 

State of the Structures and Bridges Fiscal Year 2019

July 1, 2018 – June 30, 2019

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 2019 Fiscal Year (referred to as FY2019), which ran from July 1, 2018 through June 30, 2019. Salient historical trends are also provided. All "current" data in this report reflect inventory and condition information as of July 1, 2019.

Unless specifically noted otherwise, data presented in this report provide the condition and inventory information for all highway structures meeting the criteria for the population of the structures referred to as "Virginia Responsible Structures". The term "Virginia Responsible Structures" 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. Virginia Responsible Structures include temporarily closed structures, as well as bridges of any length and culverts with total opening in excess of 36 square feet.

There are currently 21,173 Virginia Responsible Structures, of which 19,598 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 Virginia Responsible Structures are on secondary routes, of which the vast majority are owned by VDOT. 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 (92.8%) of Virginia's bridges were built prior to 2007 and were designed with anticipated design service lives of 50 years. About 50.8% percent of the Virginia Responsible Structures are 50 years or older (10,751 of 21,173), meaning these structures have reached or exceeded their anticipated service lives.

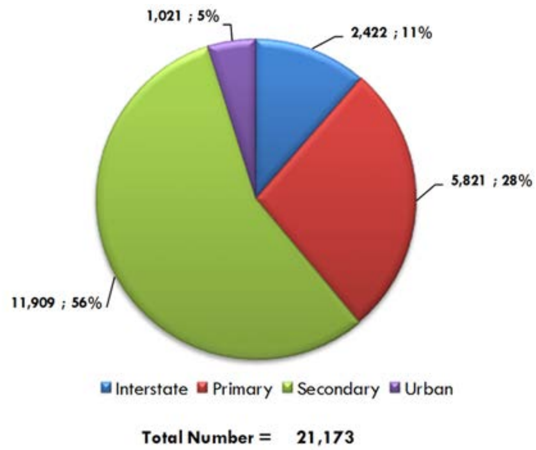


Figure 1-1- Distribution of Structures by Highway System

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 cost over the next 50 years would be $54 billion. However, if current funding remains constant over the same 50-year interval, approximately $15 billion will be available to address these bridges (combined maintenance and construction funds). Structure deterioration occurs over a period of decades rather than months or years, so the results of short-term funding deficiencies will not necessarily be readily evident in near-term trends of conditions. However, over the long-term, if the funding for structure maintenance is not increased, we should expect to see significant degradation of the average structure conditions, particularly when evaluated through the metric of deck area as opposed to structure count.

Additional funding is clearly needed, as is evident from the annually calculated monetary needs for the bridge inventory. However, in recognition of real fiscal constraints, Virginia has developed a proactive approach for making the best use of the available funding. Virginia's program uses the techniques below to optimize bridge life, safety, and value of funds invested:

- 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 construction program (State of Good Repair) that emphasizes the most cost-effective and appropriate repairs in conjunction with preservation techniques
- 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

1.2 PERFORMANCE

In 2012, Virginia attained its long-standing goal when more than 92% of its structures were in Good or Fair condition. This led to the development of new targets, which are shown in Table 1-1, along with current performance levels. Section 3 and Appendix D of this report provide detailed definitions of the "Good", "Fair", and "Poor (SD)" condition designations that are assigned to major components for bridges and large culverts. As of January 1, 2018, FHWA's definition of Structurally Deficient (SD) structures is in complete alignment with the definition of Poor structures so now all Poor structures are SD and all SD structures are Poor.

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

District	Interstate		Primary		Secondary & Urban		NBI* Only		All Systems	
	Current	Goal	Current	Goal	Current	Goal	Current	Goal	Current	Goal
1 Bristol	96.3%	99%	97.6%	96%	94.4%	94%	94.7%	94.0%	95.4%	94.0%
2 Salem	98.6%		97.1%		96.9%		96.4%		97.0%	
3 Lynchburg	N/A		98.5%		94.8%		96.0%		96.0%	
4 Richmond	98.5%		95.4%		92.8%		93.9%		94.7%	
5 H. Roads	99.8%		96.1%		95.2%		96.2%		96.6%	
6 F'burg	97.5%		90.9%		95.1%		92.8%		94.1%	
7 Culpeper	100.0%		98.6%		95.2%		95.5%		96.5%	
8 Staunton	99.8%		97.1%		96.0%		95.8%		96.7%	
9 NOVA	99.2%		97.7%		98.0%		97.8%		98.2%	
Statewide	98.9%	99%	96.9%	96%	95.5%	94%	95.6%	95.5%	96.3%	95.5%

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

During FY2019, Virginia reduced the number of Poor (SD) structures from 844 (4.0% of structures) to 792 (3.7%). For nationwide comparison, 7.6% of the bridges in the National Bridge Inventory (NBI) were Poor (SD) as of December, 2018 (the latest date for which data are available). Figure 1-2 provides long-term trends showing changes to the number, percentage, and deck area of Virginia's structures in Good or Fair condition. Additional multiyear bridge condition trends are provided in the body of this report.

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 as being 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. As with most physical systems, 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 additional performance metrics that will lead to an improved balance of expenditures, emphasizing system preservation in addition to work on Poor (SD) structures. Specifically, VDOT has added goals for improving its structures in Fair condition and the conditions of bridge deck expansion joints. VDOT is addressing the condition of joints since most of the problems on bridges occur when joints leak, thereby causing the elements below to deteriorate at a much faster rate.

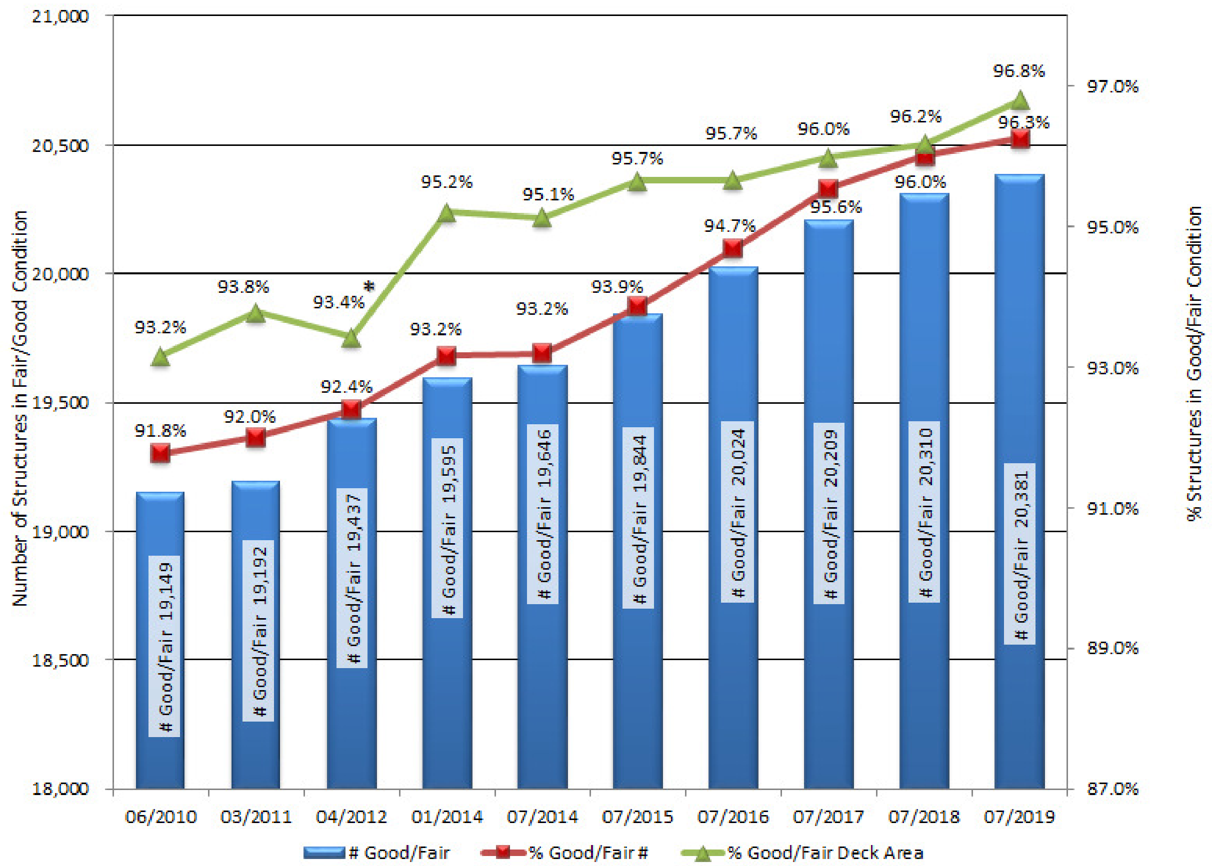


Figure 1-2- Percentage of Structures in Good or Fair Condition Statewide by Count and Deck Area by Year

***** *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.*

VDOT is also responsible for the inventory, maintenance and inspection of ancillary structures, which include five types: signs, luminaires, signals, high mast lights, and camera poles. Their conditions are summarized in Table 1-2 for the 34,732 ancillary structures in the inventory. All information for ancillary structures is based on condition and inventory data at the end of FY2019. 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

	Percentage of Primary Components in Good or Fair Condition		
Structure Type	**Foundation**	**Parapet**	**Superstructure**
Signs	73.7%	86.3%	89.3%
Luminaires	75.6%	N/A	86.2%
Signals	77.6%	N/A	78.1%
High Mast Lights and Camera Poles	89.2%	N/A	98.8%

1.3 INVENTORY ADDRESSED IN REPORT

Data presented in this report provide the condition and inventory information for all highway structures meeting the criteria for the population of the structures referred as "Virginia Responsible Structures". The term, "Virginia Responsible Structures" was developed to provide a consistent and coherent group of structures for internal and external reporting.

Virginia Responsible Structures excludes the following: 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 1-3 displays the distribution of Virginia Responsible 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 (Chesapeake Bay Bridge and Tunnel District), other state agencies (e.g. Game and Inland Fisheries, State Parks), and other toll authorities (Richmond Metropolitan Authority, Dulles Greenway Toll, Globalvia (Pocahontas Parkway- Route 895)), and border bridges.

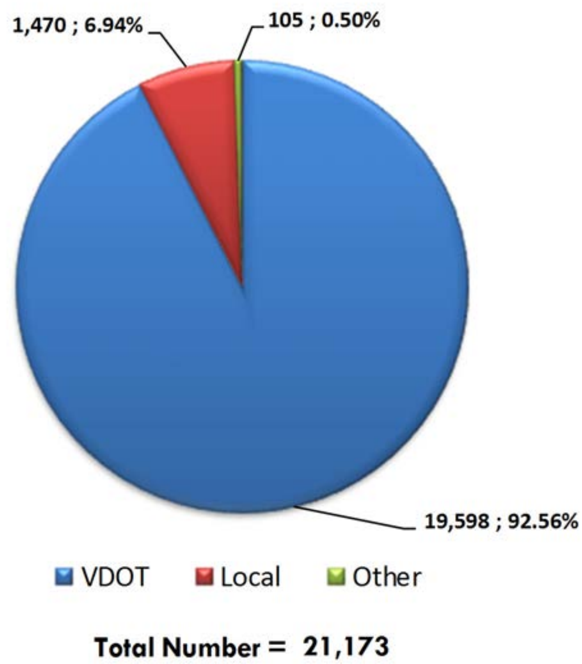


Figure 1-3- Distribution of Structures by Owner

Virginia Responsible Structures include structures that meet one of the following criteria:

- Structures in the NBI for which Virginia is responsible for reporting condition data to FHWA. These structures are described as NBI structures and include bridges and culverts with a length greater than 20 feet.
- Non-NBI structures that are shorter bridges with a length less than or equal to 20 feet; and large culverts that have a length less than 20 feet and total openings with an area greater than 36 square feet.

FHWA holds VDOT responsible for the inspection of all Virginia Responsible NBI structures, regardless of owner. However, VDOT is only responsible for the maintenance of VDOT-owned NBI structures, while localities, other state agencies, or other legal entities of the Commonwealth of Virginia are responsible for the maintenance of all other NBI structures. VDOT chooses to also inspect and maintain the Non-NBI structures through its Structure and Bridge Division.

Specific technical definitions of many of the terms used in this report are provided in Appendix A.

2 INVENTORY

2.1 STRUCTURES

Virginia Responsible 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
- 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	526	1,319	2,009	163	174	1	338	216	956	2,224	3,396
2 Salem	138	456	1,236	1,830	137	235	4	376	209	824	2,038	3,071
3 Lynchburg	0	408	931	1,339	0	217	4	221	0	658	1,411	2,069
4 Richmond	364	582	1,028	1,974	359	365	25	749	520	786	1,301	2,607
5 H. Roads*	376	381	669	1,426	371	237	81	689	458	465	805	1,728
6 F'burg*	45	177	322	544	45	112	7	164	80	254	491	825
7 Culpeper	84	244	716	1,044	83	95	5	183	120	495	1,094	1,709
8 Staunton	254	455	1,158	1,867	250	155	2	407	431	827	2,233	3,491
9 NOVA*	296	407	858	1,561	293	330	35	658	388	556	1,333	2,277
Total	1,721	3,636	8,237	13,594	1,701	1,920	164	3,785	2,422	5,821	12,930	21,173

**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- 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	3.4	2.4	7.3	1.5	1.5	0.0	3.0	1.6	3.6	2.7	7.8
2 Salem	1.3	3.9	3.0	8.2	1.3	2.5	0.0	3.8	1.3	4.2	3.2	8.7
3 Lynchburg	0.0	4.3	2.4	6.7	0.0	2.5	0.0	2.5	0.0	4.4	2.6	7.0
4 Richmond	5.7	8.9	4.4	19.1	5.7	7.0	0.4	13.1	5.9	9.1	4.5	19.5
5 H. Roads	10.6	15.3	4.1	29.9	10.5	12.9	1.6	25.0	10.7	15.3	4.1	30.1
6 F'burg	0.4	2.9	1.1	4.5	0.4	2.0	0.1	2.6	0.5	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	8.6	2.5	1.6	0.0	4.1	2.6	3.4	3.2	9.3
9 NOVA	8.1	6.0	5.5	19.6	8.0	5.3	0.5	13.8	8.2	6.2	5.8	20.1
Total	30.9	49.3	27.3	107.6	30.8	36.0	2.7	69.5	31.6	50.5	29.0	111.0

2.2 Inventory Changes from Previous Years

Some of the charts in the report provide multi-year trends for various performance measures. Inventory numbers provided in this report for the years 2007-2011 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 Report with the fiscal year and with reports developed by other VDOT divisions.

Other factors causing differences between this report and previous editions of this 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 structures being removed from or added to the list of NHS structures. This redesignation effort was performed in accordance with FHWA requirements. The historic data used for the tables and charts were updated to reflect the current NHS designation.

- **Areas for all Structures:** Prior to the 2018 report, areas for culverts were computed based on barrel length of culvert multiplied by the culvert width. Starting with the 2018 report, bridge and culvert area is based on the FHWA Computation Procedure for the Bridge Condition Measures (FHWA-HI-18-023). Length is based on NBI Item 49 (Structure Length), and width is based on NBI Item 52 (Deck Width) or Item 32 (Approach Roadway) for culverts where the roadway is on a fill (i.e., traffic does not directly run on the top slab (or wearing surface) of the culvert).

Figure 2-1, Figure 2-2, and Figure 2-3 provide data on the ages of Virginia Responsible Structures.

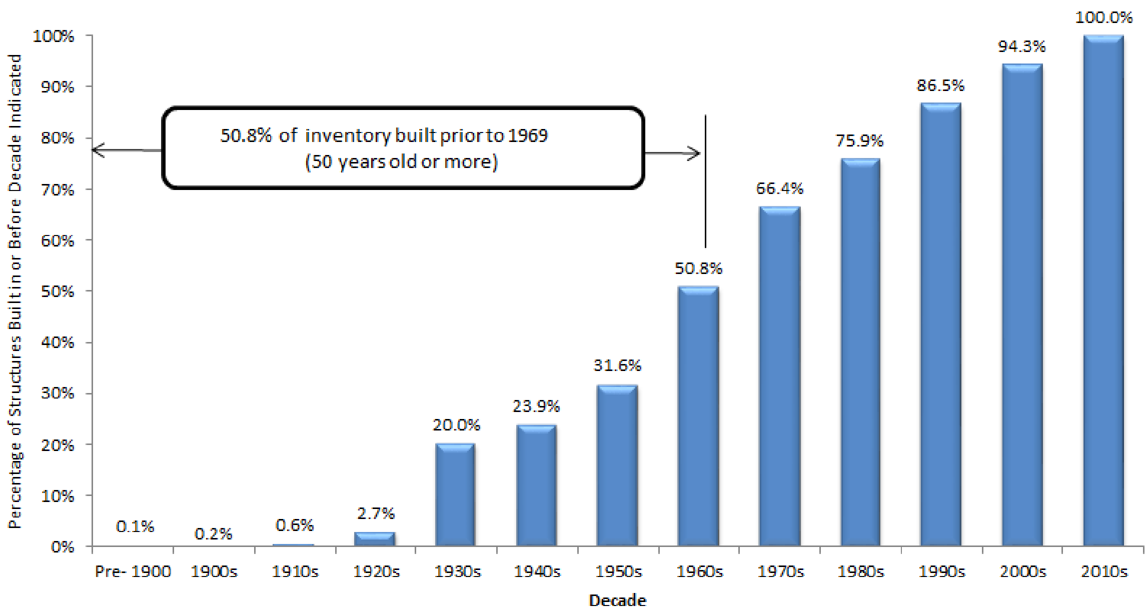


Figure 2-1- Cumulative Age Distribution of Structures by Decade

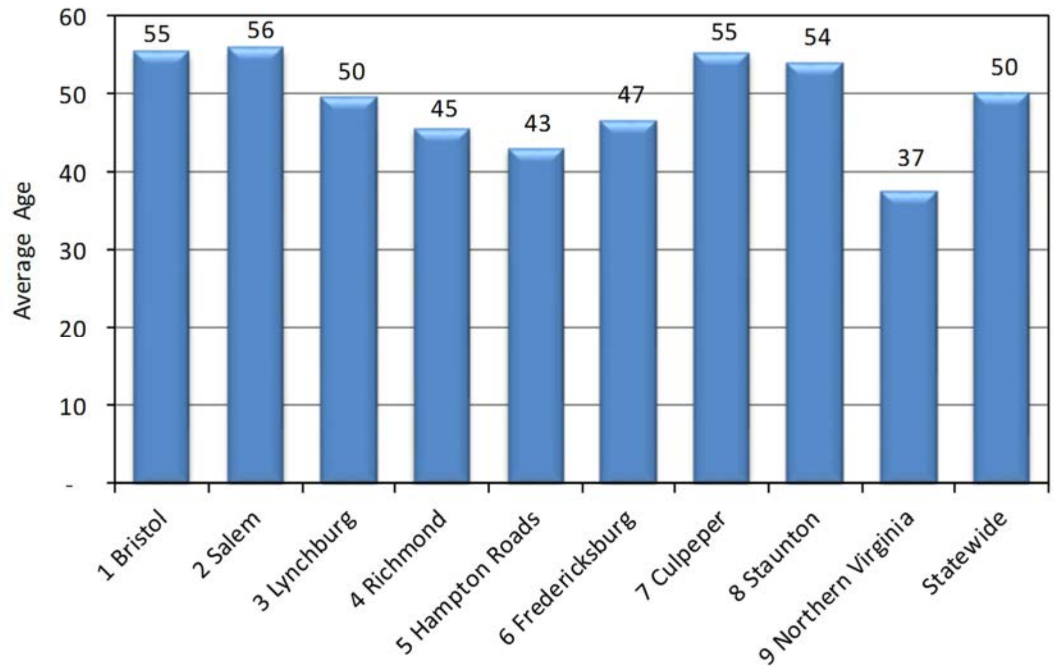


Figure 2-2- Average Age of Structures by District

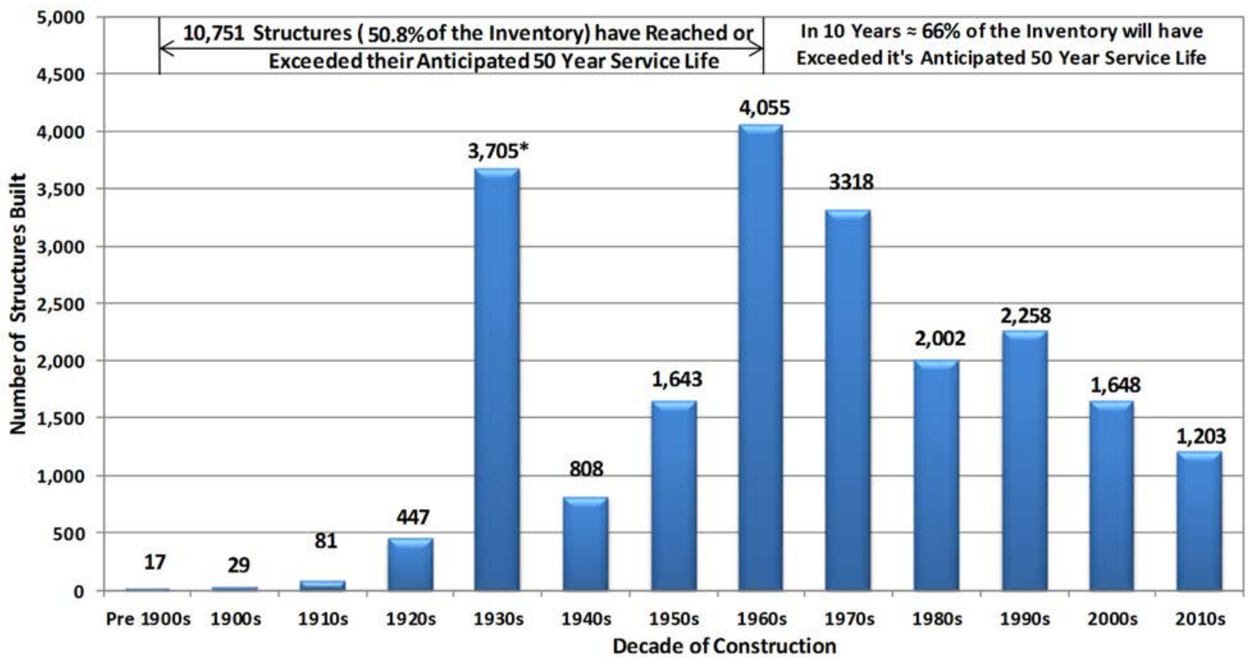


Figure 2-3- Number of Structures Built by Decade

**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.*

2.3 CATEGORIES OF STRUCTURES

Given the large number and broad geographic distribution of Virginia Responsible Structures, it is often convenient to use 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" conditions in each structure category. These categories describe both material type and structural system used. As the charts show, the performance and durability vary considerably between categories, with large concrete culverts showing the greatest durability and timber deck bridges, T-beams, and large metal culverts displaying the least favorable performance.

These charts provide the number of structures in "Good", "Fair", and "Poor" conditions in each structure category.

VDOT has also identified a group of "Special Structures" with characteristics that warrant additional consideration for maintenance, repair, and funding. These structures are large and/or complex and play a critical role in the function of the transportation network. They include large and complex bridges, movable bridges, and tunnels. A list of the special structures is provided in Table 2-3.

