REPORT OF THE
VIRGINIA DEPARTMENT OF TRANSPORTATION

Asset Management Methodology and Asset Management Systematic Mechanisms

TO THE GOVERNOR AND
THE GENERAL ASSEMBLY OF VIRGINIA

HOUSE DOCUMENT NO. 88

COMMONWEALTH OF VIRGINIA
RICHMOND
2006

COMMONWEALTH of VIRGINIA

DEPARTMENT OF TRANSPORTATION
1401 EAST BROAD STREET
RICHMOND, VIRGINIA 23219-2000

David S. Ekern, P.E.
COMMISSIONER

December 29, 2006

Members of the General Assembly

Dear Ladies and Gentlemen:

The Virginia Department of Transportation (VDOT) was directed through Item 444 A.4 of the 2006 Appropriation Act to develop an asset management methodology to include performance targets to monitor and evaluate the effectiveness of maintenance activities. This methodology shall, in accordance with generally accepted engineering principles and business practices, identify and prioritize statewide and district maintenance and operations needs. These needs include, but are not limited to, pavement, structures and bridges, pipes and drainage, roadside operations and statewide programs such as snow removal and equipment replacement.

VDOT's Asset Management Methodology intended to achieve the following three goals:

- Employ best practices to plan, budget, implement, monitor and measure performance;
- Manage VDOT's assets based on a life-cycle analysis approach; and
- Establish a Needs Based Budgeting approach to identify and prioritize statewide allocation of available maintenance funding.

Our methodology is consistent with the American Association of State Highway Transportation Official's (AASHTO) guidelines for Transportation Asset Management.

The attached report provides information on the asset management methodology. If you have questions or need additional information, please let me know.

Sincerely,

David S. Ekern

Attachment

cc: The Honorable Pierce R. Homer

VDOT Report to the General Assembly on:

- **Asset Management Methodology**
- **Asset Management Systematic Mechanisms**

2006 Virginia General Assembly
Appropriations Act, Items 444 A.4 & B 1

Virginia Department of Transportation
Asset Management Division
1401 East Broad Street
Richmond, Virginia 23219

December 29, 2006

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VDOT Asset Management Methodology

I. Preface

The 2006 Appropriation Act (HB 5002), Items 444, A.4, A.5, and B.1-4 required the Virginia Department of Transportation (VDOT) to develop and submit Highway System Maintenance documents to the members of the Virginia General Assembly (see Appendix A). These documents included five major multi-functional programs.

These items in HB 5002, Item 444, require three (3) different due dates.

- Asset Management Methodology. VDOT shall report to the General Assembly by **December 31, 2006**, on progress made and future plans to incorporate principles of asset management into its maintenance and operations practices (Items 444, A.4).
- Six-Year Maintenance and Operations Program. VDOT shall develop and submit to the General Assembly a six-year maintenance and operations program no later than **July 1, 2007**, to provide greater transparency, predictability and equity of funding, and stability of investment over time (Items 444, A.5). This report will be submitted separately.
- Transportation Infrastructure Conditions and Measures. By **November 30** of each year, VDOT shall submit to the Governor, General Assembly, and the Commonwealth Transportation Board a report on the condition of existing transportation infrastructure and proposed measures to improve the operations of the transportation system and the service. This report will include systematic mechanisms to evaluate the Asset Management Methodology; all outsourcing, privatizing and downsizing initiatives; major bridge projects; and railroad grade crossings. (Items B. and B1-4). Except for Item B.1, this report was submitted separately.

This report will identify information and data governing VDOT's Asset Management Methodology (HB 5002, Item 444 A.4) and the systematic mechanisms to evaluate the Asset Management Methodology (HB 5002, Item 444 B.1).

II. Executive Summary

The 2006 General Assembly included in the Appropriation Act Item 444A and B1 directing VDOT to report on its Asset Management Methodology for review by the General Assembly. VDOT was directed to use an asset management approach to develop and include performance targets to monitor and evaluate the effectiveness of maintenance activities, identify and prioritize state and district maintenance and operations needs, including but not limited to pavement, structures and bridges, pipes and drainage, roadside operations and statewide programs such as snow removal and equipment replacement. The Commonwealth Transportation Board is directed to review the methodology before its submission to the General Assembly by December 31, 2006. Progress made and future plans to incorporate principles of asset management into maintenance and operations practices are to be included.

Asset Management has been defined in the *Code of Virginia* in Section 33.1-23.02 as "a systematic process of operating and maintaining the state system of highways by combining engineering practices and analysis with sound business practices and economic theory to achieve cost-effective outcomes."

The Joint Legislative Audit Commission (JLARC) in 2002 issued a report recommending several actions for VDOT to continue to pursue the implementation of an asset management approach as a priority. Many aspects of VDOT's maintenance program were commended by JLARC. JLARC made a number of recommendations that have guided the development of the asset management approach implementation in VDOT.

The Asset Management approach to maintenance of the highway network assets reflects a comprehensive view of the highway network assets' performance. Resource allocation decisions are based on the desired system condition, level of service, and safety provided to customers.

VDOT's Asset Management Approach is based on the following three goals:

- Manage VDOT's assets based on a life-cycle analysis approach
- Use a Needs Based Budgeting approach to identify and prioritize statewide maintenance and operations needs based on the inventory and condition assessments
- Employ processes to plan, budget, implement, monitor and measure performance

VDOT Asset Management Methodology is consistent with the American Association of State Highway Transportation Official's (AASHTO) model for Transportation Asset Management, which includes systematic processes for Asset Inventory, Condition Assessment and Performance, and Performance Monitoring.

VDOT's Asset Management Methodology follows the AASHTO model for asset management. It includes a Needs-Based Budgeting (NBB) process, which systematically identifies asset maintenance needs based on quantifiable, measurable asset inventory and condition data. This process is used to develop the annual budget request, and to guide the allocation of available resources across maintenance activities and districts. The methodology provides a means of assessing the total statewide maintenance needs for major assets and measures progress in improving asset conditions over time.

VDOT's Asset Management Methodology is supported by information technology tools referred to as the Asset Management System (AMS). AMS integrates systematic and economic decision tools both in place and under development that will enable VDOT to more efficiently and effectively manage roadway assets. The framework of AMS includes an Inventory Module, Random Condition Assessment Module, Planning Module, Work Accomplishments Module, and a Decision Tree Builder. It also relies on inventory and condition data from the Pavement management System and Bridge Management Systems.

Pavement condition data is collected on an annual basis for 100% of the interstate and primary networks. Data for the secondary network has been collected on a sample basis; this method has recently been shifted to provide complete coverage of the secondary network every five years. The actual conditions of pavements are compared to a performance target.

Each structure (bridges and large culverts) is inspected at regular intervals by certified Bridge Safety Inspectors. The inspection quantifies the condition of the structure and provides the basis for asset preservation analysis. The actual conditions of structures are compared to a performance target.

VDOT's Random Condition Assessment (RCA) surveys collect data on a sample basis for an additional eight traffic and drainage assets (signs, pavement markings, guardrail, guardrail terminals, pipes, paved and unpaved ditches, and unpaved shoulders). The RCA survey identifies the type and extent of damage or deterioration to these assets that can be related to the need for maintenance actions.

