STATE OF THE STRUCTURES AND BRIDGES REPORT

July 2011

Prepared by:
Virginia Department of Transportation
Structure & Bridge Division

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Executive Summary

The Virginia Department of Transportation (VDOT) is responsible for the inventory and inspection of 20,908 structures (bridges and culverts) across all of the Commonwealth's roadway systems. Of these structures 13,244 are part of the National Bridge Inventory (NBI). VDOT maintains 19,390 of these structures and 1,518 are maintained by localities and private owners. At the end of Fiscal Year (FY) 2011 (VDOT's fiscal year runs from July 1 through June 30) an additional 33 structures were added to the inventory. VDOT inspects over 10,000 structures annually at an approximate cost of $18 million. This report summarizes the condition of the states bridges and culverts. All of the tables and figures in this report reflect the 2011 accomplishments and are based on the inventory and condition data as of July 1, 2011.

The majority of Virginia's bridges were designed with a design service life of 50 years, but with the evolution of new design guidelines and construction materials the anticipated service life for newly constructed bridges is 75 years. Fifty-eight (58%) 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 system global performance measure for structures is based on the percentage of structurally deficient (SD) structures in the Department's inventory. VDOT's current goal is to have no more than eight (8%) percent of the structure inventory rated as SD by the end of FY 2012. The number of SD structures in the VDOT inventory at the end of FY 2011 was 1,720 (8.2%). As of the end of FY 2011 0.3% of the SD structures were removed from the inventory. The national average of structurally deficient structures in the National Bridge Inventory is 11.5% (as of December, 2010). The NBI inventory only includes bridges and culverts with a length of 20 feet or greater. The percentage of NBI structures within Virginia that are SD is 9.4%.

A structure is defined as SD if it has deficient components (deck, superstructure, substructure) 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.

Functionally Obsolete (FO) bridges are those with deck geometry (e.g., lane width), load carrying capacity, clearance, waterway adequacy or approach roadway alignment that no longer meet the current criteria for the roadway system of which the bridge is a part. The number of Functionally Obsolete (FO) structures in the VDOT inventory is 3,247 (15.5%). By the end of FY 2011 an additional 0.1% FO structures were added to the inventory. This increase can primarily be attributed to a reclassification of rehabilitated structures from SD to FO (many structures that were both SD and FO were rehabilitated during the year, and after the rehabilitation they were no longer SD but were still FO). Nationally, 12.8% of the structures in the National Bridge Inventory are FO (as of December, 2010). The proportion of Virginia's NBI structures that are FO is 16.0%.

A structure is deemed "deficient" if it is either (SD) or functionally obsolete (FO). The number of deficient structures in the VDOT's entire inventory is 4,967 (23.8%). As of the end of FY 2011, 0.2% of the deficient structures were removed from this inventory.

Of Virginia's NBI structures (those structures in the National Bridge Inventory), 25.4 % are deficient (SD or FO). Nationwide, the percentage of deficient structures in the National Bridge Inventory is 24.3% percent.

VDOT uses several performance indicators in the overall management of the structural inventory. These include: functional obsolescence; deficient structures; the number of weight-posted structures; deficient deck area: and Health Index. These performance measures are discussed in greater detail later in this report.

The Commonwealth's inventory includes 4,611 structures (22.1%) 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 number of weight-posted structures in the inventory is 1,403 (6.7%). As of the end of FY 2011, 0.2% of the weight-posted structures were removed from the inventory.

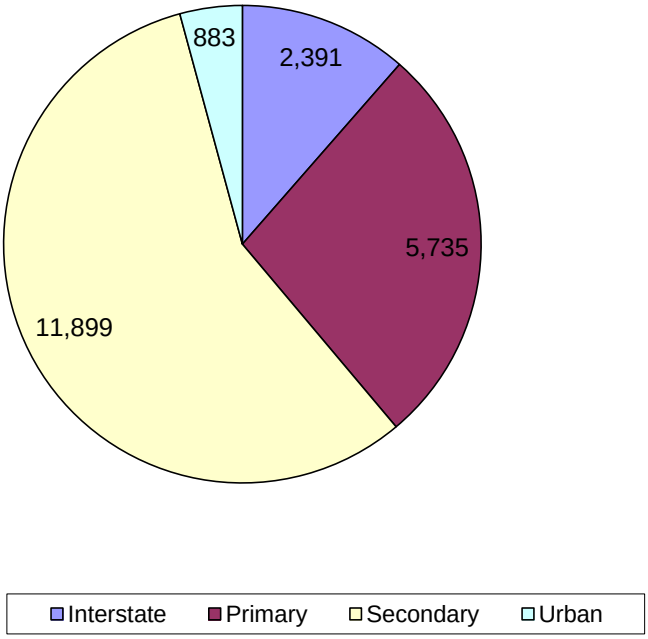
Another method to evaluate structures is the Health Index from the Pontis Bridge Management System. The Health Index of any particular structure is calculated by dividing the sum of the current value of all the structure's elements by the sum of the failure value (replacement or repair) of all elements. A Health Index of 100% indicates that all of the condition units of the structure are in the best possible condition state. A Health Index of 0% indicates that all of the condition units are in the worst possible condition state.

Background

The Virginia Department of Transportation (VDOT) is responsible for the inventory and inspection of 20,908 structures (bridges and culverts) across all of the Commonwealth's roadway systems. Of this inventory 19,390 structures are maintained by VDOT and 1,518 are maintained by localities and private owners. As of the end of Fiscal Year (FY) 2011 (VDOT's fiscal year runs from July 1 through June 30) an additional 33 structures were added to the inventory. All of the tables and figures in this report are based on the inventory and condition data as of July 1, 2011.

The 2011 estimated value of Virginia's structure inventory is approximately $7.4 billion.

Chart 1 - Distribution of Structures (Bridges and Culverts) by System



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 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 National Bridge Inspection Standards (NBIS) in the Code of Federal Regulations.

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.

Structure Inventory

VDOT uses the Pontis Bridge Management System inspection module to maintain data on all of the Commonwealth's structures. Tables 1 through 3 show the distribution of structures in each of the Districts by system. Tables 1a to 1c show the total number of bridges and culverts in the Commonwealth. Tables 2a to 2c show the total number of NBI bridges and culverts in the Commonwealth. Tables 3a to 3c show the total number of Non-NBI bridges and culverts in the Commonwealth. Unless otherwise stated the data and charts shown in this report include both NBI and Non-NBI bridges and culverts.

Table 1a – Total Number of Structures (Bridges and Culverts)

DISTRICT	No. of Structures (Bridges and Culverts)				
	Interstate	Primary	Secondary	Urban	Total
Bristol	216	953	2,045	79	3,293
Salem	217	800	1,937	104	3,058
Lynchburg	0	664	1,393	58	2,115
Richmond	527	802	1,151	159	2,639
Hampton Roads	456	458	515	260	1,689
Fredericksburg	79	253	473	7	812
Culpeper	122	496	1,053	23	1,694
Staunton	430	828	2,142	102	3,502
NOVA	344	481	1,190	91	2,106
Total	2,391	5,735	11,899	883	20,908

Table 1b – Total Number of Bridges by District

DISTRICT	Number of Bridges				
	Interstate	Primary	Secondary	Urban	Total
Bristol	136	548	1559	61	2,304
Salem	117	478	1358	75	2,028
Lynchburg	0	364	790	39	1,193
Richmond	268	506	671	99	1,544
Hampton Roads	331	338	319	199	1,187
Fredericksburg	21	141	215	6	383
Culpeper	71	252	668	11	1,002
Staunton	206	506	1426	62	2,200
NOVA	219	302	516	48	1,085
Total	1,369	3,435	7,522	600	12,926

Table 1c – Total Number of Culverts by District

DISTRICT	Number of Culverts				
	Interstate	Primary	Secondary	Urban	Total
Bristol	80	405	486	18	989
Salem	100	322	579	29	1,030
Lynchburg	0	300	603	19	922
Richmond	259	296	480	60	1,095
Hampton Roads	125	120	196	61	502
Fredericksburg	58	112	258	1	429
Culpeper	51	244	385	12	692
Staunton	224	322	716	40	1,302
NOVA	125	179	674	43	1,021
Total	1,022	2,300	4,377	283	7,982

Table 2a- Total Number of NBI Structures (Bridges and Culverts)

DISTRICT	No. of Structures (Bridges and Culverts)				
	Interstate	Primary	Secondary	Urban	Total
Bristol	164	520	1110	76	1,870
Salem	140	441	1136	94	1,811
Lynchburg	0	417	910	58	1,385
Richmond	358	597	858	158	1,971
Hampton Roads	374	371	393	257	1,395
Fredericksburg	43	175	304	7	529
Culpeper	85	239	684	16	1,024
Staunton	255	456	1047	100	1,858
NOVA	247	338	747	69	1,401
Total	1,666	3,554	7,189	835	13,244

Table 2b - Number of NBI Bridges by District

DISTRICT	Number of Bridges				
	Interstate	Primary	Secondary	Urban	Total
Bristol	136	419	981	59	1,595
Salem	113	364	905	71	1,453
Lynchburg	0	330	668	39	1,037
Richmond	265	477	617	98	1,457
Hampton Roads	331	332	298	199	1,160
Fredericksburg	21	133	192	6	352
Culpeper	71	165	509	10	755
Staunton	206	373	810	62	1,451
NOVA	219	266	422	35	942
Total	1,362	2,859	5,402	579	10,202

Table 2c - Number of NBI Culverts by District

DISTRICT	Number of Culverts				
	Interstate	Primary	Secondary	Urban	Total
Bristol	28	101	129	17	275
Salem	27	77	231	23	358
Lynchburg	0	87	242	19	348
Richmond	93	120	241	60	514
Hampton Roads	43	39	95	58	235
Fredericksburg	22	42	112	1	177
Culpeper	14	74	175	6	269
Staunton	49	83	237	38	407
NOVA	28	72	325	34	459
Total	304	695	1,787	256	3,042

Table 3a – Total Number of Non-NBI Structures (Bridges and Culverts)

DISTRICT	No. of Structures (Bridges and Culverts)				
	Interstate	Primary	Secondary	Urban	Total
Bristol	52	433	935	3	1,423
Salem	77	359	801	10	1,247
Lynchburg	0	247	483	0	730
Richmond	169	205	293	1	668
Hampton Roads	82	87	122	3	294
Fredericksburg	36	78	169	0	283
Culpeper	37	257	369	7	670
Staunton	175	372	1095	2	1,644
NOVA	97	143	443	22	705
Total	725	2,181	4,710	48	7,664

Table 3b - Number of Non-NBI Bridges by District

DISTRICT	Number of Bridges				
	Interstate	Primary	Secondary	Urban	Total
Bristol	0	129	578	2	709
Salem	4	114	453	4	575
Lynchburg	0	34	122	0	156
Richmond	3	29	54	1	87
Hampton Roads	0	6	21	0	27
Fredericksburg	0	8	23	0	31
Culpeper	0	87	159	1	247
Staunton	0	133	616	0	749
NOVA	0	36	94	13	143
Total	7	576	2,120	21	2,724

Table 3c - Number of Non-NBI Culverts by District

DISTRICT	Number of Culverts				
	Interstate	Primary	Secondary	Urban	Total
Bristol	52	304	357	1	714
Salem	73	245	348	6	672
Lynchburg	0	213	361	0	574
Richmond	166	176	239	0	581
Hampton Roads	82	81	101	3	267
Fredericksburg	36	70	146	0	252
Culpeper	37	170	210	6	423
Staunton	175	239	479	2	895
NOVA	97	107	349	9	562
Total	718	1,605	2,590	27	4,940

A large proportion (58.1%) 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: 61.8% of the interstate, 63.0% of the primary, 56.5% of the secondary, and 37.9% of the urban system structures. The average age is 45 years. The age of Virginia's highway structures is depicted graphically in Charts 2 – 4.

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 2 - Cumulative Age Distribution of Structures

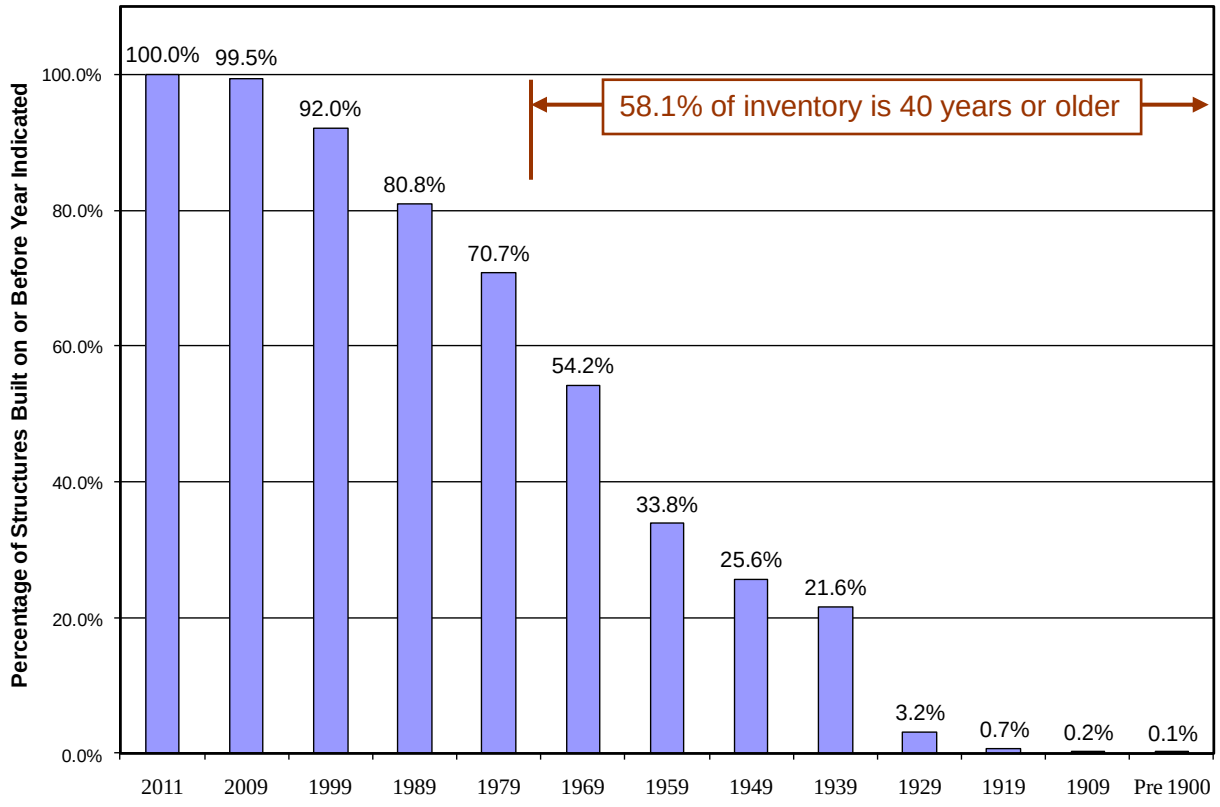


Chart 3: Average Age of Structures by Highway System and District

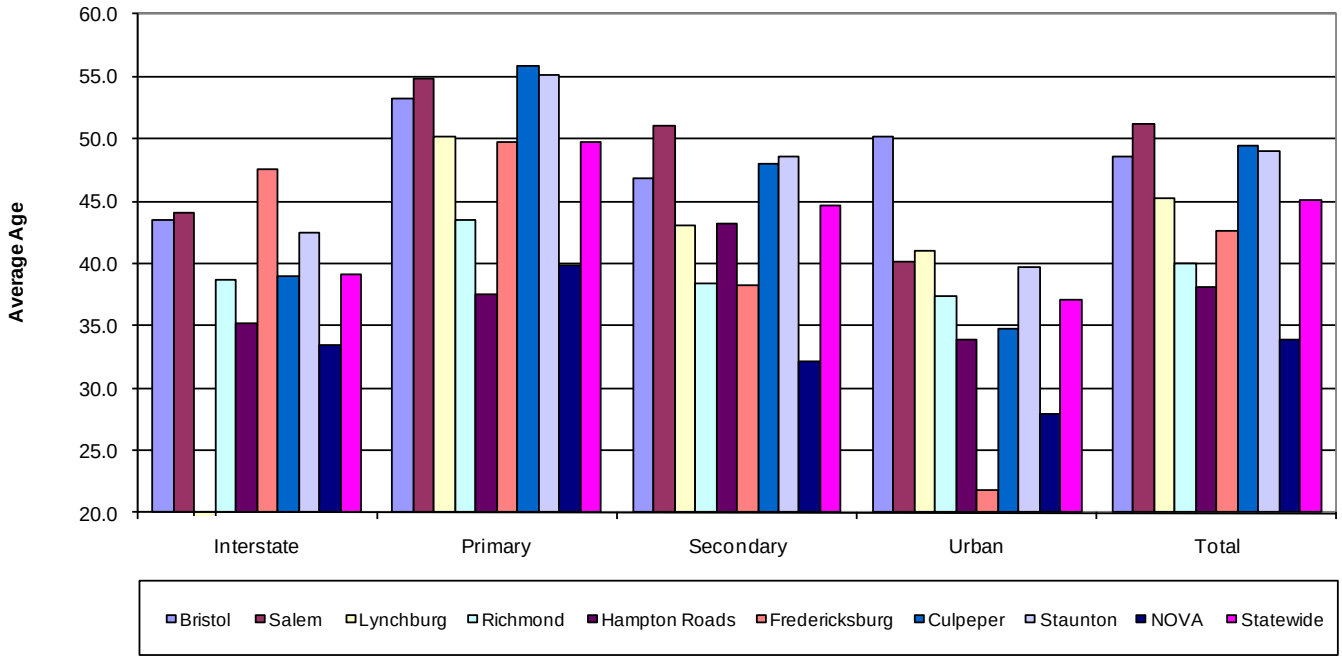
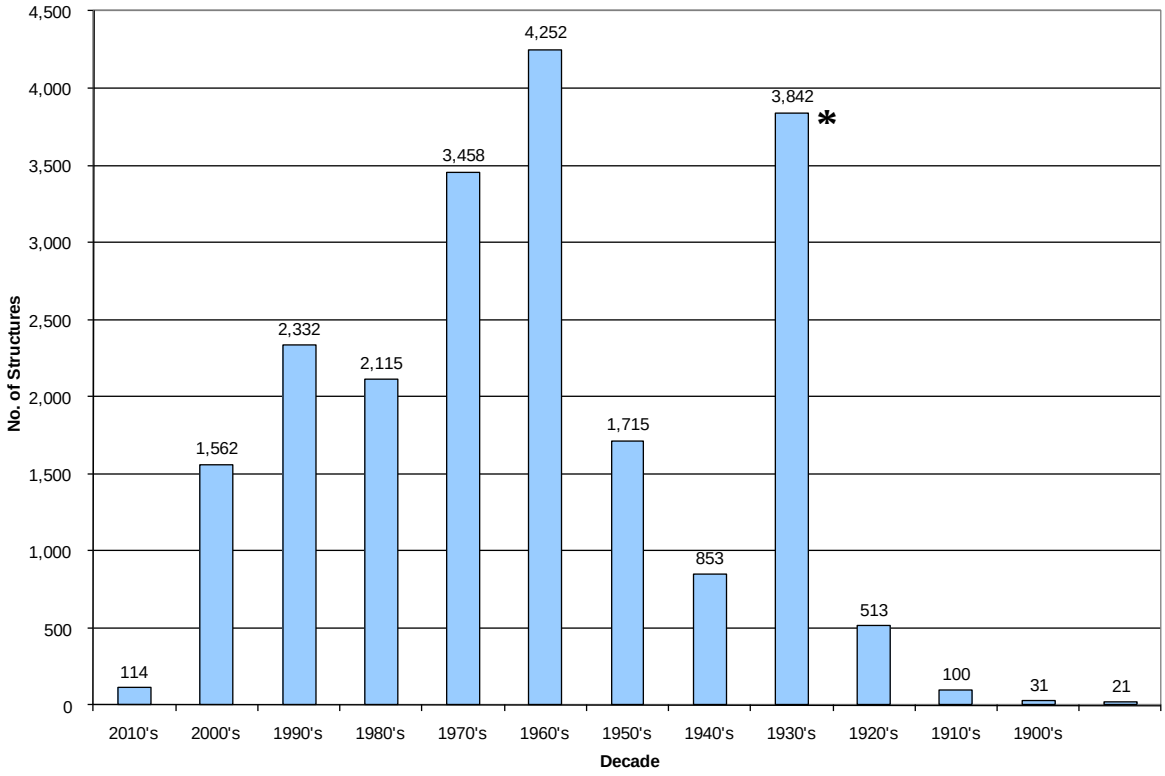


Chart 4 –Number of Structures (Bridges & Culverts) Built per Decade



*** County Bridges added to the VDOT Inventory during this period with unknown construction dates (Assumed year built equaled year added to system)**

Measuring Performance

VDOT's system performance measure for 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 A provides definitions of the general condition ratings. In addition, Appendix A (page number 27) 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 statewide by the end of FY 2012. The goals by system are to have no more than three (3 %) SD structures for Interstate, six (6 %) percent for Primary and eleven (11 %) percent for Secondary. Appendix B (page number 46) shows the location of the SD structures statewide and by District.

On July 1, 2011 8.2% percent of the total inventory (1,720 structures) were rated as SD. Table 4 shows the number of SD structures that were restored and those that fell into SD status during FY 2011. Chart 5 graphically displays this information by District. Charts 6 through 15 show the current percentage of SD structures by District (District percentages are based on the number of structures in that particular District) for each roadway classification and a five year trend for each roadway system. These charts address all of the Commonwealth's structures, including those that are not part of the NBI.

Appendix C (page number 58) shows the national trend of deficient structures from 2002 to 2010. The Virginia data shown in Appendix C is for only the NBI bridges and culverts and does not include bridges under 20 feet in length.

Table 4 – Change in number of Structurally Deficient Structures between FY 2010 and FY 2011

District	Structurally Deficient			During FY 2011		
	End of FY 2010	End of FY 2011	Change	Restored	Deteriorated	Change
Bristol	357	341	-4.5%	42	26	-16
Salem	364	362	-0.5%	31	29	-2
Lynchburg	204	156	-23.5%	71	23	-48
Richmond	251	253	0.8%	20	22	2
Hampton Roads	81	92	13.6%	9	20	11
Fredericksburg	68	73	7.4%	6	11	5
Culpeper	112	118	5.4%	13	19	6
Staunton	278	256	-7.9%	39	17	-22
NOVA	70	69	-1.4%	10	9	-1
Statewide	1,785	1,720	-3.6%	241	176	-65

Note: Percentages are based on percentage of FY10 inventory.

Chart 5 - Number of Structurally Deficient Structures Restored vs. Deteriorated During FY 2011

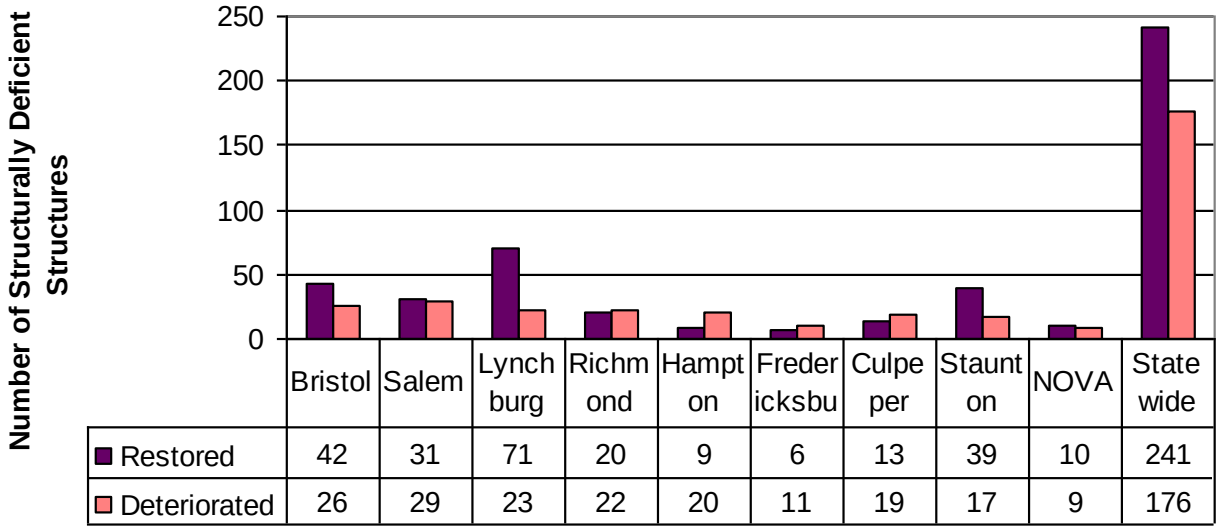


**Chart 6 - Percentage of Structurally Deficient Structures Statewide
End of FY 2011**

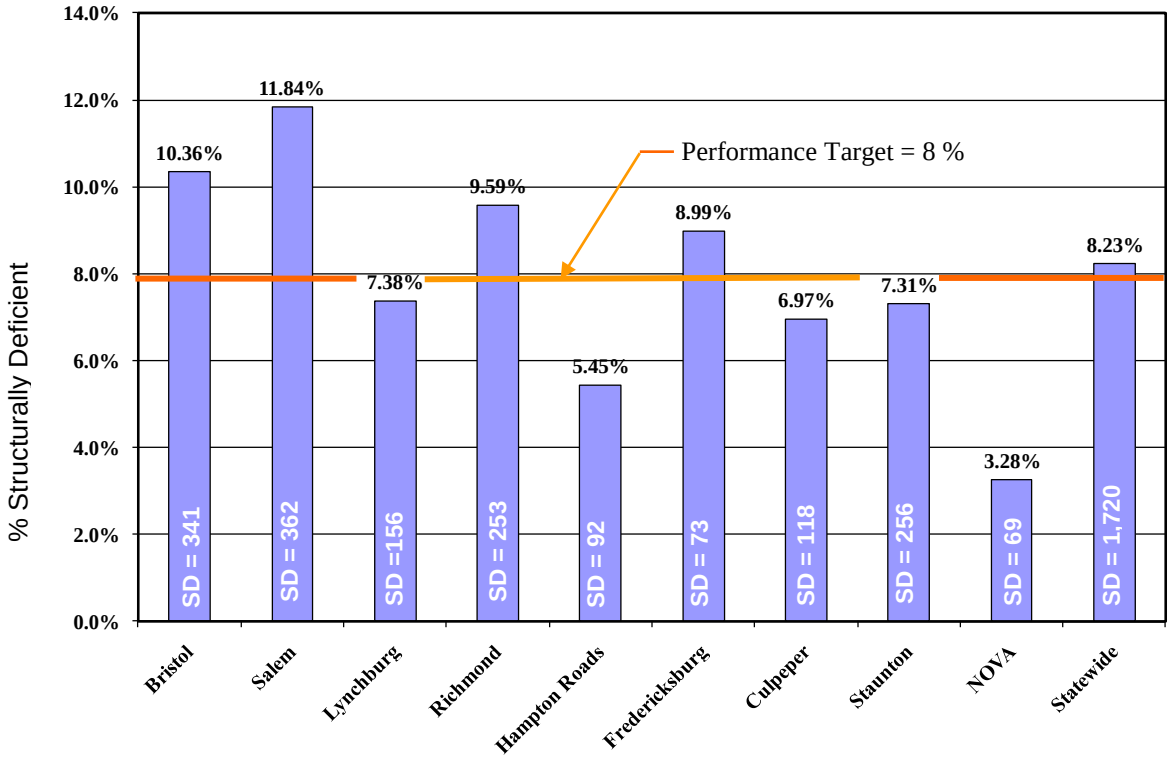
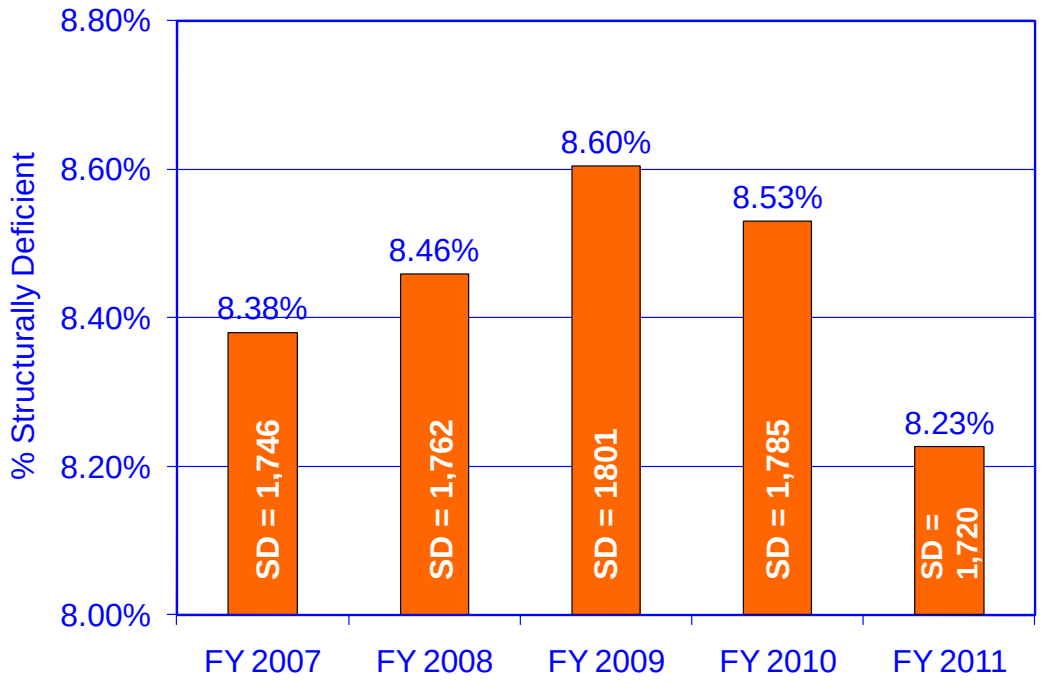


**Chart 7 - Percentage of SD Structures – Statewide
Five Year Trend**



Note: See Appendix G for changes in data from past reports.

