State of the Structures and Bridges Report Fiscal Year 2014

July 1, 2014

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Virginia Department of Transportation

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INTRODUCTION

This annually produced report summarizes the condition of the bridges and culverts, ancillary structures (traffic control devices), bridge and ancillary safety inspection program, and bridge-related financial information for the Commonwealth of Virginia. The report reflects the accomplishments for the 2014 Fiscal Year (FY2014) for the Virginia Department of Transportation (VDOT) and provides some historical trends. The Fiscal Year runs from July 1 through June 30.

VDOT inspects bridges and culverts that are part of the National Bridge Inventory (NBI), which includes structures on public roadways exceeding 20 feet in length. VDOT's Structure and Bridge Division also inventories structures that do not meet the definition of NBI Structures (which are called "non-NBI" structures in this report). These structures include bridges measuring 20 feet or less in length and large culverts having an opening of 36 square feet or greater. The above structures and bridges are addressed in this report, while smaller culverts not meeting the above criteria are maintained and inspected by other VDOT divisions and are not addressed in this report. Data used in the report is that reported at the end of FY2014 on June 30, 2014.

There are currently 21,061 structures (bridges and culverts) located throughout the Commonwealth, of which 13,453 are NBI structures. VDOT maintains 19,414 of these structures and 1,647 are maintained by localities and private owners. The inventory experienced a net increase of 64 structures during FY2014.

The majority of Virginia's bridges were designed with an anticipated design service life of 50 years, but with the adoption of new design guidelines and construction materials the anticipated service life for newly constructed bridges is 75 years. About sixty two (62.2%) percent of the structure inventory is 40 years or older, meaning that this percentage of the Commonwealth's structures have either exceeded or are within 10 years of the end of their anticipated service design life. The anticipated service life of structures can be extended though preventative and proactive maintenance and major repairs and rehabilitation.

VDOT's global performance measure for structures is based on the percentage of Structurally Deficient (SD) structures in the Department's inventory. VDOT's goal is to have no more than eight (8%) percent of the structure inventory rated as SD. The number of SD structures in the VDOT NBI/non-NBI inventory at the end of the Fiscal Year was 1,453 (6.9%), of which 1,052 are NBI structures. During the Fiscal Year, the percentage of SD structures was reduced by 0.48% (using number of structures) or 0.34% (using deck area of structures). Nationally, 10.5% of the NBI structures are SD as of December, 2013.

A structure is defined as SD if one or more of its major components (deck, superstructure, substructure, or culvert) is deficient which requires the structure to be monitored and/or repaired, or if it lacks adequate strength or waterway clearance. When one or more of a structure's major components have a General Condition Rating (GCR) of four (4) or less it is defined as an SD structure. The GCR is a nationally established numerical grading system with values that range from 0 (failed condition) to 9 (excellent condition). GCRs are assigned to each major component of each structure during regular inspections and are reported in

inspection reports. VDOT uses several performance indicators in the overall management of the structural inventory. These include: functional obsolescence (FO), structurally deficient structures, the number of posted structures, deficient deck area and the Health Index. These performance indicators are discussed in greater detail in the body of the report.

Structure Type	Percentage By Major Components in Good or Fair Condition			
	Deck	Superstructure	Substructure	Culvert
Bridges	97.4%	93.3%	97.2%	---
Culverts	---	---	---	97.0%

The Commonwealth's inventory includes 4,942 bridges and culverts (23.5%) that are at risk of becoming Structurally Deficient. These structures have at least one major component (deck, superstructure, substructure or culvert) with a GCR of five (5).

The bridge safety inspection program provides the basis for most of the Commonwealth's bridge maintenance and management decisions. During the Fiscal Year, VDOT inspected 10,368 bridges/culverts at a cost of $26.1 million. Inspections on the majority of the structures are performed on a two year cycle. Data collected from inspections are used to evaluate each structure's safety and are used for decisions on planning, budgeting, and performance of maintenance, repair, rehabilitation and replacement of our structures. Underwater inspection QA/QC was performed on 16 structures at a cost of $39,000. The Federal Highway Administration (FHWA) conducted an annual National Bridge Inspection Standards (NBIS) Compliance Review from April 1, 2013 to March 30, 2014 and issued a draft report dated December 31, 2013. The Compliance Review consisted of a review of the statewide inventory/database/ organization/procedures for bridge safety inspections and a QA review of a sample of bridge records and bridge field reviews of the Bristol and Fredericksburg Districts. The Department was found to be in compliance with 21 of the 23 NBIS metrics and substantially compliant with 2 of the 23 NBIS metrics that were reviewed for calendar year 2013.

VDOT is also responsible for the inventory, inspection and maintenance of 32,304 ancillary structures. VDOT's inventory includes five types of ancillary structures: Signs, Luminaires, Signals, High Mast Lights; and Camera Poles.

This report summarizes the inventory and condition of Virginia's ancillary structures based on the inventory data at the end of the Fiscal Year. VDOT inspected 4,872 of these structures in the fiscal year, at an approximate cost of $4.5 million. VDOT utilizes an inspection program to evaluate and monitor the condition of its ancillary structures. The data collected during inspections is the primary source of information for determining maintenance, repair and replacement needs for structural components. Inspections of the majority of the ancillary structures are performed on a five year cycle, but the required inspection interval varies depending on the purpose, condition and type of the structure. It is important to note that inventory and rating data reflect the condition of the structure as of its most recent inspection, and because there is a lag time of five or more years between inspections, the inspection data available at any given time do not necessarily provide a present indication of current conditions.

The number of ancillary structures per district varies widely, from 13,292 (41.1% of the inventory) in the Northern Virginia District to 564 (1.7%) in the Culpeper District. Each ancillary structure is comprised of primary components. These components describe the structure and its support but not the attached appurtenances (sign panels, signals, lights, etc.). A parapet mount sign or a parapet mount luminaire has only one primary component while the other types of signs or luminaires have both foundation and superstructure components. Signals have either parapet or foundation and a superstructure. High mast light and camera poles have foundation and superstructure as primary components. The percentages of the primary components that are in good or fair condition (statewide) are shown in the table below.

Structure Type	Percentage of Primary Components in Good or Fair Condition		
	Foundation	Parapet	Superstructure
Sign	86.0%	91.6%	93.9%
Luminaries	73.7%	68.6%	90.4%
Signal	88.6%	73.3%	86.1%
High Mast and Camera Poles	93.5%	---	99.2%

Whenever a primary component of an ancillary structure is assigned a poor rating, the inspector provides a descriptive note indicating the most significant cause for the rating. Anchor bolt problems and loose nuts are the most common reasons for foundations receiving poor condition ratings. For the parapet mounted signs and luminaires, the most frequently identified problems are the attachments of the ancillary structure to the bridge structure. There is a much broader set of conditions that cause superstructures to be rated as poor, but “damaged chord members” is the most common reason.

The Construction 603 program for VDOT was $1.4B and the Highway Maintenance 604 Program was $1.4B.

The Structure & Bridge Division received approximately $184M in Dedicated Bridge Funds in FY2014 from the 603 Construction program. This is roughly 13% of total funds allocated to VDOT’s 603 Construction Program. S&B expenditures in FY2014 for the 603 program were $190M.

The Structure & Bridge Division received approximately $158.9M in FY2014 from the Maintenance 604 Program. This is roughly 10% of total funds allocated to the Highway Maintenance 604 Program. These 604 funds allocated to the S&B Division include funding for maintenance of the bridge inventory as well as the bridge and ancillary structure inspection programs. S&B expenditures for the S&B 604 program were $161.3M.

The calculated monetary need for bridge maintenance and construction significantly exceeds available funding. The calculated need is the amount of money required to meet our performance measures. These performance measures were established using thresholds that, if met, would keep the bridge inventory steady at their current average overall condition ratings, The performance measures were determined through an analysis of the entire inventory over a multi-year period. The analysis utilizes condition data in addition to historical deterioration curves and action-effectiveness scenarios to determine the most cost-effective interventions

and the associated costs necessary for maintaining and improving the condition of Virginia's bridges.

The availability of funding is the most significant factor in the performance of the bridge inventory. In recent years, the percentage of structurally deficient (poor) structures has steadily decreased, reflecting an apparent improvement in bridge conditions. However, while the number of poor structures has indeed decreased, the overall condition of the inventory has not improved. This slow decrease in overall condition ratings can primarily be attributed to the gap between required and available funding. Allocated funds are often used to address structures in immediate need of repair or replacement, leaving less money than required for preventive and restorative maintenance.

Another significant factor affecting long-term performance relates to the selection of structures scheduled for replacement or major rehabilitation. In recent years, available funding in the 603 Construction Program has often led to the selection of smaller structures for replacement. This has resulted in a notable reduction in the number of poor structures. However, in selecting smaller, less expensive structures for replacement and rehabilitation, we are also developing a backlog of larger, more expensive structures that will soon require significant work.

The percentage of SD structures was reduced by 0.48% using the number of structures while there was a reduction of 0.34% using deck area of structures. The higher rate using number of structures indicates that bridges with a smaller deck area are being selected for major rehabilitation or replacement.

Bridge 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 time, if the funding for bridge maintenance and replacement is not increased, we should expect to see significant degradation of the average bridge conditions.

BACKGROUND

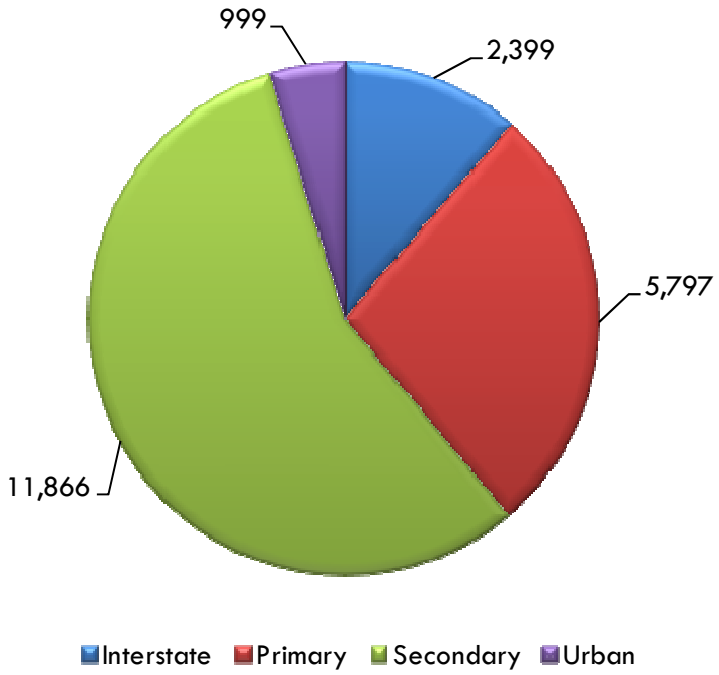
In accordance with the Code of Federal Regulations, The Virginia Department of Transportation (VDOT) inspects bridges and culverts that are part of the National Bridge Inventory (NBI), which includes structures on public roadways exceeding 20 feet in length. In addition to the federal inventory and inspection requirements, VDOT's Structure and Bridge Division also inspects and inventories structures that do not meet the definition of NBI Structures (which are called "non-NBI" structures in this report). These structures include bridges measuring 20 feet or less in length and large culverts having an opening of 36 square feet or greater. The above structures and bridges are addressed in this report.

VDOT maintains a large inventory of smaller culverts that do not meet the above criteria. These culverts are not maintained by the Structure and Bridge Division and have a separate maintenance and inspection cycle. These smaller culverts are not addressed in this report.

VDOT is responsible for the inventory and inspection of 21,061 structures (bridges and culverts). Of these structures, 13,453 are part of the National Bridge Inventory (NBI). VDOT maintains 19,414 of these structures and 1,647 are maintained by localities and private owners. All of the tables and figures in this report reflect the FY2014 accomplishments and are based on the inventory and condition data at the end of the Fiscal Year.

The estimated current value of Virginia's structure inventory for the Fiscal Year is approximately $43 billion. Note that this is not the same as the replacement value, which would be significantly higher. Chart 1 shows the distribution of bridges and culverts by highway system.

Chart 1 – Distribution of Bridges and Culverts by System



VDOT is also responsible for the inventory, inspection and maintenance of 32,304 ancillary structures. VDOT's inventory includes five types of ancillary structures, three of which are further divided into subcategories:

1. High mast lighting structures
2. Camera pole structures
3. Signal structures
    - Span Wire
    - Cantilever
    - Bridge-parapet mounted
4. Luminaires
    - Ground Mounted (Luminaire)
    - Parapet Mounted
5. Sign structures
    - Overhead span sign structures
    - Cantilever sign structures
    - Butterfly sign structures
    - Bridge-parapet mounted

Charts 2 and 3 indicate the distribution of the Ancillary structures by District and type.

Chart 2 – Distribution of Ancillary Structures by District

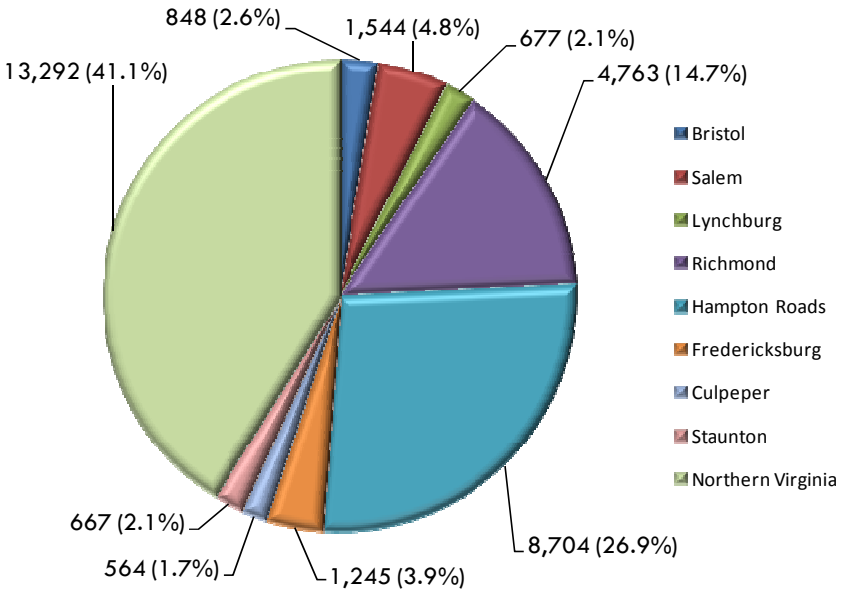
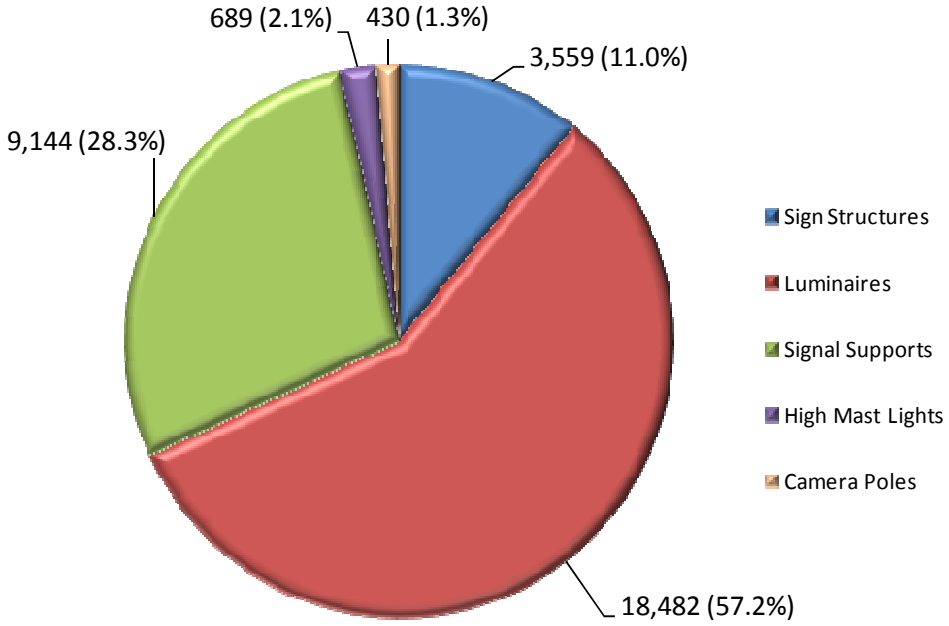


Chart 3 – Distribution of Ancillary Structures by Type



Determining the Conditions of the Structures

VDOT uses its comprehensive inspection program to evaluate and monitor the condition 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 receive detailed inspections at regular intervals not exceeding 24 months. The non-NBI bridges are inspected at intervals not exceeding 24 months, and the non-NBI culverts are inspected at intervals not exceeding 48 months.

Inspectors use condition ratings to describe each existing structure. These condition ratings are based on the Federal Highway Administration's (FHWA) criteria. The condition assessments of the structures are performed by qualified inspectors, and all assessments are performed in accordance with the National Bridge Inspection Standards (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 and the NBIS in the Code of Federal Regulations.

VDOT inspects over 10,368 of bridges and culverts annually, at an approximate cost of $26.1 million. This report summarizes the inventory and condition of Virginia's bridges and culverts based on data at the end of the current fiscal year.

In addition to the specific data required by the NBIS, VDOT inspectors collect and record detailed structural element data, which is 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.

VDOT utilizes an inspection program to evaluate and monitor the condition of its ancillary structures. The data collected during inspections is the primary source of information for determining maintenance, repair and replacement needs for structural components.

VDOT utilizes an internally-developed inventory and inspection software system to maintain data on its ancillary structures. Inspections of the ancillary structures are usually performed on a five (5) 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 the Federal Highway Administration's (FHWA) Bridge Inspection criteria. The condition assessments of the structures are performed by qualified inspectors, and all 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 Memorandums IIM-S&B-82 and IIM-S&B-90, and VDOT's "Traffic Ancillary Structures Inventory and Inspection Manual."

VDOT inspects over 4,872 of these structures annually, at an approximate cost of $4.5 million. This report summarizes the inventory and condition of Virginia's ancillary structures based on the inventory at the end of the fiscal year.

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" and draw on this training when performing inspections.

STRUCTURE INVENTORY

VDOT uses the AASHTOWare Bridge Management System inspection module to maintain data on all of the Commonwealth's highway structures. Tables 1 through 3 show the distribution of structures in each of the Districts by system. Unless otherwise stated, the data and charts shown in this report include both NBI and Non-NBI bridges and culverts.

Table 1 – Total Number of Bridges and Culverts

DISTRICT	Number of Structures (Bridges and Culverts)				
	Interstate	Primary	Secondary	Urban	Total
Bristol	216	953	2,038	210	3,417
Salem	217	810	1,948	103	3,078
Lynchburg	0	664	1,395	58	2,117
Richmond	508	795	1,123	160	2,586
Hampton Roads	453	456	496	284	1,689
Fredericksburg	79	254	474	6	813
Culpeper	121	498	1,058	19	1,696
Staunton	431	824	2,139	106	3,500
NOVA	374	543	1,195	53	2,165
Grand Total	**2,399**	**5,797**	**11,866**	**999**	**21,061**

Table 2 – Number of NBI - Bridges and Culverts

DISTRICT	Number of NBI Structures (Bridges and Culverts)				
	Interstate	Primary	Secondary	Urban	Total
Bristol	164	518	1,111	207	2,000
Salem	139	447	1,138	96	1,820
Lynchburg	0	419	922	58	1,399
Richmond	352	595	843	159	1,949
Hampton Roads	375	370	373	280	1,398
Fredericksburg	43	177	302	6	528
Culpeper	85	240	687	15	1,027
Staunton	256	456	1,049	102	1,863
NOVA	279	394	744	52	1,469
Grand Total	**1,693**	**3,616**	**7,169**	**975**	**13,453**

Table 3 – Number of Non-NBI - Bridges and Culverts

DISTRICT	Number of Non-NBI Structures (Bridges and Culverts)				
	Interstate	Primary	Secondary	Urban	Total
Bristol	52	435	927	3	1,417
Salem	78	363	810	7	1,258
Lynchburg	0	245	473	0	718
Richmond	156	200	280	1	637
Hampton Roads	78	86	123	4	291
Fredericksburg	36	77	172	0	285
Culpeper	36	258	371	4	669
Staunton	175	368	1,090	4	1,637
NOVA	95	149	451	1	696
Grand Total	**706**	**2,181**	**4,697**	**24**	**7,608**

A large proportion (62.2%) of the Commonwealth's structure inventory is 40 years old or older. These structures have either exceeded or will soon exceed their originally anticipated design service life of 50 years. The percentage of structures equal to or greater than 40 years in age, by system, is as follows: 66.5% of the interstate, 65.4% of the primary, 61.0% of the secondary, and 48.0% of the urban system structures. The average age of all structures is 47 years. The age of Virginia's highway structures is depicted graphically in Charts 4 thru 6.

Bridges designed prior to 2007 could be expected to have a service life of 50 years, but with improvements in design guidelines and construction materials the anticipated service life of bridges constructed since 2007 is 75 years. Improvements have included the following:

- Low permeability concrete in 2003 *
- Corrosion resistant reinforcement in 2009*
- Jointless bridge technology in 2011*
- Self-consolidating concrete for drilled shafts
- Deck overlays starting in the 1970's

  * Year of full implementation

In the near future, the Structure and Bridge Division will be implementing the following to further improve the durability of its structures:

- The use of low paste deck concrete
- Use of materials for culverts that have shown past performance
- Carbon fiber prestressing strands
- Lightweight concrete

A large portion of the inventory was constructed using older construction technology and is approaching the last quarter of useful service life. This period can be extended through preventative and proactive maintenance, major repairs and rehabilitation.

Chart 4 – Cumulative Age Distribution of Bridges and Culverts

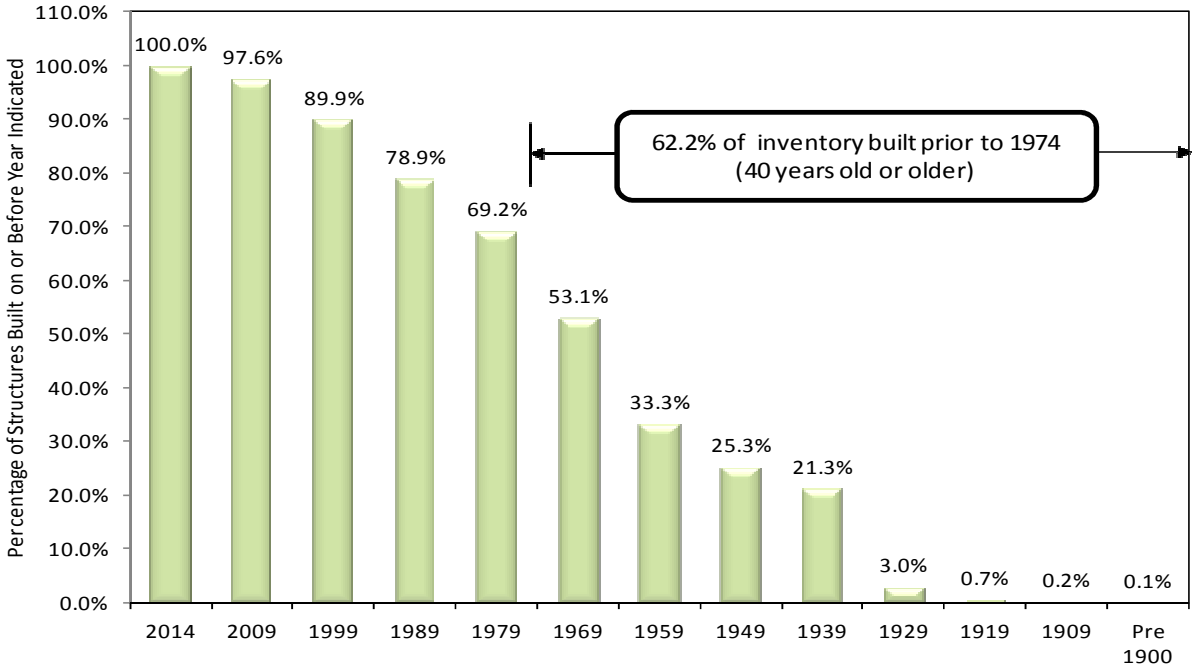


Chart 5 – Average Age of Bridges and Culverts by District

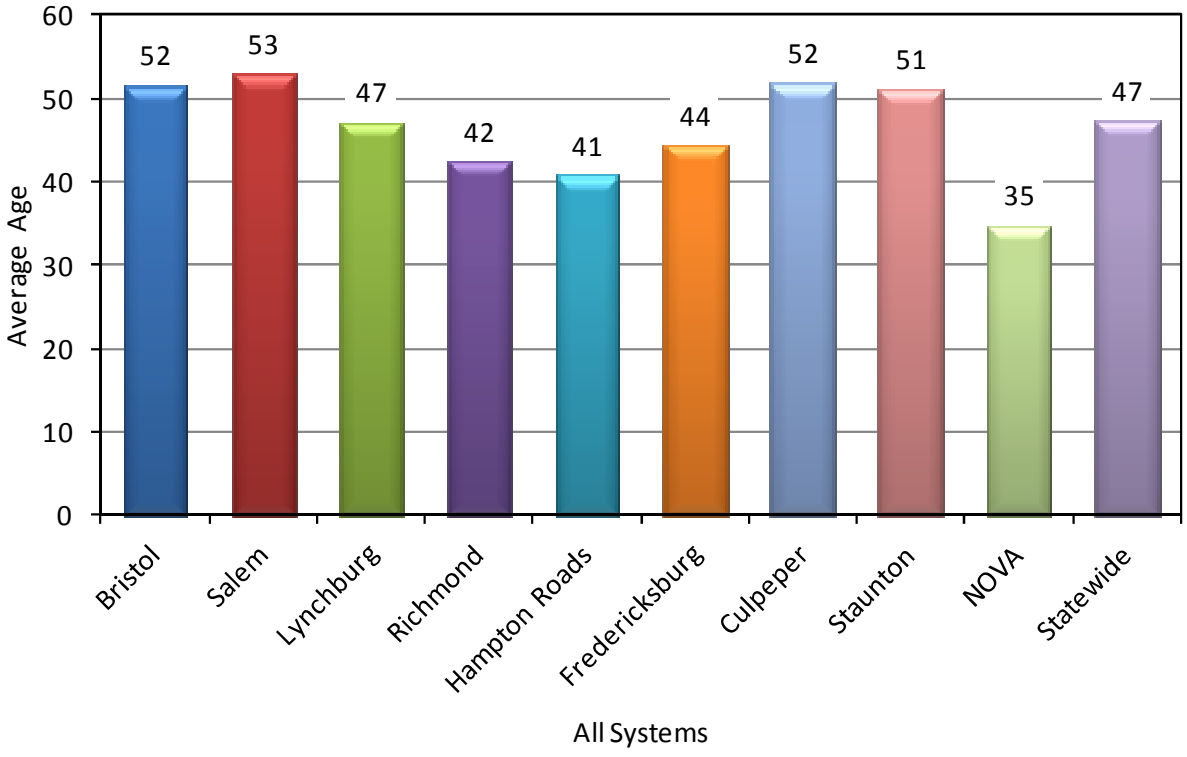
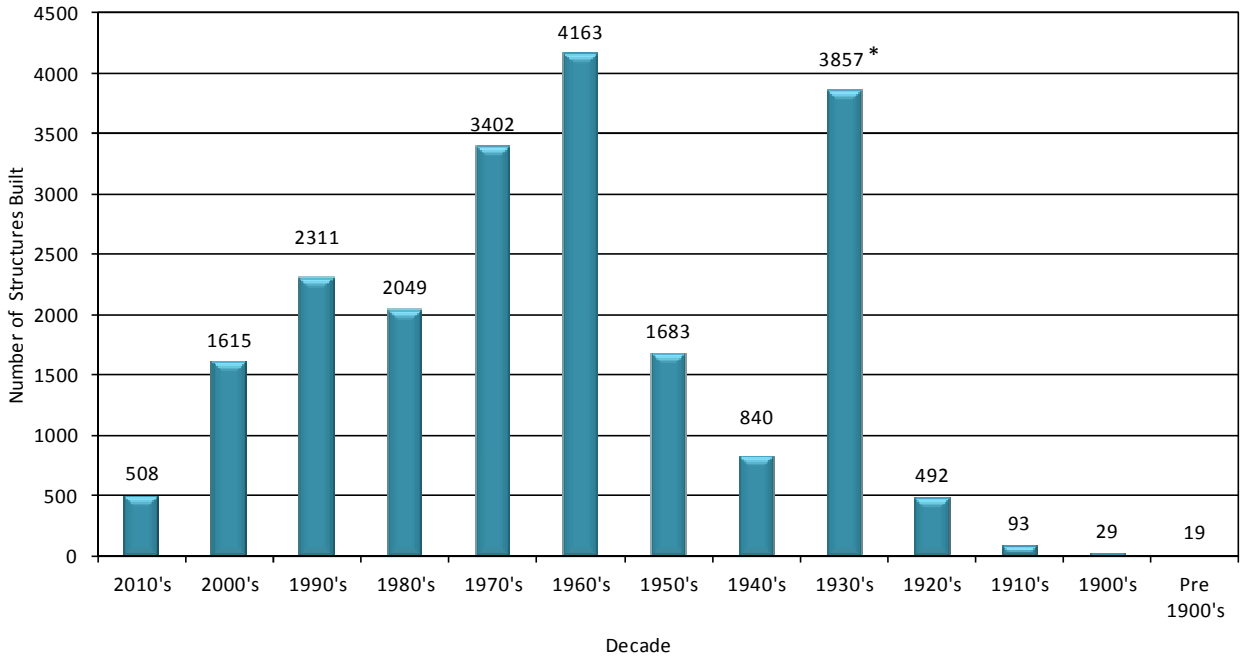


Chart 6 – Number of Bridges and Culverts Built per Decade



* County Bridges added to the VDOT Inventory during this period with unknown construction dates. Those structures with unknown construction dates have been assumed to have been built in the 1930s.

Additional inventory information on bridges and culverts can be found in Appendix A.

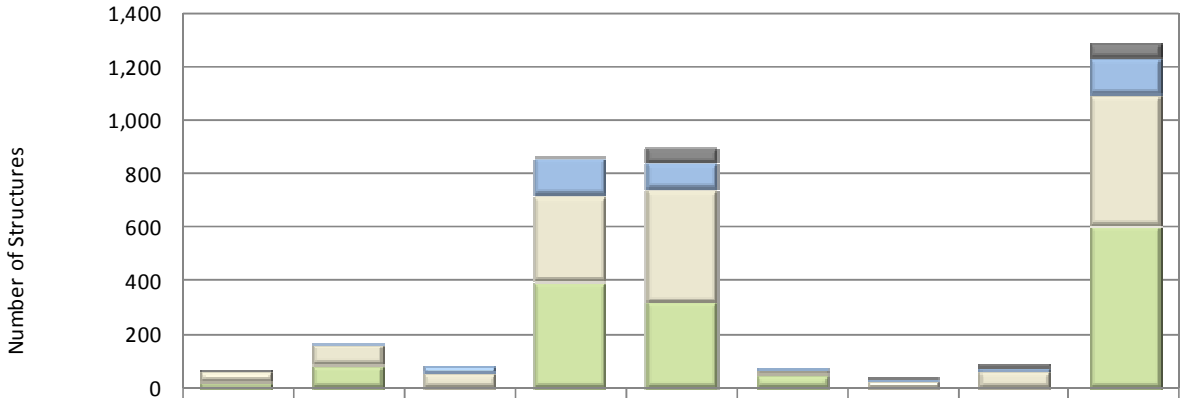
Table 4 below provides a summary of the total number and type of ancillary structures in each district. Similar information for the subcategories of each type of ancillary structure, along with pictures providing typical examples of each type of ancillary structure, is provided in Appendix B.

Table 4 – Total Number of Ancillary Structures

DISTRICT	Number of Ancillary Structures						Percent
	Sign Structures	Luminaires	Signal Supports	High Mast Lights	Camera Poles	Total	
Bristol	72	457	242	76	1	848	2.6%
Salem	172	821	538	13	0	1,544	4.8%
Lynchburg	85	302	290	0	0	677	2.1%
Richmond	855	2,273	1,530	105	0	4,763	14.7%
Hampton Roads	894	6,855	522	145	288	8,704	26.9%
Fredericksburg	72	453	718	1	1	1,245	3.9%
Culpeper	39	158	367	0	0	564	1.7%
Staunton	92	45	451	26	53	667	2.1%
Northern Virginia	1,278	7,118	4,486	323	87	13,292	41.1%
Statewide	**3,559**	**18,482**	**9,144**	**689**	**430**	**32,304**	**100.0%**

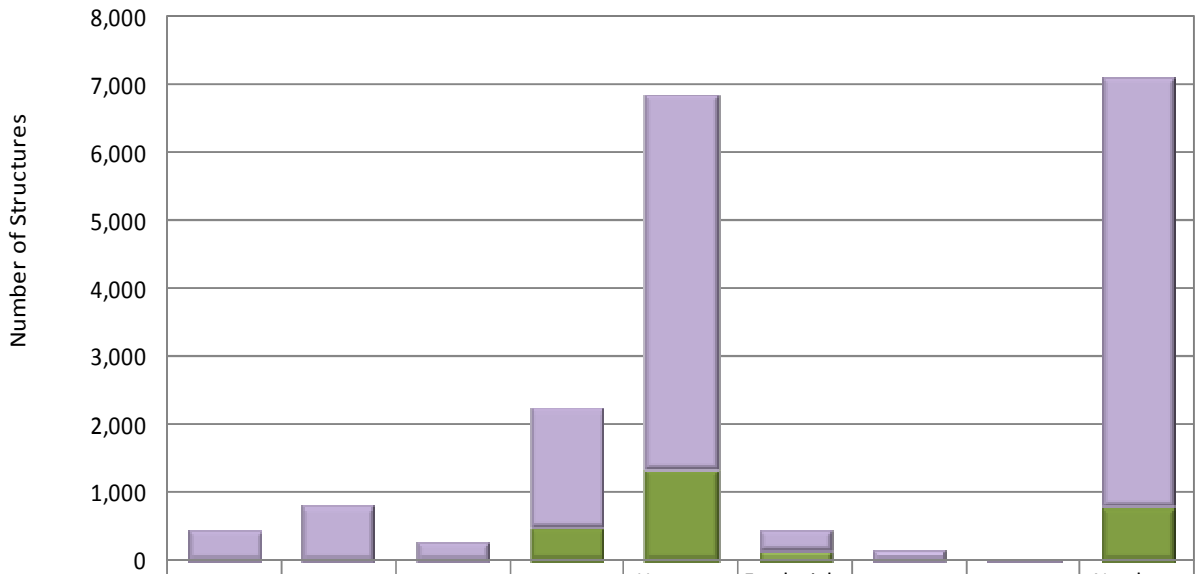
Charts 7 through 10 graphically display the total number of ancillary structures for each of the general structure types by subcategory and district.

Chart 7 – Number of Sign Structures by Subcategory and District



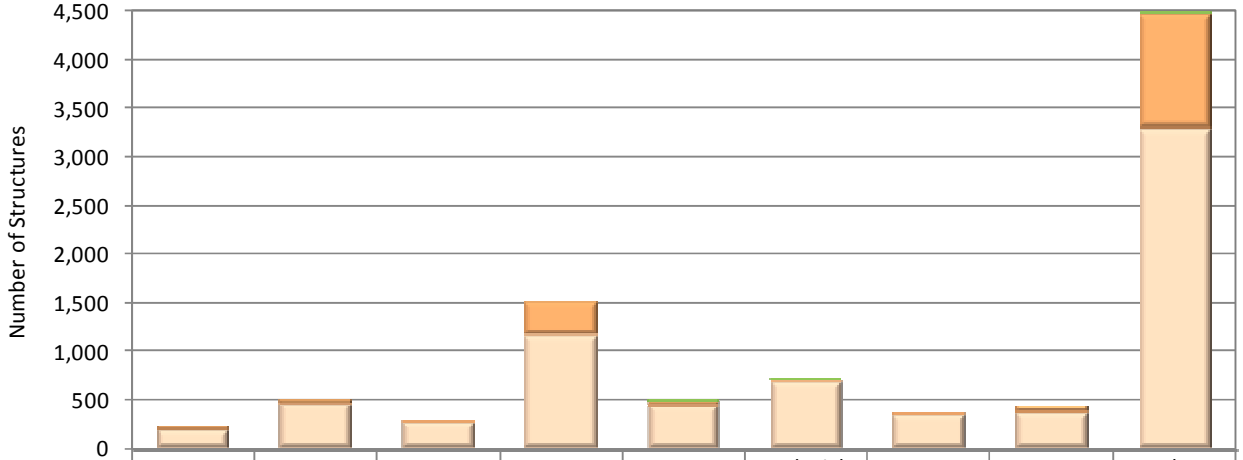
	Bristol	Salem	Lynchburg	Richmond	Hampton Roads	Fredericksburg	Culpeper	Staunton	Northern Virginia
Butterfly	10	0	0	1	57	0	3	15	51
Parapet Mount	2	6	29	140	99	1	10	16	137
Overhead	38	82	52	325	420	21	18	51	486
Cantilever	22	84	4	389	318	50	8	10	604
Total	72	172	85	855	894	72	39	92	1,278

Chart 8 – Number of Luminaire Structures by Subcategory and District



	Bristol	Salem	Lynchburg	Richmond	Hampton Roads	Fredericksburg	Culpeper	Staunton	Northern Virginia
Luminaires	455	797	302	1,765	5,494	325	158	45	6,319
Parapet Mount	2	24	0	508	1,361	128	0	0	799
Total	457	821	302	2,273	6,855	453	158	45	7,118

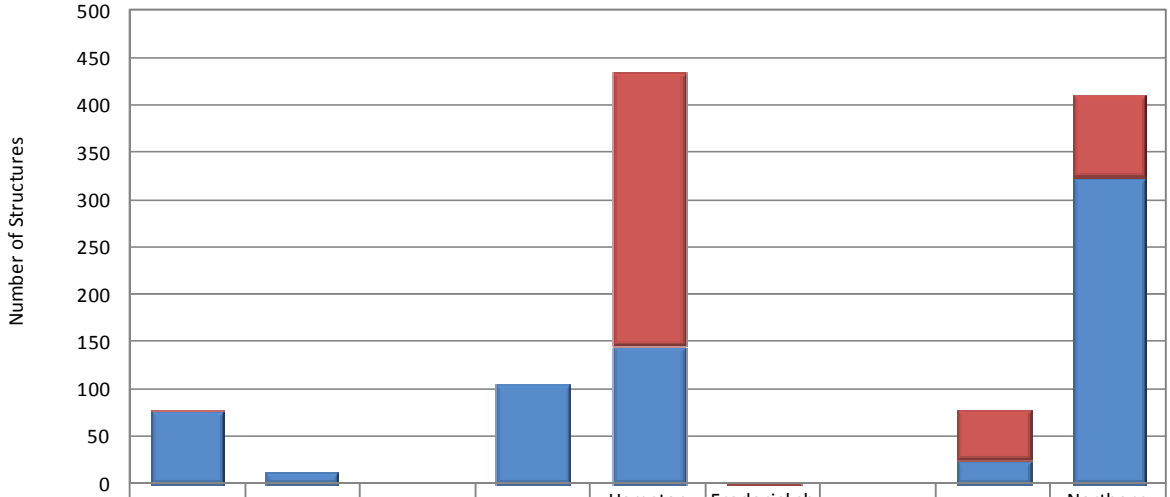
Chart 9 – Number of Signal Structures by Subcategory and District



	Bristol	Salem	Lynchburg	Richmond	Hampton Roads	Fredericksburg	Culpeper	Staunton	Northern Virginia
Other *	0	0	0	0	1	1	0	0	14
Span Wire	30	53	2	358	55	16	8	77	1,170
Cantilever	212	485	288	1,172	466	701	359	374	3,302
Total	242	538	290	1,530	522	718	367	451	4,486

*Other - Overhead and Parapet Mount Structures

Chart 10 – Number of High Mast Lights and Camera Poles by Subcategory and District



	Bristol	Salem	Lynchburg	Richmond	Hampton Roads	Fredericksburg	Culpeper	Staunton	Northern Virginia
High Mast Lighting	1	0	0	0	288	1	0	53	87
Camera Poles	76	13	0	105	145	1	0	26	323
Total	77	13	0	105	433	2	0	79	410

MEASURING PERFORMANCE

VDOT's system performance measure for bridge and culvert structures is based on the percentage of structurally deficient structures in the Department's inventory. A Structurally Deficient (SD) structure has either of the following:

- a general condition rating (GCR) of poor (GCR of 4) or less for one or more of the following structural components: deck, superstructure, substructure or culvert, or
- an appraisal rating of two (2) or less for the structural condition or waterway adequacy.

These deficient structural components 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. Appendix C provides definitions of the general condition ratings. Appendix C also provides comparative data on the average condition ratings by District.

VDOT's current goal is to have no more than eight (8%) percent SD structures for the entire state. Goals have also been established to limit the percentage of SD structures on each of the three highway systems. These goals apply statewide and to the Districts individually: three (3%) percent of Interstate system structures, six (6%) percent of Primary system structures, and eleven (11%) percent of Secondary system structures.

At the end of the Fiscal Year, 6.9% percent (1,453 structures) of the total inventory was rated as SD. Tables 5a and 5b show the number of SD structures that were restored and those that fell into SD status during the fiscal year. Chart 11 graphically displays this information by District. Charts 12 and 13 show the current percentage of SD structures by District (District percentages are based on the number of structures in that particular District) for each highway system and a six year trend for each highway system. These charts address all of the Commonwealth's structures, including those that are not part of the NBI. Appendix D provides more detailed data by highway system.

Appendix L shows the national trend of deficient structures from 2000 to 2013. National data is reported by the states at the end of March for the previous year and is not available until May or June of the following year. The data for Virginia shown in Appendix L only addresses the NBI bridges and culverts, which does not include structures with a length 20 feet or less.

Table 5a – Change in Number of Structurally Deficient Structures Between FY2013 and FY2014

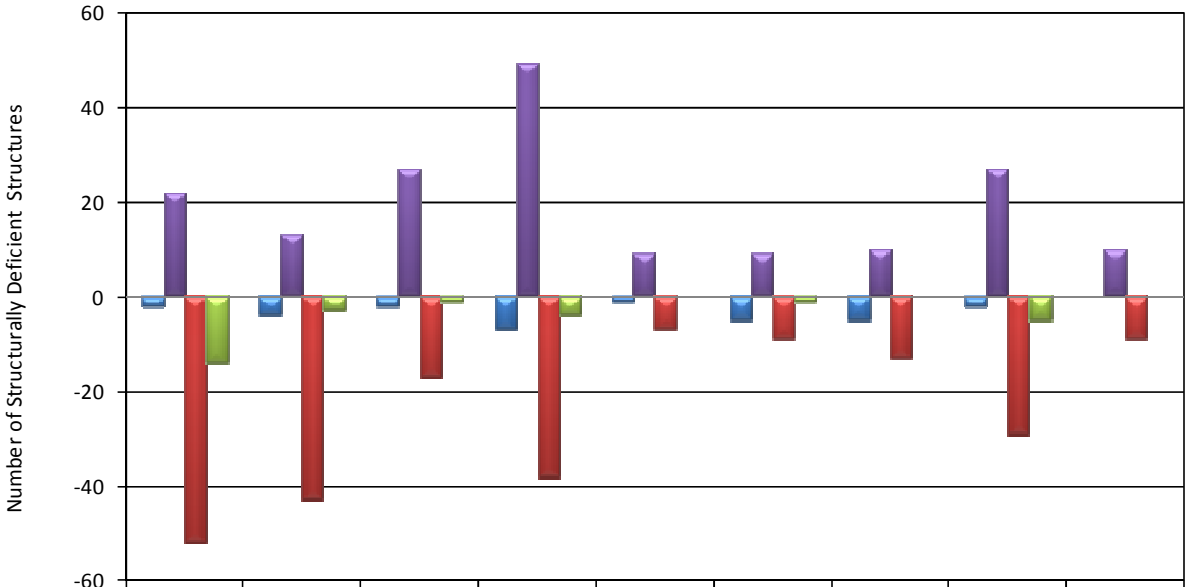
DISTRICT	Structurally Deficient		
	End of FY2013	End of FY2014	Change
Bristol	346	300	-13.3%
Salem	282	245	-13.1%
Lynchburg	126	133	5.6%
Richmond	241	241	0.0%
Hampton Roads	88	89	1.1%
Fredericksburg	80	74	-7.5%
Culpeper	125	117	-6.4%
Staunton	212	203	-4.2%
NOVA	50	51	2.0%
Statewide	**1,550**	**1,453**	**-6.3%**

Note: Percentages are based on count of FY2014 inventory

Table 5b – Change in Number of Structurally Deficient Structures During FY2014

DISTRICT	During FY14				
	Restored	Closed	Removed	Deteriorated	Change
Bristol	-52	-2	-14	+22	-46
Salem	-43	-4	-3	+13	-37
Lynchburg	-17	-2	-1	+27	7
Richmond	-38	-7	-4	+49	0
Hampton Roads	-7	-1	0	+9	1
Fredericksburg	-9	-5	-1	+9	-6
Culpeper	-13	-5	0	+10	-8
Staunton	-29	-2	-5	+27	-9
NOVA	-9	0	0	+10	1
Statewide	**-217**	**-28**	**-28**	**+176**	**-97**

Chart 11 –Number of Structurally Deficient Structures Restored Vs. Deteriorated During FY2014



	Bristol	Salem	Lynchburg	Richmond	Hampton Roads	Fredericksburg	Culpeper	Staunton	NOVA
Closed	-2	-4	-2	-7	-1	-5	-5	-2	0
Deteriorated	+22	+13	+27	+49	+9	+9	+10	+27	+10
Restored	-52	-43	-17	-38	-7	-9	-13	-29	-9
Removed	-14	-3	-1	-4	0	-1	0	-5	0

Chart 12 – Percentage of Number of Structurally Deficient Structures Statewide End of FY2014

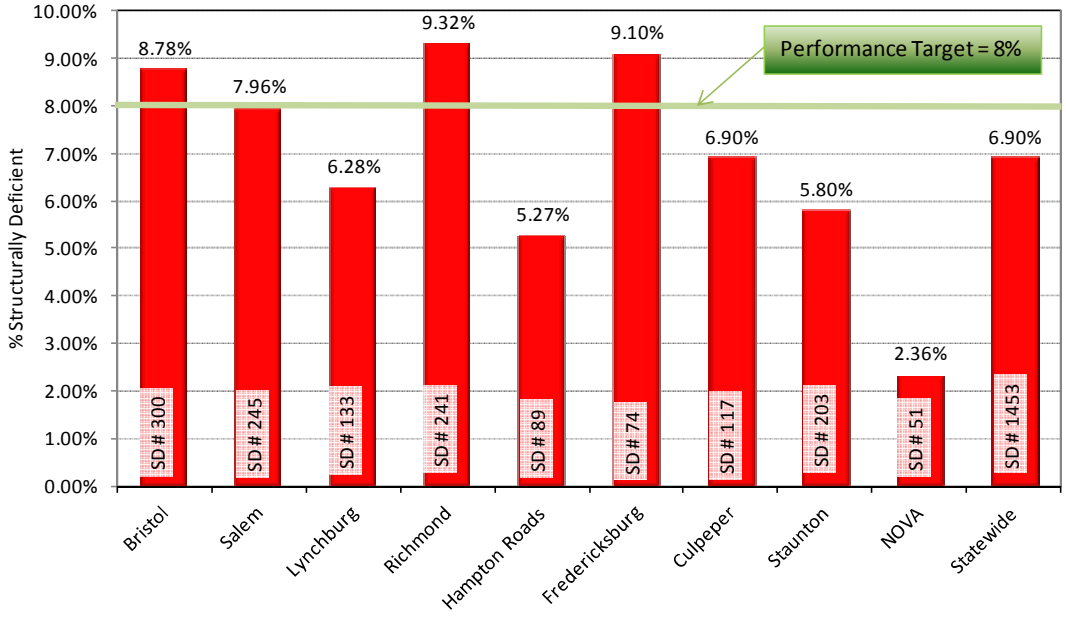
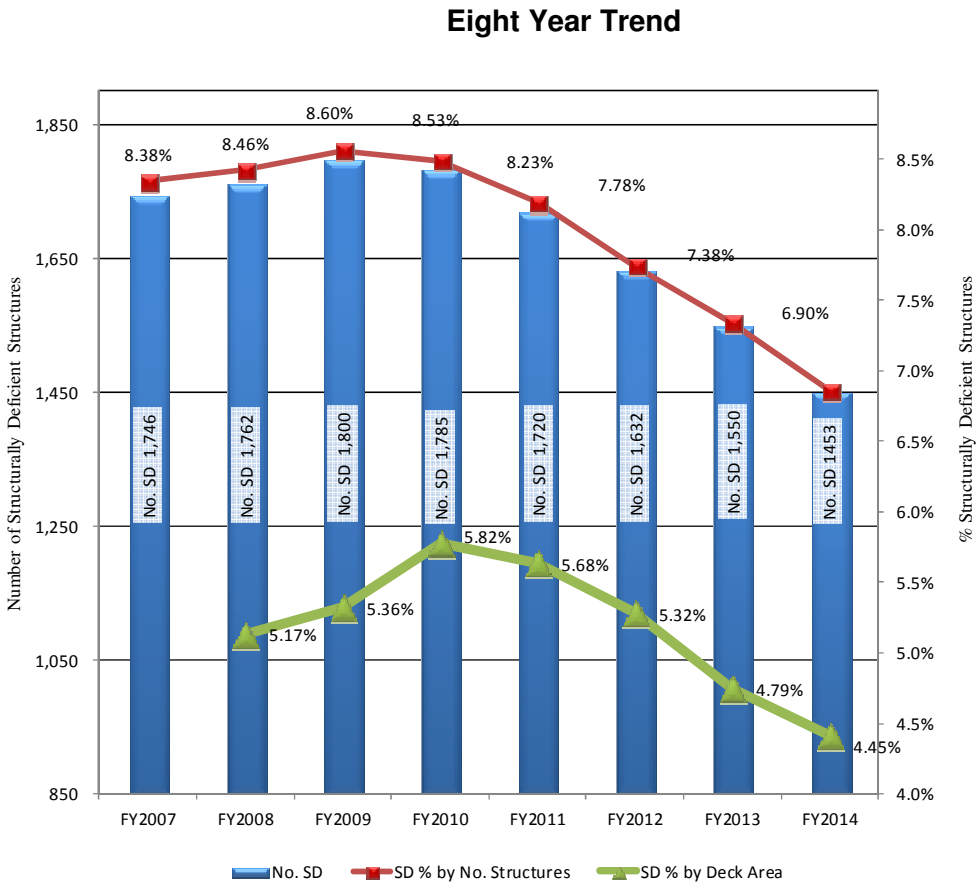


Chart 13 – Percentage of Structurally Deficient Structures Statewide



VDOT also tracks other indicators to assist in the overall management of the structural inventory. These include: functional obsolescence (FO), structurally deficient structures, the number of posted structures, deficient deck area and the Health Index.

