Presentation Outline

- About VDOT
- VDOT’s Bridge Management Program
- Preservation Technologies
VDOT maintains the 3rd largest state-owned road system in the U.S.

- 57,867 miles of state maintained roadway system
- 20,914 Structures (Bridges and Large Culverts)
  - 19,380 (93%) Maintained by VDOT
  - 1,534 (7%) Maintained by Localities
- 4 Underwater Crossings
- 2 Mountain Tunnels
- 3 Toll Roads
- 1 Toll Bridge
- 4 Ferry Services
- 41 Rest Areas
- 107 Commuter Parking Lots
The current FY2010 budget is $3.38 billion

- $1.63 billion – Maintenance (includes city and county street payments)
- $669 million – Construction
- $459 million – Support to other agencies, tolls, administration, and other programs
- $362 million – Special financing and earmarks
- $257 million – Debit service
About VDOT

➢ 9 Districts and one Central Office
  ❖ Districts - are divided into 42 Residencies, each is responsible for 1 to 4 counties.
  ❖ Central Office - in Richmond is headquarters to approximately 30 operational and administrative units
  ❖ Employees - 10,380 in 2001; 8500 in 2007; 7,500 in 2010
    - Approx. 450 Staff members are dedicated to the bridge program Statewide
Presentation Outline

- About VDOT

VDOT’s Bridge Management Program

- Preservation Technologies
VDOT’s Bridge Management Program

- **Bridge Management Goals:**
  - Manage VDOT’s structures using a life-cycle approach
  - Identify and prioritize statewide needs
  - Provide adequate processes to plan, budget, implement, and monitor work efforts
VDOT’s Bridge Management Program

VDOT’s Past Approach:
- Maintenance budget historically based:
- Annual percentage increase

What is VDOT Doing Differently?
- Asset Management approach
- Transition to performance based budgeting
- Establishment of a dedicated bridge fund
VDOT’s Bridge Management Program

▷ Primary Performance Measure
  ❖ No more than 8% of all bridges are structurally deficient (SD)

▷ Secondary Performance Measures
  ❖ No more than 3% of Interstate bridges are SD
  ❖ No more than 6% of Primary System bridges are SD
  ❖ No more than 11% of Secondary System bridges are SD
VDOT’s Bridge Management Program

- Performance measure is tracked on the dashboard
- VDOT’s goal is to have no more than 8% of Virginia bridges and culverts to be rated as structurally deficient

<table>
<thead>
<tr>
<th>Bridge Condition</th>
<th>Target 92% (Non-Red)</th>
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<tbody>
<tr>
<td>R</td>
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<td>3110</td>
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<td>G</td>
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Green and Yellow Percent: 91.5%
VDOT’s Bridge Management Program

Condition

Pavement Condition
Target 82%

Bridge Condition
Target 92% Non-Red (Non-SD)
- R 1777
- Y 3223
- G 15875

Ride Quality
Target 85%

Bridges and Structures (All Conditions)

Detail | Charts / Trends

Deficient | All
NBI | All
Route | All
Condition Rating | All
Bridge/Culvert | All
Report Date | [Current]
Open/Posted | All
Rating Method | Structurally Deficient

Include Non-VDOT Maintained | ✓
VDOT’s Bridge Management Program

<table>
<thead>
<tr>
<th>Bridge</th>
<th>District</th>
<th>Jurisdiction</th>
<th>Responsibility</th>
<th>Feature Intersected</th>
<th>Route</th>
<th>GCR</th>
<th>Condition</th>
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This data reflects the selections made with the drop-down lists, filters, and radio buttons. The Red – Yellow – Green condition is based on the Structurally Deficient / Functionally Obsolete rating method where SD = Red; FO = Yellow; non-Deficient = Green. This rating method matches the one that is used to determine the R/Y/G “lights” at the top of the page.

Disclaimer: Bridge conditions refer to maintenance conditions, and are not safety related.

