STATE OF THE STRUCTURES AND BRIDGES REPORT

JANUARY 2010

Prepared by:
Virginia Department of Transportation
Structure & Bridge Division

Comments and or questions may be directed to:
Kendal R. Walus, P.E.
State Structure and Bridge Engineer
Virginia Department of Transportation
1401 East Broad Street, Richmond, VA 23219
Telephone: (804) 786-4575 Email: Kendal.Walus@VDOT.Virginia.Gov

Executive Summary

The Virginia Department of Transportation (VDOT) is responsible for the inventory, inspection, maintenance, and improvement of 20,920 structures (bridges and culverts) across all of the Commonwealth's roadway systems. Of this inventory 19,397 structures are maintained by VDOT and 1,523 are maintained by localities and private owners. The total represents a net increase of 89 structures from Fiscal Year (FY) 2008.

VDOT inspects over 10,000 structures annually at an approximate cost of $16 million.

VDOT's system global performance measure for structures is based on the number of structurally deficient (SD) structures in the Department's inventory. SD structures are those with deficient elements that require the structure to be monitored and/or repaired and has either been restricted to light weight vehicles or has been closed to traffic. A bridge is deemed SD when one or more of its major components have a General Condition Rating (GCR) of four (4) or less. A "GCR" is a National numerical system that ranges from 0 (failed condition) to 9 (excellent condition).

There are 4,551 (22%) of the structures inventory are at risk of becoming structurally deficient. These structures have a GCR of five (5).

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 2009 was 1,801 (8.6%). This represents a 0.1% increase from FY 2008. The national average of structurally deficient structures is twelve (12%) percent.

Other performance indicators that are used by VDOT in the overall management of the structural inventory include: functional obsolescence; deficient structures (combined structurally deficient and functional obsolete); and number of weight posted structures. Following is a summary of these measures:

The number of functionally obsolete structures in the VDOT inventory is 3,104 (14.8%). This represents a 0.1% increase from FY 2008. The national average of functionally obsolete structures is thirteen (13%) percent. Functionally obsolete bridges are those with deck geometry (e.g., lane width), load carrying capacity, clearance, or approach roadway alignment that no longer meet the criteria for the system of which the bridge is a part.

The combined deficient (structurally deficient and functional obsolete) structures in the VDOT inventory is 4,905 (23.4%). This represents a 0.2% increase from FY 2008. The national average of deficient structures is twenty five (25%) percent.

The number of weight posted structures in the inventory is 1,501 (7.2%). This value is a 0.1% decrease from FY 2008.

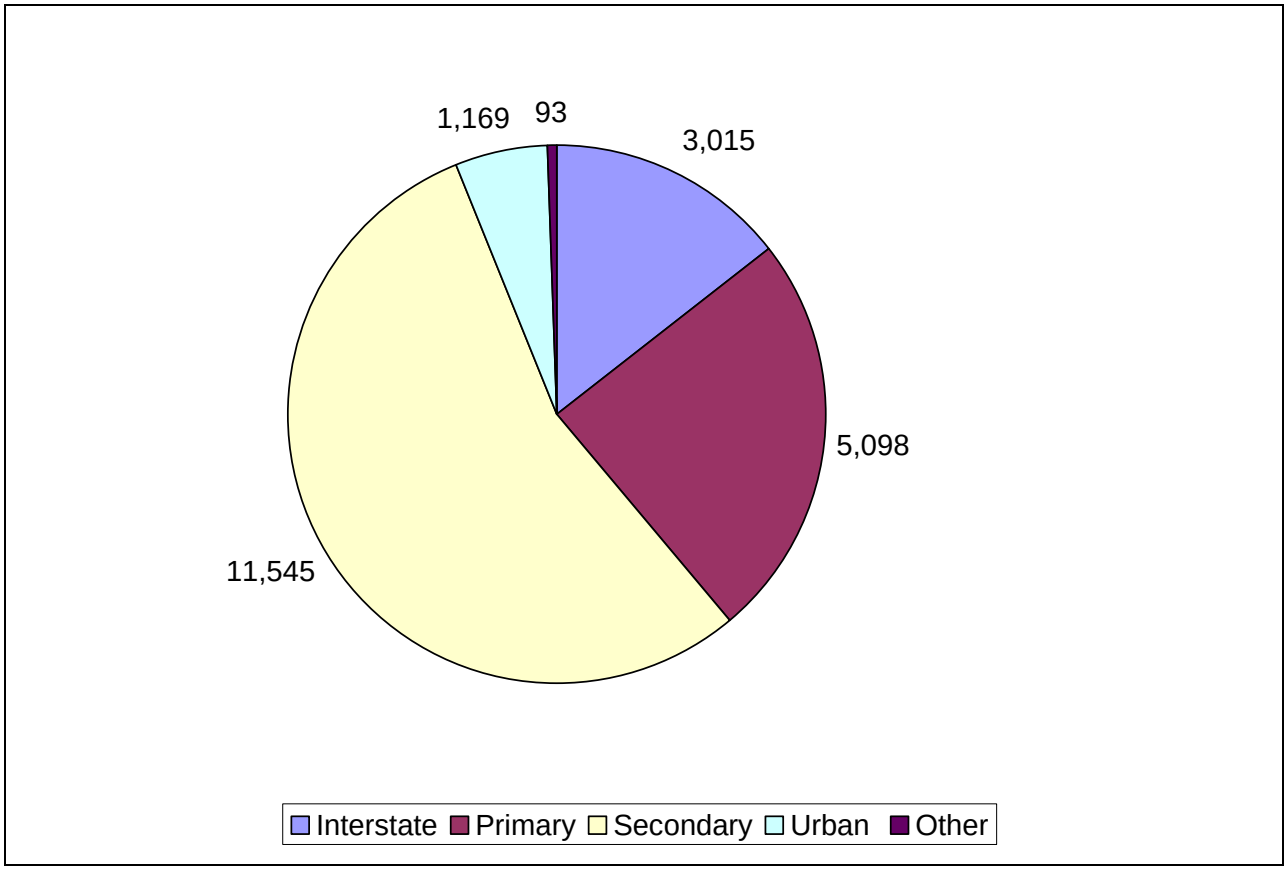
The design service life of a bridge has been 50 years, but with the evolution of new design guidelines and construction materials the anticipated service life for newly constructed bridges is 75 years. Fifty-five (55%) percent of the structure inventory has exceeded or is approaching the end of its anticipated service design life (40 years or older).

Background

The Virginia Department of Transportation (VDOT) is responsible for the inventory, inspection, maintenance, and improvement of 20,920 structures (bridges and culverts) across all of the Commonwealth's roadway systems. Of this inventory 19,397 structures are maintained by VDOT and 1,523 are maintained by localities and private owners. The total represents a net increase of 89 structures from Fiscal Year (FY) 2008.

The 2009 estimated value of Virginia's structure inventory is approximately $33 billion.

Chart 1. Distribution of Structures by System



Determining Bridge Conditions

VDOT's bridge inspection and maintenance program is responsible for inspecting, and managing the bridge maintenance, rehabilitation and replacement work.

The Federal Highway Administration (FHWA) requires VDOT to inventory and inspect all structures with lengths greater than twenty (20) feet. In addition, VDOT inventories and inspects all bridges regardless of their length and culverts having an opening of 36 square feet or greater.

Inspection procedures and requirements are detailed in the National Bridge Inspection Standards (NBIS) of the Code of Federal Regulations and in the latest (VDOT) Informational & Instructional Memorandum dealing with bridge inspection.

Bridges are inspected at a minimum once every two years. The condition assessments of the structures are performed by qualified inspectors, and all assessments are performed in accordance with the NBIS, and VDOT's policies and procedures.

In addition to the NBIS data, VDOT collects detailed structural element data which is used in the development of its' Bridge Management System (BMS). The BMS information is used to determine current and future maintenance and preservation needs of the structures.

Tables 1 through 3 show the distribution of structures in each of the Districts by system.

Table 1 - Number of Structures (Bridges and Culverts)

DISTRICT	No. of Structures (Bridges and Culverts)					
	Interstate	Primary	Secondary	Urban	Other[(1)]	Total
Bristol	258	898	2012	117	0	3,285
Salem	274	728	1890	161	2	3,055
Lynchburg	0	601	1412	118	0	2,131
Richmond	720	691	1099	117	26	2,653
Hampton Roads	535	268	469	412	2	1,686
Fredericksburg	106	239	451	13	2	811
Culpeper	147	483	1026	31	5	1,692
Staunton	529	758	2072	139	0	3,498
NOVA	446	432	1114	61	56	2,109
Total	**3,015**	**5,098**	**11,545**	**1,169**	**93**	**20,920**

(1) Denotes structures owned by private or other government agencies, such as the Richmond Metropolitan Authority, the Pocahontas Parkway, Dulles-Greenway, Department of Game and Inland Fisheries (State Park) and a few bridges on university properties.

Virginia Department of Transportation
State of the Structures and Bridges Report

Table 2 - Number of Bridges by District

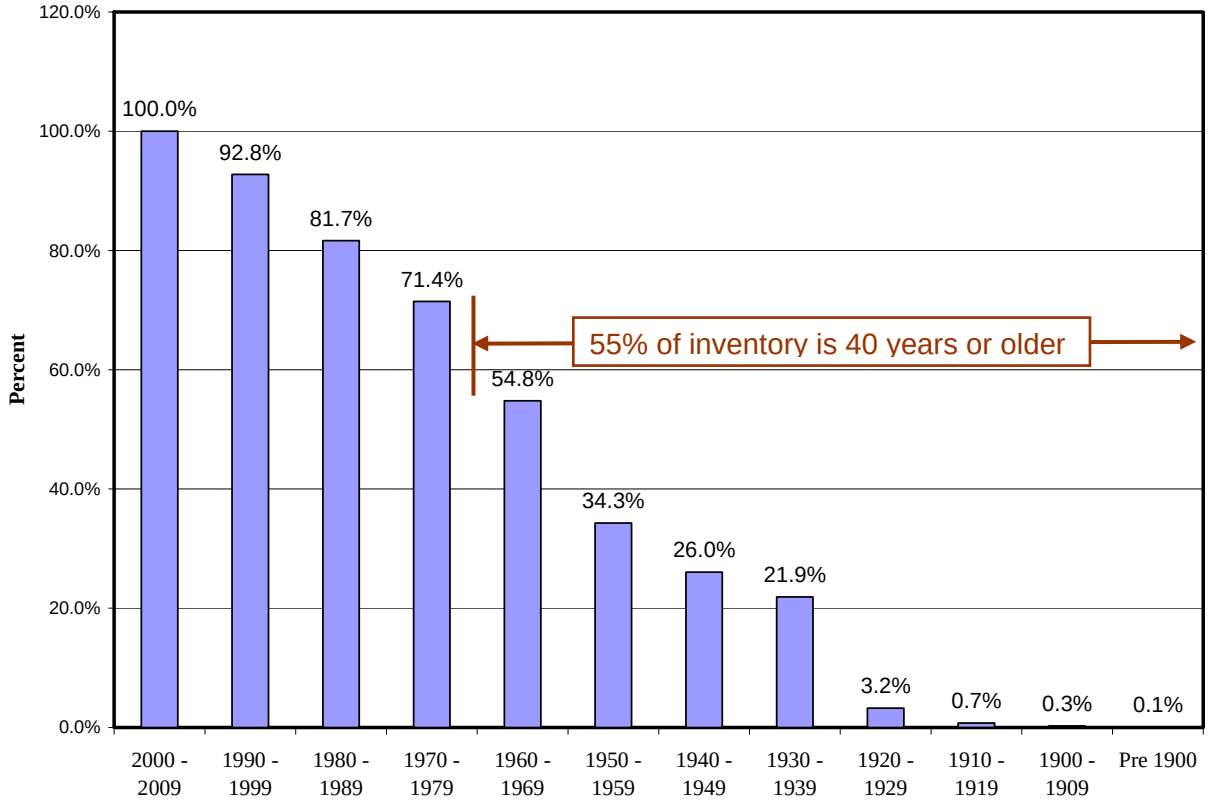
DISTRICT	Number of Bridges					
	Interstate	Primary	Secondary	Urban	Other[(1)]	Total
Bristol	166	514	1536	87	0	2,303
Salem	161	417	1329	122	1	2,030
Lynchburg	0	315	801	86	0	1,202
Richmond	453	413	583	75	15	1,539
Hampton Roads	401	181	276	329	1	1,188
Fredericksburg	48	128	194	12	2	384
Culpeper	94	241	651	16	2	1,004
Staunton	302	455	1372	88	0	2,217
NOVA	314	256	451	25	36	1,082
Total	**1,939**	**2,920**	**7,193**	**840**	**57**	**12,949**

Table 3 - Number of Culverts by District

DISTRICT	Number of Culverts					
	Interstate	Primary	Secondary	Urban	Other[(1)]	Total
Bristol	92	384	476	30	0	982
Salem	113	311	561	39	1	1,025
Lynchburg	0	286	611	32	0	929
Richmond	267	278	516	42	11	1,114
Hampton Roads	134	87	193	83	1	498
Fredericksburg	58	111	257	1	0	427
Culpeper	53	242	375	15	3	688
Staunton	227	303	700	51	0	1,281
NOVA	132	176	663	36	20	1,027
Total	**1,076**	**2,178**	**4,352**	**329**	**36**	**7,971**

It is important to note that 55% of the statewide structure inventory has reached or is approaching (40 years or older) the end of its anticipated service design life of 50 years. This affects 57% of the interstate, 62% of the primary, 53% of the secondary, and 41% of the urban system structures.

Chart 2 - Cumulative Age Distribution of Structures



In the past, the anticipated design service life of a bridge was 50 years, but since 2000 with the evolution of new design guidelines and construction materials the anticipated service life for newly constructed bridges is 75 years.

Measuring Performance

VDOT's system performance measure for structures is based on the number 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 less) or worse for one or more of the following structural elements: 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 elements require the structure to be monitored and/or repaired and has either been restricted to light weight vehicles or have been closed to traffic. Appendix A provides definitions of the general condition ratings.

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 for Interstate, Six (6 %) percent for primary and eleven (11 %) percent for Secondary.

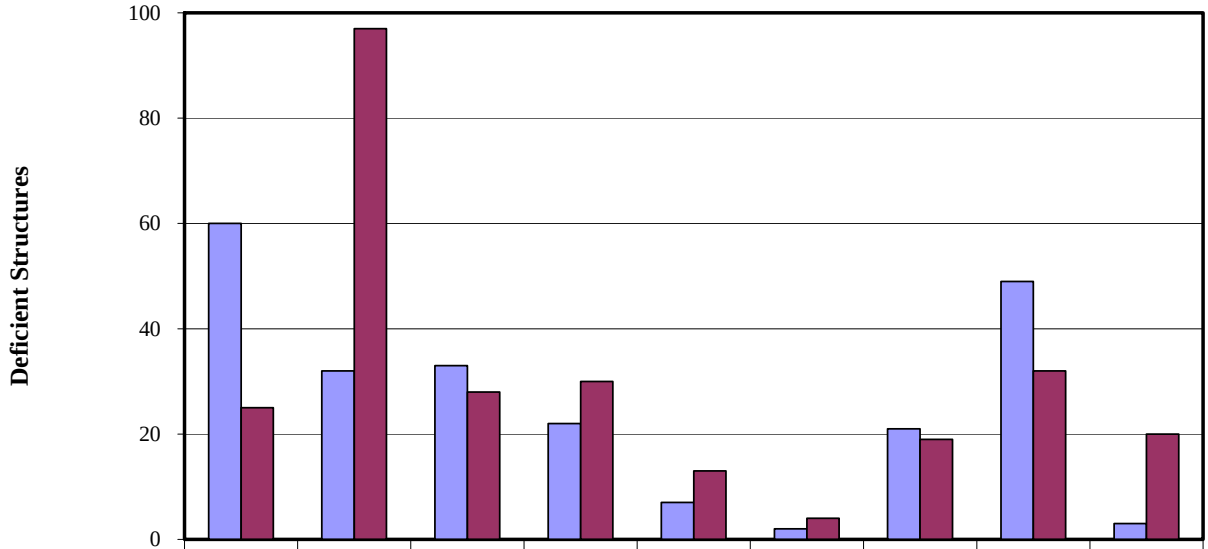
For the current FY, eight point six (8.6%) percent (1,801) of the inventory is rated as SD. Table 4 shows the number of SD structures that were restored and those that dropped to SD due to deterioration between the period of FY 2008 and FY 2009. Chart 3 graphically displays this information by district. Charts 4 through 13 show the current percent of SD structures by District for each roadway classification, and a four year trend for each roadway system.

Appendix C shows the National trend of deficient structures from 2000 to 2008.

