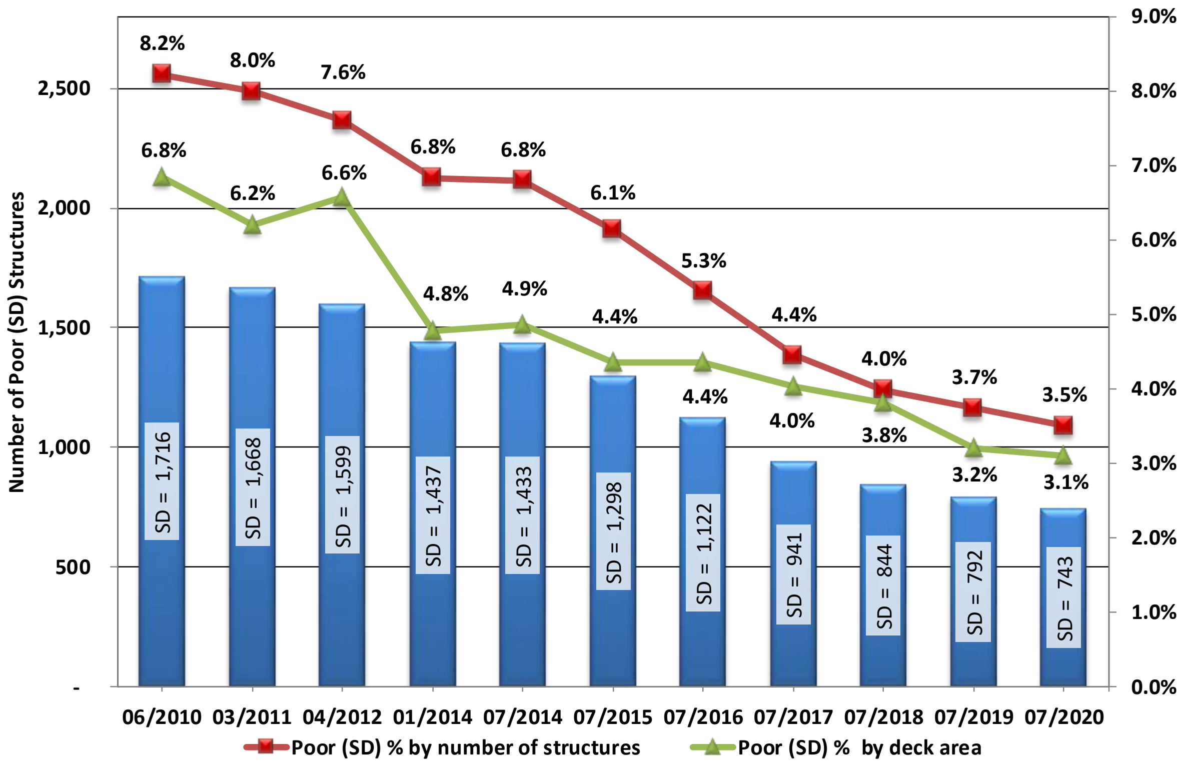


Figure 3-20- Multi-Year Performance History of Percentage of Poor (SD) Structures on All Systems

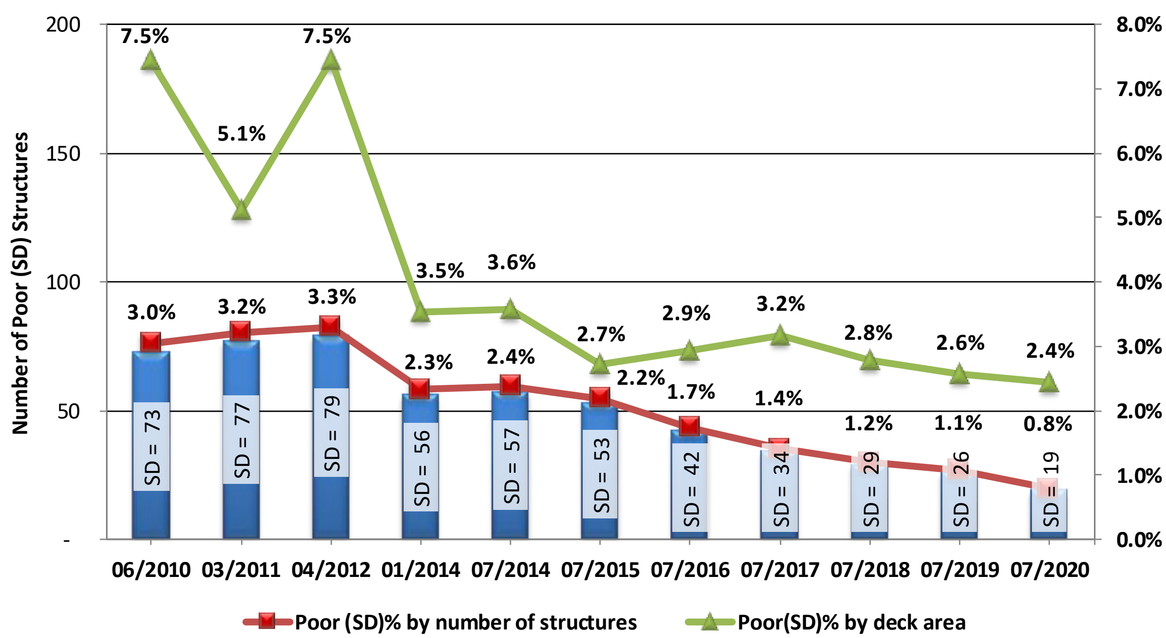


Figure 3-21- Multi-Year Performance History of Percentage of Poor (SD) Structures for Interstate System

Note: A large effort was made between 04/2012 and 01/2014 to repair Interstate structures in order to reduce the number of poor (SD) structures.

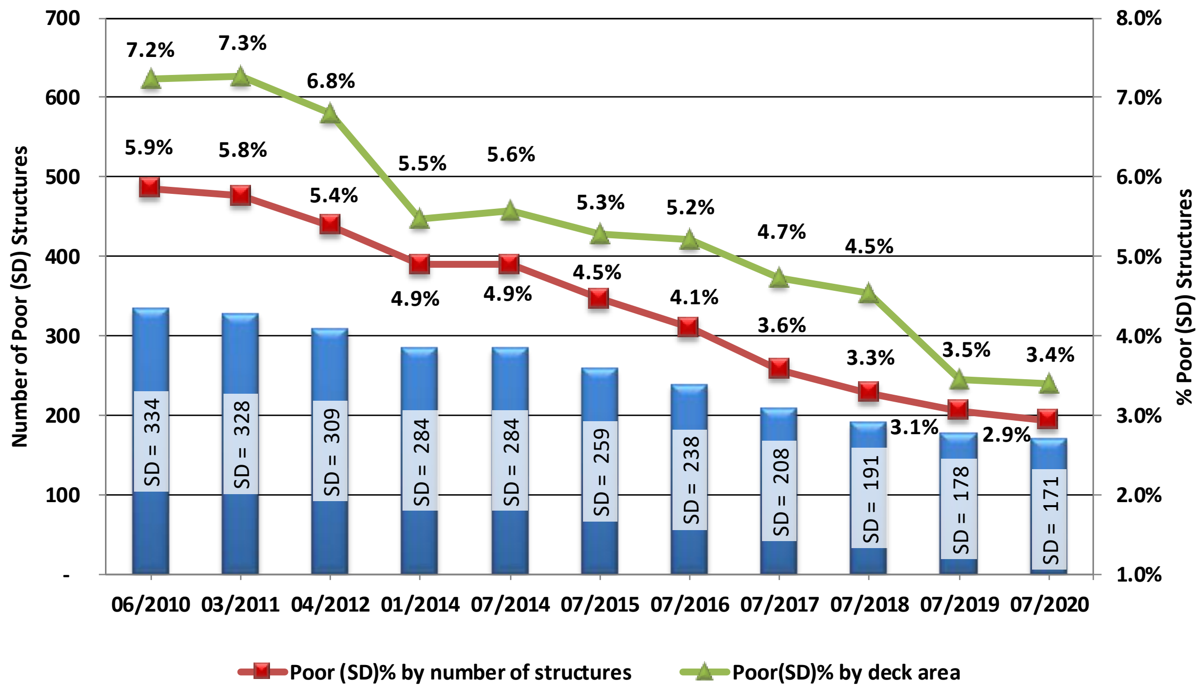


Figure 3-22- Multi-Year Performance History of Percentage of Poor (SD) Structures for Primary System by Year

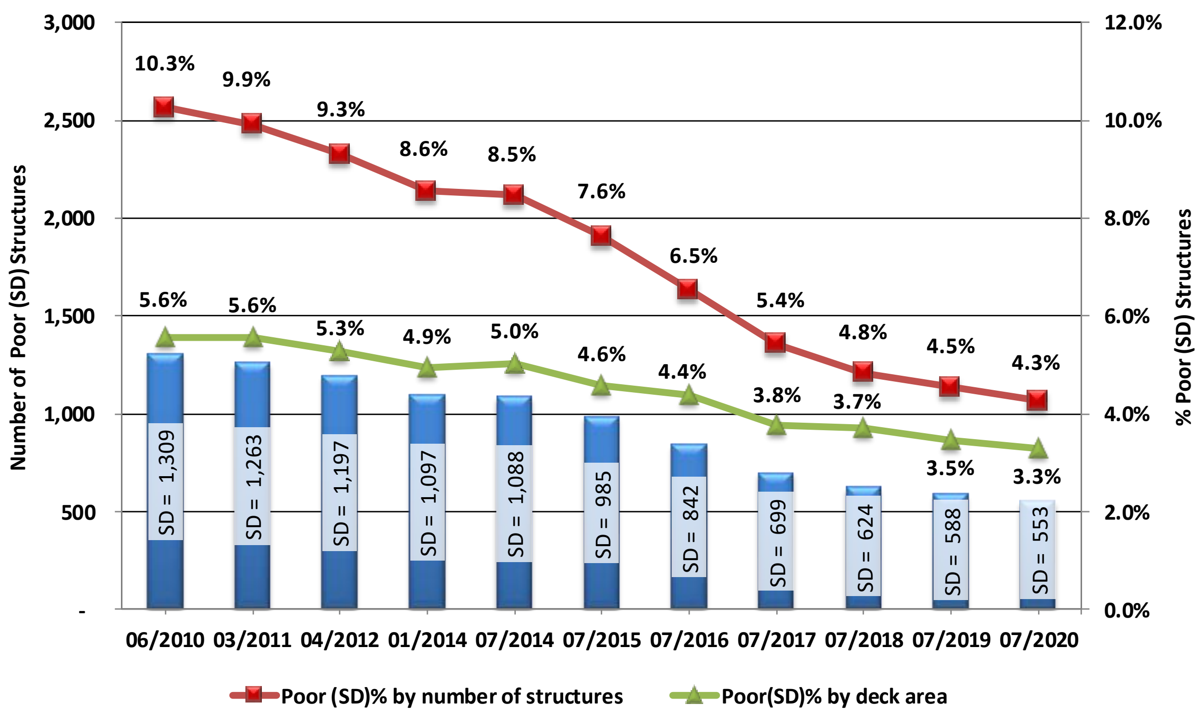
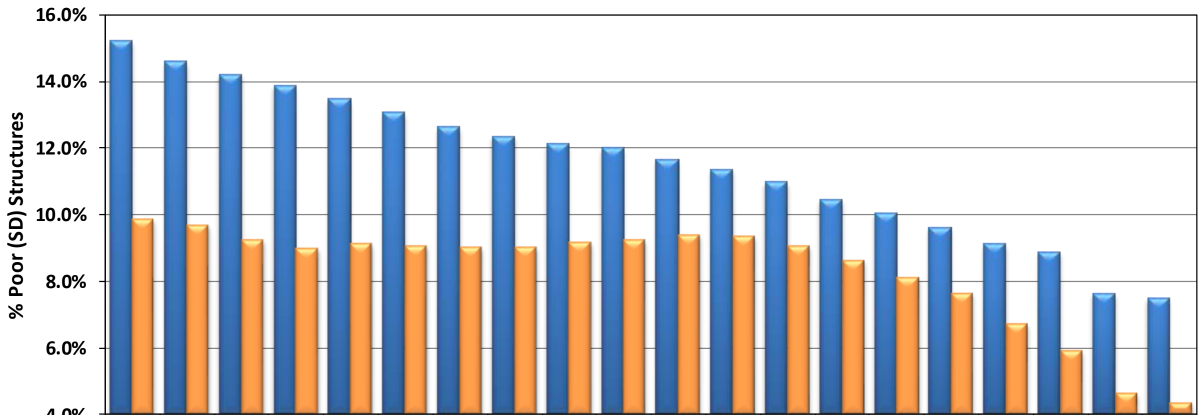


Figure 3-23- Multi-Year Performance History of Percentage of Poor (SD) Structures for Secondary and Urban Systems

Note: A large number of poor (SD) Structures were added in Buchanan County in 2012. See notes in section 2.2 of this report.