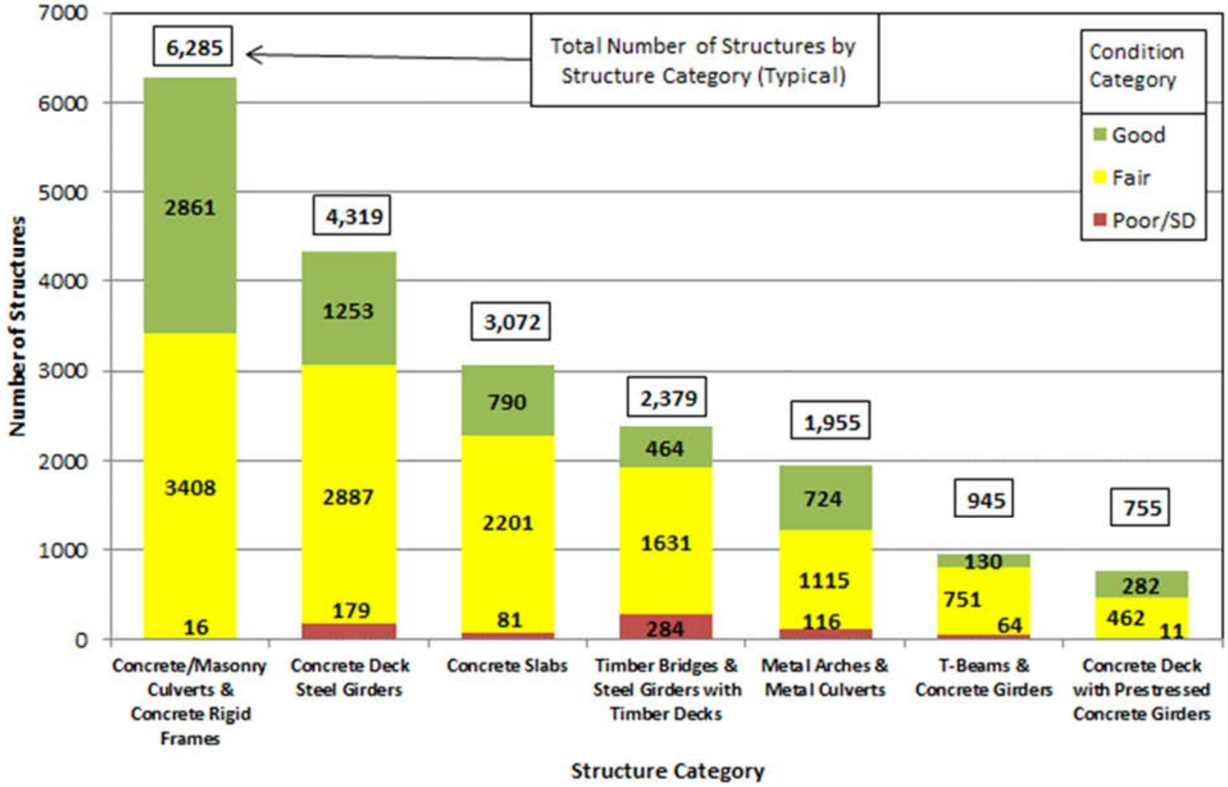


Figure 2-4- Count and Condition Data for Most Common Structure Categories (All Structures)

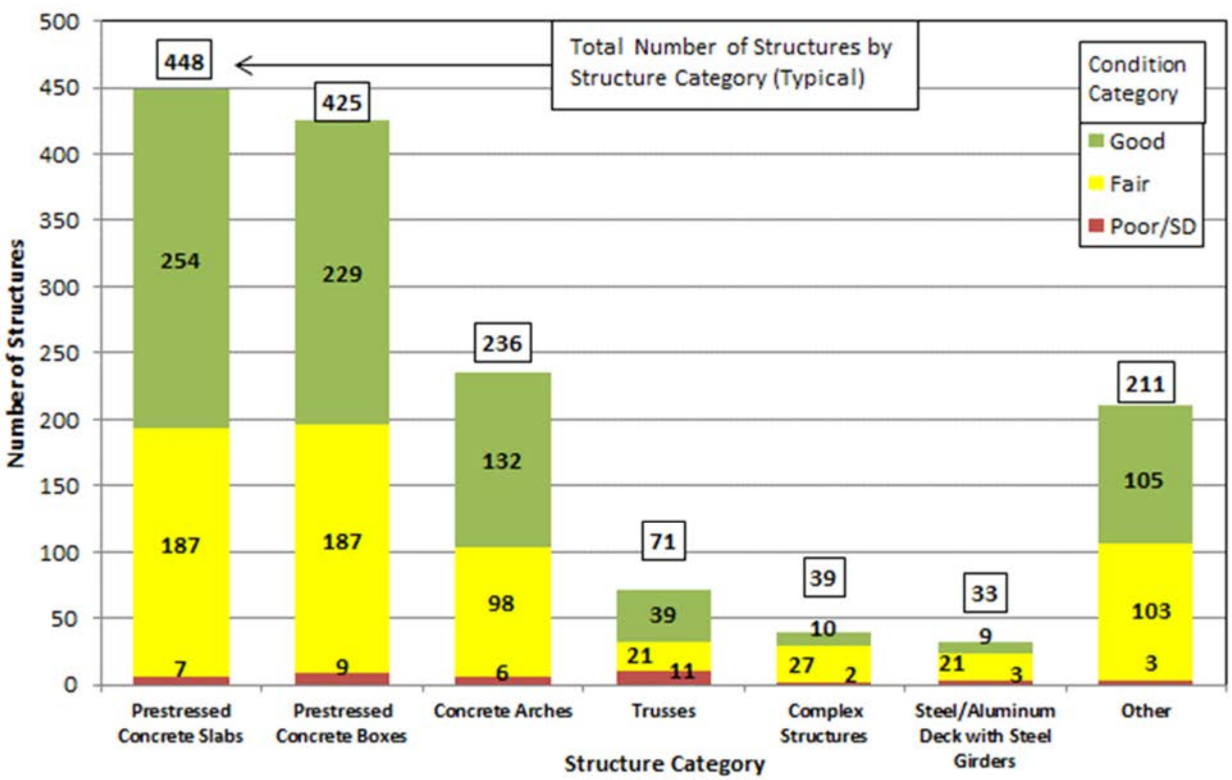


Figure 2-5- Count and Condition Data for Less Common Structure Categories (All Structures)

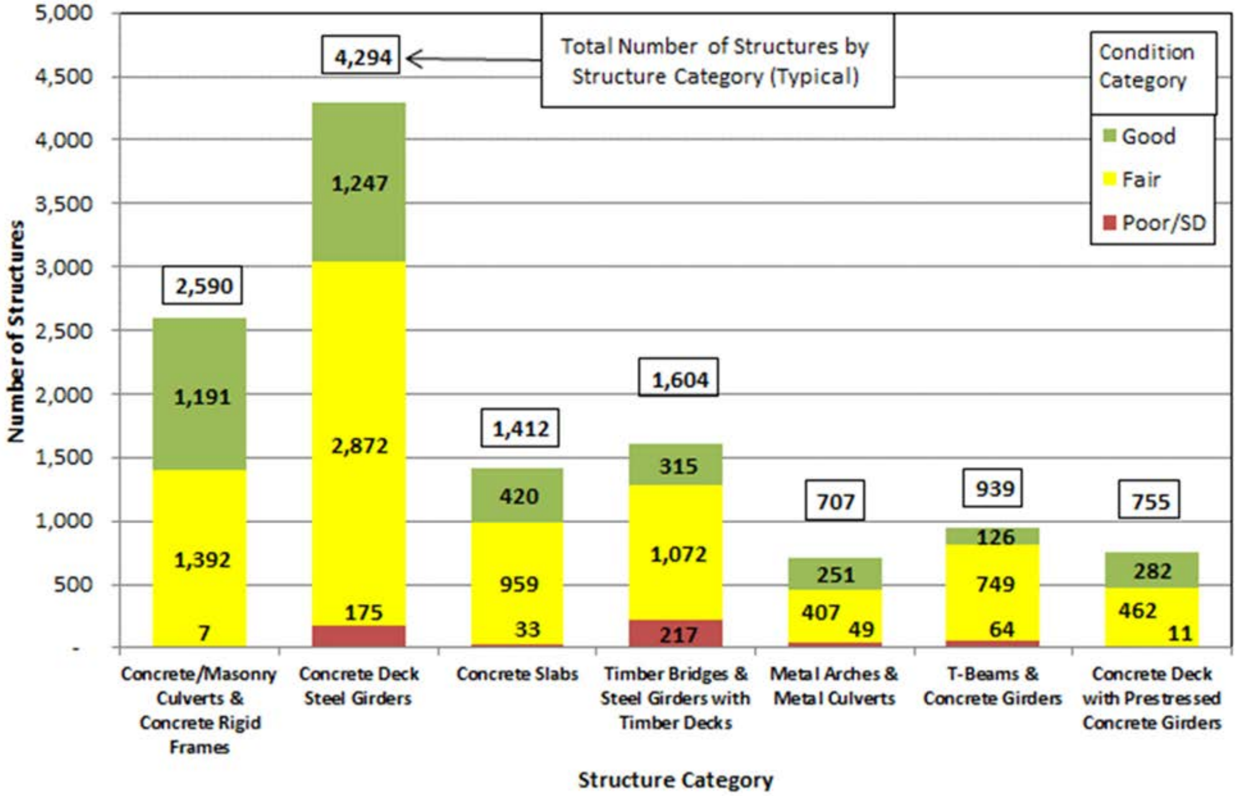


Figure 2-6- Count and Condition Data for Most Common Structure Categories (NBI Structures)

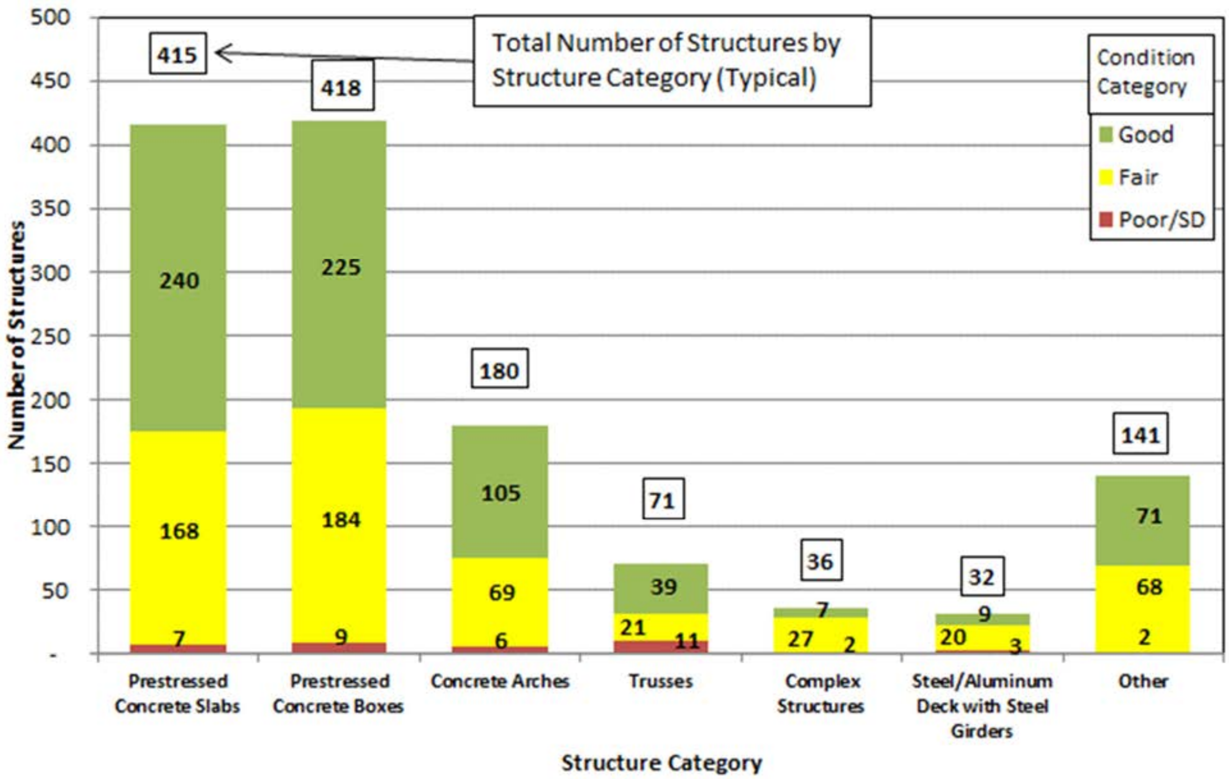


Figure 2-7- Count and Condition Data for Less Common Structures Categories (NBI Structures)

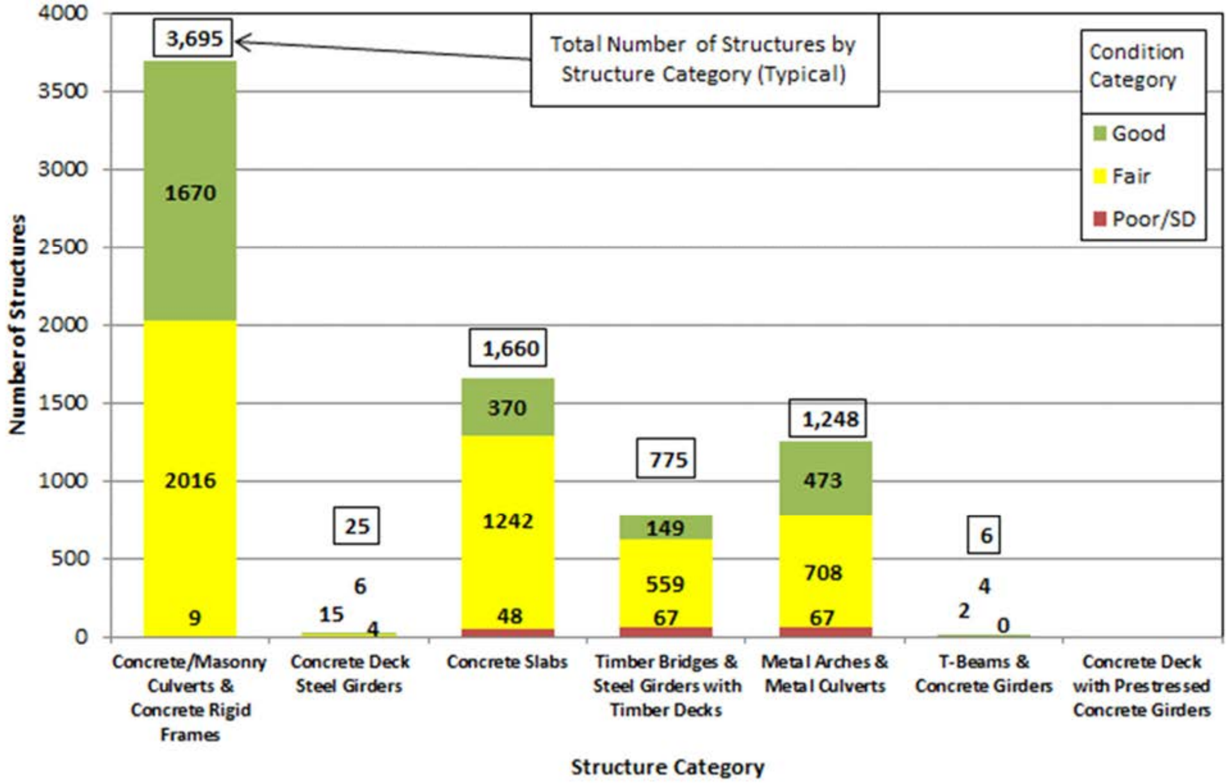


Figure 2-8- Count and Condition Data for Most Common Structure Categories (Non-NBI Structures)

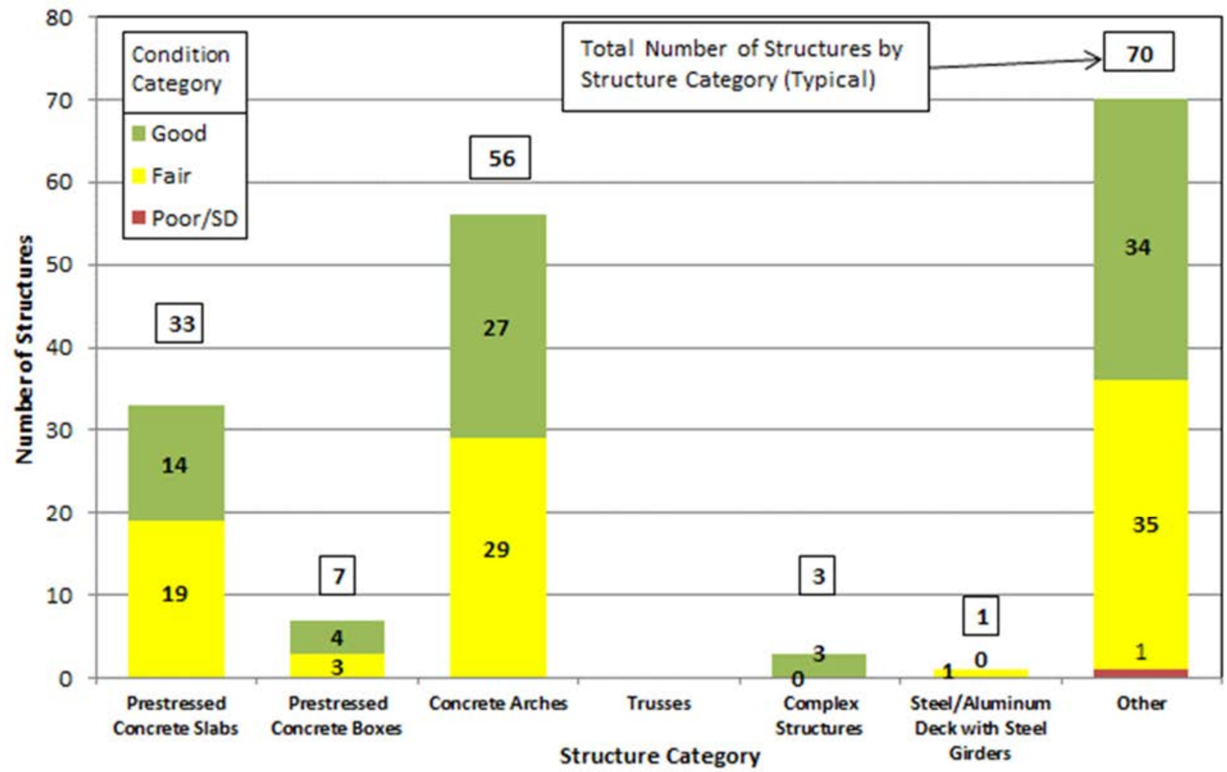


Figure 2-9- Count and Condition Data for Less Common Structure Categories (Non-NBI Structures)

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 (MMBT)	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

2.4 ANCILLARY STRUCTURES

VDOT is responsible for the inventory, inspection, and maintenance of 34,732 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 wire
    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.

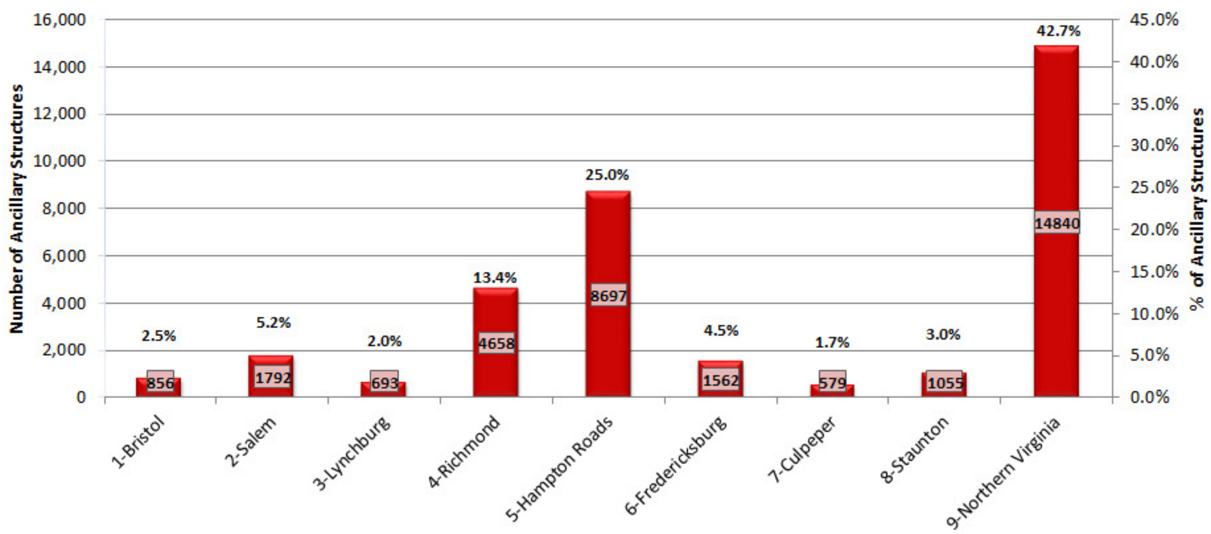


Figure 2-10- Distribution of Ancillary Structures by District

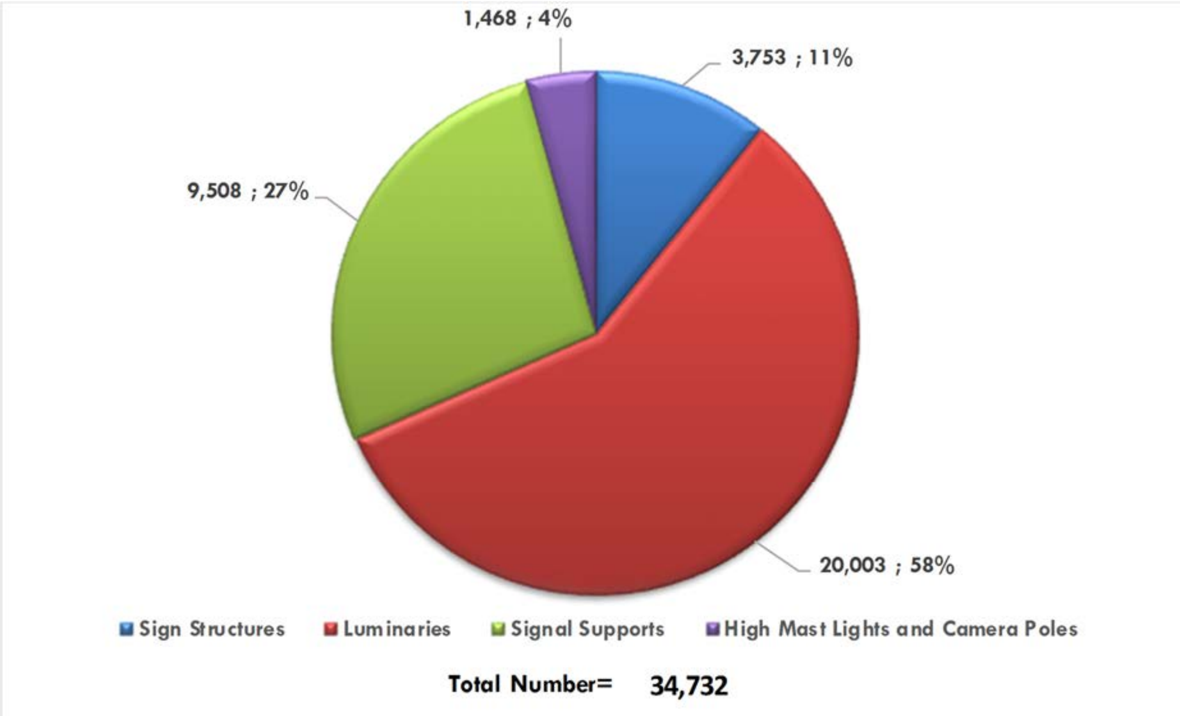


Figure 2-11- Distribution of Ancillary Structures by Type

3 CONDITION

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

A true 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*.

Descriptions of GCRs are also provided in Appendix D of this report. Measured on a 0-9 scale, with 0 representing a failed structure and a 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

Prior to FHWA establishing the category definitions above in 23 CFR Part 490 § 490.409, Virginia defined a Fair structure as a structure with a minimum GCR equal to 5 and Good structure as a structure with a minimum GCR equal to 6 or more. VDOT aligned with the FHWA definitions starting with the 2018 report.

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 years of work to identify and adopt a set of metrics that are meaningful, actionable, and practical to measure.

Virginia's maintenance program is large and complex, so in order to more easily direct its efforts, performance goals have been developed for each of the three condition categories described in the previous section (Good, Fair, and Poor (SD)). While Virginia has been using performance measures for many years, FHWA recently required states to track bridge conditions, establish performance targets, and report results. Therefore, Virginia now has two sets of performance targets: state and federal.

3.2.2 State Performance Management Measures

Virginia uses two types of performance management measures for determining the condition of structures in Virginia:

- Poor (SD) Performance Management Measures
- System Preservation Performance Management Measures

Poor (SD) Performance Management Measures: A structure is designated as Poor (SD) if one or more of the structure components, deck, superstructure, substructure or large culvert, has a GCR of 4 or less. Poor (SD) structures have deficient structural components that require the structure to be monitored and/or repaired. In some instances, these structures have been posted to restrict the weight of vehicles driving on the structure.

Virginia's overall goal for Poor (SD) structures is to limit their number to 4.5% of the overall inventory (95.5% in Good or Fair condition). Goals have also been established regarding the minimum percentage of structures in Good or Fair condition on each of the three highway systems. These targets, which apply statewide and to the nine construction districts individually are provided in Table 3-2 along with the previous targets. Figure 3-1, which provides a ten-year trend of the number and percentage of Good, Fair and Poor (SD) structures, shows that the number and percentage of Poor (SD) structures have been steadily decreasing, while the number and percentage of Fair structures have been increasing.