Technology assets such as traffic signals, overhead signs, tunnels, rest areas, ferries, smart traffic devices, movable bridges, and paved shoulders, are assessed by the districts responsible for these assets. Districts currently draw upon a variety of specialized asset inventories, together with generally accepted life cycle assumptions and first-hand knowledge of asset condition and serviceability. The needs requests are developed by the districts. Future actions include adding these assets to AMS.

VDOT's Snow & Ice Control activities have Levels of Service that, when implemented, are cost-effective and enable the attainment of reasonable performance targets while remaining within snow budget allocations.

Equipment replacement needs are identified using the VDOT Rental Equipment Budget System (REBS). This system identifies total replacement needs for each district based on established statewide replacement criteria for each class of equipment.

Two major assets—pavements and bridges—significantly and materially affect VDOT's Asset Management Program and the transportation interests of the traveling public. The Department has approved performance targets for these major assets, which are used to gauge how well actual pavement and bridge conditions compare to the targets. The current targets for these two major assets are:

- Pavements: No more than 18% of Interstate and Primary pavements are rated as deficient
- Bridges: No more than 40% of bridges need repair/rehabilitation

Based on the most recent assessment, conditions for pavements and bridges achieved the current targets:

- Pavements: 16.1% of Interstate and Primary pavements are rated as deficient
- Bridges: 38.5% of bridges need repair/rehabilitation

The Asset Management Methodology is embedded with a number of specific systematic mechanisms. This report identifies systematic mechanisms for each major component:

- Asset Management System
- Pavement Management
- Bridge Management
- Random Condition Assessment
- Other Infrastructure Assets
- Equipment Management
- Snow Removal

The Asset Management Methodology and the associated Asset Management System (AMS) have moved from the historical allocation of funds to funding allocations based on actual, qualified maintenance needs. The current needs-based budgeting process using AMS is focused on preserving the infrastructure by identifying maintenance work needed to correct observed deficiencies in assets. Maintenance and Operations Funds are distributed annually as follows:

- Funds are allocated to districts based on each district's share of total needs
- A hold harmless policy is applied
- Budgeting guidance to the districts is provided on distribution of needs by asset and system
- District budgeting actions are based on, but not constrained by this guidance, and consider local conditions
- Districts report on variances between actual expenditures and budgets

Most recently, VDOT has undertaken a new assessment of the existing system and needs for further development. This has lead to the creation of a new vision to move from a "needs-based" approach to a "performance-based" approach over the coming years as the information system tools and data are developed. The next steps in the evolution of the asset management system have been identified and include enhancements in the areas of inventory, data collection, asset needs and tradeoffs, and resource allocation.

III. Item 444 A.4 – Asset Management Methodology Report

Legislation

The 2006 General Assembly included in the Appropriation Act of 2006, Item 444A and B1 directing VDOT to report on its Asset Management Methodology for review by the General Assembly. VDOT was directed to use an asset management approach to develop and include performance targets to monitor and evaluate the effectiveness of maintenance activities, identify and prioritize state and district maintenance and operations needs, including but not limited to pavement, structures and bridges, pipes and drainage, roadside operations and statewide programs such as snow removal and equipment replacement. The Commonwealth Transportation Board is directed to review the methodology before its submission to the General Assembly by December 31, 2006. Progress made and future plans to incorporate principles of asset management into maintenance and operations practices are to be included.

Methodology

Asset Management has been recognized in the *Code of Virginia* in Section 33.1-23.02 as "a systematic process of operating and maintaining the state system of highways by combining engineering practices and analysis with sound business practices and economic theory to achieve cost-effective outcomes." The Joint Legislative Audit Commission (JLARC) in 2002 issued a report recommending several actions for VDOT to continue to pursue the implementation of an asset management approach as a priority. Many aspects of VDOT's maintenance program were commended and JLARC made a number of recommendations which have guided the development of the asset management approach implementation in VDOT. In 2005, Booz Allen reported VDOT's significant progress ahead of many states in its development and implementation of asset management. VDOT was also recently recognized by FHWA for its data integration in the asset management system.

VDOT's Asset Management Methodology involves a Needs-Based Budgeting (NBB) process, which systematically identifies asset maintenance needs based on asset inventory and condition data. This process is used to develop the annual budget request, and to guide the allocation of available resources across maintenance activities and districts.

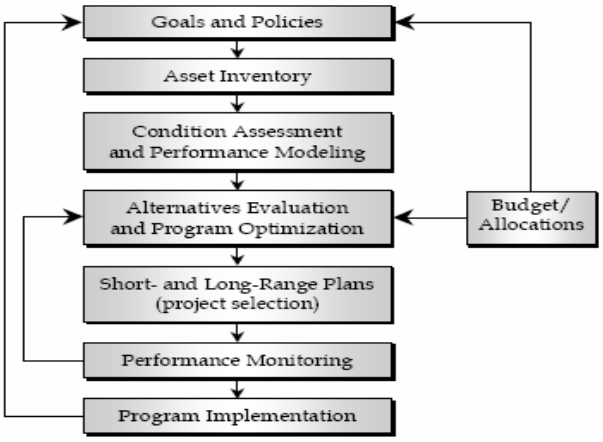
NBB process steps include:

- **Inventory and condition data collection,** which will include:
  - Yearly collection of pavement condition data on 100% of interstate and primary and approximately 20% of the secondary pavements.
  - Bridge condition data on all NBI structures every two years
  - Statewide random sampling for selected traffic and drainage assets every two years
- **Business rules** including decision logic for what maintenance treatments should be applied based on asset characteristics and condition to restore serviceability and minimize life cycle costs. Business rules also include deterioration/life cycle and cost models.
- **Needs analysis** to estimate the current maintenance backlog (total needs) and the cost to maintain assets at their current condition level.

- **Development of budget requests and resource allocation strategies** to address the identified needs and move towards greater balance in the backlog of maintenance needs across districts over time.
- **Tracking of work accomplishments** in order to provide accountability for expenditures and also to build better information over time on asset age, detailed inventory characteristics, and resource utilization.