Appendix C compares general condition ratings by structure component and District. Appendix F shows the fiscal year performance measures based on the square footage area of the structures. Charts showing multi-year trends for these indicators statewide and for each highway system are given in Appendix E. The charts address all of the bridges and culverts that comprise the Commonwealth's inventory, including those that are not part of the NBI. As discussed in Appendix G, the method of accounting for the number of structures by system has changed from previous years. Accordingly, graphs depicting data for specific highway systems show trend lines beginning in FY2009.

Statewide and District maps showing the location of each SD structure are located in Appendix H. Appendix I shows examples of items that can cause a structure to be functionally obsolete.

VDOT operates a Quality Assurance Program to help ensure that all of the inspections performed follow the national and VDOT requirements for the inspection of structures in the Commonwealth. Appendix J gives an overview of the Quality Assurance Program followed in the Commonwealth.

VDOT's Future Performance goals And Work Needs

Performance measurement has become an essential tool for making the best use of limited funds in a highly transparent and accountable manner. A sound performance measurement program cannot be implemented overnight. It requires years of work to identify and adopt a set of metrics that are meaningful, actionable and practical to measure.

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

The Structure and Bridge Division uses three sets of performance goals in determining its program's monetary needs. These performance goals address structures in various condition categories. True system preservation extends the service life of structures, which requires a balanced approach that places emphasis on structures in good, fair and poor condition. For consistency and ease of measurement, structures are placed in one of the three condition categories based on the minimum General Condition Rating of each structure, as assigned during the structure's most recent safety inspection. As explained elsewhere in this report, the General Condition Rating is a numerical measurement of the primary components of each structure. Measured on a 0-9 scale, with 0 representing a failed structure, a General Condition Rating (GCR) is assigned to each bridge's deck, superstructure and substructure at each inspection. Culverts receive a single GCR. The minimum GCR for each bridge or culvert is used to define its condition category (good, fair or poor) as follows:

Good Structures:	Minimum GCR ≥ 6
Fair Structures:	Minimum GCR = 5
Poor Structures:	Minimum GCR ≤ 4

The general work needs for a balanced approach to bridges in good, fair or poor condition are shown below and are noted in Chapter 32 of Volume 5, Part 2, of the VDOT Manuals of the Structure and Bridge Division:

- Maintain 90% of expansion joints in a Condition State of 1[1].
- Eliminate 2% of the expansion joints in each District in each fiscal year.
- Perform maintenance activities on at least 6% of structures with a minimum GCR of 5 in each District in each fiscal year.
- Perform maintenance activities on at least 2% of structures with a minimum GCR of 6 in each District in each fiscal year.
- For each highway system no more than the following percentage of structures can be structurally deficient[2]

Interstates	3%
Primaries	6%
Secondaries	11%
All	8%

[1] *In addition to GCR, Condition States are assigned to various critical bridge elements during bridge inspections. Elements in good condition are assigned a condition state of "1", and higher numbers are assigned to elements in worse condition*

[2] *There is a very close, but not exact, correlation between "Poor" structures and "Structurally Deficient" (SD) structures. All poor structures (min GCR≤4) are SD, but about 5% of VDOT's SD structures are in fair or good condition, and these structures receive the SD designation due to other factors (waterway clearance or load capacity).*

The performance goals above were determined using an analysis of the annual transition of VDOT's structures from one condition classification to another. Recognizing that the bridge maintenance program requires a balanced approach, where the maintenance needs of structures in each of the three condition classifications 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. Since the goal of the study was to determine how individual structures deteriorate from the beginning to the end of a fiscal year (year-to-year) only those structures that existed at begining and end of the Fiscal Year were included in the study. The numbers of actual year-to-year transitions for the Fiscal Year is displayed in Chart 15, which depicts the number of structures that transition from one condition classification to another or move up or down within a condition classification. The initial study focused on the transition between 2009 and 2010, and the numbers were used to establish a baseline and develop achievable goals for each condition classification.

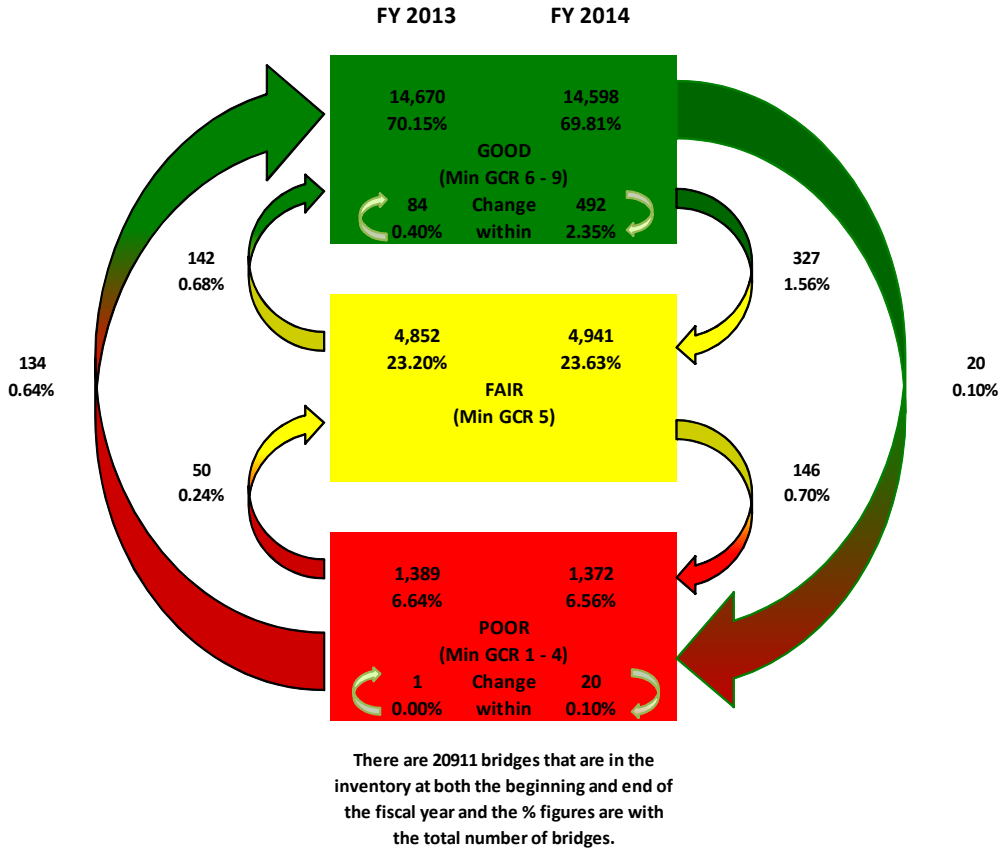
Based on the study, it was determined that system sustainability could be achieved with the goals shown above. Furthermore, these goals were deemed to be reasonably attainable with existing staff. However, the funding required to meet these goals remains significantly higher than provided.

As shown in Chart 15, in the current Fiscal Year, 327 structures went from "Good" to "Fair" condition and 142 structures were improved from "Fair" to "Good" condition. This analysis utilized only structures that were present in the inventory at both the beginning and end of the Fiscal Year, thus eliminating any influence of new, replaced and closed bridges.

While early preservation actions are significantly more cost-effective, the maintenance program cannot focus exclusively on the better structures. The age and condition of the inventory, along with the needs of the traveling public, require that poor structures be repaired, rehabilitated or replaced. These very real constraints have led VDOT to adopt a balanced approach to bridge maintenance, which is reflected in the three sets of performance goals.

The establishment of performance goals for bridges has received a great deal of attention nationally, and the Federal Highway Administration and AASHTO have been working to establish consensus on the best guidelines and methodologies.

Chart 14 – Annual Transitions of GCR from FY2013 to FY2014



Tthe most recent federal highway legislation, MAP-21 establishes a minimum standard for NHS bridge conditions. If more than 10% of the total deck area of NHS bridges in a State is on structurally deficient bridges for three consecutive years, the State must devote National Highway Performance Program (NHPP) funds in an amount equal to 50% of the State's FY 2009 Highway Bridge Program apportionment to improve bridge conditions during the following fiscal year (and each year thereafter if the condition remains below the minimum). MAP21 also requires each state to establish and meet performance goals for its inventory. MAP-21. Nearly all of the reports published to date have aligned closely with VDOT's approach, recommending a balanced approach to both maintenance and measurement of performance.

More information about the national effort to understand performance measurement and goals may be found in the following links and documents:

DRAFT Report to the AASHTO Subcommittee on Bridges and Structures (SCOBS)
Topic: Development of National Performance Measures for Highway Bridges
Presentations concerning performance measures for bridges:
http://bridges.transportation.org/Documents/2014%20SCOBS%20presentations/Technical%20Committee%20Presentations/T-9_9_Bruce%20Johnson_National%20Bridge%20Performance%20Measures.pdf

ANCILLARY STRUCTURES

Ancillary structures are rated using general condition rating definitions that are similar to those used in the FHWA's National Bridge Inventory System. General Condition Ratings (GCRs) are assigned based on a numerical grading system that ranges from 0 (failed condition) to 9 (excellent condition). Appendix K gives a brief description for each of the ratings and also provides illustrative examples.

At the time of each inspection, inspectors assign a GCR for each of the major structural components: foundation; parapet mounting; and superstructure. They do not rate the appurtenances supported by the ancillary structure such as sign panels, light fixtures and traffic signals.

In order to develop a general understanding of the condition of the ancillary structure inventory, the nine condition ratings have been combined into three categories: Good (GCR > 5), Fair (GCR = 5) and Poor (GCR < 5). Summaries of this analysis for the four general type structures are provided in Tables 6 and Charts 14a through 14e. Charts 14a through 4d presents minimum general condition rating by structure type with GCR percentages.

Table 6 – Minimum General Condition by Structure Type

Structure Type	Minimum General Condition Rating (No. of Structures)			Minimum General Condition Rating (Percentage)		
	Good	Fair	Poor	Good	Fair	Poor
Signs	2,194	795	570	61.6%	22.3%	16.0%
Signals	3,585	3,477	2,082	39.2%	38.0%	22.8%
High Mast Lights and Camera Poles	875	165	79	78.2%	14.7%	7.1%
Luminaires	6,529	6,005	5,948	35.3%	32.5%	32.2%
Total	**13,183**	**10,442**	**8,679**	**40.8%**	**32.3%**	**26.9%**

Chart 15a – Sign Structures by Minimum General Condition Rating

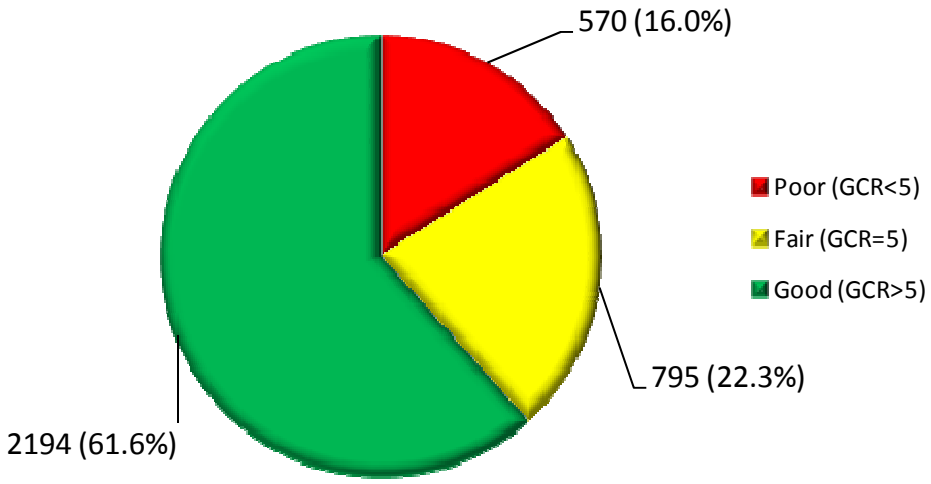


Chart 15b – Signal Structures by Minimum General Condition Rating

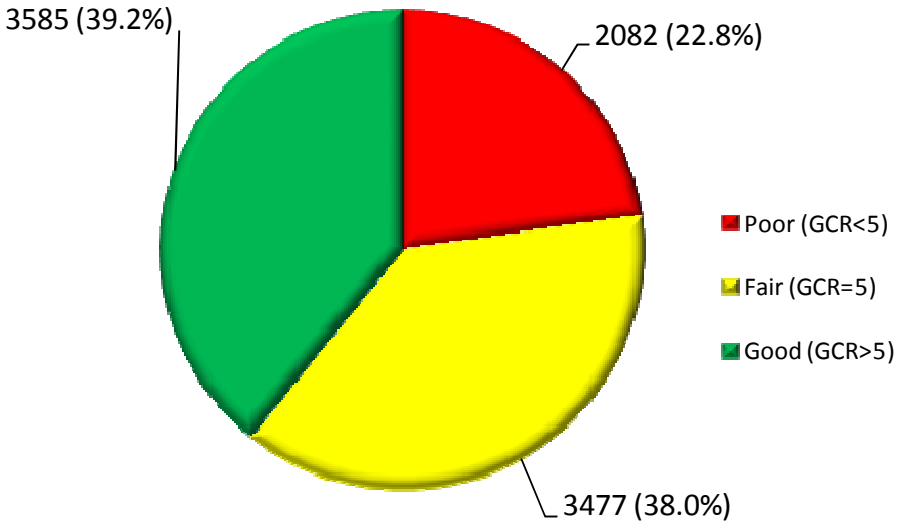


Chart 15c – High Mast Lights and Camera Poles by Minimum General Condition Rating

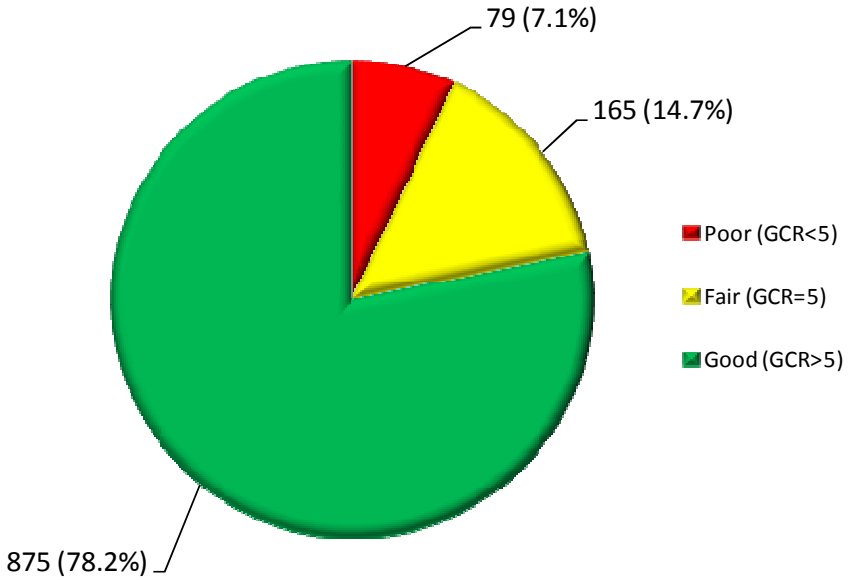


Chart 15d – Luminaires by Minimum General Condition Rating

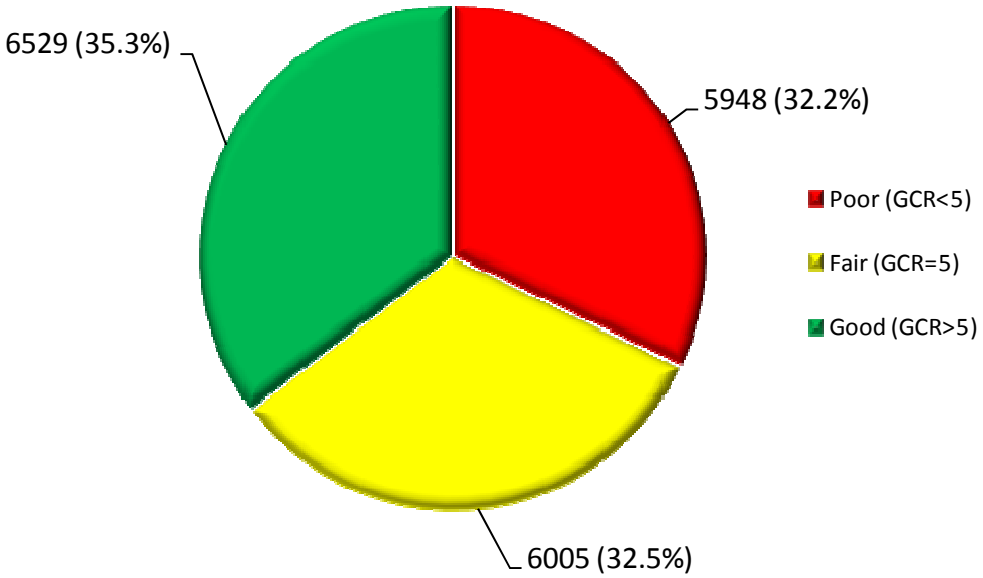
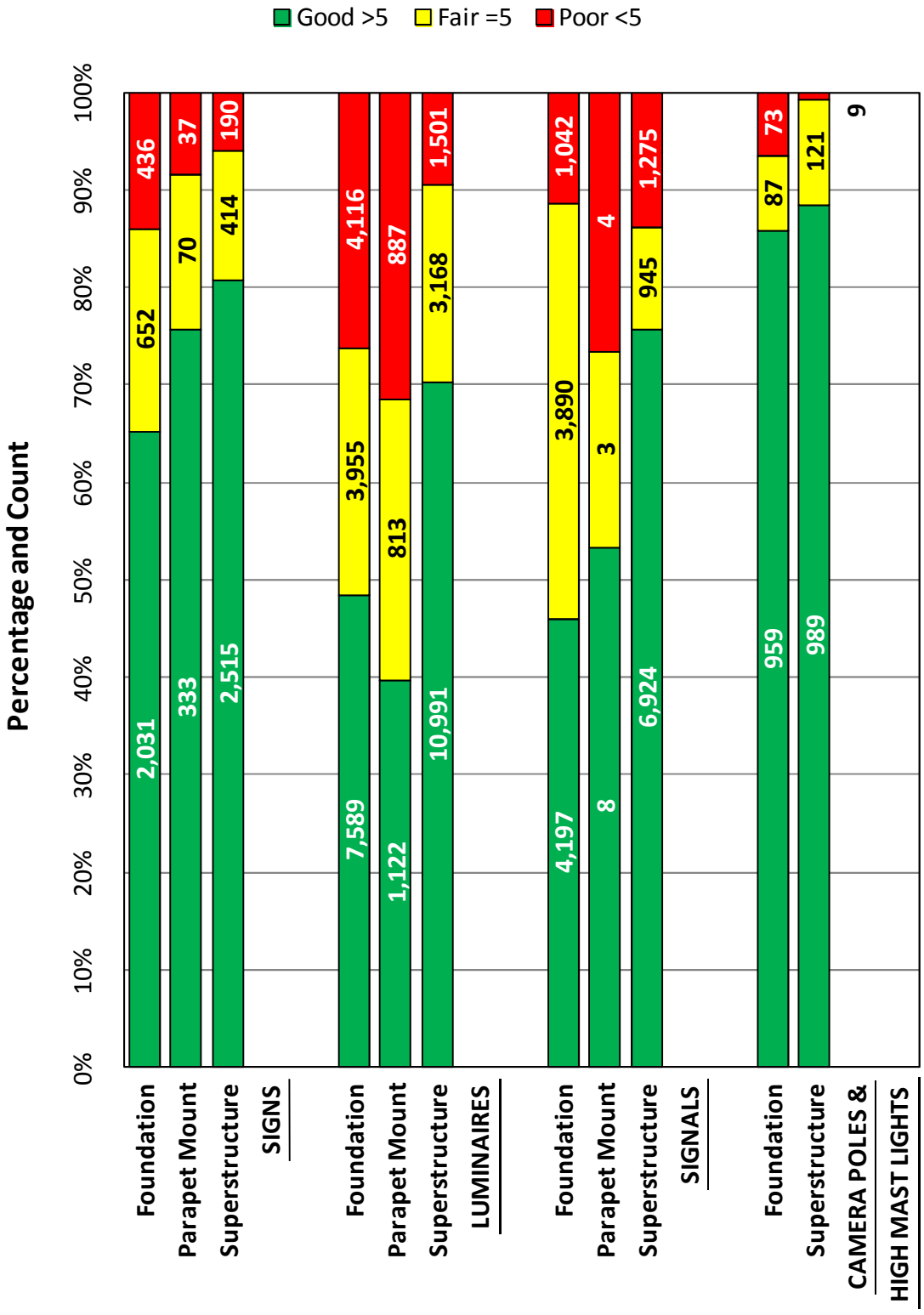


Chart 14e provides the condition of the ancillary structures by structural component by asset statewide. In Appendix K, other charts are presented to gain a more specific understanding of the conditions that cause structures to receive reduced GCRs.

Chart 15e – Statewide Ancillary Structure Condition by Asset Type



VDOT's Structure & Bridge Program Funding

The Structure & Bridge Division receives funding for bridge projects through two programs within VDOT: Highway System Acquisition and Construction (603) Program and Highway System Maintenance (604) Program.

The Construction (603) Program is primarily supported by a federal fund formerly known as the Highway Bridge Replacement Program (HBRRP), created in 1978 by the Surface Transportation Assistance Act. The HBRRP was established by the United States Congress to provide a funding source for the nation's in-service bridges. The original intent of the program was to fund bridge rehabilitation and replacement needs. In 2005, the Safe, Accountable, Flexible, Efficient Transportation Equity Act (SAFETEA-LU) was signed into law. SAFETEA-LU established extensive new resources and opportunities to fund bridge construction. Federal Funds apportioned as the HBRPP shall be allocated and obligated as required by federal law to eligible projects. The anticipated federal bridge allocations were taken out of the system formula to create what was known as the Dedicated Bridge Fund (DBF). Funding eligibility for bridge projects then extended beyond replacement and rehabilitation to include preservation activities.

In October 1, 2012, the federal government implemented a new funding program to replace SAFETEA-LU called MAP-21. MAP-21 eliminated the federal dedicated bridge program. MAP-21 created three funding sources for the S&B Construction (603) Program. The bridge program funds are denoted as NHPP-BR, STP-BR and STP-BROS.

NHPP-BR funds are designated for structures on the National Highway System (NHS).

STP-BR funds are the most flexible type funds. They can be used on any bridge project regardless of roadway classification or NBI status.

STP-BROS funds are mandated by the federal government. These funds can only be used for bridges that are not on the NHS.

Along with the new MAP-21 funds in FY2014, the Governor's Transportation Package of 2012 introduced new Commonwealth Transportation Board (CTB) funds in FY2014. The General Assembly has identified 25% of the CTB funding to be directed to the Commonwealth's bridge program from FY2014 through FY2020. These are state funds contributing to the bridge program. In FY2014, the S&B Division had funding distribution for NHPP-BR, STP-BR and STP-BROS. In FY2015, S&B gained control the CTB Bridge funds and now has funding distribution responsibility for all four funding sources. The CTB Bridge funds are being utilized to supplement the S&B bridge program priorities.

The eligibility of the different types of federal funding available to the S&B Construction (603) Program is shown in the table below:

BRIDGE FUND ELIGIBILITY				
	NHS (On System)	Non NHS (Off System)	NBI (> 20' Length)	Non NBI Structures (< 20' Length)
NHPP-BR	X		X	X
STP-BR	X	X	X	X
STP-BROS		X	X	
CTB BRIDGE	X	X	X	X

Structures meeting the requirements are eligible for bridge program funds:

1. The bridge is structurally deficient.
2. The bridge meets the National Bridge Inventory (NBI) criteria (carries highway traffic and is greater than 20 feet in length).
3. The bridge sufficiency rating shall be less than 80.
4. No major reconstruction work can be done to the bridge in the last 10 years regardless of the funding source or type that was used.
5. Estimated project cost is less than $20 million.
6. Only VDOT maintained bridges.

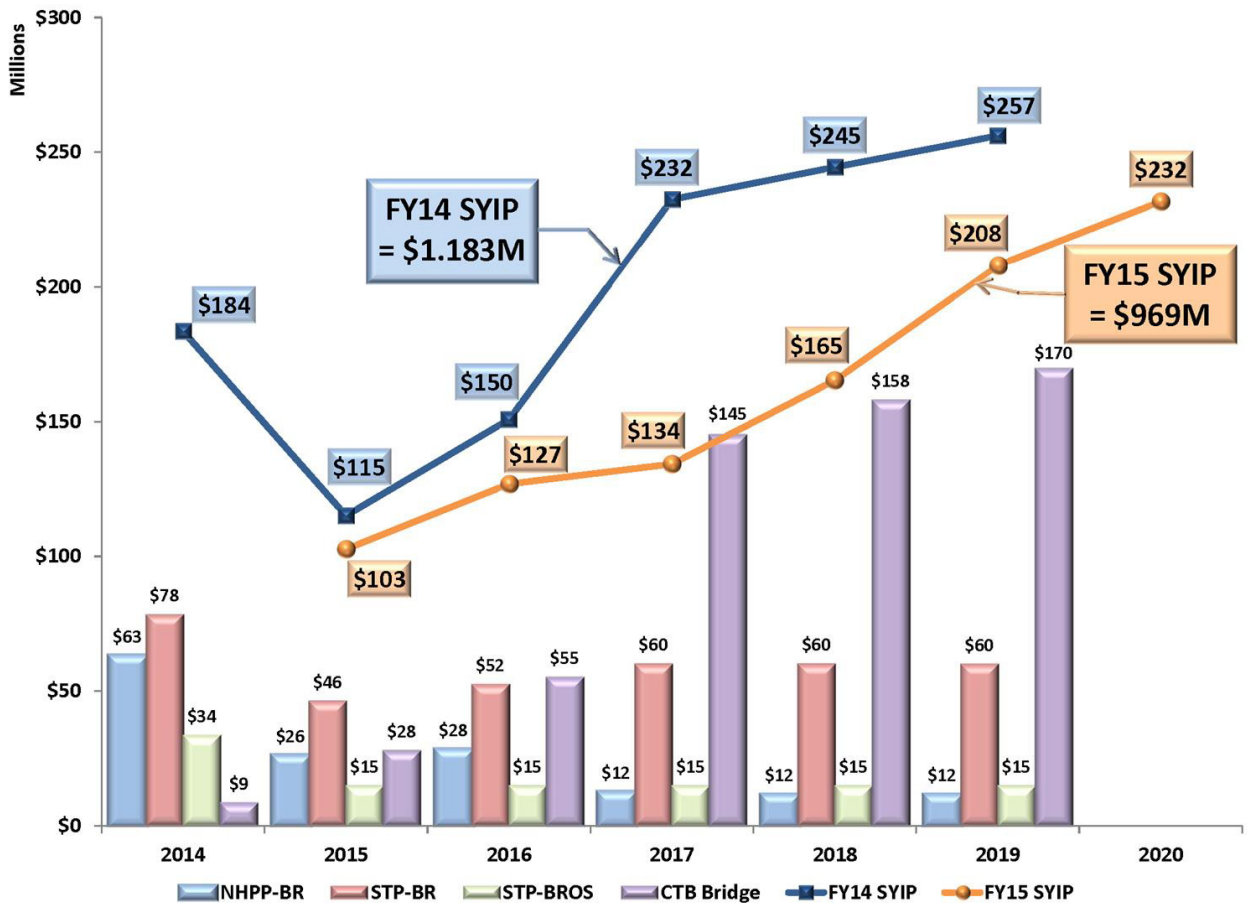
The federal funds for the S&B Construction (603) Program are apportioned to the S&B Division by the VDOT Programming Division Office. NHPP-BR and STP-BR funding levels are apportioned at the discretion of the VDOT Programming Division Office. The STP-BROS funding levels are set aside at no less than 15% of the State's Highway Bridge Program apportionment.

The Structure and Bridge Division then distributes the bridge program funds among the nine (9) VDOT District Bridge offices based on a distribution formula. This formula allocates funds for each district based the square footage area of deficient bridges and the number of SD structures that are not currently funded in each district. The districts distribute their allocated funds based on structural priorities. A ranking formula was developed to aid in prioritizing the funding and programming of eligible projects. The formula considers the following factors: Average Daily Traffic (ADT), Truck ADT, Weight Restrictions, Detour Length, Sufficiency Rating, Fracture Critical, Scour Critical, Structural Deficiency, General Condition Rating, Substandard Roadway Width; and Age. Each factor is weighted equally. This methodology is monitored yearly for continuous improvement.

For FY2014, the Structure and Bridge Division had $184M for the Construction (603) Program to address structurally deficient structures.

Graph 16 below shows the funding levels of the Bridge Program for FY2014 and projected funding in FY2015. The column graphs show the breakdown of the FY2014 funds per funding type (NHPP-BR, STP-BR, STP- BROS, CTB Bridge).

Chart 16 – S&B Construction (603) Program Funding FY2014 SYIP vs. FY2015 SYIP



The CTB Bridge funds made up approximately 50% of the S&B Construction (603) FY2014 SYIP. The majority of the CTB Bridge funds are expected in FY2017 through FY2019. The CTB Bridge funds are expected to sunset in FY2020, after which the S&B Construction (603) bridge program funding is expected to return to pre-CTB Bridge levels of approximately $80M per year.

The S&B 603 SYIP program saw a $214M drop between FY2014 and FY2015. This is mainly attributed to lower than expected state revenues. Most of the reduction was in the CTB Bridge funds, as they are funded through state revenues.

The three curves shown in Chart 17 compare the funding plans for the most recent fiscal years. Each curve displays the six-year improvement plan as it went live at the beginning of the fiscal year.

FY2014 was the first year in which CTB Bridge Funds were programmed, so FY2013 provides a baseline comparison for funding levels before and after the introduction of these funds. The infusion of the CTB funds in FY2014 caused the total bridge construction funding to more than double from FY2013 levels

Chart 17 – S&B Construction (603) Program Comparison from FY2013, FY2014 and FY2015

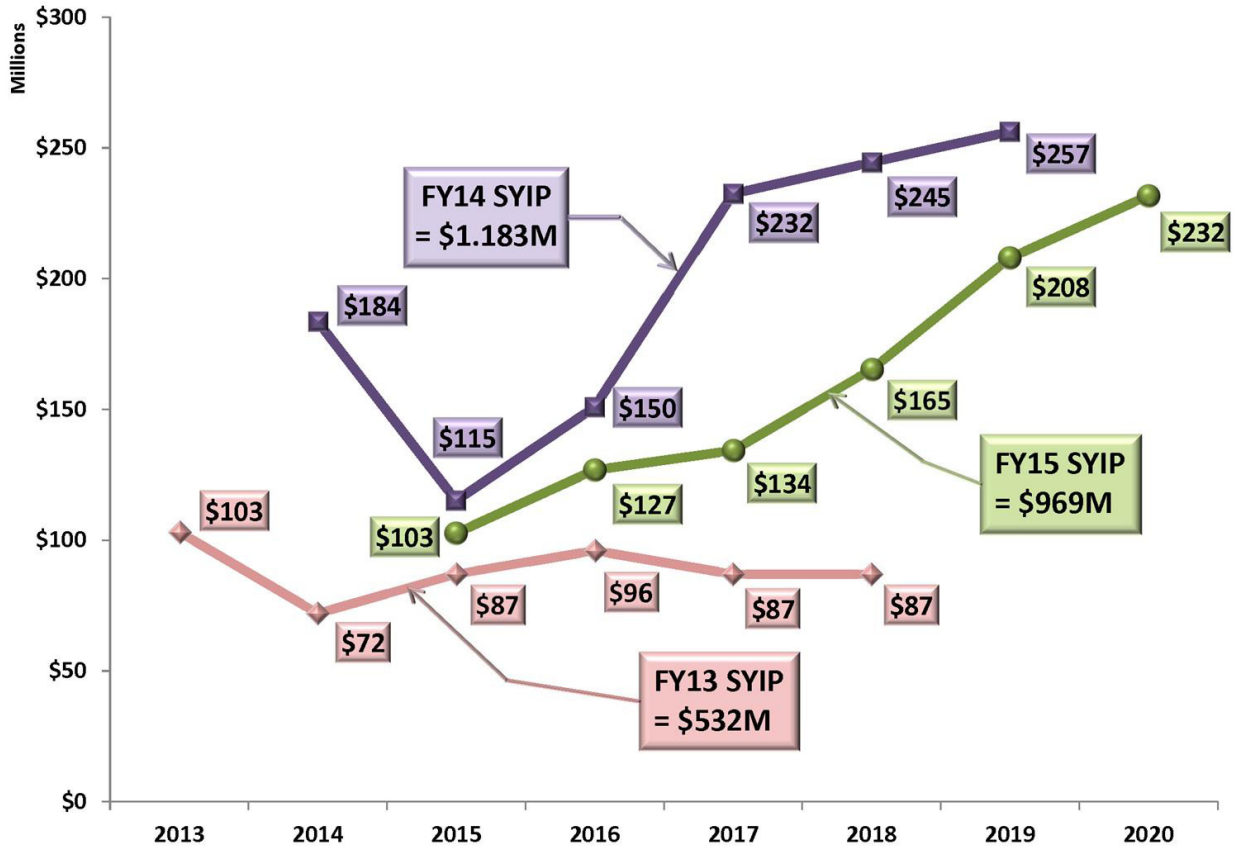
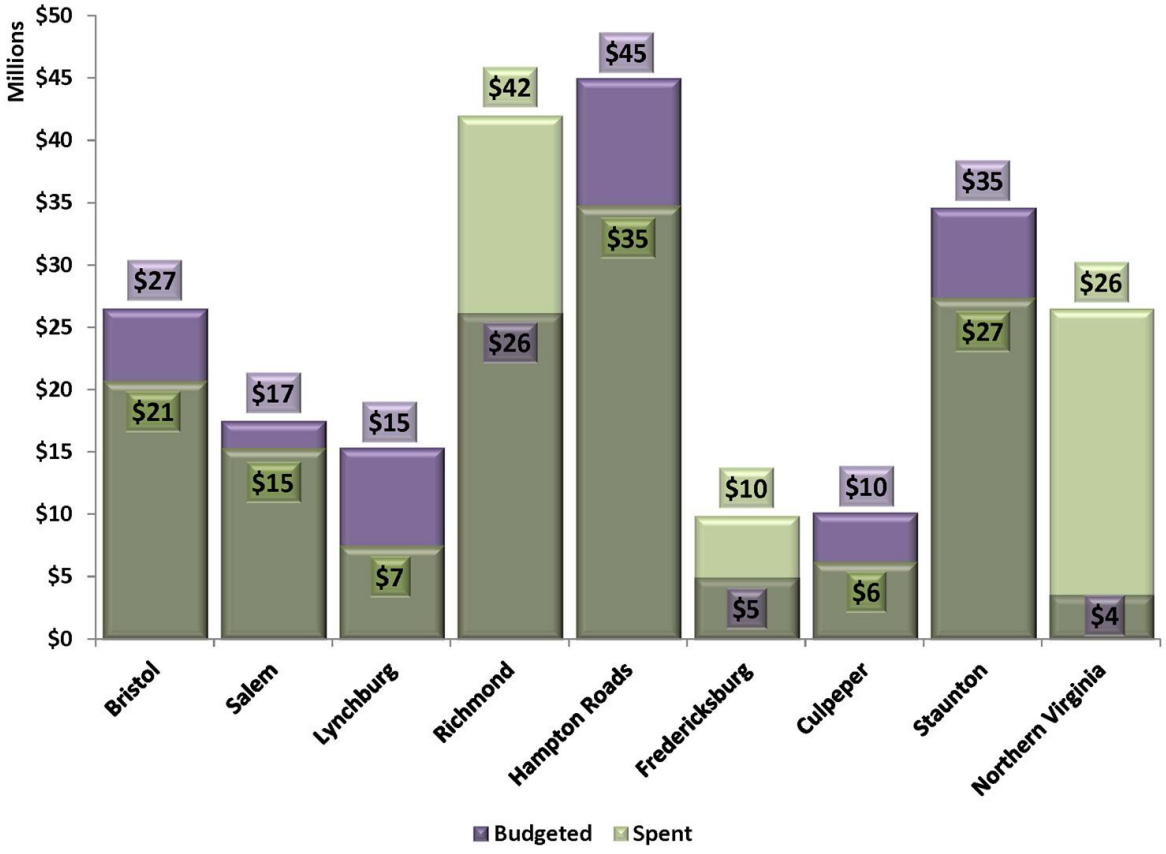


Chart 18 below shows the district distribution of the $184M allocated to the bridge program in FY2014. Actual expenditures for bridge projects in the S&B 603 Construction Program in FY2014 are shown. The program was budgeted for $184M and had $190M in total expenditures. Unspent funds are not lost but rather carry over with the project into the subsequent fiscal year. Differences between the anticipated pace of funding and the spent amounts are often the result of a difference between the anticipated pace of construction and the actual pace. For the same reason, some districts actually spent more than allocated (Fredericksburg, Northern Virginia and Richmond), as funds from previous year(s) carried over on certain projects.

Chart 18 – S&B Construction (603) Program FY2014 Budget vs. Expenditures by District



The difference between budgeted and actual expenditures can be primarily attributed to the multi-year nature of the SYIP projects and should not imply that project budgets are being exceeded.

S&B Maintenance (604) Program Overview

The S&B Maintenance (604) Program is developed and managed by the District Bridge Offices in accordance with the Highway System Maintenance (604) Program. VDOT's Operations Planning Office (OPO) allocates these funds to each District maintenance office and the Central Office Structure & Bridge Division every fiscal year in accordance with the direction of VDOT's Executive Management.

Allocations represent a suggested funding level for each of the activities that require 604 funds. The allocations are based on a proportional formula that determines the suggested funding level based on the program needs as submitted in the Biennial Needs Report. The term "allocation", as used in the process, does not represent an actual funding amount. Rather, it is a recommended funding level for particular activities and cost centers. DMMs use the allocations as a guide to build budgets, which establish the actual funding level for each of the program areas for which the manager has funding responsibility.

OPO generates the Biennial Needs Report and updates the report annually. The monetary needs in the report are determined by the various responsible divisions and are submitted to OPO in tabular format. The needs for the statewide bridge program are developed by the S&B Central Office staff. The reported needs *do not* represent the total funding required to improve all of the structures. Rather, S&B reports needs for the amount of money required to meet its performance goals. The Structure and Bridge Division has implemented performance goals that address structures in "good", "fair" and "poor" condition. The total funding required to improve all of the structures is considerably higher than the amount required to meet the above-referenced performance goals.

The S&B Maintenance (604) Program budget in FY2014 was $158.9M. In recent years the calculated monetary need for bridge maintenance and construction has significantly exceeded available funding. The availability of funding is the most significant factor in the performance of the bridge inventory. The Structure and Bridge Division's single performance measure limits the percentage of structurally deficient structures to 8%. In recent years the percentage of structurally deficient (poor) structures has steadily decreased, reflecting an apparent improvement in bridge conditions. However, while the number of poor structures has indeed decreased, the overall condition of the inventory has not improved. This slow decrease in overall condition can primarily be attributed to the gap between required and available funding. Allocated funds are often used to address structures in immediate need of repair or replacement, leaving less money than required for preventive maintenance.

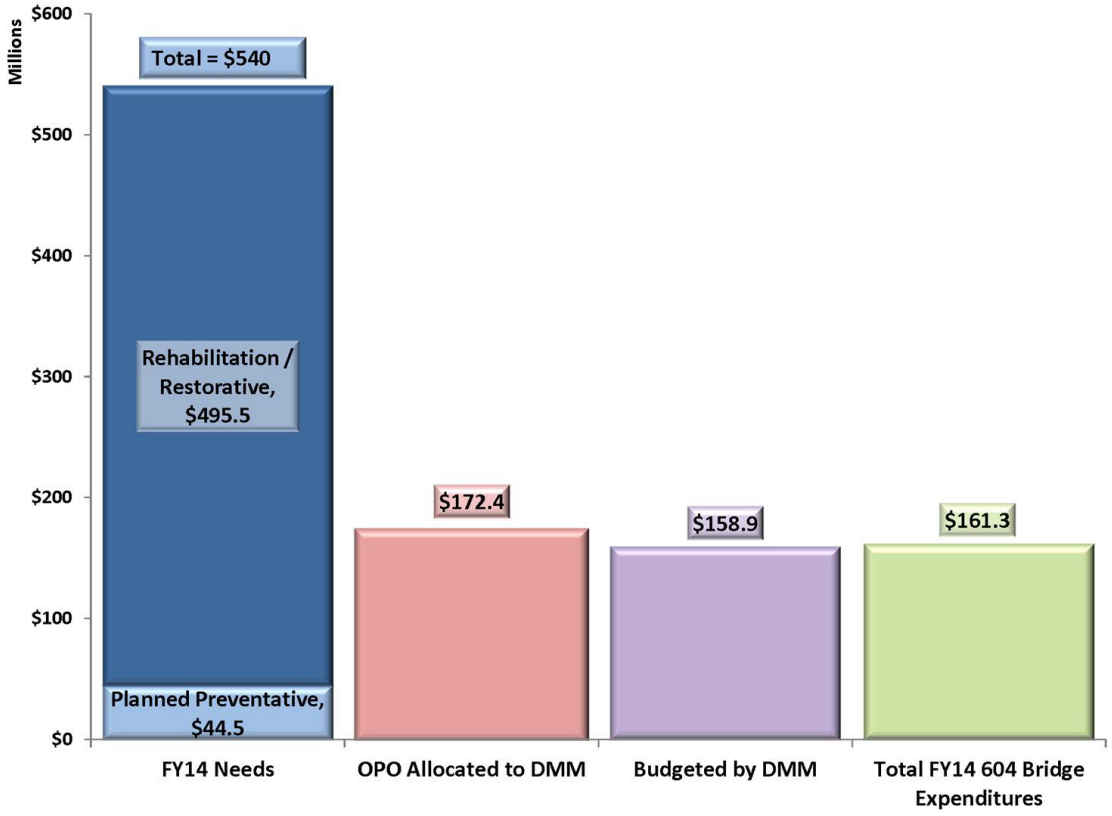
Another significant factor affecting long-term performance relates to the selection of structures scheduled for replacement or major rehabilitation. In recent years available funding in the construction program has often led us to select smaller structures for this work. This has resulted in a notable reduction in the number of poor structures. However, in selecting smaller, less expensive structures for replacement and rehabilitation, we are also developing a backlog of larger, more expensive structures that will soon require significant work.

Bridge 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 time, if the funding for bridge maintenance and

replacement is not increased, we should expect to see significant degradation of the average bridge conditions.

Chart 19 below compares the total amounts of the S&B Maintenance (604) Program needs, allocations provided to the DMM by the OPO, the actual S&B budget built by the DMM and the expenditures for FY2014.

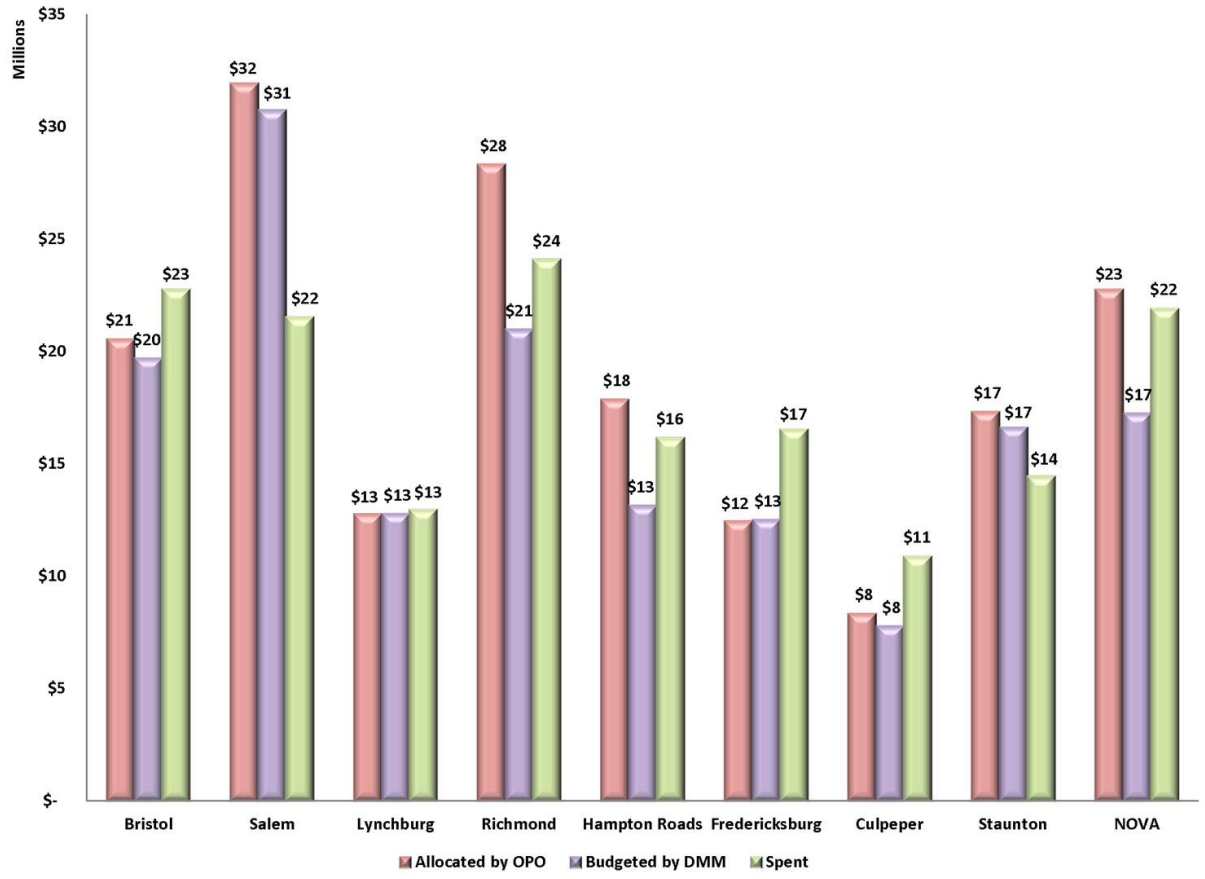
Chart 19 – FY2014 S&B Maintenance (604) Program Overview



*These values are for structural maintenance. Movable bridge operations are not included in these values

Chart 20 below shows total S&B 604 maintenance District program distribution of allocated by OPO to the DMMs, budgeted by DMM and Expenditures for FY2014. This is typically around $130M per year. Inspection made up $26.1M of the $158.9M budgeted by the DMM in FY2014.

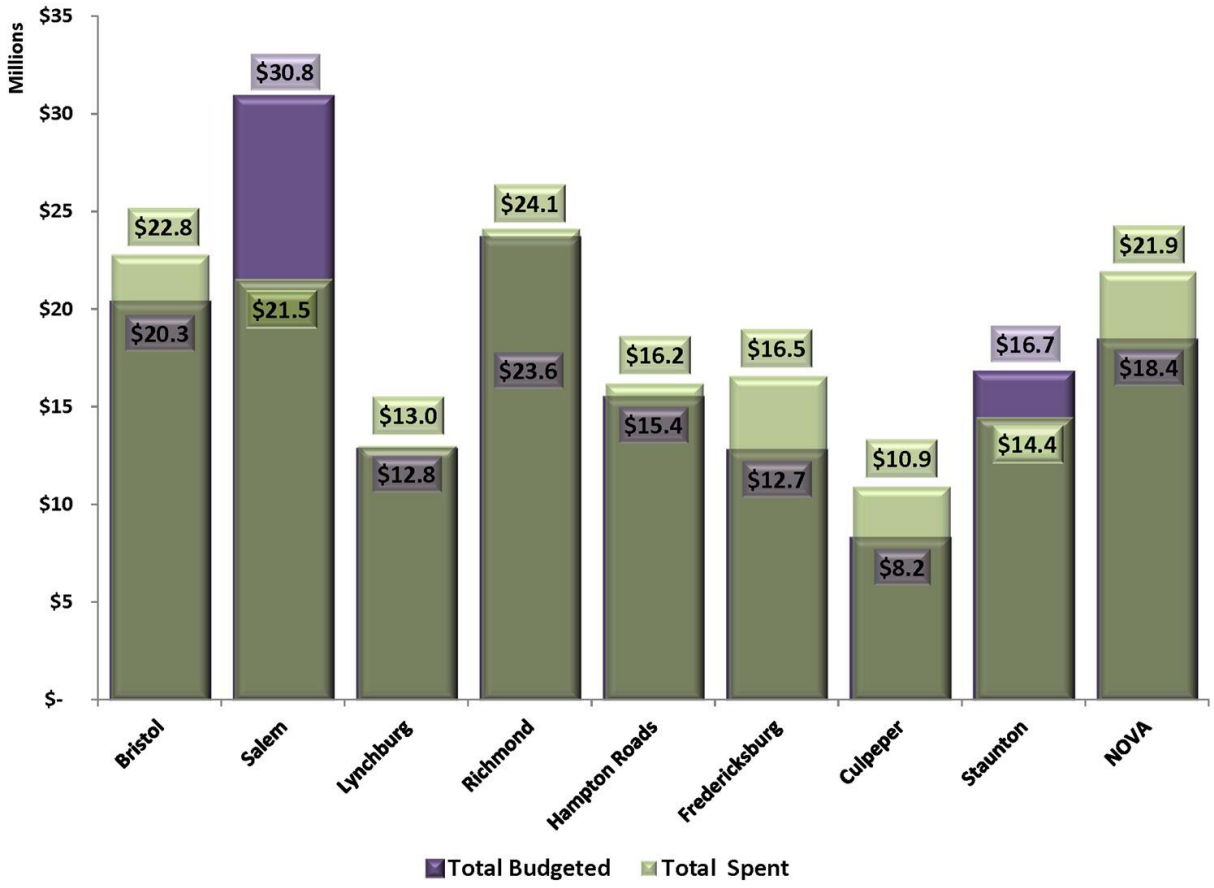
Chart 20 – FY2014 S&B Maintenance (604) Program Distribution by District



The S&B Maintenance (604) Program budget is built utilizing both Cost Centers (CSC) and UPC's. The nature of CSC and UPC are such that it is possible for expenditures to exceed amounts budgeted. CSC's can pull funds from other Districts CSC's to accommodate the over expenditures. UPC's behave similar to those funded with Construction (603). UPC over expenditures can be primarily attributed to the multi-year nature of the SYIP projects and should not imply that project budgets are being exceeded.

