State of the Structures and Bridges Report

July 2013

Prepared By: Structure and Bridge Division,

Virginia Department of Transportation

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EXECUTIVE SUMMARY

The Virginia Department of Transportation (VDOT) is responsible for the inventory and inspection of 20,997 structures (bridges and culverts) across all of the Commonwealth's roadway systems. Of these structures 13,392 are part of the National Bridge Inventory (NBI). VDOT maintains 19,356 of these structures and 1,641 are maintained by localities and private owners. At the end of Fiscal Year (FY) 2013 (VDOT's fiscal year runs from July 1 through June 30) an additional 9 structures (net) were added to the inventory. This report summarizes the condition of the states bridges and culverts, ancillary structures (traffic control devices), safety inspection, and financial information. All of the tables and figures in this report reflect the 2013 accomplishments and are based on the inventory and condition data as of July 1, 2013.

The majority of Virginia's bridges were designed with a 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 fifty five (55%) 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.

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 inventory at the end of FY 2013 was 1,550 (7.4%). As of the end of FY 2013 the number of SD structures was reduced by 0.40%. The national average of structurally deficient structures in the NBI is 11.0% (as of December, 2012). The NBI inventory only includes bridges and culverts with a length of 20 feet or greater. As of December 2012, the percentage of NBI structures within Virginia that are SD is 9.1%. VDOT inventories and inspects all bridges and culverts with an opening greater than 36 square feet. This inventory includes both NBI and non-NBI structures.

A structure is defined as SD if it has a deficient component (deck, superstructure, substructure, and culvert) that require 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 becomes an SD structure. A "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 the 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 Health Index. These Performance measures are discussed in greater detail later in the report.

Structure Type	By Major Component Location (In Good or Fair Condition)			
	Deck	Superstructure	Substructure	Culvert
Bridges	97.3%	93.2%	97.0%	---
Culverts	---	---	---	96.6%

The Commonwealth's inventory includes 4,864 bridges and culverts (23.2%) 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. In FY13 VDOT inspected over 10,700 bridges/culverts at an expenditure 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 14 structures at a cost of $31,000. The Federal Highway Administration (FHWA) conducted an annual NBIS Compliance Review from April 1, 2012 to March 30, 2013 with a report provided by December 31, 2012. 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 Staunton and Richmond Districts. The Department was found in compliance with all 23 NBIS metrics that were reviewed for calendar year 2012.

The Virginia Department of Transportation (VDOT) is also responsible for the inventory, inspection and maintenance of 31,606 ancillary structures. VDOT's inventory includes 5 types of ancillary structures: Signs, Luminaires, Signals, High Mast Lights; and Camera Poles.

VDOT inspects over 6,000 of these structures annually, at an approximate cost of $4.1 million. This report summarizes the inventory and condition of Virginia's ancillary structures based on the inventory data as of July 31, 2013. 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 5 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 5 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, with 12,951 (41.0% of the inventory) in the Northern Virginia District to 563 (1.8%) 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	By Primary Component Location (In Good or Fair Condition)		
	Foundation	Parapet	Superstructure
Signs	89%	96%	97%
Luminaires	70.7%	62.1%	91.6%
Signal	88.5%	92.9%	85.9%
High Mast Lights and Camera Poles	93.4%	---	98.0%

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 S&B 604 maintenance program budget in FY13 was $127M. In recent years the calculated monetary need for bridge maintenance and construction has significantly exceeded available funding. The calculated need is the amount of money required to maintain the bridge inventory in its current condition, and it is 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 the quality of Virginia's bridges.

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.

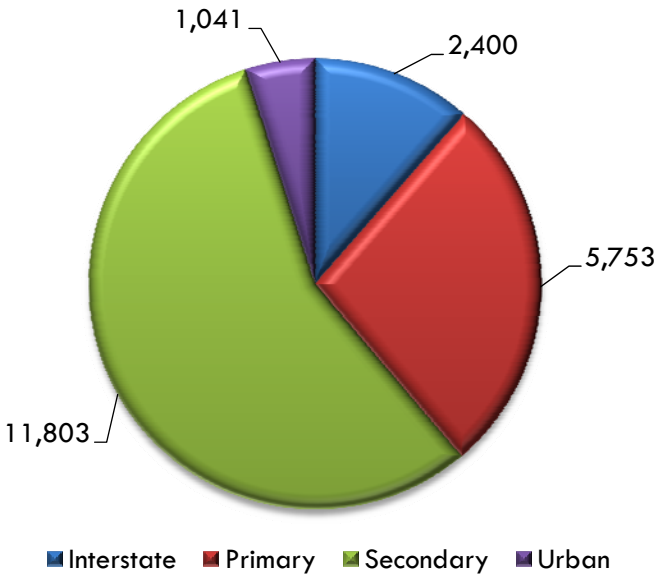
Bridge deterioration occurs over a period of decades rather than months or years, so the results of short-term funding deficiencies will not necessarily be readily evident in near-term trends of conditions. However, over time, if the funding for bridge maintenance and replacement is not increased, we should expect to see significant degradation of the average bridge conditions.

BACKGROUND

The Virginia Department of Transportation (VDOT) is responsible for the inventory and inspection of 20,997 structures (bridges and culverts) across all of the Commonwealth's roadway systems. Of these structures 13,392 are part of the National Bridge Inventory (NBI). VDOT maintains 19,356 of these structures and 1,641 are maintained by localities and private owners. At the end of Fiscal Year (FY) 2013 (VDOT's fiscal year runs from July 1 through June 30) an additional 9 structures (net) were added to the inventory. All of the tables and figures in this report reflect the 2013 accomplishments and are based on the inventory and condition data as of July 1, 2013.

The 2013 estimated current value of Virginia's structure inventory is approximately $7.5 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



The Virginia Department of Transportation is also responsible for the inventory, inspection and maintenance of 31,606 ancillary structures. VDOT's inventory includes 5 types of ancillary structures, 3 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

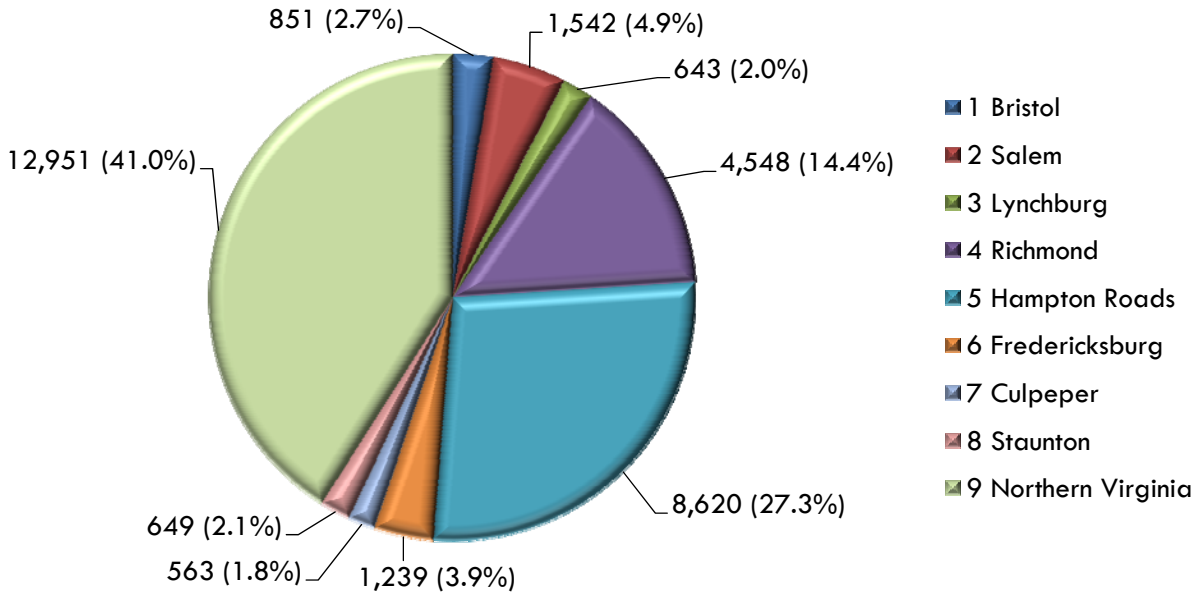
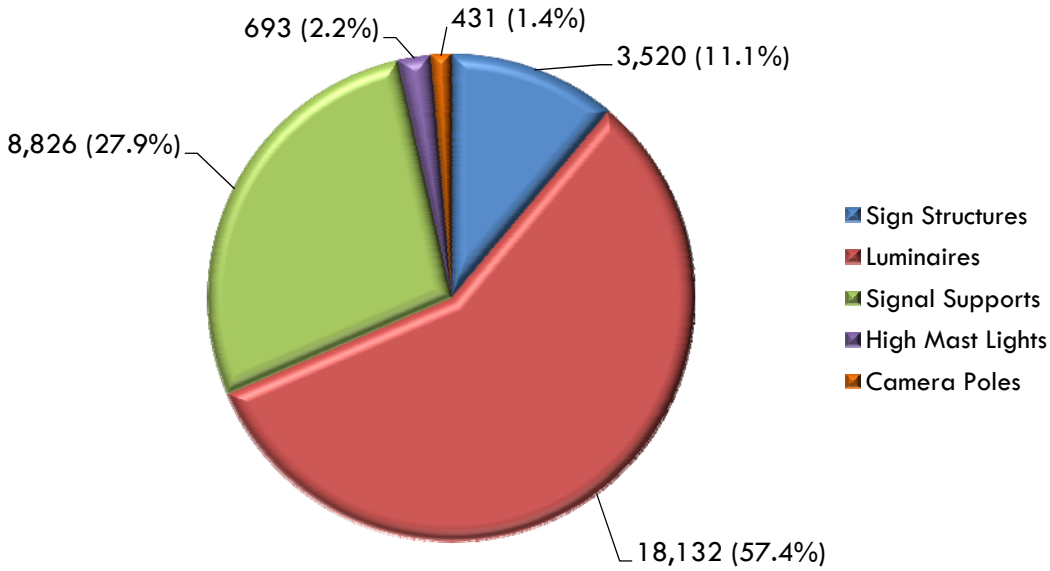


Chart 3 – Distribution of Ancillary Structures by Type



Determining the Conditions of the Structures

VDOT uses its comprehensive inspection program to evaluate and monitor the condition of the Commonwealth's structures. The data collected during the inspections is used as the primary source of information for determining maintenance, repair and replacement needs.

In accordance with the Code of Federal Regulations, 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. NBI structures receive detailed inspections at regular intervals not exceeding 24 months. In addition to the federal inventory and inspection requirements, VDOT also inventories and inspects bridges measuring 20 feet or less in length and large culverts having an opening of 36 square feet or greater (these are the only structures not in the NBI). 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 10,700 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 July 1, 2013 inventory data.

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 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 inspection procedures and requirements are detailed in VDOT's "Procedures for Inventory and Inspection of Traffic Control Device Structures" manual, the user manuals "Sign Inspection Program" and "Luminaires and Traffic Signal Supports", and VDOT Informational and

Instructional Memorandum, SB -73, "High Mast Poles: Inspection and Maintenance" and SB-82, "Traffic Structures".

VDOT inspects over 6,000 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 July 31, 2013 inventory data.

The inspection reports list prioritized 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	952	2,044	223	3,435
Salem	217	800	1,933	113	3,063
Lynchburg	0	663	1,392	59	2,114
Richmond	511	799	1,127	161	2,598
Hampton Roads	459	456	515	262	1,692
Fredericksburg	79	252	473	8	812
Culpeper	122	496	1,052	24	1,694
Staunton	429	824	2,135	109	3,497
NOVA	367	511	1,132	82	2,092
Grand Total	**2,400**	**5,753**	**11,803**	**1,041**	**20,997**

Table 2 – Total Number of NBI - Bridges and Culverts

DISTRICT	Total Number of Structures (Bridges and Culverts)				
	Interstate	Primary	Secondary	Urban	Total
Bristol	164	517	1,110	218	2,009
Salem	139	441	1,128	100	1,808
Lynchburg	0	417	921	59	1,397
Richmond	355	599	845	160	1,959
Hampton Roads	378	370	391	261	1,400
Fredericksburg	43	176	301	7	527
Culpeper	85	238	681	17	1,021
Staunton	254	454	1,045	105	1,858
NOVA	272	364	701	76	1,413
Grand Total	**1,690**	**3,576**	**7,123**	**1,003**	**13,392**

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

DISTRICT	Number of Structures (Bridges and Culverts)				
	Interstate	Primary	Secondary	Urban	Total
Bristol	52	435	934	5	1,426
Salem	78	359	805	13	1,255
Lynchburg	0	246	471	0	717
Richmond	156	200	282	1	639
Hampton Roads	81	86	124	1	292
Fredericksburg	36	76	172	1	285
Culpeper	37	258	371	7	673
Staunton	175	370	1,090	4	1,639
NOVA	95	147	431	6	679
Grand Total	**710**	**2,177**	**4,680**	**38**	**7,605**

A large proportion (56.4%) of the statewide 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 number of structures equal to or greater than 40 years in age, by system, is as follows: 59.9% of the interstate, 59.4% of the primary, 55.4% of the secondary, and 42.8% of the urban system structures. The average age is 44 years. The age of Virginia's highway structures is depicted graphically in Charts 4 thru 6.

In the past, the anticipated design service life of a bridge was 50 years, but with improvements in design guidelines and construction materials the anticipated service life of bridges constructed since 2007 is 75 years.

Chart 4 – Cumulative Age Distribution of Bridges and Culverts

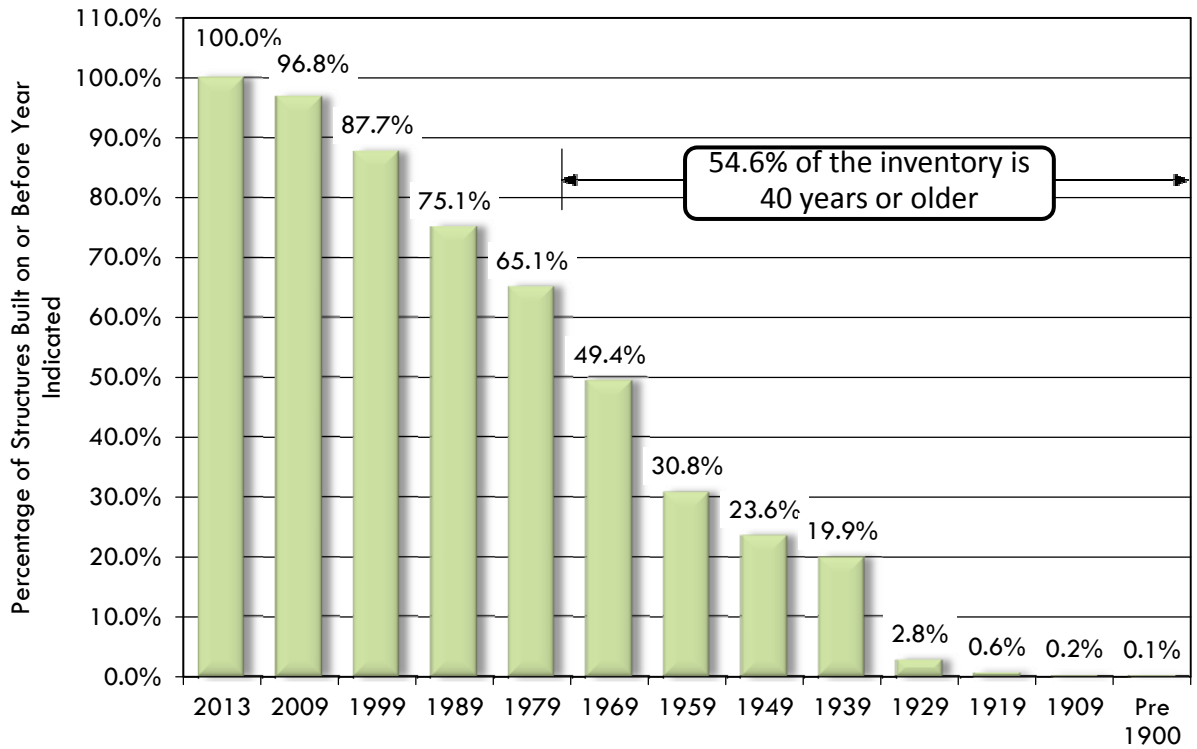


Chart 5 – Average Age of Bridges and Culverts by District

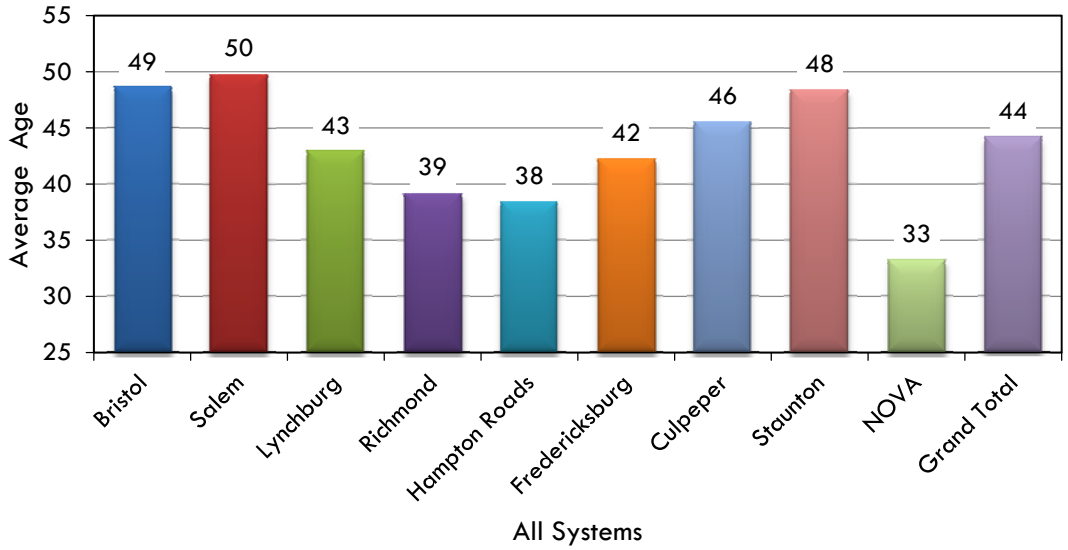
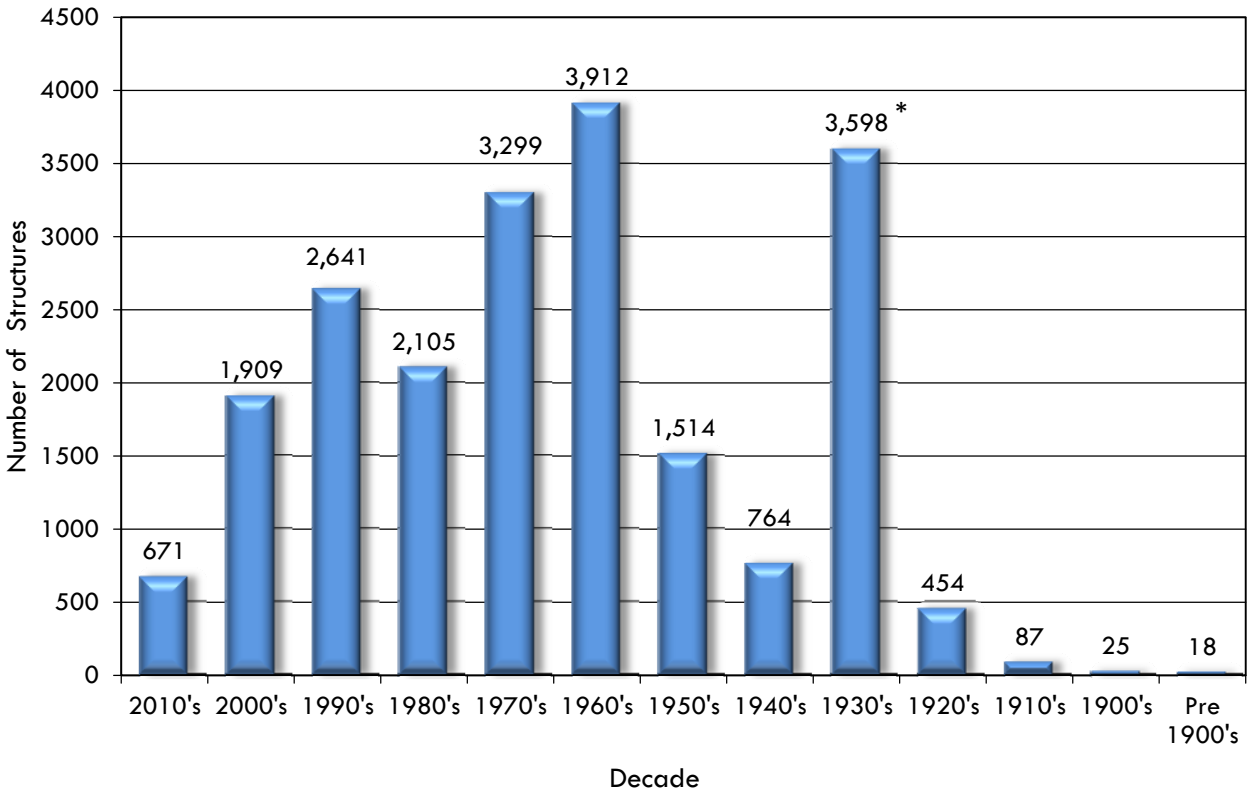


Chart 6 – Number of Bridges and Culverts per Decade



* County Bridges added to the VDOT Inventory during this period with unknown construction dates. (Assumed year built equaled year added to system). For example 144 structures in Buchanan County have been added to the inventory in 2012. 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 (page 33).

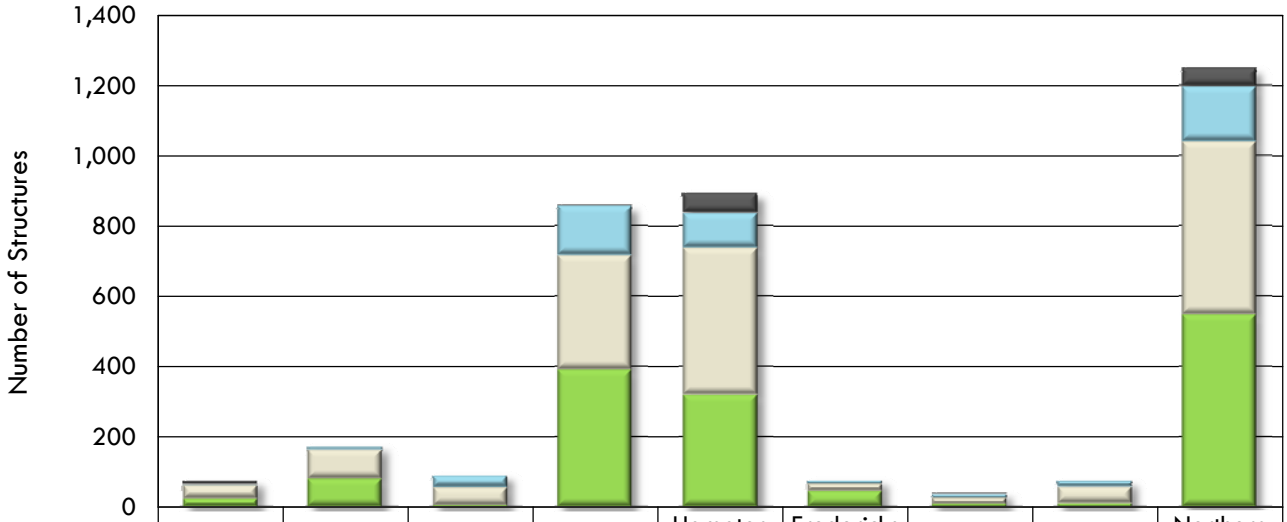
Table 4 below provides a statewide summary of the total number and type of ancillary structures in each district. Similar information for the subcategories of each type of ancillary structure along with pictures providing typical examples of each type of ancillary structure is provided in Appendix B (page 37).

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	74	457	243	76	1	851	2.7%
Salem	171	819	539	13	0	1,542	4.9%
Lynchburg	89	302	252	0	0	643	2.0%
Richmond	858	2,060	1,521	105	0	4,544	14.4%
Hampton Roads	892	6,801	493	145	289	8,620	27.3%
Fredericksburg	75	448	714	1	1	1,239	3.9%
Culpeper	39	157	367	0	0	563	1.8%
Staunton	74	45	451	26	53	649	2.1%
Northern Virginia	1,248	7,043	4,246	327	87	12,951	41.0%
Statewide	**3,520**	**18,132**	**8,826**	**693**	**431**	**31,602**	**100.0%**

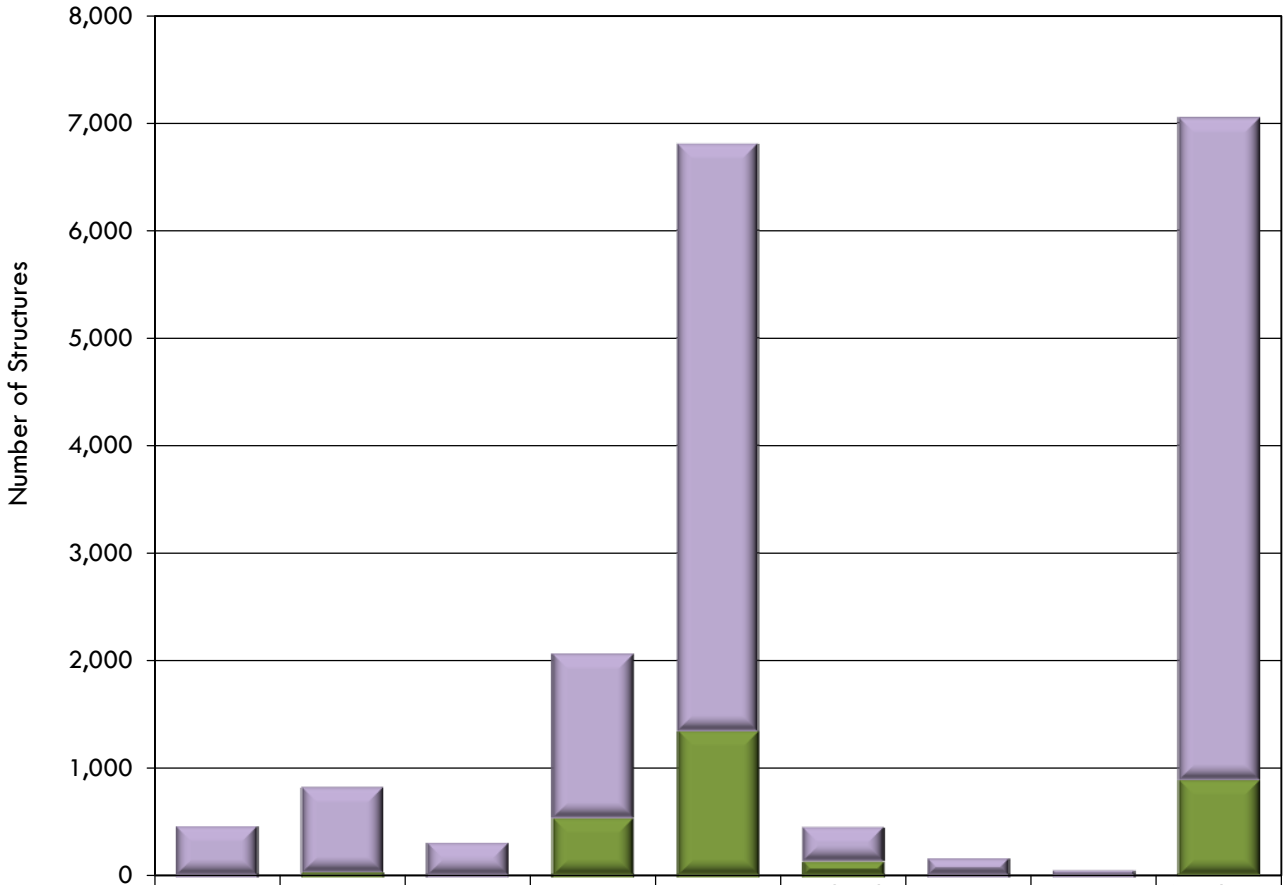
Charts 7 through 10 graphically display the total number of ancillary structures for each of the general structure by subcategory and district.

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	56	0	3	0	52
Parapet Mount	2	8	33	141	99	9	10	16	157
Overhead	39	83	52	326	418	21	18	48	492
Cantilever	23	80	4	390	319	45	8	10	547
Total	74	171	89	858	892	75	39	74	1,248

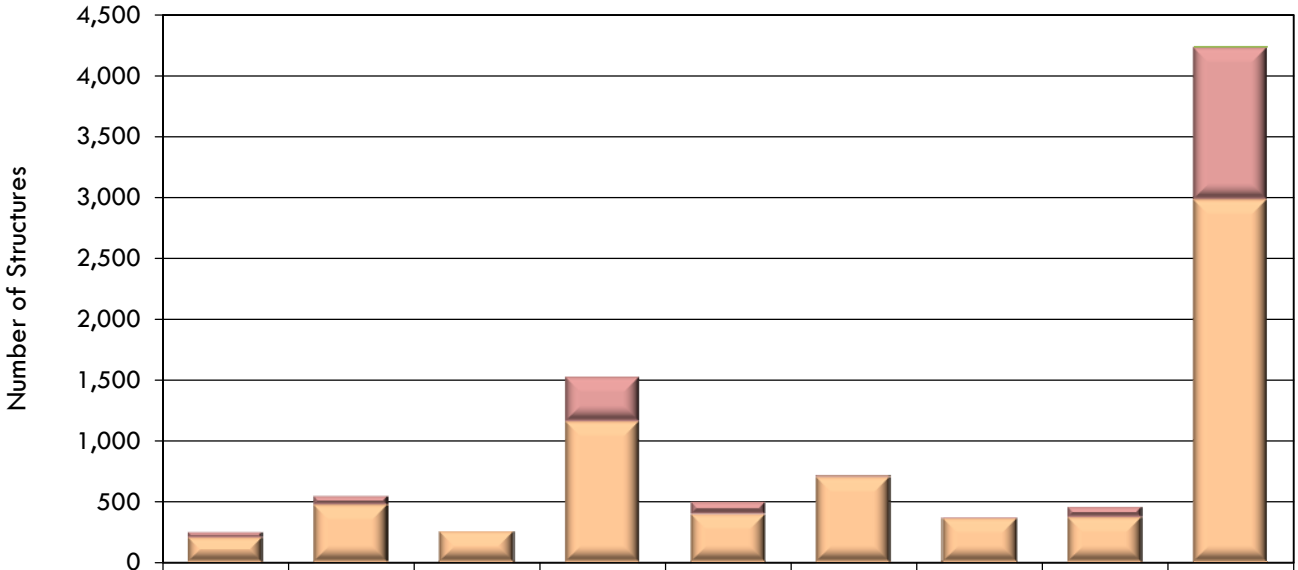
Chart 8 –Number of Luminaire Structures by Subcategory and District



	Bristol	Salem	Lynchburg	Richmond	Hampton Roads	Fredericksburg	Culpeper	Staunton	Northern Virginia
Luminaires	455	795	302	1,530	5,464	320	157	45	6,160
Parapet Mount	2	24	0	530	1,337	128	0	0	883
Total	457	819	302	2,060	6,801	448	157	45	7,043

District

Chart 9 –Number of Signal Structures by Subcategory and District

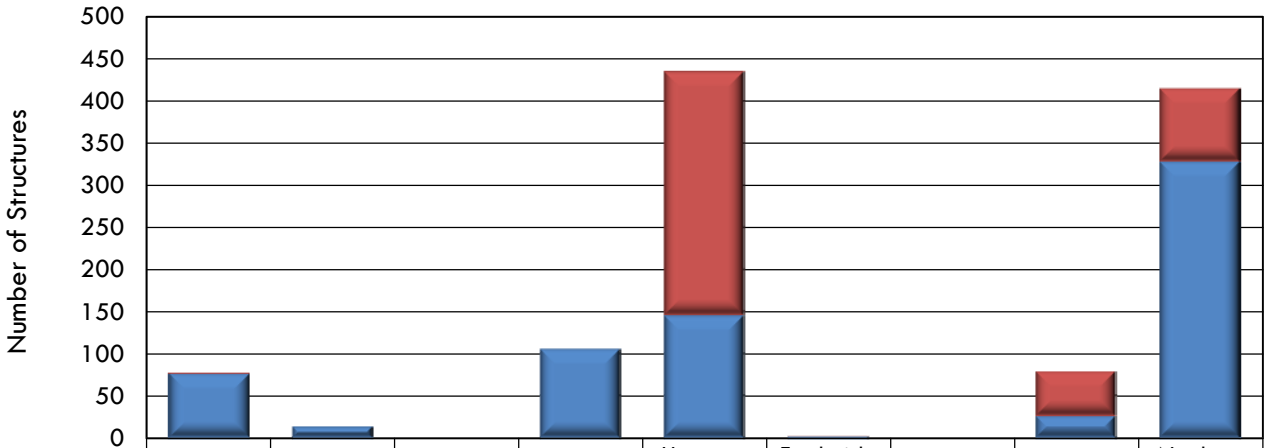


	Bristol	Salem	Lynchburg	Richmond	Hampton Roads	Fredericksburg	Culpeper	Staunton	Northern Virginia
Other *	0	0	0	0	0	1	0	0	14
Span Wire	44	70	2	366	102	16	8	85	1,251
Cantilever	199	469	250	1,155	391	697	359	366	2,981
Total	243	539	252	1,521	493	714	367	451	4,246

District

*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
Camera Poles	1	0	0	0	289	1	0	53	87
High Mast Lighting	76	13	0	105	145	1	0	26	327
Total	77	13	0	105	434	2	0	79	414

District

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 a general condition rating (GCR) of poor (GCR of 4) or worse for one or more of the following structural components: deck, superstructure, substructure or culvert, or has 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 restricted to light weight vehicles. Appendix C provides definitions of the general condition ratings. In addition, Appendix C (page 41) also provides comparative data on the average condition rating by District.

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

On July 1, 2013, 7.4% percent (1,550 structures) of the total inventory was rated as SD. Table 5a and Table 5b show the number of SD structures that were restored and those that fell into SD status during FY 2013. 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 (page 122) shows the national trend of deficient structures from 2000 to 2012. National data is reported by calendar year and reported by the states at the end of March and is not available until May or June of the next year. The Virginia data shown in Appendix L is for only the NBI bridges and culverts and does not include bridges less than 20 feet in length.

Table 5a – Change in Number of Structurally Deficient Structures Between FY2012 and FY 2013

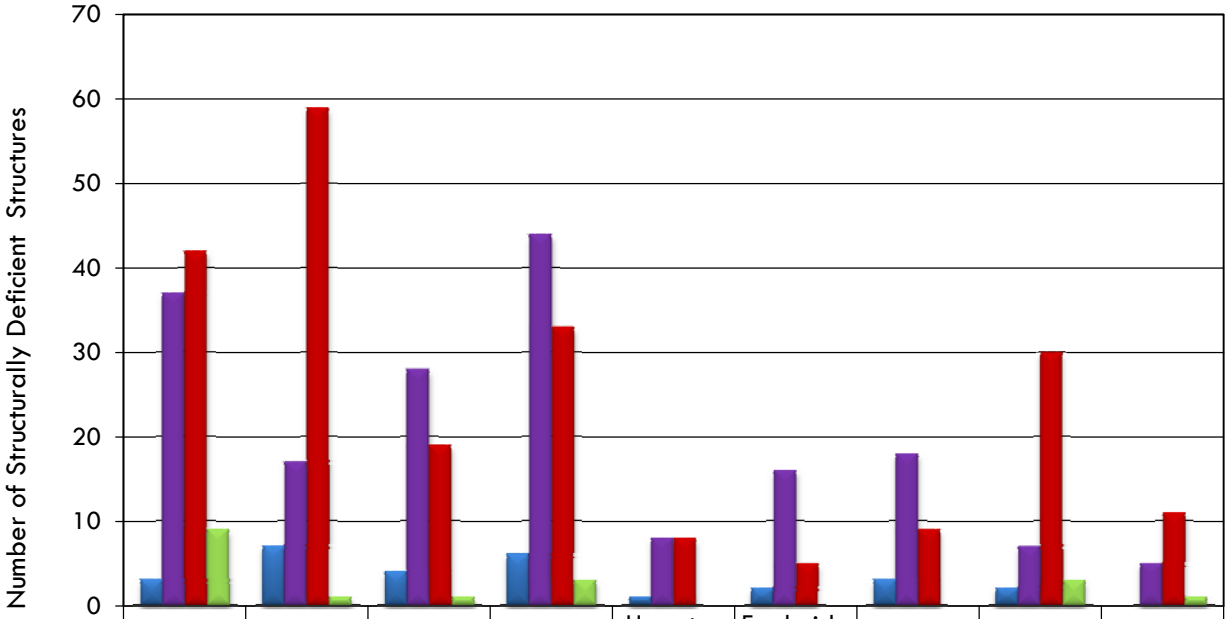
DISTRICT	Structurally Deficient		
	End of FY2012	End of FY2013	Change
Bristol	363	346	-4.7%
Salem	332	282	-15.1%
Lynchburg	122	126	3.3%
Richmond	239	241	0.8%
Hampton Roads	89	88	-1.1%
Fredericksburg	71	80	12.7%
Culpeper	119	125	5.0%
Staunton	240	212	-11.7%
NOVA	57	50	-12.3%
Statewide	**1,632**	**1,550**	**-5.0%**

Note: Percentages are based on count of FY12 inventory

Table 5b – Change in Number of Structurally Deficient Structures During FY 2013

DISTRICT	During FY13				
	Restored	Closed	Removed	Deteriorated	Change
Bristol	42	3	9	37	-17
Salem	59	7	1	17	-50
Lynchburg	19	4	1	28	4
Richmond	33	6	3	44	2
Hampton Roads	8	1	0	8	-1
Fredericksburg	5	2	0	16	9
Culpeper	9	3	0	18	6
Staunton	30	2	3	7	-28
NOVA	11	0	1	5	-7
Statewide	**216**	**28**	**18**	**180**	**-82**

Chart 11 –Number of Structurally Deficient Structures Restored Vs. Deteriorated During FY 2013



	Bristol	Salem	Lynchburg	Richmond	Hampton Roads	Fredericksburg	Culpeper	Staunton	NOVA
Closed	3	7	4	6	1	2	3	2	0
Deteriorated	37	17	28	44	8	16	18	7	5
Restored	42	59	19	33	8	5	9	30	11
Removed	9	1	1	3	0	0	0	3	1

Chart 12 – Percentage of Number of Structurally Deficient Structures Statewide End of FY2013

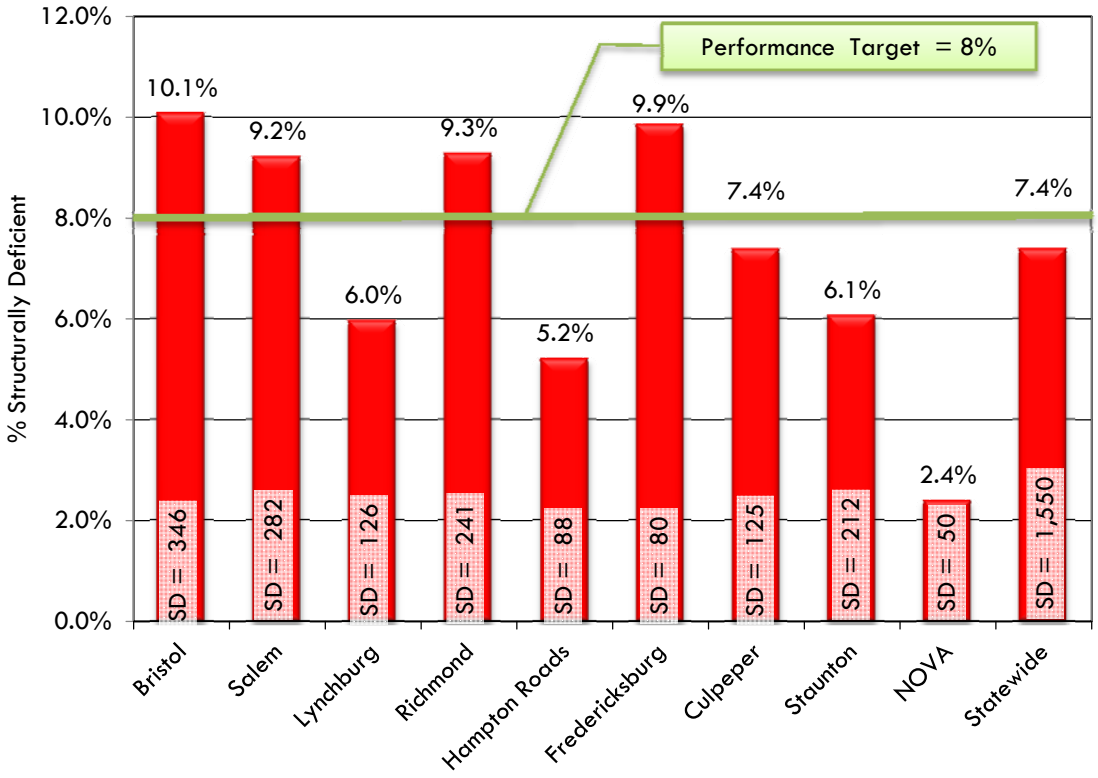
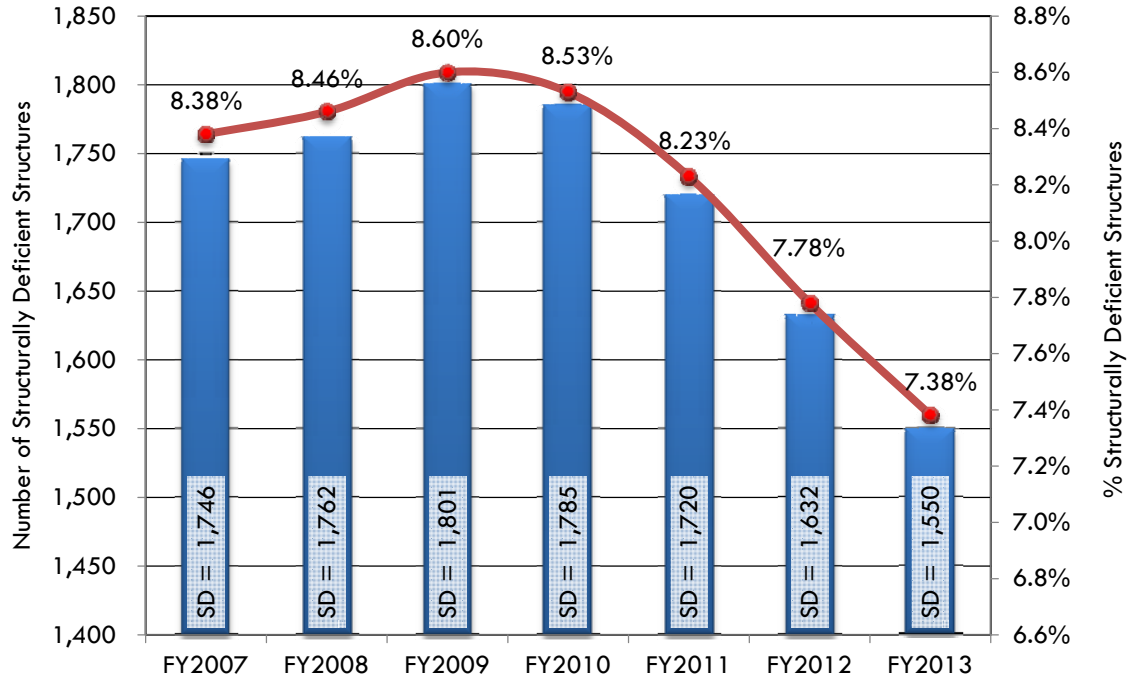


Chart 13 – Percentage of Structurally Deficient Structures Statewide Seven Year Trend



Other performance indicators that are used by VDOT in the overall management of the structural inventory include: Functional Obsolete, Deficient Structures (SD or FO), Weight Posted and Health Index.

Appendix C (page 41) compares general condition ratings by structure component and District. Appendix E (page 64) shows the 2013 performance measures based on the square footage area of the structures. Charts show multi-year trends for each of these measures statewide and for each system are given in Appendix F (page 73). 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 (page 84), 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.

Additionally, Statewide and District maps showing the location of each of the SD structures are located in Appendix H (page 85). Appendix I (page 95) 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 (page 97) gives an overview of the Quality Assurance Program followed in the Commonwealth.

