



**Structure and Bridge Division**  
**Status of the Commonwealth's Structures**  
**September 2007**

# Presentation Outline

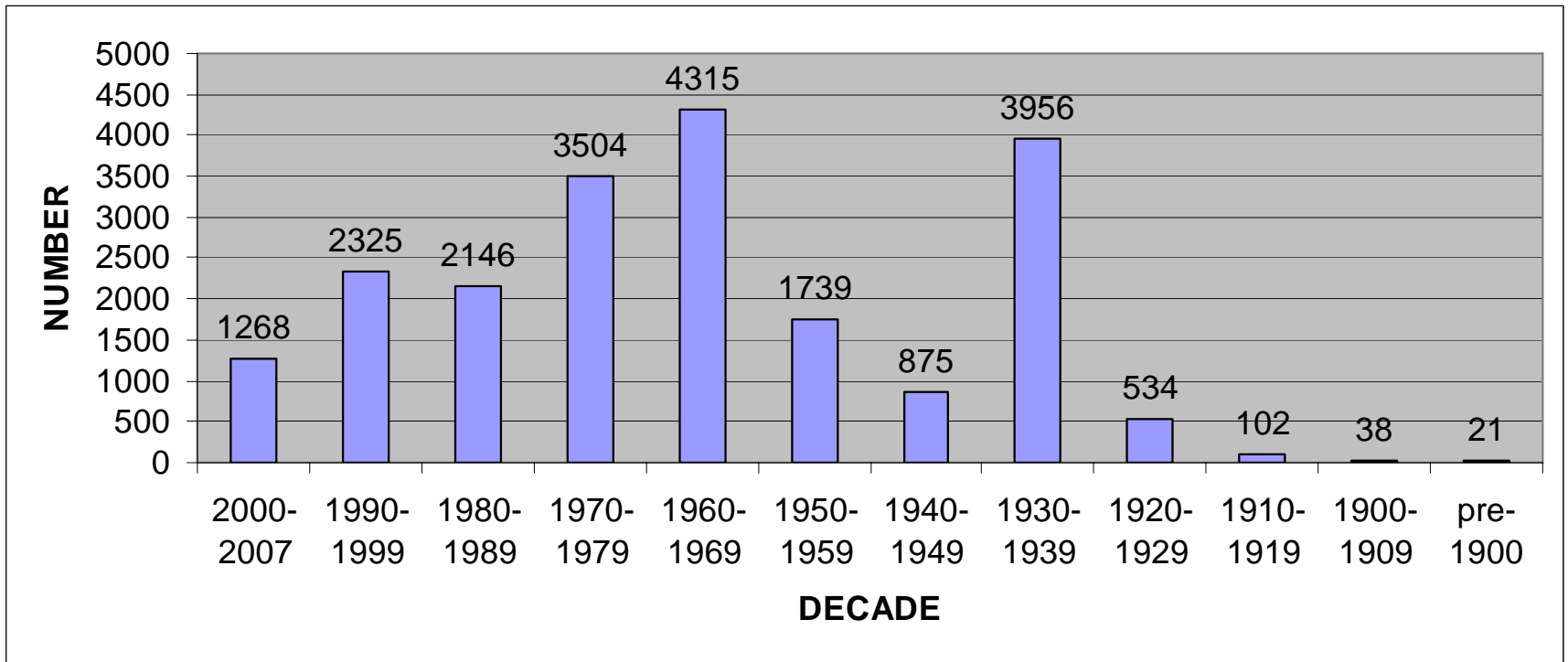
- **Commonwealth's Structure Inventory**
- **Bridge Project Information**
- **VDOT's Inspection Practices**
- **How did VDOT react to I-35W Bridge collapse?**

