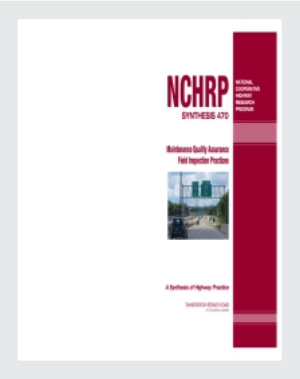

Maintenance Quality Assurance Field Inspection Practices

DETAILS

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SYNTHESIS 470

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Maintenance Quality Assurance Field Inspection Practices

A Synthesis of Highway Practice

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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

NCHRP **SYNTHESIS 470**

Maintenance Quality Assurance Field Inspection Practices

A Synthesis of Highway Practice

CONSULTANT
Kathryn A. Zimmerman
Applied Pavement Technology, Inc.
Urbana, Illinois

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The synthesis herein was performed under NCHRP Project 20-05 by Ms. Kathryn A. Zimmerman of Applied Pavement Technology, Inc. The work was conducted under the leadership and guidance of Ms. Jo Allen Gause, Senior Program Officer at the Transportation Research Board. Throughout this project, Ms. Gause has provided tremendous support and encouragement.

The author is indebted to the state DOTs listed in Appendix B that participated in the survey. Their thoughtful responses to the survey are appreciated and their contributions to making this information available are noted. In addition, the time and efforts of the representatives from Alaska, Florida, Kentucky, Montana, North Carolina, Utah, Washington, and Wisconsin DOTs who participated in the interviews are recognized with gratitude. The contributions of Mr. Carlos Braceras, the Director of the Utah DOT and the Chair of the AASHTO Subcommittee on Maintenance, to entice state DOTs to complete the survey of practice are also greatly appreciated.

Finally, the author recognizes with sincere gratitude and appreciation the contributions of the Topic Panel. Their careful review and insights greatly enhanced the final product.

Cover figure: Entrance ramp to I-35W in Minnesota. *Photo by:* Applied Pavement Technology, Inc.

FOREWORD

Highway administrators, engineers, and researchers often face problems for which information already exists, either in documented form or as undocumented experience and practice. This information may be fragmented, scattered, and unevaluated. As a consequence, full knowledge of what has been learned about a problem may not be brought to bear on its solution. Costly research findings may go unused, valuable experience may be overlooked, and due consideration may not be given to recommended practices for solving or alleviating the problem.

There is information on nearly every subject of concern to highway administrators and engineers. Much of it derives from research or from the work of practitioners faced with problems in their day-to-day work. To provide a systematic means for assembling and evaluating such useful information and to make it available to the entire highway community, the American Association of State Highway and Transportation Officials—through the mechanism of the National Cooperative Highway Research Program—authorized the Transportation Research Board to undertake a continuing study. This study, NCHRP Project 20-5, "Synthesis of Information Related to Highway Problems," searches out and synthesizes useful knowledge from all available sources and prepares concise, documented reports on specific topics. Reports from this endeavor constitute an NCHRP report series, *Synthesis of Highway Practice*.

This synthesis series reports on current knowledge and practice, in a compact format, without the detailed directions usually found in handbooks or design manuals. Each report in the series provides a compendium of the best knowledge available on those measures found to be the most successful in resolving specific problems.

PREFACE

By Jo Allen Gause
Senior Program Officer
Transportation
Research Board

This synthesis examines Maintenance Quality Assurance field inspection practices used by state transportation agencies to support maintenance investments. The report documents and summarizes the type of data collected, the methodology used to assess condition, and the processes in place to ensure the quality of the data. In addition, the synthesis presents information on how the field inspection data are used to report highway conditions, estimate budget needs, and establish targeted levels of service.

Information used in this study was gathered through a literature review and a survey of state departments of transportation. Follow-up interviews with selected agencies provided additional information.

Kathryn A. Zimmerman, Applied Pavement Technology, Inc., Urbana, Illinois, collected and synthesized the information and wrote the report. The members of the topic panel are acknowledged on the preceding page. This synthesis is an immediately useful document that records the practices that were acceptable with the limitations of the knowledge available at the time of its preparation. As progress in research and practice continues, new knowledge will be added to that now at hand.

CONTENTS

APPENDICES A and B beginning on page 44 are web-only and can be found at www.trb.org, search on NCHRP SYNTHESIS 470.

Note: Many of the photographs, figures, and tables in this report have been converted from color to grayscale for printing. The electronic version of the report (posted on the web at www.trb.org) retains the color versions.

MAINTENANCE QUALITY ASSURANCE FIELD INSPECTION PRACTICES

SUMMARY

In the mid-1990s, Maintenance Quality Assurance (MQA) programs emerged as a method to estimate maintenance funding needed to achieve a given level of service. These programs required agencies to adopt a method of documenting work accomplishments and productivity, reliable cost data, and an inventory of highway maintenance features. Since that time, the capabilities of MQA programs have evolved as data collection and analysis technology has improved and transportation agencies have become more customer focused. Today, agencies are using the results of MQA programs to estimate the cost of providing different maintenance service levels to the traveling public, essentially enabling maintenance personnel to defend budget requests and to establish reasonable performance targets under constrained conditions.

A number of initiatives have been undertaken to share MQA practices among practitioners, and they are explored in more detail below.. For instance, major national peer exchanges were conducted in 2004 and 2008, and a recent U.S. Domestic Scan (Best Practices in Performance Measurement for Highway Maintenance and Preservation) focused on the degree to which state MQA programs are linked to agency business and strategic plans. In addition, the University of Wisconsin at Madison established an MQA website where state transportation agencies can post MQA resources. In 2012, TRB published an NCHRP synthesis titled *Performance-Based Highway Maintenance and Operations Management* that summarized the role of MQA programs within the broader context of performance-based management, which is supported under the recent highway legislation commonly known as Moving Ahead for Progress in the 21st Century (or MAP-21).

An objective of these initiatives has been to expand the use of MQA programs among state highway practitioners and to share experiences so that the practice continues to advance. This synthesis, which documents the current field inspection procedures being used to support a state MQA program, builds on previous efforts to document MQA practices and brings the documentation up to date.

The information contained in this synthesis was obtained using three different sources. First, a literature review was conducted to provide background information about the state of the practice and recent developments that have taken place in the implementation and use of MQA programs. Second, a survey was distributed to voting members of AASHTO Subcommittee on Maintenance for each of the 50 states and the District of Columbia, asking for information on their MQA field inspection practices. A total of 40 agencies responded to the survey. Finally, follow-up interviews with representatives from eight departments of transportation (DOTs) were conducted to expand on the following three aspects of their program:

- The rationale and motivation for initiating their MQA program.
- The procedures used to ensure the quality and consistency of the MQA data and results.

- The impact their methodology has had on how the MQA results can be used to support agency decisions.

The study found that most state DOTs have an MQA program in place or intend to implement a program within the next 5 years. Among the states that have an MQA program in place, most have had their program for more than 10 years and have made substantial changes to the program within the past 5 years. A number of factors have driven the interest and activity in the MQA area, with most state DOTs indicating that their program was initiated so agencies could

- Improve accountability,
- Estimate maintenance needs,
- Develop performance-based budgets,
- Monitor asset performance,
- Make good use of available funding, and
- Track and report maintenance activities.

The survey of state practice investigated data collection practices in six asset categories: drainage, roadside assets, pavements, bridges, traffic, and special facilities. Of these asset categories, the most complete inventories were established for pavements and bridges. Several assets within the traffic and special facilities categories also had complete inventories established in more than half of the state DOTs with MQA programs. The survey of state practice focused only on data being collected to establish inventories and to assess the condition of the various assets. It did not include questions about operational maintenance activities such as snow removal or mowing.

Most state DOTs report conducting manual surveys to collect the condition information, with annual surveys being most common. Bridges are the lone exception, as they are typically inspected every other year. Automated equipment is most commonly used for paved roadways, but the equipment is also used to some degree for other assets found along the road edge. The survey found that condition surveys for pavements and bridges are conducted outside of the MQA program in some agencies because information is already being collected as part of a pavement management condition survey or an annual bridge inspection.

Half of the state DOTs use the survey results in a hybrid model that uses features of both the pass/fail and graded condition assessment methods. Surveys are typically conducted by district or regional personnel, and central office personnel are responsible for conducting random checks of data quality. Manual survey methods are most commonly used and nearly half of the state DOTs report using handheld computers to record information. Pencils and paper are still very common tools used during the MQA surveys.

Most state DOTs with MQA programs survey representative samples of the network to estimate statewide conditions. The samples are typically 0.10 mi long, and between 10% and 20% of the total samples are inspected. For example, state DOTs may use statistical methods to estimate the number of samples to inspect, or they could just set a number based on experience, but most agencies report that they strive for a 95% confidence level in the data.

The resources required to conduct the surveys vary among the states, with most reporting that they spend more than 6 person-months conducting surveys. The level of resources required is dependent on the sampling rate and the size of the network. In a typical MQA program, these efforts are spread out among several raters.

With one exception, the state DOTs with MQA programs are actively taking steps to manage data quality, making use of rating manuals, training programs, independent

assurance checks, and data reasonableness checks to support their efforts. To help reduce bias, most states use a team of two raters to conduct surveys. A number of states certify their raters and at least one state has posted the qualifications for raters on their website. Several states have initiated studies to statistically evaluate the number of samples that need to be inspected to provide a reasonable level of confidence in the data.

MQA data are used in a variety of ways to support agency decisions. Most states use the survey results to establish a level of service (LOS), with letter grades (A to F) being most commonly used. The results have been used to establish performance targets and some states have established (or are establishing) links between their performance targets and resource requirements.

Most of the state DOTs with MQA programs have a computerized maintenance management system (MMS) in place, yet less than half of the states use the MMS to estimate budget needs or to schedule work activities. In addition, few state DOTs report that their MMS is integrated with their pavement or bridge management systems.

The survey results are typically reported to maintenance and field personnel in virtually all of the state DOTs. Some agencies provide the information to other agency personnel, but few provide the information to elected officials or the public. Reports are the most common method of presenting information, but agencies also use websites and dashboards to communicate with stakeholders.

Most state DOTs report that their MQA program has helped their agency achieve more consistent conditions on a statewide basis and that the information has helped them establish maintenance priorities. The following factors have most contributed to the success of the program:

- Support of upper management,
- Training,
- Simplicity of the program,
- Ease of use,
- Confidence in the data, and
- Buy-in from field personnel.

Planned enhancements will occur in the following areas:

- Implementation of new software,
- Development of handheld computer applications for recording field data,
- Adding GPS characteristics to the data, and
- Exploring the use of automated surveys.

Further research is needed for the following areas:

- Establishing more consistency in performance measures, to help state DOTs better communicate on an equal basis and to facilitate national reporting of maintenance needs.
- Monitoring progress made over the next several years by repeating in 3 to 5 years the survey conducted under this project.
- Improving the efficiency of data collection activities, by taking advantage of statistical analyses to determine the sample sizes needed to achieve a reasonable level of confidence in the data and by exploring the use of ongoing automated data collection activities being used for pavement management to support MQA efforts.
- Increasing the use of MQA results for planning and budgeting activities through the development of implementation guidance, peer exchanges, domestic scans, and workshops.

- Establishing LOS-cost relationships that allow states to better communicate maintenance funding needed to achieve various levels of service with stakeholders.
- Improving the integration of capital and maintenance expenditures for whole-life costing, so the future impacts on maintenance from capital expansion projects can be better understood.
- Demonstrating the benefits of maintenance investments to improve communication with stakeholders and to help agencies justify expenditures on MQA programs.

CHAPTER ONE

INTRODUCTION

BACKGROUND

In the mid-1990s, Maintenance Quality Assurance (MQA) programs emerged as a method to estimate maintenance funding needed to achieve a given level of service. These programs required agencies to adopt a method of documenting work accomplishments and productivity, reliable cost data, and an inventory of highway maintenance features. Since that time, the capabilities of MQA programs have evolved as data collection and analysis technology has improved and transportation agencies have become more customer focused. Today, agencies are using the results of MQA programs, often in conjunction with computerized maintenance management systems (MMS), to estimate the cost of providing different maintenance service levels to the traveling public, essentially enabling maintenance personnel to defend budget requests and to establish reasonable performance targets under constrained conditions.

A number of initiatives have been undertaken to share MQA practices among practitioners since NCHRP published its *Maintenance QA Program Implementation Manual* in 1999 (Stivers et al. 1999). For instance, major national peer exchanges were conducted in 2004 and 2008, and a recent U.S. Domestic Scan (Best Practices in Performance Measurement for Highway Maintenance and Preservation) focused on the degree to which state MQA programs are linked to agency business and strategic plans (Markow 2012). In addition, the University of Wisconsin at Madison established an MQA website where state transportation agencies can post MQA resources and where materials from the national peer exchanges can be found (http://www.wistrans.org/mrutc/training-libraries/mqa/). In 2012, NCHRP published a synthesis titled *Performance-Based Highway Maintenance and Operations Management* that summarized the role of MQA programs within the broader context of performance-based management, which is supported under the recent highway legislation commonly known as Moving Ahead for Progress in the 21st Century (or MAP-21).

One objective of these initiatives has been to expand the use of MQA programs among state highway practitioners and to share experiences so that the state of the practice continues to advance. This synthesis, which documents the current field inspection procedures being used to support a state MQA program, builds on previous efforts to document MQA practices and brings the documentation up to date.

SYNTHESIS OBJECTIVES

The objective of this synthesis is to document current MQA field inspection practices administered within state DOT maintenance offices. The information contained in this document is intended to benefit transportation agencies that are building asset inventories and acquiring performance-based data on highway assets, such as roadside and drainage features, as part of an asset management program.

SYNTHESIS SCOPE AND APPROACH

The synthesis addresses all aspects of MQA field inspection practices used to manage physical assets, including the type of data collected, the methodology used to assess condition, and the processes in place to ensure the quality of the data. Performance metrics for operational factors (e.g., snow and ice removal, mowing, and accident response), which are often a large part of a maintenance budget, are not included in the scope of this synthesis.

In addition to summarizing the types of data collected and the methodologies used, the synthesis presents information on how the field inspection data are used to report highway conditions, to estimate budget needs, and to establish targeted levels of service. The rationale and motivation behind the adoption of an MQA program are also explored.

Overall, the information documented in this synthesis presents current practices in the following areas:

- The scope of the agency's MQA program, including program objectives, assets assessed, and assessment criteria used.
- The inspection processes used, including information on the frequency of inspection, the methodology used, the methods used to train inspectors, and the reliance on in-house versus contract personnel to conduct the surveys.
- The methods used to ensure the quality and consistency of the data collection processes and outcomes.

- The use of MQA data to support agency business processes and outreach activities with both internal and external stakeholders.
- New initiatives and technologies that are being considered to improve existing MQA programs.

The information contained in this synthesis was obtained using three sources. First, a literature review was conducted to provide background information about the state of the practice and recent developments that have taken place in the implementation and use of MQA programs. Second, a survey was distributed to voting members of AASHTO Subcommittee on Maintenance (SCOM) for each of the 50 states and the District of Columbia, asking for information on their MQA field inspection practices. A total of 40 states (80% of the 50 states) responded to the survey. Finally, phone or face-to-face interviews with representatives from eight DOTs were conducted to expand on the following three aspects of their program:

- The rationale and motivation for initiating their MQA program.
- The procedures used to ensure the quality and consistency of the MQA data and results.
- The impact their methodology has had on how the MQA results can be used to support agency decisions.

The eight state transportation agencies selected to participate in the interviews were chosen based on several factors, including their expressed willingness to provide additional information. To ensure that a range of approaches were represented in the case examples presented in the document, selection factors also included the age of the program, the use of automated or manual approaches to collect data, the degree of detail in the survey approach, and the use of in-house versus contract personnel to collect the data.

The information obtained from these three sources was used to develop the findings presented in this synthesis.

TERMINOLOGY

Several terms used throughout the synthesis were defined in the survey of state practice for use by the practitioners in preparing their responses. These terms, and the definitions that were provided, are listed here. These same definitions were used in presenting the survey results in this document.

- **Agency district/region**—Different geographic areas of responsibility within a given agency.
- **Agency division/section**—Various areas within a given agency; includes such divisions/sections as materials, construction, roadway design, planning, maintenance, and so on.
- **Asset**—A physical item of roadway infrastructure that has value. Assets are sometimes referred to as roadway "furniture" or "features." An asset may be a single item, such as a sign, or a linear item, such as a road or guardrail section. An asset may also be a spatial item, such as a rest area or mowable acreage.
- **Asset inventory**—A physical count of assets. The count may be by coordinates, milepoints, road section, geographical area, road network, maintenance section, or other convenient method of sorting and reporting the amount of assets in the road system.
- **Category**—Logical groups of maintained assets that are combined because of their common function or location on the highway, such as pavements and drainage structures.
- **Characteristic**—Specific performance measures that are rated for each feature.
- **Condition assessment**—A physical inspection and rating of roadway assets to determine the condition of individual assets, roadway sections, or overall road networks.
- **Feature**—Assets that are contained in a category. For instance, the traffic category might include guardrails, impact attenuators, and barriers.
- **Independent assurance (IA)**—An assessment of the reliability of test results that is performed by a third party not directly responsible for process control or acceptance testing. The survey found that other terms may be used by some agencies for this activity.
- **Level of service (LOS)**—A measure of the condition of individual assets as well as the overall condition of the roadway. LOS measures are generally specified in customer service terms related to safety, preservation, convenience, aesthetics, comfort, and mobility. Some agencies also measure LOS in terms of environmental impacts or legislative mandates.
- **Maintenance management system (MMS)**—A modern MMS at a high level of maturity integrates organization structure, business processes, and technology to provide a systematic approach for planning and executing an efficient customer-oriented and performance-based maintenance program. At the most basic level, an MMS tracks maintenance activities, costs, and resources.
- **Maintenance Quality Assurance (MQA)**—A process of physically inspecting and rating the condition of the roadway assets and maintenance services. The quality assessment employs the same measures used to set performance targets. The data from the maintenance quality assessment are used to assess outcomes, actual performance, and maintenance LOS.
- **Performance measure**—A quantifiable measure of performance to determine progress toward specific, defined organization objectives based on statistical evidence. Sample measures include height of grass, number of potholes per lane mile, and percent of signs below standard.

- **Performance target**—A targeted level of an activity or performance expressed as a tangible, measurable goal against which achievement can be compared. A performance target is usually a numerical rating, such as "pavement drop-off less than x inches," but it could also be an overall rating, such as a targeted LOS equal to "A" in an A to F rating scale.
- **Quality assurance (QA)**—All planned and systematic actions necessary to provide confidence that a product or facility will perform satisfactorily in service. The survey found that other terms may be used by some agencies for these activities.
- **Quality control (QC)**—Actions and considerations necessary to adjust a process to ensure the process produces reliable results. The survey found that other terms may be used by some agencies for these activities.
- **Sampling**—A small group of sections selected from the entire population (usually statistically) that is used to represent the condition of the entire population.

Other terminology in this synthesis and in the literature review should be interpreted in context. The meanings will generally be clear from the definitions provided, the discussions presented, or the examples provided by the source.

REPORT ORGANIZATION

This synthesis of practice is organized into the five chapters described here.

- Chapter one—Introduction. This chapter introduces the synthesis, providing background information and summarizing the scope and organization of the document.
- Chapter two—Literature Review. The findings from the literature are summarized and presented in this chapter. Relevant topics covered in the literature review include the MQA approaches that are generally used, the methodologies used to collect inventory and condition data, and the use of MQA results.
- Chapter three—State of the Practice. The results of the survey of state practice are presented in this chapter by topic area. These include the following:
  - Survey content;
  - MQA program status;
  - Data collection and quality assurance procedures;
  - Use of MQA data; and
  - Innovations, improvements, and enhancements.
- Chapter four—Case Examples. This chapter summarizes the information provided by the eight agencies that were interviewed, in terms of the three topic areas that were explored in more detail: the rationale and motivation for their program, the procedures used to ensure quality, and the impact the methodology has had on the use of their MQA data.
- Chapter five—Conclusions. The synthesis concludes with a summary of key observations from the findings and suggestions for further research and outreach in the MQA area.
- Appendices—Two appendices are included with the synthesis. The first appendix (Appendix A) provides a copy of the questionnaire that was distributed electronically to the state participants. The second appendix (Appendix B) presents the responses by state for each of the questions posed to the survey participants. Both appendices are available in the online version of the report.