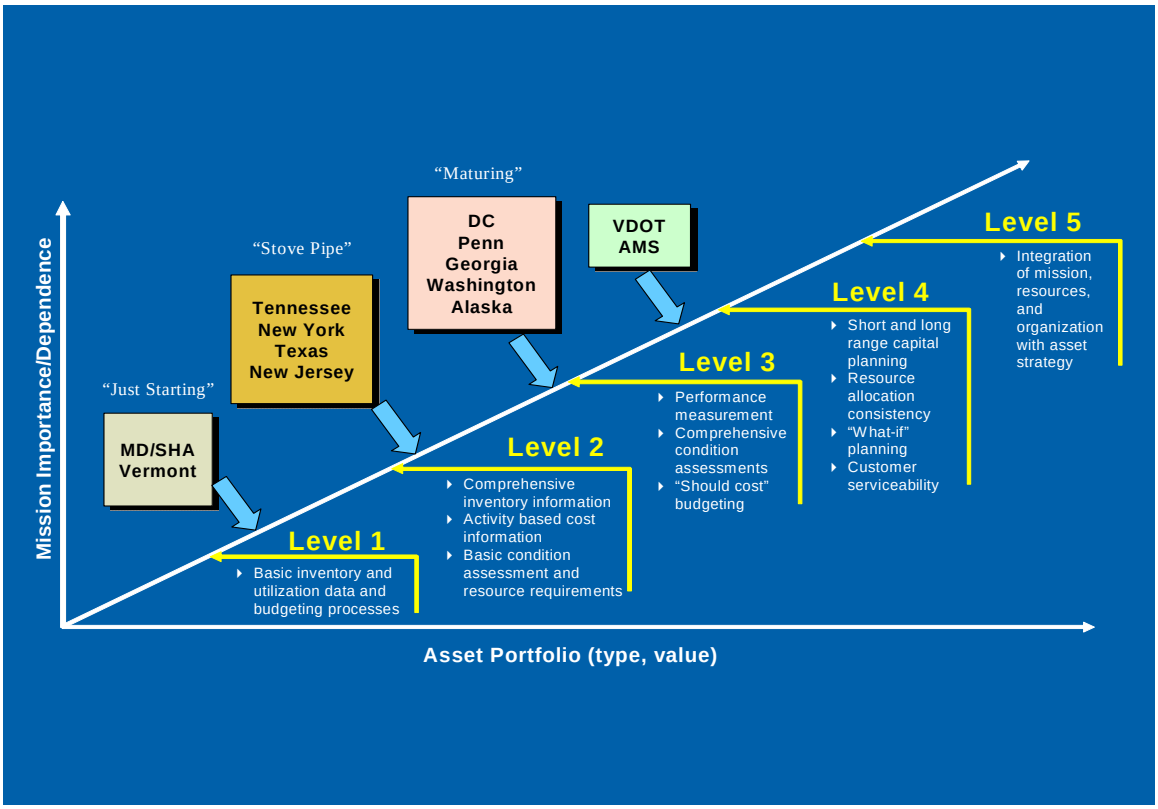
VDOT's Asset Management System (AMS) integrates systematic and economic decision tools that will enable VDOT to more efficiently and effectively manage roadway assets. AMS v1.0 is a set of databases and analysis tools that support the NBB process. The system was developed in-house and completed in June 2005. Below is the AASHTO Guide Model for Asset Management Systems. VDOT's methodology follows this model.

Figure 1. AASHTO Guide Model to Asset Management



In 2005, Booz Allen reported VDOT's significant progress ahead of many states in its development and implementation of asset management (see Figure 2). In 2006, VDOT's work in data integration was recognized in a published case study by FHWA.

Figure 2. Booz Allen Assessment of VDOT Asset Management Methodology Progress



VDOT's Asset Management System includes the following components:

- **Inventory Module** stores data on asset location and characteristics. The inventory will be populated incrementally over time.
- **RCA Module** manages the collection, quality assurance, and storage of random condition assessment data. This module is currently utilized for eight assets: cross pipes, signs, guardrails, guardrail ends, paved and unpaved ditches, unpaved shoulders, and pavement markings.
- **Planning Module** provides a multi-year simulation and planning tool for RCA assets and pavements for estimating network level changes in the maintenance backlog over time based on asset deterioration rates, inflation rates, and planned expenditures.
- **Work Accomplishments Module** stores information on quantities of work performed by field personnel. This is still in testing and development. Work currently underway will allow for inventory information to be updated in conjunction with work accomplishment recording.
- **Decision Tree Builder (DTB)** compiles unit costs for labor, equipment and materials; stores business rules regarding maintenance treatments, and estimates the quantity and cost of required maintenance work based on asset quantity and condition.

Pavement Management

VDOT maintains approximately 5,363 lane miles of interstate, 21,781 lane miles of primary and 96,873 lane miles of secondary main line pavements. These mileages constitute the third largest state maintained network in the nation.

Pavement condition data is collected on an annual basis for 100% of the interstate and primary networks. Data for the secondary network has been collected on a sample basis; this method has recently been shifted to provide complete coverage of the secondary network every five years. VDOT has been phasing in automated pavement data collection technology over the past two years. Starting in 2007, data collection and processing will be fully automated.

Pavement maintenance decision trees are applied to determine network-level needs and provide section-by-section recommendations to the districts. These decision trees have been developed and refined over the past few years, reflecting best engineering practices and the goal of minimizing life cycle costs. AMS 1.0 was used in the last budget cycle to apply these decision rules and conduct needs analysis. Starting in the FY09 budget cycle, specialized pavement management software will be utilized to analyze needs and provide additional "what-if" scenario analysis capabilities.

Bridge Management

VDOT maintains 19,276 structures, including 11,891 bridges and 7,385 large culverts. Each structure is inspected at regular intervals by certified Bridge Safety Inspectors. The inspection quantifies the condition of the structure and provides the basis for asset preservation analysis. AASHTO Pontis™ bridge management system software is used to process inspection data and perform network-level analysis for needs based budgeting. Pontis is capable of conducting a variety of life cycle cost analyses targeting specific levels of future performance.

Traffic and Drainage Assets

VDOT's Random Condition Assessment (RCA) surveys collect data on a sample basis for an additional eight traffic and drainage assets (signs, pavement markings, guardrail, guardrail terminals, pipes, paved and unpaved ditches, and unpaved shoulders.) The RCA survey identifies the type and extent of damage or deterioration to assets that can be related to the need for maintenance actions. For example, inspections of drainage pipes note conditions such as erosion, clogging, and structural soundness. Inspections of signs note damage to posts and panels, as well as obstructions that impact sign visibility. Inspection of guardrails record damage to rails and posts, and also includes assessment of where current federal safety standards are met. The RCA data are used to estimate the quantity of assets that require different types of maintenance work. This is done through application of well-documented and agreed upon business rules.

Technology and Other Infrastructure Assets

Maintenance needs for ten assets (traffic management systems, traffic signals, overhead signs, traffic counting devices, smart traffic devices, movable bridges, tunnels, rest areas, ferries paved shoulders, non plant mix secondary pavements, and non hard-surface roads) are assessed by the districts. The Technology Assets are in various inventories in each district depending on the

amount of the devices each district has. Needs assessment for these assets draws upon a variety of specialized asset inventories, together with generally accepted life cycle assumptions and first-hand knowledge of asset condition and serviceability made by the districts.

Needs assessments for remaining assets (roadside, facilities, retaining walls, and some drainage and traffic assets) are currently based on historical spending patterns.

The next development phase of the inventory module is to have the technology devices included in the AMS inventory with appropriate condition assessment data collection based on critical attributes of the devices. Other inventories and data will be built over time as funds for their development are identified.

Snow Removal

VDOT's Snow & Ice Control activities have Levels of Service (LOS) which, when implemented, are cost-effective and enable the attainment of reasonable performance targets while remaining within snow budget allocations. Highway needs for snow and ice control activities overlap highway systems and, as a result, are separated and identified by functional classifications of the highway rather than by roadway systems. Specific snow and ice control activities and time factors are identified for the four (4) LOS. For example:

- **Priority 1 Routes** should be kept free of ice and snow so that traffic can proceed in safety without severe delays, except during periods of heavy falling or drifting snow and ice storms. Priority 1 highways includes all National Highway System Routes, all Interstate Routes, selected primary routes, secondary routes of more than 10,000 vehicles per day, and access roads to special facilities such as rescue squads, hospitals, police, prisons, and high profile government centers.

Interstate and other routes designated "Priority 1" by the Residency Administrator and District Maintenance Engineer receive first service. When possible these routes should correspond with localized needs and posted Snow Emergency Routes. Other primary and high volume secondary routes are of next consideration followed by low volume routes and stabilized roads. VDOT's levels-of-service for snow removal activities can be found in Asset Maintenance's Best Practices Manual, Appendix 14.2.1.