# Commonwealth's Structure Inventory

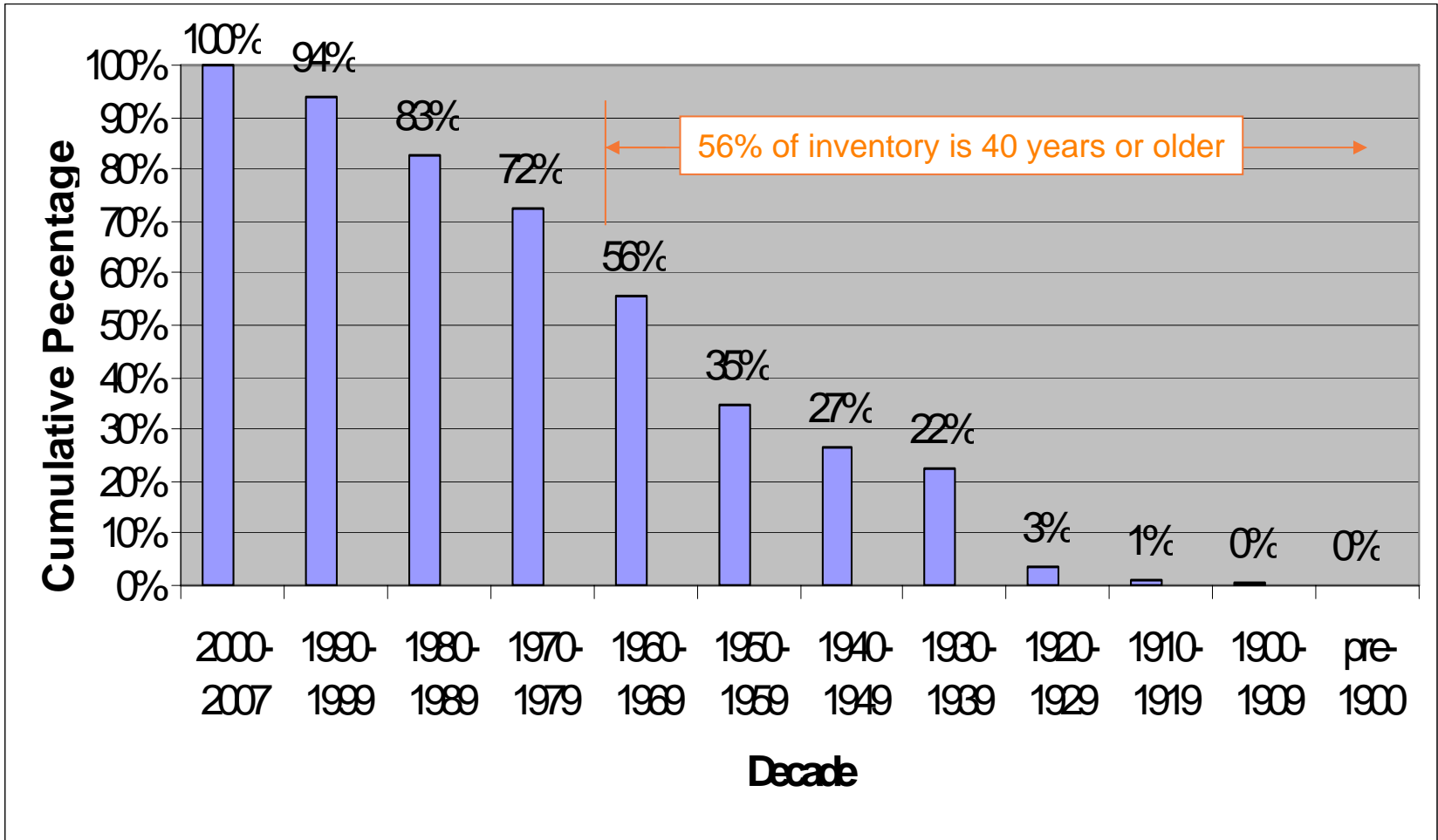
- NBI = National Bridge Inventory
- FHWA requires the states to provide only NBI data
- VDOT provides FHWA with NBI data in the month of April annually
- NBI structures include bridges and culverts that are more than 20 feet long (measured along the centerline of the road)
- Non-NBI structures include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

| DISTRICT       | No. of Structures |              |               |
|----------------|-------------------|--------------|---------------|
|                | NBI               | Non-NBI      | Total         |
| Bristol        | 1,846             | 1,430        | 3,276         |
| Salem          | 1,802             | 1,246        | 3,048         |
| Lynchburg      | 1,392             | 739          | 2,131         |
| Richmond       | 1,964             | 681          | 2,645         |
| Hampton Roads  | 1,390             | 321          | 1,711         |
| Fredericksburg | 519               | 286          | 805           |
| Culpeper       | 1,023             | 670          | 1,693         |
| Staunton       | 1,834             | 1,647        | 3,481         |
| NOVA           | 1,348             | 685          | 2,033         |
| <b>Total =</b> | <b>13,118</b>     | <b>7,705</b> | <b>20,823</b> |