Chart 8 - Percentage of Structurally Deficient Structures – Interstate
End of FY 2011

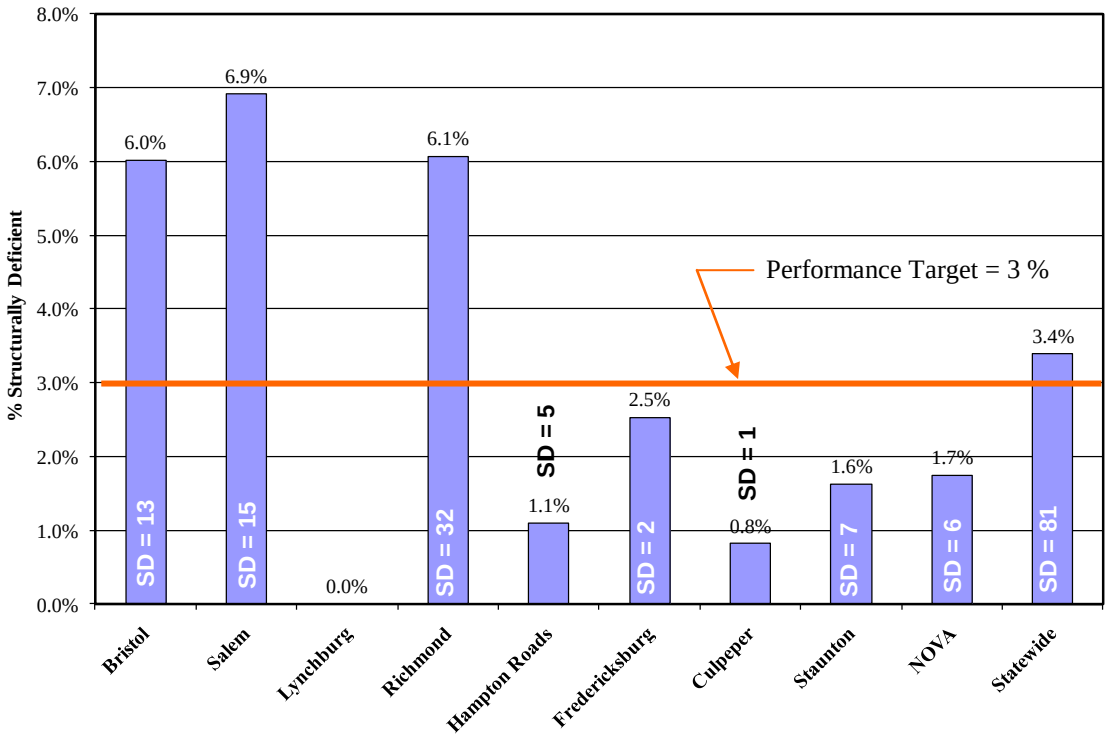
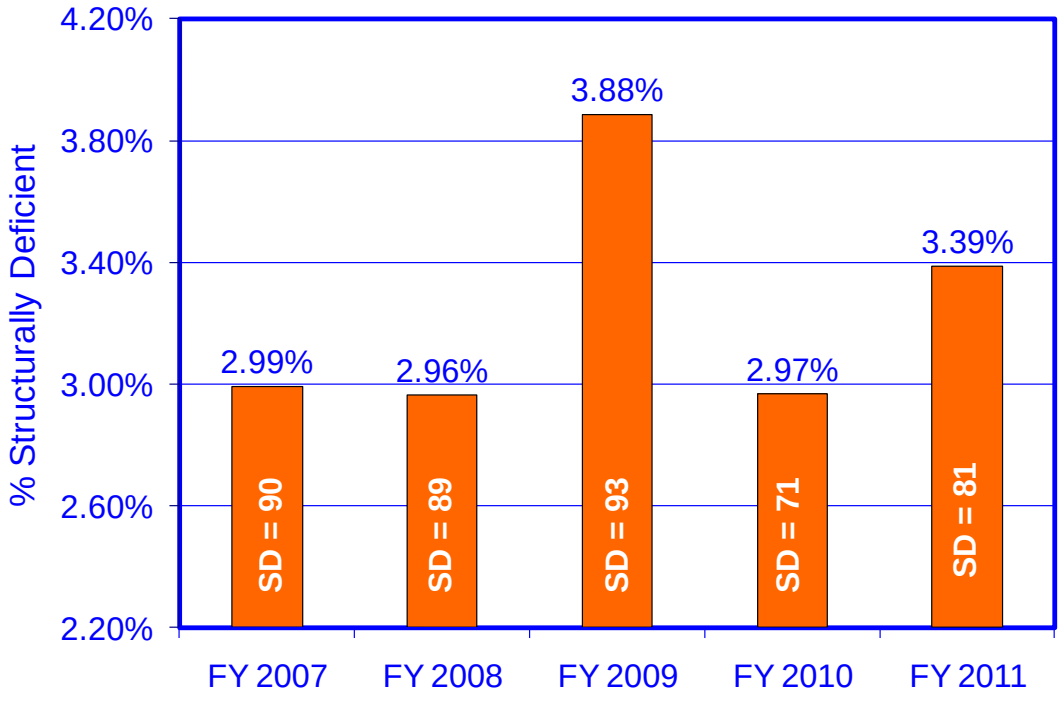


Chart 9 – Percentage of SD Structures – Interstate
Five Year Trend



Note: See Appendix G for changes in data from past reports.

Chart 10 - Percentage of Structurally Deficient Structures – Primary
End of FY 2011

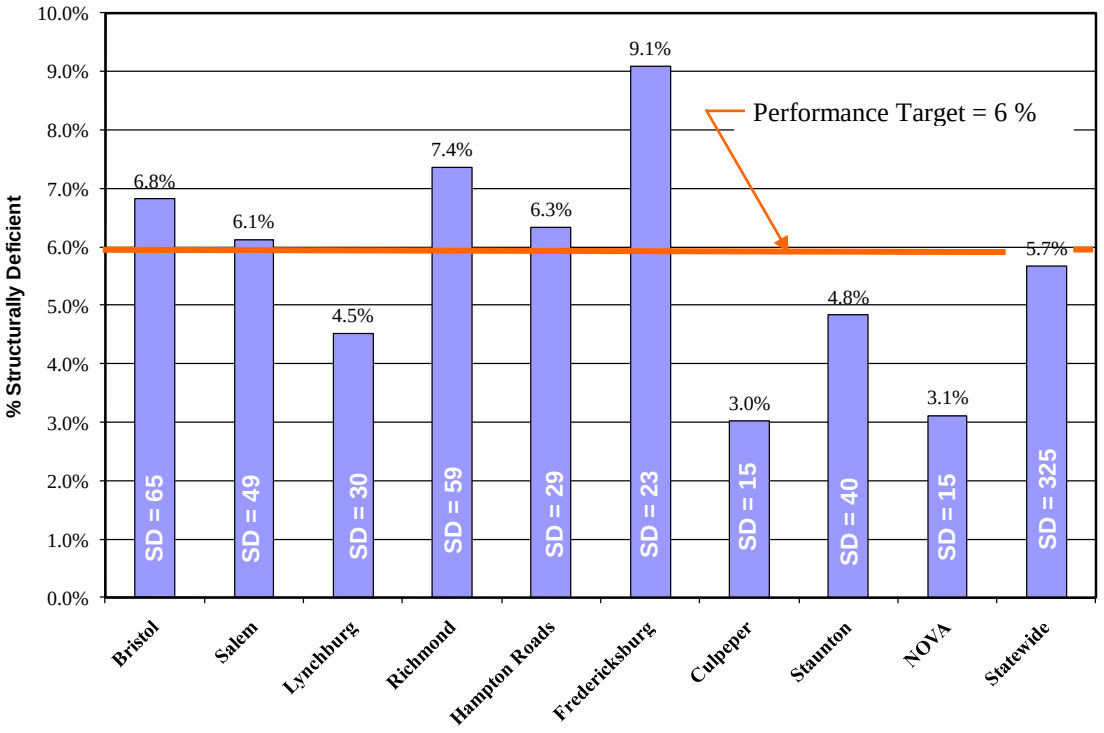
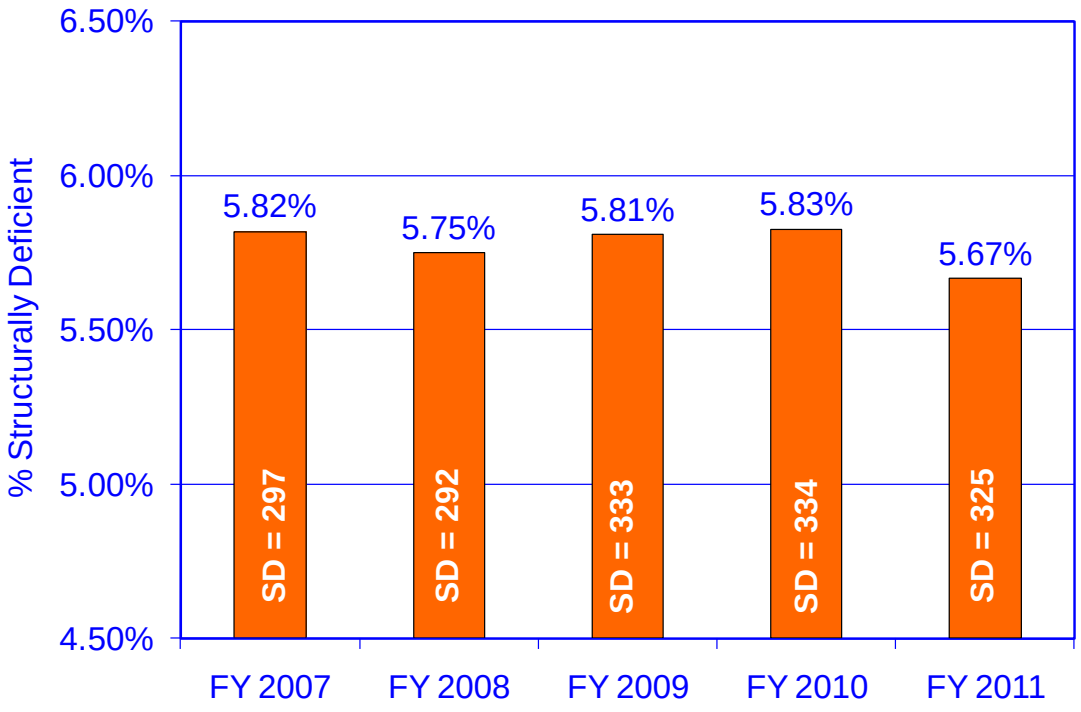


Chart 11 – Percentage of SD Structures – Primary
Five Year Trend



Note: See Appendix G for changes in data from past reports.

**Chart 12 - Percentage of Structurally Deficient Structures – Secondary
End of FY 2011**

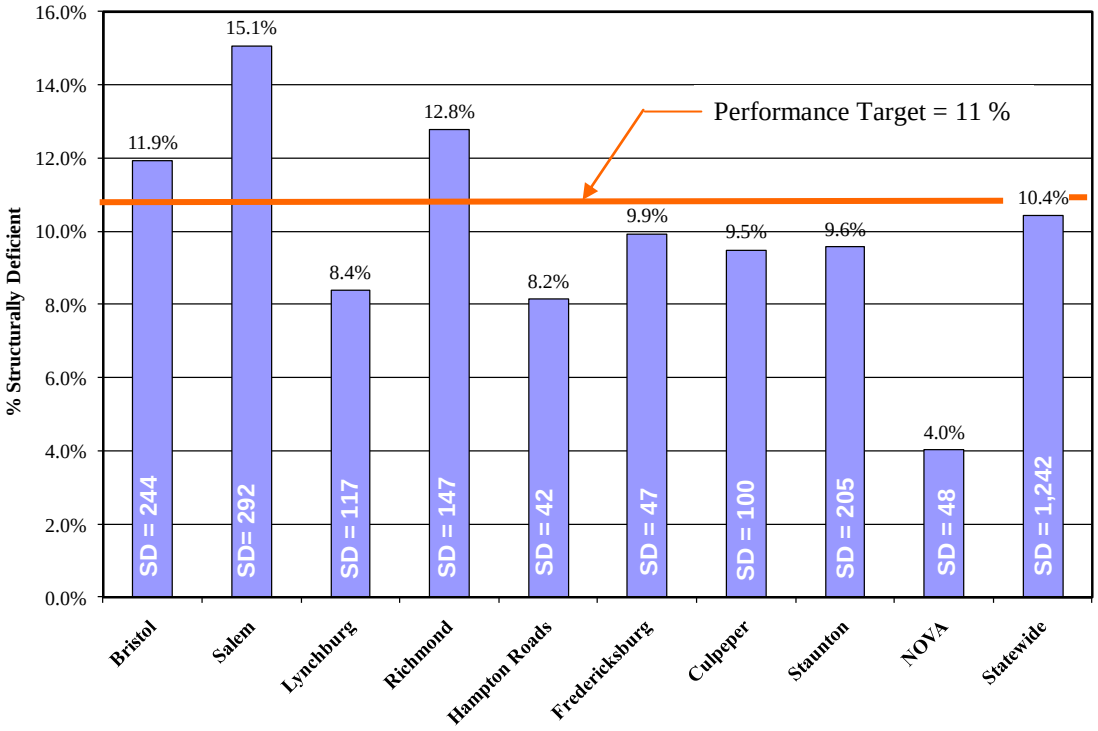
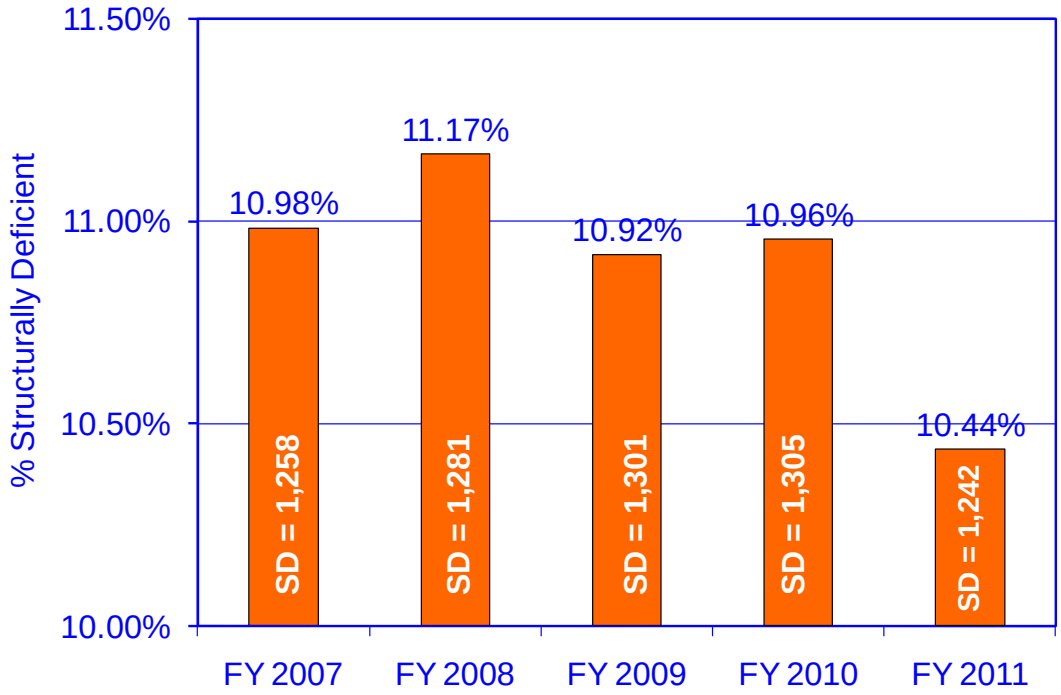


**Chart 13 – Percentage of SD Structures – Secondary
Five Year Trend**



Note: See Appendix G for changes in data from past reports.

Chart 14 - Percentage of Structurally Deficient Structures – Urban
End of FY 2011

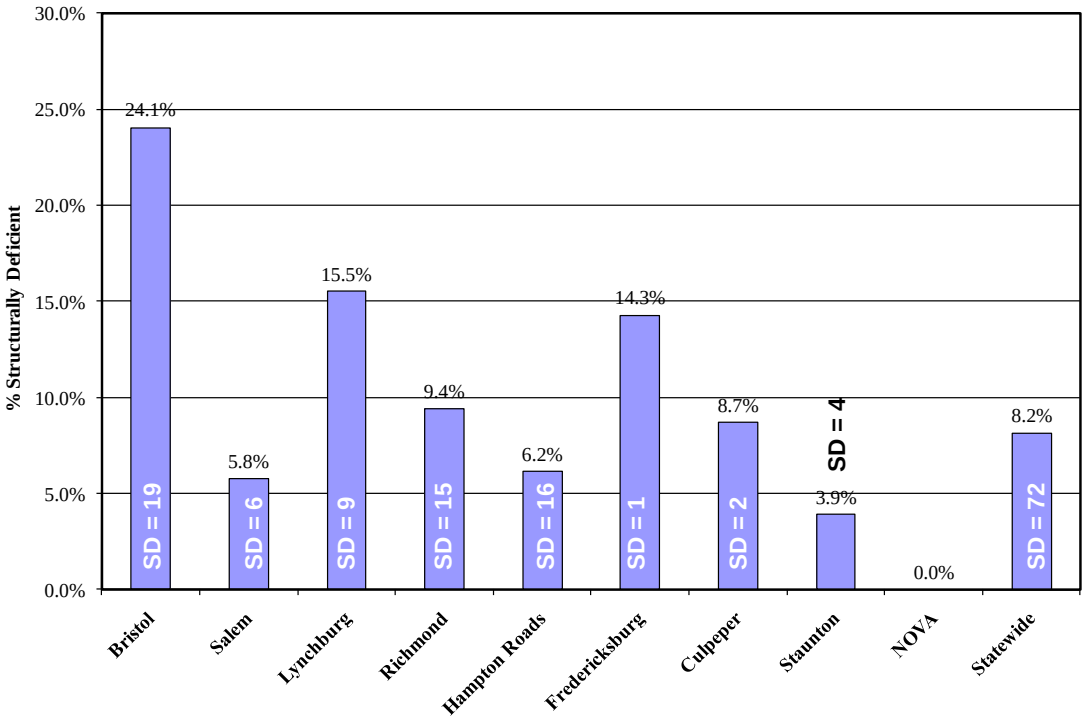
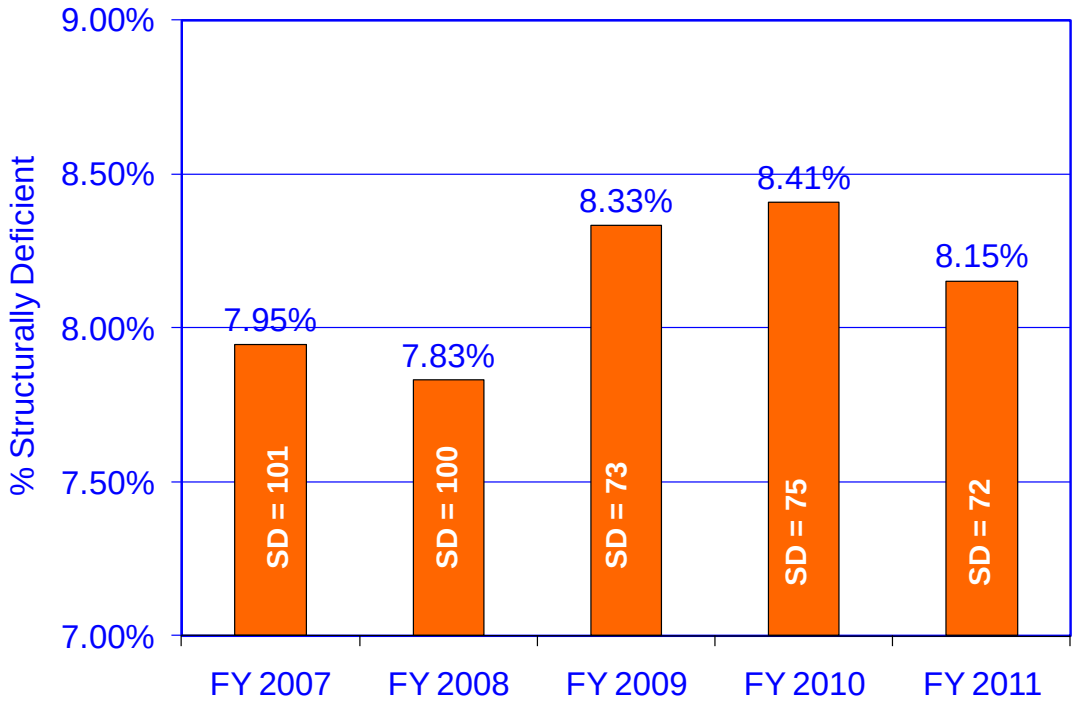


Chart 15 – Percentage of SD Structures – Urban
Five Year Trend



Note: See Appendix G for changes in data from past reports.

Statewide and District maps showing the location of each of the SD structures are located in Appendix B (page number 46).

Other performance indicators that are used by VDOT in the overall management of the structural inventory include:

- **Functionally Obsolete (FO)** - An FO designation means that the structure was built to standards that are less conservative than those used today. Charts 16 - 20

- **Deficient Structures -** A structure is deemed "deficient" if the structure is rated either SD or FO. FHWA uses the combined deficient designation in the allocation of bridge funding per State. Charts 21 - 25

- **Weight-Posted -** A weight-posted structure is one that has a rated load carrying capacity less than the Virginia designated legal loads. Charts 26 – 30

- **Health Index** – A 0 to 100 numerical method of measuring the overall health of a structure. Charts 31 and 32

Charts 16 through 32 show multi-year trends for each of these measures statewide and for each system. These charts address all of the bridges and culverts that comprise the Commonwealth's inventory, including those that are not part of the NBI. Additionally, Appendix D (page number 58) shows the 2011 performance measures based on the square footage area of the structures. Appendix A (page number 27) compares general condition ratings by structure component and District, and Appendix E (page number 67) shows examples of items that can cause a structure to be Functionally Obsolete.

