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 ≥36 SF

<table>
<thead>
<tr>
<th>DISTRICT</th>
<th>NBI</th>
<th>Non-NBI</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bristol</td>
<td>1,846</td>
<td>1,430</td>
<td>3,276</td>
</tr>
<tr>
<td>Salem</td>
<td>1,802</td>
<td>1,246</td>
<td>3,048</td>
</tr>
<tr>
<td>Lynchburg</td>
<td>1,392</td>
<td>739</td>
<td>2,131</td>
</tr>
<tr>
<td>Richmond</td>
<td>1,964</td>
<td>681</td>
<td>2,645</td>
</tr>
<tr>
<td>Hampton Roads</td>
<td>1,390</td>
<td>321</td>
<td>1,711</td>
</tr>
<tr>
<td>Fredericksburg</td>
<td>519</td>
<td>286</td>
<td>805</td>
</tr>
<tr>
<td>Culpeper</td>
<td>1,023</td>
<td>670</td>
<td>1,693</td>
</tr>
<tr>
<td>Staunton</td>
<td>1,834</td>
<td>1,647</td>
<td>3,481</td>
</tr>
<tr>
<td>NOVA</td>
<td>1,348</td>
<td>685</td>
<td>2,033</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>13,118</td>
<td>7,705</td>
<td>20,823</td>
</tr>
</tbody>
</table>
Age of Inventory

Cumulative Percentage of Structures

56% of inventory is 40 years or older.
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

Number of Bridges Based on Sufficiency Rating

- **1,531 (7.2%)** Replacement Candidate
- **6,432 (30.1%)** Rehabilitation Candidate
The Federal Highway Administration (FHWA) identifies a deficient structure as being either structurally deficient (SD) or functionally obsolete (FO).

<table>
<thead>
<tr>
<th></th>
<th>Structures in Inventory</th>
<th>Total # of SD</th>
<th>Total # of FO</th>
<th>Total # of SD and FO</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NBI</strong></td>
<td>13,118</td>
<td>1,197 (9%)</td>
<td>2,199 (17%)</td>
<td>3,396 (26%)</td>
</tr>
<tr>
<td><strong>Non-NBI</strong></td>
<td>7,705</td>
<td>542 (7%)</td>
<td>904 (12%)</td>
<td>1,446 (19%)</td>
</tr>
<tr>
<td><strong>Total =</strong></td>
<td>20,823</td>
<td>1,739 (8.4%)</td>
<td>3,103 (14.9%)</td>
<td>4,842 (23.3%)</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Structure Construction Activities</th>
<th>Year Built, Replaced or Rehabilitated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2001</td>
</tr>
<tr>
<td>New or Replaced Bridges</td>
<td>119</td>
</tr>
<tr>
<td>New or Replaced Culverts</td>
<td>78</td>
</tr>
<tr>
<td>Bridge and Culvert Rehabilitations</td>
<td>88</td>
</tr>
<tr>
<td>Total =</td>
<td>285</td>
</tr>
</tbody>
</table>
Construction Investment

Six Year Improvement Program (SYIP)
Projects with Bridges

<table>
<thead>
<tr>
<th>Funding</th>
<th>Total</th>
<th>Project Count</th>
<th>Projected (Y2-Y6)</th>
<th>Actual (Y1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$2,500,000,000</td>
<td>$2,105,705,305</td>
<td>258</td>
<td>$1,813,437,309</td>
<td>$292,267,996</td>
</tr>
<tr>
<td>$2,000,000,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$1,500,000,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$1,000,000,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$500,000,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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</table>

FY08-13
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

<table>
<thead>
<tr>
<th></th>
<th>FY07 Expenditures</th>
<th>FY08 Planned Expenditures</th>
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</thead>
<tbody>
<tr>
<td>Bridge Inspection Program</td>
<td>$13.5 Million</td>
<td>$15.7 Million</td>
</tr>
<tr>
<td>Bridge Maintenance Program</td>
<td>$78.2 Million</td>
<td>$131.4 Million</td>
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</table>
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 ≥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

