



**Structure and Bridge Division
Status of the Commonwealth's Structures
January 2009**

Commonwealth's Structure Inventory

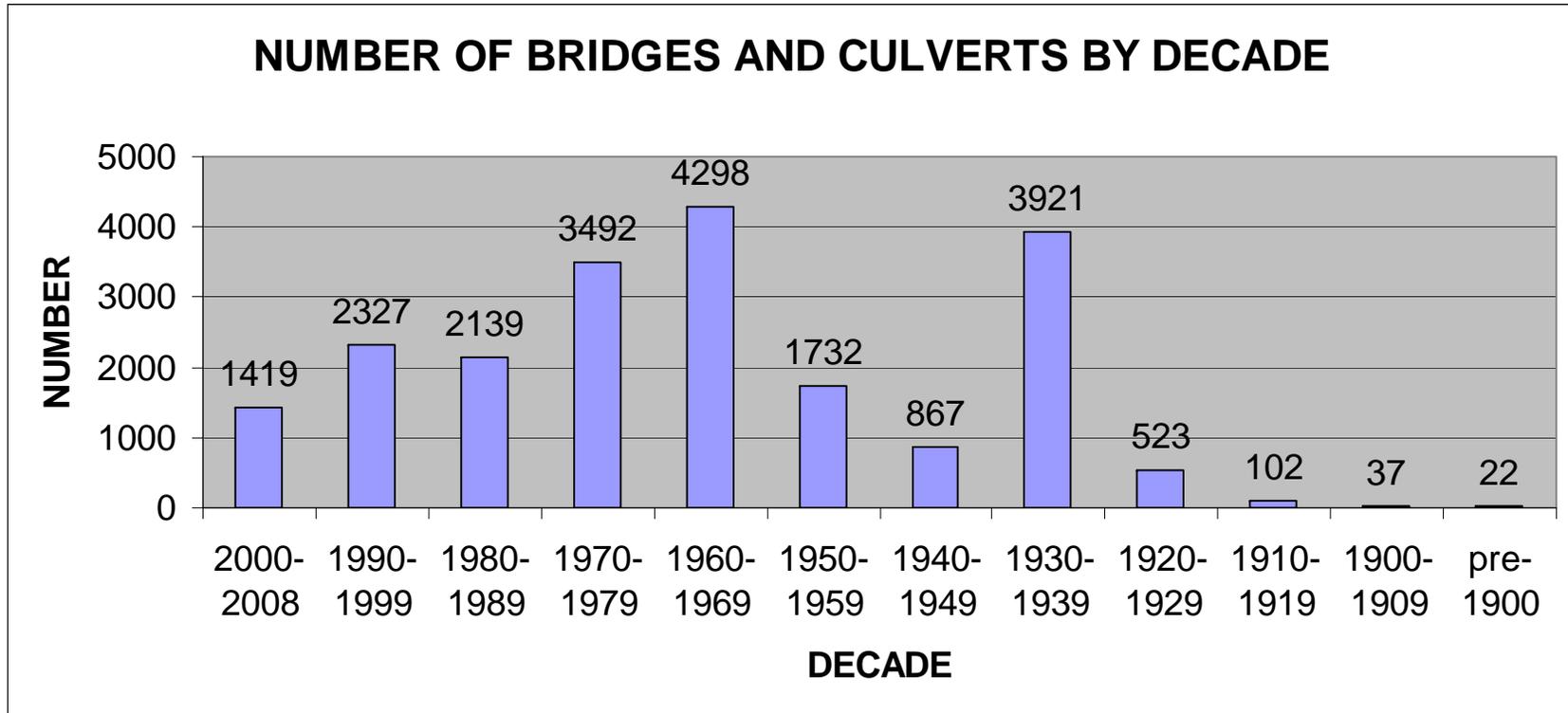
- **VDOT's Structure and Bridge Program is composed on approximately 280 dedicated personnel**
 - **100 personnel are dedicated to the structure inspection program**
- **Bridge and Culvert inventory is 20,879 structures**
- **Ancillary structure inventory is over 29,000 structures**
- **Six (6) tunnel facilities**
- **VDOT provides more than 10,000 inspections annually**
 - **Approximately 12% are conducted by Consultants**
 - **Inspections are conducted a minimum of once every two years**

