OFFICE OF THE STATE INSPECTOR GENERAL

Virginia Department of Transportation: Maintenance of Highway Infrastructure

Performance Audit

June 2018

Michael C. Westfall, CPA
State Inspector General

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COMMONWEALTH OF VIRGINIA
Office of the State Inspector General

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Governor Ralph Northam
P.O. Box 1475
Richmond, VA 23219

Dear Governor Northam:

The Office of the State Inspector General (OSIG) recently completed an audit of the Virginia Department of Transportation's (VDOT) Highway Infrastructure Maintenance. The report, which includes three findings and recommendations for improved efficiency and effectiveness, is attached for your review and information.

OSIG would like to thank former VDOT Commissioner Charles Kilpatrick, and current Commissioner Stephen C. Brich and staff for their cooperation and assistance during this audit.

Sincerely,

Michael C. Westfall, CPA
State Inspector General

CC: Clark Mercer, Chief of Staff to Governor Northam
Suzette P. Denslow, Deputy Chief of Staff to Governor Northam
Shannon R. Valentine, Secretary of Transportation
The Honorable Senator Charles W. Carrico, Sr., Chairman, Transportation Committee
The Honorable Delegate David E. Yancey, Chairman, Transportation Committee
Stephen C. Brich, P.E., Commissioner, Virginia Department of Transportation

Virginia Department of Transportation: Maintenance of Highway Infrastructure

What OSIG Found

Duplicated Effort to Record Structure Inspections

VDOT currently uses paper reports to record structure inspections in the field. Bridge inspectors enter data from these reports into the Bridge Management System (BrM) at a later date, resulting in a duplicated effort and risk of data entry errors. Structure inspections should be done as efficiently as possible, not only to keep pace with the increasing number of structures required to be inspected, but to be good stewards of Commonwealth and VDOT resources.

Improper Storage of Critical Infrastructure Information

Bridge inspection reports are labeled as Critical Infrastructure Information (CII) by the U.S. Department of Homeland Security and VDOT. CII is required to be protected at all times, either by appropriate storage or under the personal observation and control of a person authorized to receive it. During a site visit, OSIG observed CII left unsecured and exposed to inappropriate access or accidental disposal.

Commendation

VDOT management is commended for its continued dedication to improvement by already taking steps to implement audit recommendations. In addition, VDOT's Structure and Bridge Division is commended for its flexibility during the transition process of implementing a new BrM.

Management concurred with OSIG's findings and plans to implement corrective actions from December 2018 to December 2019.

June 2018

HIGHLIGHTS

Why OSIG Did This Audit

OSIG conducted this performance audit to identify potential improvements of VDOT's asset management practices. VDOT is responsible for managing the third largest state-maintained highway infrastructure in the nation. VDOT's infrastructure is comprised of more than 21,100 highway structures and 128,000 lane miles of roadway.

Virginia's infrastructure supports business, tourism and economic growth, as well as its citizens. Continued growth in population, vehicle travel and truck freight has placed increased demands on the transportation system. The additional strain on roads and bridges accelerates deterioration, creating a need for continuous maintenance and upgrades.

What OSIG Recommends

- VDOT should pursue automating the bridge inspection process, including the ability for inspectors to record inspections electronically while in the field.
- VDOT should implement a process in all districts to scan and electronically store Critical Infrastructure Information with sufficient IT controls that comply with Information Security Standard SEC 501.

For more information, please contact OSIG at (804) 625-3255 or www.osig.virginia.gov

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BACKGROUND

The mission of the Virginia Department of Transportation (VDOT) is to “plan, deliver, operate and maintain a transportation system that is safe, enables easy movement of people and goods, enhances the economy and improves quality of life." In order to help fulfill its mission of maintaining a transportation system, VDOT has divided the state into nine districts. In addition to its central office staff, personnel at VDOT’s nine district offices help to maintain more than 21,000 inventoried highway structures and 128,000 lane miles of pavement.

VDOT utilizes several divisions for asset management. These divisions include the Maintenance Division, the Structure and Bridge (S&B) Division and the Asset Management Division (AMD). AMD involves an ongoing cycle of activities, including asset inventory and condition; needs assessment; funding distribution and budget development; work planning; scheduling and management; and performance measures and targets.