Figure 3-24 compares the percentage of poor (SD) NBI structures in Virginia versus the nation as a whole from 1999 to 2018. The dates shown indicate the data year and not the year published. See Section 3.2.4 for further explanation.



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Nationwide	15.2%	14.6%	14.2%	13.9%	13.5%	13.1%	12.6%	12.3%	12.1%	12.0%	11.7%	11.4%	11.0%	10.5%	10.0%	9.6%	9.1%	8.9%	7.6%	7.5%
Virginia	9.9%	9.7%	9.2%	9.0%	9.1%	9.1%	9.0%	9.0%	9.2%	9.2%	9.4%	9.4%	9.1%	8.6%	8.1%	7.7%	6.7%	5.9%	4.6%	4.4%

Figure 3-24- Twenty-Year Comparison of Virginia's NBI Poor (SD) Structures to the National Average

Note: Data in the figure are from FHWA's database, which includes structures that are the responsibility of the Federal Government and therefore not the responsibility of the Commonwealth of Virginia. FHWA's database also uses a different reporting date than the information in this report. As a result, there are slight differences between Figure 3-24 and the information provided elsewhere in this report.

4 DELIVERY OF THE MAINTENANCE, INSPECTION, AND CONSTRUCTION PROGRAMS

4.1 MAINTENANCE (BRIDGE CREWS & CONTRACTS)

4.1.1 State Force Bridge Crews

Each of VDOT's districts has two or more maintenance crews whose primary function is to maintain state-owned structures. They are supplemented by hired equipment contractors to assist in their work. The type of work they perform varies from preventive maintenance to complete replacement of smaller structures. The types of activities performed are indicated in Table 4-1.

Table 4-1- Activities Performed by VDOT's Bridge Crews

Type of Work	Typical Activities performed
Preventive Maintenance	Deck sweeping, deck washing, beam end washing, sealing cracks, thin overlays, joint rehabilitation, large culvert cleaning, and vegetation removal
Restorative Maintenance	Overlays, rail repair, deck patching, superstructure repairs, substructure repairs, bearing repairs, painting, large culvert repairs
Rehabilitation	Deck and superstructure replacement, major repairs to substructures and large culverts
Replacement	Complete bridge and large culvert replacement
Other	Special purchases of equipment or materials

Bridge crews are able to rapidly and effectively respond to the needs of the bridge inventory, with particular focus on the secondary system. Table 4-2 indicates the number of crews and crew members in each district. Accomplishments by bridge crews are reported in Table 4-3.

Table 4-2- VDOT's Bridge Maintenance Crews

District	VDOT State Force Bridge Crews	
	No. Crews	No. Crew Members
Bristol	6	36
Salem	5	35
Lynchburg	4	30
Richmond	4	30
Hampton Roads	4	29
Fredericksburg	2	16
Culpeper	4	27
Staunton	5	36
NOVA	3	21
Statewide	**37**	**260**

Table 4-3- FY2020 Accomplishments of VDOT's Bridge Maintenance Crews, and Number of Structures Preserved, Rehabilitated, or Replaced

District	Preservation		Rehabilitation		Replacement		Total Accomplishments	
	Preventative	Restorative						
	No.	No.	No.	# SD	No.	# SD	No.	# SD
1 Bristol	1,208	106	20	2	24	16	1,358	18
2 Salem	918	206	0	0	50	4	1,174	4
3 Lynchburg	524	7	38	6	10	10	579	16
4 Richmond	274	14	23	8	1	1	312	9
5 H. Roads	220	25	15	4	8	3	268	7
6 F'burg	109	56	4	4	3	3	172	7
7 Culpeper	156	231	8	7	2	2	397	9
8 Staunton	0	70	11	5	11	5	92	10
9 NOVA	22	40	0	0	5	1	67	1
Statewide	**3,431**	**755**	**119**	**36**	**114**	**45**	**4,419**	**81**

** "# SD" is number of poor (SD) structures*

4.1.2 Contracts

In addition to its use of state-force bridge crews, VDOT partners with private industry to deliver its bridge maintenance program. There are several types of contracts that VDOT employs to accomplish bridge maintenance work:

- **Task-order consultant contracts for design of bridge rehabilitation projects:** VDOT has a group of qualified professional engineering consultants who are called upon to provide design, construction support, and engineering expertise as required
- **On-call maintenance contracts:** VDOT uses indefinite quantity contracts with specific unit prices to perform bridge maintenance, repair, and preservation work through task orders. Also referred to as "on-call", these contracts may be general in nature, encompassing a wide variety of work, or they may be more specific, targeting narrower areas of contractor expertise such as painting or traffic control. On-call contracts are usually district-based or regional.
- **Hired equipment contracts:** Many VDOT district bridge offices use hired equipment contracts to provide equipment and operators on an as-needed basis. These contracts are often limited to one or two counties within a particular district.
- **Material purchase contracts:** VDOT has several statewide contracts for materials such as lug bolts and precast concrete slabs. These contracts tend to provide better pricing by increasing the quantity. They also provide districts with ready access to materials without individual procurements, thus reducing administrative burden.

4.2 Inspection, Load Rating and Permitting

4.2.1 Bridge, Ancillary Structure, and Tunnel Inspection

Bridge and Culvert Inspection: VDOT uses its comprehensive inspection program to evaluate and monitor the conditions of its structures. The data collected during inspections is used as the primary source of information for determining maintenance, repair and replacement needs. NBI structures and non-NBI bridges receive detailed inspections at regular intervals not exceeding 24 months. Non-NBI large culverts are inspected at intervals not exceeding 48 months. Table 4-4 provides minimum inspection frequencies.

Inspectors use condition ratings to describe each existing structure. As detailed previously, these condition ratings are based on FHWA criteria. The condition assessments of the structures are performed by qualified inspectors, and all assessments are performed in accordance with the NBIS as well as VDOT's policies and procedures. VDOT's inspection procedures and requirements are detailed in VDOT's current Instructional and Informational Memorandum IIM-S&B-27.

Table 4-4- Inspection Frequencies

Structure Type	Frequency of Inspections	
	NBIS	VDOT*
Bridges	2 Years	2 Year or 1 Year (SD or Posted)
Culverts	2 Years	2 Year (NBI) or 4 Year (Non-NBI)
Fracture Critical Structures	2 Years	1 Year
Fatigue Prone Detail	2 Years	1 or 2 Years
Underwater	5 Years	5 Years
Sign Structures	No Requirement	2 - 6 Years
Signal Structures	No Requirement	4 Years
Highmast Light Poles	No Requirement	2 - 4 Years
Camera Poles	No Requirement	4 Years
Luminaires	No Requirement	4 Years

** District structure and bridge engineers may choose to inspect structures more frequently based on the conditions found during the inspections. Bridge and culvert inspection frequencies are mandated, but ancillary structure inspection frequencies may be extended if necessary.*

Ancillary Structure Inspection: VDOT utilizes a new, commercial inventory and inspection software system (HMMS) to maintain data for its ancillary structures. HMMS became available in December 2017, and data collection switched from the previous ancillary structures database(s) to HMMS. This report relies on merged data from the previous ancillary structures database(s) and HMMS.

Inspections of the ancillary structures are usually performed on a four-year cycle, but the required inspection interval varies depending on the purpose, condition, and type of the structure. At the time of each inspection, an inspector assigns condition ratings to describe each of the major structural components of each structure. These condition ratings are based on criteria similar to those defined by FHWA for bridge inspection. The condition assessments of the structures are performed by qualified inspectors, and assessments are performed in accordance with VDOT's policies and procedures.

VDOT's ancillary structure inspection procedures and requirements are detailed in VDOT's current Instructional and Informational Memoranda IIM-S&B-82 and IIM-S&B-90, and VDOT's "Traffic Ancillary Structures Inventory and Inspection Manual."

Tunnel Inspection: In August 2015, FHWA issued the National Tunnel Inspection Standards (NTIS), after which VDOT's Structure and Bridge Division created a tunnel inspection program to implement the NTIS in Virginia. Inspectors use condition states for structural, civil, and functional system elements as defined in FHWA Publication No. FHWA-HIF-15-006, *Specifications for the National Tunnel Inventory*, to describe each existing tunnel. As detailed previously, these condition ratings are based on FHWA criteria. The condition assessments of the structures are performed by qualified inspectors and all assessments are performed in accordance with the NTIS as well as VDOT's policies and procedures. VDOT's inspection procedures and requirements are detailed in VDOT's current Instructional and Informational Memorandum IIM-S&B-97 and in tunnel specific procedures. NTI tunnels owned by other Virginia entities (localities, toll authorities, etc.) must follow the minimum requirements for tunnel safety inspection established by the NTIS. Tunnel inspections were performed for seven tunnels in FY2020. Two consultant contracts for tunnel engineering have been used to perform tunnel inspections for VDOT maintained tunnels. Quality Control (QC) and Quality Assurance (QA) for tunnel inspection are described in Instructional and Informational Memorandum IIM-S&B-98.

Inspection Program Delivery and Costs: The structure safety inspection program provides the data for most of Virginia's maintenance and bridge management decisions. In FY2020, VDOT inspected 10,731 bridges and culverts at an expense of $34.0 million, utilizing in-house inspection staff and consultant contracts. Also, VDOT inspected 4,591 ancillary structures at an expense of $6.0 million.

VDOT also uses consultants to perform inspections on ancillary structures. There are a total of 24 consultant contracts: 18 for bridge and large culvert inspection; two for ancillary inspection, one statewide underwater inspection contract; and three contracts for load rating. Table 4-4 shows VDOT's inspection practices for inspection frequency compared to the NBIS. Table 4-5 shows the number of bridge, large culvert and ancillary structure inspections conducted by each district.

NBI bridges owned by other Virginia entities (localities, toll authorities, etc.) must follow the minimum requirements for bridge safety inspection established by the NBIS.