Table 3-2- Virginia's Good or Fair Condition Targets

Highway System	Previous Target (Prior to 10/17)	Current Target	Current Statewide Performance
Interstates	97.0%	99.0%	98.9%
Primaries	94.0%	96.0%	96.9%
Secondaries and Urban	89.0%	94.0%	95.5%
All Systems Combined	92.0%	95.5%	96.3%

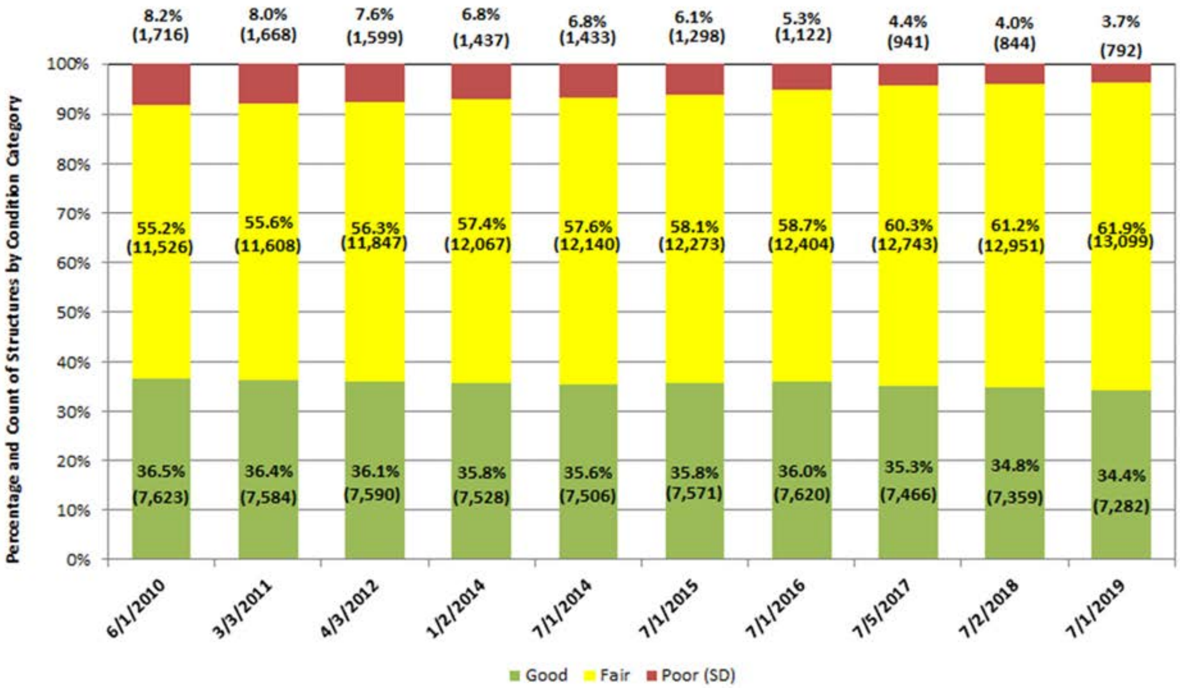


Figure 3-1: Percentage and Count of Structures in Good, Fair, and Poor (SD) Condition by Year

System Preservation Performance Management Measures: Virginia's overall goal for Fair structures, as established in October 2017, is to reduce the number of structures in Fair Condition with a minimum GCR of 5 (Fair (5)) by 0.5% by July 1st, 2019. This is a significant challenge due to the age of the inventory, and this target is still being pursued. Table 3-3 provides the number of Fair (5) structures by highway system for the past three years. Although VDOT is making an effort to reduce the number of Fair (5) structures, many are deteriorating from Good or Fair (6) to Fair (5). Also, some of the Poor (SD) structures are being rehabilitated rather than replaced, causing them to become Fair (5) structures after improvements. As can be seen in Table 3-3, the number of Fair (5) structures is increasing for primary and urban highway systems.

Table 3-3- Virginia's Count of Fair (5) Structures

Highway System	Number of Fair (5) Structures		
	07/2017	07/2018	07/2019
Interstates	745	747	742
Primaries	1,450	1,471	1,483
Secondaries and Urban	2,943	2,933	2,917
All Systems Combined	5,138	5,151	5,142

Virginia also has recently established a performance goal for improving the conditions of bridge deck expansion joints. This important goal was established because leaking bridge deck expansion joints can cause significant damage to structures by allowing water and road salts to attack bridge girders and supports. The new goal is for the percentage of expansion joints in Condition State 1 (Good) or Condition State 2 (Fair) to improve by 0.5% from the baseline established on October 1st, 2017 by December 31st, 2018. Currently, 82.6% of VDOT's expansion joints are in Condition State 1 or Condition State 2. This goal is still being pursued.

In addition to GCR, condition states are assigned to various bridge elements during bridge inspections. A condition state of 1 is "Good", 2 is "Fair", 3 is "Poor", and 4 is "Severe". Condition states provide more detailed information than GCRs about individual bridge elements. Information on the collection of condition state data may be found in the VDOT Supplement to the AASHTO Manual for Bridge Element Inspection.

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

Chapter 32, Part 2, of the *VDOT Manual of the Structure and Bridge Division* establishes recommended targets for system sustainability as follows:

- 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, a 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 3-2, 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 FY2019, 319 structures fell from "Good" to "Fair" condition, and 108 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.

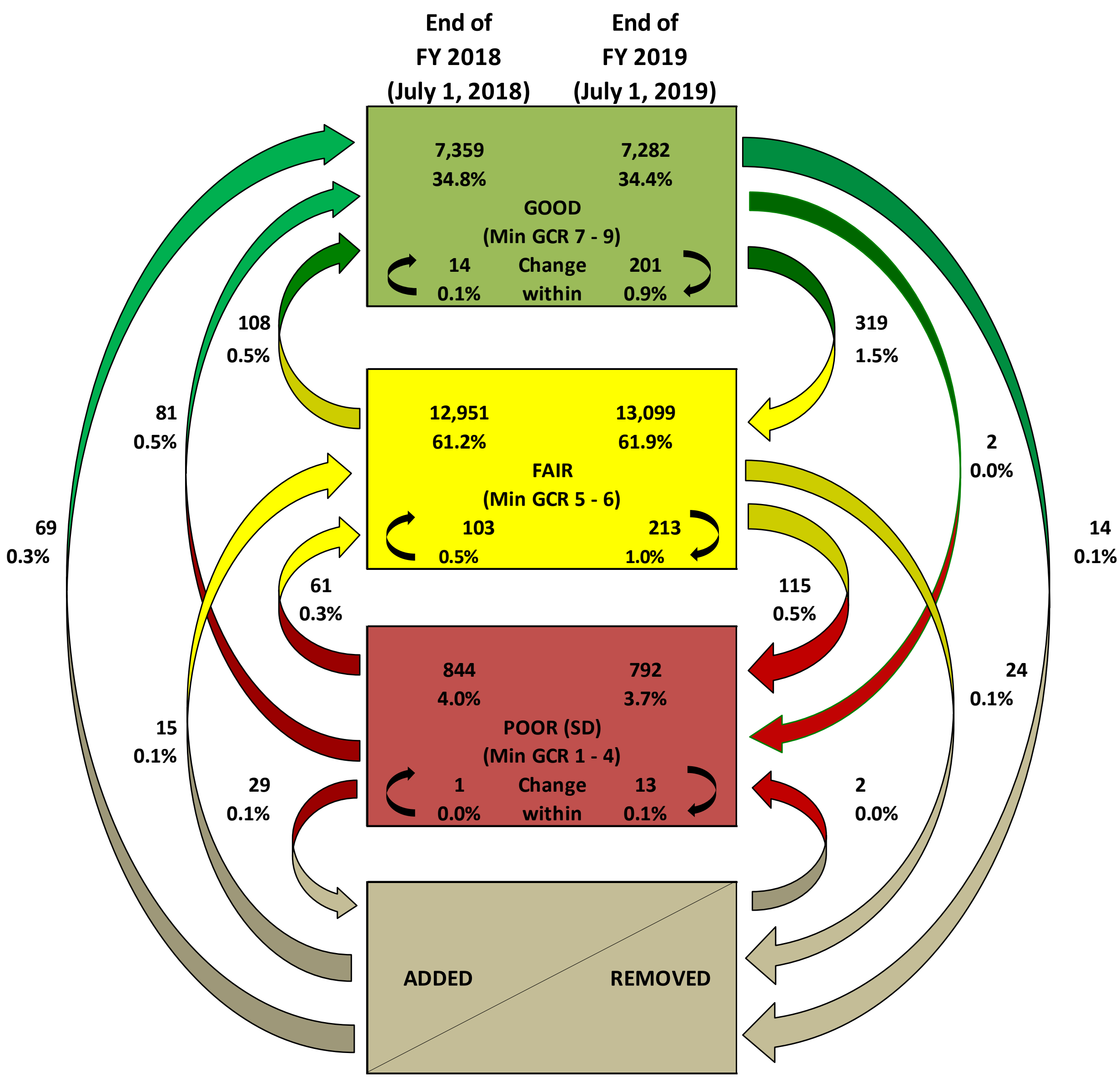


Figure 3-2- Annual Transitions between Good/Fair/Poor (SD) from End of FY 2018 to End of FY 2019

Note: Percentages based on total structures in the inventory from FY18 to FY19, inclusive of those permanently closed and/or removed over that time period.

3.2.4 Federal Performance Management Measures

The 2012 federal highway act known as "Moving Ahead for Progress in the 21st Century" (MAP21) requires states to develop Transportation Asset Management Plans (TAMPs). TAMPs track performance of various assets, including NBI structures on the NHS. Also, federal regulations require states to establish targets for their NBI structures on the NHS and to report their progress toward those targets. Performance measures and targets cover all NBI bridges carrying the NHS, which includes on- and off-ramps connected to the NHS within a state, and bridges carrying the NHS that cross a state border.

Performance Management Measures for Poor (SD) Structures: There are two specific requirements associated with Poor (SD) bridges:

1. No more than 10% of the deck area of NBI structures on the NHS may be Poor (SD)
2. Each state must establish 2-year and 4-year goals for the percentage of Poor (SD) deck area of NBI structures on the NHS.

Table 3-4 shows the current status for Poor (SD) structures, along with Virginia's 2-year target (3.5%) and 4-year target (3.0%). Table 3-5 shows the percentage of deck area of Poor (SD) NBI Structures on the NHS by district and highway system. Figure 3-3 shows the recent statewide trend of Virginia Responsible Structures for the percentage of deck area of Poor (SD) NBI Structures on the NHS. Figure 3-4 shows the current percentage of deck area of Poor (SD) NBI Structures on the NHS by district.

Performance Management Measures for System Preservation for Good/Fair Structures: MAP-21 also requires states to establish 2-year and 4-year targets for the percentage of Good NBI structures on the NHS by deck area. As shown in Figure 3-5, Virginia's 2-year target is 33.5%, and its 4-year target is 33.0%. This projected decrease in the percentage of Good deck area reflects anticipated declines in structure conditions due to age and funding limits.

Figure 3-5 shows the recent statewide trendline of the percentage of deck area of NBI Structures on the NHS in Good condition. Figure 3-6 shows the current percentage of deck area of NBI Structures on the NHS in Good condition by district.

Table 3-4- 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 2020**	**Virginia's 4 year Target 2022**	**Federal Limit**	**Current Status**
Good	33.5%	33.0%	-	32.7%
Poor (SD)	3.5%	3.0%	10.0%	2.4%

Table 3-5- 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	5.2%	1.8%	0.0%	100.0%	3.6%
2 Salem	6.3%	2.1%	0.0%	0.0%	3.5%
3 Lynchburg	N/A	0.9%	0.0%	0.0%	0.9%
4 Richmond	5.7%	2.6%	0.0%	17.2%	4.0%
5 Hampton Roads	2.7%	1.0%	0.0%	0.0%	1.7%
6 Fredericksburg	6.1%	7.4%	0.0%	0.0%	6.9%
7 Culpeper	0.0%	6.9%	0.0%	0.0%	3.1%
8 Staunton	0.3%	4.9%	0.0%	0.0%	2.1%
9 NOVA	0.1%	2.8%	0.6%	0.0%	1.1%
Statewide	**2.6%**	**2.3%**	**0.3%**	**0.9%**	**2.4%**

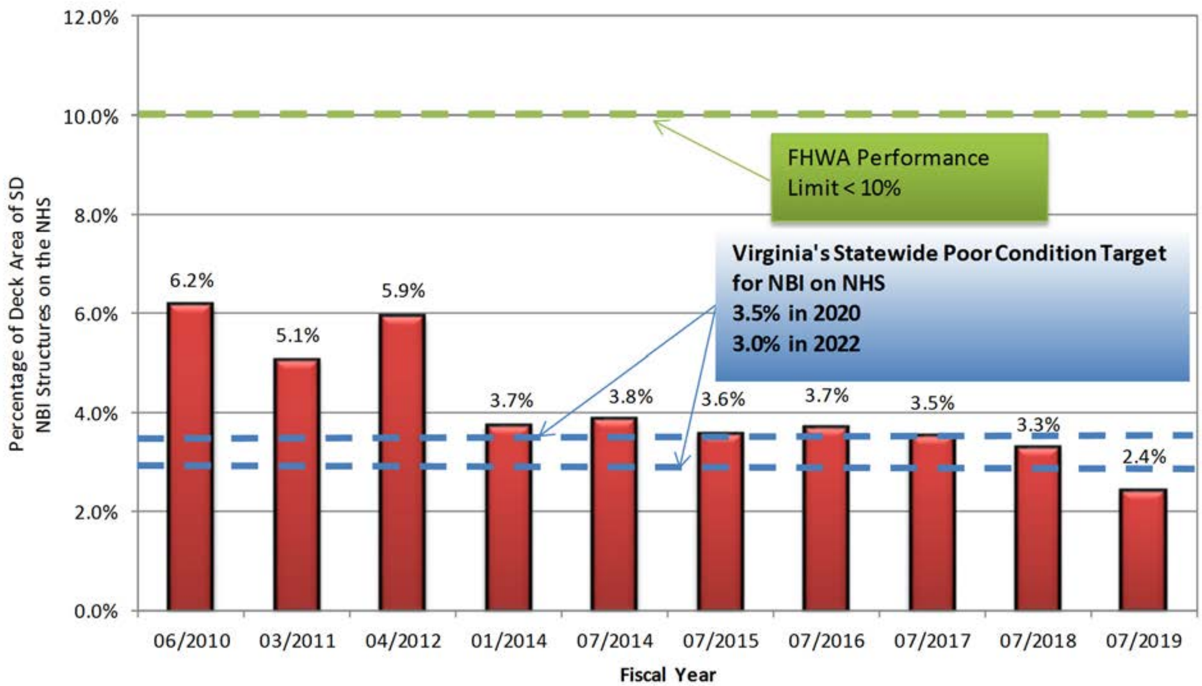


Figure 3-3- Percentage of Deck Area of Poor (SD) NBI Structures on the NHS by Year

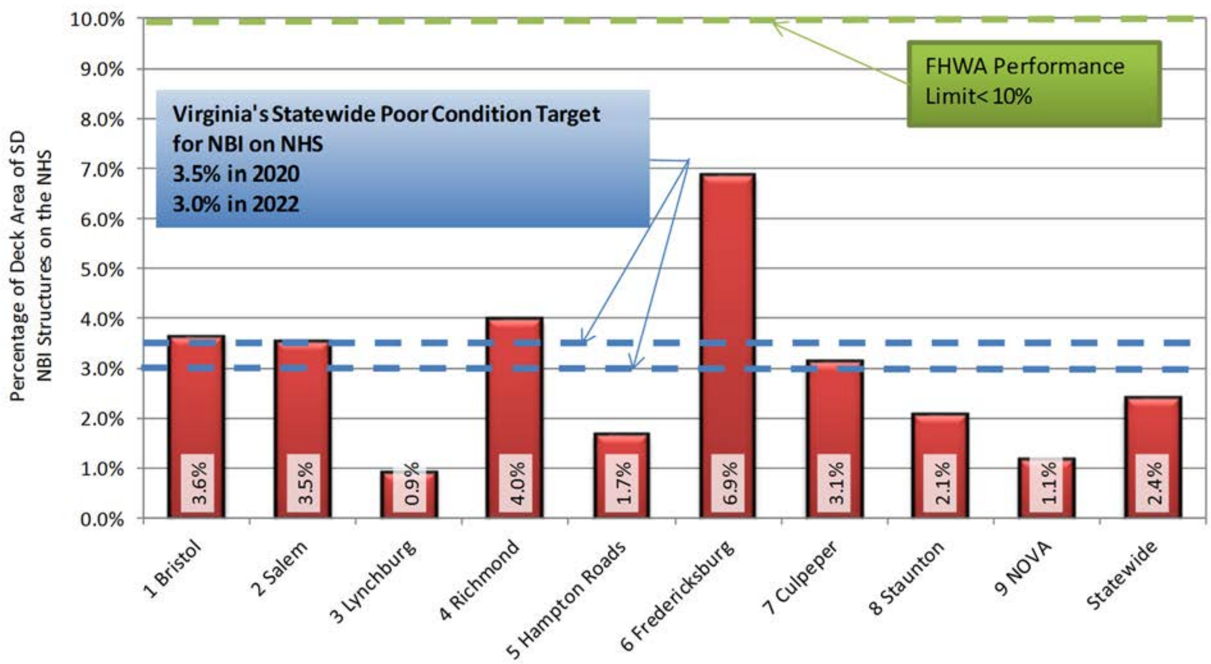


Figure 3-4- Percentage of Deck Area of Poor (SD) NBI Structures on the NHS by District

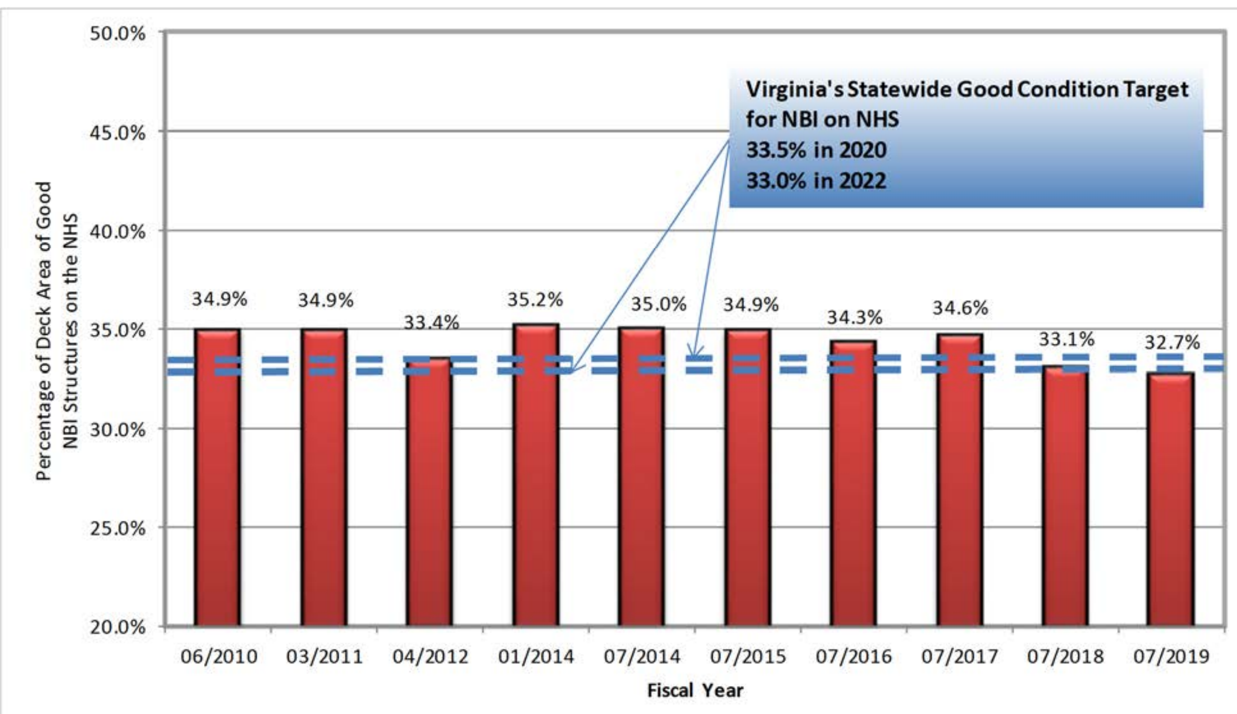


Figure 3-5- Percentage of Deck Area of NBI Structures on the NHS in Good Condition by Year

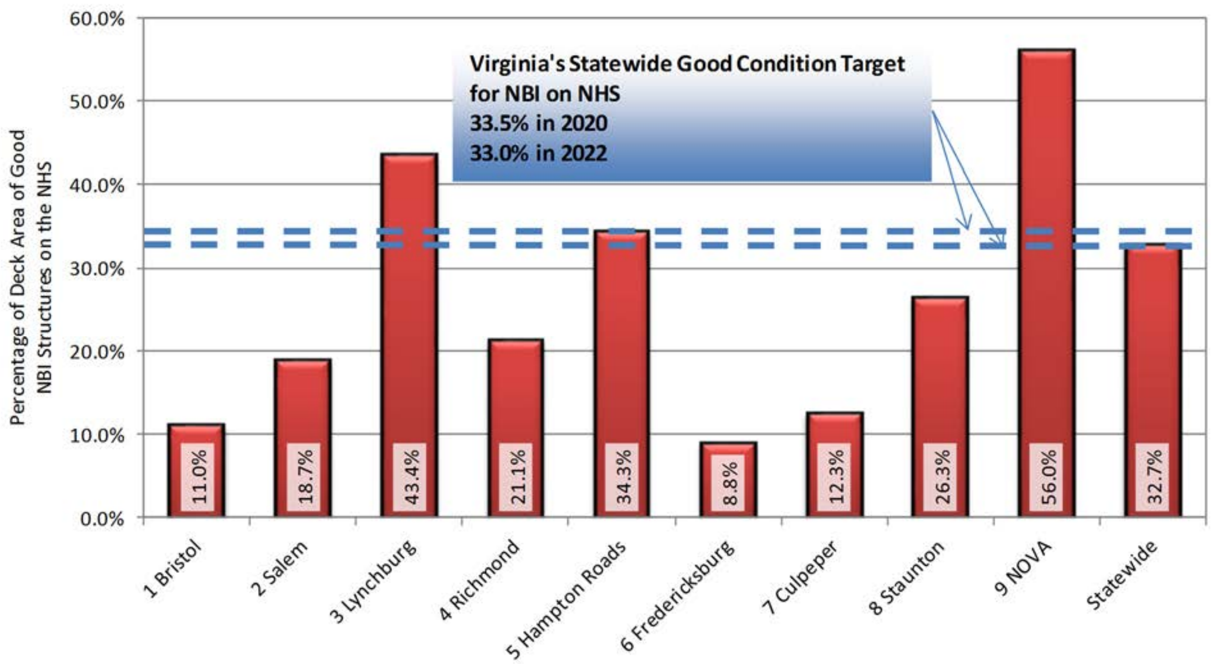


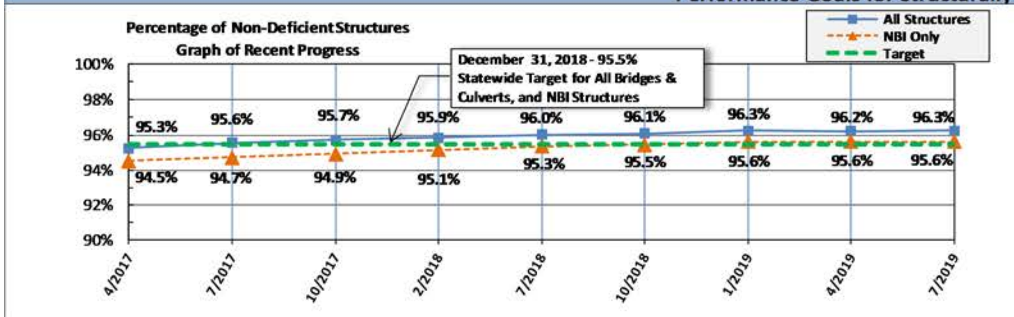
Figure 3-6- Percentage of Deck Area of NBI Structures on the NHS in Good Condition by District

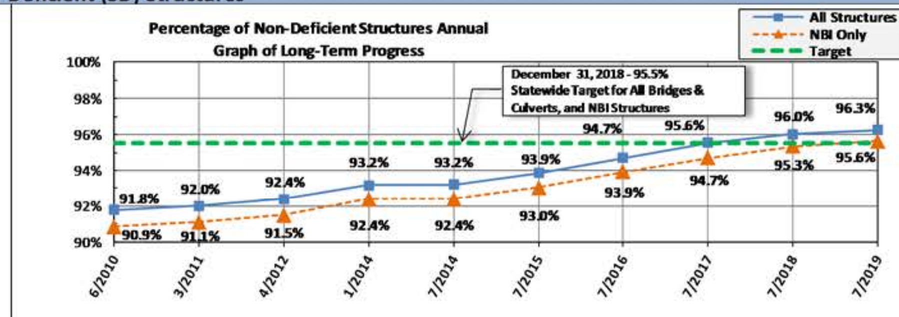
3.2.5 Targets for Chief Engineer's Quarterly Report

VDOT emphasizes the establishment of objectively measured goals and the regular reporting of progress toward those goals. VDOT's Chief Engineer holds a quarterly meeting with its division administrators during which a status update is provided. Prior to the meeting, a report is produced that includes graphs showing each division's progress toward the state and federal performance management metrics. Figure 3-7 shows the statewide status report provided by the Structure and Bridge Division for July, 2019 using the Chief Engineer's Quarterly Report format. The Chief Engineer's Quarterly Report tracks the goals below:

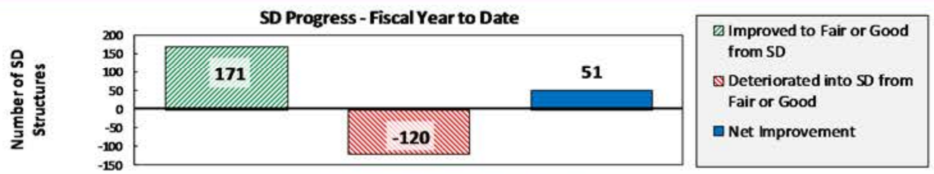
- Exceed 95.5% structures in Good or Fair condition for both NBI and Non-NBI structures and NBI structures alone by December 31, 2019
- Improve the percentage of joints in condition states 1 and 2 by 0.5% from the baseline established on October 1, 2017 by the end of the calendar year 2018. This goal is still being pursued.
- Reduce the number of Fair (5) structures by 0.5% from the baseline established on October 1, 2017 for both NBI and Non-NBI structures and NBI structures alone by the end of FY 2019. This goal is still being pursued.
- A long term goal is to have 99% of structures in Good or Fair condition and to have zero Poor (SD) structures on the interstate system

Performance Goals for Structurally Deficient (SD) Structures





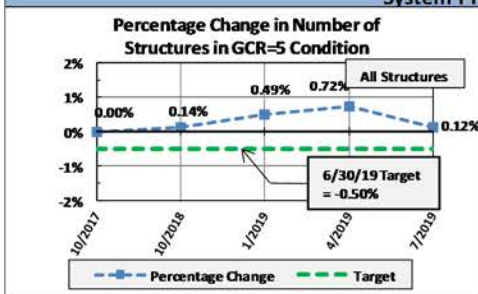
Current # of SD Structures= 793

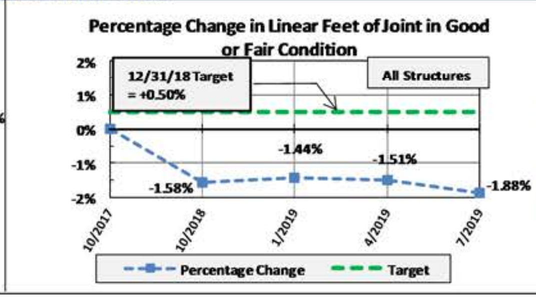


Percentage of Bridge and Culvert Structures in Fair or Good Condition	Description	Target Date	Target	Actual	Δ from Previous*
	Interstate	Current	99%	98.9%	0.12%
	Primary	Current	96%	96.9%	0.08%
	Secondary	Current	94%	95.7%	-0.02%

*Previous report was published in April of 2019.