The 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 (page 99) 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	General Condition Rating (No. of Structures)			General Condition Rating (Percentage)		
	Good	Fair	Poor	Good	Fair	Poor
Signs	2,504	597	419	71.1%	17.0%	11.9%
Signals	3,218	3,540	2,068	36.5%	40.1%	23.4%
High Mast Lights and Camera Poles	882	150	92	78.5%	13.3%	8.2%
Luminaires	6,728	5,090	6,314	37.1%	28.1%	34.8%
Total	**13,332**	**9,377**	**8,893**	**42.2%**	**29.7%**	**28.1%**

Chart 14a –Sign Structures by Minimum General Condition Rating

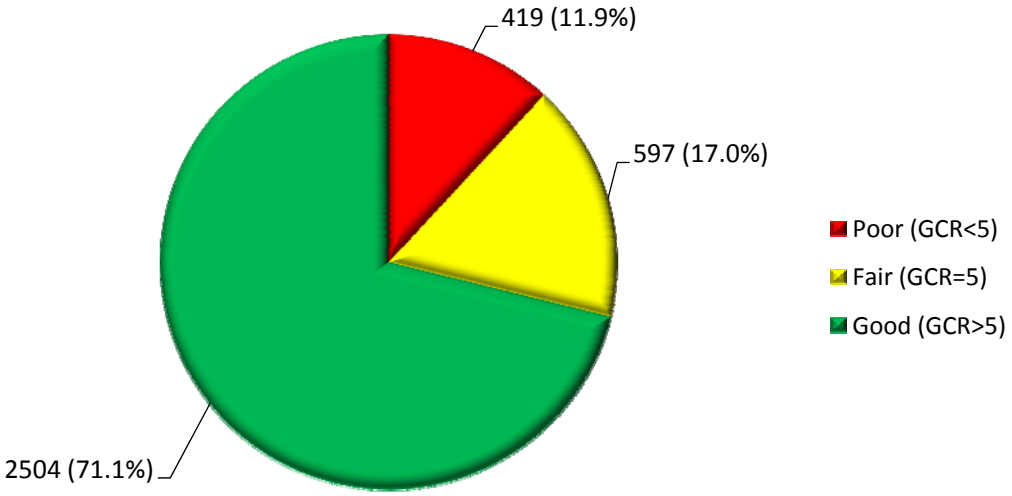


Chart 14b –Signal Structures by Minimum General Condition Rating

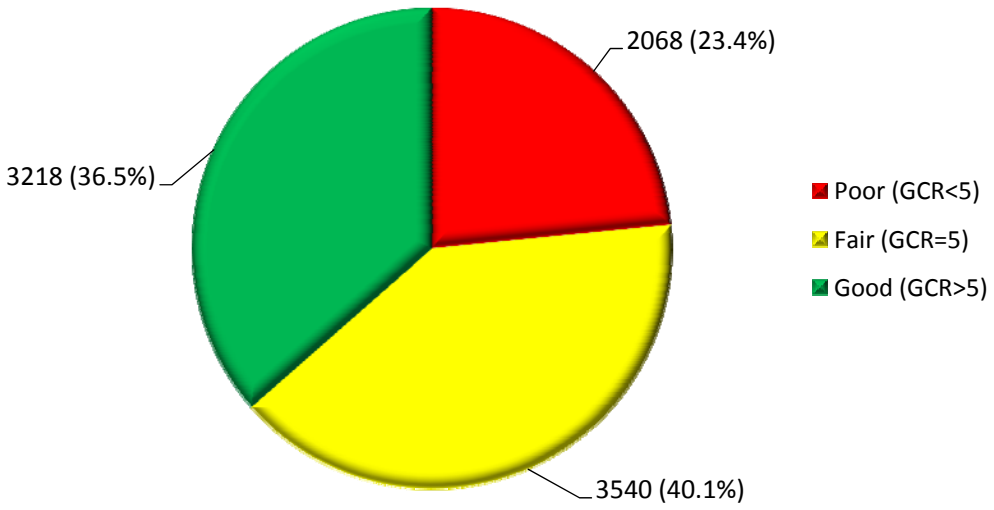


Chart 14c –High Mast Lights and Camera Poles by Minimum General Condition Rating

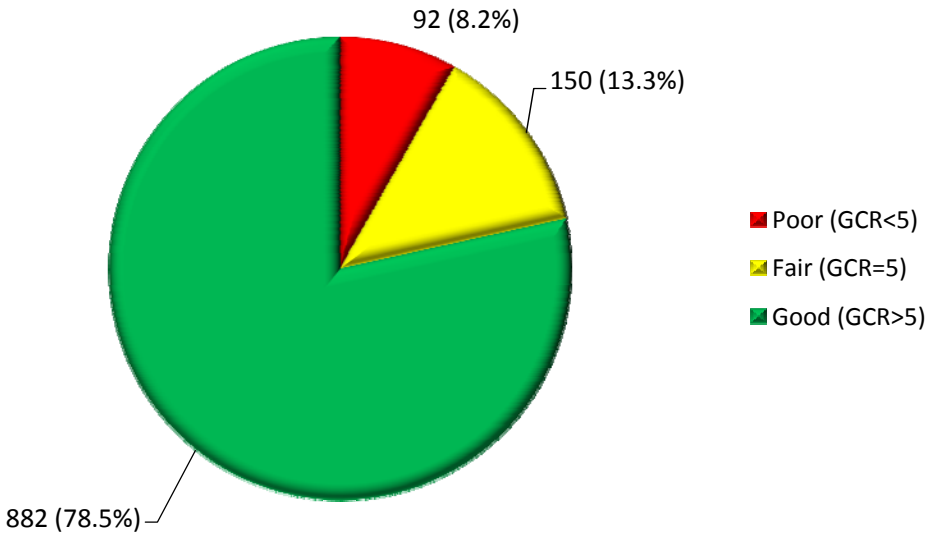


Chart 14d – Luminaires by Minimum General Condition Rating

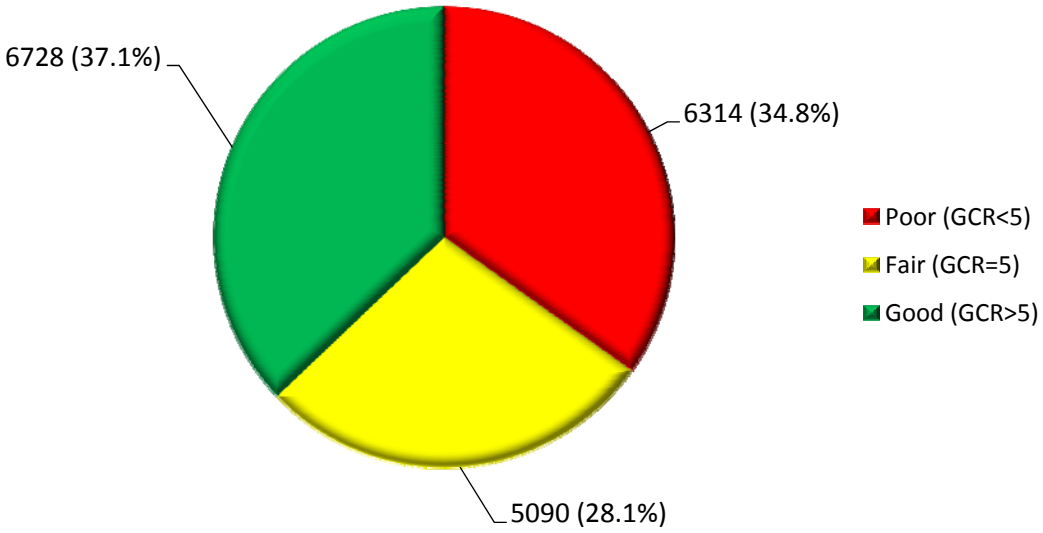
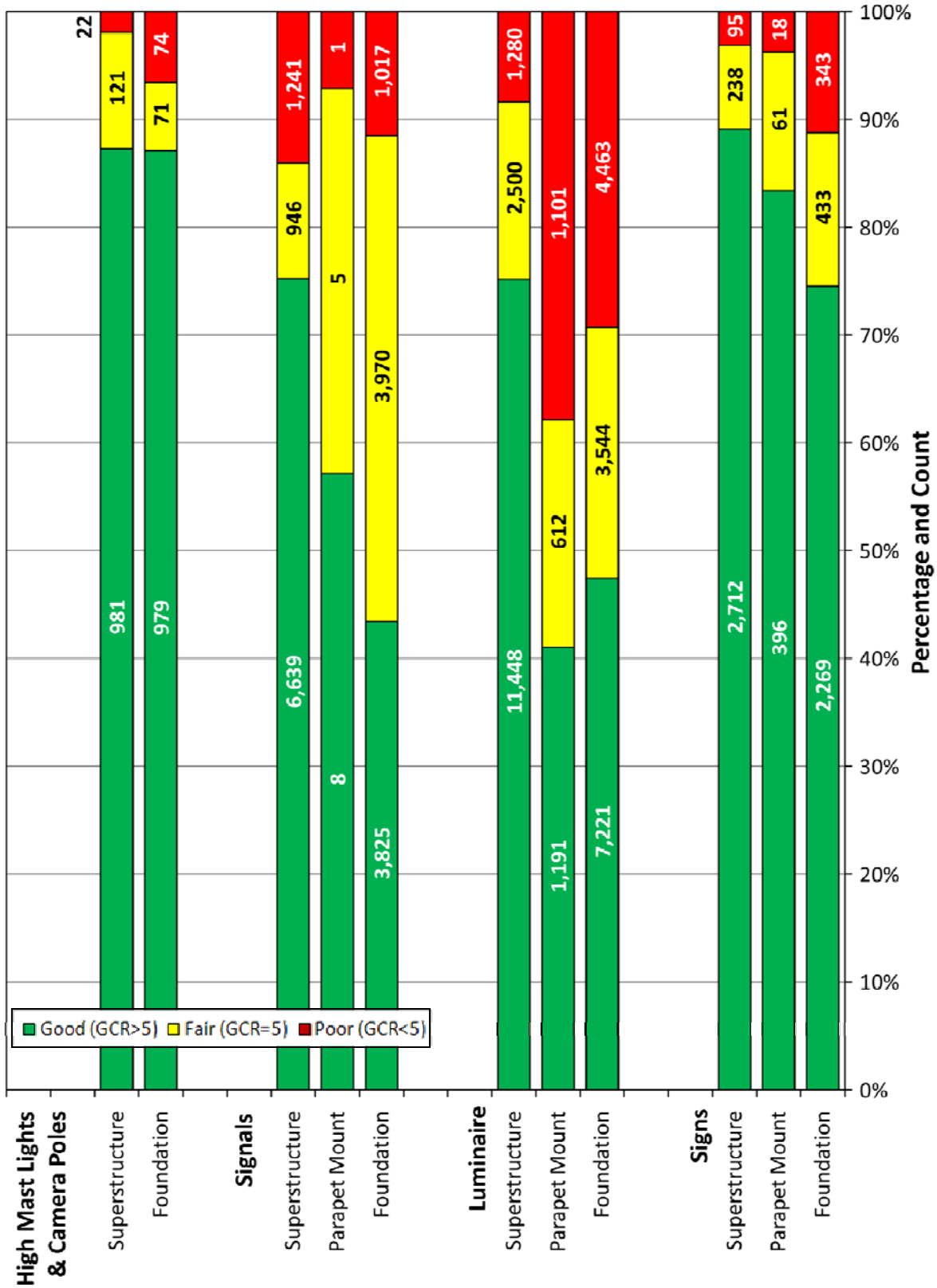


Chart 14e provides the condition of the ancillary structures by structural component by asset statewide. In Appendix K, other charts are presented to gain a more specific understanding of the conditions that cause structures to receive reduced GCRs.

Chart 14e – Statewide Ancillary Structure Condition by Asset Type



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 a set of metrics that are meaningful, actionable and practical to measure; and institutionalize use of these metrics for strategic and operational decision making.

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.

The Structure and Bridge Division uses three sets of performance goals in determining its program's monetary needs. The three sets of performance goals address structures in various condition categories.: Separate goals have been established for bridges and large culverts that are in "good condition", "fair condition" or "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 performance goals for each condition classification are shown below:

Good Structures:

- Repair or replace all joint seals in Condition State 2 or 3[1]
- Perform condition based preventive maintenance annually to 2% of all the structures with a minimum GCR of 6
- Perform planned preventive maintenance on structure with a minimum GCR of 7 in accordance with Chapter 32 of the *Manual of the Structure and Bridge Division*

Fair Structures:

- Repair or replace all joint seals in Condition State 2 or 3
- Perform routine maintenance on 6% of all the structures with a minimum GCR of 5

[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*

Poor Structures:

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%

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 the annual transition study was performed to determine the number of structures that are currently "falling" or being improved in any particular year. Since 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. Numbers of actual year-to-year transitions for Fiscal Year 2013 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.

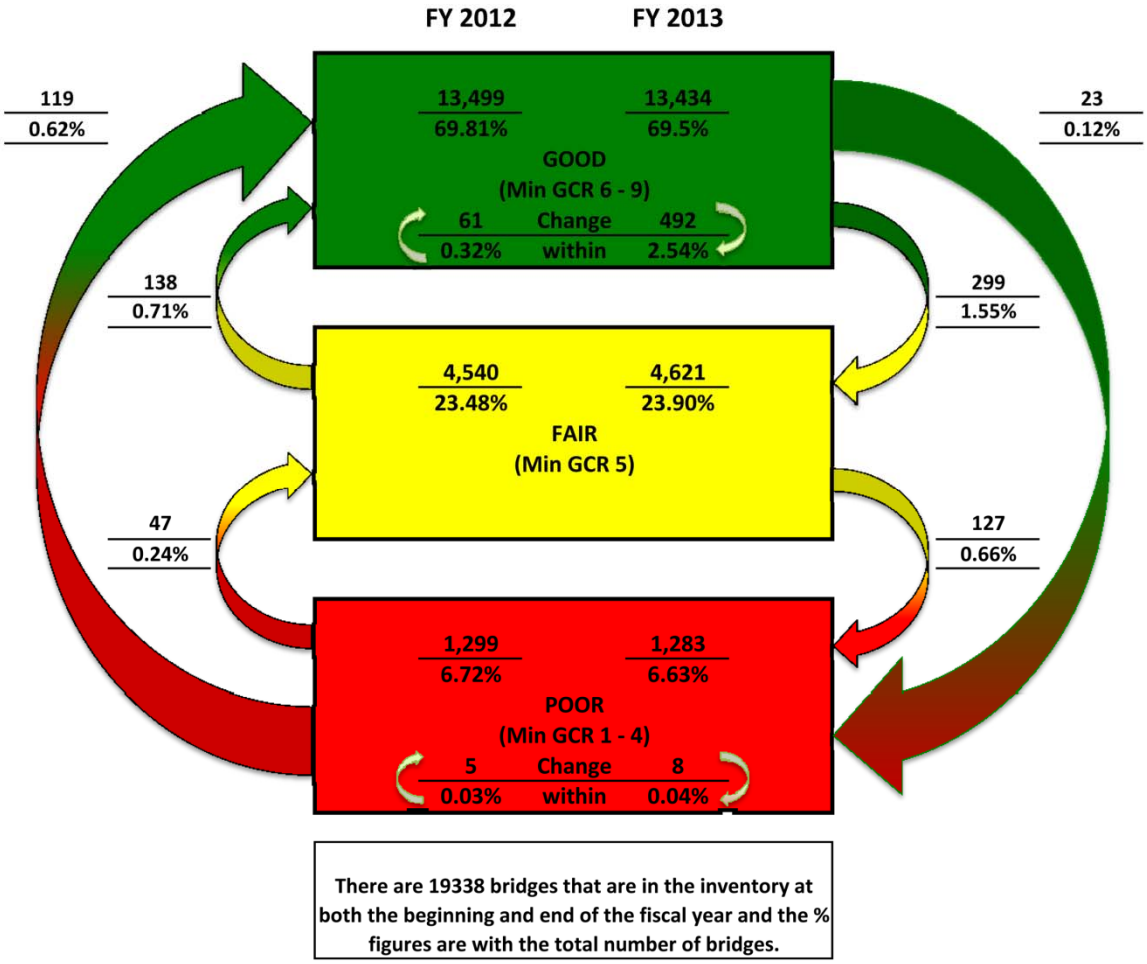
Based on the study, it was determined that the goal of system sustainability could be achieved with the goals shown above. Furthermore, these goals were deemed to be reasonably attainable with existing staff. However, the funding required to meet these goals remains significantly higher than provided.

The analysis indicates that the "Good" structures continue to move into "Fair" at a fairly consistent annual rate of 2% of good structures. The number of structures transitioning from "Fair" to "Good" annually averages approximately 5% of fair structures. The analysis between any two years utilized only structures that were present in the inventory at both the beginning and end of the fiscal year, thus eliminating any undue 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.

[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*

Chart 15 – Annual Transitions of GCR from FY12 to FY13



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. Indeed, the new federal highway legislation, MAP-21, will require each state to establish and meet performance goals for its inventory. 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://tsp2bridge.pavementpreservation.org/library/videos-powerpoint-resentations/performance-measures/

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 Program (603) and Highway System Maintenance Program (604).

603 Construction Program Overview: The Construction (603) Program is fueled 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 will be taken out of the system formula to create what is known as the Dedicated Bridge Fund (DBF). Funding eligibility for bridge projects then extended beyond replacement and rehabilitation to include preservation activities.

The federal requirements for the Dedicated Bridge Fund (DBF) funds were as follows:

1. The bridge is structurally deficient or functionally obsolete.
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 50 for replacement or less than 80 for rehabilitation.
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.

In addition to the federal requirements, VDOT also applied requirements for the DBF funds. The VDOT requirements are as follows:

1. The bridge is not part of the interstate system (does not carry interstate route or cross over the interstate).
2. Estimated project cost is less than $20 million.
3. Only VDOT maintained bridges.

These federal funds for the S&B Construction (603) Program (DBF) are apportioned to the S&B Division by the VDOT Programming Division Office. The funds are distributed into two fund types: BR and BROS.

The BR funds were dedicated to eligible bridges that are located on the Federal-Aid routes (on-system), and the BROS dedicated to eligible bridges that are located on non Federal-Aid routes (off-system).

The Structure and Bridge Division then distributes the BR and BROS funds between the nine (9) VDOT District Bridge offices based on percentage of structurally deficient structures currently not in the Six Year Improvement Plan (SYIP).

In October 1, 2012, the federal government implemented a new funding program to replace SAFETEA-LU called MAP-21. MAP-21 provided three funding sources for the S&B

Construction (603) Program beginning in FY14. The 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-BROS funds are mandated by the federal government. These funds can only be used for bridges on the secondary system or off system but on the National Bridge Inventory (NBI).

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

Along with the new MAP-21 funds in FY14, the Governor's Transportation Package of 2012 introduced new Commonwealth Transportation Board (CTB) funds in FY14. These funds are being used to fully fund existing projects in the SYIP. The CTB has identified 25% of the CTB funding to be directed to the Commonwealth's bridge program from FY14 through FY20. These projects were chosen at the discretion of the CTB members. CTB funds can be designated to any bridge regardless of system classification at the discretion of the CTB. The CTB funds are currently designated to sunset in FY20.

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

	MAP-21 BR Federal Eligibility				
	Federal –Aid System		**Off System**	**NBI** (>20' Length)	**Non NBI** (<20' Length)
	NHS	**Non NHS**			
NHPP-BR	X			X	X
STP-BR	X	X		X	X
STP-BROS			X	X	

As the CTB dollars can only be designated by the CTB members, the remaining three funding types are the only that can be used at the discretion of the Structure and Bridge Division.

The STP-BROS funding and levels are mandated by the federal government. NHPP-BR and STP-BR funding levels are apportioned at the discretion of the VDOT Programming Division Office.

Based on the flexibility of the STP-BR funds, lack of flexibility with NHPP-BR and the classification of the structurally deficient structures in the bridge inventory, the Structure and Bridge Division could effectively address more structurally deficient bridges in the SYIP with more STP-BR funds and less of the NHPP-BR.

For FY13, the Structure and Bridge Division was given $103M for the Construction 603 Program to address structurally deficient or functionally obsolete structures.

Chart 16 below shows the historical bridge funding levels of the DBF from inception through FY13 and the projected funding levels of MAP-21 funds for bridge in the SYIP (FY14 – FY19).

Chart 16 – S&B Historical and Proposed SYIP 603 Construction Budget

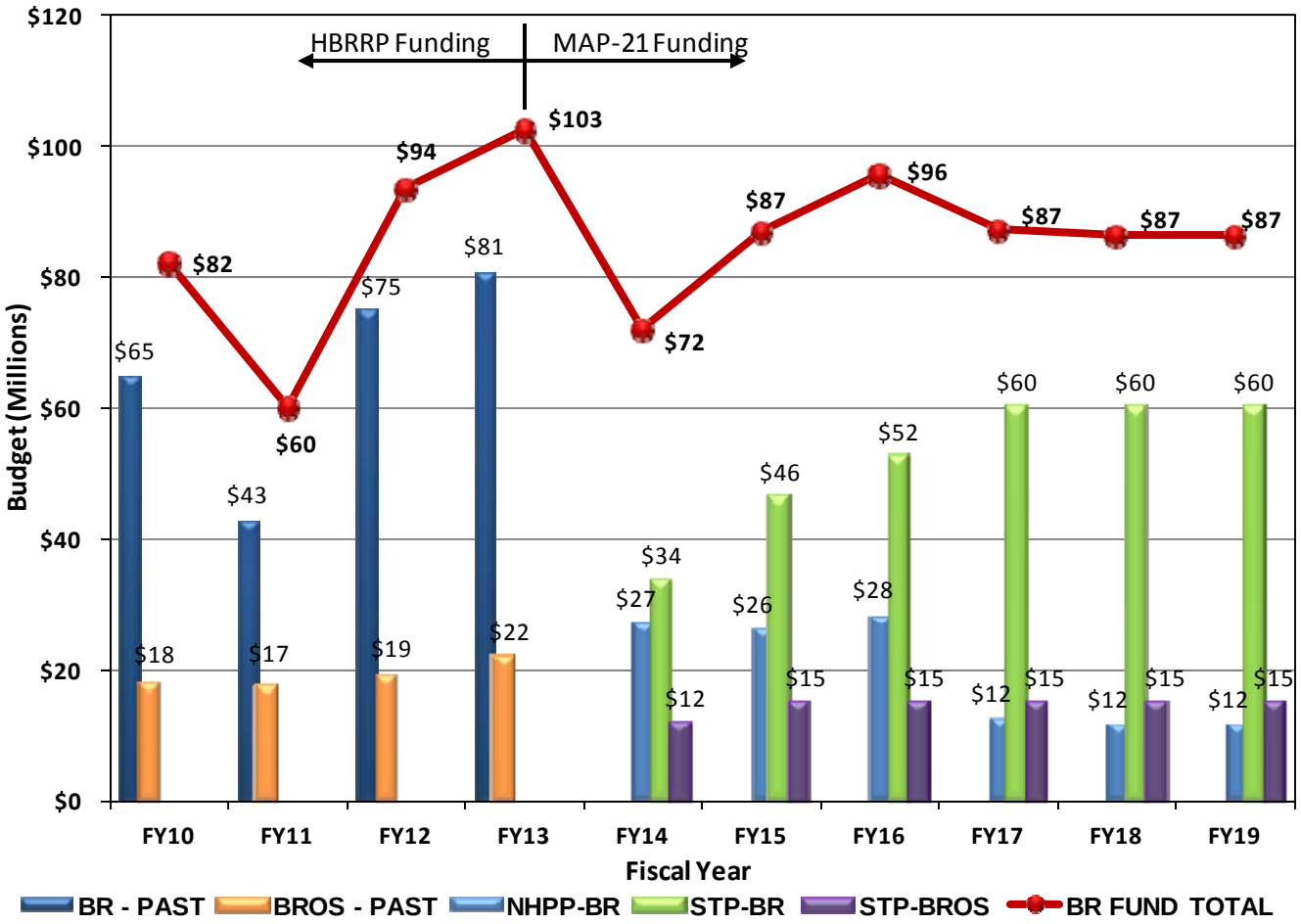


Chart 17 below shows the total funding levels of the S&B 603 Construction Program with the CTB funding.

Chart 17 – S&B Historical and Proposed SYIP 603 Construction Budget with CTB Funds

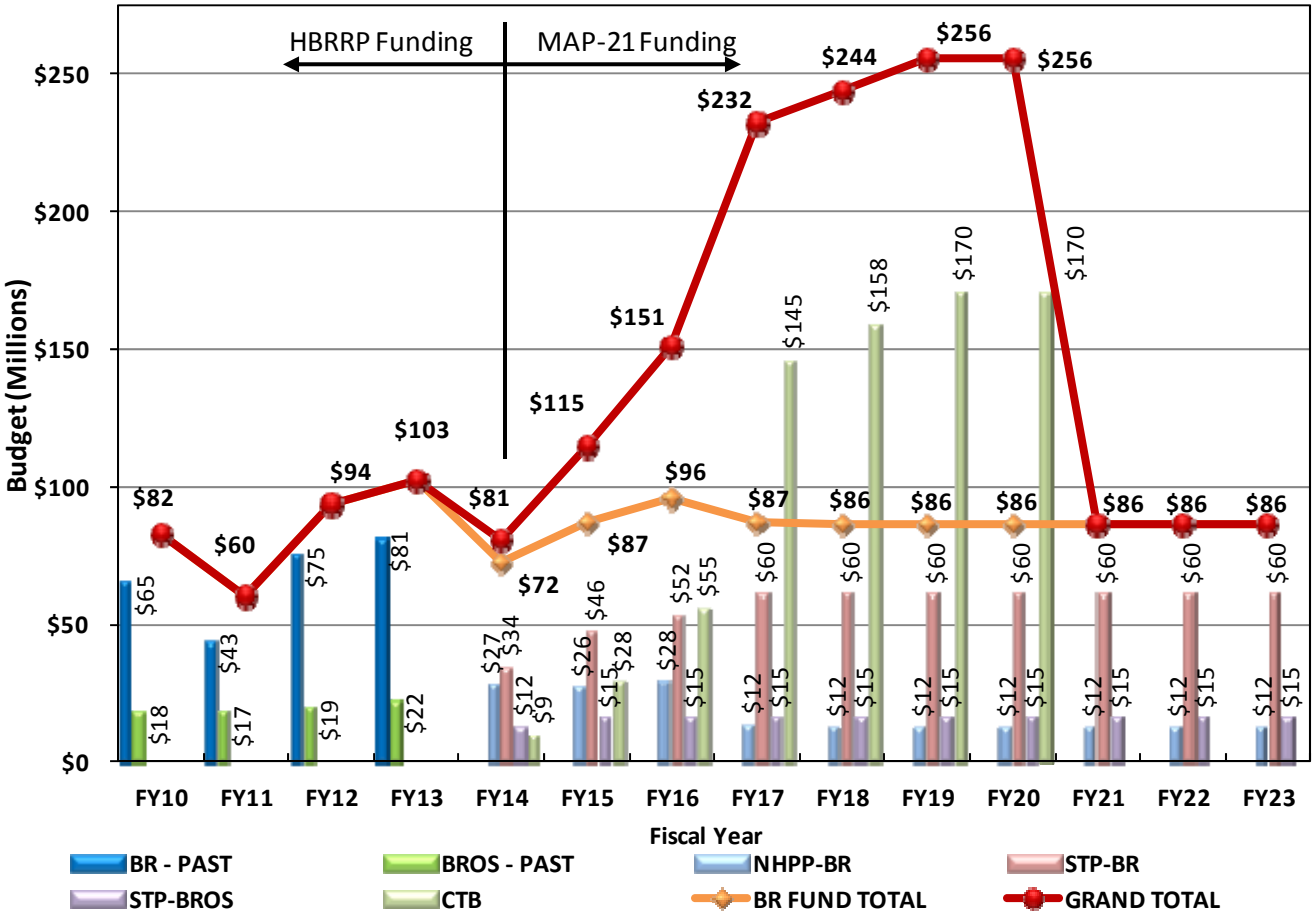
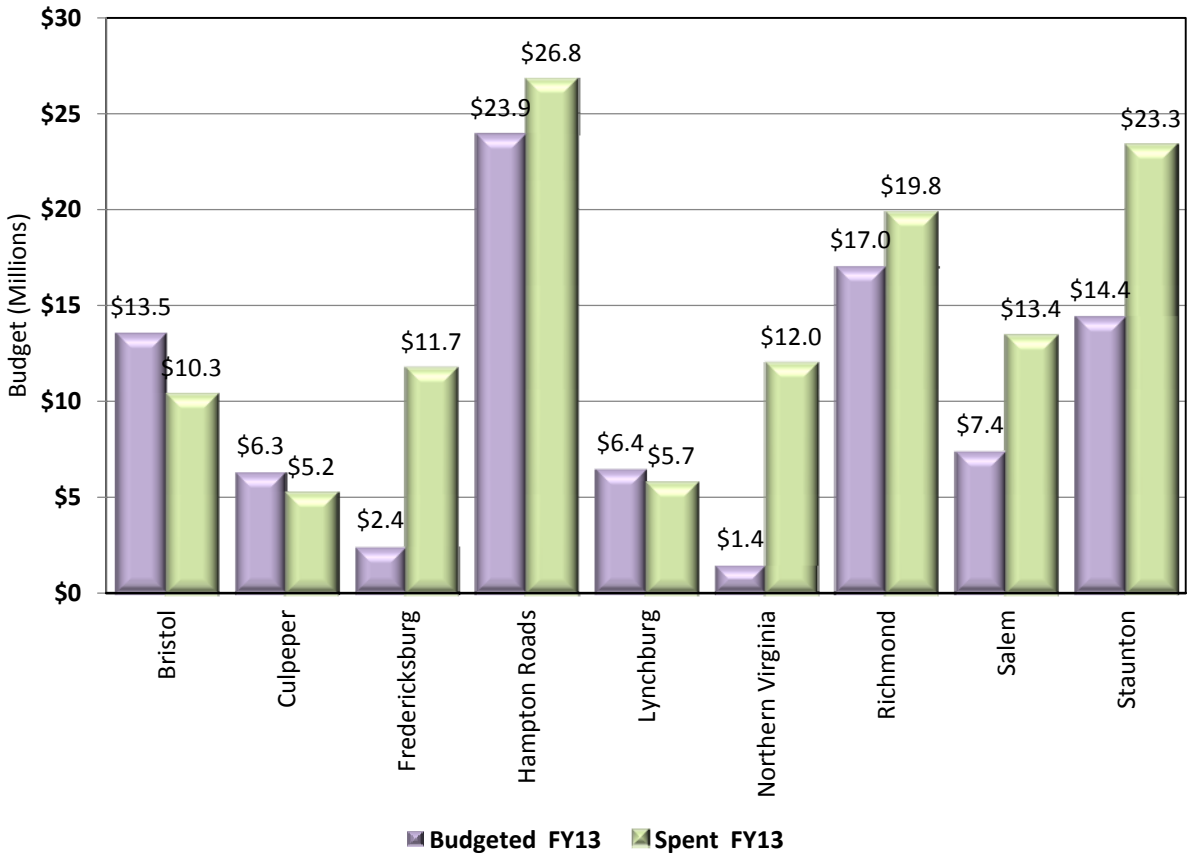


Chart 18 shows the distribution of the $103M budgeted for the DBF in FY13 among Districts in the purple. The expenditures for bridge projects in the S&B 603 Construction Program for FY13 are shown in green. The program was budgeted for $103M and had $128.2M in expenditures for FY13. It is possible to spend more than budgeted in a fiscal year because construction project UPC's can take on funding over the life of the project which can span over many fiscal years. There were 257 projects in the S&B 603 Construction Program underway and charged in FY13.

Chart 18 – S&B FY13 603 Construction Program Budget vs. Expenditures by District



The Construction Program for the S&B Division was budgeted $102.7M in FY13. Of the $102.7M, $10M were programmed to a generic UPC by the Programming Division Office at the direction of Executive Management for a future project consideration. The remaining $92.7M were budgeted to bridge projects at the discretion of the District Bridge Offices. In FY13, the S&B Construction 603 program had expenditures of $128.2M during the fiscal year. The difference between budgeted and actual expenditures can be primarily attributed to the multi-year nature of the projects that comprise the Dedicated Bridge Fund and should not imply that project budgets are being exceeded in a regular fashion.

The overall SYIP estimate for the S&B Division bridge projects is $1.08B for FY14-19. This estimate is comprised of $564.4M in CTB funds that have been allocated to projects already in the SYIP at the discretion of the CTB and remaining $515.6M are MAP-21 federal funds. The federal funds are comprised of the NHPP-BR ($117M, 23%); STP-BR ($312M, 60%) and STP-BROS ($86M, 17%).

Moving forward with the MAP-21 funds for the S&B 603 Construction Program, it would be advantageous for the Programming Division Office to align funding types and levels with classification of the structurally deficient inventory. NHS and NBI status are playing a more important role into the types of money we can use on structurally deficient bridges for rehabilitation and replacements in the Construction 603 program.

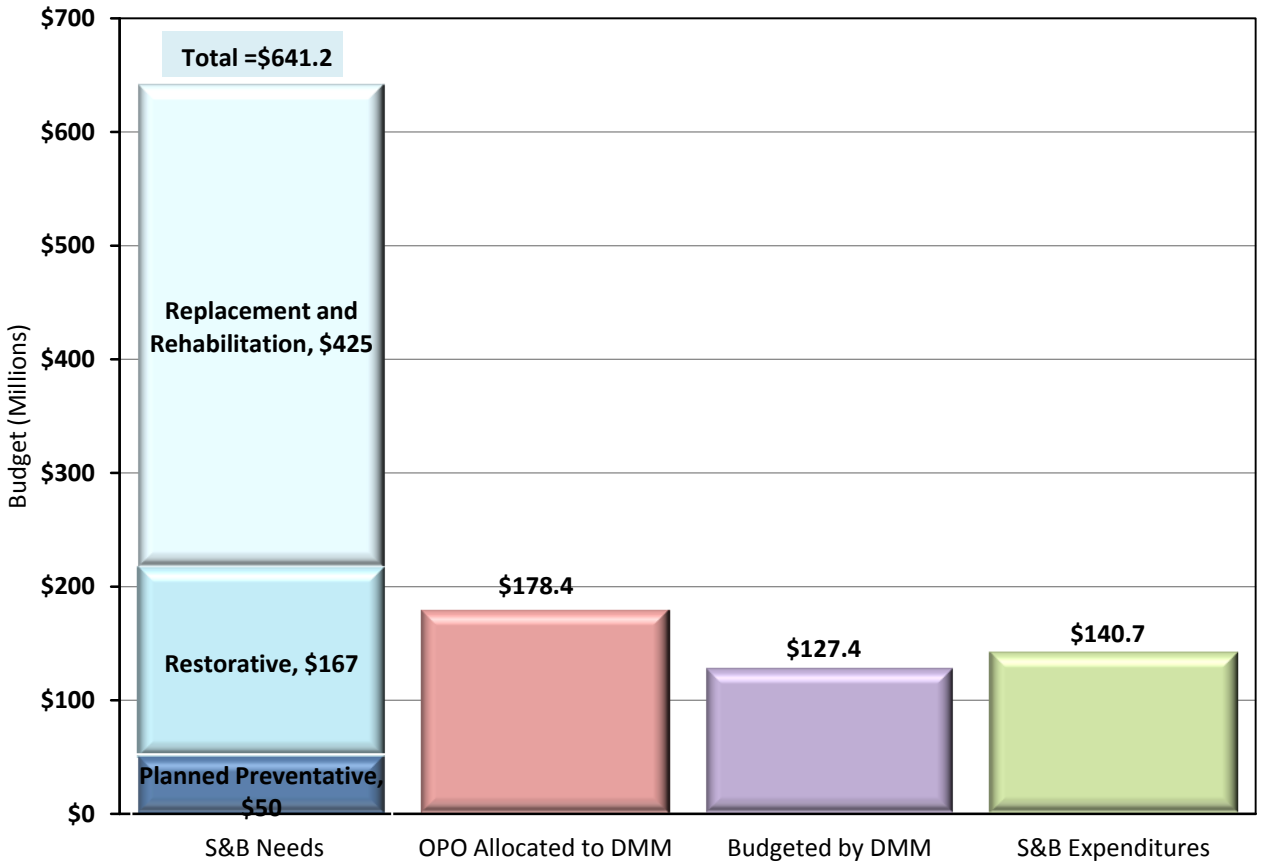
604 Maintenance Program Overview: The S&B 604 Maintenance Program is developed and managed by the District Bridge Offices in accordance with the statewide Maintenance 604 Program. VDOT's Operations Planning Office (OPO) distributes these funds to each District maintenance office and the Central Office every fiscal year in accordance with the direction of VDOT's Executive Management and the Commonwealth Transportation Board. VDOT's management may consult and utilize the Biennial Needs Report when determining funding distribution.

Along with the funding distribution, OPO provides fund allocations to the District Maintenance Managers (DMM). These allocations represent a suggested funding level for each of the activities that require 604 funds during the year. 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. Responsible managers 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. The reported needs *do not* represent the total funding required to improve all of the structures. Rather, each Division has been directed to report the amount of money required to meet it's performance measures. Total maintenance needs are considerably higher than the performance-measure amount of funding shown in the Needs Report.

Chart 19 below compares the total amounts of the S&B 604 Maintenance Program needs, allocations provided to the DMM by the OPO, the actual budgets set by the DMM and the expenditures for FY13.

Chart 19 – S&B FY13 604 Maintenance Program Overview



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

Chart 20 shows total S&B 604 maintenance program expenditures for FY13 for each district by Cost Center and UPC. The total FY13 604 program expenditures were $140.7 million.

Chart 21 compares the 604 budgets to actual expenditures for each District in terms of the money budgeted and spent. Overall, $127.4M was budgeted for the S&B 604 maintenance program and $140.7M was spent for FY13. The Maintenance Program for the S&B Division was budgeted $127M and spent $140M. This difference in budget and expenditures is reflective of the reactive nature of the maintenance program. The maintenance funds address any unplanned bridge repairs that come up during the fiscal year.

Chart 20 – S&B FY13 604 Maintenance Program Total Expenditures

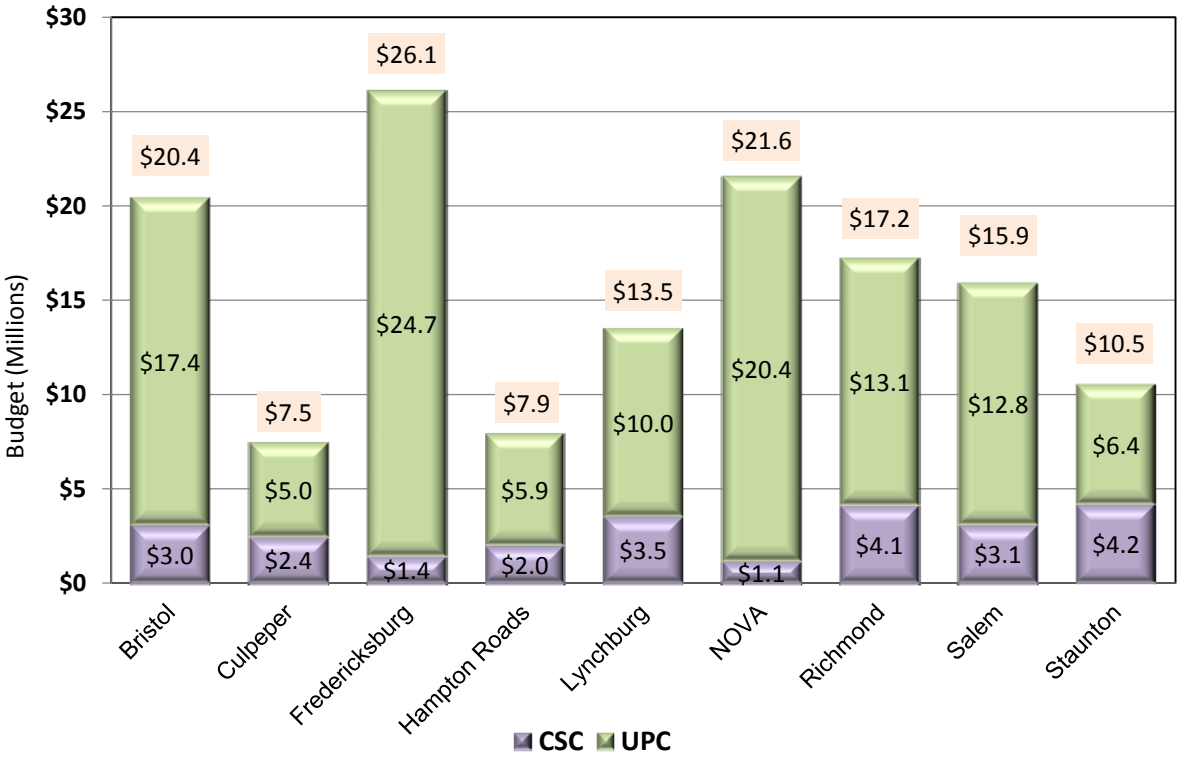
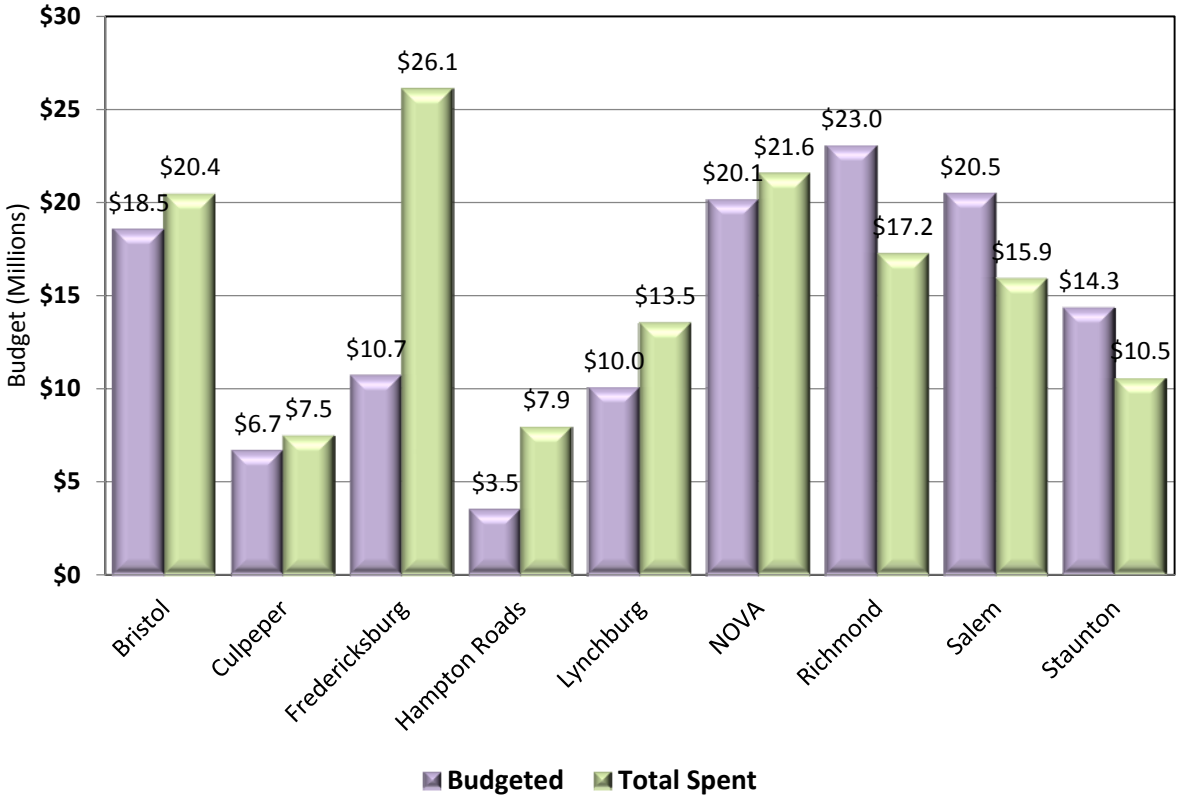


Chart 21 – S&B FY13 604 Maintenance Program Budget vs. Program



Appendix A – Additional Inventory Information on Bridges and Culverts

Tables A.1 and A.2, shows the total number of bridges and culverts separately in the Commonwealth. Tables A.3 and A.4, shows the total number of NBI bridges and culverts separately in the Commonwealth and Tables A.5 and A.6 shows the Non-NBI bridges and culverts. Charts A.1 through A.4 shows the average age of structures by system by district.