In addition to GCRs, VDOT inspectors have been collecting and recording detailed structural element data for over 20 years. These data are used by VDOT in its Bridge Management System (BMS), which is used to determine current and future maintenance and preservation needs.

The inspection reports list repair recommendations for each structure. At the time of inspection, the inspectors utilize their experience and judgment to determine the immediacy of the need for maintenance and to prioritize the recommended repairs accordingly. Many of VDOT's inspectors and all team leaders have completed FHWA's NHI training course "Inspection and Maintenance of Ancillary Highway Structures" (FHWA-NHI-130087) and draw on this training when performing inspections.

Inspection Program Quality Control and Quality Assurance (QC/QA): The accuracy, thoroughness, and completeness of the bridge safety inspections are essential. The inspections are used to evaluate each structure's safety and to make decisions on planning, budgeting, and performance of maintenance, repair, rehabilitation, and replacement of VDOT's structures. Since 1991, it has been the policy of VDOT's Structure and Bridge Division to provide rigorous quality control and quality assurance (QC/QA) of the structure safety inspection program. In January 2005, the NBIS portion of the Code of Federal Regulations was amended to require each state to "Assure systematic quality control and quality assurance procedures are used to maintain a high degree of accuracy and consistency in the inspection program. The QA program includes periodic field review of inspection teams, periodic bridge inspection refresher training for program managers and team leaders, and independent review of inspection reports and computations." The Structure and Bridge Division meets these NBIS requirements with its quality control and quality assurance programs.

Table 4-5- Number of Inspections Performed on VDOT-Owned Structures in FY2020

District	Number of Inspections						
	Bridges		Large Culverts		Ancillary		Total No. Structures
	No.	Percentage	No.	Percentage	No.	Percentage	
1 Bristol	1,411	18%	322	10%	696	15%	2,429
2 Salem	1,201	16%	353	11%	240	5%	1,794
3 Lynchburg	669	9%	438	14%	2	0%	1,109
4 Richmond	971	13%	428	14%	846	18%	2,245
5 Hampton Roads	660	9%	248	8%	167	4%	1,075
6 Fredericksburg	232	3%	143	5%	393	9%	768
7 Culpeper	613	8%	243	8%	-	0%	856
8 Staunton	1,210	16%	506	16%	200	4%	1,916
9 NOVA	689	9%	394	13%	2,047	45%	3,130
Total	**7,656**	**100%**	**3,075**	**100%**	**4,591**	**100%**	**15,322**

In 2008, VDOT's Structure and Bridge Division developed Information and Instruction Memorandum (IIM) IIM-S&B-78 (revised since release), describing the bridge safety inspection Quality Control(QC)/Quality Assurance(QA) program, which requires the following:

> *In accordance with the NBIS, program managers and team leaders must successfully complete an FHWA-approved comprehensive bridge inspection training course. Within VDOT, all bridge safety inspection personnel will successfully complete the National Highway Institute (NHI) course "Safety Inspection of In-Service Bridges" (FHWA-NHI-130055) within the first five years of employment in bridge inspection. VDOT's Structure and Bridge Division also requires inspection personnel successfully complete the NHI course 'Bridge Inspection Refresher Training' every five years. Underwater inspectors are required to fulfill the training requirements as set forth in the NBIS and the VDOT IIM-S&B-78.*

VDOT's central office and district offices have a responsibility to review and validate inspection reports and inventory data. Discrepancies found during the field and office reviews performed by district and central office personnel are documented in a written report and shared with all parties involved. The central office conducted its annual QA review on eight of the nine district bridge inspection programs during FY2020. A review of load ratings for a sample of bridges was a key component of the QA reviews. In addition, underwater inspection QA/QC field reviews are scheduled by the Central Office Underwater Inspection Coordinator. Underwater inspection QA/QC was performed on five structures during this time period.

The Virginia NBI Data was accepted by FHWA with no significant errors. VDOT has worked with FHWA to review all potential errors, and to provide clarification and correction where necessary.

FHWA conducted its annual NBIS compliance review from June 17, 2019 to October 22, 2019, with a draft report provided on December 18, 2019. VDOT had 45 days to address any deficiencies that were identified. The compliance review consisted of a review of the statewide inventory/database/organization/procedures for structure (bridge and large culvert) safety inspections and a QA review of a sample of structure records and structure field reviews of each of the nine districts. The National Bridge Inspection Program Final Summary of Metrics Performance Year 2019 (PY2019) review found VDOT Compliant with 21 of the 23 NBIS metrics. VDOT was found to be in substantial compliance of Metric 6 (Statewide Routine Low Risk Bridges) due to one (1) bridge inspection in PY2019 having been completed three months outside of the prescribed interval and two (2) bridge inspections having been completed more than four months after their due date. VDOT was found to be in substantial compliance of Metric 18 (Scour Critical Bridges) due to VDOT's document retention policy for scour evaluations differing from FHWA interpretation of published guidance. There were no problems identified on the current or previous review for Metric 18; however, the substantial compliance finding remains while the Improvement Plan is active. VDOT is establishing a QA/QC program for ancillary structures similar to those currently in place for bridge, large culvert, and tunnel inspections.

Inspection Program FY2020 Accomplishments: The Bridge Safety Inspection Program had a number of significant accomplishments this year. In order to ensure consistent and relevant inspector training, and to reduce training costs, the Central Office Bridge Safety Inspection team developed a FHWA-approved Bridge Safety Inspection Refresher Course that was delivered to over 100 participants in October, 2019. The bridge safety inspection team also finalized an RFP to procure a Digital Bridge Inspection and Reporting software solution. This innovative solution will digitize data collection during bridge safety inspections, automatically generate inspection reports, and provide comprehensive workflow and tracking for bridge safety inspection and reporting operations.

4.2.2 Load Rating

Structures are designed and constructed to support theoretical design loads. The design procedures are governed by national standards issued by the American Association of State Highway and Transportation Officials (AASHTO) and other state-specific guidelines.

Once a bridge is constructed and put into service, load rating analyses are performed when significant changes in the condition of the structure are noted during inspections. The findings from the inspection are used to update the bridge model to establish the bridge's current capacity.

This is completed for AASHTO standard design loads, legal loads, and other standard loads that assist in administrating the permitting program. All of VDOT's in-service structures are load rated using nationally adopted AASHTO standards, in compliance with the National Bridge Inspection Program and the 23 metrics used to evaluate the program. Each structure is assigned a safe capacity for the anticipated configurations of trucks that will use the structure.

4.2.3 Permitting

VDOT provides engineering services to the Virginia Department of Motor Vehicles (DMV) on the issuance of "superload" hauling permits (for very heavy vehicles). In reviewing the superload permit applications, VDOT staff convert the vehicle's axle configuration, load, and spacing to an *equivalent operating rating* (EOR) for the AASHTO standard design vehicle. This EOR can be compared to the operating load rating of the structure. The operating rating for the design vehicle is defined as the maximum infrequent load that a structure can sustain between scheduled inspections.

Certain haulers are issued "blanket superload permits", and such blanket permits are provided with a list of structures they cannot cross, corresponding to the EOR of their vehicle. The EORs of the listed structures vary from 36 tons (approximately 200 restricted structures) to 49 tons (approximately 1600 restricted structures). These lists are updated on a quarterly basis to account for any change in the bridge inventory and current condition of the bridges. The 49-ton weight limit corresponds to the maximum safe operating load rating of what is known as the "AASHTO standard vehicle".

Any vehicle with an EOR exceeding 49 tons is denied a superload blanket permit and must apply for a superload single trip permit, which is route-specific. Each route-specific permit requires a more in-depth review of the specific structures the vehicle will cross. The route-specific superload application is a more rigorous process than the blanket superload. When the EOR of the vehicle exceeds the operating rating of a specific structure for a superload single trip permit, the vehicle is given a restriction or denied passage over it.

4.3 CONSTRUCTION

Virginia's highway construction program is divided into major component programs known as "SMART SCALE" and "State of Good Repair". Both programs emphasize transparency and use formulas based on objective data for project selections. At the most general level, SMART SCALE projects are intended to improve congestion, safety, accessibility, land use, economic development, and the environment, while State of Good Repair (SGR) projects are limited to the repair, restoration or replacement of deficient bridges and pavements. The SGR program is now the most significant source of construction funds for poor (SD) structures in Virginia. More details on the program can be found on the SGR main and SGR bridge webpages.

The Commonwealth Transportation Board approved the SGR prioritization and fund distribution processes on May 16, 2018, with the resolution shown in the link below. There are currently 233 structures in the SGR program. The lists of SGR bridges in Virginia's Six-Year Improvement Program (SYIP) are provided in Table E-1 and Table E-2 in Appendix E.

http://www.ctb.virginia.gov/resources/2018/may/reso/Resolution_4_sgr.pdf

4.4 TECHNOLOGY AND INNOVATION (TECHNIQUES & MATERIALS)

Virginia has been widely recognized as a leader in the development and successful implementation of new technologies, techniques and materials for use in new and existing bridges. This history of innovation has been used to make Virginia's bridges more durable, safer, and less expensive to build. There are many elements contributing to this success, but the most prominent are the two factors indicated below:

- **The Virginia Transportation Research Council (VTRC):** This organization works with VDOT's Structure and Bridge Division, the Materials Division and the nine districts to solve problems in the most practical manner. The results are evident in all facets of VDOT's bridge program.
- **Collaboration:** VDOT, FHWA, Virginia's localities, and many of the state's universities work together to perform targeted, solution-driven research. There are nine "Research Advisory Committees" that hold semi-annual meetings, bringing together the users and developers of technology to help keep the research focused and progressing. This cooperation keeps Virginia on the cutting edge of bridge technology.

Virginia's culture of innovation has resulted in significant improvements to its bridge program, as can be seen from the list below, which highlights some of the most notable advances to date, along with the year or decade of full implementation:

- Continuous spans for new bridges starting in the 1970s
- Latex modified concrete deck overlays placed on milled surfaces: starting in the 1970s
- Epoxy deck overlays: starting in the 1970s
- Three coat zinc-based paint: 1982
- Mechanically Stabilized Earth (MSE) walls: 1990
- High Performance Concrete in all bridge elements: 2003
- High Performance weathering steel: 2005
- Corrosion resistant reinforcement: 2009
- Jointless bridge technology for new bridges: 2011
- Virginia abutment used with tooth joints: 2012
- Self-consolidating concrete for drilled shafts: 2013
- Virginia pier used with tooth joints: 2014
- Latex modified concrete overlays over hydromilled surfaces: 2016
- Low-shrinkage, low-cracking concrete in decks: 2016
- Engineered cementitious composites (ECC) for shear keys: 2016
- Virginia Adjacent Member Connection (VAMC) for prestressed concrete voided slabs and box beams: 2016
- Self-consolidating concrete for substructure surface repairs: 2016
- Carbon fiber prestressing strands in prestressed concrete piles: 2017
- Stainless steel prestressing strands in concrete piles: 2017
- Flexible concrete plug joints: 2017
- Engineered cementitious composites (ECC) for culvert liners: 2018*
- Corrosion-resistant structural steel (ASTM A709, Grade 50CR): 2018

- Very High Performance Concrete (VHPC) and Ultra High Performance Concrete (UHPC): 2018*
- MASH-compliant bridge railings and parapets: 2019
- Considerations of climate change and coastal storms: 2020

  ** The year of substantial implementation nearing full implementation*

In the near future, the Structure and Bridge Division will be placing greater emphasis on the materials and actions listed below to further improve the durability of its structures:

- Hydrodemolition for patches and refacing of substructures
- Increased use of joint elimination when repairing and rehabilitating bridges
- Use of materials for large culverts that have shown good past performance
- Lightweight concrete
- Fiber reinforced concrete
- Partial Depth Link Slabs
- Carbon fiber reinforced polymer strands for prestressed concrete beams
- Stainless steel strands for prestressed concrete beams
- Use of higher strength of corrosion resistant reinforcing (CRR) steel
- Underwater concreting
- Nondestructive evaluation (NDE) methods for bridge deck evaluation
- Use of jointless bridges in a wider range of applications

A large portion of the inventory was constructed using older technology and materials and is approaching the last years of anticipated service life. Bridge service lives can be extended through planned preventative maintenance, restorative maintenance, rehabilitation, and the strategic use of better materials. Continued innovation and technological advancement help Virginia to meet this challenge.