CHAPTER TWO

LITERATURE REVIEW

OVERVIEW

Although it is generally accepted that an AASHTO SCOM meeting held in Scottsdale, Arizona, in 2000 initiated a peer-to-peer discussion on the use of performance measures for maintenance, the publication of *NCHRP Report 422: Maintenance QA Program Implementation Manual* is recognized in the industry as the foundation for many MQA programs. That document, which helped establish the use of quality measures for maintenance activities, identified the primary goal of a maintenance quality assurance (QA) program as the efforts required to "improve quality and provide for the effective use of existing resources" (Stivers et al. 1999). It established the importance of having a method of documenting work accomplishments, establishing resource requirements for each maintenance activity, building an inventory of highway features, and acquiring a basic understanding of quality management concepts and principles to successfully implement the QA process documented in the report and thereby shift from a reactive management approach to a more proactive approach.

As transportation agencies adopted the MQA program outlined in *NCHRP Report 422*, several peer exchanges provided opportunities for practitioners to share their experiences and to learn from the experiences of others. The 2004 MQA Peer Exchange resulted in the publication of a synthesis documenting the performance measures being used by the participating agencies (Adams and Smith 2006). In addition, the synthesis established common definitions for key terms that have made it easier to share practices. Three of the terms that are defined in the synthesis include those featured in Figure 1 and listed here (Adams and Smith 2006).

FIGURE 1 Illustrative example of the relationship between key terms (Adams and Smith 2006).

- Category—Logical groups of maintained assets that are combined because of their common function or location on the highway. AASHTO (2006) defined the following common categories: pavements, roadsides, drainage structures, traffic, bridges and other structures, and special facilities (e.g., rest areas and tunnels).
- Feature—A category is made up of individual assets, known as features. The condition, or performance, of individual features is monitored as part of an MQA program.
- Characteristic—The specific performance measures that are rated for each feature are known as characteristics. Characteristics can be either specific qualities or defects.

According to the literature, the maintenance categories used in state MQA programs are generally consistent, but the features and characteristics included in each category vary greatly (Adams and Smith 2006).

In 2008, another peer exchange focused on MQA practices. According to Markow (2012), the results from that peer exchange indicate that fewer features were being measured than in 2004, and that a number of agencies were moving toward the use of broader and more general performance characteristics than in the past. For instance, rather than monitor specific types of deterioration, performance characteristics such as "operates as intended" were increasingly used.

In 2011, a Domestic Scan titled "Best Practices in Performance Measurement for Highway Maintenance and Preservation" was conducted through the NCHRP Domestic Scan Program. The scan, which was conducted as a peer exchange, provided an opportunity for representatives from 17 DOTs to discuss practices associated with collecting MQA data, using that data to improve accountability, and linking the results to planning, budgeting, and outreach activities. The Domestic Scan participants reported that performance-based data were used to some degree by all of the transportation agencies represented at the event, and that some agencies had successfully used their MQA results to secure increased funding levels for maintenance activities (NCHRP 2012). In times of limited funding, the results also provide information needed for making tough budget decisions to address agency priorities. Additionally, the scan findings indicate that there is no one approach to MQA that works for all agencies.

Rather, "the intended use of the data should drive the system requirements and the amount of data needed" (NCHRP 2012, p. 6-1). The findings also document the significant impact that technology has had on the methods of data collection, the ability to integrate MQA data with other programs, and the analysis and reporting capabilities available.

More recently, *NCHRP Synthesis 426: Performance-Based Highway Maintenance and Operations Management* focused on the use of performance-based maintenance programs to better understand maintenance policy and investment options and to account for the consequences of these decisions (Markow 2012). The synthesis sought to build on the original elements of an MQA program by documenting broader uses of performance data to address provisions in transportation legislation and to more comprehensively account for highway life-cycle costs. The findings indicate that at least 75% of the 41 agencies participating in the project survey are either using or actively developing performance-based maintenance programs in some way (Markow 2012).

The use of performance-based management of highway assets is strongly supported in the highway legislation, commonly known as Moving Ahead for Progress in the 21st Century (or MAP-21). This legislation is intended to transform the federal-aid program and substantially improve the effectiveness and transparency of federal investments. MAP-21 requires federal-aid recipients to set performance targets and then direct their federally funded programs toward the achievement of those targets. Progress will be monitored and reported at various schedules. The legislation also requires each state to develop a risk-based Transportation Asset Management Plan that documents investment strategies for pavement and bridge assets on the National Highway System. The emphasis on performance-based management is expected to increase the emphasis on performance-based budgeting activities and the use of performance data to drive investment decisions.

Markow (2012) introduces some common barriers to the use of performance-based methods, including the lack of an agency decision to adopt a performance-based philosophy and the lack of resources to implement and maintain the program once it is in place. Agencies using performance-based programs indicated that funding uncertainties can impede its effectiveness (Markow 2012).

Several specific aspects of MQA programs are explored further in this chapter, to provide a framework for considering the summary of practice provided in chapter three. The specific areas addressed in this chapter include the following:

- MQA condition assessment approaches
- Data collection activities to support MQA programs
- Maintenance levels of service
- Using MQA results.

MAINTENANCE QUALITY ASSURANCE CONDITION ASSESSMENT APPROACHES

The literature describes at least two approaches to assessing the condition of highway assets as part of an MQA program: a pass/fail approach and a scored approach (Zimmerman and Stivers 2007b; NCHRP 2010). Under the pass/fail approach, each feature is rated based on whether it meets a threshold level established by the agency as a desirable level of service (LOS). For instance, some sample thresholds for the Florida DOT's Maintenance Rating Program (MRP) are shown in Figure 2 (NCHRP 2012). Under this type of assessment approach, the feature would pass if 75% or more of the total shoulder edge is free of raveling, and if no continuous section of edge raveling (4 in. or wider) is longer than 50 ft. If either of these criteria is not met, the feature does not pass.

FIGURE 2 Sample rating assessment for edge raveling (NCHRP 2012).

In the scored approach, the amount of a defined deficiency is recorded in the field according to rating criteria established by the agency. Under this approach, rather than report whether a feature passes or fails, a grade is assigned based on the deficiencies observed. An example of the rating criteria for guardrails is illustrated in Figure 3 (NCHRP 2012). In this case, the rater records both the total length of guardrail in a feature and the amount of guardrail considered to be deficient using the description provided in the rating manual. The information is then used to calculate the percent of guardrail that is damaged or missing, and a corresponding LOS is assigned. For instance, using the example LOS categories provided in Table 1, if 2% of the guardrail is considered deficient, an LOS of "B" is assigned. In some instances, the score assigned to an asset also references the maintenance activity that will be performed or the re-inspection cycle. For instance, a culvert rating of

"1" or "2" (on a scale of 1 to 4) might trigger a re-inspection in 6 years since the culvert is considered to be "like new" or in "fair" condition. A lower score, indicating that the culvert is in "poor" or "very poor" condition, might trigger annual inspections.

FIGURE 3 Sample rating instructions for guardrail under a scored system (WSDOT 2014).

TABLE 1
SAMPLE LOS CATEGORIES FOR GUARDRAIL

	Level of Service				
	A	B	C	D	F
Amount of Damaged or Defective Guardrail	0% to 1%	1.1% to 3%	3.1% to 5%	5.1% to 10%	>10%

The results of the 2011 Domestic Scan indicate that some agencies have adopted a third approach, which is a hybrid of the pass/fail and scored approaches (NCHRP 2012). Under this hybrid approach, the conditions of the features are evaluated using the pass/fail criteria, but the conditions for the region, district, or network are reported in terms of a graded LOS (NCHRP 2012). This approach takes advantage of the speed with which pass/fail surveys can be conducted and presents the results in a format that is useful for communicating with stakeholders.

The primary advantage to the scored approach is the availability of information that can be used to estimate the amount of maintenance required to address the deficiencies or to raise the LOS from one level to another (Zimmerman and Stivers 2007b). It is difficult to estimate the amount of maintenance needed under a pass/fail approach because only the number of features that passed or failed are identified. However, it may not be known whether a feature was close to passing or whether it was nearly 100% deficient.

DATA COLLECTION ACTIVITIES TO SUPPORT MAINTENANCE QUALITY ASSURANCE PROGRAMS

Asset condition information is typically collected using either a manual or mobile approach (AASHTO 2006), but technological advances and agency efforts to improve the efficiency of its data collection efforts are leading more agencies to consider mobile technology to establish asset inventories (Zimmerman and Stivers 2007a). According to AASHTO (2006), manual data collection methods are relatively accurate and allow access to assets not visible from the road, but the process is slow and labor intensive. Mobile methods (using automated vans with digital cameras, lasers, and LiDAR) allow multiple assets to be inspected at one time while traveling at traffic speeds, but the data collection efforts are limited to assets that can be seen from a travel lane (AASHTO 2006). The suitability of different data collection methods are provided in Table 2 (Zimmerman and Stivers 2007a).

In recent years, transportation agencies have begun exploring the use of LiDAR—a remote sensing technology that measures distance by analyzing the reflected light from a laser—for building asset inventories. The Utah DOT, for example, is using this technology to gather information on signs, right-of-way (ROW) features, and vertical clearance. An example of the output from these efforts is provided in Figure 4.

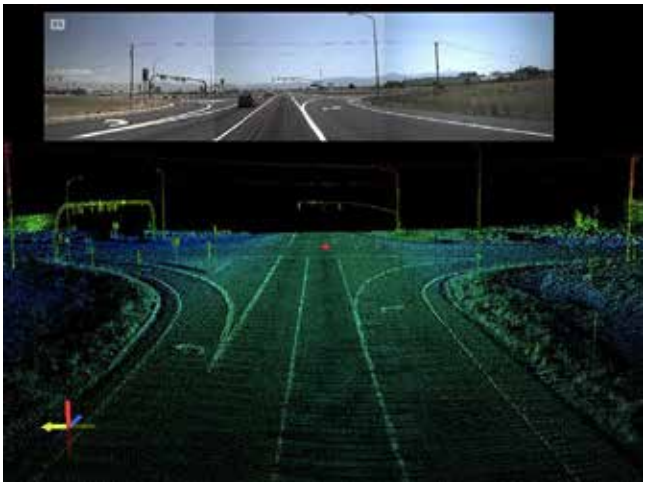
FIGURE 4 Example use of LiDAR to roadway asset inventory (Ellsworth 2014).

The use of innovations and new technology in data collection efforts was also a focus during the 2011

TABLE 2
SUITABILITY OF DIFFERENT METHODS OF DATA COLLECTION

Asset Categories	Asset Types	Data Collection Method	Asset Categories	Asset Types	Data Collection Method
Drainage	Culvert	Manual	Traffic Items	Signal	Manual
	Curb and gutter	Manual		Sign	Manual or Mobile
	Sidewalk	Manual		Pavement markings	Manual or Mobile
	Ditch	Manual		Pavement marker	Mobile
	Drop inlet and storm drain	Manual		Overhead sign structure	Manual or Mobile
	Erosion control	Manual		Traffic barrier/ median barriers	Manual
	Under or edge drain	Manual		Highway lighting	Manual or Mobile
Roadside	Fence	Manual or Mobile	Guardrail & Attenuators	Guardrail	Manual or Mobile
	Grass mowing	As Needed		Guardrail end treatments	Manual or Mobile
	Brush	As Needed		Impact attenuator	Manual or Mobile
	Landscaping	Manual	Other Facilities	Tunnels	Manual
	Sound barrier	Manual		Rest areas	Manual
Pavement	Shoulder	Manual or Mobile		Weigh stations	Manual
	Lane, paved	Manual or Mobile		Roadside graffiti	Manual
	Lane, unpaved	Manual or Mobile		Roadside litter	Manual or Mobile

Source: Zimmerman and Stivers (2007a).

Domestic Scan. The findings indicate that agencies are making use of touch-screen computers and handheld devices as a way to improve their crews' productivity (NCHRP 2012). Devices with embedded cameras were considered advantageous for coordinating the location of each photo with the data.

MQA programs commonly use sampling to reduce the amount of time dedicated to conducting surveys. Under a sampling approach, statistically representative samples of the network are inspected and these samples are considered to be representative of the entire system. In 2006, a reference was developed to assist state DOTs in determining the appropriate number of samples to inspect in order to achieve stated confidence levels (Schmitt et al. 2006).

The literature also discusses the importance of maintaining data quality by using an objective and repeatable survey procedure, developing inspection manuals, and training the inspectors regularly (NCHRP 2012). Other suggestions include developing a QA process in which an independent rater verifies the ratings in a statistically significant number of samples (Stivers et al. 1999). To help determine the number of samples to inspect as part of a QA process, or to evaluate the total number of samples that need to be inspected for an MQA program, Schmitt et al. (2006) developed guidance to the statistical analyses involved in establishing a credible MQA program.

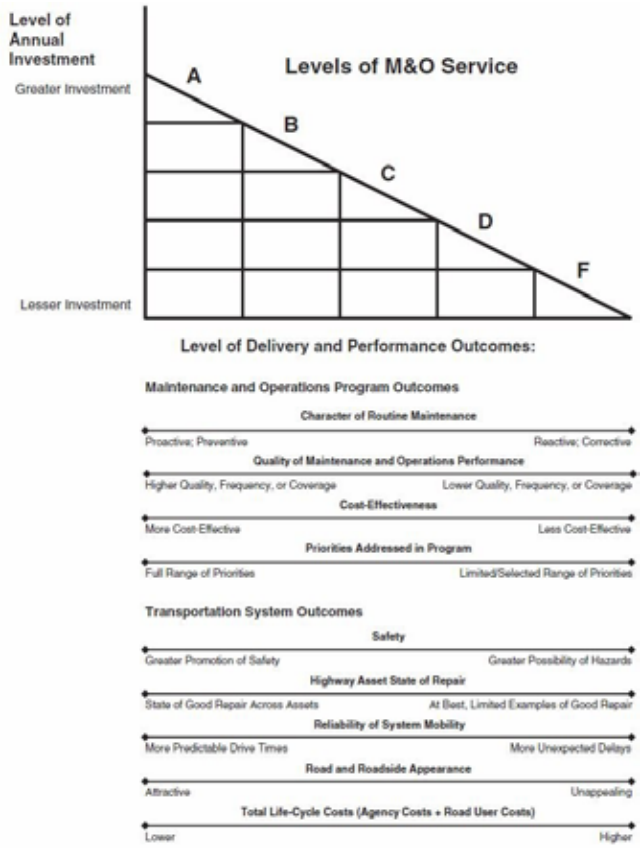

FIGURE 5 Link between LOS and performance outcomes (Markow 2012).

MAINTENANCE LEVELS OF SERVICE

The results of an MQA field assessment can be used to illustrate the relationships between maintenance budgets and the LOS that can be provided, as shown in Figure 5 (Markow 2012). The upper part of the graphic illustrates the different LOS provided through Maintenance and Operations activities and the corresponding level of investment required. As shown, the higher the LOS (e.g., LOS = A), the higher the level of investment required. Underneath the graph are lines representing program and performance outcomes related to each of the five LOS. For each line, a shift to the left indicates a higher LOS and a greater investment requirement, while a shift to the right represents a lower level of investment and a corresponding lower LOS. The graphic represents the types of considerations that maintenance personnel take into account when establishing budget needs and setting LOS targets.

The use of a graded LOS to communicate funding needs is not limited to MQA applications. *NCHRP Report 677* (NCHRP 2010) presents a standardized approach to describe the service level of assets on the Interstate Highway System that features a 5-point LOS rating scale based on asset conditions ranging from "A" (representing an excellent LOS) to "F" (representing a very poor LOS) (NCHRP 2010). These condition service levels are different from LOS established for traffic flows or geometric features of the highway. The contractor's development of this approach was largely based on the use of LOS terminology for DOT maintenance activities. The report provides sample thresholds that can be used for asset features (referred to as "elements" in the report) along the Interstate Highway System and presents sample report templates that can be used to communicate results with various stakeholders.

According to the findings from the 2011 Domestic Scan, a significant number of state maintenance agencies are using the condition assessment results to calculate a single maintenance rating (NCHRP 2012). This rating helps agencies establish maintenance priorities and provides a single number to present to agency leadership concerning maintenance accomplishments. The calculated value typically reflects a weighted average score for a group of asset features or categories. The weights are based on the perceived level of importance for each item, with safety features typically having larger weights than features associated with roadside appearance, for example (NCHRP 2010). In the Kentucky DOT, individual MQA ratings are calculated for each category and compared at the maintenance-area level to prioritize work assignments (NCHRP 2012).

As part of the maintenance budgeting activities, LOS information is also used to establish targeted condition levels. These LOS targets can be compared to the existing LOS being provided and the gaps can be used to represent funding shortfalls (in situations where the LOS target is higher than the LOS being provided). Markow (2012) reports that certain factors are considered to be most important in setting LOS targets, including the anticipated budget level, existing commitments to an agency-established goal or objective, and an objective assessment of realistic and sustainable LOS values.

USING MAINTENANCE QUALITY ASSURANCE RESULTS

Once established, MQA information can be used in a variety of ways to enhance agency decision making, communicate with shareholders, improve consistency in maintenance practices within the agency, and establish maintenance priorities. Three different uses of MQA results are presented here: budgeting activities, improving accountability, and communication and outreach.

Budgeting Activities

Traditionally, maintenance budgets have been developed based on adjustments to historical budget levels (NCHRP 2012). For example, agencies using this approach may experience a 10% cut to the previous year's budget, and maintenance activities are adjusted accordingly. However, the data from an MQA program can also be used to support performance-based budgeting activities. Under this type of approach, the costs to achieve different levels of service are estimated so that an agency can evaluate the funding needed to continue to provide the current LOS or to improve (or lower) the LOS because of funding constraints. The Washington State DOT uses a performance-based budgeting approach in its Maintenance Accountability Process, which was developed so the agency could respond to questions posed by the state legislature about expected maintenance accomplishments for different funding levels (NCHRP 2012). Using this approach, the Washington State DOT demonstrated that available funding was sufficient to address only approximately 30% of the maintenance work needed (NCHRP 2012). In addition, the agency demonstrated the increased reliability in providing working traffic signals if a higher level of maintenance could be funded. As a result, the state received additional maintenance funding and nearly half of that was allocated to signal maintenance (NCHRP 2012). As another example, the Wisconsin DOT presented its unfunded maintenance needs in terms of maintenance "price tags" so the state legislature could better understand what could be achieved for the funding provided (Markow 2012). Other state DOTs, such as South Carolina and Texas, reportedly use a performance-based budgeting approach to help defend their maintenance budgets (NCHRP 2012).

Improving Accountability

In addition to using the results of an MQA survey for budgeting purposes, some agencies use the results to improve

the accountability of maintenance personnel. For instance, the Texas DOT reports that managers are rated based on the condition of their state highways using maintenance quality and pavement condition information (Markow 2012). The North Carolina DOT also uses MQA results to improve accountability and, along with the Missouri DOT, reports that holding personnel responsible was key to making the organizational shift required to support a maintenance-based program (NCHRP 2012). Washington State DOT field personnel are also held accountable for maintenance accomplishments and are required to explain any deviations from planned accomplishments (NCHRP 2012).

Communication and Outreach

The availability of maintenance performance information from an MQA program has also helped strengthen communication and outreach efforts with both internal and external stakeholders. The New York State DOT, for example, uses the results of its MQA surveys not only to help engage

Feature	How much of the system still needs work at the end of the maintenance season?						How well maintained is the system?				
	Condition change: 2009 to 2010[4]	% of system backlogged					2010 Feature grades				
		2006	2007	2008	2009	2010	A	B	C	D	F
Hazardous debris	-	13	9	9	8	**8**			✓		
Drop-off/build-up (paved)	↑	N/A	N/A	N/A	4	**2**	✓				
Cracking (paved)	↑	50	53	53	62	**60**				✓	
Potholes/raveling (paved)	↑	5	6	6	6	**5**	✓				
Drop-off/build-up (unpaved)	↓	40	40	44	34	**37**					✓
Cross-slope (unpaved)	↑	25	18	18	22	**18**		✓			
Erosion (unpaved)	↑	3	1	2	3	**1**	✓				
Ditches	-	3	2	2	2	**2**	✓				
Culverts	↓	15	20	28	23	**28**			✓		
Under-drains/edge-drains	↑	13	20	30	24	**21**		✓			
Flumes	-	27	25	39	36	**36**				✓	
Curb & gutter	↓	8	8	5	5	**6**	✓				
Storm sewer system	↑	9	11	16	19	**17**		✓			

FIGURE 6 Wisconsin DOT report card excerpt (*Courtesy:* Teresa M. Adams).