Table A.1 – Total Number of Bridges by District

DISTRICT	Number of Bridges				
	Interstate	Primary	Secondary	Urban	Total
Bristol	136	546	1,559	203	2,444
Salem	117	478	1,348	76	2,019
Lynchburg	0	360	800	41	1,201
Richmond	268	507	668	101	1,544
Hampton Roads	336	338	321	202	1,197
Fredericksburg	21	142	214	6	383
Culpeper	71	254	670	12	1,007
Staunton	205	499	1,407	65	2,176
NOVA	244	312	482	40	1,078
Grand Total	**1,398**	**3,436**	**7,469**	**746**	**13,049**

Table A.2 – Total Number of Culverts by District

DISTRICT	Number of Culverts				
	Interstate	Primary	Secondary	Urban	Total
Bristol	80	406	485	20	991
Salem	100	322	585	37	1,044
Lynchburg	0	303	592	18	913
Richmond	243	292	459	60	1,054
Hampton Roads	123	118	194	60	495
Fredericksburg	58	110	259	2	429
Culpeper	51	242	382	12	687
Staunton	224	325	728	44	1,321
NOVA	123	199	650	42	1,014
Grand Total	**1,002**	**2,317**	**4,334**	**295**	**7,948**

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

DISTRICT	Number of Bridges				
	Interstate	Primary	Secondary	Urban	Total
Bristol	136	417	981	200	1,734
Salem	113	363	898	75	1,449
Lynchburg	0	330	678	41	1,049
Richmond	265	478	613	100	1,456
Hampton Roads	336	332	299	201	1,168
Fredericksburg	21	134	190	6	351
Culpeper	71	165	510	11	757
Staunton	205	370	810	65	1,450
NOVA	244	277	390	40	951
Grand Total	**1,391**	**2,866**	**5,369**	**739**	**10,365**

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

DISTRICT	Number of Culverts				
	Interstate	Primary	Secondary	Urban	Total
Bristol	28	100	129	18	275
Salem	26	78	230	25	359
Lynchburg	0	87	243	18	348
Richmond	90	121	232	60	503
Hampton Roads	42	38	92	60	232
Fredericksburg	22	42	111	1	176
Culpeper	14	73	171	6	264
Staunton	49	84	235	40	408
NOVA	28	87	311	36	462
Grand Total	**299**	**710**	**1,754**	**264**	**3,027**

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

DISTRICT	Number of Bridges				
	Interstate	Primary	Secondary	Urban	Total
Bristol	0	129	578	3	710
Salem	4	115	450	1	570
Lynchburg	0	30	122	0	152
Richmond	3	29	55	1	88
Hampton Roads	0	6	22	1	29
Fredericksburg	0	8	24	0	32
Culpeper	0	89	160	1	250
Staunton	0	129	597	0	726
NOVA	0	35	92	0	127
Grand Total	**7**	**570**	**2,100**	**7**	**2,684**

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

DISTRICT	Number of Culverts				
	Interstate	Primary	Secondary	Urban	Total
Bristol	52	306	356	2	716
Salem	74	244	355	12	685
Lynchburg	0	216	349	0	565
Richmond	153	171	227	0	551
Hampton Roads	81	80	102	0	263
Fredericksburg	36	68	148	1	253
Culpeper	37	169	211	6	423
Staunton	175	241	493	4	913
NOVA	95	112	339	6	552
Grand Total	**703**	**1,607**	**2,580**	**31**	**4,921**

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

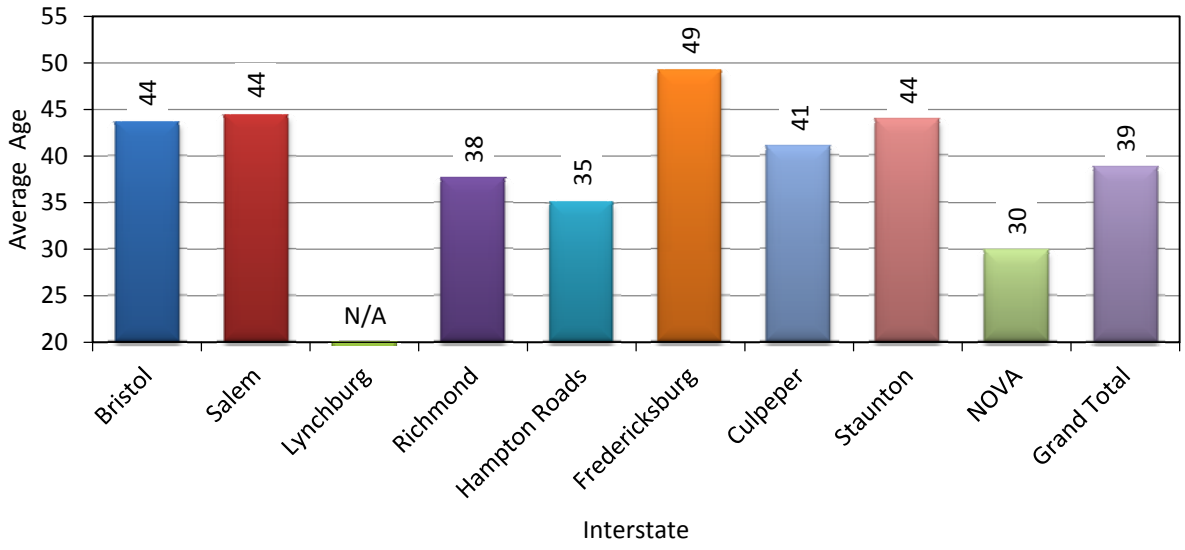


Chart A.2 – Average Age of Primary Structures by District

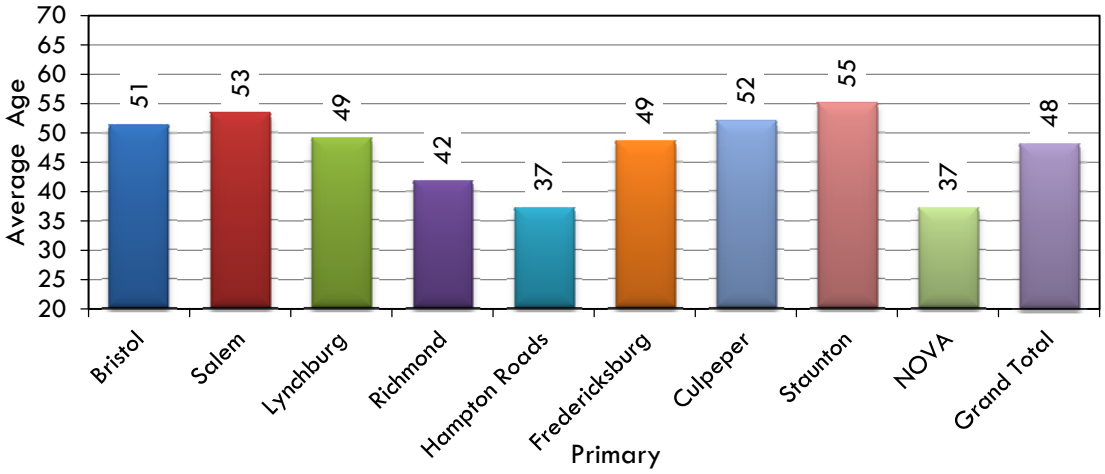


Chart A.3 – Average Age of Secondary Structures by District

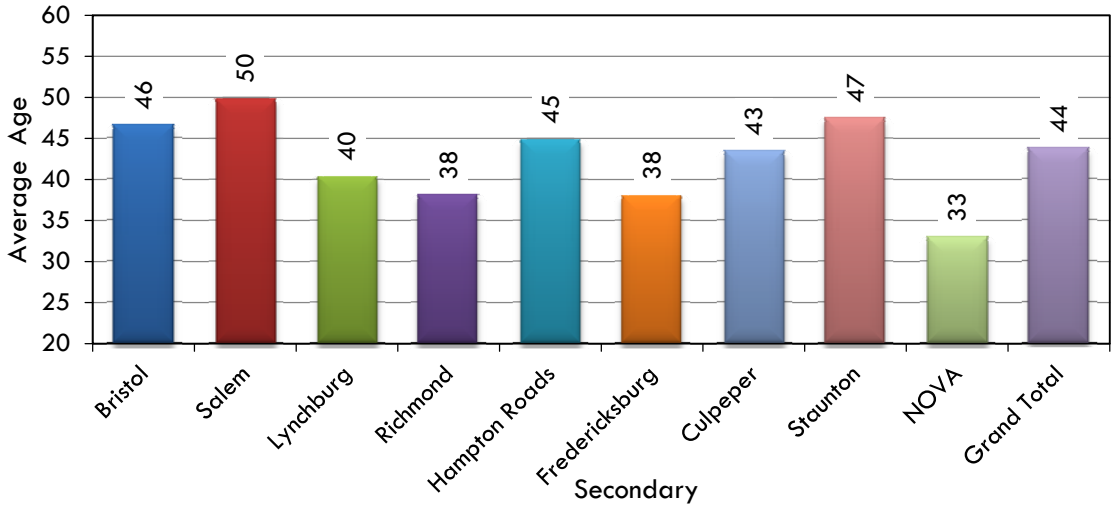
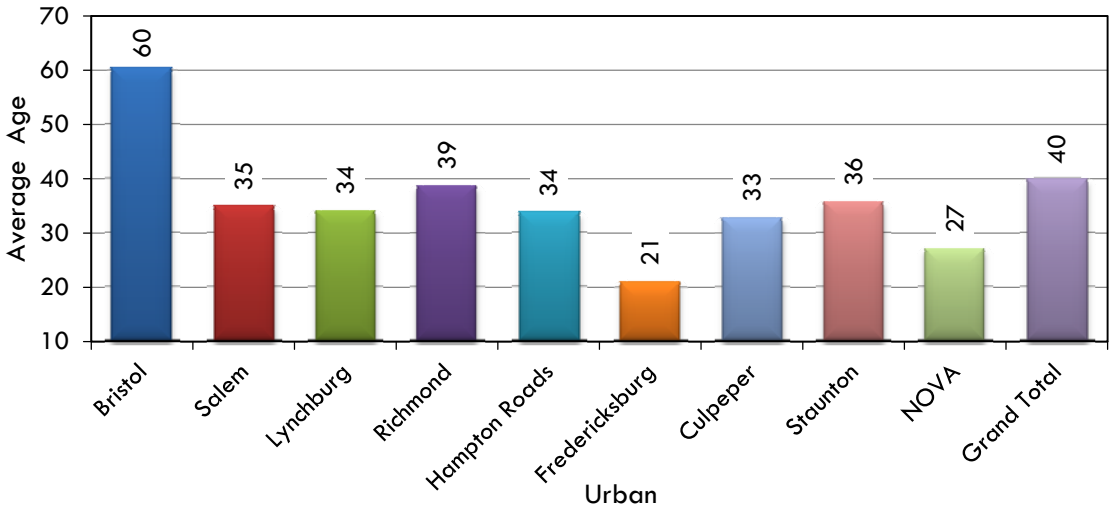


Chart A.4 – Average Age of Urban Structures by District



Appendix B – Additional Inventory Information on Ancillary Structures

Tables B.1 through B.4 provides 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	23	39	2	10	74	2.1%
Salem	80	83	8	0	171	4.9%
Lynchburg	4	52	33	0	89	2.5%
Richmond	390	326	141	1	858	24.4%
Hampton Roads	319	418	99	56	892	25.3%
Fredericksburg	45	21	9	0	75	2.1%
Culpeper	8	18	10	3	39	1.1%
Staunton	10	48	16	0	74	2.1%
Northern Virginia	547	492	157	52	1,248	35.5%
Statewide	**1,426**	**1,497**	**475**	**122**	**3,520**	**100.0%**

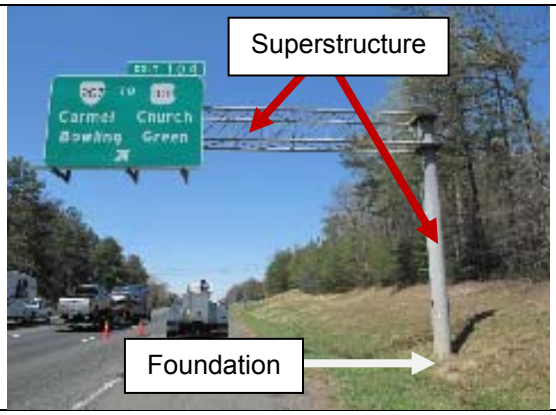


Figure 1 – Cantilever Sign Structure

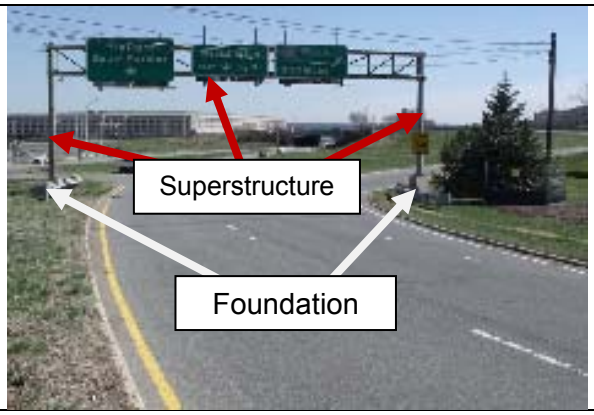


Figure 2 – Overhead Sign Structure

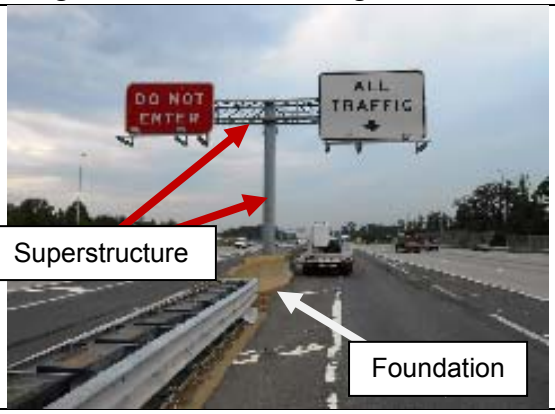


Figure 3 – Butterfly Sign Structure

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	795	819	4.5%
Lynchburg	0	302	302	1.7%
Richmond	530	1,530	2,060	11.4%
Hampton Roads	1,337	5,464	6,801	37.5%
Fredericksburg	128	320	448	2.5%
Culpeper	0	157	157	0.9%
Staunton	0	45	45	0.2%
Northern Virginia	883	6,160	7,043	38.8%
Statewide	**2,904**	**15,228**	**18,132**	**100.0%**

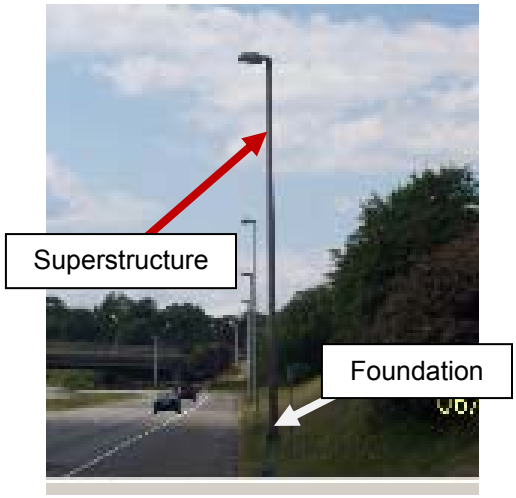


Figure 5 – Luminaire Structure

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	199	0	0	44	243	2.8%
Salem	469	0	0	70	539	6.1%
Lynchburg	250	0	0	2	252	2.9%
Richmond	1,155	0	0	366	1,521	17.2%
Hampton Roads	391	0	0	102	493	5.6%
Fredericksburg	697	1	0	16	714	8.1%
Culpeper	359	0	0	8	367	4.2%
Staunton	366	0	0	85	451	5.1%
Northern Virginia	2,981	0	14	1,251	4,246	48.1%
Statewide	**6,867**	**1**	**14**	**1,944**	**8,826**	**100.0%**

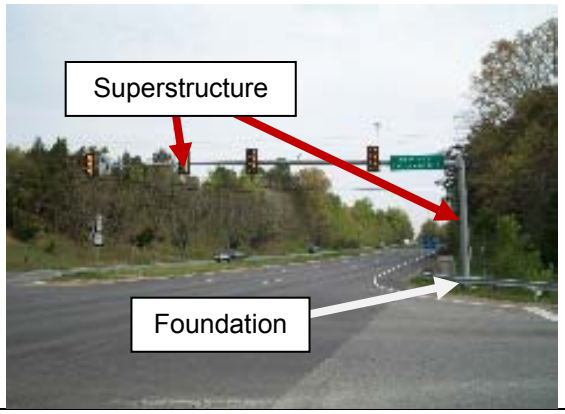


Figure 7 – Cantilevered Arm Traffic Signal Structure

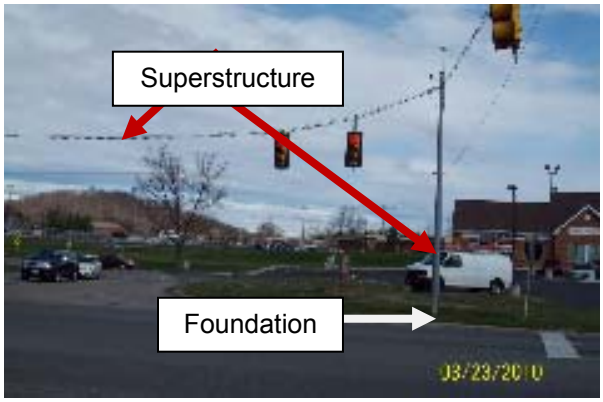


Figure 8– Span Wire Traffic Signal Structure

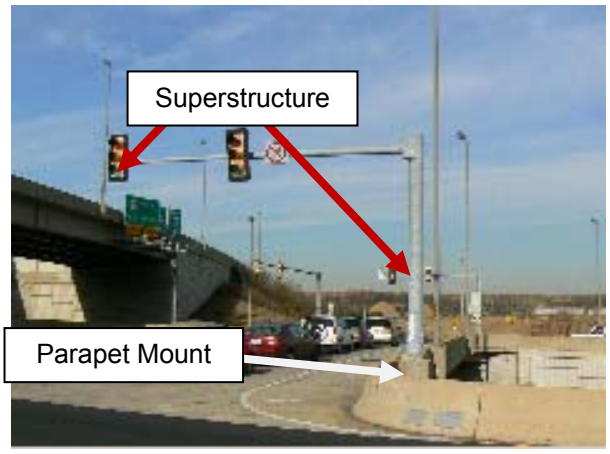


Figure 9 – Parapet Mount - Traffic Signal Structure

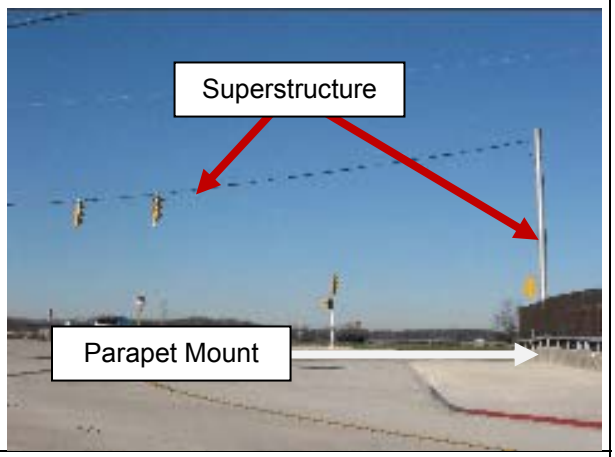


Figure 10 – Parapet Mount - Traffic Signal Structure

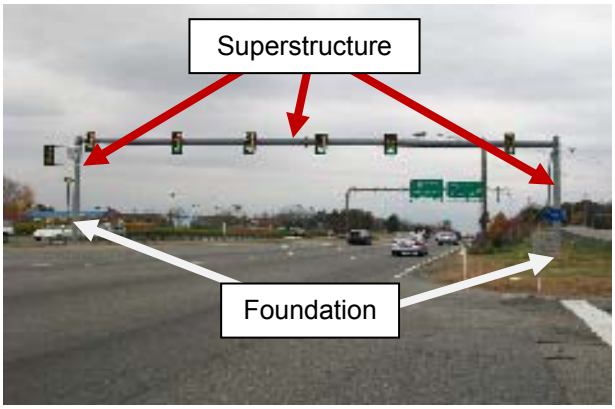


Figure 11 – Overhead Traffic Signal Structure

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	9.3%
Hampton Roads	145	289	434	38.6%
Fredericksburg	1	1	2	0.2%
Culpeper	0	0	0	0.0%
Staunton	26	53	79	7.0%
Northern Virginia	327	87	414	36.8%
Statewide	**693**	**431**	**1,124**	**100.0%**

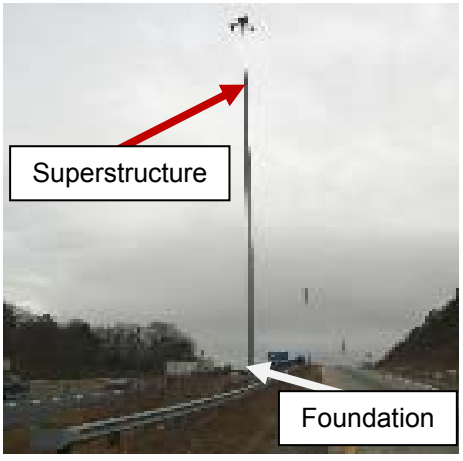


Figure 12 – High Mast Light Structure

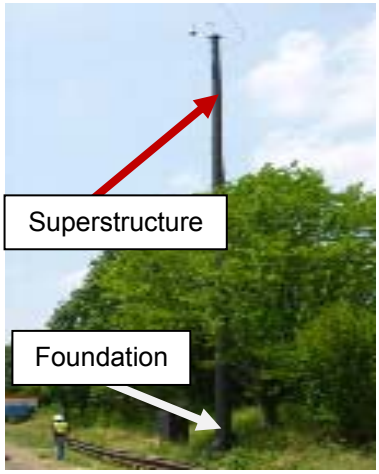


Figure 13 – Camera Pole Structure

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 and are used 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

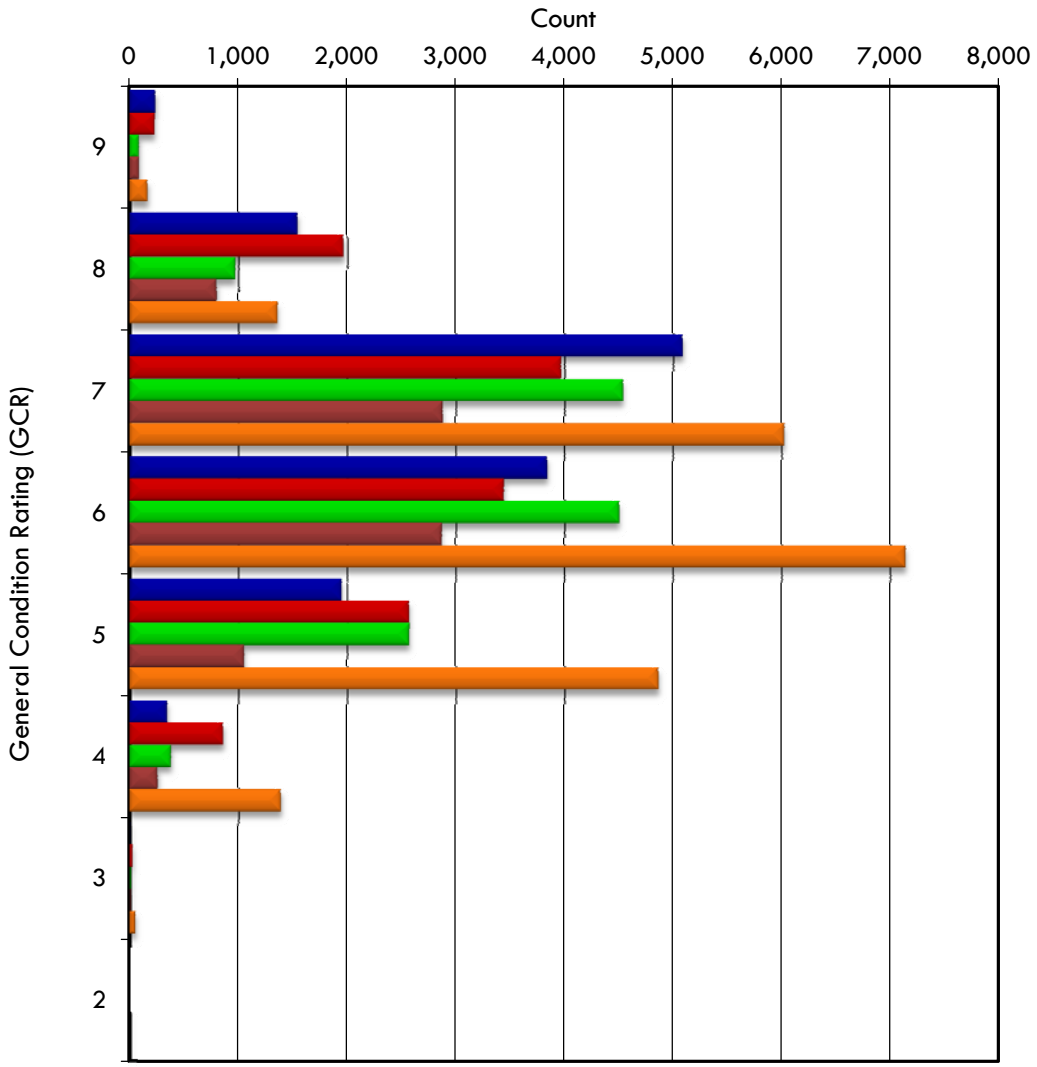
Typical Examples of General Condition Ratings for Superstructure		
General Condition Rating	Example Steel	Concrete
4 or less - (Poor Condition) Structurally Deficient	 Bridge Superstructure with advanced section loss	 Concrete Beam with major spalling (bottom of beam viewed from below)
5 – Fair Condition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

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

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

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.24 below

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



	2	3	4	5	6	7	8	9
Deck	0	9	345	1950	3840	5086	1541	234
Super	0	28	856	2568	3442	3967	1964	229
Sub	0	14	380	2570	4499	4534	972	85
Culvert	2	13	255	1052	2867	2874	798	87
Min GCR	2	52	1388	4864	7142	6026	1361	162

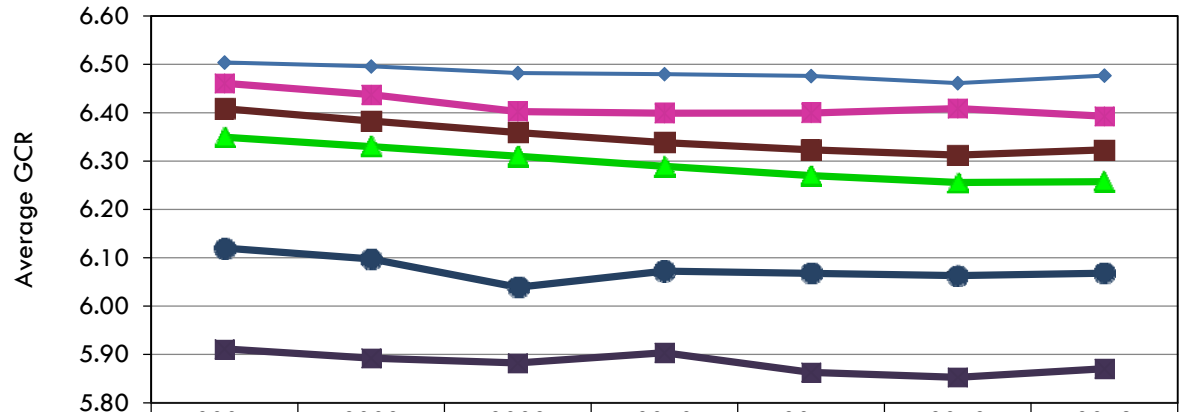
The Min GCR represents the minimum or lowest General Condition Rating (GCR) for the structure (lowest of the 4 component ratings for a particular inspection report; deck, superstructure, substructure, or culvert)

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

Highway System	Structure Component	GCR								Avg. GCR
		9	8	7	6	5	4	3	2	
Interstate	Deck	26	43	505	586	218	19	1	0	6.29
	Superstructure	26	89	382	517	346	38	0	0	6.15
	Substructure	25	43	299	604	420	7	0	0	6.02
	Bridge Min GCR	25	29	180	542	567	54	1	0	5.74
	Culvert	0	22	298	538	139	5	0	0	6.19
	Min GCR	25	51	478	1,080	706	59	1	0	5.93
Primary	Deck	26	202	1,295	1,149	643	112	4	0	6.26
	Superstructure	28	397	1,096	1,032	708	172	9	0	6.26
	Substructure	16	169	1,258	1,224	687	87	1	0	6.23
	Bridge Min GCR	14	97	846	1,213	1,019	237	10	0	5.87
	Culvert	11	101	805	1,040	325	35	0	0	6.28
	Min GCR	25	198	1,648	2,255	1,345	272	10	0	6.03
Secondary	Deck	166	1,241	2,976	1,882	987	180	2	0	6.62
	Superstructure	160	1,400	2,210	1,705	1,392	586	15	0	6.39
	Substructure	29	682	2,684	2,473	1,352	243	5	0	6.31
	Bridge Min GCR	26	403	1,904	2,303	2,067	748	18	0	5.89
	Culvert	73	627	1,640	1,205	564	210	13	2	6.48
	Min GCR	99	1,030	3,544	3,508	2,631	958	31	2	6.11
Urban	Deck	16	55	310	223	102	34	2	0	6.39
	Superstructure	15	78	279	188	122	60	4	0	6.30
	Substructure	15	78	293	198	111	43	8	0	6.37
	Bridge Min GCR	10	34	225	215	158	94	10	0	5.93
	Culvert	3	48	131	84	24	5	0	0	6.68
	Min GCR	13	82	356	299	182	99	10	0	6.14
All	Deck	234	1,541	5,086	3,840	1,950	345	9	0	6.48
	Superstructure	229	1,964	3,967	3,442	2,568	856	28	0	6.32
	Substructure	85	972	4,534	4,499	2,570	380	14	0	6.26
	Bridge Min GCR	75	563	3,155	4,273	3,811	1,133	39	0	5.87
	Culvert	87	798	2,874	2,867	1,052	255	13	2	6.39
	Min GCR	162	1,361	6,026	7,142	4,864	1,388	52	2	6.07

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

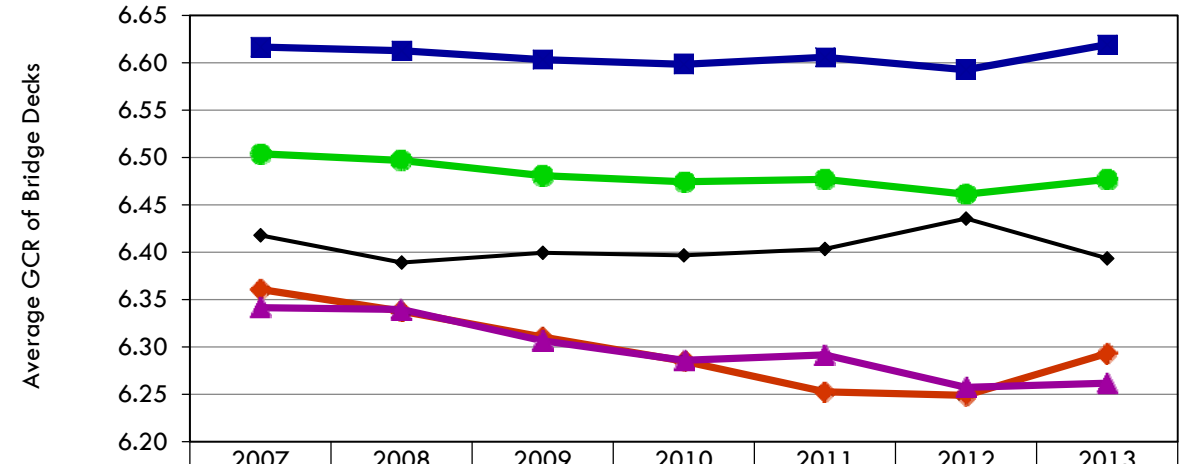
Chart C.2 – Trends in Average General Condition Ratings by Component – Statewide



	2007	2008	2009	2010	2011	2012	2013
Deck	6.50	6.50	6.48	6.48	6.48	6.46	6.48
Super	6.41	6.38	6.36	6.34	6.32	6.31	6.32
Sub	6.35	6.33	6.31	6.29	6.27	6.26	6.26
Br Min	5.91	5.89	5.88	5.90	5.86	5.85	5.87
Culvert	6.46	6.44	6.40	6.40	6.40	6.41	6.39
Str Min	6.12	6.10	6.04	6.07	6.07	6.06	6.07

Fiscal Year

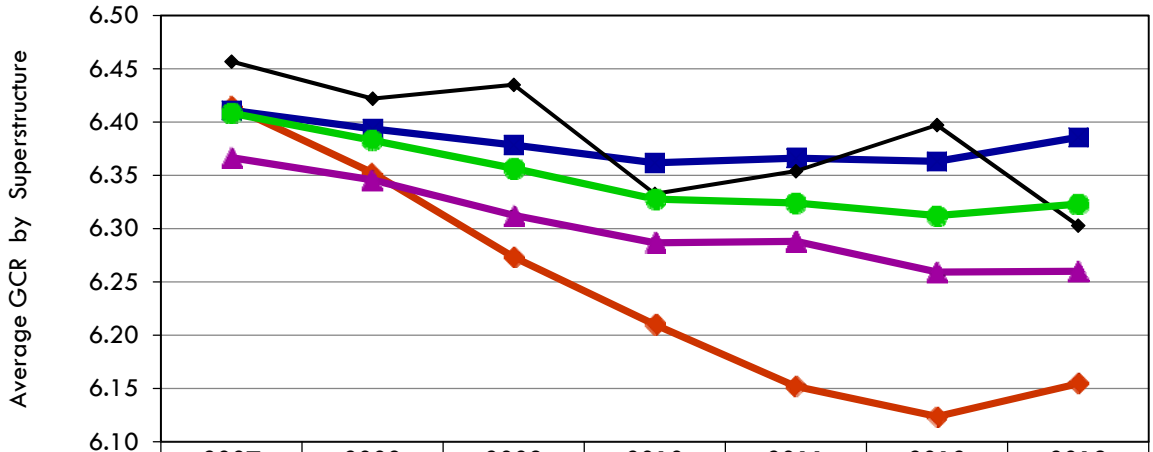
Chart C.3 – Bridge Decks: Trends in Average General Condition Ratings by Highway System



	2007	2008	2009	2010	2011	2012	2013
Interstate	6.36	6.34	6.31	6.29	6.25	6.25	6.29
Primary	6.34	6.34	6.31	6.29	6.29	6.26	6.26
Secondary	6.62	6.61	6.60	6.60	6.61	6.59	6.62
Urban	6.42	6.39	6.40	6.40	6.40	6.44	6.39
Average	6.50	6.50	6.48	6.47	6.48	6.46	6.48

Fiscal Year

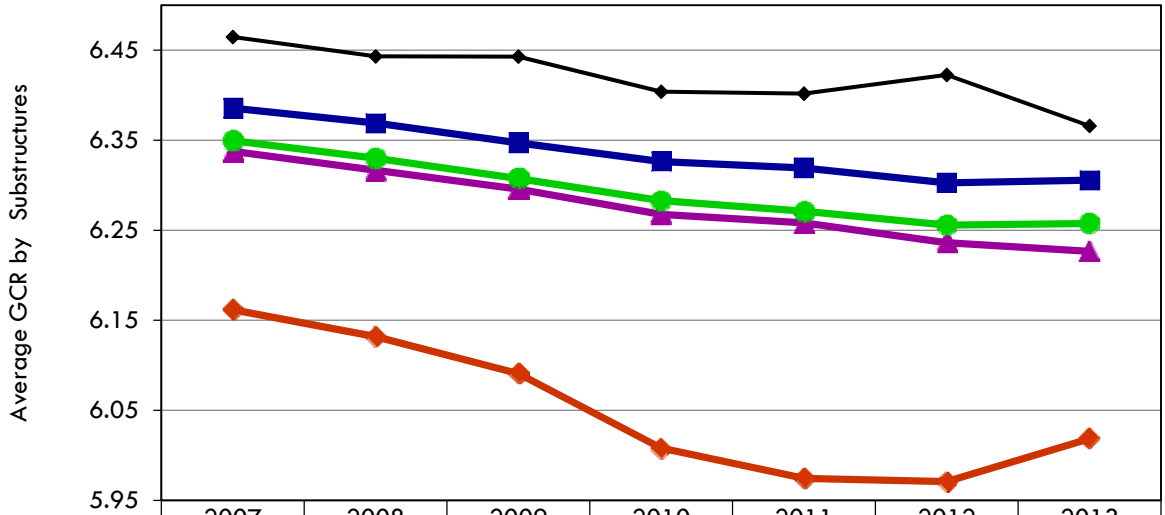
Chart C.4 – Superstructures: Trends in Average General Condition Ratings by Highway System



	2007	2008	2009	2010	2011	2012	2013
Interstate	6.41	6.35	6.27	6.21	6.15	6.12	6.15
Primary	6.37	6.35	6.31	6.29	6.29	6.26	6.26
Secondary	6.41	6.39	6.38	6.36	6.37	6.36	6.39
Urban	6.46	6.42	6.44	6.33	6.35	6.40	6.30
Average	6.41	6.38	6.36	6.33	6.32	6.31	6.32

Fiscal Year

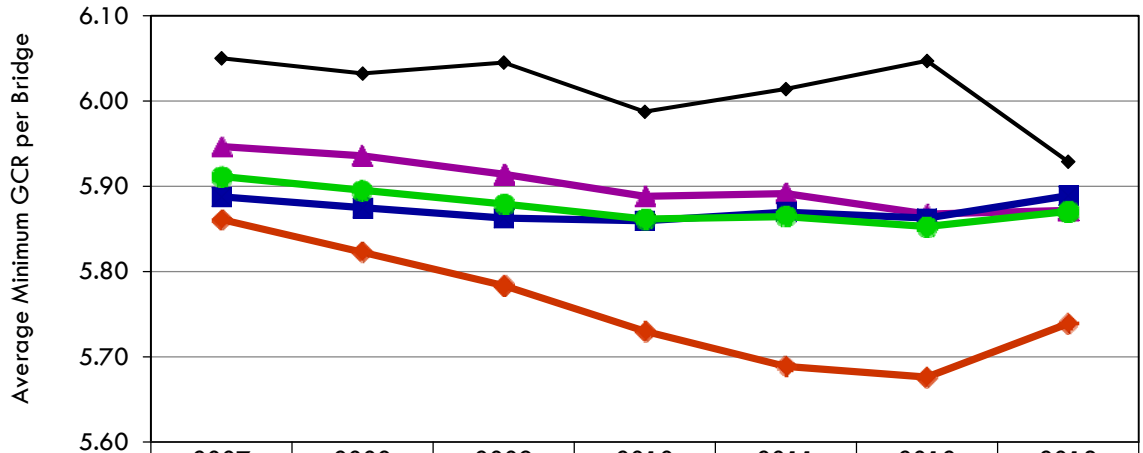
Chart C.5 – Substructures: Trends in Average General Condition Ratings by Highway System



	2007	2008	2009	2010	2011	2012	2013
Interstate	6.16	6.13	6.09	6.01	5.97	5.97	6.02
Primary	6.34	6.32	6.30	6.27	6.26	6.24	6.23
Secondary	6.39	6.37	6.35	6.33	6.32	6.30	6.31
Urban	6.46	6.44	6.44	6.40	6.40	6.42	6.37
Average	6.35	6.33	6.31	6.28	6.27	6.26	6.26

Fiscal Year

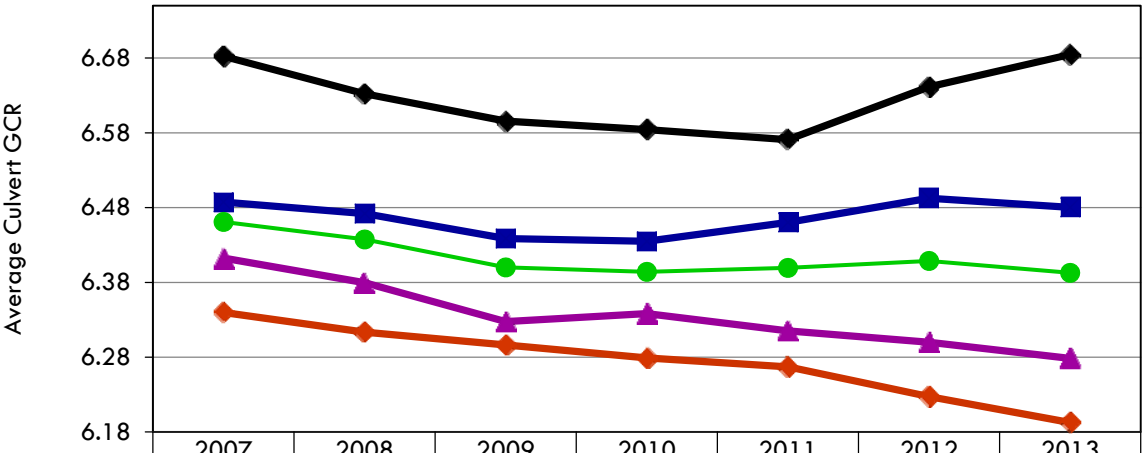
Chart C.6 – Bridges: Trends in Average General Condition Ratings by Highway System



	2007	2008	2009	2010	2011	2012	2013
Interstate	5.86	5.82	5.78	5.73	5.69	5.68	5.74
Primary	5.95	5.94	5.91	5.89	5.89	5.87	5.87
Secondary	5.89	5.87	5.86	5.86	5.87	5.86	5.89
Urban	6.05	6.03	6.05	5.99	6.01	6.05	5.93
Average	5.91	5.90	5.88	5.86	5.86	5.85	5.87

Fiscal Year

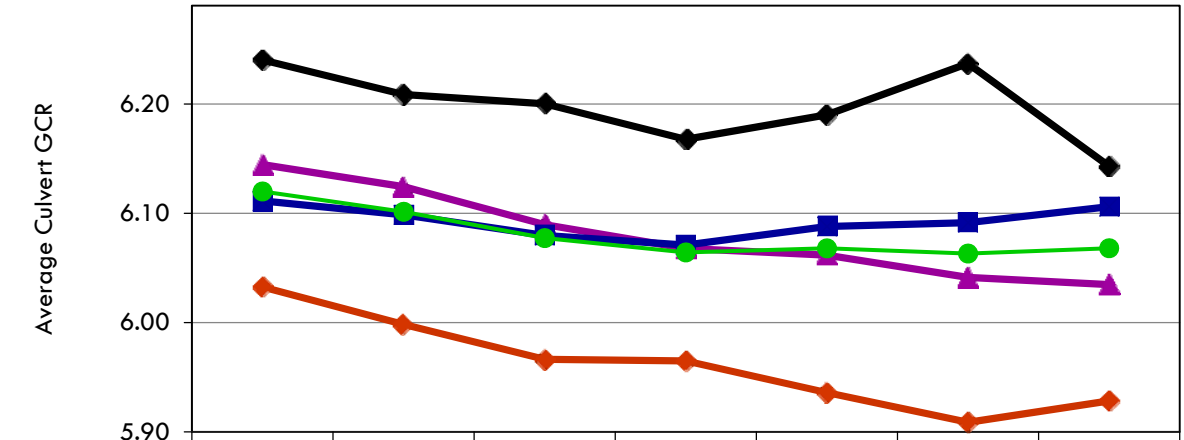
Chart C.7 – Culverts: Trends in Average General Condition Ratings by Highway System



	2007	2008	2009	2010	2011	2012	2013
Interstate	6.34	6.31	6.30	6.28	6.27	6.23	6.19
Primary	6.41	6.38	6.33	6.34	6.32	6.30	6.28
Secondary	6.49	6.47	6.44	6.44	6.46	6.49	6.48
Urban	6.68	6.63	6.60	6.58	6.57	6.64	6.68
Average	6.46	6.44	6.40	6.39	6.40	6.41	6.39

Fiscal Year

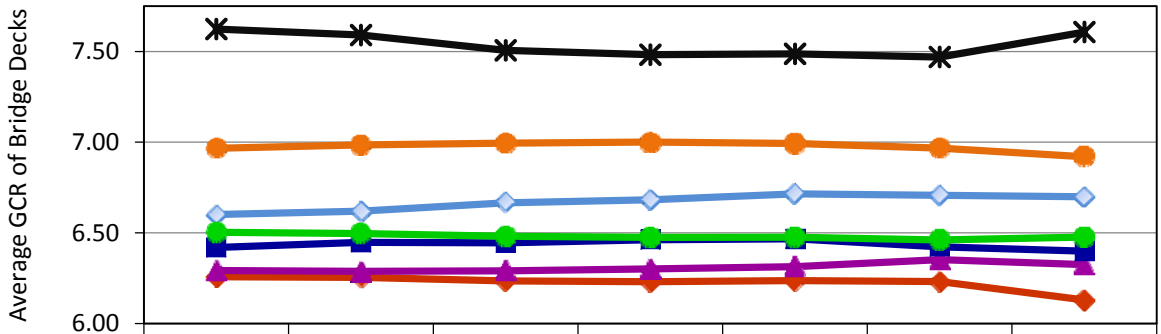
Chart C.8 – Bridges & Culverts: Trends in Average General Condition Ratings by Highway System



	2007	2008	2009	2010	2011	2012	2013
Interstate	6.03	6.00	5.97	5.96	5.94	5.91	5.93
Primary	6.14	6.12	6.09	6.07	6.06	6.04	6.03
Secondary	6.11	6.10	6.08	6.07	6.09	6.09	6.11
Urban	6.24	6.21	6.20	6.17	6.19	6.24	6.14
Average	6.12	6.10	6.08	6.06	6.07	6.06	6.07

Fiscal Year

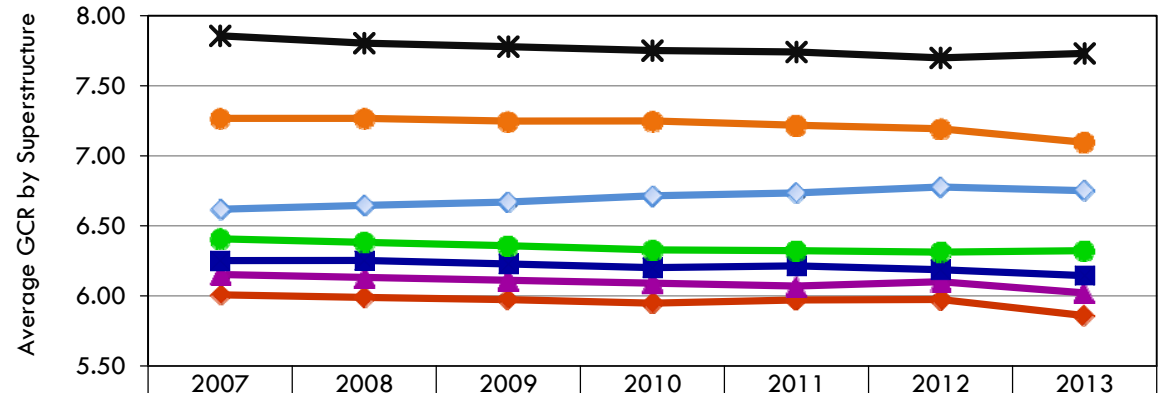
Chart C.9 – Decks: Trends in Average General Condition Ratings by Age Group



	2007	2008	2009	2010	2011	2012	2013
>50	6.26	6.25	6.23	6.23	6.24	6.23	6.13
41 - 50	6.29	6.29	6.29	6.30	6.31	6.35	6.33
31 - 40	6.42	6.45	6.45	6.46	6.47	6.42	6.40
21 - 30	6.60	6.62	6.67	6.68	6.71	6.71	6.70
11 - 20	6.97	6.98	6.99	7.00	6.99	6.97	6.92
0 - 10	7.62	7.59	7.51	7.48	7.49	7.47	7.61
Average	6.50	6.50	6.48	6.47	6.48	6.46	6.48

Fiscal Year

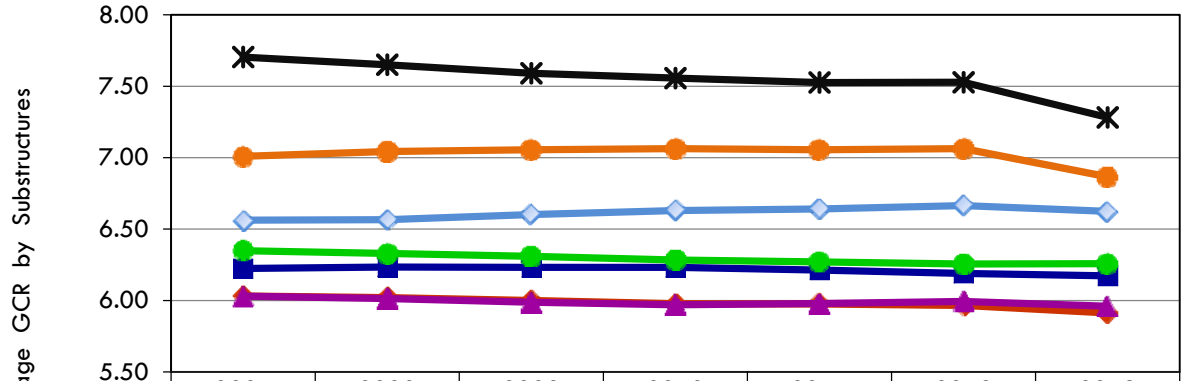
Chart C.10 – Superstructures: Trends in Average General Condition Ratings by Age Group



	2007	2008	2009	2010	2011	2012	2013
>50	6.01	5.99	5.97	5.95	5.97	5.98	5.86
41 - 50	6.15	6.13	6.11	6.09	6.07	6.10	6.02
31 - 40	6.25	6.25	6.23	6.20	6.21	6.19	6.15
21 - 30	6.62	6.65	6.67	6.71	6.74	6.78	6.75
11 - 20	7.27	7.27	7.25	7.25	7.22	7.19	7.10
0 - 10	7.86	7.80	7.78	7.75	7.74	7.70	7.73
Average	6.41	6.38	6.36	6.33	6.32	6.31	6.32

Fiscal Year

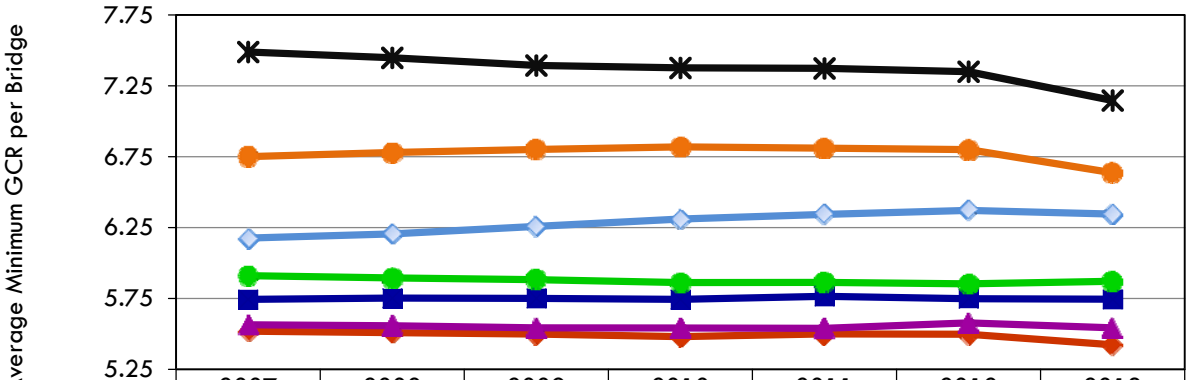
Chart C.11 – Substructures: Trends in Average General Condition Ratings by Age Group