Table 4 – Change in number of Structurally Deficient Structures between FY 2008 and FY 2009

	Structurally Deficient			During FY 2009		
District	End of FY 2008	End of FY 2009	Change	Restored	Deteriorated	Change
Bristol	422	387	-8.3%	59	27	-32
Salem	317	382	20.5%	32	97	65
Lynchburg	210	205	-2.4%	34	28	-6
Richmond	208	216	3.8%	22	28	6
Hampton Roads	68	74	8.8%	7	13	6
Fredericksburg	67	69	3.0%	2	5	3
Culpeper	117	115	-1.7%	21	19	-2
Staunton	309	292	-5.5%	49	32	-17
NOVA	44	61	38.6%	3	20	17
Statewide	1,762	1,801	2.2%	229	269	40

Chart 3 - Number of Structurally Deficient Structures Restored vs. Deteriorated During FY 2009



	Bristol	Salem	Lynchburg	Richmond	Hampton Roads	Fredcksbrg	Culpeper	Staunton	NOVA
Restored	60	32	33	22	7	2	21	49	3
Deteriorated	25	97	28	30	13	4	19	32	20

Chart 4 - Percent of Structurally Deficient Structures Systemwide
FY 2009

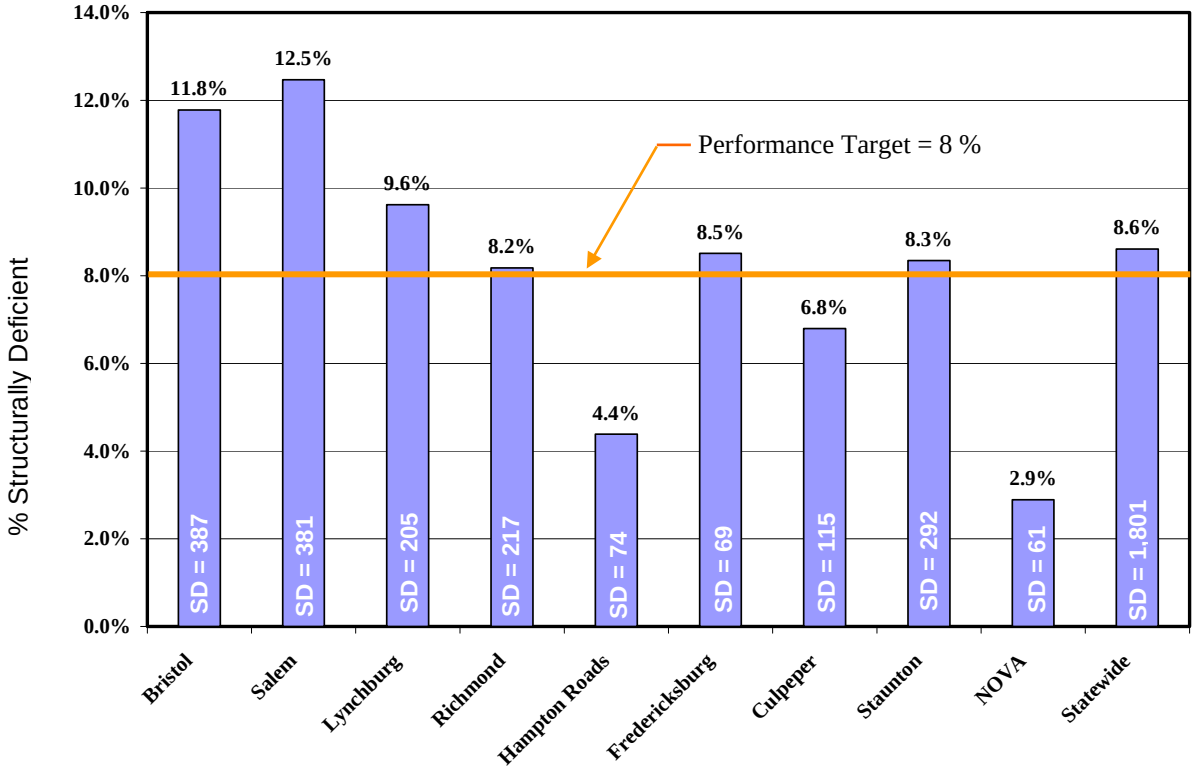


Chart 5 - Percent of SD Structures – Systemwide
Three Year Trend

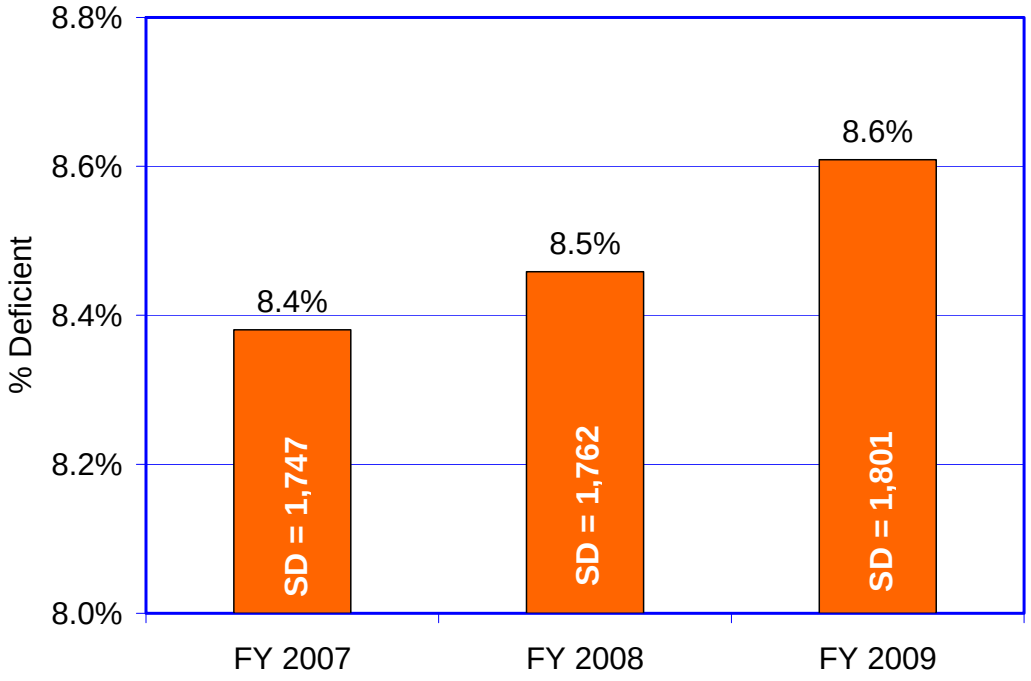


Chart 6 - Percent of Structurally Deficient Structures – Interstate FY 2009

