



Scan Team Report
NCHRP Project 20-68A, Scan 10-03

Best Practices In Performance Measurement For Highway Maintenance And Preservation

Supported by the
National Cooperative Highway Research Program

March 2012

The information contained in this report was prepared as part of NCHRP Project 20-68A U.S. Domestic Scan, National Cooperative Highway Research Program.

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Executive Summary

Overview

Preserving and maintaining the condition of highway assets is a key component to enable state highway agencies (SHAs) to provide a safe, smooth, and sustainable transportation system. While the construction phase of the highway life cycle often receives the most attention from elected officials and the public, responsibility for maintaining the roadway infrastructure assets is typically the longest phase of the highway life cycle and one of the most important factors in determining the frequency with which assets need to be reconstructed or replaced. As many transportation agencies have realized, ongoing investments in planned maintenance activities are a cost-effective way to postpone more costly treatments in the future and an important strategy for achieving customer satisfaction with the road system.

The use of performance-based management is gaining national attention as the Federal Highway Administration (FHWA) and other organizations promote a more systematic and transparent process for making transportation investment decisions. At the national level, the attention on transportation performance management is focused primarily on performance measures in these areas:

- Safety (e.g., number of fatalities and serious injuries)
- Infrastructure condition (e.g., state of good repair)
- Freight mobility and economic vitality (e.g., speed, travel time, and/or reliability on key networks)
- Mobility (e.g., travel time and reliability)
- Environment (e.g., greenhouse gases and storm water runoff)
- Livability (with potential measures to be determined)

The importance of maintenance and operations activities to highway agencies and the relationship between maintenance activities and their impact on asset performance have led to the design of numerous initiatives to improve maintenance quality and better defend maintenance budget requirements. Maintenance quality assurance (MQA) programs first emerged in the 1990s as a method of assessing and documenting maintenance quality. In their infancy, these programs focused primarily on documenting work accomplishments to report the resources used and production rates and reporting planned versus actual accomplishments. Within the past decade, however, these programs have become more customer-oriented, with an increased focus on maintenance outcomes and targeted performance levels. As a result, several SHAs are using their MQA results to set performance targets and estimate budgets needed to achieve those targets. Consequently, these agencies now can better defend

budget requests, establish maintenance priorities, and demonstrate the impact of different investment levels on maintenance quality than they could in the past.

To date, there has been a great deal of variability in how agencies have established these MQA components and how the results have been used to establish accountability, improve maintenance effectiveness, establish budget requirements, and allocate resources. Therefore, a domestic scan was organized through the U.S. Domestic Scan Program, which is managed under the auspices of the National Cooperative Highway Research Program (NCHRP). The American Association of State Highway and Transportation Officials (AASHTO) and NCHRP selected a scan team to establish the scan's scope and to identify the agencies to select for participation in the scan. A facilitator/report writer was selected to support these efforts by conducting a desk scan of current practices in this topic area and recommending agencies that had established strong practices in the topic areas the scan team had chosen.

The domestic scan took place in October 2011 in Anaheim, California. The scan team structured the scan in a peer exchange format and included representatives from 17 SHAs, who participated in discussions structured around these topic areas:

- Establishing reliable and cost-effective methods of monitoring the quality of maintenance and operations activities
- Using MQA data to establish accountability with internal and external stakeholders
- Using the MQA results to
 - Set budgets
 - Establish performance targets
 - Allocate resources
 - Justify needs
 - Establish strategic plans
 - Monitor customer satisfaction
 - Measure contributions to an agency's strategic performance targets

The team conducted the scan over a three-day period, with sessions organized to examine the organizational and institutional structures, programs, policies, operational practices, and delivery mechanisms that have enabled agencies to successfully use performance-based management practices for highway maintenance and preservation.

The scan's specific objectives included:

- Explore the experiences of top-performing agencies, examining the degree to which their business plans and system-preservation strategic plans are linked to their MQA programs

- Identify successful strategies for linking customer expectations to agency performance measures
- Examine the variables that have most influenced the use of MQA results to improve agency accountability and/or support budgeting and resource allocation decisions
- Examine if, and how, different data measures, data-collection procedures, and data verification activities influence MQA program costs and the use of MQA results
- Examine the ways in which innovation has been incorporated into MQA programs
- Explore the ways highway maintenance and preservation information is presented to senior management, elected officials, and the public
- Explore the strategies (e.g., education and training programs) that have been used successfully to build buy in and accountability among field personnel
- Identify technical and/or organizational challenges to overcome and strategies to improve the use of performance measures for highway maintenance and preservation activities

The findings and recommendations from the scan are summarized in this report.

Summarized Findings

Based on the information presented during the scan in each of the topic areas, the scan team made several significant conclusions. These findings represent the current state of the practice in the use of performance measurement for highway maintenance and preservation activities.