Chart 21 below shows the bridge maintenance funds budgeted and spent per district for FY2014. The biggest outlier is Salem district funding their superstructure replacements that have yet been awarded and thus not incurring charges. The S&B Maintenance (604) Program spends every dollar it is allocated.

Chart 21 – FY2014 S&B 604 Maintenance Program Total Budgeted and Spent



In Chart 22 below, the maintenance funds are shown budgeted and spent for bridge Cost Centers, (CSC's). Most of the budgeted funds not spent in the CSC can be attributed to accommodating the high cost of snow removal for the districts during FY2014.

Chart 22 – FY2014 S&B Maintenance (604) Program CSC Budgeted and Spent

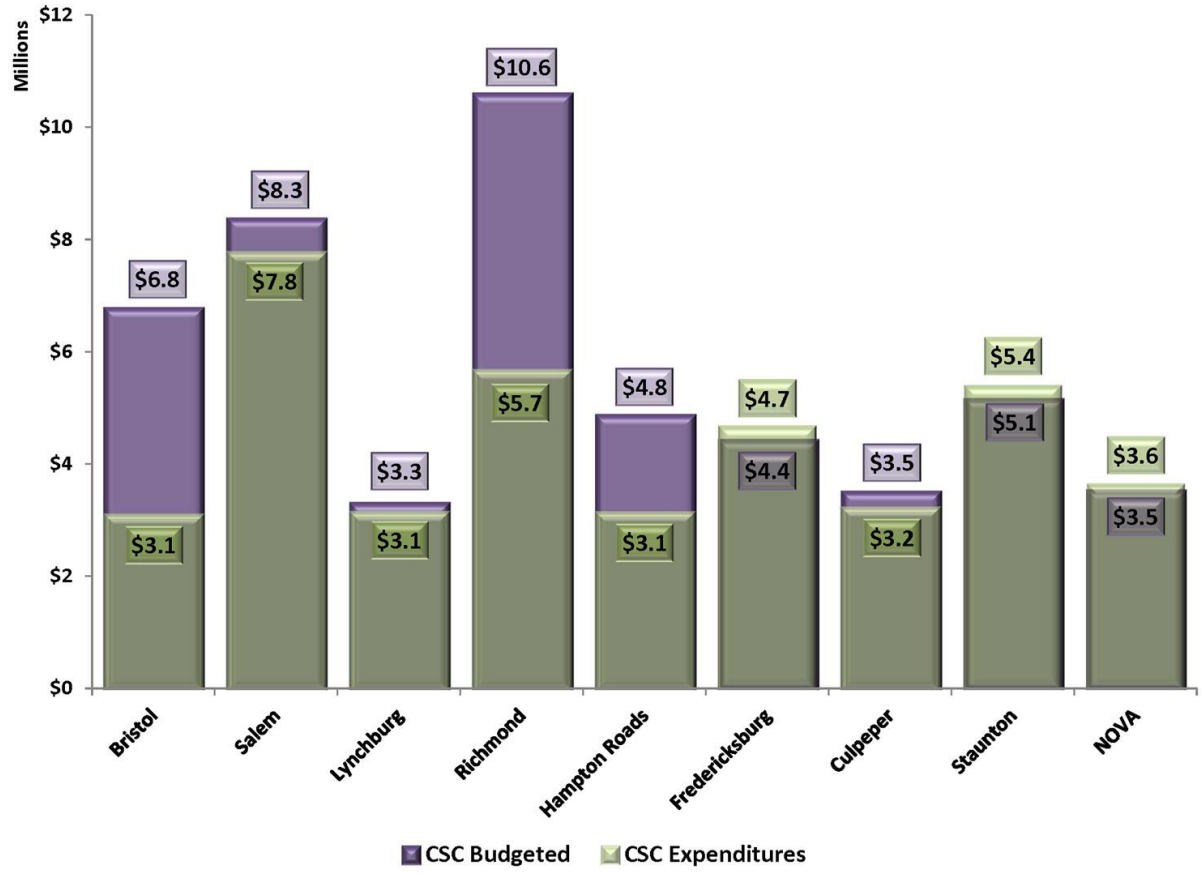


Chart 23 below shows the bridge maintenance UPC funds budgeted and spent per district for FY2014. The differences between dollars budgeted and spent can be attributed to the nature of UPCs. As with construction funding, Maintenance UPC project funding does not necessarily align with UPC project spending. The funding is established by the project, which may take place over multiple fiscal years, and spending is tracked on an annual basis by fiscal year. A couple examples include Salem district's multiple superstructure replacement contracts they are funded with 604 funds and have not yet been awarded. Therefore these projects are not yet incurring charges. Bristol district is spending funds on contracts that are under construction and funded in previous fiscal years.

Chart 23 – S&B Maintenance (604) Program FY2014 UPC Budgeted and Spent

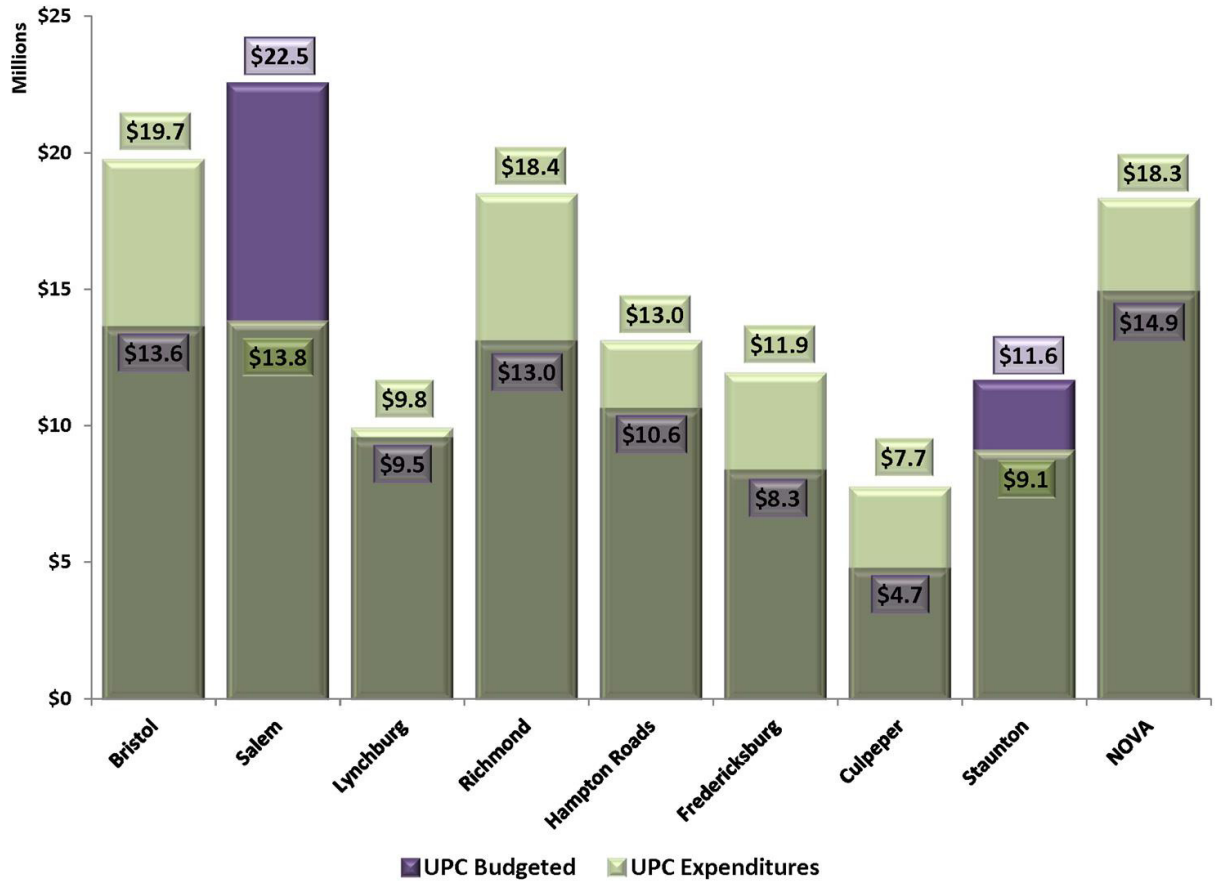
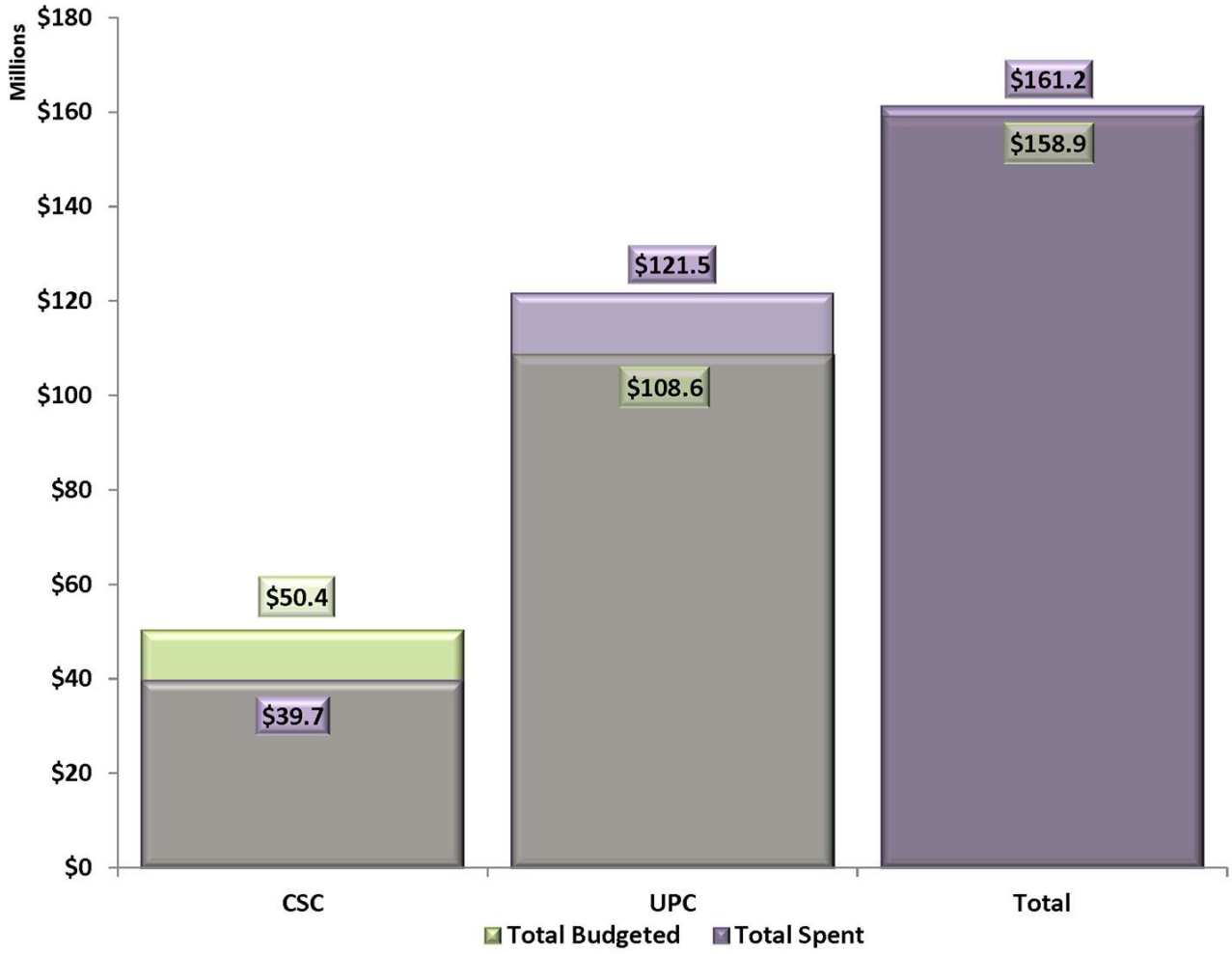


Chart 24 below shows the total bridge maintenance funds budgeted and spent for FY2014 by CSC and UPC.

Chart 24 – FY2014 S&B 604 Maintenance Program UPC Budgeted and Spent



APPENDIX A – ADDITIONAL INVENTORY INFORMATION ON BRIDGES AND CULVERTS

Tables A.1 through A.6 provide counts of the number of bridges and culverts in Virginia. Tables A.1 and A.2 address the total statewide; Tables A.3 and A.4 address NBI structures; Tables A.5 and A.6 address Non-NBI structures. Charts A.1 through A.4 show the average age of structures by system and district.

Table A.1 – Total Number of Bridges by District

DISTRICT	Number of Bridges				
	Interstate	Primary	Secondary	Urban	Total
Bristol	136	548	1,561	192	2,437
Bristol	117	484	1,353	74	2,028
Lynchburg	0	362	801	40	1,203
Richmond	268	504	667	99	1,538
Hampton Roads	335	338	302	219	1,194
Fredericksburg	21	143	214	5	383
Culpeper	71	256	677	10	1,014
Staunton	207	503	1,397	64	2,171
NOVA	251	333	517	20	1,121
Statewide	**1,406**	**3,471**	**7,489**	**723**	**13,089**

Table A.2 – Total Number of Culverts by District

DISTRICT	Number of Culverts				
	Interstate	Primary	Secondary	Urban	Total
Bristol	80	405	477	18	980
Salem	100	326	595	29	1,050
Lynchburg	0	302	594	18	914
Richmond	240	291	456	61	1,048
Hampton Roads	118	118	194	65	495
Fredericksburg	58	111	260	1	430
Culpeper	50	242	381	9	682
Staunton	224	321	742	42	1,329
NOVA	123	210	678	33	1,044
Statewide	**993**	**2,326**	**4,377**	**276**	**7,972**

Table A.3 – Total Number of NBI Bridges by District

DISTRICT	Number of Bridges				
	Interstate	Primary	Secondary	Urban	Total
Bristol	136	418	984	189	1,727
Salem	113	368	903	73	1,457
Lynchburg	0	332	679	40	1,051
Richmond	265	474	612	98	1,449
Hampton Roads	335	332	280	219	1,166
Fredericksburg	21	135	191	5	352
Culpeper	71	167	515	9	762
Staunton	207	374	811	64	1,456
NOVA	251	298	421	20	990
Statewide	**1,399**	**2,898**	**5,396**	**717**	**10,410**

Table A.4 – Total Number of NBI Culverts by District

DISTRICT	Number of Culverts				
	Interstate	Primary	Secondary	Urban	Total
Bristol	28	100	127	18	273
Salem	26	79	235	23	363
Lynchburg	0	87	243	18	348
Richmond	87	121	231	61	500
Hampton Roads	40	38	93	61	232
Fredericksburg	22	42	111	1	176
Culpeper	14	73	172	6	265
Staunton	49	82	238	38	407
NOVA	28	96	323	32	479
Statewide	**294**	**718**	**1,773**	**258**	**3,043**

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

DISTRICT	Number of Bridges				
	Interstate	Primary	Secondary	Urban	Total
Bristol	0	130	577	3	710
Salem	4	116	450	1	571
Lynchburg	0	30	122	0	152
Richmond	3	30	55	1	89
Hampton Roads	0	6	22	0	28
Fredericksburg	0	8	23	0	31
Culpeper	0	89	162	1	252
Staunton	0	129	586	0	715
NOVA	0	35	96	0	131
Statewide	**7**	**573**	**2,093**	**6**	**2,679**

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

DISTRICT	Number of Culverts				
	Interstate	Primary	Secondary	Urban	Total
Bristol	52	305	350	0	707
Salem	74	247	360	6	687
Lynchburg	0	215	351	0	566
Richmond	153	170	225	0	548
Hampton Roads	78	80	101	4	263
Fredericksburg	36	69	149	0	254
Culpeper	36	169	209	3	417
Staunton	175	239	504	4	922
NOVA	95	114	355	1	565
Statewide	**699**	**1,608**	**2,604**	**18**	**4,929**

Chart A.1 – Average Age of Interstate Structures by District

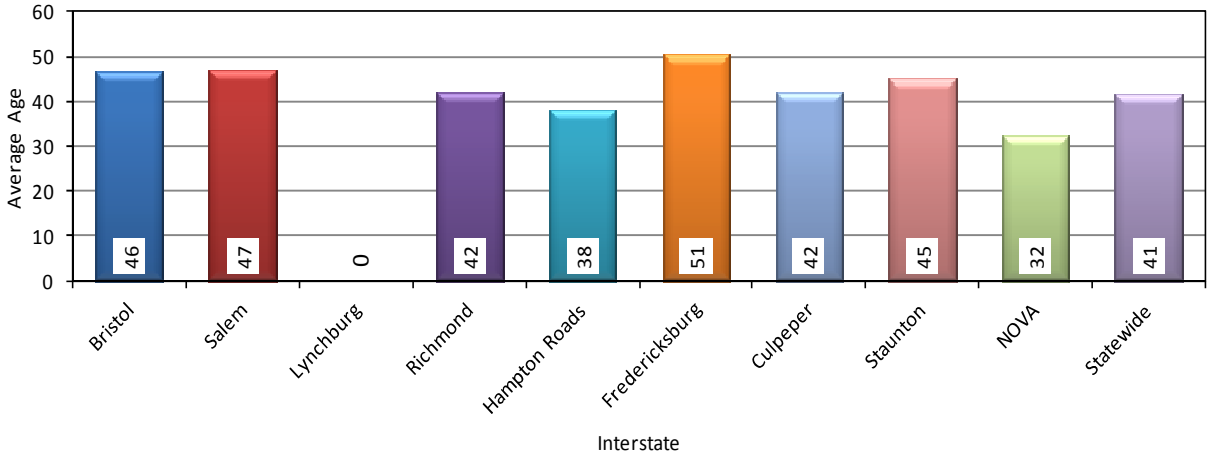


Chart A.2 – Average Age of Primary Structures by District

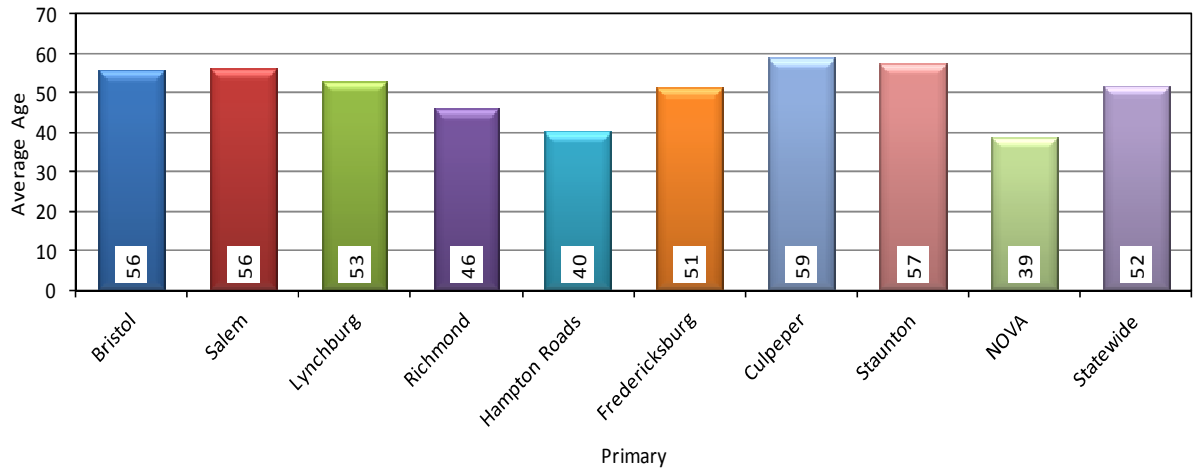


Chart A.3 – Average Age of Secondary Structures by District

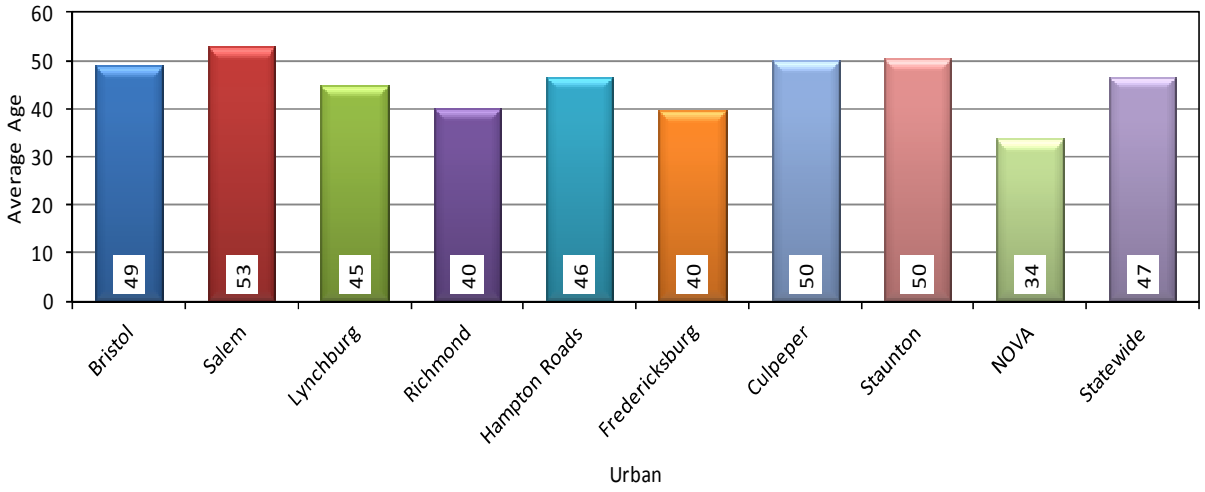
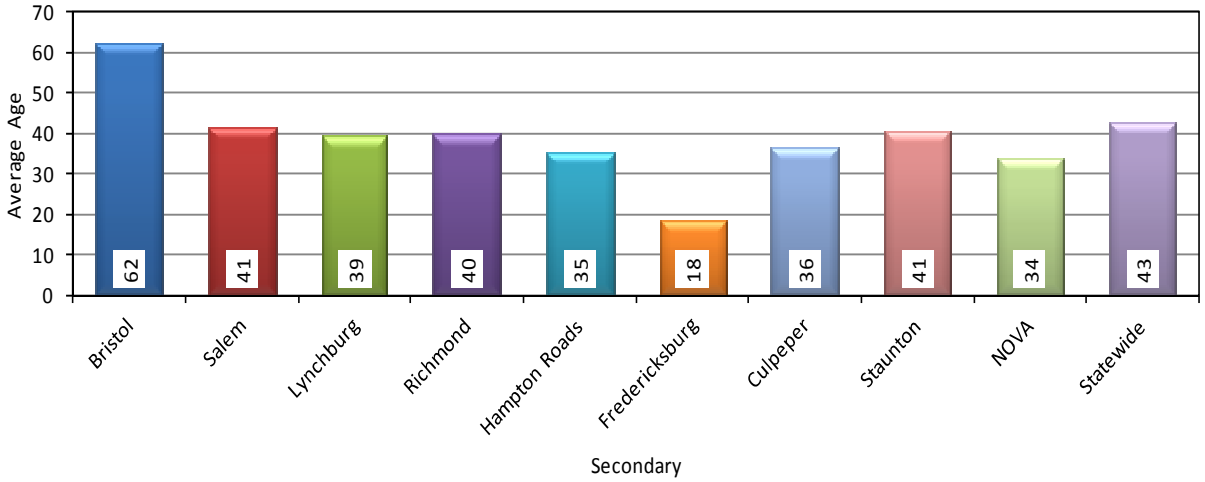


Chart A.4 – Average Age of Urban Structures by District



APPENDIX B – ADDITIONAL INVENTORY INFORMATION ON ANCILLARY STRUCTURES

Tables B.1 through B.4 provide information for the subcategories of each type of ancillary structure. Figures 1 through 13 are pictures providing typical examples of each type of ancillary structure.

Table B.1 – Total Number of Sign Structures by District

DISTRICT	Structure Type					Percent
	Cantilever	Overhead	Parapet Mount	Butterfly	Total	
Bristol	22	38	2	10	72	2.0%
Salem	84	82	6	0	172	4.8%
Lynchburg	4	52	29	0	85	2.4%
Richmond	389	325	140	1	855	24.0%
Hampton Roads	318	420	99	57	894	25.1%
Fredericksburg	50	21	1	0	72	2.0%
Culpeper	8	18	10	3	39	1.1%
Staunton	10	51	16	15	92	2.6%
Northern Virginia	604	486	137	51	1,278	35.9%
Statewide	**1,489**	**1,493**	**440**	**137**	**3,559**	**100.0%**

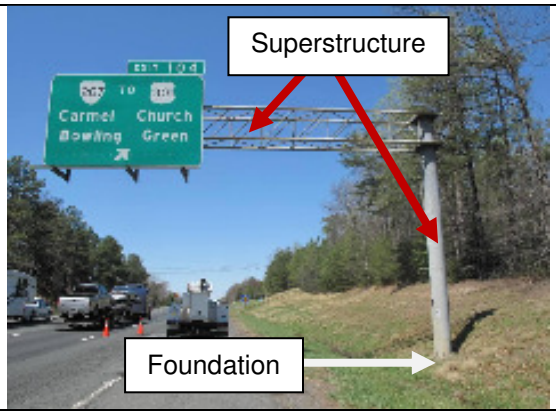


Figure 1 – Cantilever Sign Structure

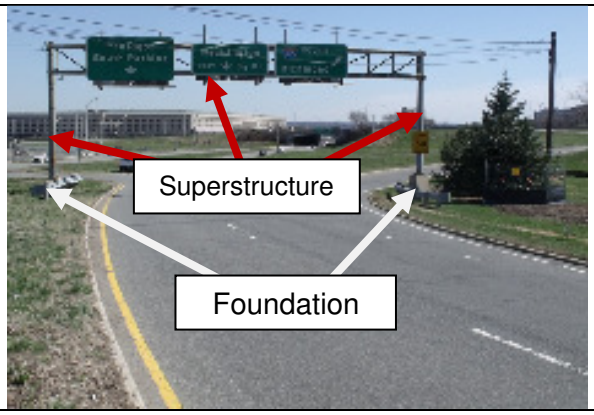


Figure 2 – Overhead Sign Structure

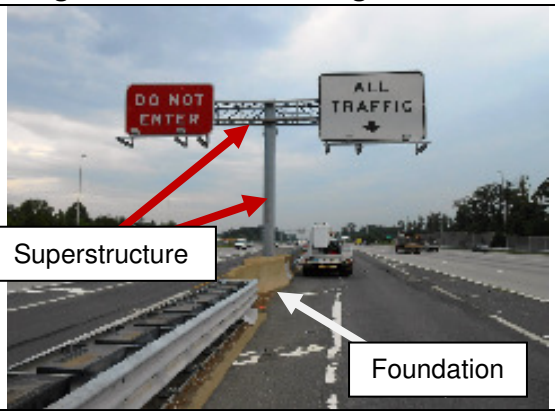


Figure 3 – Butterfly Sign Structure

Figure 4 – Parapet Mount Sign Structure
(Note that "Parapet-Mount' sign structures may also be attached to bridge girders in addition to bridge parapets)

Table B.2 – Total Number of Luminaire Structures by District

DISTRICT	Structure Type			Percent
	Parapet Mount	Luminaires	Total	
Bristol	2	455	457	2.5%
Salem	24	797	821	4.4%
Lynchburg	0	302	302	1.6%
Richmond	508	1,765	2,273	12.3%
Hampton Roads	1,361	5,494	6,855	37.1%
Fredericksburg	128	325	453	2.5%
Culpeper	0	158	158	0.9%
Staunton	0	45	45	0.2%
Northern Virginia	799	6,319	7,118	38.5%
Statewide	**2,822**	**15,660**	**18,482**	**100.0%**

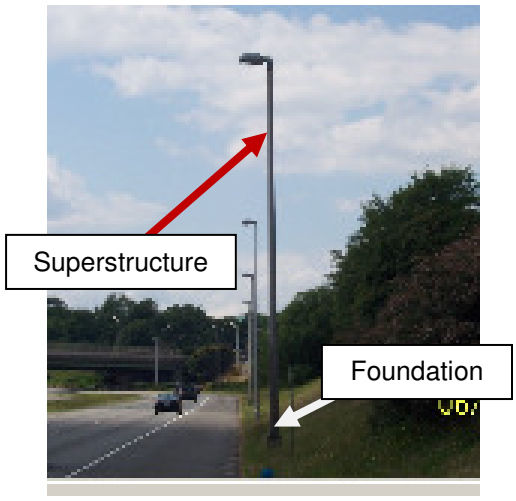


Figure 5 – Luminaire Structure

Figure 6 – Parapet Mounted Luminaire Structure

Table B.3 – Total Number of Signal Structures by District

DISTRICT	Structure Type					Percent
	Cantilever	Overhead	Parapet Mount	Span Wire	Total	
Bristol	212	0	0	30	242	2.6%
Salem	485	0	0	53	538	5.9%
Lynchburg	288	0	0	2	290	3.2%
Richmond	1,172	0	0	358	1,530	16.7%
Hampton Roads	466	0	1	55	522	5.7%
Fredericksburg	701	1	0	16	718	7.9%
Culpeper	359	0	0	8	367	4.0%
Staunton	374	0	0	77	451	4.9%
Northern Virginia	3,302	0	14	1,170	4,486	49.1%
Statewide	**7,359**	**1**	**15**	**1,769**	**9,144**	**100.0%**

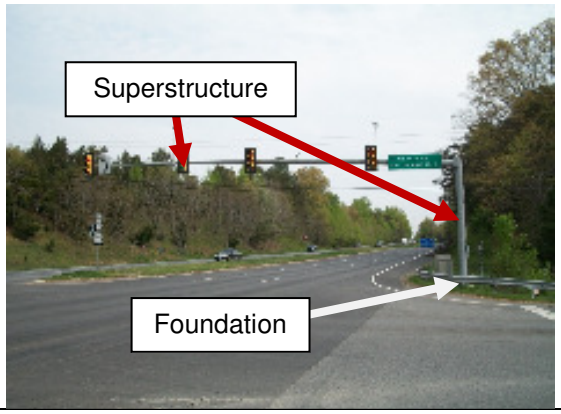


Figure 7 – Cantilevered Arm Traffic Signal Structure

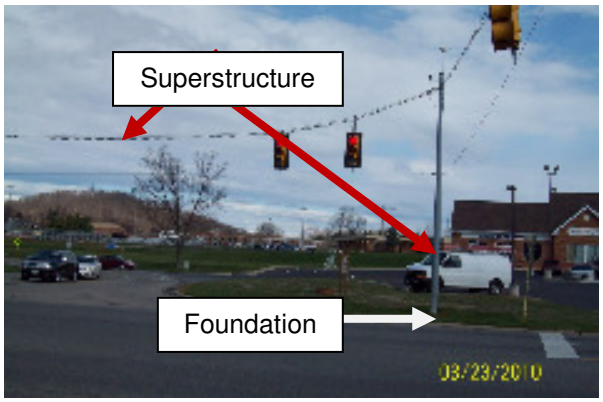


Figure 8– Span Wire Traffic Signal Structure

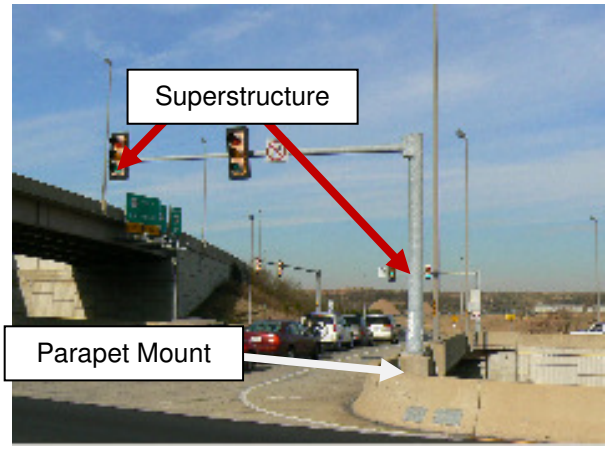


Figure 9 – Parapet Mount - Traffic Signal Structure

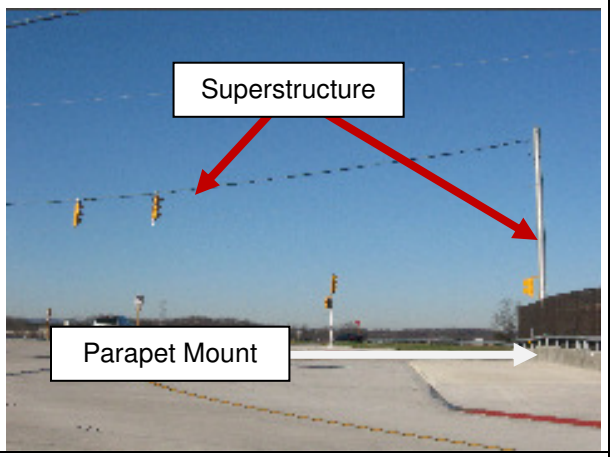


Figure 10 – Parapet Mount - Traffic Signal Structure

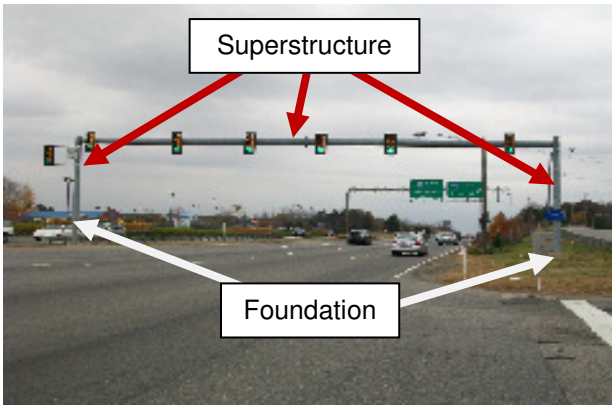


Figure 11 – Overhead Traffic Signal Structure

Table B.4 – Total Number of High Mast Light and Camera Pole Structures by District

DISTRICT	Structure Type			Percent
	High Mast Light	Camera Poles	Total	
Bristol	76	1	77	6.9%
Salem	13	0	13	1.2%
Lynchburg	0	0	0	0.0%
Richmond	105	0	105	9.4%
Hampton Roads	145	288	433	38.7%
Fredericksburg	1	1	2	0.2%
Culpeper	0	0	0	0.0%
Staunton	26	53	79	7.1%
Northern Virginia	323	87	410	36.6%
Statewide	**689**	**430**	**1,119**	**100.0%**

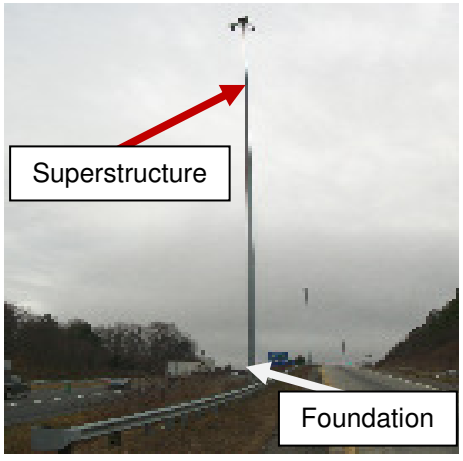


Figure 12 – High Mast Light Structure

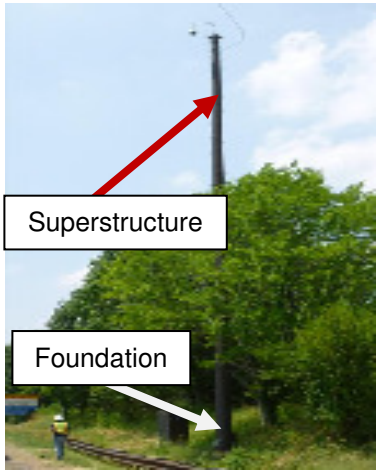


Figure 13 – Camera Pole Structure

APPENDIX C– GENERAL CONDITION RATINGS (BRIDGES AND CULVERTS)

General Condition Ratings (GCRs): According to 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 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 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 provides a description of the general condition ratings. The tables 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
Structurally Deficient									

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

Typical Examples of General Condition Ratings for Decks	
General Condition Rating	Example
4 or less - (Poor Condition) Structurally Deficient	 Bridge Deck with advanced deterioration
5 – Fair Condition (At risk of becoming structurally deficient)	 Bridge Deck with extensive cracking and patching
6 – Satisfactory Condition	 Bridge Deck with minor to no deterioration

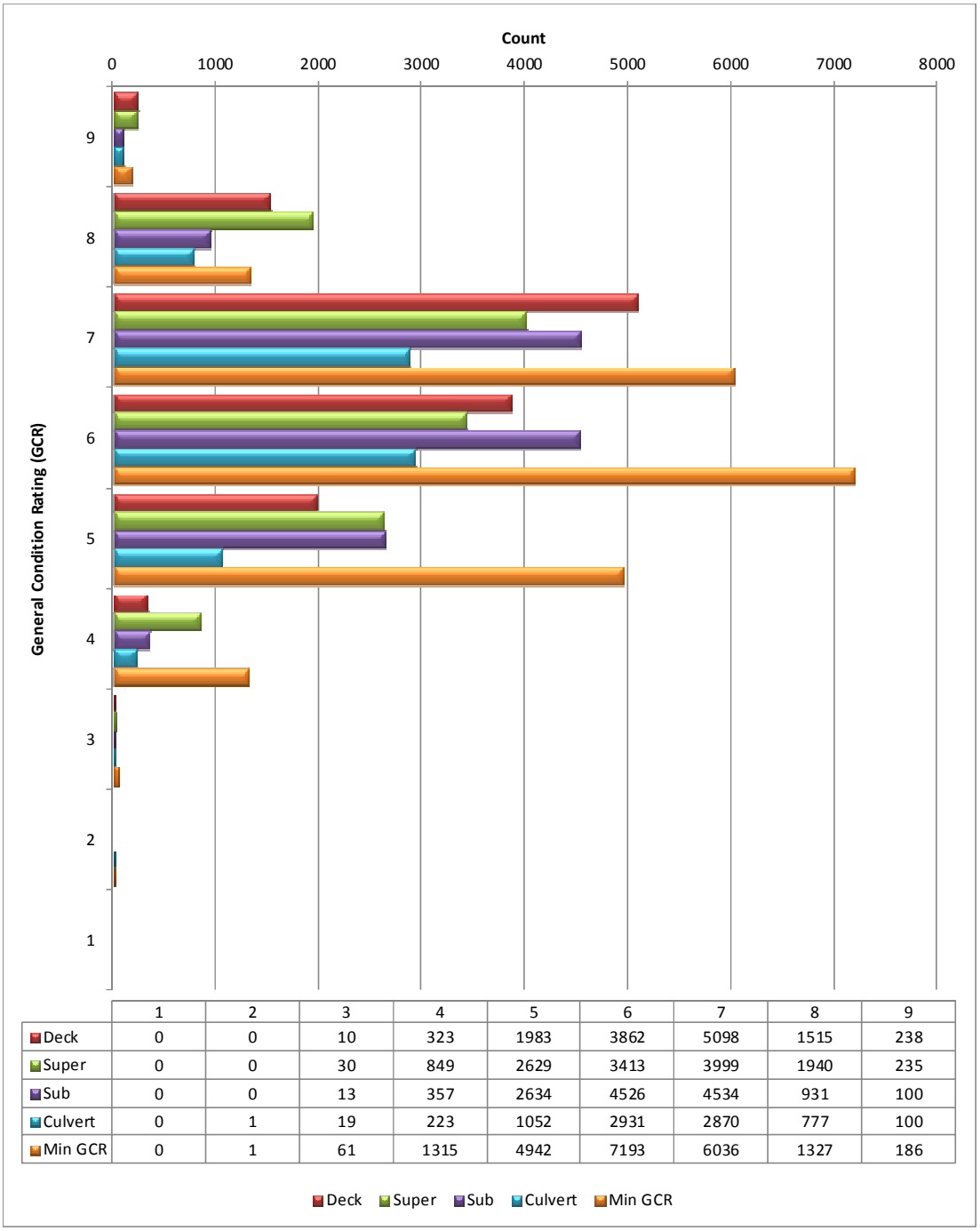
<table>
<tr><th colspan="3">Typical Examples of General Condition Ratings for Superstructure</th></tr>
<tr><td>General Condition Rating</td><td colspan="2">Example</td></tr>
<tr><td></td><td>Steel</td><td>Concrete</td></tr>
<tr><td>4 or less - (Poor Condition) Structurally Deficient</td><td> 
Bridge Superstructure with advanced section loss</td><td> 
Concrete Beam with major spalling (bottom of beam viewed from below)</td></tr>
<tr><td>5 – Fair Condition (At risk of becoming structurally deficient)</td><td> 
Bridge Superstructure with minor to moderate section loss</td><td> 
Spall on end of beam with exposed reinforcing with section loss</td></tr>
<tr><td>6 – Satisfactory Condition</td><td> 
Rust scale and minor section loss</td><td> 
Concrete Beam with localized spalling</td></tr>
</table>

Typical Examples of General Condition Ratings for Substructure	
General Condition Rating	Example
4 or less – (Poor Condition) Structurally Deficient	 Bridge Substructure with advanced deterioration
5 – Fair Condition (At risk of becoming structurally deficient)	 Bridge Substructure with moderate cracks and deterioration
6 – Satisfactory Condition	 Bridge Substructure with minor cracks

<table>
<tr><th colspan="3">Typical Examples of General Condition Ratings for Culverts</th></tr>
<tr><td>General Condition Rating</td><td colspan="2">Example</td></tr>
<tr><td></td><td>Steel</td><td>Concrete</td></tr>
<tr><td>4 or less - (Poor Condition) Structurally Deficient</td><td> 
Culvert with advanced section loss</td><td> 
Portion of center wall of box culvert missing</td></tr>
<tr><td>5 – Fair Condition (At risk of becoming structurally deficient)</td><td> 
Culvert panels separated</td><td> 
Culvert moderate deterioration</td></tr>
<tr><td>6 – Satisfactory Condition</td><td> 
Light rust along flowline</td><td> 
Culvert with minor cracks</td></tr>
</table>

The general condition ratings of Virginia's highway structures vary by region, system and age of structure. General condition rating data are provided in Charts C.1 – C.15 below

Chart C.1 – General Condition Ratings for Bridges and Culverts by Component- Statewide



	1	2	3	4	5	6	7	8	9
Deck	0	0	10	323	1983	3862	5098	1515	238
Super	0	0	30	849	2629	3413	3999	1940	235
Sub	0	0	13	357	2634	4526	4534	931	100
Culvert	0	1	19	223	1052	2931	2870	777	100
Min GCR	0	1	61	1315	4942	7193	6036	1327	186

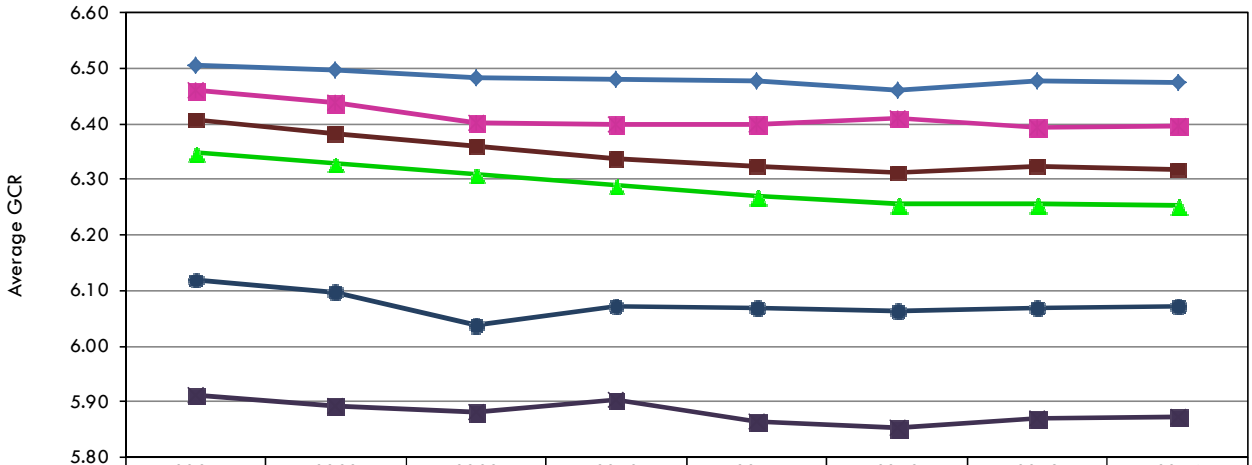
The Min GCR represents the minimum or lowest General Condition Rating (GCR) for the structure (lowest of the 4 component ratings for a particular inspection report; deck, superstructure, substructure, or culvert)

Table C.1 – Number of Structures in Each General Ratings by Component

Highway System	DISTRICT	GCR								Avg. GCR
		9	8	7	6	5	4	3	2	
Interstate	Deck	23	47	509	594	216	17	0	0	6.30
	Superstructure	25	94	377	520	350	40	0	0	6.15
	Substructure	24	45	300	596	435	6	0	0	6.01
	Bridge Min GCR	22	36	182	544	568	54	0	0	5.75
	Culvert	0	20	283	551	136	3	0	0	6.18
	Min GCR	22	56	465	1,095	704	57	0	0	5.93
Primary	Deck	26	191	1,317	1,153	668	105	6	0	6.25
	Superstructure	29	383	1,119	1,027	737	171	11	0	6.25
	Substructure	20	156	1,277	1,236	701	86	1	0	6.22
	Bridge Min GCR	18	86	856	1,213	1,050	234	14	0	5.86
	Culvert	7	100	803	1,062	329	24	1	0	6.28
	Min GCR	25	186	1,655	2,278	1,380	258	15	0	6.03
Secondary	Deck	179	1,230	2,971	1,880	1,000	174	2	0	6.62
	Superstructure	169	1,395	2,231	1,681	1,416	580	15	0	6.39
	Substructure	44	668	2,672	2,482	1,378	237	6	0	6.30
	Bridge Min GCR	39	405	1,919	2,282	2,098	726	20	0	5.90
	Culvert	92	618	1,665	1,235	560	189	18	1	6.50
	Min GCR	131	1,023	3,583	3,517	2,658	915	38	1	6.12
Urban	Deck	10	47	301	235	99	27	2	0	6.37
	Superstructure	12	68	272	185	126	58	4	0	6.26
	Substructure	12	62	285	212	120	28	6	0	6.35
	Bridge Min GCR	7	24	214	219	173	78	8	0	5.90
	Culvert	1	39	119	83	27	7	0	0	6.58
	Min GCR	8	62	333	303	200	85	8	0	6.09
All	Deck	238	1,515	5,098	3,862	1,983	323	10	0	6.47
	Superstructure	235	1,940	3,999	3,413	2,629	849	30	0	6.32
	Substructure	100	931	4,534	4,526	2,634	357	13	0	6.25
	Bridge Min GCR	86	551	3,171	4,258	3,889	1,092	42	0	5.87
	Culvert	100	777	2,870	2,931	1,052	223	19	1	6.40
	Min GCR	186	1,327	6,036	7,193	4,942	1,315	61	1	6.07

Trend lines showing the average general condition ratings of rated components are provided in Charts C.2 through C.14 below.