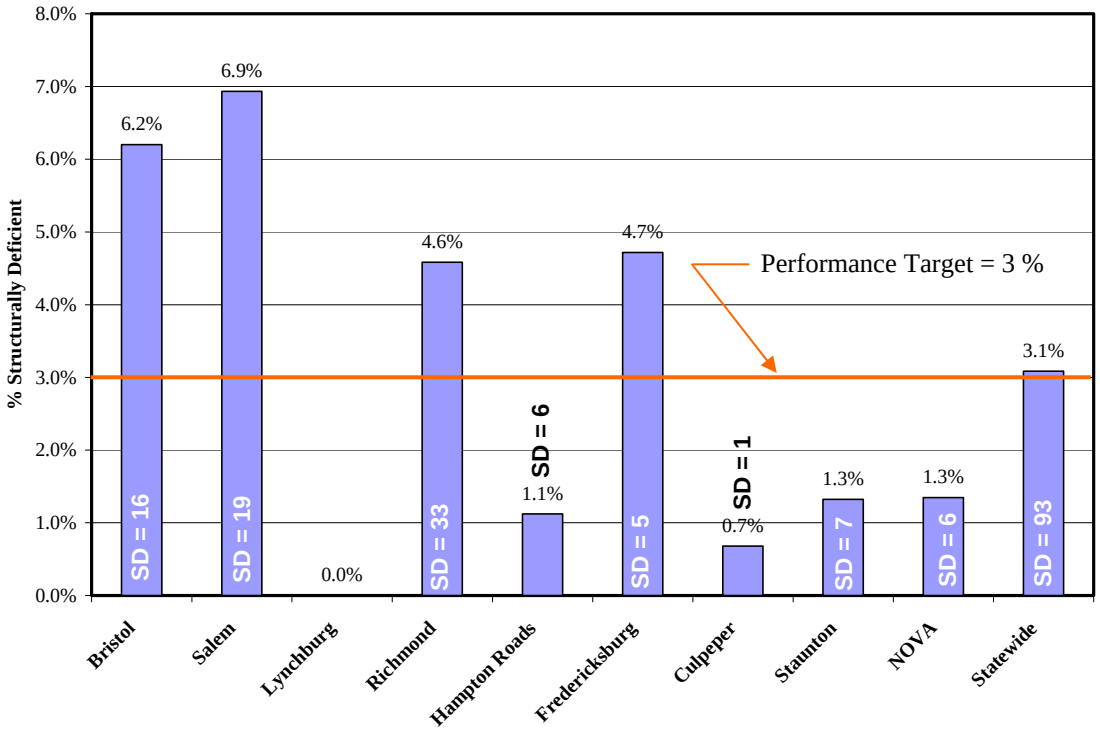


Chart 7 – Percent of SD Structures – Interstate Three Year Trend

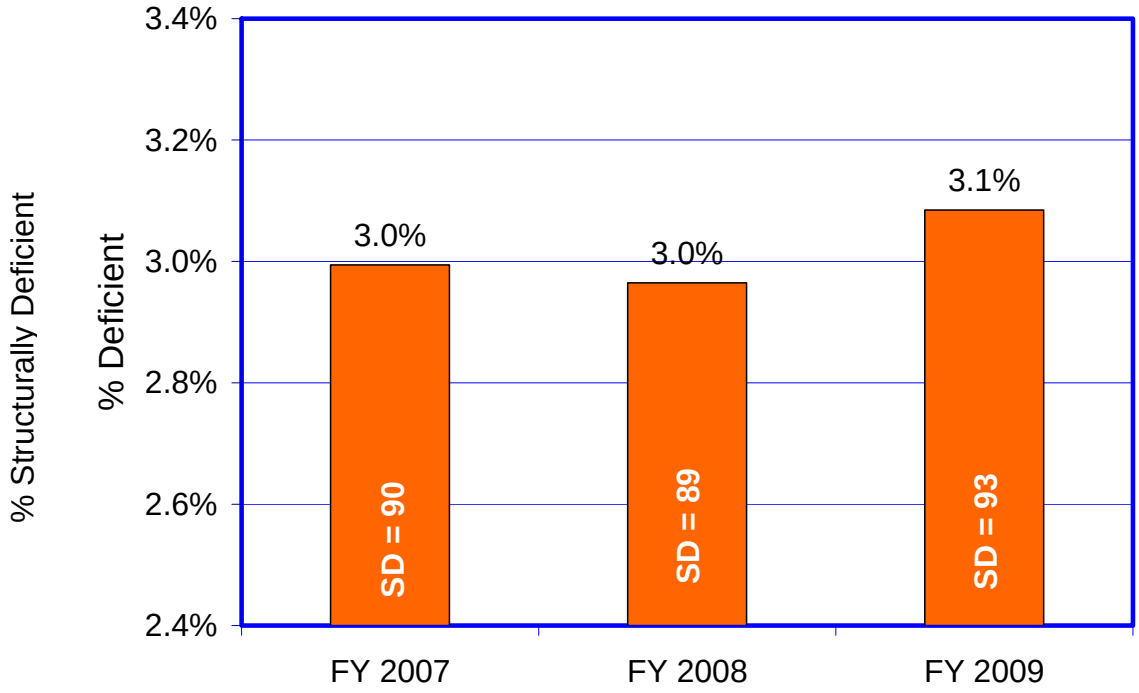


Chart 8 - Percent of Structurally Deficient Structures – Primary FY 2009

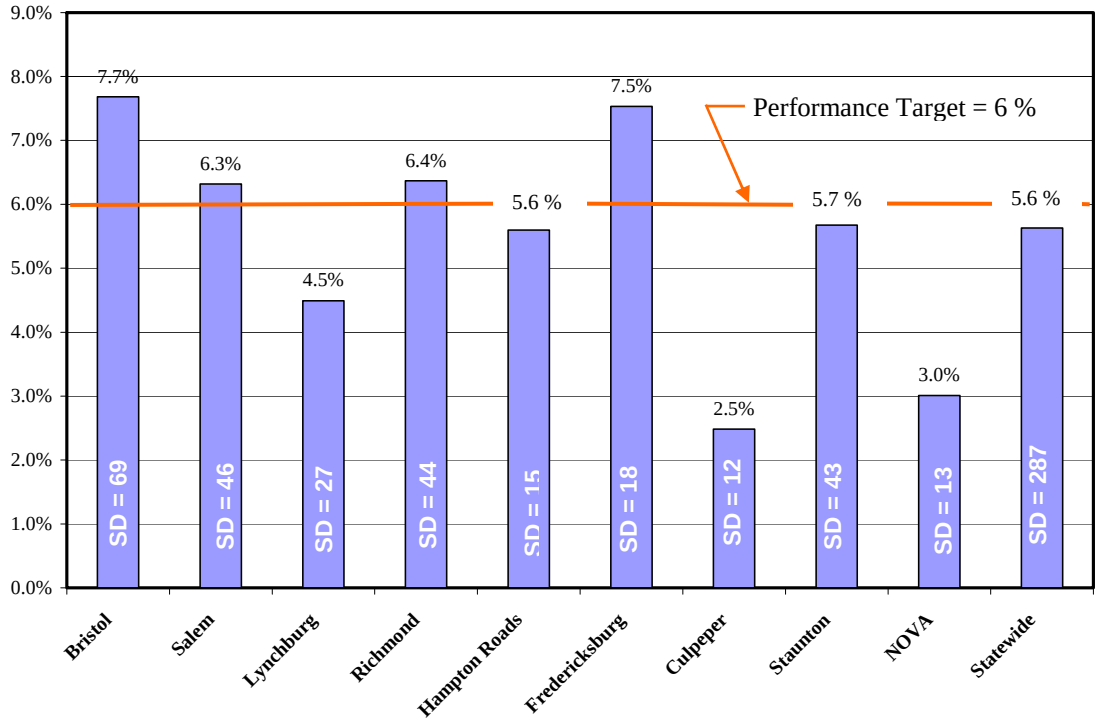


Chart 9 – Percent of SD Structures – Primary Three Year Trend

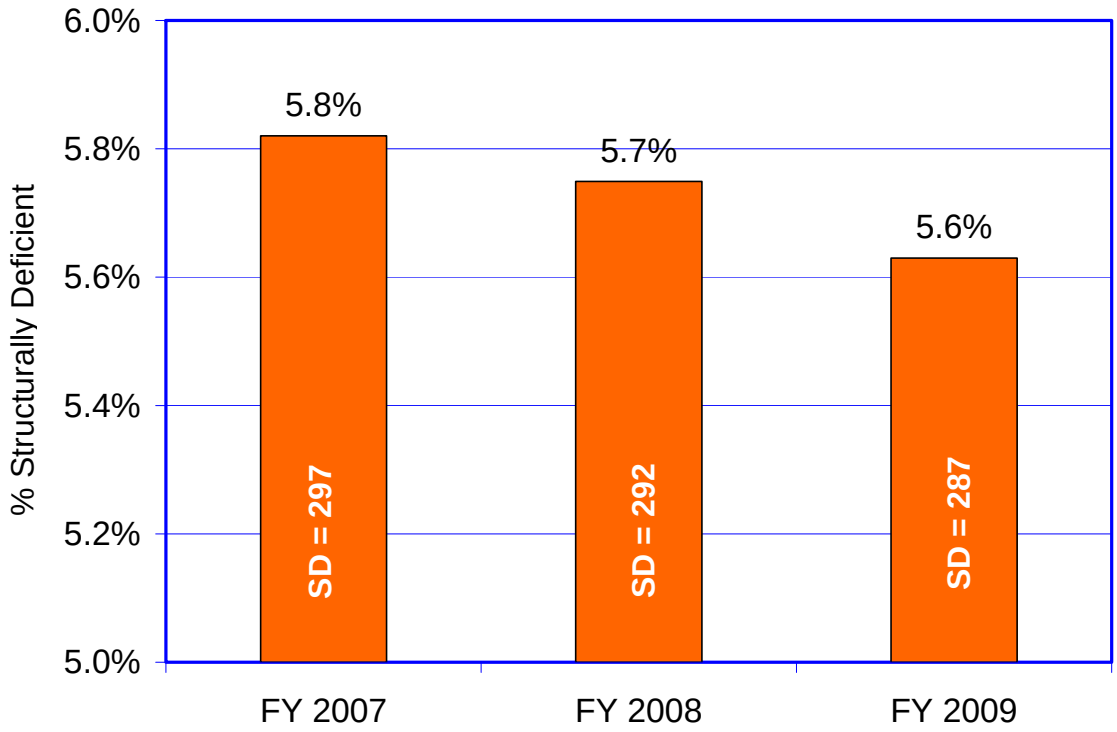


Chart 10 - Percent of Structurally Deficient Structures – Secondary FY 2009

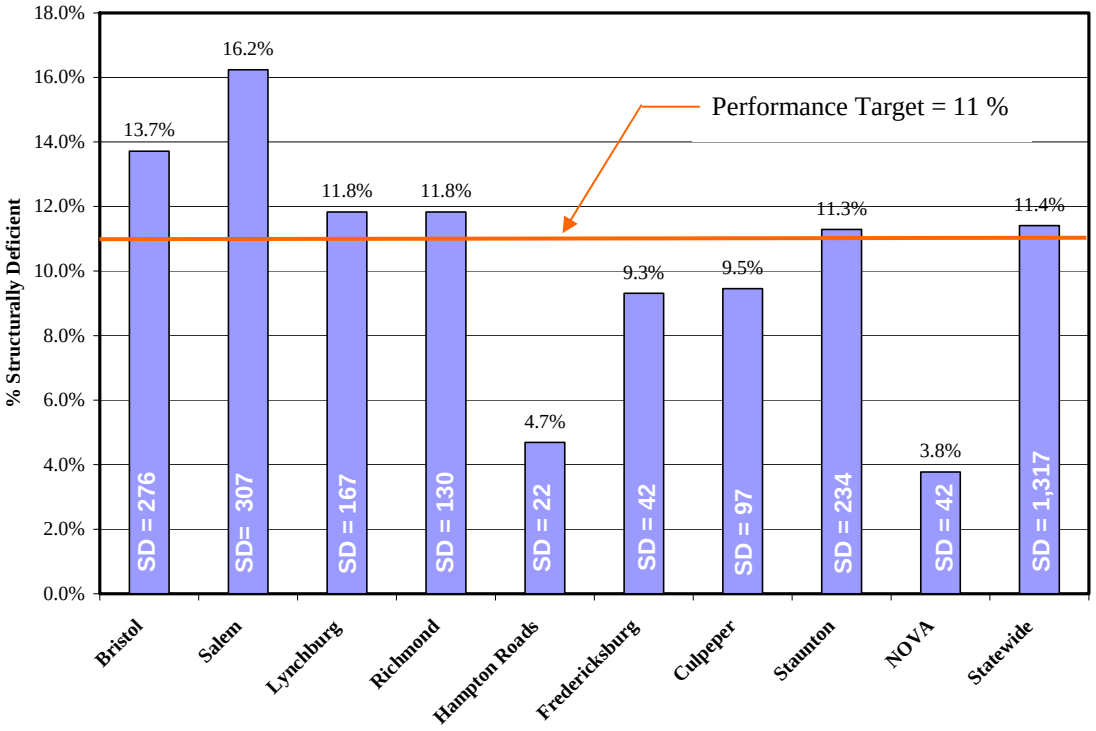


Chart 11 – Percent of SD Structures – Secondary Three Year Trend

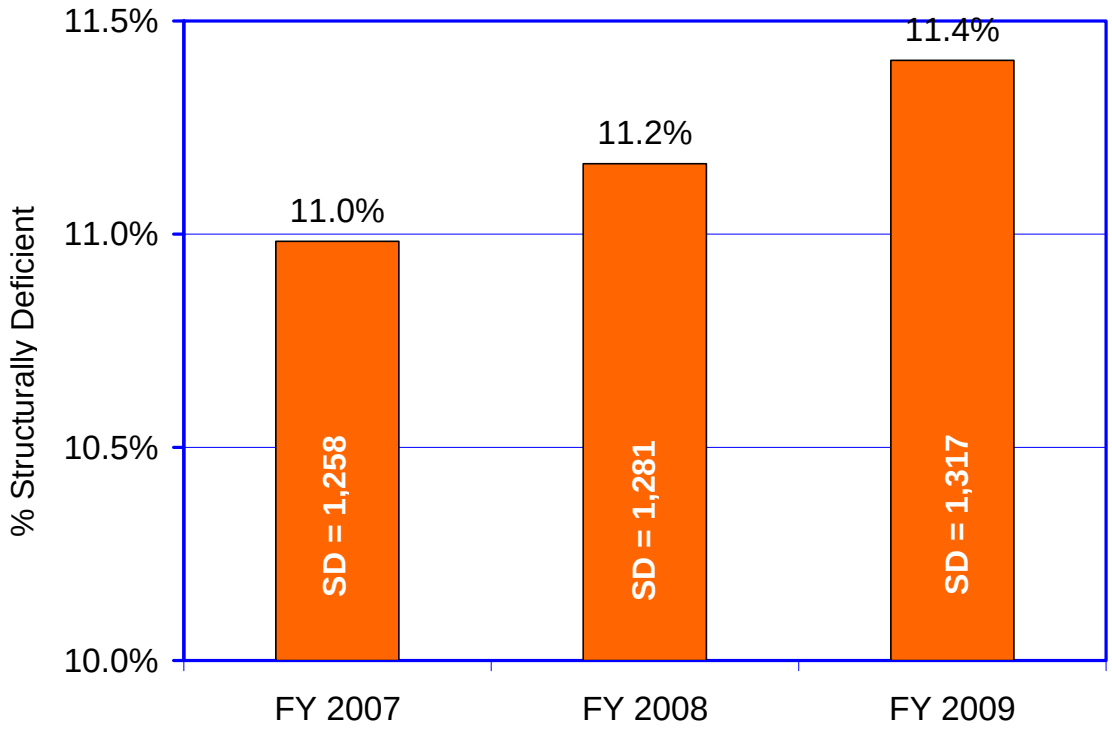


Chart 12 - Percent of Structurally Deficient Structures – Urban FY 2009

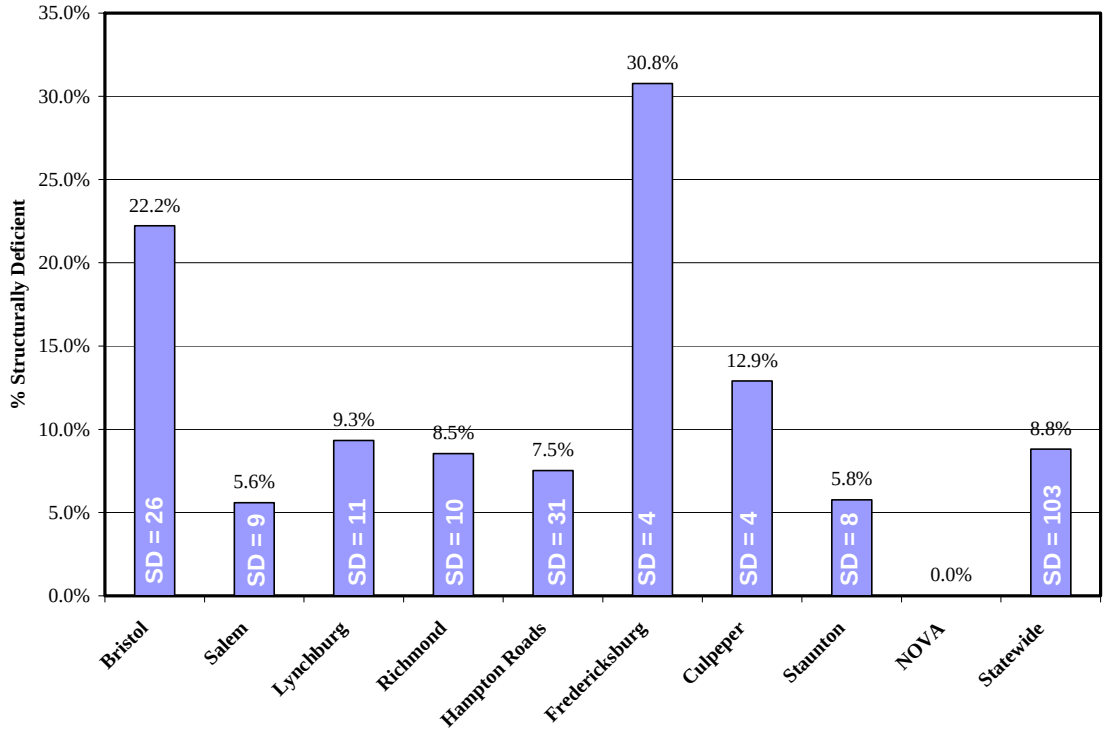
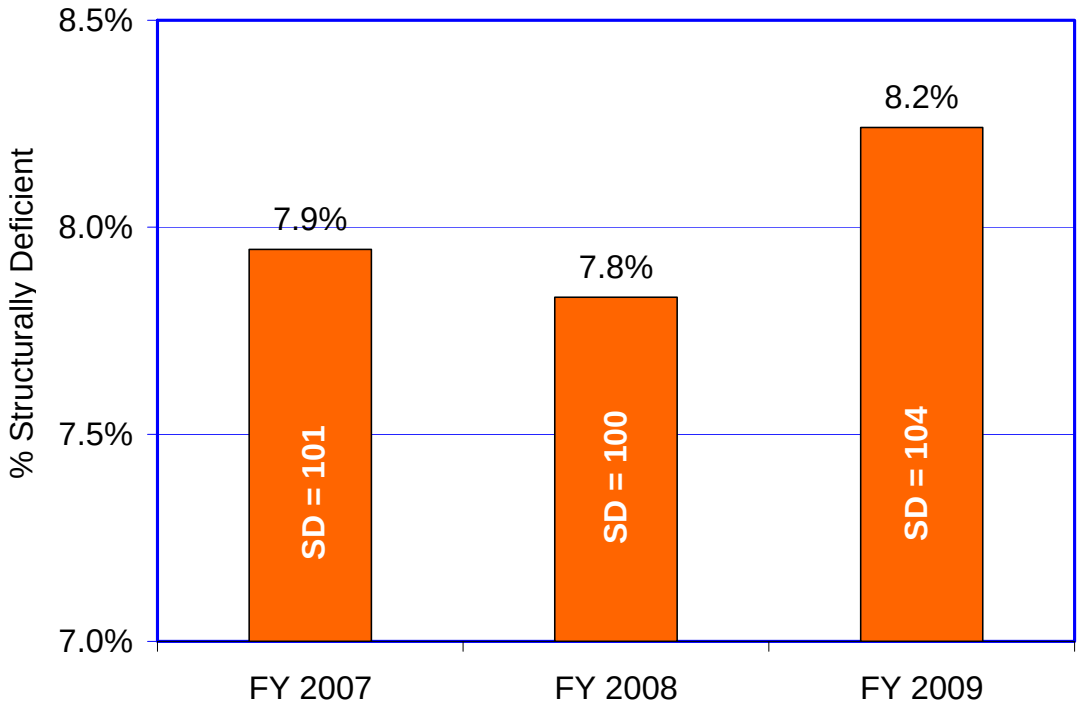


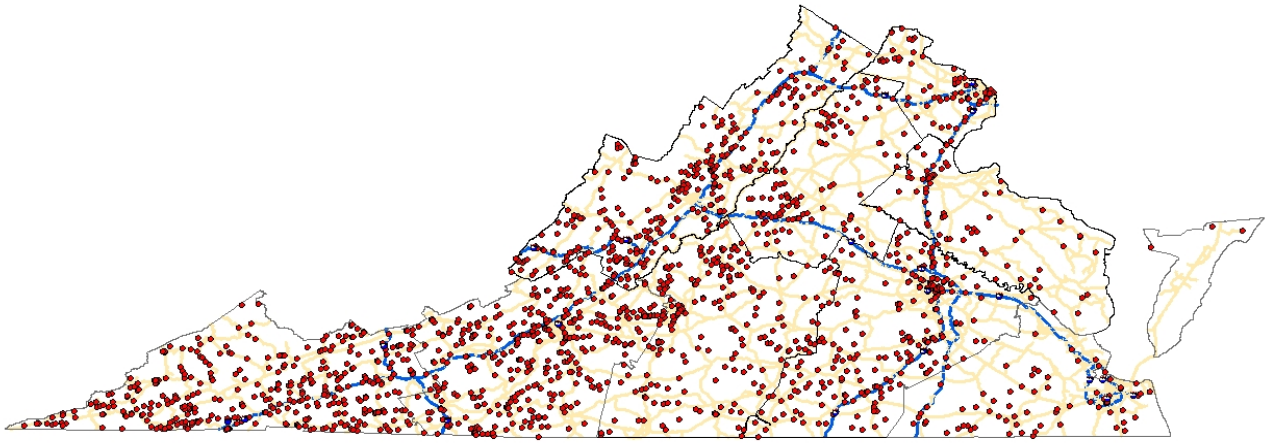
Chart 13 – Percent of SD Structures – Urban Three Year Trend



Systemwide – Current FY Structurally Deficient Structures

Total Number of Structures = 20,920
Number of SD Structures = 1,801 (8.6 %)
Total Square Foot area of structures = 112,696,942
Square foot area of SD Structures = 6,043,297 (5.4 %)