APPENDIX A – ADDITIONAL INVENTORY INFORMATION

This appendix provides additional inventory information on structures in Virginia:

- Table A-1 through Table A-8 and Figure A-1 through Figure A-3 provide counts of various structure categories and average ages of bridges and large culverts by district and highway system
- Table A-1 and Table A-2 provide the number of structures
- Table A-3 and Table A-4 provide the number of NBI structures
- Table A-5 and Table A-6 provide the number of Non-NBI structures
- Table A-7 and Table A-8 provide the number of NBI structures on the NHS
- Figure A-1 through Figure A-3 show the average age of structures by system and district

The following are brief definitions of some of the common terms used in describing the structures in this report.

- ***Bridge***: Any structure with a clear span opening over an obstacle that is not defined as a culvert. Bridges typically have deck, superstructure, and substructure components, although some bridge structures integrate the deck and superstructure components as in the case of slab/box beams, T-beams, and rigid frames.
- ***Culvert***: Any structure that has an integral floor system that supports the sidewalls and provides a lined channel. Culverts are usually buried concrete or metal pipes or box shapes. For a culvert, there is no distinction between substructure and superstructure and typically there is no deck. Multiple box or pipe culverts are considered a single structure whenever the clear distance between openings is less than half of the smaller adjacent opening. Otherwise, each opening is considered a separate structure.
- ***NBI***: Abbreviation for “National Bridge Inventory.” When a structure is referred to as an NBI structure it meets the federal definition of a bridge as defined in the NBIS. Generally, NBI structures are bridges with spans greater than 20 feet and culverts that are greater than 20 feet (when measured along the roadway).
- ***Non-NBI***: A bridge or culvert in the inventory of VDOT’s Structure and Bridge Division that does not meet the NBI definition above. Structures in this category include large culverts and bridges with spans that are 20 feet or less. All non-NBI culverts have a hydraulic opening equal to or greater than 36 square feet.
- ***Large Culvert***: A culvert that either meets the definition of a Non-NBI structure or a culvert that meets the definition of an NBI structure as defined in the NBIS.

Table A-1- Total Number of Bridges by District

District	Number of Bridges			
	Interstate	Primary	Secondary & Urban	Total
1 Bristol	136	551	1,741	2,428
2 Salem	111	492	1,416	2,019
3 Lynchburg	0	366	841	1,207
4 Richmond	281	491	778	1,550
5 Hampton Roads	342	350	529	1,221
6 Fredericksburg	23	143	235	401
7 Culpeper	70	261	692	1,023
8 Staunton	206	504	1,416	2,126
9 NOVA	266	348	587	1,201
Statewide	**1,435**	**3,506**	**8,235**	**13,176**

Table A-2- Total Number of Large Culverts by District

District	Number of Large Culverts			
	Interstate	Primary	Secondary & Urban	Total
1 Bristol	80	403	481	964
2 Salem	98	337	625	1,060
3 Lynchburg	0	294	572	866
4 Richmond	239	293	524	1,056
5 Hampton Roads	119	115	278	512
6 Fredericksburg	57	111	261	429
7 Culpeper	50	234	401	685
8 Staunton	225	320	820	1,365
9 NOVA	121	210	751	1,082
Statewide	**989**	**2,317**	**4,713**	**8,019**

Table A-3- Total Number of NBI Bridges by District

District	Number of Bridges			
	Interstate	Primary	Secondary & Urban	Total
1 Bristol	136	424	1,174	1,734
2 Salem	111	377	975	1,463
3 Lynchburg	0	324	691	1,015
4 Richmond	278	460	718	1,456
5 Hampton Roads	341	342	500	1,183
6 Fredericksburg	23	135	213	371
7 Culpeper	70	172	532	774
8 Staunton	206	370	873	1,449
9 NOVA	266	312	480	1,058
Statewide	**1,431**	**2,916**	**6,156**	**10,503**

Table A-4- Total Number of NBI Large Culverts by District

District	Number of Large Culverts			
	Interstate	Primary	Secondary & Urban	Total
1 Bristol	28	101	146	275
2 Salem	27	84	264	375
3 Lynchburg	0	85	235	320
4 Richmond	86	120	311	517
5 Hampton Roads	39	39	171	249
6 Fredericksburg	22	42	114	178
7 Culpeper	14	73	183	270
8 Staunton	47	83	286	416
9 NOVA	29	100	380	509
Statewide	**292**	**727**	**2,090**	**3,109**

Table A-5- Total Number of Non-NBI Bridges by District

District	Number of Bridges			
	Interstate	Primary	Secondary & Urban	Total
1 Bristol	0	127	567	694
2 Salem	0	115	441	556
3 Lynchburg	0	42	150	192
4 Richmond	3	31	60	94
5 Hampton Roads	1	8	29	38
6 Fredericksburg	0	8	22	30
7 Culpeper	0	89	160	249
8 Staunton	0	134	543	677
9 NOVA	0	36	107	143
Statewide	**4**	**590**	**2,079**	**2,673**

Table A-6- Total Number of Non-NBI Large Culverts by District

District	Number of Large Culverts			
	Interstate	Primary	Secondary & Urban	Total
1 Bristol	52	302	335	689
2 Salem	71	253	361	685
3 Lynchburg	0	209	337	546
4 Richmond	153	173	213	539
5 Hampton Roads	80	76	107	263
6 Fredericksburg	35	69	147	251
7 Culpeper	36	161	218	415
8 Staunton	178	237	534	949
9 NOVA	92	110	371	573
Statewide	**697**	**1,590**	**2,623**	**4,910**

Table A-7- Total Number of NBI Bridges on NHS by District

District	Number of Bridges			
	Interstate	Primary	Secondary & Urban	Total
1 Bristol	135	135	1	271
2 Salem	111	197	4	312
3 Lynchburg	0	172	1	173
4 Richmond	276	283	20	579
5 Hampton Roads	339	211	76	626
6 Fredericksburg	23	85	6	114
7 Culpeper	70	57	2	129
8 Staunton	204	131	1	336
9 NOVA	263	259	28	550
Statewide	**1,421**	**1,530**	**139**	**3,090**

Table A-8- Total Number of NBI Large Culverts on NHS by District

District	Number of Large Culverts			
	Interstate	Primary	Secondary & Urban	Total
1 Bristol	28	38	0	66
2 Salem	26	36	0	62
3 Lynchburg	0	45	0	45
4 Richmond	86	80	4	170
5 Hampton Roads	36	26	6	68
6 Fredericksburg	22	27	1	50
7 Culpeper	13	38	2	53
8 Staunton	46	22	1	69
9 NOVA	29	71	3	103
Statewide	**286**	**383**	**17**	**686**

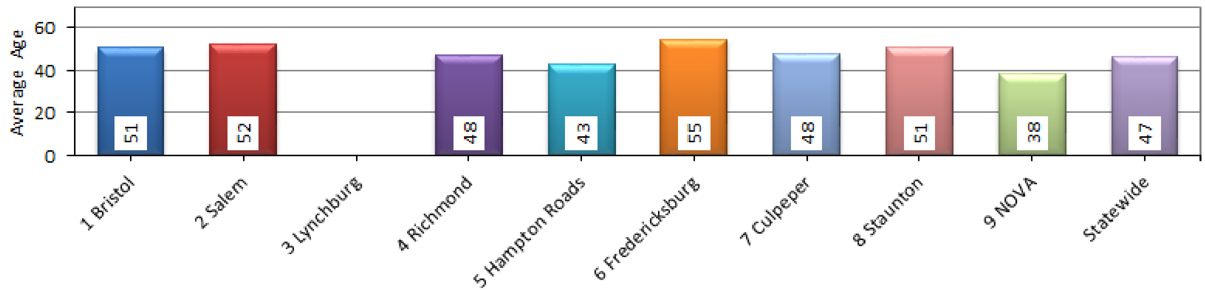


Figure A-1- Average Age of Interstate Structures by District

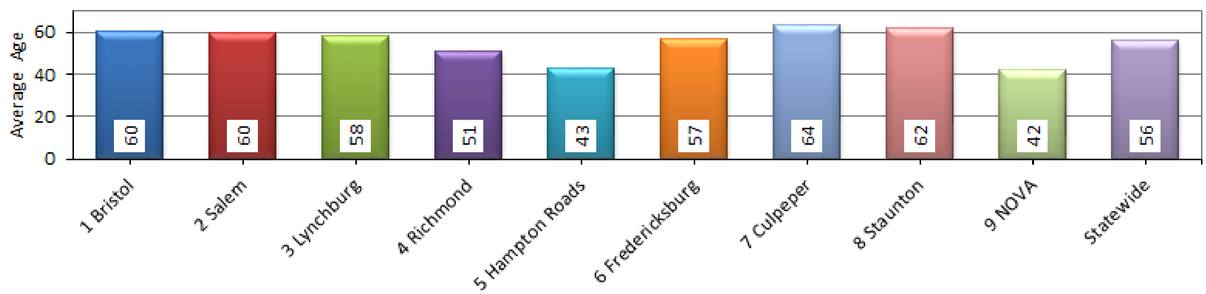


Figure A-2- Average Age of Primary Structures by District

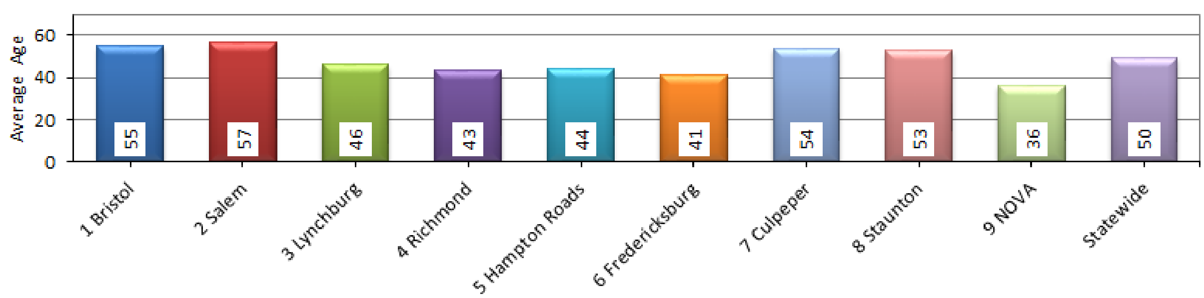


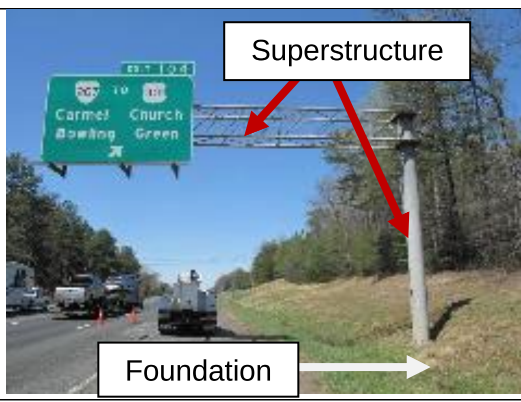
Figure A-3 - Average Age of Secondary and Urban Structures by District

APPENDIX B – ADDITIONAL INVENTORY INFORMATION ON ANCILLARY STRUCTURES

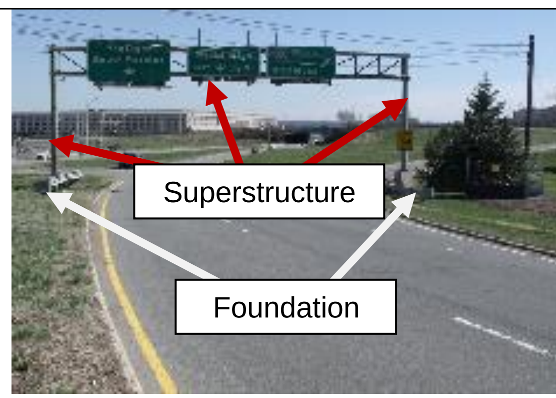
Table B-1 through Table B-4 provide information for the subcategories of each type of ancillary structure. Typical examples of each type of ancillary structure are also shown.