System Preservation Goals





Fracture Critical

Reduction in Fracture Critical Roadway Bridges All Systems ADT>1000			
	Total No. Bridges	12/31/13	139
	FC Reduction Goal (15%)		21
	No. Removed since	12/31/13	29
	No. Added since	12/31/13	21
	Total No. Bridges	Current	131

FHWA Targets: Based on Deck Area of NBI on NHS

Performance Goal	Current	Target 2020	Target 2022	FHWA Limit
Percentage SD	2.4%	3.5%	3.0%	Less than 10%

The figures shown on this page include all structures carrying traffic on public roadways in Virginia except for federally responsible bridges.

"NBI Only" includes bridges and culverts meeting the NBI definition for a bridge.

"All structures" includes closed bridges and both NBI and Non-NBI bridges and culverts.

Figure 3-7- Chief Engineer's Quarterly Report for July 2019 using July 1, 2019 data

3.3 CURRENT CONDITIONS - STRUCTURES

The following pages contain charts and tables providing information about the current conditions of the Virginia Responsible 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.

Additional inventory information on the Virginia Responsible Structures:

- Figure 3-8 addresses Poor (SD) Structures by count
- Figure 3-9 addresses Poor (SD) NBI structures on the NHS by count
- Figure 3-10 through Figure 3-13 address Poor (SD) structures by system and by count
- Figure 3-14 and Table 3-6 address deck area of NBI structures on the NHS
- Figure 3-15 and Table 3-7 address deck area of Poor (SD) NBI structures on the NHS
- Figure 3-16 and Table 3-8 address the deck area of all structures
- Figure 3-17 and Table 3-9 and 3-10 address Poor (SD) deck area
- Figure 3-18 and Table 3-11 address weight-posted deck area

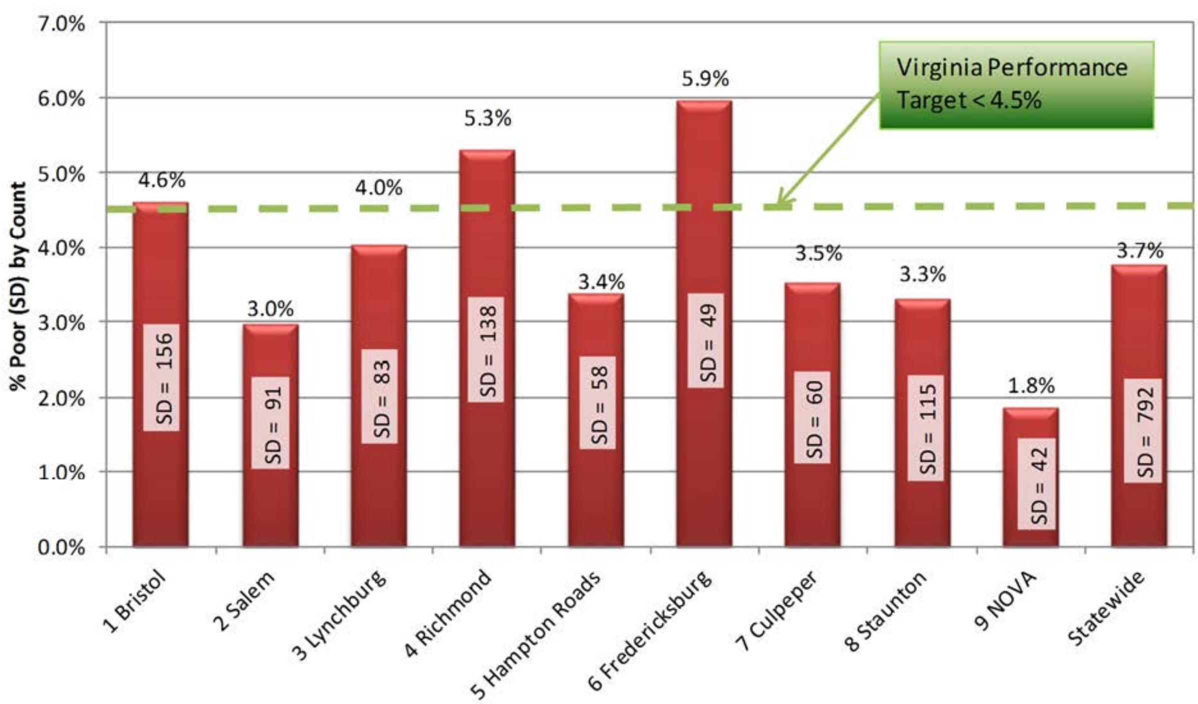


Figure 3-8- Percentage and Count of Poor (SD) Structures by District – All Systems

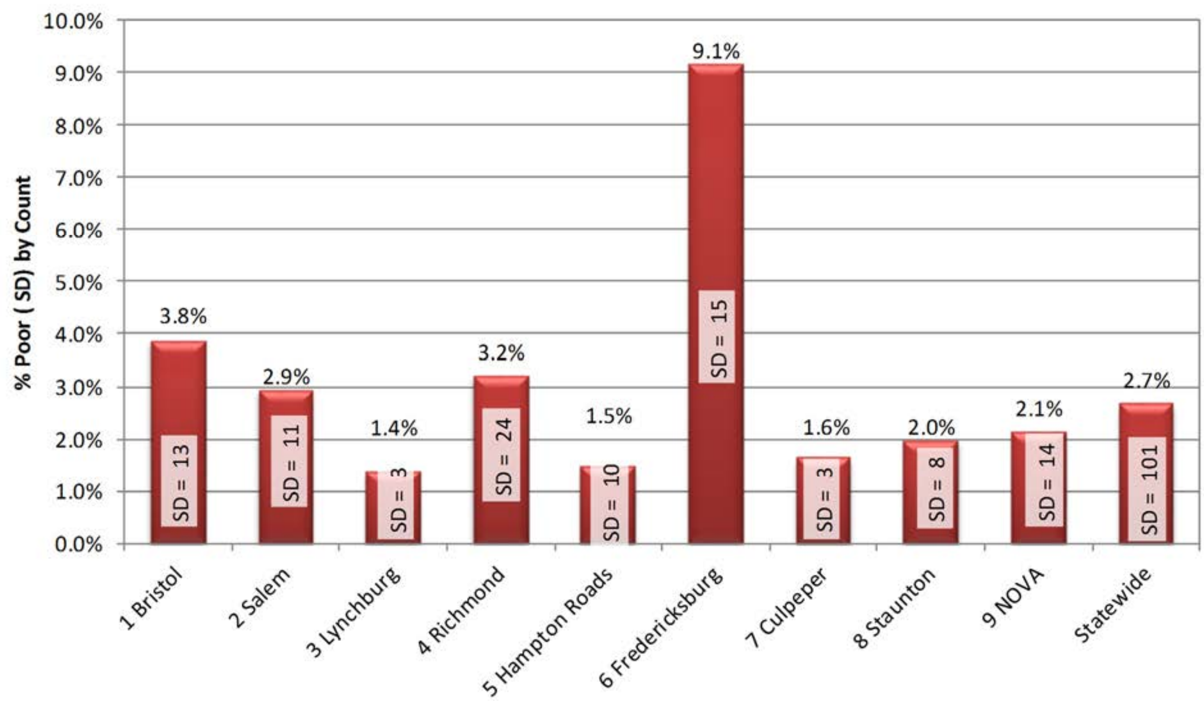


Figure 3-9- Percentage and Count of Poor (SD) NBI Structures on the NHS by District

Note: The Fredericksburg District has very few NBI structures on the NHS, so a small number of Poor (SD) structures have a very large effect on the Poor (SD) percentage.

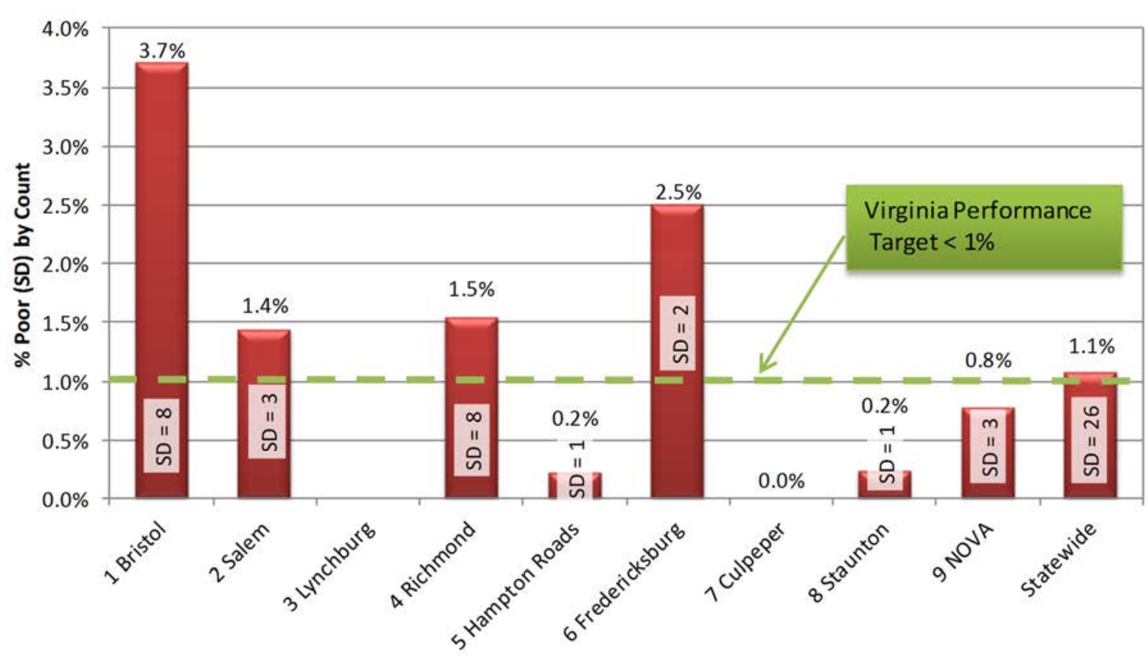


Figure 3-10- Percentage and Count of Poor (SD) Structures on Interstate System by District

Note: Districts with a smaller number of NBI structures on the NHS tend to have a larger percentage of Poor (SD) structures

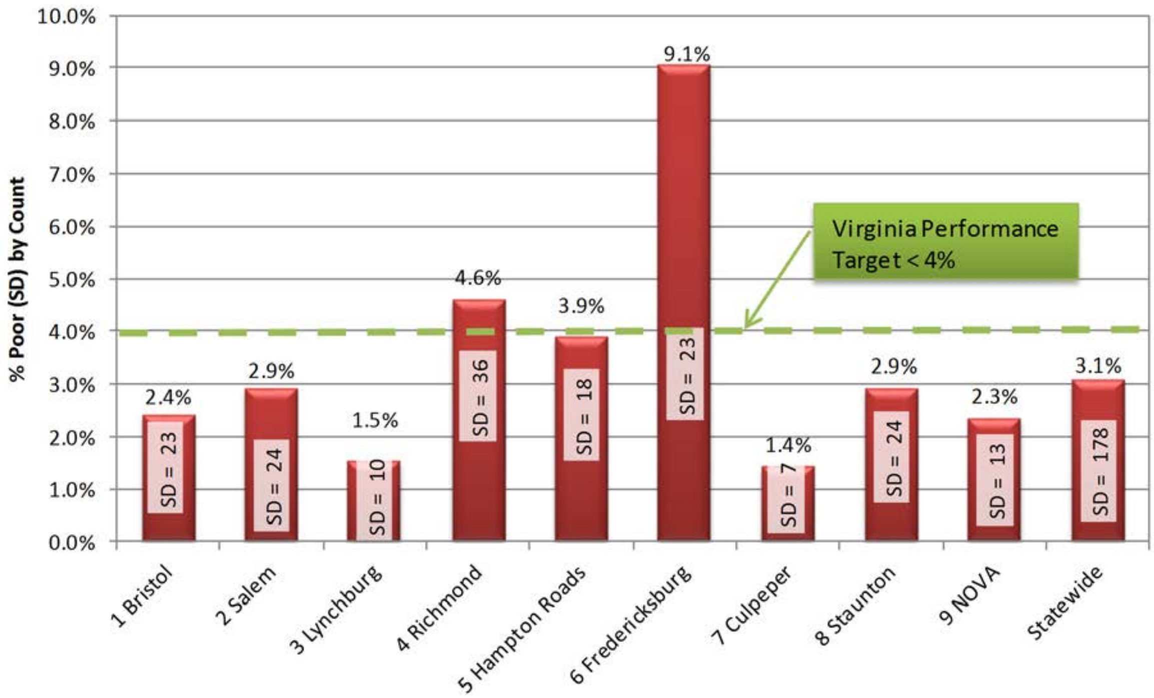


Figure 3-11- Percentage and Count of Poor (SD) Structures on Primary System by District

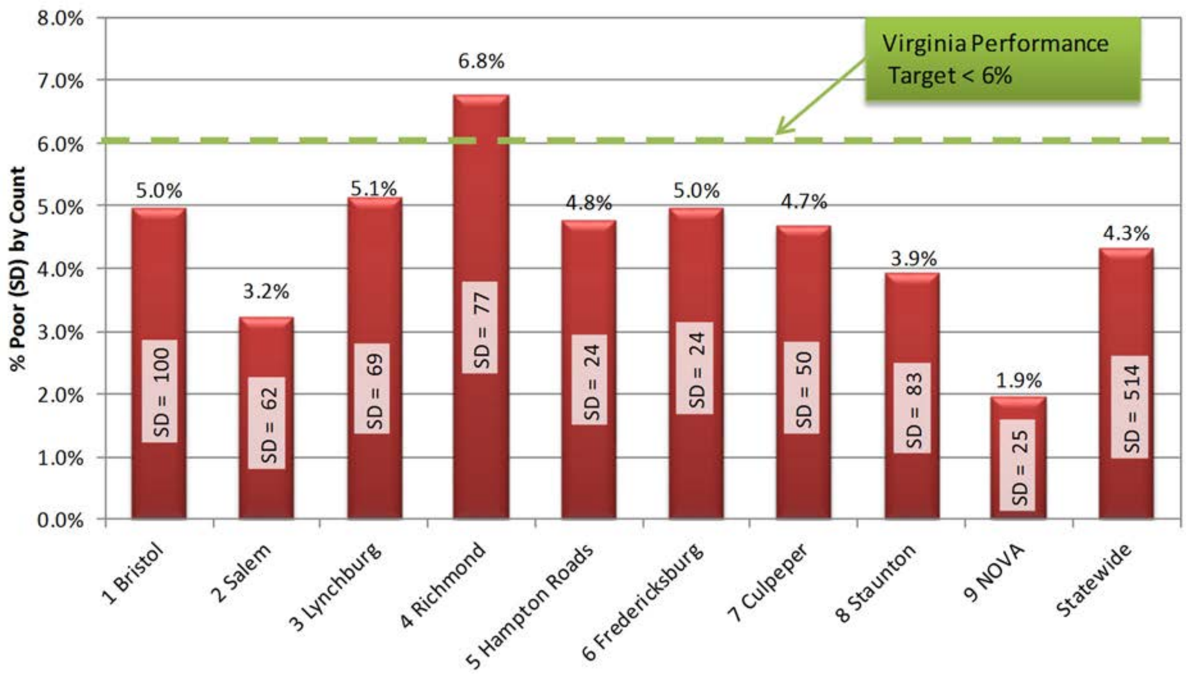


Figure 3-12- Percentage and Count of Poor (SD) Structures on Secondary System by District

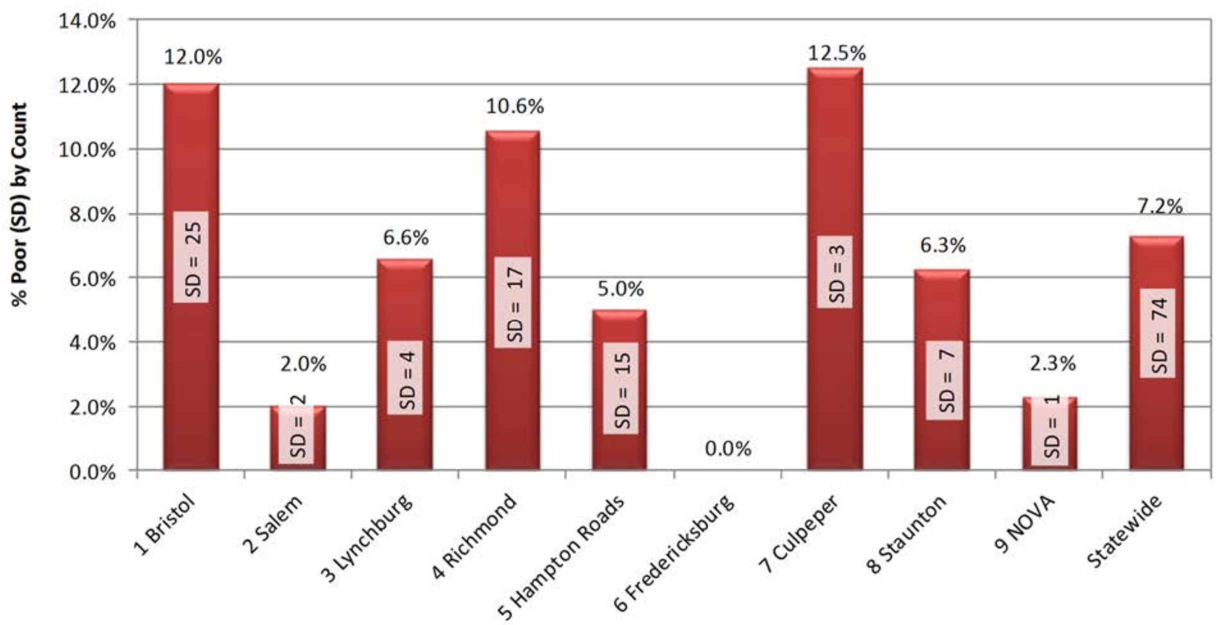


Figure 3-13- Percentage of Poor (SD) Structures on Urban System by District

3.3.1 Progress towards Federal Performance Targets

Figure 3-14 and Table 3-6 show the deck area of NBI structures on the NHS. Figure 3-15 and Table 3-7 show the Poor (SD) deck area for NBI structures on the NHS. Figure 3-15 shows that the total Poor (SD) deck area is 1,669,167 square feet, which is well below the FHWA limit of 6,954,210 square feet.