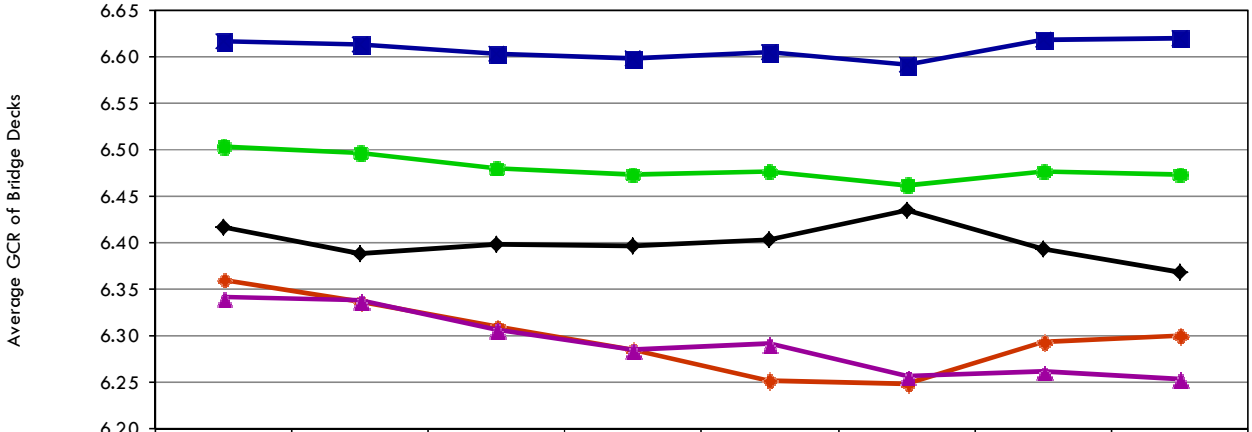
Chart C.2 – Trends in Average General Condition Ratings by Component – Statewide



	2007	2008	2009	2010	2011	2012	2013	2014
Deck	6.504	6.496	6.482	6.480	6.476	6.461	6.477	6.475
Super	6.408	6.383	6.359	6.338	6.323	6.312	6.323	6.318
Sub	6.350	6.330	6.310	6.289	6.270	6.256	6.257	6.253
Br Min	5.912	5.892	5.882	5.904	5.863	5.853	5.871	5.873
Culvert	6.461	6.437	6.402	6.399	6.399	6.409	6.393	6.397
Str Min	6.120	6.097	6.039	6.073	6.068	6.063	6.068	6.071

Fiscal Year

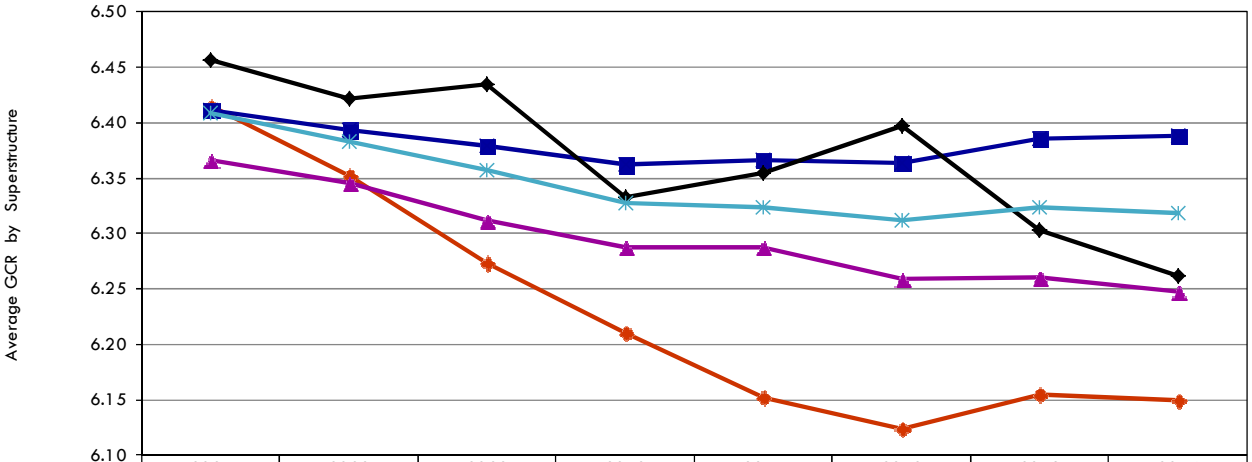
Chart C.3 – Bridge Decks: Trends in Average General Condition Ratings by Highway System



	2007	2008	2009	2010	2011	2012	2013	2014
Interstate	6.361	6.338	6.310	6.285	6.253	6.249	6.293	6.300
Primary	6.342	6.340	6.307	6.286	6.292	6.257	6.262	6.254
Secondary	6.617	6.613	6.603	6.598	6.606	6.593	6.619	6.620
Urban	6.418	6.389	6.400	6.397	6.404	6.436	6.394	6.369
Average	6.504	6.497	6.481	6.474	6.477	6.461	6.477	6.475

Fiscal Year

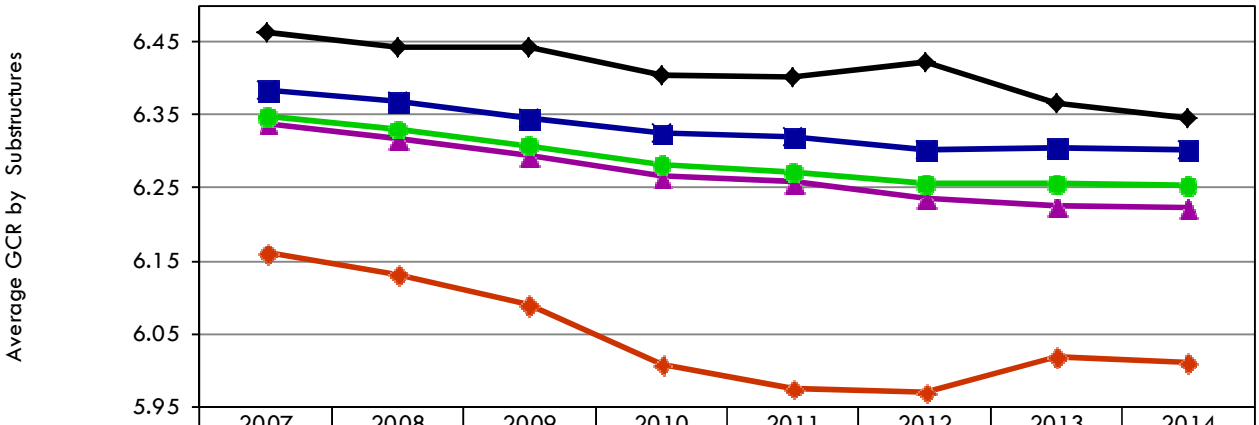
Chart C.4 – Superstructures: Trends in Average General Condition Ratings by Highway System



	2007	2008	2009	2010	2011	2012	2013	2014
Interstate	6.415	6.352	6.273	6.210	6.152	6.124	6.155	6.149
Primary	6.367	6.346	6.313	6.287	6.288	6.259	6.260	6.247
Secondary	6.411	6.394	6.379	6.362	6.366	6.363	6.386	6.388
Urban	6.457	6.422	6.435	6.333	6.354	6.397	6.303	6.262
Average	6.408	6.383	6.357	6.328	6.324	6.312	6.323	6.318

Fiscal Year

Chart C.5 – Substructures: Trends in Average General Condition Ratings by Highway System



	2007	2008	2009	2010	2011	2012	2013	2014
Interstate	6.162	6.132	6.091	6.008	5.974	5.971	6.019	6.011
Primary	6.338	6.317	6.296	6.268	6.258	6.236	6.227	6.222
Secondary	6.386	6.369	6.347	6.326	6.319	6.303	6.306	6.303
Urban	6.465	6.443	6.443	6.404	6.402	6.423	6.366	6.346
Average	6.350	6.330	6.307	6.283	6.271	6.256	6.257	6.253

Fiscal Year

Chart C.6 – Deck General Condition Ratings by District and Highway System

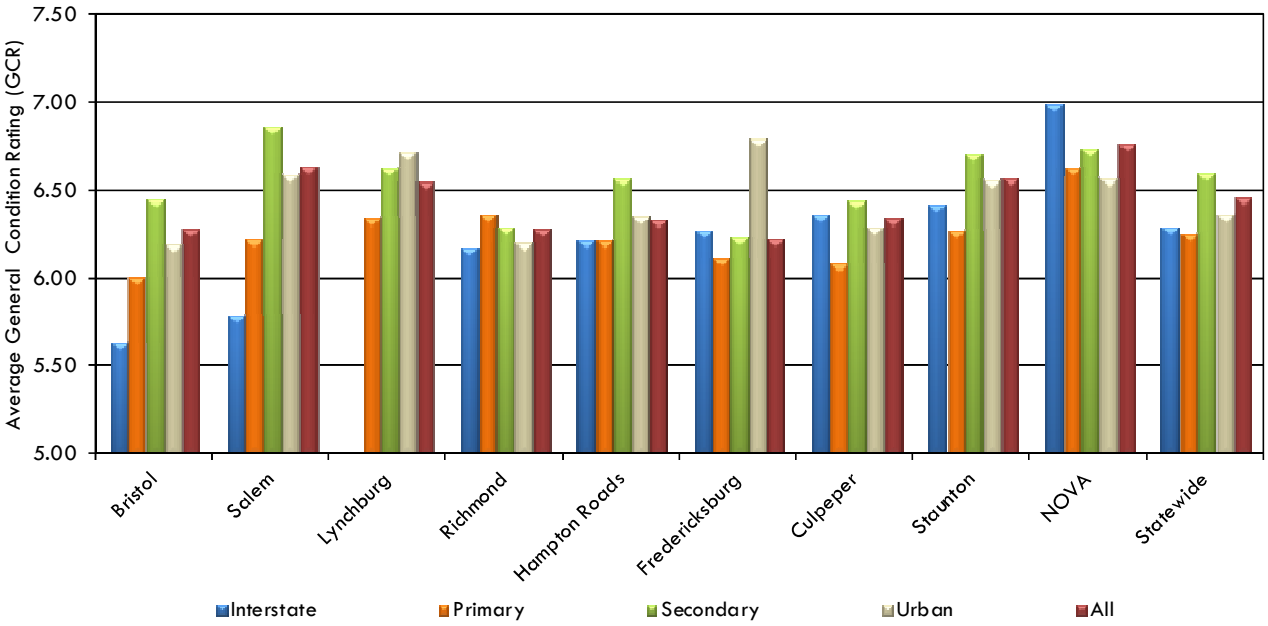


Chart C.7 – Deck General Condition Ratings by Highway System and District

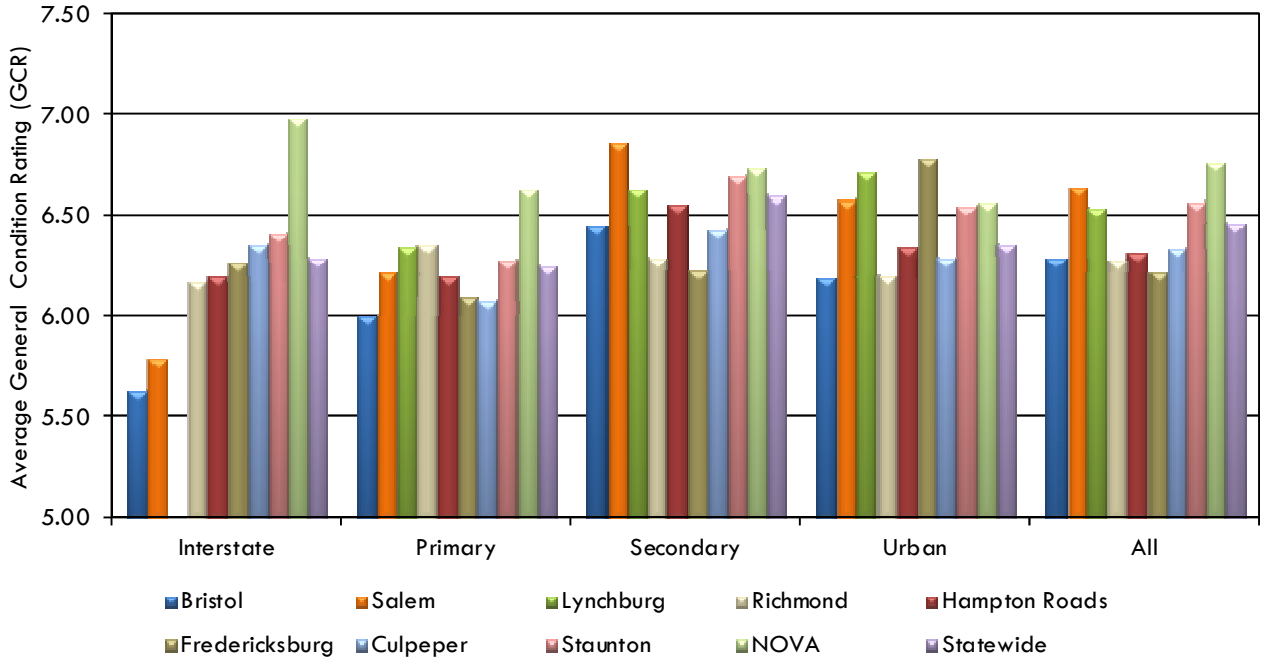


Chart C.8 – Superstructure General Condition Ratings by District and Highway System

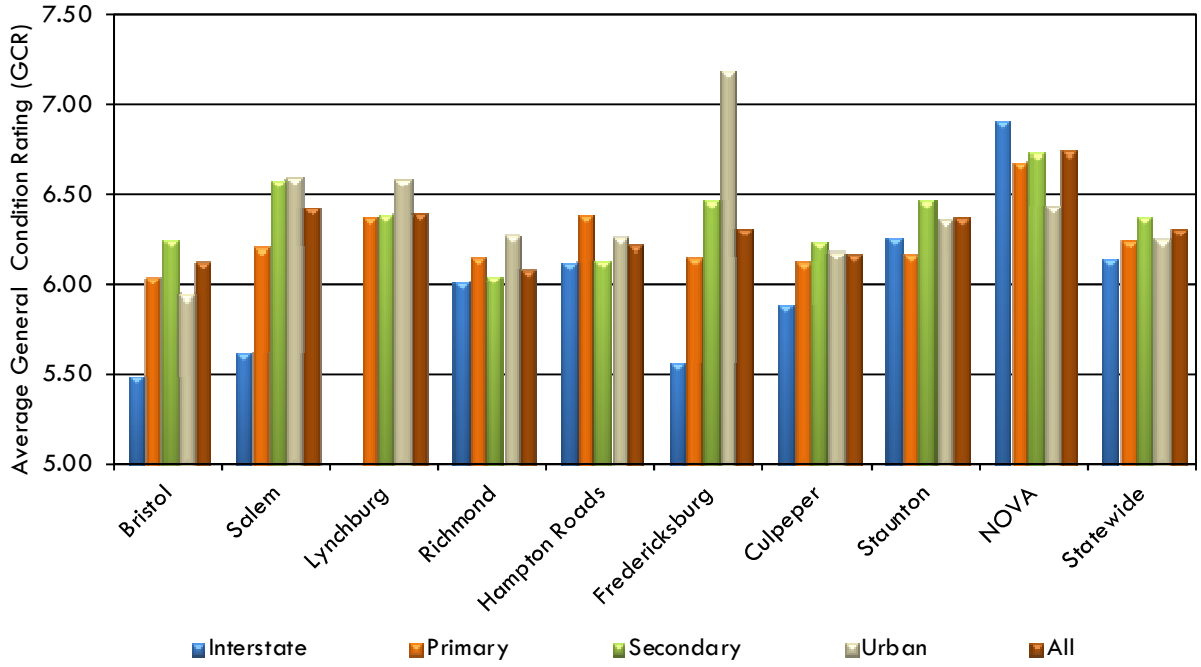


Chart C.9 – Superstructure General Condition Ratings by Highway System and District

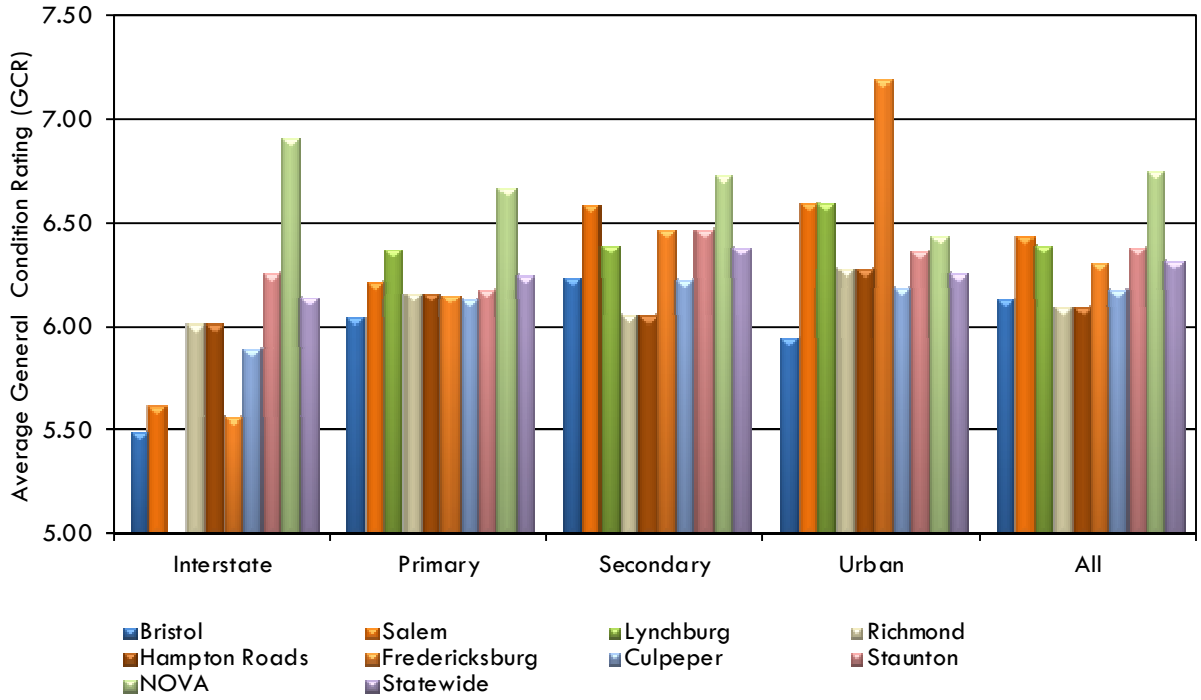


Chart C.10 – Substructure General Condition Ratings by District and Highway System

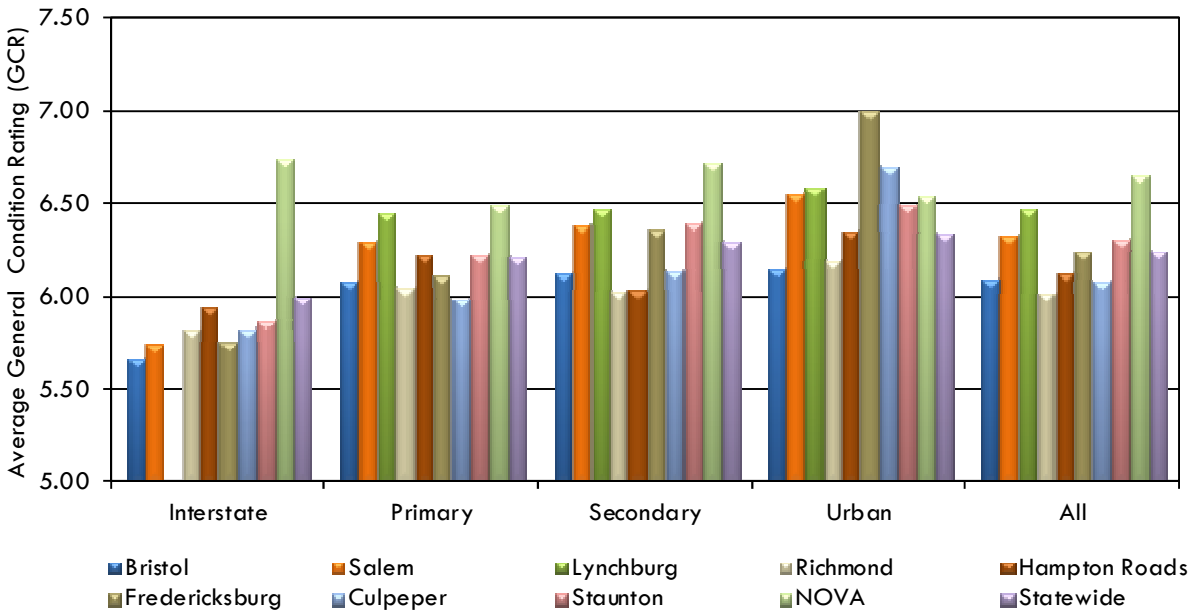


Chart C.11 – Substructure General Condition Ratings by Highway System and District

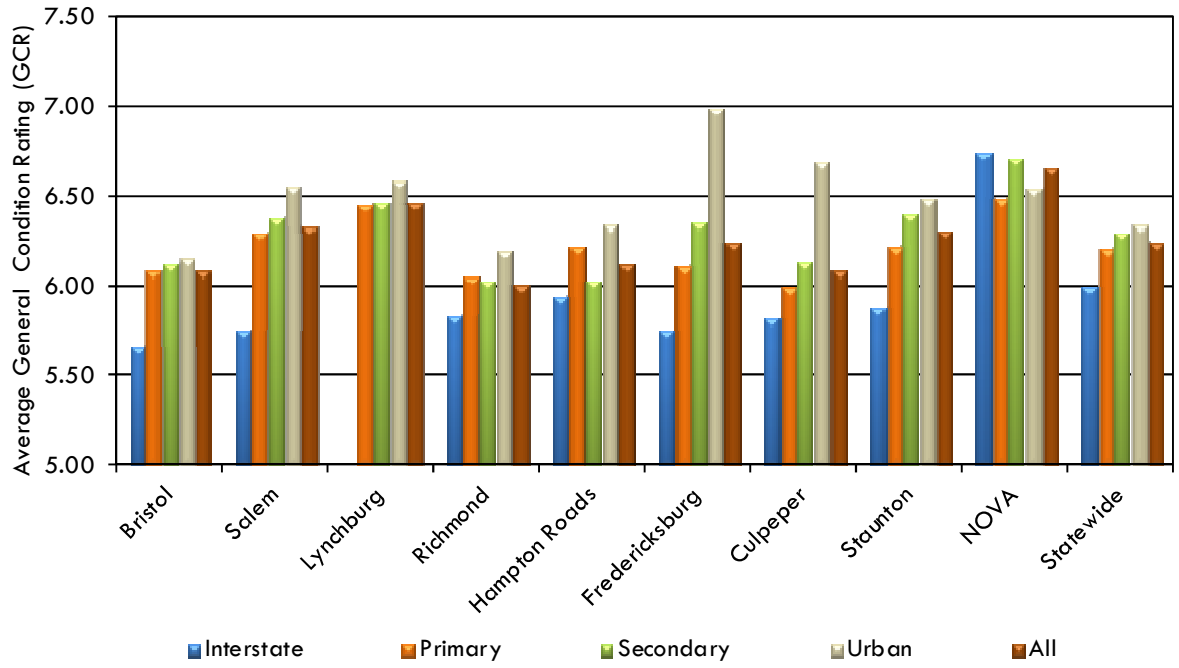


Chart C.12 – Culvert General Condition Ratings by District and Highway System

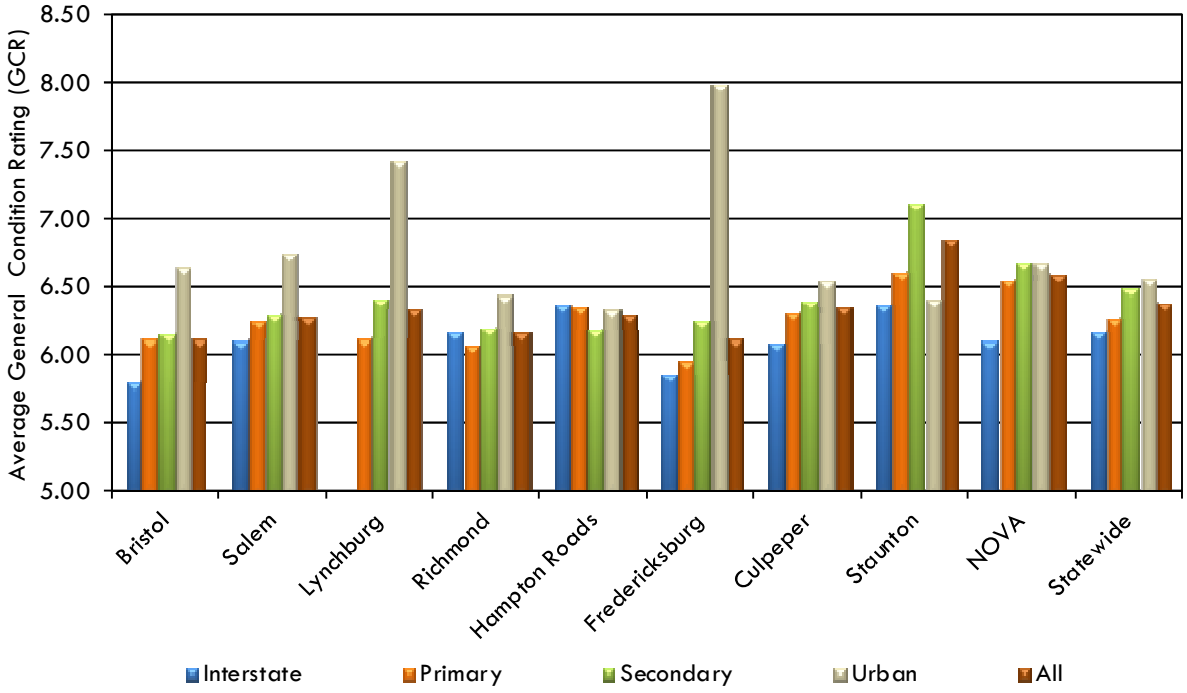


Chart C.13 – Culvert General Condition Ratings by Highway System and District

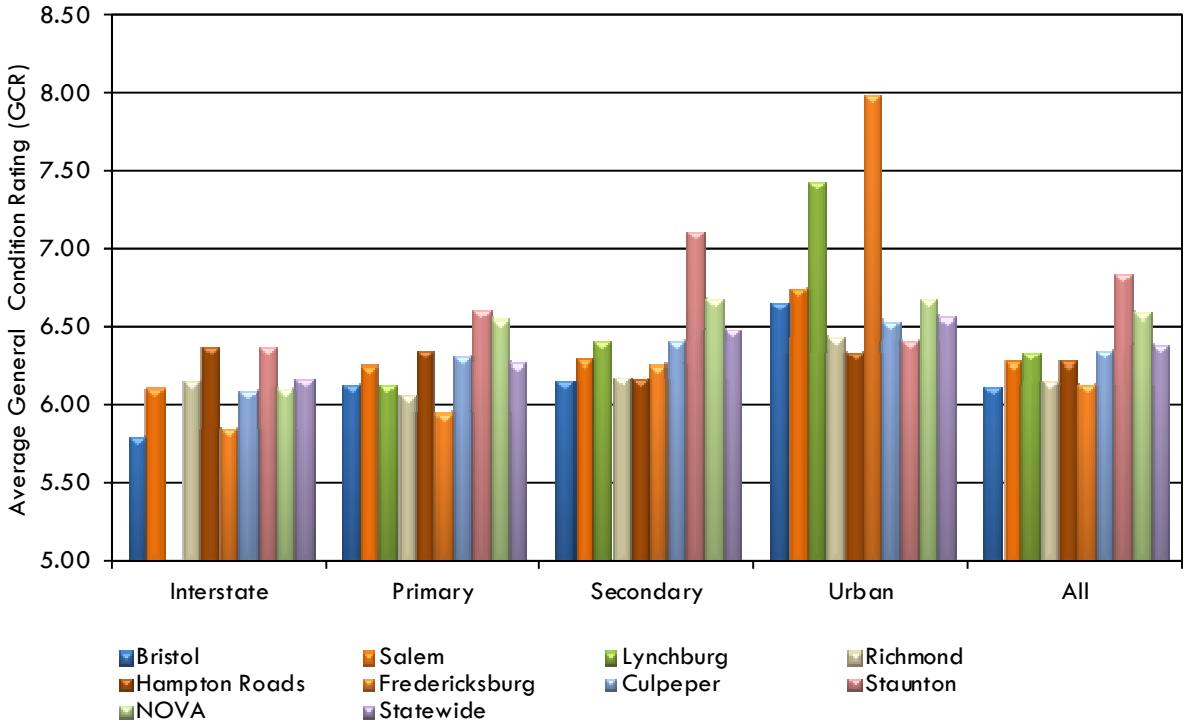


Chart C.14 – Average Minimum General Condition Ratings for Bridges and Culverts by District and Highway System

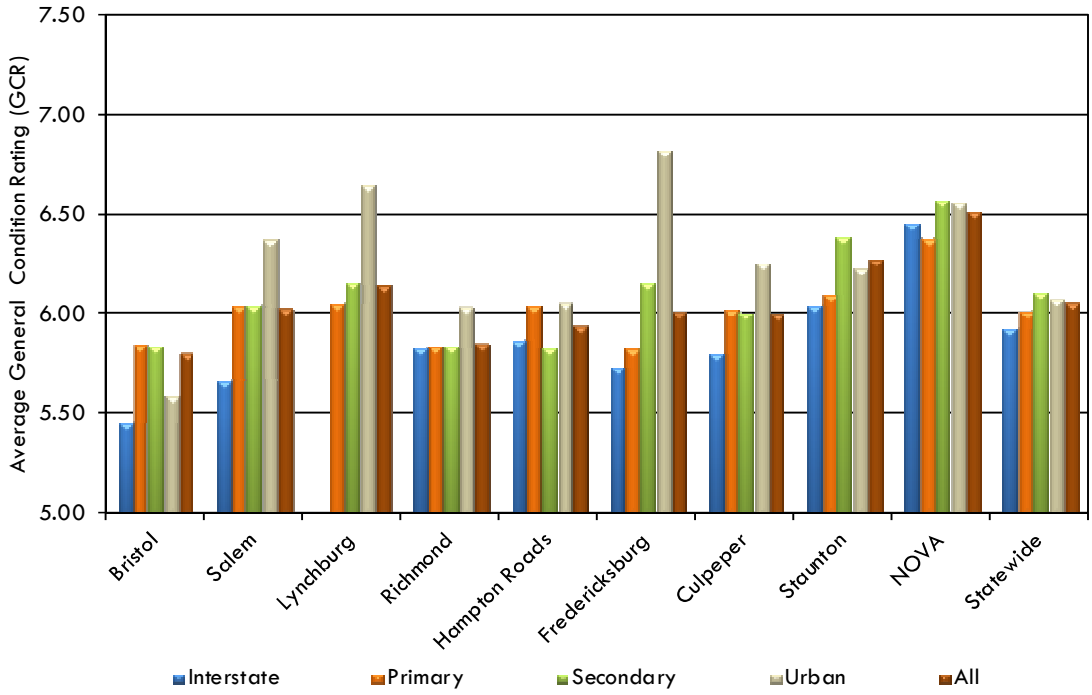
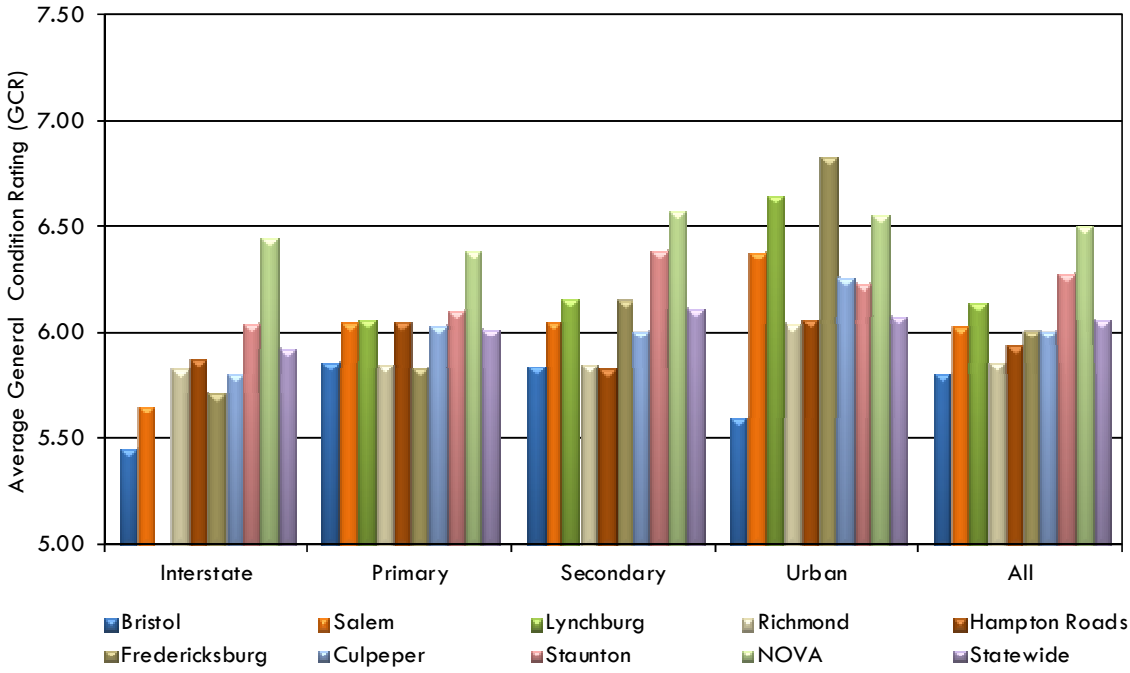


Chart C.15 – Average Minimum General Condition Ratings for Bridges and Culverts by Highway System and District



APPENDIX D– INFORMATION ON STRUCTURALLY DEFICIENT STRUCTURES BY HIGHWAY SYSTEM

Chart D.1 – Percentage of Number of Structurally Deficient Structures- Interstate End of FY 2014

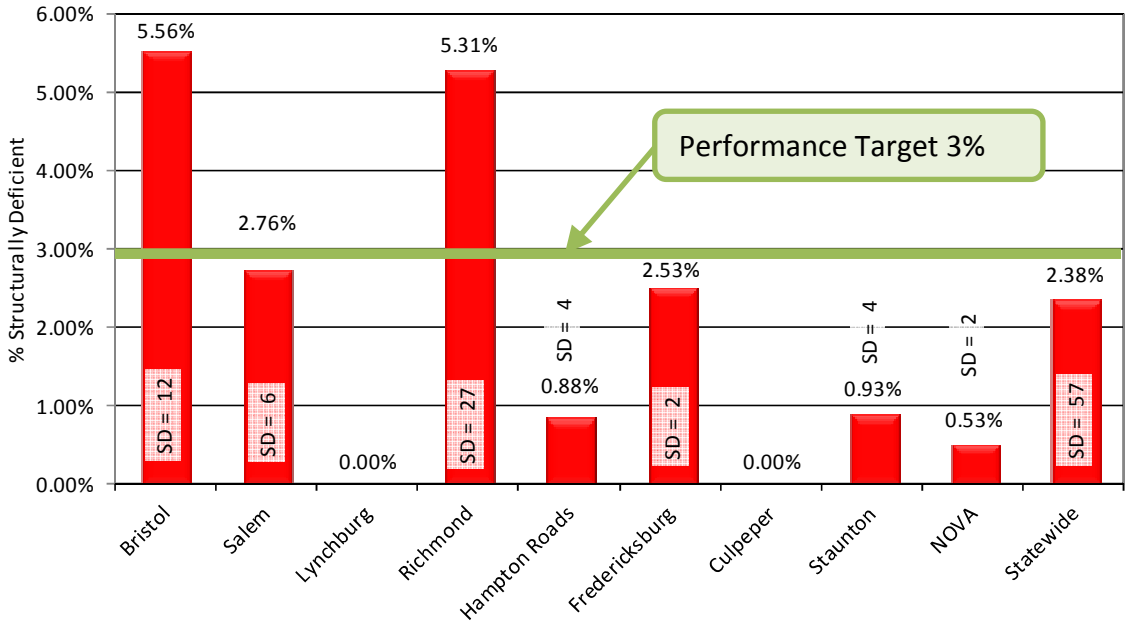
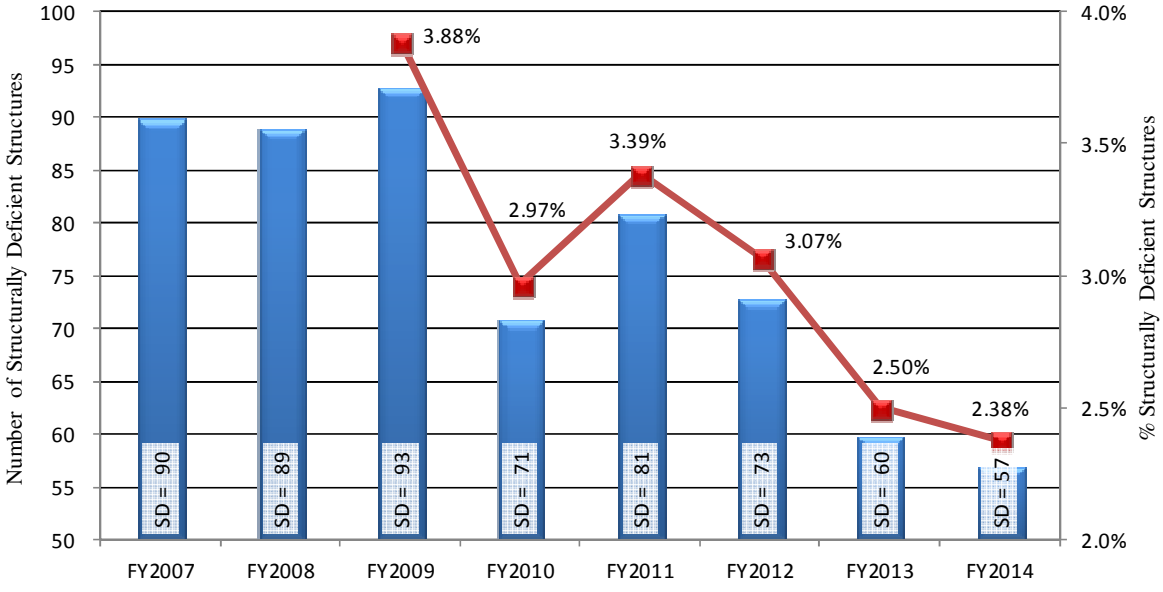


Chart D.2 – Percentage of Structurally Deficient Structures Recent Interstate Trend



Note: Method of accounting for the number of structures by system has changed from previous years. See Appendix G for discussion.

Chart D.3 – Percentage of Number of Structurally Deficient Structures- Primary End of FY 2014

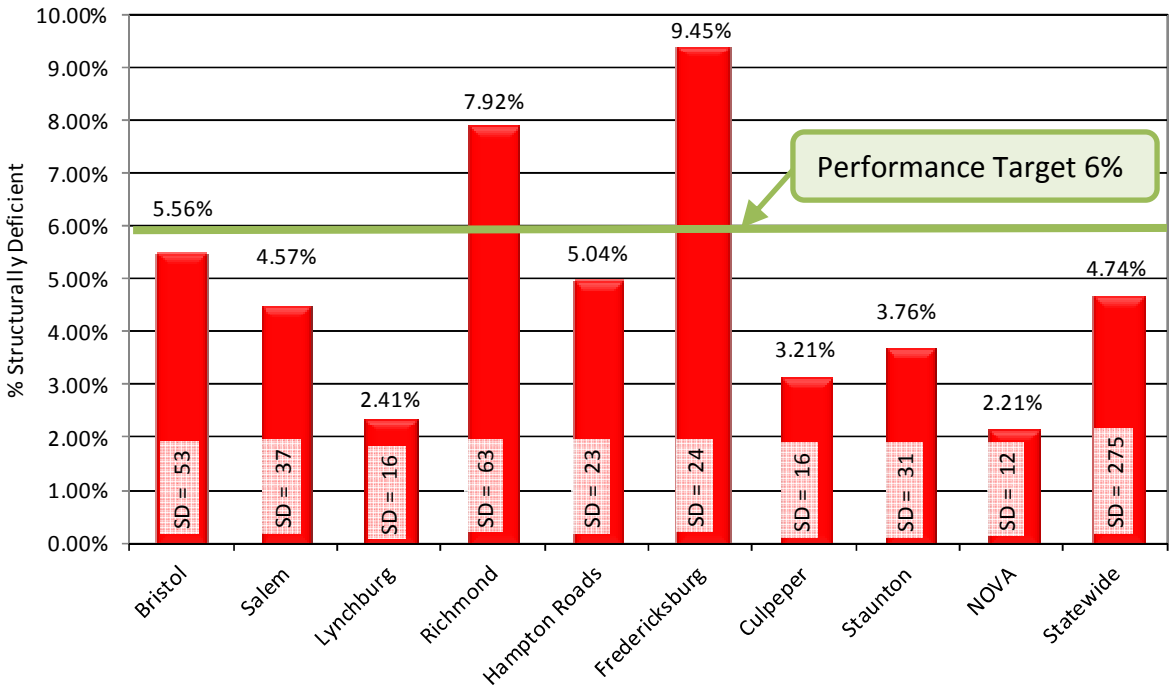
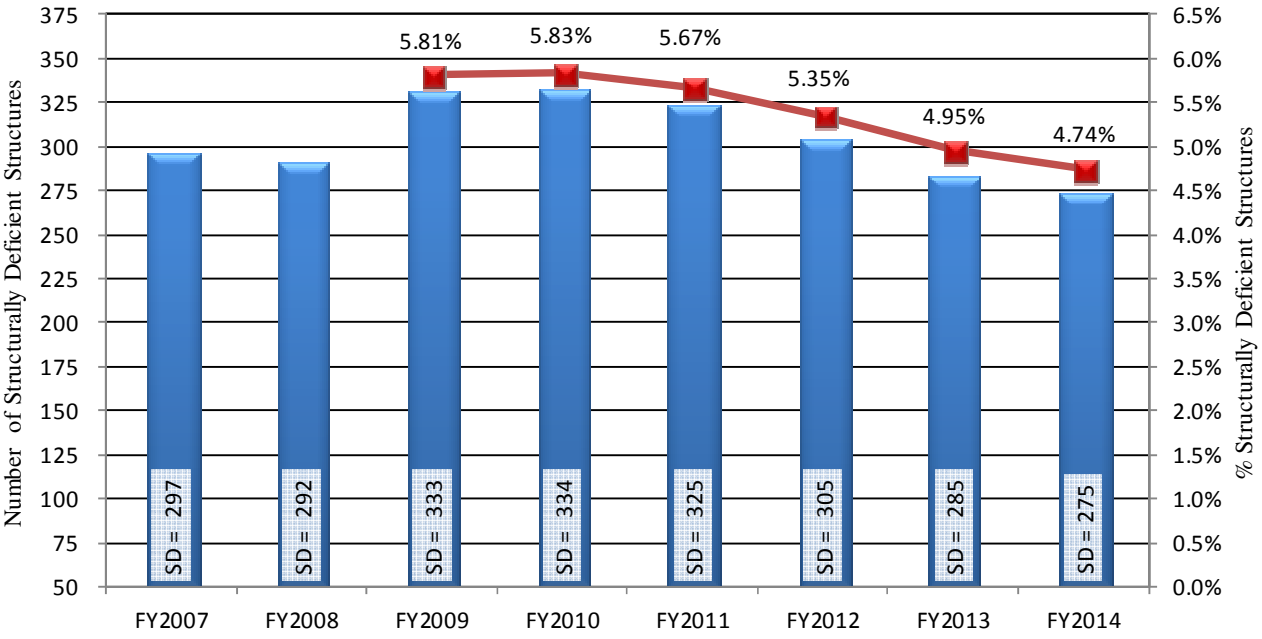


Chart D.4 – Percentage of Structurally Deficient Structures Recent Primary Trend



Note: Method of accounting for the number of structures by system has changed from previous years. See Appendix G for discussion.

Chart D.5 – Percentage of Number of Structurally Deficient Structures- Secondary End of FY 2014

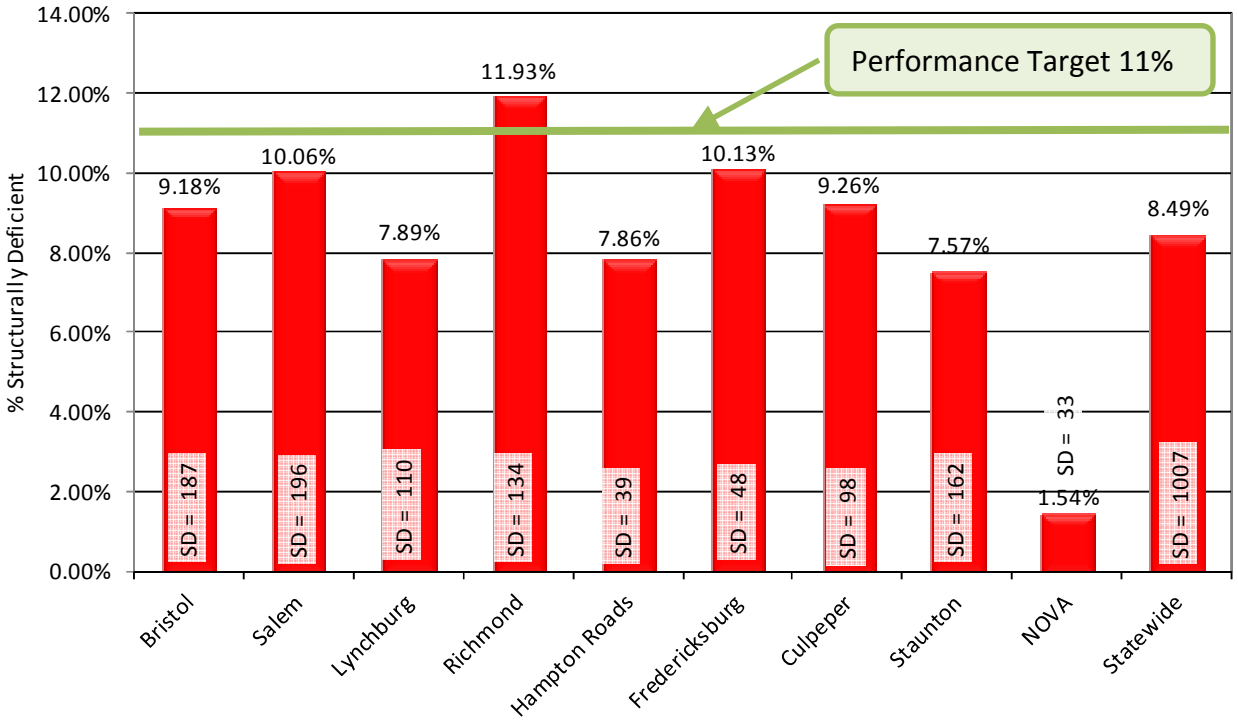
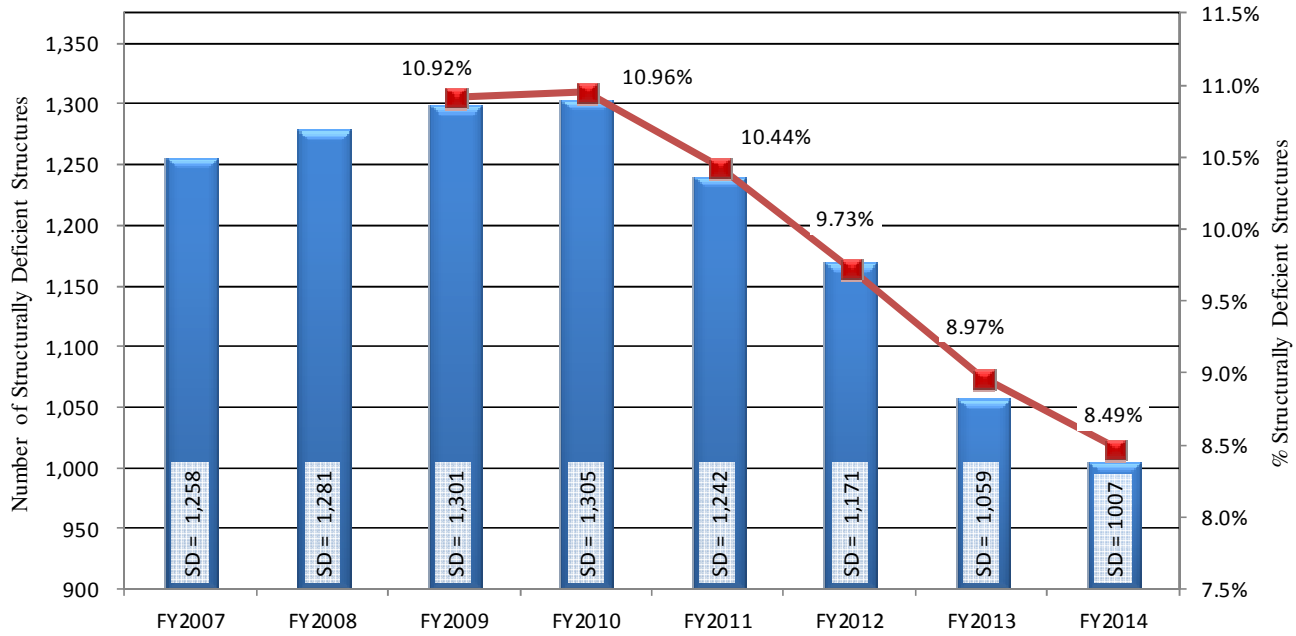


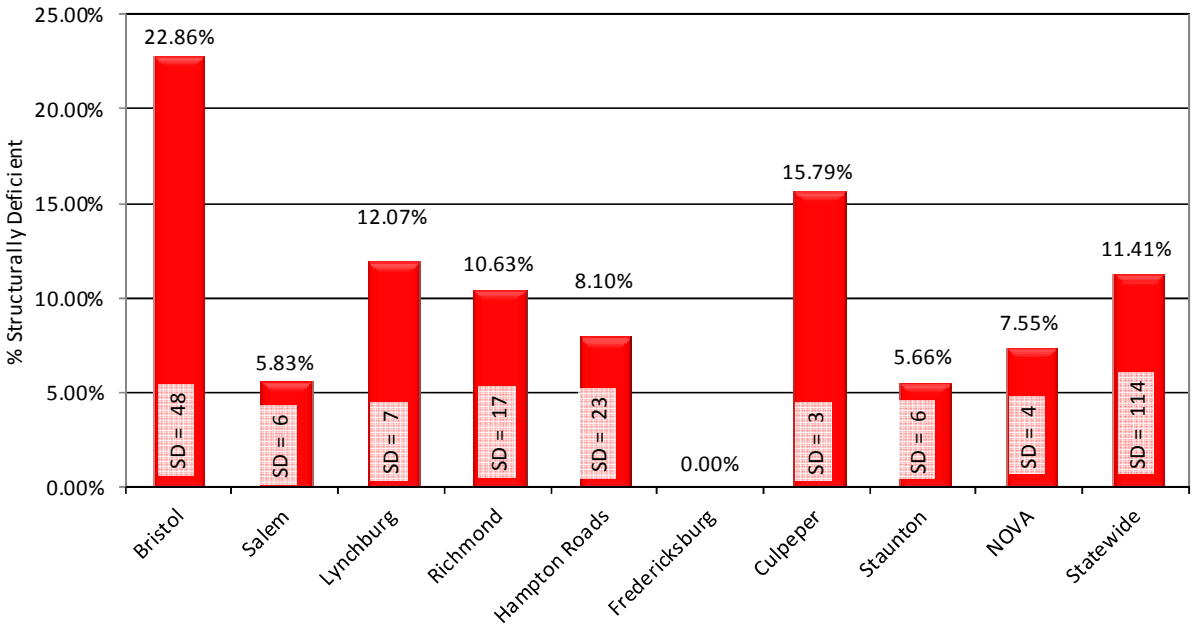
Chart D.6 – Percentage of Structurally Deficient Structures Recent Secondary Trend



Note: Method of accounting for the number of structures by system has changed from previous years. See Appendix G for discussion.