Table B-1- Number of Sign Structures by District

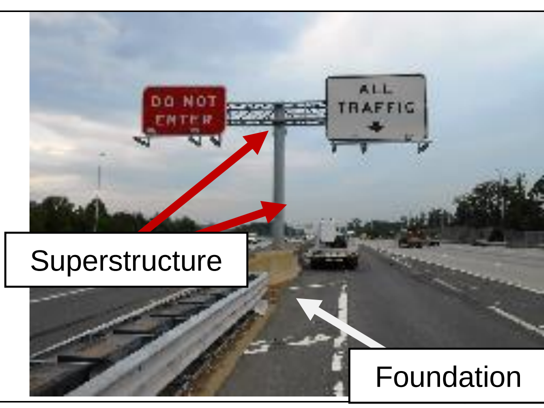
District	Structure Type					Percentage of Total Inventory
	Cantilever	Overhead	Parapet Mount	Butterfly	Total	
1 Bristol	25	37	-	10	72	1.9%
2 Salem	97	87	-	94	278	7.4%
3 Lynchburg	8	59	-	5	72	1.9%
4 Richmond	381	338	112	1	832	22.2%
5 Hampton Roads	369	434	76	66	945	25.2%
6 Fredericksburg	70	29	-	2	101	2.7%
7 Culpeper	9	21	10	5	45	1.2%
8 Staunton	18	42	14	15	89	2.4%
9 Northern Virginia	644	587	9	79	1,319	35.1%
Total	1,621	1,634	221	277	3,753	100.0%



Cantilever Sign Structure



Overhead Sign Structure



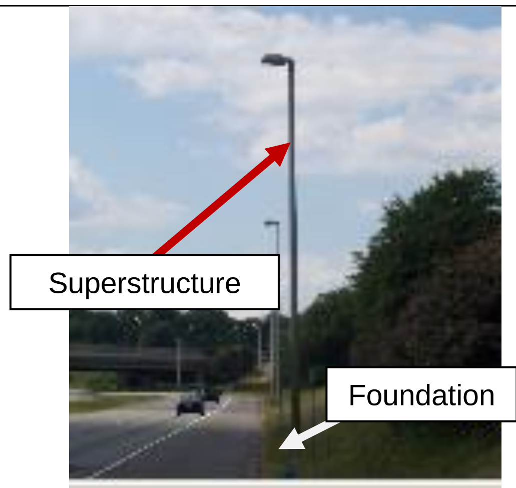
Butterfly Sign Structure

Parapet Mount Sign Structure

(Note that "Parapet-Mount' sign structures may either be attached to bridge girders or bridge parapets)

Table B-2- Number of Luminaire Structures by District

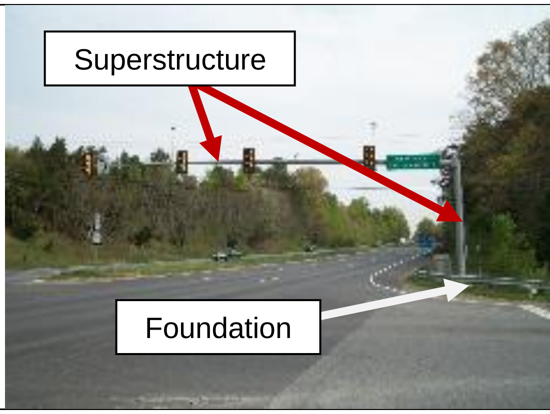
District	Structure Type Luminaire	Percentage of Total Inventory
1 Bristol	463	2.2%
2 Salem	994	4.8%
3 Lynchburg	302	1.5%
4 Richmond	2,288	11.1%
5 Hampton Roads	6,808	33.0%
6 Fredericksburg	717	3.5%
7 Culpeper	158	0.8%
8 Staunton	282	1.4%
9 Northern Virginia	8,639	41.8%
Total	20,651	100.0%



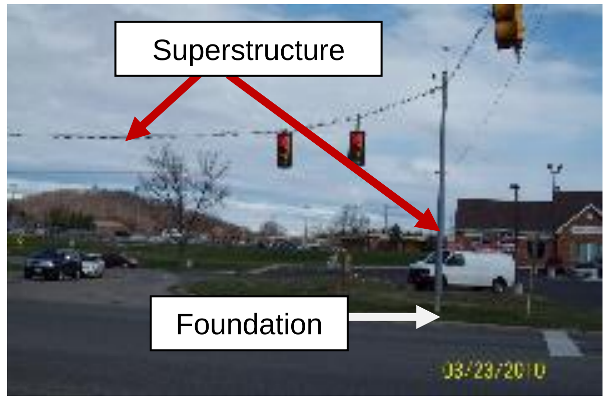
Luminaire Structure

Table B-3- Number of Traffic Signal Structures by District

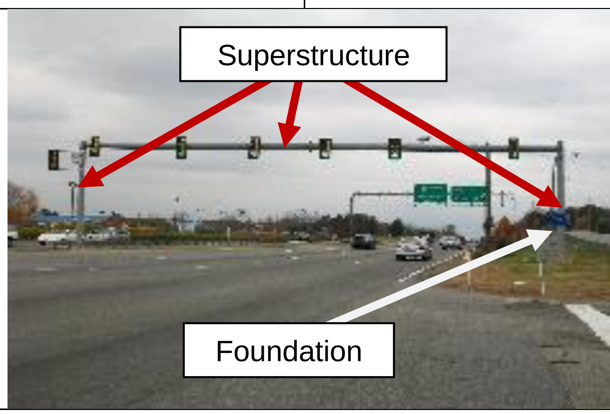
District	Structure Type				Percentage of Total Inventory
	Overhead Span	Mast Arm	Span Wire	Total	
1 Bristol	-	231	16	247	2.6%
2 Salem	-	532	14	546	5.7%
3 Lynchburg	-	290	2	292	3.0%
4 Richmond	-	1,375	232	1,607	16.6%
5 Hampton Roads	-	466	37	503	5.2%
6 Fredericksburg	1	802	8	811	8.4%
7 Culpeper	-	357	8	365	3.8%
8 Staunton	-	523	27	550	5.7%
9 Northern Virginia	3	4,027	710	4,740	49.1%
Total	4	8,603	1,054	9,661	100.0%



Cantilevered Mast Arm Traffic Signal Structure



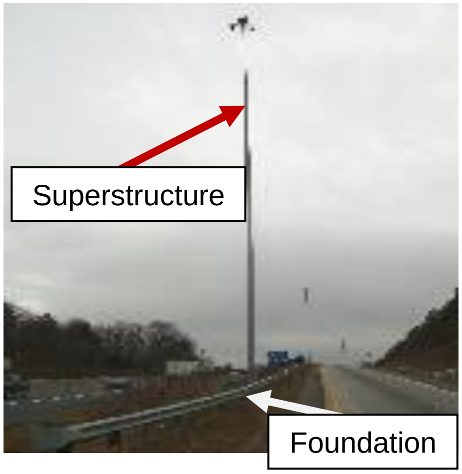
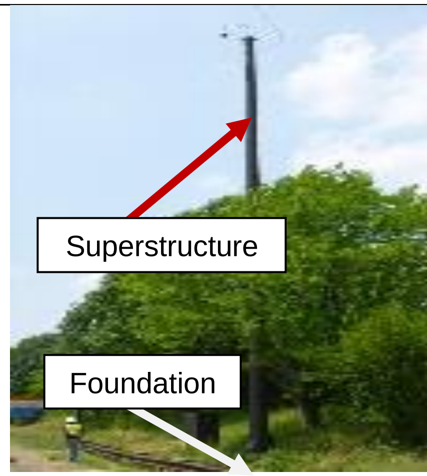
Span Wire Traffic Signal Structure



Overhead Span Traffic Signal Structure

Table B-4- Number of High Mast Light and Camera Pole Structures by District

District	Structure Type			Percentage of Total Inventory
	High Mast Light	Camera Poles	Total	
1 Bristol	76	1	77	5.2%
2 Salem	13	3	16	1.1%
3 Lynchburg	-	-	-	0.0%
4 Richmond	80	54	134	9.1%
5 Hampton Roads	146	285	431	29.3%
6 Fredericksburg	1	59	60	4.1%
7 Culpeper	-	10	10	0.7%
8 Staunton	21	66	87	5.9%
9 Northern Virginia	328	326	654	44.5%
Total	665	804	1,469	100.0%

	
High Mast Light Structure	**Camera Pole Structure**

APPENDIX C – ADDITIONAL INVENTORY AND CONDITION INFORMATION FOR STRUCTURES

In Table C-1 the "Bridge Min GCR" is the minimum GCR among the three major components that define a bridge (deck, superstructure, and substructure). The "Min GCR" is based on all four of the major components and thus includes the large culvert component.