The Maintenance Division uses a contractor, Fugro-Roadware Inc. (Fugro), to collect data on pavements in the Commonwealth. Fugro uses vehicles equipped with special cameras and sensors that are driven over state roads to capture crack detection, right-of-way images, shoulder condition, roughness and rutting data. Fugro then identifies cracks by processing images with specialized automated crack-detection software. A random sample of five percent of this data is put through Independent Validation and Verification (IV&V) by a contractor, Quality Engineering Solutions (QES). QES manually inspects and assigns ratings to five percent of the images collected by Fugro. QES then identifies and resolves material differences with Fugro. Once the data is approved from QES, VDOT applies additional checks to the data before it is uploaded for use into the Pavement Management System (PMS). These additional checks include evaluating any road that has improved more than five percent or deteriorated more than fifteen percent from the prior year, as well as performing queries on the data before and after it is uploaded into PMS to ensure the information was not altered during its transition.

The S&B Division uses both VDOT employees and contractors to inspect structures and bridges in the Commonwealth. Structures on the National Bridge Inventory (NBI) must be inspected biennially. NBI structures include bridges with a length of at least 20 feet and culverts with a length of at least 20 feet and an opening greater than 36-square feet. VDOT inspectors complete inspections in the field and then return to their offices to enter the information into the AASHTOWare Bridge Management System (BrM).

The Maintenance and S&B divisions use PMS and BrM data to inform about maintenance activities. However, final decisions about which maintenance activities will be slated for completion are made at the district level due to inherent limitations in PMS and BrM. PMS and BrM cannot take all potential factors into account when recommending maintenance activities,

such as planned new construction, access to appropriate contractors and the significance of the pavement or structure.

SCOPE

The scope of this audit includes VDOT's asset management practices relating to pavements, bridges and large culverts owned and maintained by VDOT for the period July 1, 2015 through June 30, 2017. The scope does not include work planning, scheduling and management processes performed by VDOT districts.

OBJECTIVES

Objectives of this audit were:

- Determine if the analysis conducted by the Pontis/AASHTOWare BrM system and VDOT's S&B Division provides accurate and timely:
  - Unconstrained needs assessments; and
  - Estimates of costs to achieve performance targets.
- Determine if the analysis conducted by PMS and VDOT's Maintenance Division provides accurate and timely:
  - Unconstrained needs assessments; and
  - Estimates of costs to achieve performance targets.
- Compare VDOT's infrastructure asset management funding distribution and budget development process overseen by AMD to that of other U.S. states. Identify any best practices VDOT can adopt from other states.
- Determine if VDOT's infrastructure asset management funding distribution and budget development process produces budget allocations to each of the nine VDOT districts that accurately mirror, proportionally, the estimates of costs to achieve performance targets generated by PMS and the BrM system.
- Determine if VDOT's infrastructure asset management funding distribution and budget development process produces allocations to each of the nine VDOT districts in compliance with the Commonwealth Transportation Board's (CTB) June 14, 2016, resolution on State of Good Repair.

METHODOLOGY

OSIG conducted this performance audit in accordance with generally accepted government auditing standards (GAGAS). Those standards require that OSIG plans and performs the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for the findings and conclusions based on the audit objectives. OSIG believes the evidence obtained provides a reasonable basis for the findings and conclusion based on the audit objectives.

OSIG applied various methodologies during the audit process to gather and analyze information pertinent to the audit scope and to assist with developing and testing the audit objectives. The methodologies include the following:

- Conducting interviews and observations/walk-throughs;

- Assessing processes for efficiency and effectiveness;
- Examining VDOT and Federal Highway Administration (FHWA) policies, procedures and reports;
- Analyzing and reconciling data for consistency, compliance and accuracy; and
- Benchmarking asset management and funding practices against similar states' departments of transportation.

FINDINGS

Digitize the Structure Inspection Process

VDOT currently uses paper reports to record structure inspections in the field. Bridge inspectors enter data from these reports into BrM at a later date, resulting in duplicated efforts and potential data entry errors. VDOT uses the manual process due to the financial and IT resources necessary to implement and maintain a digital inspection system, and the sensitive, Critical Infrastructure Information (CII) maintained in inspection reports.