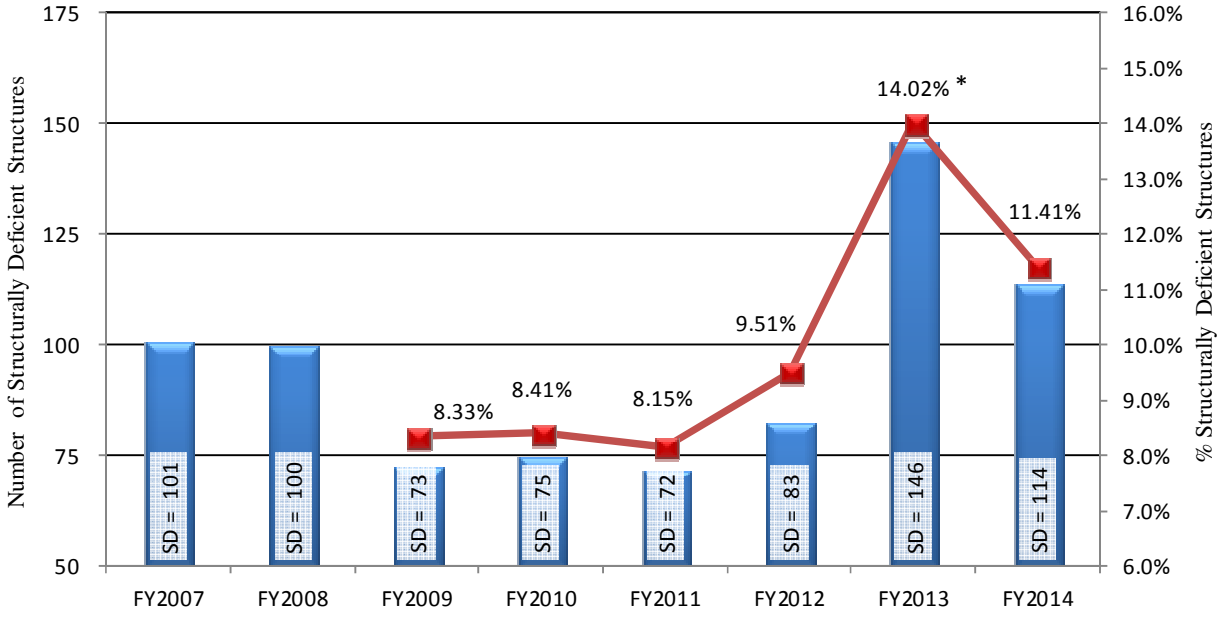
Chart D.7 – Percentage of Number of Structurally Deficient Structures- Urban

End of FY 2014



Note: A number of structures were added in Buchanan County. See Appendix G for discussion.

Chart D.8 – Percentage of Structurally Deficient Structures
Recent Urban Trend



Note: Method of accounting for the number of structures by system has changed from previous years. See Appendix G for discussion.

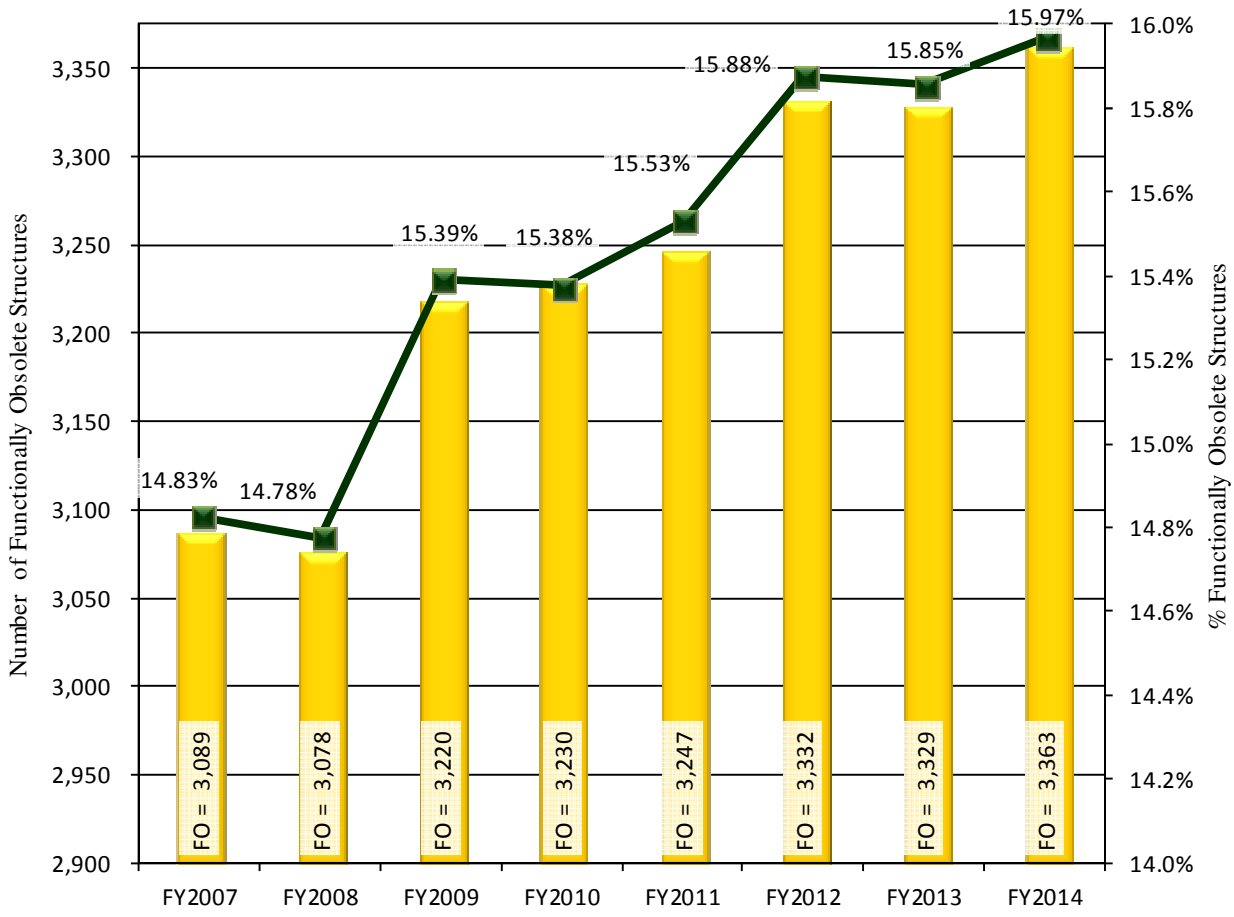
** A large number of structures deficient were added in Buchanan County in FY2014. See Appendix G for discussion*

APPENDIX E – OTHER PERFORMANCE INDICATORS

FUNCTIONALLY OBSOLETE STRUCTURES

A Functionally Obsolete (FO) structure is one that has an appraisal rating of three (3) or less for the deck geometry, under clearance, approach roadway alignment, structural condition or waterway adequacy. An FO designation means that the structure was built to standards (deck geometry, load carrying capacity, clearances, or approach roadway alignment) that are less conservative than those used for new construction projects today. Charts E.1 through E.5, depict trends statewide and by system.

Chart E.1 – Number and Percentage of FO Structures
Recent Statewide Trend



Note: Method of accounting for the number of structures by system has changed from previous years. See Appendix G for discussion. Typical for Charts E.1 through E.5.

Chart E.2 – Number and Percentage of FO Structures
Recent Interstate Trend

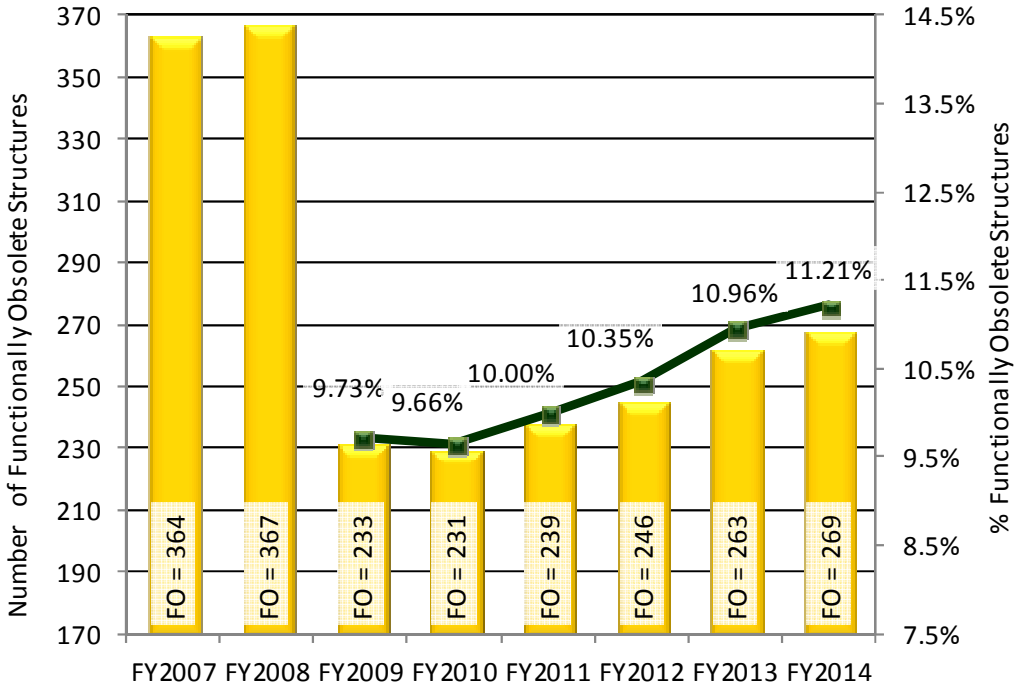
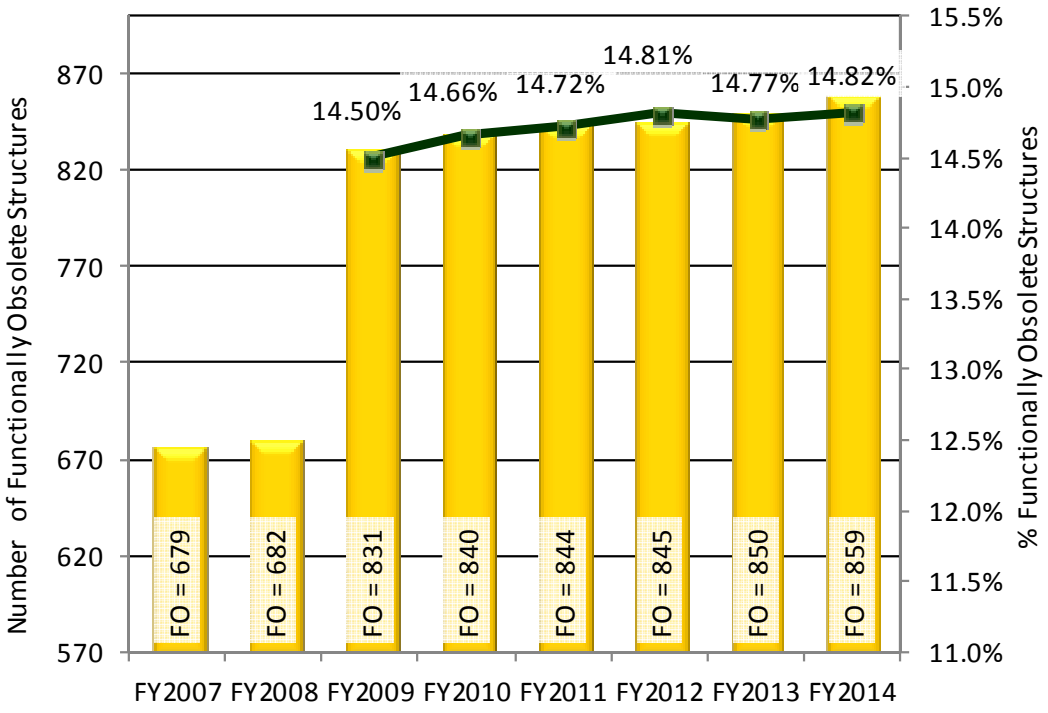


Chart E.3 – Number and Percentage of FO Structures
Recent Primary Trend



Note: Method of accounting for the number of structures by system has changed from previous years. See Appendix G for discussion

Chart E.4 – Number and Percentage of FO Structures
Recent Secondary Trend

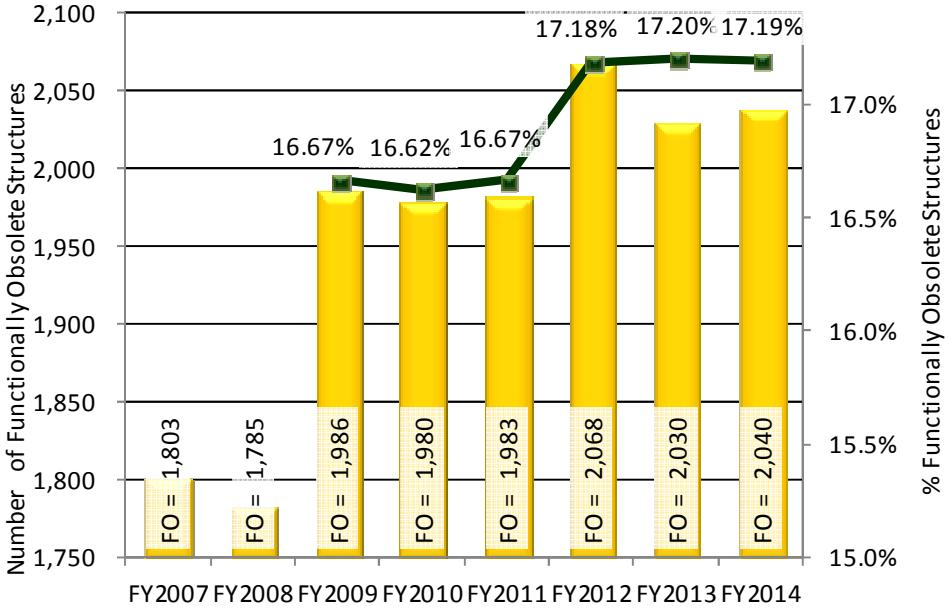
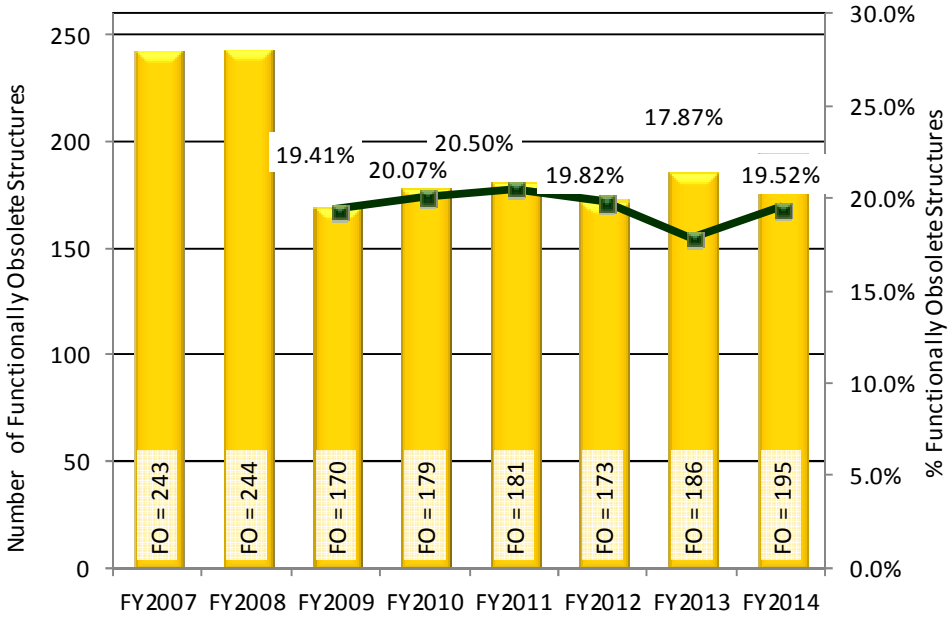


Chart E.5 – Number and Percentage of FO Structures
Recent Urban Trend

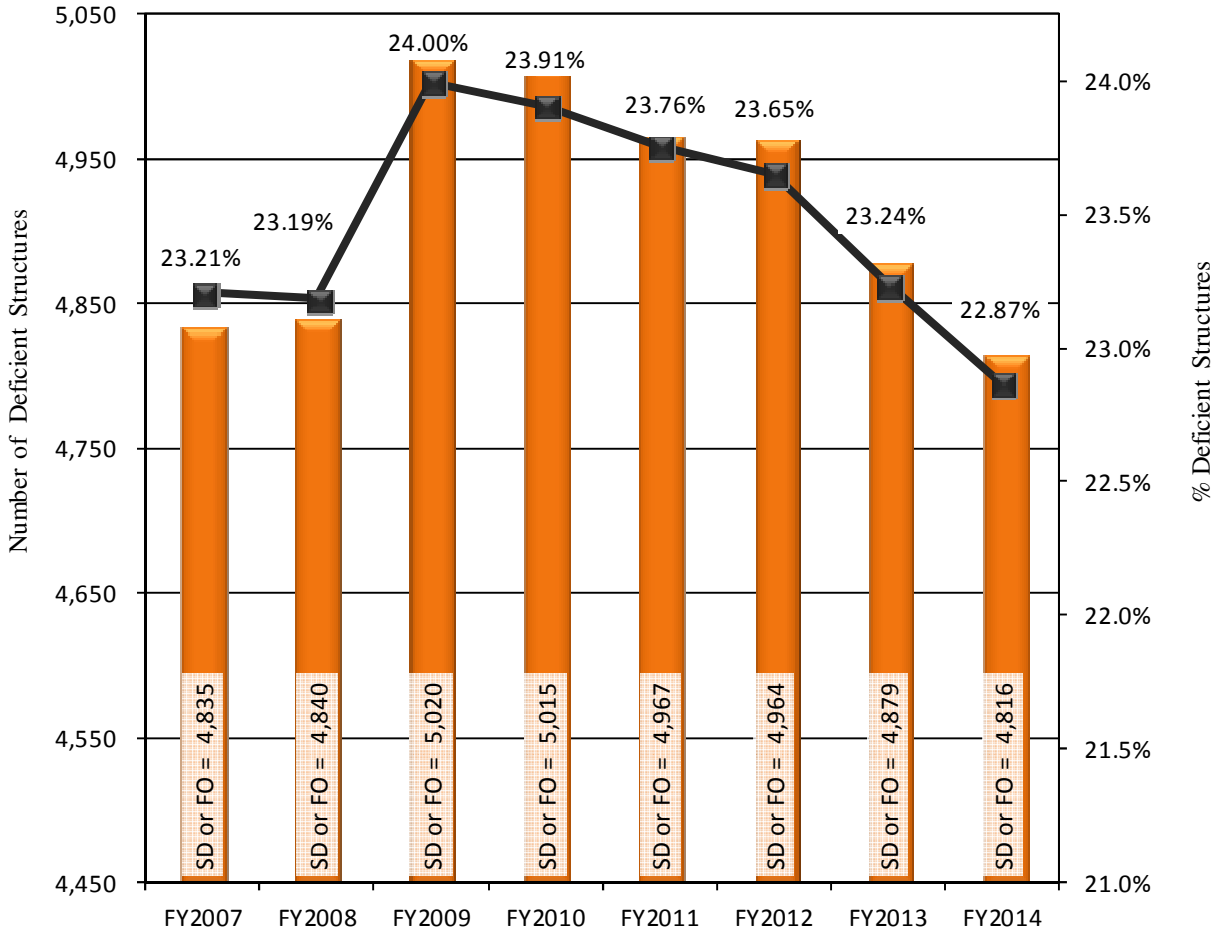


Note: Method of accounting for the number of structures by system has changed from previous years. See Appendix G for discussion

DEFICIENT STRUCTURES

Combining Structurally Deficient (SD) and Functionally Obsolete (FO) - According to the Federal Highway Administration a structure is deemed "deficient" if it is rated either SD or FO. If a structure is both SD and FO it is designated as SD. All percentages are based on the number of bridges in the inventory during the fiscal year indicated, so it is possible for the number of SD or FO structures to increase from one year to the next while the percentage decreases. Charts E.6 though E.10, show the trends statewide and by systems.

Chart E.6 – Number and Percentage of Deficient Structures
Recent Statewide Trend



Note: Method of accounting for the number of structures by system has changed from previous years. See Appendix G for discussion. Typical for Charts E.6 through E.10.

Chart E.7 – Number and Percentage of Deficient Structures
Recent Interstate Trend

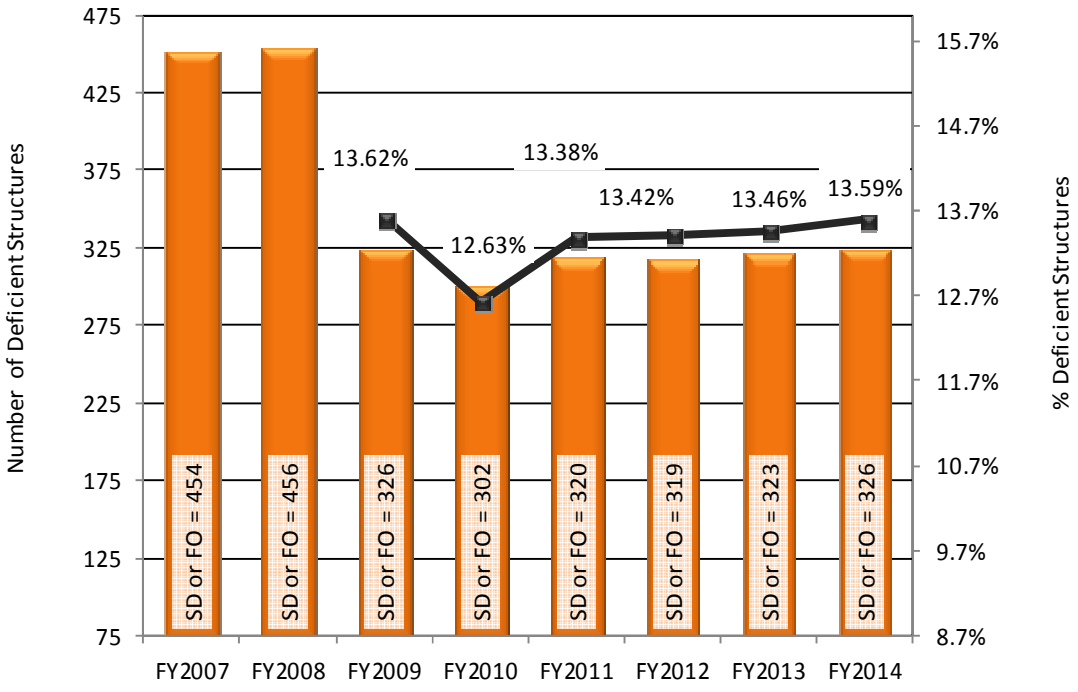


Chart E.8 – Number and Percentage of Deficient Structures
Recent Primary Trend

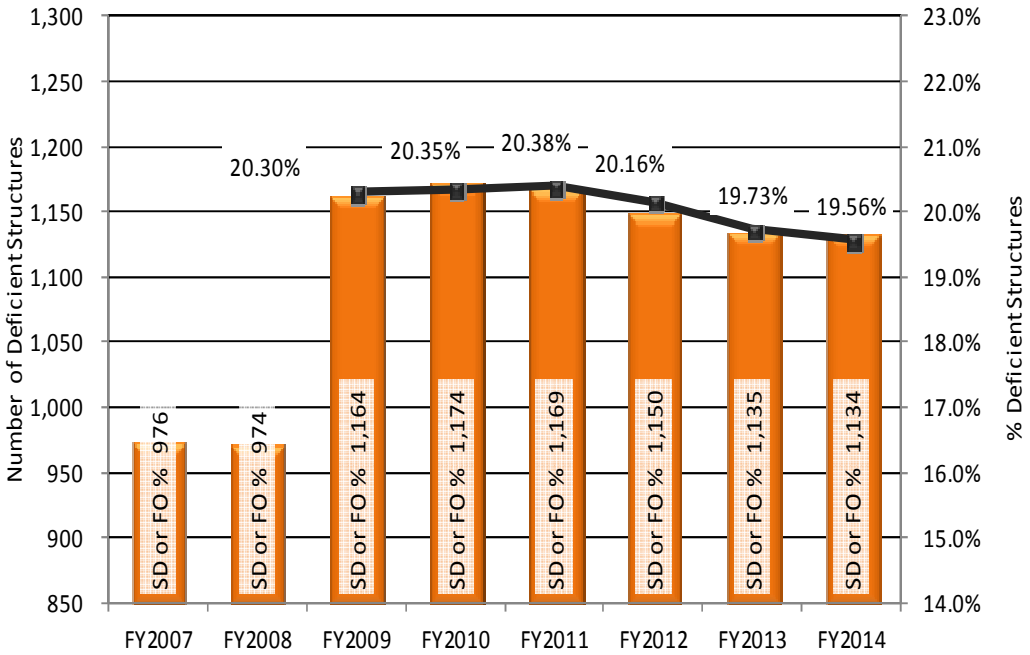


Chart E.9 – Number and Percentage of Deficient Structures
Recent Secondary Trend

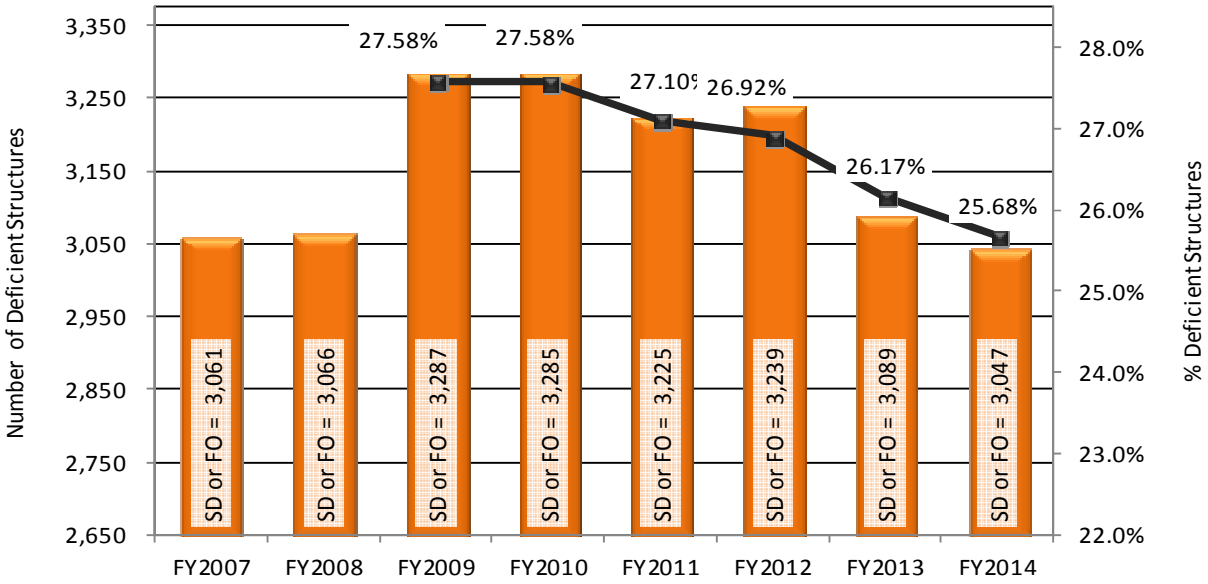
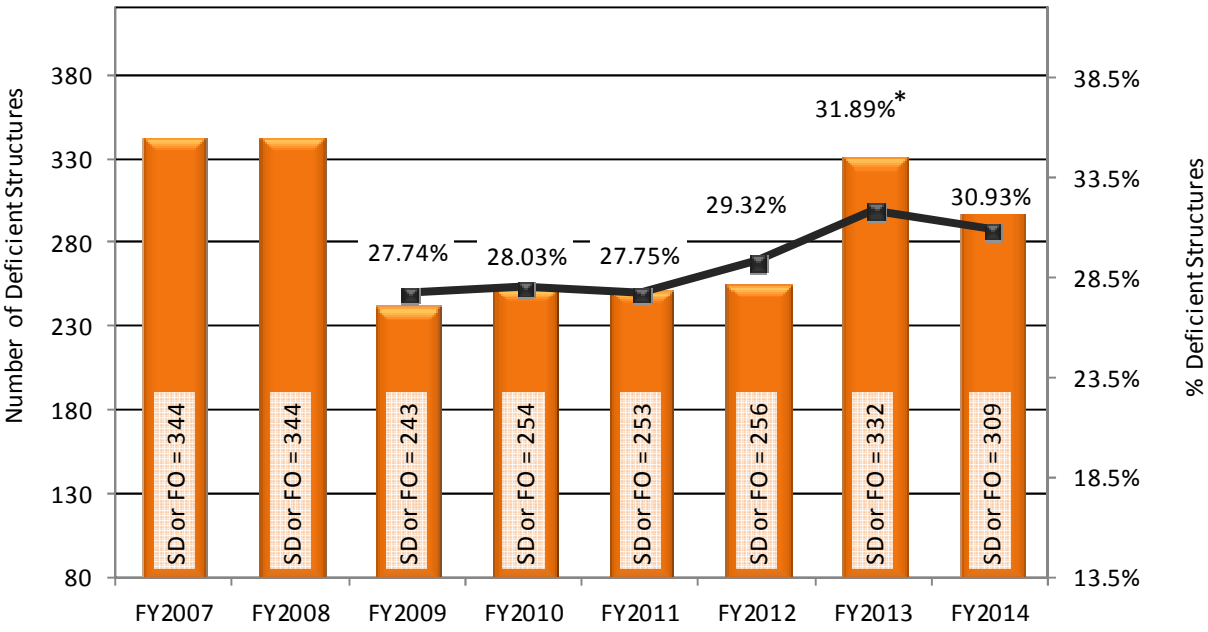


Chart E.10 – Number and Percentage of Deficient Structures
Recent Urban Trend



**Note: A large number of structures deficient were added in Buchanan County in FY2013. See Appendix G for discussion*

Weight-Posted Structures

Weight-Posted - A weight-posted structure is one that has a rated load-carrying capacity less than the Virginia designated legal loads or the 45 ton blanket vehicle. Virginia legal loads are as follows:

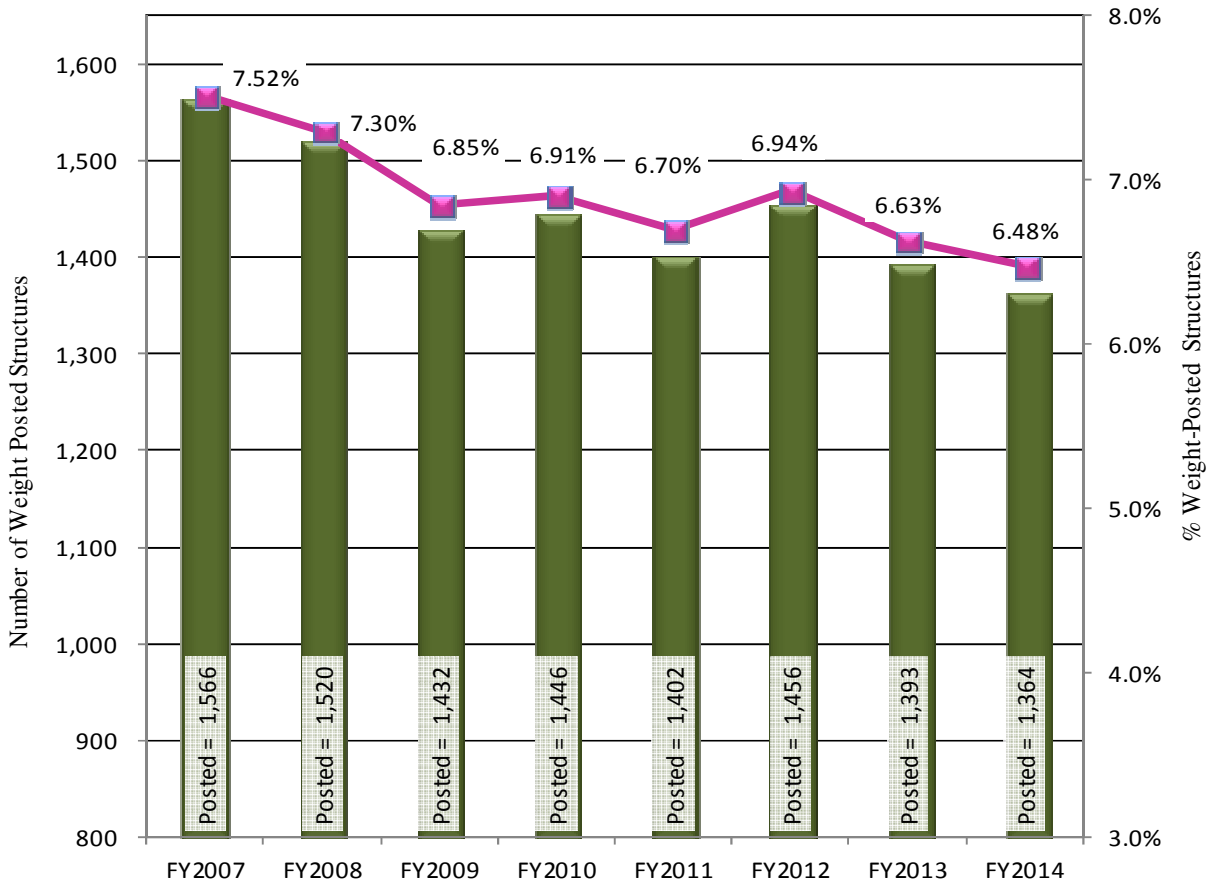
- 27 Tons for a single unit
- 40 Tons for semi-trailers

Virginia's blanket vehicles are as follows:

- 57.5 Tons on 7 axles
- 45 Tons on 5 axles

Charts E.11 thru E.15 illustrate the number and percentages of posted structures statewide and by system.

Chart E.11 – Number and Percentage of Weight-Posted Structures
Recent Statewide Trend



Note: Method of accounting for the number of structures by system has changed from previous years. See Appendix G for discussion. Typical for Charts E.11 through E.15.

Chart E.12 – Number and Percentage of Weight-Posted Structures
Recent Interstate Trend

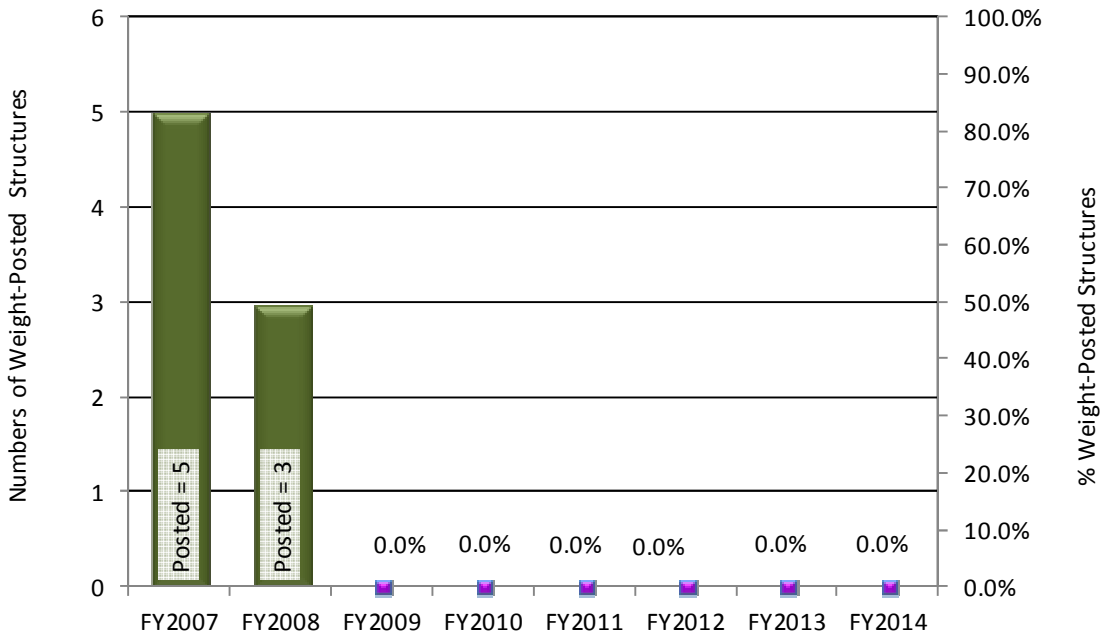


Chart E.13 – Number and Percentage of Weight-Posted Structures
Recent Primary Trend

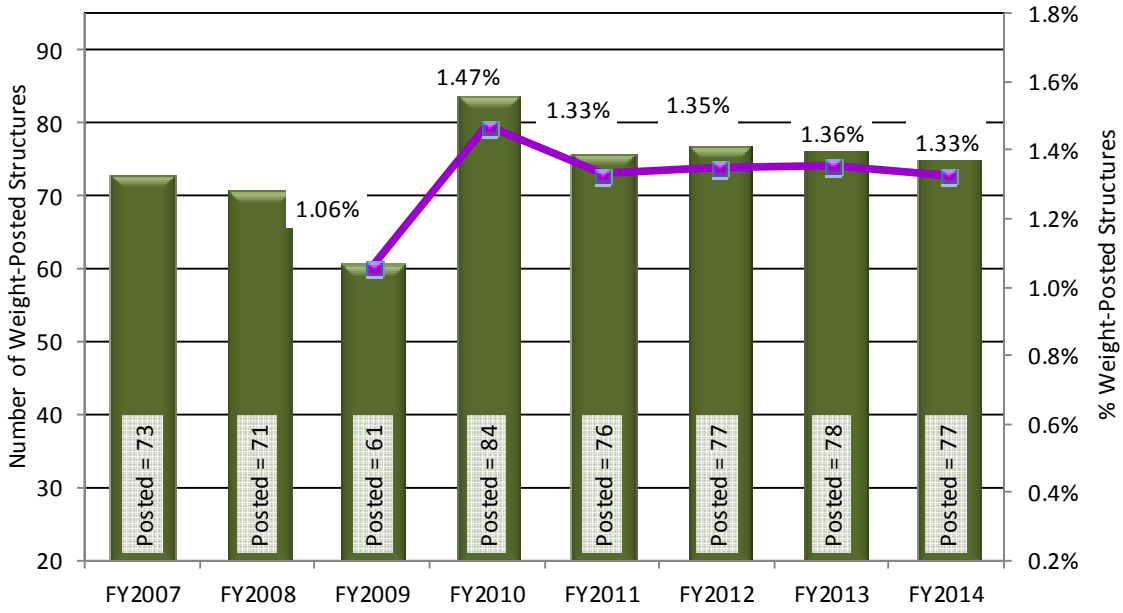


Chart E.14 – Number and Percentage of Weight-Posted Structures
Recent Secondary Trend

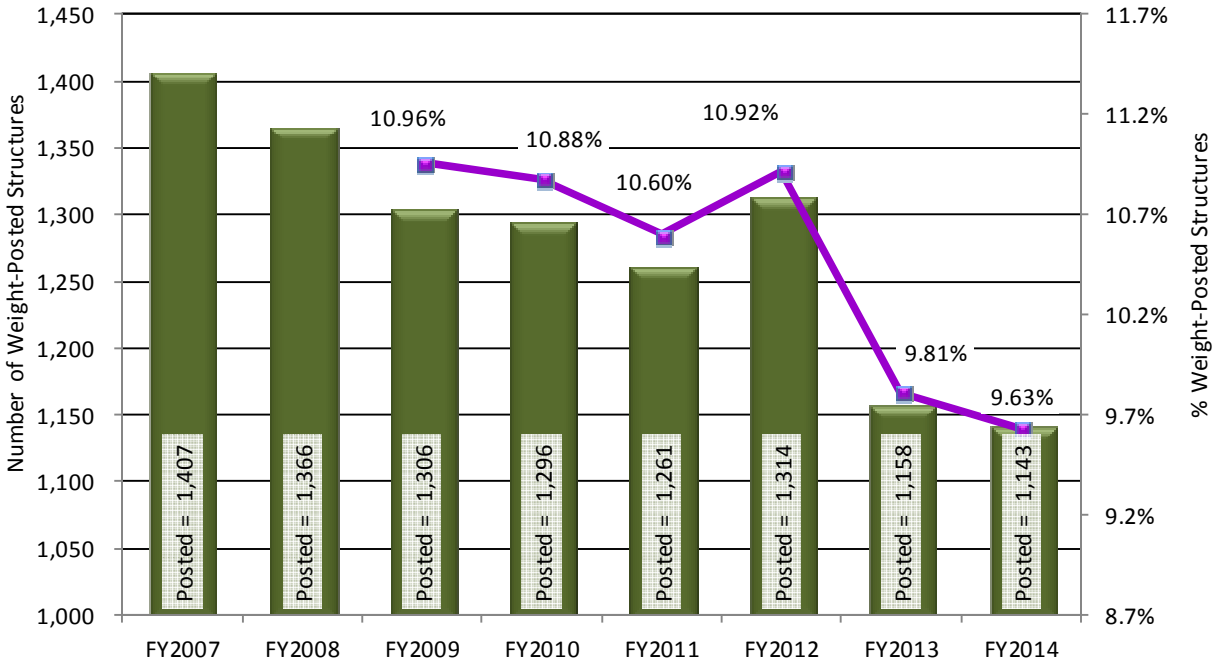
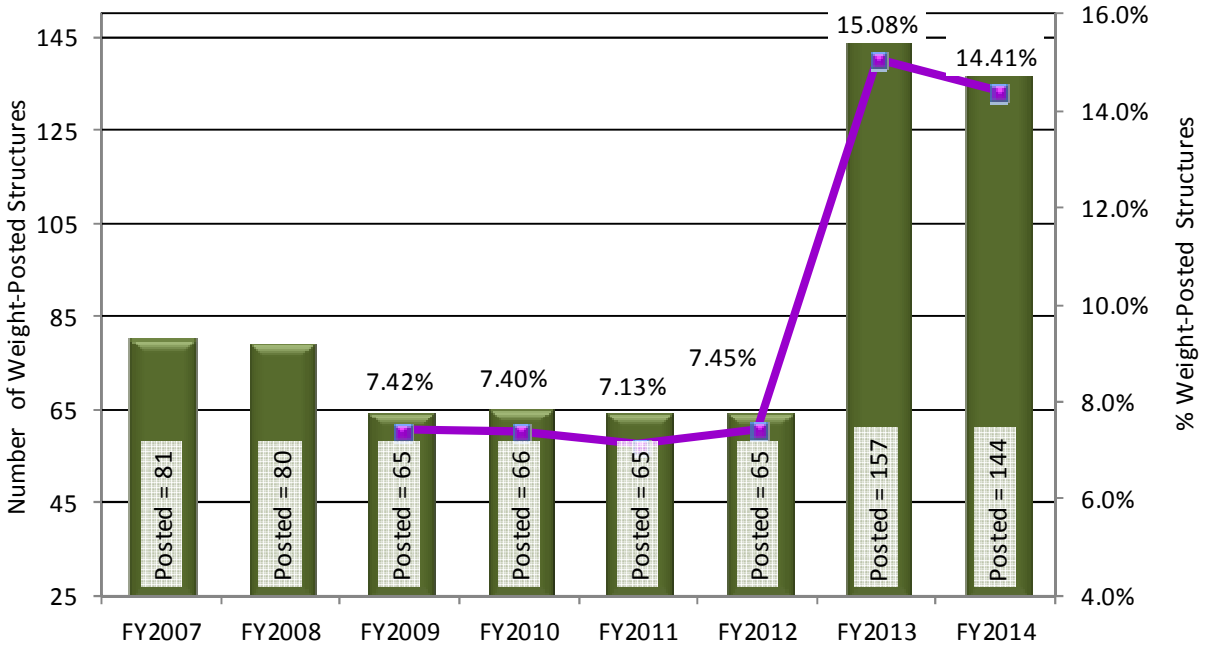


Chart E.15 – Number and Percentage of Weight-Posted Structures
Recent Urban Trend



Note: A large number of deficient structures were added in Buchanan County in FY2012. See Appendix G for discussion

HEALTH INDEX MEASURE

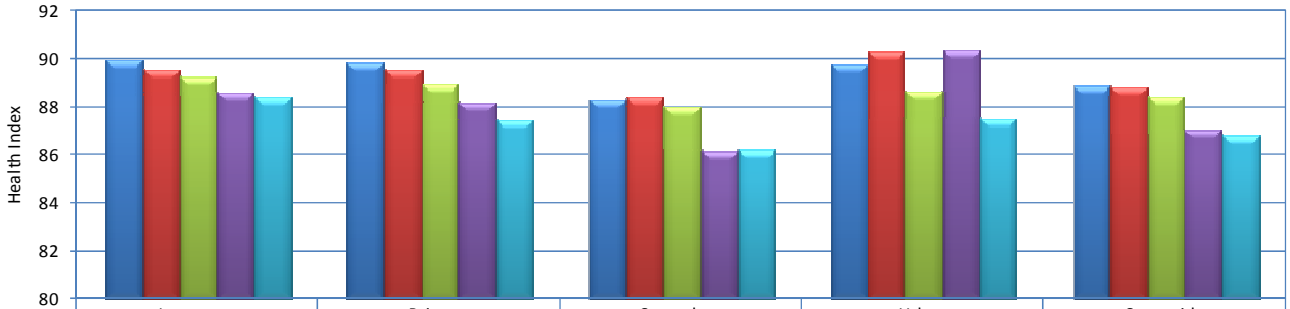
VDOT tracks a performance measure called the Health Index, which is calculated with the AASHTOWare Bridge Management System. The Health Index is calculated as the sum of the current value of all elements divided by the sum of total value of all elements. The current value is based on the quantity of the elements in each condition state. A Health Index of 100% indicates that all of the condition elements of the structure are in the best possible condition state. A Health Index of 0% indicates that all of the condition elements are in the worst possible condition state. Health index of an individual structure is calculated according to the formula following formula.

$$H = \frac{\sum_e CEVe}{\sum_e TEVe} * 100\%$$

where *CEVe* and *TEVe* are the **current** and **total element values of each element**.

An element is a part of a bridge for which condition is assessed and work maybe recommended. Each bridge element can have up to five condition states. Each condition state categorizes the nature and extent of damage or deterioration of a bridge element. Condition state one is always defined as no damage. The higher the condition state, the more damage there is on the element. Condition states for each element have been precisely defined in terms of the specific types of distresses that the elements can develop. Charts E.16 and E.17 show the average Health Index (HI) by highway system and by District from FY2010 to FY2014. HI data for earlier years is not available.