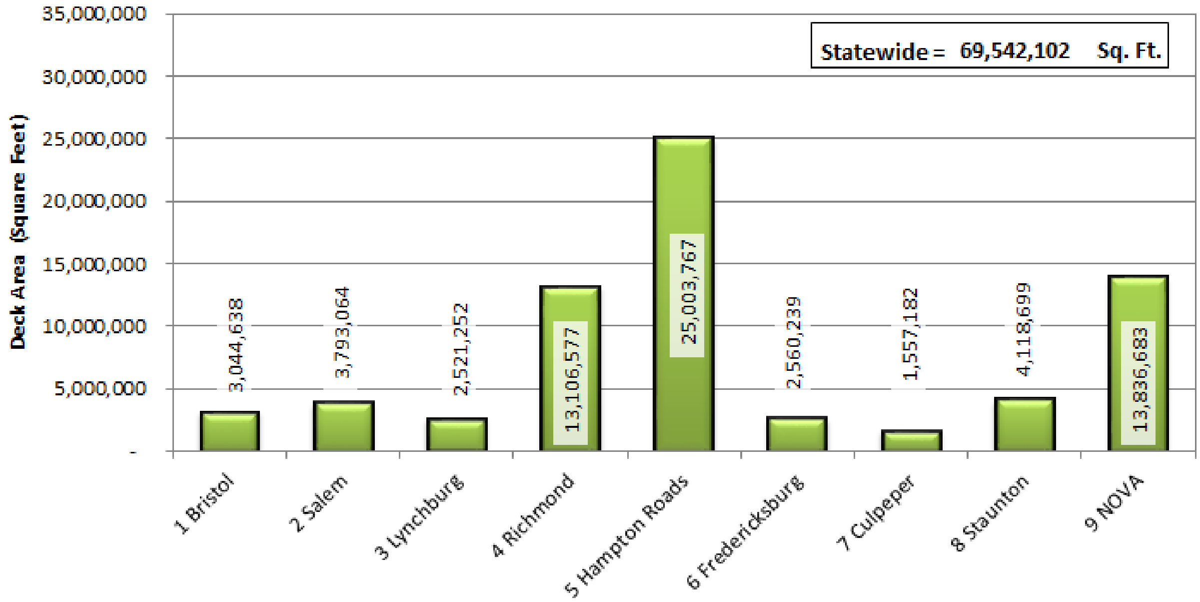


Figure 3-14- Deck Area of NBI Structures on NHS by District

Table 3-6- 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	1,517,706	1,522,595	0	4,337	3,044,638
2 Salem	1,290,319	2,466,452	1,668	34,625	3,793,064
3 Lynchburg	N/A	2,509,033	5,895	6,324	2,521,252
4 Richmond	5,723,214	6,991,692	328,312	63,360	13,106,577
5 Hampton Roads	10,548,625	12,879,213	79,424	1,496,505	25,003,767
6 Fredericksburg	430,624	2,009,704	83,228	36,683	2,560,239
7 Culpeper	815,039	705,282	29,173	7,689	1,557,182
8 Staunton	2,497,195	1,600,270	0	21,234	4,118,699
9 NOVA	8,011,880	5,305,294	519,509	0	13,836,683
Statewide	**30,834,601**	**35,989,535**	**1,047,209**	**1,670,757**	**69,542,102**

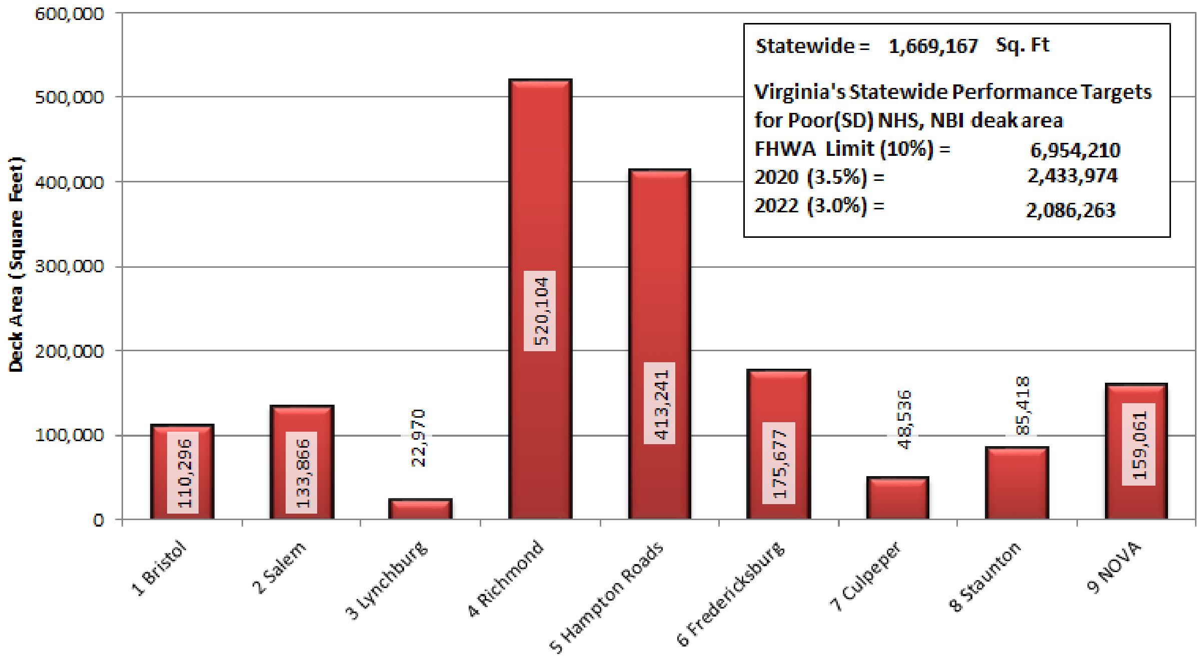


Figure 3-15- Deck Area of Poor (SD) NBI Structures on NHS by District

Table 3-7- 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				
	Interstate	Primary	Secondary	Urban	Total
1 Bristol	78,521	27,438	0	4,337	110,296
2 Salem	81,246	52,620	0	0	133,866
3 Lynchburg	N/A	22,970	0	0	22,970
4 Richmond	324,434	184,789	0	10,880	520,104
5 Hampton Roads	282,900	130,341	0	0	413,241
6 Fredericksburg	26,280	149,397	0	0	175,677
7 Culpeper	0	48,536	0	0	48,536
8 Staunton	6,798	78,620	0	0	85,418
9 NOVA	5,350	150,581	3,130	0	159,061
Statewide	**805,528**	**845,291**	**3,130**	**15,217**	**1,669,167**

3.3.2 Condition Data – Deck Area and Weight-Posted Structures

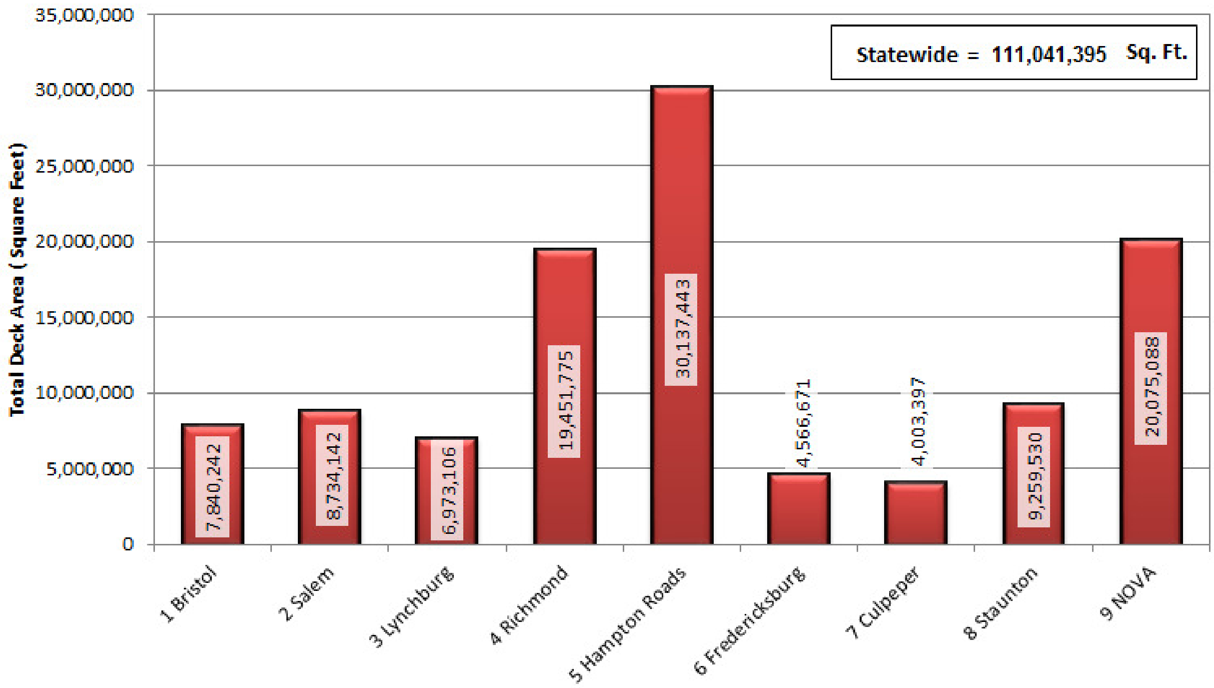


Figure 3-16- Total Deck Area of All Structures by District

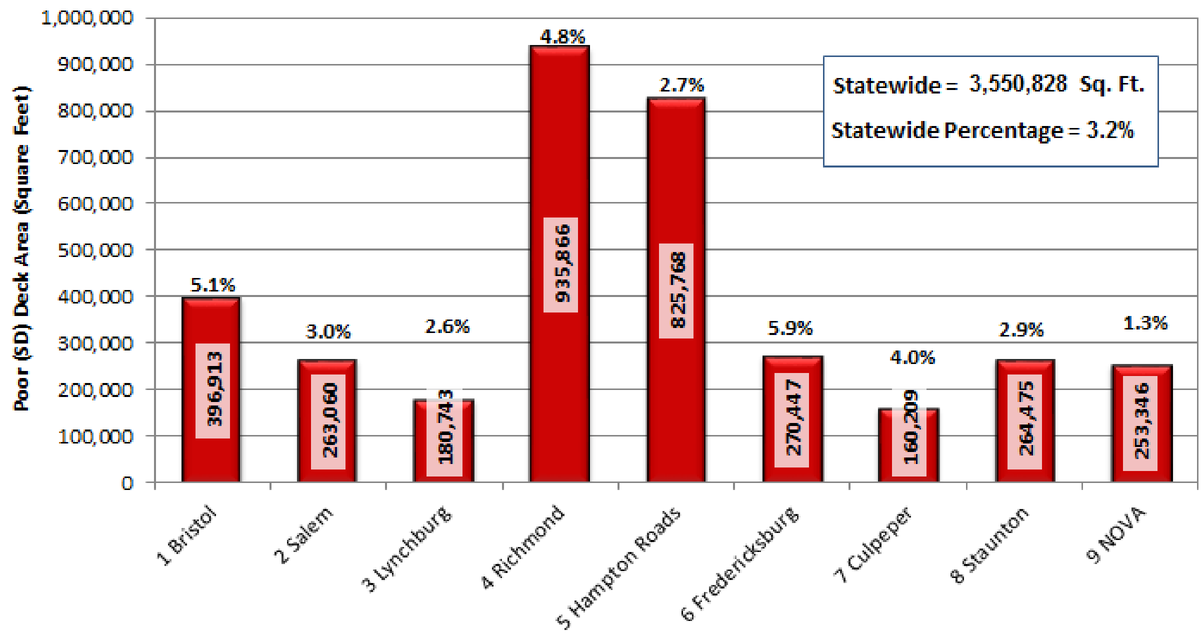


Figure 3-17- Deck Area of Poor (SD) Structures by District

Table 3-8- 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	1,586,478	3,564,948	2,379,909	308,907	7,840,242
2 Salem	1,343,293	4,170,823	2,570,395	649,631	8,734,142
3 Lynchburg	0	4,394,611	2,147,216	431,279	6,973,106
4 Richmond	5,876,348	9,058,499	3,510,897	1,006,031	19,451,775
5 Hampton Roads	10,673,675	15,340,330	1,190,491	2,932,948	30,137,443
6 Fredericksburg	450,488	2,956,700	1,103,253	56,230	4,566,671
7 Culpeper	836,739	1,495,360	1,589,139	82,160	4,003,397
8 Staunton	2,641,875	3,379,320	2,821,609	416,727	9,259,530
9 NOVA	8,155,362	6,162,275	5,457,636	299,815	20,075,088
Statewide	**31,564,257**	**50,522,867**	**22,770,544**	**6,183,728**	**111,041,395**

Table 3-9- 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	78,521	129,748	104,292	84,353	396,913
2 Salem	81,246	95,959	82,220	3,636	263,060
3 Lynchburg	0	67,773	65,936	47,034	180,743
4 Richmond	324,434	374,569	115,808	121,055	935,866
5 Hampton Roads	282,900	468,618	37,427	36,823	825,768
6 Fredericksburg	26,280	215,699	28,468	0	270,447
7 Culpeper	0	86,521	57,791	15,898	160,209
8 Staunton	6,798	125,141	102,632	29,904	264,475
9 NOVA	8,381	177,490	66,743	731	253,346
Statewide	**808,560**	**1,741,518**	**661,318**	**339,434**	**3,550,828**

Table 3-10– 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	4.9%	3.6%	4.4%	27.3%	5.1%
2 Salem	6.0%	2.3%	3.2%	0.6%	3.0%
3 Lynchburg	N/A	1.5%	3.1%	10.9%	2.6%
4 Richmond	5.5%	4.1%	3.3%	12.0%	4.8%
5 Hampton Roads	2.7%	3.1%	3.1%	1.3%	2.7%
6 Fredericksburg	5.8%	7.3%	2.6%	0.0%	5.9%
7 Culpeper	0.0%	5.8%	3.6%	19.3%	4.0%
8 Staunton	0.3%	3.7%	3.6%	7.2%	2.9%
9 NOVA	0.1%	2.9%	1.2%	0.2%	1.3%
Statewide	2.6%	3.4%	2.9%	5.5%	3.2%

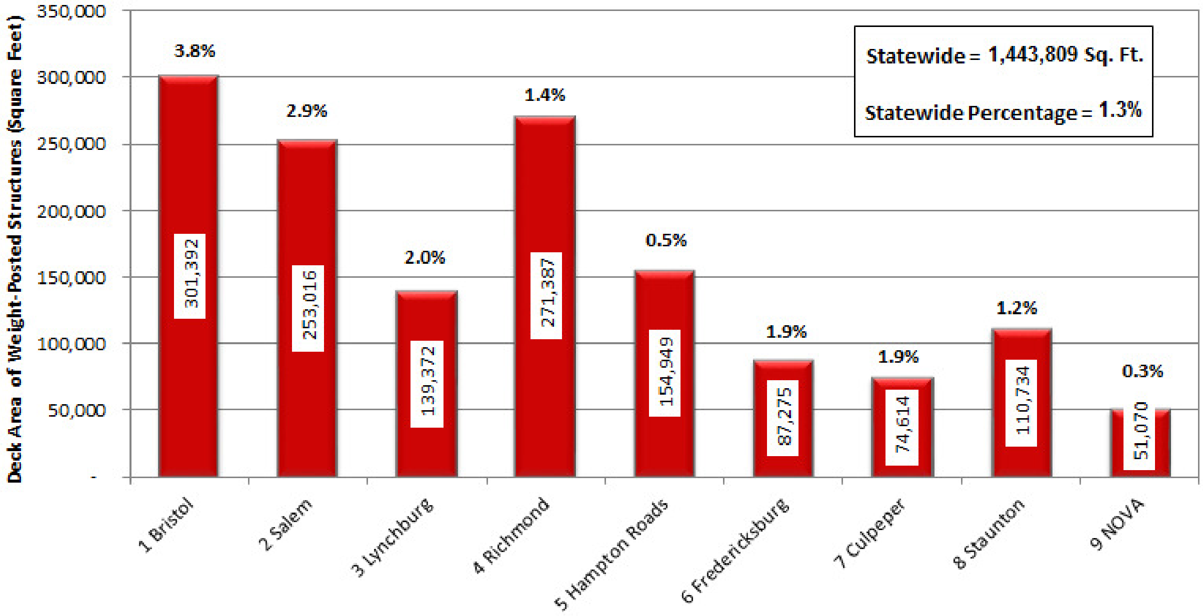


Figure 3-18- Deck Area of Weight-Posted Structures by District

Table 3-11- 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	79,576	123,869	97,947	301,392
2 Salem	0	25,204	222,156	5,656	253,016
3 Lynchburg	0	10,711	122,341	6,320	139,372
4 Richmond	0	99,814	154,865	16,708	271,387
5 Hampton Roads	0	80,111	54,161	20,678	154,949
6 Fredericksburg	0	63,228	24,046	-	87,275
7 Culpeper	0	7,380	62,242	4,992	74,614
8 Staunton	0	7,426	94,200	9,108	110,734
9 NOVA	0	998	49,341	731	51,070
Statewide	**0**	**374,449**	**907,221**	**162,139**	**1,443,809**

3.4 CURRENT CONDITIONS - ANCILLARY STRUCTURES

Conditions of ancillary structures are summarized in Table 3-12 and Figure 3-19. The condition ratings for ancillary structures has 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.

Table 3-12- Percentage and Count of Ancillary Structures by Condition Category and Structure Type

Structure Type	Condition Categories (No. of Structures)			Condition Categories		
	Good	Fair	Poor	Good	Fair	Poor
Signs	1,412	1,202	1,139	37.6%	32.0%	30.3%
Luminaires	7,593	6,128	6,282	38.0%	30.6%	31.4%
Traffic Signals	3,477	2,441	3,590	36.6%	25.7%	37.8%
High Mast Lights and Camera Poles	963	337	168	65.6%	23.0%	11.4%
Total	13,445	10,108	11,179	38.7%	29.1%	32.2%

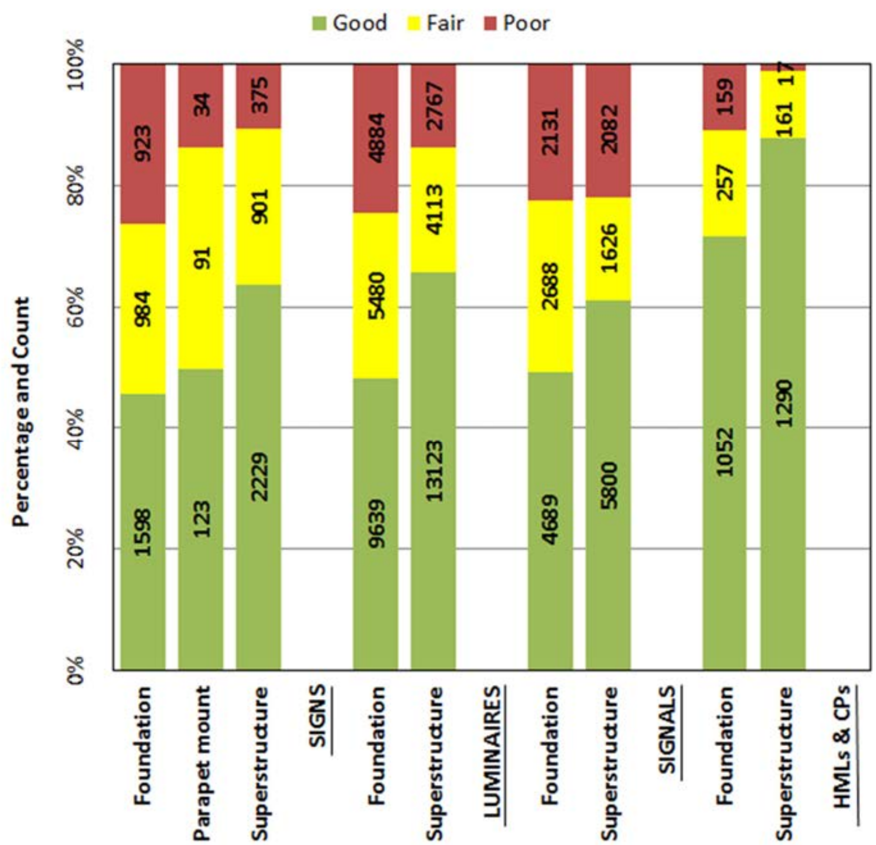


Figure 3-19- Percentage and Count of Ancillary Structures by Condition Category and Structure Type

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

3.5 CONDITION TRENDS – GENERAL

Table 3-13 and Table 3-14 show the number of Poor (SD) structures by district and the changes that occurred during FY 2019.

Table 3-13- Change in Number of Poor (SD) Structures

District	Number of Poor (SD) Structures		
	07/2018	07/2019	% Change
1 Bristol	163	156	-4.3%
2 Salem	104	91	-12.5%
3 Lynchburg	87	83	-4.6%
4 Richmond	144	138	-4.2%
5 Hampton Roads	71	58	-18.3%
6 Fredericksburg	50	49	-2.0%
7 Culpeper	64	60	-6.3%
8 Staunton	122	115	-5.7%
9 NOVA	39	42	7.7%
Statewide	**844**	**792**	**-6.2%**

Table 3-14– 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	27	20	-7
2 Salem	21	8	-13
3 Lynchburg	25	21	-4
4 Richmond	29	23	-6
5 Hampton Roads	20	7	-13
6 Fredericksburg	10	9	-1
7 Culpeper	12	8	-4
8 Staunton	18	11	-7
9 NOVA	9	12	3
Statewide	**171**	**119**	**-52**

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

Figure 3-20 through Figure 3-24 provide the percentage and total number of Poor (SD) structures for each of the Virginia Highway Systems for the last ten years. The red lines indicate the percentage of structures that are Poor (SD) and the blue bars show the number of Poor (SD) structures.

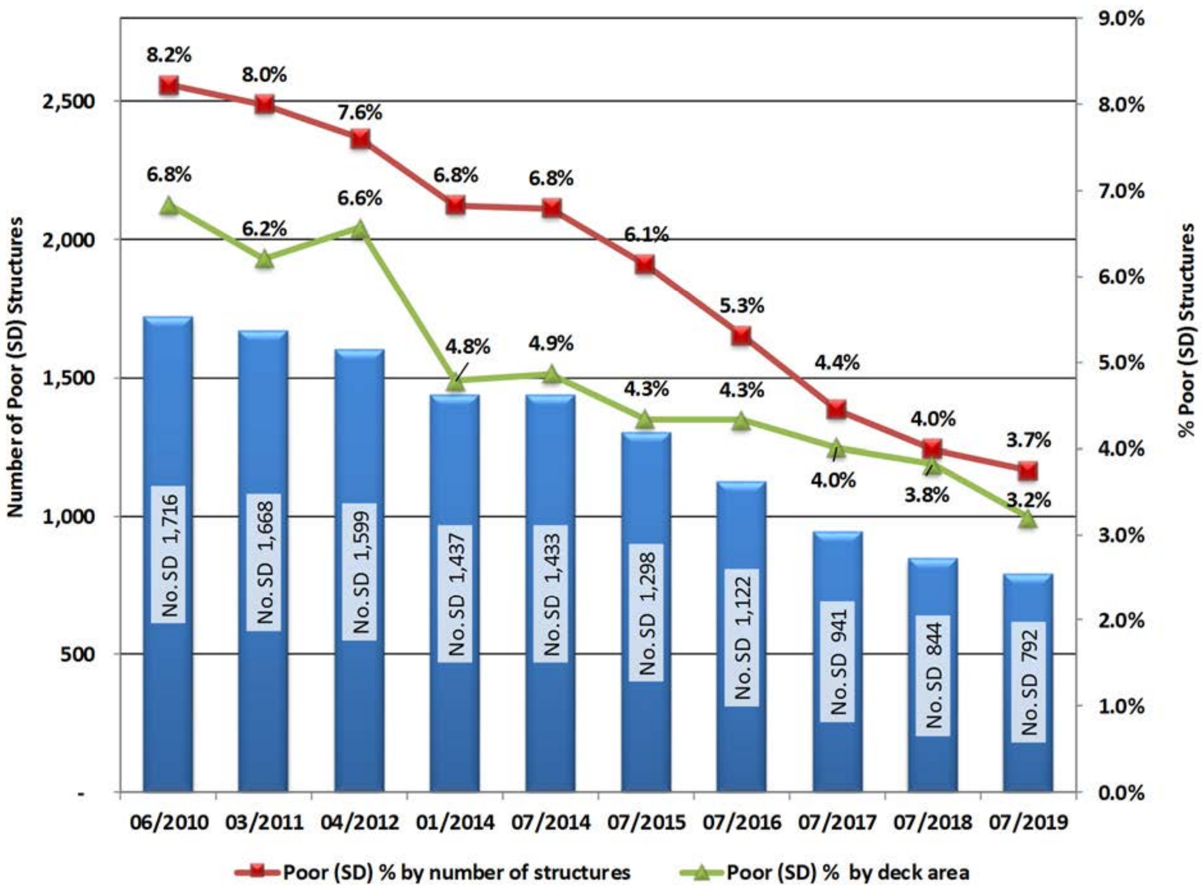


Figure 3-20- Percentage of Poor (SD) Structures - Recent Trends on All Systems by Year

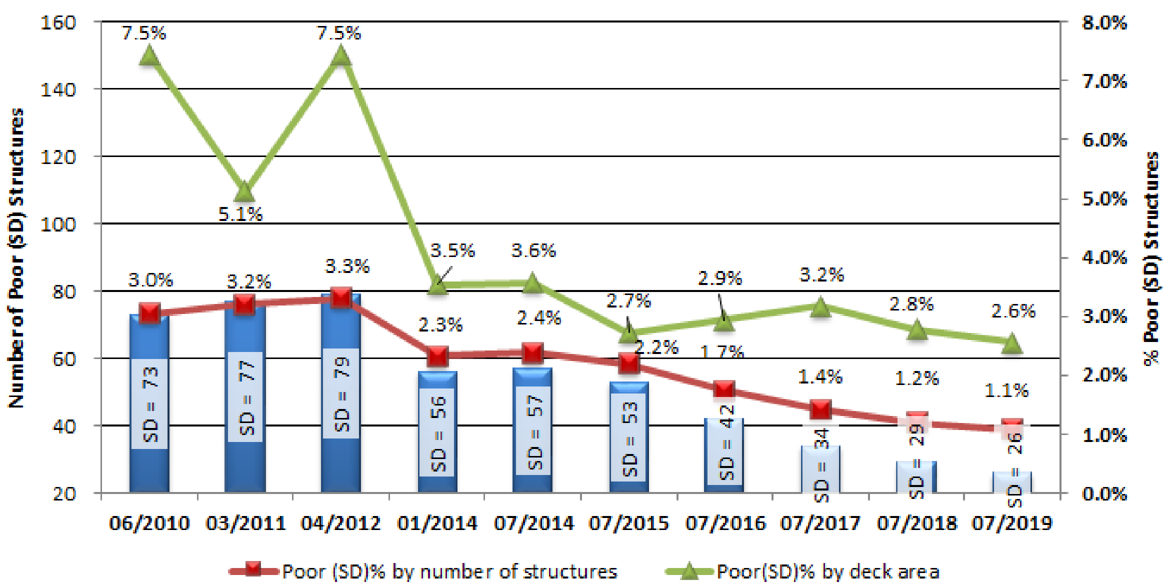


Figure 3-21- Percentage of Poor (SD) Structures - Recent Trends for Interstate System by Year

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.