Equipment Management

Equipment replacement needs are identified using the VDOT Rental Equipment Budget System (REBS). This system identifies total replacement needs for each district based on established statewide replacement criteria for each class of equipment. Replacement priorities are established based on the amount of funding available in each district and the district's business needs related to other programs in the district.

A life cycle analysis process is currently underway to more accurately determine the economic life of the various classes of VDOT equipment. When completed, this information will be used to manually update REBS process with more accurate replacement criteria, to develop long-range replacement plan, identify funding needed to support the replacement plan, and a systematic district prioritization process.

The final phase of this process includes upgrading the current legacy Equipment Management System (EMS) with a modern fleet management system that includes an equipment replacement planning module that basically automates all the functions performed in the intermediate Process. Recent approval by Information Technology Investment Board was given to move to the procurement of a new commercially available system.

Performance Targets

A performance target is defined as the outcome to be achieved by maintaining an asset type, maintenance operation, or facility to a desired condition level, or by providing a customer service to a chosen level service. Performance targets are represented as a percent of assets meeting or exceeding the desired condition level.

Two major assets, pavements and bridges, significantly and materially affect VDOT's Asset Management Program and the transportation interests of the traveling public. Together they represent approximately 2/3rds of the total needs. The performance targets for these two major assets are:

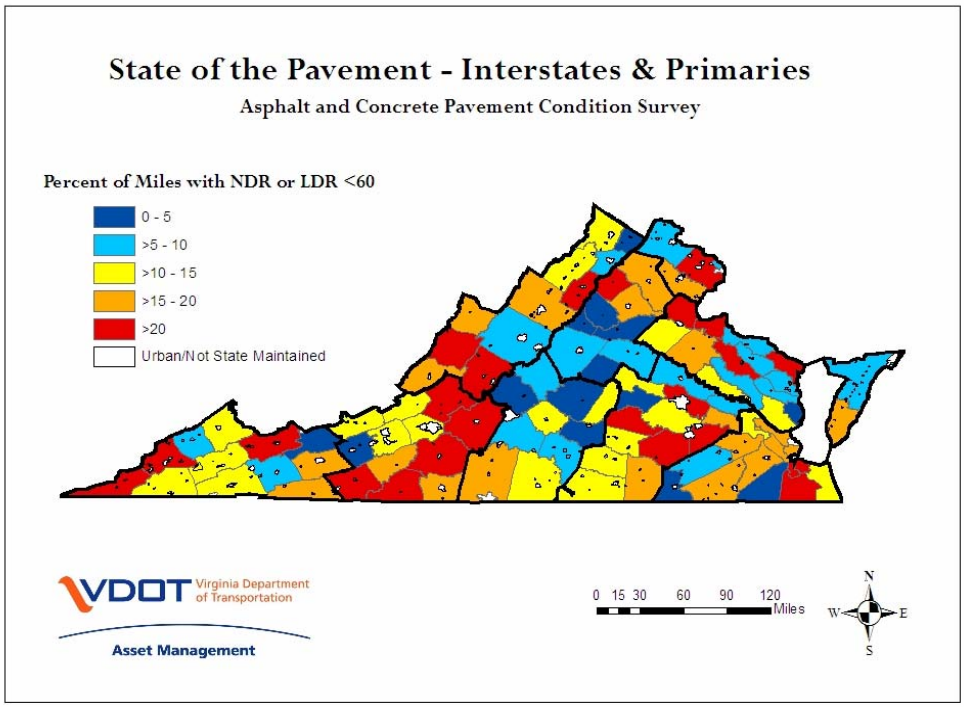
- Pavements: No more than than18% of Interstate and Primary pavements are rated as deficient
- Bridges: No more than 40% of bridges need repair/rehabilitation

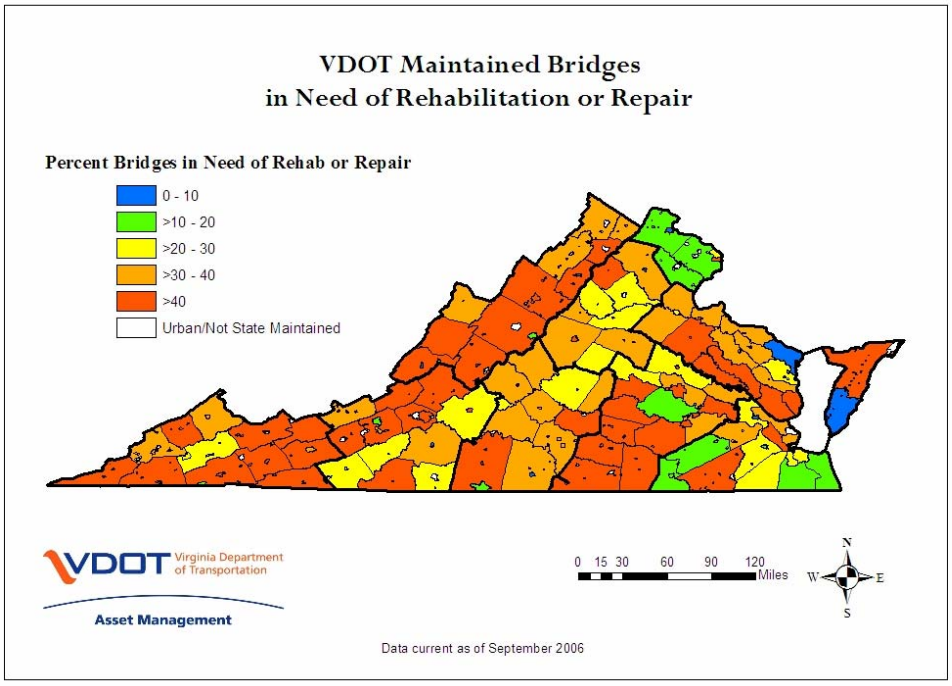
The most recent (2006) assessment of the assets reported the following accomplishments:

- Pavements: 16.1% of Interstate and Primary pavements are rated as deficient.
- Bridges: 38.5% of bridges need repair/rehabilitation

Considerable information with accompanying graphs on these assets was described in VDOT's legislative response to HB 5002, Items 444 B. and 444 B.2-4, which was issued separately. Two statewide graphs included in this VDOT's legislative response compared the Department's performance targets for pavements and bridges and the assets' current conditions by transportation district. These graphs are duplicated in Appendix B in Figures 1 and 2 of this report.

Overall statewide pavement and bridge needs were also graphically identified and explained in VDOT's legislative response to HB 5002, Items 444 B. and 444 B.2-4. These graphs are replicated here.


State of the Pavement - Interstates & Primaries
Asphalt and Concrete Pavement Condition Survey
Percent of Miles with NDR or LDR <60
0 - 5
>5 - 10
>10 - 15
>15 - 20
>20
Urban/Not State Maintained
VDOT Virginia Department of Transportation
Asset Management
0 15 30 60 90 120 Miles
N
W
E
S


VDOT Maintained Bridges
in Need of Rehabilitation or Repair
Percent Bridges in Need of Rehab or Repair
0 - 10
>10 - 20
>20 - 30
>30 - 40
>40
Urban/Not State Maintained
VDOT Virginia Department of Transportation
Asset Management
0 15 30 60 90 120 Miles
N
W
E
S
Data current as of September 2006

Future Asset Management Program Vision

The Department is nearing completion of a review of the AMS 1.0 and the Needs-Based-Budgeting (NBB) process. The review will provide recommendations for streamlining and improving the current NBB process, and outline user requirements and business needs for the next version of AMS. The intent is to enhance existing methodologies and tools for understanding the costs, benefits, and performance outcomes associated with alternative investments. This will be critical in order to compare and analyze trade-offs across investments in system preservation, traveler mobility, safety and security.