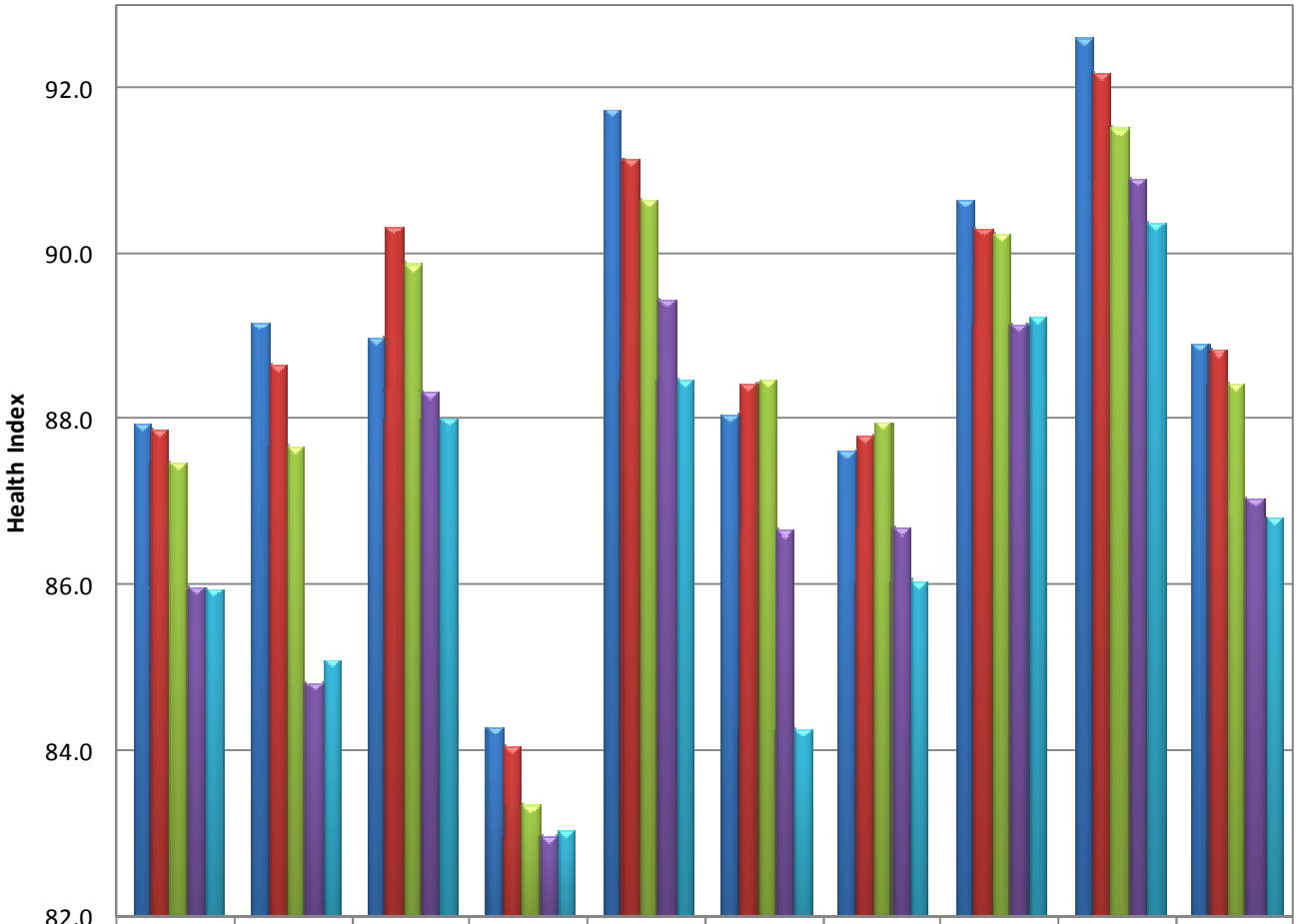
Chart E.16 – Average Health Index of VDOT Structures by System and Statewide



	Interstate	Primary	Secondary	Urban	Statewide
2010	89.98	89.88	88.33	89.79	88.95
2011	89.59	89.56	88.43	90.35	88.88
2012	89.26	89.00	88.04	88.68	88.45
2013	88.64	88.24	86.21	90.42	87.07
2014	88.43	87.48	86.22	87.58	86.84

System

Chart E.17 – Average Health Index of VDOT Structures by District and Statewide



	Bristol	Salem	Lynchburg	Richmond	Hampton Roads	Fredericksburg	Culpeper	Staunton	Northern Virginia	Statewide
2010	88.0	89.2	89.0	84.3	91.8	88.1	87.7	90.7	92.6	89.0
2011	87.9	88.7	90.4	84.1	91.2	88.5	87.8	90.3	92.2	88.9
2012	87.5	87.7	89.9	83.4	90.7	88.5	88.0	90.3	91.6	88.4
2013	86.0	84.9	88.4	83.0	89.5	86.7	86.7	89.2	90.9	87.1
2014	86.0	85.1	88.0	83.1	88.5	84.3	86.1	89.3	90.4	86.8

Districts

APPENDIX F – STRUCTURE DATA BY AREA

Table F.1 – Total Deck Area of Structures by District

DISTRICT	Deck Area of Structures (Square Feet)				
	Interstate	Primary	Secondary	Urban	Total
Bristol	1,820,736	4,081,691	2,654,469	286,686	8,843,582
Salem	1,678,340	4,638,370	3,095,718	649,028	10,061,456
Lynchburg	0	4,602,820	2,675,849	373,144	7,651,812
Richmond	5,994,675	10,050,051	3,849,913	1,165,527	21,060,166
Hampton Roads	10,793,803	14,606,362	1,278,774	2,955,922	29,634,861
Fredericksburg	591,588	2,813,427	1,245,509	57,593	4,708,117
Culpeper	1,047,337	1,830,528	1,784,420	74,398	4,736,682
Staunton	3,235,759	3,528,263	3,265,723	449,719	10,479,464
NOVA	6,340,055	6,301,535	6,103,574	443,709	19,188,872
Statewide	**31,502,293**	**52,453,047**	**25,953,949**	**6,455,725**	**116,365,014**

Chart F.1 – Total Deck Area of Structures by District

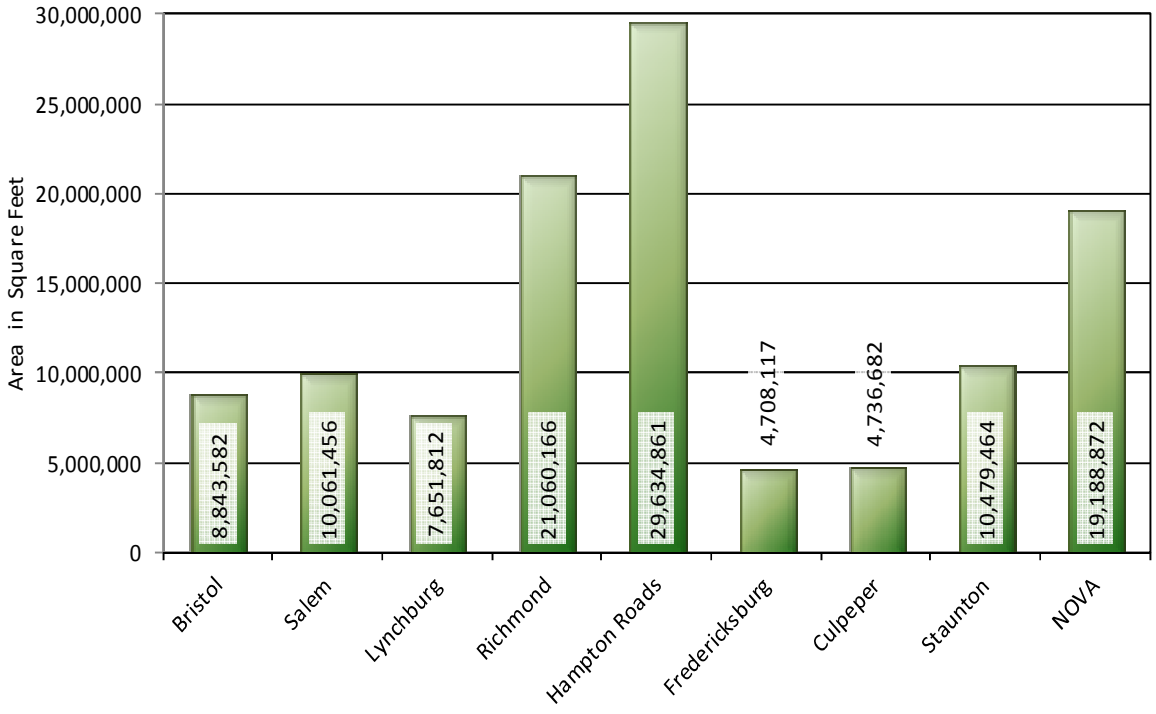


Table F.2 – Total Deck Area of Structurally Deficient Structures by District

DISTRICT	Area of Structurally Deficient Structures (Square Feet)				
	Interstate	Primary	Secondary	Urban	Total
Bristol	118,195	230,054	195,542	62,266	606,057
Salem	115,223	154,972	228,693	19,201	518,089
Lynchburg	0	152,107	143,451	17,565	313,122
Richmond	406,007	678,528	224,211	116,726	1,425,472
Hampton Roads	314,644	505,007	59,460	47,843	926,954
Fredericksburg	26,444	308,560	81,086	0	416,089
Culpeper	0	121,928	103,213	15,898	241,039
Staunton	91,056	193,163	136,462	17,635	438,316
NOVA	24,386	193,738	74,274	1,610	294,008
Statewide	**1,095,954**	**2,538,055**	**1,246,393**	**298,746**	**5,179,148**

Chart F.2 – Total Deck Area of Structurally Deficient Structures by District

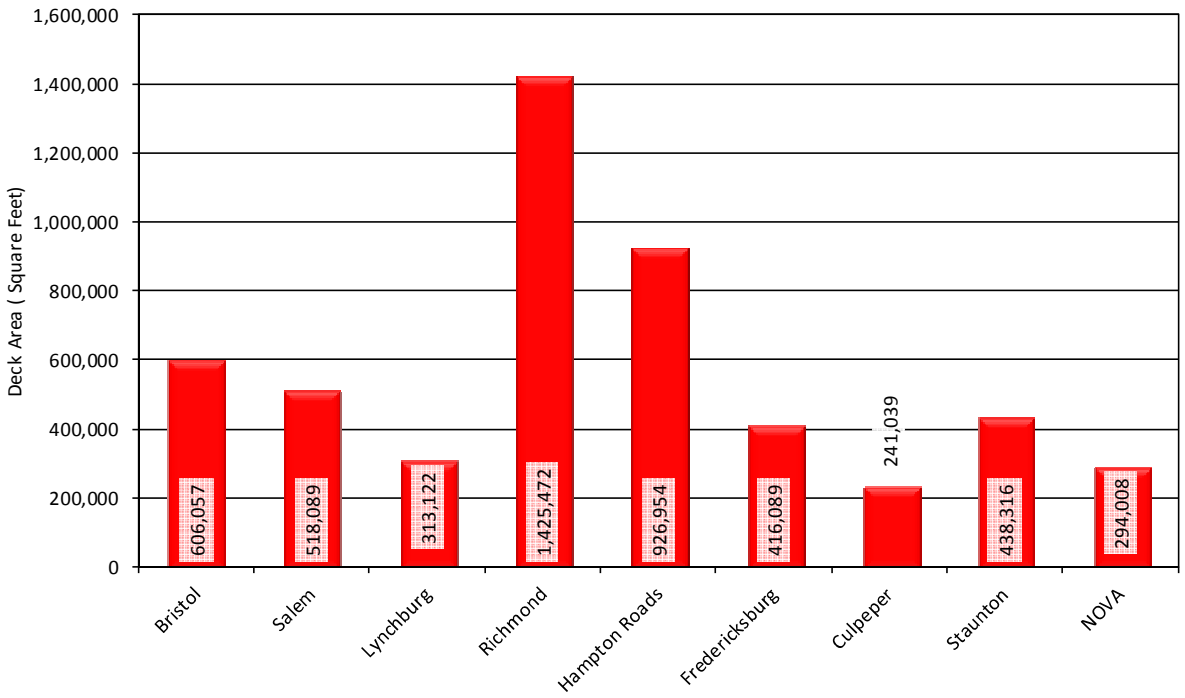


Table F.3 – Percentage of Total Deck Area of Structurally Deficient Structures by District

DISTRICT	Percent Area of Structurally Deficient Structures				
	Interstate	Primary	Secondary	Urban	Total
Bristol	6.5%	5.6%	7.4%	21.7%	6.9%
Salem	6.9%	3.3%	7.4%	3.0%	5.1%
Lynchburg	0.0%	3.3%	5.4%	4.7%	4.1%
Richmond	6.8%	6.8%	5.4%	10.0%	6.8%
Hampton Roads	2.9%	3.5%	5.8%	1.6%	3.1%
Fredericksburg	4.5%	11.0%	4.6%	0.0%	8.8%
Culpeper	0.0%	6.7%	5.8%	21.4%	5.1%
Staunton	2.8%	5.5%	4.2%	3.9%	4.2%
NOVA	0.4%	3.1%	1.2%	0.4%	1.5%
Statewide	**3.5%**	**4.8%**	**4.8%**	**4.6%**	**4.5%**

Percentages are calculated by dividing the SD area for the District by the total area for the District by highway system (example - SD Bristol Interstate area divided by all Bristol Interstate area 118,195 / 1,820,736 = 0.065 or 6.5%)

Chart F.3 – Percentage of Total Deck Area of Structurally Deficient Structures by District

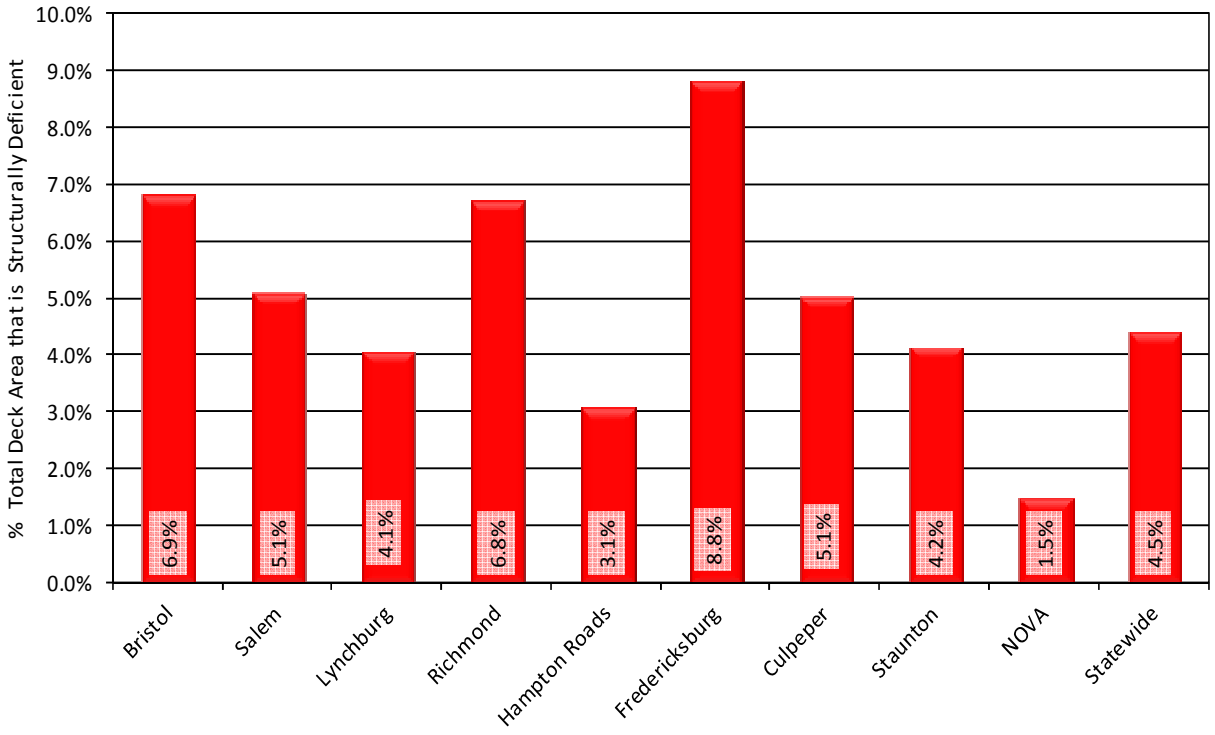


Table F.4 – Total Deck Area of Functionally Obsolete Structures by District

DISTRICT	Area of Functionally Obsolete Structures (Square Feet)				
	Interstate	Primary	Secondary	Urban	Grand Total
Bristol	235,737	432,920	284,316	38,878	991,851
Salem	194,502	807,395	548,304	224,124	1,774,325
Lynchburg	0	432,364	166,389	61,139	659,893
Richmond	1,025,175	1,995,426	338,896	302,275	3,661,772
Hampton Roads	1,757,833	4,428,300	116,592	641,806	6,944,531
Fredericksburg	51,568	742,007	125,406	0	918,981
Culpeper	6,206	95,282	234,614	12,200	348,302
Staunton	146,206	581,261	375,831	111,170	1,214,468
NOVA	2,291,283	1,579,450	1,674,973	175,584	5,721,291
Statewide	**5,708,509**	**11,094,407**	**3,865,321**	**1,567,176**	**22,235,413**

If a structure is both structurally deficient and functionally obsolete, structure is counted as structurally deficient only.

Chart F.4 – Total Deck Area of Functionally Obsolete Structures by District

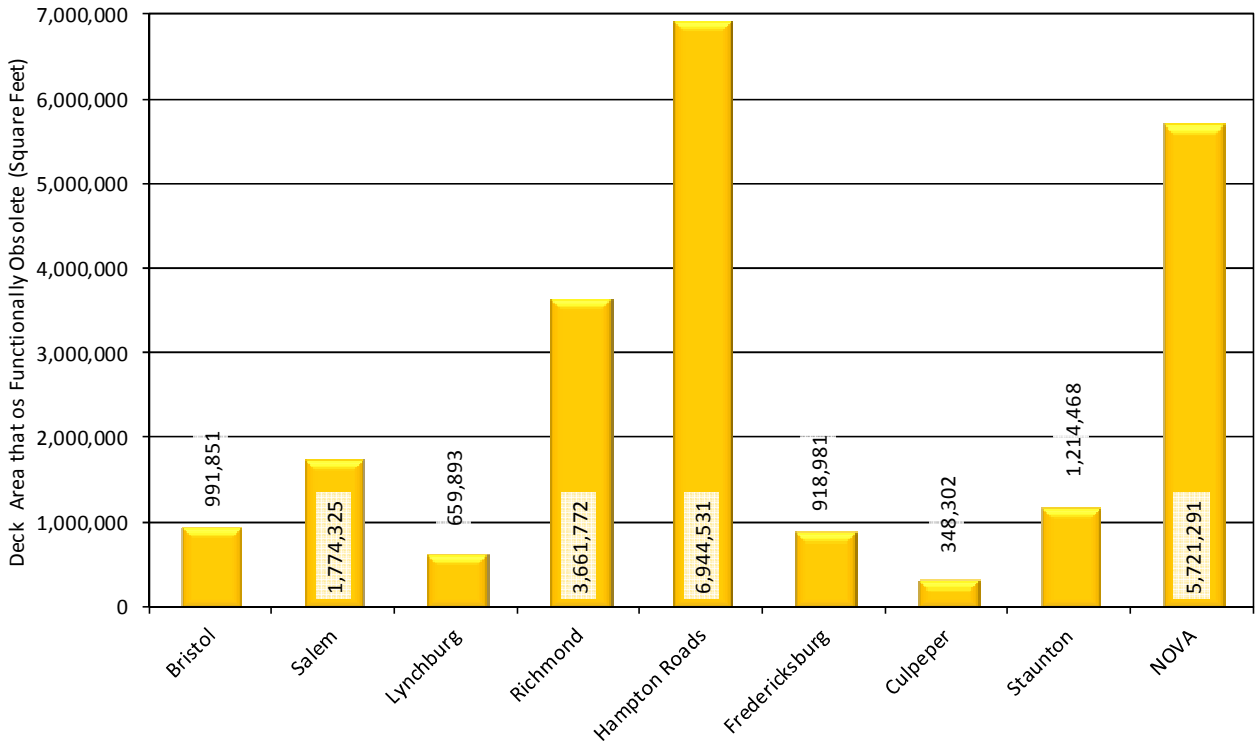


Table F.5 – Percentage of Total Deck Area that is Functionally Obsolete by District

DISTRICT	Percent of Deck Area that is Functionally Obsolete				
	Interstate	Primary	Secondary	Urban	Grand Total
Bristol	12.9%	10.6%	10.7%	13.6%	11.2%
Salem	11.6%	17.4%	17.7%	34.5%	17.6%
Lynchburg	0.0%	9.4%	6.2%	16.4%	8.6%
Richmond	17.1%	19.9%	8.8%	25.9%	17.4%
Hampton Roads	16.3%	30.3%	9.1%	21.7%	23.4%
Fredericksburg	8.7%	26.4%	10.1%	0.0%	19.5%
Culpeper	0.6%	5.2%	13.1%	16.4%	7.4%
Staunton	4.5%	16.5%	11.5%	24.7%	11.6%
NOVA	36.1%	25.1%	27.4%	39.6%	29.8%
Statewide	**18.1%**	**21.2%**	**14.9%**	**24.3%**	**19.1%**

Percentages are calculated by dividing the FO area for the District by the total area for the District by highway system (example - FO Bristol Interstate area divided by all Bristol Interstate area 235,737 / 1,820,736 = 0.129 or 12.9%)

Chart F.5 – Percentage of Total Deck Area that is Functionally Obsolete by District

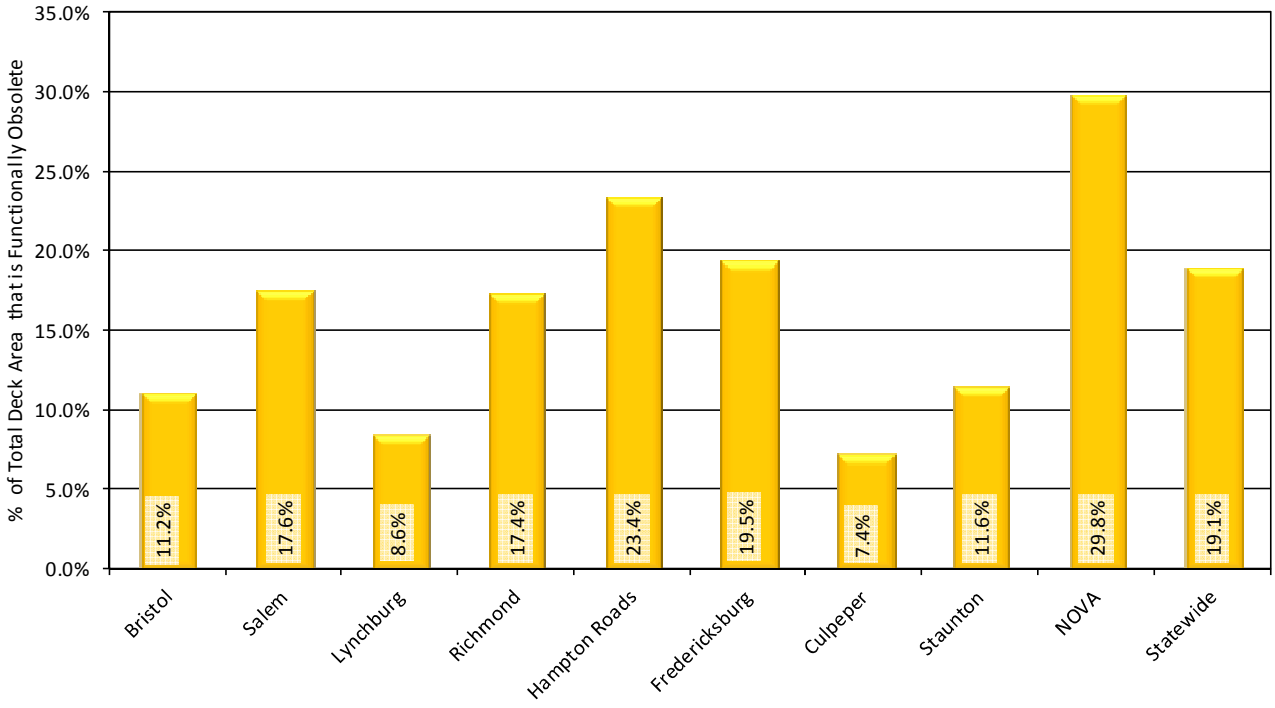


Table F.6 – Deck Area of Deficient (SD & FO) Structures by District

DISTRICT	Area of Deficient (SD or FO) Structures (Square Feet)				
	Interstate	Primary	Secondary	Urban	Grand Total
Bristol	353,931	662,974	479,858	101,144	1,597,908
Salem	309,725	962,367	776,997	243,325	2,292,413
Lynchburg	0	584,471	309,840	78,704	973,016
Richmond	1,431,182	2,673,954	563,107	419,001	5,087,244
Hampton Roads	2,072,477	4,933,307	176,051	689,649	7,871,484
Fredericksburg	78,012	1,050,567	206,492	0	1,335,070
Culpeper	6,206	217,209	337,828	28,098	589,342
Staunton	237,262	774,424	512,294	128,805	1,652,785
NOVA	2,315,669	1,773,189	1,749,247	177,194	6,015,299
Statewide	**6,804,463**	**13,632,462**	**5,111,714**	**1,865,922**	**27,414,561**

Chart F.6 – Deck Area of Deficient (SD & FO) Structures by District

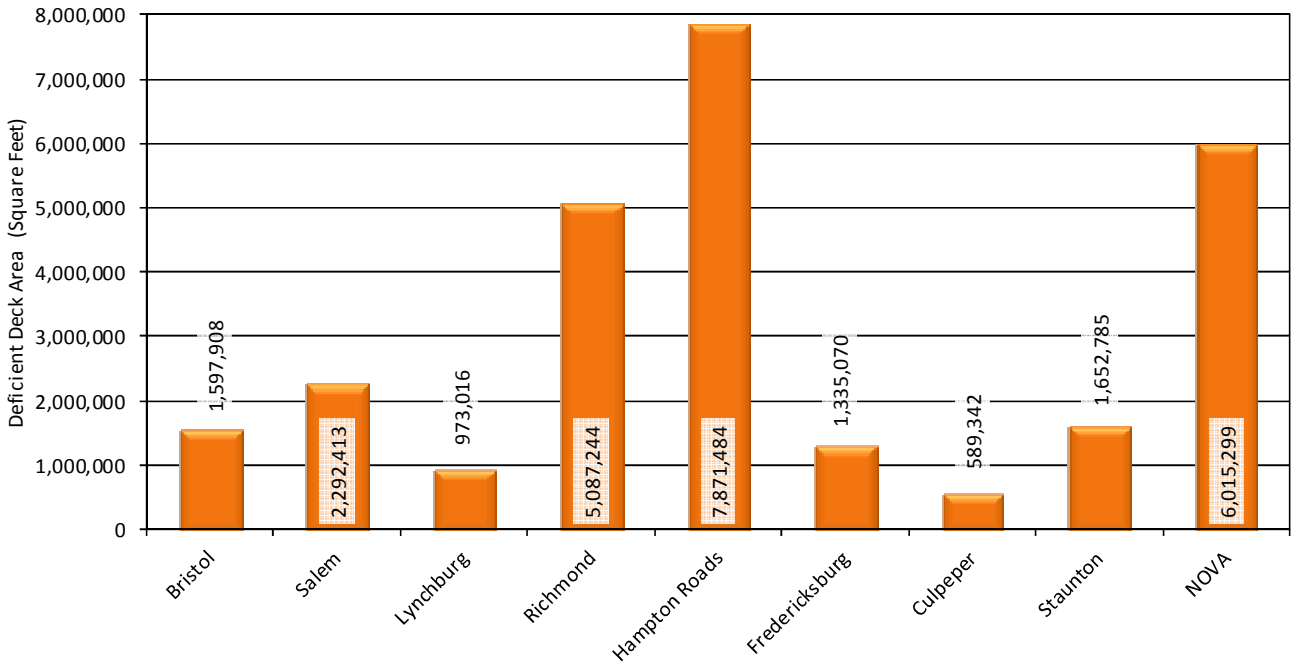


Table F.7 – Percentage of Deck Foot Area that is Deficient (SD & FO) Structures by District

DISTRICT	Percent Deck Area of Deficient (SD or FO) Structures (Square Feet)				
	Interstate	Primary	Secondary	Urban	Grand Total
Bristol	19.4%	16.2%	18.1%	35.3%	18.1%
Salem	18.5%	20.7%	25.1%	37.5%	22.8%
Lynchburg	0.0%	12.7%	11.6%	21.1%	12.7%
Richmond	23.9%	26.6%	14.6%	35.9%	24.2%
Hampton Roads	19.2%	33.8%	13.8%	23.3%	26.6%
Fredericksburg	13.2%	37.3%	16.6%	0.0%	28.4%
Culpeper	0.6%	11.9%	18.9%	37.8%	12.4%
Staunton	7.3%	21.9%	15.7%	28.6%	15.8%
NOVA	36.5%	28.1%	28.7%	39.9%	31.3%
Statewide	**21.6%**	**26.0%**	**19.7%**	**28.9%**	**23.6%**

Chart F.7 – Percentage of Deck Area that is Deficient (SD & FO) Structures by District

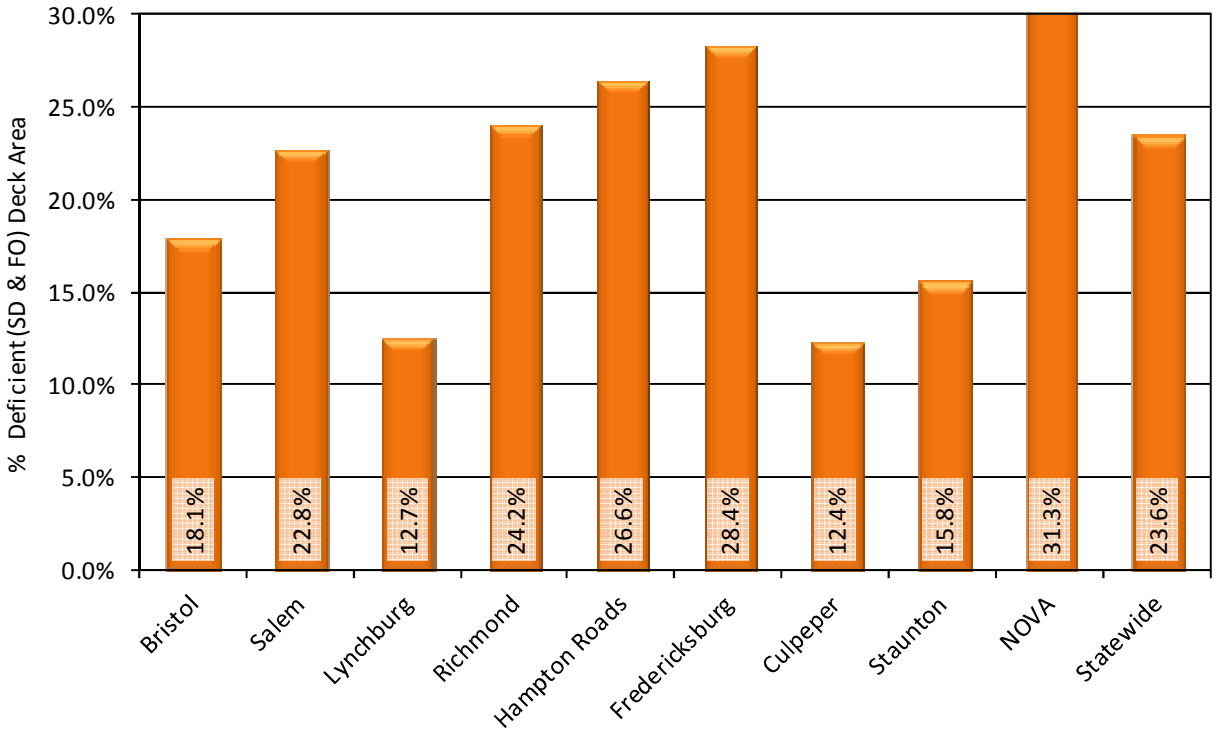


Table F.8 – Total Deck Area of Weight-Posted Structures by District

DISTRICT	Deck Area of Weight Posted Structures (Square Feet)				
	Interstate	Primary	Secondary	Urban	Grand Total
Bristol	0	52,866	187,673	77,356	317,896
Salem	0	20,806	241,801	17,019	279,627
Lynchburg	0	43,083	178,976	3,704	225,763
Richmond	0	108,223	165,985	22,271	296,479
Hampton Roads	0	165,983	71,235	35,399	272,616
Fredericksburg	0	99,309	29,801	0	129,111
Culpeper	0	19,152	82,444	4,997	106,593
Staunton	0	107,207	113,336	7,742	228,285
NOVA	0	6,409	23,592	1,610	31,611
Statewide	**0**	**623,039**	**1,094,843**	**170,099**	**1,887,981**

Chart F.8 – Total Deck Area of Weight-Posted Structures by District

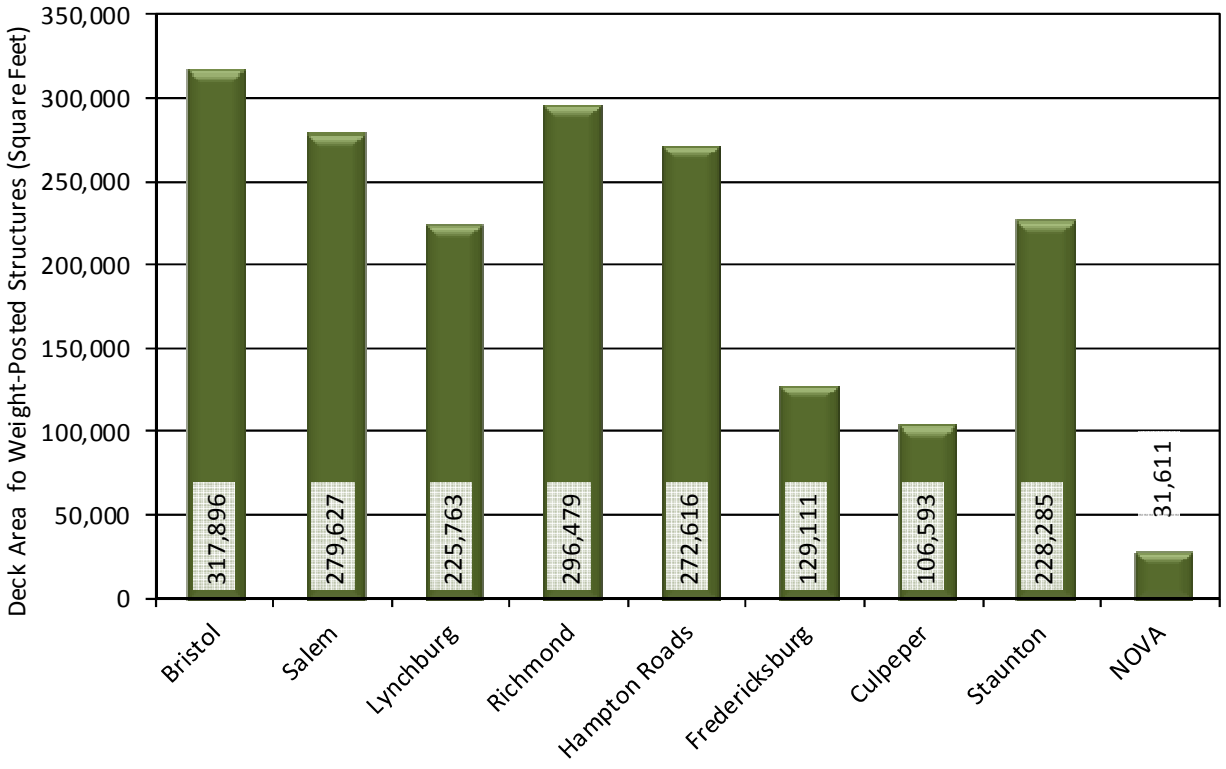
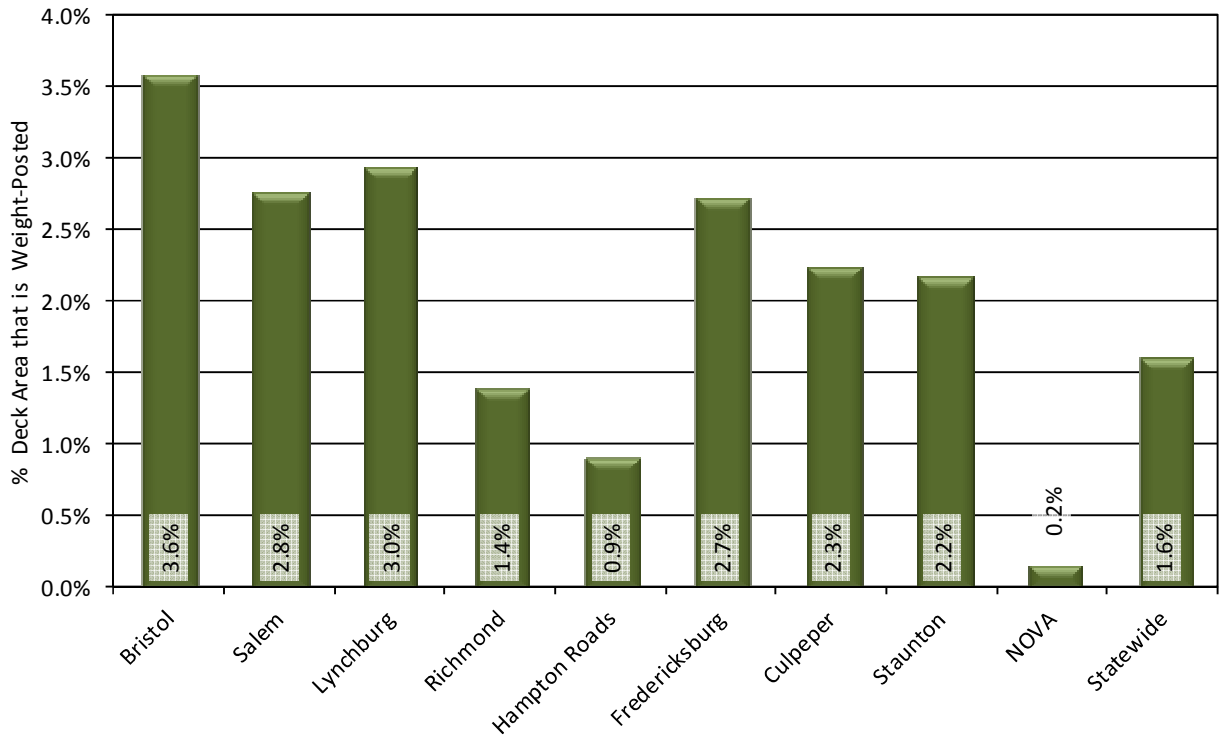


Table F.9 – Percentage of Deck area that is Weight-Posted By District

DISTRICT	Percent of Deck Area of Weight Posted Structures (Square Feet)				
	Interstate	Primary	Secondary	Urban	Grand Total
Bristol	0.0%	1.3%	7.1%	27.0%	3.6%
Salem	0.0%	0.4%	7.8%	2.6%	2.8%
Lynchburg	0.0%	0.9%	1.6%	1.0%	3.0%
Richmond	0.0%	1.1%	4.3%	1.9%	1.4%
Hampton Roads	0.0%	0.5%	5.6%	1.2%	0.9%
Fredericksburg	0.0%	1.1%	2.4%	0.0%	2.7%
Culpeper	0.0%	1.0%	4.6%	6.7%	2.3%
Staunton	0.0%	3.0%	3.5%	1.7%	2.2%
NOVA	0.0%	0.4%	0.4%	0.4%	0.2%
Statewide	**0.0%**	**2.1%**	**4.2%**	**2.6%**	**1.6%**

Chart F.9 – Percentage of Deck Area that is Weight-Posted per District



APPENDIX G – INVENTORY CHANGES FROM PREVIOUS YEARS

Notes on Charts 13, D.2 – D.8, and E.1 – E.15: 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 from numbers provided in previous reports. This is due primarily to a change in the reporting period. Some previous reports were based on calendar year (January 1 through December 31) whereas more recent reports are 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 divisions.

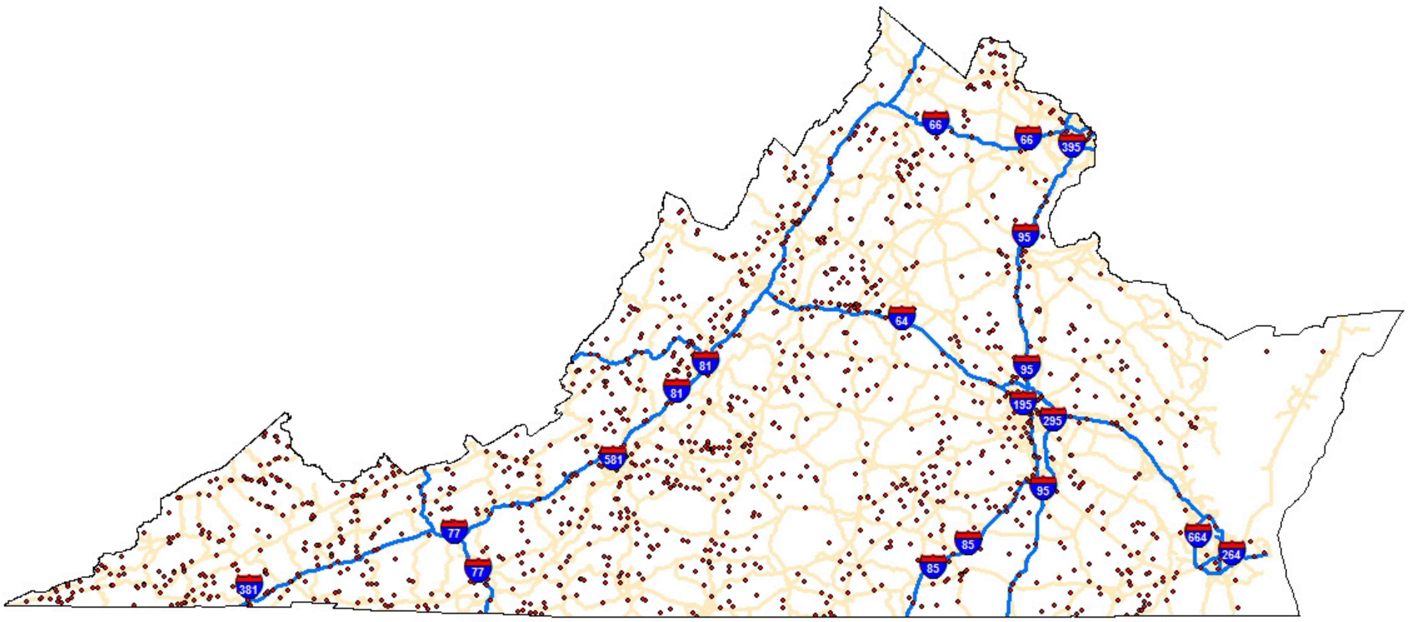
Other factors causing changes in inventory numbers for previous years between this report and previous reports include:

- Definition of Interstate Highway Bridges: From 2007 to 2009 Interstate overpasses were categorized as Interstate structures, and prior reports summarized the data accordingly. Values shown in this report for 2009 have been adjusted from those included in previous reports to reflect the removal of Interstate overpasses from the Interstate inventory. Values for 2007 and 2008 have not been adjusted due to a lack of sufficient data. Values for 2010 to the current report are based on the new criteria.
- Changes in bridge inventory. Until 2009, pedestrian and footbridge structures were included in the State of the Structures Report. They have not been included since the 2010 report. Pedestrian structures, when included, tend to provide misleading data regarding the number of SD and FO structures.
- Metropolitan Washington Airport Authority Structures are no longer reported as part of VDOT's inventory. This Authority owns these structures and reports directly to FHWA.
- In Fiscal Year 2012 VDOT accepted into its inventory 144 existing structures from Buchanan County in the Bristol District. Prior to FY2012 year these structures had not been included in VDOT's inventory.
- In Fiscal Year 2013 all the bridges that were accepted from Buchanan County in Bristol District had a change in the system type from Secondary to Urban, which is reflected in charts presented in the report.
- Since Fiscal Year 2013 VDOT has used both of the federal inventory fields, Year Built (F27) and Year Reconstructed (F106) to determine the actual age of the structure. Charts 4 to 6 reflect this change.

APPENDIX H– LOCATIONS OF STRUCTURALLY DEFICIENT STRUCTURES

Statewide – Current Fiscal Year Structurally Deficient Structures

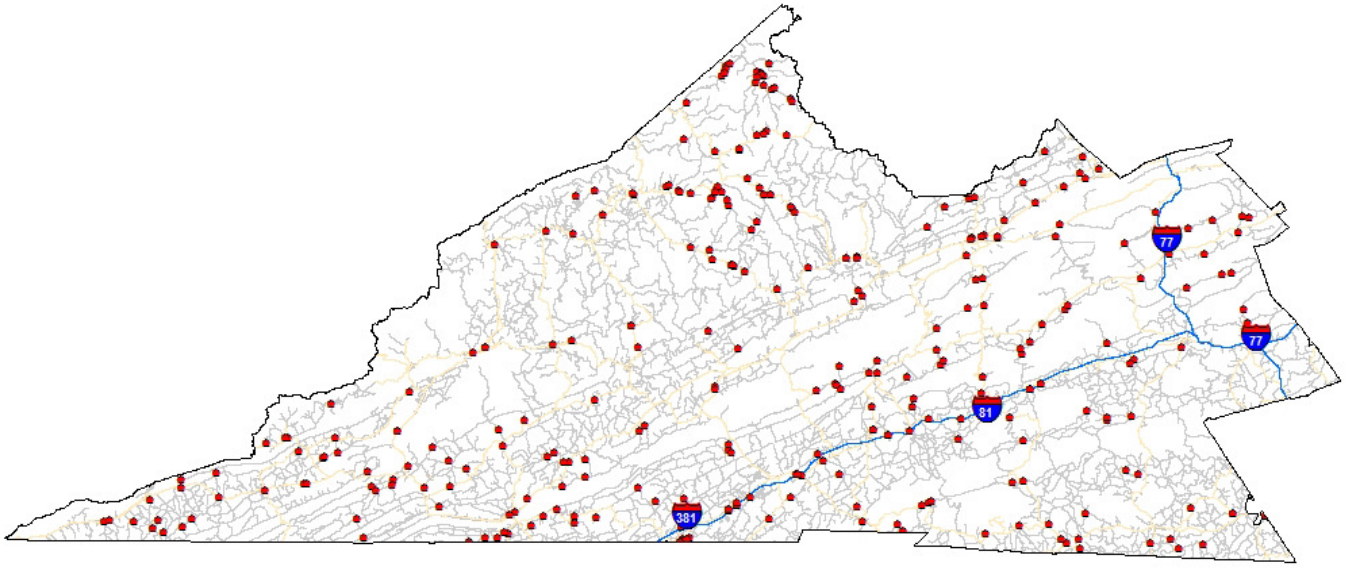
Total Number of Structures = 21,061
Number of SD structures = 1,453 (6.9%)
Total Square Foot Area of Structures = 116,365,014
Square Foot Area of SD Structures = 5,179,148 (4.5%)
● Denotes SD Structure



STATEWIDE

Bristol District – Current Fiscal Year Structurally Deficient Structures

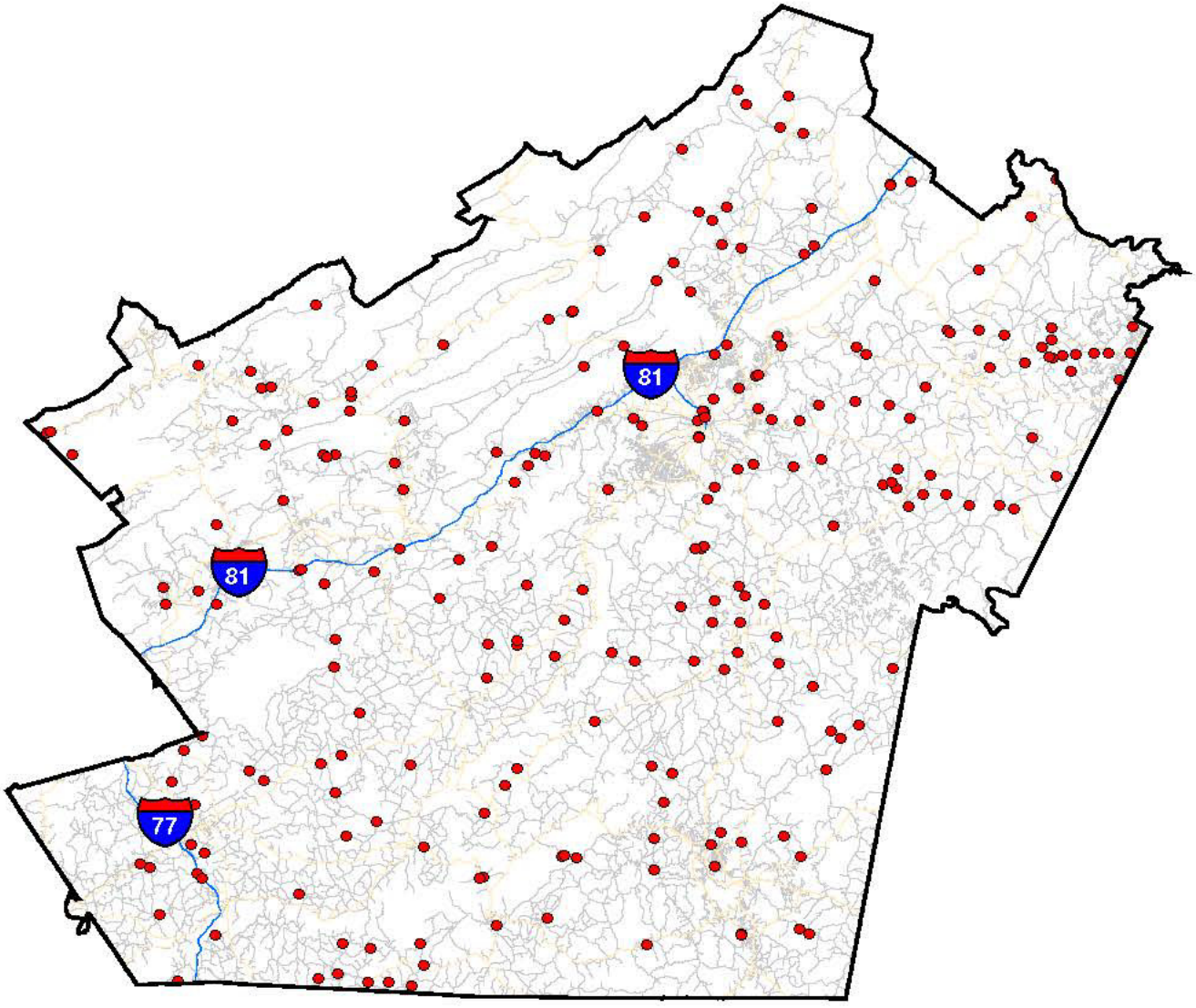
Number of SD structures = 300
Square Foot Area of SD Structures = 606,057
● Denotes SD Structure



BRISTOL

Salem District – Current Fiscal Year Structurally Deficient Structures

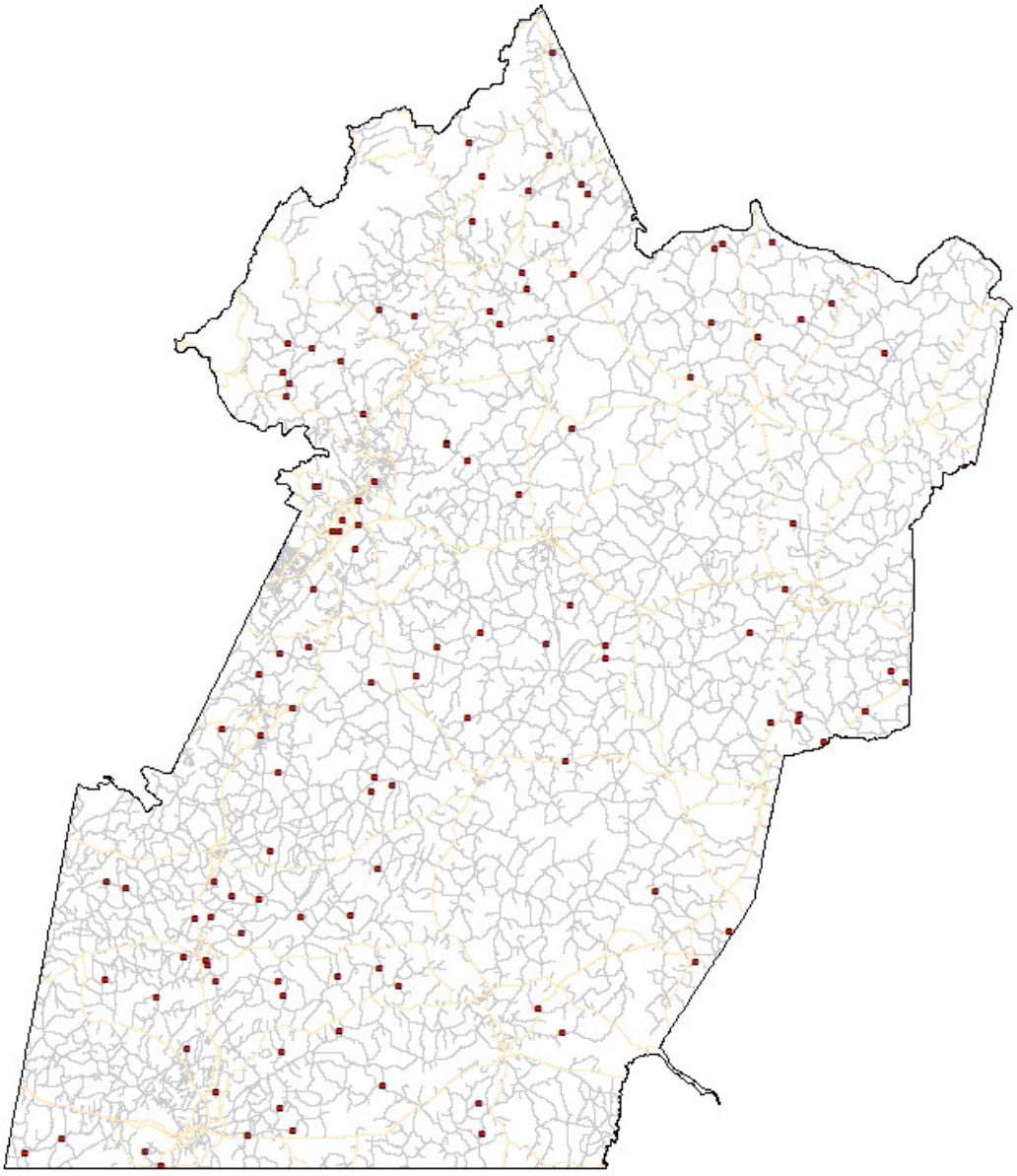
Number of SD structures = 245
Square Foot Area of SD Structures = 518,089
Denotes SD Structure