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VDOT’s Bridge Management Program

This data reflects the selections made with the drop-down lists, filters, and radio buttons. This chart refers to the General Condition Rating (GCR), which is different from the default view seen on the rest of the Bridge measure. For each structure, a rating from zero through nine is assigned to each of the deck, substructure, and superstructure. The minimum of the three ratings becomes the General Condition Rating for the structure. For a culvert, only one overall rating is assigned. The rules for GCR are: Red = 0 – 4, Yellow = 5 and Green = 6 – 9. This will not match the R/Y/G “lights” at the top of the page.
VDOT’s Bridge Management Program

This chart shows the average Health Index for whatever set of structures are selected using the filters, drop-down lists, and radio buttons. Individual Districts may be viewed by using the District filter (above the “gauges”).

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VDOT’s Bridge Management Program

This data reflects the selections made with the drop-down lists and radio buttons. Structurally Deficient = Red; Functionally Obsolete = Yellow; non-Deficient = Green. This rating method matches the one that is used to determine the R/Y/G “lights” at the top of the page.

Disclaimer: Bridge conditions refer to maintenance conditions, and are not safety related.
### VDOT’s Bridge Management Program

<table>
<thead>
<tr>
<th>District</th>
<th>Previous Year Total</th>
<th>Current Year Total</th>
<th>Change (%)</th>
<th>Restored</th>
<th>Deteriorated</th>
<th>Change</th>
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### Graphs

- **Change in Deficient Structures**
  - Bristol: 0
  - Culpeper: 9
  - Fredericksburg: 0
  - Hampton Roads: 1
  - Lynchburg: 9
  - Northern Virginia: 1
  - Richmond: 0
  - Salem: -2
  - Staunton: 0

- **Deficient Structures**
  - Bristol: 4
  - Culpeper: 8
  - Fredericksburg: 4
  - Hampton Roads: 2
  - Lynchburg: 10
  - Northern Virginia: 1
  - Richmond: 14
  - Salem: 6
  - Staunton: 6
VDOT’s Bridge Management Program
VDOT’s Bridge Management Program

- Bridge Management Needs:
  - **Maintenance & Preservation**
    - Ordinary and Preventive Maintenance
    - Planned Preventive Maintenance
    - Restorative Maintenance
    - Major Rehabilitation
  - **Replacement**
VDOT’s Bridge Management Program

- Needs are identified and prioritized through BMS
- VDOT uses the AASHTO software Pontis for bridge management
- VDOT has customized the software to meet agency specific needs
  - Customization included bridge element specifications; cost models, deterioration trends, feasible actions, business roles, etc.
- Inventory, condition, and prioritized needs are generated from BMS for use at both network and local levels.
VDOT’s Bridge Management Program

- Funds are allocated and work is prioritized and programmed in accordance with federal standards, state policies, and best practices.

- Work is programmed and accomplished by:
  - In-house staff
  - Outsourcing

- Six-Year Improvement Plan is used to direct resources.
VDOT’s Bridge Management Program

**Bridge Management Process**

- **General Condition Ratings (GCR) (0-9)**
  - GCR 9.7: Prev. Maint. (PM)
  - GCR 6: PM, Ordinary Minor Repair
  - GCR 5: PM, Ordinary, Major Repair, Rehab.
  - GCR 4: PM, Ordinary, Major Repair, Rehab., Replace

- **Deficient Status (Structurally Deficient or Functionally Obsolete)**
  - Def.: No → PM & Ordinary Maintenance
  - Def.: Yes → PM, Ordinary Maint. or Replace

- ** Sufficiency Rating (0-100%)**
  - SR 0-50%: Candidate for Replace
  - SR 50-80%: Candidate for Maint/ Rehab
  - SR 80-100%: PM & Ordinary

- **Structure Maintenance Plan**
  - Ordinary & Preventative Maintenance
  - Restorative
  - Major Repairs and Rehabilitation

- **Prioritization**

- **Structure Replacement Plan**

- **PONTIS Maintenance Recommendations based on Cost/Benefit**
Various types of contracts and consulting engineering services are used to complement the in-house resources.

- **TAMS** – Routine maintenance on Interstate System
- **SAAP** - Special Advertised and Awarded Contracts
- **RAAP** – Regular Advertised and Awarded Contracts
- **M&R** – District wide Maintenance & Repair contracts
VDOT’s Bridge Management Program

Funding Bridge Needs

- Central Office performs statewide needs assessments and allocates maintenance funds to the districts annually.

- The Districts identify and prioritize maintenance work within their respective districts.