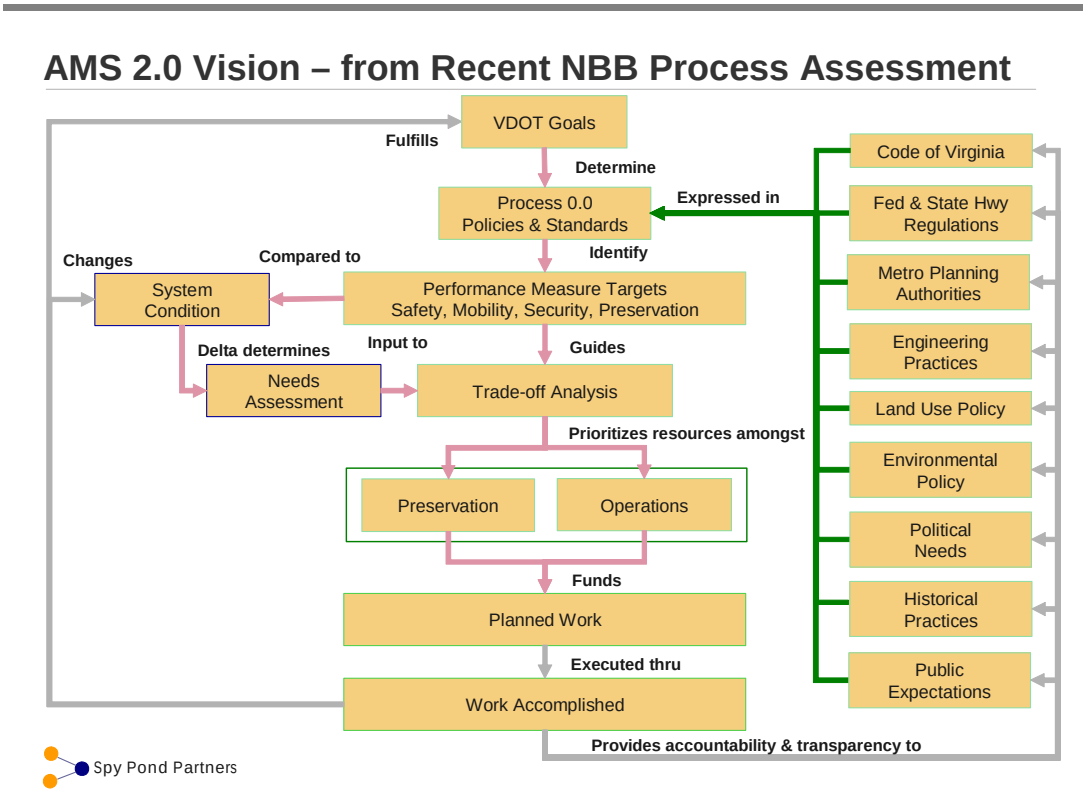
In the three years since VDOT began implementing the Asset Management System (AMS 1.0) and allocating funds to districts based on needs rather than previous allocations, the agency has undergone significant changes in organization and Program budgeting. In January 2004, all maintenance and operations were moved under a new executive level position called the Chief of System Operations. In 2005, for the first time in 20 years, federal funds were included in the Highway Maintenance and Operating Program, which required maintenance and operations to adopt new business processes in order to utilize. In 2006, five regional offices were established to consolidate responsibilities for operations.

These changes have set the stage for VDOT to take the next steps in the development of its asset management methodology and supporting systems. The current needs-based budgeting process using AMS 1.0 is focused on preserving the infrastructure by identifying maintenance work needed to correct observed deficiencies in assets. The implementation of AMS 1.0 and NBB has established an objective, data-driven approach to needs identification and resource allocation for infrastructure preservation. Additional work is needed to expand the set of assets included in AMS 1.0 and refine the analytical capabilities of that system. However, the major challenge to be undertaken for the next version of AMS is to incorporate operational, safety and security needs that are distinct from preservation of existing assets.

While technical methods are currently in place for identification of safety, security and mobility needs, establishment of a performance-based resource allocation framework encompassing preservation, mobility and safety will allow VDOT to further increase transparency and accountability in its Maintenance and Operations Program budgeting process. Performance based budgeting will require new analytical capabilities in order to examine the relative value of shifting investment in safety, mobility, security or preservation, the costs and tradeoffs of achieving different levels of performance in each of these areas, and the impact of delaying certain types of work. These capabilities will take time to develop and implement fully, and will be phased in over time.

VDOT's vision is consistent with the current AASHTO definition of asset management: "a strategic and systematic process of operating, maintaining, upgrading, and expanding physical assets effectively throughout their lifecycle, focusing on business and engineering practices for resource allocation and utilization, with the objective of better decision making based upon quality information and well defined objectives." VDOT is poised to continue its track record as an innovator and national leader in asset management as it brings AMS to the next level of sophistication.

The flowchart "AMS 2.0 Vision – from Recent NBB Process Assessment" illustrates the methodology work flows.



FY 08-FY10 Plans for Implementing Future Methodology

The long-term goals of performance based budgeting across all facets of maintenance and operations include the ability to conduct economic analysis of the tradeoffs between different investment scenarios. The goals of the Asset Management Program are estimated to take approximately three years. Many of the analytical methods necessary are currently the subject of academic research, and are very new. The strategy is to develop and implement components and capabilities of the process incrementally over time. Some components may be developed by VDOT staff, while others may be purchased or developed by consultants. The Operations Planning Division will coordinate and lead in this future effort.
The planned changes for this 3-year process include multi-functional strategies, including the following items:

<u>Planned Changes for FY08</u>:

- Establish a Change Management Task Force to oversee assessment and communication of potential impacts of changes planned; i.e. organizational and process changes needed to shift to a goal oriented, performance based process that addresses not only preservation, but safety, mobility, and security as well.
- Identify process and data models for identifying performance measures, business rules, and organizational responsibilities.

- Develop business systems requirements to support performance based planning, budgeting, and Program management.
- Identify research needed to support performance based budgeting and initiate studies in those areas.
- Develop Data Business Plan for System Operations to support performance based planning, budgeting, and Program management; to include assessment of current applications to define a common baseline and sunset unnecessary and/or duplicate applications.
- Collect or purchase data to support reporting of congestion, travel time and travel time reliability in major urban areas of the state.
- Use of a pavement management system to conduct life-cycle cost analysis and optimization of investments in pavement.
- Modifications to AMS to simplify data transfers between modules and stages of analysis. This will reduce the labor time required to conduct needs assessments and reduce the risk of mistakes or data errors.
- Modifications to the Budget Program to
    - simplify budget development and data entry
    - enable budgeting for Regions as well as Districts
    - enable budgeting by federal fund type
    - enable six year budget development
- Provide reporting capabilities to track District, Region and Central Office State and federal expenditures.
- Document and make available standard account coding schemes to applications.
- Develop process and data models for federal funds and integrate federal funds into the process and systems.
    - Document federal funds usage policies and regulations.
    - Identify needs that are federally eligible and maximize the use of federal funds for all current activities.