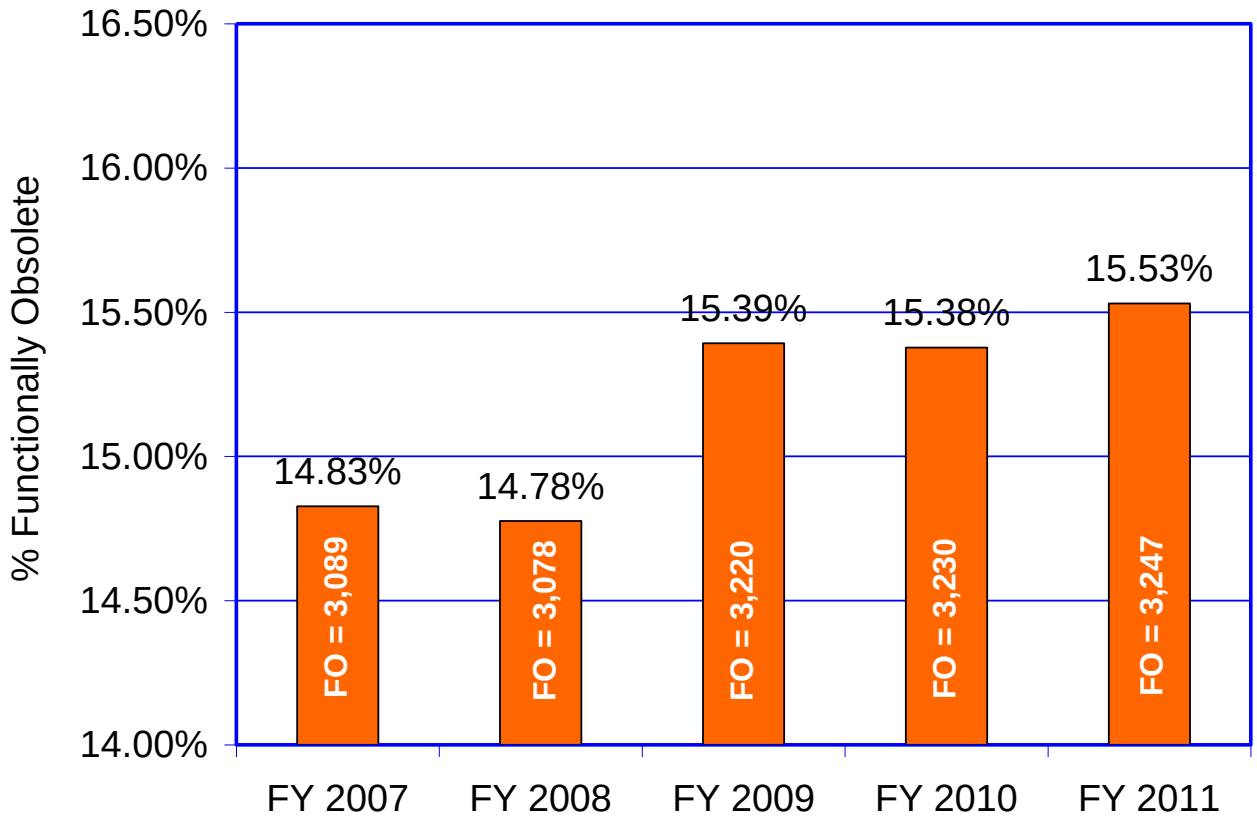
VDOT is now tracking a performance measure called the Health Index, which is part of the Pontis Bridge Management System. The Health Index of any particular structure is calculated by dividing the sum of the current value of all structure's components by the sum of the failure value (replacement or repair) of all components. A Health Index of 100% indicates that all of the components of the structure are in the best possible condition state. A Health Index of 0% indicates that all of the components are in the worst possible condition state. Charts 31 and 32 show the average Health Index (HI) by highway system and by District for FY 2010 and FY 2011. HI data for earlier years is not available.

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 F (page number 69) gives an overview of the Quality Assurance Program followed in the Commonwealth.

Functionally Obsolete Measure (Charts 16 – 20)

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.

Chart 16 – Percentage of FO Structures – Statewide
Five Year Trend



Note: See Appendix G for changes in data from past reports.

Chart 17 – Percentage of FO Structures – Interstate Five Year Trend

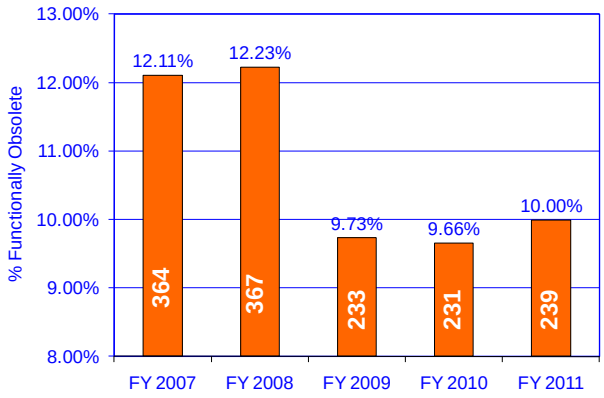


Chart 18 – Percentage of FO Structures – Primary Five Year Trend

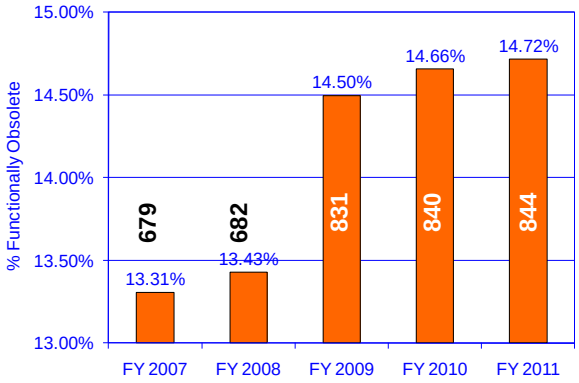


Chart 19 – Percentage of FO Structures – Secondary Five Year Trend

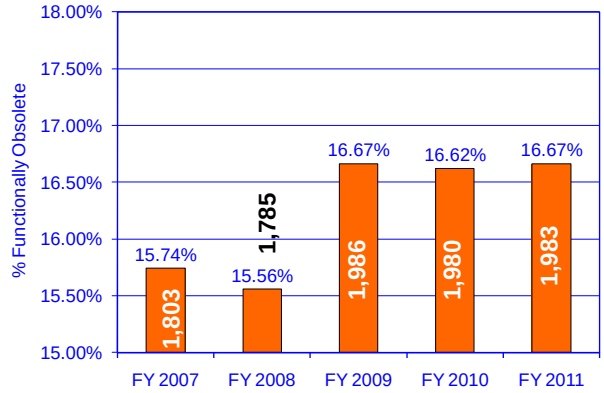
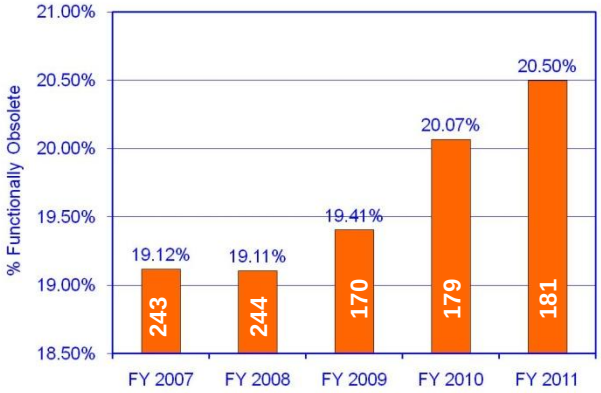


Chart 20 – Percentage of FO Structures – Urban Five Year Trend

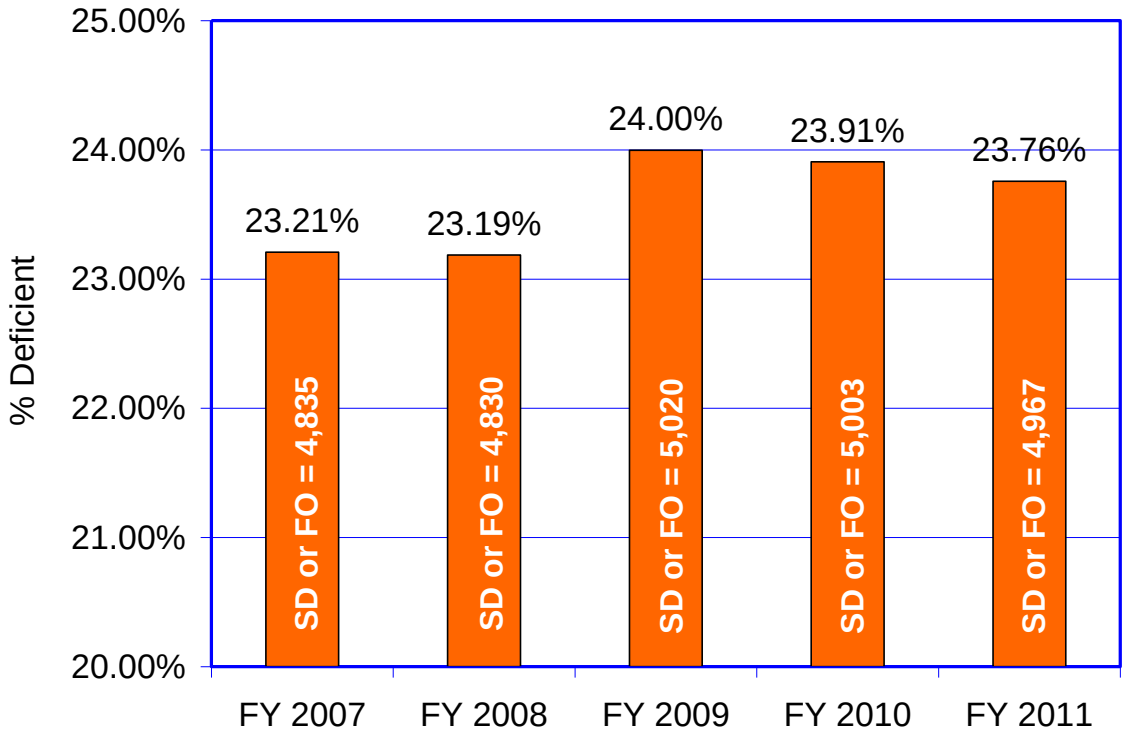


Note: See Appendix G for changes in data from past reports.

Deficient Structures (Charts 21 - 25)

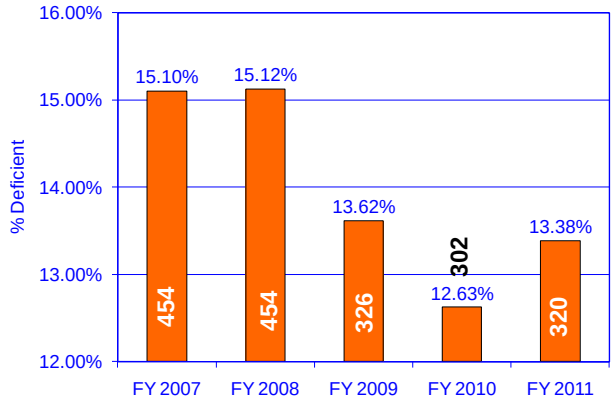
Combining Structurally Deficient (SD) and Functionally Obsolete (FO) - According to the Federal Highway Administration a structure is deemed "deficient" if the structure is rated either SD or FO. If a structure is both SD and FO it is designated simply as structurally deficient. FHWA uses the combined 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.

Chart 21 – Percentage of SD or FO Structures – Statewide
Five Year Trend



Note: See Appendix G for changes in data from past reports.

Chart 22 – Percentage of SD or FO Structures - Interstate Five Year Trend



Chart– 23 – Percentage of SD or FO Structures - Primary Five Year Trend

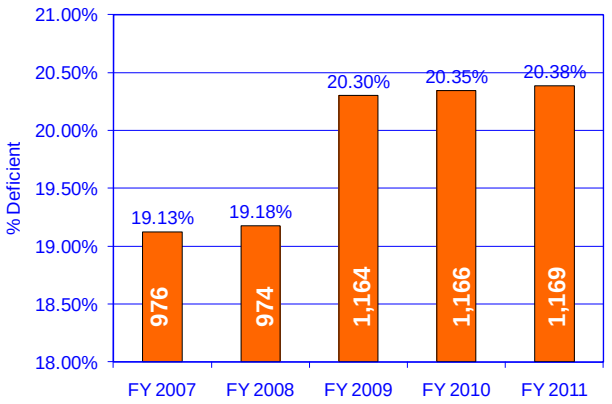


Chart 24 - Percentage of SD or FO Structures - Secondary Five Year Trend

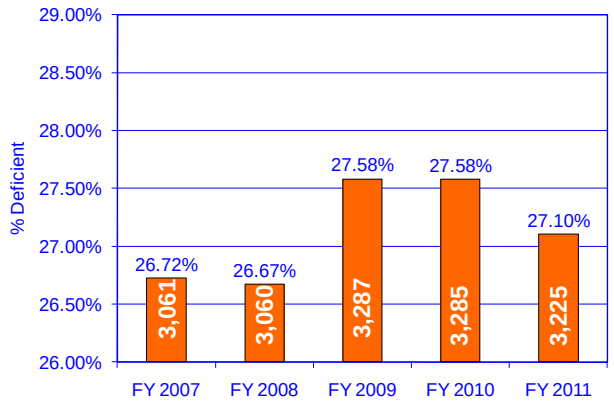
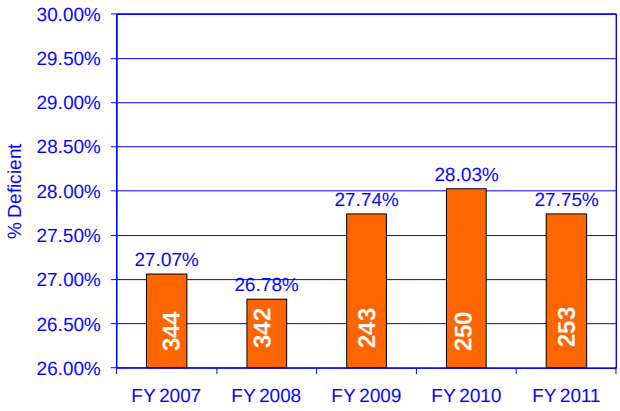


Chart 25 - Percentage of SD or FO Structures – Urban Five Year Trend



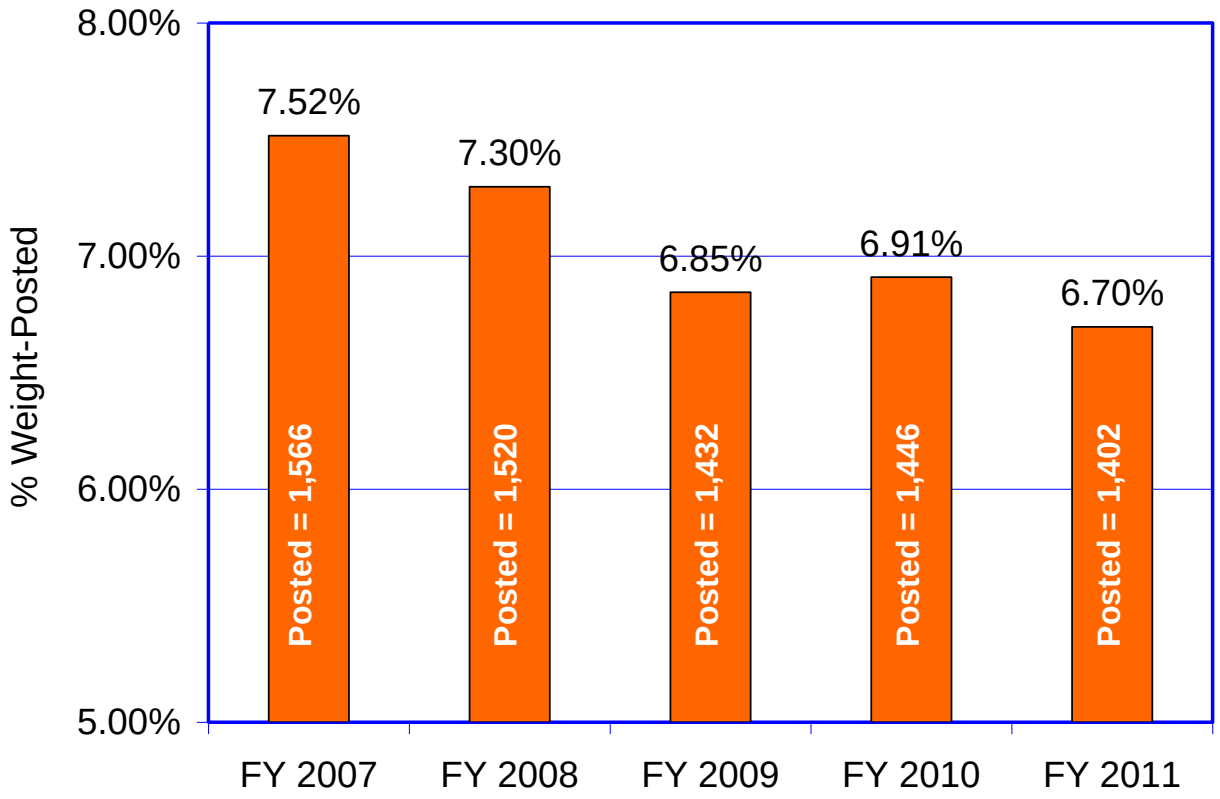
Note: See Appendix G for changes in data from past reports.

Weight-Posted Structures Measure (Charts 26 – 30)

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

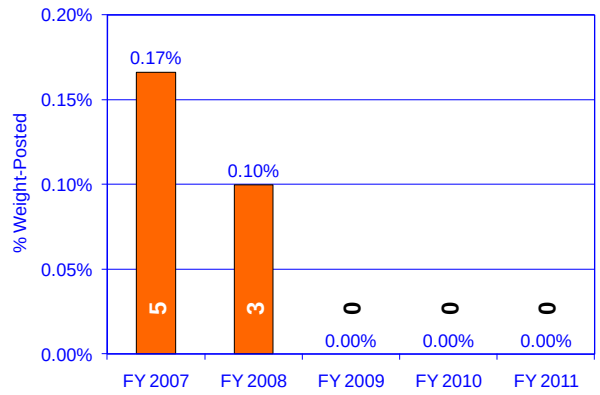
- 27 Tons for a single unit
- 40 Tons for semi-trailers

Chart 26 – Percentage of Weight-Posted Structures – Statewide
Five Year Trend



Note: See Appendix G for changes in data from past reports.

Chart 27 – Percentage of Weight-Posted Structures - Interstate Five Year Trend



Note: In FY2007 and FY2008 overpasses over interstates were classified as interstate bridges

Chart 28 – Percentage of Weight-Posted Structures - Primary Five Year Trend

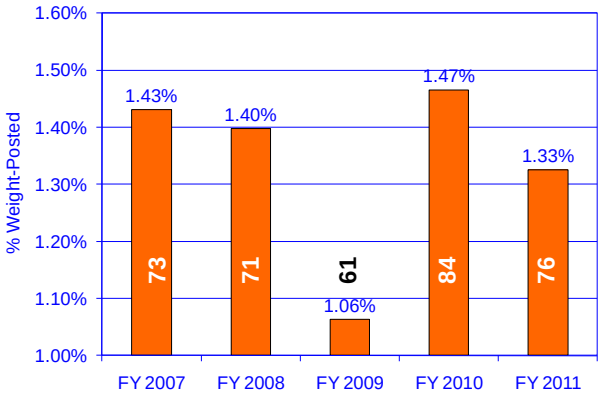


Chart 29 – Percentage of Weight-Posted Structures – Secondary Five Year Trend

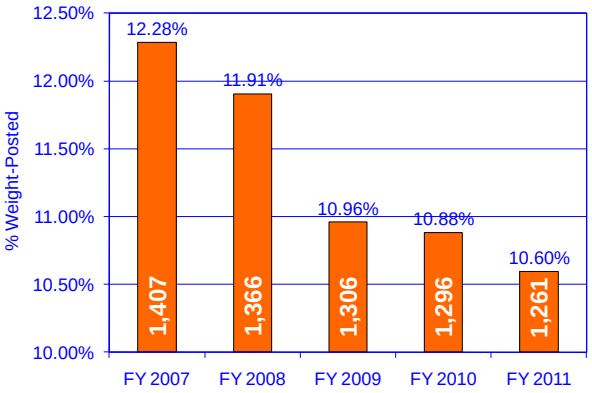
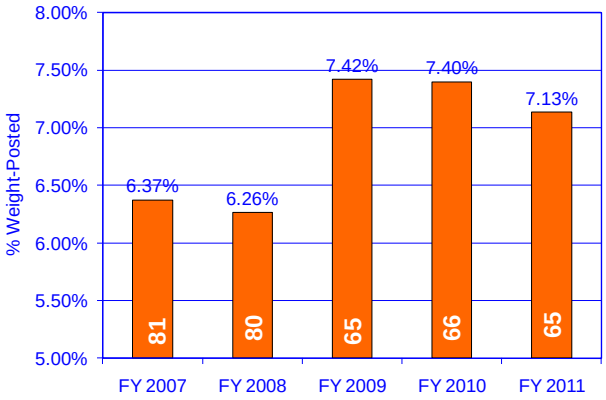


Chart 30 – Percentage of Weight-Posted Structures -Urban Five Year Trend



Note: See Appendix G for changes in data from past reports.

Health Index Measure (Charts 31 – 32)

Another way to evaluate the structures is with the Health Index from the Pontis Bridge Management System. The Health Index is calculated as the sum of the current value of all condition units divided by the sum of total value of all condition units. A Health Index of 100% indicates that all of the condition units of the structure are in the best possible condition state. A Health Index of 0% indicates that all of the condition units are in the worst possible condition state. Health index of an individual component is calculated according to the formula following formula.

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

where CEV_e and TEV_e 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.

Chart 31 - Average Health Index by Highway System

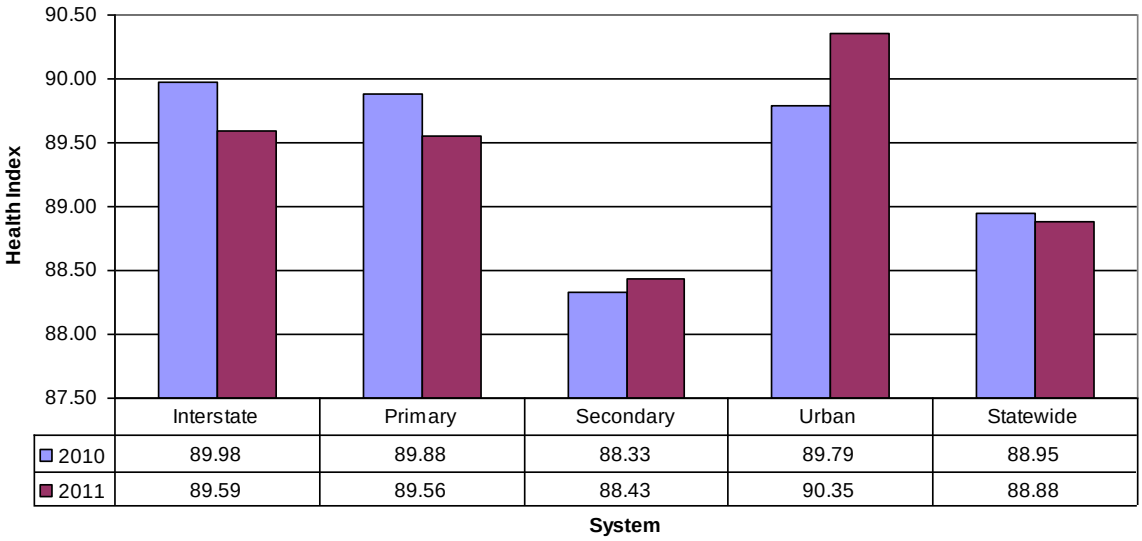
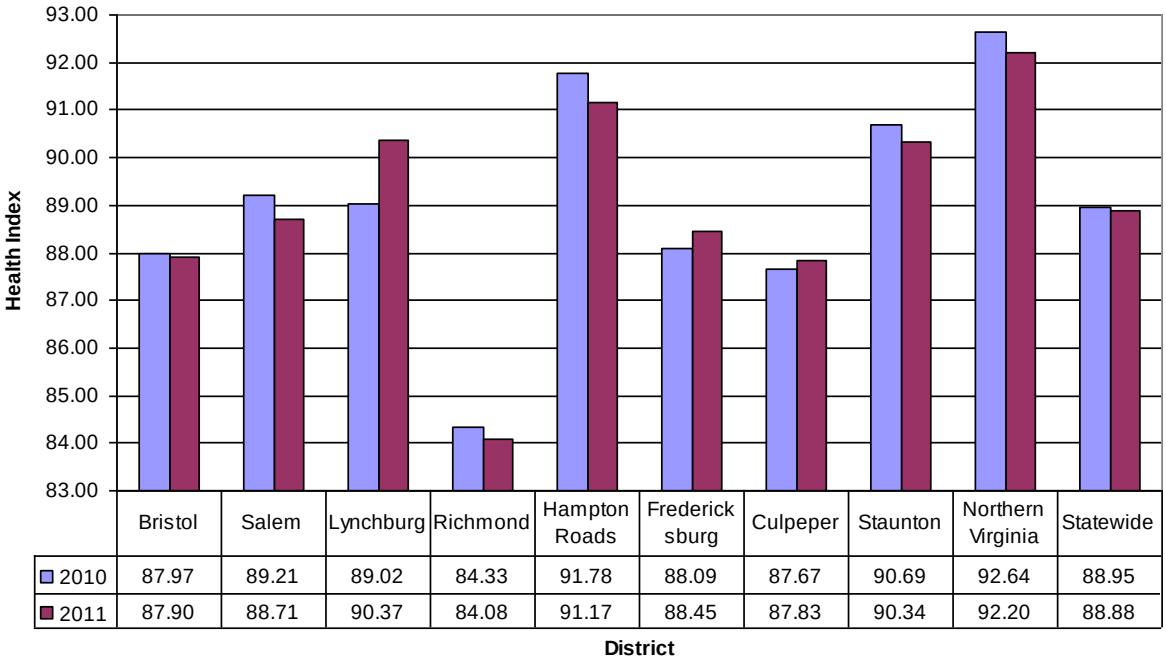


Chart 32 - Average Health Index by District



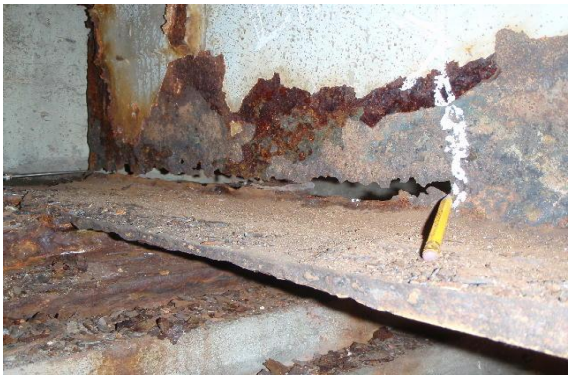
	Bristol	Salem	Lynchburg	Richmond	Hampton Roads	Fredericksburg	Culpeper	Staunton	Northern Virginia	Statewide
2010	87.97	89.21	89.02	84.33	91.78	88.09	87.67	90.69	92.64	88.95
2011	87.90	88.71	90.37	84.08	91.17	88.45	87.83	90.34	92.20	88.88

Appendix A– General Condition Ratings

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.