- Denotes SD Structure

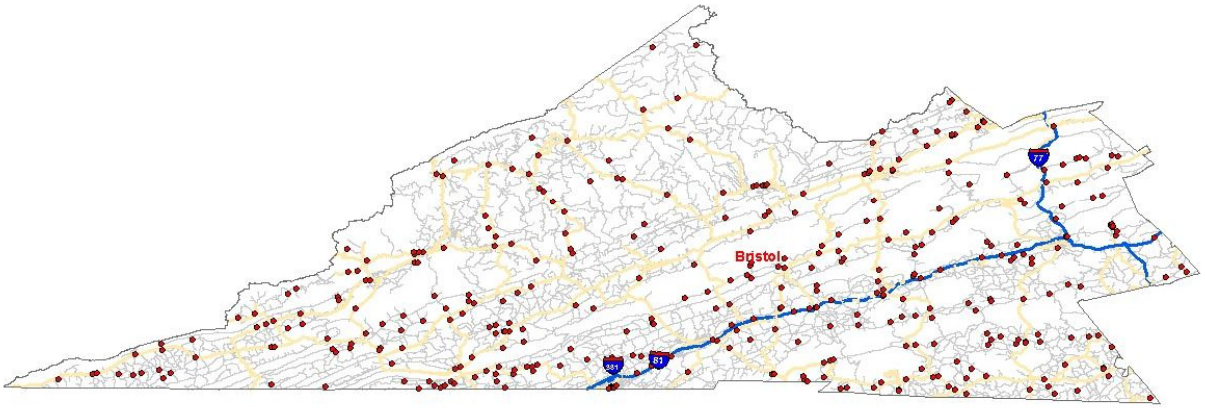


Virginia Department of Transportation
State of the Structures and Bridges Report

Bristol District – Current FY Structurally Deficient Structures

Number of SD Structures = 387
Square foot area of SD Structures = 714,734

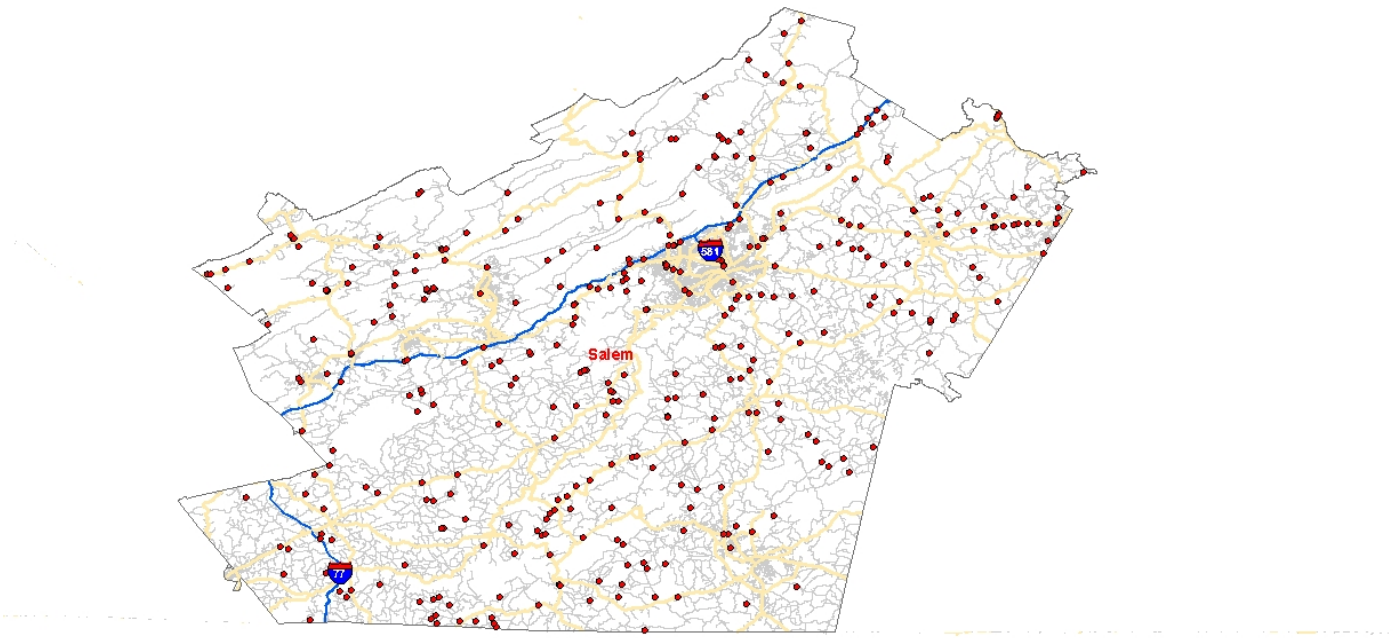
- Denotes SD Structure



Salem District – Current FY Structurally Deficient Structures

Number of SD Structures = 381
Square foot area of SD Structures = 793,426

- Denotes SD Structure

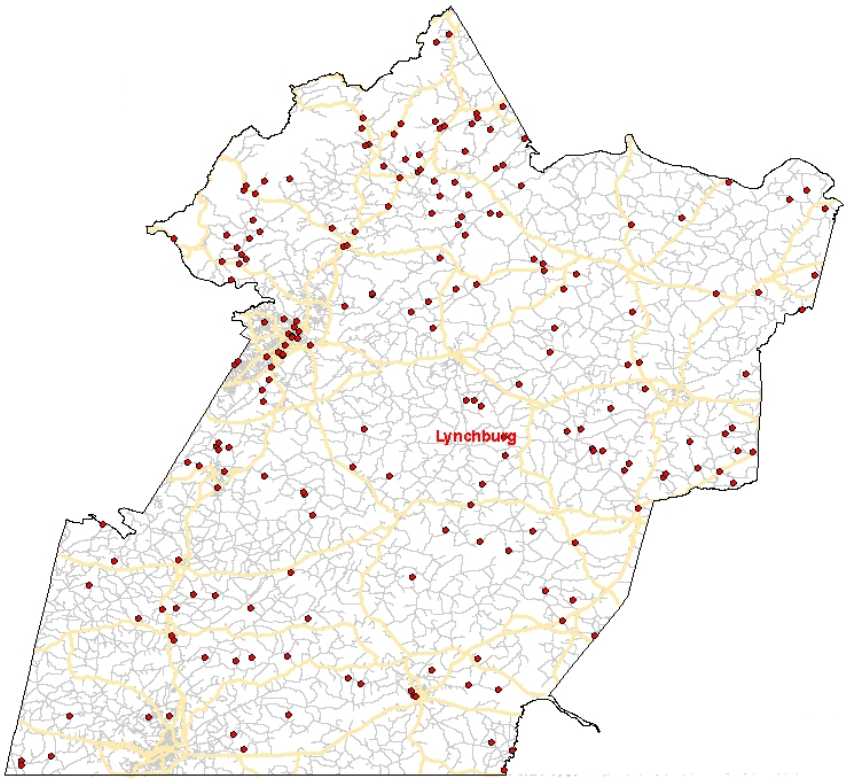


Virginia Department of Transportation
State of the Structures and Bridges Report

Lynchburg District – Current FY Structurally Deficient Structures

Number of SD Structures = 205
Square foot area of SD Structures = 490,234

- Denotes SD Structure

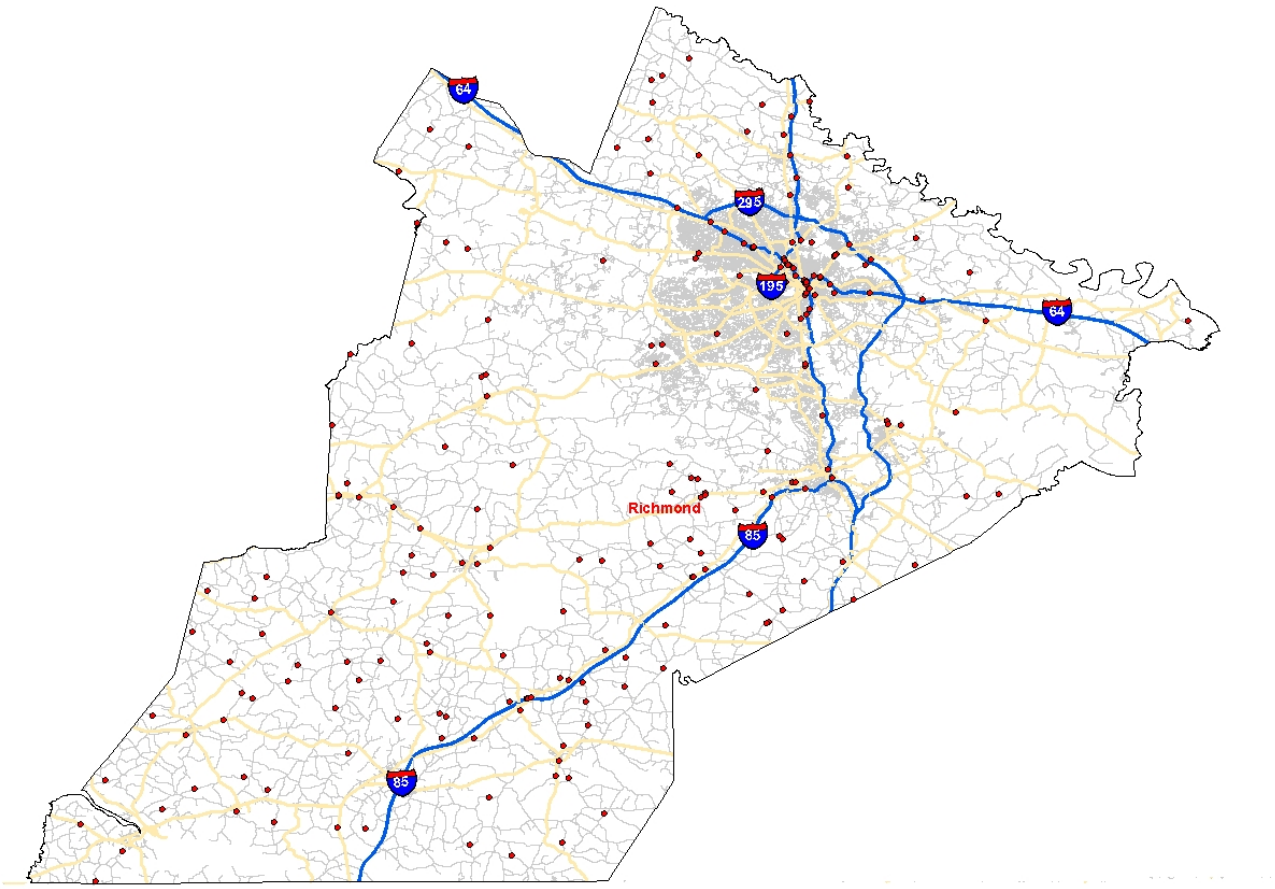


Virginia Department of Transportation
State of the Structures and Bridges Report

Richmond District – Current FY Structurally Deficient Structures

Number of SD Structures = 217
Square foot area of SD Structures = 1,418,135

- Denotes SD Structure

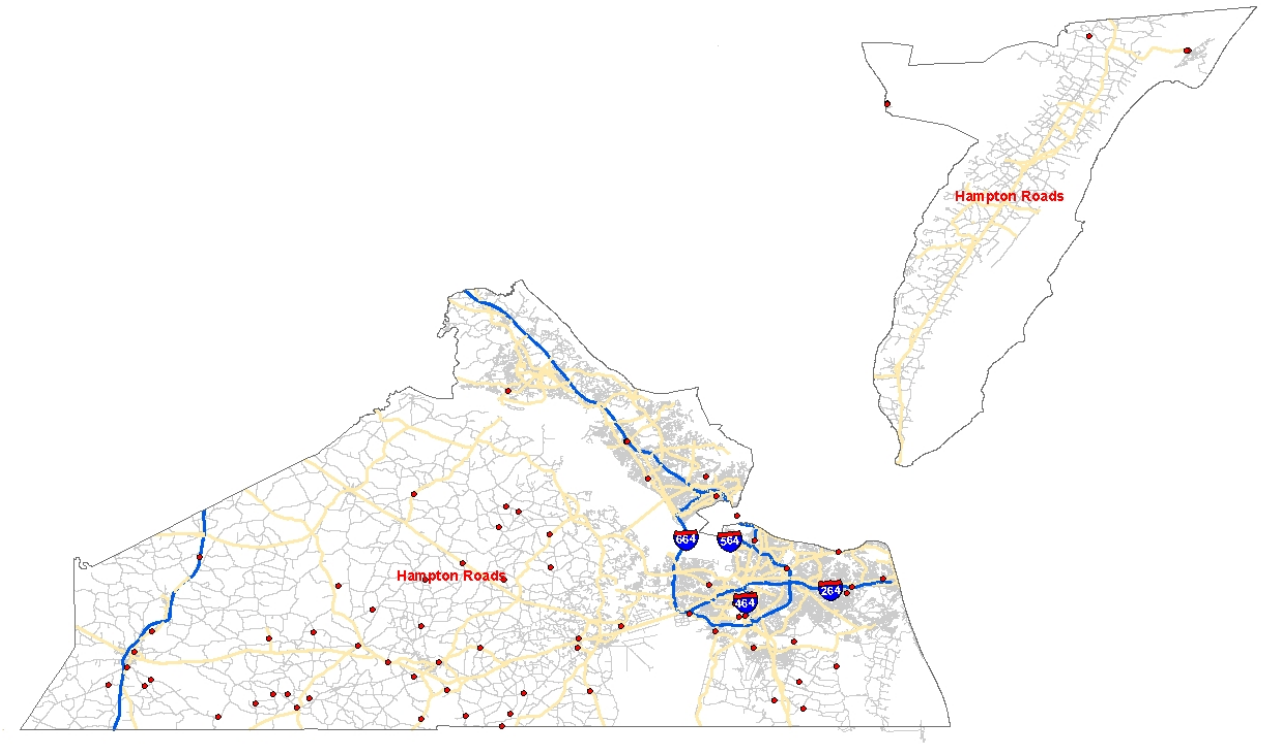


Virginia Department of Transportation
State of the Structures and Bridges Report

Hampton Roads District – Current FY Structurally Deficient Structures

Number of SD Structures = 74
Square foot area of SD Structures = 1,053,052

- Denotes SD Structure

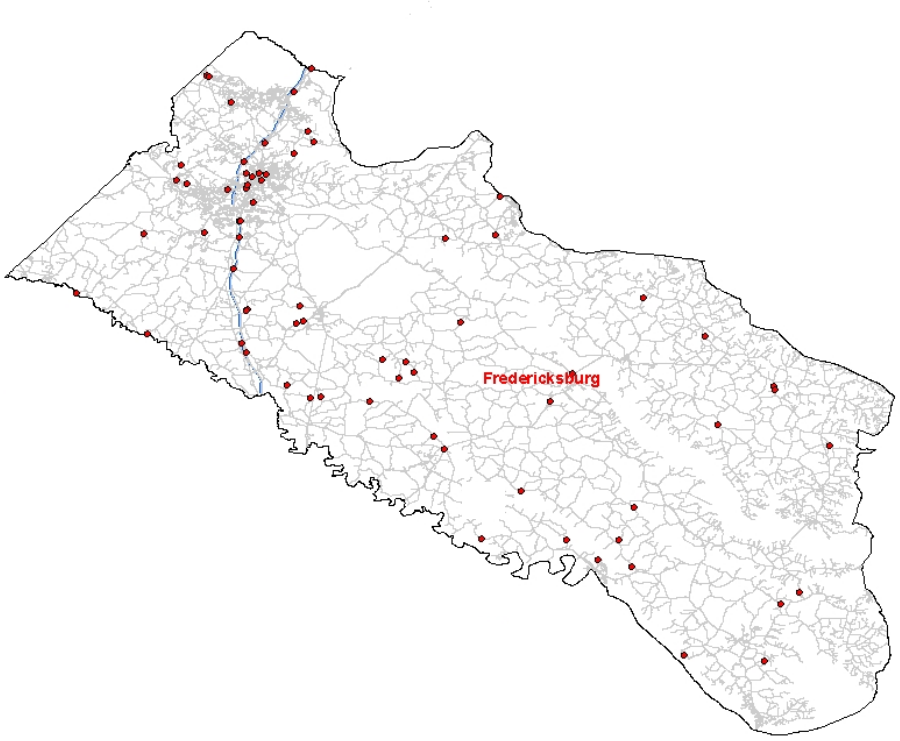


Virginia Department of Transportation
State of the Structures and Bridges Report

Fredericksburg District – Current FY Structurally Deficient Structures

Number of SD Structures = 69
Square foot area of SD Structures = 511,527

- Denotes SD Structure

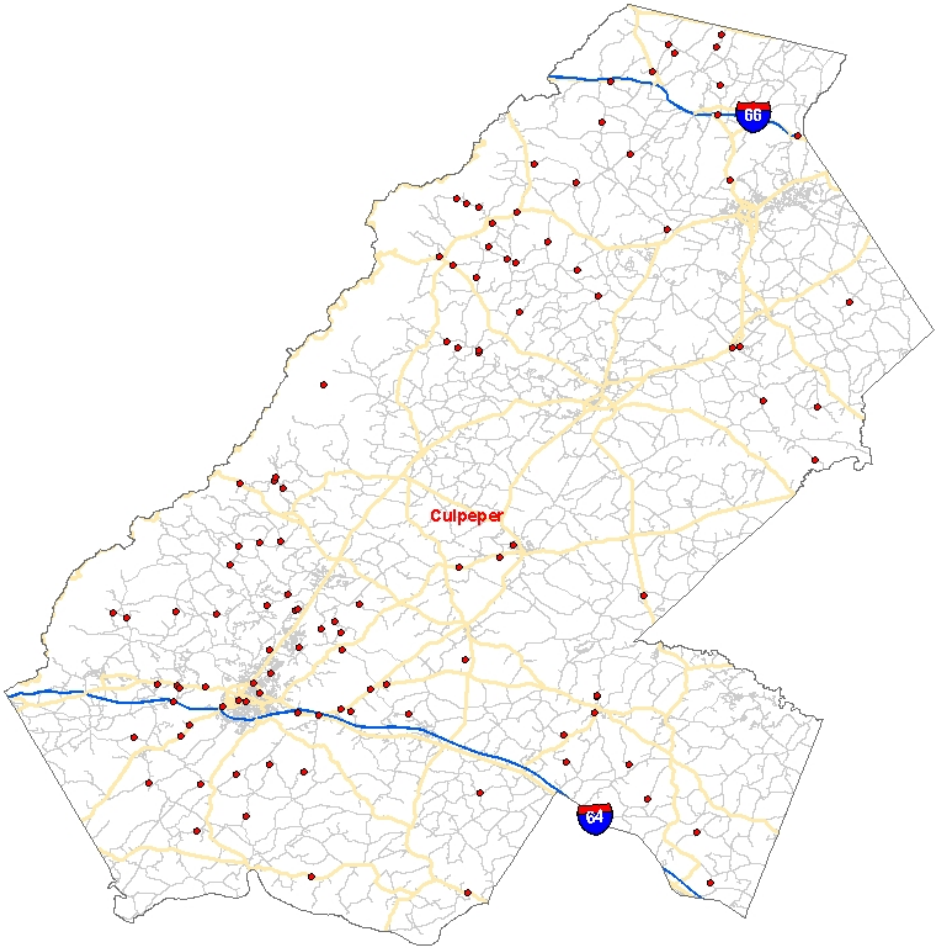


Virginia Department of Transportation
State of the Structures and Bridges Report

Culpeper District – Current FY Structurally Deficient Structures

Number of SD Structures = 115
Square foot area of SD Structures = 201,524

- Denotes SD Structure

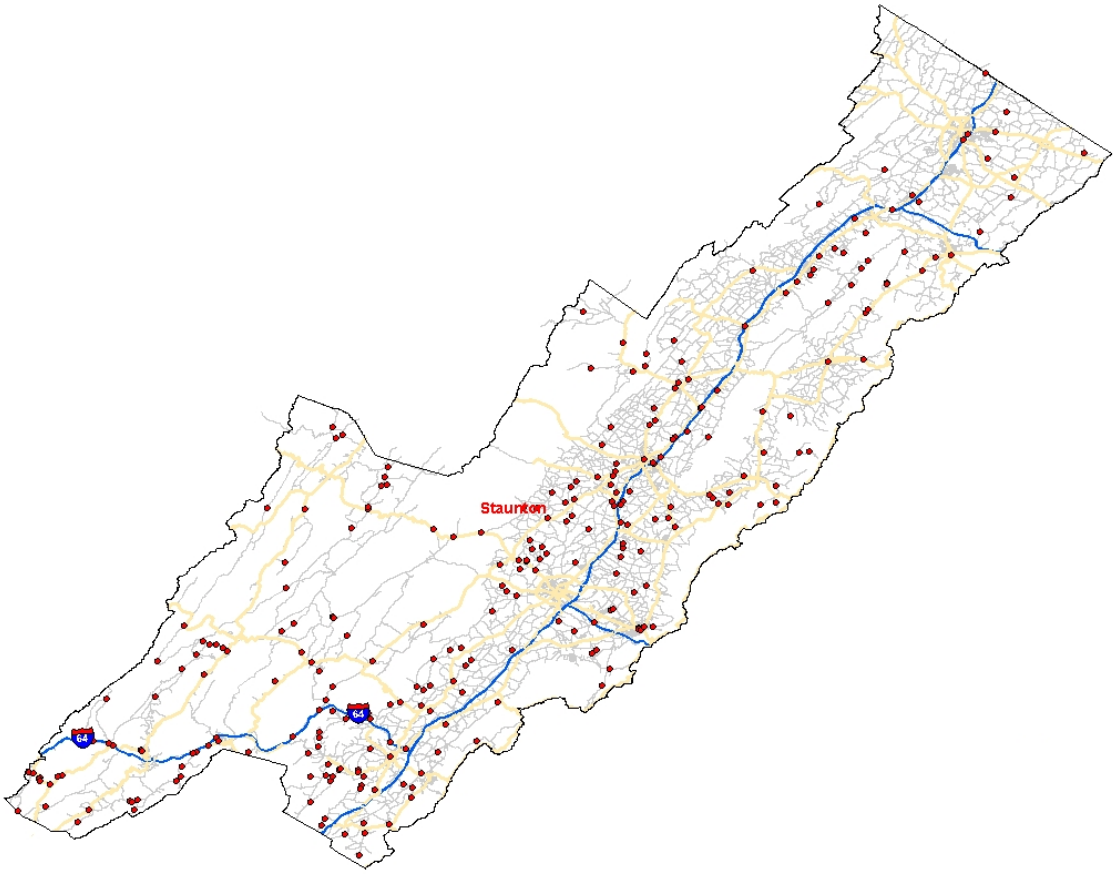


Virginia Department of Transportation
State of the Structures and Bridges Report

Staunton District – Current FY Structurally Deficient Structures

Number of SD Structures = 292
Square foot area of SD Structures = 521,393

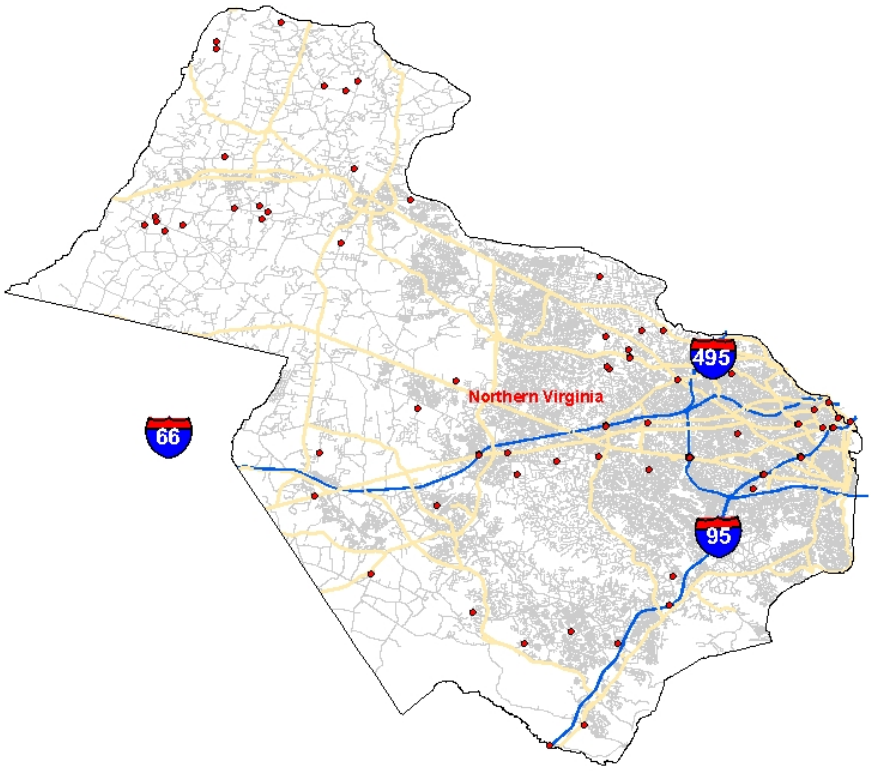
- Denotes SD Structure



NOVA District – Current FY Structurally Deficient Structures

Number of SD Structures = 61
Square foot area of SD Structures = 339,272

- Denotes SD Structure



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

- **Functionally Obsolete (FO)** - A FO designation means that the structure was built to standards that are less conservative than those used today. Charts 14 - 18