Planned Changes for FY09:

- Create and implement a structured, continuous training program to foster process understanding and improve process execution, synchronized with systems changes.
- Develop process and data models for conducting performance based needs assessment for operations.
- Initiate new data collection processes identified in the Data Business Plan.
- Migrate road and asset inventory, condition, and performance data from Highway Traffic Records Information System to the Roadway Network System (RNS) currently under development. RNS will provide the base map and linear referencing capabilities necessary for the next generation analytical tools.
- Continue to contract out RCA data collection to ensure better accuracy and consistency.
- Enhance analytical capabilities to utilize automated pavement condition data by employing a specialized pavement management system.

Planned Changes for FY10:

- Provide six-year performance analysis and prediction capabilities for pavements and bridges; to include ability to estimate minimum cost of achieving different performance targets, or tradeoff in performance under different investment scenarios.
- Provide six-year performance analysis and prediction capabilities for operations; to include ability to estimate minimum cost of achieving different performance targets, or tradeoff in performance under different investment scenarios.
- Provide data models and analytical tools to conduct economic analysis of the tradeoffs between different investment scenarios and the goals of the Program.
- Develop and maintain a complete inventory of selected above-ground assets in a linearly referenced system.

IV. Item 444 B.1 – Systematic Asset Assessment Mechanisms within the Asset Management Methodology

The 2006 Appropriations Act also included Section B1, calling for an assessment of VDOT's "efforts to develop systematic mechanisms to evaluate its efforts" in development of the asset methodology. Based on the systematic assessment tools VDOT has developed, the State of the Assets 2006 Report presents the most recent asset condition assessment for pavements, structures, and the eight (8) assets collected in the Random Condition Assessment (RCA).

The legislative report that the Department issued on November 30, 2006 provides detailed information on the state of the assets in response to other legislative reporting requirements in the Appropriations Act of 2006. A summary of the "State of the Assets 2006" Report can be found in Appendix B.

Collectively, the ten assets described in the State of the Assets 2006 Report account for approximately 70% of VDOT's asset maintenance Expenditures on Interstate, Primary and Secondary highway systems. VDOT has started testing for the implementation of a Work Accomplishments Reporting module. Fully implemented, this system will effectively report the units of measure of maintenance work accomplished by the agency. Full implementation is expected by mid-2009.

The Asset Management Methodology is embedded with a number of specific systematic mechanisms, including:

Asset Management System

- Systematical identification of asset maintenance needs based on asset inventory and condition data.
- Development of annual budget requests
- Bridge condition data on all NBI bridges bi-annually (annually on posted bridges)
- Bridge condition data on all bridges at least every four year
- Statewide random sampling for selected traffic and drainage assets bi-annually

- Business rules including decision logic for what maintenance treatments applied based on asset characteristics and serviceability
- Use of deterioration/life cycle and cost models
- Needs analysis based on total needs and the maintenance costs
- Development of budget requests and resource allocation strategies
- Tracking of work accomplishments (under development)
- Inventory Module stores data on asset location and characteristics. The inventory will be populated incrementally over time.
- Use of Planning and Work Accomplishments Modules
- Application of Decision Tree Builder for labor, equipment and materials costs

Pavement Management

- Yearly collection of pavement condition data on 100% of interstate and primary
- Secondary network has been collected on a sample basis (approx. 20%)
- Automated pavement data collection technology
- Implementation of pavement maintenance decision trees
- Data collection and processing fully automated in 2007
- Network-level needs and section-by-section recommendations
- Use of best engineering practices
- Use of a Pavement Management System to perform life cycle cost analysis
- "What-if" scenario analysis capabilities in the FY09 budget cycle

Bridge Management

- Regular inspection intervals by certified Bridge Safety Inspectors
- Use of asset preservation analysis
- Use of AASHTO Pontis™ bridge management system software
- Network-level analysis for needs based budgeting
- Life cycle cost analyses targeting specific levels of future performance.

Random Condition Assessments

- Statistical surveys of eight traffic and drainage assets
- Qualitative inspections, criteria
- Approved, documented inspection criteria and tolerances
- Assessments of where current federal safety standards are met
- Through application of well-documented and agreed upon business rules
- Post-inspection quality assurance reviews to ensure recorded data are complete and accurate

Technology and Other Infrastructure Assets (traffic signals, overhead signs, traffic counting devices, smart traffic devices, movable bridges, tunnels, rest areas, ferries paved shoulders, non plant mix secondary pavements, and non hard-surface roads)

- Maintenance needs assessed by district staffs

- Needs assessments utilize specialized asset inventories
- Generally follow accepted life cycle assumptions
- First-hand knowledge of asset condition and serviceability
- Historical spending patterns

Equipment Management

- Use of Rental Equipment Budget System (REBS)
- Statewide replacement criteria for each class of equipment
- Analysis of district's business needs
- Life cycle analysis process
- Systematic updates of REBS process
- Long-range replacement plan
- Funding supports the replacement plan
- Systematic district prioritization process
- Upgrades to legacy Equipment Management System (EMS)
- Automation of functions

Snow Removal

- Documented Levels of Service (LOS) for Snow & Ice Control activities
- Cost-effective targets
- Highway needs identified by functional classifications
- LOS for specific snow and ice control activities and time factors
- Direct input by Residency Administrators and District Maintenance Engineers
- Recognition of localized needs
- Posted Snow Emergency Routes
- LOS for all classes of roads, including low volume routes and stabilized roads

Future Asset Management Program Vision

- Documented vision, goals and strategies for future fiscal years for the Asset Management Program

Next Steps in AMS Evolution...

Data Collection

- Put consistent statewide data collection methods in place for traffic/ITS assets: signals, cameras, VMS, detectors.
- Explore use of current videolog contract (for pavement data collection) to gather inventory and condition data on above ground assets – replacement for some RCA assets; expansion to other assets

Inventory

- RNS to provide backbone of centerlines and geographic referencing translation (HTRIS cutoff scheduled for 2009).
- Population of other asset inventory data TBD – still need to address appropriate level of detail for enterprise data, QA and data maintenance strategy.

Needs & Tradeoffs

- Incorporate methods for operations assets and programs
- Implement COTS PMS compatible with VDOT IT Architecture
- Coordinate with Bridge Div on expanding use of Pontis for investment-performance scenarios
- Investigate transitioning some of the RCA-decision tree-based analysis to life cycle-based analysis in conjunction with use of videolog inventory data
- Investigate adding data-driven needs methods for additional assets that account for significant portions of the budget (e.g. highway lighting, roadside.)
- Enhance AMS to accommodate regions, improve ease of use, better support QA and "what-if" analysis and reduce manual steps.

Resource Allocation

- Take the next steps toward performance-based resource allocation to allow for more informed tradeoffs across assets and program categories.
- Continue efforts (currently underway) to define performance measures and determine analytical tools and techniques to support this process.
- Establish performance targets linked to budgets, beginning with pavements and bridges.

Next Steps in AMS Evolution (continued)...

Programming and Budgeting

- Evaluate solutions to provide project planning capability for non-federal projects. Candidates include iSYP or enhancements to the AMS Budget Program.
- Enhance AMS to make the budgeting process less time consuming and to better integrate needs estimates, performance targeting and budgeting activities.
- Implement integrated work scheduling/maintenance management capability (longer term.)