- Each District bridge section develops maintenance plan based on allocated funds and available resources.

- The District maintenance budget is comprised of the following categories:
  - Preventive /Ordinary Maintenance
  - Restorations
  - Major Rehabilitation
  - Bridge Replacement… typically funded by construction funds
VDOT’s Bridge Management Program

Dedicated Bridge Replacement Fund

- Program established in 2003 dedicated to replacing bridges
- Available funds are allocated to each district based on deficient square foot area
- The funds are dedicated to the state primary and secondary systems
- A ranking scoring system is utilized for statewide prioritization (SR, ADT, Detour, GCR, Posting, etc)
VDOT’s Bridge Management Program

Challenges:

- Aging infrastructure
  - 56% of VDOT’s bridge inventory is 40 years or older
- 20% of the inventory is at risk of becoming SD
- Shortfall in State and Federal revenues
- Estimated $1.9 billion in maintenance and rehabilitation needs
- Estimated $4.2 billion in replacement needs
- Approximately 3.5 billion reduction in the six-year plan
Presentation Outline

- About VDOT
- VDOT’s Bridge Management Program
- Preservation Technologies
Preservation Technologies

- Epoxy overlays
- Gravity fill polymer crack sealing
- Corrosion resistant reinforcement
- Light weight and Self consolidating concrete
- Cathodic protection
- Chloride extraction
Epoxy Overlays

2 layers of epoxy and broadcasted aggregate placed on a dry, shot blasted surface.

Test patches done to verify materials, surface preparation, and mixing and placing of materials are acceptable.

Overlay is 0.25 in thick.

Economical alternative to concrete overlays for extending the life of decks in good condition.
Preservation Technologies

- **Sealing Cracks with Gravity Fill Polymers**
  - High molecular weight methacrylate
  - Epoxy
  - Urethane
Corrosion Resistant Reinforcement (CRR)

- High Performance Concrete can last more than 100 years
- CRR must be used to achieve a 100 year + service life
- VDOT is discontinuing the use of Epoxy coated and galvanized bars
- VDOT will use the following three types of CRR:
  - Solid Stainless Steel
  - Stainless steel clad
  - Low Carbon/Chromium steel
Corrosion of Epoxy Coated Reinforcement at construction joint. The green coating has turned brown and the bars have sheared after 17 years.
Preservation Technologies

Cathodic Prevention

- Mitigates the Initiation of New Corrosion
- Probe anodes used to mitigate ring or halo-effect
- Projected life is approximately 10 years

Anodes Embedded and Shotcrete Repair Complete
Preservation Technologies

- **Cathodic Protection**
  - Mitigates Ongoing Corrosion
  - Various anode types used to mitigate corrosion mainly in piles and columns
  - Wide range of life expectancy, which is dependent on many factors such as anode type and severity of exposure
    - Projected life exceeds 10 years
Example of Cathodic Protection: Galvanic Jacket

- Zinc Corrodes instead of adjacent steel
- Eliminates the need for rectifier
- Galvanic anode can be used for cathodic prevention or protection
Electrochemical Chloride Extraction

- In-situ corrosion mitigation technique
- A direct current (DC) is used to remove chlorides and increase the alkalinity adjacent to the reinforcing steel
- Long-term maintenance of DC equipment not required since it is a temporary treatment techniques
- Can be applied to either deck or substructural elements
- Projected life has not been clearly determined
Preservation Technologies

Example of Electrochemical Chloride Extraction Treatment on Deck
Preservation Technologies

Example of Electrochemical Chloride Extraction Treatment on Substructure
Preservation Technologies

- Self-Consolidating Concrete - SCC
Preservation Technologies

Benefits of SCC

- No consolidation concerns
- Faster construction
- Less labor required
- Smoother surface finish
Preservation Technologies

- **Lightweight HPC - LWHPC**
  - High durability
  - High strength
    - 8,000 psi in Beams
    - 5,000 psi in Decks
  - Reduced dead load
  - Enabling:
    - Longer spans
    - Fewer beams
    - Fewer piers
    - Fewer cracks in decks
    - Extended service life
SEBPP Workshop - Orlando, Florida
VDOT Bridge Management Practices
Anwar S. Ahmad, P.E.
Assistant State Bridge Engineer
April 28, 2010