SALEM

Lynchburg District – Current Fiscal Year Structurally Deficient Structures

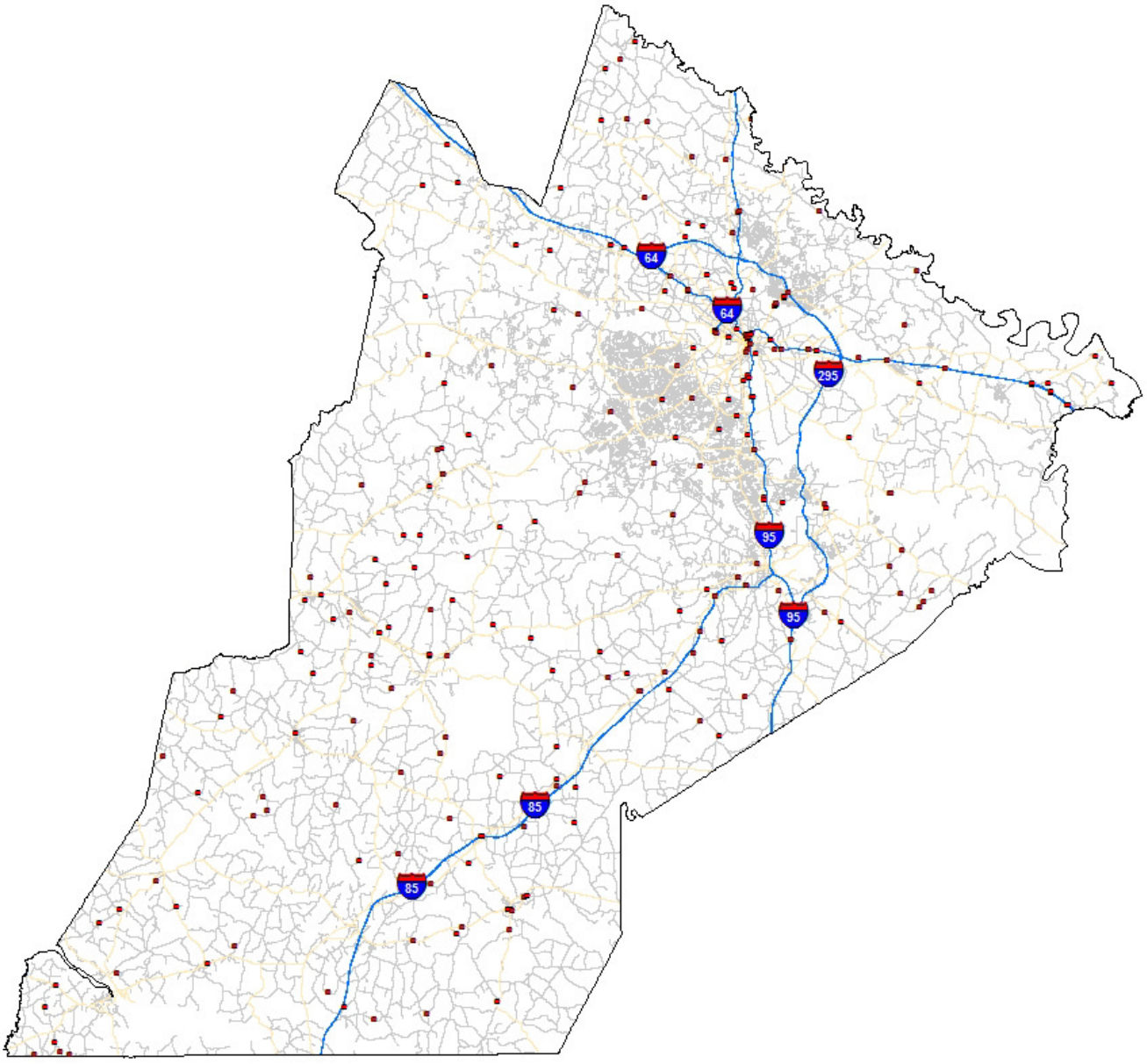
Number of SD structures = 133
Square Foot Area of SD Structures = 313,122
Denotes SD Structure



LYNCHBURG

Richmond District – Current Fiscal Year Structurally Deficient Structures

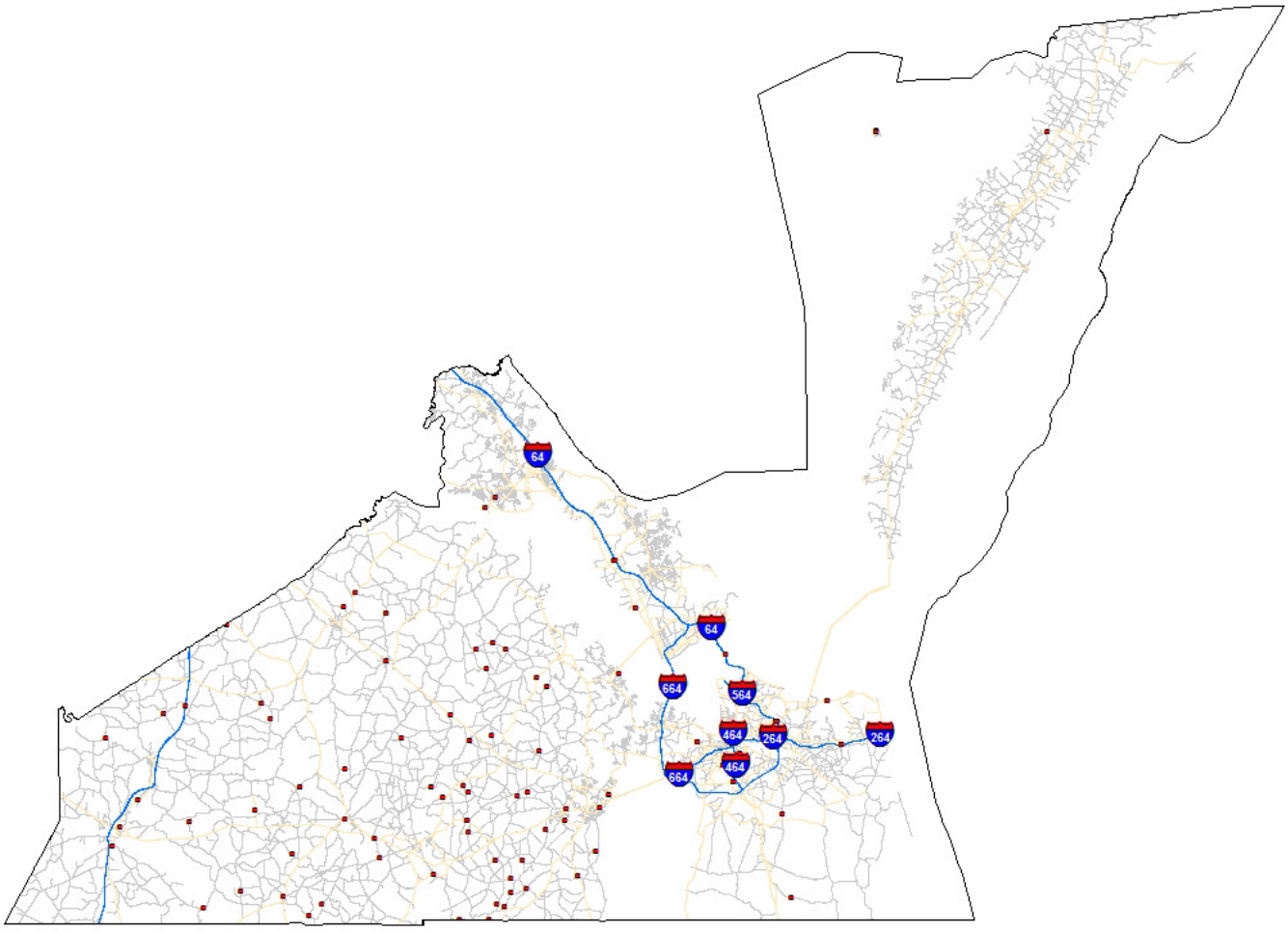
Number of SD structures = 241
Square Foot Area of SD Structures = 1,425,472
Denotes SD Structure



RICHMOND

Hampton Roads District – Current Fiscal Year Structurally Deficient Structures

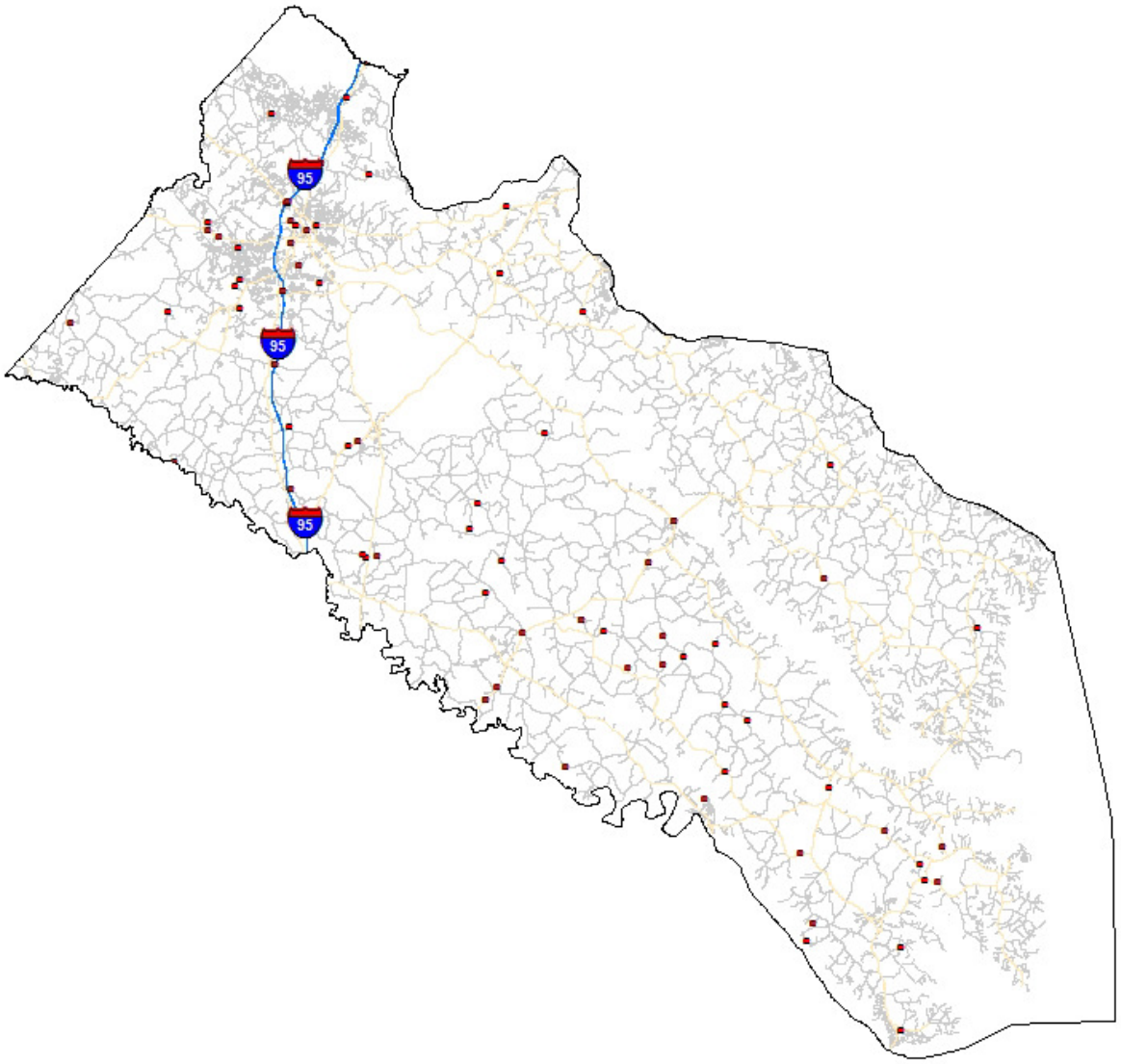
Number of SD structures = 89
Square Foot Area of SD Structures = 926,954
● Denotes SD Structure



HAMPTON ROADS

Fredericksburg District – Current Fiscal Year Structurally Deficient Structures

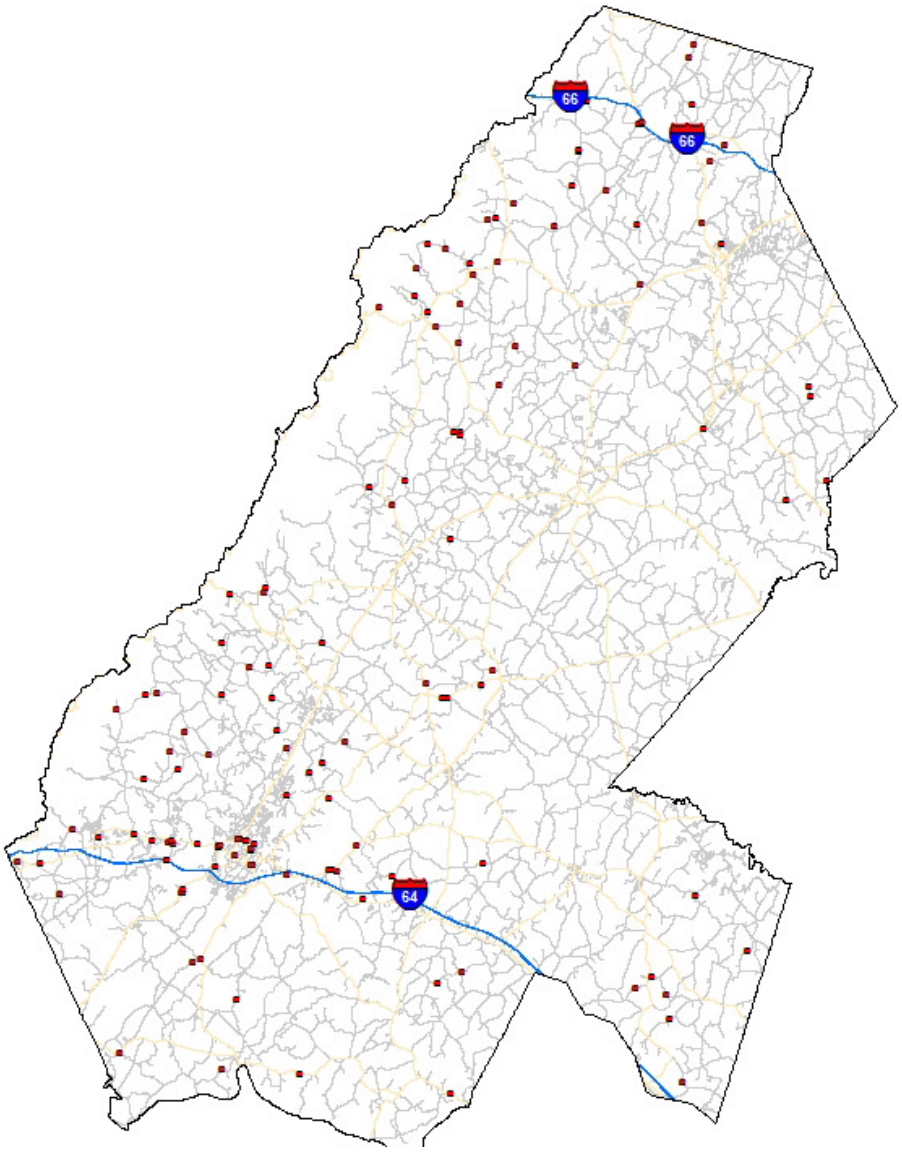
Number of SD structures = 74
Square Foot Area of SD Structures = 416,089
● Denotes SD Structure



FREDERICKSBURG

Culpeper District – Current Fiscal Year Structurally Deficient Structures

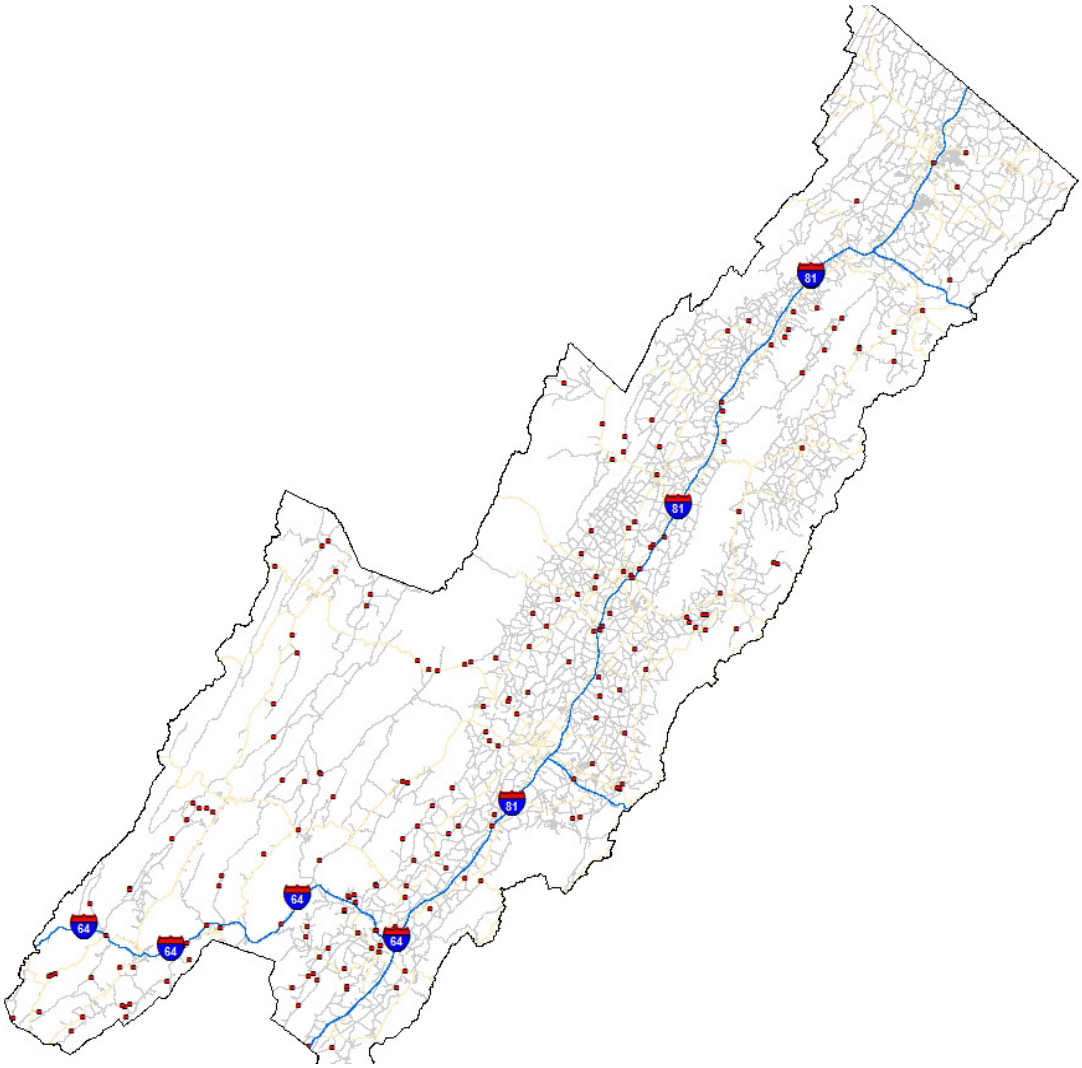
Number of SD structures = 117
Square Foot Area of SD Structures = 241,039
Denotes SD Structure



CULPEPER

Staunton District – Current Fiscal Year Structurally Deficient Structures

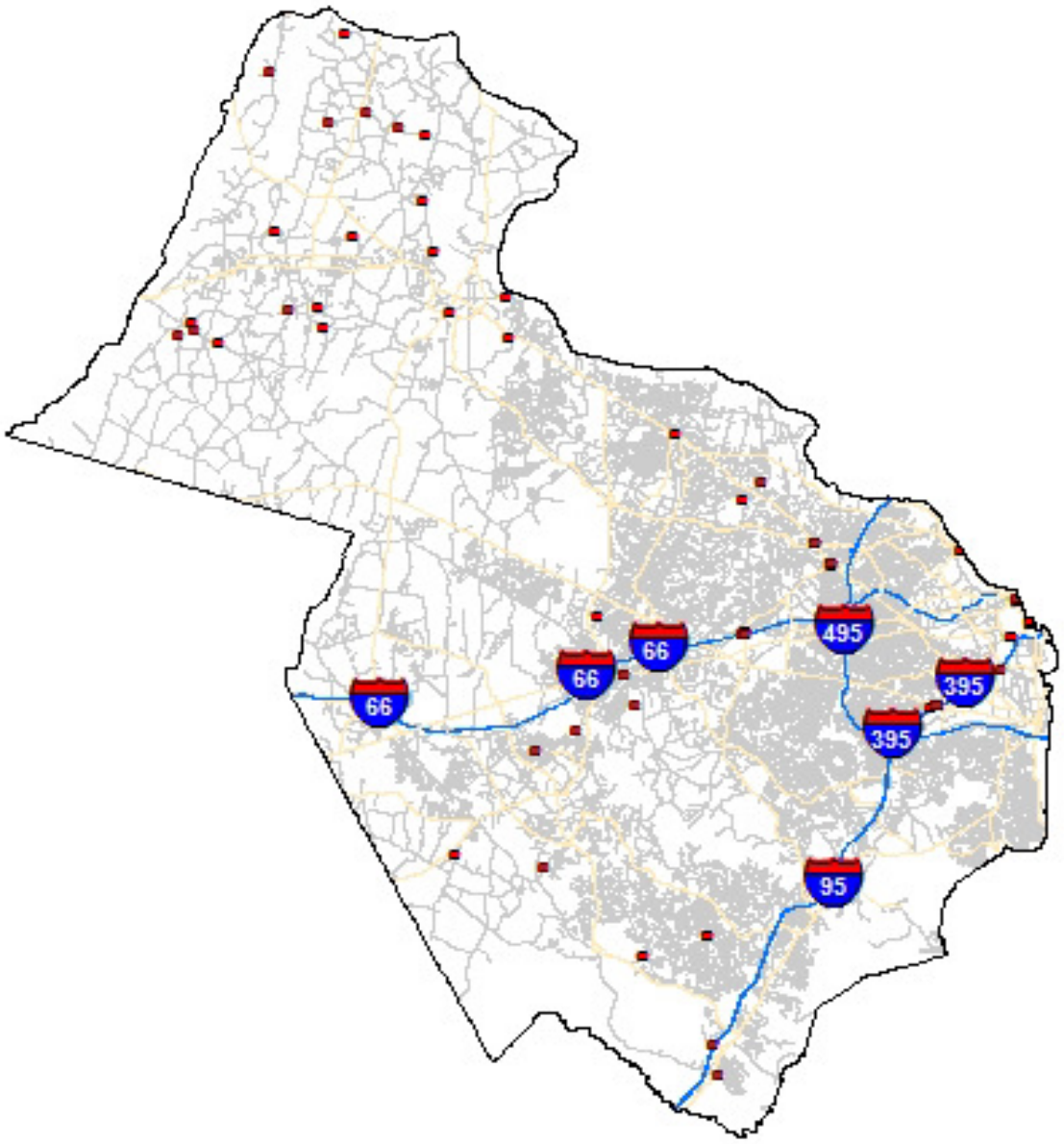
Number of SD structures = 203
Square Foot Area of SD Structures = 438,316
Denotes SD Structure



STAUNTON

NOVA District – Current Fiscal Year Structurally Deficient Structures

Number of SD structures = 51
Square Foot Area of SD Structures = 294,008
● Denotes SD Structure



NOVA

APPENDIX I – FUNCTIONALLY OBSOLETE CRITERIA

The table below provides visual examples of some of the criteria that cause a structure to be classified as Functionally Obsolete.

Typical Examples of Functionally Obsolete Structures	
Appraisal Rating	Example
Deck Geometry (No shoulder)	
Water Adequacy (Inadequate free board. Bridge is susceptible to overtopping and/or flooding)	
Roadway Approach Alignment (Sharp curve at the approach to the bridge requires substantial reduction in speed)	

Typical Examples of Functionally Obsolete Structures	
Appraisal Rating	Example
Under Clearance Vertical (Inadequate under bridge vertical clearance)	
Under Clearance (Inadequate under bridge horizontal clearance)	
Structural Adequacy (Low bridge weight carrying capacity)	

APPENDIX J – BRIDGE SAFETY INSPECTION QUALITY ASSURANCE PROGRAM

The bridge safety inspection program provides the basis for most of the Commonwealth's maintenance and bridge management decisions. In Fiscal Year 2014, VDOT inspected 10,368 bridges/culverts at an expense of $26.1 million utilizing in-house inspection staff and 16 consultant contracts. Also, VDOT inspected 4,872 ancillary structures at an expense of $4.5 million. Ten (10) of the consultant contracts were for bridge and ancillary structures inspection, including one (1) of the statewide underwater inspection contract. Three (3) contracts were for load rating. Table J.1 shows VDOT's inspection practices for inspection frequency compared to the National Bridge Inspection Standards (NBIS) and includes the ancillary structures inspection requirements. Table J.2 shows the number of bridge, culvert and ancillary structure inspections conducted by each district.

Table J.1 – Inspection Practices

Standard	Inspection Frequency	
	NBIS	VDOT*
Bridges	2 Year	2 Year or 1 Year (SD or Posted)
Culverts	2 Year	2 Year (NBI) or 4 Year (Non-NBI)
Fracture Critical Structures	2 Year	1 Year
Fatigue Prone Details	2 Year	1 or 2 Year
Underwater	5 Year	5 Year
Sign Structures	No Requirement	4 – 6 Year
Signal Structures	No Requirement	4 – 6 Year
High Mast Lights Poles	No Requirement	4 – 6 Year
Camera Poles	No Requirement	10 Year
Luminaires	No Requirement	10 Year

*District Structure and Bridge Engineers may choose to inspect structures more frequently based on the conditions found during the inspections.

The accuracy, thoroughness and completeness of the bridge safety inspections are essential. The inspections are used to evaluate each structure's safety and are used for decisions on planning, budgeting, and performance of maintenance, repair, rehabilitation and replacement of our structures. Since 1991, it has been the policy of the Structure and Bridge Division (S&B) to provide rigorous quality control and quality assurance (QC/QA) of the structure safety inspection program. In January 2005, the National Bridge Inspection Standards (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 J.2 – Number of Inspection in 2014 Fiscal Year

District	Number of Inspections						
	Bridges		Culverts		Ancillary		Total No. Structures
	No.	Percent	No.	Percent	No.	Percent	
Bristol	1,432	19%	369	13%	106	2%	1,907
Salem	1,183	16%	263	9%	147	3%	1,593
Lynchburg	655	9%	392	14%	93	2%	1,140
Richmond	978	13%	359	13%	1,658	34%	2,995
Hampton Roads	643	9%	235	8%	1,258	26%	2,136
Fredericksburg	219	3%	193	7%	42	1%	454
Culpeper	607	8%	279	10%	-	0%	886
Staunton	1,168	16%	396	14%	18	0%	1,582
NOVA	624	8%	373	13%	1,550	32%	2,547
Total	**7,509**	**100%**	**2,859**	**100%**	**4,872**	**100%**	**15,240**

In 2008, VDOT S&B developed Information and Instruction Memorandum (IIM) IIM-S&B-78, describing the bridge safety inspection QC/QA program which requires the following: In accordance with the NBIS, Program Managers and Team Leaders must successfully complete a Federal Highway Administration (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&B also requires inspection personnel successfully complete the NHI course 'Bridge Inspection Refresher Training' every three (3) years; underwater inspectors are required to fulfill the training requirements as set forth in the NBIS and the VDOT 'Dive Safety Manual'.

Both the Central Office and the Districts have a responsibility to review and validate inspection reports and inventory data. Discrepancies found during the field and office reviews performed by the both District and Central Office personnel are documented in a written report and shared with all parties involved. The Central Office conducted an annual QA review of all nine (9) district bridge inspection programs. 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 Engineer. Underwater inspection QA/QC was performed on 16 structures.

The Federal Highway Administration (FHWA) conducted an annual NBIS Compliance Review from April 1, 2013 to March 30, 2014 with a draft report provided on December 31, 2013. The Department had 45 days to address any deficiencies that were identified. The review consisted of a review of the statewide inventory/database/organization/procedures for bridge safety inspections and a QA review of a sample of bridge records and bridge field reviews of the Bristol and Fredericksburg Districts. VDOT was found to be in compliance with 21 of the 23 NBIS metrics and substantial compliance for the remaining 2 of the 23 NBIS metrics that were reviewed for calendar year 2013. VDOT developed an improvement plans for Metrics 6 and 22 that were substantially compliant, and FHWA approved the improvement plan on March 12, 2014. The Department is establishing a QA/QC program for ancillary structures similar to the one currently in place for bridge inspections.

APPENDIX K – ANCILLARY STRUCTURES CONDITION RATINGS

General Condition Ratings are assigned by the structure inspection team after each ancillary structure inspection. These ratings are included in each inspection report and are used to describe the current physical state of the structure. Evaluation is based on the physical condition of the structure at the time of inspection. Separate GCR values are assigned to the foundation, bridge parapet mounting and superstructure components of the ancillary structure. The GCRs are assigned based on a numerical grading system that ranges from 0 (failed condition) to 9 (excellent condition). The table below provides a description of the general condition ratings for ancillary structures. The tables in the following pages provide illustrative examples of some 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

Ancillary Structure Condition Rating Table

Code	Description
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.
4	**POOR CONDITION** Advanced section loss, deterioration, spalling.
3	**SERIOUS CONDITION** Loss of section, deterioration, spalling have seriously affected primary structural components. Local failures are possible. Fatigue cracks in steel may be present.
2	**CRITICAL CONDITION** Advanced deterioration of primary structural elements. Fatigue cracks in steel may be present. Unless closely monitored it may be necessary to remove the structure.
1	**"IMMINENT" FAILURE CONDITION** Major deterioration or section loss present in critical structural components or obvious vertical or horizontal movement affecting structure stability. The structure should be removed.
0	**FAILED CONDITION** Out of service - beyond corrective action.

Examples of Foundations that are in Fair to Poor Condition

Rusted anchor bolts and missing nut

Leveling nut is loose and gap is too high

Loose anchor bolt with 1” gap between nut and base plate

Deteriorated and cracked grout

Deteriorated grout pad and cracked pedestal

Severely corroded anchor bolts exposed when grout has fallen away

Examples of Foundations that are in Fair to Poor Condition

Corrosion with 1/8" deep pitting on breakaway couplers

Loose anchor bolt nut at luminaire base

Examples of Bridge Parapet Mountings that are in Fair to Poor Condition

Failed mounting bolt (circled)

Twisted anchor clamp over the parapet

Failed bolt (circled) at parapet mount.

Two failed bolts (circled) at parapet mount

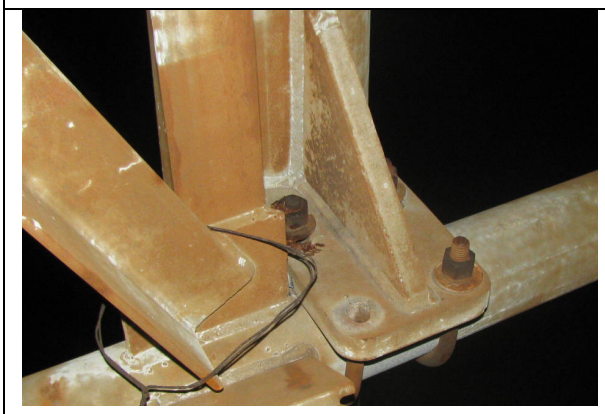
Examples of Superstructure elements that are in Fair to Poor Condition

Loose Bolt at splice plate.

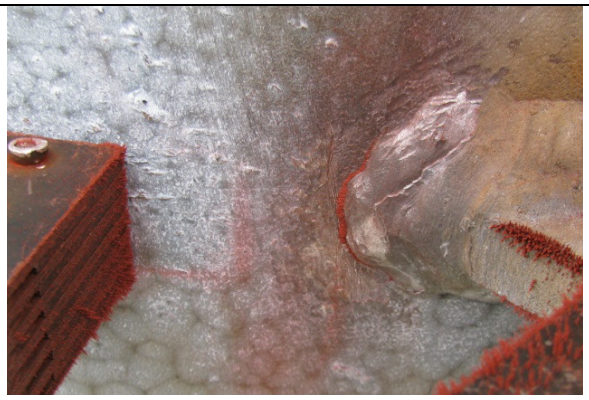
Poor vertical hanger connection with the Z-bar

Damaged & bent flange of vertical hanger

Column torn and bent 3" at point of impact



U-bolt sheared at left front pole to bottom chord Connection



1-1/4" long vertical crack in pole along toe of weld at the bottom chord

Examples of Superstructure elements that are in Fair to Poor Condition

Section loss to the bottom of the pole.

4" vertical crack at the slip joint

1 1/2" gap between upper chord and connection strap

Missing bolt at wind beam to vertical hanger connection

6" crack in lower chord of luminaire

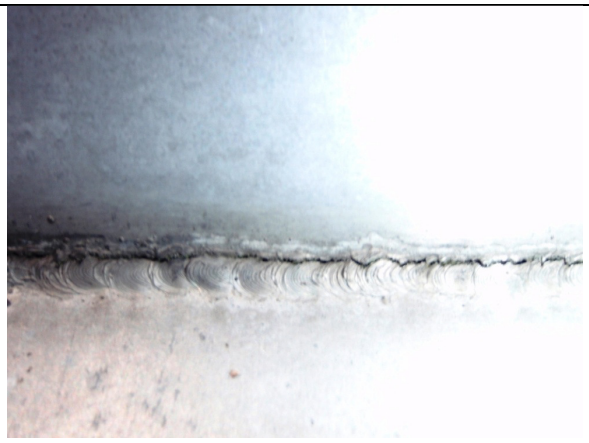
Two of four bolts loose in top chord connection to luminaire pole

Examples of Superstructure elements that are in Fair to Poor Condition

Lower arm of luminaire chord has a 3.5" fatigue crack in weld at connection to pole

Weld around upper chord to mounting plate connection 50% complete

Fracture in weld of lower arm tube to luminaire pole connection



Crack in luminaire bracket saddle to connection plate weld

Crack in orbital bracket of 2nd signal from right pole

Nut on strap bolt for signal from pole lacks 50% thread contact

Tables K.1a through K.3d give a summary of the current condition of the ancillary structures by structure type and the primary components or areas of the structure with average GCR.

Table K.1a – Sign Structures by General Condition Rating*

Location on Structure	Structure Type	# of Elements with General Condition Rating Indicated								Average General Condition Rating
		Good				Fair	Poor			
		9	8	7	6	5	4	3	<2	
Foundation	Cantilever	61	106	464	328	311	69	74	76	5.86
	Overhead	43	133	427	359	317	92	103	19	5.95
	Butterfly	8	34	60	8	24	1	1	1	6.87
	Total	**112**	**273**	**951**	**695**	**652**	**162**	**178**	**96**	**5.95**
Parapet	Parapet Mount	1	17	153	162	70	18	14	5	6.03
	Total	**1**	**17**	**153**	**162**	**70**	**18**	**14**	**5**	**6.03**
Superstructure	Cantilever	65	136	642	353	198	30	15	50	6.40
	Overhead	57	147	585	402	208	46	45	3	6.40
	Butterfly	9	32	67	20	8	1	0	0	7.08
	Total	**131**	**315**	**1,294**	**775**	**414**	**77**	**60**	**53**	**6.43**

*A parapet mount structure has only one primary component rating at the parapet, while other types of sign structures have component ratings at foundation and superstructure. Signal structures have component ratings either at parapet or foundation and superstructure. High mast light and camera poles have both foundation and superstructure component ratings.

Table K.1b – Luminaire Structures by General Condition Rating

Location on Structure	# of Elements with General Condition Rating Indicated								Average General Condition Rating
	Good				Fair	Poor			
	9	8	7	6	5	4	3	<2	
Foundation	371	4,332	1,971	915	3,955	185	3,503	428	5.68
Parapet	11	377	432	302	813	51	814	22	5.21
Superstructure	402	4,093	4,992	1,504	3,168	218	1,120	163	6.42

Table K.1c – Signal Structures by General Condition Rating

Location on Structure	Structure Type	# of Elements with General Condition Rating Indicated								Average General Condition Rating
		Good				Fair	Poor			
		9	8	7	6	5	4	3	<2	
Foundation	Cantilever	976	1,113	677	1,024	2,735	222	507	105	6.09
	Span Wire	27	72	67	241	1,154	51	101	56	5.15
	Over Head	0	0	0	0	1	0	0	0	5.00
	Total	**1,003**	**1,185**	**744**	**1,265**	**3,890**	**273**	**608**	**161**	**5.91**
Parapet	Parapet Mount	1	1	2	4	3	1	1	2	5.40
	Total	**1**	**1**	**2**	**4**	**3**	**1**	**1**	**2**	**5.40**
Superstructure	Cantilever	1,010	1,486	2,161	1,268	640	139	457	198	6.69
	Span Wire	28	85	480	406	305	185	142	138	5.48
	Parapet Mount	0	0	0	0	0	0	0	15	0.00
	Over Head	0	0	0	0	0	0	1	0	3.00
	Total	**1,038**	**1,571**	**2,641**	**1,674**	**945**	**324**	**600**	**351**	**6.45**

Table K.1d – High Mast Light and Camera Pole by General Condition Rating

Location on Structure	Structure Type	# of Elements with General Condition Rating Indicated								Average General Condition Rating
		Good				Fair	Poor			
		9	8	7	6	5	4	3	<2	
Foundation	High Mast	1	83	265	204	67	39	10	20	6.26
	Camera Pole	0	15	330	61	20	3	0	1	6.77
	Total	**1**	**98**	**595**	**265**	**87**	**42**	**10**	**21**	**6.45**
Parapet	High Mast	0	103	422	40	120	2	1	1	6.72
	Camera Pole	2	14	359	49	1	1	0	4	6.85
	Total	**2**	**117**	**781**	**89**	**121**	**3**	**1**	**5**	**6.77**

Summaries of this analysis for the four general type structures are provided in Tables K.2a through K.2e and Charts K.1a through K.1g. Charts K.1a through K.1d present the minimum general condition rating by structure type and GCR percentages. In order to present meaningful graphs with appropriate vertical scales, Charts K.1e through K.1g provide separate displays for districts with large inventories and those with smaller inventories.

Table K.2a – Sign Structures by General Condition Category

Location on Structure	Structure Type	# of Elements with General Condition Rating Indicated			Total	% General Condition Rating Indicated		
		Good	Fair	Poor		Good	Fair	Poor
Foundation	Cantilever	959	311	219	1,489	64.4%	20.9%	14.7%
	Overhead	962	317	214	1,493	64.4%	21.2%	14.3%
	Butterfly	110	24	3	137	80.3%	17.5%	2.2%
	Total	**2,031**	**652**	**436**	**3,119**	**65.1%**	**20.9%**	**14.0%**
Parapet	Parapet Mount	333	70	37	440	75.7%	15.9%	8.4%
	Total	**333**	**70**	**37**	**440**	**75.7%**	**15.9%**	**8.4%**
Superstructure	Cantilever	1,196	198	95	1,489	80.3%	13.3%	6.4%
	Overhead	1,191	208	94	1,493	79.8%	13.9%	6.3%
	Butterfly	128	8	1	137	93.4%	5.8%	0.7%
	Total	**2,515**	**414**	**190**	**3,119**	**80.6%**	**13.3%**	**6.1%**

Table K.2b – Luminaire Structures by General Condition Category

Location on Structure	# of Elements with General Condition Rating Indicated			Total	% of Elements with General Condition Rating Indicated		
	Good	Fair	Poor		Good	Fair	Poor
Foundation	7,589	3,955	4,116	15,660	48.5%	25.3%	26.3%
Parapet	1,122	813	887	2,822	39.8%	28.8%	31.4%
Superstructure	10,991	3,168	1,501	15,660	70.2%	20.2%	9.6%

Table K.2c – Signal Structures by General Condition Category

Location on Structure	Structure Type	# of Elements with General Condition Rating Indicated			Total	# of Elements with General Condition Rating Indicated		
		Good	Fair	Poor		Good	Fair	Poor
Foundation	Cantilever	3,790	2,735	834	7,359	51.5%	37.2%	11.3%
	Span Wire	407	1,154	208	1,769	23.0%	65.2%	11.8%
	Over Head	0	1	0	1	0.0%	100.0%	0.0%
	Total	**4,197**	**3,890**	**1,042**	**9,129**	**46.0%**	**42.6%**	**11.4%**
Parapet	Parapet Mount	8	3	4	15	53.3%	20.0%	26.7%
	Total	**8**	**3**	**4**	**15**	**53.3%**	**20.0%**	**26.7%**
Superstructure	Cantilever	5,925	640	794	7,359	80.5%	8.7%	10.8%
	Span Wire	999	305	465	1,769	56.5%	17.2%	26.3%
	Parapet Mount	0	0	15	15	0.0%	0.0%	100.0%
	Over Head	0	0	1	1	0.0%	0.0%	100.0%
	Total	**6,924**	**945**	**1,275**	**9,144**	**75.7%**	**10.3%**	**13.9%**

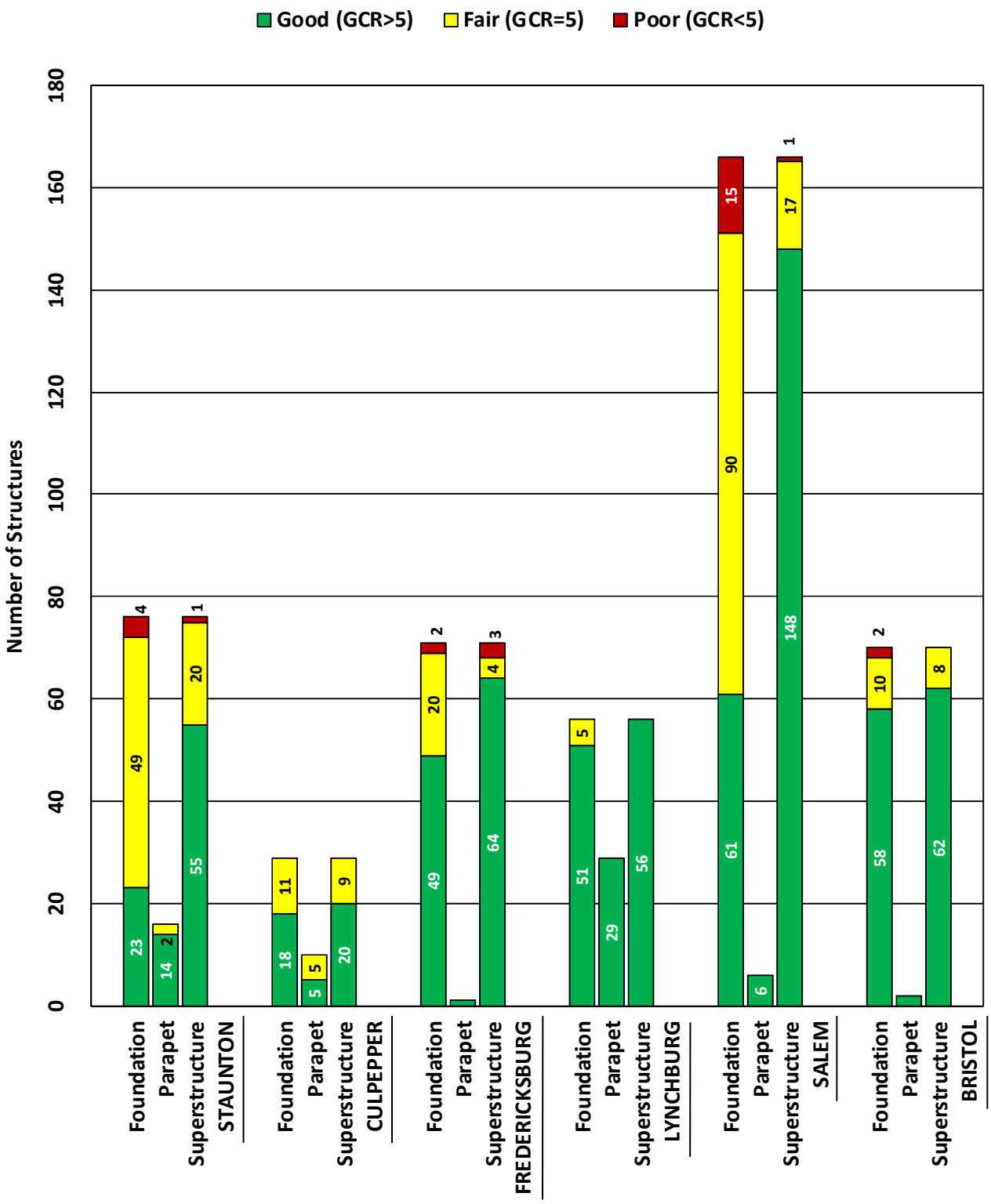
Table K.2d – High Mast Light & Camera Pole Structures by General Condition Category

Location on Structure	Structure Type	# of Elements with General Condition Rating Indicated			Total	# of Elements with General Condition Rating Indicated		
		Good	Fair	Poor		Good	Fair	Poor
Foundation	High Mast	553	67	69	689	80.3%	9.7%	10.0%
	Camera Pole	406	20	4	430	94.4%	4.7%	0.9%
	Total	**959**	**87**	**73**	**1,119**	**85.7%**	**7.8%**	**6.5%**
Superstructure	High Mast	565	120	4	689	82.0%	17.4%	0.6%
	Camera Pole	424	1	5	430	98.6%	0.2%	1.2%
	Total	**989**	**121**	**9**	**1,119**	**88.4%**	**10.8%**	**0.8%**

Table K.2e – Minimum General Condition by Structure Type

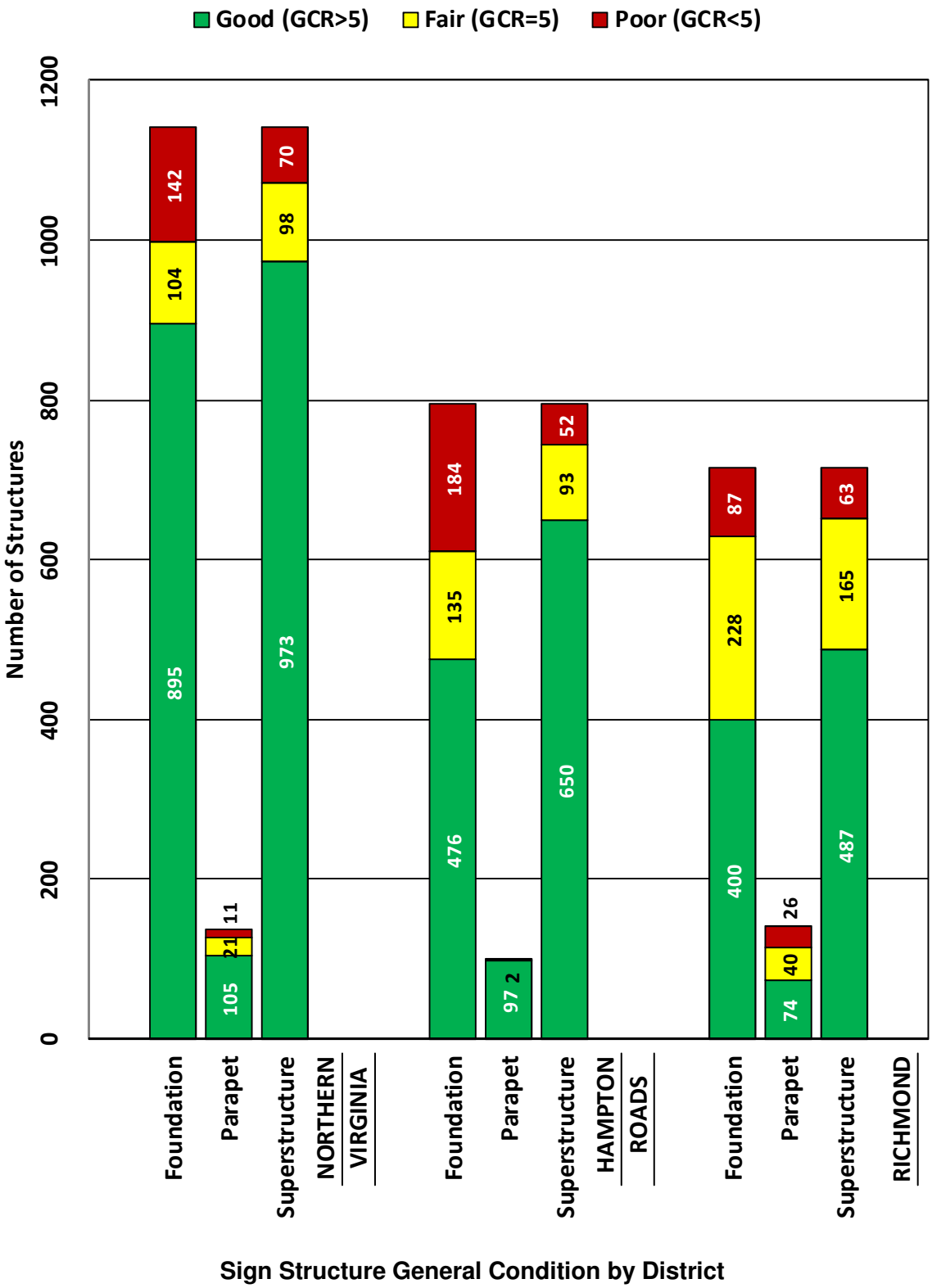
Structure Type	Minimum General Condition Rating (No. of Structures)			Minimum General Condition Rating (Percentage)		
	Good	Fair	Poor	Good	Fair	Poor
Signs	2,194	795	570	61.6%	22.3%	16.0%
Signals	3,585	3,477	2,082	39.2%	38.0%	22.8%
High Mast Lights and Camera Poles	875	165	79	78.2%	14.7%	7.1%
Luminaires	6,529	6,005	5,948	35.3%	32.5%	32.2%
Total	**13,183**	**10,442**	**8,679**	**40.8%**	**32.3%**	**26.9%**