# Age of Inventory



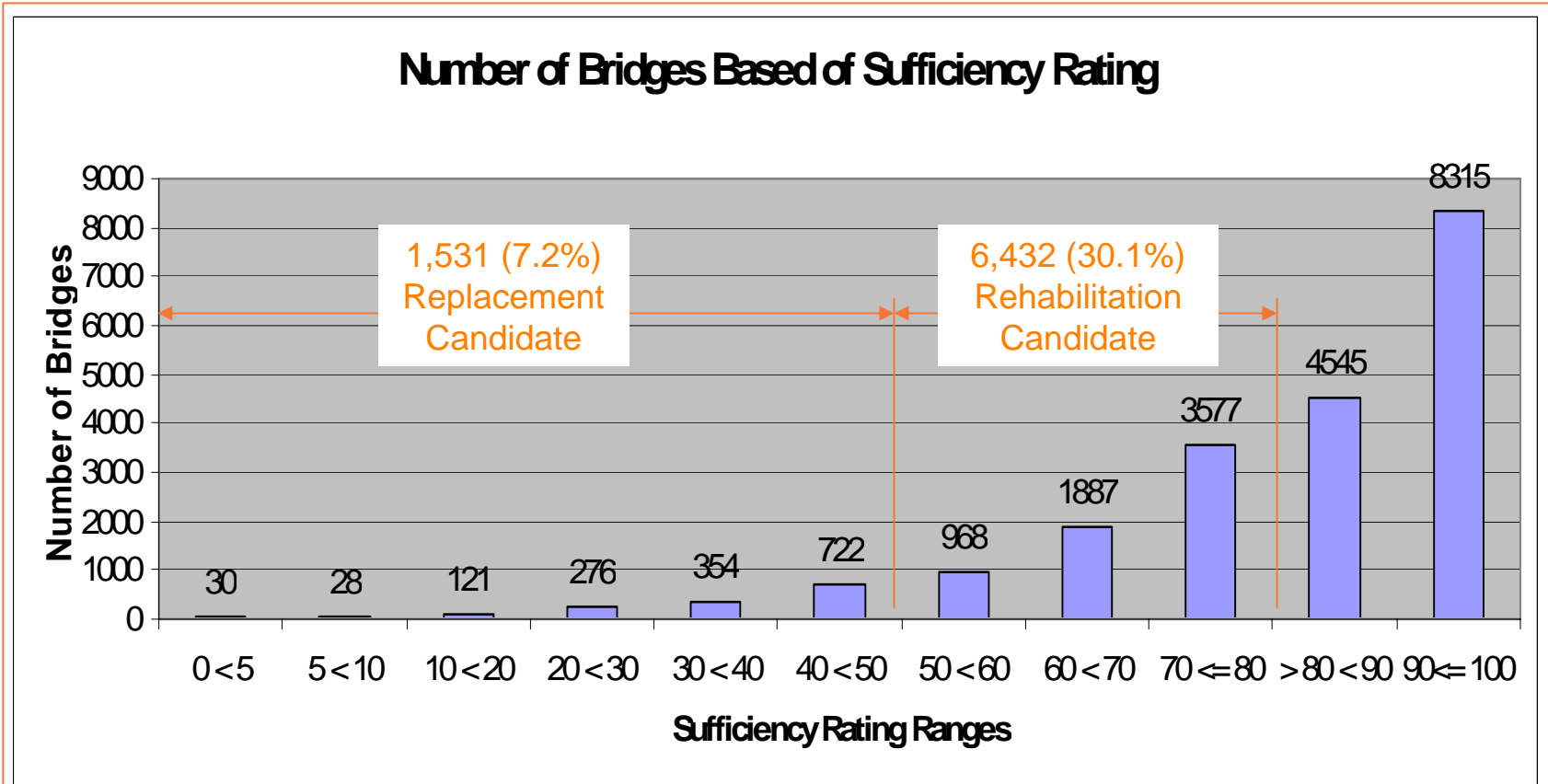
# Cumulative Percentage of Structures



# 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**
  - 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).

# Sufficiency Ratings of Inventory



## FHWA 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 |
|----------------|-------------------------|-----------------|------------------|----------------------|
| <b>NBI</b>     | 13,118                  | 1,197<br>(9%)   | 2,199<br>(17%)   | 3,396<br>(26%)       |
| <b>Non-NBI</b> | 7,705                   | 542<br>(7%)     | 904<br>(12%)     | 1,446<br>(19%)       |
| <b>Total =</b> | 20,823                  | 1,739<br>(8.4%) | 3,103<br>(14.9%) | 4,842<br>(23.3%)     |