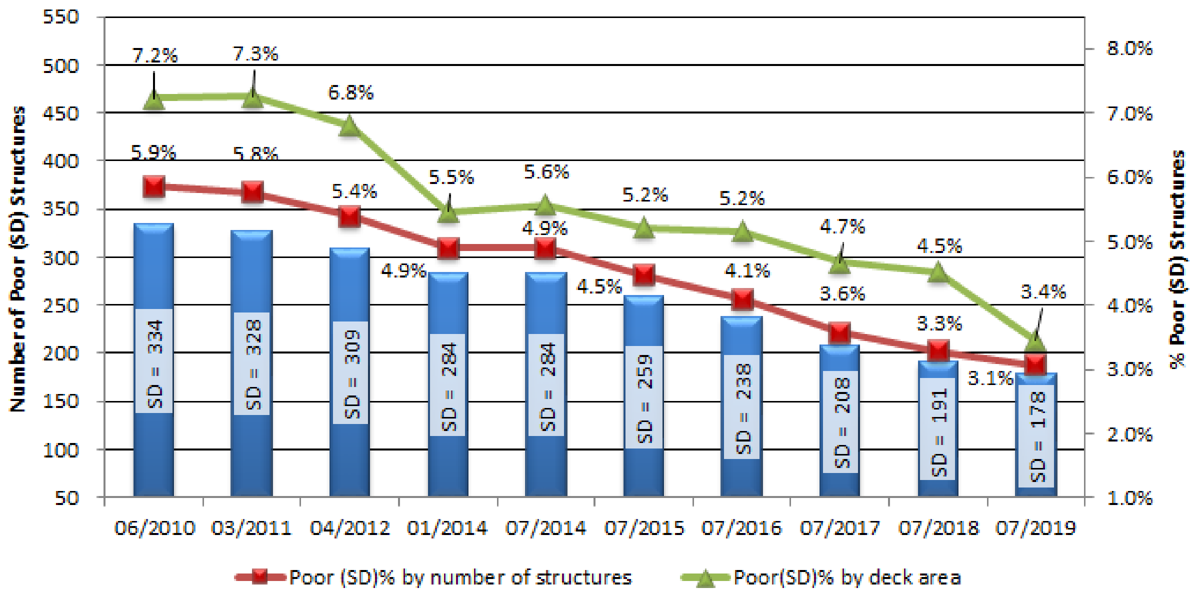


Figure 3-22- Percentage of Poor (SD) Structures - Recent Trends for Primary System by Year

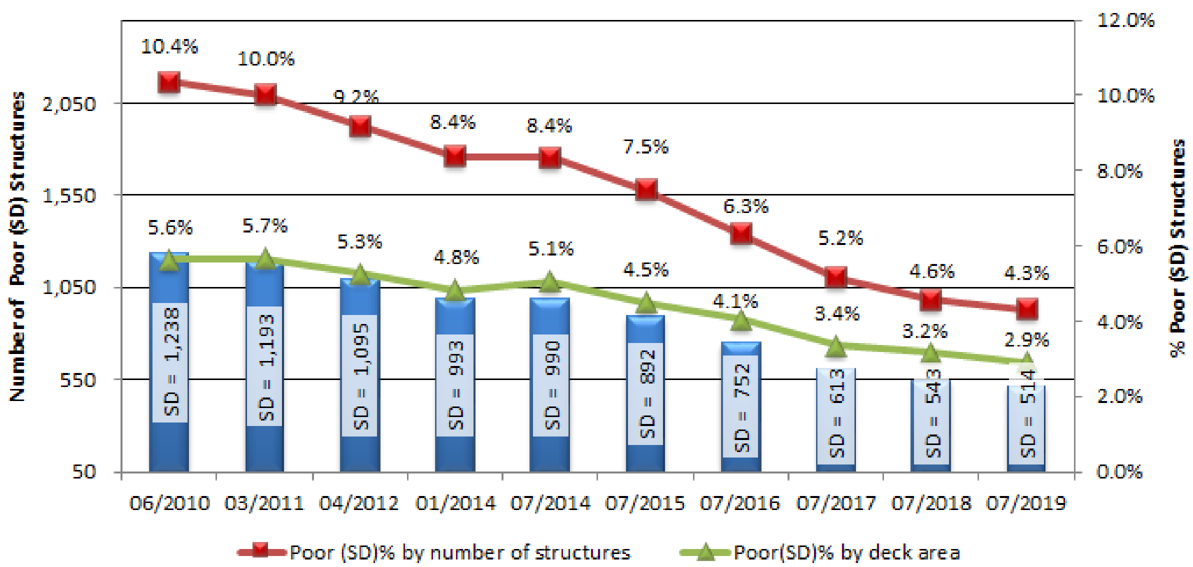


Figure 3-23- Percentage of Poor (SD) Structures - Recent Trends for Secondary System by Year

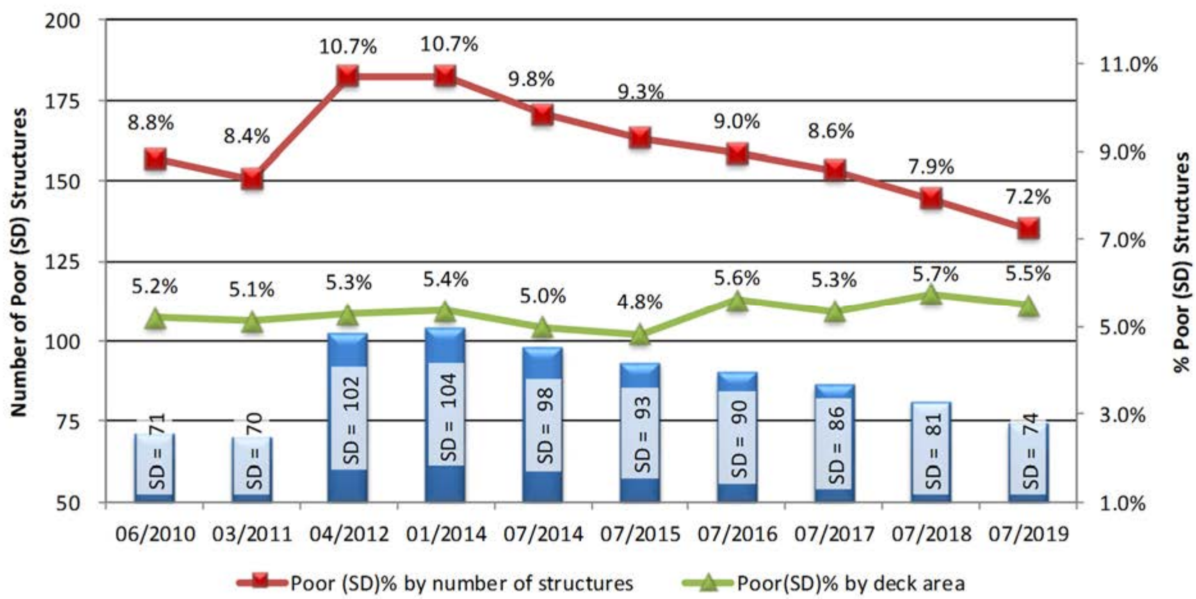
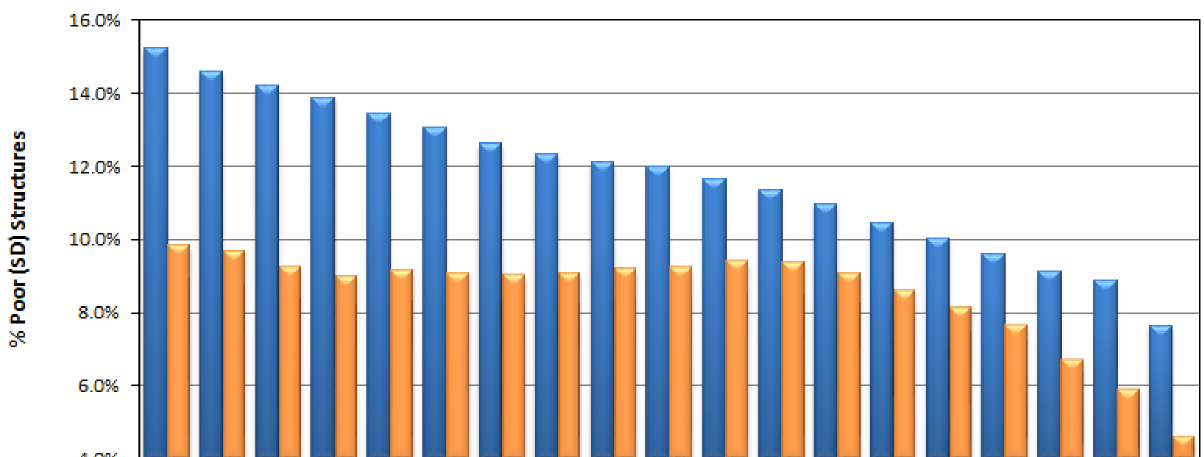


Figure 3-24- Percentage of Poor (SD) Structures - Recent Trends for Urban System by Year

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 3-25 compares the percentage of Poor (SD) NBI structures in Virginia vs. the nation as a whole from 2000 to 2018.



	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%
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%

Figure 3-25- Comparing Virginia's NBI Poor (SD) Structures to the National Average by Year

Note: Data in the figure are from FHWA's database, which includes both Virginia Responsible Structures and Federally Responsible Structures which, along with different reporting dates results in slight differences from the information reported elsewhere in this report. The data is submitted by all states and federal agencies to FHWA in March of each year. FHWA then publishes combined "cleared" state and federal responsible structures for each state in June of the same year. FHWA then issues final data in December of each year.

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 operators 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	6	35
Lynchburg	4	28
Richmond	4	31
Hampton Roads	4	29
Fredericksburg	2	16
Culpeper	4	26
Staunton	5	36
NOVA	3	22
Statewide	**38**	**259**

Table 4-3- FY2019 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.	No. SD	No.	No. SD	No.	No. SD
1 Bristol	980	186	40	1	27	27	1,233	28
2 Salem	820	193	26	7	1	1	1,040	8
3 Lynchburg	NA	NA	4	4	5	5	11	11
4 Richmond	233	32	20	5	1	1	286	6
5 H. Roads	218	73	21	9	16	7	328	16
6 F'burg	53	65	13	5	7	3	138	8
7 Culpeper	300	NA	8	NA	5	NA	313	NA
8 Staunton	0	116	65	4	64	7	245	11
9 NOVA	471	58	2	1	2	2	529	3
Statewide	**3,075**	**723**	**199**	**36**	**128**	**53**	**4,123**	**91**

** "No. SD" is number of Poor (SD) structures*

Note: "NA" indicates Not Available

4.1.2 Contracts

In addition to using state-force bridge crews, VDOT partners with private industry to deliver its bridge maintenance program. There are several types of contracts that VDOT's districts employ 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. 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 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 and Ancillary Structure 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 is the first to rely 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."

Inspection Program Delivery and Costs: The structure safety inspection program provides the data for most of Virginia's maintenance and bridge management decisions. In FY2019, VDOT inspected 10,005 bridges and culverts at an expense of $33.5 million, utilizing in-house inspection staff and consultant contracts. Also, VDOT inspected 5,472 ancillary structures at an expense of $6.2 million.

VDOT also uses consultants to perform inspections on ancillary structures. There are a total of 23 consultant contracts: 18 for bridge and large culvert inspection; two for ancillary inspection, one statewide underwater inspection contract; and two 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 collect and record detailed structural element data, which are used in the operation of its Bridge Management System (BMS). The BMS information is used to determine current and future maintenance and preservation needs of the structures.

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 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 FY2019

District	Number of Inspections						
	Bridges		Large Culverts		Ancillary		Total No. Structures
	No.	Percentage	No.	Percentage	No.	Percentage	
1 Bristol	1,258	18%	320	11%	40	1%	1,618
2 Salem	609	8%	263	9%	306	6%	1,178
3 Lynchburg	244	3%	200	7%	22	0%	466
4 Richmond	497	7%	141	5%	256	5%	894
5 Hampton Roads	737	10%	268	9%	838	15%	1,843
6 Fredericksburg	589	8%	444	16%	643	12%	1,676
7 Culpeper	829	12%	379	13%	-	0%	1,208
8 Staunton	1,138	16%	426	15%	115	2%	1,679
9 NOVA	1,271	18%	392	14%	3,252	59%	4,915
Total	**7,172**	**100%**	**2,833**	**100%**	**5,472**	**100%**	**15,477**

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 'Dive Safety Manual'.*

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 FY2019. 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 eight structures during this time period.

FHWA conducted its annual NBIS compliance review from September 24, 2018 to November 19, 2018, with a draft report provided on December 7, 2018. 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 PY2018 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 PY2018 having been completed two months outside of the prescribed interval. VDOT was also 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. VDOT is establishing a QA/QC program for ancillary structures and tunnels similar to the one currently in place for bridge and large culvert inspections.

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. Policies and procedures for tunnel inspection, including specific inspection manuals for each tunnel, are being developed. Tunnel inspections were performed for seven tunnels in FY2019. Two consultant contracts for tunnel engineering have been used to perform tunnel inspections for VDOT maintained tunnels.

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 in 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 bridge 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.

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 240 bridges 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 (milling only) starting in the 1970s
- Epoxy deck overlays starting in the 1970s
- Three coat zinc-based paint in 1982
- Mechanically Stabilized Earth (MSE) walls in 1990
- High Performance Concrete in all bridge elements in 2003
- High Performance weathering steel in 2005
- Corrosion resistant reinforcement in 2009
- Jointless bridge technology for new bridges in 2011
- Virginia abutment used with tooth joints in 2012
- Self-consolidating concrete for drilled shafts in 2013
- Virginia pier used with tooth joints in 2014
- Latex modified concrete overlays (the addition of hydrodemolition to milling) in 2016
- Low-shrinkage, low-cracking, concrete in decks in 2016
- Engineered cementitious composites (ECC) for shear keys in 2016

- Virginia Adjacent Member Connection (VAMC) for prestressed concrete voided slabs and box beams in 2016
- Self-consolidating concrete for substructure surface repairs in 2016
- Carbon fiber prestressing strands in prestressed concrete piles in 2017
- Stainless steel prestressing strands in concrete piles in 2017
- Flexible Concrete Plug Joints in 2017*
- Engineered cementitious composites (ECC) for culvert liners in 2018*
- Corrosion-resistant structural steel (ASTM A709, Grade 50CR) in 2018*
- Very High Performance Concrete (VHPC) in 2018*

** The year of substantial implementation nearing full implemenation*

In the near future, the Structure and Bridge Division will be placing greater emphasis on the materials and actions 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
- 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

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 on Virginia Responsible Structures

Additional inventory information on Virginia Responsible Structures:

- Table A-1 through Table A-8 and Figure A-1 through Figure A-4 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-4 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	552	1,550	191	2,429
2 Salem	111	491	1,342	75	2,019
3 Lynchburg	0	365	795	43	1,203
4 Richmond	281	493	680	99	1,553
5 Hampton Roads	337	350	308	221	1,216
6 Fredericksburg	23	143	224	6	396
7 Culpeper	70	259	680	12	1,021
8 Staunton	206	505	1,354	66	2,131
9 NOVA	267	347	569	16	1,199
Statewide	**1,431**	**3,505**	**7,502**	**729**	**13,167**

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

District	Number of Large Culverts				
	Interstate	Primary	Secondary	Urban	Total
1 Bristol	80	404	466	17	967
2 Salem	98	333	594	27	1,052
3 Lynchburg	0	293	555	18	866
4 Richmond	239	293	460	62	1,054
5 Hampton Roads	121	115	195	81	512
6 Fredericksburg	57	111	260	1	429
7 Culpeper	50	236	390	12	688
8 Staunton	225	322	767	46	1,360
9 NOVA	121	209	720	28	1,078
Statewide	**991**	**2,316**	**4,407**	**292**	**8,006**

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

District	Number of Bridges				
	Interstate	Primary	Secondary	Urban	Total
1 Bristol	136	425	985	188	1,734
2 Salem	111	373	899	73	1,456
3 Lynchburg	0	324	648	43	1,015
4 Richmond	278	462	619	98	1,457
5 Hampton Roads	336	342	279	220	1,177
6 Fredericksburg	23	135	202	6	366
7 Culpeper	70	171	521	11	773
8 Staunton	206	371	809	65	1,451
9 NOVA	267	309	461	16	1,053
Statewide	**1,427**	**2,912**	**5,423**	**720**	**10,482**

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	129	17	275
2 Salem	27	83	242	22	374
3 Lynchburg	0	84	222	18	324
4 Richmond	86	120	250	61	517
5 Hampton Roads	40	39	93	77	249
6 Fredericksburg	22	42	113	1	178
7 Culpeper	14	73	176	8	271
8 Staunton	48	84	242	42	416
9 NOVA	29	98	354	27	508
Statewide	**294**	**724**	**1,821**	**273**	**3,112**

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

District	Number of Bridges				
	Interstate	Primary	Secondary	Urban	Total
1 Bristol	0	127	565	3	695
2 Salem	0	118	443	2	563
3 Lynchburg	0	41	147	0	188
4 Richmond	3	31	61	1	96
5 Hampton Roads	1	8	29	1	39
6 Fredericksburg	0	8	22	0	30
7 Culpeper	0	88	159	1	248
8 Staunton	0	134	545	1	680
9 NOVA	0	38	108	0	146
Statewide	**4**	**593**	**2,079**	**9**	**2,685**

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	303	337	0	692
2 Salem	71	250	352	5	678
3 Lynchburg	0	209	333	0	542
4 Richmond	153	173	210	1	537
5 Hampton Roads	81	76	102	4	263
6 Fredericksburg	35	69	147	0	251
7 Culpeper	36	163	214	4	417
8 Staunton	177	238	525	4	944
9 NOVA	92	111	366	1	570
Statewide	**697**	**1,592**	**2,586**	**19**	**4,894**

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

District	Number of Bridges				
	Interstate	Primary	Secondary	Urban	Total
1 Bristol	135	136	0	1	272
2 Salem	111	199	2	2	314
3 Lynchburg	0	172	1	1	174
4 Richmond	276	286	14	7	583
5 Hampton Roads	334	212	3	72	621
6 Fredericksburg	23	85	4	2	114
7 Culpeper	70	57	1	1	129
8 Staunton	204	132	0	1	337
9 NOVA	264	260	32	0	556
Statewide	**1,417**	**1,539**	**57**	**87**	**3,100**

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	0	66
2 Salem	26	36	0	0	62
3 Lynchburg	0	45	2	0	47
4 Richmond	83	79	2	2	166
5 Hampton Roads	37	25	0	6	68
6 Fredericksburg	22	27	1	0	50
7 Culpeper	13	38	1	2	54
8 Staunton	46	23	0	1	70
9 NOVA	29	70	3	0	102
Statewide	**284**	**381**	**9**	**11**	**685**

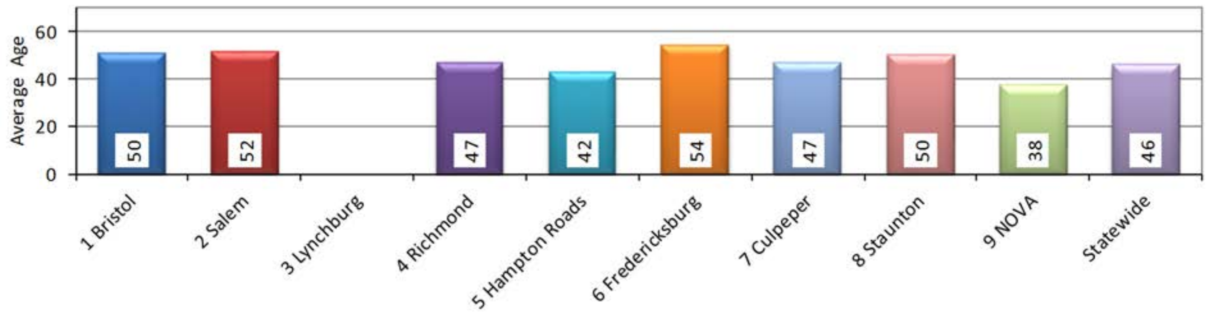


Figure A-1- Average Age of Interstate Structures by District

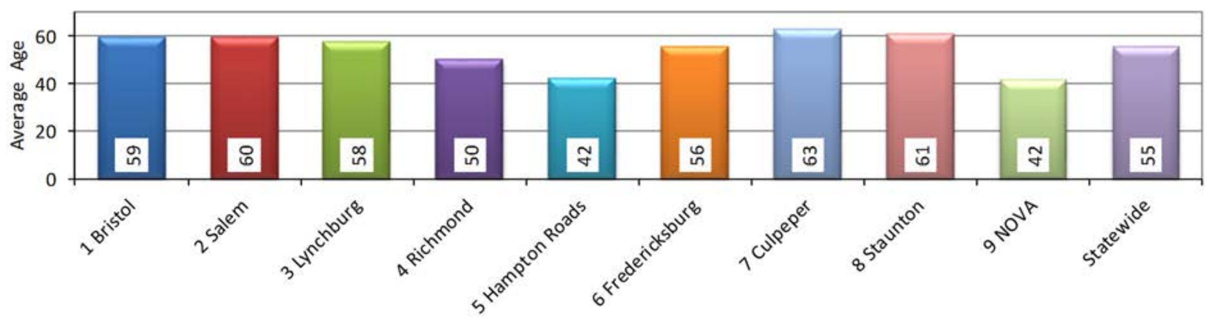


Figure A-2- Average Age of Primary Structures by District

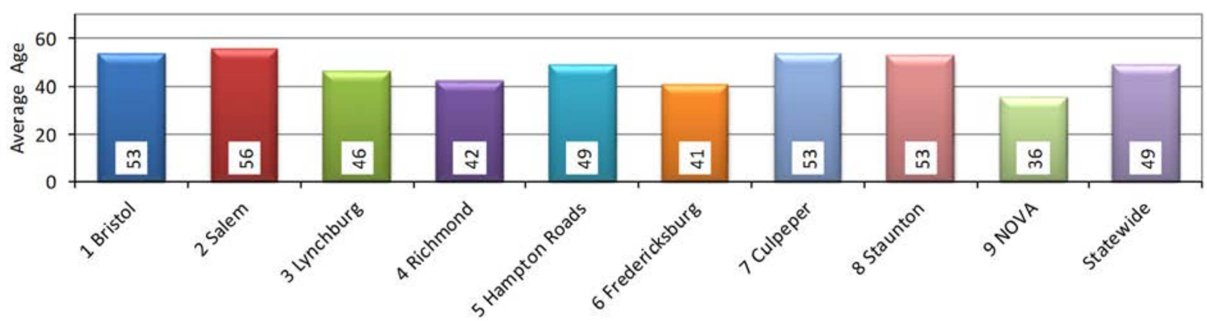


Figure A-3 - Average Age of Secondary Structures by District

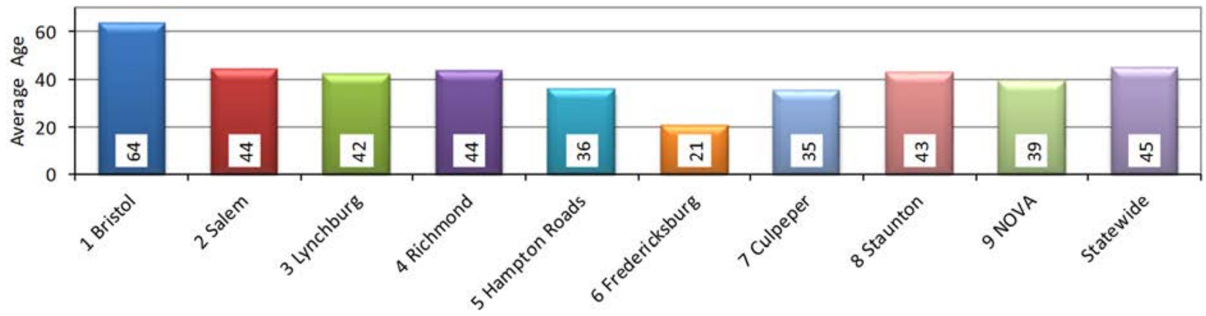


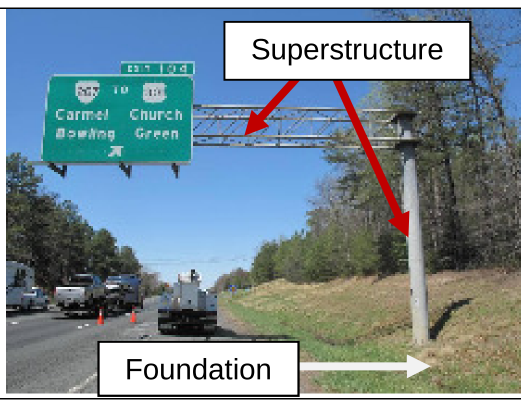
Figure A-4 - Average Age of Urban Structures by District

APPENDIX B – ADDITIONAL INVENTORY INFORMATION ON ANCILLARY STRUCTURES

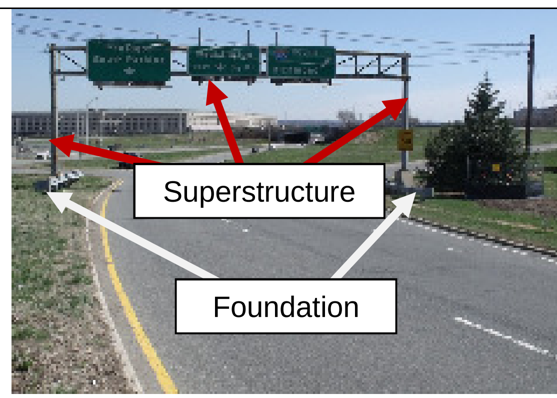
Table B-1 through Table B-4 provide information for the subcategories of each type of ancillary structure. Typical examples of each type of ancillary structure are also shown.