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

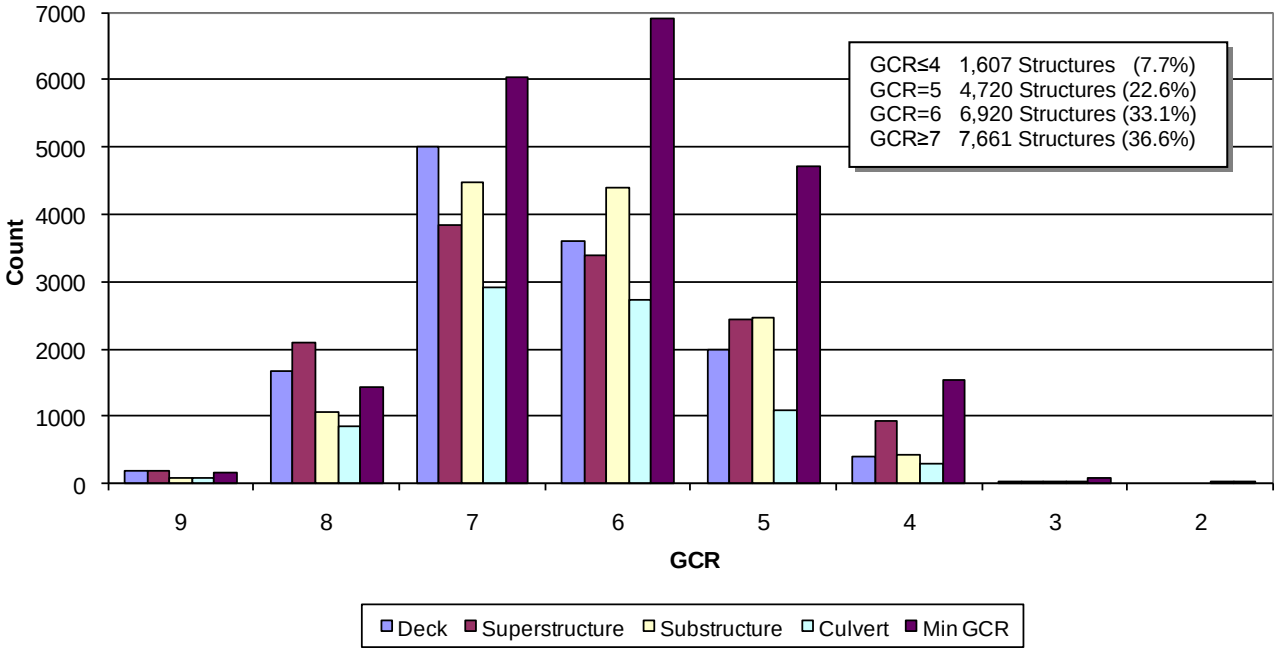
Typical Examples of General Condition Ratings for Superstructure		
General Condition Rating	Example Steel	Concrete
4 or less - (Poor Condition) Structurally Deficient	 Bridge Superstructure with advanced section loss	 Concrete Beam with major spalling (bottom of beam viewed from below)
5 – Fair Condition (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 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 A.1 – A.11 below

Chart A.1 - General Condition Ratings by Component - Statewide



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 A.1 - Number of Structures in Each General Condition Rating – by Component

Highway System	Structure Component	GCR								Average GCR
		9	8	7	6	5	4	3	2	
Interstate	Deck	14	37	517	539	237	25	0	0	6.3
	Superstructure	14	89	400	505	311	49	1	0	6.2
	Substructure	13	34	296	607	400	19	0	0	6.0
	Culvert	0	29	365	484	138	6	0	0	6.3
	Min GCR	13	52	540	1,032	673	80	1	0	5.9
Primary	Deck	38	246	1,295	1,090	616	130	9	0	6.3
	Superstructure	41	463	1,037	1,008	686	189	11	0	6.3
	Substructure	28	205	1,243	1,204	661	92	2	0	6.3
	Culvert	8	138	814	985	318	36	1	0	6.3
	Min GCR	34	246	1,686	2,165	1,293	293	18	0	6.1
Secondary	Deck	148	1,327	2,923	1,808	1,054	213	4	0	6.6
	Superstructure	139	1,449	2,166	1,749	1,336	655	27	0	6.4
	Substructure	38	760	2,682	2,425	1,325	280	11	0	6.3
	Culvert	82	640	1,613	1,186	601	243	11	1	6.5
	Min GCR	117	1,071	3,487	3,480	2,594	1,099	50	1	6.1
Urban	Deck	4	51	277	161	75	26	1	0	6.4
	Superstructure	6	86	237	126	104	38	3	0	6.4
	Substructure	4	55	266	164	87	23	1	0	6.4
	Culvert	1	46	122	77	33	4	0	0	6.6
	Min GCR	2	75	338	243	160	62	3	0	6.2
All	Deck	204	1,661	5,012	3,598	1,982	394	14	0	6.5
	Superstructure	200	2,087	3,840	3,388	2,437	931	42	0	6.3
	Substructure	83	1,054	4,487	4,400	2,473	414	14	0	6.3
	Culvert	91	853	2,914	2,732	1,090	289	12	1	6.4
	Min GCR	166	1,444	6,051	6,920	4,720	1,534	72	1	6.1

Chart A.2 - Deck General Condition Rating
By District and Highway System

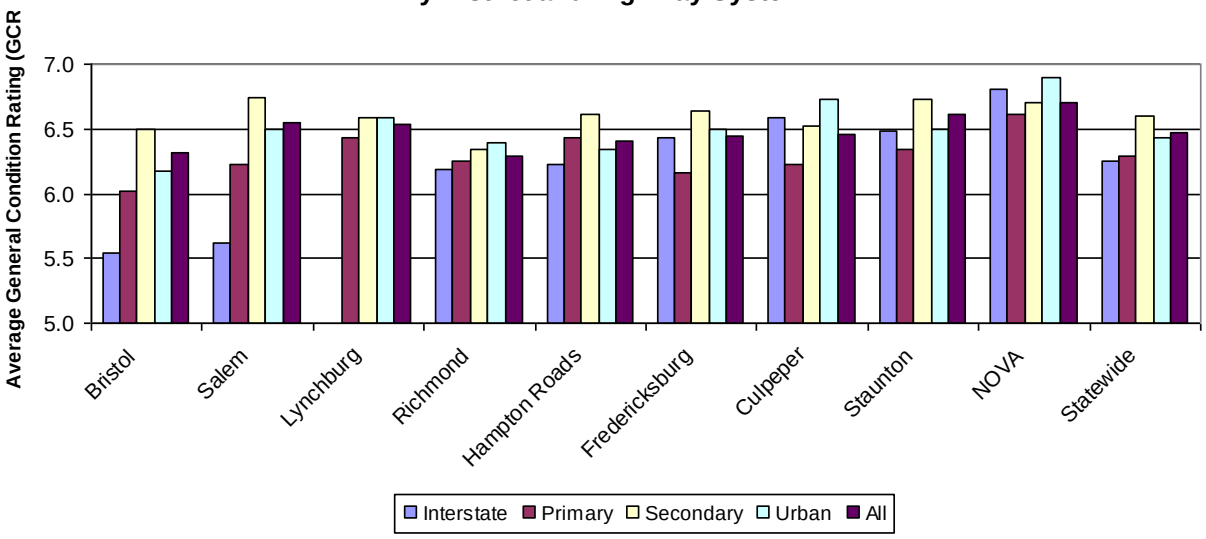


Chart A.3 - Deck General Condition Rating
By Highway System and District

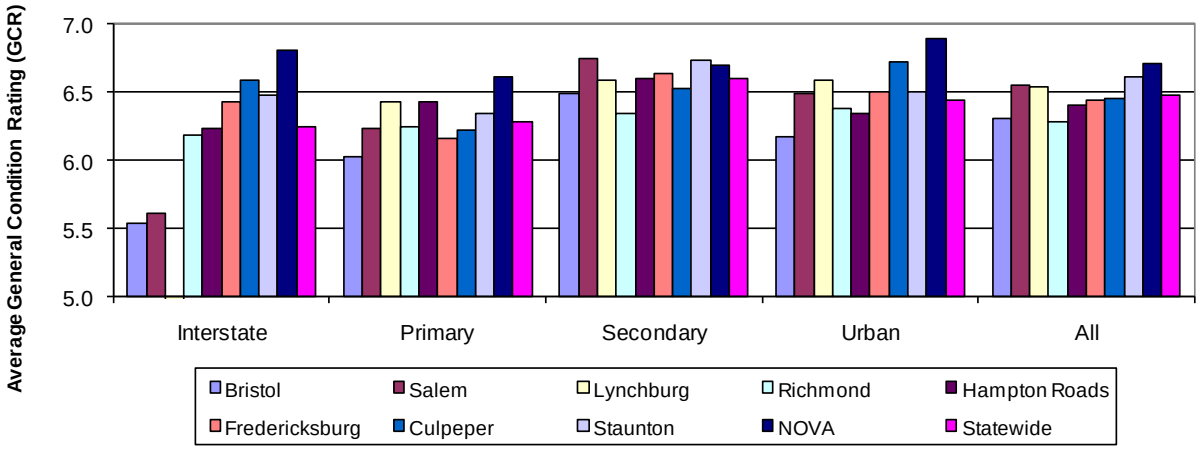


Chart A.4 - Superstructure General Condition Rating
By District and Highway System

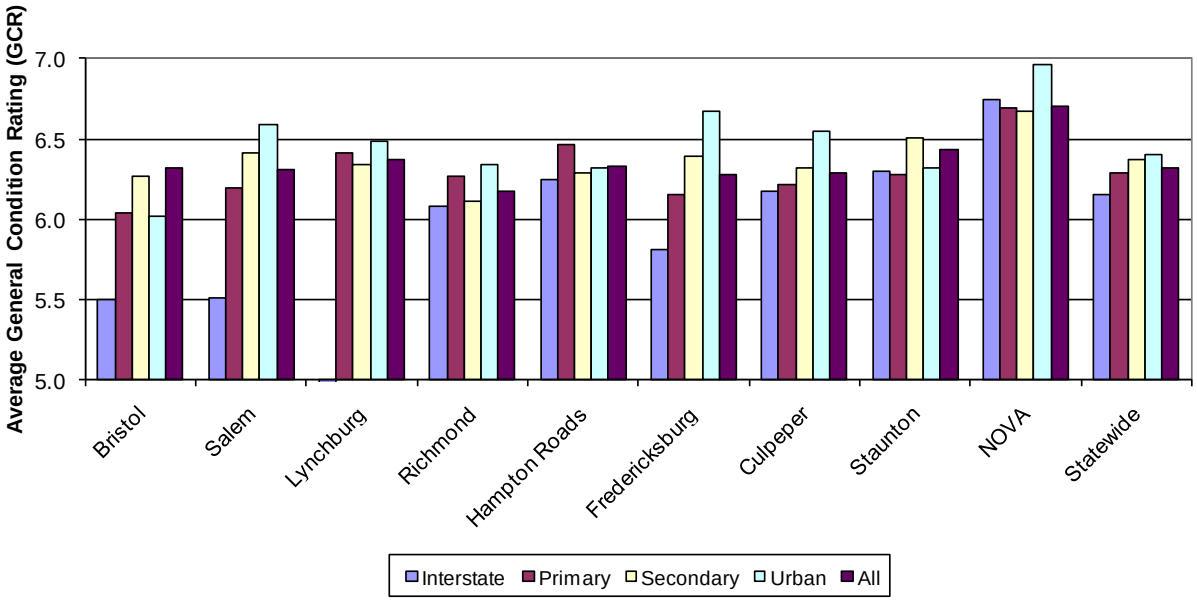


Chart A.5 - Superstructure General Condition Ratings
By Highway System and District

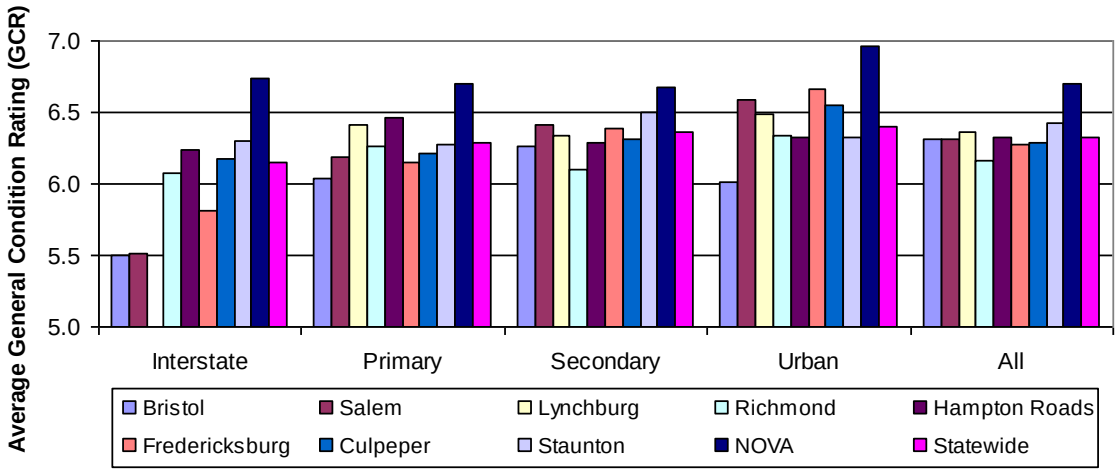


Chart A.6 - Substructure General Condition Rating
By District and Highway System

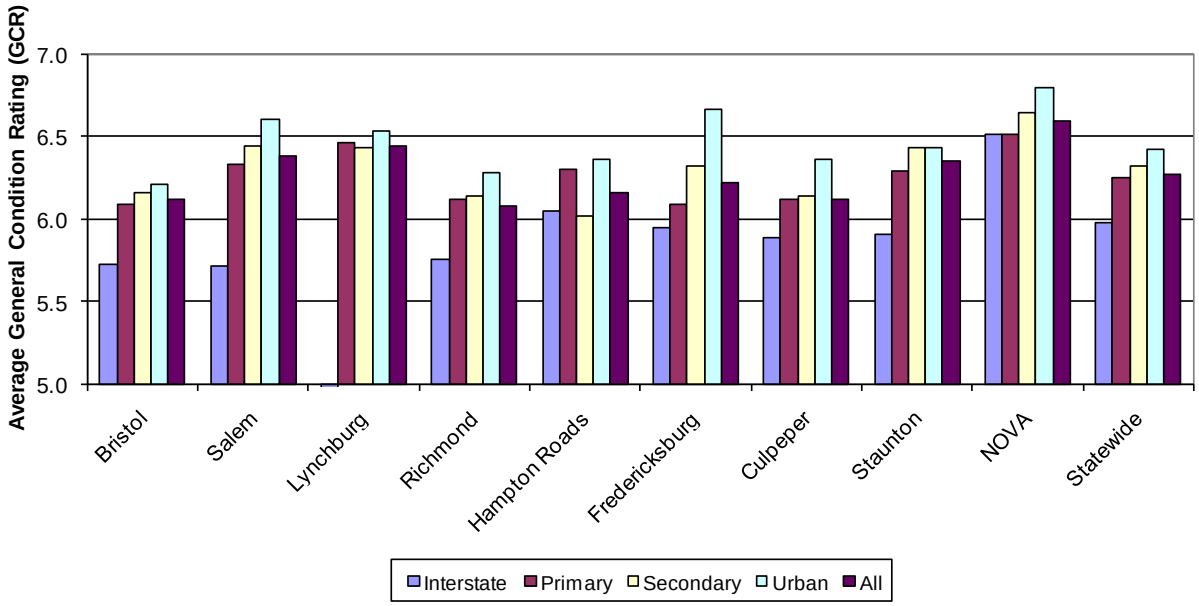


Chart A.7 - Substructure General Condition Rating
By Highway System and District

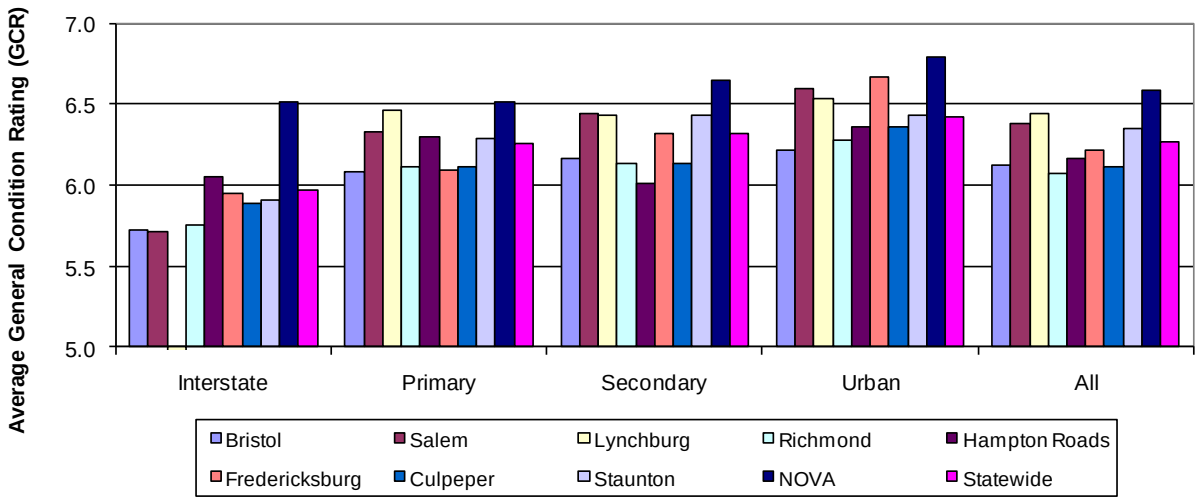


Chart A.8 - Culvert General Condition Rating
By District and Highway System

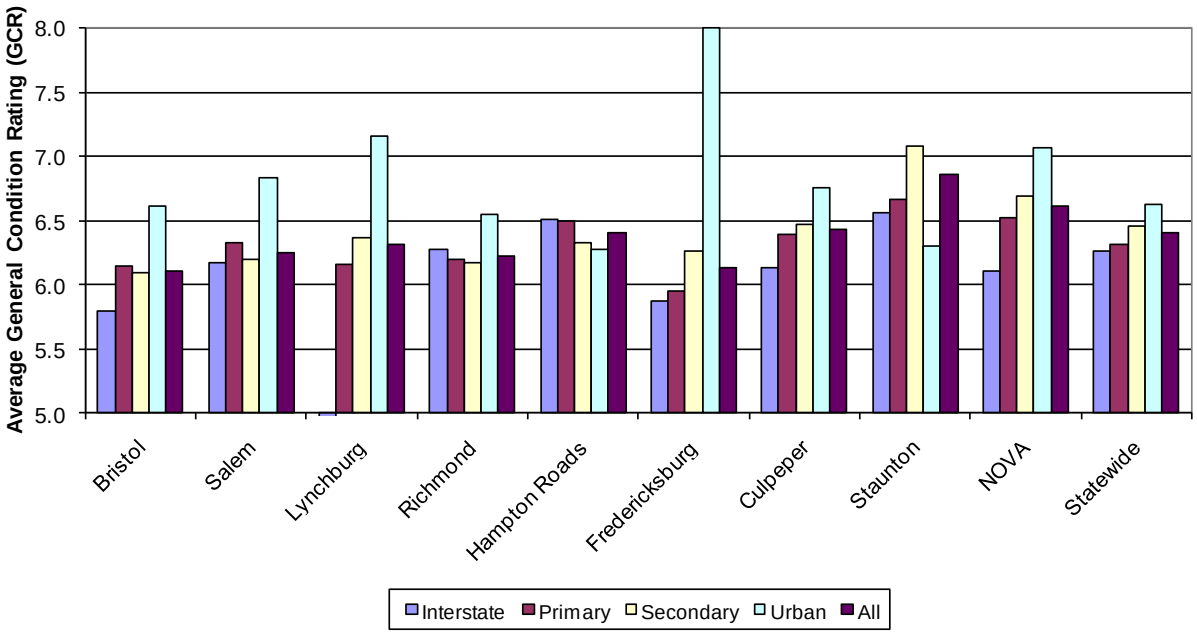


Chart A.9 - Culvert General Condition Rating
By Highway System and District

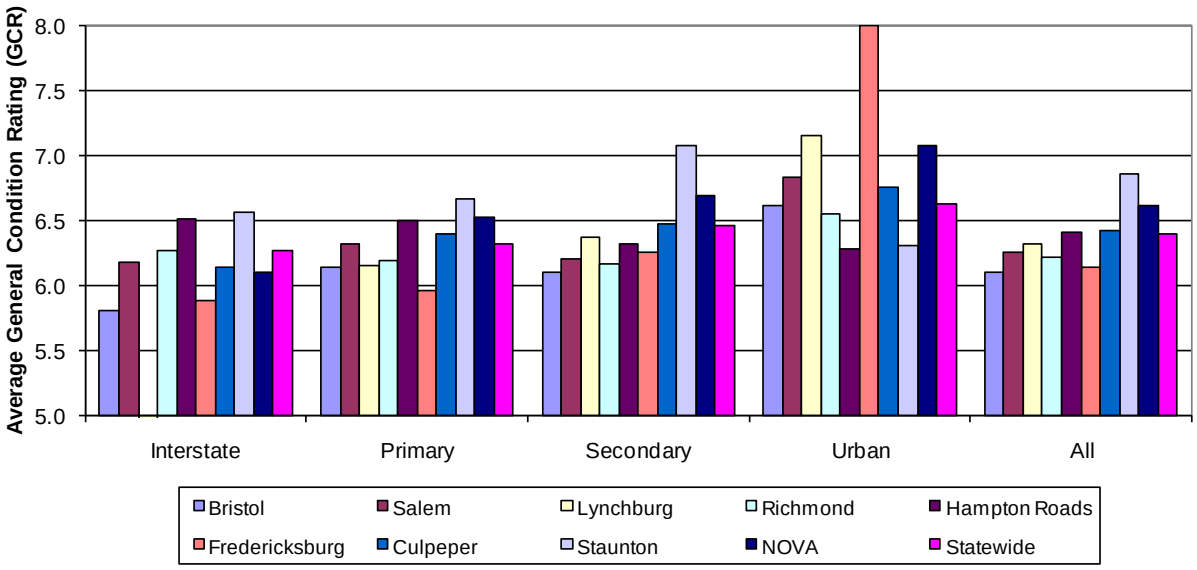


Chart A.10 - Average Minimum General Condition Rating per Bridge
By District and Highway System

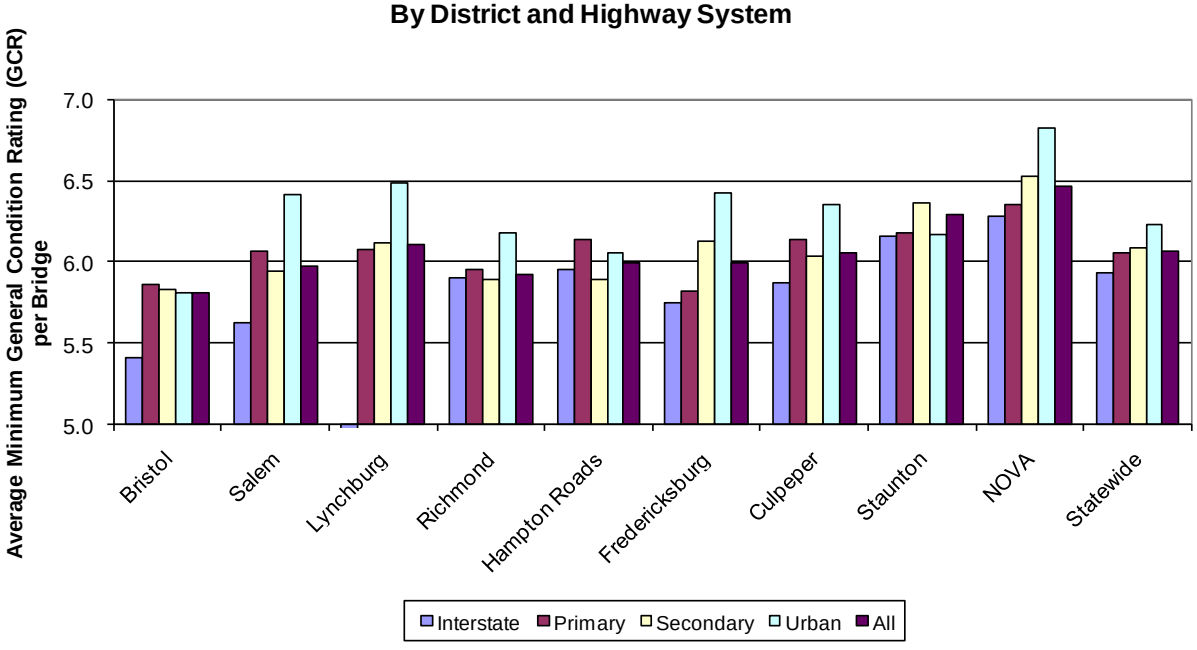
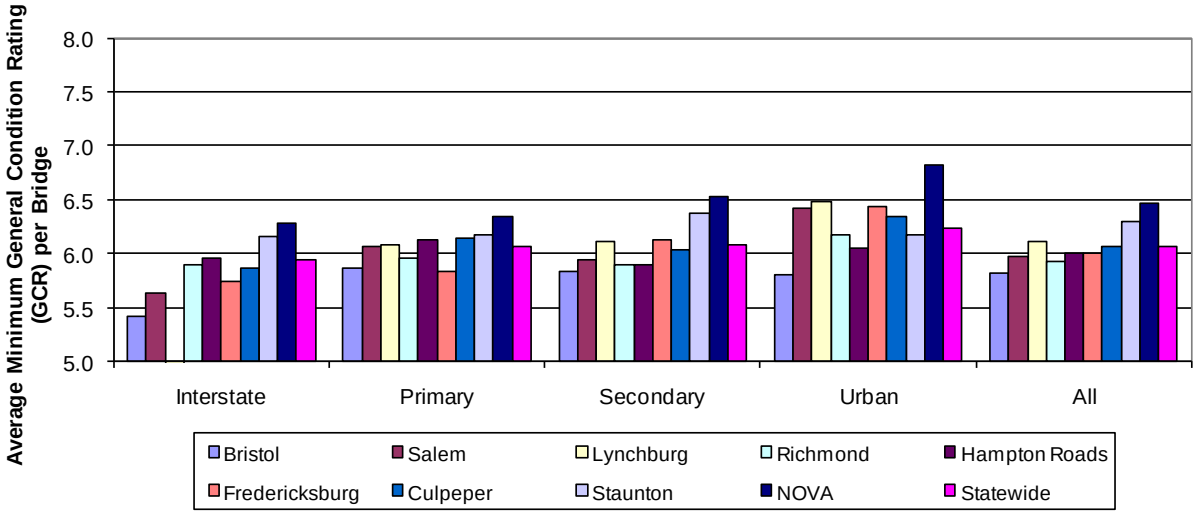
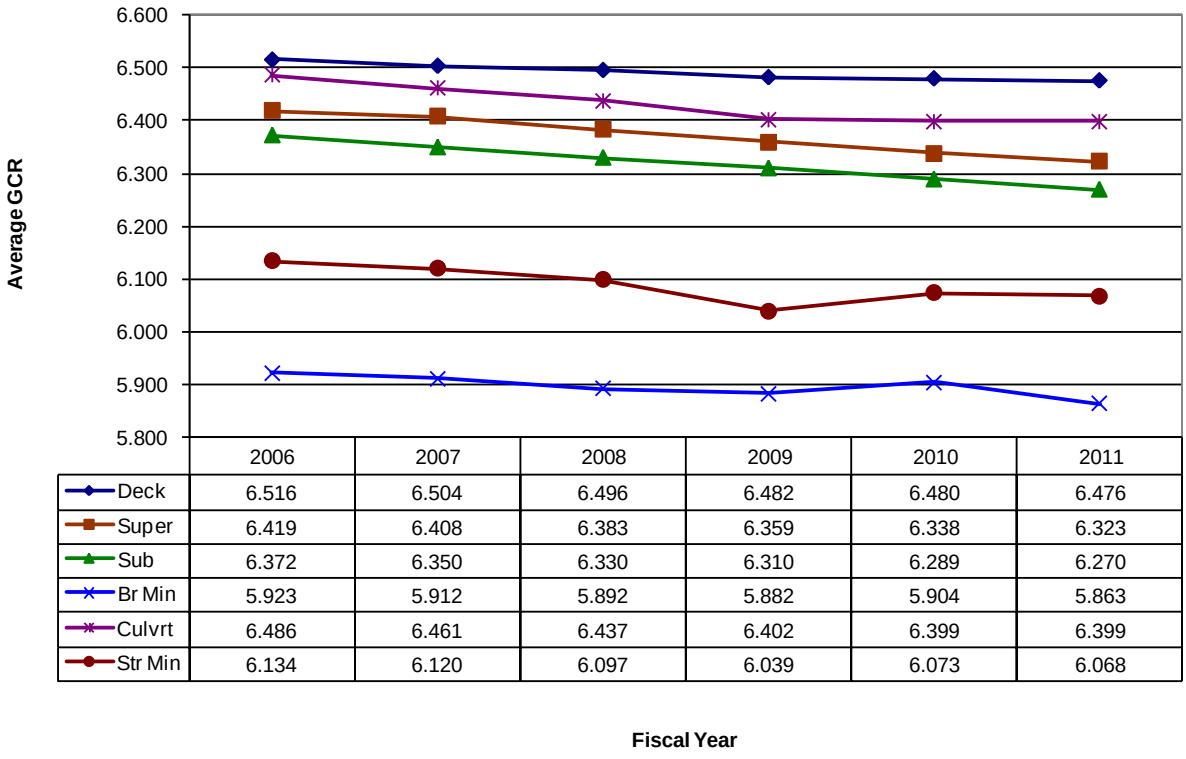