Table C-1- Number of Structure Components in Each General Condition Rating by System

Highway System	Component	GCR								Avg. GCR
		9	8	7	6	5	4	3	0 - 2	
Interstate	Deck	3	38	524	663	197	10	0	0	6.27
	Superstructure	4	68	381	562	406	14	0	0	6.07
	Substructure	2	35	333	632	429	4	0	0	5.98
	Bridge Min GCR	2	21	225	566	603	18	0	0	5.74
	Large Culvert	1	10	203	627	147	1	0	0	6.08
	Min GCR	3	31	428	1,193	750	19	0	0	5.88
Primary	Deck	18	126	1,301	1,298	695	58	3	0	6.22
	Superstructure	23	317	1,081	1,161	818	102	3	1	6.21
	Substructure	13	121	1,199	1,399	720	54	0	0	6.19
	Bridge Min GCR	10	59	799	1,352	1,136	146	3	1	5.86
	Large Culvert	4	64	657	1,211	360	20	1	0	6.17
	Min GCR	14	123	1,456	2,563	1,496	166	4	1	5.98
Secondary & Urban	Deck	181	1,320	3,416	2,164	1,009	109	4	3	6.65
	Superstructure	178	1,554	2,739	1,957	1,476	309	15	6	6.51
	Substructure	42	614	2,973	3,004	1,442	157	2	1	6.31
	Bridge Min GCR	33	382	2,339	2,819	2,230	410	16	6	6.01
	Large Culvert	65	534	1,829	1,551	613	118	3	0	6.47
	Min GCR	98	916	4,168	4,370	2,843	528	19	6	6.18
All	Deck	202	1,484	5,241	4,125	1,901	177	7	3	6.50
	Superstructure	205	1,939	4,201	3,680	2,700	425	18	7	6.38
	Substructure	57	770	4,505	5,035	2,591	215	2	1	6.24
	Bridge Min GCR	45	462	3,363	4,737	3,969	574	19	7	5.94
	Large Culvert	70	608	2,689	3,389	1,120	139	4	0	6.34
	Min GCR	115	1,070	6,052	8,126	5,089	713	23	7	6.09

** A small number of bridges have particular configurations so that they don't have all the major components. Accordingly, there is a small difference in the total number of deck, superstructure, and substructure components.*

APPENDIX D – GENERAL CONDITION RATINGS (BRIDGES AND LARGE CULVERTS)

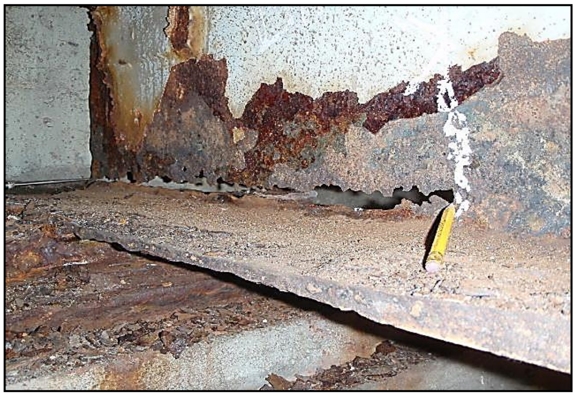
General Condition Ratings (GCRs): In accordance with the requirements of the National Bridge Inventory (NBI), General Condition Ratings are assigned by the structure inspection team after each bridge inspection. These ratings are included in each inspection report to describe the current physical state of the bridge or large culvert. Evaluation is based on the physical condition of the structure at the time of inspection. Separate GCR values are assigned to the deck, superstructure, and substructure components of a bridge. A large culvert receives a single GCR. The GCRs are assigned based on a numerical grading system that ranges from 0 (failed condition) to 9 (excellent condition). The table below describes the general condition ratings. The figures in the following pages provide illustrative examples of these ratings.

0	1	2	3	4	5	6	7	8	9
Failed	Imminent Failure	Critical	Serious	Poor	Fair	Satisfactory	Good	Very Good	Excellent
POOR (SD)					FAIR		GOOD		

A structure is defined as poor (SD) if one or more of its major components (deck, superstructure, substructure, or large culvert) has a General Condition Rating (GCR) less than or equal to four (4).

Code	Description
N	**NOT APPLICABLE**
9	**EXCELLENT CONDITION**
8	**VERY GOOD CONDITION**: No problems noted.
7	**GOOD CONDITION**: Some minor problems.
6	**SATISFACTORY CONDITION**: Structural components show some minor deterioration.
5	**FAIR CONDITION**: All primary structural elements are sound but may have some minor section loss, cracking, spalling or scour
4	**POOR CONDITION**: Advanced section loss, deterioration, spalling or scour.
3	**SERIOUS CONDITION**: Loss of section, deterioration, spalling or scour have seriously affected primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.
2	**CRITICAL CONDITION**: Advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored it may be necessary to close the bridge until corrective action is taken.
1	**"IMMINENT" FAILURE CONDITION**: Major deterioration or section loss present in critical structural components or obvious vertical or horizontal movement affecting structure stability. Bridge is closed to traffic but corrective action may put back in light service.
0	**FAILED CONDITION**: Out of service - beyond corrective action.

Typical Examples of General Condition Ratings for Deck	
GCR	Example
4 or less – Poor Condition	 Bridge Deck with advanced deterioration
5 – Fair Condition (At Risk of Becoming Poor Condition)	 Bridge Deck with cracking and some patching
6 – Satisfactory Condition	 Bridge Deck with minor to no deterioration

Typical Examples of General Condition Ratings for Superstructure		
GCR	Example Steel	 Concrete
4 or less - Poor Condition	 Bridge Superstructure with advanced section loss	 Concrete Beam with major spalling (bottom of beam viewed from below)
5 – Fair Condition (At Risk of Becoming Poor Condition)	 Bridge Superstructure with minor to moderate section loss	 Spall on end of beam with exposed reinforcing with minor section loss
6 – Satisfactory Condition	 Rust scale and minor section loss	 Concrete Beam with localized spalling

Typical Examples of General Condition Ratings for Substructure

GCR	Example
4 or less – Poor Condition	 Bridge Substructure with advanced deterioration
5 – Fair Condition (At Risk of Becoming Poor Condition)	 Bridge Substructure with moderate cracks and deterioration
6 – Satisfactory Condition	 Bridge Substructure with minor cracks

Typical Examples of General Condition Ratings for Large Culverts

GCR	Example Steel	Concrete
4 or less - Poor Condition	 Culvert with advanced section loss	 Portion of center wall of box culvert missing
5 – Fair Condition (At Risk of Becoming Poor Condition)	 Culvert panels separated	 Culvert moderate deterioration
6 – Satisfactory Condition	 Light rust along flow line	 Culvert with minor cracks

APPENDIX E – STATE OF GOOD REPAIR STRUCTURES IN VIRGINIA'S APPROVED SIX YEAR IMPROVEMENT PLAN

The Virginia General Assembly authorized the State of Good Repair (SGR) program during the 2015 session. The program was later incorporated into the Code of Virginia, authorizing the Commonwealth Transportation Board to use funds for reconstruction and replacement of Poor (SD) state and locality-owned structures. Structures include bridges and large culverts. The SGR program is intended to fund structure work that provides long-term solutions exceeding routine maintenance, but should not be viewed solely as a structure replacement program. In general, project scopes are established to rehabilitate, reconstruct, or replace deficient elements in the most practical and cost-effective manner while including measures to mitigate future deterioration. More details on the program can be found on the SGR main and SGR bridge webpages.

Table E-1 and Table E-2 provide lists of all the structures currently in the SGR program as of June 18, 2020. SYIP refers to the Commonwealth's official Six Year Improvement Program.

Table E-1- SGR Structures in Virginia's Approved SYIP: VDOT- Owned Structures

FED ID	Route	Featured Intersection	Virginia System	District	SGR Selection Year	SGR Total Allocation	Total Project Allocations
8727	58	Peggy Branch	Primary	Bristol	FY17	$ 3,318,960	$ 4,501,472
19308	893	Little Toms Crk	Secondary	Bristol	FY17	$ 470,429	$ 470,429
10697	23	NSRR	Primary	Bristol	FY17	$ 2,205,519	$ 3,865,120
19597	81	Reed Creek in Wythe Co	Interstate	Bristol	FY17	$ 11,750,000	$ 12,618,417
19596	81	Reed Creek in Wythe Co	Interstate	Bristol	FY17	$ 11,750,000	$ 12,618,417
16511	664	Rte 63	Secondary	Bristol	FY17	$ 1,300,000	$ 4,495,000
17470	81	Rte 686 (Mulberry Lane)	Interstate	Bristol	FY17	$ 7,100,000	$ 7,632,379
17472	81	Rte 686 (Mulberry Lane)	Interstate	Bristol	FY17	$ 7,100,000	$ 7,632,379
18461	19	NSRR & Wrights Valley Creek	Primary	Bristol	FY17	$ 2,800,000	$ 4,816,416
16840	682	Copper Creek	Secondary	Bristol	FY17	$ 1,154,737	$ 1,154,737
17648	658	S Fork Holston River	Secondary	Bristol	FY17	$ 1,016,115	$ 1,180,000
19566	77	COVE CREEK	Interstate	Bristol	FY18	$ 7,900,000	$ 7,900,000
17478	81	Rt 11, NSRR, M.F. Holston River	Interstate	Bristol	FY18	$ 12,499,999	$ 16,239,695
19565	77	COVE CREEK	Interstate	Bristol	FY19	$ 9,100,000	$ 9,100,000
18469	61	COVE CREEK	Primary	Bristol	FY19	$ 750,000	$ 750,000
5792	63	RUSSELL FORK RIVER	Primary	Bristol	FY19	$ 3,828,000	$ 6,120,016
22453	58	GUEST RV & NS RAILWAY	Primary	Bristol	FY19	$ 2,840,000	$ 2,840,000
4713	703	Little Reed Island Creek	Secondary	Salem	FY17	$ 1,062,642	$ 2,034,177
2718	634	Roanoke River	Secondary	Salem	FY17	$ 7,138,904	$ 12,982,098
22513	81	Route 8	Interstate	Salem	FY17	$ 22,137,195	$ 24,490,216
22515	81	Route 8	Interstate	Salem	FY17	$ 8,631,005	$ 9,524,185
2594	43	Big Otter River	Primary	Salem	FY17	$ 2,813,466	$ 4,148,187
12363	813	Roanoke River @ Kumis	Secondary	Salem	FY17	$ 4,944,758	$ 4,952,596
2780	666	NS Railway	Secondary	Salem	FY17	$ 3,482,633	$ 4,038,255
13191	8	Mayo River	Primary	Salem	FY18	$ 3,756,340	$ 3,756,340
4544	58	Crooked Creek	Primary	Salem	FY18	$ 3,943,914	$ 4,583,205