Table B-1- Number of Sign Structures by District

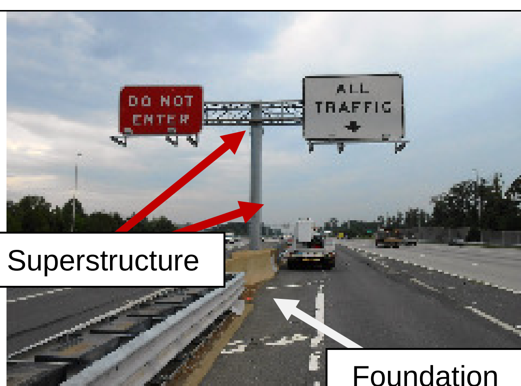
District	Structure Type					Percentage of Total Inventory
	Cantilever	Overhead	Parapet Mount	Butterfly	Total	
1 Bristol	22	37	1	10	70	1.9%
2 Salem	97	87	-	94	278	7.4%
3 Lynchburg	7	60	-	5	72	1.9%
4 Richmond	393	327	125	1	846	22.5%
5 Hampton Roads	398	413	80	59	950	25.3%
6 Fredericksburg	67	32	-	1	100	2.7%
7 Culpeper	9	21	10	5	45	1.2%
8 Staunton	22	39	14	22	97	2.6%
9 Northern Virginia	631	579	18	67	1,295	34.5%
Total	1,646	1,595	248	264	3,753	100.0%



Cantilever Sign Structure



Overhead Sign Structure



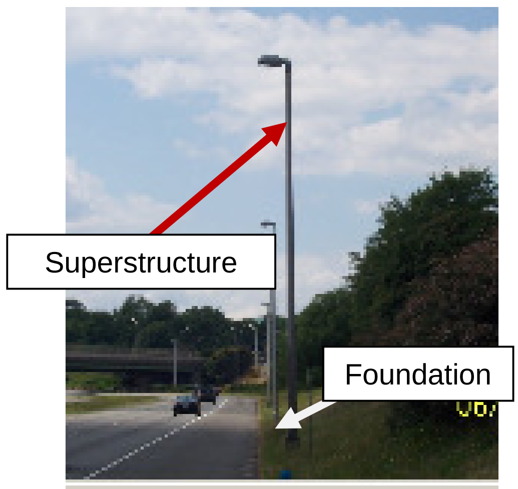
Butterfly Sign Structure

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

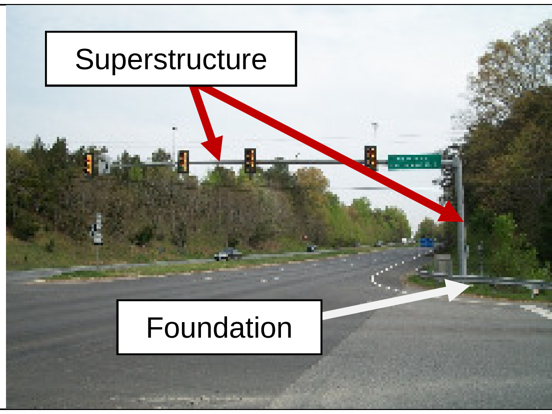
District	Structure Type	Percentage of Total Inventory
	Luminaire	
1 Bristol	462	2.3%
2 Salem	952	4.8%
3 Lynchburg	302	1.5%
4 Richmond	2,077	10.4%
5 Hampton Roads	6,828	34.1%
6 Fredericksburg	642	3.2%
7 Culpeper	157	0.8%
8 Staunton	282	1.4%
9 Northern Virginia	8,301	41.5%
Total	20,003	100.0%



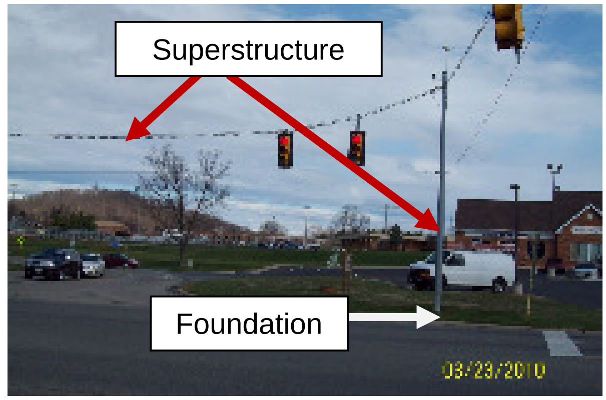
Luminaire Structure

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

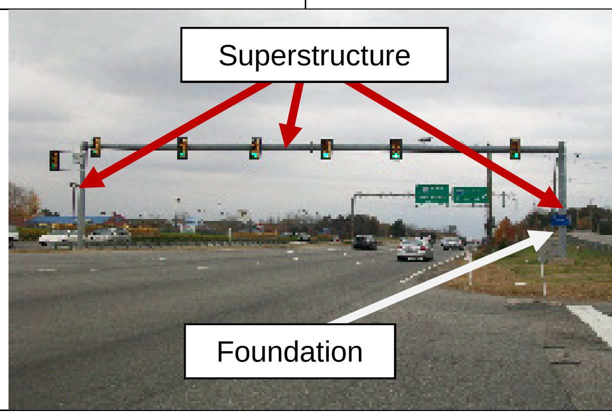
District	Structure Type				Percentage of Total Inventory
	Overhead Span	Mast Arm	Span Wire	Total	
1 Bristol	-	231	16	247	2.6%
2 Salem	-	527	19	546	5.7%
3 Lynchburg	-	309	10	319	3.4%
4 Richmond	-	1,297	278	1,575	16.6%
5 Hampton Roads	-	467	51	518	5.4%
6 Fredericksburg	1	751	8	760	8.0%
7 Culpeper	-	359	8	367	3.9%
8 Staunton	-	540	49	589	6.2%
9 Northern Virginia	2	3,776	809	4,587	48.2%
Total	3	8,257	1,248	9,508	100.0%



Cantilevered Mast Arm Traffic Signal Structure



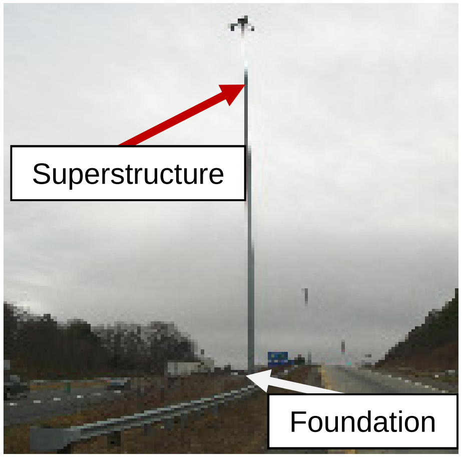
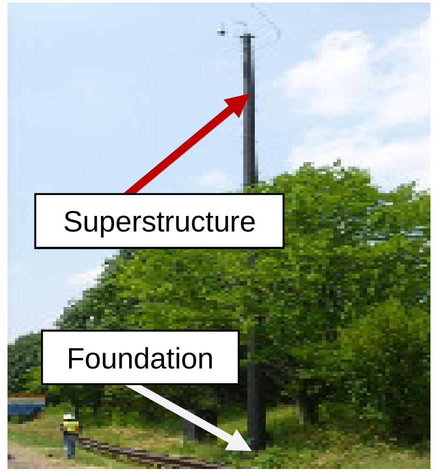
Span Wire Traffic Signal Structure



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	105	55	160	10.9%
5 Hampton Roads	145	256	401	27.3%
6 Fredericksburg	1	59	60	4.1%
7 Culpeper	-	10	10	0.7%
8 Staunton	21	66	87	5.9%
9 Northern Virginia	331	326	657	44.8%
Total	692	776	1,468	100.0%

	
High Mast Light Structure	**Camera Pole Structure**

APPENDIX C – ADDITIONAL INVENTORY AND CONDITION INFORMATION FOR STRUCTURES

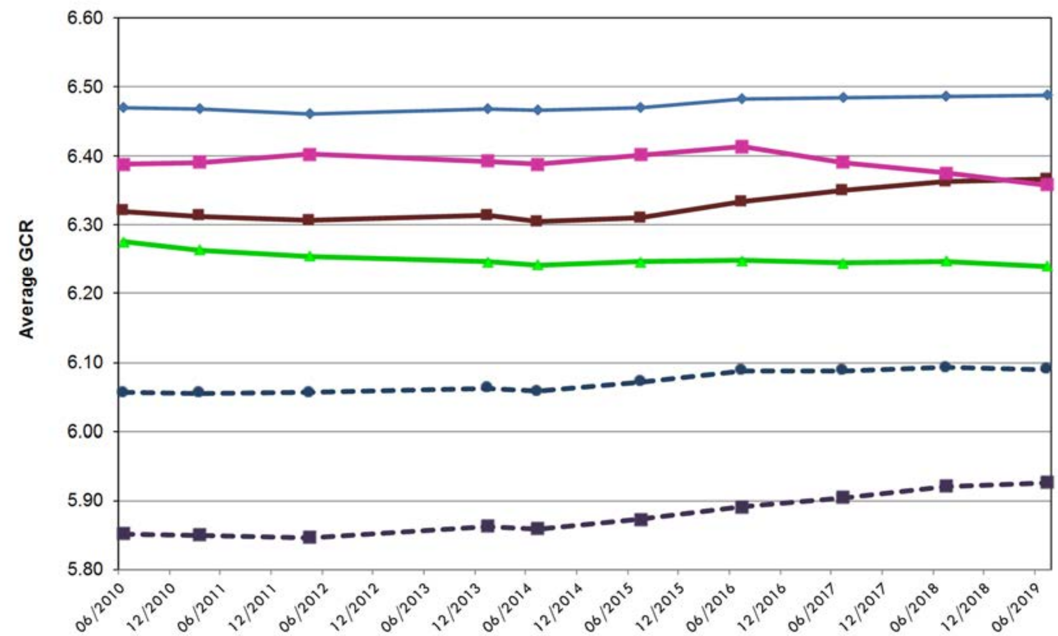
In Table C-1 the "Bridge Min GCR" is the minimum GCR among the three major components that define a bridge (deck, superstructure, and substructure). The "Min GCR" is based on all four of the major components and thus includes the large culvert component.

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	2	35	523	649	208	14	0	0	6.25
	Superstructure	1	72	379	563	398	18	0	0	6.06
	Substructure	0	31	336	633	427	4	0	0	5.97
	Bridge Min GCR	0	20	220	568	599	24	0	0	5.73
	Large Culvert	1	10	221	614	143	2	0	0	6.10
	Min GCR	1	30	441	1,182	742	26	0	0	5.88
Primary	Deck	25	135	1,299	1,278	695	63	3	0	6.23
	Superstructure	31	326	1,078	1,142	808	116	3	1	6.22
	Substructure	21	128	1,202	1,379	719	56	0	0	6.20
	Bridge Min GCR	18	63	804	1,332	1,125	158	4	1	5.86
	Large Culvert	4	67	677	1,195	358	14	1	0	6.19
	Min GCR	22	130	1,481	2,527	1,483	172	5	1	5.99
Secondary	Deck	167	1,242	3,104	1,928	938	97	1	1	6.66
	Superstructure	157	1,453	2,413	1,745	1,424	292	15	1	6.50
	Substructure	42	558	2,673	2,731	1,350	143	2	2	6.30
	Bridge Min GCR	37	352	2,067	2,522	2,118	387	17	2	5.99
	Large Culvert	77	542	1,688	1,411	581	105	3	0	6.50
	Min GCR	114	894	3,755	3,933	2,699	492	20	2	6.18
Urban	Deck	15	45	307	220	110	24	3	1	6.37
	Superstructure	20	67	276	185	130	45	3	3	6.31
	Substructure	15	52	282	231	123	24	2	0	6.35
	Bridge Min GCR	11	19	232	211	186	62	5	3	5.95
	Large Culvert	0	21	131	104	32	4	0	0	6.46
	Min GCR	11	40	363	315	218	66	5	3	6.10
All	Deck*	209	1,457	5,233	4,075	1,951	198	7	2	6.49
	Superstructure*	209	1,918	4,146	3,635	2,760	471	21	5	6.37
	Substructure*	78	769	4,493	4,974	2,619	227	4	2	6.24
	Bridge Min GCR	66	454	3,323	4,633	4,028	631	26	6	5.93
	Large Culvert	82	640	2,717	3,324	1,114	125	4	0	6.36
	Min GCR	148	1,094	6,040	7,957	5,142	756	30	6	6.09

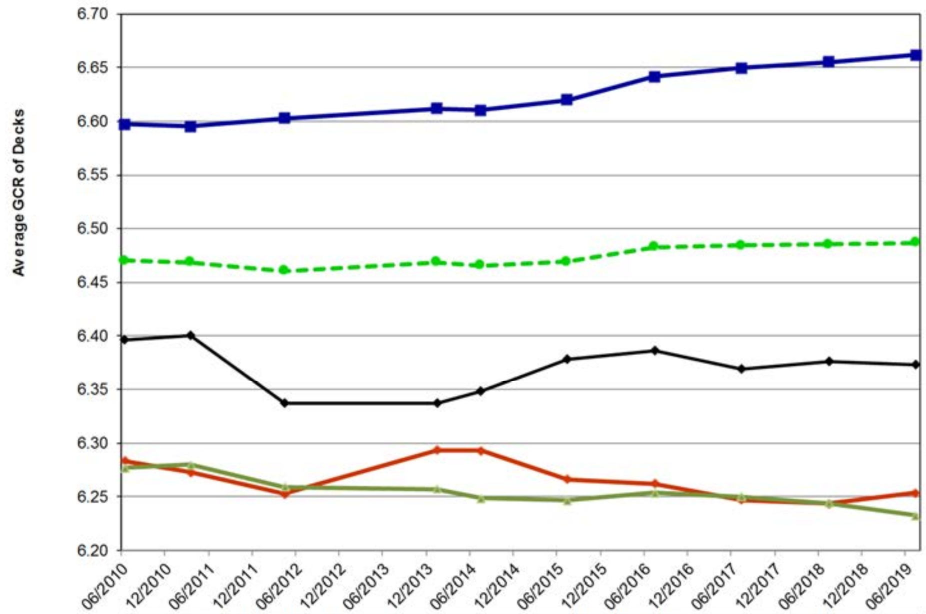
** A small number of bridges have particular configurations so that they don't have all the major components. Accordingly, there is a small difference in the total number of deck, superstructure, and substructure components.*

Trend lines showing the average general condition ratings of rated components are provided in Figure C-1 through Figure C-4 . For Figure C-1 the “Br Min” only includes the minimum condition ratings of bridges while the “Str Min” includes the minimum condition ratings for both bridges and large culvert components.



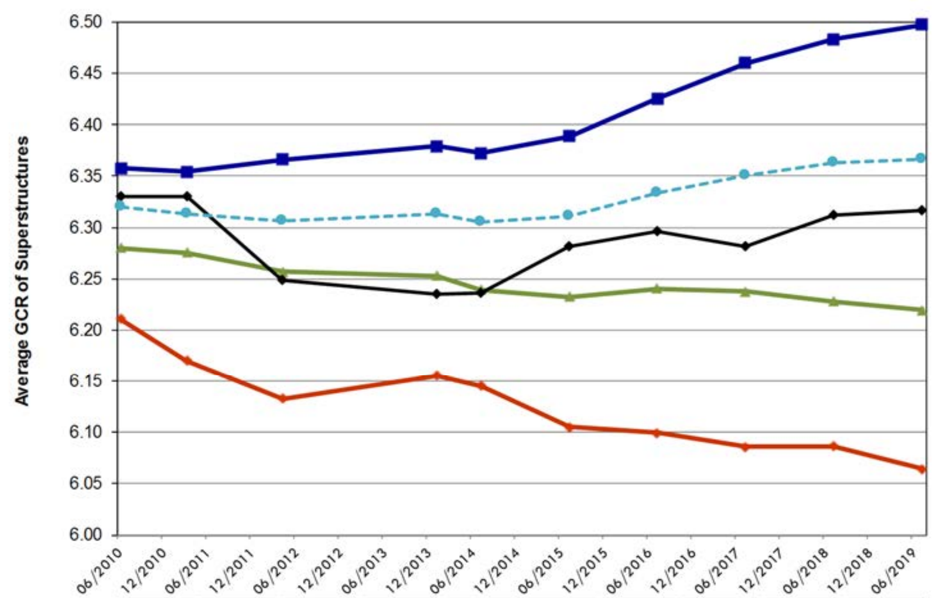
	06/2010	03/2011	04/2012	01/2014	07/2014	07/2015	07/2016	07/2017	07/2018	07/2019
Deck	6.47	6.47	6.46	6.47	6.47	6.47	6.48	6.48	6.49	6.49
Super	6.32	6.31	6.31	6.31	6.31	6.31	6.33	6.35	6.36	6.37
Sub	6.28	6.26	6.25	6.25	6.24	6.25	6.25	6.25	6.25	6.24
Br Min	5.85	5.85	5.85	5.86	5.86	5.87	5.89	5.90	5.92	5.93
Culvert	6.39	6.39	6.40	6.39	6.39	6.40	6.41	6.39	6.38	6.36
Str Min	6.06	6.06	6.06	6.06	6.06	6.07	6.09	6.09	6.09	6.09

Figure C-1- Trends in Average General Condition Ratings by Component – Statewide



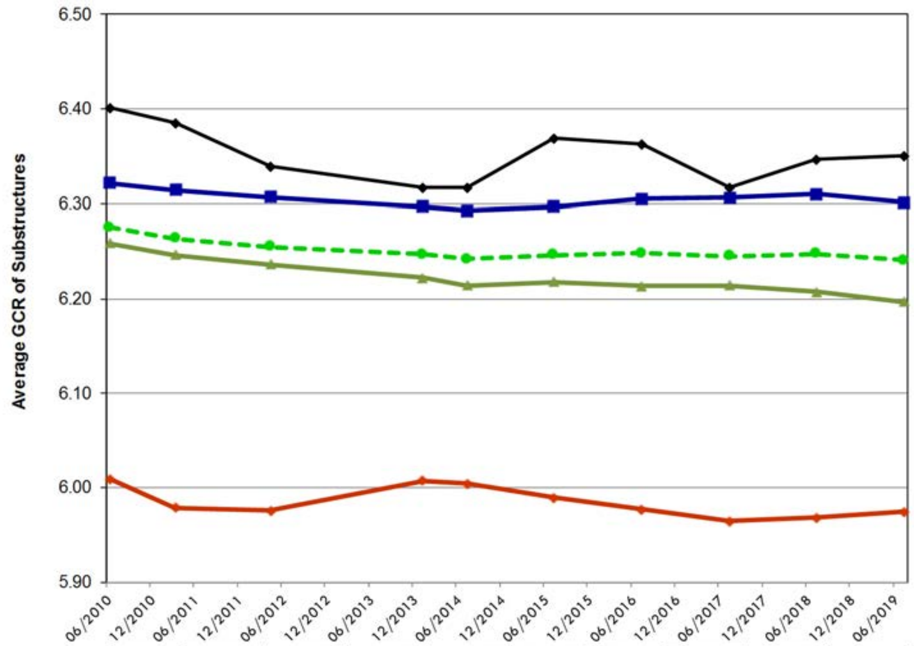
	06/2010	03/2011	04/2012	01/2014	07/2014	07/2015	07/2016	07/2017	07/2018	07/2019
Interstate	6.28	6.27	6.25	6.29	6.29	6.27	6.26	6.25	6.24	6.25
Primary	6.28	6.28	6.26	6.26	6.25	6.25	6.25	6.25	6.24	6.23
Secondary	6.60	6.59	6.60	6.61	6.61	6.62	6.64	6.65	6.66	6.66
Urban	6.40	6.40	6.34	6.34	6.35	6.38	6.39	6.37	6.38	6.37
Average	6.47	6.47	6.46	6.47	6.47	6.47	6.48	6.48	6.49	6.49

Figure C-2- Bridge Decks: Trends in Average General Condition Ratings by Highway System



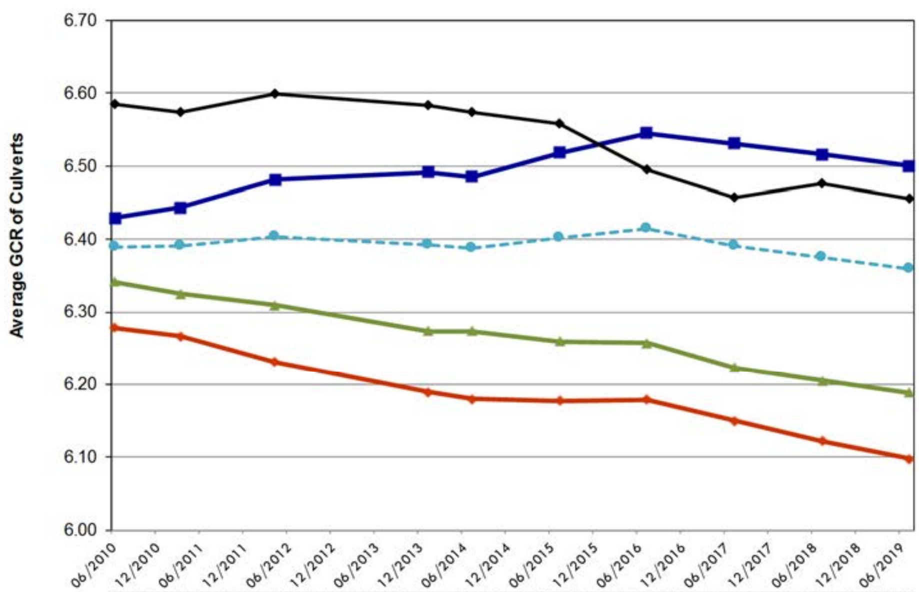
	06/2010	03/2011	04/2012	01/2014	07/2014	07/2015	07/2016	07/2017	07/2018	07/2019
Interstate	6.21	6.17	6.13	6.16	6.15	6.11	6.10	6.09	6.09	6.06
Primary	6.28	6.28	6.26	6.25	6.24	6.23	6.24	6.24	6.23	6.22
Secondary	6.36	6.35	6.37	6.38	6.37	6.39	6.43	6.46	6.48	6.50
Urban	6.33	6.33	6.25	6.24	6.24	6.28	6.30	6.28	6.31	6.32
Average	6.32	6.31	6.31	6.31	6.31	6.31	6.33	6.35	6.36	6.37

Figure C-3- Superstructures: Trends in Average General Condition Ratings by Highway System



	06/2010	03/2011	04/2012	01/2014	07/2014	07/2015	07/2016	07/2017	07/2018	07/2019
Interstate	6.01	5.98	5.98	6.01	6.00	5.99	5.98	5.96	5.97	5.97
Primary	6.26	6.25	6.24	6.22	6.21	6.22	6.21	6.21	6.21	6.20
Secondary	6.32	6.31	6.31	6.30	6.29	6.30	6.31	6.31	6.31	6.30
Urban	6.40	6.39	6.34	6.32	6.32	6.37	6.36	6.32	6.35	6.35
Average	6.28	6.26	6.25	6.25	6.24	6.25	6.25	6.25	6.25	6.24

Figure C-4- Substructures: Trends in Average General Condition Ratings by Highway System



	06/2010	03/2011	04/2012	01/2014	07/2014	07/2015	07/2016	07/2017	07/2018	07/2019
Interstate	6.28	6.27	6.23	6.19	6.18	6.18	6.18	6.15	6.12	6.10
Primary	6.34	6.32	6.31	6.27	6.27	6.26	6.26	6.22	6.20	6.19
Secondary	6.43	6.44	6.48	6.49	6.49	6.52	6.54	6.53	6.52	6.50
Urban	6.58	6.57	6.60	6.58	6.57	6.56	6.49	6.46	6.48	6.46
Average	6.39	6.39	6.40	6.39	6.39	6.40	6.41	6.39	6.38	6.36

Figure C-5- Culverts: Trends in Average General Condition Ratings by Highway System

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.