Chart A.11 - Average Minimum General Condition Rating per Bridge By Highway System and District



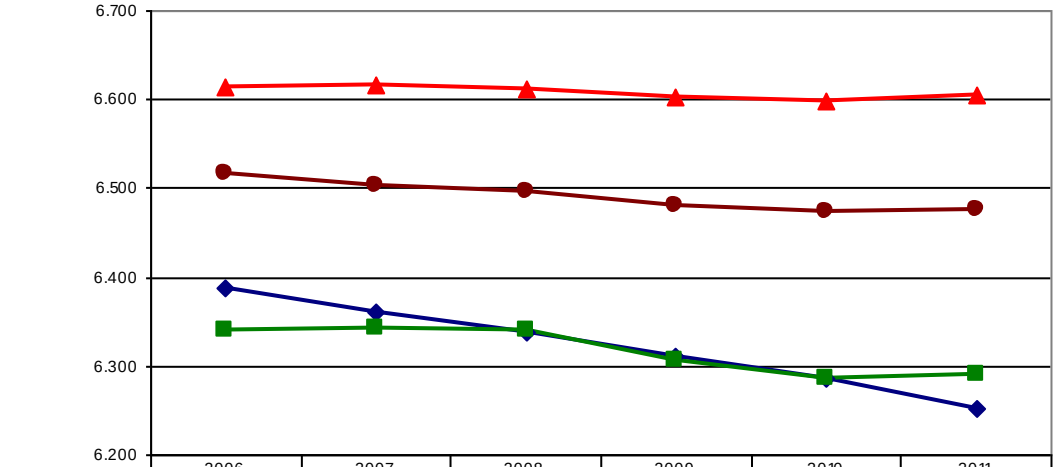
Trend lines showing the average general condition ratings of rated components are provided in Charts A.12 through A.24 below.

Chart A.12 - Trends in Average General Condition Rating (GCR) By Component - Statewide



	2006	2007	2008	2009	2010	2011
Deck	6.516	6.504	6.496	6.482	6.480	6.476
Super	6.419	6.408	6.383	6.359	6.338	6.323
Sub	6.372	6.350	6.330	6.310	6.289	6.270
Br Min	5.923	5.912	5.892	5.882	5.904	5.863
Culvrt	6.486	6.461	6.437	6.402	6.399	6.399
Str Min	6.134	6.120	6.097	6.039	6.073	6.068

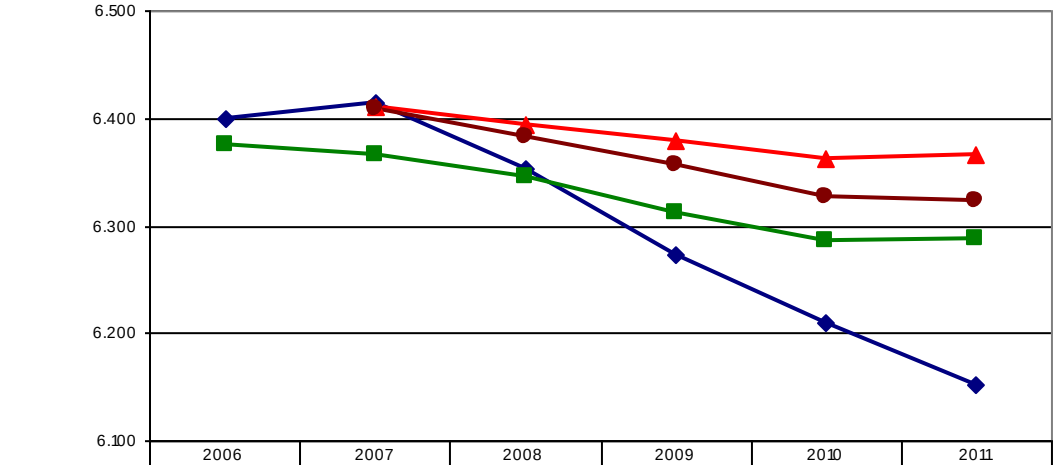
Chart A.13 - Bridge Decks: Trends in Average GCR By Highway System



	2006	2007	2008	2009	2010	2011
Interstate	6.387	6.361	6.338	6.310	6.285	6.253
Primary	6.339	6.342	6.340	6.307	6.286	6.291
Secondary	6.614	6.617	6.613	6.603	6.598	6.606
Average	6.516	6.504	6.497	6.481	6.474	6.477

Fiscal Year

Chart A.14 - Superstructures: Trends in Average GCR By Highway System

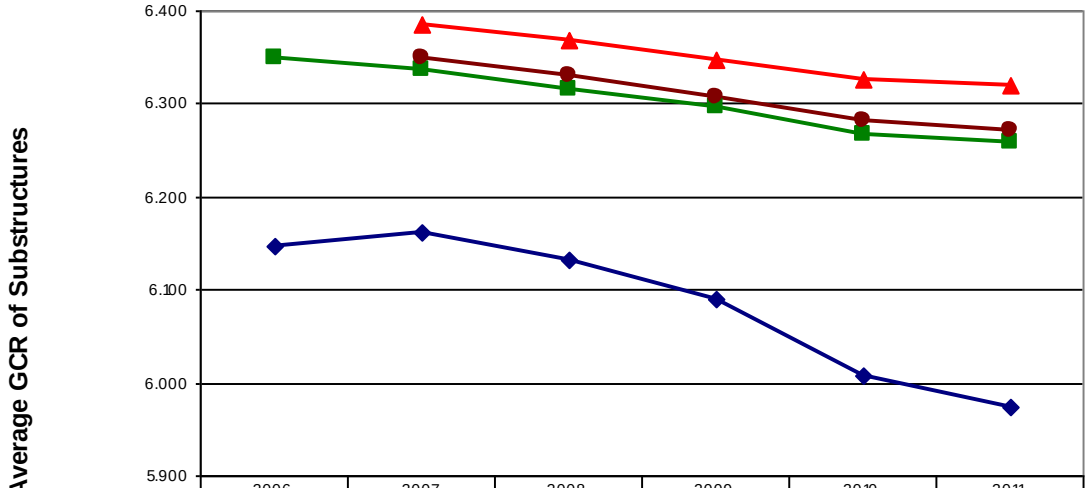


	2006	2007	2008	2009	2010	2011
Interstate	6.400	6.415	6.352	6.273	6.210	6.152
Primary	6.375	6.367	6.346	6.313	6.287	6.288
Secondary	*	6.411	6.394	6.379	6.362	6.366
Average	*	6.408	6.383	6.357	6.328	6.324

* Data not available

Fiscal Year

Chart A.15 - Substructures: Trends in Average GCR By Highway system

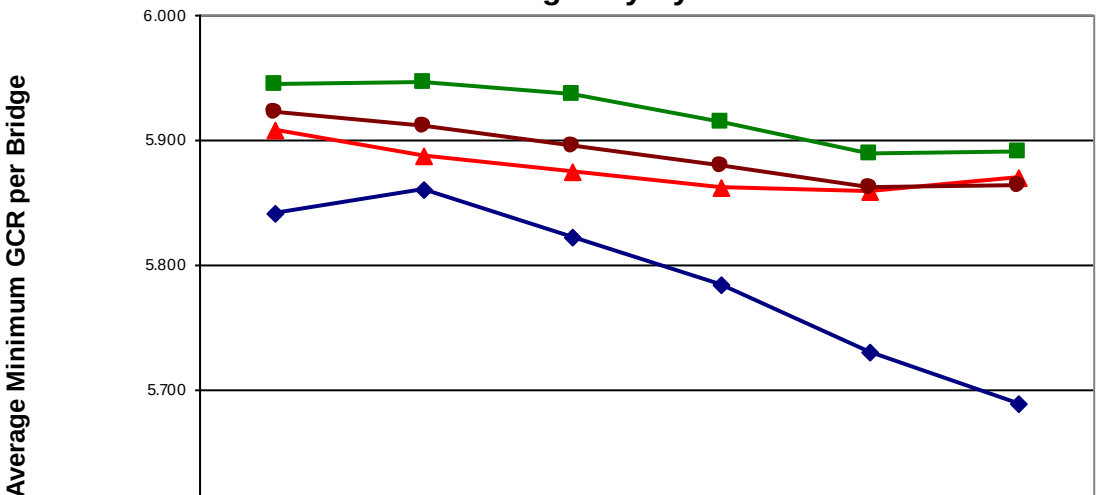


	2006	2007	2008	2009	2010	2011
Interstate	6.147	6.162	6.132	6.091	6.008	5.974
Primary	6.349	6.338	6.317	6.296	6.268	6.258
Secondary	*	6.386	6.369	6.347	6.326	6.319
Average	*	6.350	6.330	6.307	6.283	6.271

* Data not available

Fiscal Year

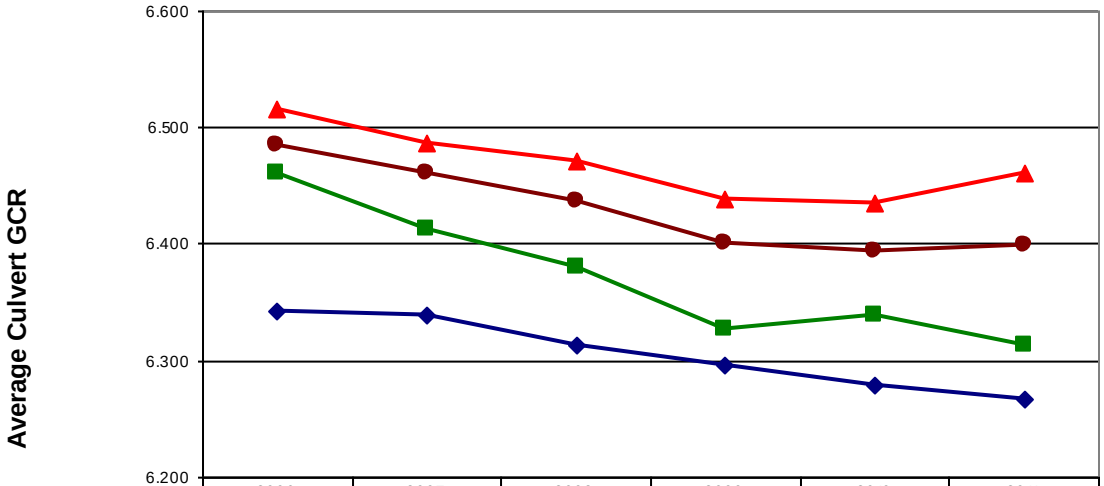
Chart A.16 - Bridges: Trends in Min GCR (per Bridge) By Highway System



	2006	2007	2008	2009	2010	2011
Interstate	5.842	5.861	5.823	5.784	5.730	5.689
Primary	5.945	5.947	5.936	5.914	5.888	5.891
Secondary	5.908	5.888	5.875	5.863	5.860	5.870
Average	5.923	5.912	5.895	5.879	5.862	5.864

Fiscal Year

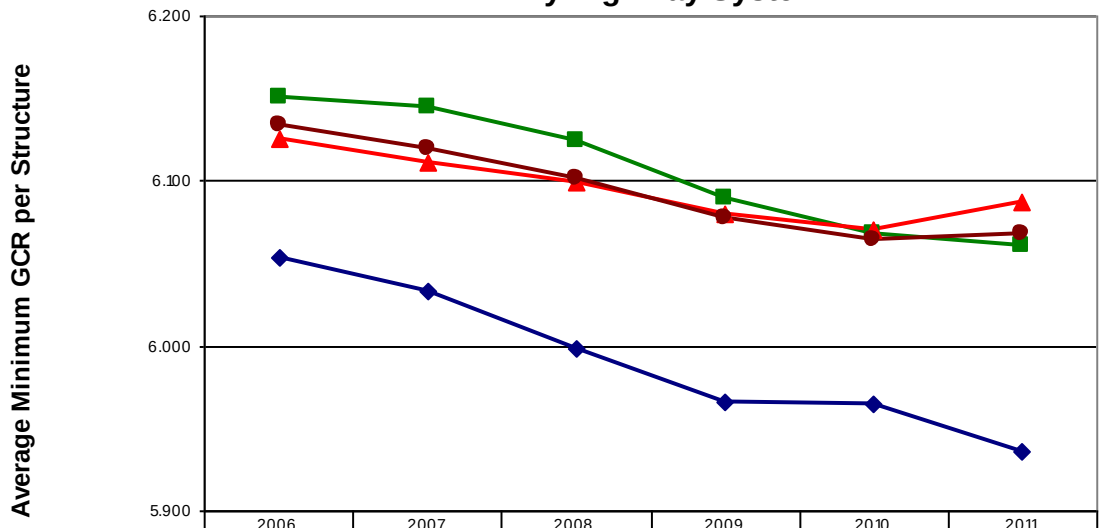
Chart A.17 - Culverts: Trends in Average GCR By Highway System



	2006	2007	2008	2009	2010	2011
Interstate	6.343	6.340	6.313	6.296	6.279	6.267
Primary	6.460	6.412	6.380	6.328	6.338	6.313
Secondary	6.515	6.487	6.472	6.439	6.435	6.460
Average	6.486	6.461	6.437	6.400	6.394	6.399

Fiscal Year

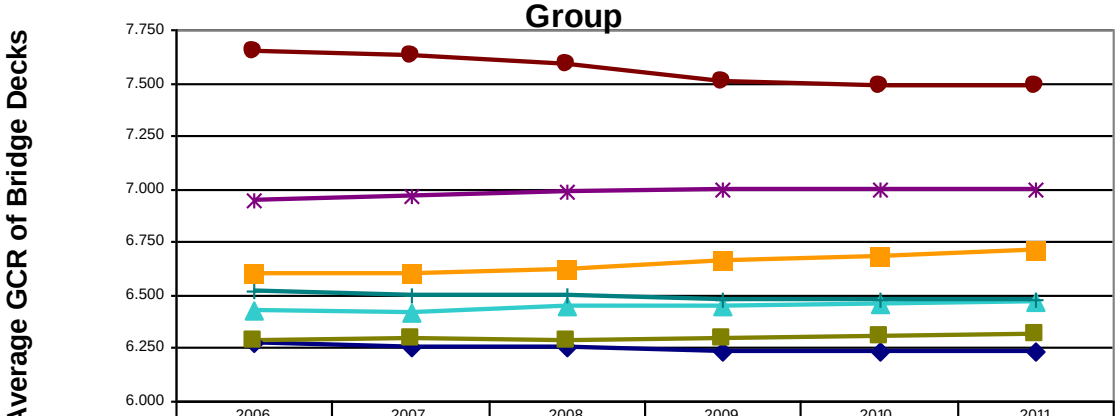
Chart A.18 - Bridges & Culverts: Trends in Minimum GCR By Highway System



	2006	2007	2008	2009	2010	2011
Interstate	6.053	6.033	5.998	5.966	5.965	5.936
Primary	6.150	6.145	6.124	6.090	6.068	6.061
Secondary	6.126	6.111	6.099	6.080	6.071	6.087
Average	6.134	6.120	6.101	6.077	6.064	6.068

Fiscal Year

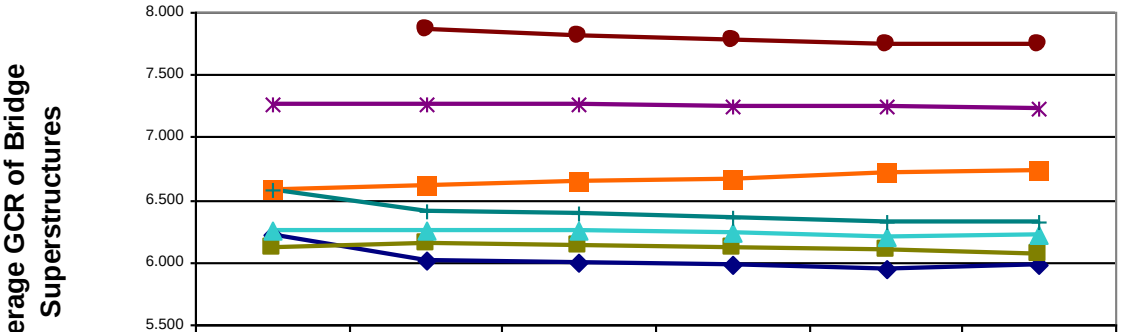
Chart A.19 - Bridge Decks: Trends in Average GCR By Age Group



	2006	2007	2008	2009	2010	2011
>50	6.274	6.259	6.255	6.235	6.231	6.237
41-50	6.290	6.293	6.288	6.291	6.301	6.313
31-40	6.429	6.420	6.448	6.445	6.462	6.467
21-30	6.598	6.601	6.620	6.666	6.683	6.714
11-20	6.951	6.967	6.985	6.995	7.001	6.994
0-10	7.653	7.624	7.590	7.506	7.482	7.485
Average	6.516	6.504	6.496	6.482	6.475	6.476

Fiscal Year

Chart A.20 - Bridge Superstructures: Trends in Average GCR By Age Group

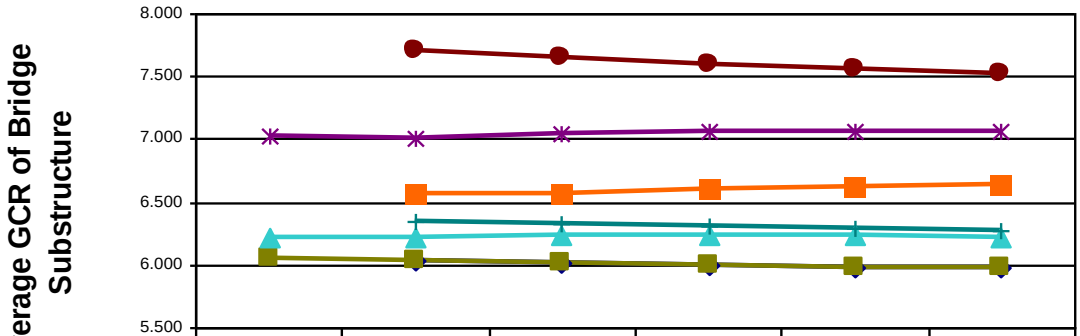


	2006	2007	2008	2009	2010	2011
>50	6.226	6.007	5.990	5.973	5.948	5.971
41-50	6.123	6.152	6.132	6.112	6.092	6.070
31-40	6.262	6.252	6.253	6.228	6.201	6.214
21-30	6.585	6.618	6.646	6.671	6.715	6.736
11-20	7.267	7.267	7.267	7.248	7.249	7.221
0-10	*	7.857	7.805	7.780	7.751	7.740
Average	6.572	6.408	6.382	6.359	6.328	6.323

* Data not available

Fiscal Year

Chart A.21 - Substructures: Trends in Average GCR By Age Group

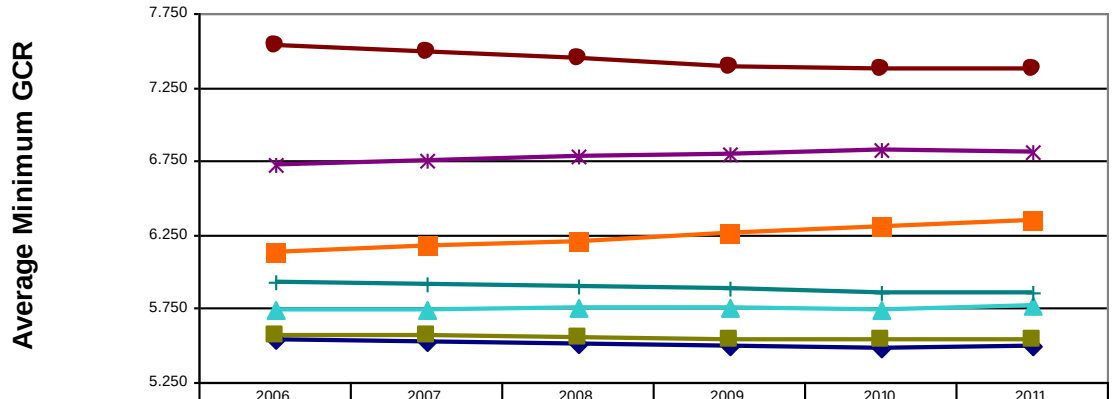


	2006	2007	2008	2009	2010	2011
>50	*	6.032	6.020	6.001	5.978	5.976
41-50	6.052	6.031	6.014	5.988	5.970	5.979
31-40	6.219	6.224	6.234	6.232	6.232	6.214
21-30	*	6.562	6.566	6.602	6.630	6.641
11-20	7.018	7.010	7.044	7.055	7.064	7.056
0-10	*	7.704	7.651	7.591	7.557	7.525
Average	*	6.349	6.329	6.310	6.284	6.270

* Data not available

Fiscal Year

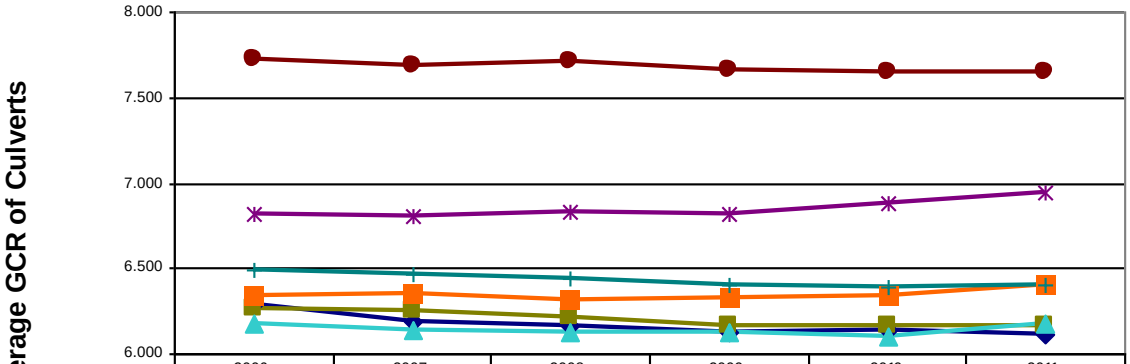
Chart A.22 - Bridges: Trends in Average Minimum GCR per Bridge By Age Group



	2006	2007	2008	2009	2010	2011
>50	5.540	5.519	5.509	5.498	5.481	5.500
41-50	5.569	5.564	5.557	5.542	5.542	5.540
31-40	5.739	5.744	5.753	5.751	5.743	5.765
21-30	6.129	6.176	6.205	6.258	6.311	6.342
11-20	6.725	6.751	6.780	6.802	6.819	6.813
0-10	7.531	7.489	7.448	7.394	7.377	7.372
Average	5.923	5.911	5.895	5.882	5.862	5.863

Fiscal Year

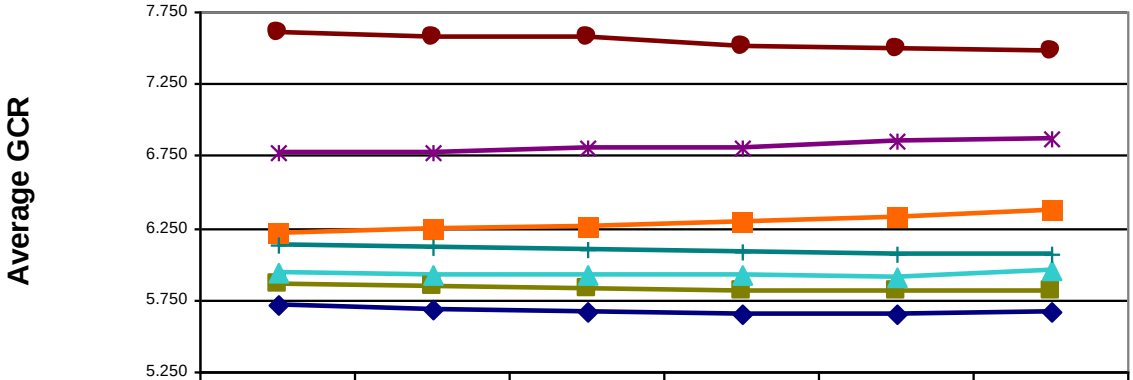
Chart A.23 - Culverts: Trends in Average GCR By Age Group



	2006	2007	2008	2009	2010	2011
>50	6.285	6.183	6.166	6.126	6.133	6.111
41-50	6.268	6.247	6.212	6.165	6.161	6.166
31-40	6.176	6.138	6.123	6.122	6.102	6.172
21-30	6.335	6.347	6.320	6.326	6.335	6.397
11-20	6.814	6.804	6.827	6.814	6.878	6.941
0-10	7.724	7.686	7.711	7.655	7.646	7.644
Average	6.486	6.460	6.437	6.402	6.394	6.399