Chart K.1a – General Condition of Sign Structures – Small Inventory Districts



Sign Structure General Condition by District

Chart K.1b – General Condition of Sign Structures – Large Inventory Districts



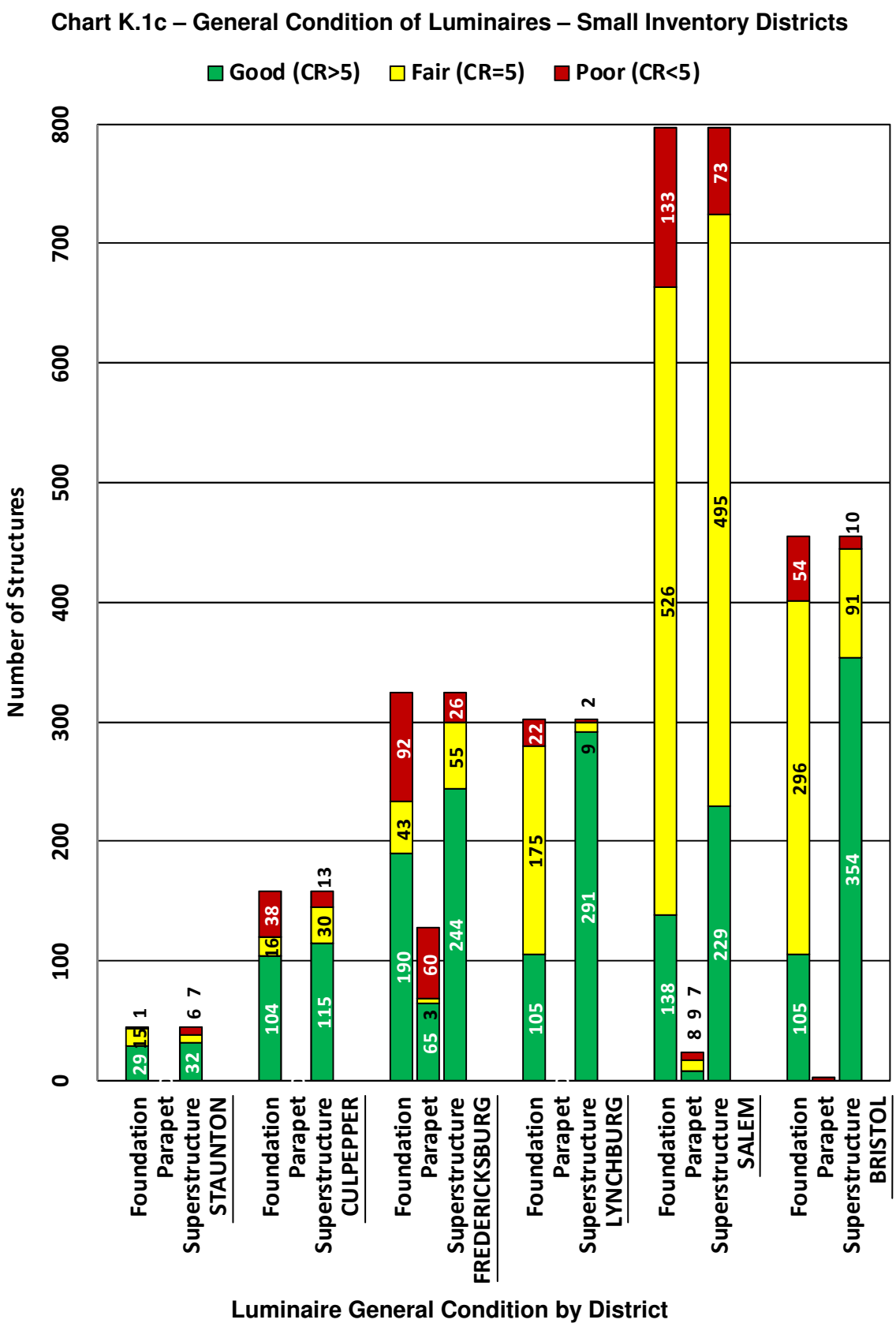


Chart K.1c – General Condition of Luminaires – Small Inventory Districts
Good (CR>5)
Fair (CR=5)
Poor (CR<5)
Number of Structures
0
100
200
300
400
500
600
700
800
Foundation
Parapet
Superstructure
STAUNTON
29
15
1
32
6
7
Foundation
Parapet
Superstructure
CULPEPPER
104
16
38
115
30
13
Foundation
Parapet
Superstructure
FREDERICKSBURG
190
43
92
65
3
60
244
55
26
Foundation
Parapet
Superstructure
LYNCHBURG
105
175
22
291
9
2
Foundation
Parapet
Superstructure
SALEM
138
526
133
8
9
7
229
495
73
Foundation
Parapet
Superstructure
BRISTOL
105
296
54
354
91
10
Luminaire General Condition by District

Chart K.1d – General Condition of Luminaires – Large Inventory Districts

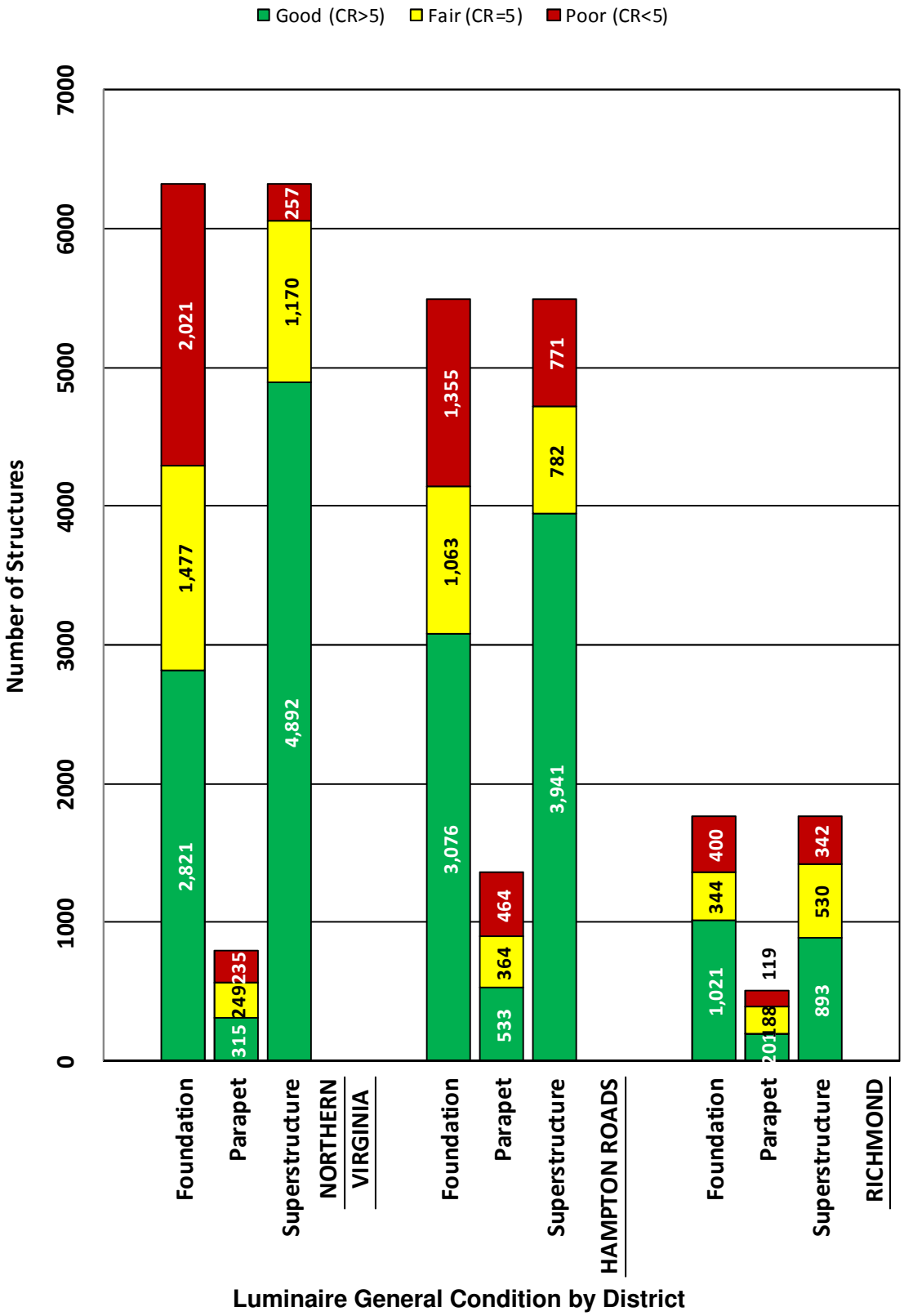
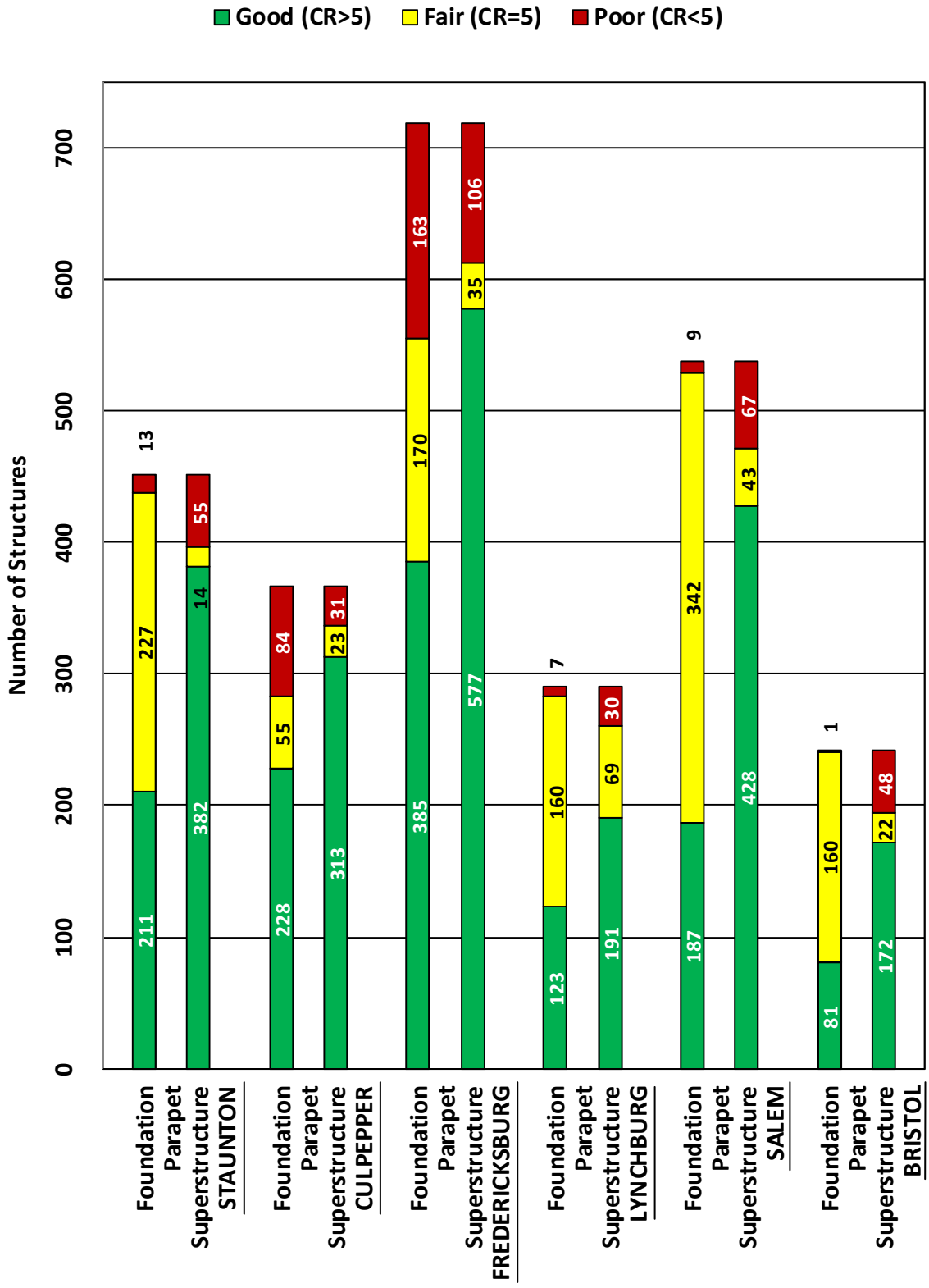


Chart K.1e – General Condition of Signal Structures – Small Inventory Districts



Signal Structure General Condition by District

Chart K.1f – General Condition of Signal Structures – Large Inventory Districts

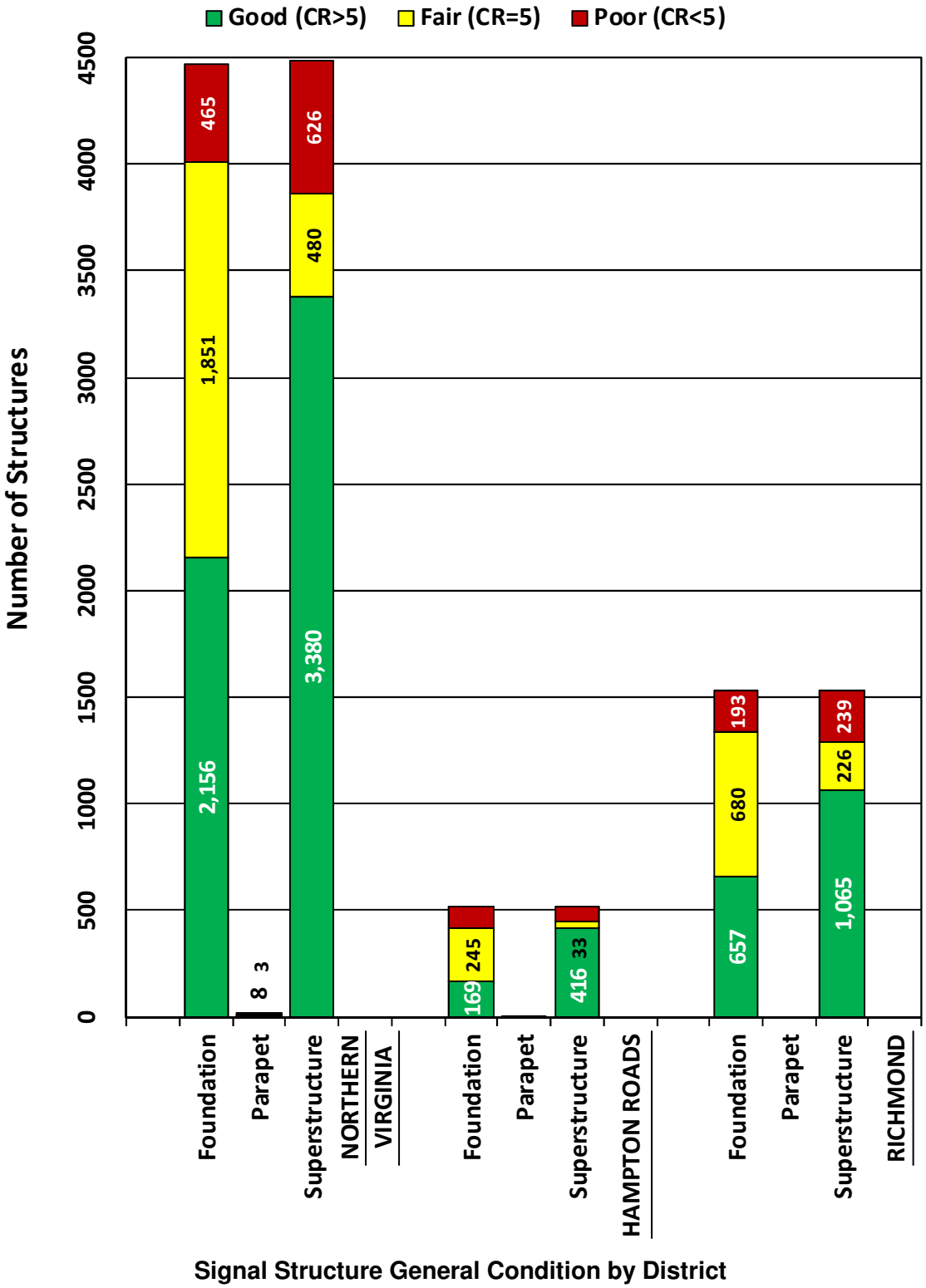
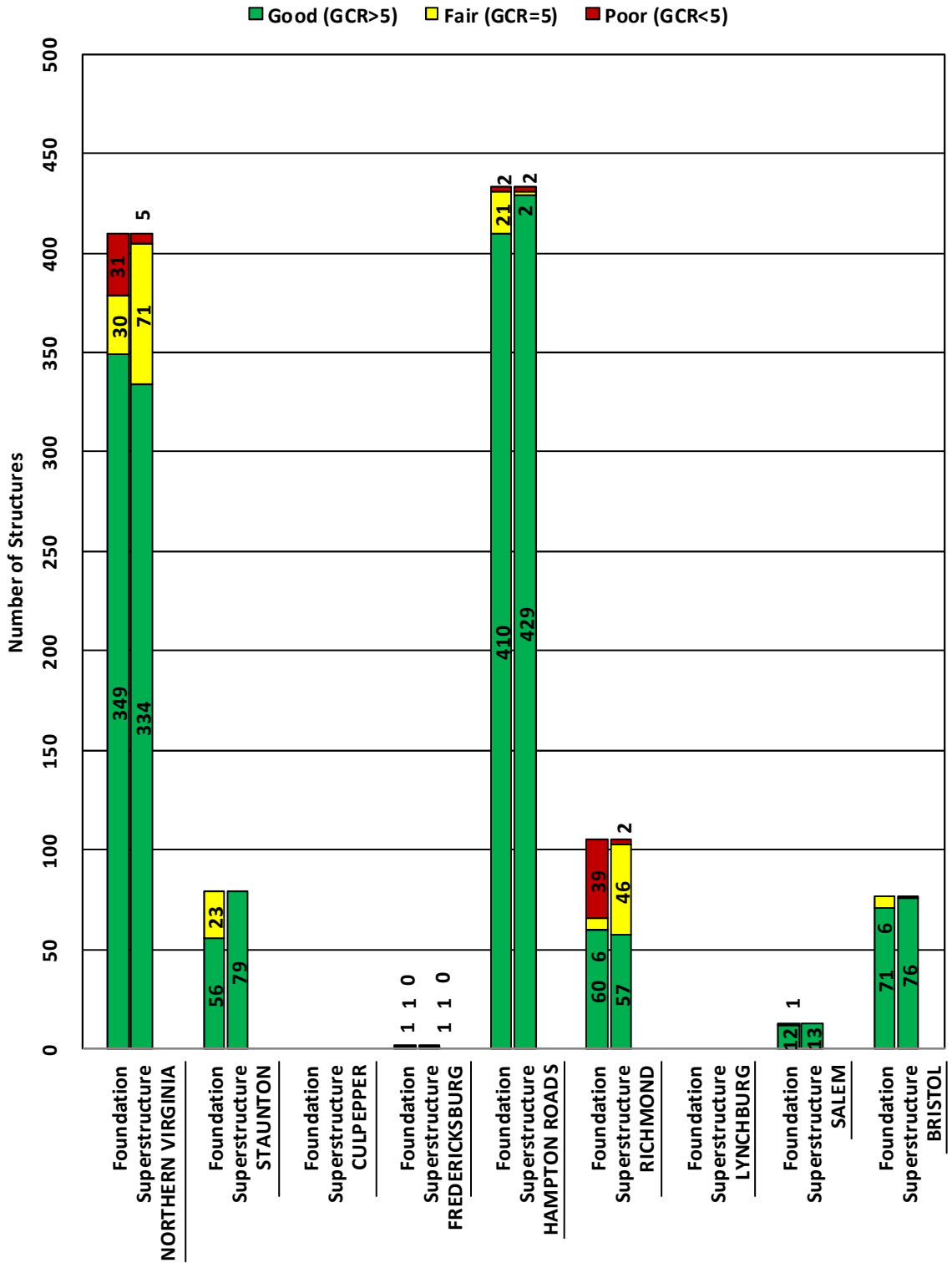


Chart K.1g –Condition of High Mast Lights and Camera Poles– All Inventory Districts



High Mast and Camera Poles Structures Condition by District

Charts K.2 through K.5, provided below, were developed in order to gain a more specific understanding of the conditions that cause structures to receive reduced GCRs.

These charts identify the number and percentage of ancillary structures with significant identified problems and summarize the specific sources of those problems. Charts K.2.a through K.2.c address sign structures by foundation, parapet mount and superstructure. Charts K.3.a through K.3.c address luminaire structures by foundation, parapet mount and superstructure. Charts K.4.a and K.4.b address the signal structures by foundation, parapet mount and superstructure. Charts K.5.a and K.5.b address high mast light and camera pole structures by foundation and superstructure.

The charts below reflect tallies of all identified problems, so a structure with multiple problem areas will be represented more than once in any particular chart. Accordingly, the total number of structures in each chart will not necessarily agree with summaries provided elsewhere in this report.

Chart K.2.a – Reasons Coded for Poor Sign Structure Foundation

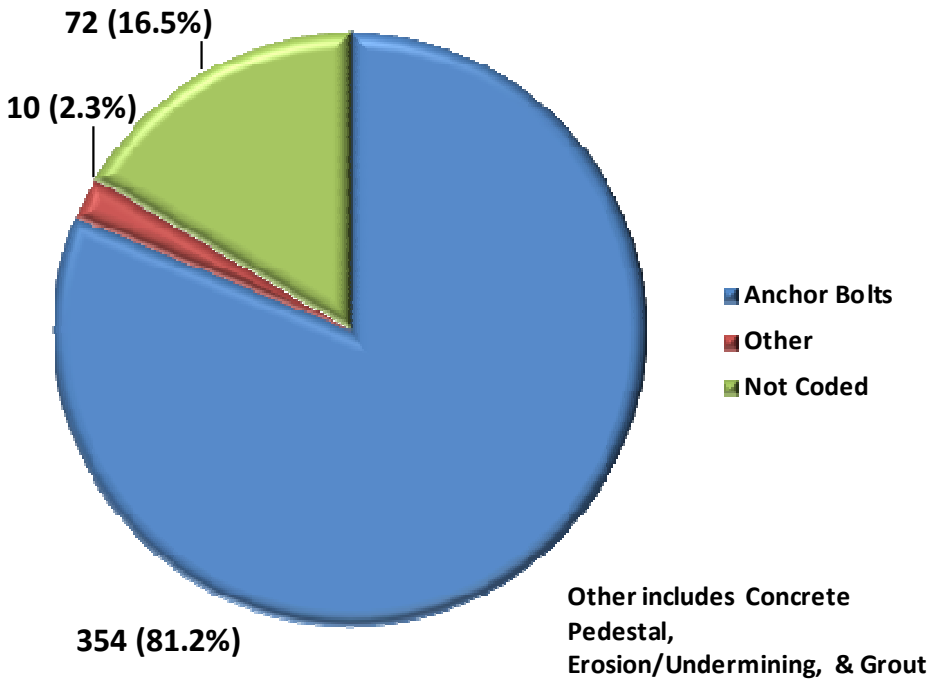


Chart K.2.b – Reasons Coded for Poor Sign Structure Parapet Mounting

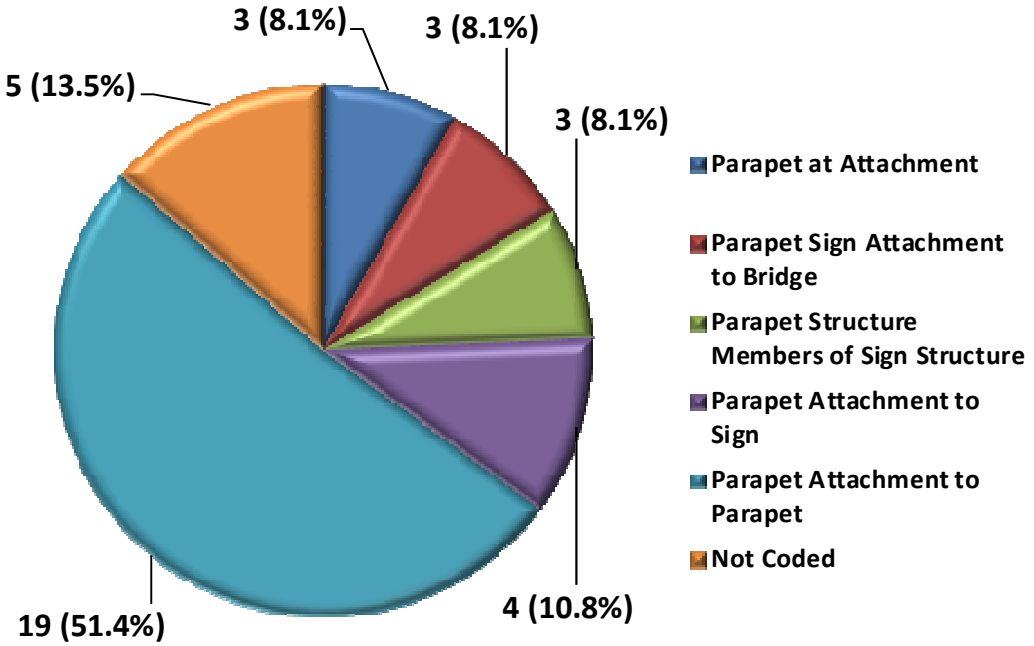


Chart K.2.c – Reasons Coded for Poor Sign Structure Superstructure

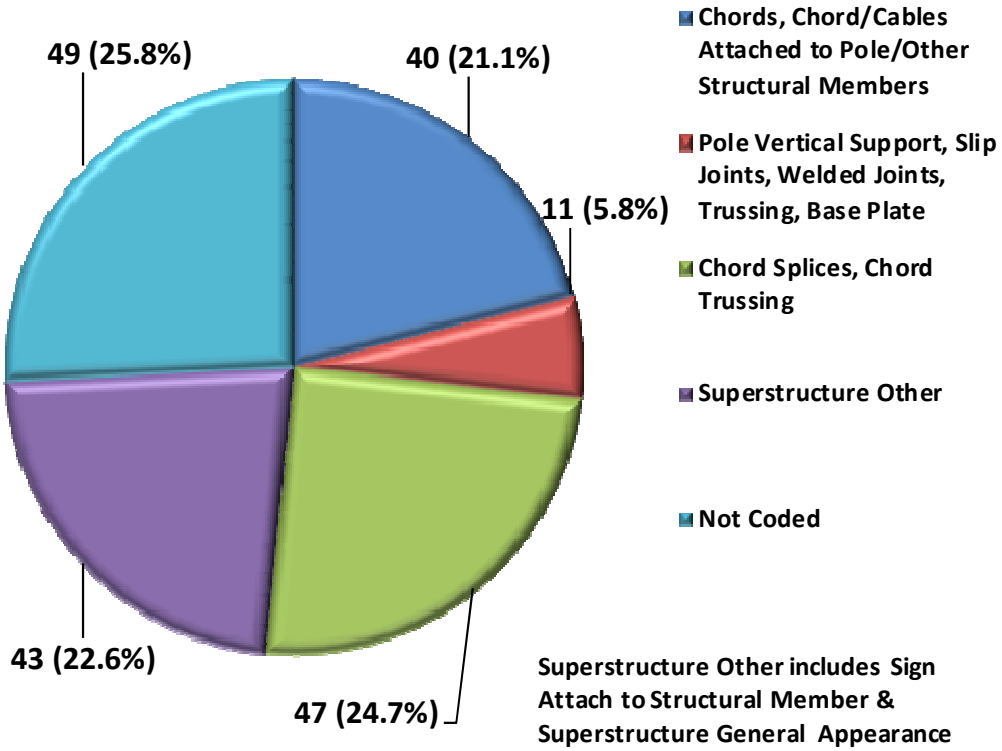


Chart K.3.a – Reasons Coded for Poor Luminaire Structure Foundation

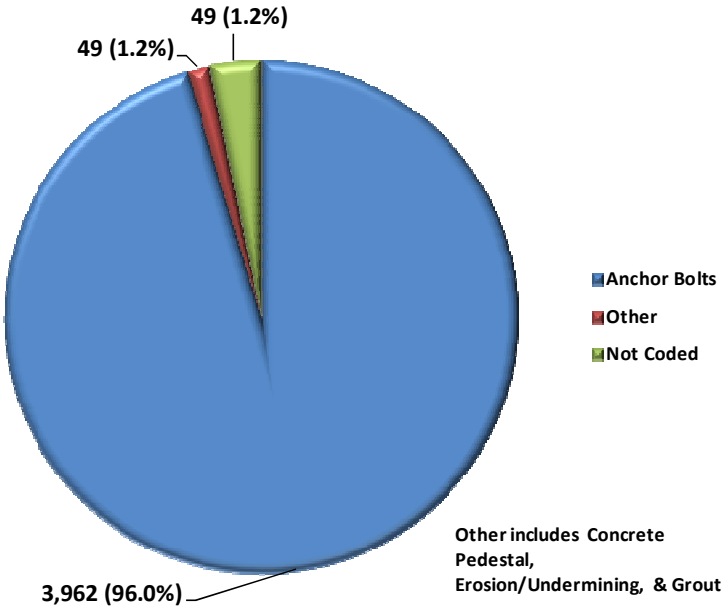


Chart K.3.b – Reasons Coded for Poor Luminaire Structure Parapet Mounting

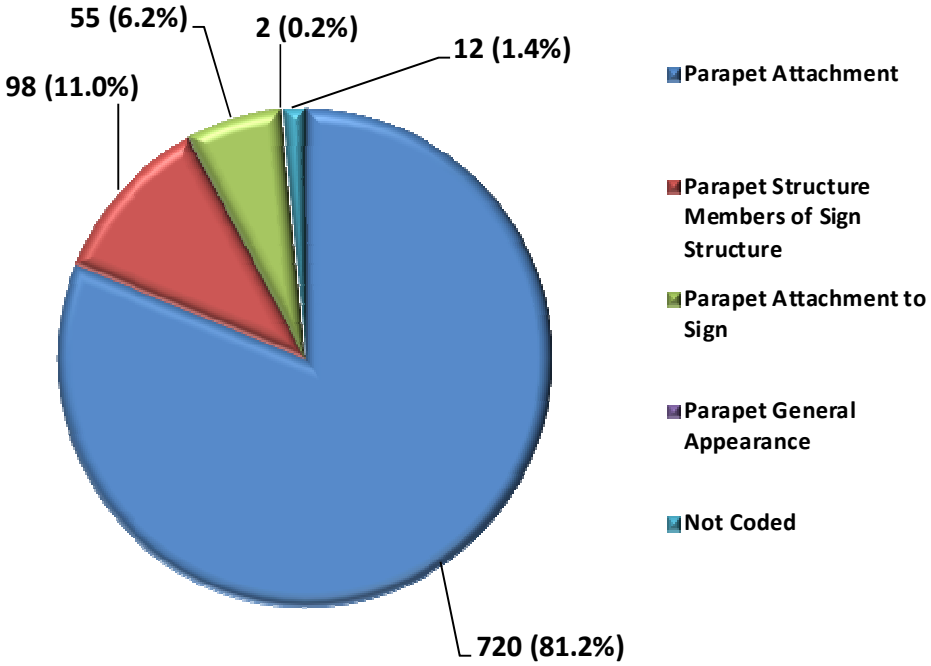


Chart K.3.c – Reasons Coded for Poor Luminaire Structure Superstructure

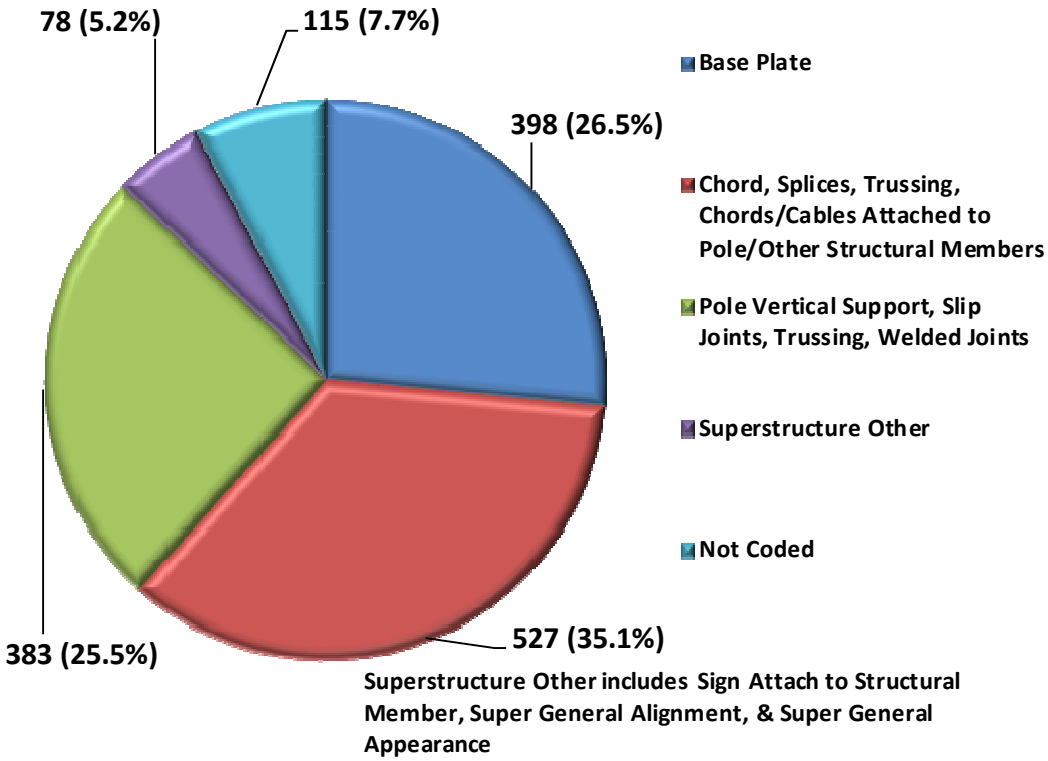


Chart K.4.a – Reasons Coded for Poor Signal Structure Foundation

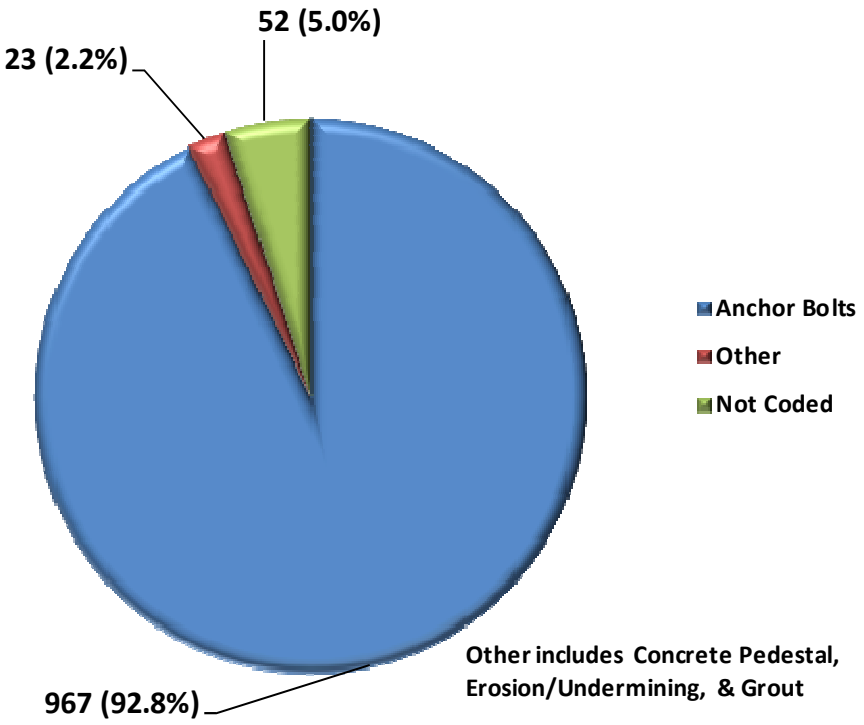


Chart K.4.b – Reasons Coded for Poor Signal Structure Superstructure

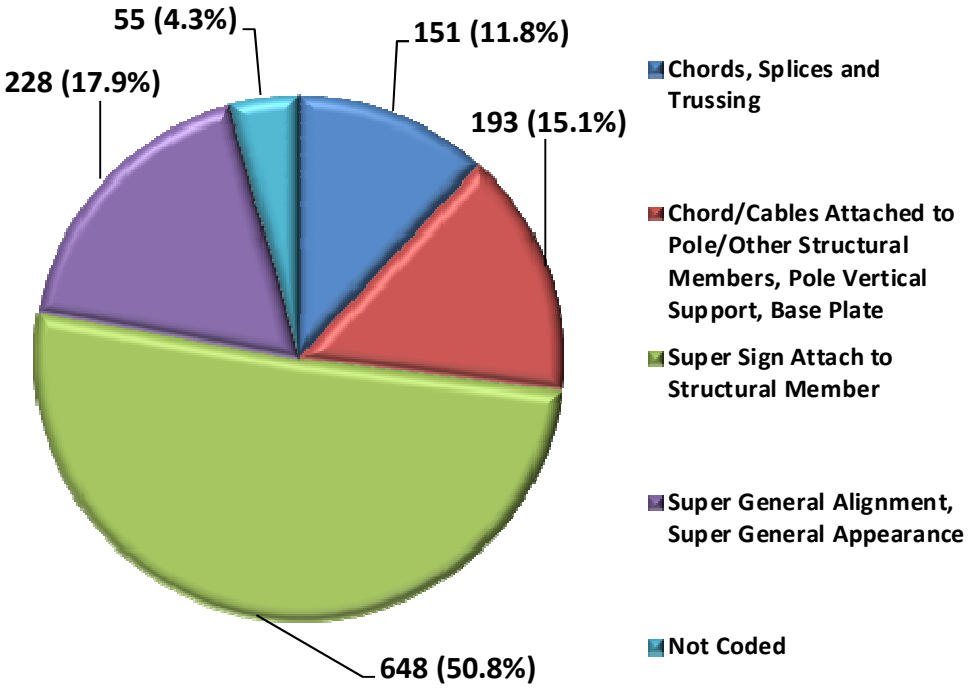


Chart K.5.a – Reasons Coded for Poor High Mast Light and Camera Poles Foundation

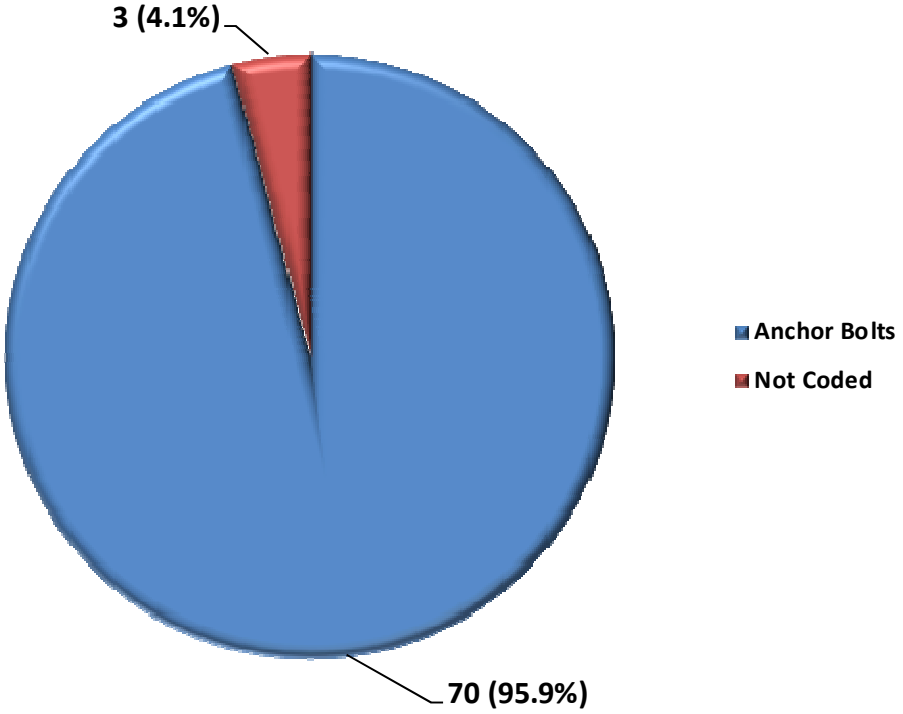
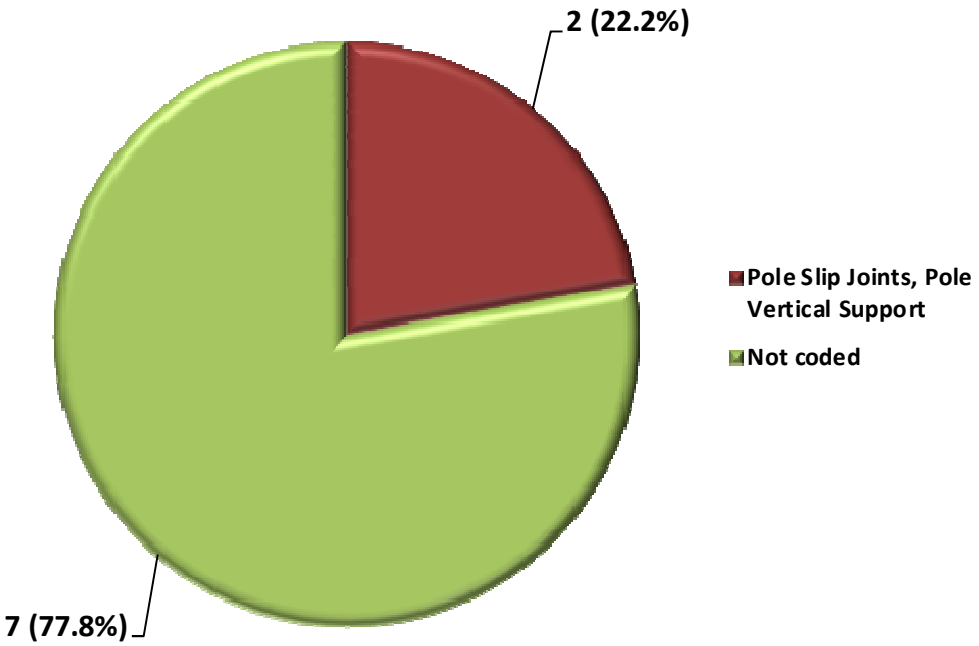


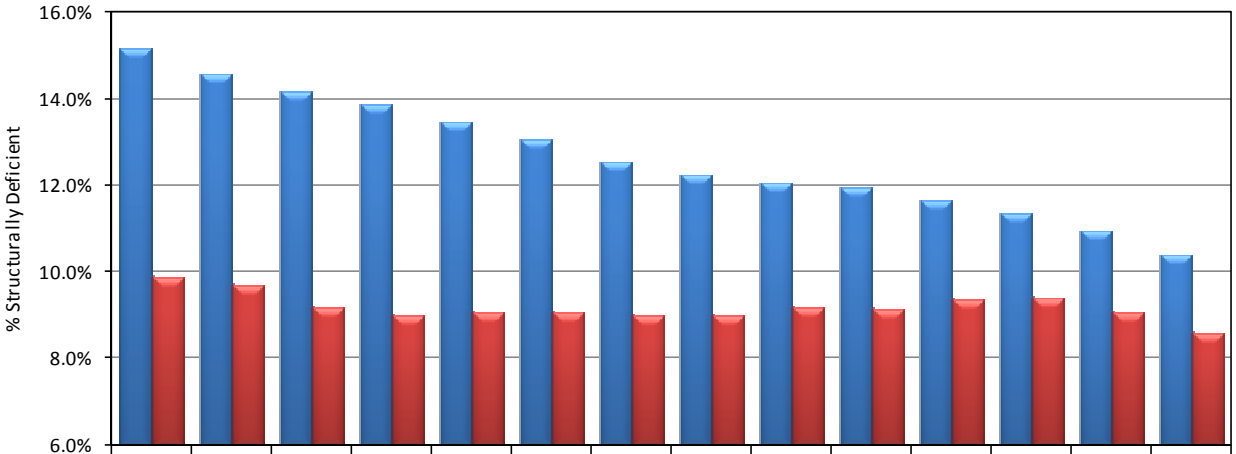
Chart K.5.b – Reasons Coded for Poor High Mast Light and Camera Poles Superstructure



APPENDIX L – NATIONAL PERFORMANCE TRENDS

Every Year FHWA collects data of NBI structures from all the states. The National Bridge Inventory reports data by calendar year and the 2014 data will not be available until after April 2015. The following charts compare Virginia's percentage of deficient structures with the national average as reported by FHWA. Percentages are based on National Bridge Inventory structures only. See previous charts for percentages of the entire Virginia inventory.

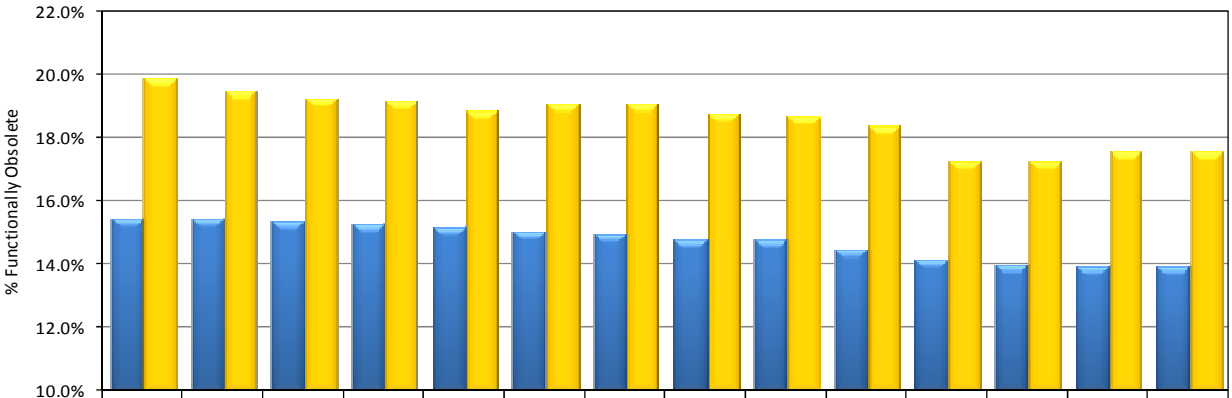
Chart L.1 – Comparing Virginia's Structurally Deficient (SD) Structures to the National Average



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
National	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%
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%

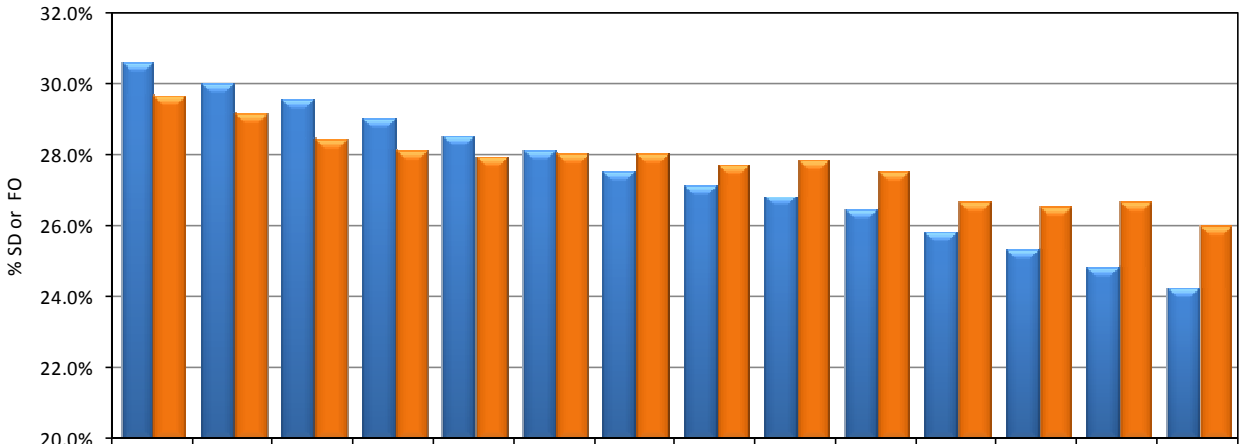
Note: Percentages are based on National Bridge Inventory structures only. See previous charts for percentages of entire Virginia inventory.

Chart L.2 –Comparing Virginia's Functionally Obsolete (FO) Structures to the National Average



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
National	15.5%	15.5%	15.4%	15.3%	15.2%	15.1%	15.0%	14.8%	14.8%	14.5%	14.2%	14.0%	14.0%	14.0%
Virginia	19.9%	19.5%	19.3%	19.2%	18.9%	19.1%	19.1%	18.8%	18.7%	18.4%	17.3%	17.3%	17.6%	17.6%

Chart L.3 –Comparing Virginia's Deficient (SD & FO) Structures to the National Average



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
National	30.7%	30.1%	29.6%	29.1%	28.6%	28.2%	27.6%	27.2%	26.9%	26.5%	25.9%	25.4%	24.9%	24.3%
Virginia	29.7%	29.2%	28.5%	28.2%	28.0%	28.1%	28.1%	27.8%	27.9%	27.6%	26.7%	26.6%	26.7%	26.1%

Note: Percentages are based on National Bridge Inventory structures only. See previous charts for percentages of entire Virginia inventory.