- **Combining Structurally Deficient and Functionally Obsolete** - 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 19 - 23

- **Weight Posted** - A weight posted structure is one that has a rated load carrying capacity less than the Virginia designated legal loads. Charts 24 - 28

Charts 14 through 28 show a four year trend for each of these measures statewide and for each system. In addition, Appendix D shows the 2009 performance measures based on the square footage area of the structures. Appendix E shows examples of items that can cause a structure to be Functionally Obsolete.

Functionally Obsolete Measure (Charts 14 – 18)

A functionally obsolete (FO) structure is one that has an appraisal rating of three (3) or worse for the deck geometry, under clearance, approach roadway alignment, structural condition or waterway adequacy. A 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 today.

Chart 14 – Percent of FO Structures – Systemwide
Three Year Trend

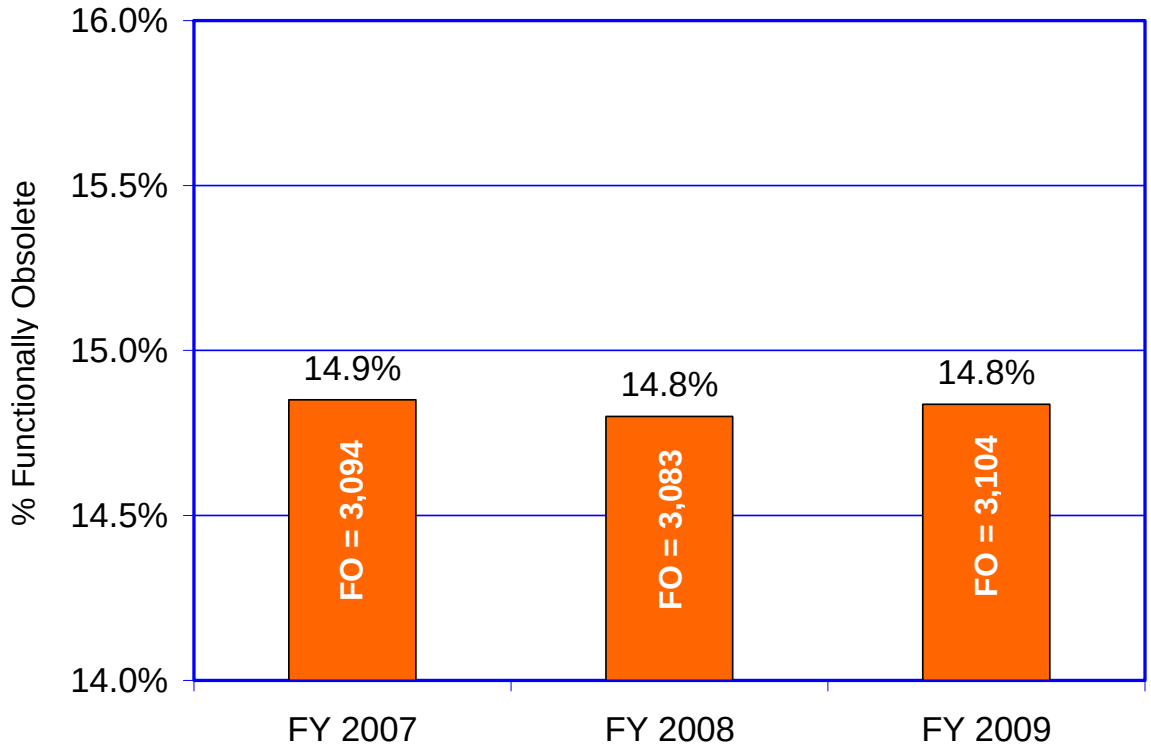


Chart 15 – Percent of FO Structures – Interstate Three Year Trend

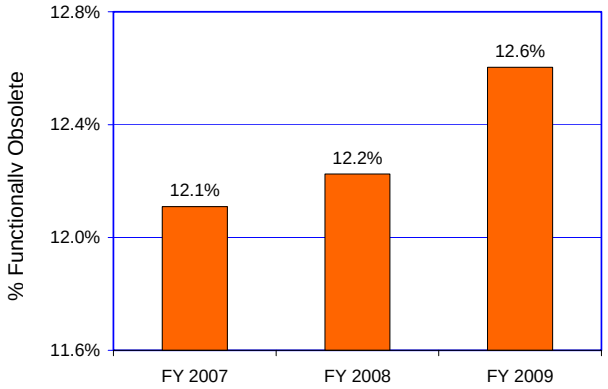


Chart 16 – Percent of FO Structures – Primary Three Year Trend

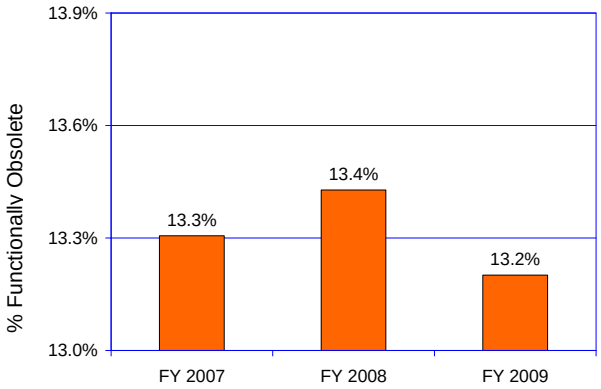


Chart 17 – Percent of FO Structures – Secondary Three Year Trend

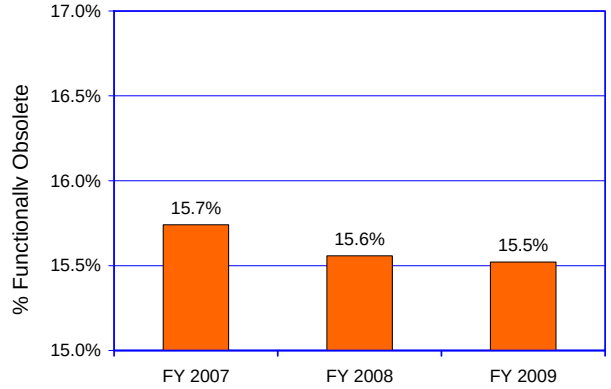
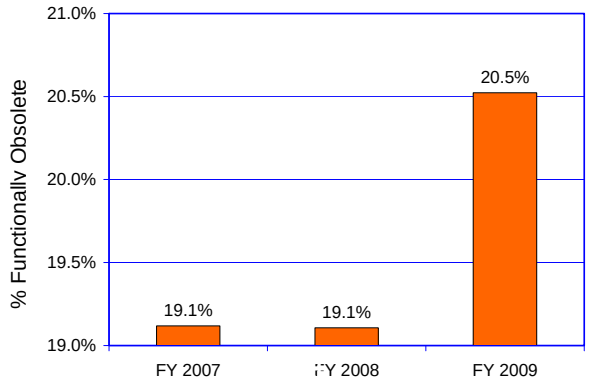


Chart 18 – Percent of FO Structures – Urban Three Year Trend



Structurally Deficient or Functionally Obsolete Measure (Charts 19 - 23)

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. A deficient structure may not be both SD and FO…. It's one or the other. FHWA uses the combined deficient designation in the allocation of bridge funding per State.

Chart 19 – Percent of SD or FO Structures – Systemwide
Three Year Trend

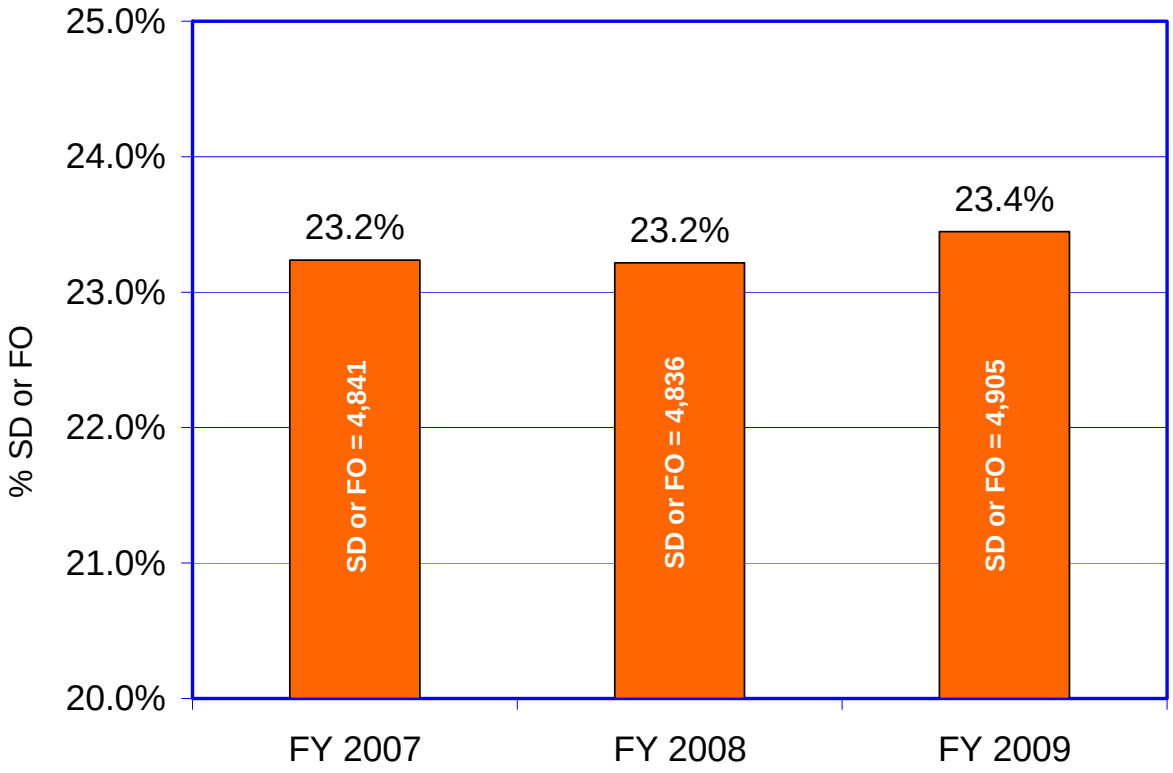
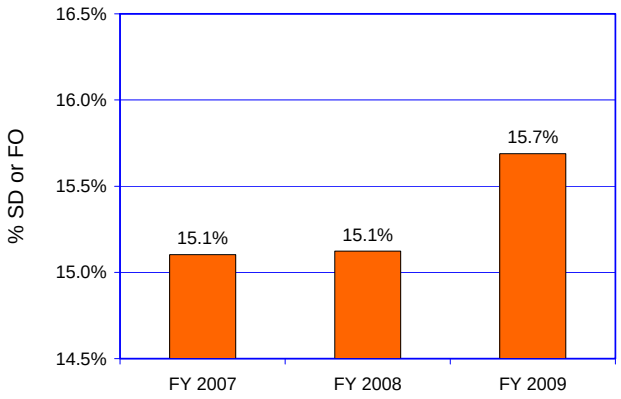


Chart 20 – Percent of SD or FO Structures
Interstate
Three Year Trend



Chart– 21 – Percent of SD or FO Structures
Primary
Three Year Trend

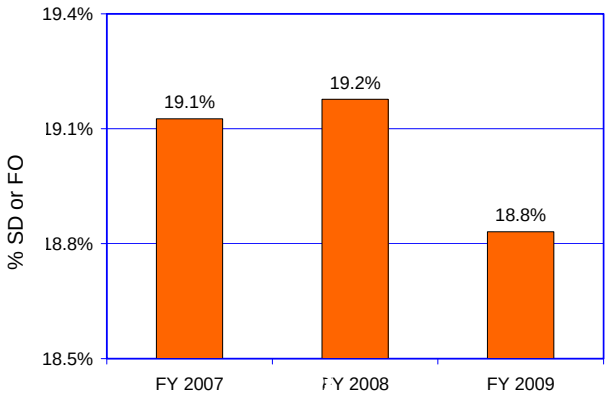


Chart 22 - Percent of SD or FO Structures
Secondary
Three Year Trend

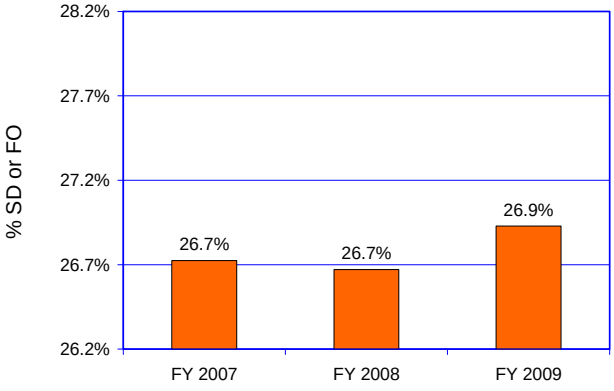
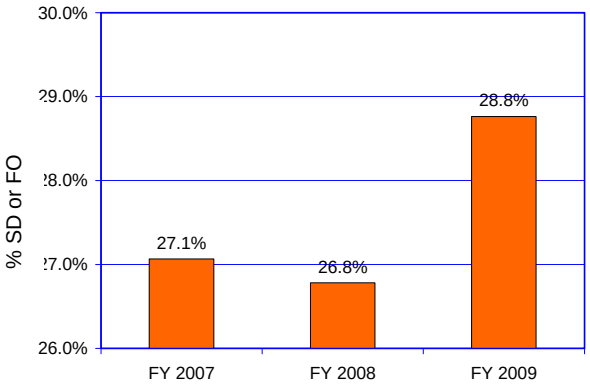


Chart 23 - Percent of SD or FO Structures
Urban
Three Year Trend



Weight Posted Structures Measure (Charts 24 – 28)

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 24 – Percent of Weight Posted Structures – Systemwide
Three Year Trend