Fiscal Year

Chart A.24 - Bridges and Culverts: Trends in Minimum GCR by Age Group



	2006	2007	2008	2009	2010	2011
>50	5.722	5.678	5.671	5.656	5.648	5.661
41-50	5.852	5.843	5.833	5.807	5.804	5.808
31-40	5.938	5.922	5.919	5.916	5.907	5.953
21-30	6.217	6.251	6.254	6.287	6.321	6.366
11-20	6.768	6.777	6.803	6.808	6.848	6.876
0-10	7.613	7.580	7.567	7.510	7.493	7.484
Average	6.134	6.120	6.101	6.080	6.065	6.068

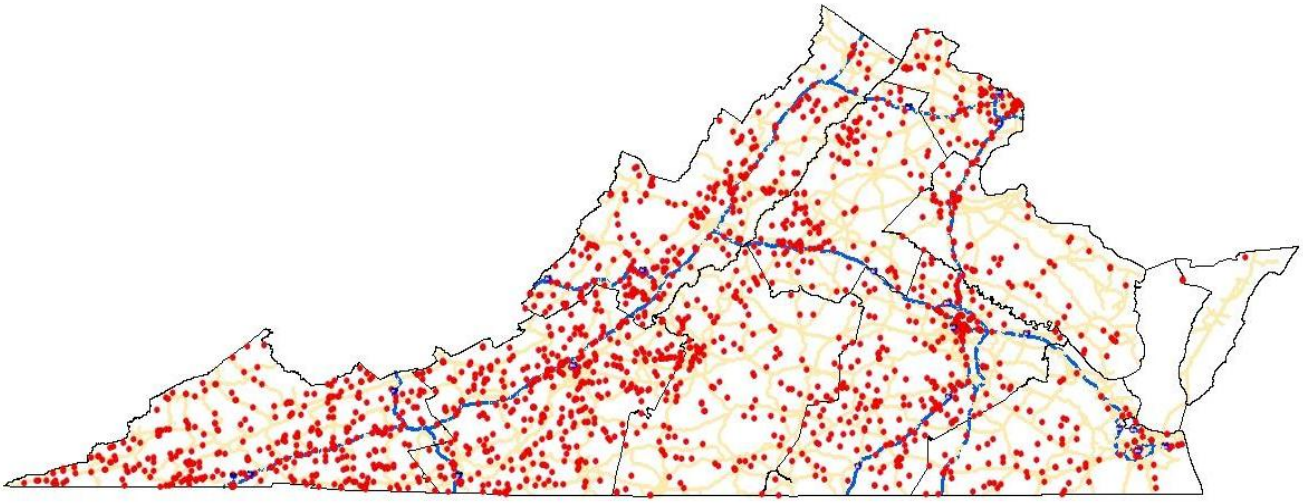
Fiscal Year

Appendix B – Location of Structurally Deficient Structures

Statewide – Current FY Structurally Deficient Structures

Total Number of Structures = 20,908
Number of SD Structures = 1,720 (8.2 %)
Total Square Foot area of structures = 115,337,078
Square foot area of SD Structures = 6,545,730 (5.7 %)