Roadway			Interstate		Primary		Secondary	
			2012	State Avg	2012	State Avg	2012	State Avg
	ELEMENT	PERFORMANCE MEASURE	Target	Score	Target	Score	Target	Score
DRAINAGE	Unpaved Shoulders	No dropoffs greater than 3 inches and no shoulders higher than 2 inches	95	92	90	92	85	93
	Ditches (Lateral Ditches)	No blocked, eroded, or nonfunctioning ditches	95	99	90	97	85	96
	Crossline Pipe (Blocked)	Greater than 50% diameter open	95	87	90	81	85	82
	Crossline Pipe (Damaged)	No damage or structural deficiency effecting functionality	95	91	90	97	85	96
	Curb & Gutter (Blocked)	No obstruction greater than 2 inches for 2 feet	95	96	90	97	85	97
	Boxes (Blocked or Damaged)	Grates and outlet pipes of boxes blocked <50%, inlets and outlets of boxes not damaged, and grates are present not broken	95	84	90	90	85	92
ROADSIDE	Vegetation (Brush & Tree)	Freeways: 45' from travelway, 5' behind guardrail, not blocking signs; Non-Freeways: Vertical clearance of 15' over roadway and 10' back of ditch centerline or shoulder point	90	92	85	90	80	86
	Vegetation (Turf Condition)	Areas free of erosion	95	91	90	94	85	94
	Stormwater Devices (NPDES)	Functioning as designed	90	94	90	94	90	94
	Landscape Plant Beds	Achieving a score of 2 or higher on the inspection form	90	90	80	90	N/A	N/A
	Rest Areas & Welcome Centers	Condition Rating of 90	90	96	90	93	N/A	N/A
TRAFFIC	Long Line Pavement Markings	Present, visible	90	96	85	94	80	88
	Words and Symbols	Present, visible	N/A	N/A	85	87	80	85
	Pavement Markers	Present and reflective	90	91	85	81	N/A	N/A
	Ground Mounted Signs	Visible and legible	90	94	85	94	85	89
	Overhead Signs	Visible and legible	92	99	85	97	N/A	N/A
BRIDGE	NBIS Culverts	Condition Rating >= 6	85	86	80	87	75	89
	Non-NBIS Culverts	Condition Rating = Good	80	81	70	72	60	56
	Overhead Sign Structures	Condition Rating = Good	95	88	92	93	92	84
	Totals		**91.27**	**91.43**	**86.16**	**90.27**	**82.16**	**87.43**

Red – More than 10% below the target; Yellow – Within 10% of the target, Green – Met or exceeded target; Gray – Element was not rated

FIGURE 7 Excerpt from the North Carolina DOT *Report on the Condition of the State Highway System* (https://connect.ncdot.gov/resources/Asset-Management/MSADocuments/MCAP%202012%20Maintenance%20Condition%20Report.pdf).

field personnel in improving maintenance practices and establishing maintenance priorities, but also to communicate maintenance needs to elected officials (NCHRP 2012).

MQA program results are being communicated through a variety of formats, including printed report cards (such as the one shown in Figure 6), performance reports (such as the one shown in Figure 7), and electronic dashboards (such as the one shown in Figure 8) (NCHRP 2012). The results have enabled states to better "tell their story" about maintenance investment needs and trends.

FIGURE 8 Sample from North Carolina DOT performance dashboard (https://apps.dot.state.nc.us/dot/dashboard/).

CHAPTER THREE

STATE OF THE PRACTICE

OVERVIEW

To better understand the current MQA field inspection practices used by state transportation agencies, a survey of practice was conducted through NCHRP in cooperation with AASHTO. AASHTO provided an e-mail distribution list that identified each of the voting members of the Subcommittee on Maintenance (SCOM). After a preliminary questionnaire was pretested by the members of the Topic Panel, the survey instrument was distributed to the voting members of the SCOM, who were encouraged to forward the survey to the appropriate person if the voting member was not familiar with the agency's MQA practice. E-mail reminders were sent to encourage participation. These efforts resulted in 40 completed responses, which represents an 80% response rate among state DOTs.

This chapter summarizes the findings from the survey of practices. The information is presented in a number of formats, including both table and graph, as appropriate. A copy of the survey questions that were distributed electronically as Appendix A and the state responses received are presented in Appendix B. Appendices A and B are web-only and can be found at www.trb.org, search "NCHRP Synthesis 470."

SURVEY CONTENT

The survey questions were organized into the following four categories:

- **General Information**—The first question in this section asked participants whether their agency had an MQA program in place. If so, additional questions asked about the name of the program, the length of time it had been in place, and the approach used to develop the program. If no MQA program was in place, participants were asked to describe their plans for establishing a program.
- **Condition Assessment Activities**—This section of the survey asked about the MQA data being collected on various roadway assets. Participants were asked to consider each category of assets and determine (a) whether they have a complete inventory for those assets, (b) whether they rate the condition of the assets, and (c) the methodology used to collect the information. The following are asset categories and features included in the survey:
  - Drainage, including culverts, flumes, curbs and gutters, sidewalks, ditches or slopes, drop inlets, and underdrains/edgedrains.
  - Roadside, including fence, landscaping, plant beds, and sound barriers.
  - Pavement, including paved shoulders, unpaved shoulders, and paved roadways.
  - Bridge, including all bridge structures.
  - Traffic items, including signals, signs, pavement markings, pavement markers, guardrail end treatments, overhead sign structures, impact attenuators, and protective barriers.
  - Special facilities, including rest areas, tunnels, weigh stations, and traffic monitoring systems.
- **Use of MQA Data**—The questions in this section of the survey investigated how the MQA results are used to support agency decision processes and to communicate with internal and external stakeholders.
- **Impact of the MQA Program**—The final section of questions explored the impact the MQA program has had on the agency, the program's level of success in meeting its objectives, and the types of new technology being explored.

Survey results are presented in the remainder of this chapter. In addition to the survey results, representatives from eight state DOTs were interviewed to explore additional program features. The results from those interviews are presented in chapter four.

MAINTENANCE QUALITY ASSURANCE PROGRAM STATUS

Of the 40 state DOTs that responded to the survey, 28 (70%) have a program in place for monitoring their maintenance activities through an MQA or similar program. As shown in Figure 9, eight of the 12 state DOTs that do not currently have an MQA program intend to develop or implement a program in 2 to 5 years, while two state DOTs will be developing or implementing a plan within the next 1 to 2 years. The remaining two agencies have no plans to develop or implement an MQA program at this time.

FIGURE 9 Time frame that agencies without an MQA program will be developing or implementing a program.

Among the 28 state DOTs with an MQA program in place, eight states refer to the program as an MQA Program while five refer to it as a Maintenance Management Program, as shown in Figure 10. The figure also shows that 15 states developed their own unique name for the program, as shown in Table 3.

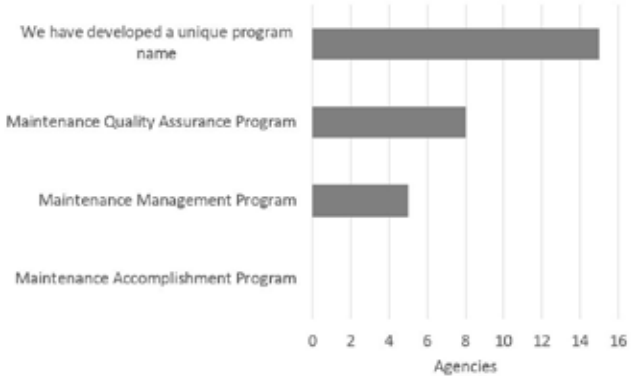

FIGURE 10 MQA program name.

TABLE 3
UNIQUE MQA PROGRAM NAMES BY STATE

State DOTs	Program Name
Arizona	Level of Service (LOS)
Colorado	Maintenance Level of Service (MLOS)
Florida, Kentucky	Maintenance Rating Program (MRP)
Iowa	Maintenance Performance Measurement
Missouri	Maintenance Performance Indicators
Nevada	Maintenance Achievement Program
New Jersey	Have several systems, including pavement, drainage, maintenance, and asset management
North Carolina	Maintenance Condition Assessment Program
Ohio	Maintenance Condition Rating
South Carolina	Maintenance Assessment Program
Tennessee	Maintenance Rating Index (MRI) Program
Texas	Texas Maintenance Assessment Program (TxMAP)
Washington	Maintenance Accountability Process (MAP)
Wisconsin	Compass

As shown in Figure 11, 75% of the MQA programs have been in place for more than 10 years. The remaining 25% of the programs have been in place for a shorter period of time, mostly 5 to 10 years.

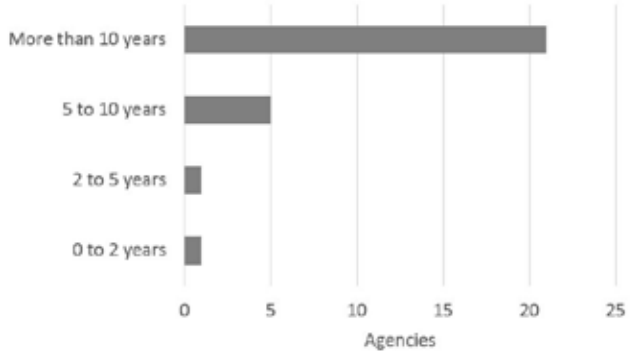

FIGURE 11 Number of years MQA program has been in place.

Although these programs have been in place for a substantial length of time in most instances, Figure 12 presents the responses to a question asking participants to identify the amount of time that has passed since they last made substantial changes to their MQA program, such as software enhancements or the addition of data elements. The results indicate that very few systems have remained unchanged in the past 10 years, with 78% of the respondents indicating that substantial changes have been made within the past 5 years. In fact, 14 of the 21 agencies with an MQA program more than 10 years old have made substantial changes to their program within the past 5 years.

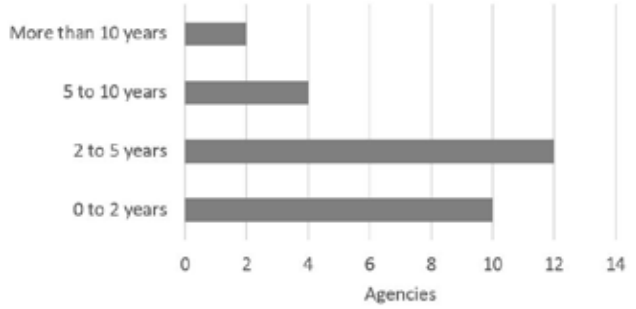

FIGURE 12 Years since substantial program changes were made.

Participants were also asked to provide information about how their MQA program was developed. The responses, summarized in Figure 13, indicate that 57% of the agencies developed their programs themselves, 21% developed the program in partnership with a consultant, and 7% modified a consultant-based program. In addition, one state's MQA program was developed by a consultant and one state's program was developed in partnership with another state. For the remaining two states, one did not know how the

original program was developed and the other indicated that parts of the program were developed by a consultant while other parts were developed in house.

FIGURE 13 Method used to develop the MQA program.

The final question in this section for agencies that have MQA programs asked respondents to identify the factors that were most significant in establishing their MQA programs. As shown in Figure 14, at least six factors have had the most influence on motivating state DOTs to establish an MQA program: estimating maintenance needs, monitoring maintenance effectiveness, making good use of available funds, improving agency accountability, developing performance-based budgets, and tracking and reporting maintenance accomplishments. Other factors, such as improving the accountability of personnel, improving work activity scheduling, and responding to a mandate, were also identified.

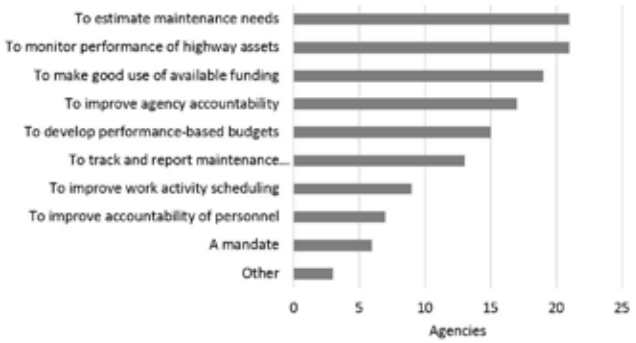

FIGURE 14 Important factors in establishing the MQA program.

DATA COLLECTION AND QUALITY ASSURANCE PROCEDURES

The information in this section of the survey is presented in three sections: condition assessment activities, survey and sampling details, and quality assurance procedures. Only state DOTs that have MQA programs in place were asked to complete the questions in this survey section, which reduced the total number of possible responses to each question to 28. Participants responded only to the questions for assets that are included in their MQA program; therefore, questions with fewer responses indicate that a smaller number of states include that type of information in their MQA program. The information on condition assessment activities is provided for each of the asset categories separately.

Condition Assessment Activities

Drainage Assets

Drainage assets include culverts, flumes, curbs and gutters, sidewalks, ditches or slopes, drop inlets, and underdrains or edgedrains. As shown in Figure 15, few state DOTs have fully completed inventories for these assets. Culvert inventories are either complete or partially complete for the greatest number of the 28 states that were asked to complete this question. A smaller number of the 28 states have established completed or partially completed inventories for curbs and gutters, drop inlets, ditches or slopes, and sidewalks.

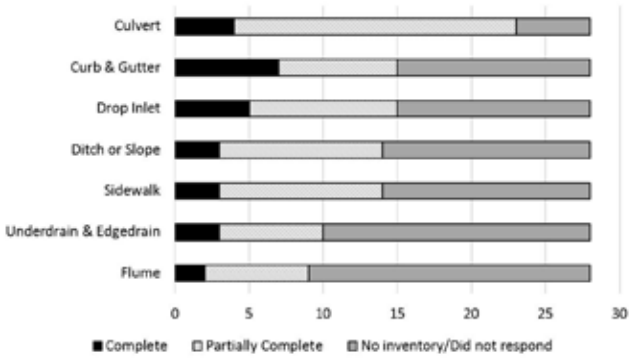

FIGURE 15 Inventory status of drainage assets.

Participants that collect information on drainage assets were also asked to identify the method used to collect the information and the frequency with which the data are collected. As shown in Table 4, drainage information is primarily collected using manual walking methods on an annual basis. No DOTs use automated surveys for these assets, presumably because they are not easily seen or evaluated from the driving lane of the highway. For the majority of state DOTs that collect condition information on drainage assets, the primary items included are culverts, drop inlets, and ditches and slopes.

For each of the assets surveyed as part of an MQA program, state DOTs were asked to identify the condition assessment attributes collected. The attributes commonly used for drainage assets are presented in Table 5. As the table shows, similarities exist in the use of channel condition and culvert condition for culverts, flowline interruption and structural damage for curbs and gutters, erosion settling for ditches, and blockage, structural deficiencies, and grate

damage for drop inlets. For the other assets listed, more varied approaches are used.

TABLE 4
SURVEY METHODS USED FOR DRAINAGE ASSETS

	Method of Collection		Frequency of Survey		
Asset	Manual Walking	Manual Windshield	Annual	Every Other Year	More Than Once/ Year
Culvert	20	4	14	4	4
Curb and Gutter	10	3	8	1	3
Drop Inlet	18	2	11	2	4
Ditch	18	4	15	1	4
Slope	16	2	12	1	3
Sidewalk	4	1	3	1	1
Underdrain and Edgedrain	8	1	6	1	1
Flumes	5	3	4	1	1

Roadside Assets

Roadside assets include fences, landscaping, plant beds, and sound barriers. Other roadside system attributes, such as grass mowing, brush, litter, and weed control or noxious weeds, may also be incorporated into an MQA program, although inventories for these items are not established. As shown in Figure 16, less than half of the agencies with MQA programs have fully established inventories for these roadside assets. For those agencies that have begun building these inventories, sound barriers and fences are the most complete.

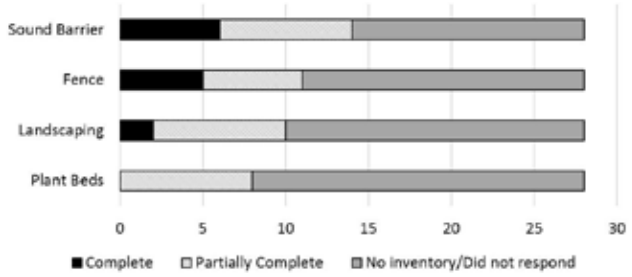

FIGURE 16 Inventory status of roadside assets.

Responses to questions about survey methods and frequency indicate that fences, grass, and litter are the most common maintenance activities evaluated for performance, although a significant number of states also report rating brush and vegetation/noxious weeds. These assets are entirely collected using manual methods, with most agencies indicating that a walking survey is conducted (see Table 6). However, it is worth noting that a significant number of agencies use a windshield survey for monitoring litter, grass, and weeds. For the most part, the surveys are conducted annually, but grass height and litter volume are monitored more frequently.

TABLE 5
CONDITION ATTRIBUTES COLLECTED FOR DRAINAGE ASSETS

Asset	Attribute	States	Other
Culvert	Channel condition	22	
	Erosion	13	
	Culvert condition	18	
	Other	3	Pass/fail by segment; per NBIS standards; separated
Flume	Channel condition	7	
	Flume condition	7	
Curb and Gutter	Settlement	9	
	Undermining	2	
	Flowline interrupted	12	
	Structural damage/spalling	10	
	Curb/gutter cracking	7	
	Curb/gutter low curb reveal	2	
Sidewalk	Cracking	3	
	Structural deterioration	4	
	Displacement/heaving	5	
	Settlement	3	
Ditch	Settlement	5	
	Erosion	16	
	Misalignment	4	
	Structural deterioration	8	
	Inadequate drainage (due to silting or debris)	21	
Slope	Settlement	5	
	Erosion	14	
	Misalignment	2	
	Structural deterioration	5	
	Inadequate drainage (due to silting or debris)	7	
Drop Inlet	Insufficient capacity	2	
	Blockage	20	
	Structural deficiency	13	
	Grate broken/missing	16	
	Other	1	Damage that affects function
Underdrain and Edgedrain	End protection damage	7	
	Pipe crushed	6	
	Pipe blocked	8	
	Other	2	Proper marking; properly marked for locating

NBIS = National Bridge Inspection Standards.

The condition attributes collected for roadside assets are summarized in Table 7. As shown in the table, most states monitor the length of damaged or missing fence, grass height, visual obstructions from brush, litter volume, and percent area of noxious weeds. Only a small number of states collect information on landscaping, plant beds, and sound barriers. The states that collect information on these assets are commonly rating the appearance of landscaping and plant beds, and the structural condition or functionality of sound barriers.

TABLE 6
SURVEY METHODS USED FOR ROADSIDE ASSETS

	Method of Collection		Frequency of Survey		
Asset	Manual Walking	Manual Windshield	Annual	Every Other Year	More Than Once/ Year
Sound Barrier	3	1	1	1	1
Fence	12	3	8	1	3
Landscaping	6	2	6	0	2
Plant Beds	2	1	1	1	1
Grass	12	5	10	1	5
Brush	9	4	7	1	3
Litter	13	7	12	1	5
Vegetation (Weed) Control or Noxious Weeds	9	5	8	0	3
Sound Barrier	3	1	1	1	1

Pavement Assets

The pavement asset category includes paved roadways as well as paved and unpaved shoulders. Not unexpectedly, the survey shows that all of the agencies with MQA programs in place have established, or are establishing, an inventory of their paved roadways (see Figure 17). Most of the agencies have also established, or are establishing, inventories for both paved and unpaved shoulders. Because many states conduct pavement condition surveys as part of their pavement management programs, a group other than maintenance and operations may be responsible for collecting pavement attributes. This factor may have affected the numbers reported for this asset, because the data collection activities are not conducted under the MQA program.

As shown in Table 8, the majority of agencies use manual walking surveys to rate the condition of their paved and unpaved shoulders. An equal number of agencies collect information on their paved roadways using manual walking or automated survey methods, and five states collect the information using a windshield method. For the most part, this information is collected on an annual basis.

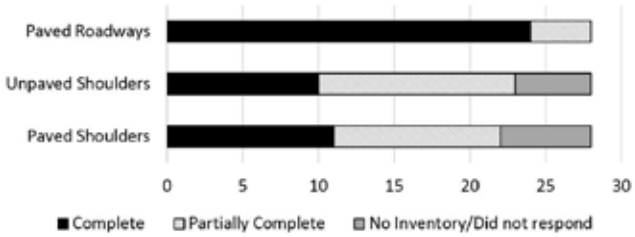

FIGURE 17 Inventory status of pavements.