	2007	2008	2009	2010	2011	2012	2013
>50	6.03	6.02	6.00	5.98	5.98	5.97	5.91
41 - 50	6.03	6.01	5.99	5.97	5.98	5.99	5.96
31 - 40	6.22	6.23	6.23	6.23	6.21	6.19	6.17
21 - 30	6.56	6.57	6.60	6.63	6.64	6.67	6.62
11 - 20	7.01	7.04	7.06	7.06	7.06	7.06	6.87
0 - 10	7.70	7.65	7.59	7.56	7.53	7.53	7.28
Average	6.35	6.33	6.31	6.28	6.27	6.26	6.26

Fiscal Year

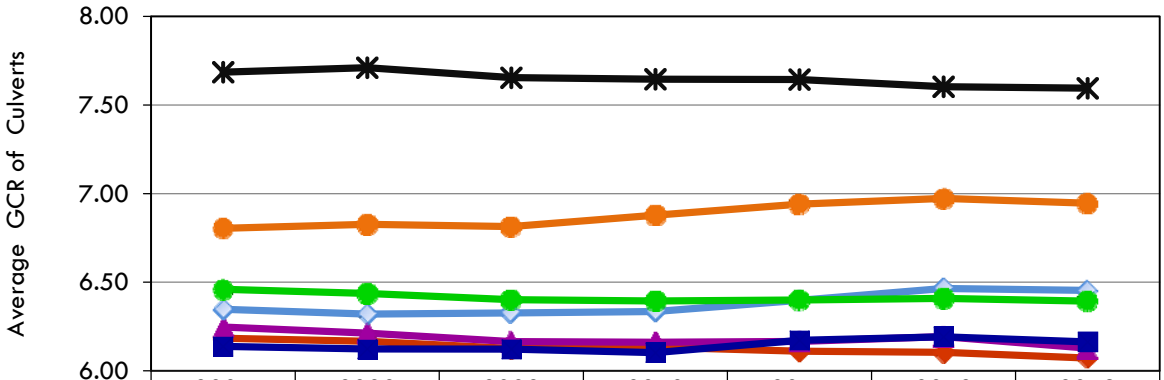
Chart C.12 – Bridges: Trends in Average General Condition Ratings by Age Group



	2007	2008	2009	2010	2011	2012	2013
>50	5.52	5.51	5.50	5.48	5.50	5.50	5.42
41 - 50	5.56	5.56	5.54	5.54	5.54	5.58	5.54
31 - 40	5.74	5.75	5.75	5.74	5.77	5.75	5.74
21 - 30	6.18	6.21	6.26	6.31	6.34	6.37	6.35
11 - 20	6.75	6.78	6.80	6.82	6.81	6.80	6.64
0 - 10	7.49	7.45	7.39	7.38	7.37	7.35	7.15
Average	5.91	5.89	5.88	5.86	5.86	5.85	5.87

Fiscal Year

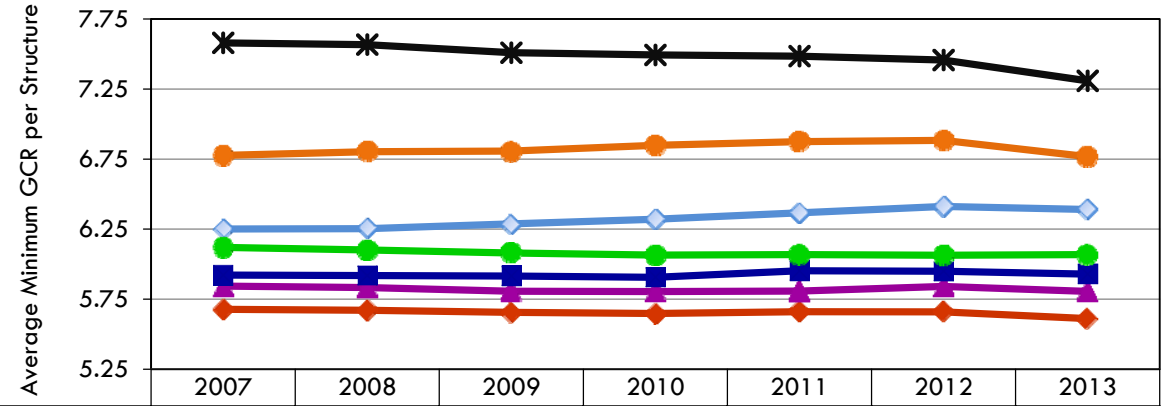
Chart C.13 – Culverts: Trends in Average General Condition Ratings by Age Group



	2007	2008	2009	2010	2011	2012	2013
>50	6.18	6.17	6.13	6.13	6.11	6.10	6.07
41 - 50	6.25	6.21	6.16	6.16	6.17	6.19	6.13
31 - 40	6.14	6.12	6.12	6.10	6.17	6.19	6.16
21 - 30	6.35	6.32	6.33	6.33	6.40	6.46	6.45
11 - 20	6.80	6.83	6.81	6.88	6.94	6.97	6.95
0 - 10	7.69	7.71	7.65	7.65	7.64	7.60	7.59
Average	6.46	6.44	6.40	6.39	6.40	6.41	6.39

Fiscal Year

Chart C.14 – Bridges & Culverts: Trends in Average General Condition Ratings by Age Group



	2007	2008	2009	2010	2011	2012	2013
>50	5.68	5.67	5.66	5.65	5.66	5.66	5.61
41 - 50	5.84	5.83	5.81	5.80	5.81	5.84	5.81
31 - 40	5.92	5.92	5.92	5.91	5.95	5.95	5.93
21 - 30	6.25	6.25	6.29	6.32	6.37	6.41	6.39
11 - 20	6.78	6.80	6.81	6.85	6.88	6.88	6.77
0 - 10	7.58	7.57	7.51	7.49	7.49	7.46	7.31
Average	6.12	6.10	6.08	6.06	6.07	6.06	6.07

Fiscal Year

Chart C.15 – Deck General Condition Ratings by District and Highway System

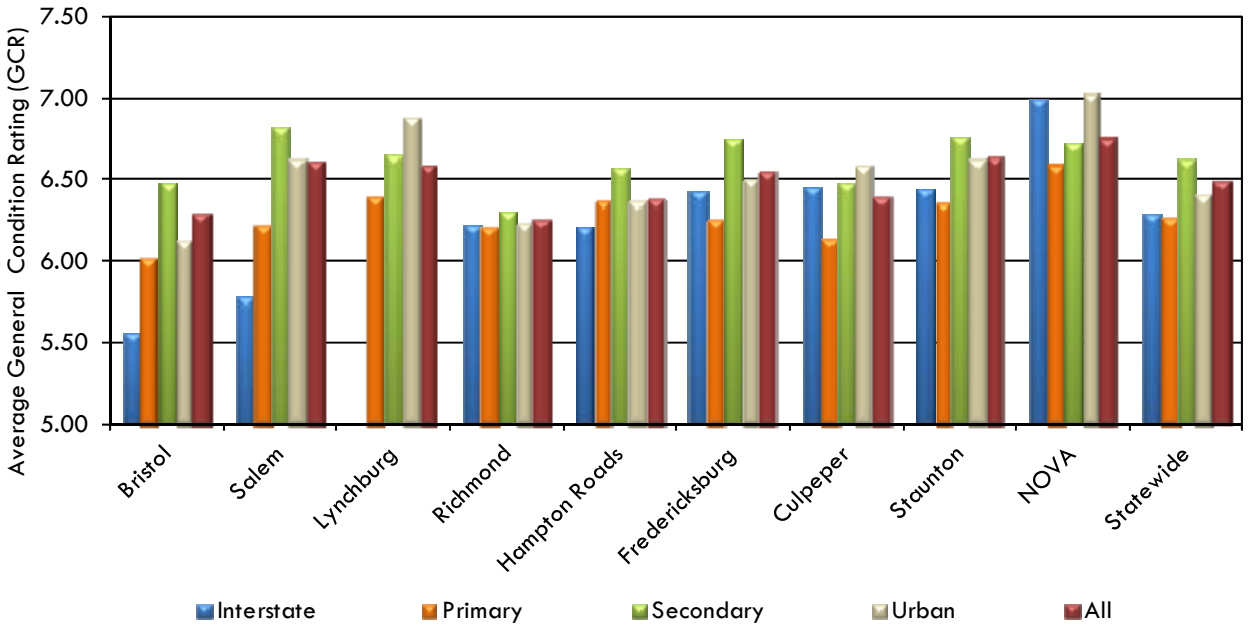


Chart C.16 – Deck General Condition Ratings by Highway System and District

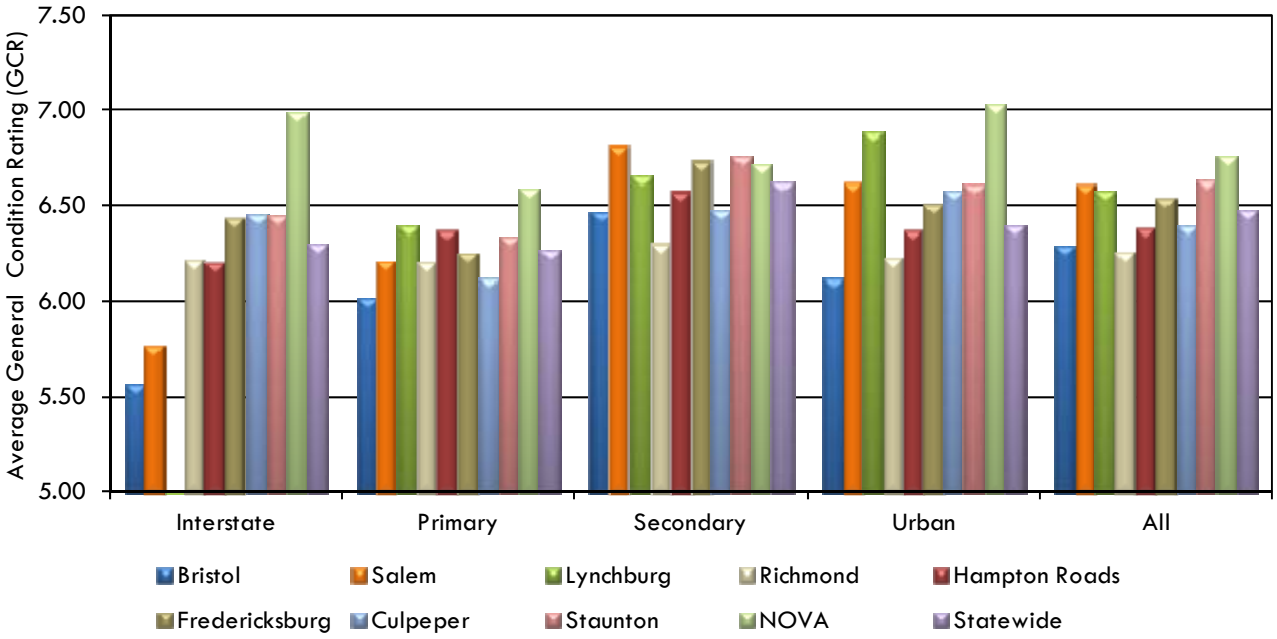


Chart C.17 – Superstructure General Condition Ratings by District and Highway System

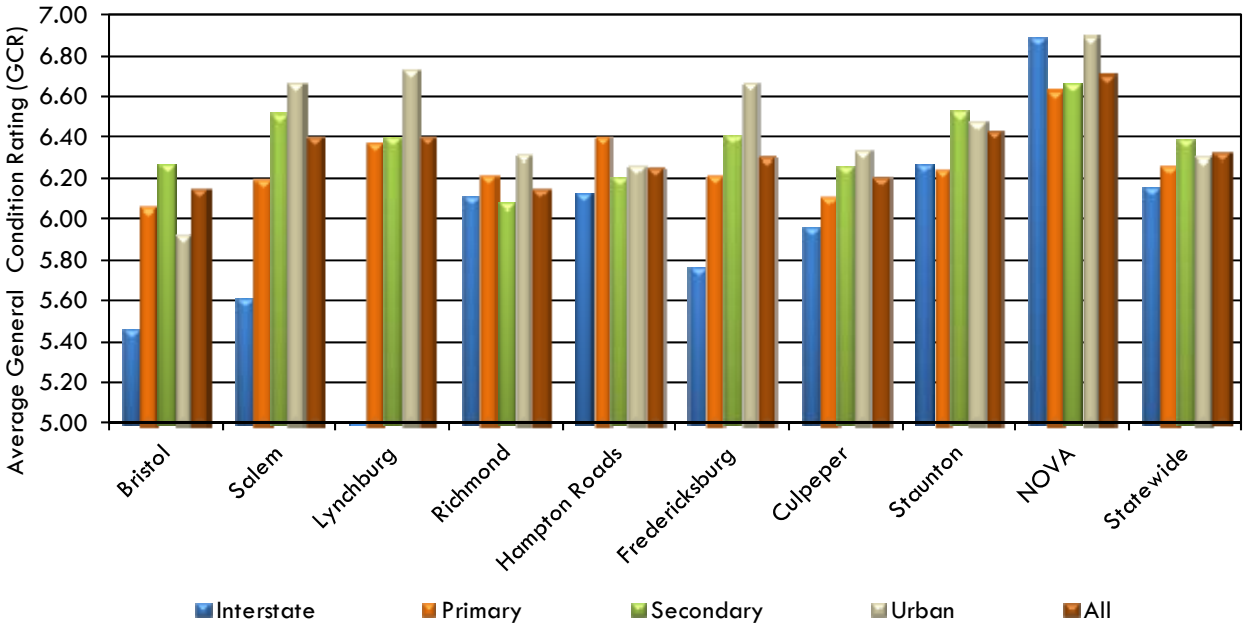


Chart C.18 – Superstructure General Condition Ratings by Highway System and District

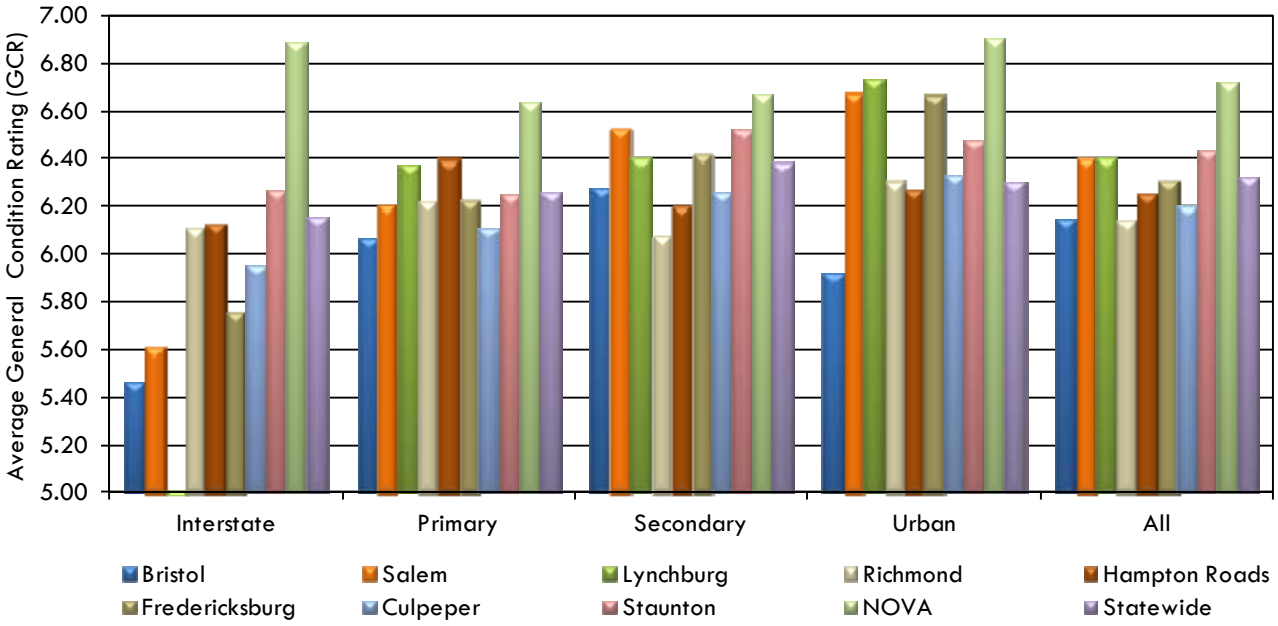


Chart C.19 – Substructure General Condition Ratings by District and Highway System

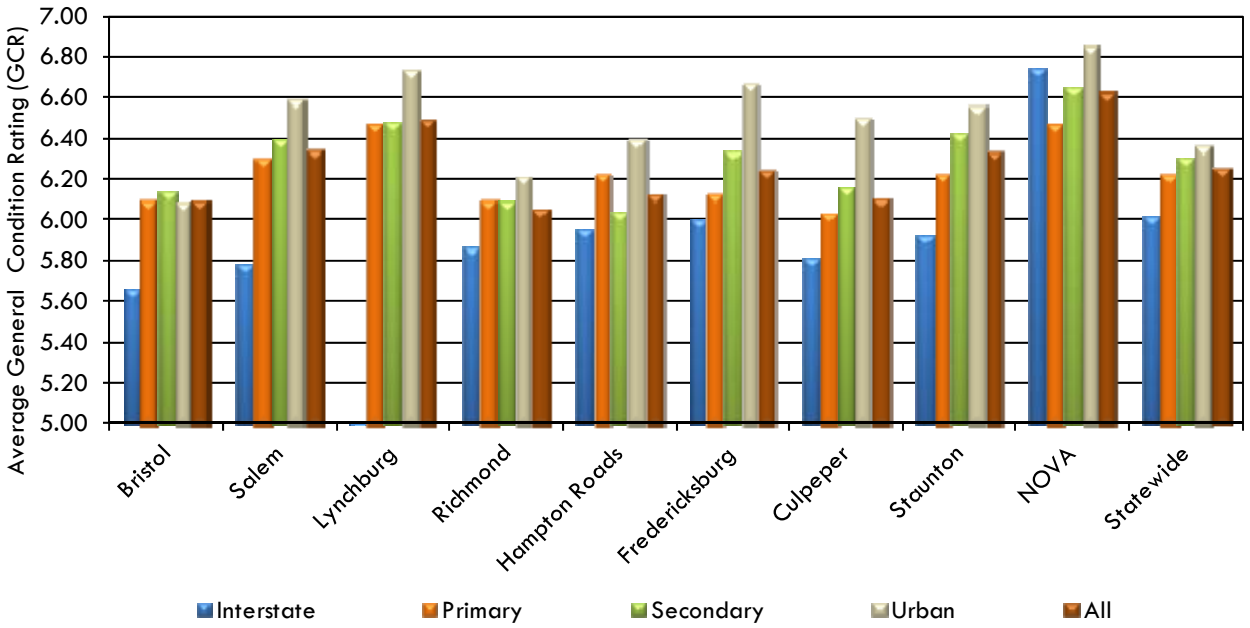


Chart C.20 – Substructure General Condition Ratings by Highway System and District

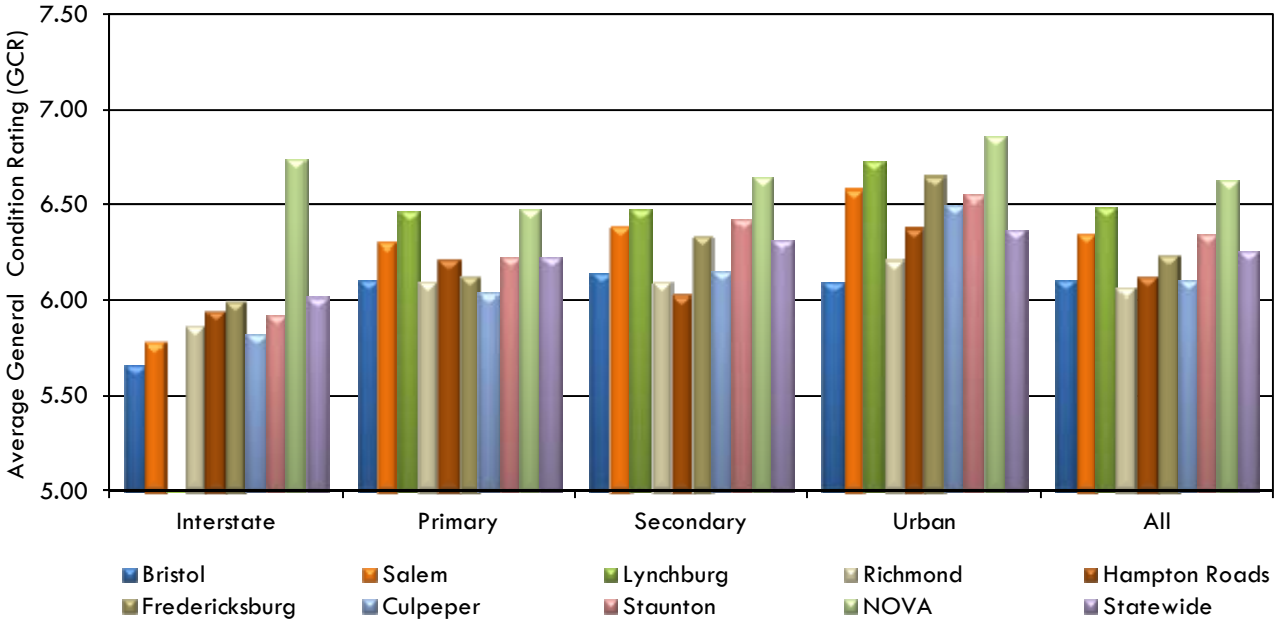


Chart C.21 – Culvert General Condition Ratings by District and Highway System

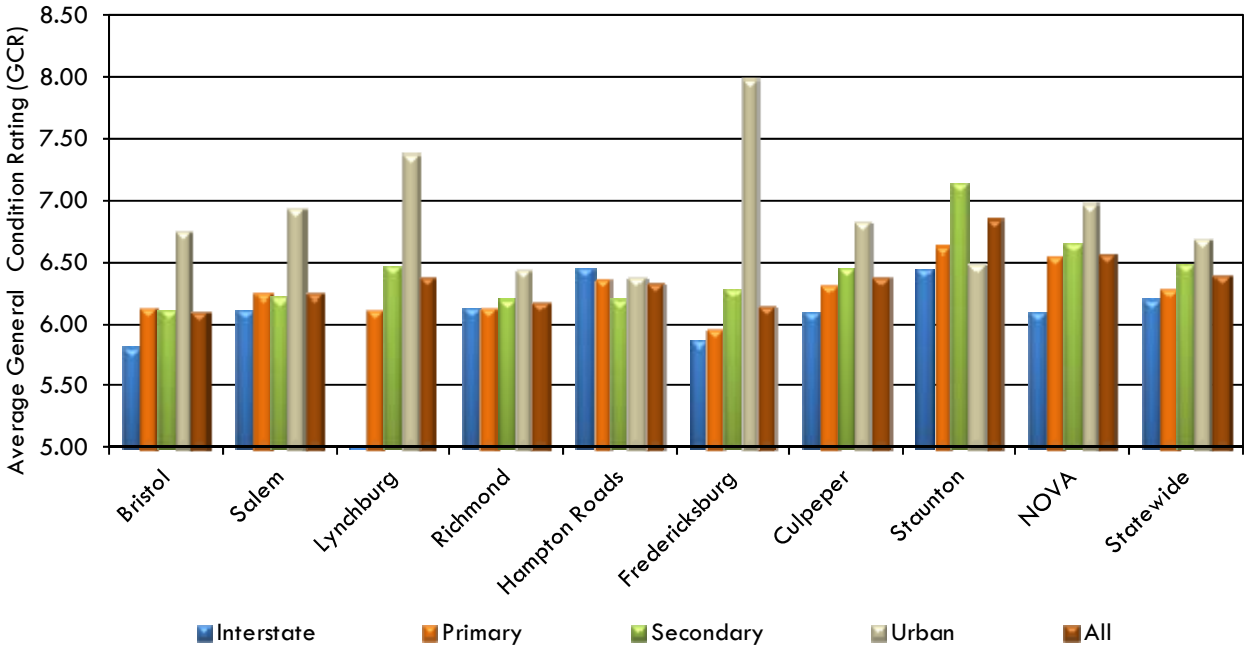


Chart C.22 – Culvert General Condition Ratings by Highway System and District

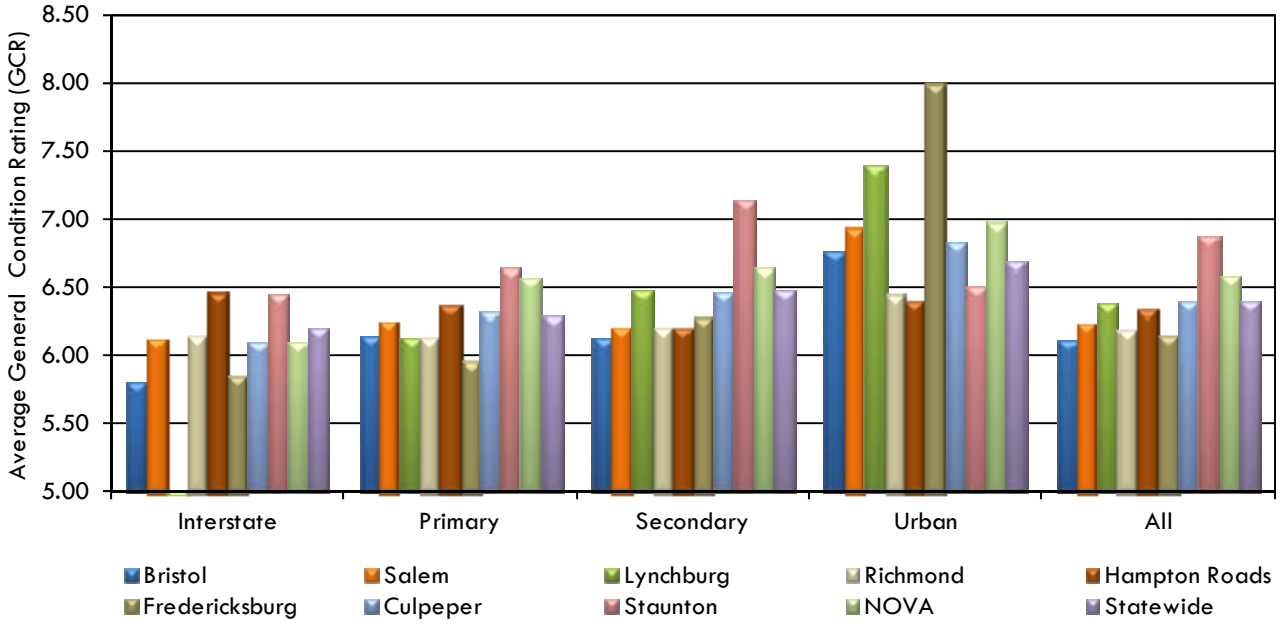


Chart C.23 – Average Minimum General Condition Ratings by District and Highway System

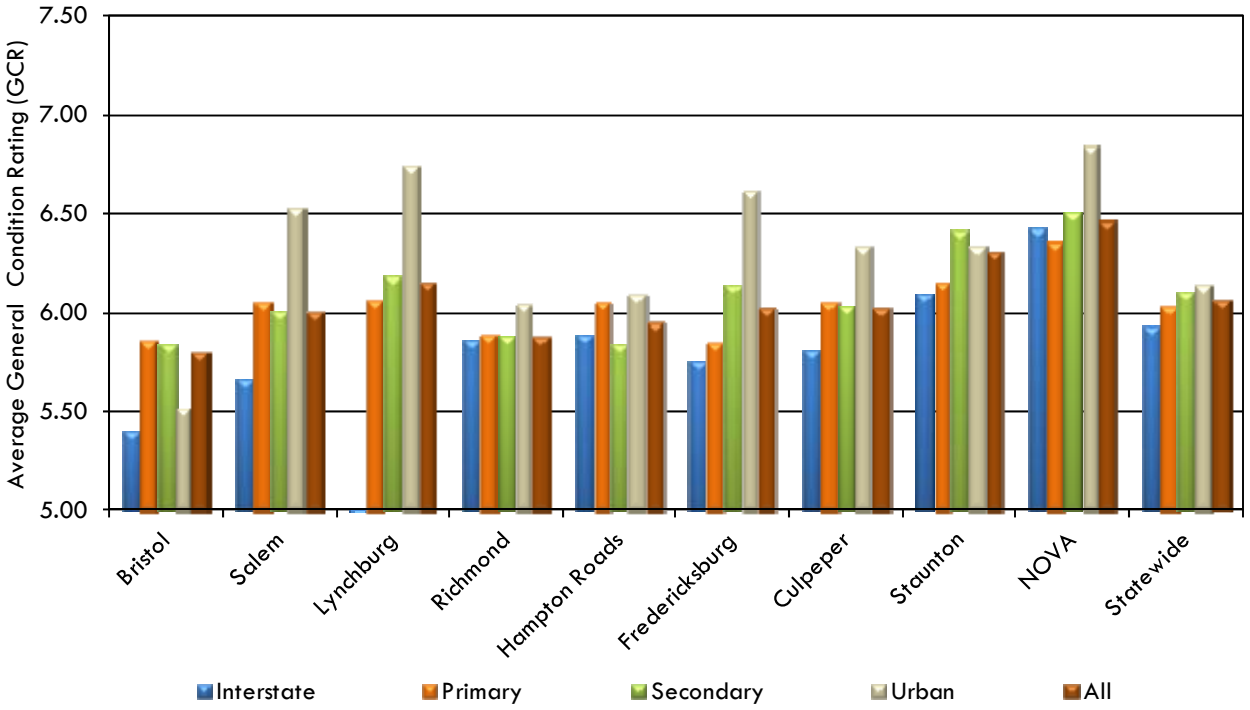
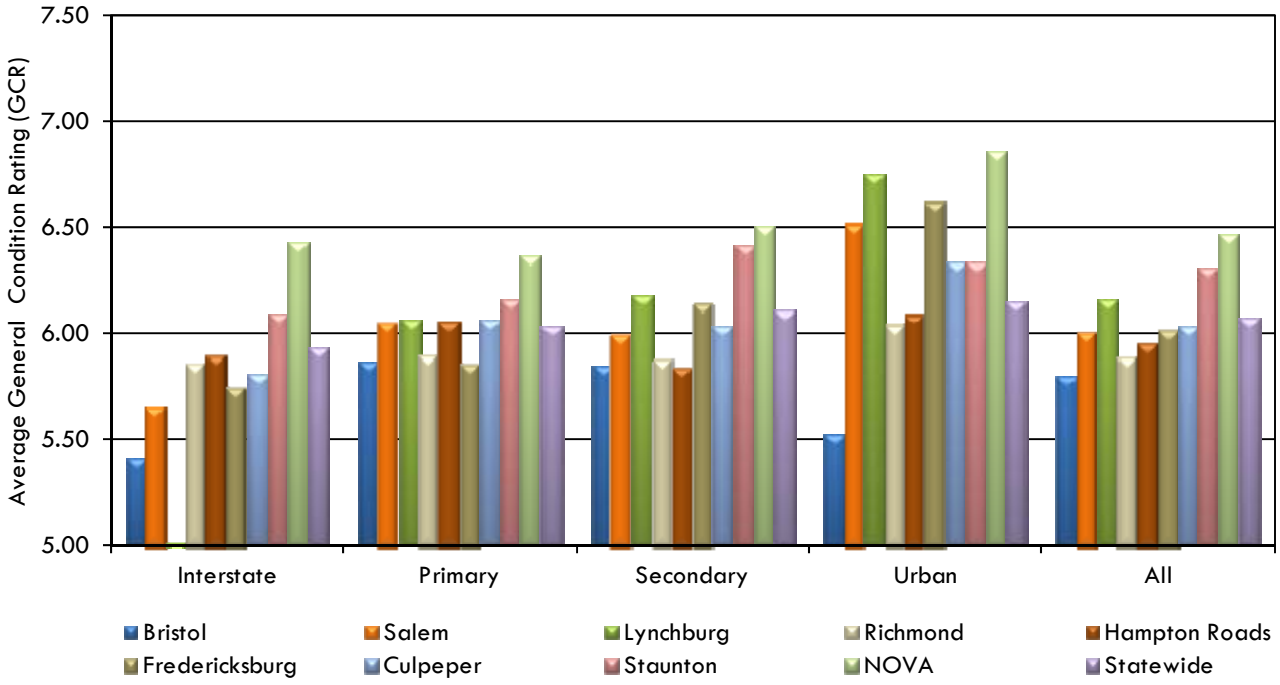


Chart C.24 – Average Minimum General Condition Ratings by Highway System and District



APPENDIX D– INFORMATION ON STRUCTURALLY DEFICIENT STRUCTURES BY HIGHWAY SYSTEM

Chart D.1 – Percentage of Number of Structurally Deficient Structures- Interstate End of FY 2013

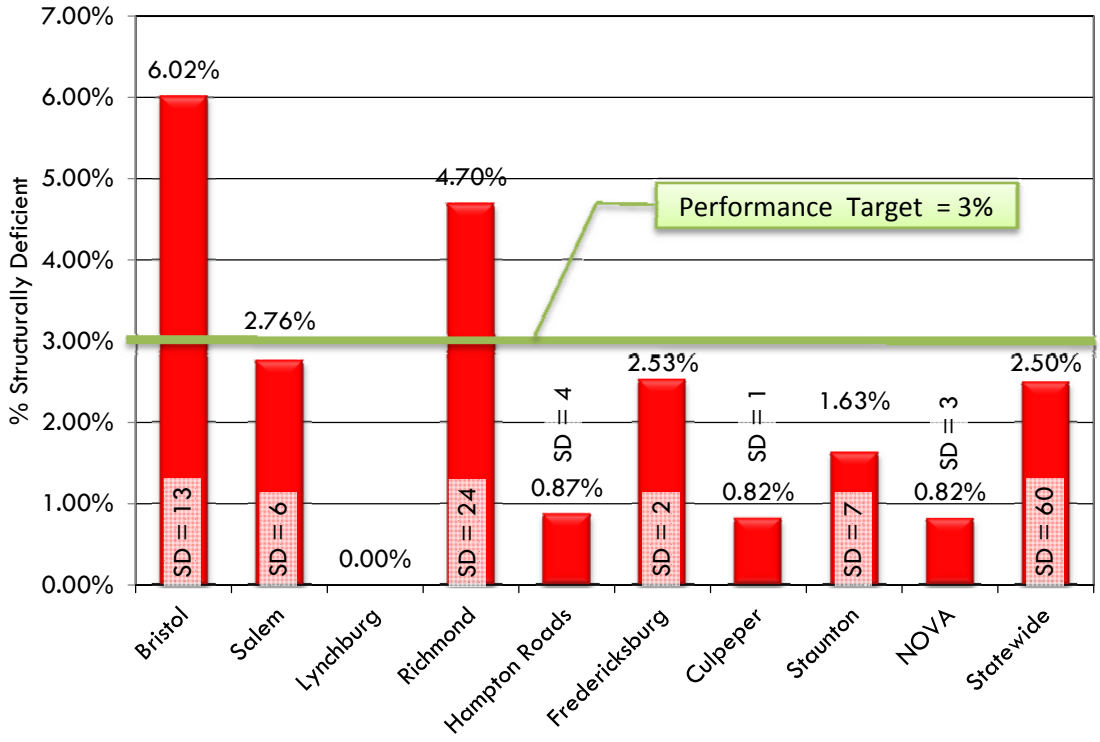
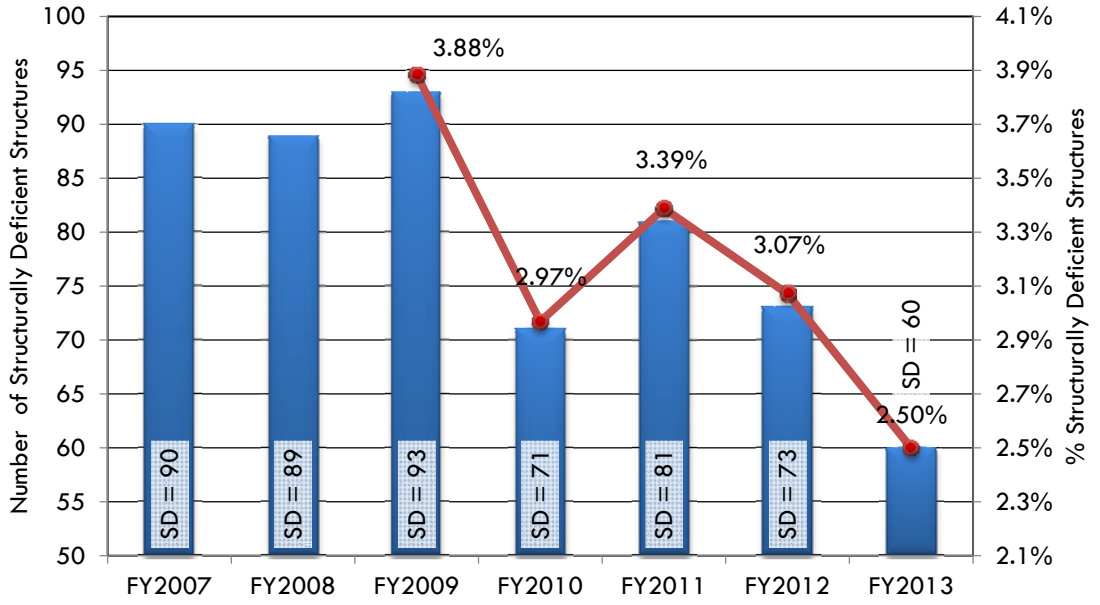


Chart D.2 – Percentage of Structurally Deficient Structures- Interstate Seven Year Trend



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 2013

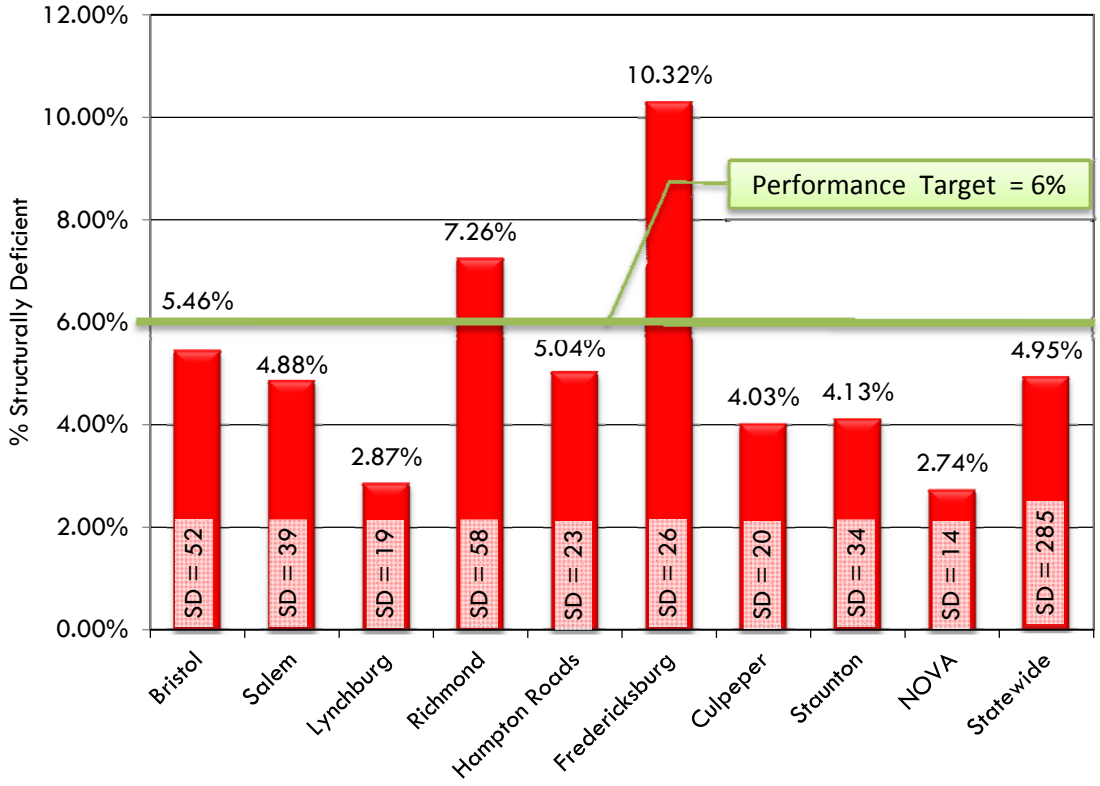
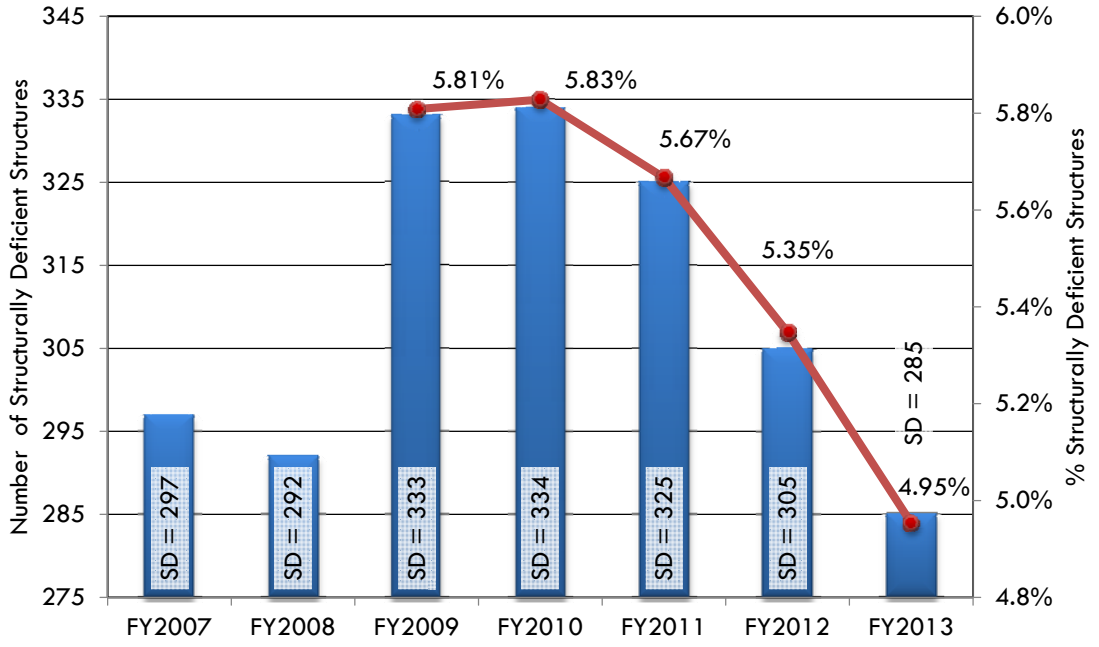


Chart D.4 – Percentage of Structurally Deficient Structures- Primary Seven Year Trend