- Performance-based data (e.g., inputs to MQA programs) provide the foundation for assessing maintenance needs and for reporting results in all of the participating agencies. Several of the participating agencies have successfully used their MQA results to secure additional funds and improve communication with both internal and external stakeholders.
- The most successful agencies have established organizational cultures that support the use of performance data to drive maintenance and preservation decisions. Some of the participating agencies have been able to change their organizational cultures by holding people accountable for the decisions they make. Other agencies have used training programs effectively to help change the culture in support of performance-based programs and to build buy in among field personnel.
- No single approach represents best practice in the use of performance-based data for highway maintenance and preservation. In practice, the intended use of the data drives the system requirements and the amount of data needed.
- The quality of the data used in performance-based decision-making is critically important. Therefore, the agencies represented by the scan participants have

developed strong quality assurance (QA) programs to help ensure the reliability and completeness of the data.

- Technology has had a significant impact on the efficiency with which data can be collected, integrated with other programs, analyzed, and reported. The South Carolina Department of Transportation (DOT), for example, reported that it doubled the productivity of its surveys and improved its data accuracy by incorporating innovations into the data-collection process. In a pilot study, the Utah DOT found that data could be collected using semi-automated or manual means and handheld devices as quickly and as accurately as with automated data-collection vans, demonstrating that data can be collected very cost-effectively.
- Most of the scan participants roll their MQA results into a single statewide maintenance score that is weighted to reflect their own agency's priorities.
- Some standardization of commonly used performance measures would facilitate the exchange of information among agencies and simplify the startup activities in agencies that are just beginning to build their performance-based programs. The availability of guidelines and training in this area would benefit the industry.
- The cost of collecting data for MQA programs is insignificant when compared to the impact the results can have on maintenance budgets. The Utah DOT, for example, spends less than 1% of its maintenance budget on these activities, even while performing a 100% survey of most items each year.
- It is important that links be established between the performance data and budget changes. For instance, changes in budgets or standards should have a corresponding change in the achievable level of service (LOS). This link establishes a connection between the performance data and agency decisions that is important for building buy in and justifying maintenance expenditures.
- Additional efforts are needed to improve the methods used to report the results of performance-based programs to both internal and external stakeholders. Most of the participating agencies would welcome guidance on more-effective strategies for reporting needs that will resonate with politicians.

Recommendations

The scan team developed recommendations for each of the topic areas explored during the scan. The team organized the recommendations into six activities that will promote and facilitate the use of a performance-based, customer-oriented approach for estimating maintenance needs and budgets, communicating with various stakeholder groups, improving the transparency of maintenance activities, and allocating resources effectively. The team also identified suggested actions within each of the six activity areas. The six activities and the action items include the following:

- **Measure**—Recognizing the national trend toward performance measures, initiate and lead activities that identify common performance measures that align with and contribute to high-level goals, such as safety and pavement/bridge condition
 - Elevate the importance of maintenance by establishing a link to the agency’s asset-management framework and strategic performance measures
 - Charge the AASHTO Subcommittee on Maintenance (SCOM) with identifying commonly used performance measures in the areas of safety, asset preservation, environment, and mobility to support the development of national performance measures that “measure what matters”

- **Report**—Identify communication and analysis tools that enable maintenance agencies to better “tell their stories” and move the industry toward an open-architecture platform
 - Conduct a study to evaluate the impact of maintenance performance measures on national strategic goals
 - Develop methods of using technology and innovation to produce timely and actionable data or reports
 - Promote mechanisms for sharing technology that establish stronger collaborations between industry and the maintenance community and accelerate the application of technology in transportation agencies
 - Initiate research to develop deterioration models and/or life-cycle models for key maintenance assets and identify reciprocal relationships between capital investments (for preservation and expansion) and maintenance requirements

- **Improve**—Develop strategies that improve the quality of data used for performance-based maintenance programs, including strategies that accelerate the use of new technology and innovation
 - Document the benefits of MQA data-collection activities to support the agency’s maintenance, preservation, and asset-management needs
 - Charge the SCOM with developing guidelines for data collection at various levels of sampling to ensure the statistical validity of the data and to evaluate underrepresented assets appropriately
 - Given that performance-based contracting for maintenance is becoming more widely used, develop the means to use MQA tools to manage such contracts and help compare the costs of contract forces to the costs to achieve the same LOS using in-house forces

- **Train**—Develop and conduct training programs to support performance-based maintenance programs

- Review existing training programs and needs, assess gaps between the two, and support the development of new or modified training initiatives to address those gaps
- Encourage federal support for sponsoring training and technology-transfer activities to promote performance-based maintenance programs
- **Share**—Develop a sustainable mechanism for sharing performance-based maintenance practices and experiences in SHAs
 - Update and maintain the MQA Web site maintained by the Midwest Regional University Transportation Center at the University of Wisconsin¹
 - Develop guidelines illustrating how agencies can use MQA data to improve performance, support budgeting activities, build buy in, and hold people accountable
- **Promote**—Actively promote the use of performance-based maintenance programs among SHAs and develop strategies to increase the number of agencies using these programs
 - Promote the best practices from this scan to SHAs and other transportation agencies and the transportation industry in general
 - Document the contribution of performance-based programs to support the agency’s asset management and pavement preservation programs and demonstrate how agencies have successfully built collaborative programs
 - Disseminate the results of current NCHRP research on promoting the benefits of maintenance
 - Develop marketing material that agencies can use to promote and sustain the use of performance-based programs to decision makers

¹ <http://www.wistrans.org/mrutc/events/maintenance-quality-assurance/>