The condition attributes collected for these assets are summarized in Table 9. The results indicate that several attributes are commonly collected for paved shoulders, including drop-off, structural distress, and functional distress. For unpaved shoulders, drop-off is by far the most common condition attribute used. For paved roadways, 12 state DOTs use the results of their pavement management systems for assessing pavement condition. Because the surveys are not conducted as part of an MQA program, these states may not have completed this portion of the survey. States that have MQA programs in place monitor condition attributes for structural distress, crack sealing, and rutting.

Bridge Assets

The bridge category includes any structures maintained by the DOTs as a bridge, which FHWA defines as any structure equal to or greater than 20 feet long. According to the 28 states with an MQA program in place, 27 have complete bridge inventories; the remaining state is developing its inventory. Not all of the states monitor bridges as part of their MQA program, which is reflected in the number of states that responded to questions about the survey method and frequency. Instead, a number of states rely on their Bridge Divisions to monitor bridge performance in accordance with legislated requirements. As shown in Table 10, bridge surveys for MQA purposes are primarily conducted every other year using a walking survey. This matches the frequency with which states are required to report bridge conditions to FHWA.

The condition attributes collected for bridges are shown in Table 11. A total of 14 state DOTs use the results from their bridge management system's bridge inspections to monitor bridge conditions. Additionally, 10 or more state DOTs collect condition ratings for decks, bearings, joints, and structural adequacy to represent bridge conditions for their MQA program.

Traffic Assets

Traffic assets (which include signs, signals, pavement markings and markers, guardrail end treatments, overhead sign structures, variable message boards, impact attenuators, and protective barriers) are generally considered to be

TABLE 7
CONDITION ATTRIBUTES COLLECTED FOR ROADSIDE ASSETS

Asset	Attribute	States	Other
Fence	Number of broken posts	5	
	Length of damaged or missing	13	
	Rusted fence connections	1	
	Vegetation on fence present	0	
	Other	0	Presents a satisfactory appearance; provides positive barrier; bent stays, missing staples/clips
Grass Mowing	Grass height	17	
	Presence of undesirable vegetation	5	
	Other	4	Excessive mowing beyond the limits established in SHA guidelines, blocking signs, or guardrail-mounted delineators, covering over linestriping, affecting sight distance; complaints, sight distance; bare or erodible areas; mowed width
Brush	Obstructions in the clear zone	7	
	Vision obstructions	10	
	Other	5	Dead trees; travel way is free of tree encroachment 15 ft vertically; any brush in the right-of-way; deadfalls; tree trunk size 4 in. max. in clear zone
Litter	Volume within a certain length	18	
	Other	5	Percent of roadside area affected by litter; litter considered to be a hazard; unauthorized graffiti; complaints; no. of fist-sized pieces of litter; no animal carcasses present on roadway or visible in right-of-way
Weed Control	Amount or % within a certain area	13	
	Other	3	Amount of bare ground; just overall; soil sterilant, no broadleaf vegetation within 15 ft of pavement
Landscaping	Appearance	7	
	Obstructions	3	
Plant Beds	Appearance	3	
	Presence of undesirable vegetation	3	
Sound Barrier	Functionality	1	
	Clear of vegetation	0	
	Other	3	New inventory added; structural condition; visible damage or graffiti

SHA = State Highway Administration

important contributors to the safety of the highway system. Therefore, as shown in Figure 18, the majority of states with MQA programs in place either has established inventories for most of these assets or is in the process of developing their inventories. The most complete inventories have been established for variable message boards (18 state DOTs), overhead sign structures (17 state DOTs), and signals (15 state DOTs).

TABLE 8
SURVEY METHODS USED FOR PAVEMENTS

Asset	Method of Collection			Frequency of Survey		
	Manual Walking	Manual Windshield	Automated	Annual	Every Other Year	More Than Once/Year
Paved Shoulders	11	4	2	11	1	3
Unpaved Shoulders	14	3	1	9	2	4
Paved Roadways	8	5	8	9	7	2

TABLE 9
CONDITION ATTRIBUTES COLLECTED FOR PAVEMENTS

Asset	Attribute	States	Other
Paved Shoulders	Drop-off	14	
	Structural distress	12	
	Functional distress	10	
	Rumble strip not functioning	2	
	Travel way and shoulder separation	9	
	Shoulder maintenance	7	
	Other	2	General surface condition; cracking, potholes/raveling
Unpaved Shoulders	Drop-off	17	
	Adequacy of gravel	6	
	Other	6	Build-up; cross-slope, general surface condition, distortion and vegetation growth; build-up (high shoulder); high shoulder and low shoulder; two measures for adequacy of gravel: cross-slope and erosion
Paved Roadway	We use Pavement Management survey results	12	
	Structural distress HMA	14	
	Structural distress PCC	13	
	Functional distress HMA	9	
	Functional distress PCC	8	
	Cracking/crack sealing HMA	16	
	Cracking/crack sealing PCC	16	
	Faulting PCC	11	
	Roughness HMA or PCC	12	
	Rutting HMA	15	
	Pavement patching HMA	10	
	Pavement patching PCC	8	
	Other	2	HMA—rolldown at joints; we also use profilometer data from Materials Program

TABLE 10
SURVEY METHODS USED FOR BRIDGES

Asset	Method of Collection		Frequency of Survey		
	Manual Walking	Manual Windshield	Annual	Every Other Year	More Than Once/Year
Bridge	12	2	1	13	1

TABLE 11
CONDITION ATTRIBUTES COLLECTED FOR BRIDGES

Asset	Attribute	States	Other
Bridge	Bridge inspections used for bridge management	14	
	Condition ratings for decks	13	
	Condition ratings for bearings	10	
	Condition ratings for joints	11	
	Structural adequacy	10	
	Drainage	8	
	Other	2	Concrete parapet. This is done outside our Maintenance QA program. Work is performed by Bridge Program inspectors.

TABLE 12
SURVEY METHODS USED FOR TRAFFIC ASSETS

	Method of Collection			Frequency of Survey		
Asset	Manual Walking	Manual Windshield	Automated	Annual	Every Other Year	More Than Once/Year
Signal	1	1	1	2	0	1
Sign	10	13	2	16	3	4
Pavement Marking	12	9	3	17	2	4
Pavement Marker	11	7	0	13	1	4
Guardrail End Treatment	12	6	0	11	2	4
Overhead Sign Structure	7	2	1	2	4	0
Impact Attenuator	12	4	0	10	2	3
Protective Barriers	13	5	0	12	1	4
Variable Message Board	0	0	1	1	0	0
Highway Lighting	1	4	1	1	0	4

For the most part, condition assessment surveys on traffic assets are conducted using manual walking methods, with the notable exception of signs, which are more typically conducted using a windshield survey (see Table 12). Some agencies have begun using automated condition surveys to collect condition information on pavement markings and signs. One agency also uses automated data collection methods for signals, overhead sign structures, variable message boards, and highway lighting. The surveys are typically collected annually, but a few state DOTs conduct the surveys more frequently than annually while others conduct the surveys every other year.

The condition attributes collected on traffic assets are summarized in Table 13. As the table shows, similar condition attributes are being used for some of the traffic assets, such as signs, pavement marking, pavement markers, guardrail end treatment, impact attenuators, and protective barriers. Less common are metrics for reporting signals, overhead sign structures, variable message signs, and highway lighting.

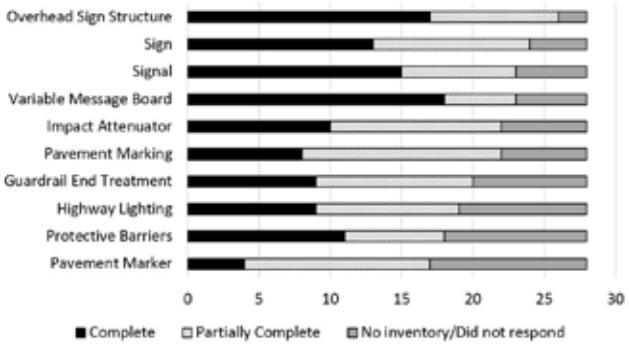

FIGURE 18 Inventory status of traffic assets.

Special Facilities

In addition to the highway network, some state DOTs are responsible for the maintenance and management of special facilities that might include rest areas, tunnels, weigh stations, and traffic monitoring systems. According to the information provided by the states with MQA programs in place, 24 of the 28 agencies have established, or are in the

TABLE 13
CONDITION ATTRIBUTES COLLECTED FOR TRAFFIC ASSETS

Asset	Attribute	States	Other
Signal	Post damage	1	Number of malfunctions
	Visibility	1	
	Bulbs burned out	1	
	Signal orientation	1	
	Other	1	
Sign	Panels damaged	22	
	Retroreflectivity at standard distance	6	
	Visibility at standard distance	13	
	Standard height	10	
	Post damage	17	
	Legibility	20	
	Sign orientation	15	
	Obstructions	14	
	Other	4	Age; breakaway features functional; age; traffic program conducts additional signing evaluations outside MQA. This includes retroreflectivity.
Pavement Marking	Day visibility	16	
	Night retroreflectivity	10	
	Missing/damaged	18	
	Other	3	Retroreflectometer readings; alignment of multiple striping applications; retro van data collection
Pavement Marker	Number missing, damaged, or obstructed	15	
	Other	3	Same criteria as for markings; 75% of every pavement marking must be intact, 90% threshold for RR crossing or school; pavement marking; see MMQA+ manual
Guardrail End Treatment	End treatment damage	18	
	End treatment alignment	10	
	Post damage	15	
	Functionality	11	
Overhead Sign Structure	Structural integrity	9	
	Anchor bolts clear of debris	3	
	Other	1	Per bridge program standards
Impact Attenuator	Misaligned	9	
	Structurally damaged	16	
	Functionality	15	
Protective Barriers	Misaligned	11	
	Structurally damaged	18	
	Functionality	14	
Variable Message Board	Percent operational	0	

process of establishing, inventories for their rest areas (see Figure 19). Although fewer states have inventoried weigh stations and tunnels, more than half of the agencies with MQA programs have established inventories for these assets.

As shown in Table 14, few states regularly monitor the condition of these assets as part of their MQA program, with the exception of rest areas. A total of five state DOTs monitor the condition of their tunnels, but only two states monitor the condition of weigh stations. None of the states with MQA programs that participated in this survey monitor the condition of their traffic monitoring systems as part of their program. For the assets that are incorporated into the MQA program, the surveys are generally conducted annually, but

some agencies monitor rest areas more frequently. Other agencies collect the information only every other year, but that cycle appears to be less common.

A variety of attributes are used to monitor the condition of special facilities, as shown in Table 15. A number of attributes are used to monitor the condition of rest areas, presumably because of the different types of facilities that have to be maintained (e.g., lawn, bathrooms, and buildings).

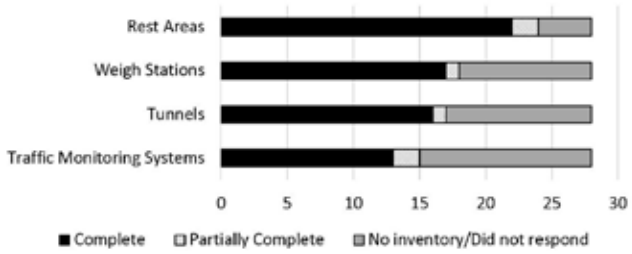

FIGURE 19 Inventory status of special facilities.

Few state DOTs collect condition information on tunnels, weigh stations, and traffic monitoring systems; however, lighting, debris, and drainage appear to be equally important when monitoring the condition of tunnels.

Survey and Sampling Details

Survey Methods

The 28 state DOTs with MQA programs in place were asked several additional questions to learn more about their field inspection practices. One question asked participants to classify their rating method into one of the three approaches described in chapter two: a pass/fail approach, a graded approach (where performance deficiencies are recorded), or a combination of the two. The responses are presented in Figure 20. As shown in the figure, 15 of the 28 states with MQA programs use a hybrid approach that combines the pass/fail and graded approaches. A total of seven state DOTs

TABLE 14
SURVEY METHODS USED FOR SPECIAL FACILITIES

	Method of Collection			Frequency of Survey		
Asset	Manual Walking	Manual Windshield	Automated	Annual	Every Other Year	More Than Once/Year
Rest Areas	11	0	0	5	1	4
Tunnels	3	1	1	4	1	0
Weigh Stations	2	0	0	0	2	0
Traffic Monitoring Systems	0	0	0	0	0	0

TABLE 15
CONDITION ATTRIBUTES COLLECTED FOR SPECIAL FACILITIES

Asset	Attribute	States	Other
Rest Areas	Graffiti	8	
	Facilities working properly	10	
	Appearance	10	
	Mowing	9	
	Landscaping	10	
	Odor	7	
	Cleanliness	10	
	Other	1	Handicap accessibility, structural conditions, parking lot conditions, vending machine conditions, telephone conditions
Tunnels	Lighting	4	
	Debris	4	
	Drainage	4	
	Other	2	Structural condition, mechanical and electrical; number of tunnel closures to flammable loads
Weigh Stations	Functionality	2	
	Appearance	1	
	Other	1	Perform functional tests
Traffic Monitoring Systems	Functionality	0	
	Other	0	

use a pass/fail approach and only three state DOTs use a graded approach exclusively. Two states report using some other approach. Of the states using some other approach, one state compares the assets to predefined criteria and another state rates the asset on a 0 to 4 criteria (with "0" representing a failed asset and "4" representing a new asset). One state did not answer the question.

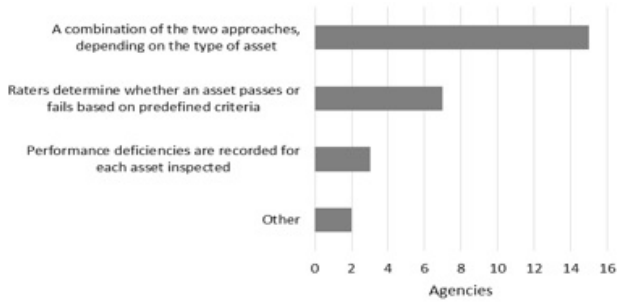

FIGURE 20 Type of rating method used.

Participants were also asked to provide information on whether the surveys are conducted using in-house personnel or by contract personnel. As shown in Figure 21, more than 20 state DOTs rely on district or region personnel to conduct MQA surveys. The states that do not use district or region personnel are equally divided between using central office personnel or using a consultant/vendor. Two states use other approaches. In one of those states, a combination of state and county personnel are used to conduct the survey. In the remaining state, the districts conduct the surveys and the central office conducts verification testing on the results to check consistency. As reported later, the use of central office staff to verify the reasonableness of surveys conducted by others is a common quality assurance procedure practiced by other states.

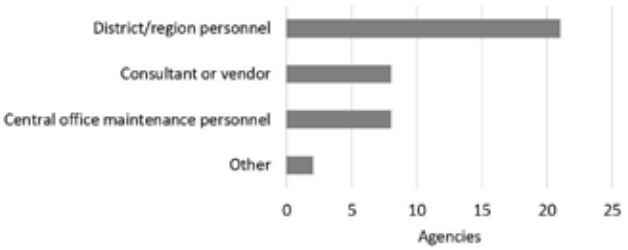

FIGURE 21 Parties responsible for conducting the MQA surveys.

As reported earlier, MQA surveys are predominantly conducted as manual walking surveys, although some states conduct windshield surveys and automated surveys using specially equipped vans. The 28 state DOTs with MQA programs in place were asked to identify each of the types of equipment that are used during the survey process. The results, which are summarized in Figure 22, show that most states rely on multiple types of equipment to conduct the surveys. For instance, 22 states continue to rely on low-technology approaches that feature pens, pencils, and paper. Twelve DOTs use handheld computers and 11 DOTs use GPS recorders for at least some of the assets. In addition, 10 state DOTs use automated vans with lasers. Few states use LiDAR or voice recording devices. Other equipment used to record conditions include cameras, tablets, and laptops.

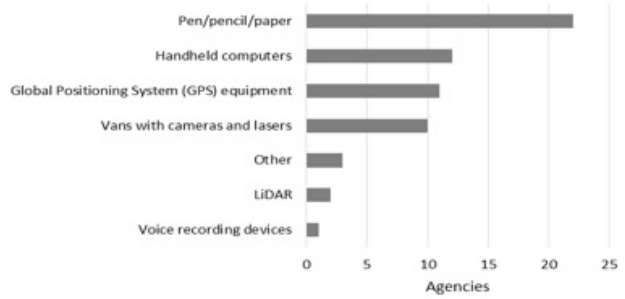

FIGURE 22 Type of equipment used during surveys.

Sampling

Because it may be impractical to collect asset condition information for an entire state on a regular basis, some states have elected to inspect samples of their network to approximate the conditions of the entire system. This approach, which is commonly referred to as sampling, is used by 23 of the 28 agencies with MQA programs in place. In the five states that did not report using a sampling basis, the size of the network and the method of reporting performance data vary. Interestingly, three of those states use automated vehicles for conducting surveys. Among the 23 state DOTs that use a sampling process, several additional questions were posed to learn more about the size of the sample and the number of samples inspected.

First, the 23 state DOT representatives were asked to provide information on the size of their samples. The results, presented in Figure 23, indicate that a 0.10-mi sample size is most commonly used. Four states entered a different sample size. Of those states, two use 1-mi samples and one uses a sample size of 0.33 mi. One state surveys 15% of the centerline miles in each county. One of the states that reports using a 0.10-mi sample size uses longer lengths for rural highways.

The total number of samples inspected by the agencies varies dramatically, with 100 samples being the smallest number of samples reported and 22,000 the largest. Among states that report the number of samples in terms of a percentage, one state surveys 10% of the network, one state surveys 15% of the network, and one state surveys 20% of the network. For example, a state surveying 10% of the network would inspect 500 samples for a 5,000-mi highway system. In response to a question about how many equivalent person-months are spent collecting condition information (assuming 20 days in a person-month), 14 of the 26 states that responded report that the surveys require more than 6

person-months per year and an additional five state DOTs spend 4 to 5 person-months collecting data annually. The remaining responses range from less than 1 person-month to up to 6 person-months per year. The results are presented in Figure 24.

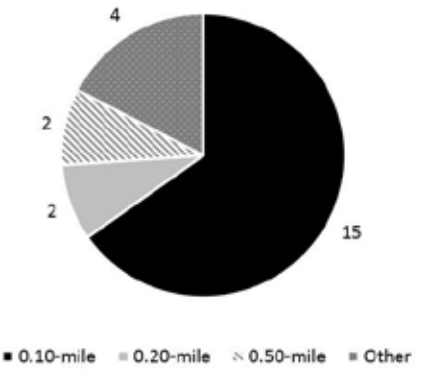

FIGURE 23 Number of agencies using each sample size.

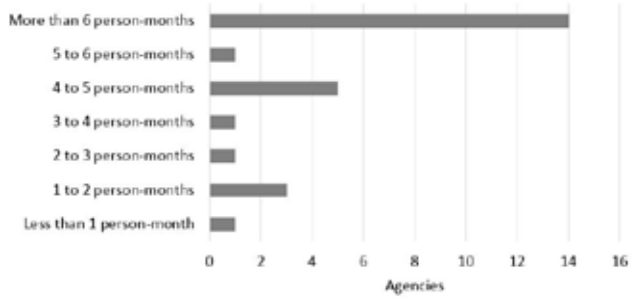

FIGURE 24 Number of person-months spent on data collection annually.

The number of samples inspected influences the statistical validity of the data to represent system conditions. For instance, to establish a high degree of confidence in the statistical validity of data for each region, a statistically significant number of the samples in each region must be inspected. To use the data to rate shop performance, it is important to inspect a significant number of samples within the system maintained by each shop. Therefore, the more the agency plans to use the data for a segment of the network, the more samples must be inspected to maintain statistical validity.

To learn more about the statistical basis for their MQA programs, the 23 state DOTs that use a sampling approach were asked to provide information about each level at which they considered their data to be statistically valid and the approach used to determine the number of samples to inspect. As shown in Figure 25, 18 of the 23 agencies consider their MQA data to be valid at the region level (which automatically makes it valid at the statewide level) and 17 consider it valid only at the statewide level. A significantly smaller number of state DOTs have confidence in the data at a county, roadway corridor, or shop level.

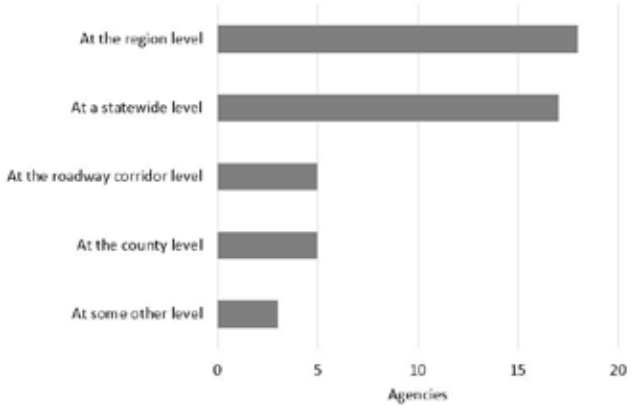

FIGURE 25 Level at which the MQA results are considered to be statistically valid.