FED ID	Route	Featured Intersection	Virginia System	District	SGR Selection Year	SGR Total Allocation	Total Project Allocations
2843	715	NS Railway	Secondary	Salem	FY18	$ 2,376,197	$ 3,085,019
10063	220	Reed Creek	Primary	Salem	FY18	$ 5,885,000	$ 6,350,000
15105	760	ROANOKE RIVER	Secondary	Salem	FY18	$ 2,280,939	$ 2,280,939
12118	11	N&W RAILWAY	Primary	Salem	FY18	$ 2,625,000	$ 2,625,000
7757	40	Tharp Creek	Primary	Salem	FY18	$ 1,240,199	$ 1,240,199
2708	622	NS Railway	Secondary	Salem	FY19	$ 1,830,127	$ 4,664,000
5471	311	MEADOW CREEK	Primary	Salem	FY19	$ 3,150,000	$ 3,150,000
13221	58	Dan River	Primary	Salem	FY19	$ 6,550,000	$ 6,550,000
4328	711	NS Railway	Secondary	Lynchburg	FY17	$ 3,219,191	$ 3,820,045
1551	778	Buffalo River	Secondary	Lynchburg	FY17	$ 1,860,269	$ 2,571,026
1524	681	Williams Run	Secondary	Lynchburg	FY17	$ 1,492,258	$ 1,492,258
4159	29	Staunton River & NS Railway	Primary	Lynchburg	FY17	$ 10,766,201	$ 25,198,388
4220	622	Flat Creek	Secondary	Lynchburg	FY18	$ 736,867	$ 11,029,052
20579	29	NS Railway	Primary	Lynchburg	FY18	$ 7,019,105	$ 7,019,105
4851	92	Staunton River	Primary	Lynchburg	FY18	$ 13,796,497	$ 25,224,963
5741	621	Appomattox River	Secondary	Lynchburg	FY18	$ 3,194,285	$ 3,277,443
12538	653	NS Railway	Secondary	Lynchburg	FY19	$ 4,504,276	$ 4,504,276
11603	621	MEHERRIN RIVER	Secondary	Richmond	FY17	$ 1,367,714	$ 2,047,012
21552	195	RTE 76, CSX, RAMP S	Interstate	Richmond	FY17	$ 15,291,000	$ 15,291,000
3678	630	WAQUA CREEK	Secondary	Richmond	FY17	$ 1,252,778	$ 1,252,778
5238	604	TOMAHAWK CREEK	Secondary	Richmond	FY17	$ 2,102,047	$ 3,153,599
1224	360	NS RAILWAY & RTE 360 BUS	Primary	Richmond	FY17	$ 4,384,600	$ 4,384,600
11943	92	BUTCHERS CREEK	Primary	Richmond	FY17	$ 2,000,000	$ 2,000,000
1226	360	NS RAILWAY & RTE 360BUS	Primary	Richmond	FY18	$ 6,165,986	$ 6,165,986
6104	703	CSX TRANSP RIGHT OF WAY	Secondary	Richmond	FY18	$ 2,500,000	$ 2,500,000
3572	46	U.S. 58 BYPASS	Primary	Richmond	FY18	$ 1,796,971	$ 1,952,759
9378	30	NORTH ANNA RIVER	Primary	Richmond	FY18	$ 3,000,000	$ 3,000,000
9412	156	RTE 360	Primary	Richmond	FY18	$ 2,000,000	$ 2,000,000
9612	7667	ROUTE 0064	Secondary	Richmond	FY18	$ 4,000,000	$ 4,500,000
9875	157	I-64 & RAMPS GASKIN RD	Primary	Richmond	FY18	$ 4,000,000	$ 4,000,000
21287	64	ROUTE I-95	Interstate	Richmond	FY18	$ 6,111,770	$ 6,111,770
9536	657	RTE I 95	Secondary	Richmond	FY18	$ 6,000,000	$ 6,000,000
12826	460	U.S. 460 (BYPASS)	Primary	Richmond	FY18	$ 3,993,541	$ 3,993,541
5280	641	CSX TRNS & USDGSC SERVIC	Secondary	Richmond	FY18	$ 3,500,000	$ 6,000,000
21282	0	ROUTE I-95 (I-64)	Urban	Richmond	FY18	$ 9,036,957	$ 9,436,957
5058	95	RTE 608 (REYMET RD)	Interstate	Richmond	FY18	$ 9,602,319	$ 9,602,319
21441	64	ROUTE 95	Interstate	Richmond	FY18	$ 4,650,000	$ 4,650,000
21087	0	INTERSTATE-85	Urban	Richmond	FY19	$ 4,000,000	$ 4,000,000
3562	1	CSX TRANSP RIGHT OF WAY	Primary	Richmond	FY19	$ 2,940,000	$ 2,940,000
21284	0	ROUTE I-95	Urban	Richmond	FY19	$ 6,325,000	$ 6,325,000
12630	33	RTE I 64 @ BOTTOMS BRIDG	Primary	Richmond	FY19	$ 9,100,000	$ 9,500,000
21137	95	RTES 301 & EB 460	Interstate	Richmond	FY19	$ 7,035,614	$ 7,035,614
21569	250	I-95	Primary	Richmond	FY19	$ 9,500,000	$ 9,500,000

FED ID	Route	Featured Intersection	Virginia System	District	SGR Selection Year	SGR Total Allocation	Total Project Allocations
9880	195	RTE 197 & CSX TRANSP. RR	Interstate	Richmond	FY19	$ 5,800,000	$ 6,000,000
20727	173	I-64 & CSX RR	Primary	Hampton Roads	FY17	$ 1,240,020	$ 34,726,582
17813	635	N&W RAILWAY	Secondary	Hampton Roads	FY17	$ 2,973,472	$ 4,433,043
17755	189	BLACKWATER RIVER	Primary	Hampton Roads	FY17	$ 18,132,564	$ 19,477,671
399	1306	WEST RIDGE CK @TANGIER	Secondary	Hampton Roads	FY17	$ 1,670,982	$ 2,524,662
398	1304	WEST RIDGE CK @TANGIER	Secondary	Hampton Roads	FY17	$ 800,466	$ 2,197,543
18304	603	Blackwater River	Secondary	Hampton Roads	FY17	$ 2,576,164	$ 2,576,164
17757	308	Three Creek	Secondary	Hampton Roads	FY17	$ 3,266,662	$ 3,710,573
17865	671	Nottoway River	Secondary	Hampton Roads	FY18	$ 7,000,000	$ 7,297,305
22615	10	Cypress Ck	Primary	Hampton Roads	FY18	$ 1,600,000	$ 5,000,000
10445	692	Champion Swamp	Secondary	Hampton Roads	FY18	$ 1,250,000	$ 2,073,594
18185	40	Otterdam Swamp	Primary	Hampton Roads	FY18	$ 1,715,151	$ 5,057,211
10417	638	Burnt Mill Swamp	Secondary	Hampton Roads	FY19	$ 1,559,104	$ 1,559,104
10442	690	Ennis Pond	Secondary	Hampton Roads	FY19	$ 2,700,000	$ 2,700,000
24320	707	Pitts Creek	Secondary	Hampton Roads	FY19	$ 3,395,999	$ 3,395,999
10441	683	Stallings Creek	Secondary	Hampton Roads	FY19	$ 3,800,000	$ 3,800,000
10424	644	Pope Swamp	Secondary	Hampton Roads	FY19	$ 4,200,000	$ 4,200,000
356	178	Occohannock Creek	Primary	Hampton Roads	FY19	$ 5,220,396	$ 5,220,396
17901	743	Tarrara Creek	Secondary	Hampton Roads	FY19	$ 3,250,000	$ 3,250,000
20353	64	Hampton Roads	Interstate	Hampton Roads	FY20	$ 52,974,733	$ 74,207,043
18034	658	NORTH ANNA RIVER	Secondary	Fredericksburg	FY17	$ 2,101,556	$ 2,834,580
8552	662	FOX CREEK	Secondary	Fredericksburg	FY17	$ 1,730,433	$ 2,440,433
17984	606	ROUTE I-95	Secondary	Fredericksburg	FY17	$ 4,424,138	$ 11,889,993
18073	3	RAPPAHANNOCK RIVER @	Primary	Fredericksburg	FY17	$ 18,623,759	$ 20,819,472
6153	620	PISCATAWAY CREEK	Secondary	Fredericksburg	FY17	$ 1,600,000	$ 1,600,000
10588	14	PORPOTANK CREEK	Primary	Fredericksburg	FY17	$ 2,250,000	$ 3,452,000
8548	216	NORTHWEST BR SARAH CREEK	Secondary	Fredericksburg	FY17	$ 500,000	$ 500,000
10645	360	MONCUIN CREEK	Primary	Fredericksburg	FY17	$ 500,000	$ 500,000
14782	360	RAPPAHANNOCK R RTE-1013@	Primary	Fredericksburg	FY17	$ 500,000	$ 500,000
12086	17	DRAGON RUN	Primary	Fredericksburg	FY17	$ 4,128,836	$ 4,128,836
4398	207	MATTAPONI RIVER	Primary	Fredericksburg	FY17	$ 7,474,802	$ 7,474,802
10674	632	HARRISONS CREEK	Secondary	Fredericksburg	FY17	$ 1,750,000	$ 1,761,319
18057	1	CHOPAWAMSIC CREEK	Primary	Fredericksburg	FY17	$ 5,750,000	$ 7,750,000
18083	95	Rte. 17	Primary	Fredericksburg	FY18	$ 6,666,815	$ 6,666,815
18085	95	Rte. 17	Primary	Fredericksburg	FY18	$ 6,666,815	$ 6,666,815
10610	617	EXOL SWAMP	Secondary	Fredericksburg	FY18	$ 1,987,372	$ 1,987,372
11835	3	NORTH END BRANCH	Primary	Fredericksburg	FY18	$ 2,558,165	$ 3,245,000
6145	607	DRAGON RUN	Secondary	Fredericksburg	FY19	$ 3,000,000	$ 3,000,000
18157	644	AQUIA CREEK	Secondary	Fredericksburg	FY19	$ 4,400,000	$ 5,100,000
4471	638	SOUTH RIVER	Secondary	Fredericksburg	FY19	$ 3,450,000	$ 4,100,000
4485	652	BRANCH OF STEVENS MILL	Secondary	Fredericksburg	FY19	$ 2,500,000	$ 2,500,000
18067	3	CSX RAILROAD	Primary	Fredericksburg	FY19	$ 2,000,000	$ 2,000,000
18053	1	POTOMAC RUN	Primary	Fredericksburg	FY19	$ 5,856,870	$ 6,961,673

FED ID	Route	Featured Intersection	Virginia System	District	SGR Selection Year	SGR Total Allocation	Total Project Allocations
11834	3	BURKE MILL STREAM	Primary	Fredericksburg	FY19	$ 4,500,000	$ 5,520,000
4505	743	SOUTH RIVER	Secondary	Fredericksburg	FY19	$ 1,727,586	$ 1,860,460
857	795	HARDWARE RIVER	Secondary	Culpeper	FY17	$ 1,055,548	$ 1,055,548
808	717	SOUTH FORK HARDWARE RVR	Secondary	Culpeper	FY17	$ 639,089	$ 779,089
11553	701	Little River	Secondary	Culpeper	FY17	$ 2,215,000	$ 2,215,000
724	667	PINEY CREEK	Secondary	Culpeper	FY17	$ 1,723,500	$ 1,923,500
814	726	TOTIER CREEK	Secondary	Culpeper	FY17	$ 2,300,755	$ 2,300,755
709	641	MARSH RUN	Secondary	Culpeper	FY17	$ 700,000	$ 1,600,000
589	240	LICKINGHOLE CREEK	Primary	Culpeper	FY17	$ 1,900,000	$ 2,210,000
792	708	NORTH FORK HARDWARE RVR	Secondary	Culpeper	FY17	$ 5,100,000	$ 5,100,000
11515	647	South Anna River	Secondary	Culpeper	FY18	$ 1,200,000	$ 1,750,000
638	601	ROUTE 29 & 250 BYPASS	Secondary	Culpeper	FY18	$ 1,858,026	$ 3,038,026
7324	647	East Branch Thumb Run	Secondary	Culpeper	FY18	$ 1,970,000	$ 2,600,000
11828	707	Hughes River	Secondary	Culpeper	FY19	$ 4,700,000	$ 4,700,000
9007	638	South River	Secondary	Culpeper	FY19	$ 3,280,000	$ 3,280,000
16026	682	PLEASANT RUN	Secondary	Staunton	FY17	$ 3,546,210	$ 5,447,424
8299	723	Opequon Creek	Secondary	Staunton	FY17	$ 1,325,731	$ 2,143,587
2176	703	EDISON CREEK	Secondary	Staunton	FY17	$ 1,981,095	$ 2,700,000
15753	11	I-81	Primary	Staunton	FY17	$ 8,777,796	$ 16,378,399
20408	720	I-81	Secondary	Staunton	FY17	$ 2,245,388	$ 10,220,470
17236	698	MILL CREEK	Secondary	Staunton	FY17	$ 658,216	$ 2,266,012
1858	250	Bell Creek	Primary	Staunton	FY17	$ 3,295,695	$ 5,117,279
20446	33	NSRR	Primary	Staunton	FY17	$ 8,111,903	$ 9,579,551
20447	33	NSRR	Primary	Staunton	FY18	$ 8,352,944	$ 9,820,592
20443	33	I-81	Primary	Staunton	FY18	$ 11,278,670	$ 12,900,164
15862	259	LINVILLE CK @ BROADWAY	Primary	Staunton	FY19	$ 6,641,121	$ 6,641,121
1195	696	KARNES CREEK	Secondary	Staunton	FY19	$ 2,638,208	$ 4,420,914
20441	33	I-81	Primary	Staunton	FY19	$ 9,280,525	$ 9,280,525
16958	11	NF Shen River	Primary	Staunton	FY19	$ 6,529,192	$ 7,872,809
8055	17	I-81	Primary	Staunton	FY19	$ 25,420,595	$ 31,328,926
11253	673	Catoctin Creek	Secondary	NoVa	FY17	$ 4,500,000	$ 4,500,000
19934	236	I-395	Primary	NoVa	FY17	$ 11,844,889	$ 15,735,787
6829	674	Colvin Run	Secondary	NoVa	FY17	$ 2,273,488	$ 3,899,999
174	66	RMPS B & F	Interstate	NoVa	FY17	$ 5,249,491	$ 5,249,491
19944	395	I-395	Urban	NoVa	FY18	$ 3,201,641	$ 13,472,757
6269	28	BULL RUN	Primary	NoVa	FY18	$ 2,586,993	$ 2,586,993
6685	613	ARLINGTON BOULEVARD	Secondary	NoVa	FY18	$ 2,500,000	$ 2,500,000
6235	7	SUGARLAND RUN	Primary	NoVa	FY18	$ 4,709,641	$ 4,709,641
6463	123	LEESBURG PIKE (RTE. 7)	Primary	NoVa	FY18	$ 1,250,000	$ 1,250,000
6465	123	LEESBURG PIKE, ROUTE 7	Primary	NoVa	FY18	$ 1,250,000	$ 1,250,000
14320	627	QUANTICO CREEK	Secondary	NoVa	FY18	$ 1,280,849	$ 1,280,849
11305	711	BRANCH OF CATOCTIN CREEK	Secondary	NoVa	FY18	$ 1,700,245	$ 1,700,245
217	120	PIMMITT RUN	Primary	NoVa	FY18	$ 7,000,000	$ 7,000,000