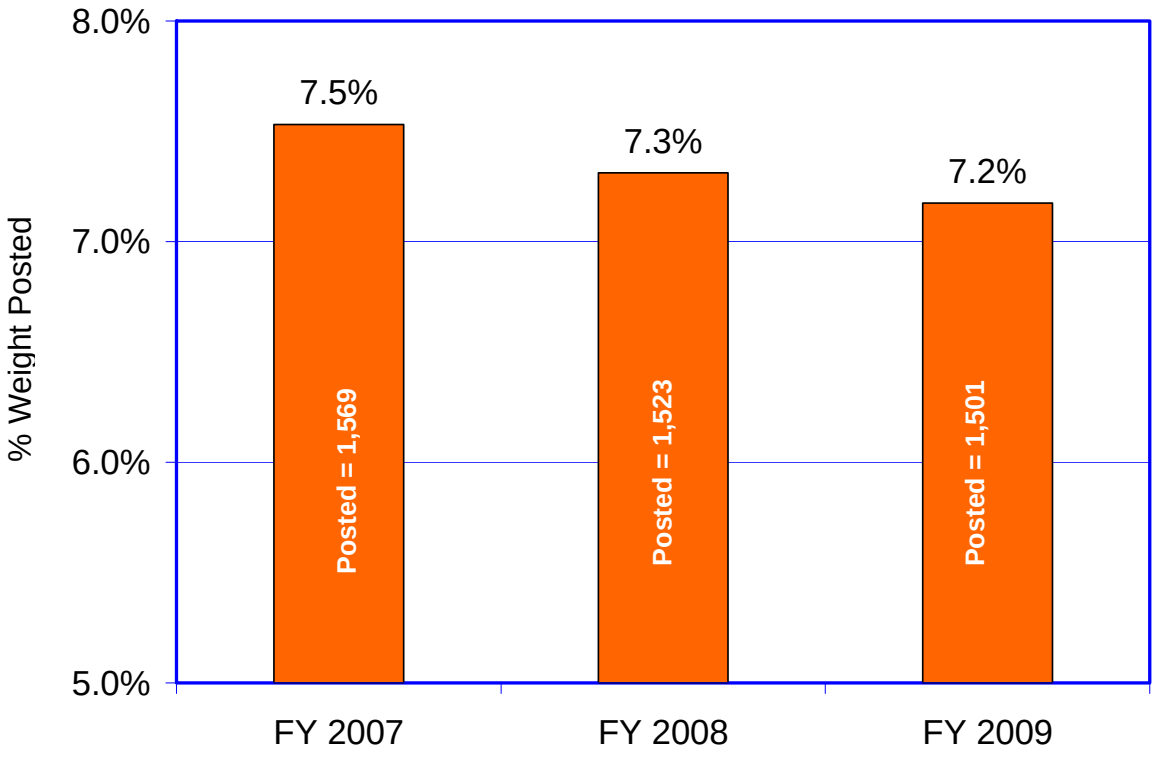


Chart 25 – Percent of Weight Posted Structures
Interstate
Three Year Trend

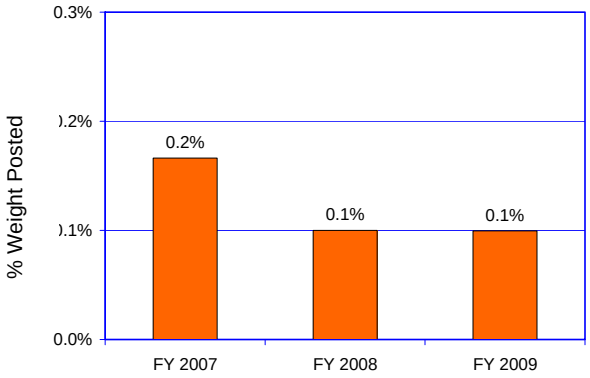


Chart 26 – Percent of Weight Posted Structures
Primary
Three Year Trend

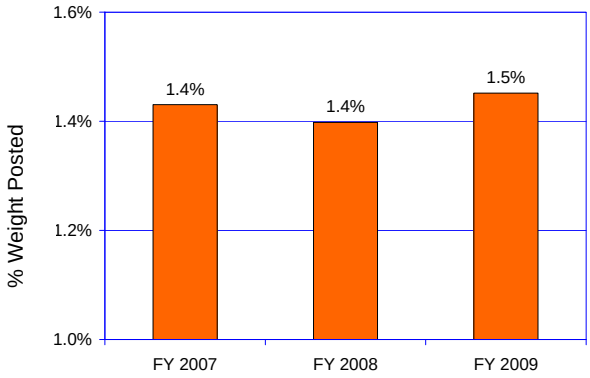


Chart 27 – Percent of Weight Posted Structures
Secondary
Three Year Trend

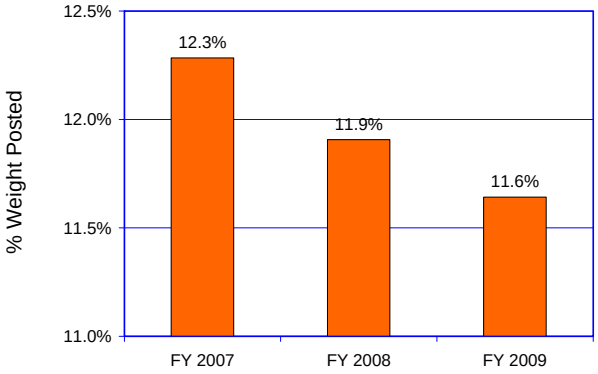
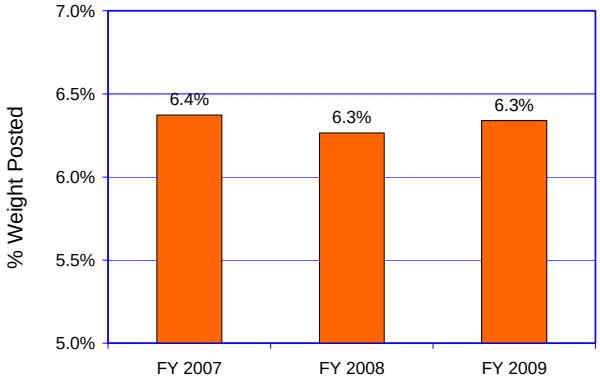


Chart 28 – Percent of Weight Posted Structures
Urban
Three Year Trend



Appendix A– General Condition Ratings

General Condition Ratings (GCR's): According to the National Bridge Inventory (NBI), Condition ratings are used to describe the existing, in-place bridge or culvert as compared to the as-built condition. Evaluation is for the materials related, physical condition of the deck, superstructure and substructure components of a bridge. GCR's is a numerical system that ranges from 0 (failed condition) to 9 (excellent condition). The following general condition ratings are used as a guide in evaluating bridge decks, bridge superstructures, bridge substructures, and culverts. The following Tables give the type of criteria that causes a structure to be assigned a particular condition rating. In addition, example pictures are shown are provided to help clarify the criteria.

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 elements 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
4 or less - (Poor Condition) Structurally Deficient	 Bridge Superstructure with advanced section loss
5 – Fair Condition (At risk of becoming structurally deficient)	 Bridge Superstructure with minor to moderate section loss
6 – Satisfactory Condition	 Bridge Superstructure 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
4 or less - (Poor Condition) Structurally Deficient	 Culvert with advanced section loss
5 – Fair Condition (At risk of becoming structurally deficient)	 Culvert moderate deterioration
6 – Satisfactory Condition	 Culvert with minor cracks

Appendix B– Quality Assurance Program

The accuracy, thoroughness and completeness of the bridge safety inspections are essential for the evaluation of a structure's safety and for decisions on planning, budgeting, and performing of maintenance, repair, rehabilitation and replacement of our structures. Since 1991, the Structure and Bridge Division (S&B) has had in place a policy for the quality control and quality assurance of the structure safety inspection program. In January 2005, the NBIS portion of the Code of Federal Regulations was amended to require each state to "Assure systematic quality control and quality assurance procedures are used to maintain a high degree of accuracy and consistency in the inspection program. 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 NBIS requires Program Managers and Team Leaders to successfully complete the FHWA - National Highway Institute (NHI) course 'Safety Inspection of In-Service Bridges' within the first five (5) 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. VDOT requires the underwater inspectors to fulfill the training requirements as set forth in the VDOT 'Dive Safety Manual'.

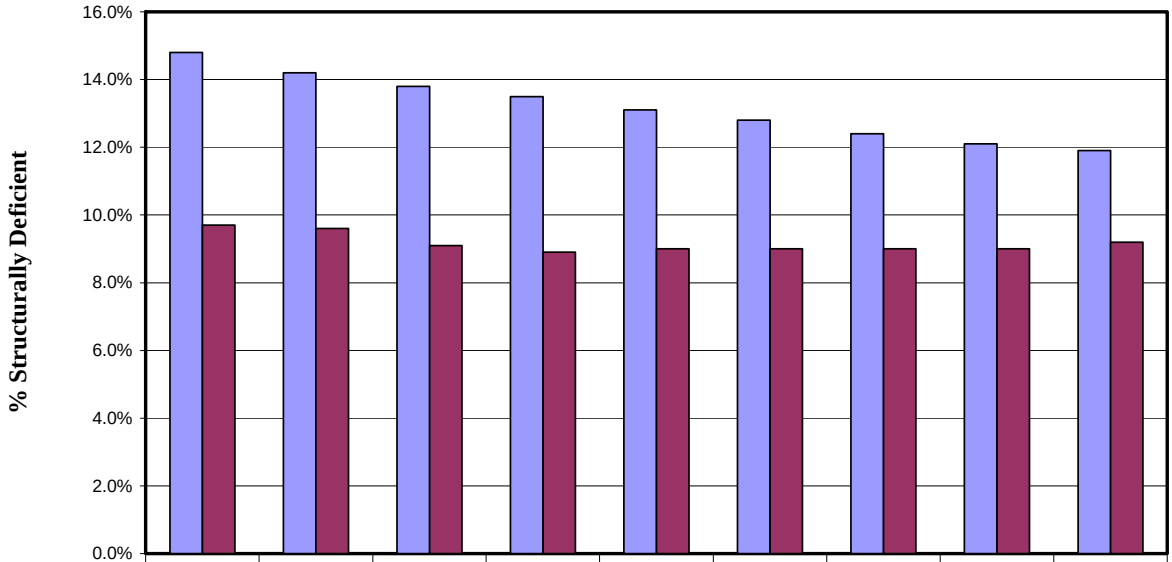
Both the Central Office and the Districts have a responsibility to review and validate inspection reports and inventory data. Discrepancies found during field and office reviews performed by both District and Central Office personnel shall be documented in a written report and shared with all parties involved.

It is important that 'best practices' are shared throughout the state. It is also important to correct inaccuracies that are discovered that indicate a misunderstanding or misapplication of a policy/procedure. Each year a summary report is compiled of the findings of the Central Office review and sent to all Districts by March of the following year.

VDOT inspects over 10,000 structures annually at an approximate cost of $16 million.

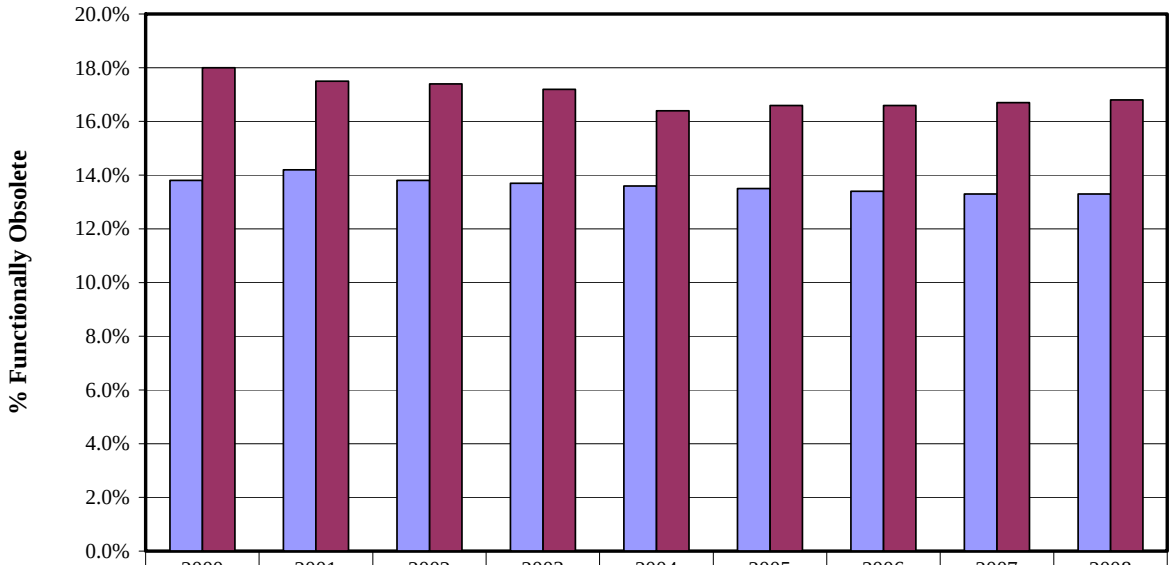
Appendix C– National Performance Trends

Chart C.1 - Comparing Virginia's SD Structures to the National Average



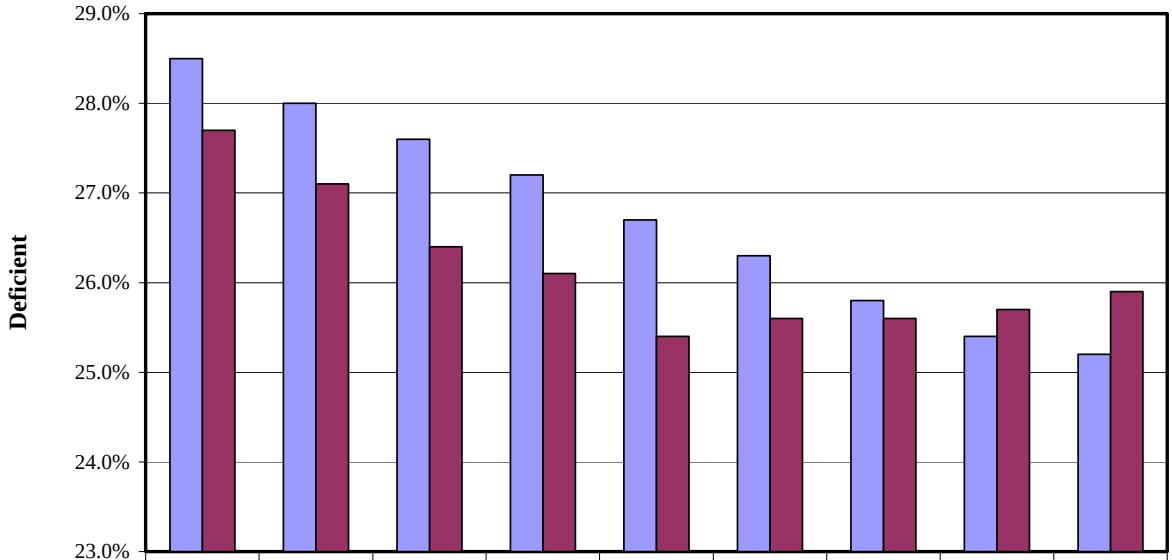
	2000	2001	2002	2003	2004	2005	2006	2007	2008
National	14.8%	14.2%	13.8%	13.5%	13.1%	12.8%	12.4%	12.1%	11.9%
Virginia	9.7%	9.6%	9.1%	8.9%	9.0%	9.0%	9.0%	9.0%	9.2%

Chart C.2 - Comparing Virginia's FO Structures to the National Average



	2000	2001	2002	2003	2004	2005	2006	2007	2008
National	13.8%	14.2%	13.8%	13.7%	13.6%	13.5%	13.4%	13.3%	13.3%
Virginia	18.0%	17.5%	17.4%	17.2%	16.4%	16.6%	16.6%	16.7%	16.8%

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



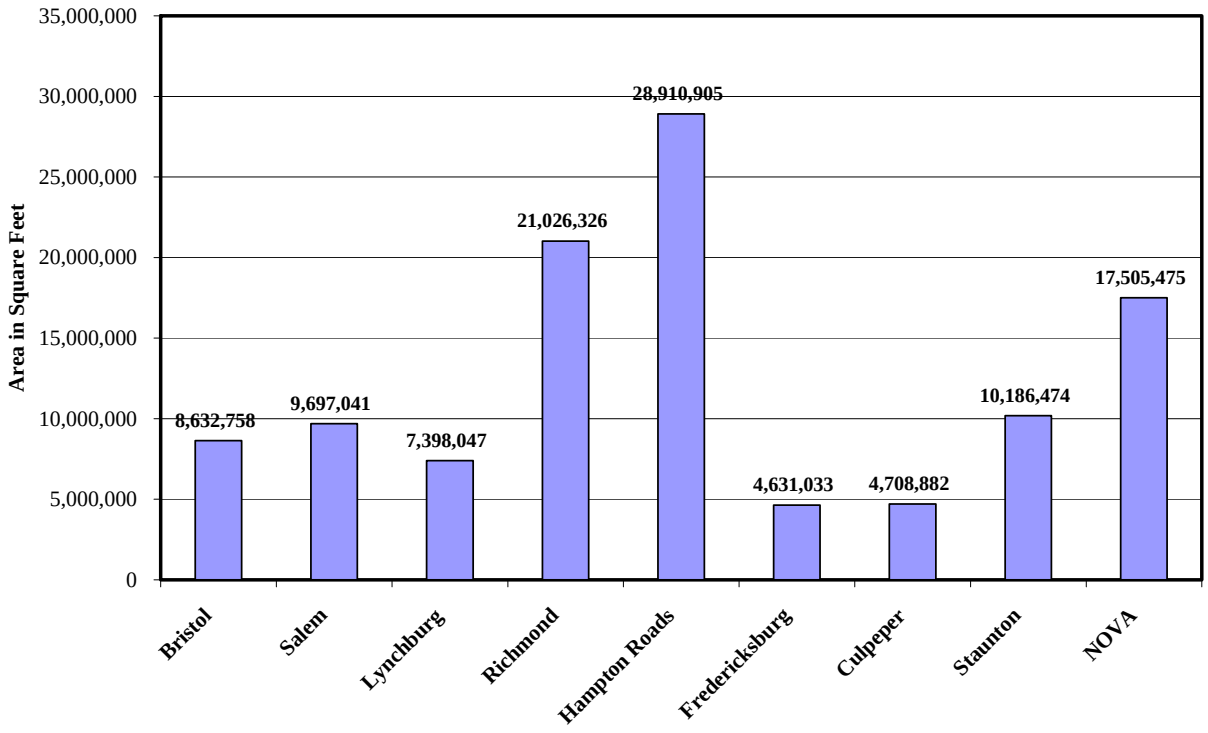
	2000	2001	2002	2003	2004	2005	2006	2007	2008
National	28.5%	28.0%	27.6%	27.2%	26.7%	26.3%	25.8%	25.4%	25.2%
Virginia	27.7%	27.1%	26.4%	26.1%	25.4%	25.6%	25.6%	25.7%	25.9%