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 2013

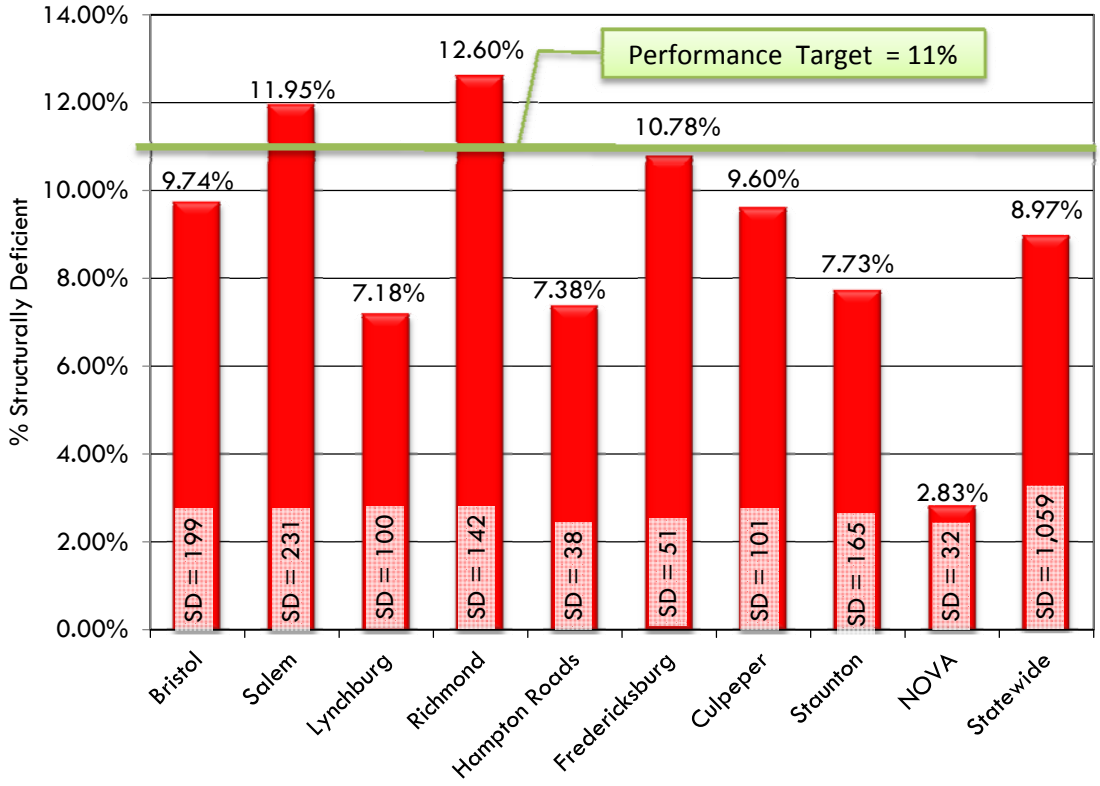
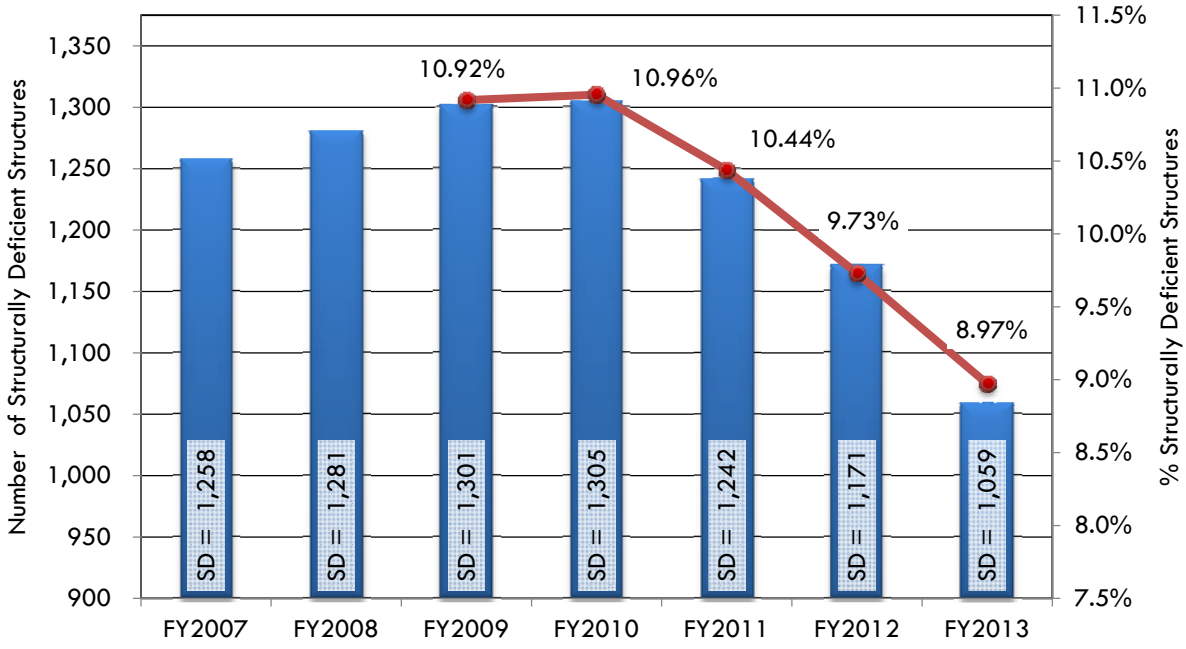
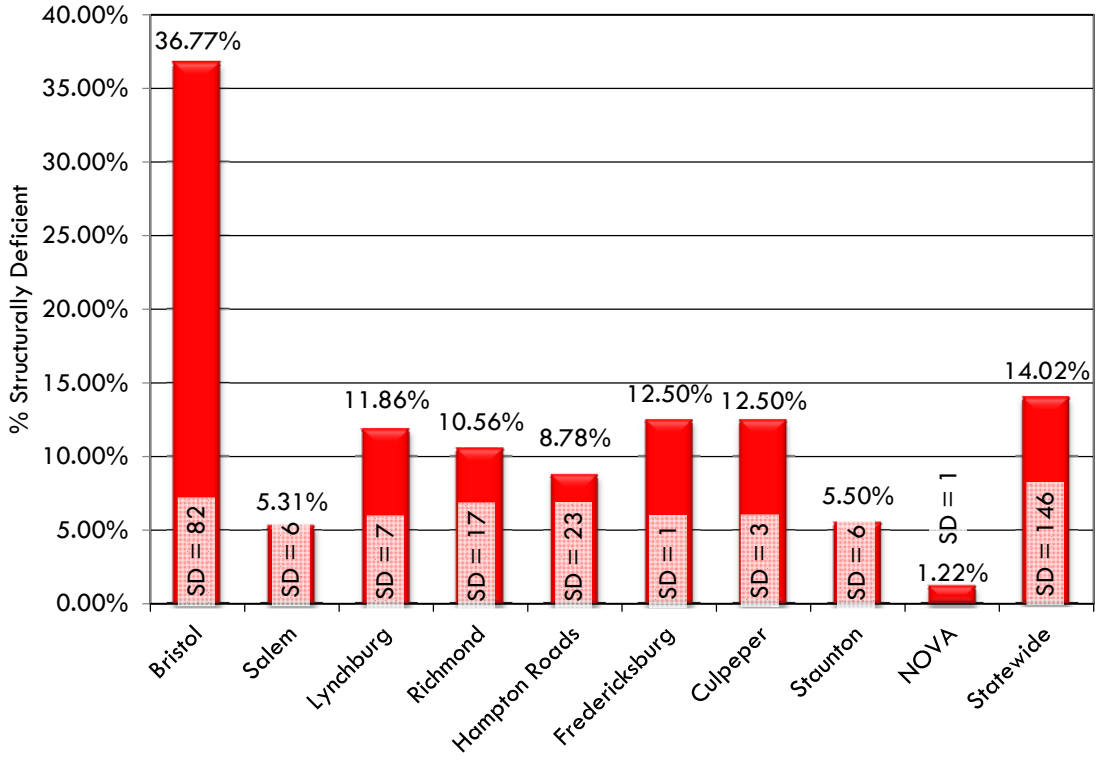


Chart D.6 – Percentage of Structurally Deficient Structures- Secondary Seven Year Trend



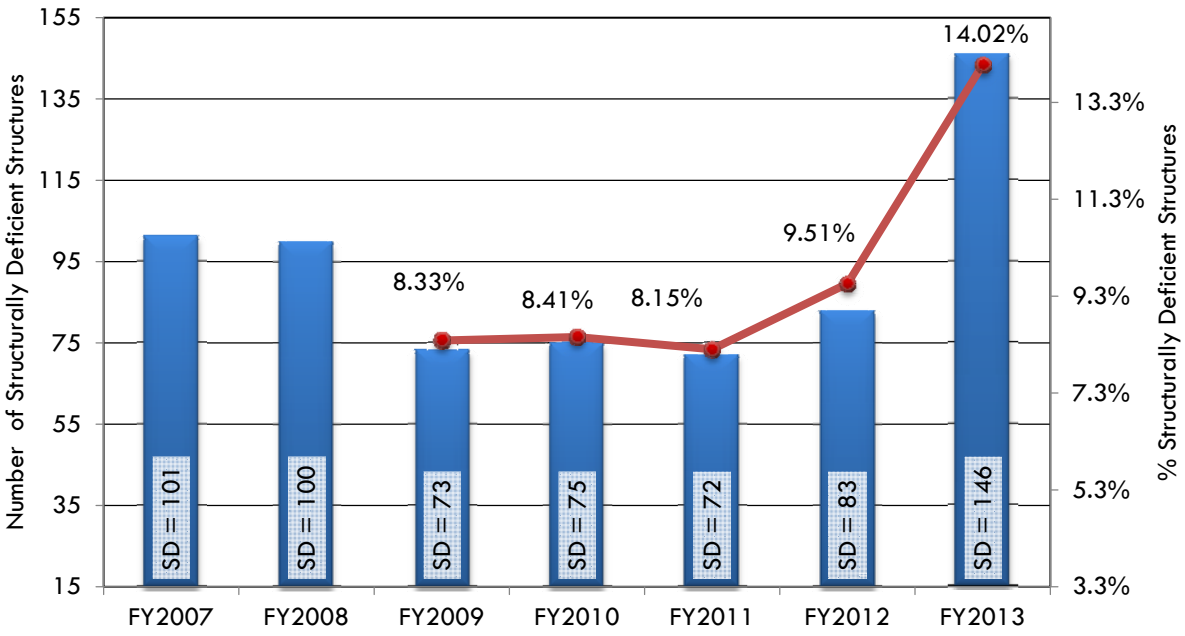
Note: Method of accounting for the number of structures by system has changed from previous years. See Appendix G for discussion.

Chart D.7 – Percentage of Number of Structurally Deficient Structures- Urban End of FY 2013



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

Chart D.8 – Percentage of Structurally Deficient Structures- Urban Seven Year Trend



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

Appendix E – Structure Data by Square Foot Area

Table E.1 – Total Square Foot Area of Structures by District

DISTRICT	Sq-Ft Area of Structures (Bridges and Culverts)				
	Interstate	Primary	Secondary	Urban	Total
Bristol	1,820,736	4,072,191	2,660,309	293,285	8,846,521
Salem	1,678,340	4,549,521	3,024,667	678,173	9,930,703
Lynchburg	0	4,585,699	2,594,963	374,029	7,554,692
Richmond	6,010,727	10,133,190	3,847,559	1,175,100	21,166,575
Hampton Roads	10,845,187	14,513,372	1,725,200	2,392,782	29,476,541
Fredericksburg	591,588	2,811,246	1,223,633	61,225	4,687,693
Culpeper	1,053,183	1,845,620	1,778,529	77,495	4,754,827
Staunton	3,228,259	3,510,955	3,233,443	459,084	10,431,741
NOVA	6,244,294	5,770,828	5,791,076	967,430	18,773,628
Statewide	**31,472,315**	**51,792,622**	**25,879,380**	**6,478,605**	**115,622,921**

Chart E.1 – Total Square Foot Area of Structures by District

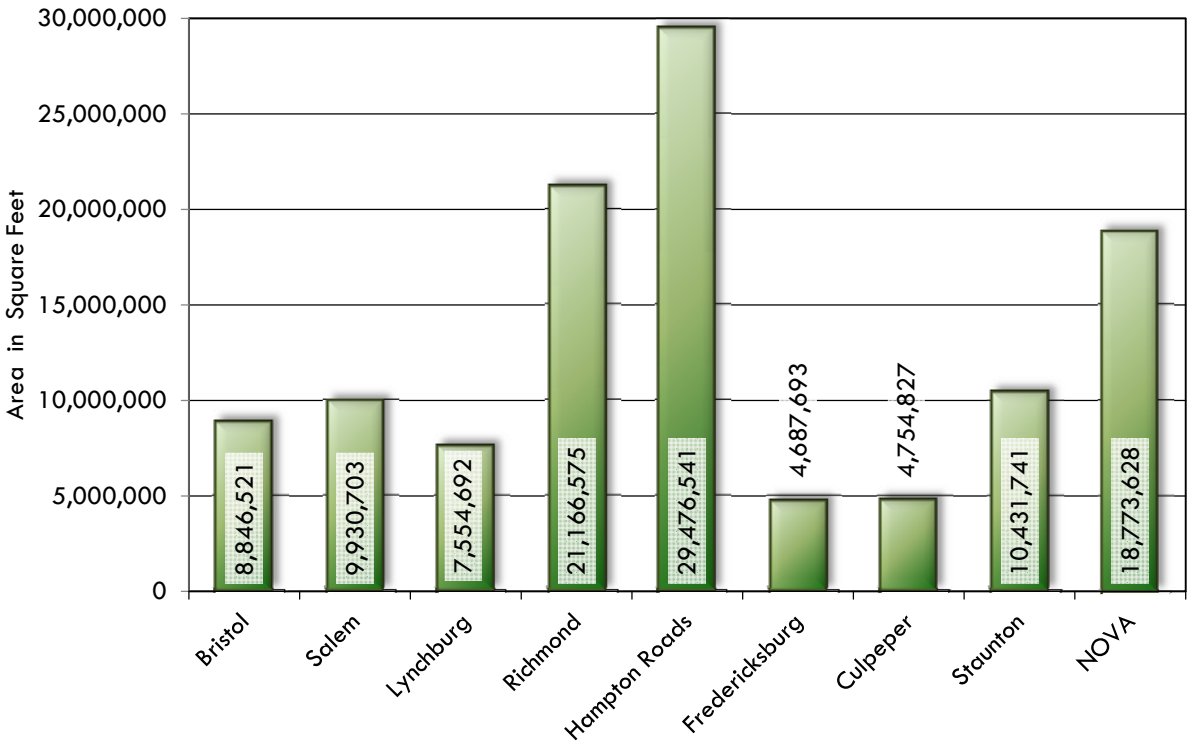


Table E.2 – Total Square Foot Area of Structurally Deficient Structures by District

DISTRICT	Sq-Ft Area of Structurally Deficient Structures				
	Interstate	Primary	Secondary	Urban	Total
Bristol	121,440	239,916	199,143	82,372	642,872
Salem	115,223	193,273	258,614	19,201	586,311
Lynchburg	0	157,539	138,457	17,565	313,560
Richmond	421,146	659,024	265,679	105,954	1,451,803
Hampton Roads	314,644	537,963	56,518	47,843	956,968
Fredericksburg	26,444	391,103	77,631	1,472	496,650
Culpeper	20,212	126,328	109,663	15,898	272,102
Staunton	150,392	198,070	142,266	18,800	509,528
NOVA	35,786	201,842	67,012	730	305,371
Statewide	**1,205,288**	**2,705,057**	**1,314,983**	**309,837**	**5,535,165**

Chart E.2 – Total Square Foot Area of Structurally Deficient Structures by District

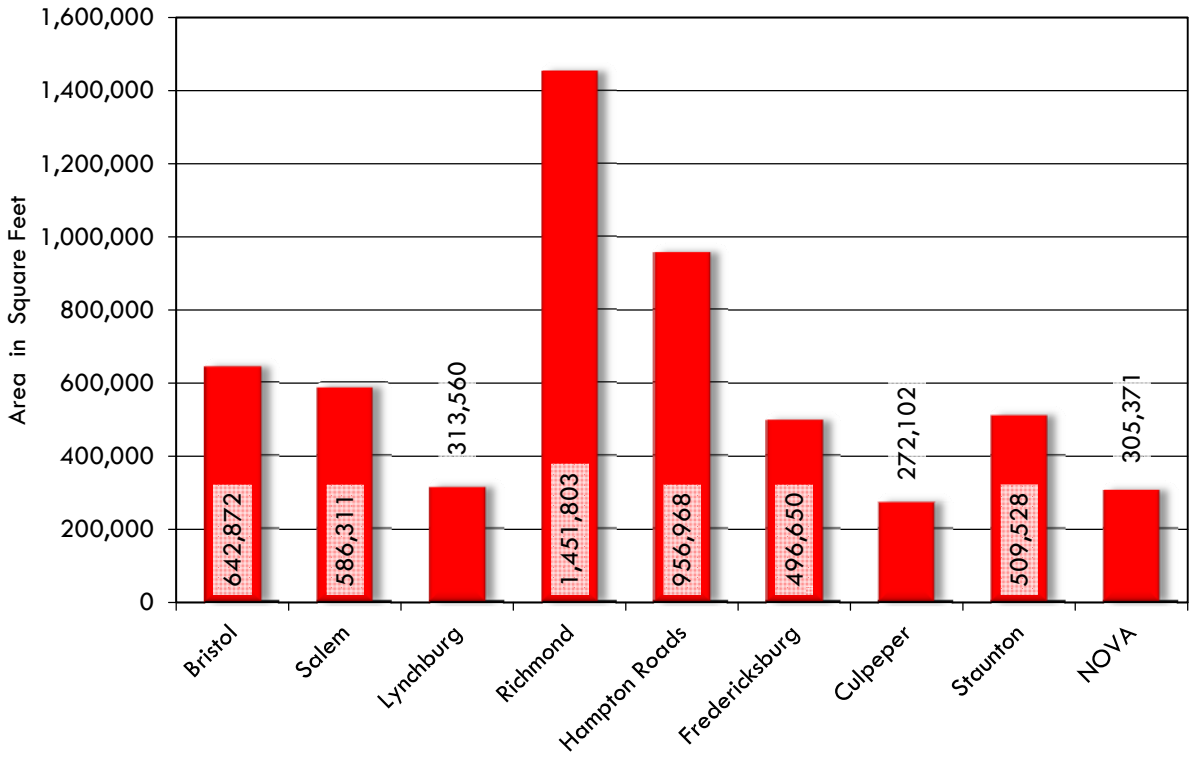


Table E.3 – Percentage of Square Foot Area of Structurally Deficient Structures by District

DISTRICT	Percent Sq-Ft Area of Structurally Deficient Structures				
	Interstate	Primary	Secondary	Urban	Total
Bristol	6.7%	5.9%	7.5%	28.1%	7.3%
Salem	6.9%	4.2%	8.6%	2.8%	5.9%
Lynchburg	0.0%	3.4%	5.3%	4.7%	4.2%
Richmond	7.0%	6.5%	6.9%	9.0%	6.9%
Hampton Roads	2.9%	3.7%	3.3%	2.0%	3.2%
Fredericksburg	4.5%	13.9%	6.3%	2.4%	10.6%
Culpeper	1.9%	6.8%	6.2%	20.5%	5.7%
Staunton	4.7%	5.6%	4.4%	4.1%	4.9%
NOVA	0.6%	3.5%	1.2%	0.1%	1.6%
Statewide	**3.8%**	**5.2%**	**5.1%**	**4.8%**	**4.8%**

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 121,440/ 1,820,736 = 0. 06669 or 6.7%**)**

Chart E.3 – Percentage of Square Foot Area of Structurally Deficient Structures by District

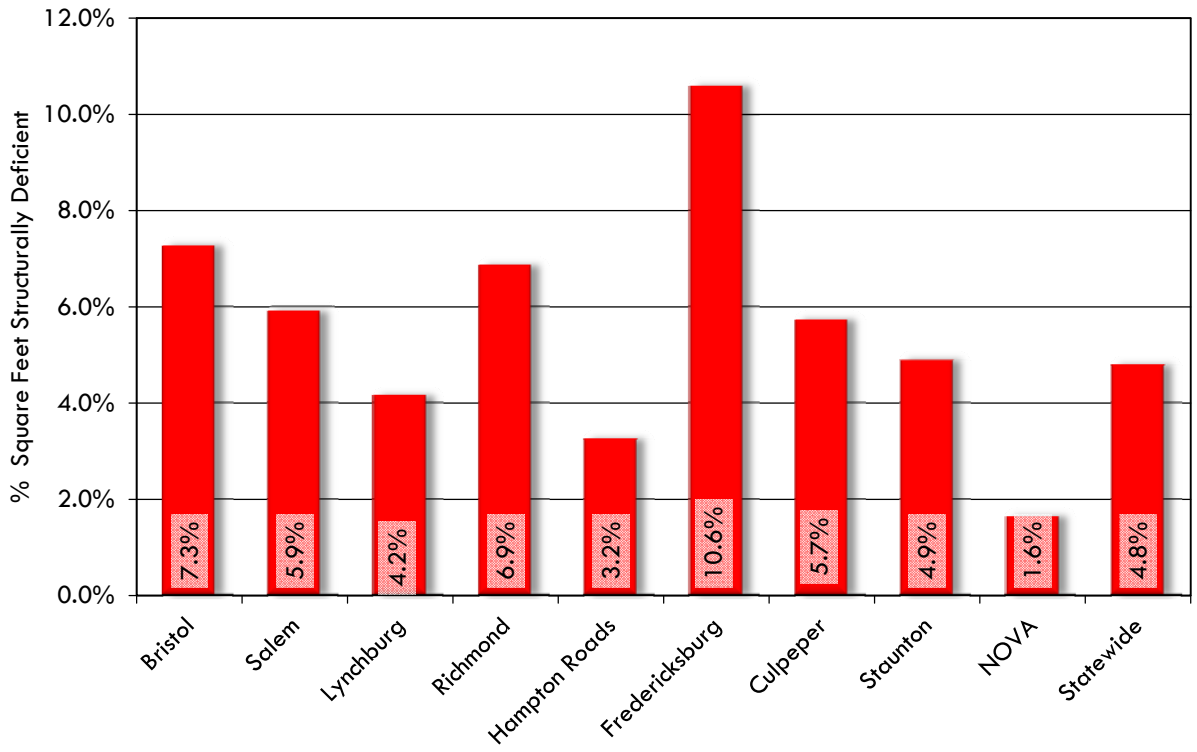


Table E.4 – Total Square Foot Area of Functionally Obsolete Structures by District

DISTRICT	Sq-Ft Area of Functionally Obsolete Structures				
	Interstate	Primary	Secondary	Urban	Grand Total
Bristol	243,403	417,544	289,661	33,782	984,390
Salem	160,472	846,725	542,247	164,740	1,714,183
Lynchburg	0	432,781	168,854	58,926	660,561
Richmond	771,458	1,960,953	279,100	324,676	3,336,187
Hampton Roads	1,800,728	4,391,639	401,873	346,881	6,941,121
Fredericksburg	51,568	562,869	124,076	0	738,513
Culpeper	6,206	92,476	229,097	13,122	340,901
Staunton	147,598	662,486	383,569	122,493	1,316,146
NOVA	1,904,905	1,425,557	1,587,819	106,029	5,024,310
Statewide	**5,086,338**	**10,793,030**	**4,006,295**	**1,170,650**	**21,056,313**

If a structure is both structurally deficient and functionally obsolete, structure is considered only under structurally deficient.

Chart E.4 – Total Square Foot Area of Functionally Obsolete Structures by District

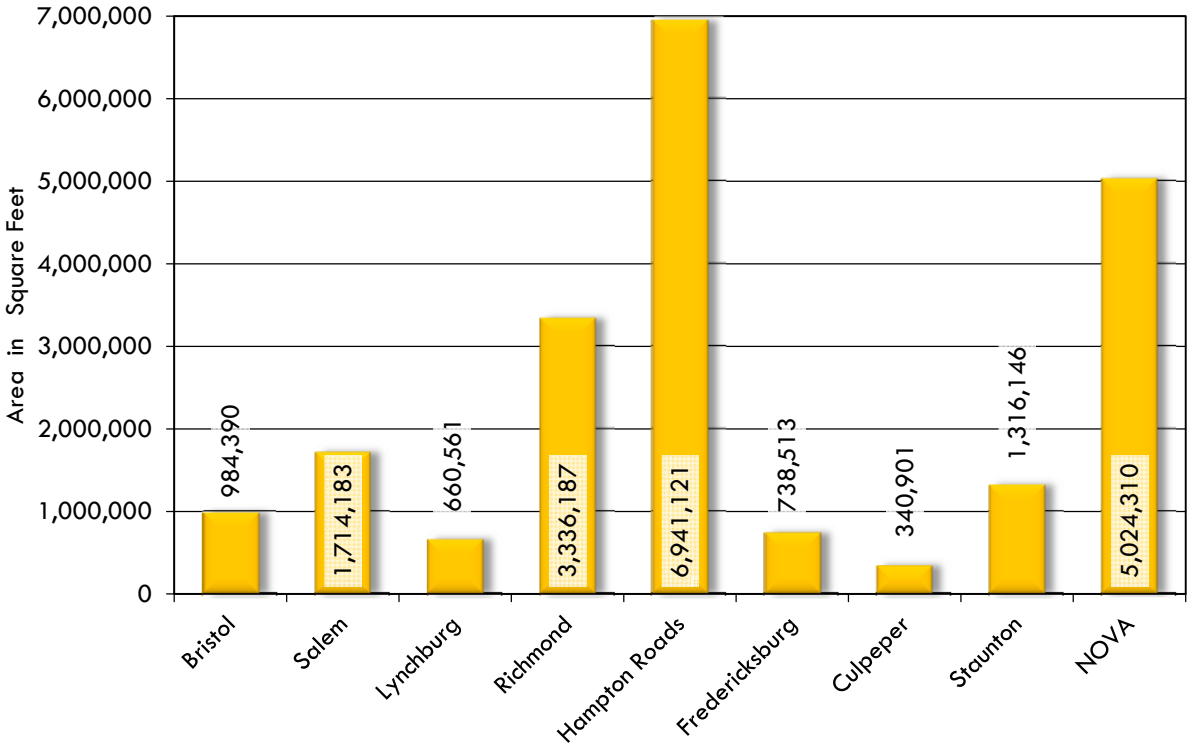


Table E.5 – Percentage of Square Foot Area of Functionally Obsolete Structures by District

DISTRICT	Percent Sq-Ft Area of Functionally Obsolete Structures				
	Interstate	Primary	Secondary	Urban	Grand Total
Bristol	13.4%	10.3%	10.9%	11.5%	11.1%
Salem	9.6%	18.6%	17.9%	24.3%	17.3%
Lynchburg	0.0%	9.4%	6.5%	15.8%	8.7%
Richmond	12.8%	19.4%	7.3%	27.6%	15.8%
Hampton Roads	16.6%	30.3%	23.3%	14.5%	23.5%
Fredericksburg	8.7%	20.0%	10.1%	0.0%	15.8%
Culpeper	0.6%	5.0%	12.9%	16.9%	7.2%
Staunton	4.6%	18.9%	11.9%	26.7%	12.6%
NOVA	30.5%	24.7%	27.4%	11.0%	26.8%
Statewide	**16.2%**	**20.8%**	**15.5%**	**18.1%**	**18.2%**

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 243,403 / 1,821,667 = 0.1336 or 13.4%)

Chart E.5 – Percentage of Square Foot Area of Functionally Obsolete Structures by District

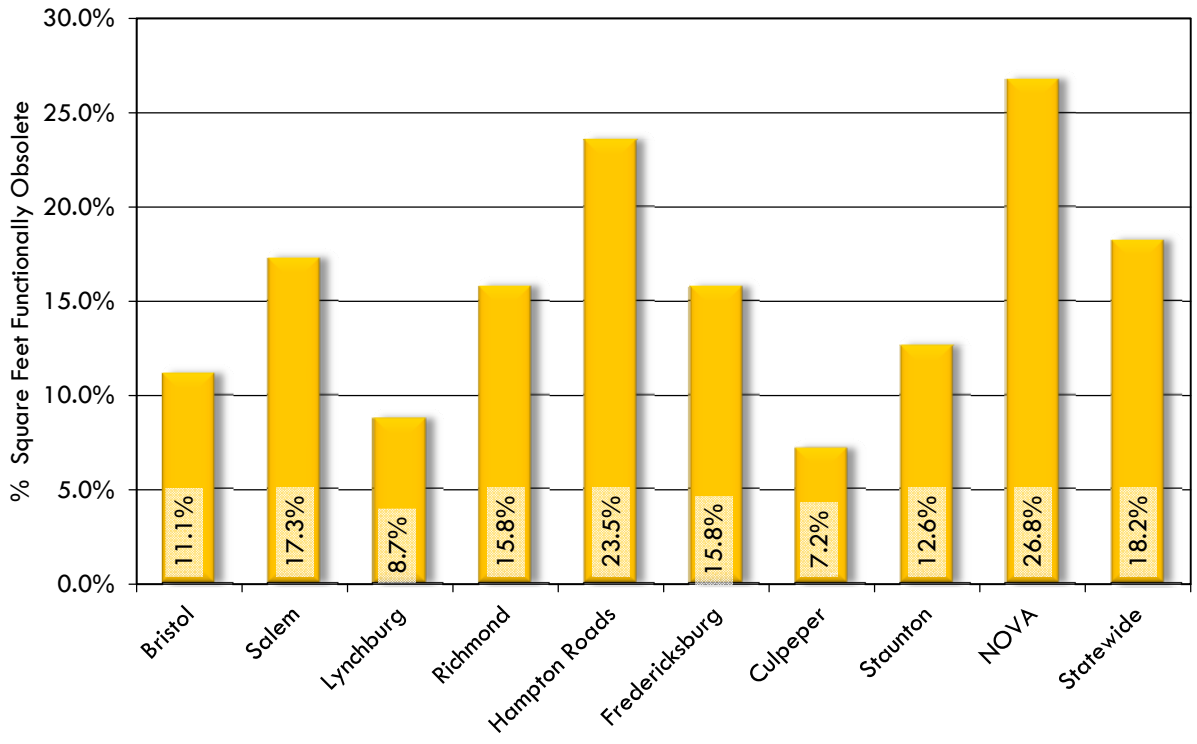


Table E.6 – Square Foot Area of Deficient (SD & FO) Structures by District

DISTRICT	Sq-Ft Area of Deficient (SD or FO) Structures				
	Interstate	Primary	Secondary	Urban	Grand Total
Bristol	364,843	657,460	488,804	116,155	1,627,262
Salem	275,695	1,039,998	800,860	183,941	2,300,495
Lynchburg	0	590,320	307,310	76,491	974,121
Richmond	1,192,604	2,619,977	544,780	430,630	4,787,991
Hampton Roads	2,115,371	4,929,602	458,390	394,725	7,898,088
Fredericksburg	78,012	953,972	201,707	1,472	1,235,162
Culpeper	26,418	218,804	338,760	29,020	613,003
Staunton	297,990	860,556	525,835	141,293	1,825,674
NOVA	1,940,691	1,627,399	1,654,831	106,760	5,329,681
Statewide	**6,291,626**	**13,498,087**	**5,321,279**	**1,480,487**	**26,591,478**

Chart E.6 – Square Foot Area of Deficient (SD & FO) Structures by District

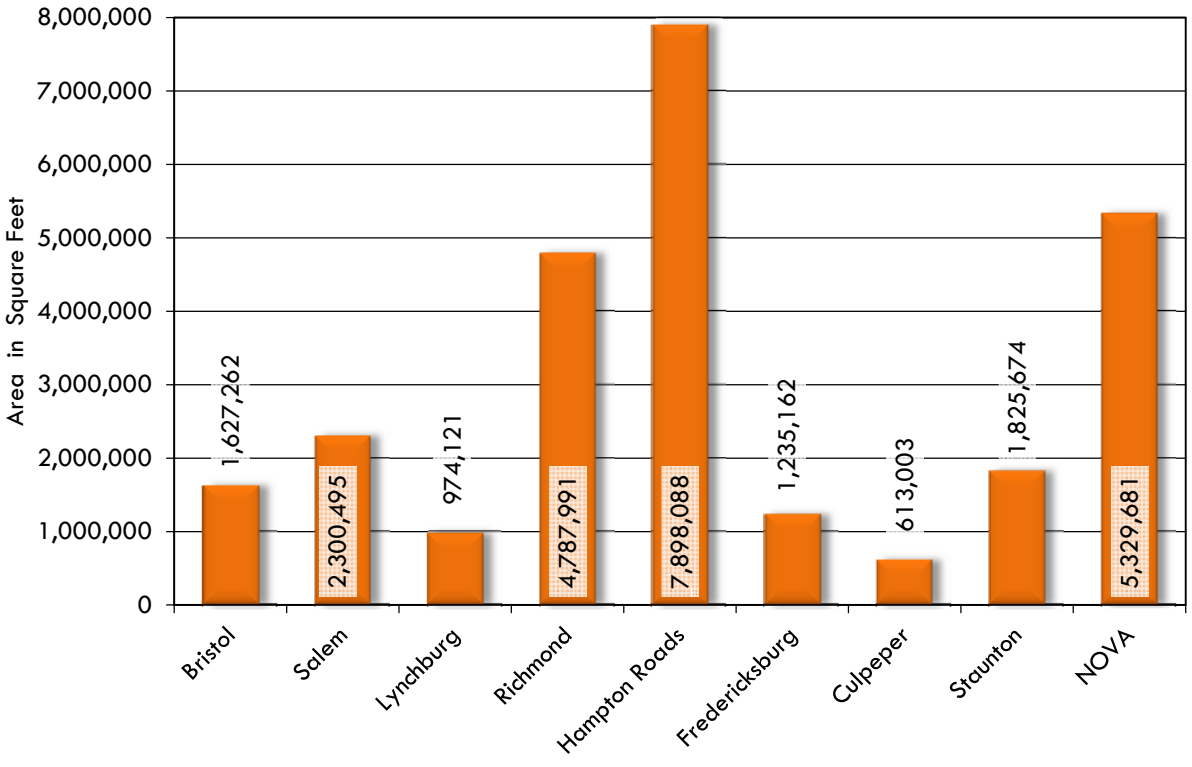


Table E.7 – Percentage of Square Foot Area of Deficient (SD & FO) Structures by District

DISTRICT	Percent Sq-Ft Area of Deficient (SD or FO) Structures				
	Interstate	Primary	Secondary	Urban	Grand Total
Bristol	20.0%	16.1%	18.4%	39.6%	18.4%
Salem	16.4%	22.9%	26.5%	27.1%	23.2%
Lynchburg	0.0%	12.9%	11.8%	20.5%	12.9%
Richmond	19.8%	25.9%	14.2%	36.6%	22.6%
Hampton Roads	19.5%	34.0%	26.6%	16.5%	26.8%
Fredericksburg	13.2%	33.9%	16.5%	2.4%	26.3%
Culpeper	2.5%	11.9%	19.0%	37.4%	12.9%
Staunton	9.2%	24.5%	16.3%	30.8%	17.5%
NOVA	31.1%	28.2%	28.6%	11.0%	28.4%
Statewide	**20.0%**	**26.1%**	**20.6%**	**22.9%**	**23.0%**

Chart E.7 – Percentage of Square Foot Area of Deficient (SD & FO) Structures by District

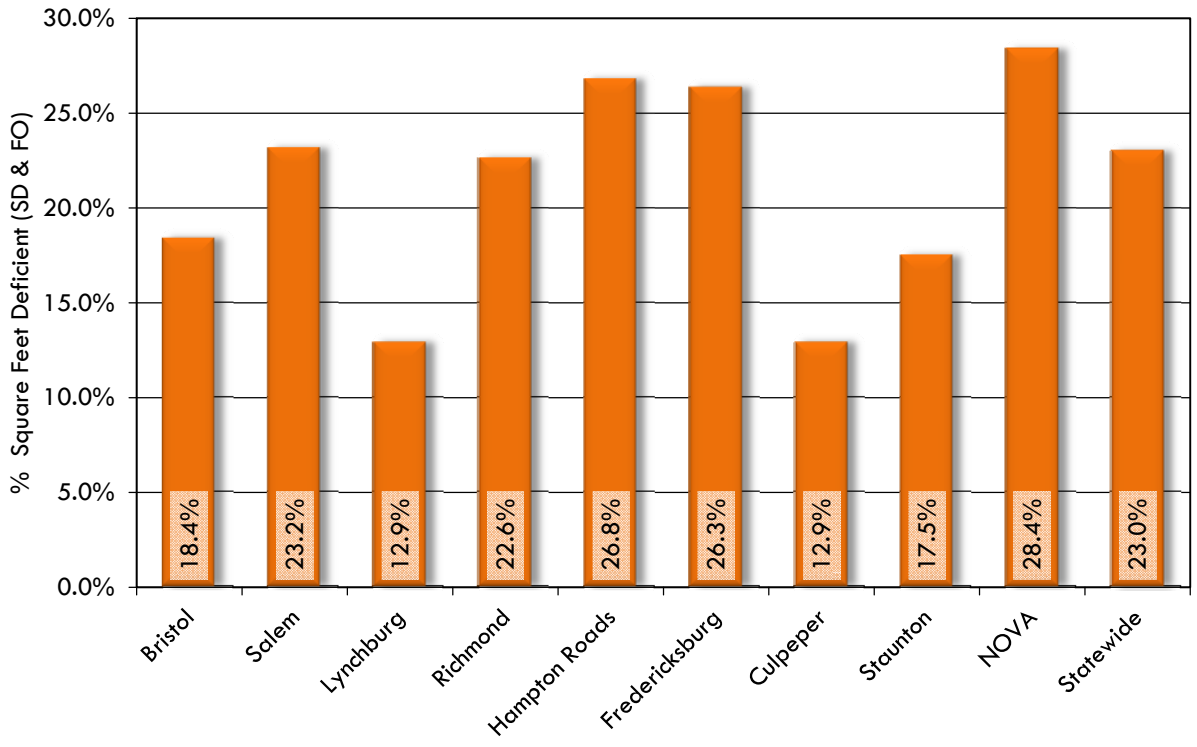


Table E.8 – Square Foot Area of Weight-Posted Structures by District

DISTRICT	Sq-Ft Area of weight Posted Structures				
	Interstate	Primary	Secondary	Urban	Grand Total
Bristol	0	52,866	188,966	82,175	324,008
Salem	0	20,806	242,611	17,019	280,436
Lynchburg	0	43,083	184,208	3,704	230,996
Richmond	0	112,687	167,786	24,833	305,306
Hampton Roads	0	165,983	74,306	35,399	275,687
Fredericksburg	0	99,309	31,887	1,472	132,668
Culpeper	0	19,152	89,546	5,919	114,617
Staunton	0	107,207	115,007	7,742	229,956
NOVA	0	6,409	23,592	730	30,731
Statewide	**0**	**627,503**	**1,117,908**	**178,995**	**1,924,406**

Chart E.8 – Square Foot Area of Weight-Posted Structures by District

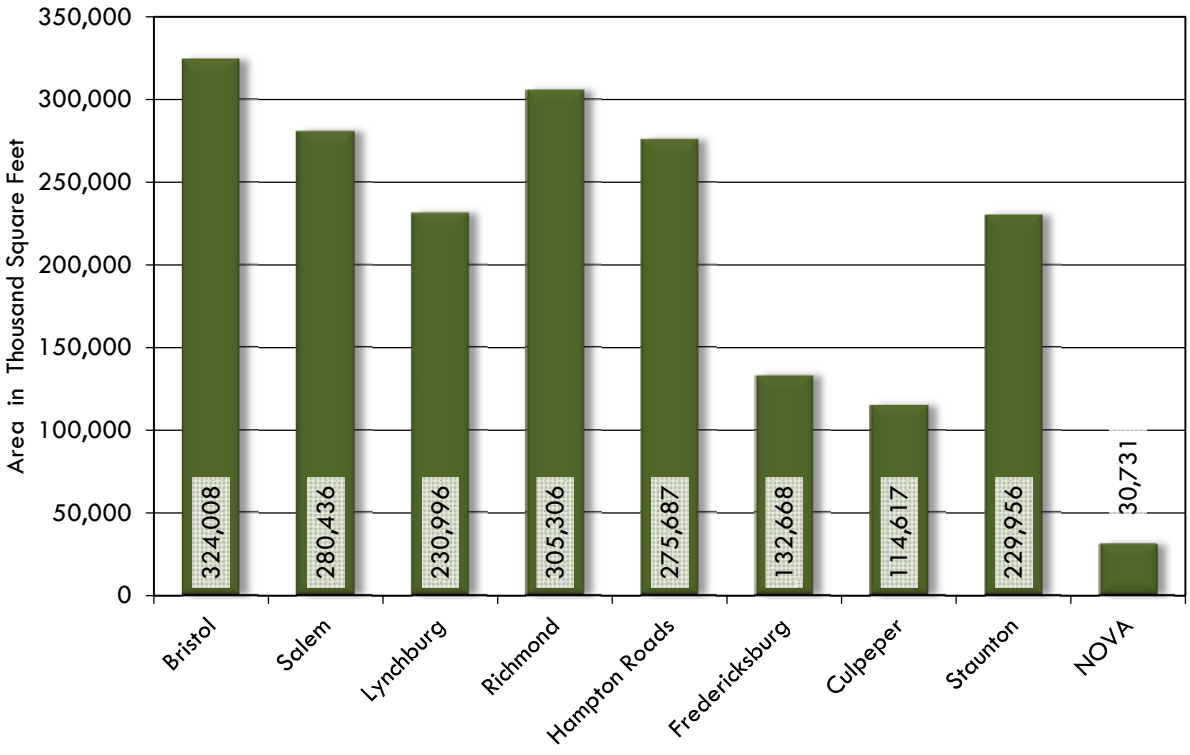
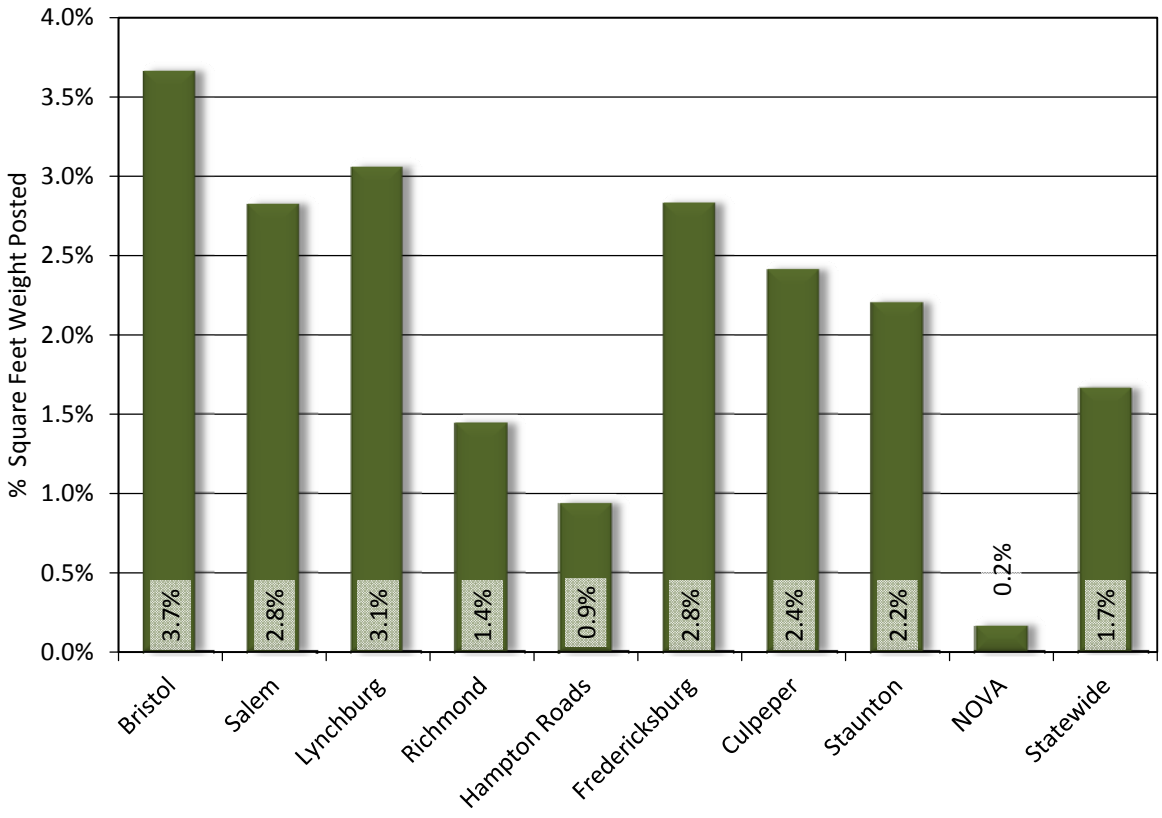


Table E.9 – Percentage of Weight-Posted Structures By Square Foot Area and District

DISTRICT	Percent Sq-Ft Area of weight Posted Structures				
	Interstate	Primary	Secondary	Urban	Grand Total
Bristol	0.0%	1.3%	7.1%	28.0%	3.7%
Salem	0.0%	0.5%	8.0%	2.5%	2.8%
Lynchburg	0.0%	0.9%	7.1%	1.0%	3.1%
Richmond	0.0%	1.1%	4.4%	2.1%	1.4%
Hampton Roads	0.0%	1.1%	4.3%	1.5%	0.9%
Fredericksburg	0.0%	3.5%	2.6%	2.4%	2.8%
Culpeper	0.0%	1.0%	5.0%	7.6%	2.4%
Staunton	0.0%	3.1%	3.6%	1.7%	2.2%
NOVA	0.0%	0.1%	0.4%	0.1%	0.2%
Statewide	**0.0%**	**1.2%**	**4.3%**	**2.8%**	**1.7%**

Chart E.9 – Percentage of Weight-Posted Structures By Square Foot Area and District

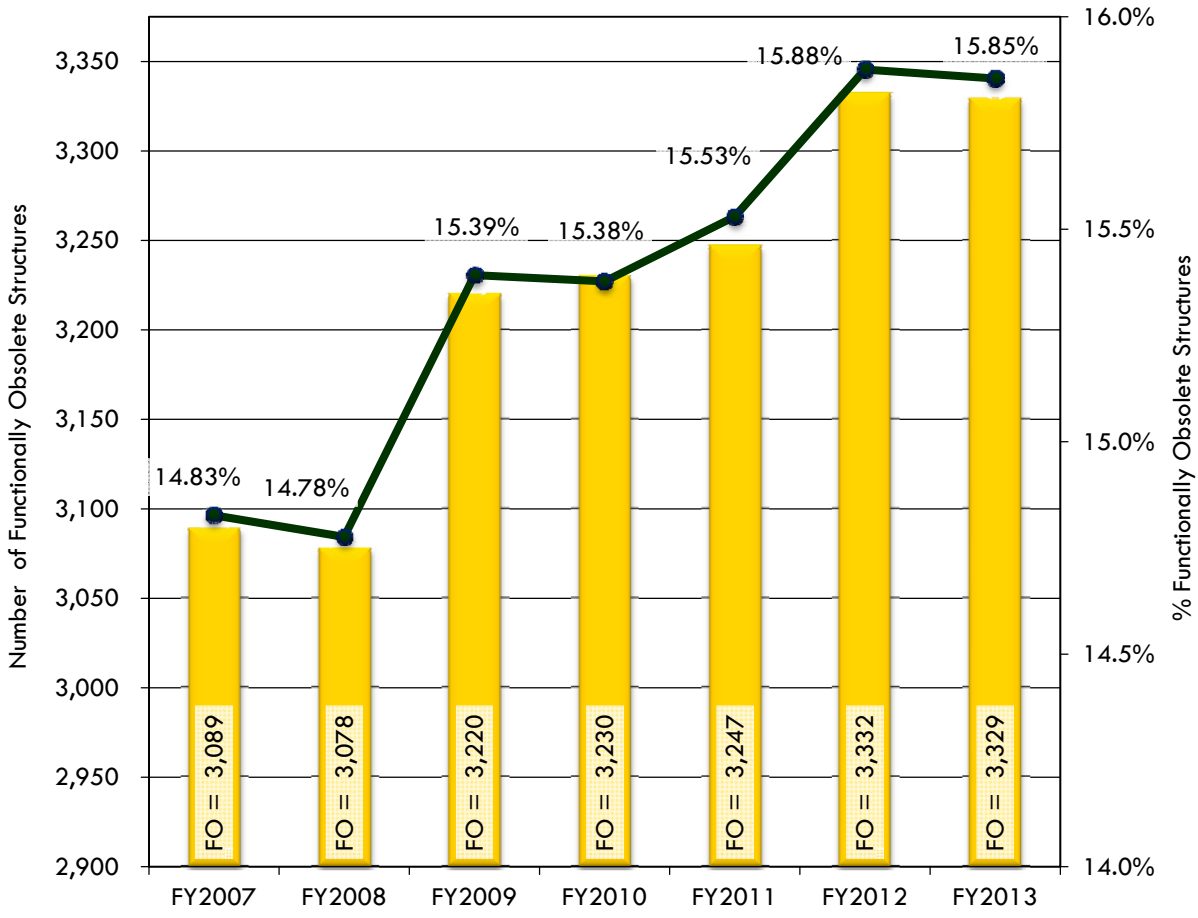


APPENDIX F – OTHER PERFORMANCE INDICATORS

FUNCTIONALLY OBSOLETE MEASURE

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 F.1 through F.5, depicts trends statewide and by system.

Chart F.1 – Number and Percentage of FO Structures - Statewide
Seven Year 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 F.1 through F.5.