Two primary methods are used in determining the number of samples to inspect, as shown in Figure 26. The most common approach is to select a specific number of samples or to identify a specific percentage of the network that will be inspected. Alternatively, the number of samples to inspect is calculated based on a statistical formula that considers the size of the network, the confidence interval desired, and other important factors. Other responses indicate that one agency inspects a specific number of samples for each facility type and another agency bases the number of samples on mileage.

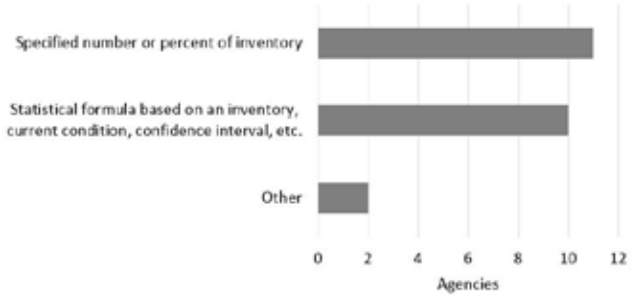

FIGURE 26 Methodology used to determine the number of samples to inspect.

For those agencies using a statistical calculation to determine the number of samples to inspect, a follow-up question asked about the level of confidence desired. As shown in Figure 27, 12 agencies use a 95% confidence level, four use a 90% confidence level, and one uses a 90% confidence level for primary routes and an 80% confidence level for secondary routes. Setting a lower confidence level results in a smaller number of samples to be inspected.

Quality Assurance Procedures

To learn more about the quality assurance procedures being used, the 28 state DOTs with MQA programs were asked to identify all of the quality control and independent assurance activities used to ensure the quality of their data. As shown in Figure 28, of the 28 agencies that responded to this question, two states responded that they do not verify the quality of their data. The remaining state DOTs rely on a combination of

quality control (e.g., rating manual and training), independent assurance (e.g., independent checks), and data reasonableness checks (e.g., ratings are compared to previous surveys). The use of a team of raters who must agree on the rating for each sample is a form of independent assurance used by 16 of the 28 state DOTs to help reduce bias.

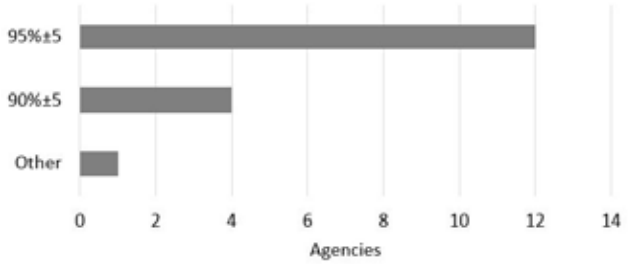

FIGURE 27 Confidence interval used.

FIGURE 28 Methods used to ensure the quality of MQA data.

Rater certification is a quality control method used to ensure quality. As shown in Figure 29, seven state DOTs do not formally certify their raters. Of the 19 agencies that do, 10 certify raters annually, four certify raters as needed, and three certify raters every other year. Of the two agencies that report some other frequency, one state uses the verification of survey results as its certification process and the other conducts annual meetings with rating team leaders to discuss and review the field inspection process.

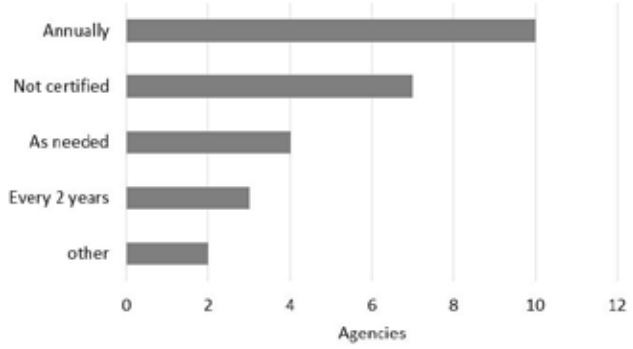

FIGURE 29 Rater certification frequency.

USE OF MAINTENANCE QUALITY ASSURANCE DATA

Although the focus of this synthesis is field inspection processes, the survey included questions to learn more about how MQA data are used to support agency decisions. A total of 21 of the 28 state DOTs with MQA programs use the field inspection results to establish LOS in accordance with the scale shown in Figure 30. As the results show, the "A to F" scale is by far the most common approach being used by the participating agencies. Four states report results in terms of a percent passing or failing, and one state reports using a "1 to 5" scale for reporting results. Two states use a combination of these approaches, depending on the asset. One state reports the percent passing in terms of a "Need Level 1" or "Need Level 2," one reports the percent meeting the passing criteria, one uses a weighted percentage, and one uses a percent "Good, Fair, or Poor."

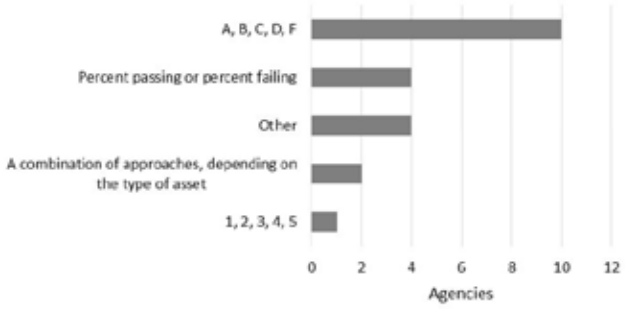

FIGURE 30 LOS scale used.

Use in Establishing LOS and Performance Targets

The 28 state DOTs were asked whether they had established performance targets using the MQA field inspection results. A total of 23 of the state DOTs have established performance targets and three additional state DOTs report that development is under way. Two state DOTs have not used their MQA data to develop performance targets.

Participants were also asked whether they had established links between performance targets and the resources needed to provide the LOS. For instance, state DOTs were asked if they knew the resources that would be required to move from an LOS B to an LOS A. As shown in Figure 31, 11 state DOTs have established these links and another 11 are in the process of establishing these links to further support their performance-based budgeting activities.

Use in Budgeting Activities

Finally, the 28 state DOTs with MQA programs were asked whether the field inspection results were used as part of the budgeting process to determine the funding needed to meet LOS targets. The results to this question, which are presented as Figure 32, show results similar to the previous

question: 11 state DOTs have established these links and eight are in the process of establishing them.

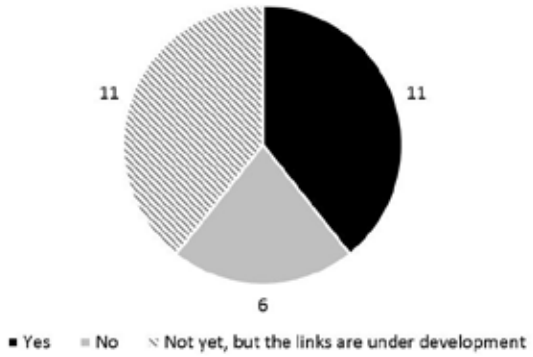

FIGURE 31 Number of state DOTs with links between performance targets and resources needed to provide the LOS.

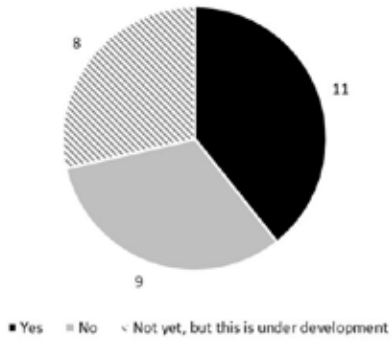

FIGURE 32 Number of state DOTs using performance data to determine funding needed to meet LOS targets.

The state DOTs that indicated they use performance data to determine the level of funding needed to meet LOS targets were asked whether they apply weights to any category of assets to place more of a priority to some assets over others during the budgeting process. Of the 11 state DOTs that responded to this question, eight weight some asset categories over others in the budgeting process and one state's weighting factors are under development (see Figure 33). In response to a question asking which assets are weighted the highest, the survey showed that assets related to safety, snow removal, and asset preservation typically receive more priority in the budgeting process.

Other Uses of Maintenance Quality Assurance Field Inspection Results

The survey of state practice shows that MQA field inspection results are used by 14 of the 28 state DOTs with MQA programs to identify, program, and schedule maintenance work activities (see Figure 34). Six additional state DOTs are in the process of developing these capabilities. Far less common is the use of MQA data to determine contractor compliance on maintenance contracts, as shown in Figure 35. These results are not surprising because only a limited number of states typically contract out maintenance activities under performance-based contracts.

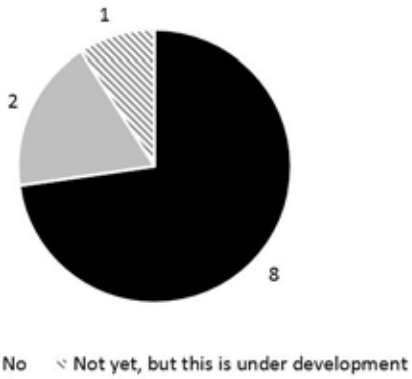

FIGURE 33 Number of state DOTs using weights to establish budget priorities.

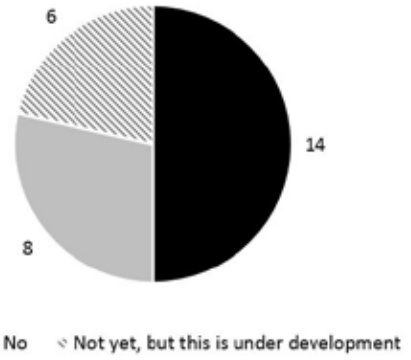

FIGURE 34 Number of state DOTs using MQA results to program and schedule work activities.

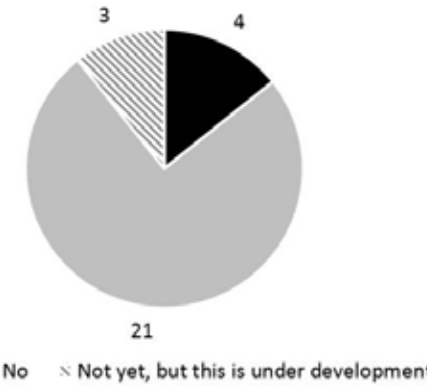

FIGURE 35 Number of state DOTs using MQA results to determine contractor compliance on maintenance contracts.

Availability and Use of Computerized Maintenance Management Systems

A total of 20 of the 28 state DOTs with MQA programs in place use a computerized maintenance management system for tracking, reporting, and analyzing the results of the MQA

program (Figure 36). Two additional state DOTs are in the process of implementing an MMS. The use of MQA results within the MMS was the basis for two additional questions that are summarized in Table 16. As the results show, six state DOTs are using their MQA results within their MMS for budgeting activities and for scheduling work activities. More than half of the state DOTs with an MMS in place are not using the system in these ways, indicating that the MMS is used more for tracking work activities rather than for planning and budgeting activities.

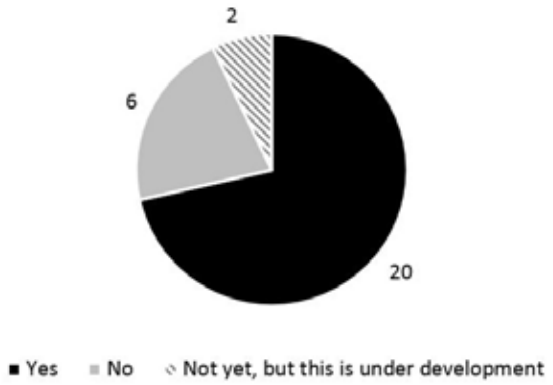

FIGURE 36 Number of states with a computerized maintenance management system.

TABLE 16

MAINTENANCE MANAGEMENT SYSTEM USE OF MQA RESULTS

	Number of State Responses		
Does Your MMS Use MQA Results To:	Yes	Not Yet, But Under Development	No
Estimate budget needs and/or provide the information needed to evaluate different strategies?	6	3	11
Schedule work activities?	6	2	12

Another question in this section of the survey asked participants with MMS to indicate the degree to which their system is integrated with pavement or bridge management systems. As Figure 37 indicates, these systems are fully integrated in only five of the 20 state DOTs. Five additional states have partially integrated these systems, and integration is under development in another state. The degree to which these systems are integrated may impact an agency's ability to consider both capital and maintenance expenditures when calculating the whole-life cost of managing transportation assets.

Access to Maintenance Quality Assurance Data

State DOTs with MQA programs in place were asked two questions related to the accessibility of MQA results and the manner in which information is conveyed. As shown in Figure 38, MQA results are commonly provided to maintenance personnel in the central office in all 28 agencies. In 27 of the 28 agencies, field offices can access MQA results. In 19 state DOTs, the results are also made available to other agency personnel. The information is less commonly provided to elected officials and to the public—10 state DOTs provide MQA results to elected officials and seven make the information available to the public. Other responses indicate that budgeting, communication, and county personnel are also given access to MQA results.

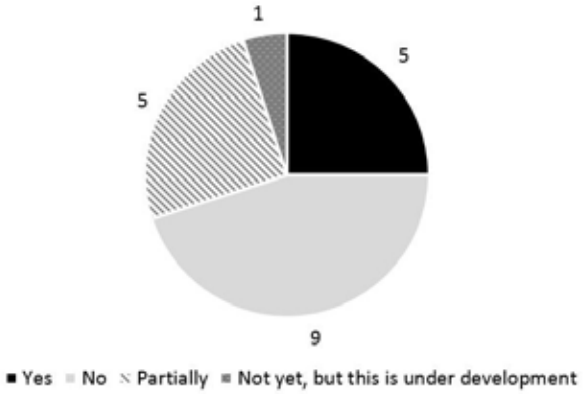

FIGURE 37 Number of state DOTs with their MMS integrated with pavement or bridge management.

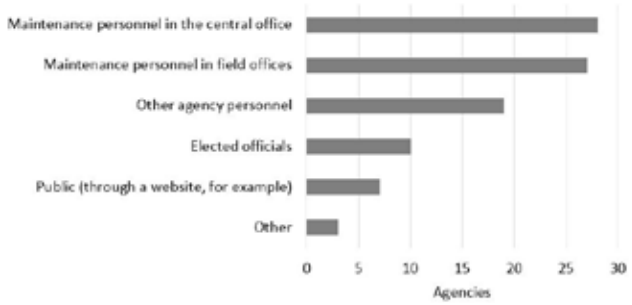

FIGURE 38 Access to MQA results.

The formats used to present results are summarized in Figure 39. MQA results are most commonly presented in internal reports (19 state DOTs). A total of 13 state DOTs report MQA results on a website and eight also use a dashboard presentation (similar to the dashboard of a car that summarizes important metrics). Only six state DOTs provide MQA results in a public report and only five use their geographic information system to present results. The one other response indicates that results are presented to field personnel at a meeting. No agencies use MQA results to prepare press releases.

Impact of the Maintenance Quality Assurance Program

A total of 23 of the 28 state DOTs with an MQA program in place report that it has helped their agency achieve more consistent conditions on a statewide basis. Furthermore, 25

of the 28 states report that the MQA results have been used to establish and address maintenance priorities on a statewide basis. Figure 40 presents the results of a question that asked the 28 state DOTs with MQA programs to describe their agency's level of success with the MQA program. As shown, no state DOT indicates that they have had "little" success and no state indicates that they have accomplished all that they had set out to accomplish. Rather, 19 state DOTs have had some success, but have room for additional improvements. A total of eight state DOTs have had a high degree of success with their program and one state DOT is too early in its development process to rate success. The results for this question clearly indicate that more can be done to add to the success of MQA programs.

FIGURE 39 Methods used to present MQA results.

FIGURE 40 Level of success with the MQA program.

When asked to identify the factors that most contributed to the success of the program, responses varied (see Figure 41). The support of upper management is recognized by 23 of the 28 state DOTs that responded to this question. The importance of training is noted by 19 of the state DOTs. Interestingly, 19 state DOTs also believe the simplicity of their system contributes to its success and 12 reference the ease with which the program can be used. A total of 16 state DOTs think the degree of confidence in the data is a critical factor for success and 15 note the importance of buy-in by field personnel. Other noted factors include involving field personnel in the program development, having a champion, having adequate staffing levels, and having the involvement of county personnel. No agency identified the complexity of its system as a factor contributing to the program's success.

FIGURE 41 Factors contributing to MQA program success.

INNOVATIONS, IMPROVEMENTS, AND ENHANCEMENTS

The final question in the survey of state practice asked the 28 state DOTs with MQA programs in place to identify new initiatives or technology they are considering to enhance their MQA program. The results are presented in Figure 42. As the results show, half of the state DOTs are considering new computer software and 16 of the 28 states are investigating replacing pencils, pens, and paper with handheld data collection devices. A total of eight state DOTs are considering adding GPS information to the data collected, and seven states are considering using automated surveys. Three state DOTs specifically indicated their interest in using LiDAR in conjunction with the automated surveys. Other responses include the following (the number of responses is shown in parenthesis):

- Re-evaluating the entire program (1)
- Considering changes to the interstate inspection process (1)
- Converting from pass/fail to a graded approach (1)
- Incorporating public survey results (1)
- Recently upgraded to handheld devices (1).

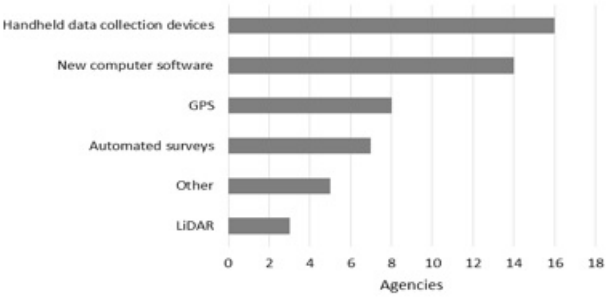

FIGURE 42 Initiatives and new technology under consideration.

CHAPTER FOUR

CASE EXAMPLES

APPROACH

Three aspects of an MQA program were difficult to explore through a survey of state practice. Therefore, in addition to the survey, representatives from eight DOTs were interviewed to further explore practices in the following areas:

- The rationale and motivation for initiating their MQA program
- The procedures used to ensure the quality and consistency of the MQA data and results
- The impact their methodology has had on how the MQA results can be used to support agency decisions.

The eight state transportation agencies selected to participate in the interviews (Alaska, Florida, Kentucky, Montana, North Carolina, Utah, Washington, and Wisconsin) were chosen based on several factors, including their expressed willingness to provide additional information. To ensure that a range of program characteristics and approaches were represented in the case examples presented in the document, selection factors also included the age of the program, the use of automated or manual approaches to collect data, the degree of detail in the survey approach, and the use of in-house versus contract personnel to collect the data. A summary of some of the characteristics provided during the survey of state practice for each agency that participated in the interviews is presented in Table 17.

The information presented in this chapter is not intended to provide a comprehensive summary of the practices in any of the eight states that participated in the interviews. Rather, to focus on the findings and overall lessons learned, only the highlights of the discussions in each of the three areas are provided.

RATIONALE AND MOTIVATION FOR GETTING STARTED

The eight states interviewed represent a range of experience with MQA programs, and all but one have had an MQA program in place for more than 10 years. Several of the representatives from states that have had their program in place for more than 10 years referenced *NCHRP Report 422: Maintenance QA Program Implementation Manual,* published in 1999, as having had a significant impact on the early stages of their MQA program.

The Florida DOT reports that its program began as early as 1985 in an effort to have a consistent method of rating maintenance activities. Therefore, one of the

TABLE 17
CHARACTERISTICS OF THE STATE DOTS INTERVIEWED

State	Centerline Miles	MQA Approach (Pass/Fail, Deficiencies Recorded, or a Combination of the Two)	Are Automated Vans Used?	Number of Segments Inspected Per Cycle	Sample Length (mile)	Group Responsible for Surveys
Alaska	5,745	Combination	No	1,000	0.1	Districts/regions + vendor
Florida	12.099	Pass/fail	No	8,568	0.1	Districts/regions + vendor
Kentucky	27,600	Combination	No	4,200	0.1	Districts/regions
Montana	12,000	Combination	Yes	12,000	0.5	Districts/regions
North Carolina	80,000	Combination	Yes	22,000	0.1	Central office + vendor
Utah	6,000	Combination	Yes	Depends on measure	0.1	Districts/regions
Washington	7,000	Deficiencies recorded	No	2,000	0.1	Districts/regions
Wisconsin	11,770	Combination	No	1,200	0.1	Districts + counties

early goals of the program was to provide an indicator that would help DOT prioritize maintenance activities across the state. As a result of this effort, the Florida DOT developed a handbook that included criteria that had to be met to satisfy DOT standards and a "yes/no" rating process was developed to indicate whether those standards were being met. The process developed in the 1980s has been updated somewhat over the ensuing years, but the system's framework is very similar to the original program. Even though the Florida DOT now uses performance-based contracts, where a contractor is responsible for performing maintenance work, the program continues to be used to monitor contractor performance and to report overall maintenance accomplishments.