Structure inspections should be done as efficiently as possible, not only to keep pace with the increasing number of structures required to be inspected, but to be good stewards of Commonwealth and VDOT resources. In addition, the type of inspection report information recorded in BrM can be time sensitive, potentially jeopardizing VDOT's mission to "maintain[ing] a transportation system that is safe."

Inspectors need 20 minutes to two hours to enter inspection information from paper reports into BrM. If the conservative, 20-minute figure is used, when combined with the more than 10,000 structures annually inspected by VDOT, a total of 3,333 hours or $106,656 a year is spent entering inspection information from paper reports into BrM. If the two-hour figure is used, the number of hours increases to 20,000 and the cost grows to $640,000. Additional resources, including travel time and fuel for vehicles, are consumed by inspectors who return to district offices to enter information. Further, the manual process reduces the timeliness of BrM information and increases the risk of data entry errors from written notes to the electronic system. Time saved from entering inspection data could be used to perform more inspections annually or expand time for existing inspections.

The North Carolina Department of Transportation estimates an annual cost savings of $400,000 due to its digital inspection system. VDOT recognizes the potential benefits of automating the inspection process and has begun to assess the feasibility of implementing a digital inspection system in Virginia.

Recommendation(s):

VDOT should pursue automating the bridge inspection process, including the ability for inspectors to record the inspection electronically while in the field.

Management Response:

VDOT **agrees** with the conditions observed and recommendations as presented, with the following statement:

VDOT agrees in concept with the recommendation to automate the bridge inspection process as it relates to inspection reports, including the ability for inspectors to record the inspection electronically while in the field. VDOT will explore this recommendation, considering things such as software applications and needed interfaces, computer equipment, remote connectivity, security of data, available funding, federal/state requirements, training, risks, cost/benefit analysis, etc. Although, VDOT agrees in concept with the automation, it will be necessary to determine the viability of the project, especially in comparison to other agency information technology needs. Staff from the Structure & Bridge Division, Information Technology Division and the Office of Technology Strategic Planning have started this evaluation.

Corrective Action(s):

Responsible Position: Structure & Bridge Division Administrator, Information Technology Division Administrator, Office of Technology, Strategic Planning –, Chief Information Officer/ Information Security Officer
Estimated Completion Date: December 31, 2018

1. A feasibility evaluation to consider the viability of automating the bridge inspection process.

Improve Critical Infrastructure Information Storage

Bridge inspection reports are not consistently handled as Critical Infrastructure Information (CII). Although it was not a high traffic area, OSIG observed large quantities of bridge inspection reports that were not securely stored, including some stored in hallways or other common areas of the building during a site visit. VDOT staff explained all inspection reports have to be retained for the life of a structure and there is not sufficient space to store all inspection reports securely. They further explained some districts are already scanning reports for electronic storage.

Bridge inspection reports meet the U.S. Department of Homeland Security's (DHS) definition of Critical Infrastructure Information (CII). DHS defines CII as, "records or information concerning … actual, potential, or threatened interference with, attack on, compromise of, or incapacitation of critical infrastructure … that violates Federal, State or local law, harms interstate commerce of the United States or threatens public health or safety." VDOT's CII policy calls for CII to "be protected at all times, either by appropriate storage or having it under the personal observation and control of a person authorized to receive it."

Without secured storage of CII, such as the bridge inspection reports, the risk of inappropriate access and accidental disposal of the information could take place. The lack of secured storage is also noncompliant with applicable policy.

Recommendation(s):

VDOT should implement a process in all districts to scan and electronically store bridge inspection reports with sufficient IT controls that comply with Information Security Standard SEC 501. This would allow for compliance with CII policies and easier cataloging and searching of bridge inspections. Electronic storage would also help alleviate the physical record retention burden on the districts. For the immediate protection of existing inspection reports, VDOT should employ the use of secure filing cabinets or other adequate storage for all physical inspection reports.

Management Response:

VDOT **agrees** with the conditions observed and recommendations as presented, with the following statement:

VDOT recognizes the importance of the proper management of critical structure information in the form of the bridge inspection report. The State Structure and Bridge Engineer has reemphasized the importance of protecting the safety inspection reports with the district bridge engineers. Additionally, an information technology solution to scan and archive inspection reports was approved by the Strategic Technology Board and is under active development.