Table E-2- SGR Structures in Virginia's Approved SYIP: Locality - Owned Structures

FED ID	Route	Featured Intersection	Virginia System	District	SGR Selection Year	SGR Total Allocation	Total Project Allocations
19965	0	S.F. Powell River	Urban	Bristol	FY17	$ 676,508	$ 2,130,916
22542	16	CAVITTS CREEK	Primary	Bristol	FY17	$ 1,300,000	$ 1,300,000
22548	61	N FORK CLINCH RIVER	Primary	Bristol	FY17	$ 1,500,000	$ 1,500,000
22543	16	CLINCH RIVER	Primary	Bristol	FY17	$ 357,810	$ 357,810
22546	19	S FORK CLINCH RIVER	Primary	Bristol	FY17	$ 968,982	$ 968,982
22441	0	BENGES BRANCH	Urban	Bristol	FY17	$ 316,000	$ 316,000
29712	3050	Booth Branch	Urban	Bristol	FY17	$ 290,000	$ 290,000
29702	3137	Slate Creek	Urban	Bristol	FY17	$ 180,000	$ 180,000
29759	2164	Knox Creek	Urban	Bristol	FY17	$ 92,500	$ 92,500
29803	4263	Stream	Urban	Bristol	FY17	$ 290,000	$ 290,000
29801	1030	Stream	Urban	Bristol	FY17	$ 180,000	$ 180,000
29696	5417	Granny Creek	Urban	Bristol	FY17	$ 180,000	$ 180,000
29744	2080	Left Fork	Urban	Bristol	FY17	$ 60,000	$ 60,000
29739	2435	Dan Branch	Urban	Bristol	FY17	$ 180,000	$ 180,000
29685	5105	Levisa Fork	Urban	Bristol	FY17	$ 575,000	$ 575,000
29731	2078	Knox Creek	Urban	Bristol	FY17	$ 170,000	$ 170,000
29793	4062	War Fork	Urban	Bristol	FY17	$ 85,000	$ 85,000
29760	2163	Knox Creek	Urban	Bristol	FY17	$ 85,000	$ 85,000
19974	0	BEAVER CREEK	Urban	Bristol	FY17	$ 286,000	$ 286,000
22467	460	CLINCH RIVER	Primary	Bristol	FY17	$ 2,158,556	$ 2,158,556
29808	4245	Russell Fork	Urban	Bristol	FY17	$ 265,000	$ 265,000
29679	0	BLUESTONE RIVER	Urban	Bristol	FY19	$ 620,000	$ 620,000
22544	16	CLINCH RIVER	Primary	Bristol	FY19	$ 2,300,000	$ 2,300,000
22539	0	FAIRGROUND CREEK	Urban	Bristol	FY19	$ 700,000	$ 700,000
22461	0	BIG CREEK	Urban	Bristol	FY19	$ 740,000	$ 740,000
19971	0	BEAVER CREEK	Urban	Bristol	FY19	$ 2,000,000	$ 2,000,000
22423	0	BEAVER POND CREEK	Urban	Bristol	FY19	$ 1,170,000	$ 1,170,000
19982	0	NS RWY	Urban	Bristol	FY19	$ 3,000,000	$ 3,000,000
20004	0	BEAVER CREEK	Urban	Bristol	FY19	$ 2,150,000	$ 2,150,000
22611	0	N F HOLSTON RIVER	Urban	Bristol	FY19	$ 620,000	$ 620,000
22469	67	CLINCH RIVER	Primary	Bristol	FY19	$ 1,650,000	$ 1,650,000
21771	11	APPERSN DR O ROANOKE RV	Primary	Salem	FY17	$ 972,694	$ 3,328,203
21774	11	COLORADO ST O NS RWY @	Primary	Salem	FY17	$ 6,450,000	$ 6,450,000
21258	0	COMMERCE ST O PEAK CK.	Urban	Salem	FY19	$ 868,249	$ 2,176,293
20504	0	Ivy Creek	Urban	Lynchburg	FY17	$ 2,000,000	$ 4,236,175
21583	360	JAMES RIVER SOUTH DIV @	Primary	Richmond	FY17	$ 1,050,000	$ 4,558,840
21584	360	JAMES RIVER NORTH DIV @	Primary	Richmond	FY17	$ 700,000	$ 4,208,840
9634	0	CSX RAILWAY	Urban	Richmond	FY17	$ 1,774,000	$ 1,774,000
21113	36	APPOMATTOX RIVER CANAL	Primary	Richmond	FY17	$ 2,025,000	$ 2,025,000
9657	0	NORTH RUN	Urban	Richmond	FY19	$ 3,750,000	$ 5,837,500
9661	0	UPHAM BROOK	Urban	Richmond	FY19	$ 1,853,000	$ 1,853,000

FED ID	Route	Featured Intersection	Virginia System	District	SGR Selection Year	SGR Total Allocation	Total Project Allocations
21185	301	LIEUTENANT RUN	Primary	Richmond	FY19	$ 616,000	$ 616,000
21357	0	BROAD ROCK CREEK	Urban	Richmond	FY19	$ 499,000	$ 1,100,000
20720	105	N.N. Resevoir	Primary	Hampton Roads	FY17	$ 5,100,000	$ 24,000,000
21797	0	CHESAPEAKE&ALBEMARLE CAN	Urban	Hampton Roads	FY17	$ 4,036,475	$ 8,871,745
22159	688	Kilby Creek Spillway	Urban	Hampton Roads	FY17	$ 778,000	$ 2,128,000
21827	13	RTE. 460 & NS RAILWAY	Primary	Hampton Roads	FY17	$ 5,110,040	$ 5,110,040
21937	460	RTE 166 & U # 1808	Primary	Hampton Roads	FY17	$ 2,215,700	$ 2,672,200
22027	32	CYPRESS SWAMP	Urban	Hampton Roads	FY17	$ 1,988,889	$ 2,705,971
22091	337	Beamons Mill Pond	Urban	Hampton Roads	FY17	$ 880,183	$ 1,121,252
22088	337	Jerico Canal	Urban	Hampton Roads	FY17	$ 479,633	$ 620,900
22111	616	Jones Swamp	Urban	Hampton Roads	FY17	$ 1,397,829	$ 1,815,362
22137	660	Somerton Creek	Urban	Hampton Roads	FY17	$ 1,981,084	$ 2,589,652
22107	608	Cohoon Creek	Urban	Hampton Roads	FY17	$ 470,400	$ 769,920
22121	639	SBD SYS RR & NS RAILWAY	Urban	Hampton Roads	FY17	$ 2,838,000	$ 3,440,000
22138	661	Chapel Swamp	Urban	Hampton Roads	FY17	$ 408,459	$ 724,275
21830	13	NS RAILWAY	Primary	Hampton Roads	FY17	$ 2,912,000	$ 3,187,000
21821	0	TRIB. GOOSE CREEK	Urban	Hampton Roads	FY19	$ 1,195,000	$ 1,195,000
21824	0	SPILLWAY AT NORFOLK RES.	Urban	Hampton Roads	FY19	$ 6,540,000	$ 6,540,000
30267	17	DEEP CREEK	Secondary	Hampton Roads	FY19	$ 1,153,000	$ 1,153,000
21816	0	LINDSEY DRAINAGE CANAL	Urban	Hampton Roads	FY19	$ 1,251,000	$ 1,251,000
21935	407	Indian River	Primary	Hampton Roads	FY19	$ 5,128,000	$ 5,128,000
22110	613	Kingsale Swamp	Urban	Hampton Roads	FY19	$ 839,000	$ 1,199,000
22148	668	SPIVEY SWAMP	Urban	Hampton Roads	FY19	$ 838,000	$ 1,193,000
22150	668	Mill Swamp	Urban	Hampton Roads	FY19	$ 994,000	$ 1,420,000
22158	688	KILBY CREEK	Urban	Hampton Roads	FY19	$ 650,000	$ 745,000
21217	239	PARADISE CREEK	Primary	Hampton Roads	FY19	$ 8,342,928	$ 10,367,928
18073	3	RAPPAHANNOCK RIVER @	Primary	Fredericksburg	FY17	$ 4,098,012	$ 4,105,651
20076	0	NORFOLK SOUTHERN RAILWAY	Urban	Culpeper	FY17	$ 2,440,626	$ 2,440,626
20092	250	RUGBY AVE	Primary	Culpeper	FY17	$ 2,488,292	$ 2,488,292
20094	250	RTE 29 BUSINESS	Primary	Culpeper	FY17	$ 3,847,554	$ 3,847,554
20096	250	NORFOLK SOUTHERN RAILWAY	Primary	Culpeper	FY17	$ 1,303,496	$ 1,303,496
20087	20	CSX & WATER STREET	Urban	Culpeper	FY19	$ 1,000,000	$ 25,187,399
22557	211	HAWKSBILL CK	Primary	Staunton	FY17	$ 1,953,030	$ 5,796,485
22294	0	CSX RAILROAD	Urban	Staunton	FY17	$ 300,001	$ 2,331,179
16265	1411	N FORK SHENANDOAH RIVER	Secondary	Staunton	FY17	$ 676,491	$ 676,491
20473	0	WOODS CRK	Urban	Staunton	FY19	$ 1,662,561	$ 1,662,561
30144	0	4 mile run	Secondary	NOVA	FY17	$ 302,610	$ 1,833,998