<table>
<tr><th colspan="2">Typical Examples of General Condition Ratings for Deck</th></tr>
<tr><th>GCR</th><th>Example</th></tr>
<tr><td>4 or less –
Poor Condition</td><td>
Bridge Deck with advanced deterioration</td></tr>
<tr><td>5 – Fair Condition (At risk of becoming Poor Condition)</td><td>

Bridge Deck with cracking and some patching</td></tr>
<tr><td>6 – Satisfactory Condition</td><td>
Bridge Deck with minor to no deterioration</td></tr>
</table>

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 BRIDGES IN VIRGINIA'S APPROVED SYIP

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

Table E-1 and Table E-2 provide lists of all the bridges currently in the SGR program as of June 18, 2019. SYIP refers to the Commonwealth's official Six Year Improvement Program.

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

Route	Featured Intersection	Virginia System	District	SGR Total Allocation	Total Project Allocations
58	Peggy Branch	Primary	Bristol	$ 3,405,953	$ 4,567,485
893	Little Toms Crk	Secondary	Bristol	$ 493,847	$ 493,847
23	NSRR	Primary	Bristol	$ 1,700,000	$ 3,359,601
81	Reed Creek in Wythe Co	Interstate	Bristol	$ 11,750,000	$ 12,618,417
81	Reed Creek in Wythe Co	Interstate	Bristol	$ 11,750,000	$ 12,618,417
664	Rte 63	Secondary	Bristol	$ 1,300,000	$ 4,495,000
81	Rte 686 (Mulberry Lane)	Interstate	Bristol	$ 7,100,000	$ 7,982,379
81	Rte 686 (Mulberry Lane)	Interstate	Bristol	$ 7,100,000	$ 7,982,379
19	NSRR & Wrights Valley Creek	Primary	Bristol	$ 2,800,000	$ 4,816,416
682	Copper Creek	Secondary	Bristol	$ 1,255,510	$ 1,255,510
658	S Fork Holston River	Secondary	Bristol	$ 1,016,115	$ 1,180,000
703	Little Reed Island Creek	Secondary	Salem	$ 1,117,528	$ 2,089,063
668	NS Railway	Secondary	Salem	$ 750,353	$ 4,819,174
634	Roanoke River	Secondary	Salem	$ 7,138,904	$ 12,982,098
81	Route 8	Interstate	Salem	$ 22,137,195	$ 24,490,216
81	Route 8	Interstate	Salem	$ 8,631,005	$ 9,524,185
43	Big Otter River	Primary	Salem	$ 2,813,466	$ 4,143,930
813	Roanoke River @ Kumis	Secondary	Salem	$ 4,944,758	$ 4,952,596
666	NS Railway	Secondary	Salem	$ 3,864,445	$ 4,420,067
711	NS Railway	Secondary	Lynchburg	$ 3,219,191	$ 3,820,045
778	Buffalo River	Secondary	Lynchburg	$ 1,860,269	$ 2,567,099
681	Williams Run	Secondary	Lynchburg	$ 1,882,965	$ 2,182,965
29	Staunton River & NS Railway	Primary	Lynchburg	$ 10,766,201	$ 25,198,388
621	MEHERRIN RIVER	Secondary	Richmond	$ 1,367,714	$ 2,047,012
625	CHICKAHOMINY RIVER	Secondary	Richmond	$ 1,886,289	$ 2,852,622
195	RTE 76, CSX, RAMP S	Interstate	Richmond	$ 15,700,000	$ 15,700,000

Route	Featured Intersection	Virginia System	District	SGR Total Allocation	Total Project Allocations
708	Namozine Creek	Secondary	Richmond	$ 1,943,985	$ 2,737,985
703	ROWANTY CREEK	Secondary	Richmond	$ 1,889,917	$ 2,988,629
630	WAQUA CREEK	Secondary	Richmond	$ 1,544,886	$ 1,894,886
604	TOMAHAWK CREEK	Secondary	Richmond	$ 2,102,047	$ 3,153,599
360	NS RAILWAY & RTE 360 BUS	Primary	Richmond	$ 4,384,600	$ 4,384,600
92	BUTCHERS CREEK	Primary	Richmond	$ 3,020,000	$ 3,845,000
173	I-64 & CSX RR	Primary	Hampton Roads	$ 1,240,020	$ 34,726,582
635	N&W RAILWAY	Secondary	Hampton Roads	$ 2,973,472	$ 4,433,043
189	BLACKWATER RIVER	Primary	Hampton Roads	$ 18,132,564	$ 19,477,671
1306	WEST RIDGE CK @TANGIER	Secondary	Hampton Roads	$ 1,800,210	$ 2,653,890
1304	WEST RIDGE CK @TANGIER	Secondary	Hampton Roads	$ 1,525,805	$ 2,922,882
35	Tarrara Creek	Primary	Hampton Roads	$ 2,207,818	$ 2,963,669
603	Blackwater River	Secondary	Hampton Roads	$ 2,576,164	$ 2,576,164
308	Three Creek	Secondary	Hampton Roads	$ 3,266,662	$ 3,710,573
658	NORTH ANNA RIVER	Secondary	Fredericksburg	$ 2,101,556	$ 2,834,580
662	FOX CREEK	Secondary	Fredericksburg	$ 1,759,785	$ 2,469,785
606	ROUTE I-95	Secondary	Fredericksburg	$ 4,424,138	$ 11,915,178
3	RAPPAHANNOCK RIVER @	Primary	Fredericksburg	$ 19,000,000	$ 21,195,713
620	PISCATAWAY CREEK	Secondary	Fredericksburg	$ 1,600,000	$ 1,600,000
14	PORPOTANK CREEK	Primary	Fredericksburg	$ 2,250,000	$ 3,452,000
216	NORTHWEST BR SARAH CREEK	Secondary	Fredericksburg	$ 500,000	$ 550,000
360	MONCUIN CREEK	Primary	Fredericksburg	$ 500,000	$ 550,000
360	RAPPAHANNOCK R RTE-1013@	Primary	Fredericksburg	$ 500,000	$ 550,000
17	DRAGON RUN	Primary	Fredericksburg	$ 6,200,000	$ 6,200,000
207	MATTAPONI RIVER	Primary	Fredericksburg	$ 8,060,970	$ 8,060,970
632	HARRISONS CREEK	Secondary	Fredericksburg	$ 1,750,000	$ 1,750,000
1	CHOPAWAMSIC CREEK	Primary	Fredericksburg	$ 5,750,000	$ 7,750,000
795	HARDWARE RIVER	Secondary	Culpeper	$ 1,064,177	$ 1,064,177
717	SOUTH FORK HARDWARE RVR	Secondary	Culpeper	$ 711,784	$ 851,784
701	Little River	Secondary	Culpeper	$ 2,215,000	$ 2,215,000
667	PINEY CREEK	Secondary	Culpeper	$ 1,723,500	$ 1,923,500
726	TOTIER CREEK	Secondary	Culpeper	$ 3,020,000	$ 3,020,000
641	MARSH RUN	Secondary	Culpeper	$ 700,000	$ 1,600,000
240	LICKINGHOLE CREEK	Primary	Culpeper	$ 1,900,000	$ 2,210,000
708	NORTH FORK HARDWARE RVR	Secondary	Culpeper	$ 5,100,000	$ 5,100,000
682	PLEASANT RUN	Secondary	Staunton	$ 3,546,210	$ 5,447,424
723	Opequon Creek	Secondary	Staunton	$ 1,325,731	$ 2,150,001
703	EDISON CREEK	Secondary	Staunton	$ 1,981,095	$ 2,700,000
11	I-81	Primary	Staunton	$ 8,782,394	$ 16,382,997
720	I-81	Secondary	Staunton	$ 2,245,388	$ 10,220,470
687	CASCADES CREEK	Secondary	Staunton	$ 1,044,866	$ 2,424,119
698	MILL CREEK	Secondary	Staunton	$ 1,407,507	$ 3,015,303
250	Bell Creek	Primary	Staunton	$ 3,295,695	$ 5,117,279

Route	Featured Intersection	Virginia System	District	SGR Total Allocation	Total Project Allocations
33	NSRR	Primary	Staunton	$ 8,111,903	$ 9,579,552
673	Catoctin Creek	Secondary	NoVa	$ 4,500,000	$ 5,280,000
236	I-395	Primary	NoVa	$ 11,844,889	$ 15,735,787
674	Colvin Run	Secondary	NoVa	$ 2,273,488	$ 4,899,999
66	RMPS B & F	Interstate	NoVa	$ 5,249,491	$ 5,949,491
77	COVE CREEK	Interstate	Bristol	$ 7,900,000	$ 8,400,000
81	Rt 11, NSRR, M.F. Holston River	Interstate	Bristol	$ 12,499,999	$ 16,239,695
8	Mayo River	Primary	Salem	$ 3,756,340	$ 5,156,340
58	Crooked Creek	Primary	Salem	$ 3,943,914	$ 6,125,383
715	NS Railway	Secondary	Salem	$ 2,376,197	$ 3,085,019
220	Reed Creek	Primary	Salem	$ 5,885,000	$ 7,750,000
760	ROANOKE RIVER	Secondary	Salem	$ 2,280,939	$ 3,080,939
11	N&W RAILWAY	Primary	Salem	$ 2,625,000	$ 2,625,000
40	Tharp Creek	Primary	Salem	$ 1,240,199	$ 1,240,199
622	Flat Creek	Secondary	Lynchburg	$ 736,867	$ 11,029,052
29	NS Railway	Primary	Lynchburg	$ 6,842,565	$ 6,842,565
92	Staunton River	Primary	Lynchburg	$ 11,904,228	$ 25,224,963
621	Appomattox River	Secondary	Lynchburg	$ 3,194,285	$ 4,527,443
360	NS RAILWAY & RTE 360BUS	Primary	Richmond	$ 6,165,986	$ 6,165,986
703	CSX TRANSP RIGHT OF WAY	Secondary	Richmond	$ 2,500,000	$ 2,850,000
46	U.S. 58 BYPASS	Primary	Richmond	$ 1,850,000	$ 2,005,788
30	NORTH ANNA RIVER	Primary	Richmond	$ 3,000,000	$ 3,300,000
156	RTE 360	Primary	Richmond	$ 2,000,000	$ 2,200,000
7667	ROUTE 0064	Secondary	Richmond	$ 4,000,000	$ 4,800,000
157	I-64 & RAMPS GASKIN RD	Primary	Richmond	$ 4,000,000	$ 4,300,000
64	ROUTE I-95	Interstate	Richmond	$ 6,111,770	$ 6,111,770
657	RTE I 95	Secondary	Richmond	$ 5,000,000	$ 5,000,000
460	U.S. 460 (BYPASS)	Primary	Richmond	$ 4,500,000	$ 4,500,000
641	CSX TRNS & USDGSC SERVIC	Secondary	Richmond	$ 3,500,000	$ 6,000,000
0	ROUTE I-95 (I-64)	Urban	Richmond	$ 8,436,957	$ 9,436,957
95	RTE 608 (REYMET RD)	Interstate	Richmond	$ 11,000,000	$ 12,050,000
64	ROUTE 95	Interstate	Richmond	$ 4,050,000	$ 4,050,000
671	Nottoway River	Secondary	Hampton Roads	$ 7,000,000	$ 7,900,915
10	Cypress Ck	Primary	Hampton Roads	$ 1,600,000	$ 5,900,000
692	Champion Swamp	Secondary	Hampton Roads	$ 1,250,000	$ 2,773,594
40	Otterdam Swamp	Primary	Hampton Roads	$ 1,715,151	$ 6,157,211
95	Rte. 17	Primary	Fredericksburg	$ 6,666,815	$ 6,666,815
95	Rte. 17	Primary	Fredericksburg	$ 6,666,815	$ 6,666,815
617	EXOL SWAMP	Secondary	Fredericksburg	$ 2,000,000	$ 2,000,000
3	NORTH END BRANCH	Primary	Fredericksburg	$ 2,558,165	$ 3,745,000
647	South Anna River	Secondary	Culpeper	$ 1,200,000	$ 2,050,000
601	ROUTE 29 & 250 BYPASS	Secondary	Culpeper	$ 1,858,026	$ 3,358,026
647	East Branch Thumb Run	Secondary	Culpeper	$ 1,970,000	$ 2,800,000

Route	Featured Intersection	Virginia System	District	SGR Total Allocation	Total Project Allocations
33	NSRR	Primary	Staunton	$ 8,352,943	$ 9,820,592
33	I-81	Primary	Staunton	$ 11,278,670	$ 12,900,164
395	I-395	Urban	NoVa	$ 2,690,332	$ 12,961,448
28	BULL RUN	Primary	NoVa	$ 2,586,993	$ 2,586,993
613	ARLINGTON BOULEVARD	Secondary	NoVa	$ 2,500,000	$ 2,500,000
7	SUGARLAND RUN	Primary	NoVa	$ 6,700,000	$ 8,725,000
123	LEESBURG PIKE (RTE. 7)	Primary	NoVa	$ 1,250,000	$ 1,250,000
123	LEESBURG PIKE, ROUTE 7	Primary	NoVa	$ 1,250,000	$ 1,250,000
627	QUANTICO CREEK	Secondary	NoVa	$ 1,300,000	$ 1,800,000
711	BRANCH OF CATOCTIN CREEK	Secondary	NoVa	$ 1,500,000	$ 1,500,000
120	PIMMITT RUN	Primary	NoVa	$ 7,000,000	$ 8,000,000
77	COVE CREEK	Interstate	Bristol	$ 9,100,000	$ 9,600,000
61	COVE CREEK	Primary	Bristol	$ 750,000	$ 885,000
63	RUSSELL FORK RIVER	Primary	Bristol	$ 3,828,000	$ 6,400,016
58	GUEST RV & NS RAILWAY	Primary	Bristol	$ 2,840,000	$ 2,955,000
622	NS Railway	Secondary	Salem	$ 1,830,127	$ 4,664,000
311	MEADOW CREEK	Primary	Salem	$ 3,150,000	$ 4,495,000
58	Dan River	Primary	Salem	$ 6,550,000	$ 6,550,000
653	NS Railway	Secondary	Lynchburg	$ 4,504,276	$ 4,504,276
0	INTERSTATE-85	Urban	Richmond	$ 4,000,000	$ 4,000,000
1	CSX TRANSP RIGHT OF WAY	Primary	Richmond	$ 2,560,000	$ 2,560,000
0	ROUTE I-95	Urban	Richmond	$ 6,325,000	$ 6,325,000
33	RTE I 64 @ BOTTOMS BRIDG	Primary	Richmond	$ 9,500,000	$ 9,500,000
95	RTES 301 & EB 460	Interstate	Richmond	$ 5,000,000	$ 5,000,000
250	I-95	Primary	Richmond	$ 9,500,000	$ 9,500,000
195	RTE 197 & CSX TRANSP. RR	Interstate	Richmond	$ 6,000,000	$ 6,000,000
638	Burnt Mill Swamp	Secondary	Hampton Roads	$ 1,559,104	$ 2,659,104
690	Ennis Pond	Secondary	Hampton Roads	$ 2,700,000	$ 3,900,000
707	Pitts Creek	Secondary	Hampton Roads	$ 2,750,000	$ 3,800,000
683	Stallings Creek	Secondary	Hampton Roads	$ 3,800,000	$ 3,800,000
644	Pope Swamp	Secondary	Hampton Roads	$ 4,200,000	$ 4,200,000
178	Occohannock Creek	Primary	Hampton Roads	$ 5,220,396	$ 5,220,396
743	Tarrara Creek	Secondary	Hampton Roads	$ 3,250,000	$ 3,250,000
607	DRAGON RUN	Secondary	Fredericksburg	$ 3,000,000	$ 3,000,000
644	AQUIA CREEK	Secondary	Fredericksburg	$ 4,400,000	$ 5,100,000
638	SOUTH RIVER	Secondary	Fredericksburg	$ 3,450,000	$ 4,100,000
652	BRANCH OF STEVENS MILL	Secondary	Fredericksburg	$ 2,500,000	$ 2,500,000
3	CSX RAILROAD	Primary	Fredericksburg	$ 1,000,000	$ 1,000,000
1	POTOMAC RUN	Primary	Fredericksburg	$ 5,856,870	$ 6,776,870
3	BURKE MILL STREAM	Primary	Fredericksburg	$ 4,500,000	$ 5,520,000
743	SOUTH RIVER	Secondary	Fredericksburg	$ 1,727,586	$ 1,860,460
707	Hughes River	Secondary	Culpeper	$ 4,700,000	$ 4,700,000
638	South River	Secondary	Culpeper	$ 3,280,000	$ 3,280,000

Route	Featured Intersection	Virginia System	District	SGR Total Allocation	Total Project Allocations
259	LINVILLE CK @ BROADWAY	Primary	Staunton	$ 6,641,250	$ 7,800,000
696	KARNES CREEK	Secondary	Staunton	$ 2,284,025	$ 4,066,731
33	I-81	Primary	Staunton	$ 9,280,525	$ 10,220,525
11	NF Shen River	Primary	Staunton	$ 5,329,014	$ 6,672,631
17	I-81	Primary	Staunton	$ 21,591,669	$ 29,280,000

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

Route No.	Featured Intersection	Virginia System	District	SGR Total Allocation	Total Project Allocations
0	S.F. Powell River	Urban	Bristol	$ 676,508	$ 2,130,916
16	CAVITTS CREEK	Primary	Bristol	$ 1,300,000	$ 1,300,000
61	N FORK CLINCH RIVER	Primary	Bristol	$ 1,500,000	$ 1,500,000
16	CLINCH RIVER	Primary	Bristol	$ 357,810	$ 357,810
19	S FORK CLINCH RIVER	Primary	Bristol	$ 1,100,000	$ 1,100,000
0	BENGES BRANCH	Urban	Bristol	$ 316,000	$ 316,000
3050	Booth Branch	Urban	Bristol	$ 290,000	$ 290,000
3137	Slate Creek	Urban	Bristol	$ 180,000	$ 180,000
2164	Knox Creek	Urban	Bristol	$ 92,500	$ 92,500
4263	Stream	Urban	Bristol	$ 290,000	$ 290,000
1030	Stream	Urban	Bristol	$ 180,000	$ 180,000
5417	Granny Creek	Urban	Bristol	$ 180,000	$ 180,000
2080	Left Fork	Urban	Bristol	$ 60,000	$ 60,000
2435	Dan Branch	Urban	Bristol	$ 180,000	$ 180,000
5105	Levisa Fork	Urban	Bristol	$ 575,000	$ 575,000
2078	Knox Creek	Urban	Bristol	$ 170,000	$ 170,000
4062	War Fork	Urban	Bristol	$ 85,000	$ 85,000
2163	Knox Creek	Urban	Bristol	$ 85,000	$ 85,000
0	BEAVER CREEK	Urban	Bristol	$ 286,000	$ 286,000
460	CLINCH RIVER	Primary	Bristol	$ 2,158,556	$ 2,158,556
4245	Russell Fork	Urban	Bristol	$ 265,000	$ 265,000
11	APPERSN DR O ROANOKE RV	Primary	Salem	$ 972,694	$ 3,328,203
11	COLORADO ST O NS RWY @	Primary	Salem	$ 6,450,000	$ 6,450,000
0	Ivy Creek	Urban	Lynchburg	$ 2,000,000	$ 4,358,783
360	JAMES RIVER SOUTH DIV @	Primary	Richmond	$ 1,050,000	$ 4,300,000
360	JAMES RIVER NORTH DIV @	Primary	Richmond	$ 700,000	$ 3,950,000
0	CSX RAILWAY	Urban	Richmond	$ 1,774,000	$ 1,774,000
36	APPOMATTOX RIVER CANAL	Primary	Richmond	$ 2,025,000	$ 2,025,000
105	N.N. Resevoir	Primary	Hampton Roads	$ 5,100,000	$ 24,000,000
0	CHESAPEAKE&ALBEMARLE CAN	Urban	Hampton Roads	$ 4,036,475	$ 8,871,745
688	Kilby Creek Spillway	Urban	Hampton Roads	$ 778,000	$ 2,128,000
13	RTE. 460 & NS RAILWAY	Primary	Hampton Roads	$ 5,110,040	$ 5,110,040
460	RTE 166 & U #1808	Primary	Hampton Roads	$ 2,215,700	$ 2,672,200
32	CYPRESS SWAMP	Urban	Hampton Roads	$ 1,988,889	$ 2,705,971
337	Beamons Mill Pond	Urban	Hampton Roads	$ 880,183	$ 1,121,252
337	Jerico Canal	Urban	Hampton Roads	$ 479,633	$ 620,900
616.00	Jones Swamp	Urban	Hampton Roads	$ 1,397,829	$ 1,815,362
660.00	Somerton Creek	Urban	Hampton Roads	$ 1,981,084	$ 2,589,652
608.00	Cohoon Creek	Urban	Hampton Roads	$ 470,400	$ 769,920
639.00	SBD SYS RR & NS RAILWAY	Urban	Hampton Roads	$ 2,838,000	$ 3,440,000
674.00	WASHINGTON DITCH	Urban	Hampton Roads	$ 414,104	$ 762,771

Route	Featured Intersection	Virginia System	District	SGR Total Allocation	Total Project Allocations
661.00	Chapel Swamp	Urban	Hampton Roads	$ 408,459	$ 724,275
13.00	NS RAILWAY	Primary	Hampton Roads	$ 2,912,000	$ 3,187,000
3	RAPPAHANNOCK RIVER @	Primary	Fredericksburg	$ 2,200,000	$ 2,207,639
0	NORFOLK SOUTHERN RAILWAY	Urban	Culpeper	$ 2,440,626	$ 2,440,626
250	RUGBY AVE	Primary	Culpeper	$ 2,488,292	$ 2,488,292
250	RTE 29 BUSINESS	Primary	Culpeper	$ 3,847,554	$ 3,847,554
250	NORFOLK SOUTHERN RAILWAY	Primary	Culpeper	$ 1,303,496	$ 1,303,496
211	HAWKSBILL CK	Primary	Staunton	$ 1,953,030	$ 5,796,485
0	CSX RAILROAD	Urban	Staunton	$ 300,001	$ 1,827,179
1411	N FORK SHENANDOAH RIVER	Secondary	Staunton	$ 676,491	$ 676,491
0	4 mile run	Secondary	NOVA	$ 302,610	$ 1,833,998
0	BLUESTONE RIVER	Urban	Bristol	$ 620,000	$ 620,000
16	CLINCH RIVER	Primary	Bristol	$ 2,300,000	$ 2,300,000
0	FAIRGROUND CREEK	Urban	Bristol	$ 700,000	$ 700,000
0	BIG CREEK	Urban	Bristol	$ 740,000	$ 740,000
0	BEAVER CREEK	Urban	Bristol	$ 2,000,000	$ 2,000,000
0	BEAVER POND CREEK	Urban	Bristol	$ 1,170,000	$ 1,170,000
0	NS RWY	Urban	Bristol	$ 3,000,000	$ 3,000,000
0	BEAVER CREEK	Urban	Bristol	$ 2,150,000	$ 2,150,000
0	N F HOLSTON RIVER	Urban	Bristol	$ 620,000	$ 620,000
67	CLINCH RIVER	Primary	Bristol	$ 1,650,000	$ 1,650,000
0	COMMERCE ST O PEAK CK.	Urban	Salem	$ 868,249	$ 2,176,293
0	NORTH RUN	Urban	Richmond	$ 3,750,000	$ 3,750,000
0	LIEUTENANT RUN	Urban	Richmond	$ 1,516,000	$ 1,516,000
0	UPHAM BROOK	Urban	Richmond	$ 1,853,000	$ 1,853,000
301	LIEUTENANT RUN	Primary	Richmond	$ 616,000	$ 616,000
0	BROAD ROCK CREEK	Urban	Richmond	$ 499,000	$ 1,100,000
0	TRIB. GOOSE CREEK	Urban	Hampton Roads	$ 1,195,000	$ 1,195,000
0	SPILLWAY AT NORFOLK RES.	Urban	Hampton Roads	$ 6,540,000	$ 6,540,000
17	DEEP CREEK	Secondary	Hampton Roads	$ 1,153,000	$ 1,153,000
0	LINDSEY DRAINAGE CANAL	Urban	Hampton Roads	$ 1,251,000	$ 1,251,000
407	Indian River	Primary	Hampton Roads	$ 5,128,000	$ 5,128,000
613	Kingsale Swamp	Urban	Hampton Roads	$ 839,000	$ 1,199,000
668	SPIVEY SWAMP	Urban	Hampton Roads	$ 838,000	$ 1,193,000
668	Mill Swamp	Urban	Hampton Roads	$ 994,000	$ 1,420,000
688	KILBY CREEK	Urban	Hampton Roads	$ 650,000	$ 745,000
239	PARADISE CREEK	Primary	Hampton Roads	$ 8,342,928	$ 10,367,928
20	CSX & WATER STREET	Urban	Culpeper	$ 1,000,000	$ 25,187,399
0	WOODS CRK	Urban	Staunton	$ 1,662,561	$ 1,662,561