Corrective Action(s):

Responsible Position: Structure & Bridge Division Administrator, Information Technology Division Administrator

Estimated Completion Date: The solution is estimated to be fully developed and tested by December 31, 2018. Implementation of solution to follow thereafter, with full implementation by December 31, 2019.

1. Develop, test and implement an information technology solution to scan and archive inspection reports.

Monitor and Track Maintenance Activities

Although dollar amounts spent on structures and bridges can be tracked through Cardinal, the actual maintenance activities performed cannot be tracked in BrM for structures and bridges. VDOT recognizes this limitation and is implementing the Highway Maintenance Management System (HMMS) to track actual maintenance activities for VDOT's tunnels and ancillary structures.

The Structure and Bridge Division Instructional and Informational Memorandum IIM-S&B-85.2 states, "In order to properly manage the bridges and structures owned and maintained by VDOT,

it is essential to properly capture all work accomplishment activities performed on the bridge and large culvert assets."

Limitations in its work accomplishment tracking systems inhibit VDOT's ability to obtain long-term maintenance records for structures or groups of structures. This adversely affects VDOT's bridge management system. A fully functional system that comprehensively collects maintenance history would lead to a better understanding of the performance and investment value of VDOT's bridge maintenance actions. This performance data could be used as the basis for future recommendations and optimization of the bridge maintenance program.

Recommendation(s):

VDOT is commended for recognizing system limitations and should continue to implement HMMS to provide for tracking of actual maintenance activities for structures and bridges.

Management Response:

VDOT **agrees** with the conditions observed and recommendations as presented, with the following statement:

As noted in the report, VDOT is implementing the Highway Maintenance Management System (HMMS) to track annual maintenance activities for VDOT's bridge, culverts, tunnels, movable bridges and ancillary structures. This functionality is included in Release 2 (Roadway) and Release 3 (Movable Bridges and Tunnels).

Corrective Action(s):

Responsible Positions: Information Technology, Division Administrator
Estimated Completion Date: December 31, 2018

1. Inclusion (and ability to track) maintenance activities for VDOT's bridges, culverts, tunnels, movable bridges and ancillary structures in the Highway Maintenance Management System (HMMS).

AUDIT RESULTS

This report presents the audit results of VDOT's highway infrastructure asset management practices. The following audit testing was performed with less significant or no discrepancies noted:

- Using information provided from the S&B Division, OSIG found that:
  - Information collected through structure inspections is properly reflected inside BrM.
  - Structure inspection team leaders maintain proper certifications.

  - VDOT internal audit reports have not identified any systemic issues relating to BrM.
  - The health index represented inside BrM is calculated using the AASHTOWare BrM default calculation instead of VDOT's more precise health index calculation. This results in the current health index in BrM not being used for bridge management purposes.
  - BrM accurately labels structures as functionally obsolete and/or structurally deficient.
  - Results of the Performance Year 2017 Federal Bridge Inspections quality assurance review found that VDOT had met or exceeded expectations for all 23 metrics tested.
  - Construction cost estimates are not currently recorded in BrM due to continuous upgrades from AASHTOWare.
  - BrM's inventory is complete.
- Using information provided from the Maintenance Division, OSIG found that:
  - The IV&V process performed provides a cost-effective means to enhance data integrity.
  - Pavement information collected by Fugro is accurately reflected in PMS.
  - VDOT internal audit reports have not identified any systemic issues relating to PMS.
  - PMS's inventory is complete.
  - Source information collected by Fugro supports the recommended treatments produced by PMS.
  - Construction cost estimates are properly uploaded into PMS.
  - PMS is a useful tool in helping management during project selection.
- VDOT has similar funding distribution and budget development practices as other states. No best practices or potential improvements were noted relating to funding distribution and budget development.
- In most instances, actual allocations made to VDOT's districts do not significantly differ from estimates generated by BrM and PMS. Instances where allocations do differ are due to variables and processes taken into account in preparing the Constrained Needs that are not taken into account during preparation of the Unconstrained Needs.
- Using VDOT's public-facing Six Year Improvement Program, OSIG found that AMD's funding distribution and budget development process is compliant with the June 14, 2016, CTB resolution.

Based on the results and findings of the audit test work conducted of highway infrastructure maintenance at VDOT, OSIG concluded that internal controls were operating properly as they relate to the audit objectives, except as identified in the report findings.