Chart F.2 – Number and Percentage of FO Structures - Interstate Seven Year Trend

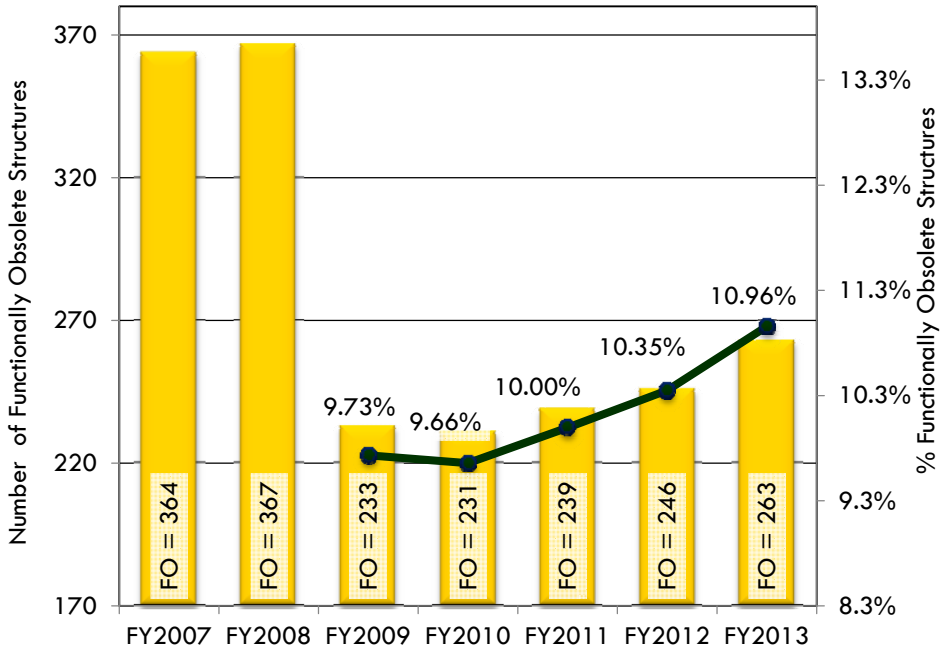
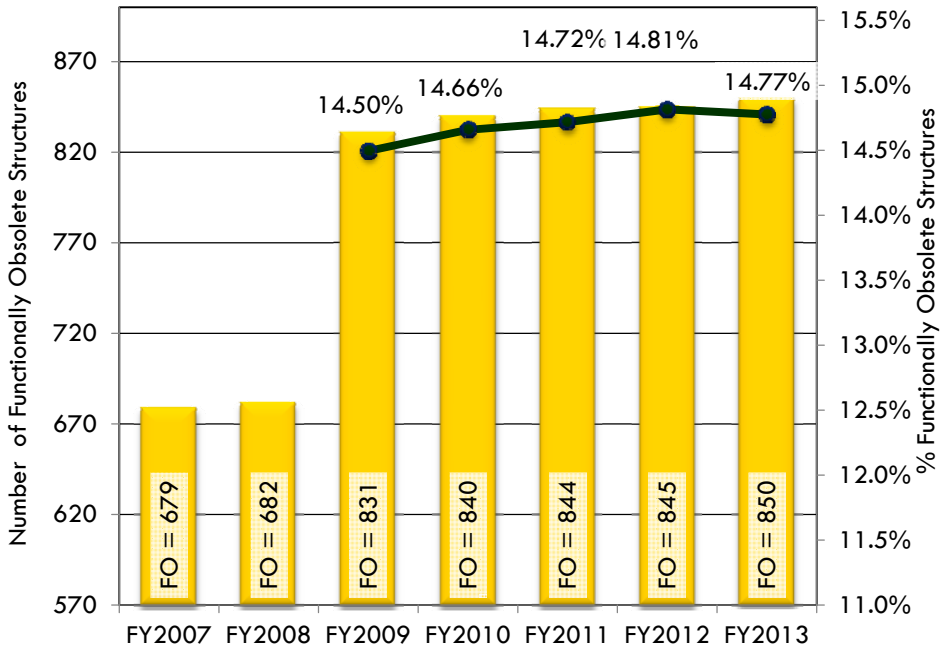


Chart F.3 – Number and Percentage of FO Structures - Primary Seven Year Trend



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

Chart F.4 – Number and Percentage of FO Structures - Secondary Seven Year Trend

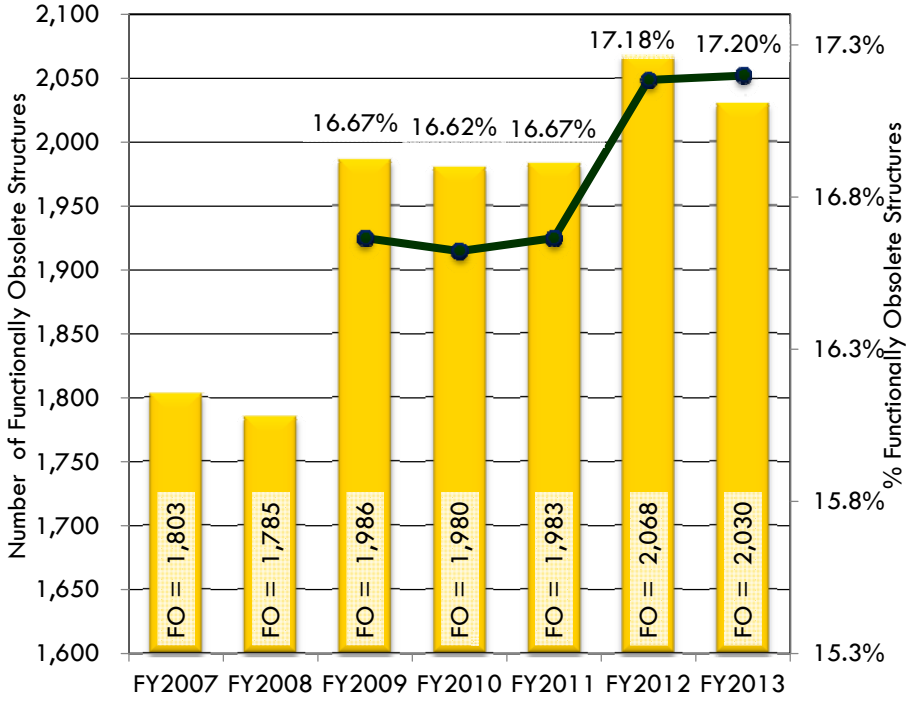
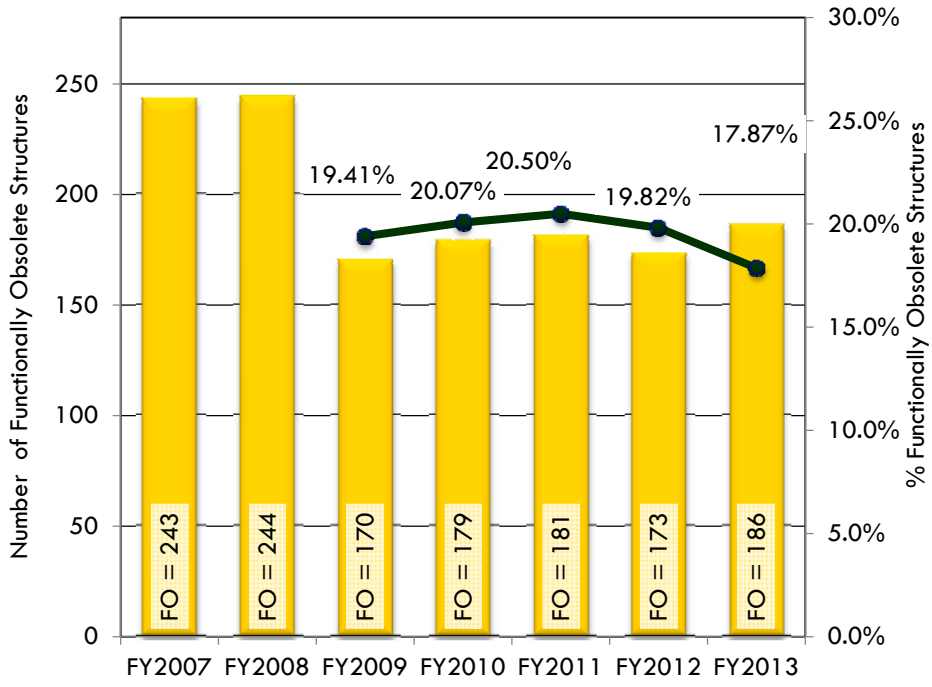


Chart F.5 – Number and Percentage of FO Structures - Urban Seven Year Trend

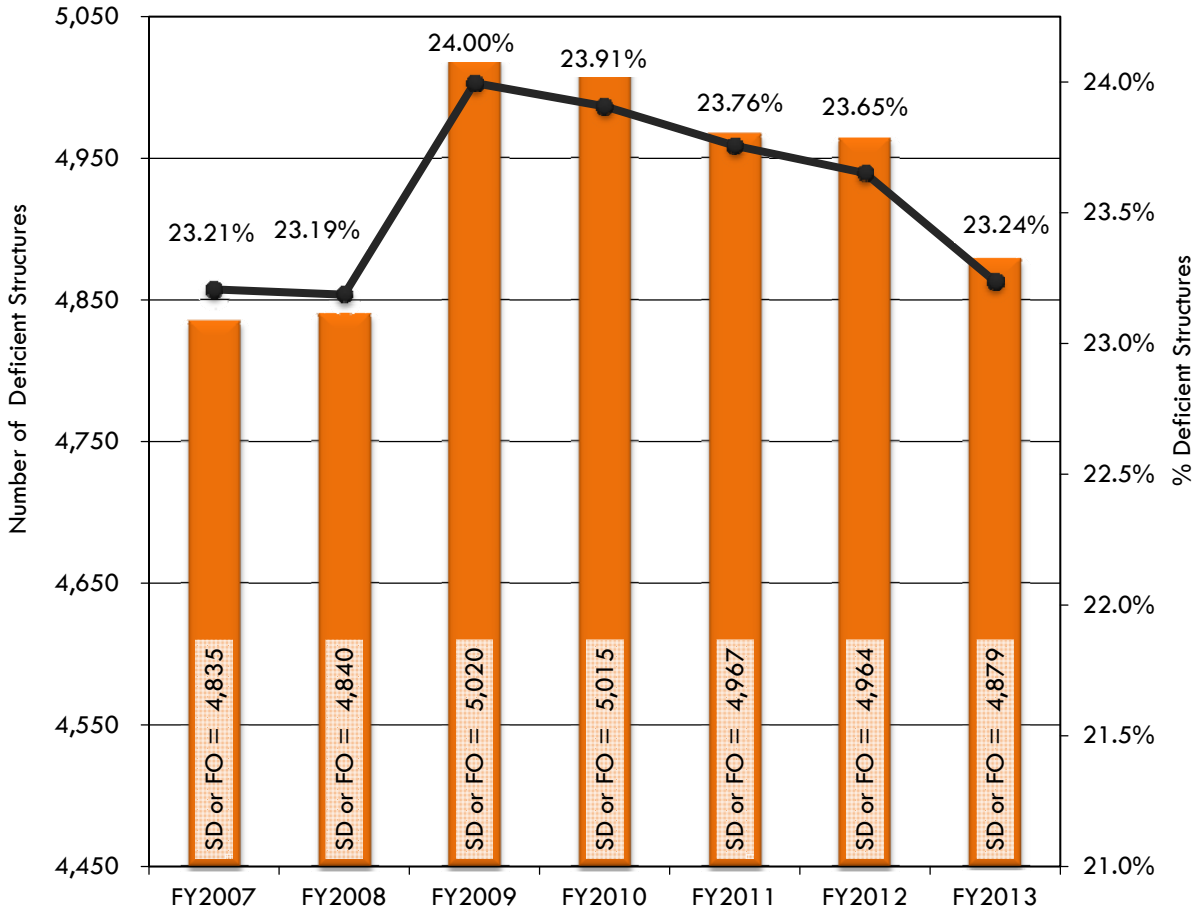


Note: Method of accounting for the number of structures by system has changed from previous years. See Appendix G for discussion

DEFICIENT STRUCTURES

Combining Structurally Deficient (SD) and Functionally Obsolete (FO) - According to the Federal Highway Administration a structure is deemed "deficient" if the structure is rated either SD or FO. If a structure is both SD and FO it is designated simply as structurally deficient. FHWA uses the combined deficient designation in the allocation of bridge funding per State. 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 F.6 though F.10, shows the trends statewide and by systems.

Chart F.6 – Number and Percentage of SD or FO Structures - Statewide Seven Year 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 F.6 through F.10.

Chart F.7 – Number and Percentage of SD or FO Structures – Interstate Seven Year Trend

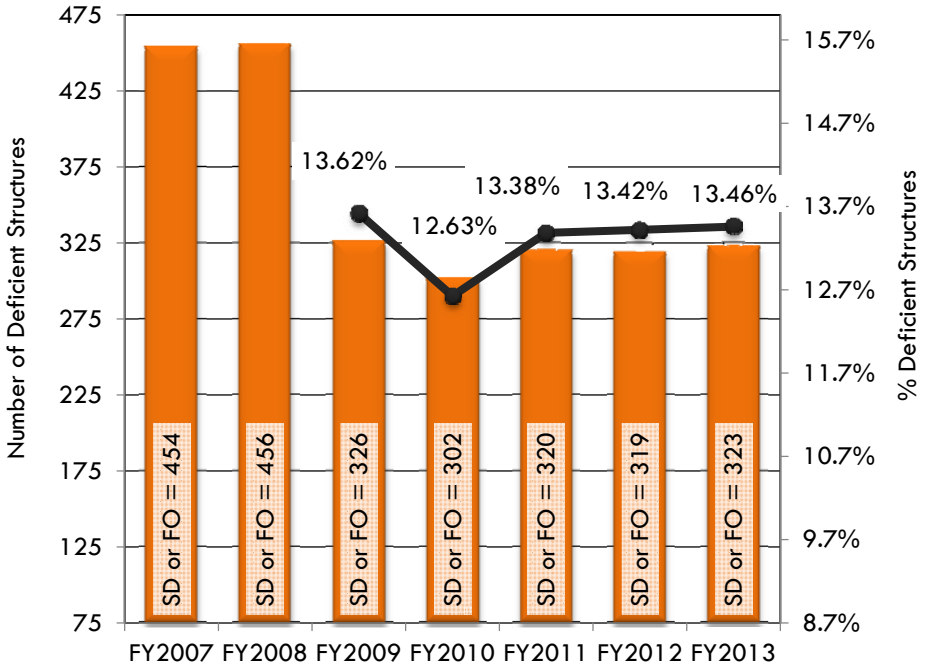


Chart F.8 – Number and Percentage of SD or FO Structures - Primary Seven Year Trend

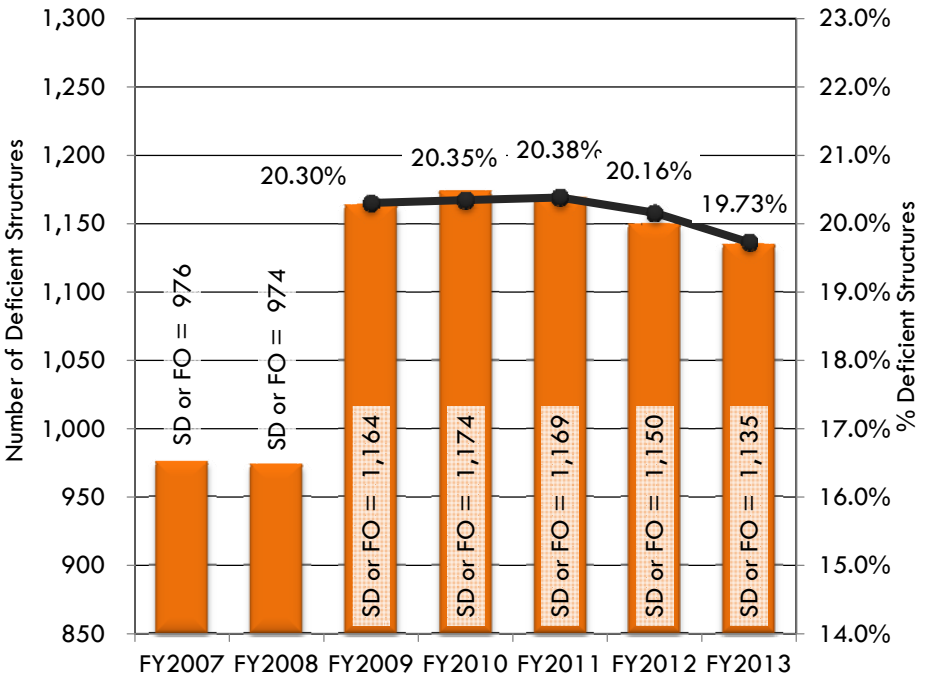


Chart F.9 – Number and Percentage of SD or FO Structures - Secondary Seven Year Trend

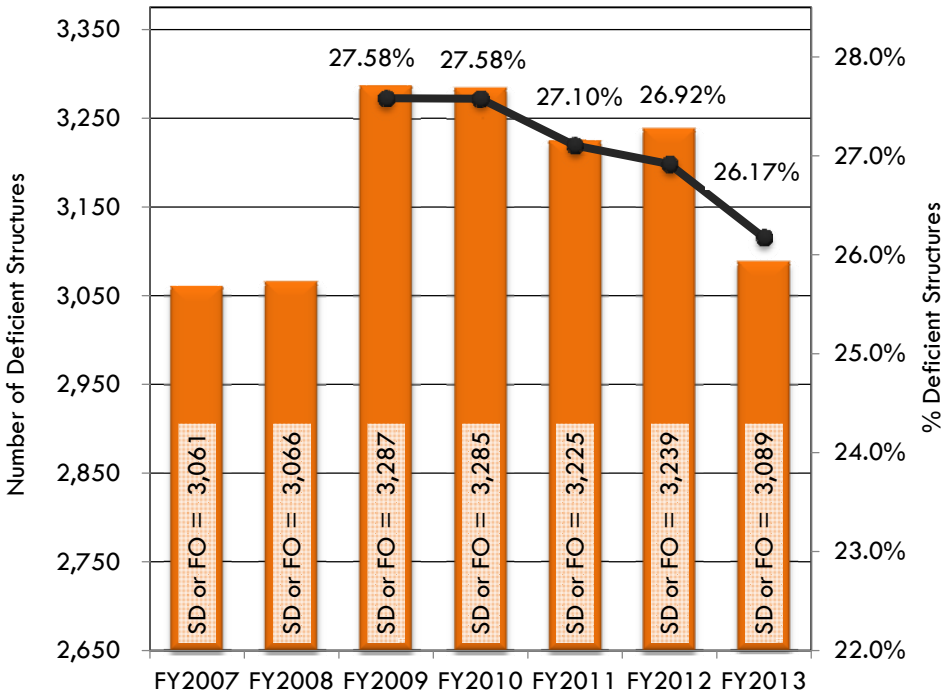
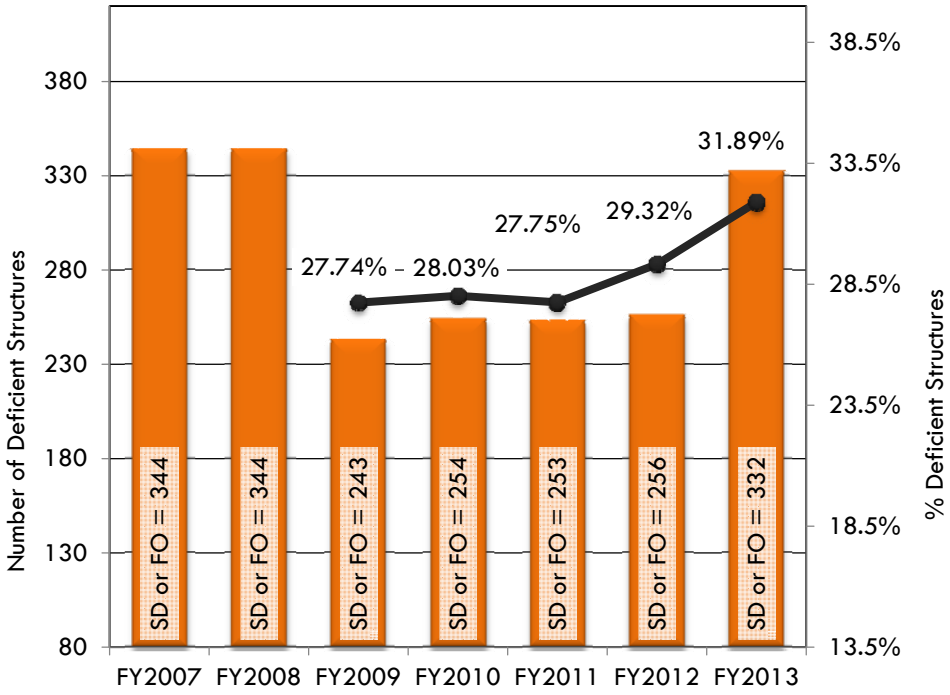


Chart F.10 – Number and Percentage of SD or FO Structures - Urban Seven Year Trend



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

Weight-Posted Structures Measure

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:

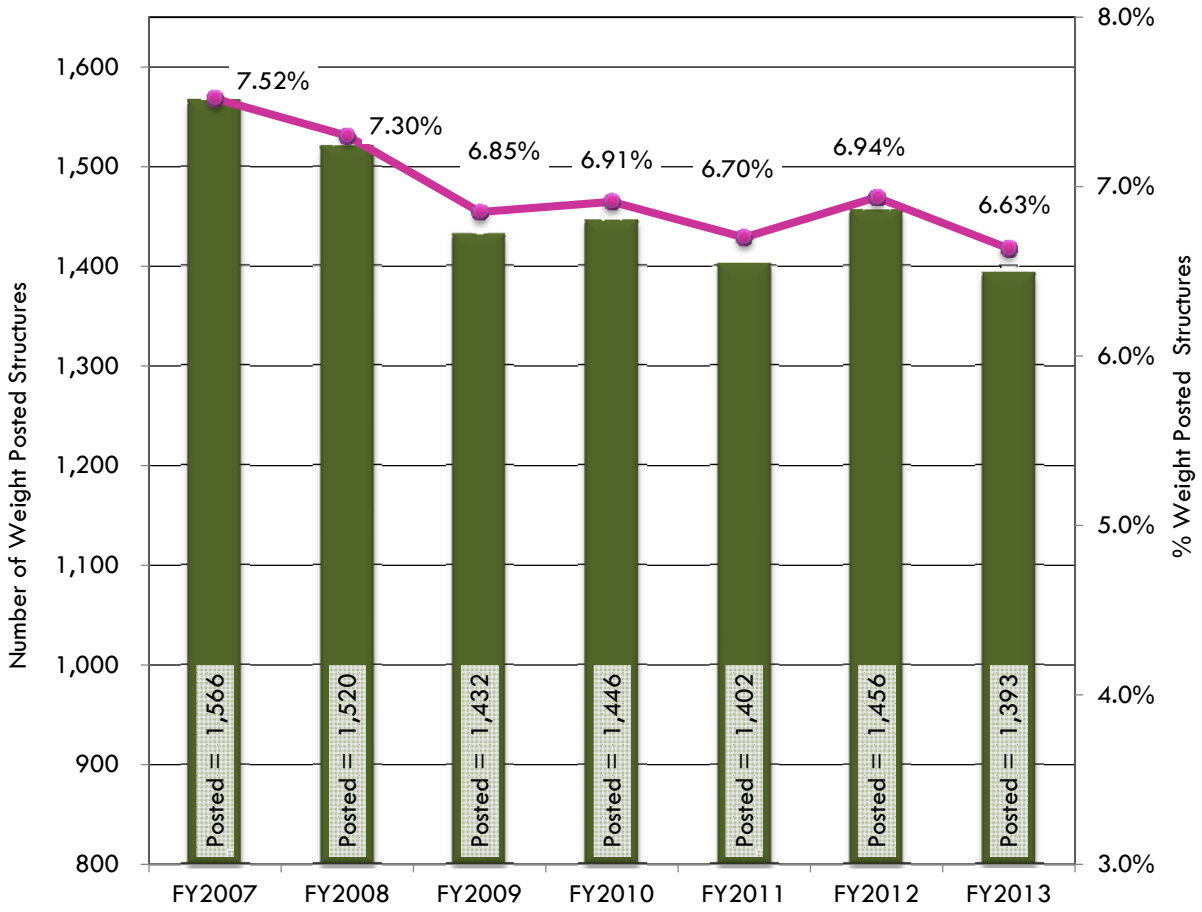
- 27 Tons for a single unit
- 40 Tons for semi-trailers

Virginia's blanket vehicles are as follows:

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

Charts F.11 thru F.15 illustrates number and percentages of posted structures statewide and by system.

Chart F.11 – Number and Percentage of Weight-Posted Structures - Statewide Seven Year 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 F.11 through F.15.

Chart F.12 – Number and Percentage of Weight-Posted Structures - Interstate Seven Year Trend

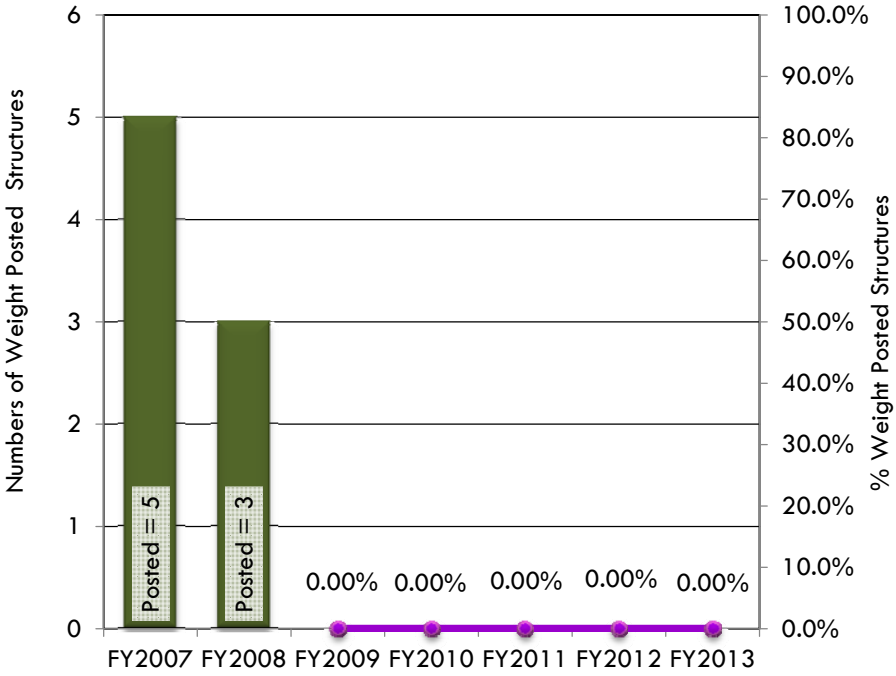


Chart F.13 – Number and Percentage of Weight-Posted Structures - Primary Seven Year Trend

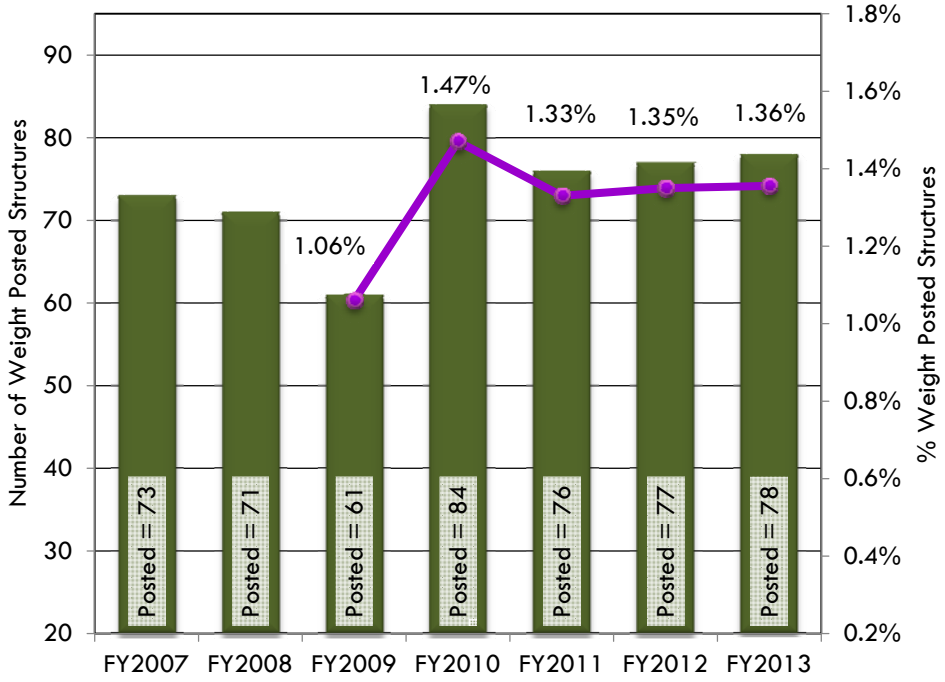


Chart F.14 – Number and Percentage of Weight-Posted Structures - Secondary Seven Year Trend

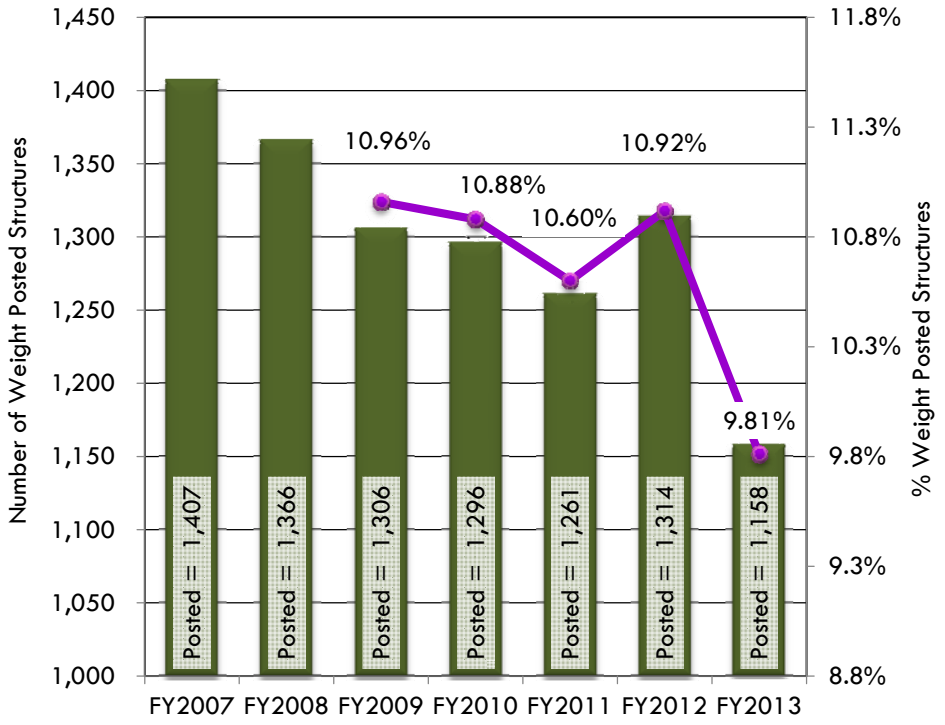
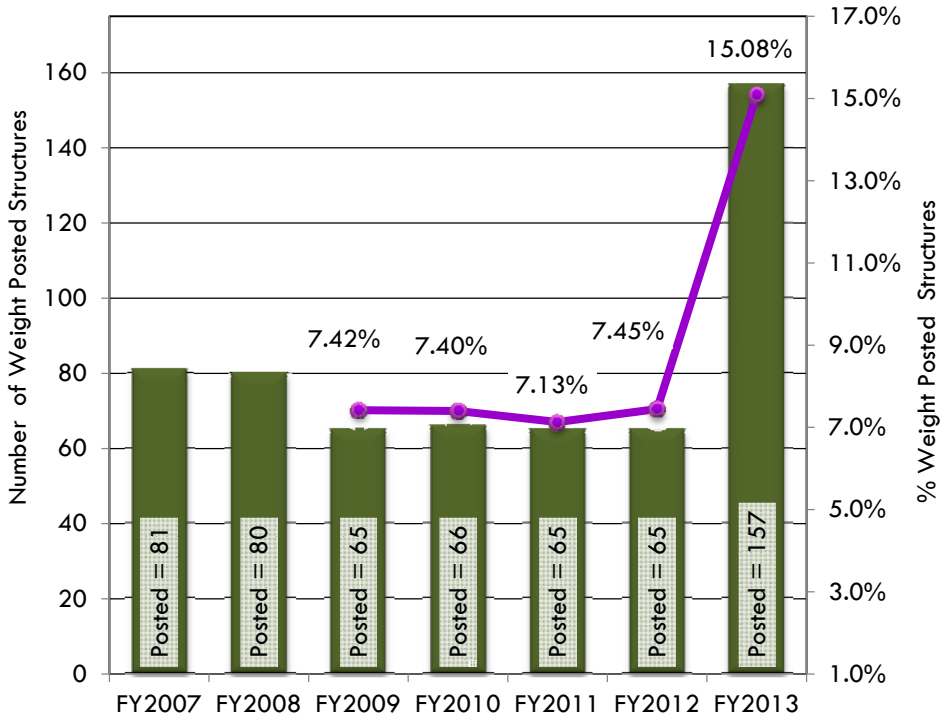


Chart F.15 – Number and Percentage of Weight-Posted Structures - Urban Seven Year Trend



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

HEALTH INDEX MEASURE

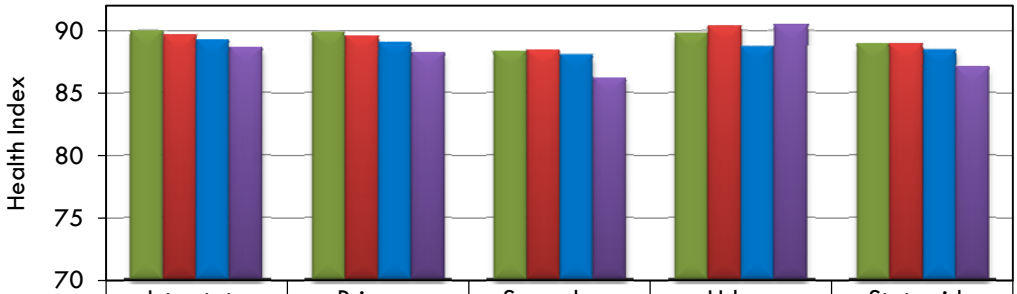
VDOT is now tracking a performance measure called the Health Index, which is part of the AASHTOWare Bridge Management System. The Health Index is calculated as the sum of the current value of all components (elements) divided by the sum of total value of all components. The current value is based on the quantity of the component in each condition state. A Health Index of 100% indicates that all of the condition components of the structure are in the best possible condition state. A Health Index of 0% indicates that all of the condition components 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 component values of each component**.

A component is a part of a bridge for which condition is assessed and work is recommended. Each bridge component can have up to five condition states. Each condition state categorizes the nature and extent of damage or deterioration of a bridge component. Condition state one is always defined as no damage. The higher the condition state, the more damage there is on the component. Condition states for each component have been precisely defined in terms of the specific types of distresses that the components can develop. Charts F.16 and F.17 show the average Health Index (HI) by highway system and by District from FY 2010 to FY 2013. HI data for earlier years is not available.

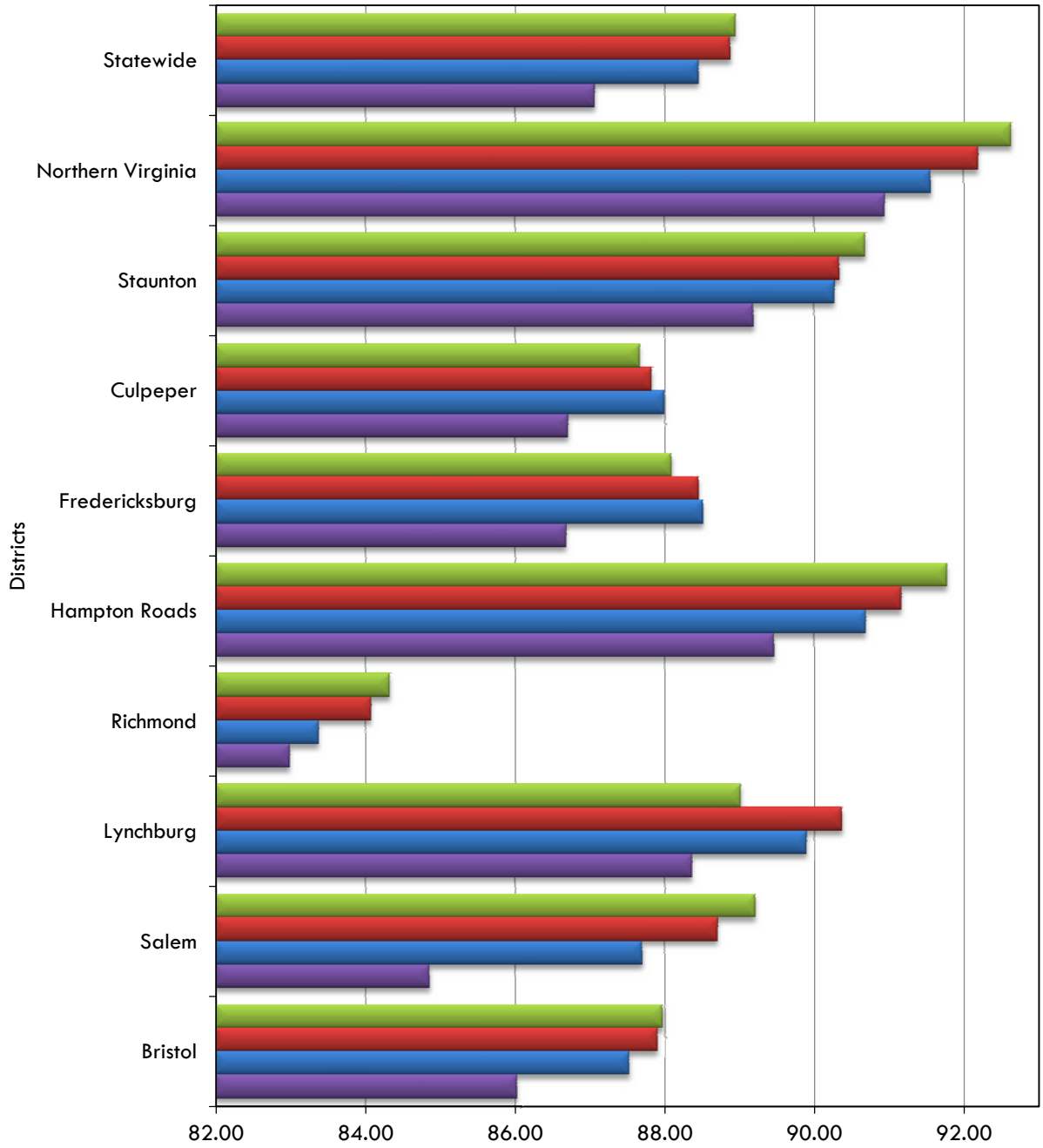
Chart F.16 – Average Health Index of VDOT Structures by System and Statewide



	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

System

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



	Bristol	Salem	Lynchburg	Richmond	Hampton Roads	Fredericksburg	Culpeper	Staunton	Northern Virginia	Statewide
2010	87.97	89.21	89.02	84.33	91.78	88.09	87.67	90.69	92.64	88.95
2011	87.90	88.71	90.37	84.08	91.17	88.45	87.83	90.34	92.20	88.88
2012	87.52	87.70	89.90	83.38	90.69	88.51	87.99	90.28	91.56	88.45
2013	86.02	84.86	88.37	82.99	89.47	86.69	86.71	89.19	90.95	87.07

Appendix G – Inventory Changes from Previous Years

Notes on Charts 13, D.2 – D.8, and F.1 – F.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 reports developed by other divisions.

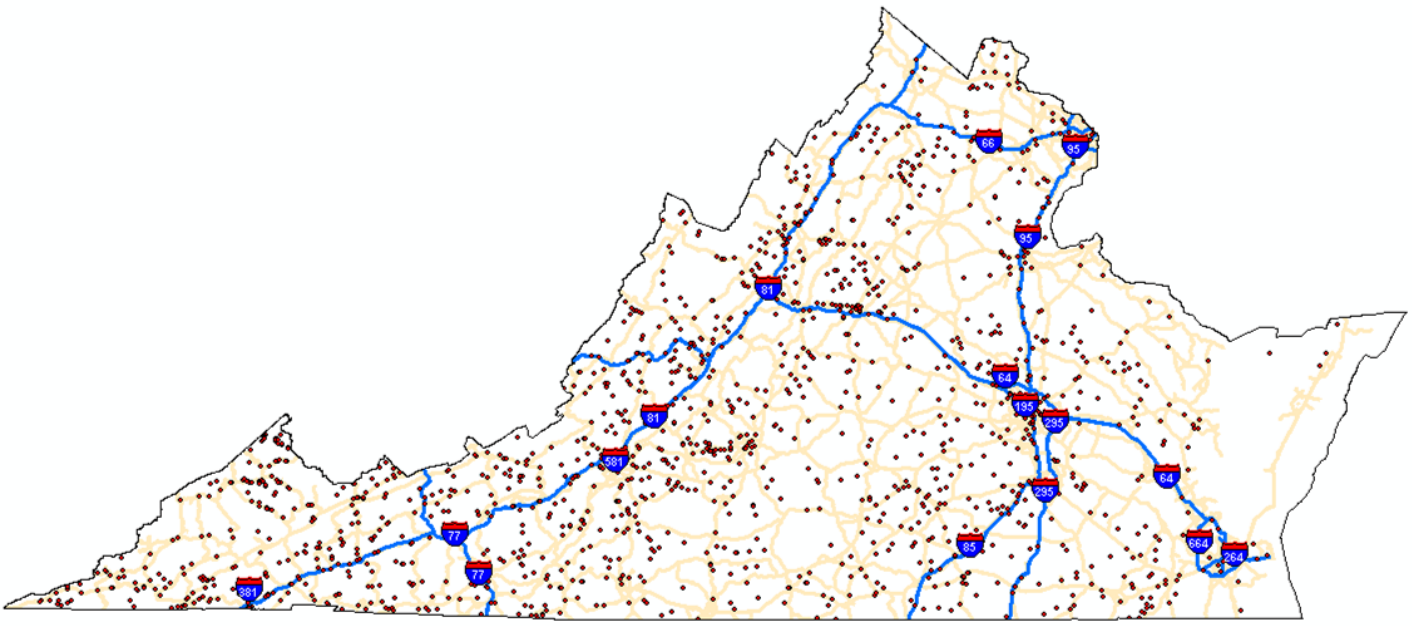
Other factors causing changes in inventory numbers for previous years between this report and previous reports include:

- 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 2013 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, as 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 this year these structures had not been included in VDOT's inventory.
- In Fiscal Year 2013 all the bridges that are 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.
- In Fiscal Year 2013 VDOT looked at both the federal inventory fields, Year Built (F27) and Year Reconstructed (F106) to determine the actual age of the structure. Charts 4 to 6 depict these changes.