Commonwealth's Structure Inventory

- NBI = National Bridge Inventory
- FHWA requires the states to provide only NBI data
- VDOT provides FHWA with NBI data in the month of April annually
- NBI structures include bridges and culverts that are more than 20 feet long (measured along the centerline of the road)
- Non-NBI structures include bridges that are equal to or less than 20 feet long and culverts that have an opening ≥ 36 SF

DISTRICT	No. of Structures		
	NBI	Non-NBI	Total
Bristol	1,850	1,427	3,277
Salem	1,802	1,255	3,057
Lynchburg	1,395	736	2,131
Richmond	1,970	675	2,643
Hampton Roads	1,390	314	1,704
Fredericksburg	523	284	807
Culpeper	1,023	669	1,692
Staunton	1,843	1,654	3,497
NOVA	1,372	689	2,071
Total =	13,168	7,711	20,879

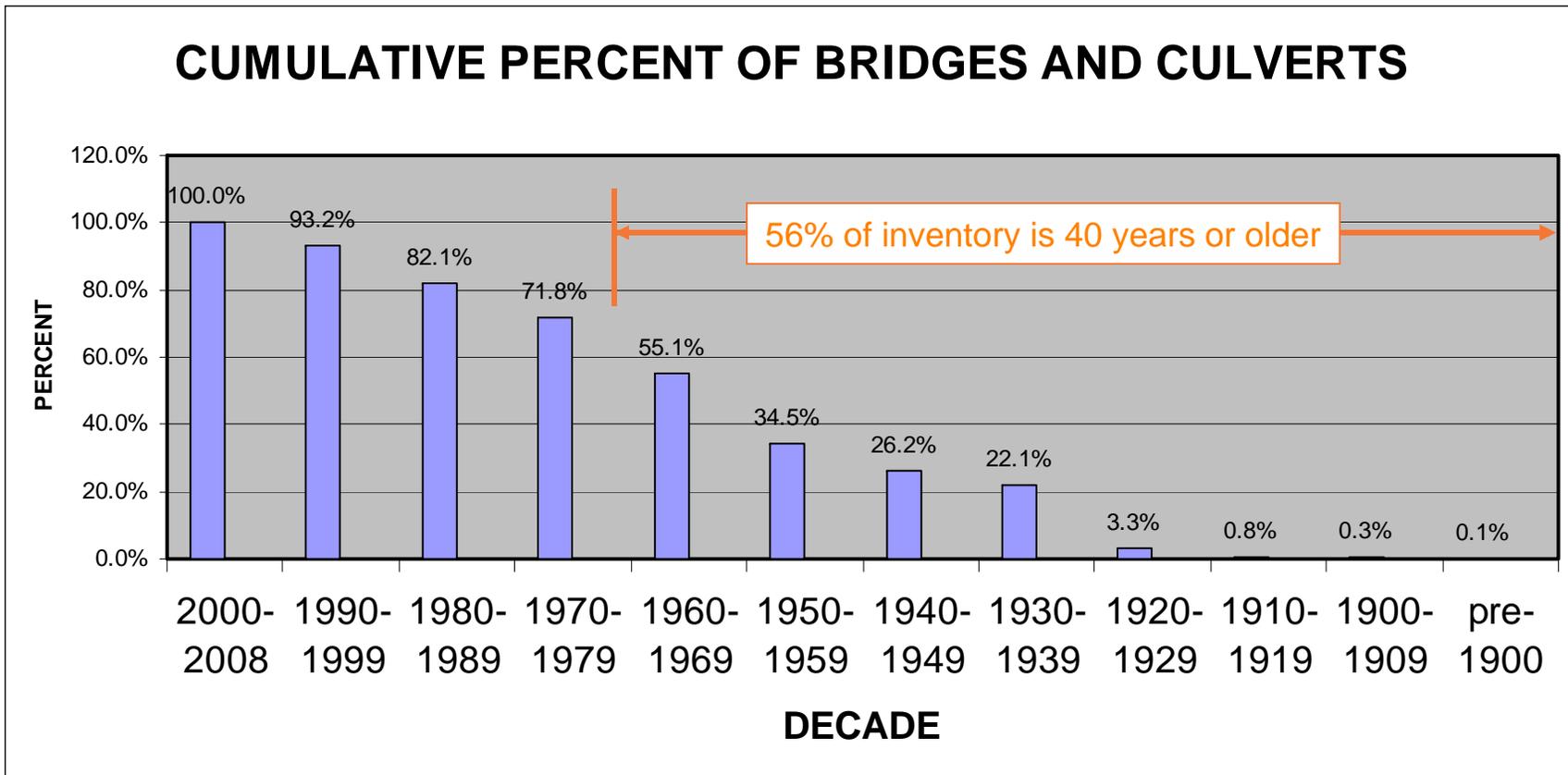
Age of Inventory



Commonwealth's Structure Inventory

Decade	No. of Structures		
	2007	2008	Net Change
2000 - 2007	1,268	1,419	+151
1990-1999	2,325	2,327	+2
1980-1989	2,146	2,139	-7
1970-1979	3,504	3,492	-12
1960-1969	4,315	4,298	-17
1950-1959	1,739	1,732	-7
1940-1949	875	867	-8
1930-1939	3,956	3,921	-25
1920-1929	534	523	-11
1910-1919	102	102	0
1900-1909	38	37	-1
Pre 1900	21	22	+1
Total =	20,823	20,879	+56

Cumulative Percentage of Structures



Bridge Sufficiency Rating Formula

- The **Sufficiency Rating Formula** is a method of evaluating factors that indicate a bridge's sufficiency to remain in service. The result of the formula is a percentage in which 100 percent represents an entirely sufficient bridge and zero percent represents an entirely insufficient or deficient bridge. The sufficiency rating is never less than 0 or more than 100.
- **Federal Bridge Funding**
 - The Importance of the Sufficiency Rating is for determination of Federal Allocations
 - Applies only to NBI Structures (Bridges and Culverts > 20 feet in length)
 - Structure Replacement
 - Structure requires a Sufficiency Rating of less than 50
 - Structure Rehabilitation
 - Structure requires a Sufficiency Rating of less than or equal to 80
 - Ten Year Rule