The Washington State DOT (WSDOT) initiated its Maintenance Accountability Process (MAP) as a result of the state legislature's 1995 budgeting process, which questioned the DOT's ability to monitor maintenance efficiency and to identify the impacts of changes to the amount of money allocated for maintenance. As a result of this process, the state legislature mandated that WSDOT develop a method for communicating the outcomes of its investment choices. The agency initiated a project with a consultant to develop its condition assessment process and to implement a maintenance management system. However, the implementation of the computerized system proved too expensive for the DOT and only the condition assessment portion of the project was fully implemented. Over time, MAP has evolved into an investment model used by the state legislature to appropriate funds to preserve and maintain highway assets. The state legislature reportedly has demonstrated strong support for the maintenance program because of its ability to effectively communicate maintenance needs and impacts. An example of the types of information that WSDOT has developed to improve communication is the "Owner's Manuals" that have been developed for each asset feature. These manuals outline a series of activities that should be conducted over the life of each asset to extend its life span as much as possible.

The North Carolina DOT initiated its MQA activities in 1998, also in response to the state legislature. The initial program focused on a statewide assessment of maintenance accomplishments based on public opinion polls and a survey of about 750 samples. By about 2000 or 2002 the program had expanded to the Division level (i.e., a group of counties) and in 2003 a computerized MMS was implemented to conduct scenario planning and to drive the operation of the MQA program. Several changes took place during this time, including increasing the number of samples inspected, reducing the size of a sample unit from 0.20 mi to 0.10 mi, modifying the level of confidence required (from 95% confidence to 90% confidence), and adjusting the attributes being collected. The information is now being used to drive the allocation of maintenance funds at the division level, which has made maintenance personnel much more interested in the process.

The Wisconsin DOT (WisDOT) reports that the publication of NCHRP Report 422 spurred the development of what is referred to as the Compass program. About the time that the report was published, the director of maintenance for WisDOT had been actively involved in the AASHTO SCOM and was familiar with the MQA practices being followed in other states. The director created a position to develop a program similar to the one described in NCHRP Report 422 and the department was able to work with representatives from the Florida and Washington State DOTs to help get the program started.

Around 1997, the Utah DOT was trying to better understand its assets and the costs for the agency to maintain them. An individual within one of the regions began to push for the use of performance-based data, seeing benefit from the type of information that could be used to defend maintenance needs. Around 2004/2005, the program was implemented on a statewide basis, but it was met with a significant amount of resistance from region personnel. As a result of the resistance, the quality of the data suffered. In regions with a supervisor who supported the program, the data quality was higher than in regions where the program was not fully supported. The department continues to face the challenge of getting all regions on board with the program to ensure the quality of the data. In 2012, changes to the program reduced the number of raters and improved data quality. Future goals include using the data for allocating maintenance funds and becoming more proactive in how highway assets are maintained.

The Montana DOT initiated its MMS sometime during the 1980s and has used the program primarily to track work accomplishments. Maintenance is funded entirely using gas tax revenue, so the Maintenance Division has not needed to defend budget requests. However, if the state decides to pursue a gas tax increase in the future, the MQA information will likely be needed to support this analysis.

The Alaska DOT was another early implementer of an MQA program to enable the agency to engage the state legislature in setting funding levels instead of merely providing information. The department initially implemented a system developed by a consultant, but the program has undergone a number of changes over the years. The program was developed with the input of Alaska DOT maintenance personnel and was influenced by personnel with military experience in this area. Today, the DOT can report the current system LOS and the costs needed to achieve the LOS desired by external stakeholders, but it reportedly took 3 to 5 years before the DOT could use the MQA results reliably to make good maintenance decisions. Upper-management support was influential

in obtaining the additional staff needed to manage the program, and the department is pleased to report that it has been able to maintain the program through a number of administrative changes at the top of the organization. The program is reported to have enabled the Alaska DOT to enter into discussions about maintenance needs with the state legislature and to reduce the fluctuations in maintenance funding.

The most recent of the eight states to implement its program was the Kentucky DOT. Its MQA program was initiated to provide data needed to support the DOT's reporting under the Governmental Accounting Standards Board Statement 34 and to align maintenance activities with the department's strategic plan. Although the program that was implemented has achieved the original two goals, the department reports some limitations to the data that agency personnel would like to address through program changes. For instance, the Kentucky Transportation Cabinet would like to develop complete asset inventories and have more information on the value of each asset. In addition, the department would like to use its MQA results for performance-based budgeting in the future.

The following observations can be made from the information provided by the agencies interviewed:

- Upper-level support is very important to providing the resources needed to implement and maintain an MQA program.
- Access to guidance from NCHRP reports or access to practices in other states, or both, can be very helpful for states just beginning to implement new business processes.
- MQA programs evolve over time as data quality improve, as the agency becomes more comfortable with the information available, and as the agency needs change.
- Regardless of the initial objectives for an MQA program, state DOTs have successfully demonstrated their ability to use MQA results to communicate effectively with state legislatures to establish and defend maintenance budget requests.

METHODS TO ENSURE QUALITY AND CONSISTENCY

As reported in the previous chapter, state DOTs use a variety of methods to ensure the quality and consistency of MQA results. During the interviews, each of the eight state DOT representatives was asked to provide additional information about their quality assurance practices to gain further insight into this important aspect of an MQA program. The Montana DOT did not have any information to provide in this area, but the practices identified in the seven other states are documented in this section of the synthesis.

The Florida DOT follows a Maintenance Rating Program (MRP) handbook and conducts an annual training program to ensure data quality. The department requires that each two-person inspection team be led by a qualified team leader, who has to demonstrate his or her qualifications in a 10-point field test where the raters' scores are compared to other team leaders and to the task team. A score of 85% is required to remain certified as a team leader. All of the districts have at least one two-person inspection team (some districts may have two) and these positions are reported to be highly valued. The qualifications to become a team leader are posted on the DOT's website (http://www.dot.state.fl.us/statemaintenanceoffice/MaintRatingProgram.shtm). They include at least 2 years of experience conducting MRP inspections and at least 3 years of MRP training. A registered professional engineer with demonstrated field experience and MRP training can also serve as a team leader if he or she passes the required test. The 10-point test that is administered as part of the training includes field sites selected by the Task Team and the Steering Committee to present characteristics commonly found in the field. District raters inspect samples within their own district and random data checks can be performed to prevent bias from influencing the results. To date, the DOT reports that bias has not been an issue.

The field surveys conducted for the Washington State DOT's MAP are conducted by maintenance crews who are not responsible for the maintenance of that area. Headquarters conducts duplicate surveys on about 10% of the samples, to compare results. Any variances observed in the field are addressed by either sending the raters to training or replacing the raters with other individuals. Since surveys are conducted within a 6-week period, there is a quick turnaround in results. Therefore, reviews for unusual results in the data submitted are limited to scans by the central office and the division head. If something looks amiss, the sample can be re-inspected. Also, training is conducted annually to calibrate the raters. In addition to the data provided through these field surveys, several additional departmental efforts collect asset performance data for 100% of certain assets on a 2-year cycle. Because of the quality of the data from the 100% coverage, those assets are no longer surveyed as part of the MQA program. Instead, the data from the other programs are used to report conditions for those assets.

The North Carolina DOT (NCDOT) uses a number of approaches to collect MQA data, each of which has had an impact on the quality and reliability of the data. Through the years NCDOT has used in-house staff, consultants, and a mix of the two. It reports the most success with a team of retirees and college students because the retirees are familiar with the program and the college students are comfortable with entering information into a tablet computer. The department currently relies on consultants and temporary workers, with half of the state surveyed by one of three consultant

teams and the other half of the state surveyed by temporary employees. Each member of the team is assigned exclusively to the surveys so they are not distracted by other assignments. The surveys are facilitated using an ESRI program (ArcPad) on a tablet that calculates the number of samples that should be inspected in each location. Tablets have also allowed the department to check the reasonableness of data entered, which has had a tremendous positive impact on data quality.

Training is an important part of NCDOT's quality assurance activities. A typical 2-day training class involves a day in the field during which each team individually rates 10 samples in two counties. On the second day of training, the participants gather in a meeting room and review the results from the 10 samples. The differences are discussed and clear guidance is provided for areas where subjectivity is expected. A rating manual is provided as part of the training and crews are expected to adhere to the manual to ensure uniformity among teams. In addition, a separate team checks the ratings assigned to approximately 10% of the samples in each division to verify the accuracy of the ratings. Each quarter, the crews meet to discuss issues that have arisen and to pass out survey scorecards.

Because the survey results are used as part of the individual performance ratings, and for performance-based planning purposes, the department recently has been placing more of a focus on the data quality. Current confidence levels are reported to be 90% on the primary system and 80% on the secondary system. The department reports that it has good coverage of linear items in the samples inspected, but has less coverage on point data (e.g., pipes and drop inlets), since a sample may or may not include those features.

The information from the NCDOT MQA program is also used for its performance-based maintenance contracts, in which the number of samples is based on a process developed by Virginia Tech University for the Virginia DOT using a 95% confidence level and 5% precision. Because the total population included under the maintenance contracts is limited to the interstates and two counties, this level of detail is considered reasonable.

NCDOT is currently attempting to evaluate the return on investment for its MQA surveys, especially since they spend approximately $2 million on its MQA program. The current efforts are intended to determine whether the department can reduce its confidence level and correspondingly reduce the number of samples inspected.

WisDOT has published its quality control measures for its Compass program. These measures include the following:

- Ratings are performed by a team of two raters, typically the WisDOT maintenance coordinator for the region and a county representative.
- Ratings are typically performed by staff who identify maintenance needs and oversee maintenance activities.
- Data are statistically valid at the region and statewide levels, and the results are not used to evaluate individual performance.
- A 2-day introductory training program is required for all new raters.
- An annual "refresher" training program is required for veteran raters.

As part of an annual quality assurance review, 60 segments (roughly 5%) are inspected on a statewide basis to evaluate differences in the ratings. The results of these reviews provide feedback to the raters, but also help the program manger to develop the training curriculum or to make program modifications. In addition, the Compass program promotes data quality through the random selection of samples to inspect, the availability of a rating manual to guide inspections, the logic built into the database to check the reasonableness of data entered, and the consideration of system improvements based on feedback from the raters.

The Utah DOT also uses central office personnel to conduct random checks on approximately 50% of the data collected by the data collection teams within seven to 10 days of survey completion. Any discrepancies are reported and discussed with the teams, although very few discrepancies are noted. The department recently initiated a study with a university to review its quality assurance procedures to determine the correct number of samples to inspect to ensure a reasonable level of confidence in the data.

The Alaska DOT central office also conducts quality assurance checks on its MQA ratings, inspecting about 50 samples (roughly 5%) soon after the contractor completes the inspections. The number of samples inspected provides the department with a 95% confidence level, which is reported to be similar to what other states are using. The department does not train the contractors conducting the inspections, because the contractors typically staff their teams with former DOT foremen who have had years of experience. The quality assurance checks have been conducted by the same individuals for years, and each year they calibrate themselves at a meeting. The department reports that the use of an unbiased contractor to collect MQA data helps ensure data quality, especially since the individuals conducting the surveys are dedicated to that job and are not pulled in many different directions.

The central office of the Kentucky Transportation Cabinet randomly re-inspects approximately 10% of the inspected samples as part of its MQA program for quality assurance purposes. Every other year, the district personnel who conduct the inspections attend a training class and are given pocket manuals to serve as a reference to guide

the ratings. The quality assurance inspections are now conducted by a dedicated team for consistency purposes. Any discrepancies in the ratings require district personnel to re-inspect a sample.

The Kentucky Transportation Cabinet reports that another factor that has contributed to the quality of its inspections is the simplicity of the rating form. As shown in Figure 43, the mobile rating form allows ratings to be entered and each section can be linked to a map to ensure that the correct sections are inspected. The program also provides guidance from the rating manual for each of the condition attributes.

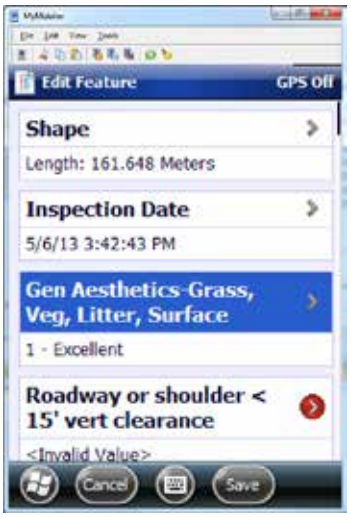

FIGURE 43 Sample inspection form used by the Kentucky DOT.

The information provided on quality assurance procedures led to the following observations:

- For the most part, agencies rely on training, rating manuals, and re-inspections of some samples as quality control activities to ensure the quality of their MQA processes.
- The states conduct independent assurance checks on the data by re-inspecting a portion of the network. No established guidance exists for the percentage of samples to be re-inspected, although the state DOTs interviewed re-inspect between 5% and 50% of the samples. Several states have initiated studies to determine the appropriate number of samples that should be inspected.
- Another quality control technique has been the development of simple, automated rating forms that have helped streamline the data entry process and reduce data entry errors.
- Several states have established qualifications for crews conducting the MQA inspections and the positions are highly desirable. This has reportedly also contributed positively to data quality.

IMPACT OF SELECTED APPROACH ON CAPABILITIES

During the interviews, participants were asked to comment on whether the format or approach that they had adopted for their MQA program in any way limited their ability to achieve program objectives. For the most part, the eight agencies have been able to adapt their MQA program to meet agency needs, or that they expected to be able to adapt their program to meet agency needs in the future. A summary of some of the activities conducted to ensure quality is presented in Table 18.

The Florida DOT's MQA program uses a form of a pass/fail approach in which raters determine whether an asset meets predefined criteria. The department considers the survey results to be a good assessment of conditions and has found its Maintenance Rating Program to be accepted by contractors for monitoring contractor performance.

The Washington DOT recognizes that because of its decision to use a sampling approach, the results of its MAP could be used only as an overall indicator of maintenance performance and not as a tool to plan work on a particular asset. However, over time some additional databases have been created that have increased the amount of information available on certain assets and has led to the ability to use the resulting information to plan and schedule work activities. For instance, Traffic personnel developed a safety management system that inspects half of the signs located on the highway network each year. Therefore, updated information on all signs maintained by the department is available every other year. Databases for catch basins and other assets now provide additional information on close to half of the assets included in MAP, which has led to much better information for planning work activities. As an additional benefit, the amount of time required to conduct MAP surveys has been reduced.

The North Carolina DOT has been able to establish a good deal of confidence in its MQA program because of the quality of the data collected. It uses the program results for more applications than it ever expected, and is proud that the information is now being used to establish budget allocations for the districts. With the passage of the MAP-21 legislation, the North Carolina DOT reports that it is in a good position to be able to respond because of its focus on performance-based decisions. As a result, MQA data are expected to be helpful in developing the Transportation Asset Management Plan required under MAP-21 to document investment strategies in certain transportation assets.

The Compass program developed by the Wisconsin DOT was designed to be statistically valid at both the state and regional levels. The program involves an annual snapshot of conditions, which is used to determine the funding needed to achieve different LOS. Maintenance funding allocations

TABLE 18
SUMMARY OF ACTIVITIES TO PROMOTE QUALITY

State	Quality Control Activities	Independent Assessment Activities	Reasonableness Checks
Alaska	• Consistent raters	• Central office conducts random checks on 50 samples (roughly 5%)	• Not identified
Florida	• Rating handbook • Annual training • Team leader must pass a test	• Random field checks	• Not identified
Kentucky	• Simple computerized rating form • Form linked to map to ensure right sample is inspected • Rating manual built into app	• Not identified	• Not identified
Montana	• A new process is under development		
North Carolina	• Consistent raters • Training • Rating manual • Quarterly meetings to discuss lessons learned	• Separate rating team checks approximately 10% of samples	• Use of tablets to check data
Utah	• Training • Rating handbook	• Central office conducts random checks on 50% of samples	• Not identified
Washington	• Raters rate outside their geographic area of responsibility • Annual training	• Headquarters conducts duplicate surveys on 10% of samples	• Scans for unusual results
Wisconsin	• Surveys conducted by two raters with maintenance backgrounds • Data are statistically valid at region and state levels • Training	• 60 segments (roughly 5%) inspected	• Logic built into database to check reasonableness of data

to the counties, however, are not based on conditions, but are determined based on the number of assets that are being maintained. To use the condition data at a finer level, the department would have to collect condition data on additional sample units to remain statistically valid and there has not yet been a motivating factor to institute this change.

The Utah DOT is considering a number of changes to its program to strengthen its use of MQA data for maintenance budgeting, but the program's framework will not change dramatically. The department is currently conducting a study to determine the statistical validity of its rating process to better evaluate the amount of data needed to drive the program. Improvements to the regression models used in the budgeting process are also needed. In addition to solidifying its use of MQA data to support maintenance budgeting activities, the department hopes to use the MQA results to "identify sleeping giants," which are items that cannot be cost-effectively maintained using only maintenance funds.

The Alaska DOT program was developed for a statewide analysis by design, but a new system is being implemented to provide information at the district and station levels. This change is expected to lead to an increase in the number of samples inspected, from a current sampling of approximately 1,000 samples (roughly 1.5% of the system) to approximately 2,800 samples (roughly 5% of the system). A change in the number of samples, if adopted, will address the only deficiencies that were reported by the interviewee: the reliability and confidence level in the data. The department reports that it has found unexpected uses for the MQA data, including assistance with determining routes that have adequate width to support bike routes and evaluating the effectiveness of certain maintenance activities at the station level.

In Kentucky, the Transportation Cabinet uses a pass/fail approach for rating maintenance performance. The information has proven useful at the statewide or district level to show spending levels versus conditions achieved. The data are not currently valid at the county level, but the agency combines 3 years' of data to produce a county report every other year. Because of the disparity in the system, and the differences in geography across the state, using the survey results to differentiate trends between districts or to compare one district with another can be difficult. Instead, trends are flagged at the statewide level and investigated further to determine whether any changes in practices are needed.

The Montana DOT has plans for a new system that will enable the department to prioritize highway assets as it builds its statewide inventory. The new system will be designed to

determine both the LOS being provided for each asset and the cost of managing the asset over its service life.

The information obtained from the interviews led to the following observations:

- The overall approach used in developing MQA programs has not appeared to have restricted the ability of state DOTs to use the results for their intended purpose. The most common limitations are related to the number of samples that can be inspected owing to the limited resources available. As a result, the number of samples may not be statistically valid for analyzing subsets of the statewide data.
- Agencies that have been using their MQA data to support performance-based budgeting processes indicate that they are aligned with the direction outlined in MAP-21. They anticipate that this will make them better prepared to respond to MAP-21 requirements for planning investment strategies to achieve agency-established performance targets.
- The use of "unit cost" models to pay for maintenance activities has improved accountability and led to innovations to reduce costs.

CHAPTER FIVE

CONCLUSIONS

OVERALL FINDINGS

Over the past 20 years, Maintenance Quality Assurance (MQA) programs have been implemented by state DOTs as a method of monitoring maintenance work accomplishments and documenting the resources required to perform common maintenance activities. Over time, the programs have evolved to support an agency's performance management activities, including the development of targeted level of service (LOS) and the use of performance-based budgeting to establish and communicate maintenance needs. As these MQA programs have evolved, a number of initiatives have been designed to expand the use of MQA programs at the state DOT level and to share MQA practices among practitioners. Given the level of interest in MQA programs among state DOT maintenance practitioners, and the recent support for performance-based management in the MAP-21 legislation, this synthesis of MQA field inspection practices serves as a timely resource for any agency trying to enhance its asset preservation efforts.

The findings presented in this synthesis were primarily obtained through the results of a survey of practice that was completed by representatives from 40 state DOTs. Additional information was obtained from interviews of representatives from eight DOTs in the following three areas:

- The rationale and motivation for initiating their MQA program
- The procedures used to ensure the quality and consistency of the MQA data and results
- The impact their methodology has had on how the MQA results can be used to support agency decisions.