APPENDIX H– LOCATIONS OF STRUCTURALLY DEFICIENT STRUCTURES

Statewide – Current FY Structurally Deficient Structures

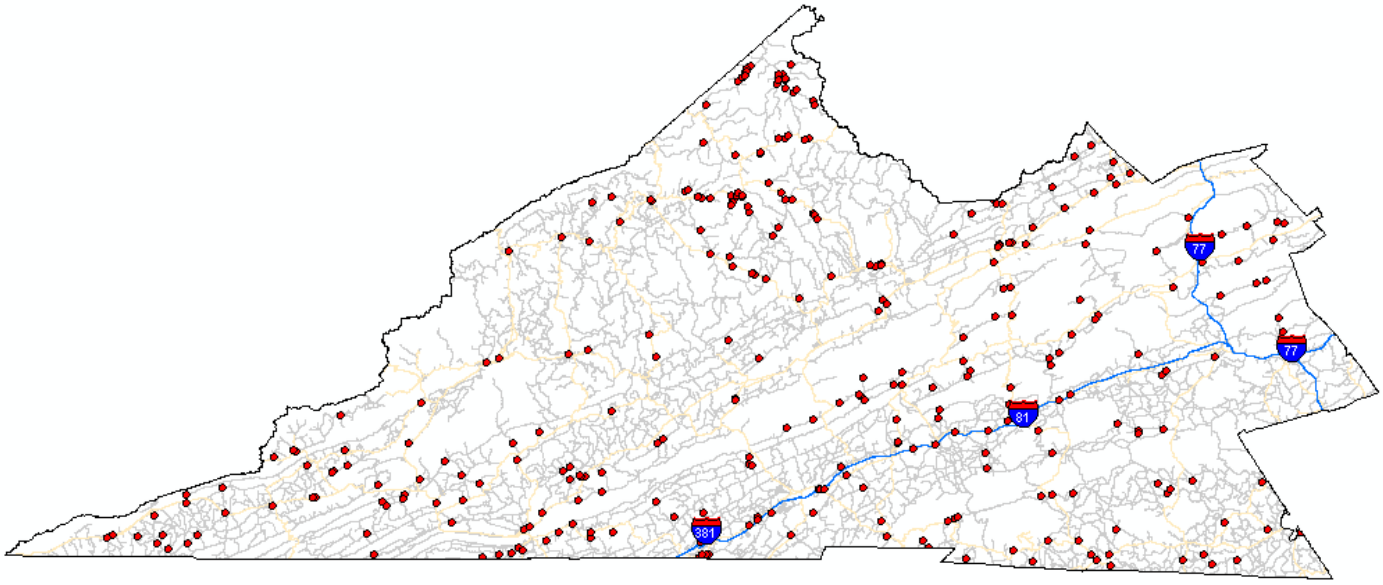
Total Number of Structures = 20,997
Number of SD structures = 1,550 (7.4%)
Total Square Foot Area of Structures = 115,622,921
Square Foot Area of SD Structures = 5,535,165 (4.8%)
● Denotes SD Structure



STATEWIDE

Bristol District – Current FY Structurally Deficient Structures

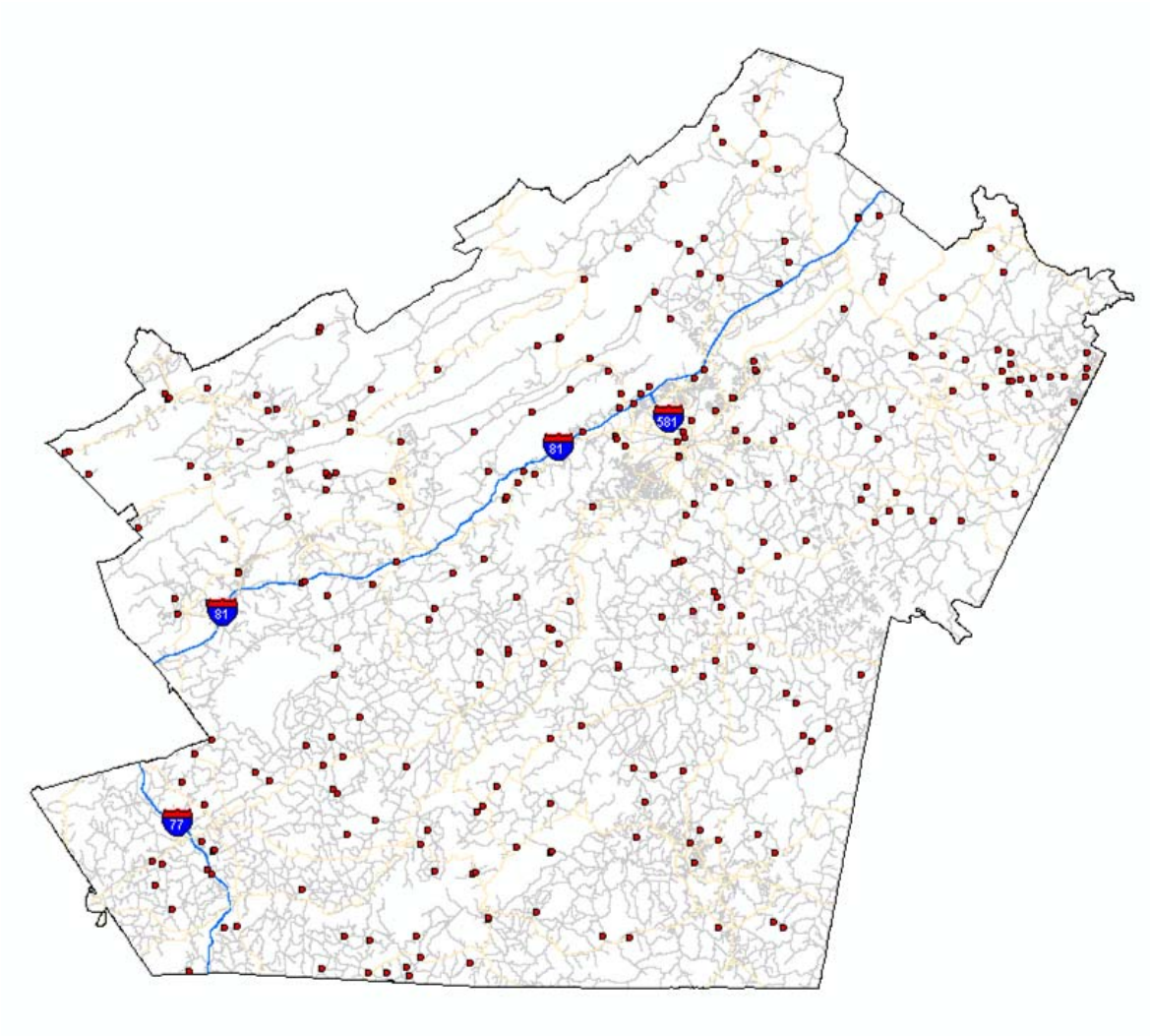
Number of SD structures = 346
Square Foot Area of SD Structures = 642,872
● Denotes SD Structure



BRISTOL

Salem District – Current FY Structurally Deficient Structures

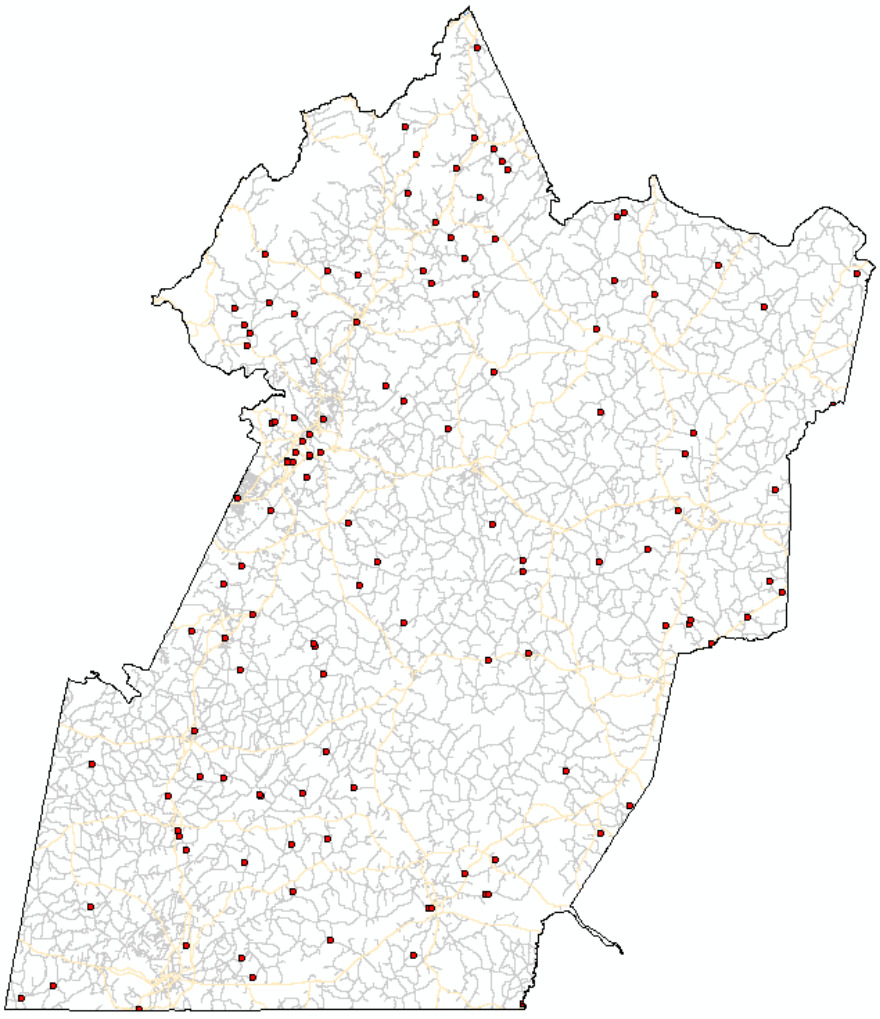
Number of SD structures = 282
Square Foot Area of SD Structures = 586,311
● Denotes SD Structure



SALEM

Lynchburg District – Current FY Structurally Deficient Structures

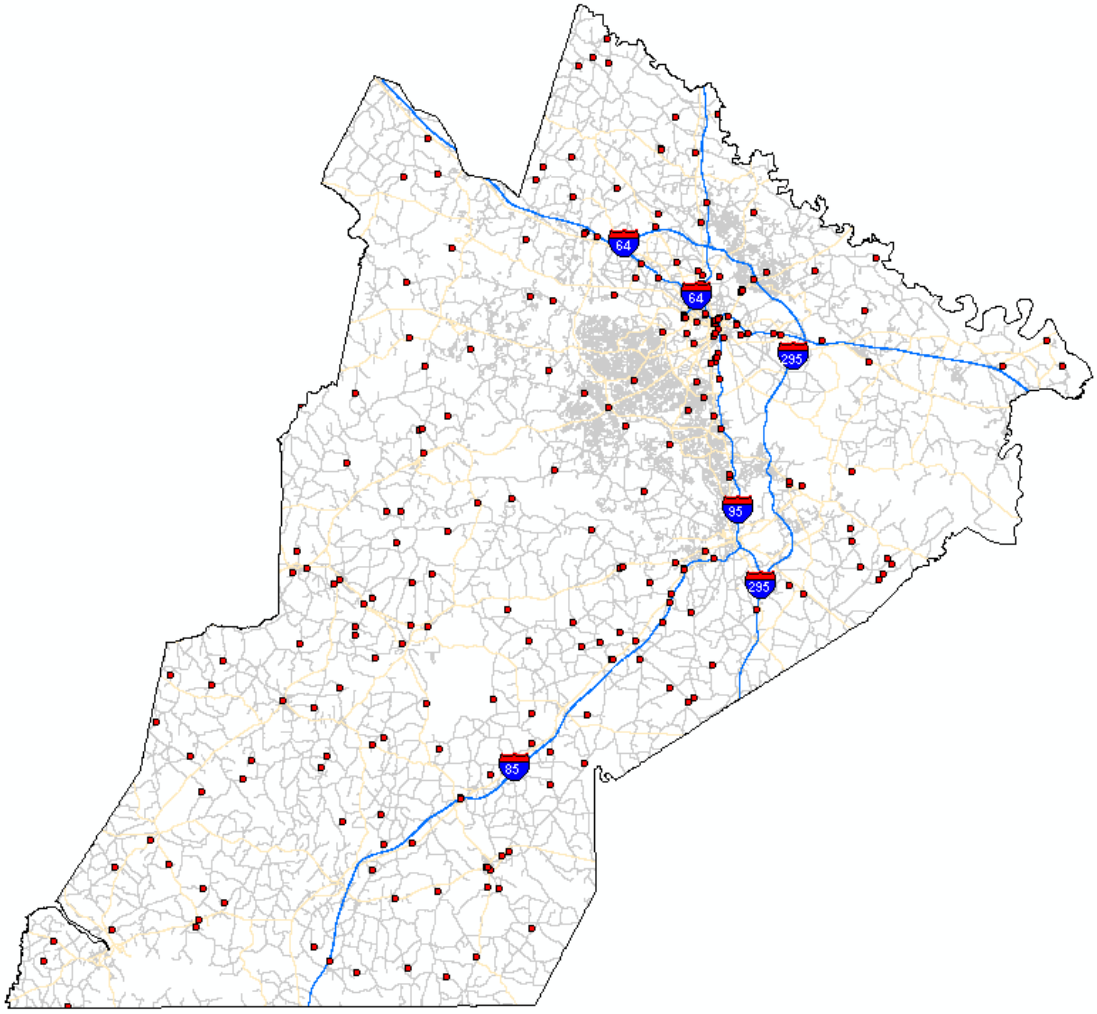
Number of SD structures = 126
Square Foot Area of SD Structures = 313,560
Denotes SD Structure



LYNCHBURG

Richmond District – Current FY Structurally Deficient Structures

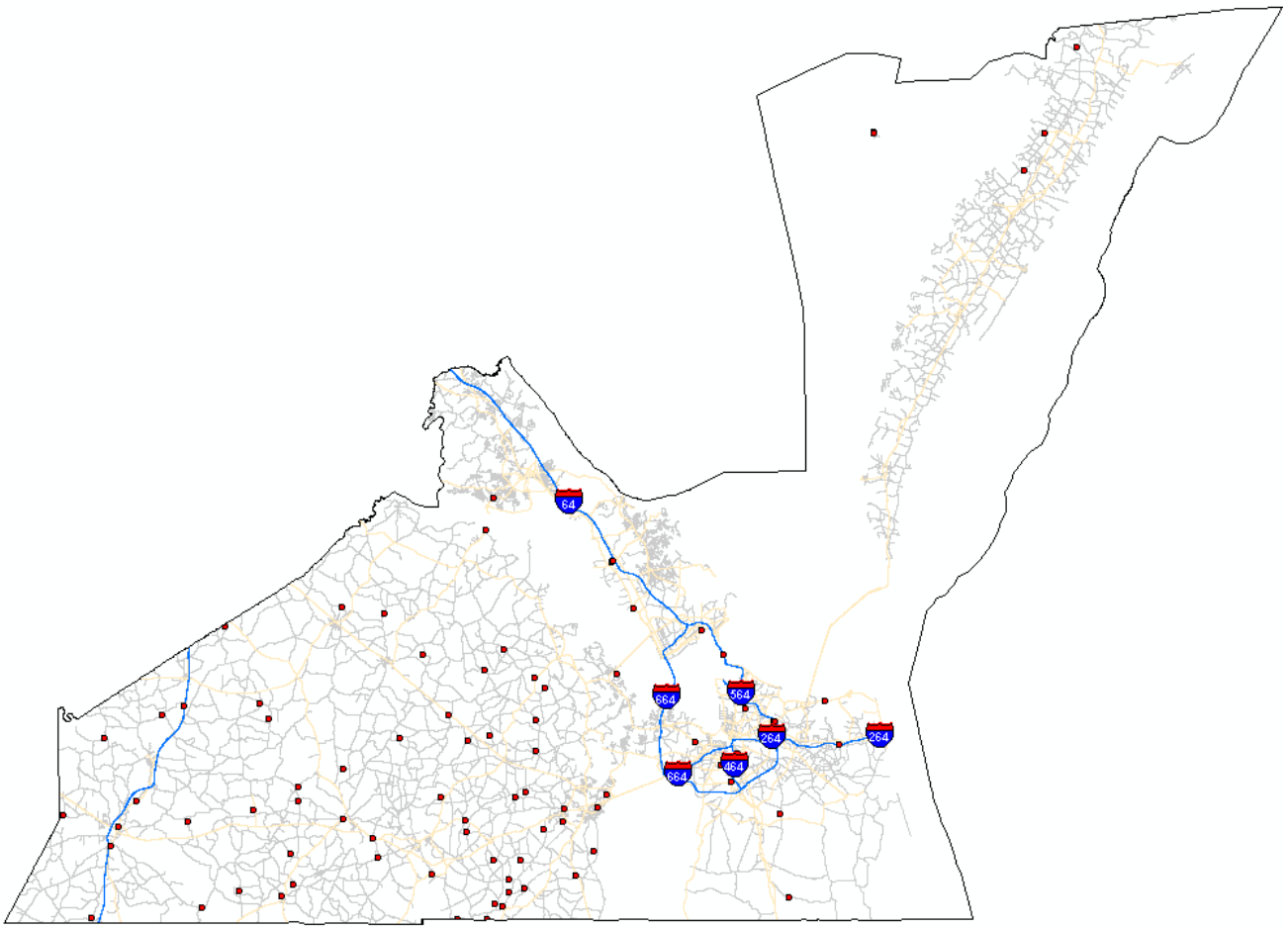
Number of SD structures = 241
Square Foot Area of SD Structures = 1,451,803
● Denotes SD Structure



RICHMOND

Hampton Roads District – Current FY Structurally Deficient Structures

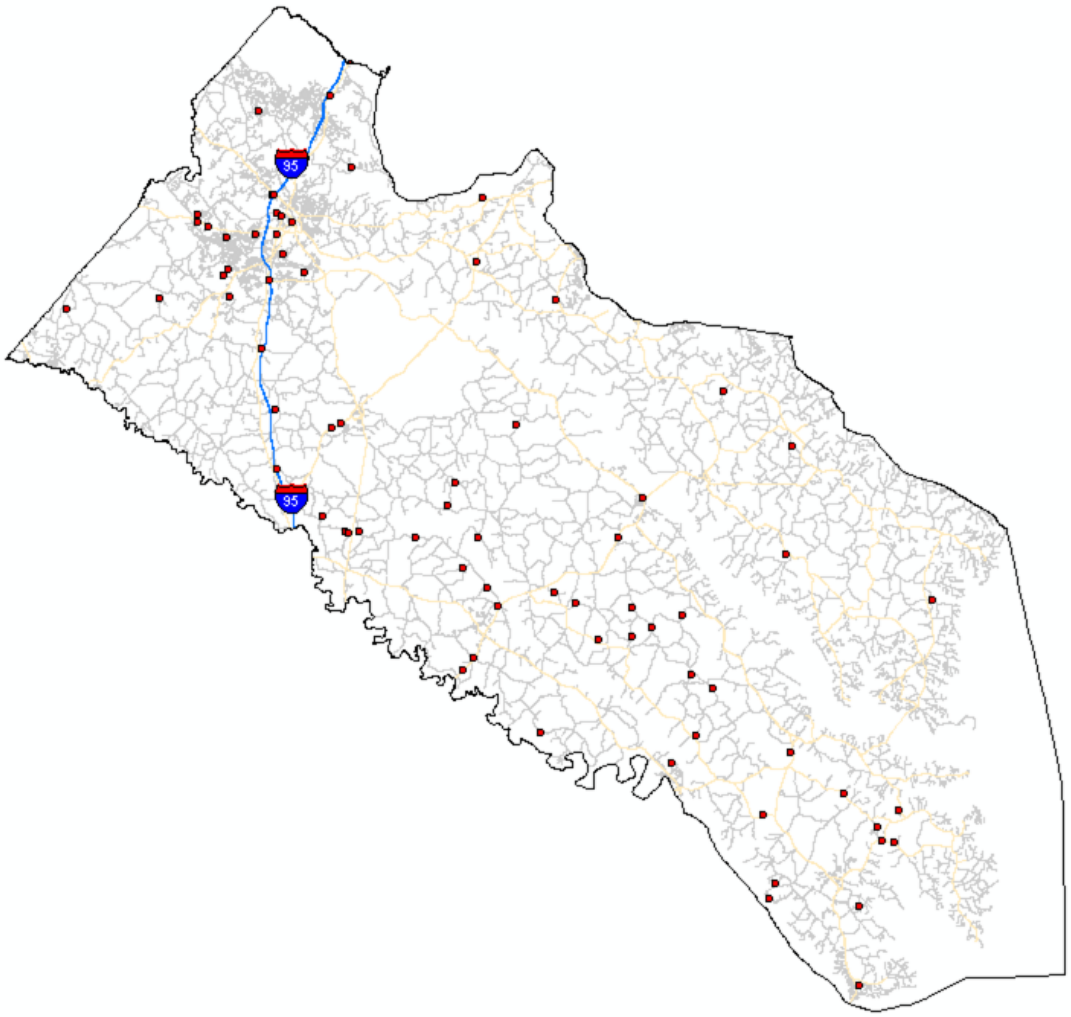
Number of SD structures = 88
Square Foot Area of SD Structures = 956,968
● Denotes SD Structure



HAMPTON ROADS

Fredericksburg District – Current FY Structurally Deficient Structures

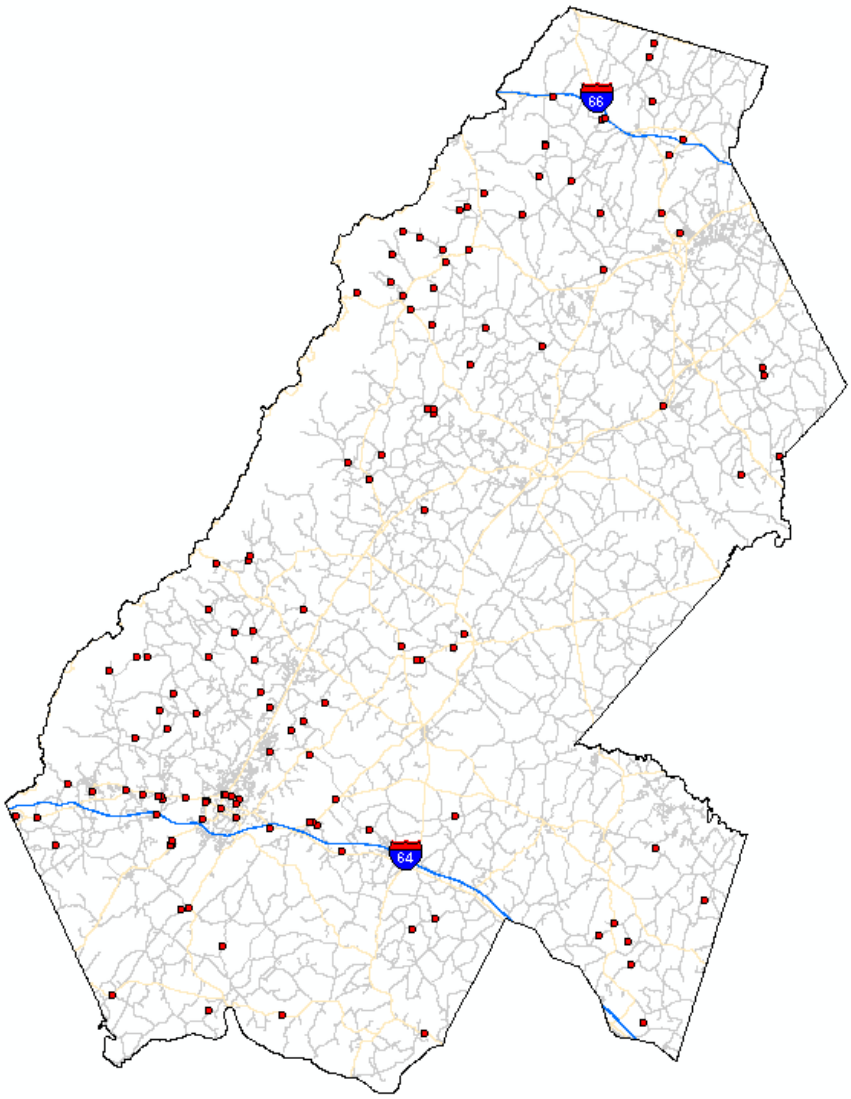
Number of SD structures = 80
Square Foot Area of SD Structures = 496,650
● Denotes SD Structure



FREDERICKSBURG

Culpeper District – Current FY Structurally Deficient Structures

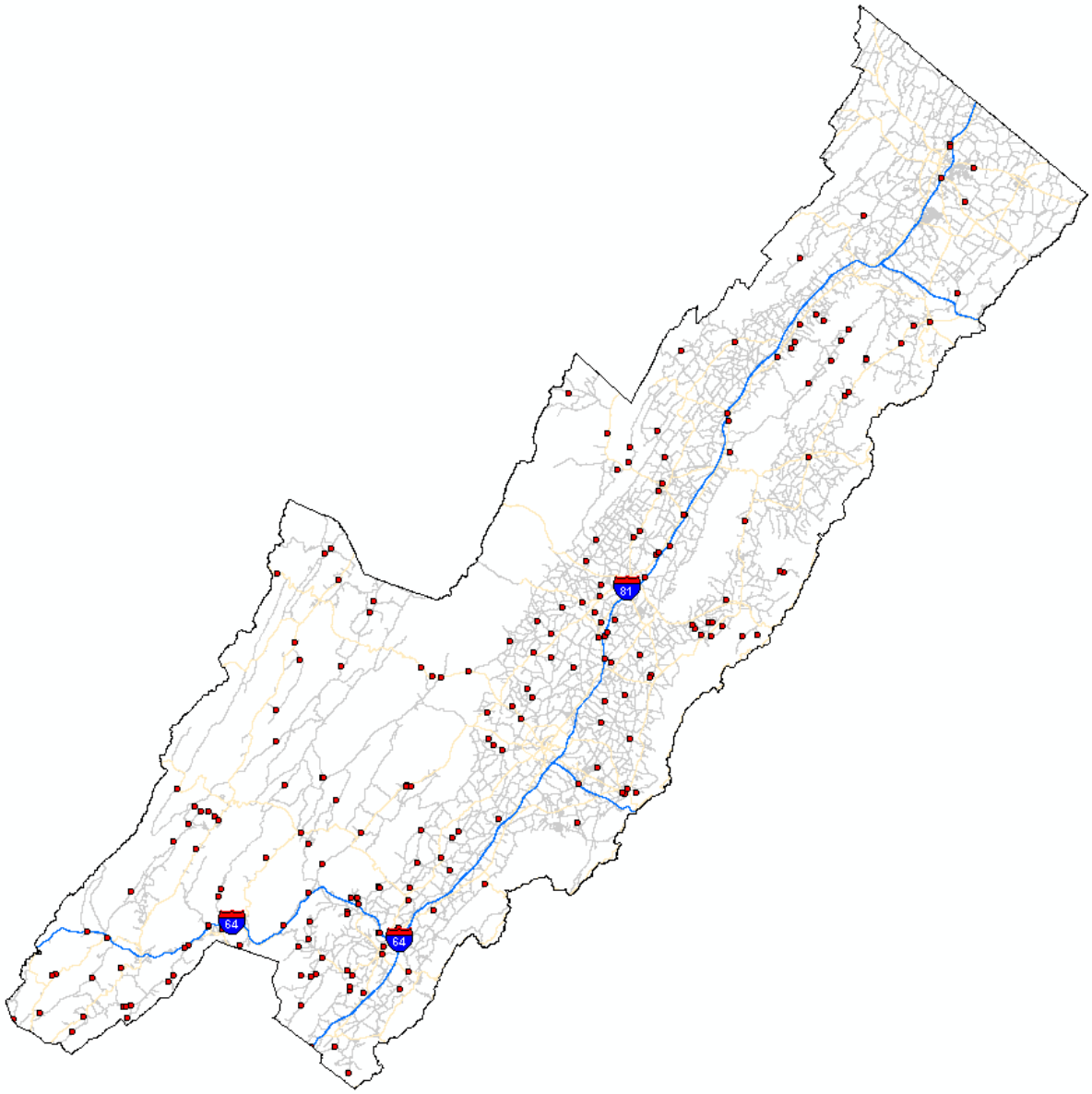
Number of SD structures = 125
Square Foot Area of SD Structures = 272,102
Denotes SD Structure



CULPEPER

Staunton District – Current FY Structurally Deficient Structures

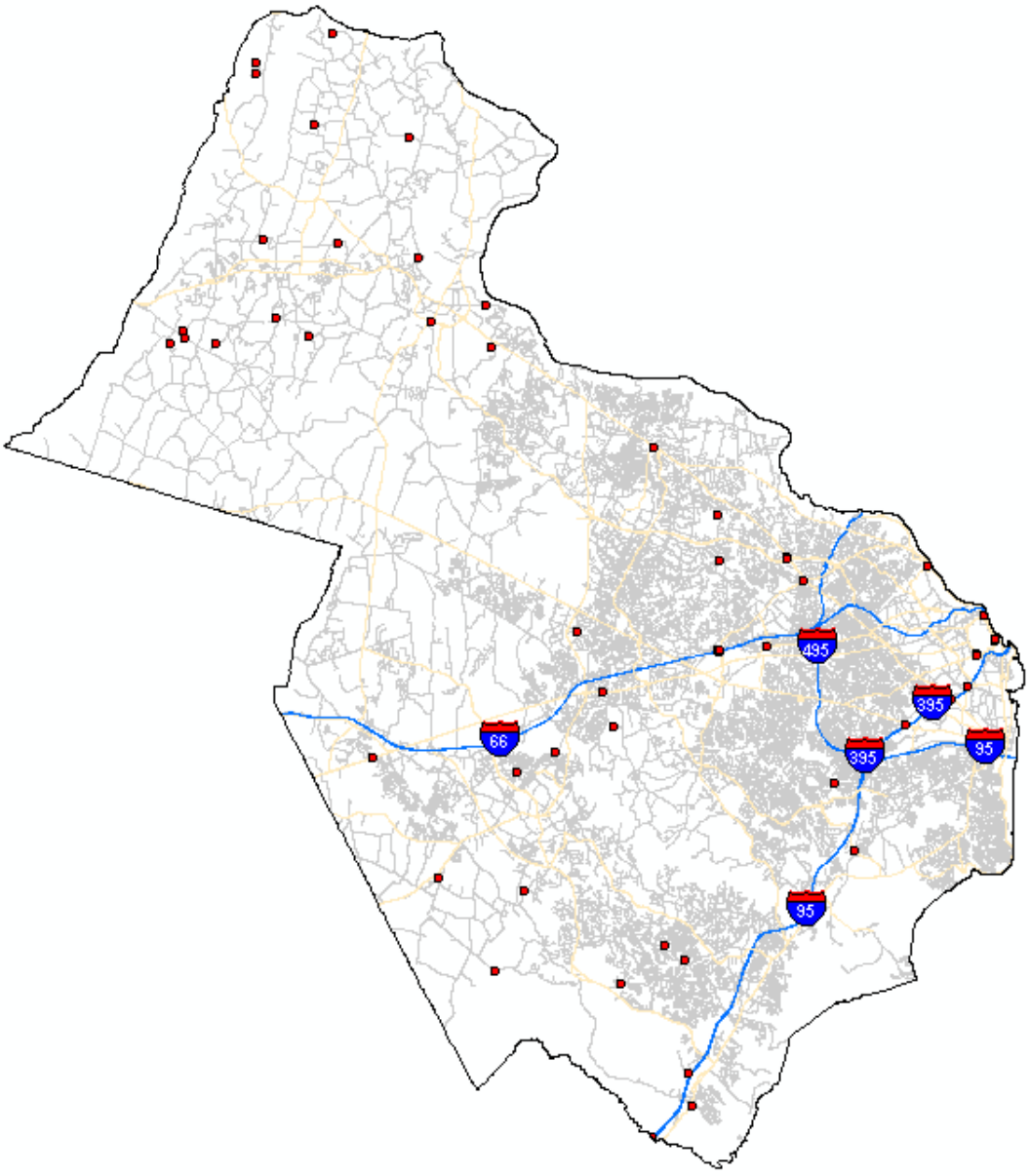
Number of SD structures = 212
Square Foot Area of SD Structures = 509,528
Denotes SD Structure



STAUNTON

NOVA District – Current FY Structurally Deficient Structures

Number of SD structures = 50
Square Foot Area of SD Structures = 305,371
● Denotes SD Structure

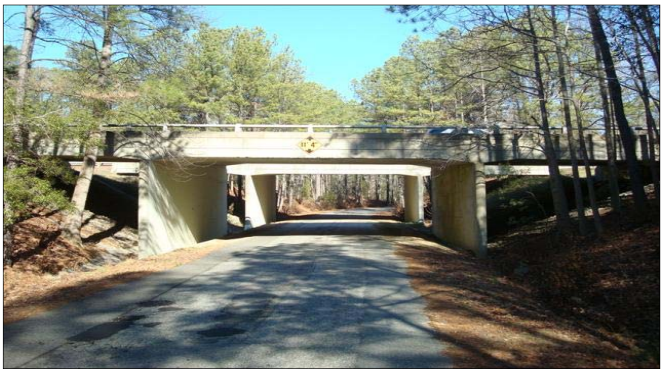


NOVA

Appendix I – Functionally Obsolete Criteria

The following table 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. For Fiscal Year 2013, VDOT inspected 10,775 bridges/culverts at an expenditure of $26.1 million utilizing in-house inspection staff and 14 consultant contracts. Also, VDOT inspected 3,068 ancillary structures at an expenditure of $4.6 million. The ten (10) consultant contracts were for bridge and ancillary structures inspection and included one (1) 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 can 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 safety inspection program provides the basis for most of the Commonwealth's maintenance and bridge management decisions. Accordingly, 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. Include 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 FY13

District	Number of Inspections (July 2012 thru June 2013)						
	Bridges		Culverts		Ancillary		Total No. Structures
	No.	Percent	No.	Percent	No.	Percent	
Bristol	1,324	18.4%	436	11.4%	74	2.4%	1,834
Salem	1,135	115.7%	610	11.8%	810	26.4%	2,555
Lynchburg	707	9.8%	308	15.2%	21	0.7%	1,036
Richmond	793	11.0%	528	14.5%	1,126	36.7%	2,447
Hampton Roads	655	9.1%	167	7.5%	161	5.2%	983
Fredericksburg	245	3.4%	189	4.1%	110	3.6%	544
Culpeper	556	7.7%	303	8.7%	170	5.5%	1,029
Staunton	1,320	18.3%	645	15.8%	0	0.0%	1,965
NOVA	478	6.6%	376	10.9%	596	19.4%	1,450
Total	**7,213**	**100.0%**	**3,562**	**100.0%**	**3,068**	**100.0%**	**13,843**

In 2008, VDOT S&B developed Information and Instruction Memorandum (IIM) IIM-S&B-78 describing the bridge safety inspection QC/QA program which includes 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. In addition to this requirement, VDOT S&B 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 bridge 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 14 structures at a cost of $31,000.

The Federal Highway Administration (FHWA) conducted an annual NBIS Compliance Review from April 1, 2012 to March 30, 2013 with a report provided by December 31, 2012. The Department had 45 days to address any deficiencies that are 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 Staunton and Richmond Districts. The Department was found in compliance with all 23 NBIS metrics that were reviewed for calendar year 2012. The Department is establishing a QA/QC program for ancillary structures similar to what is established for bridge inspections.

APPENDIX K – ANCILLARY STRUCTURES CONDITION RATINGS

The 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. The tables in the following pages provide illustrative examples of some of these ratings.

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

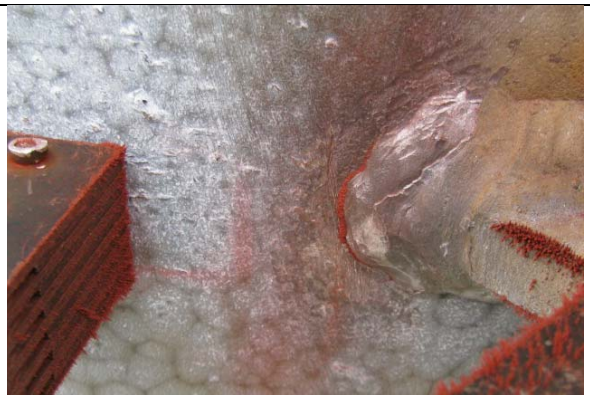
Loose Bolt at splice plate.

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	General Condition Rating								Average General Condition Rating
		Good				Fair	Poor			
		9	8	7	6	5	4	3	<2	
Foundation	Cantilever	37	112	525	368	211	75	70	28	6.12
	Overhead	36	141	482	460	211	80	74	13	6.15
	Butterfly	8	31	61	8	11	2	0	1	7.05
	Total	**81**	**284**	**1,068**	**836**	**433**	**157**	**144**	**42**	**6.17**
Parapet	Parapet Mount	3	18	188	187	61	16	2	0	6.28
	Total	**3**	**18**	**188**	**187**	**61**	**16**	**2**	**0**	**6.28**
Superstructure	Cantilever	36	142	709	394	113	19	5	8	6.63
	Overhead	50	158	631	479	117	30	32	0	6.55
	Butterfly	9	27	56	21	8	1	0	0	7.04
	Total	**95**	**327**	**1,396**	**894**	**238**	**50**	**37**	**8**	**6.61**

*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	Structure Type	General Condition Rating								Average General Condition Rating
		Good				Fair	Poor			
		9	8	7	6	5	4	3	<2	
Foundation	Luminaires	274	4,321	1,646	980	3,544	189	4,120	154	5.61
	Total	**274**	**4,321**	**1,646**	**980**	**3,544**	**189**	**4,120**	**154**	**5.61**
Parapet	Parapet Mount	11	478	421	281	612	41	977	83	5.08
	Total	**11**	**478**	**421**	**281**	**612**	**41**	**977**	**83**	**5.08**
Superstructure	Luminaires	298	4,501	4,988	1,661	2,500	268	939	73	6.57
	Total	**298**	**4,501**	**4,988**	**1,661**	**2,500**	**268**	**939**	**73**	**6.57**

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

Location on Structure	Structure Type	General Condition Rating								Average General Condition
		Good				Fair	Poor			
		9	8	7	6	5	4	3	<2	
Foundation	Cantilever	663	1,075	636	1,024	2,671	202	524	72	5.97
	Span Wire	22	80	67	258	1,298	58	128	33	5.14
	Over Head	0	0	0	0	1	0	0	0	5.00
	Total	**685**	**1,155**	**703**	**1,282**	**3,970**	**260**	**652**	**105**	**5.79**
Parapet	Papapet Mount	1	1	2	4	5	0	1	0	5.93
	Total	**1**	**1**	**2**	**4**	**5**	**0**	**1**	**0**	**5.93**
Superstructure	Cantilever	694	1,448	2,101	1,272	617	144	441	150	6.62
	Span Wire	23	106	501	484	325	250	206	49	5.56
	Papapet Mount	1	3	1	5	4	0	0	0	6.43
	Over Head	0	0	0	0	0	0	1	0	3.00
	Total	**718**	**1,557**	**2,603**	**1,761**	**946**	**394**	**648**	**199**	**6.39**

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

Location on Structure	Structure Type	General Condition Rating								Average General Condition
		Good				Fair	Poor			
		9	8	7	6	5	4	3	<2	
Foundation	High Mast	1	97	267	207	52	38	10	21	6.32
	Camera Pole	0	40	301	66	19	4	0	1	6.81
	Total	**1**	**137**	**568**	**273**	**71**	**42**	**10**	**22**	**6.51**
Parapet	High Mast	0	140	391	36	120	2	3	1	6.77
	Camera Pole	2	56	313	43	1	1	0	15	6.78
	Total	**2**	**196**	**704**	**79**	**121**	**3**	**3**	**16**	**6.78**

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.1l. Charts K.1a through K.1d presents minimum general condition rating by structure type with GCR percentages. In order to present meaningful graphs with appropriate vertical scales, Charts K.1e through K.1l 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	General Condition Rating			Total	General Condition Rating		
		Good	Fair	Poor		Good	Fair	Poor
Foundation	Cantilever	1,042	211	173	1,426	73.1%	14.8%	12.1%
	Overhead	1,119	211	167	1,497	74.7%	14.1%	11.2%
	Butterfly	108	11	3	122	88.5%	9.0%	2.5%
	Total	**2,269**	**433**	**343**	**3,045**	**74.5%**	**14.2%**	**11.3%**
Parapet	Parapet Mount	396	61	18	475	83.4%	12.8%	3.8%
	Total	**396**	**61**	**18**	**475**	**83.4%**	**12.8%**	**3.8%**
Superstructure	Cantilever	1,281	113	32	1,426	89.8%	7.9%	2.2%
	Overhead	1,318	117	62	1,497	88.0%	7.8%	4.1%
	Butterfly	113	8	1	122	92.6%	6.6%	0.8%
	Total	**2,712**	**238**	**95**	**3,045**	**89.1%**	**7.8%**	**3.1%**

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

Location on Structure	Structure Type	General Condition Rating			Total	General Condition Rating		
		Good	Fair	Poor		Good	Fair	Poor
Foundation	Luminaires	7,221	3,544	4,463	15,228	47.4%	23.3%	29.3%
	Total	**7,221**	**3,544**	**4,463**	**15,228**	**47.4%**	**23.3%**	**29.3%**
Parapet	Parapet Mount	1,191	612	1,101	2,904	41.0%	21.1%	37.9%
	Total	**1,191**	**612**	**1,101**	**2,904**	**41.0%**	**21.1%**	**37.9%**
Superstructure	Luminaires	11,448	2,500	1,280	15,228	75.2%	16.4%	8.4%
	Total	**11,448**	**2,500**	**1,280**	**15,228**	**75.2%**	**16.4%**	**8.4%**

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

Location on Structure	Structure Type	General Condition Rating			Total	General Condition Rating		
		Good	Fair	Poor		Good	Fair	Poor
Foundation	Cantilever	3,398	2,671	798	6,867	49.5%	38.9%	11.6%
	Span Wire	427	1,298	219	1,944	22.0%	66.8%	11.3%
	Over Head	0	1	0	1	0.0%	100.0%	0.0%
	Total	**3,825**	**3,970**	**1,017**	**8,812**	**43.4%**	**45.1%**	**11.5%**
Parapet	Papapet Mount	8	5	1	14	57.1%	35.7%	7.1%
	Total	**8**	**5**	**1**	**14**	**57.1%**	**35.7%**	**7.1%**
Superstructure	Cantilever	5,515	617	735	6,867	80.3%	9.0%	10.7%
	Span Wire	1,114	325	505	1,944	57.3%	16.7%	26.0%
	Papapet Mount	10	4	0	14	71.4%	28.6%	0.0%
	Over Head	0	0	1	1	0.0%	0.0%	100.0%
	Total	**6,639**	**946**	**1,241**	**8,826**	**75.2%**	**10.7%**	**14.1%**

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

Location on Structure	Structure Type	General Condition Rating			Total	General Condition Rating		
		Good	Fair	Poor		Good	Fair	Poor
Foundation	High Mast	572	52	69	693	82.5%	7.5%	10.0%
	Camera Pole	407	19	5	431	94.4%	4.4%	1.2%
	Total	**979**	**71**	**74**	**1,124**	**87.1%**	**6.3%**	**6.6%**
Parapet	High Mast	567	120	6	693	81.8%	17.3%	0.9%
	Camera Pole	414	1	16	431	96.1%	0.2%	3.7%
	Total	**981**	**121**	**22**	**1,124**	**87.3%**	**10.8%**	**2.0%**

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

Structure Type	General Condition Rating			General Condition Rating		
	Good	Fair	Poor	Good	Fair	Poor
Signs	2,504	597	419	71.1%	17.0%	11.9%
Signals	3,218	3,540	2,068	36.5%	40.1%	23.4%
High Mast Lights and Camera Poles	882	150	92	78.5%	13.3%	8.2%
Luminaires	6,728	5,090	6,314	37.1%	28.1%	34.8%
Total	**13,332**	**9,377**	**8,893**	**42.2%**	**29.7%**	**28.1%**

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

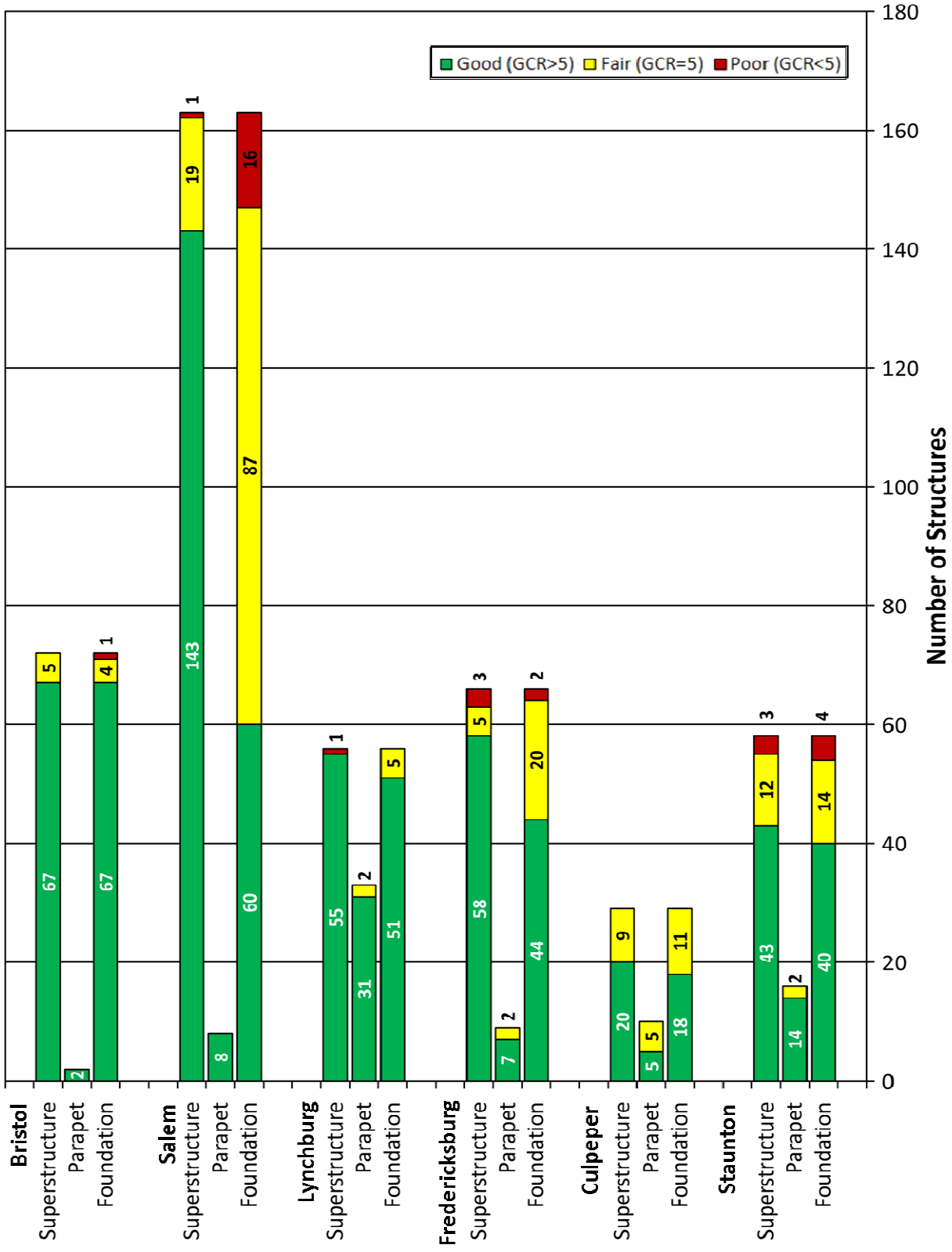
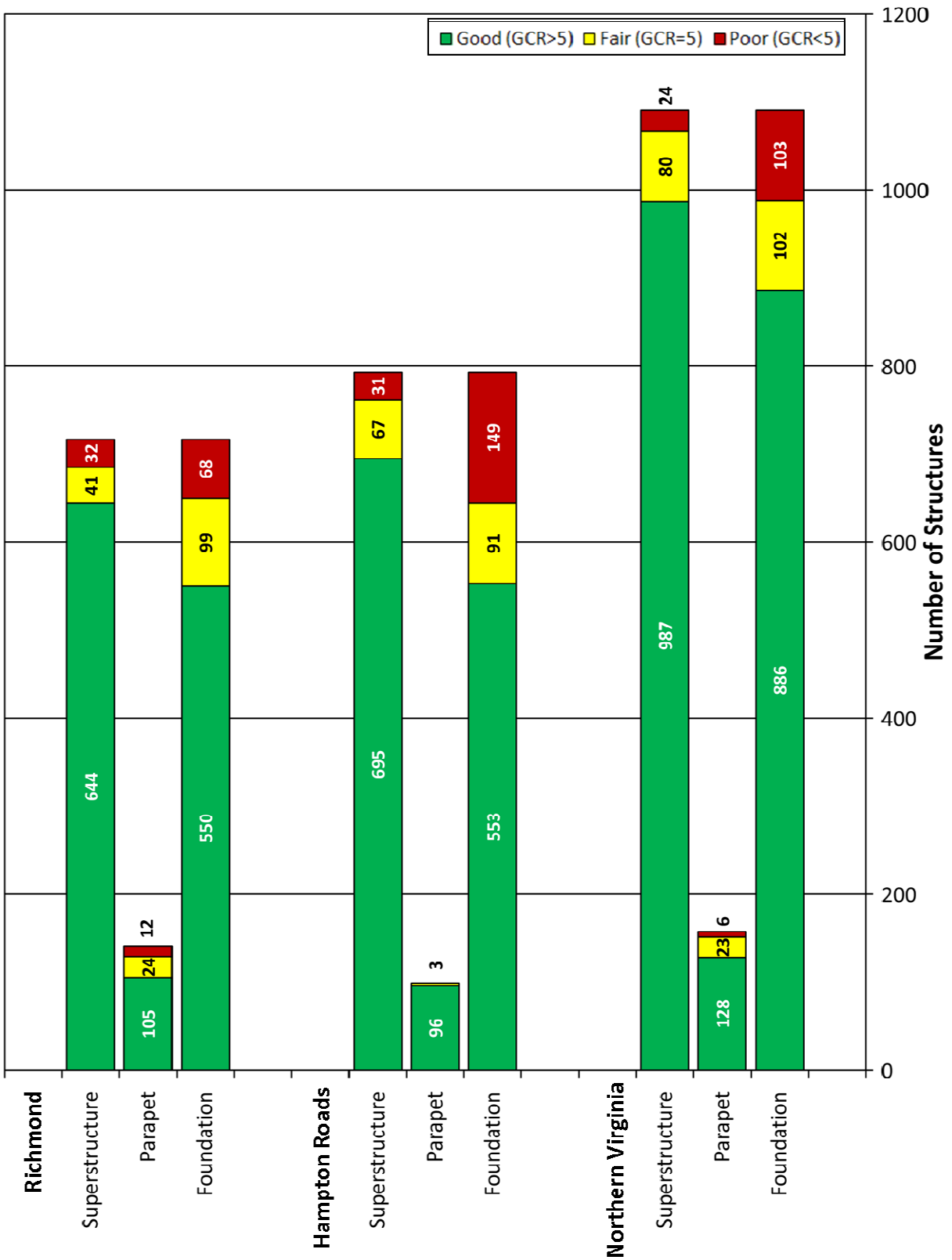