## Structurally Deficient Structures

- **Structurally Deficient** means there are elements of the bridge that need to be monitored and/or repaired.
  - 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

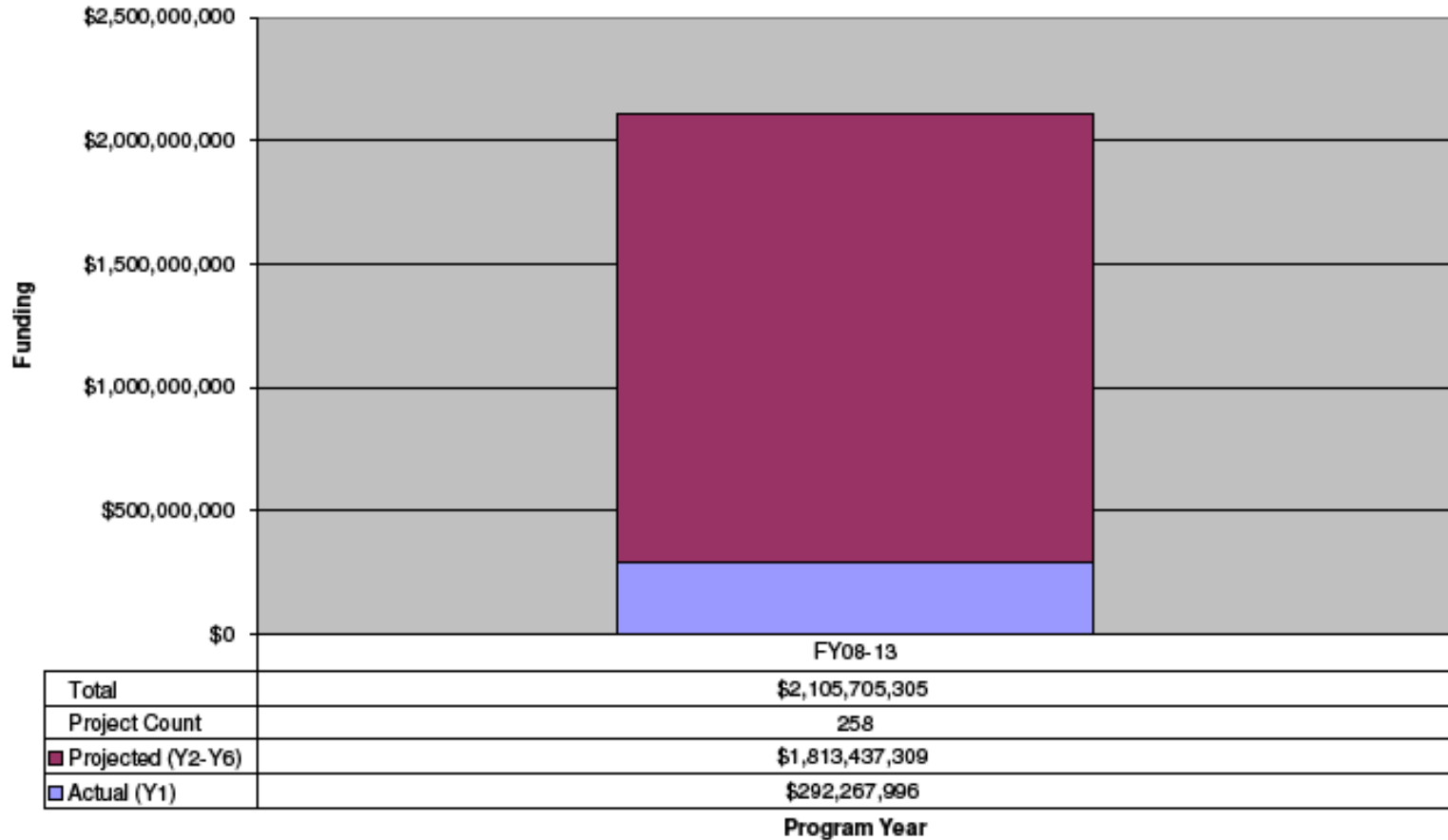
- Do not meet current standards

## Historical S&B Construction Activities

| Structure Construction Activities  | Year Built, Replaced or Rehabilitated |            |            |            |            |            |              |
|------------------------------------|---------------------------------------|------------|------------|------------|------------|------------|--------------|
|                                    | 2001                                  | 2002       | 2003       | 2004       | 2005       | 2006       | Total        |
| New or Replaced Bridges            | 119                                   | 129        | 115        | 97         | 98         | 94         | 652          |
| New or Replaced Culverts           | 78                                    | 69         | 67         | 83         | 81         | 64         | 442          |
| Bridge and Culvert Rehabilitations | 88                                    | 95         | 90         | 83         | 73         | 70         | 499          |
| <b>Total =</b>                     | <b>285</b>                            | <b>293</b> | <b>272</b> | <b>263</b> | <b>252</b> | <b>228</b> | <b>1,593</b> |

# Construction Investment

Six Year Improvement Program (SYIP)  
Projects with Bridges





## Six Year Improvement Program (SYIP) and Secondary Six Year Plans (SSYP) for 2008 - 2013

- 515 bridge projects within the SYIP and SSYPs
- Approximately 555+ bridges
- 228+ Structurally Deficient bridges being addressed by the SYIP and SSYPs
- 72+ Functionally Obsolete bridges being addressed by the SYIP and SSYPs



# Bridge Maintenance Investment

|                                   | <b>FY07 Expenditures</b> | <b>FY08 Planned Expenditures</b> |
|-----------------------------------|--------------------------|----------------------------------|
| <b>Bridge Inspection Program</b>  | <b>\$13.5 Million</b>    | <b>\$15.7 Million</b>            |
| <b>Bridge Maintenance Program</b> | <b>\$78.2 Million</b>    | <b>\$131.4 Million</b>           |

# Inspection Practices

- **NBIS = National Bridge Inspection Standards**
  - The Code of Federal Regulations mandate the inventory and inspection of structures and the annual reporting of data to FHWA in accordance with the National Bridge Inspections Standards (NBIS)
  - **NBIS Requirements:**
    - 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