The overall findings are summarized in the following areas:

- Condition assessment methods
- Data collected
- Managing data quality
- Using and communicating results.

Condition Assessment Methods

According to the survey results, 70% (28 of 40) of the state DOTs have an MQA program in place, an additional eight state DOTs intend to implement a program within the next 2 to 5 years, and two more state DOTs intend to implement an MQA program in 1 to 2 years. Among the states that have an MQA program in place, 75% of them have had their program for more than 10 years and most of the remaining programs have been in place for 5 to 10 years. Although the MQA programs have been in place for many years, they have not been static, with 78% of the states with MQA programs indicating that they have made substantial changes to their programs in the past 5 years. The names of the programs vary, but the majority of the programs are reported to have been developed by agency personnel. Some additional state DOTs developed their programs in partnership with a consultant.

A number of factors have driven the interest and activity in the MQA area, with most state DOTs indicating that their program was initiated to:

- Improve accountability
- Estimate maintenance needs
- Develop performance-based budgets
- Monitor the performance of assets
- Make good use of available funding
- Track and report maintenance activities.

Data Collected

The survey of state practice investigated data collection practices in six asset categories: drainage, roadside assets, pavements, bridges, traffic, and special facilities. Of these asset categories, pavements and bridges had the most complete inventories established. Several assets within the traffic and special facilities categories also reportedly had complete inventories established in more than half of the 28 state DOTs with MQA programs.

The drainage category included assets such as culverts, flumes, ditches, and drop inlets. Culvert inventories were established or were being established for the greatest number of states responding, but initiatives to inventory curbs and gutters, drop inlets, ditches and slopes, and sidewalks were also in place in close to half of the states with MQA programs. More than half of the 28 state DOTs reported collecting the following condition attributes for drainage assets:

- Culverts: Channel and culvert condition
- Ditches: Erosion and inadequate drainage as a result of silting

- Slopes: Erosion
- Drop inlets: Blockage and grate broken or missing.

Similar results were reported for roadside assets, which include fences, landscaping, plant beds, and sound barriers. Less than half of the state DOTs had established complete inventories of these assets and less than half reported that partial inventories were in place. Of those state DOTs that had established inventories, the inventories for sound barriers and fences were the most complete. More than half of the 28 state DOTs with MQA programs in place collect the following condition attributes for these assets:

- Fences: Length damaged or missing
- Grass: Grass height
- Litter: Volume
- Vegetation: Amount.

Most of the state DOTs with MQA programs have complete inventories for their paved roads and close to half have complete inventories of their paved and unpaved shoulders. Common condition attributes that are used by more than half of the state DOTs with MQA programs include the following:

- Paved roadways: Structural distress, cracking, and rutting
- Shoulders: Drop-off.

Most states with MQA programs have a complete inventory of their bridges. Half of the agencies with MQA programs use the results of inspections conducted for their bridge management system to monitor bridge conditions.

The traffic category typically includes assets that contribute to the safety of the roadways, such as signs, pavement marking, guardrail end treatments, overhead sign structures, and impact attenuators. Of the assets in this category, 18 states have a complete inventory of their variable message boards, 17 have a complete inventory of their overhead sign structures, and 15 have a complete inventory of their signals. The most common condition attributes collected by more than half of the state DOTs with MQA programs in place include the following:

- Signs: Panels damaged, post down, legibility, orientation, obstruction
- Pavement markings: Visibility, amount missing or damaged
- Pavement markers: Amount missing or damaged
- Guardrail end treatments: Damage to end treatment and damage to post
- Impact attenuators: Structural damage, functional damage.

Four types of special facilities were included in the survey of state practice: rest areas, tunnels, weigh stations, and traffic monitoring systems. A total of 24 of the 28 agencies with MQA programs in place have a complete inventory of their rest areas and more than half have complete inventories of the weigh stations and tunnels maintained by the state DOT. No condition attributes are commonly used by more than half of the agencies with MQA programs, but the most commonly used attributes are related to rest areas, including those listed here:

- Facilities working,
- Appearance,
- Landscaping, and
- Cleanliness.

Interestingly, no state DOT uses condition attributes to track traffic monitoring systems.

Most state DOTs conduct manual surveys to collect the condition information for the various asset categories, with annual surveys being most common. The lone exception is that bridges are typically inspected every other year. Automated equipment is most commonly used for paved roadways, and the equipment is also used to some degree for other assets found along the road edge.

Several of the 28 state DOTs rate the condition of assets to a predefined pass/fail criterion or they record the deficiencies found for each asset. Far more common is the use of a combination of these two approaches, depending on the type of asset. A total of 15 state DOTs use a combination of approaches to rate conditions. Surveys are typically conducted by district or regional personnel, and central office personnel are responsible for conducting random checks of data quality. Manual survey methods are most commonly used and nearly half of the state DOTs report using handheld computers to record information. Pencils and paper are still very common tools used during the MQA surveys.

Twenty-three of the 28 state DOTs with MQA programs survey samples of the network to estimate statewide conditions. The samples are typically 0.10 mi long and between 10% to 20% of the total samples are inspected. State DOTs may use statistical methods to estimate the number of samples to inspect, or they may just set a number based on experience, but most agencies strive for a 95% confidence level in the data.

Fourteen states spend more than 6 person-months conducting MQA surveys and five more states report spending 4 to 5 person-months on these activities. Sampling enables states to collect the data needed for maintenance planning within available resource constraints.

Managing Data Quality

With one exception, the state DOTs with MQA programs are actively taking steps to manage data quality, making use of

rating manuals, training programs, independent verification checks, and data reasonableness checks to support their efforts. Most states use a team of two raters to conduct surveys to help reduce bias. A total of 19 states certify their raters and at least one state has posted the qualifications for raters on its website. Several states have initiated studies to statistically evaluate the number of samples that need to be inspected in order to provide a reasonable level of confidence in the data.

Using and Communicating Results

MQA data are used in a variety of ways to support agency decisions. A total of 21 states use the survey results to establish a LOS, with letter grades (A to F) being most commonly used. Twenty-three states have used the data to establish performance targets and 11 of these states have established links between their performance targets and resource requirements. Another 11 states are in the process of establishing these links.

A total of eight states place a higher weight on the MQA scores for some asset categories in their budgeting activities (e.g., safety assets). This process allows states to prioritize maintenance needs on a statewide basis and helps to ensure that the highest-priority activities are funded.

Twenty states have a computerized maintenance management system in place, yet less than half of the state DOTs use the MMS to estimate budget needs or schedule work activities. In addition, only nine states have integrated their MMS with their pavement or bridge management systems.

The survey results are typically reported to maintenance and field personnel in virtually all of the state DOTs. Nineteen agencies provide the information to other agency personnel and less than half of the state DOTs present the information to elected officials or the public. Reports are the most common method of presenting information, but agencies also use websites and dashboards to communicate with stakeholders.

Twenty-three of the 28 state DOTs report that their MQA program has helped their agency achieve more consistent conditions on a statewide basis and 25 of 28 state DOTs report that the information has helped them establish maintenance priorities. The program also enables the agencies to be more proactive in communicating maintenance needs. Most state DOTs report that their program has been a success, but they see additional areas for improvement. The following factors have most contributed to the success of the program:

- Support of upper management,
- Training,
- Simplicity of the program,
- Ease of use,
- Confidence in the data, and
- Buy-in from field personnel.

A number of enhancements are planned in the next few years, including those listed here.

- Approximately 14 state DOTs will be implementing new software.
- Sixteen state DOTs are developing handheld computer applications for recording data from the field.
- Eight agencies are adding GPS characteristics to the data.
- Seven state DOTs are investigating the use of automated surveys.

FURTHER RESEARCH

The results from this synthesis identified several gaps in current knowledge that could be addressed by the research and outreach activities described here.

- **Establish more consistent performance measures:** As legislation and funding constraints continue to drive the transportation industry toward a performance-based management approach for making investment decisions, the survey results indicate a growing interest in the application of these concepts for managing maintenance activities at the state DOT level. The literature indicates consistency exists in the asset categories normally considered in an MQA program, but the features and condition attributes vary. As demonstrated by the survey results, some consistency exists in some of the condition attributes being used, but the industry would benefit from more consistency among practitioners in terms of the primary metrics that are used to monitor maintenance performance. The establishment of one or two condition attributes for each feature would allow state DOTs to better communicate with one another on an equal basis and would facilitate national reporting of maintenance needs.
- **Resurvey in 3 to 5 years to see if progress has been made.** Based on the survey results, it is apparent that there is a lot of interest in MQA programs and initiatives are under way to improve existing capabilities. Therefore, it would be beneficial to the maintenance practitioners to monitor the changes that are taking place through another survey of practice in 3 to 5 years. At that time, new areas of emphasis could be identified and additional implementation guidance could be developed.
- **Improve the efficiency and safety aspects of data collection activities.** The survey of practice found that the majority of state DOTs with MQA programs in place spend more than 6 person-months collecting data. Several state DOTs have initiated research studies

to determine, statistically, the lowest number of sample units that can be inspected with a reasonable level of confidence. Other state DOTs inspect between 5% and 50% of their total network samples. These inspection rates may be determined statistically, but they may also be based on the judgment of DOT personnel and the resources available to support the program. These efforts would benefit from the development of guidance to help agencies establish a reasonable confidence level for different highway system priorities and asset categories, and to determine the corresponding number of samples that need to be inspected. In addition, agencies would benefit from research that demonstrates how automated data collection equipment vans can be used to improve the efficiency of MQA surveys if the equipment is already being used for pavement management surveys. Automated equipment could also contribute to improved worker safety by taking raters off the road.

- I**ncrease the use of MQA results for planning and budgeting activities.** Although 20 of the 28 state DOTs with MQA programs have an MMS in place, less than half of them use it to estimate budget needs or schedule work activities. Rather, the MQA results are primarily used to track maintenance accomplishments and report maintenance conditions. The state DOTs that use their MMS for budgeting purposes report that they can be more proactive in communicating maintenance needs effectively with state legislators and defending the funding needed to achieve different levels of service. States where the MMS is not being used for budgeting and planning activities would benefit from peer exchanges, domestic scans, and workshops in which these activities' benefits can be conveyed. Research or guidance on enhancing the maturity of an MQA program would also benefit this group.
- **Establish LOS-cost relationships for maintenance activities.** Only nine state DOTs with an MMS have integrated the system with their pavement or bridge management systems. As a result, it is difficult for an agency to fully quantify the capital and maintenance costs of preserving the transportation network over the entire life of roadway assets. Research is needed to develop methodologies for better integrating capital and maintenance expenditures on roadway assets to enable states to reduce the overall life-cycle costs. This research would further support the consideration of life-cycle costs as required under MAP-21 in a state's Transportation Asset Management Plan.
- **Develop methods of demonstrating the benefits of maintenance expenditures.** Most of the states with MQA programs in place have realized benefits in terms of more consistent conditions on a statewide basis and clearer maintenance priorities. Research that demonstrates the benefits of investing in maintenance and methods of sharing the results to different stakeholder groups would strengthen communication results. The research results would also help state DOTs justify the expenditures being made on MQA programs.

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ABBREVIATIONS, ACRONYMS, INITIALISMS, AND SYMBOLS

HMA	Hot-mix asphalt
LOS	Level of service
MAP-21	Moving Ahead for Progress in the 21st Century
MMS	Maintenance Management System
MMQA+	Name of the MQA program used by the Utah DOT
MQA	Maintenance Quality Assurance
MRP	Maintenance Rating Program (Florida and Kentucky DOT Programs)
NCDOT	North Carolina DOT
PCC	Portland cement concrete
SCOM	Subcommittee on Maintenance
WisDOT	Wisconsin DOT
WSDOT	Washington State DOT

APPENDIX A
SURVEY QUESTIONNAIRE (WEB VERSION ONLY)

This appendix is provided only in the version of the document published on the NCHRP website.

Dear Maintenance Engineer:

The Transportation Research Board (TRB) is preparing a synthesis on Maintenance Quality Assurance (MQA) Field Inspection Practices. This is being done for the National Cooperative Highway Research Program (NCHRP), under the sponsorship of the American Association of State Highway and Transportation Officials (AASHTO), in cooperation with the Federal Highway Administration (FHWA).

The purpose of this questionnaire is to identify and summarize the MQA field inspection practices used by state highway agencies and the way these processes are administered within maintenance organizations. The results of the survey will be incorporated into a synthesis of highway agency practice that will highlight agency's practices and lessons learned, with the intent of aiding the implementation process for those agencies that have yet to implement an MQA program or are in the process of implementing a new or revised maintenance inspection regimen.

This survey is being sent to the voting member of the AASHTO Subcommittee on Maintenance for each state department of transportation. Your cooperation in completing the questionnaire will ensure the success of this effort. If you are not the appropriate person at your agency to complete this questionnaire, please forward it to the correct person.

Please complete and submit this survey by February 26, 2014. We estimate that it should take no more than 25 minutes to complete. It is designed so you can exit and return to the survey if you need to allocate your time over several days. If you have any questions or problems related to this questionnaire, please contact our principal investigator Ms. Katie Zimmerman at (217) 398-3977 or kzimmerman@appliedpavement.com.

Questionnaire Instructions

1. To view and print the entire questionnaire, Click on the following link and print using "control p." //surveygizmolibrary.s3.amazonaws.com/library/64484/NCHRPSynthesis4513survey3.pdf

2. To save your partial answers and complete the questionnaire later, click on the "Save and Continue Later" link at the top of your screen. A link to the incomplete questionnaire will be e-mailed to you from *SurveyGizmo*. To return to the questionnaire later, open the e-mail from *SurveyGizmo* and click on the link. We suggest using the "Save and Continue Later" feature if there will be more than 15 minutes of inactivity while the survey is opened, as some firewalls may terminate due to inactivity. Otherwise, utilizing the "next" and "previous" buttons will navigate through the survey.

3. To pass a partially completed questionnaire to a colleague, click on the on the "Save and Continue Later" link in the upper right-hand corner of your screen. A link to the incomplete questionnaire will be e-mailed to you from *SurveyGizmo*. Open the e-mail from *SurveyGizmo* and forward it to a colleague.

4. To view and print your answers before submitting the survey, click forward to the page following question 38. Print using "control p."

5. To submit the survey, click on "Submit" on the last page.

Thank you very much for your time and expertise in completing this important questionnaire.

Definitions

The following definitions are used in conjunction with this questionnaire:

- Agency district/region—the different geographic areas of responsibility within a given agency.
- Agency division/section—the various areas within a given agency and includes such divisions/sections as materials, construction, roadway design, planning, maintenance, and so on.
- Asset—a physical item of roadway infrastructure that has value. Assets are sometimes referred to as roadway "furniture" or "features." An asset may be a single item, such as a sign, or a linear item, such as a road or guardrail section. An asset may also be a spatial item, such as a rest area or mowable acreage.
- Asset inventory—a physical count of assets. The count may be by coordinates, milepoints, road section, geographical area, road network, maintenance section, or other convenient method of sorting and reporting the amount of assets in the road system.
- Condition assessment—a physical inspection and rating of roadway assets to determine the condition of individual assets, roadway sections, or overall road networks.
- Maintenance Quality Assurance (MQA)—a process of physically inspecting and rating the condition of the roadway assets and maintenance services. The quality assessment employs the same measures used to set performance targets. The data from the maintenance quality assessment is used to assess outcomes, actual performance, and maintenance LOS.

Definitions continued

- Performance Measure—a quantifiable measure of performance to determine progress toward specific, defined organization objectives based on statistical evidence. Sample measures include height of grass, number of potholes per lane mile, and percent of signs below standard.
- Performance Target—a targeted level of an activity or performance expressed as a tangible measurable goal, against which achievement can be compared. A performance target is usually a numerical rating, such as "pavement drop-off less than x inches," but it could also be an overall rating, such as a targeted LOS equal to "A" in an A to F rating scale.
- Sampling—a small group of sections selected from the entire population (usually statistically) that are used to represent the condition of the entire population.
- Level of Service (LOS)—a measure of the condition of individual assets as well as the overall condition of the roadway. LOS measures are generally specified in customer service terms related to safety, preservation, convenience, aesthetics, comfort, and mobility. Some states also measure LOS in terms of environmental impacts or legislative mandates.
- Maintenance Management System (MMS)—a modern MMS integrates organization structure, business processes, and technology to provide a systematic approach for planning and executing an efficient customer-oriented and performance-based maintenance program.

General Information

1) Select the state you represent.*

- ☐ Alabama
- ☐ Alaska
- ☐ Arizona
- ☐ Arkansas
- ☐ California
- ☐ Colorado
- ☐ Connecticut
- ☐ Delaware
- ☐ District of Columbia
- ☐ Florida
- ☐ Georgia
- ☐ Hawaii
- ☐ Idaho
- ☐ Illinois
- ☐ Indiana
- ☐ Iowa
- ☐ Kansas
- ☐ Kentucky
- ☐ Louisiana
- ☐ Maine
- ☐ Maryland
- ☐ Massachusetts
- ☐ Michigan
- ☐ Minnesota
- ☐ Mississippi
- ☐ Missouri
- ☐ Montana
- ☐ Nebraska
- ☐ Nevada
- ☐ New Hampshire
- ☐ New Jersey
- ☐ New Mexico
- ☐ New York
- ☐ North Carolina
- ☐ North Dakota
- ☐ Ohio
- ☐ Oklahoma
- ☐ Oregon
- ☐ Pennsylvania
- ☐ Rhode Island
- ☐ South Carolina
- ☐ South Dakota
- ☐ Tennessee
- ☐ Texas
- ☐ Utah
- ☐ Vermont
- ☐ Virginia
- ☐ Washington
- ☐ West Virginia
- ☐ Wisconsin
- ☐ Wyoming

2) Approximately how many centerline miles?*

_____

3) Do you have a program for monitoring maintenance condition of highway assets, such as a Maintenance Quality Assurance Program?*

- ☐ Yes
- ☐ No

IF: Question #3 = (“Yes”) **THEN:** Jump to page 6.

FINAL QUESTION

If you answered no, please answer this final question before returning the survey: Is your agency planning to develop/implement a program in:*

- ☐ 1 to 2 years
- ☐ 2 to 5 years
- ☐ Not at this time

Jump to page 60.

GENERAL INFORMATION

4) What term is used to describe your program?

- ☐ Maintenance Quality Assurance Program
- ☐ Maintenance Accomplishment Program
- ☐ Maintenance Management Program
- ☐ We have developed a unique name for the program. Enter your program name here:

_____

5) Approximately how long has your agency's MQA program been in place?

- ☐ 0 to 2 years
- ☐ 2 to 5 years
- ☐ 5 to 10 years
- ☐ More than 10 years

6) When was the last time your agency made substantial changes to your MQA program (substantial changes can be software enhancements or the addition of data elements)?

- ☐ 0 to 2 years
- ☐ 2 to 5 years
- ☐ 5 to 10 years
- ☐ More than 10 years

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7) How was your program developed?

- ☐ The agency developed the program.
- ☐ A consultant or vendor developed and implemented the program.
- ☐ A consultant or vendor developed and implemented the original program, but the agency has modified the program since that time.
- ☐ The agency worked in partnership with a consultant or vendor to develop and implement the program.
- ☐ The agency partnered with another public agency to develop the program.
- ☐ Other: _____

8) Which of the following items were factors in establishing your MQA program? Select all that apply.

- ☐ A mandate
- ☐ To make good use of available funding
- ☐ To track and report maintenance accomplishments
- ☐ To monitor performance of highway assets
- ☐ To improve work activity scheduling
- ☐ To develop performance-based budgets
- ☐ To estimate maintenance needs
- ☐ To improve agency accountability
- ☐ To improve accountability of personnel
- ☐ Other: _____

Condition Assessment Activities

This section of the survey asks about the MQA data being collected on various types of assets. Assets are organized by asset category. Within each category, please identify (a) whether you have a complete inventory for that asset, and (b) whether you assess (rate) the condition of that asset as part of your MQA program.

You will be asked for additional information about each asset that is rated as part of your MQA program. These questions will only appear if the asset is included in your MQA program. These questions ask for:

1. the method used to collect the information (Automated, Manual Windshield, Manual Walking, or Other) (Note: Automated may include both LiDAR or digital images from a vehicle traveling at near-traffic speeds),

2. whether representative samples are inspected during the survey process (Yes or No),

3. the cycle used to collect performance data (Annually, Every Other Year, More Than Once a Year, or Other), and

4. the condition assessment attribute used (select "Not Rated" if this asset is not part of your inspections).