Chart K.1b – General Condition of Sign Structures – Large Inventory Districts



Sign Structure General Condition by District

Chart K.1c – General Condition of Luminaire – Small Inventory Districts

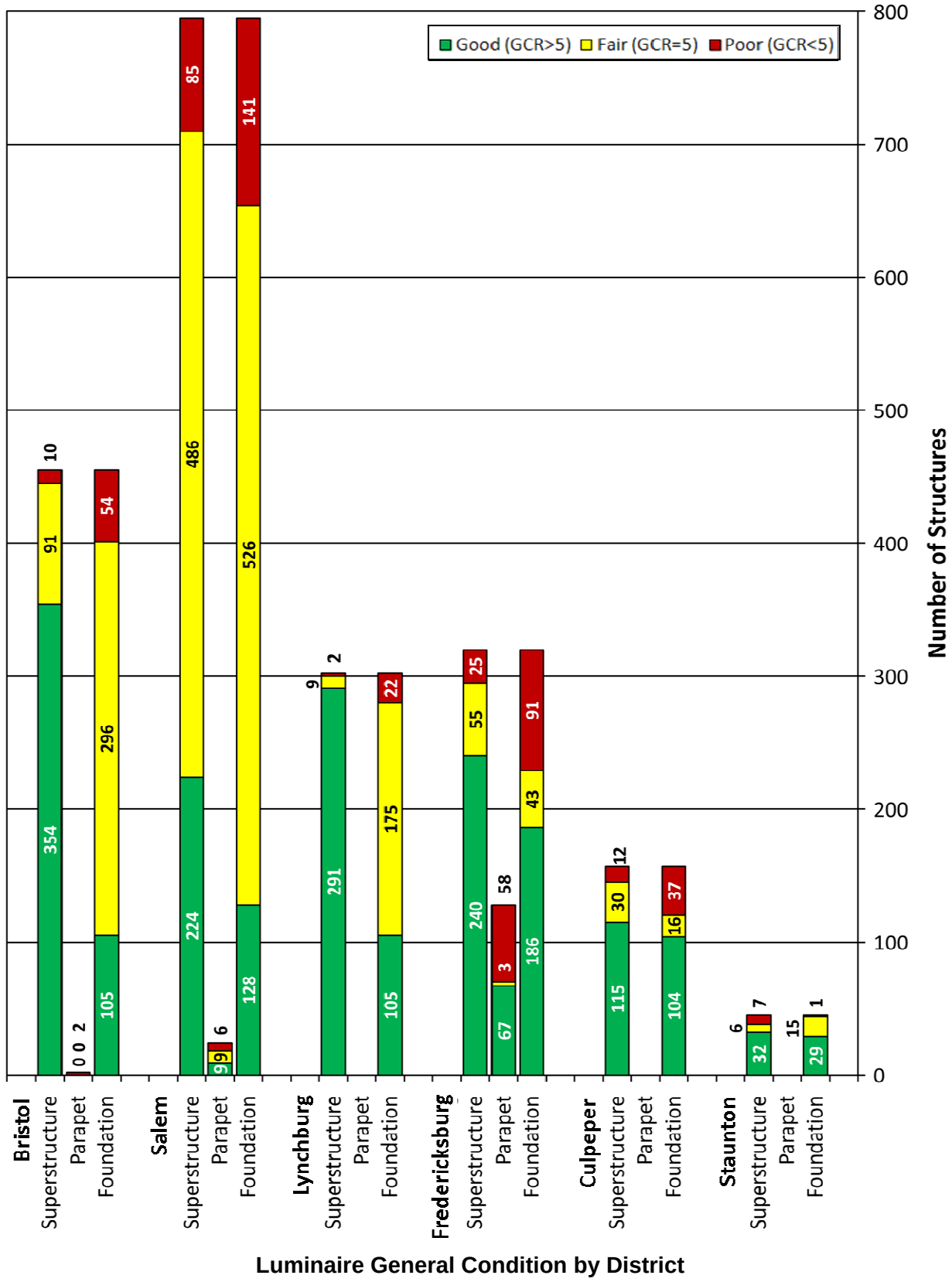


Chart K.1d – General Condition of Luminaire – Large Inventory Districts

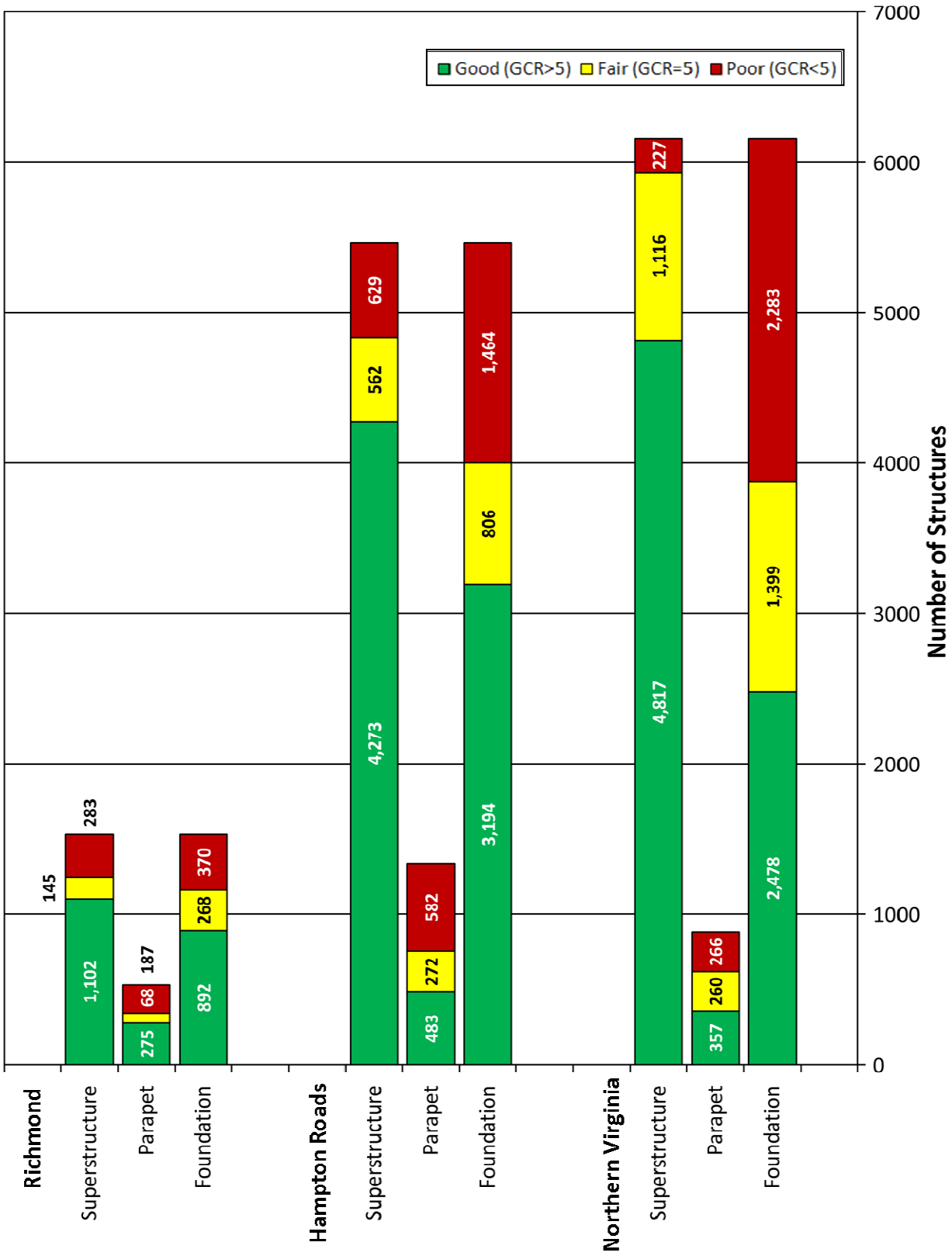
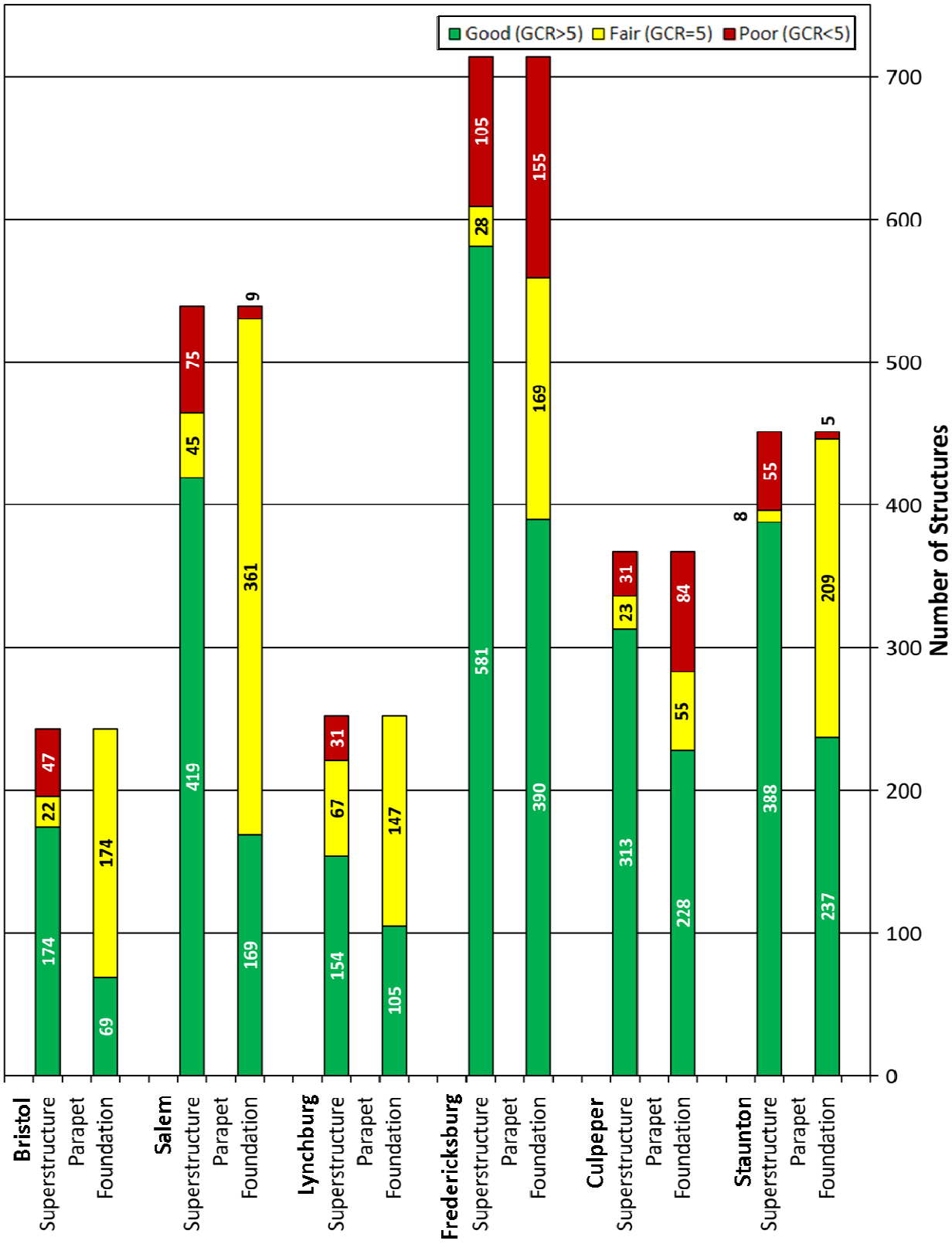
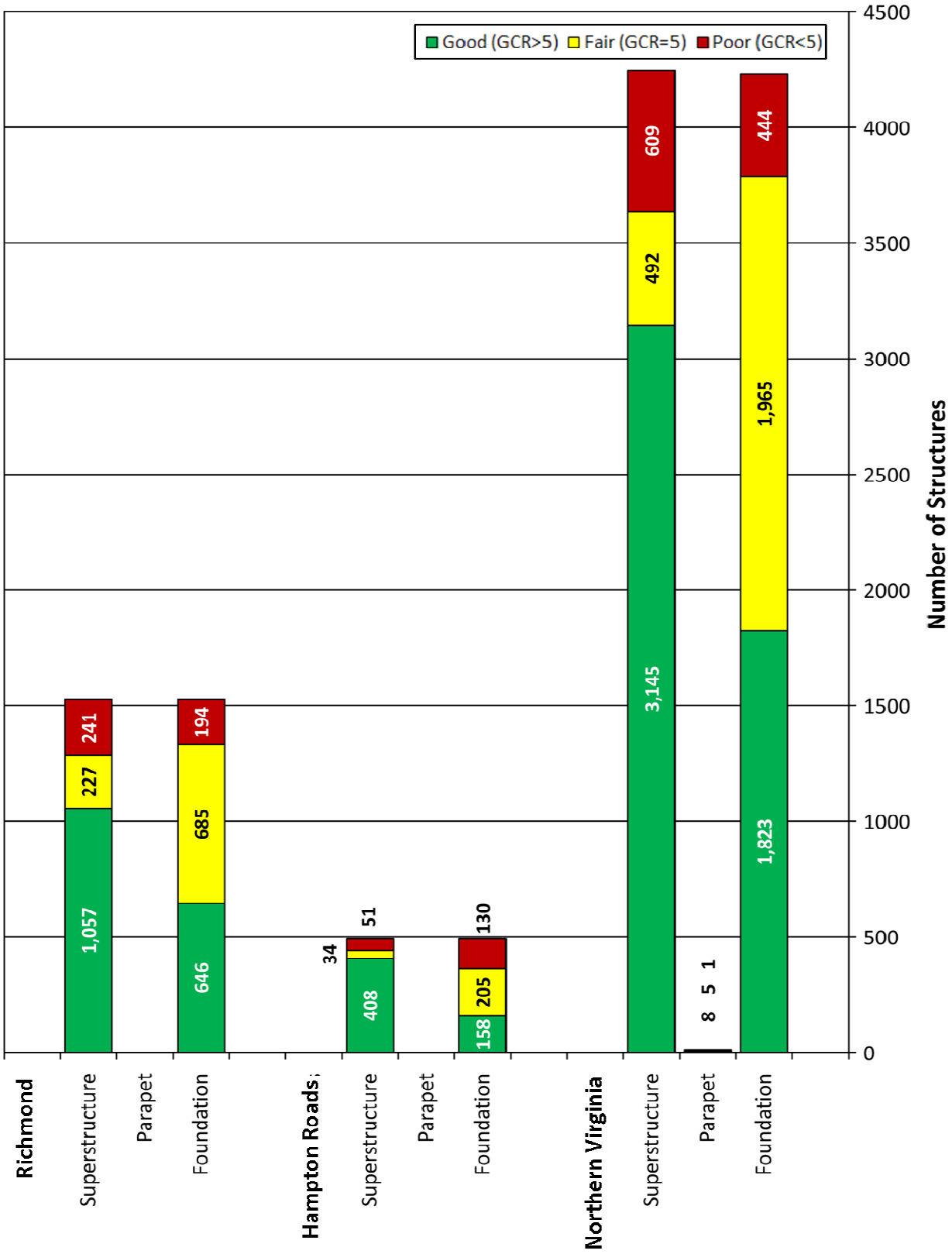


Chart K.1e – General Condition of Signal Structures – Small Inventory Districts



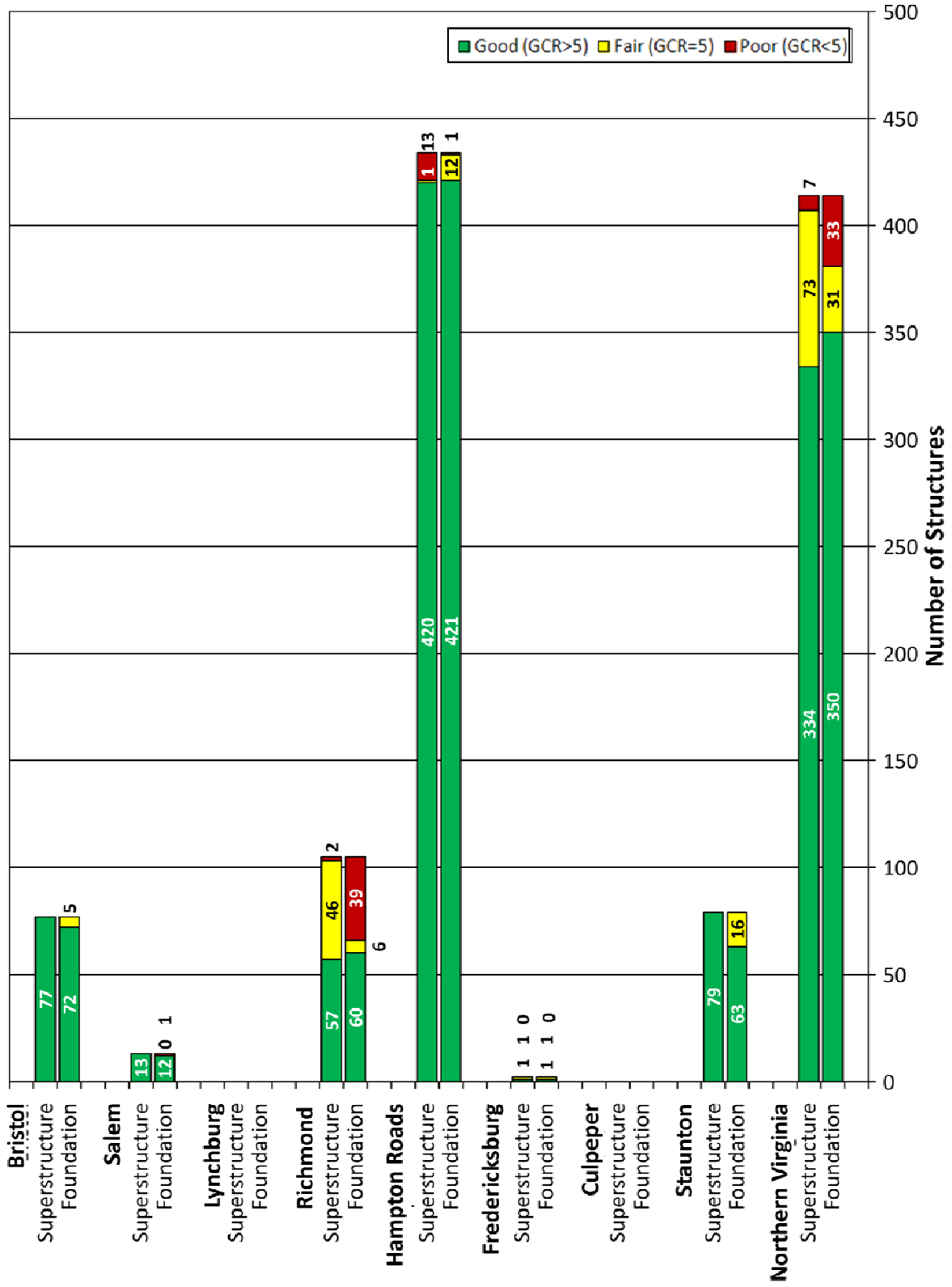
Signal Structure General Condition by District

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



Signal Structure General Condition by District

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 – Problems Identified with Sign Structure Foundations that are in Poor Condition

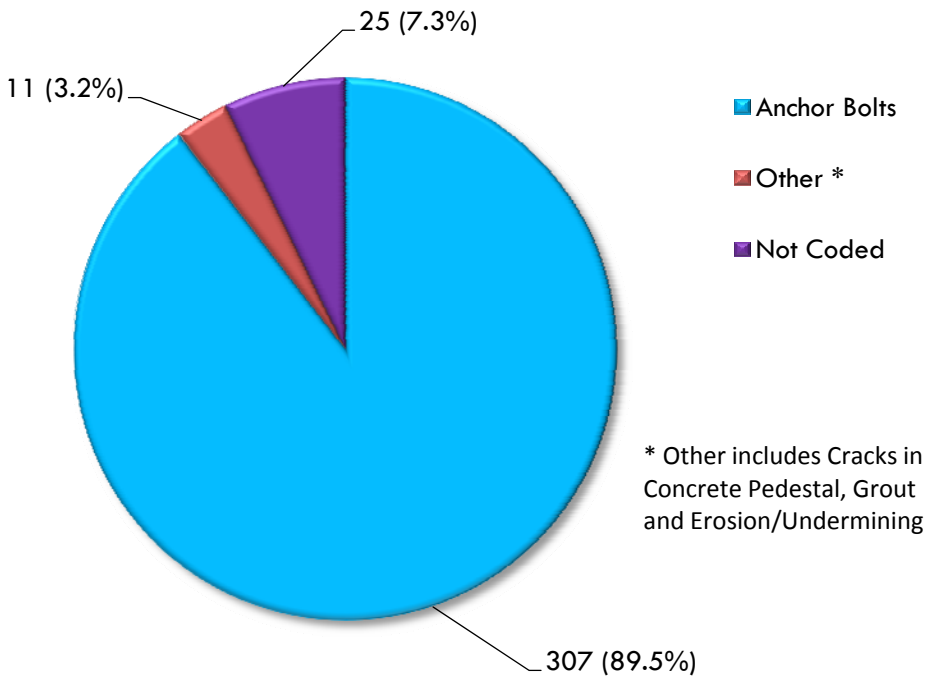


Chart K.2.b – Problems Identified with Sign Structure Parapet Mounting that are in Poor Condition

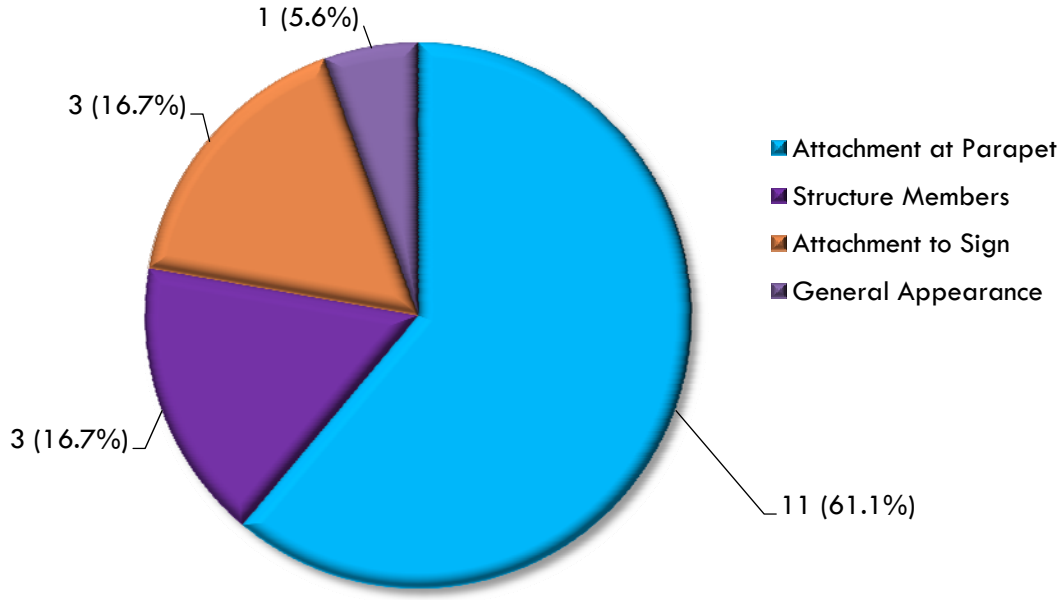


Chart K.2.c – Problems Identified with Sign Structure Superstructures that are in Poor Condition

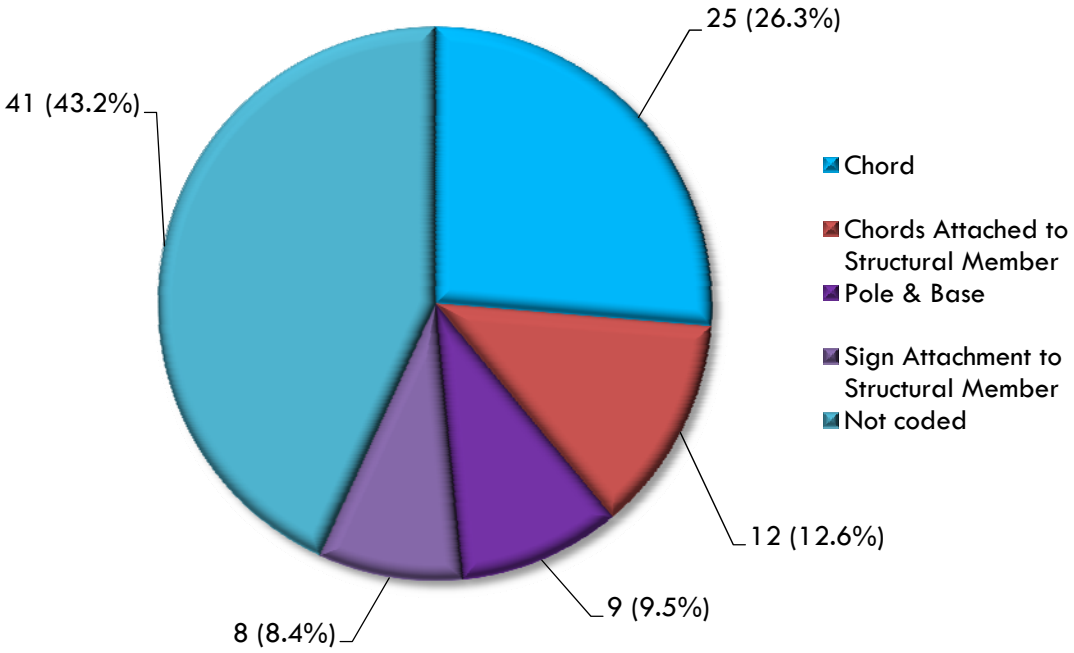


Chart K.3.a – Problems Identified with Luminaire Foundations that are in Poor Condition

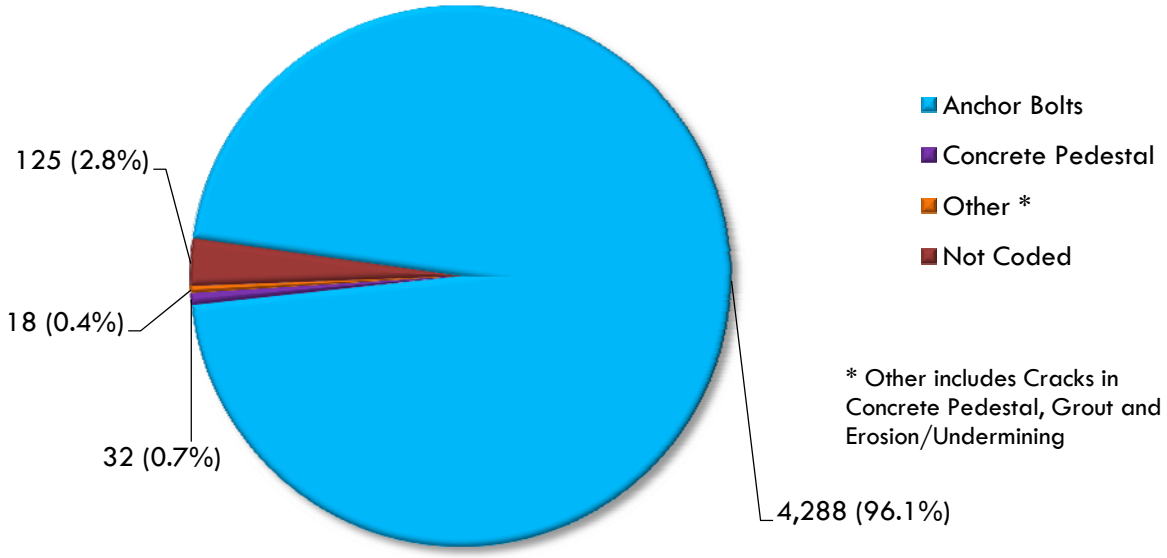


Chart K.3.b – Problems Identified with Luminaire Parapet Mounts that are in Poor Condition

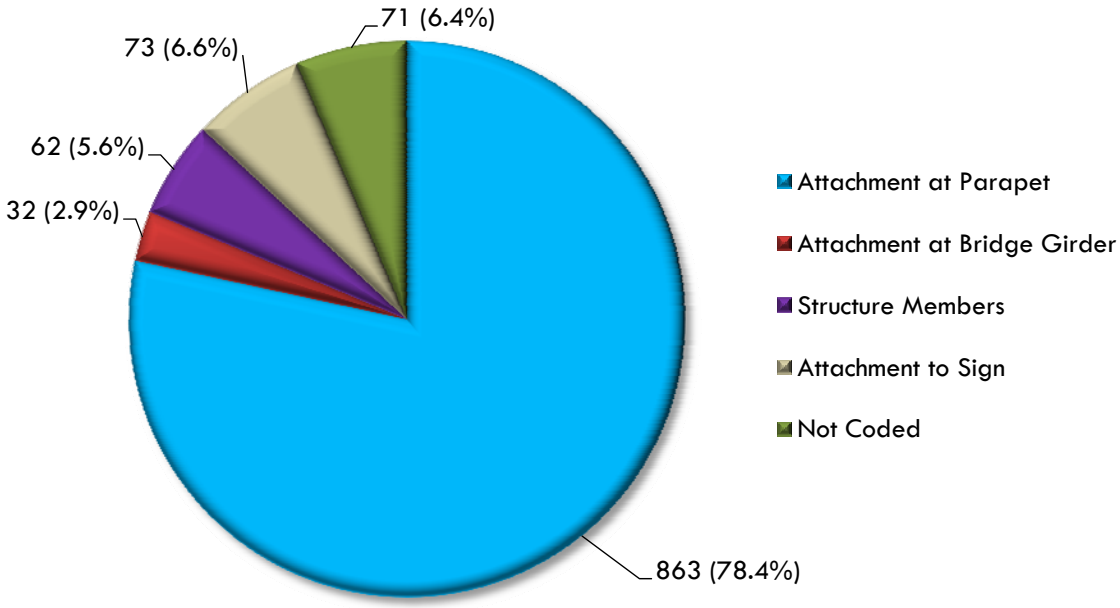


Chart K.3.c – Problems Identified with Luminaire Superstructures that are in Poor Condition

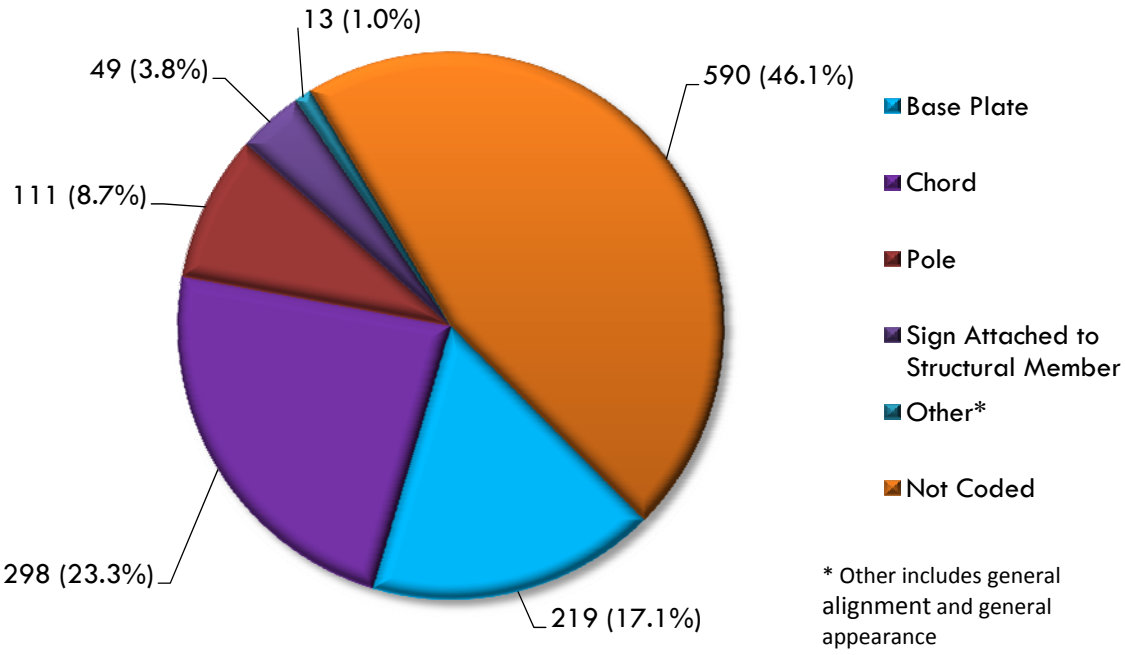


Chart K.4.a – Problems Identified with Signal Structure Foundations that are in Poor Condition

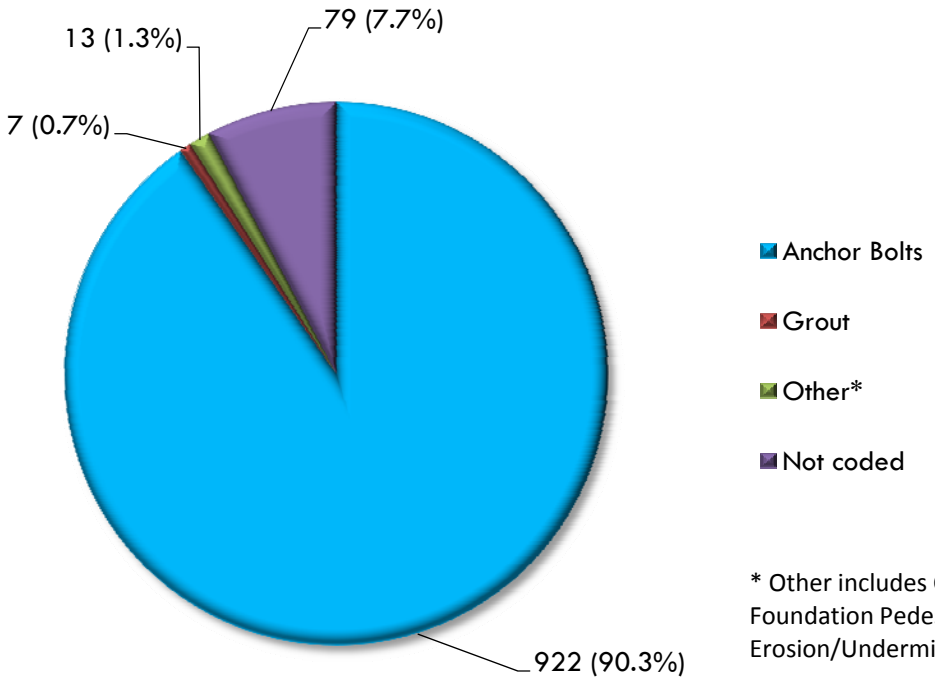


Chart K.4.b – Problems Identified with Signal Structure Superstructures that are in Poor Condition

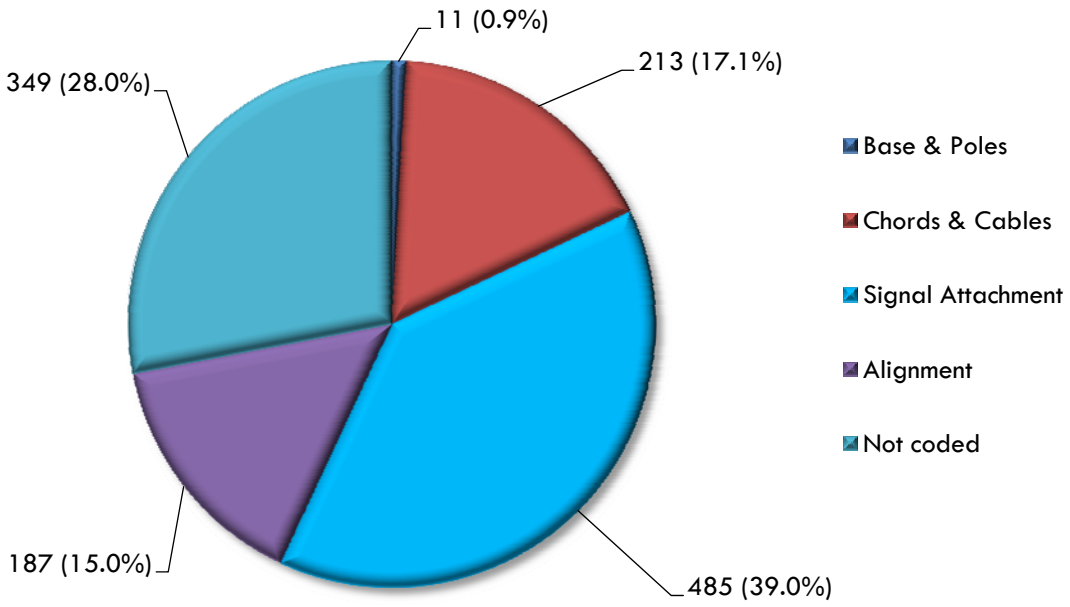


Chart K.5.a – Problems Identified with High Mast Light and Camera Poles Foundations that are in Poor Condition

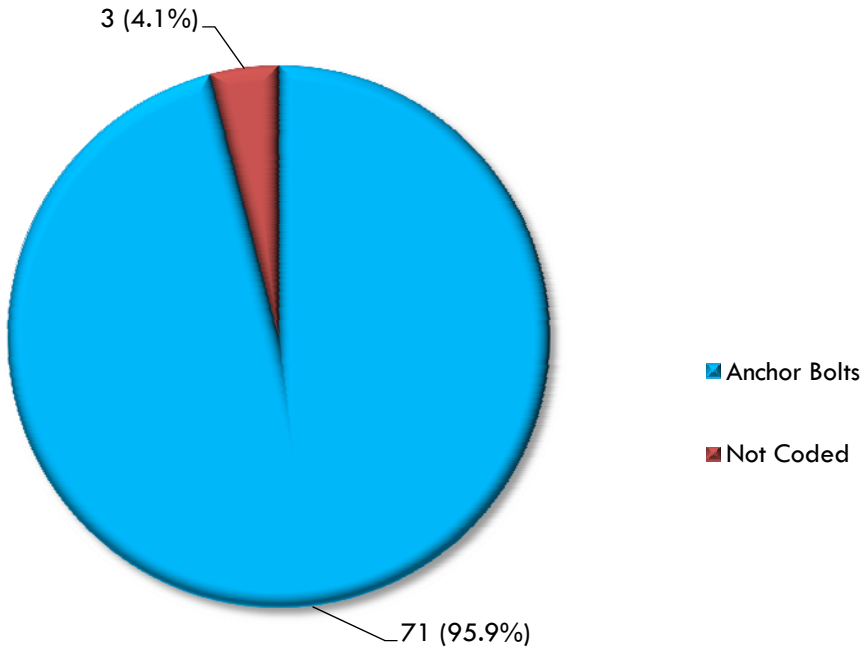
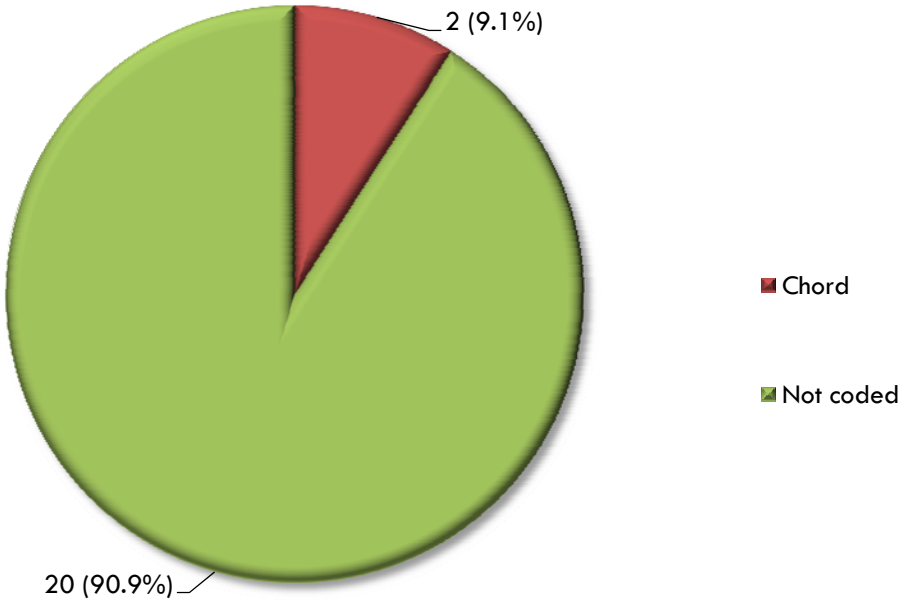


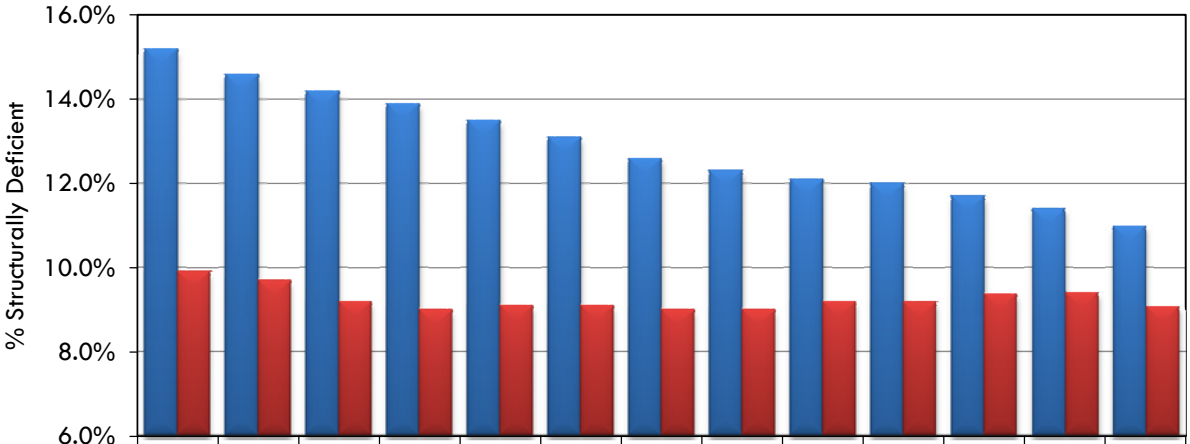
Chart K.5.b – Problems Identified with High Mast Light and Camera Poles Superstructures



APPENDIX L – NATIONAL PERFORMANCE TRENDS

Every Year FHWA collects data of NBI structures from all the states. The National Bridge Inventory is by calendar year and the 2013 data will not be available until after April 2014. The following charts compare Virginia's percentage of deficient structures with national average. Percentages are based on National Bridge Inventory structures only. See previous charts for percentages of entire Virginia inventory.

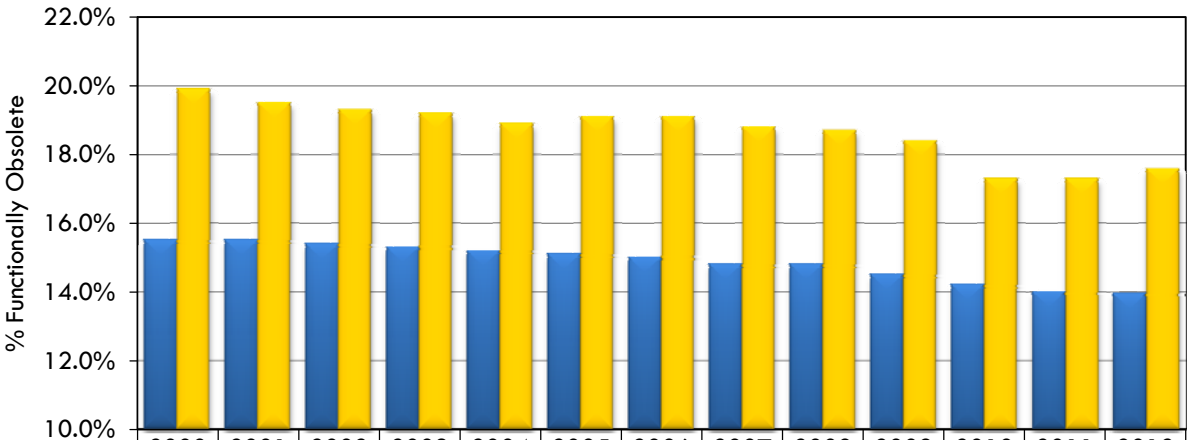
Chart L.1 –Comparing Virginia's Structurally Deficient (SD) Structures to the National Average



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

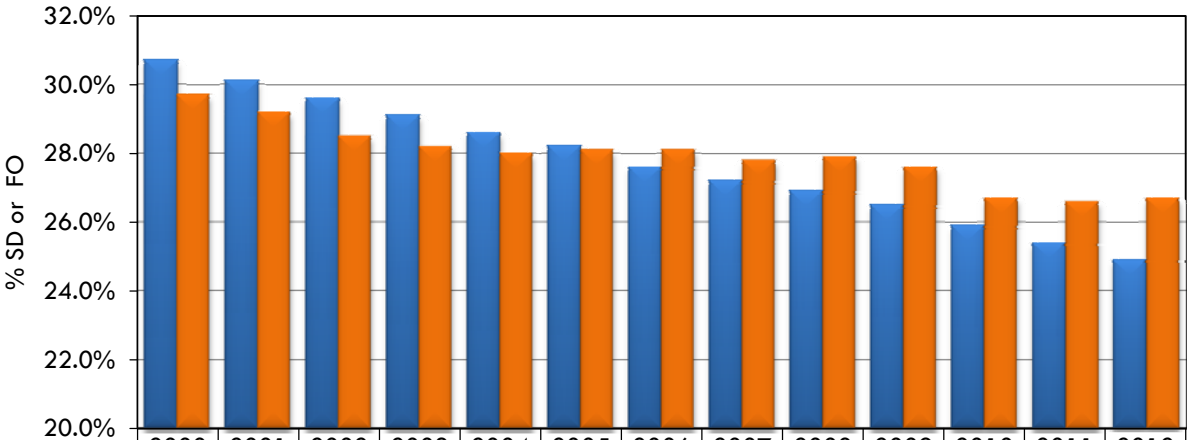
Note: Percentages are based on National Bridge Inventory structures only. See previous charts for percentages of entire Virginia inventory.

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
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%
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%

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
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%
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%

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