- Denotes SD Structure

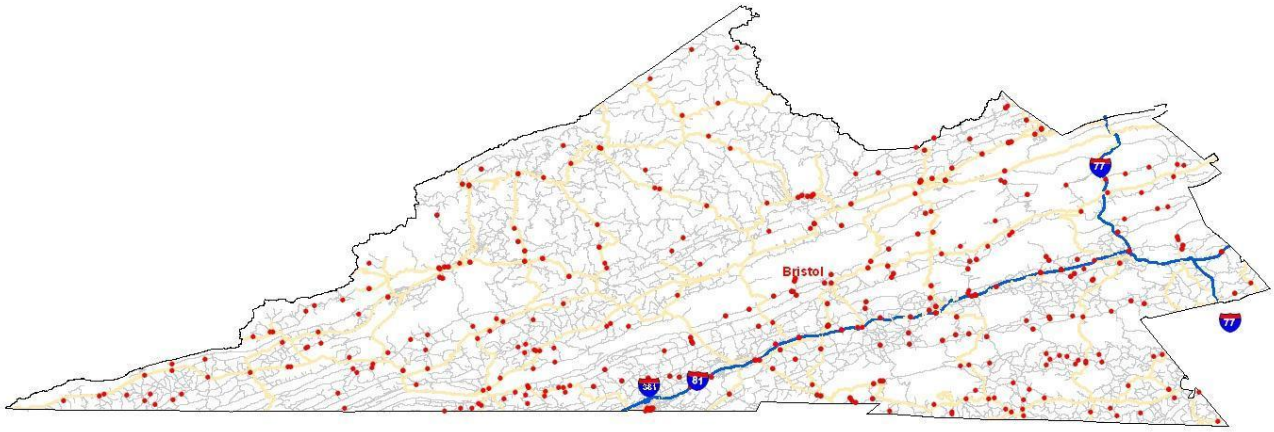


Virginia Department of Transportation
State of the Structures and Bridges Report

Bristol District – Current FY Structurally Deficient Structures

Number of SD Structures = 341
Square foot area of SD Structures = 676,867

- Denotes SD Structure

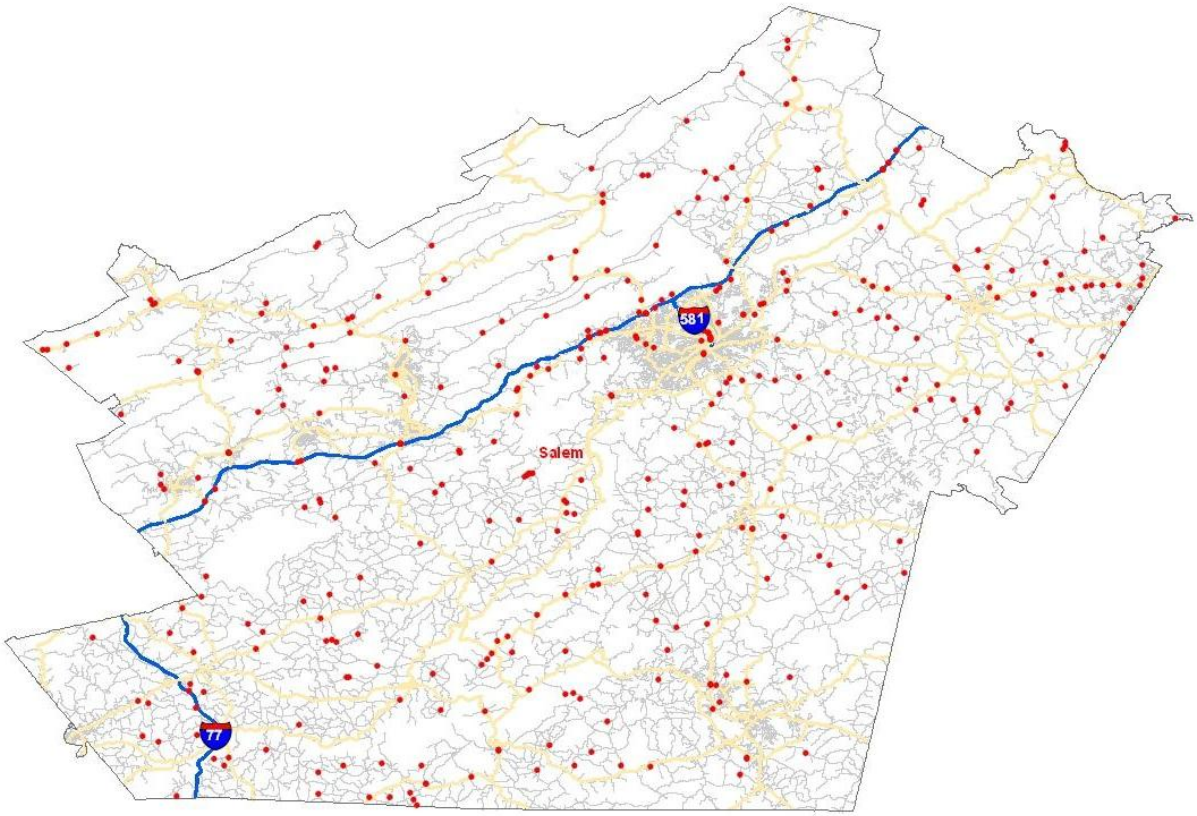


Virginia Department of Transportation
State of the Structures and Bridges Report

Salem District – Current FY Structurally Deficient Structures

Number of SD Structures = 362
Square foot area of SD Structures = 843,060

- Denotes SD Structure

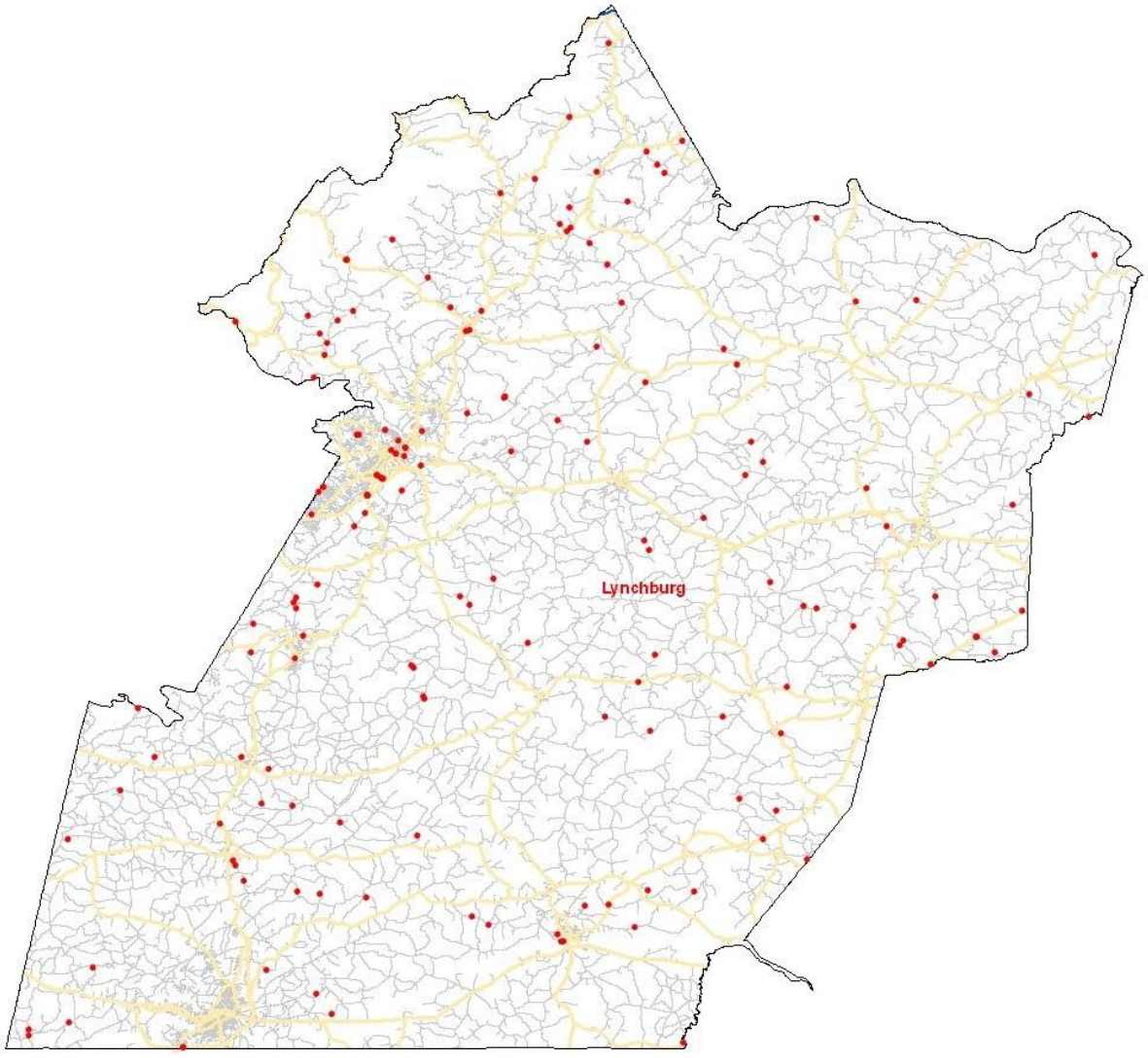


Virginia Department of Transportation
State of the Structures and Bridges Report

Lynchburg District – Current FY Structurally Deficient Structures

Number of SD Structures = 156
Square foot area of SD Structures = 445,682

- Denotes SD Structure

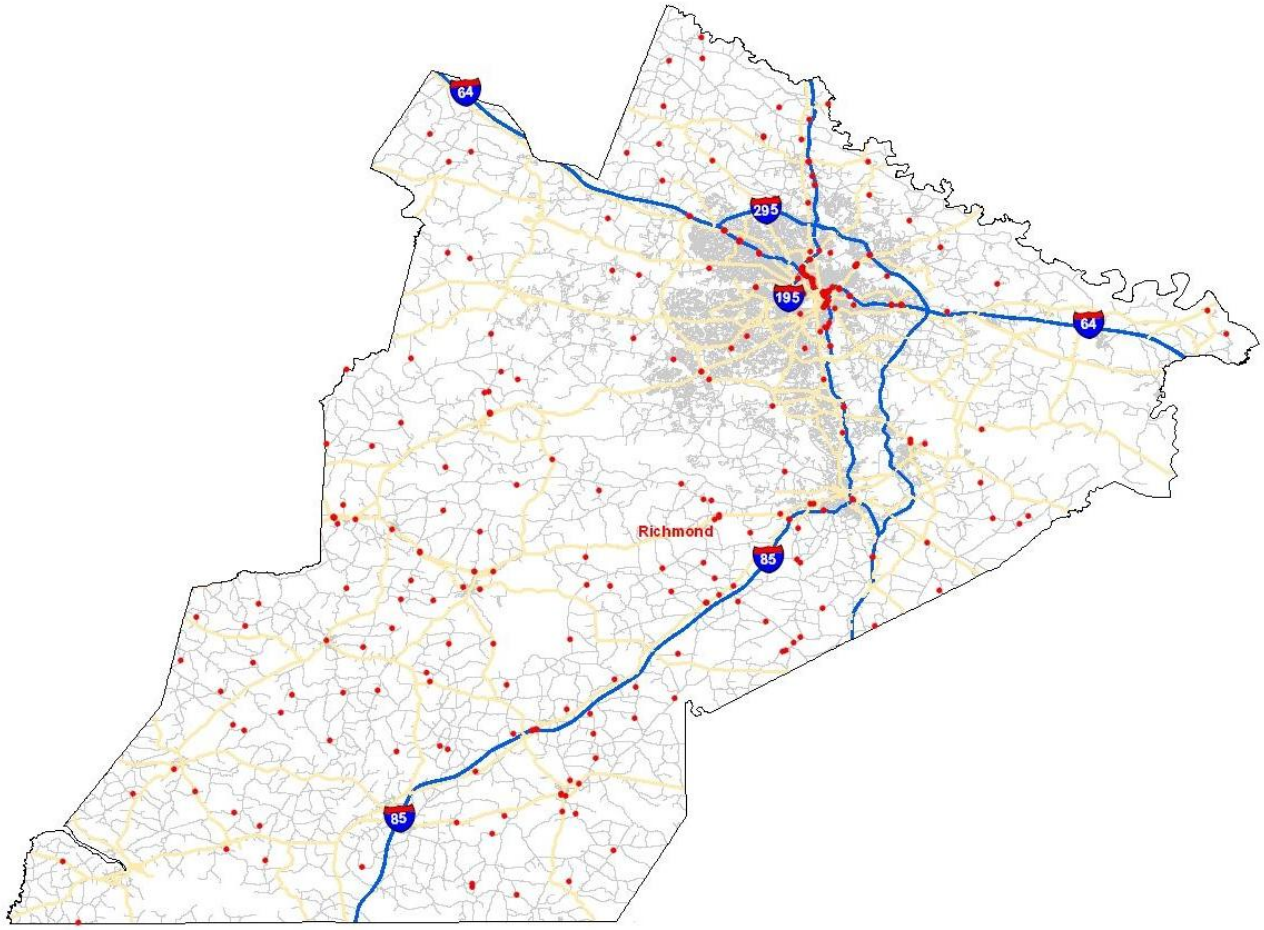


Virginia Department of Transportation
State of the Structures and Bridges Report

Richmond District – Current FY Structurally Deficient Structures

Number of SD Structures = 253
Square foot area of SD Structures = 1,779,833

- Denotes SD Structure

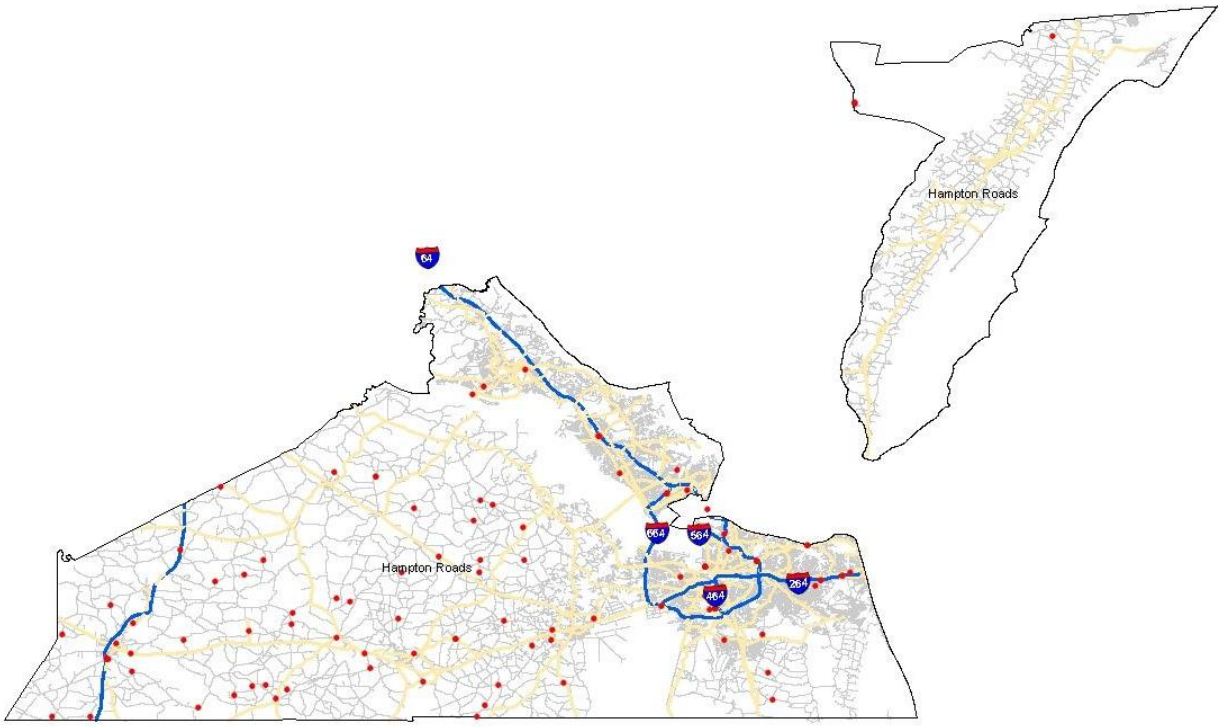


Virginia Department of Transportation
State of the Structures and Bridges Report

Hampton Roads District – Current FY Structurally Deficient Structures

Number of SD Structures = 92
Square foot area of SD Structures = 1,140,968

- Denotes SD Structure

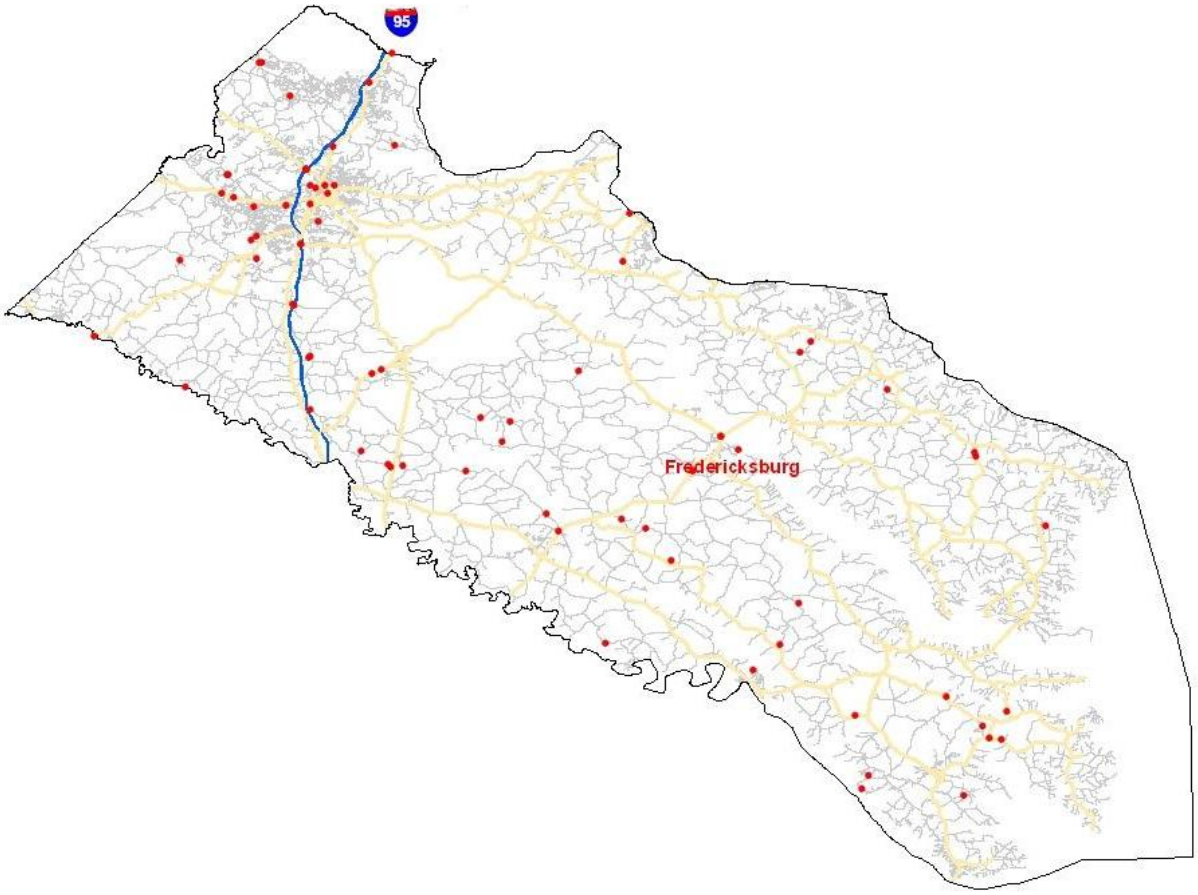


Virginia Department of Transportation
State of the Structures and Bridges Report

Fredericksburg District – Current FY Structurally Deficient Structures

Number of SD Structures = 73
Square foot area of SD Structures = 499,422

- Denotes SD Structure

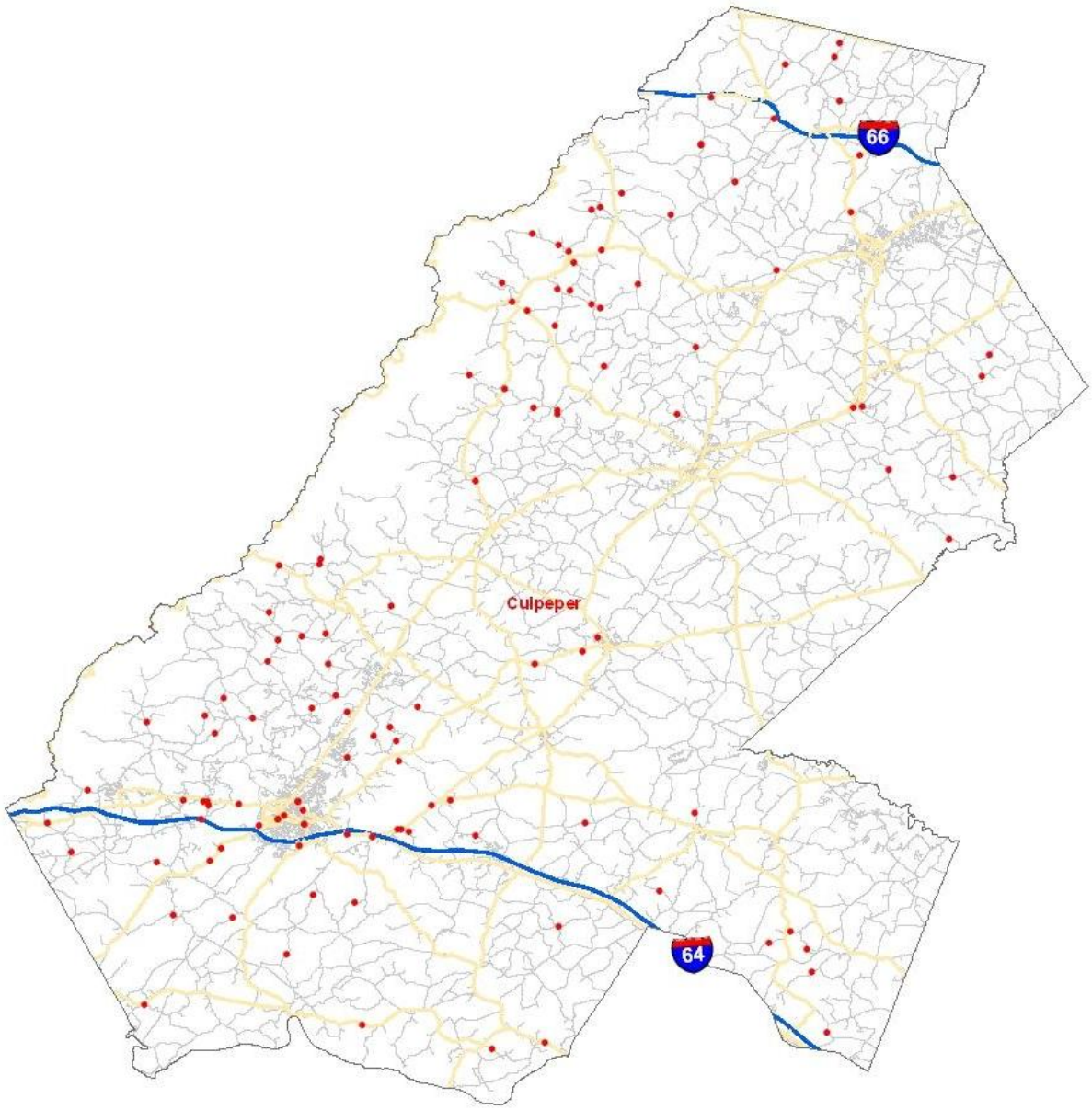


Virginia Department of Transportation
State of the Structures and Bridges Report

Culpeper District – Current FY Structurally Deficient Structures

Number of SD Structures = 118
Square foot area of SD Structures = 205,608

- Denotes SD Structure

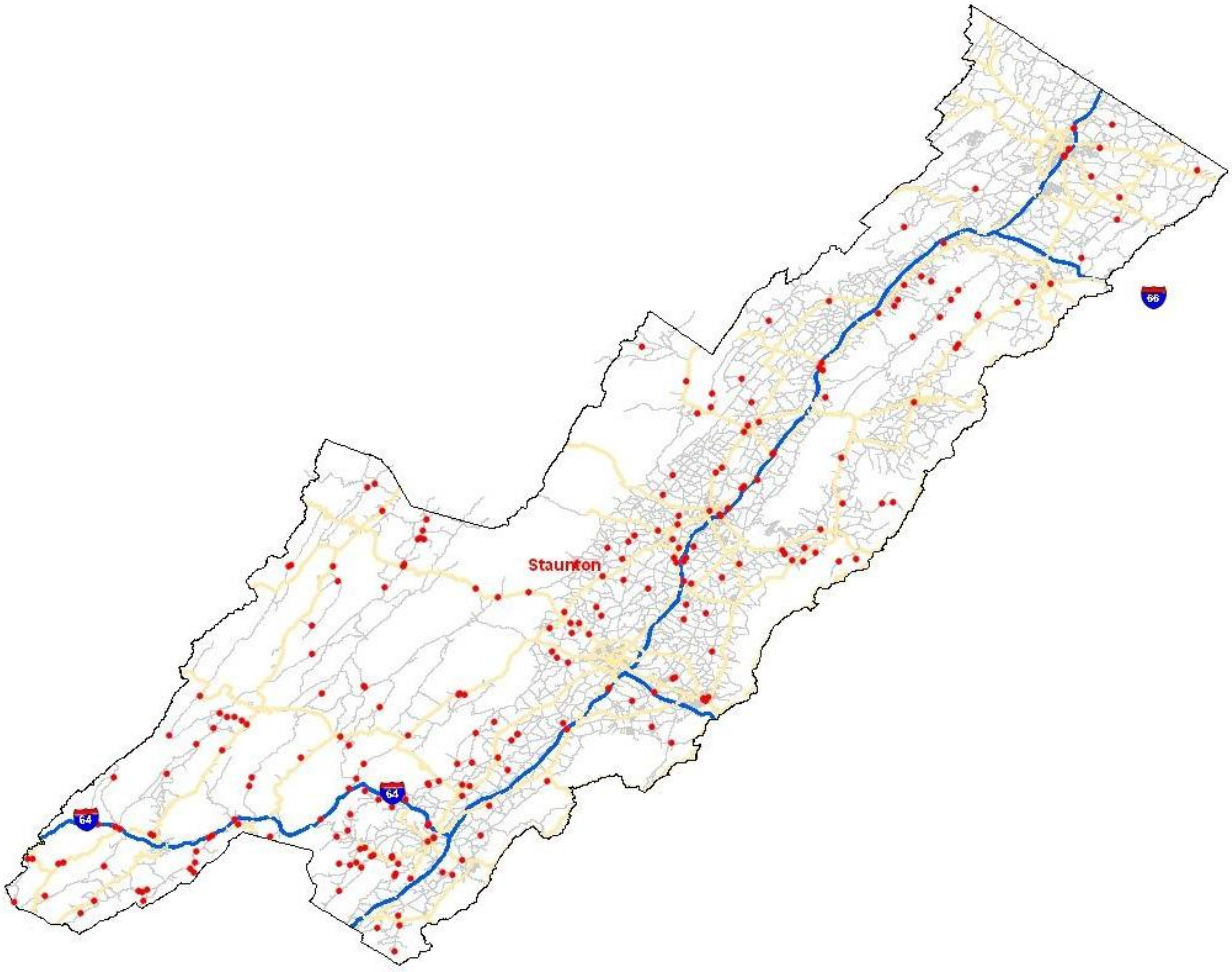


Virginia Department of Transportation
State of the Structures and Bridges Report

Staunton District – Current FY Structurally Deficient Structures

Number of SD Structures = 256
Square foot area of SD Structures = 575,291

- Denotes SD Structure

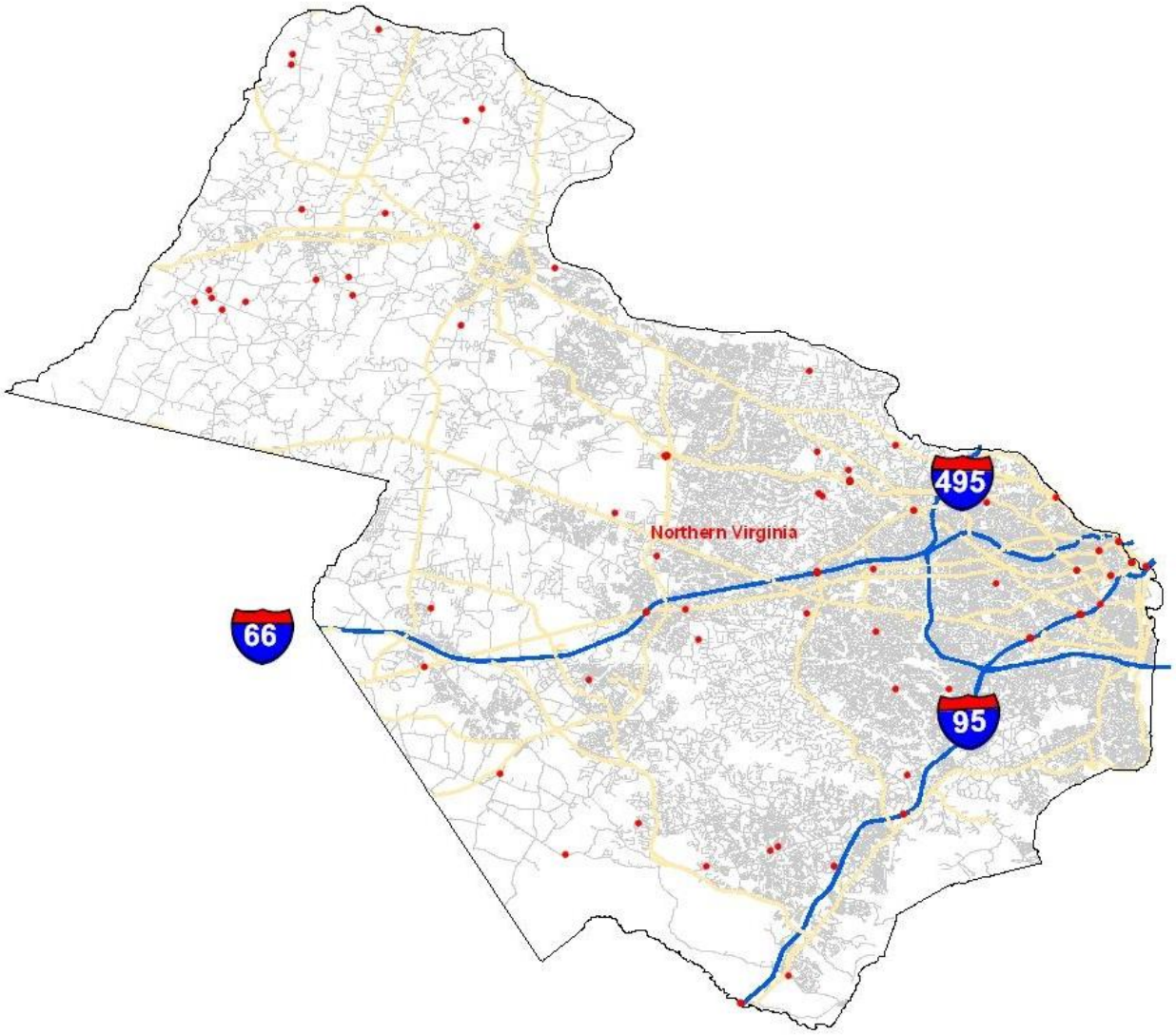


Virginia Department of Transportation
State of the Structures and Bridges Report

NOVA District – Current FY Structurally Deficient Structures

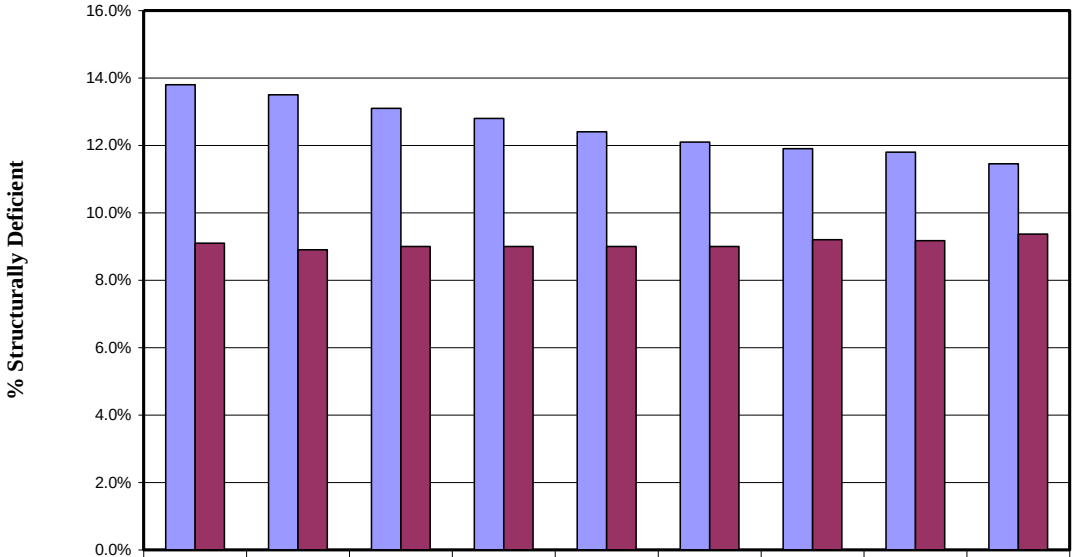
Number of SD Structures = 69
Square foot area of SD Structures = 378,999

- Denotes SD Structure



Appendix C– National Performance Trends

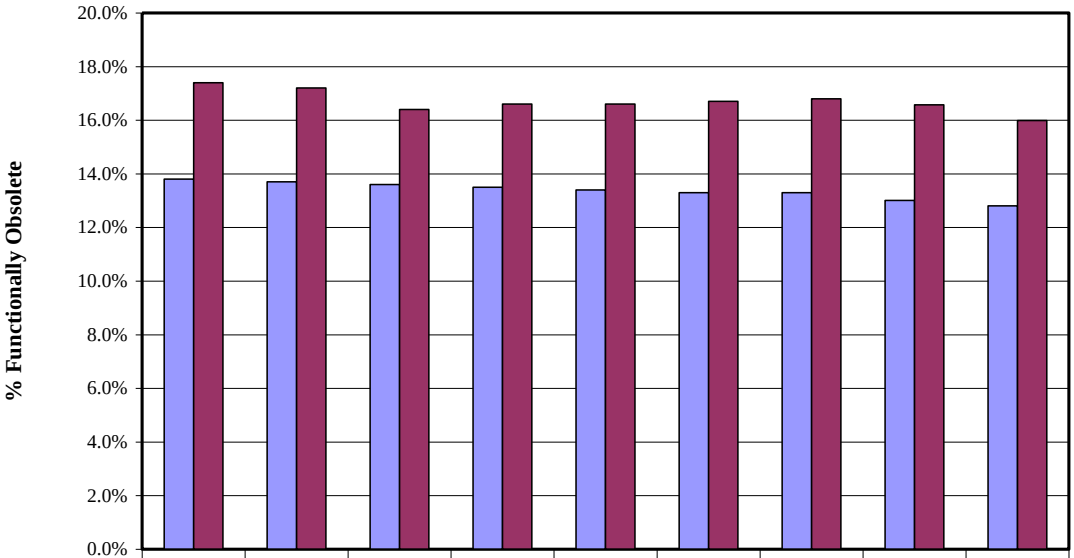
Chart C.1 - Comparing Virginia's Structurally Deficient (SD) Structures to the National Average



	2002	2003	2004	2005	2006	2007	2008	2009	2010
National	13.8%	13.5%	13.1%	12.8%	12.4%	12.1%	11.9%	11.8%	11.5%
Virginia	9.1%	8.9%	9.0%	9.0%	9.0%	9.0%	9.2%	9.2%	9.4%

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

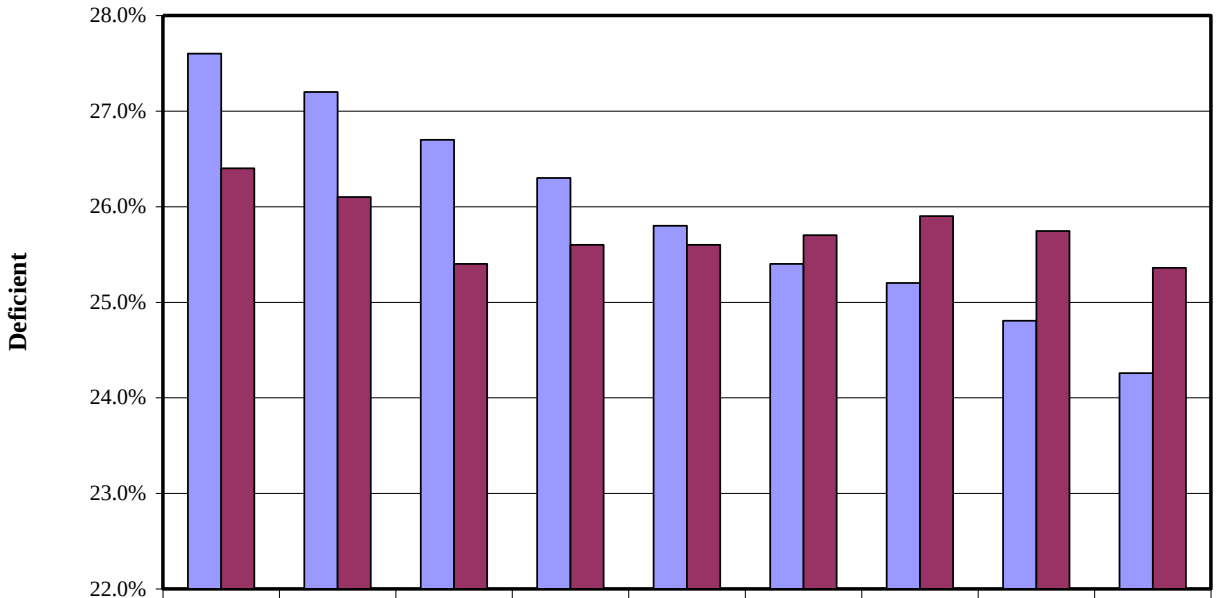
Chart C.2 - Comparing Virginia's Functionally Obsolete (FO) Structures to the National Average



	2002	2003	2004	2005	2006	2007	2008	2009	2010
National	13.8%	13.7%	13.6%	13.5%	13.4%	13.3%	13.3%	13.0%	12.8%
Virginia	17.4%	17.2%	16.4%	16.6%	16.6%	16.7%	16.8%	16.6%	16.0%

Note: Percentages are based on National Bridge Inventory structures only. See previous charts for percentages of entire Virginia inventory. The 2011 National Bridge Inventory data is not yet available.

Chart C.3 - Comparing Virginia's Deficient (SD or FO) to the National Average



	2002	2003	2004	2005	2006	2007	2008	2009	2010
National	27.6%	27.2%	26.7%	26.3%	25.8%	25.4%	25.2%	24.8%	24.3%
Virginia	26.4%	26.1%	25.4%	25.6%	25.6%	25.7%	25.9%	25.7%	25.4%

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

Appendix D– Structures Data by Square Foot Area

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

DISTRICT	Sq-Ft Area of Structures (Bridges and Culverts)				
	Interstate	Primary	Secondary	Urban	Total
Bristol	1,821,114	4,060,904	2,643,070	195,001	8,720,089
Salem	1,677,651	4,544,156	3,071,697	644,962	9,938,466
Lynchburg	0	4,499,760	2,578,748	331,624	7,410,132
Richmond	6,047,111	10,036,592	3,830,365	1,164,478	21,078,546
Hampton Roads	11,148,958	14,413,127	1,824,306	2,391,578	29,777,969
Fredericksburg	591,522	2,806,363	1,231,325	59,082	4,688,292
Culpeper	1,052,394	1,852,168	1,754,384	70,979	4,729,925
Staunton	3,222,236	3,565,641	3,297,128	430,897	10,515,902
NOVA	5,588,380	4,909,097	7,072,469	907,810	18,477,756
Statewide	31,149,366	50,687,808	27,303,492	6,196,411	115,337,077

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

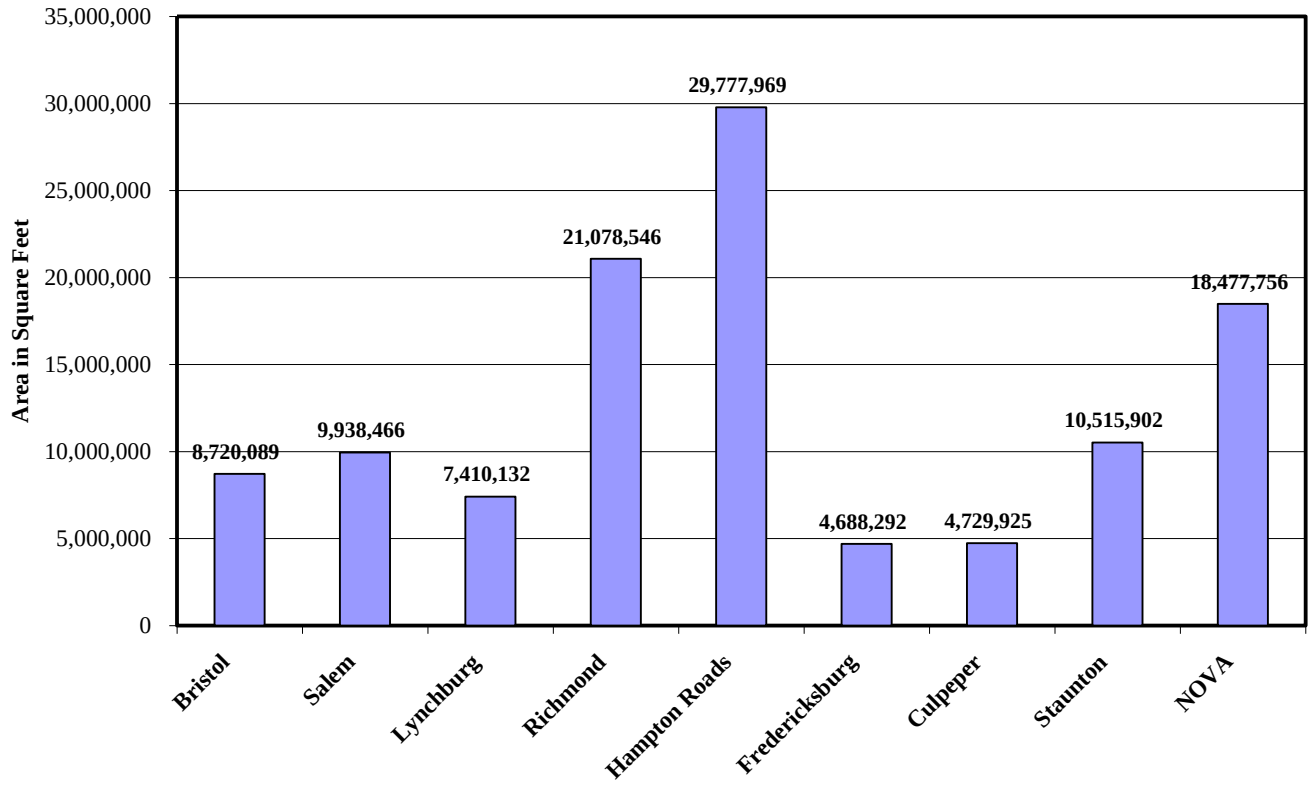


Table D.2 – Square Foot Area of Structurally Deficient Structures Statewide

DISTRICT	Sq-Ft Area of Structurally Deficient Structures				
	Interstate	Primary	Secondary	Urban	Total
Bristol	105,379	284,029	241,276	46,183	676,867
Salem	229,233	259,970	334,624	19,233	843,060
Lynchburg	0	274,172	155,822	15,688	445,682
Richmond	592,967	828,308	263,882	94,676	1,779,833
Hampton Roads	357,161	643,571	93,484	46,752	1,140,968
Fredericksburg	26,447	406,142	65,364	1,469	499,422
Culpeper	20,182	82,294	97,833	5,299	205,608
Staunton	112,041	249,247	195,266	18,737	575,291
NOVA	92,132	185,044	101,823	0	378,999
Statewide	1,535,542	3,212,777	1,549,374	248,037	6,545,730

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

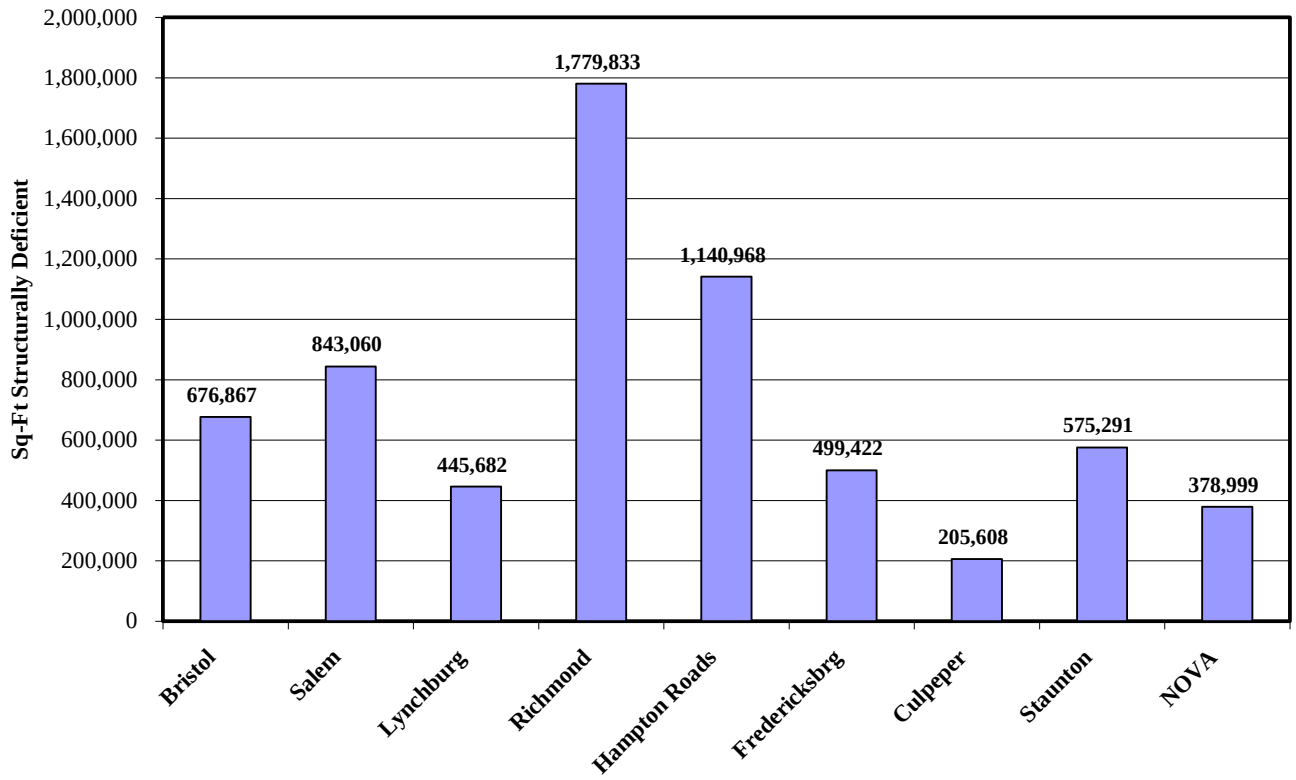


Table D.3 – Percentage of Square Foot Area of Structurally Deficient Structures Statewide

DISTRICT	Percent of Sq-Ft Area of Structurally Deficient Structures				
	Interstate	Primary	Secondary	Urban	Total
Bristol	5.8%	7.0%	9.1%	23.7%	7.8%
Salem	13.7%	5.7%	10.9%	3.0%	8.5%
Lynchburg	0.0%	6.1%	6.0%	4.7%	6.0%
Richmond	9.8%	8.3%	6.9%	8.1%	8.4%
Hampton Roads	3.2%	4.5%	5.1%	2.0%	3.8%
Fredericksburg	4.5%	14.5%	5.3%	2.5%	10.7%
Culpeper	1.9%	4.4%	5.6%	7.5%	4.3%
Staunton	3.5%	7.0%	5.9%	4.3%	5.5%
NOVA	1.6%	3.8%	1.4%	0.0%	2.1%
Statewide	4.9%	6.3%	5.7%	4.0%	5.7%

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 105,379 / 1,821,114 = 0. 0579 or 5.8%**)**