 - Structures built or reconstructed within the last 10 years are not counted by FHWA as structurally deficient (SD) or functionally obsolete (FO).

Deficient Structures

The Federal Highway Administration (FHWA) identifies a deficient structure as being either structurally deficient (SD) or functionally obsolete (FO).

	Structures in Inventory	Total # of SD	Total # of FO	Total # of SD and FO
NBI	13,168	1,181 (9.0%)	2,196 (16.7%)	3,377 (25.6%)
Non-NBI	7,711	549 (7.1%)	900 (11.7%)	1,449 (19.4%)
Total =	20,879	1,730 (8.3%)	3,096 (14.8%)	4,826 (23.1%)

Structurally Deficient Structures

- **Structurally Deficient** means there are elements of the bridge that need to be monitored and/or repaired.
 - General Condition Rating of the structure is based on a scale of 0 (Failed Condition) to 9 (Excellent Condition)
 - An element (deck, superstructure or substructure) receives a general condition rating of a 4 or less (poor or worse condition)
 - Structural Condition or Waterway Adequacy rated a 2 or less
 - Very low load rating and bridge needs replacement
 - Frequently floods causing traffic delays

Structurally Deficient Structure Example



Superstructure



Deck



Substructure

Functionally Obsolete Structures

- **Functionally Obsolete** means that the bridge was built to standards that are not used today.
- **Examples:**
 - Deck Geometry (Shoulder requirements have increased)
 - Load Carrying Capacity
 - Horizontal and Vertical Clearances
 - Approach Roadway Alignment
 - Waterway Adequacy

Functionally Obsolete Structure Example



Vertical Clearance



Functionally Obsolete Structure Example



Shoulder Widths

- Do not meet current standards

Structural Inventory per VDOT Construction District

Inventory per District				
	Total	SD	FO	Total SD/FO
Bristol	3,277	393	435	828
Salem	3,057	329	631	960
Lynchburg	2,131	201	312	513
Richmond	2,643	207	292	499
Hampton Roads	1,704	67	298	365
Fredericksburg	807	66	79	145
Culpeper	1,692	121	250	371
Staunton	3,497	297	499	796
NOVA	2,071	49	300	349
Total =	20,879	1,730	3,096	4,826