Appendix D– Square Foot Area of Structures

D.1 – Square Foot Area of Structures Systemwide

DISTRICT	Sq-Ft Area of Structures (Bridges and Culverts)					
	Interstate	Primary	Secondary	Urban	Other	Total
Bristol	2,072,910	3,756,011	2,427,384	376,452	0	8,632,758
Salem	2,070,355	3,677,163	2,772,006	1,174,548	2,969	9,697,041
Lynchburg	0	3,722,793	2,597,515	1,077,739	0	7,398,047
Richmond	8,983,634	6,381,253	2,562,914	1,982,322	1,116,202	21,026,326
Hampton Roads	12,327,018	10,096,253	861,186	5,613,831	12,617	28,910,905
Fredericksburg	1,010,359	2,594,839	895,287	122,844	7,704	4,631,033
Culpeper	1,345,510	1,664,697	1,515,142	180,419	3,114	4,708,882
Staunton	4,177,584	2,766,936	2,584,559	657,395	0	10,186,474
NOVA	7,283,619	3,579,498	5,511,980	573,125	557,253	17,505,475
Statewide	**39,270,988**	**38,239,444**	**21,727,975**	**11,758,676**	**1,699,859**	**112,696,942**

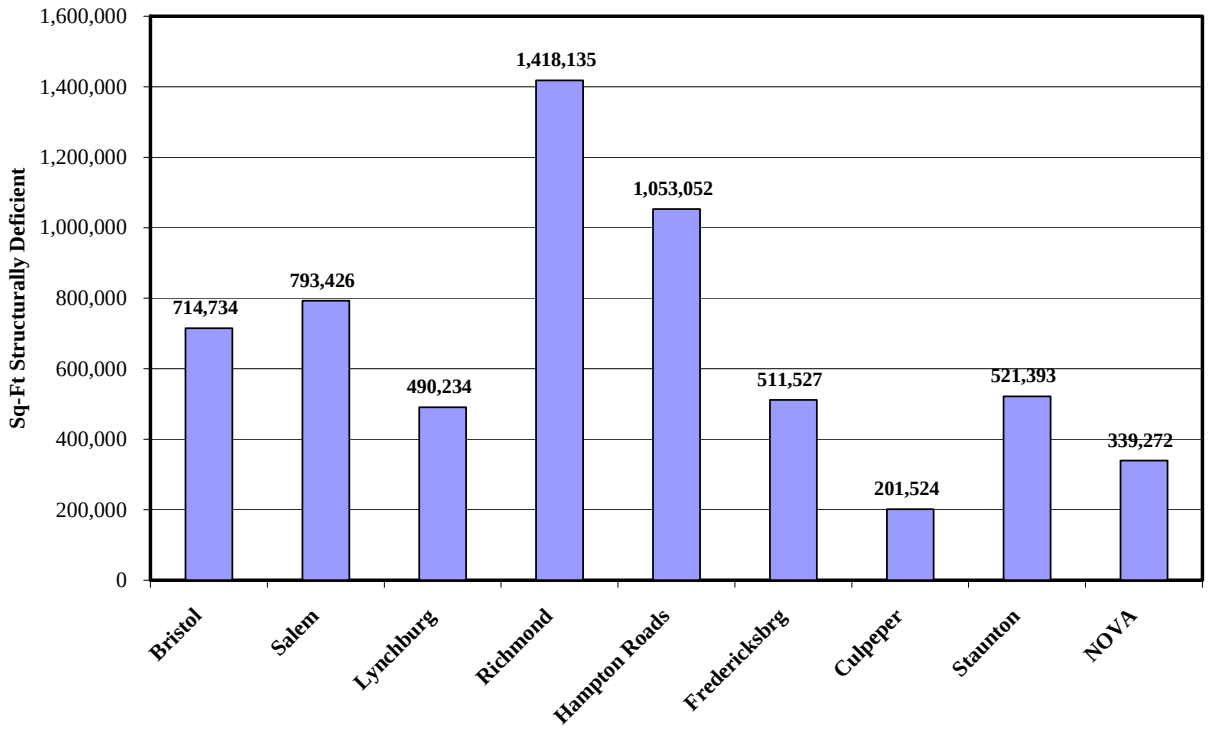
Square Foot Area of Structures Systemwide



D.2 – Square Foot Area of Structurally Deficient Structures Systemwide

DISTRICT	Sq-Ft Area of Structurally Deficient Structures					
	Interstate	Primary	Secondary	Urban	Other	Total
Bristol	117,806	274,612	260,845	61,471	0	714,734
Salem	272,400	163,258	309,513	48,255	0	793,426
Lynchburg	0	206,623	190,997	92,614	0	490,234
Richmond	634,662	482,916	188,044	112,513	0	1,418,135
Hampton Roads	385,261	155,411	35,673	476,708	0	1,053,052
Fredericksburg	53,358	370,680	57,016	30,473	0	511,527
Culpeper	20,280	40,053	96,678	44,057	456	201,524
Staunton	79,395	170,370	208,597	63,031	0	521,393
NOVA	115,714	165,874	57,685	0	0	339,272
Statewide	**1,678,875**	**2,029,796**	**1,405,048**	**929,122**	**456**	**6,043,297**

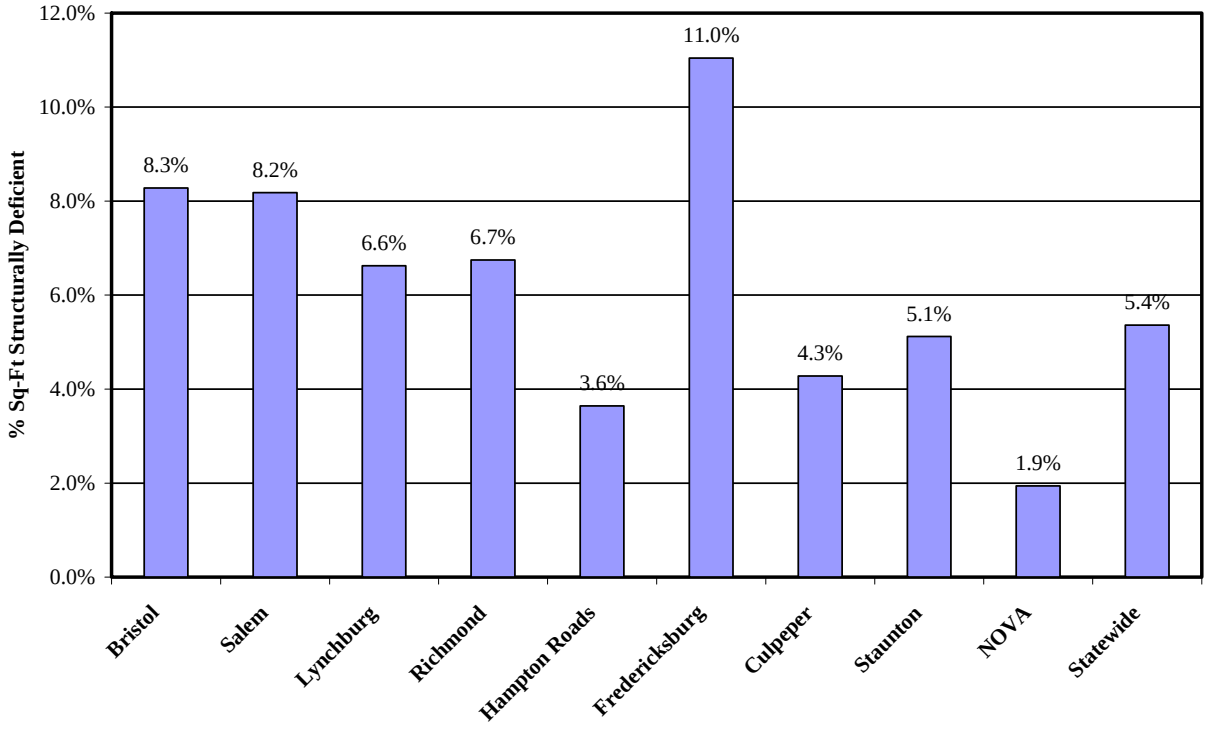
Square Foot Area of Structurally Defficient Structures Systemwide



D.3 – Percent of Square Foot Area of Structurally Deficient Structures Systemwide

DISTRICT	Percent of Sq-Ft Area of Structurally Deficient Structures					
	Interstate	Primary	Secondary	Urban	Other	Total
Bristol	5.7%	7.3%	10.7%	16.3%	0.0%	8.3%
Salem	13.2%	4.4%	11.2%	4.1%	0.0%	8.2%
Lynchburg	0.0%	5.6%	7.4%	8.6%	0.0%	6.6%
Richmond	7.1%	7.6%	7.3%	5.7%	0.0%	6.7%
Hampton Roads	3.1%	1.5%	4.1%	8.5%	0.0%	3.6%
Fredericksburg	5.3%	14.3%	6.4%	24.8%	0.0%	11.0%
Culpeper	1.5%	2.4%	6.4%	24.4%	14.6%	4.3%
Staunton	1.9%	6.2%	8.1%	9.6%	0.0%	5.1%
NOVA	1.6%	4.6%	1.0%	0.0%	0.0%	1.9%
Statewide	4.3%	5.3%	6.5%	7.9%	0.0%	5.4%

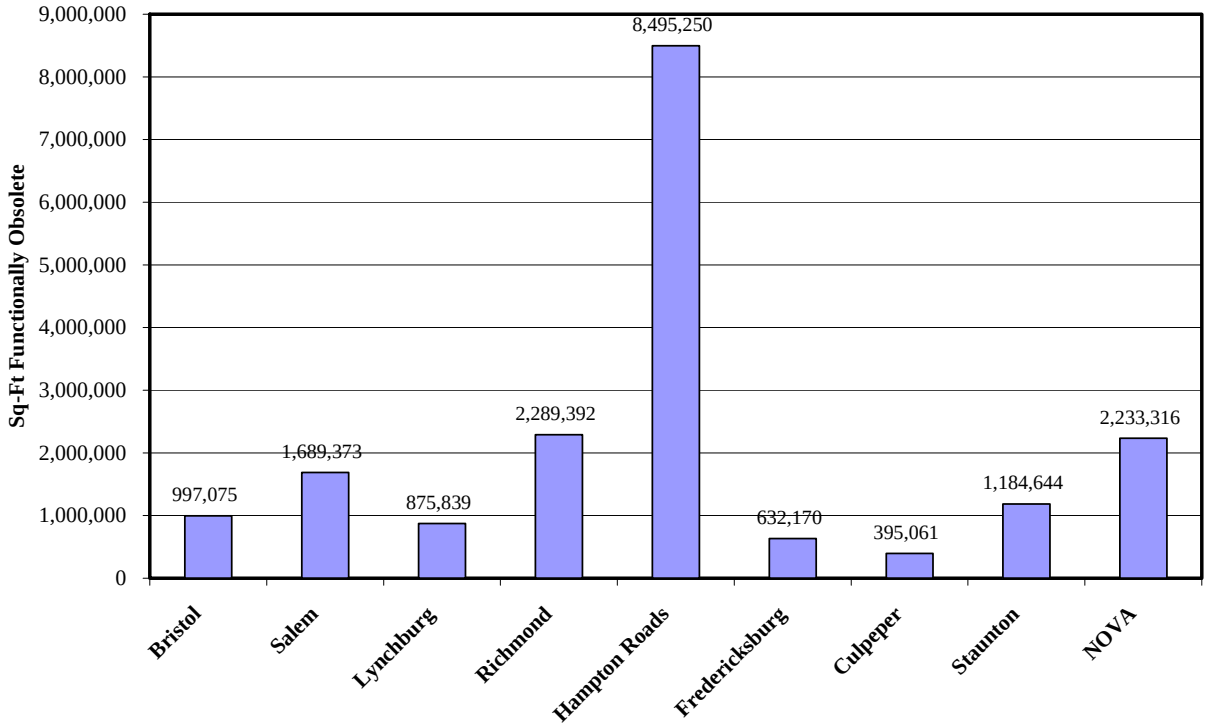
Percent of Square Foot Area of Structurally Deficient Structures



D.4 – Square Foot Area of Functionally Obsolete Structures Systemwide

DISTRICT	Sq-Ft Area of Functionally Obsolete Structures					
	Interstate	Primary	Secondary	Urban	Other	Total
Bristol	320,472	365,484	258,821	52,299	0	997,075
Salem	320,251	552,183	412,977	403,963	0	1,689,373
Lynchburg	0	321,845	177,642	376,353	0	875,839
Richmond	736,723	794,573	237,103	520,993	0	2,289,392
Hampton Roads	2,213,905	4,998,049	105,769	1,177,528	0	8,495,250
Fredericksburg	70,670	504,804	56,696	0	0	632,170
Culpeper	71,356	102,732	177,176	43,341	456	395,061
Staunton	326,819	466,838	279,719	111,269	0	1,184,644
NOVA	1,310,432	334,127	491,563	85,481	11,712	2,233,316
Statewide	**5,370,627**	**8,440,634**	**2,197,465**	**2,771,226**	**12,168**	**18,792,120**

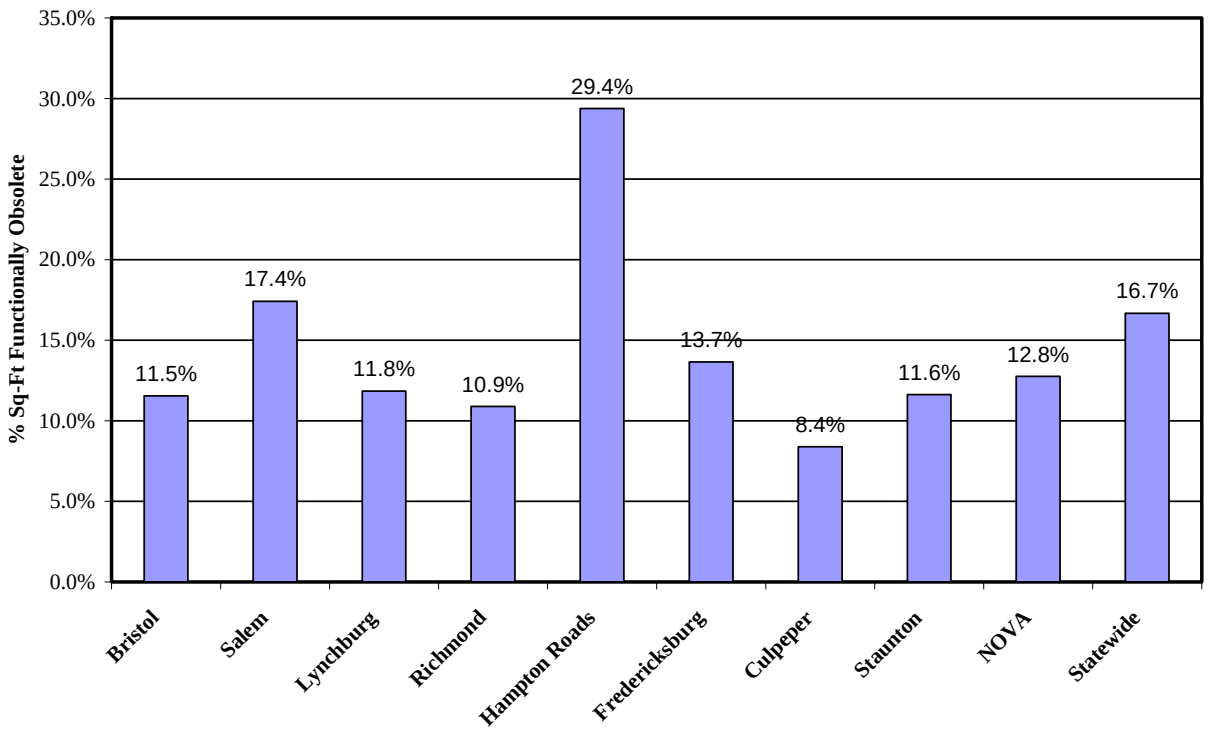
Square Foot Area of Functionally Obsolete Structures Systemwide



D.5 – Percent of Square Foot Area of Functionally Obsolete Structures System wide