<table>
<thead>
<tr>
<th>District</th>
<th>County/City</th>
<th>Route</th>
<th>Bridge Name</th>
<th>Crossing</th>
<th>Fed Struc. ID</th>
<th>VA Struc. No.</th>
<th>Inspect By</th>
<th>Begin Inspection Date</th>
<th>Update as of 9/17/07</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salem</td>
<td>Bedford</td>
<td>666</td>
<td>Elk Creek</td>
<td></td>
<td>2781</td>
<td>6087</td>
<td>Clark Nexsen</td>
<td>Week of 08/13/2007</td>
<td>Completed Field Inspections</td>
</tr>
<tr>
<td>Salem</td>
<td>Botetourt</td>
<td>817</td>
<td>Craig Creek</td>
<td></td>
<td>3534</td>
<td>6100</td>
<td>Clark Nexsen</td>
<td>September, 2007 - Pending completion of repair work</td>
<td>Completed Field Inspections</td>
</tr>
<tr>
<td>Salem</td>
<td>Botetourt</td>
<td>685</td>
<td>Craig Creek</td>
<td></td>
<td>3496</td>
<td>6386</td>
<td>Clark Nexsen</td>
<td>Week of 09/04/2007</td>
<td>Completed Field Inspections</td>
</tr>
<tr>
<td>Salem</td>
<td>Patrick</td>
<td>772</td>
<td>Spoon Creek</td>
<td></td>
<td>13399</td>
<td>6153</td>
<td>Schwartz &amp; Associates</td>
<td>September, 2007 - Pending completion of repair work</td>
<td>Completed Field Inspections</td>
</tr>
<tr>
<td>Richmond</td>
<td>City of Richmond</td>
<td>95</td>
<td>JAMES RV, RTE 360(60)&amp;CSX</td>
<td></td>
<td>21494</td>
<td>2835</td>
<td>Schwartz &amp; Associates</td>
<td>Week of 08/20/2007 - Week of 09/3/2007</td>
<td>Completed Field Inspections</td>
</tr>
<tr>
<td>Richmond</td>
<td>City of Richmond</td>
<td>161</td>
<td>Boulevard (Nickel) Bridge</td>
<td>JAMES RV, SOU RWAY, CSXT RR</td>
<td>21528</td>
<td>1826</td>
<td>TRC</td>
<td>Week of 08/27/2007 - Week of 09/17/2007</td>
<td>Inspection in progress - started on 8/27</td>
</tr>
<tr>
<td>Hampton Roads</td>
<td>York</td>
<td>17</td>
<td>George P. Coleman Bridge</td>
<td>YORK RIVER &amp; SR 238</td>
<td>19824</td>
<td>1946</td>
<td>Clark Nexsen</td>
<td>Week of 08/20/2007 - Week of 09/10/2007</td>
<td>Completed Field Inspections</td>
</tr>
<tr>
<td>Fredericksburg</td>
<td>Middlesex</td>
<td>3</td>
<td>Robert O. Norris Jr. Bridge</td>
<td>RAPPANNOCK RIVER</td>
<td>12083</td>
<td>1959</td>
<td>TRC</td>
<td>Week of 08/20/2007</td>
<td>Completed Field Inspections</td>
</tr>
<tr>
<td>Staunton</td>
<td>Page</td>
<td>340</td>
<td>JEREMIAHS RUN</td>
<td></td>
<td>13066</td>
<td>1004</td>
<td>Schwartz &amp; Associates</td>
<td>08/18 - 19/2007</td>
<td>Completed Field Inspections</td>
</tr>
<tr>
<td>Staunton</td>
<td>Page</td>
<td>340</td>
<td>OVERALL RUN</td>
<td></td>
<td>13087</td>
<td>1900</td>
<td>Schwartz &amp; Associates</td>
<td>08/17 - 18/2007</td>
<td>Completed Field Inspections</td>
</tr>
</tbody>
</table>
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