  - **VDOT Practices:**
    - VDOT is in full compliance with the NBIS criteria
    - In addition:
      - All bridges are inventoried and inspected regularly regardless of length
      - All culverts having an opening of  $\geq 36$  SF are inventoried and inspected regularly
      - Bridges with FCM receive “close up” inspections annually
      - Bridges having fatigue prone details receive “close up” inspections

# Inspection Practices

- **District Organization:**
  - Districts are responsible for the inventory and inspections of structures within their district
  - Districts have a dedicated safety bridge inspection engineer that oversees the district wide inspection program
  - Districts have dedicated bridge safety inspection teams
  - 100+ S&B personnel dedicated to the bridge safety inspection program
  - Professional engineers or NBIS certified engineers and technicians perform inspections
- **Central Office:**
  - Dedicated safety inspection section (underwater inspection, QA/QC, inventory)
  - Three (3) regional consultant inspection contracts (12% outsourced)
  - Conducts the statewide underwater inspection program
- **Inspection Program:**
  - 10,377 bridges and culverts were inspected within the last year (8/06-8/07)
- **Quality Assurance:**
  - Central Office conducts an annual QA/QC review of three (3) district bridge safety inspection programs
  - FHWA conducts an annual review of the statewide inspection program
  - FHWA conducts a QA/QC review of one district per year

# How has VDOT reacted to I-35W Bridge collapse?

- **Identified all bridges with similar deck truss construction**
  - Total of twelve (12) bridges were identified
  - One (1) bridge is maintained by the Richmond Metropolitan Authority
  - Eleven (11) bridges are maintained by VDOT
  - One (1) bridge has been recently replaced
  - One (1) bridge is being replaced under an active construction contract
  - One (1) bridge is going to advertisement in October 2007
- **FHWA and VDOT reviewed the latest inspection reports of the eleven (11) bridges**
  - Nothing out of the ordinary was discovered during the review
  - All bridges were inspected within the last two (2) years
  - Some were inspected as recently as May 2007
- **Assigned the inspections of all bridges to the three (3) engineering consulting firms**
  - Ensured a different firm performed the inspection since the last inspection
- **The field inspection status:**
  - Five (5) bridge inspections have been completed
  - Four (4) bridges are currently being inspected
  - Two (2) bridges will be inspected in September
  - All inspections reports are due to VDOT by October 2007