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

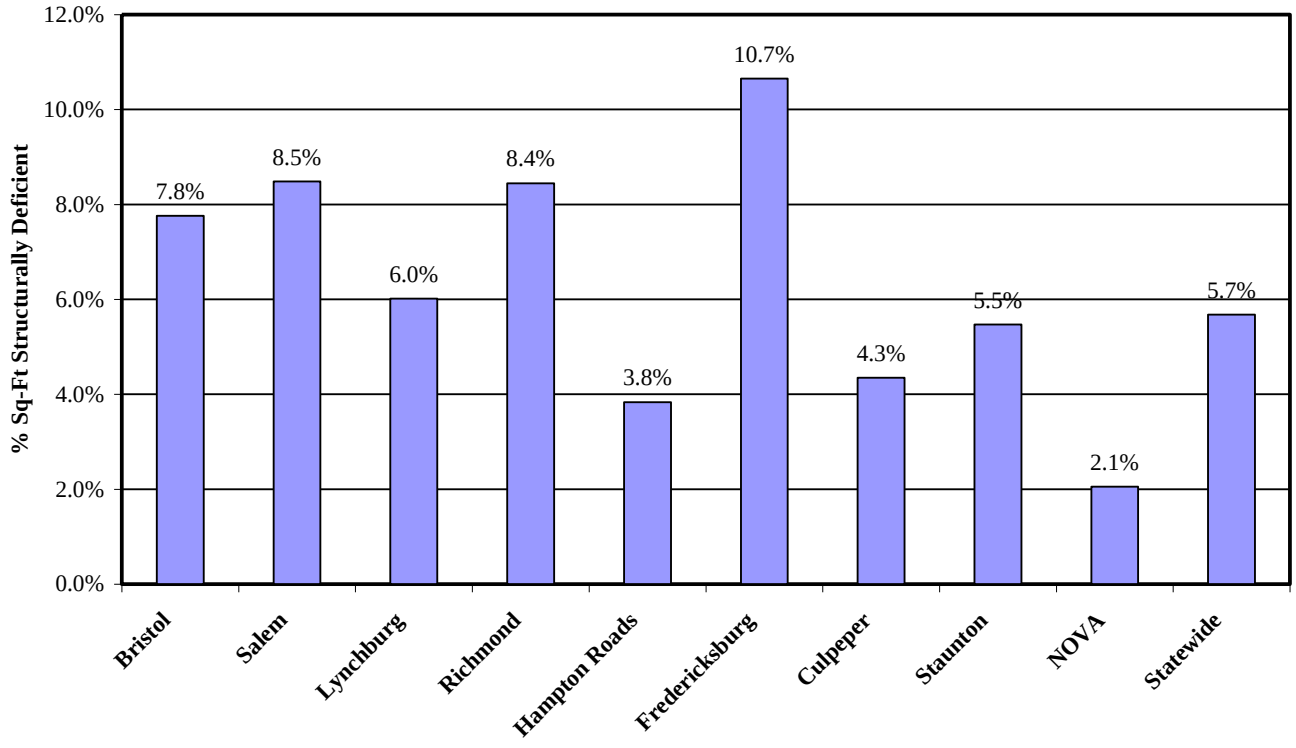


Table D.4 – Square Foot Area of Functionally Obsolete Structures Statewide

DISTRICT	Sq-Ft Area of Functionally Obsolete Structures				
	Interstate	Primary	Secondary	Urban	Total
Bristol	267,252	390,041	289,206	17,879	964,378
Salem	97,148	845,595	517,851	153,964	1,614,558
Lynchburg	0	448,495	188,435	71,663	708,593
Richmond	181,605	1,806,869	271,649	329,529	2,589,652
Hampton Roads	1,773,302	4,451,763	341,815	342,534	6,909,414
Fredericksburg	51,585	576,504	129,573	0	757,662
Culpeper	6,192	98,871	227,595	6,633	339,291
Staunton	147,534	648,338	374,339	118,241	1,288,452
NOVA	1,544,719	1,138,115	1,715,361	94,541	4,492,736
Statewide	4,069,337	10,404,591	4,055,824	1,134,984	19,664,736

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

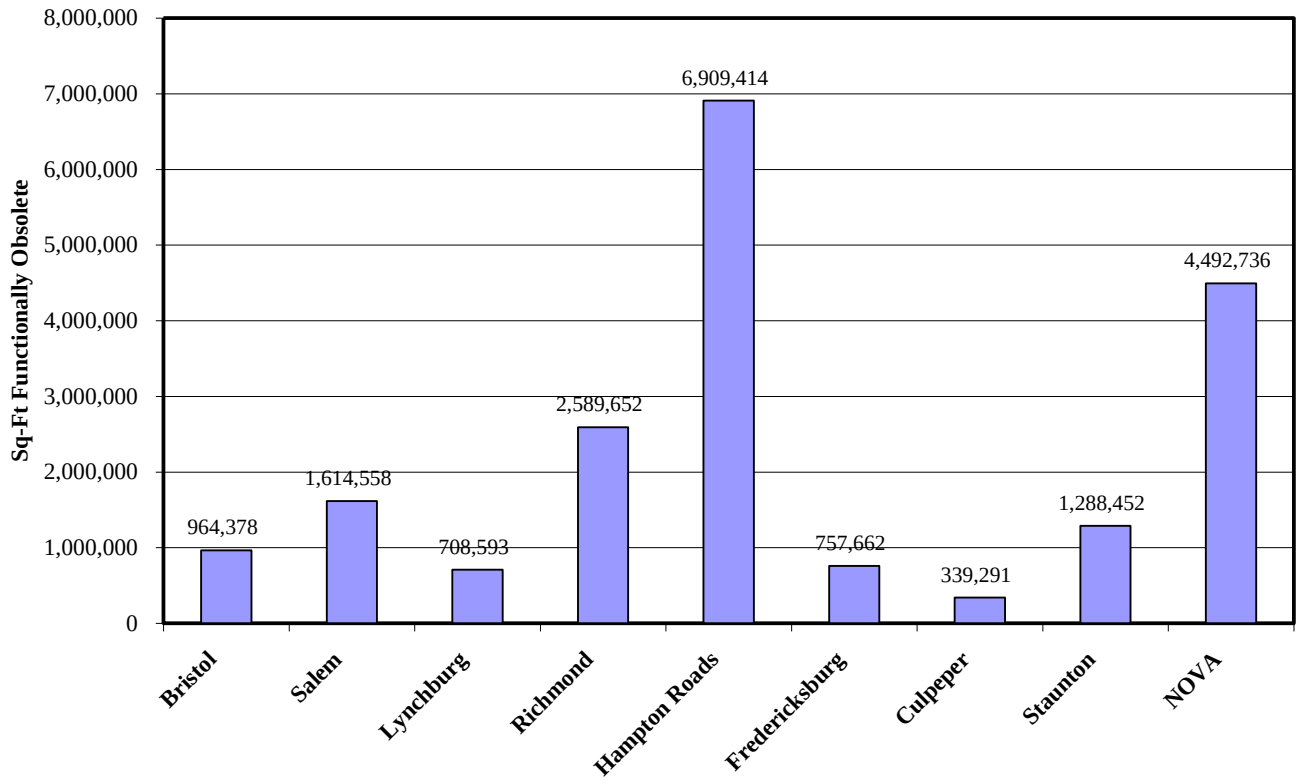


Table D.5 – Percentage of Square Foot Area of Functionally Obsolete Structures Statewide

DISTRICT	Percent of Sq-Ft Area of Functionally Obsolete Structures				
	Interstate	Primary	Secondary	Urban	Total
Bristol	14.7%	9.6%	10.9%	9.2%	11.1%
Salem	5.8%	18.6%	16.9%	23.9%	16.2%
Lynchburg	0.0%	10.0%	7.3%	21.6%	9.6%
Richmond	3.0%	18.0%	7.1%	28.3%	12.3%
Hampton Roads	15.9%	30.9%	18.7%	14.3%	23.2%
Fredericksburg	8.7%	20.5%	10.5%	0.0%	16.2%
Culpeper	0.6%	5.3%	13.0%	9.3%	7.2%
Staunton	4.6%	18.2%	11.4%	27.4%	12.3%
NOVA	27.6%	23.2%	24.3%	10.4%	24.3%
Statewide	13.1%	20.5%	14.9%	18.3%	17.0%

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 267,252 / 1,821,114 = 0. 1468 or 14.7%**)**

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

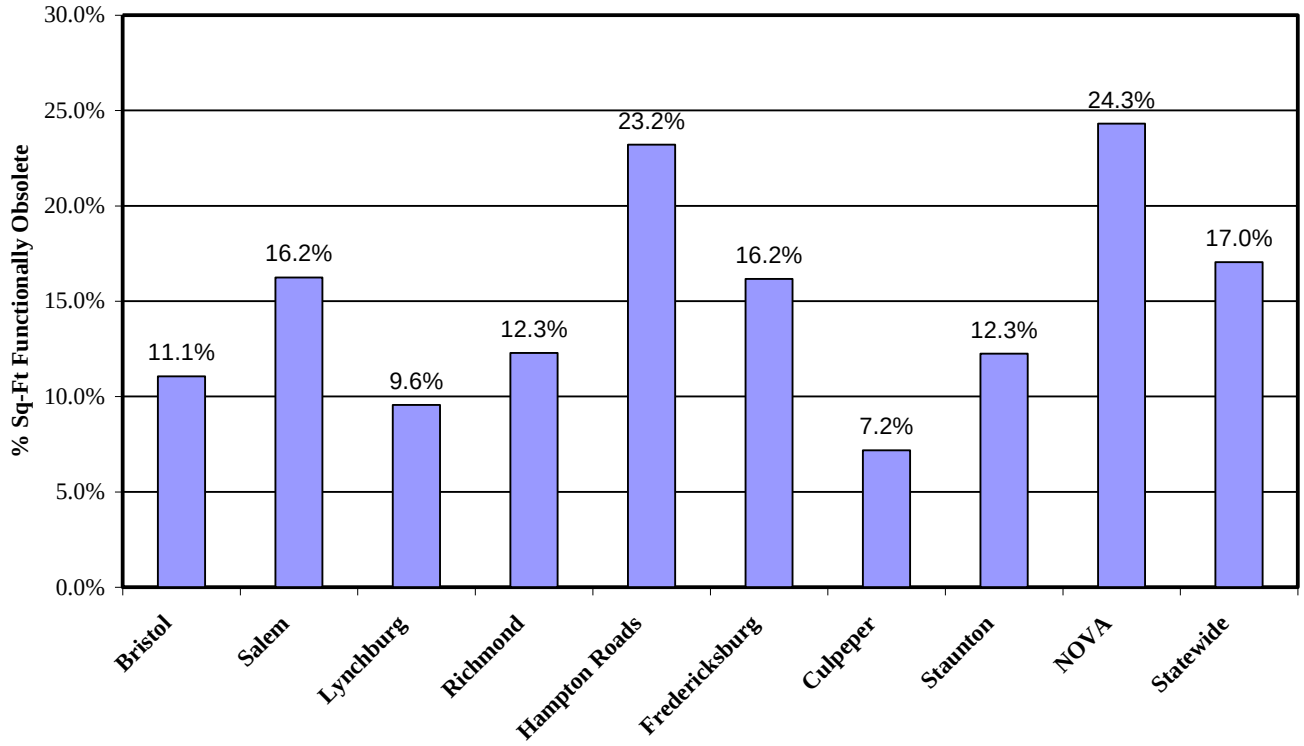


Table D.6 – Square Foot Area of Deficient (SD or FO) Structures Statewide

DISTRICT	Sq-Ft Area of Deficient (SD or FO) Structures				
	Interstate	Primary	Secondary	Urban	Total
Bristol	372,631	674,069	530,482	64,063	1,641,245
Salem	326,381	1,105,565	852,475	173,197	2,457,618
Lynchburg	0	722,667	344,257	87,351	1,154,275
Richmond	774,572	2,635,177	535,532	424,204	4,369,485
Hampton Roads	2,130,463	5,095,335	435,298	389,286	8,050,382
Fredericksburg	78,032	982,646	194,937	1,469	1,257,084
Culpeper	26,374	181,165	325,428	11,932	544,899
Staunton	259,575	897,585	569,606	136,978	1,863,744
NOVA	1,636,851	1,323,159	1,817,184	94,541	4,871,735
Statewide	5,604,879	13,617,368	5,605,199	1,383,021	26,210,467

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

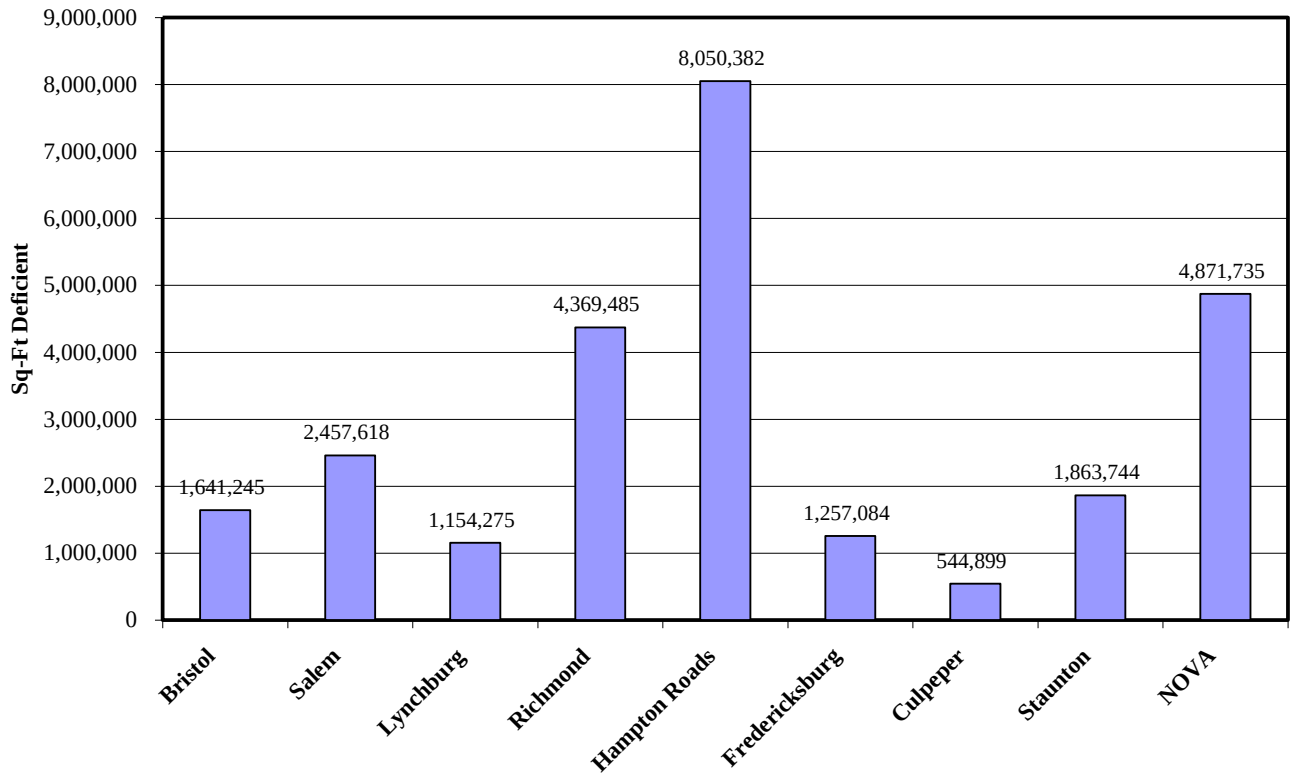


Table D.7 – Percent of Square Foot Area of Deficient (SD or FO) Structures Statewide

DISTRICT	Percent of Sq-Ft Area of Deficient (SD & FO) Structures				
	Interstate	Primary	Secondary	Urban	Total
Bristol	20.5%	16.6%	20.1%	32.9%	18.8%
Salem	19.5%	24.3%	27.8%	26.9%	24.7%
Lynchburg	0.0%	16.1%	13.3%	26.3%	15.6%
Richmond	12.8%	26.3%	14.0%	36.4%	20.7%
Hampton Roads	19.1%	35.4%	23.9%	16.3%	27.0%
Fredericksburg	13.2%	35.0%	15.8%	2.5%	26.8%
Culpeper	2.5%	9.8%	18.5%	16.8%	11.5%
Staunton	8.1%	25.2%	17.3%	31.8%	17.7%
NOVA	29.3%	27.0%	25.7%	10.4%	26.4%
Statewide	18.0%	26.9%	20.5%	22.3%	22.7%

Percentages are calculated by dividing the SD or FO area for the District by the total area for the District by highway system (example - SD or FO Bristol Interstate area divided by all Bristol Interstate area 372,631 / 1,821,114 = 0. .2046 or 20.5%)

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

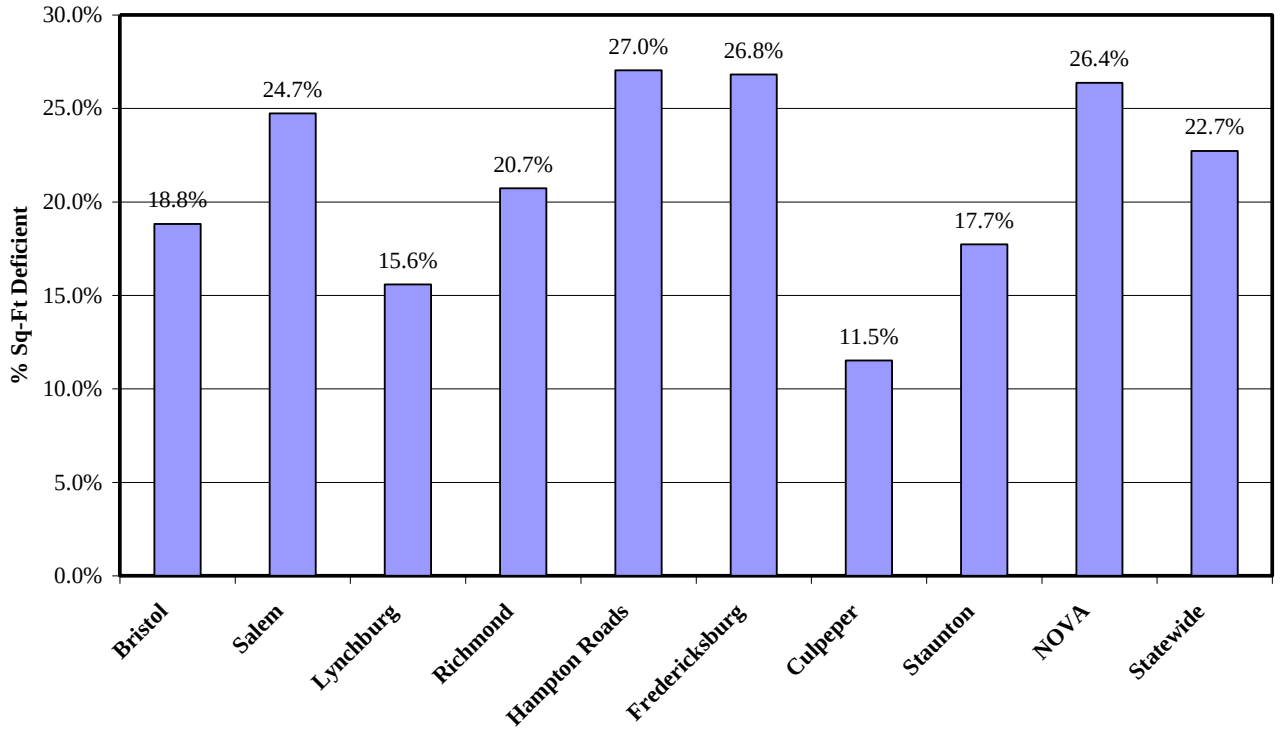


Table D.8 – Square Foot Area of Weight-Posted Structures Statewide

DISTRICT	Sq-Ft Area of Weight Posted Structures				
	Interstate	Primary	Secondary	Urban	Total
Bristol	0	66,591	193,250	28,425	288,265
Salem	0	45,189	283,307	19,684	348,180
Lynchburg	0	37,850	191,546	4,297	233,693
Richmond	0	189,474	164,176	11,858	365,508
Hampton Roads	0	207,589	75,927	35,582	319,098
Fredericksburg	0	6,568	29,693	1,470	37,731
Culpeper	0	25,801	99,256	5,917	130,974
Staunton	0	115,729	120,197	7,742	243,668
NOVA	0	6,412	33,547	0	39,959
Statewide	0	701,203	1,190,899	114,974	2,007,076

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

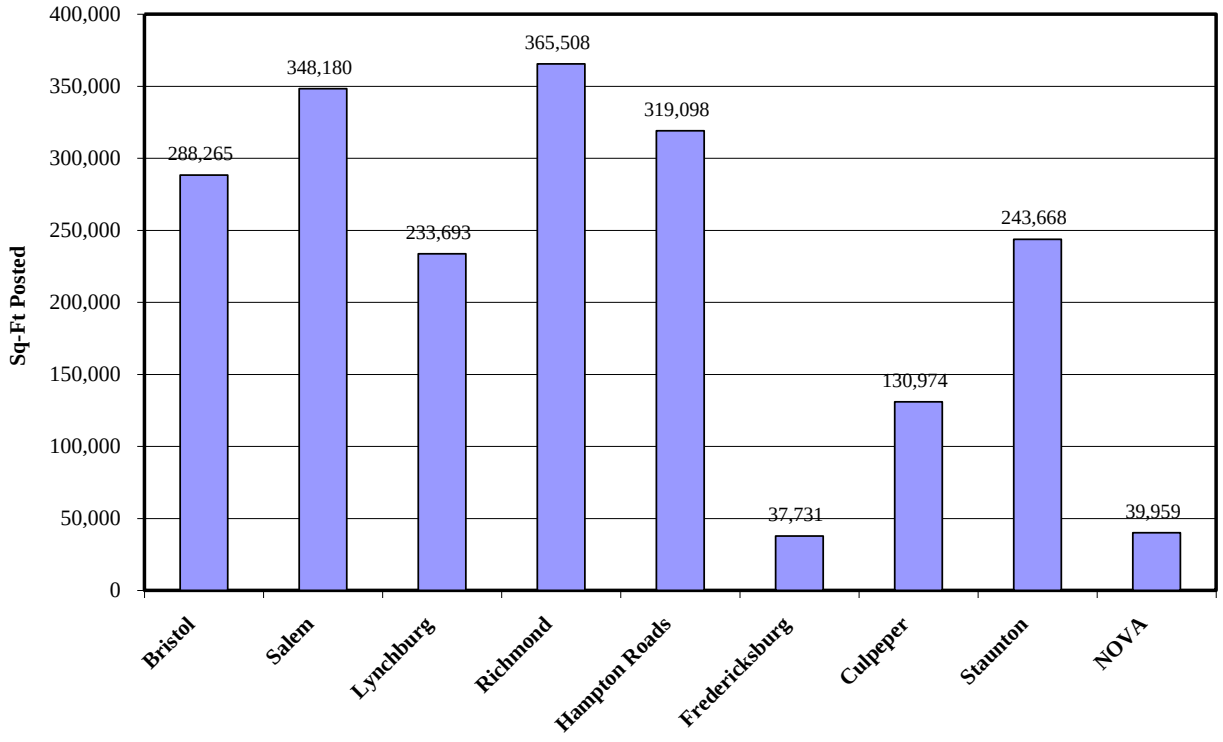
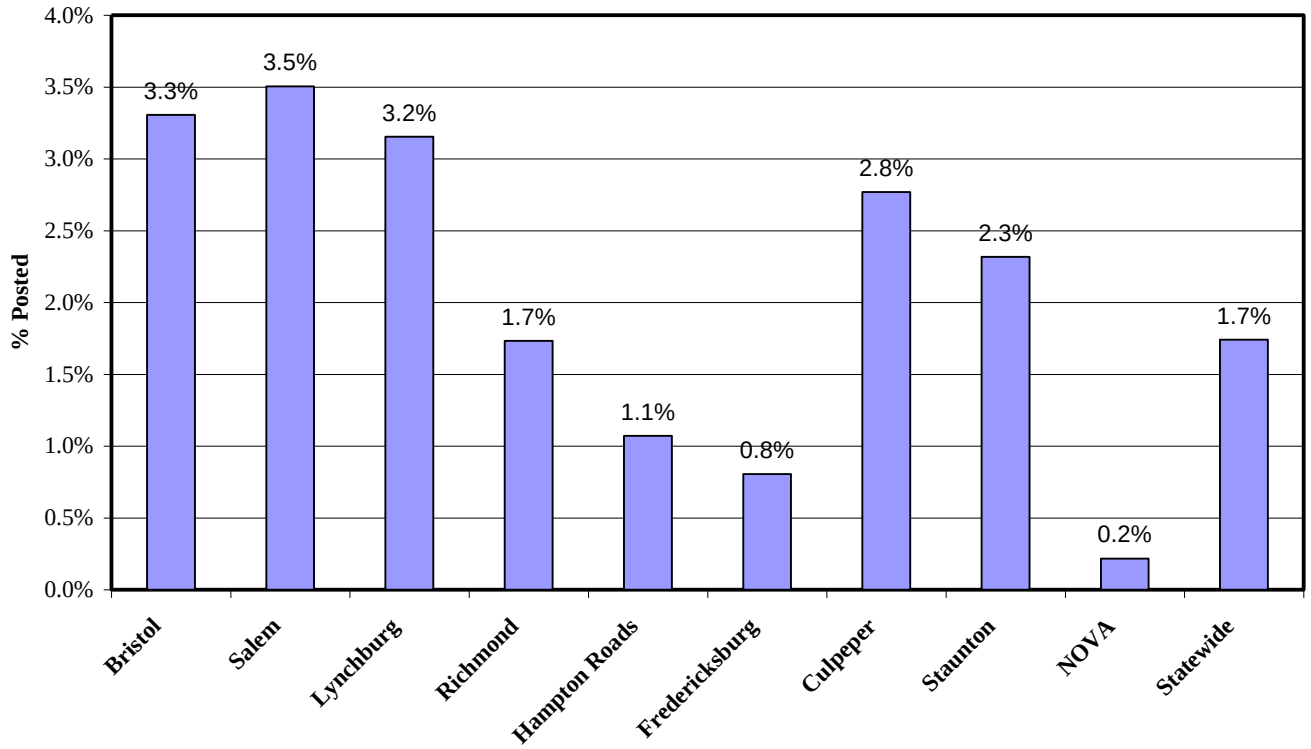


Table D.9 – Percentage of Weight-Posted Structures by Square Foot Area and District

DISTRICT	Percent of Sq-Ft Area of Weight Posted Structures				
	Interstate	Primary	Secondary	Urban	Total
Bristol	0.0%	1.6%	7.3%	14.6%	3.3%
Salem	0.0%	1.0%	9.2%	3.1%	3.5%
Lynchburg	0.0%	0.8%	7.4%	1.3%	3.2%
Richmond	0.0%	1.9%	4.3%	1.0%	1.7%
Hampton Roads	0.0%	1.4%	4.2%	1.5%	1.1%
Fredericksburg	0.0%	0.2%	2.4%	2.5%	0.8%
Culpeper	0.0%	1.4%	5.7%	8.3%	2.8%
Staunton	0.0%	3.2%	3.6%	1.8%	2.3%
NOVA	0.0%	0.1%	0.5%	0.0%	0.2%
Statewide	0.0%	1.4%	4.4%	1.9%	1.7%

Percentages are calculated by dividing the Weight-Posted area for the District by the total area for the District by highway system (example – Weight-Posted Bristol Primary area divided by all Bristol Primary area 66,591 / 4,060,904 = 0. 0164 or 1.6%)

Table D.9 – Percentage of Weight-Posted Structures by Square Foot Area and District



Appendix E– 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 F– Quality Assurance Program

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.

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 to 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 field and office reviews performed by both District and Central Office personnel are documented in a written report and shared with all parties involved.

VDOT inspects over 10,000 structures annually at an approximate cost of $18 million.

Appendix G – Inventory Changes from Previous Years

Notes on Charts 7-30: Some of the charts in the report provide multi-year trends for various performance measures. Inventory numbers provided in this report for the years 2007-2010 may vary from numbers provided in previous reports. This is due primarily to a change in the reporting period. Previous reports were based on calendar year (January 1 through December 31) whereas this report is 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 reports from prior years reported 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 and 2011 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 2010. Pedestrian structures, when included, tend to provide misleading data regarding the number of SD and FO structures.