Work Accomplishments

- Complete roll-out of Work Accomplishments including Inventory Module.
- Fully integrate information on work accomplishment via contract and TAMS contracts (for Interstate Maintenance) to provide a complete picture.
- Utilize work accomplishment data to assess performance and to update deterioration and cost models in the AMS.

V. Conclusion

HB 5002, Items 444 A.4 and B.1 required VDOT to develop a report on its Asset Management Methodology, including systematic mechanisms to evaluate the efforts of the methodology.

VDOT has made significant progress toward a comprehensive asset management system and has been recognized by FHWA and other states as a leader in its asset management system development. VDOT has accomplished n a number of milestones and initiatives as outlined above. Systematic mechanisms have been created to effectively implement an Asset Management Program that will help to ensure successful delivery of a transportation infrastructure and its mobility, safety, and travel time reliability.

VDOT Asset Management Methodology's current needs-based budgeting process is focused on preserving the infrastructure by identifying maintenance work needed to correct observed deficiencies in assets. The implementation of the Department's Asset Management System and the Needs Based Budgeting has established an objective, data-driven approach to needs identification and resource allocation for infrastructure preservation.

The future vision is to move the Asset Management capability from a need based system to a performance based system that can match system performance with investments over time.

Appendix A: House Bill 5002, Item 444

Highway System Maintenance (60400)

A. 1. The Interstate, Primary and Secondary Maintenance service areas preserve the public's investment through the delivery of an effective and efficient statewide maintenance program to protect and enhance the transportation infrastructure and the safety of the traveling public.

2. The Transportation Operations Services service area improves mobility, safety, travel time reliability, and security on the transportation system through the deployment of a variety of operational strategies including regional smart traffic centers, emergency services, traveler services, congestion management and traffic signalization optimization.

3. The Highway Maintenance Program Management and Direction service area provides management, direction, and administration to support the program's activities.

4. The Department shall develop an asset management methodology for the review by the General Assembly in the 2007 Session. As part of the methodology, the Department shall develop and include performance targets to monitor and evaluate the effectiveness of maintenance activities. The methodology shall, in accordance with generally accepted engineering principles and business practices, identify and prioritize statewide and district maintenance and operations needs. These needs include, but are not limited to, pavement, structures and bridges, pipes and drainage, roadside operations and statewide programs such as snow removal and equipment replacement. The Commonwealth Transportation Board shall review the proposed methodology before submission to the General Assembly. The Department shall report to the General Assembly by December 31, 2006, on progress made and future plans to incorporate principles of asset management into its maintenance and operations practices.

5. Prior to adoption, the Department shall develop and submit to the General Assembly a six-year maintenance and operations program no later than July 1, 2007, to provide greater transparency, predictability and equity of funding, and stability of investment over time. This program shall equitably distribute maintenance funds to districts based on objectively identified needs, define the base needs for each district and include future adjustments based on additional funding in district budgets to address differences in need across them. The Commonwealth Transportation Board shall review and approve the six-year maintenance and operations program and the annual updates.

B. By November 30 of each year, the Department shall submit to the Governor, General Assembly, and the Commonwealth Transportation Board a report on the condition of existing transportation infrastructure and proposed measures to improve the operations of the transportation system and the service areas listed in paragraph A. Such report shall include:

1) An assessment of the department's efforts to develop systematic mechanisms to evaluate its efforts as outlined in paragraph A.4. of this Item;

2) A report on all actions, accomplishments, achievements, and initiatives of the Virginia Department of Transportation, in the preceding fiscal year that involved outsourcing, privatization, and downsizing, as required pursuant to Chapter 420, Acts of Assembly of 2006;

3) An enumeration of the status of major bridge maintenance and replacement projects and the availability of federal highway bridge rehabilitation and replacement apportionments; and

4) In conjunction with the Department of Rail and Public Transportation, a report on the number of rail crossings in the metropolitan areas of Hampton Roads, Richmond and Northern Virginia. The report shall take into consideration the impediments to safety, mobility and economic development caused by the rail crossings as measured by the number of trains and frequency of train traffic; the vehicular traffic volumes at the crossings; and the lack of nearby rail and road alternatives. The report shall include an estimate of the costs to remove, relocate or remediate those rail crossings that have the greatest impacts on communities, including environmental.

Appendix B: Summary of the State of the Assets 2006 Report

ASSET CONDITION SUMMARY 2006

The 2006 House Bill 5002 Budget Amendment in Item 444 B, established a requirement for VDOT to submit an annual performance report to the Governor, General Assembly and Commonwealth Transportation Board by November 30 of each year. This performance report must include "a summary of the condition of existing transportation infrastructure and proposed measures to improve system operations".

This "State of the Assets 2006" report was prepared to address the requirement for a summary of transportation infrastructure condition and sent under a separate cover.

Summary of "State of the Assets 2006" Report

Virginia has the third largest state-maintained highway system in the country (behind North Carolina and Texas), with about 57,000 miles of roads and over 19,000 structures (bridges and large culverts). Through VDOT's Asset Management Program, asset condition is regularly assessed in order to track system performance and estimate needs for routine, preventative and restorative maintenance work. VDOT collects detailed condition data for its major assets – pavements and bridges. VDOT's Random Condition Assessment (RCA) surveys collect data on a sample basis for an additional eight traffic and drainage assets (signs, pavement markings, guardrail, guardrail terminals, pipes, paved and unpaved ditches, and unpaved shoulders.)

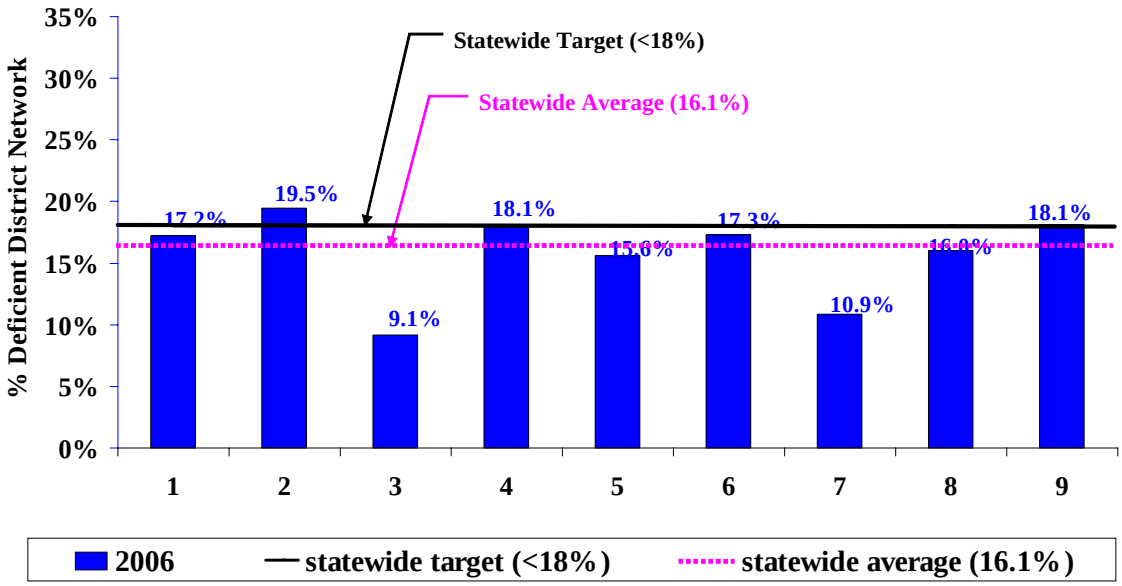
This report presents the most recent condition information for pavements, structures, and the eight assets collected in the RCA. Collectively, these ten assets account for roughly 80% of VDOT's asset maintenance expenditures on Interstate, Primary and Secondary systems.