Structural Inventory Yearly Comparison VDOT Construction District

Inventory per District								
DISTRICT	No. of Structures		SD		FO		Total SD/FO	
	2007	2008	2007	2008	2007	2008	2007	2008
Bristol	3,276	3,277	443	393	410	435	853	828
Salem	3,048	3,057	314	329	629	631	943	960
Lynchburg	2,131	2,131	204	201	329	312	533	513
Richmond	2,645	2,643	194	207	296	292	490	499
Hampton Roads	1,711	1,704	64	67	302	298	366	365
Fredericksburg	805	807	67	66	82	79	149	145
Culpeper	1,693	1,692	114	121	252	250	366	371
Staunton	3,481	3,497	305	297	503	499	808	796
NOVA	2,033	2,071	34	49	300	300	334	349
Total =	20,823	20,879	1,739	1,730	3,103	3,096	4,842	4,826

Inventory on National Highway System

DISTRICT	Total Inventory	# on NHS	% of Total	# SD NHS	% of NHS	# FO NHS	% of NHS
Bristol	3,277	487	14.9%	21	4.3%	62	12.7%
Salem	3,057	492	16.1%	15	3.0%	72	14.6%
Lynchburg	2,131	300	14.1%	12	4.0%	42	14.0%
Richmond	2,643	913	34.5%	37	4.1%	52	5.7%
Hampton Roads	1,704	772	45.3%	15	1.9%	130	16.8%
Fredericksburg	807	161	20.0%	5	3.1%	15	9.3%
Culpeper	1,692	284	16.8%	4	1.4%	13	4.6%
Staunton	3,497	506	14.5%	3	0.6%	34	6.7%
NOVA	2,071	786	38.0%	13	1.7%	127	16.2%
Total =	20,879	4,701	22.5%	125	2.7%	547	11.6%

Bridge Inspections

Number of Inspections (July 2007 thru July 2008)

DISTRICT	No. Bridge Inspections	Percent of State	Bridge Area	Percent of State	No. Culvert Inspections	Percent of State	Culvert Area	Percent of State	Total Structures
Bristol	1,425	19%	6,798,993	7%	340	11%	1,747,698	10%	1,765
Salem	1,321	17%	7,868,446	8%	320	10%	1,840,511	11%	1,641
Lynchburg	685	9%	5,852,616	6%	531	17%	1,549,884	9%	1,216
Richmond	962	12%	17,829,632	19%	436	14%	3,027,583	17%	1,398
Hampton Roads	662	9%	27,821,007	29%	240	8%	1,116,000	6%	902
Fredericksburg	213	3%	3,822,936	4%	126	4%	729,639	4%	339
Culpeper	707	9%	3,422,314	4%	288	9%	1,285,609	7%	995
Staunton	1,242	16%	8,013,985	8%	454	15%	2,166,556	12%	1,696
NOVA	485	6%	12,923,499	14%	373	12%	3,911,436	23%	87,558
Total	7,702	100%	94,353,428	100%	3,108	100%	17,374,916	100%	10,810

In Summary

- **VDOT Inspection Practices**

- **VDOT is in full compliance with the National Bridge Inspection Standards (NBIS) criteria**

- Bridges and culverts measuring more than 20 feet (measured along the roadway Centerline) be inventoried and receive routine inspections at a frequency not to exceed 2 years
- Bridges with Fracture Critical Members (FCM) to receive a “close-up” inspections at a frequency not to exceed two (2) years
- Bridges crossing major waterways to receive underwater inspections at a frequency not to exceed five (5) years

- **In addition:**

- All bridges are inventoried and inspected at least once every two years regardless of length
- All culverts having an opening of ≥ 36 SF are inventoried and inspected regularly
- Bridges with Fracture Critical Members (FCM) receive “close up” inspections annually
- Bridges having fatigue prone details receive “close up” inspections

- **Appropriation of Federal Bridge Funds**

- Calculated based on percentage of the total NBI deficient structure deck area compared to the total deck area of all NBI structures

- **Structurally Deficient Structures**

- 8.4% of the total structure inventory (1,730 bridges)
- Holding consistently for the past six years at approximately 9%



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