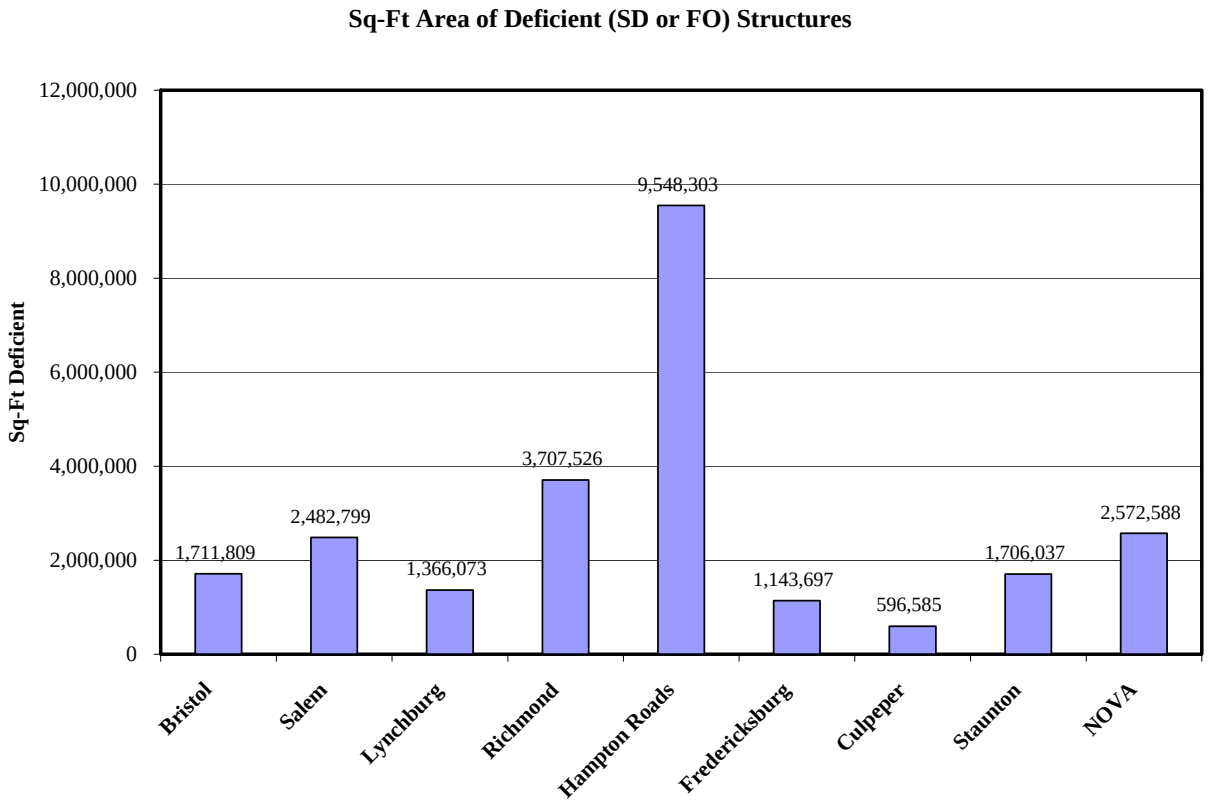
DISTRICT	Percent of Sq-Ft Area of Functionally Obsolete Structures					
	Interstate	Primary	Secondary	Urban	Other	Total
Bristol	15.5%	9.7%	10.7%	13.9%	0.0%	11.5%
Salem	15.5%	15.0%	14.9%	34.4%	0.0%	17.4%
Lynchburg	0.0%	8.6%	6.8%	34.9%	0.0%	11.8%
Richmond	8.2%	12.5%	9.3%	26.3%	0.0%	10.9%
Hampton Roads	18.0%	49.5%	12.3%	21.0%	0.0%	29.4%
Fredericksburg	7.0%	19.5%	6.3%	0.0%	0.0%	13.7%
Culpeper	5.3%	6.2%	11.7%	24.0%	14.6%	8.4%
Staunton	7.8%	16.9%	10.8%	16.9%	0.0%	11.6%
NOVA	18.0%	9.3%	8.9%	14.9%	2.1%	12.8%
Statewide	13.7%	22.1%	10.1%	23.6%	0.7%	16.7%

Percent Square Foot Area of Functionally Obsolete Structures Systemwide



D.6 – Square Foot Area of Deficient (SD or FO) Structures System wide

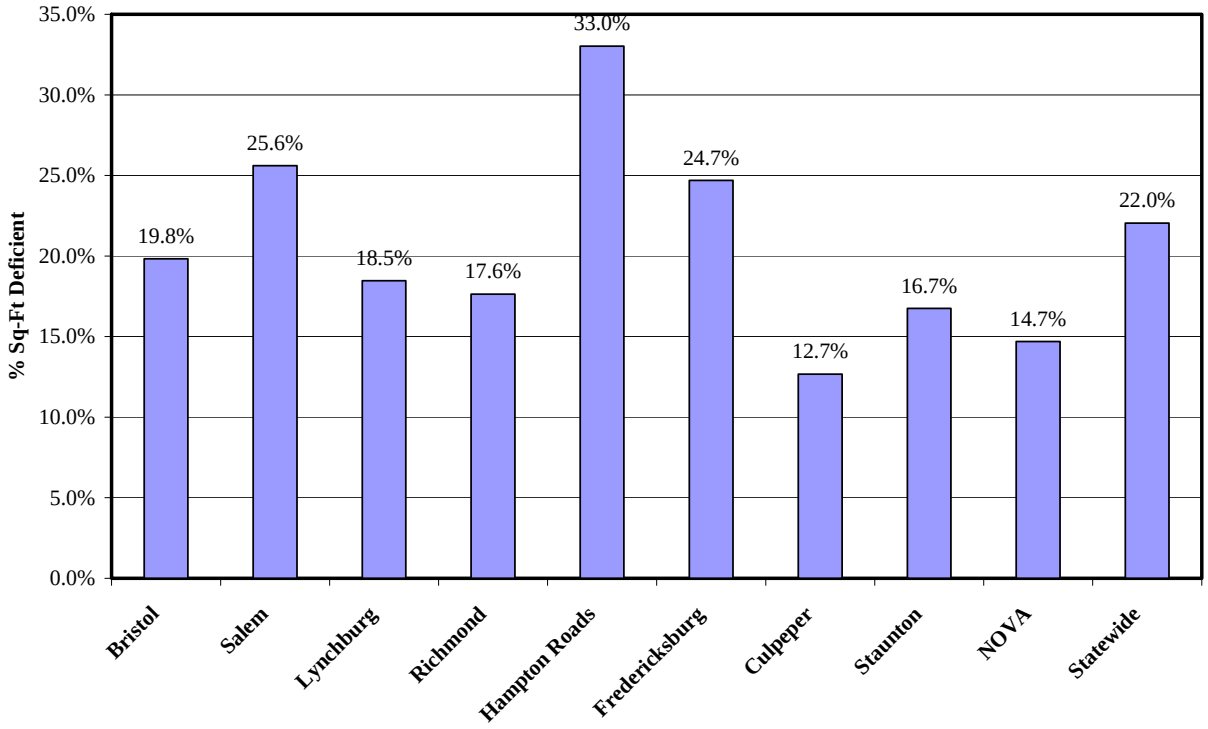
DISTRICT	Sq-Ft Area of Deficient (SD or FO) Structures					
	Interstate	Primary	Secondary	Urban	Other	Total
Bristol	438,278	640,096	519,666	113,770	0	1,711,809
Salem	592,650	715,440	722,490	452,218	0	2,482,799
Lynchburg	0	528,468	368,638	468,967	0	1,366,073
Richmond	1,371,385	1,277,489	425,147	633,506	0	3,707,526
Hampton Roads	2,599,166	5,153,460	141,441	1,654,235	0	9,548,303
Fredericksburg	124,028	875,484	113,712	30,473	0	1,143,697
Culpeper	91,636	142,785	273,854	87,398	912	596,585
Staunton	406,214	637,207	488,316	174,300	0	1,706,037
NOVA	1,426,145	500,001	549,248	85,481	11,712	2,572,588
Statewide	**7,049,502**	**10,470,430**	**3,602,512**	**3,700,349**	**12,624**	**24,835,417**



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

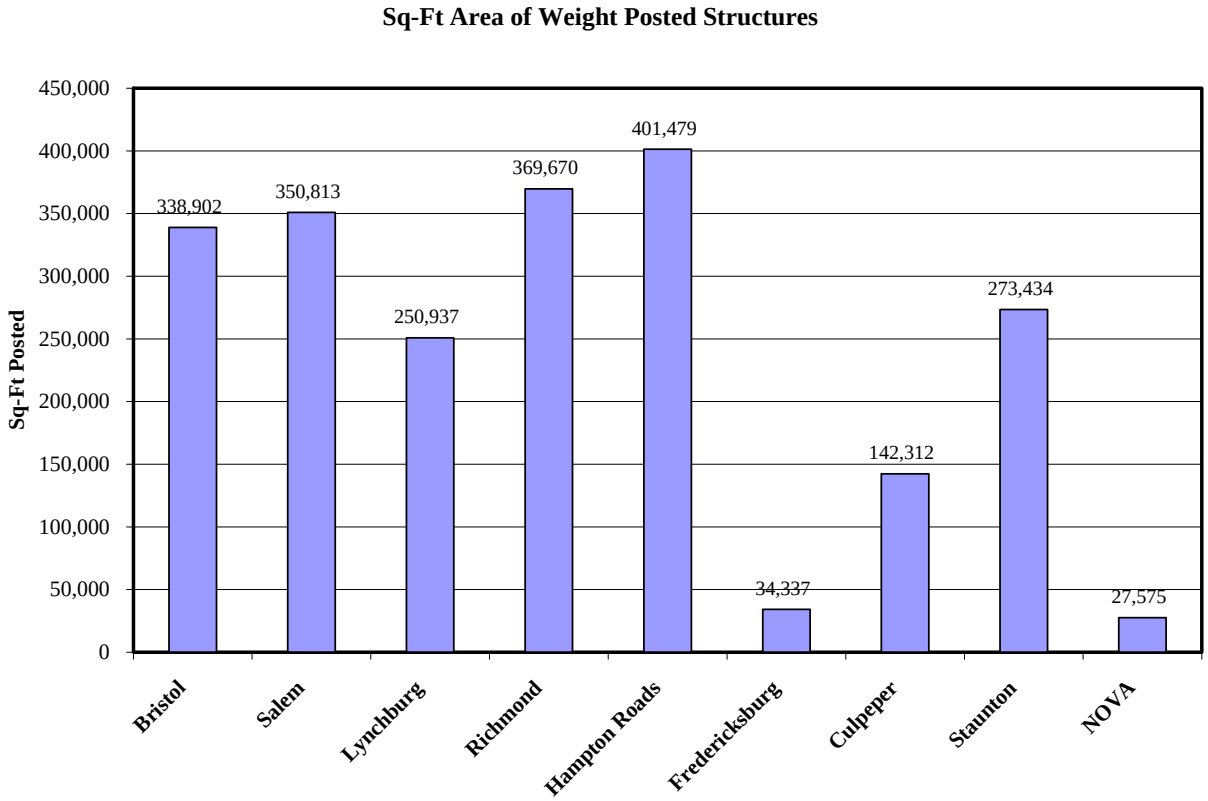
DISTRICT	Percent of Sq-Ft Area of Deficient (SD or FO) Structures					
	Interstate	Primary	Secondary	Urban	Other	Total
Bristol	21.1%	17.0%	21.4%	30.2%	0.0%	19.8%
Salem	28.6%	19.5%	26.1%	38.5%	0.0%	25.6%
Lynchburg	0.0%	14.2%	14.2%	43.5%	0.0%	18.5%
Richmond	15.3%	20.0%	16.6%	32.0%	0.0%	17.6%
Hampton Roads	21.1%	51.0%	16.4%	29.5%	0.0%	33.0%
Fredericksburg	12.3%	33.7%	12.7%	24.8%	0.0%	24.7%
Culpeper	6.8%	8.6%	18.1%	48.4%	29.3%	12.7%
Staunton	9.7%	23.0%	18.9%	26.5%	0.0%	16.7%
NOVA	19.6%	14.0%	10.0%	14.9%	2.1%	14.7%
Statewide	18.0%	27.4%	16.6%	31.5%	0.7%	22.0%

Percent of Sq-Ft Area of Deficient (SD or FO) Structures Systemwide



D.8 – Square Foot Area of Weight Posted Structures Systemwide

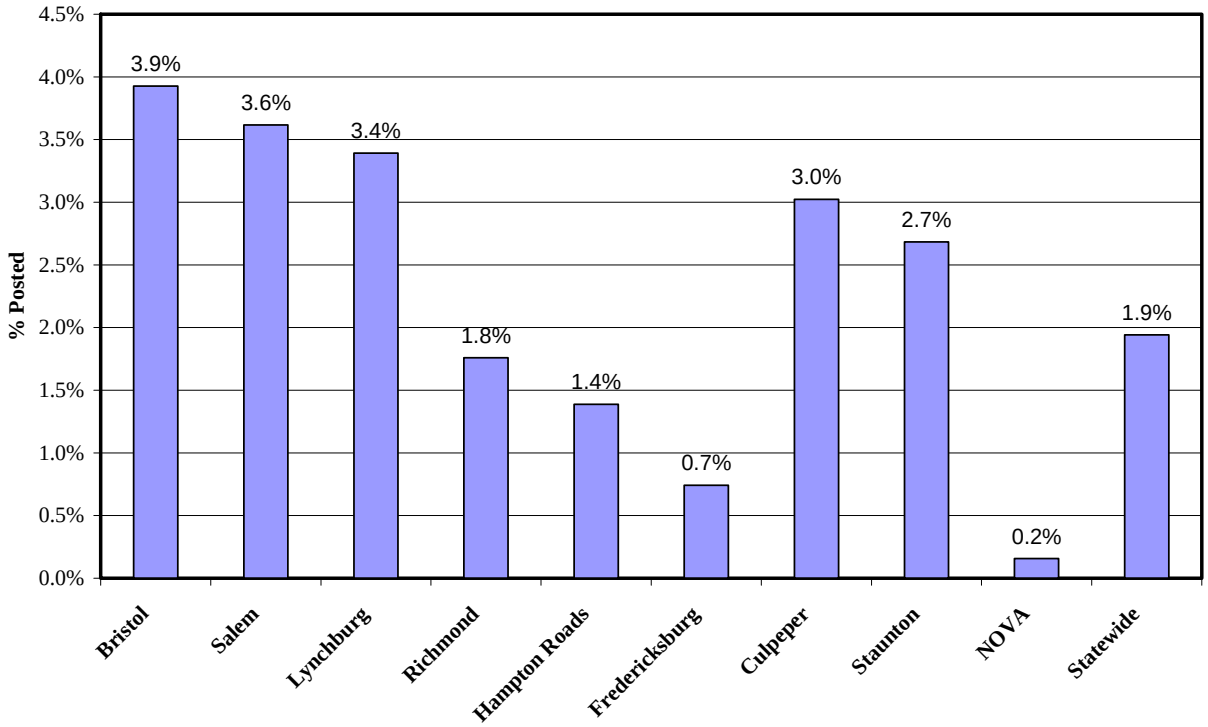
DISTRICT	Sq-Ft Area of Weight Posted Structures					
	Interstate	Primary	Secondary	Urban	Other	Total
Bristol	6,996	86,784	220,740	24,383	0	338,902
Salem	12,811	12,727	269,217	56,058	0	350,813
Lynchburg	0	37,708	208,786	4,444	0	250,937
Richmond	0	190,942	173,630	5,099	0	369,670
Hampton Roads	0	166,647	76,433	158,399	0	401,479
Fredericksburg	0	4,468	28,397	1,472	0	34,337
Culpeper	0	25,721	111,574	5,017	0	142,312
Staunton	0	92,474	141,838	39,122	0	273,434
NOVA	0	6,425	21,150	0	0	27,575
Statewide	**19,807**	**623,897**	**1,251,763**	**293,993**	**0**	**2,189,460**



D.9 – Percent of Square Foot Area of Weight Posted Structures Systemwide

DISTRICT	Percent of Sq-Ft Area of Weight Posted Structures					
	Interstate	Primary	Secondary	Urban	Other	Total
Bristol	0.3%	2.3%	9.1%	6.5%	0.0%	3.9%
Salem	0.6%	0.3%	9.7%	4.8%	0.0%	3.6%
Lynchburg	0.0%	1.0%	8.0%	0.4%	0.0%	3.4%
Richmond	0.0%	3.0%	6.8%	0.3%	0.0%	1.8%
Hampton Roads	0.0%	1.7%	8.9%	2.8%	0.0%	1.4%
Fredericksburg	0.0%	0.2%	3.2%	1.2%	0.0%	0.7%
Culpeper	0.0%	1.5%	7.4%	2.8%	0.0%	3.0%
Staunton	0.0%	3.3%	5.5%	6.0%	0.0%	2.7%
NOVA	0.0%	0.2%	0.4%	0.0%	0.0%	0.2%
Statewide	**0.1%**	**1.6%**	**5.8%**	**2.5%**	**0.0%**	**1.9%**

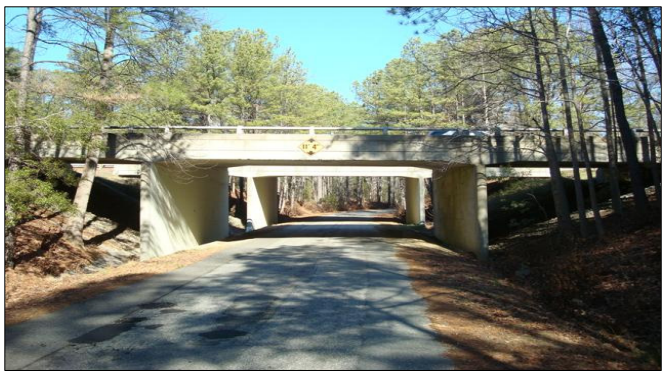
Percent Sq-Ft Area of Weight Posted Structures



Appendix D– Functionally Obsolete Criteria

The following Tables give the type of criteria that causes a structure to be classified as Functionally Obsolete. In addition, sample pictures are provided to help clarify the criteria.

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)