# Commonwealth Deck Truss Bridges

## Steel Deck Truss Inspection Schedule

Sept. 17, 2007

| District       | County/City      | Route | Bridge Name                 | Crossing                   | Fed<br>Struc.<br>ID | VA<br>Struc.<br>No. | Inspect By            | Begin Inspection Date                               | Update as of 9/17/07                     |
|----------------|------------------|-------|-----------------------------|----------------------------|---------------------|---------------------|-----------------------|---|--|
| Salem          | Bedford          | 666   |                             | Elk Creek                  | 2781                | 6087                | Clark Nexsen          | Week of 08/13/2007                                  | Completed Field Inspections              |
| Salem          | Botetourt        | 817   |                             | Craig Creek                | 3534                | 6100                | Clark Nexsen          | September, 2007 - Pending completion of repair work | Completed Field Inspections              |
| Salem          | Botetourt        | 685   |                             | Craig Creek                | 3496                | 6386                | Clark Nexsen          | Week of 09/04/2007                                  | Completed Field Inspections              |
| Salem          | Patrick          | 772   |                             | Spoon Creek                | 13399               | 6153                | Schwartz & Associates | September, 2007 - Pending completion of repair work | Completed Field Inspections              |
| Richmond       | City of Richmond | 95    |                             | JAMES RV, RTE 360(60)&CSX  | 21494               | 2835                | Schwartz & Associates | Week of 08/20/2007 - Week of 09/3/2007              | Completed Field Inspections              |
| Richmond       | City of Richmond | 161   | Boulevard (Nickel) Bridge   | JAMES RV, SOU RWY, CSXT RR | 21528               | 1826                | TRC                   | Week of 08/27/2007 - Week of 09/17/2007             | Inspection in progress - started on 8/27 |
| Hampton Roads  | York             | 17    | George P. Coleman Bridge    | YORK RIVER & SR 238        | 19824               | 1946                | Clark Nexsen          | Week of 08/20/2007 - Week of 09/10/2007             | Completed Field Inspections              |
| Fredericksburg | Middlesex        | 3     | Robert O. Norris Jr. Bridge | RAPPAHANNOCK RIVER         | 12083               | 1959                | TRC                   | Week of 08/20/2007                                  | Completed Field Inspections              |
| Staunton       | Page             | 340   |                             | JEREMIAHS RUN              | 13066               | 1004                | Schwartz & Associates | 08/18 - 19/2007                                     | Completed Field Inspections              |
| Staunton       | Page             | 340   |                             | OVERALL RUN                | 13087               | 1990                | Schwartz & Associates | 08/17 - 18/2007                                     | Completed Field Inspections              |
| Staunton       | Warren           | 522   |                             | S F SHENANDOAH RV & N&W    | 20272               | 1901                | Schwartz & Associates | 08/15 - 19/2007                                     | Completed Field Inspections              |

## How has VDOT reacted to I-35W Bridge collapse?

- **Added a link to VDOT's website (<http://www.virginiadot.org/info/bridge.asp>)**
  - Letters from the Commissioner and other leaders
  - A comprehensive list containing information on all of the 20,823 structures broken down by district
  - Common bridge related definitions and explanations
  - Video clips
  - Web links to other useful sites
- **Responded to extensive requests from the media and the general public**
- **In the process of amending our Road & Bridge Specifications to address FHWA Technical Advisory regarding construction loads on bridges**
- **Restricted the disclosure of inspection reports in response to a national advisory from the Homeland Security Office**

## How has VDOT reacted to I-35W Bridge collapse?

- **Identified all Fracture Critical Member (FCM) bridges and is in the process of reviewing all inspection reports (305 total)**
- **Planning to re-inspect some FCM bridges for QA measures...focusing on those districts that did not have deck truss bridges**
- **Central Office safety and inspection personnel will conduct a special review of the districts inspection program with emphasis on bridges with FCM and fatigue prone details**



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