Pavements

Pavement condition data are collected annually for 100% of Interstate and Primary pavements. Secondary pavements are surveyed on a sample basis – the 2005 survey covered 10% of the network. Detailed pavement condition information observed in the surveys is summarized into a condition index that range from 0 to 100, where 100 represents the best condition. Pavements with a condition index below 60 are considered to be in a deficient condition, which means that they require resurfacing, restorative maintenance, or rehabilitation.

The 2006 pavement condition survey found that 16.1% of the statewide pavement lane miles are deficient, on the interstate and primary system. This is within the established target to keep the percent of deficient pavements below 18%. Figure 1 shows how pavement condition varies across the state – for example, districts 3-Lynchburg and 7-Culpeper districts have less than 11% deficient pavement lane miles – well below the statewide average.

Figure 1. Percent Deficient Pavement by District.



Note: Bristol – 1; Salem – 2; Lynchburg – 3; Richmond – 4; Hampton Roads – 5; Fredericksburg – 6; Culpeper – 7; Staunton – 8; NOVA – 9

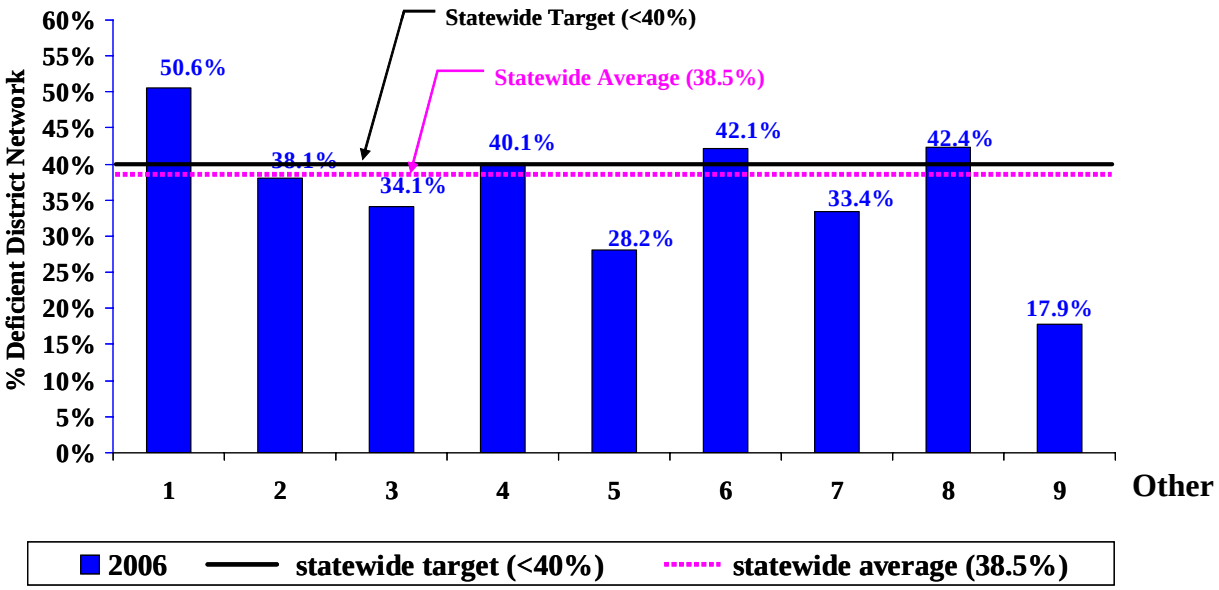
Structures

In accordance with the Code of Federal Regulations, VDOT inspects bridges and culverts that are on public roadways and exceed 20 feet in length along the centerline. The structures receive a detailed inspection at regular intervals not exceeding 24 months. VDOT also conducts safety inspections for bridges 20 feet or less in length and large culverts on a 48 month cycle.

Inspectors use condition ratings to describe the existing, in-place structure as compared to the as-built condition. The physical condition of the deck, superstructure, substructure, or culvert is evaluated and assigned a general condition rating (GCR) based on a scale of 0-9. Nine indicates the best condition and zero indicates the worst condition. A structure with a condition rating less than 6 for deck, superstructure, substructure or culvert typically requires repair or rehabilitation work.

As shown in Figure 2, the latest (2006) structure inspection data shows that 38.5% of bridges statewide require repair or rehabilitation. This is within the statewide target of 40%. As is the case with pavements, there are significant variations across districts in structure condition.

Figure 2. Percent of Bridges Needing Repair or Rehabilitation by District.



Note: Bristol – 1; Salem – 2; Lynchburg – 3; Richmond – 4; Hampton Roads – 5; Fredericksburg – 6; Culpeper – 7; Staunton – 8; NOVA – 9

Assets

Condition of selected drainage and traffic assets is assessed via random sampling. Data are collected for a total of 10,700 tenth-mile roadway sections – with a statistical sampling approach designed to achieve an acceptable level of accuracy and precision for estimating maintenance needs within each district by system (Interstate, Primary, Secondary).

The RCA survey identifies the type and extent of damage or deterioration to assets that can be related to the need for maintenance actions. For example, inspections of drainage pipes note conditions such as erosion, clogging, and structural soundness. Inspections of signs note damage to posts and panels, as well as obstructions that impact sign visibility. Inspection of guardrails record damage to rails and posts, and also includes assessment of where current federal safety standards are met. The RCA data are used to estimate the quantity of assets that require different types of maintenance work. This is done through application of well-documented and agreed upon business rules.

The estimated percentage of assets requiring some kind of maintenance work (including ordinary maintenance, corrective maintenance and replacement) based on the analysis of RCA data collected in 2005 is displayed in Table 1. This metric was selected in order to provide a high-level, common yardstick of condition across these eight asset types. It can be seen that for two of these assets (guardrail and pavement markings), the percentage of the inventory requiring work is quite high. The high figure for guardrail is related to the fact that over 50% of the guardrails surveyed did not meet the current federal standards. (It should be noted that current VDOT policy is to replace substandard guardrails when they are damaged, when substandard guardrail is on a Federal maintenance contract, or when the guardrail is within the limits of a construction project.) For pavement markings, the high percentage is related to the short

lifecycle for latex paint – current maintenance practice is to replace painted pavement markings every two years.

Table 1 - Percent of Assets Needing Work by Roadway System

	Percent Needing Work			
Asset	**Interstate**	**Primary**	**Secondary**	**Total**
Guardrail	74.0%	59.7%	61.1%	64.9%
Pipe	10.4%	24.7%	25.0%	24.5%
Unpaved Ditch	12.1%	10.5%	19.9%	18.3%
Guardrail End	41.1%	37.5%	32.2%	36.1%
Pavement Marking	15.3%	51.6%	73.0%	52.8%
Unpaved Shoulder	--	13.3%	12.1%	12.3%
Paved Ditch	17.4%	15.4%	15.2%	15.8%
Sign	9.0%	14.9%	17.4%	15.8%