Please complete the following tables as much as possible with readily-available information. We do not expect you to do extensive research to gather this information.

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Condition Assessment Activities—Drainage

9) Indicate if Drainage system assets inventory (e.g., location, number) is complete, partially complete, or if there is no inventory available.

	Complete	Partially complete	No inventory available
Culvert	( )	( )	( )
Flume	( )	( )	( )
Curb & Gutter	( )	( )	( )
Sidewalk	( )	( )	( )
Ditch or Slope	( )	( )	( )
Drop Inlet	( )	( )	( )
Underdrain & Edgedrain	( )	( )	( )

10) Select all Drainage system attributes that are rated.

- ☐ Culvert
- ☐ Flume
- ☐ Curb & Gutter
- ☐ Sidewalk
- ☐ Ditch or Slope
- ☐ Drop Inlet
- ☐ Underdrain & Edgedrain

Logic: Hidden unless: Question #10 contains any ("Culvert")

11) You indicated that you rate this asset. Please complete the associated tables.

Culvert - Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Culvert	( )	( )	( )		( )	( )	( )	( )	( )	

Culvert - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes			Other
	Channel condition (e.g., Clogged)	Erosion	Culvert condition (e.g., Deterioration at bottom due to scour or collapse)	
Culvert	[ ]	[ ]	[ ]	

Logic: Hidden unless: Question #10 contains any ("Flume")

12) You indicated that you rate this asset. Please complete the associated tables.

Flumes - Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Flumes	( )	( )	( )		( )	( )	( )	( )	( )	

Flumes - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes		Other
	Channel condition (e.g., Clogged)	Flume condition (e.g., deteriorated and causing erosion)	
Flumes	[ ]	[ ]	

Logic: Hidden unless: Question #10 contains any ("Curb & Gutter")

13) You indicated that you rate this asset. Please complete the associated tables.

Curb and Gutter - Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Curb & Gutter	( )	( )	( )		( )	( )	( )	( )	( )	

Curb & Gutter - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes						Other
	Settlement (Displacement /heaving)	Undermining	Flowline interrupted	Structural damage/ spalling	Curb/gutter cracking	Curb/gutter low curb reveal	
Curb & Gutter	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	

Logic: Hidden unless: Question #10 contains any ("Sidewalk")

14) You indicated that you rate this asset. Please complete the associated tables.

Sidewalk - Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Sidewalk	( )	( )	( )		( )	( )	( )	( )	( )	

Sidewalk - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes				Other
	Cracking	Structural deterioration	Displacement/heaving	Settlement	
Sidewalk	[ ]	[ ]	[ ]	[ ]	

Logic: Hidden unless: Question #10 contains any ("Ditch or Slope")

15) You indicated that you rate this asset. Please complete the associated tables.

Ditch or Slope - Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Ditch	( )	( )	( )		( )	( )	( )	( )	( )	
Slope	( )	( )	( )		( )	( )	( )	( )	( )	

Ditch or Slope - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes					Other
	Settlement	Erosion	Misalignment	Structural deterioration	Inadequate drainage (due to silting or debris)	
Ditch	[ ]	[ ]	[ ]	[ ]	[ ]	
Slope	[ ]	[ ]	[ ]	[ ]	[ ]	

Logic: Hidden unless: Question #10 contains any ("Drop Inlet")

16) You indicated that you rate this asset. Please complete the associated tables.

Drop Inlet - Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Drop Inlet	( )	( )	( )		( )	( )	( )	( )	( )	

Drop Inlet - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes				Other
	Insufficient capacity	Blockage	Structural deficiency	Grate broken/missing	
Drop Inlet	[ ]	[ ]	[ ]	[ ]	

Logic: Hidden unless: Question #10 contains any ("Underdrain & Edgedrain")

17) You indicated that you rate this asset. Please complete the associated tables.

Underdrain and Edgedrain - Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Underdrain & Edgedrain	( )	( )	( )		( )	( )	( )	( )	( )	

Underdrain & Edgedrain - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes			Other
	End protection damage	Pipe crushed	Pipe blocked	
Underdrain & Edgedrain	[ ]	[ ]	[ ]	

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Condition Assessment Activities—Roadside

18) Indicate if Roadside system assets inventory (e.g., location, number) is complete, partially complete, or if there is no inventory available.

	Complete	Partially complete	No inventory available
Fence	( )	( )	( )
Landscaping	( )	( )	( )
Plant Beds	( )	( )	( )
Sound Barrier	( )	( )	( )

19) Select all Roadside system attributes that are rated.

- ☐ Fence
- ☐ Grass Mowing
- ☐ Brush
- ☐ Litter
- ☐ Weed Control or Noxious Weeds
- ☐ Landscaping
- ☐ Plant Beds
- ☐ Sound Barrier

Logic: Hidden unless: Question #19 contains any ("Fence")

20) You indicated that you rate this asset. Please complete the associated tables.

Fence - Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Fence	( )	( )	( )		( )	( )	( )	( )	( )	

Fence - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes				Other
	Number of broken posts	Length of damaged or missing	Rusted fence connections	Vegetation on fence present	
Fence	[ ]	[ ]	[ ]	[ ]	

Logic: Hidden unless: Question #19 contains any ("Grass Mowing")

21) You indicated that you rate this asset. Please complete the associated tables.

Grass Mowing - Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Grass Mowing	( )	( )	( )		( )	( )	( )	( )	( )	

Grass Mowing - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes		Other
	Grass height	Presence of undesirable vegetation	
Grass Mowing	[ ]	[ ]	

Logic: Hidden unless: Question #19 contains any ("Brush")

22) You indicated that you rate this asset. Please complete the associated tables.

Brush - Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Brush	( )	( )	( )		( )	( )	( )	( )	( )	

Brush - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes		Other
	Obstructions in the clear zone	Vision obstructions	
Brush	[ ]	[ ]	

Logic: Hidden unless: Question #19 contains any ("Litter")

23) You indicated that you rate this asset. Please complete the associated tables.

Litter - Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Litter	( )	( )	( )		( )	( )	( )	( )	( )	

Litter - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes		Other
	Volume within a certain length	Other	
Litter	[ ]	[ ]	

Logic: Hidden unless: Question #19 contains any ("Weed Control or Noxious Weeds")

24) You indicated that you rate this asset. Please complete the associated tables.

Vegetation (Weed) Control or Noxious Weeds - Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Vegetation (Weed) Control or Noxious Weeds	( )	( )	( )		( )	( )	( )	( )	( )	

Weed Control - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes		Other
	Amount or percentage within a certain area	Other	
Vegetation (Weed) Control or Noxious Weeds	[ ]	[ ]	

Logic: Hidden unless: Question #19 contains any ("Landscaping")

25) You indicated that you rate this asset. Please complete the associated tables.

Landscaping - Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Landscaping	( )	( )	( )		( )	( )	( )	( )	( )	

Landscaping - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes		Other
	Appearance	Obstructions	
Landscaping	[ ]	[ ]	

Logic: Hidden unless: Question #19 contains any ("Plant Beds")

26) You indicated that you rate this asset. Please complete the associated tables.

Plant Beds - Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Plant Beds	( )	( )	( )		( )	( )	( )	( )	( )	

Plant Beds - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes		Other
	Appearance	Presence of undesirable vegetation	
Plant Beds	[ ]	[ ]	

Logic: Hidden unless: Question #19 contains any ("Sound Barrier")

27) You indicated that you rate this asset. Please complete the associated tables.

Sound Barrier - Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Sound Barrier	( )	( )	( )		( )	( )	( )	( )	( )	

Sound Barrier - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes		Other
	Functionality	Clear of vegetation	
Sound Barrier	[ ]	[ ]	

Condition Assessment Activities—Pavement

28) Indicate if Pavement system assets inventory (e.g., location, number) is complete, partially complete, or if there is no inventory available.

	Complete	Partially complete	No inventory available
Paved Shoulders	( )	( )	( )
Unpaved Shoulders	( )	( )	( )
Paved Roadways	( )	( )	( )

29) Select all Pavement system attributes that are rated.

- ☐ Paved Shoulders
- ☐ Unpaved Shoulders
- ☐ Paved Roadways

Logic: Hidden unless: Question #29 contains any ("Paved Shoulders")

30) You indicated that you rate this asset. Please complete the associated tables.

Paved Shoulders - Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Paved Shoulders	( )	( )	( )		( )	( )	( )	( )	( )	

Paved Shoulders - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes						Other
	Drop-off	Structural distress	Functional distress	Rumble strip not functioning	Travel way & shoulder separation	Shoulder maintenance	
Paved Shoulders	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	

Logic: Hidden unless: Question #29 contains any ("Unpaved Shoulders")

31) You indicated that you rate this asset. Please complete the associated tables.

Unpaved Shoulders - Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Unpaved Shoulders	( )	( )	( )		( )	( )	( )	( )	( )	

Unpaved Shoulders - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes		Other
	Drop-off	Adequacy of gravel	
Unpaved Shoulders	[ ]	[ ]	

Logic: Hidden unless: Question #29 contains any ("Paved Roadways")

32) You indicated that you rate this asset. Please complete the associated tables.

Paved Roadways - Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Paved Roadways	( )	( )	( )		( )	( )	( )	( )	( )	

Paved Roadways - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes												Other
	We use Pavement Management survey results	Structural distress HMA	Structural distress PCC	Functional distress HMA	Functional distress PCC	Cracking /Crack Sealing HMA	Cracking /Crack Sealing PCC	Faulting PCC	Roughness HMA or PCC	Rutting HMA	Pavement Patching HMA	Pavement Patching PCC	
Paved Roadways	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	

Condition Assessment Activities—Bridge

33) Indicate if Bridge system assets inventory (e.g., location, number) is complete, partially complete, or if there is no inventory available.

	Complete	Partially complete	No inventory available
Bridge	( )	( )	( )

34) Are Bridge condition assessment attributes rated?

☐ Yes

☐ No

Logic: Hidden unless: Question #34 contains any ("Yes")

35) You indicated that you rate this asset. Please complete the associated tables.

Bridge - Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Bridge	( )	( )	( )		( )	( )	( )	( )	( )	

Bridge - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes						Other
	Bridge inspections used for bridge management	Condition ratings for decks	Condition ratings for bearings	Condition ratings for joints	Structural adequacy	Drainage	
Bridge	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	

Condition Assessment Activities—Traffic Items

36) Indicate if Traffic Items system assets inventory (e.g., location, number) is complete, partially complete, or if there is no inventory available.

	Complete	Partially complete	No inventory available
Signal	( )	( )	( )
Sign	( )	( )	( )
Pavement Marking (long lines, e.g., centerline or edgeline)	( )	( )	( )
Pavement Marker (special pavement markings, e.g., only, arrow, etc.)	( )	( )	( )
Guardrail End Treatment	( )	( )	( )
Overhead Sign Structure	( )	( )	( )
Impact Attenuator	( )	( )	( )
Protective Barriers	( )	( )	( )

37) Select all Traffic Item system attributes that are rated.

- ☐ Signal
- ☐ Sign
- ☐ Pavement Marking (long lines, e.g., centerline or edgeline)
- ☐ Pavement Marker (special pavement markings, e.g., only, arrow, etc.)
- ☐ Guardrail End Treatment
- ☐ Overhead Sign Structure
- ☐ Impact Attenuator
- ☐ Protective Barriers (e.g., beam guard, cable guard, and concrete barriers)
- ☐ Variable Message Board
- ☐ Highway Lighting

Logic: Hidden unless: Question #37 contains any ("Signal")

38) You indicated that you rate this asset. Please complete the associated tables.

Signal - Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Signal	( )	( )	( )		( )	( )	( )	( )	( )	

Signal - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes				Other
	Post damage	Visibility	Bulbs burned out	Signal orientation	
Signal	[ ]	[ ]	[ ]	[ ]	

Logic: Hidden unless: Question #37 contains any ("Sign")

39) You indicated that you rate this asset. Please complete the associated tables.

Sign - Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Sign	( )	( )	( )		( )	( )	( )	( )	( )	

Sign - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes								Other
	Panels damaged	Retro-reflectivity at standard distance	Visibility at standard distance	Standard height	Post damage	Legibility	Sign orientation	Obstructions	
Sign	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	

Logic: Hidden unless: Question #37 contains any ("Pavement Marking (e.g., centerline or edgeline)")

40) You indicated that you rate this asset. Please complete the associated tables.

Pavement Marking (e.g., centerline or edgeline)
Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Pavement Marking	( )	( )	( )		( )	( )	( )	( )	( )	

Pavement Marking - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes			Other
	Day visibility	Night retroreflectivity	Missing/ damaged	
Pavement Marking	[ ]	[ ]	[ ]	

Logic: Hidden unless: Question #37 contains any ("Pavement Marker")

41) You indicated that you rate this asset. Please complete the associated tables.

Pavement Marker (special pavement markings, e.g., only, arrow, etc.)
Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Pavement Marker	( )	( )	( )		( )	( )	( )	( )	( )	

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Pavement Marker - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes		Other
	Number missing, damaged, or obstructed	Other	
Pavement Marker	[ ]	[ ]	

Logic: Hidden unless: Question #37 contains any ("Guardrail End Treatment")

42) You indicated that you rate this asset. Please complete the associated tables.

Guardrail End Treatment - Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Guardrail End Treatment	( )	( )	( )		( )	( )	( )	( )	( )	

Guardrail End Treatment - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes				Other
	End treatment damage	End treatment alignment	Post damage	Functionality	
Guardrail End Treatment	[ ]	[ ]	[ ]	[ ]	

Logic: Hidden unless: Question #37 contains any ("Overhead Sign Structure")

43) You indicated that you rate this asset. Please complete the associated tables.

Overhead Sign Structure - Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Overhead Sign Structure	( )	( )	( )		( )	( )	( )	( )	( )	

Overhead Sign Structure - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes		Other
	Structural integrity	Anchor bolts clear of debris	
Overhead Sign Structure	[ ]	[ ]	

Logic: Hidden unless: Question #37 contains any ("Impact Attenuator")

44) You indicated that you rate this asset. Please complete the associated tables.

Impact Attenuator - Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Impact Attenuator	( )	( )	( )		( )	( )	( )	( )	( )	

Impact Attenuator - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes			Other
	Misaligned	Structurally damaged	Functionality	
Impact Attenuator	[ ]	[ ]	[ ]	

Logic: Hidden unless: Question #37 contains any ("Protective Barriers…")

45) You indicated that you rate this asset. Please complete the associated tables.

Protective Barriers (e.g., beam guard, cable guard, and concrete barriers)
Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Protective Barriers	( )	( )	( )		( )	( )	( )	( )	( )	

Protective Barriers - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes			Other
	Misaligned	Structurally damaged	Functionality	
Protective Barriers	[ ]	[ ]	[ ]	

Logic: Hidden unless: Question #37 contains any ("Variable Message Board")

46) You indicated that you rate this asset. Please complete the associated tables.

Variable Message Board - Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Variable Message Board	( )	( )	( )		( )	( )	( )	( )	( )	

Variable Message Board - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes		Other
	Percent operational	Structural integrity	
Variable Message Board	[ ]	[ ]	

Logic: Hidden unless: Question #37 contains any ("Highway Lighting")

47) You indicated that you rate this asset. Please complete the associated tables.

Highway Lighting - Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Highway Lighting	( )	( )	( )		( )	( )	( )	( )	( )	

Highway Lighting - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes			Other
	Percent operational	Structural integrity	Anchor assembly clear of debris and all wiring enclosed	
Highway Lighting	[ ]	[ ]	[ ]	

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Condition Assessment Activities—Special Facilities

48) Indicate if Special Facilities system assets inventory (e.g., location, number) is complete, partially complete, or if there is no inventory available.

	Complete	Partially complete	No inventory available
Rest Areas	( )	( )	( )
Tunnels	( )	( )	( )
Weigh Stations	( )	( )	( )
Traffic Monitoring Systems	( )	( )	( )

49) Select all Special Facilities System Attributes that are rated.

- ☐ Rest Areas
- ☐ Tunnels
- ☐ Weigh Stations
- ☐ Traffic Monitoring Systems

Logic: Hidden unless: Question #49 contains any ("Rest Areas")

50) You indicated that you rate this asset. Please complete the associated tables.

Rest Areas - Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Rest Areas	( )	( )	( )		( )	( )	( )	( )	( )	

Rest Areas - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes							Other
	Graffiti	Facilities working properly	Appearance	Mowing	Landscaping	Odor	Cleanliness	
Rest Areas	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	

Logic: Hidden unless: Question #49 contains any ("Tunnels")

51) You indicated that you rate this asset. Please complete the associated tables.

Tunnels - Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Tunnels	( )	( )	( )		( )	( )	( )	( )	( )	

Tunnels - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes			Other
	Lighting	Debris	Drainage	
Tunnels	[ ]	[ ]	[ ]	

Logic: Hidden unless: Question #49 contains any ("Weigh Stations")

52) You indicated that you rate this asset. Please complete the associated tables.

Weigh Stations - Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Weigh Stations	( )	( )	( )		( )	( )	( )	( )	( )	

Weigh Stations - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes		Other
	Functionality	Appearance	
Weigh Stations	[ ]	[ ]	

Logic: Hidden unless: Question #49 contains any ("Traffic Monitoring Systems")

53) You indicated that you rate this asset. Please complete the associated tables.

Traffic Monitoring Systems - Method and Frequency (as part of the MQA program)

	Method of Collection			Method of Collection (Other)	Sampling Used?		Frequency of Survey			Frequency of Survey (Other)
	Auto-mated	Manual Windshield	Manual Walking		Yes	No	Annual	Every other year	More than once/yr	
Traffic Monitoring Systems	( )	( )	( )		( )	( )	( )	( )	( )	

Traffic Monitoring Systems - Condition Assessment Attributes

Select one or more attributes.

	Condition Assessment Attributes		Other
	Functionality	Other	
Traffic Monitoring Systems	[ ]	[ ]	

Condition Assessment Activities—Questions

54) Which of the following best describes the rating method used to assess the performance of maintenance activities?

- ☐ Raters determine whether an asset passes or fails based on predefined criteria.
- ☐ The number of performance deficiencies are recorded for each asset inspected.
- ☐ A combination of the two approaches is used, depending on the type of asset.
- ☐ Other: _____

55) Who conducts your maintenance condition assessment surveys?

- ☐ Central office maintenance personnel
- ☐ District/region personnel
- ☐ Consultant or vendor
- ☐ Other: _____

56) Approximately how many roadway segments are evaluated as part of a complete survey cycle?

_____

57) Please mark each type of equipment used during the conduct of the condition assessment surveys.

- ☐ Pen/pencil/paper
- ☐ Handheld computers
- ☐ GPS equipment
- ☐ Vans with cameras and lasers
- ☐ LiDAR
- ☐ Voice recording devices
- ☐ Other: _____

58) Does your agency use sampling to collect condition information on any assets?

- ☐ Yes
- ☐ No

IF: (Question #58 = (“No”) OR Question #58 is not answered) **THEN:** Jump to page 51.

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Sampling Details

Please select the length of your sample size.

- ☐ 0.10 mile
- ☐ 0.20 mile
- ☐ 0.50 mile
- ☐ Other: _____

At which of the following levels do you consider your MQA results to be a statistically valid representation of system conditions?

- ☐ At a statewide level
- ☐ At the region level
- ☐ At the county level
- ☐ At the roadway corridor level
- ☐ Not at any level
- ☐ At some other level

Does the sample include both directions for divided highways?

- ☐ Yes
- ☐ No

How is the number of samples determined?

- ☐ Statistical formula based on an inventory, current condition, confidence interval, etc.
- ☐ Specified number or percent of inventory
- ☐ Other: _____

If sampling is based on a confidence interval, what interval is used?

- ☐ 95% ± 5
- ☐ 90% ± 5
- ☐ 85% ± 5
- ☐ Other: _____

Condition Assessment Activities—Questions (continued)

59) How do you ensure the quality of the data you receive from the surveys? Select all that apply.

- ☐ Our agency does not check the quality of the data from the surveys.
- ☐ Our agency conducts training classes for the raters before each survey.
- ☐ Our agency has a rating manual to assist the raters.
- ☐ Our agency conducts independent checks of data from representative samples. Approximately how many samples are checked? (%):_____
- ☐ Raters do not inspect assets they are responsible for maintaining.
- ☐ A team of raters is used to reduce bias.
- ☐ Ratings are compared to previous surveys.
- ☐ Equipment checks and calibration are performed.
- ☐ Test sites are used to verify quality.
- ☐ We conduct checks of data reasonableness upon submittal.
- ☐ Other: _____

IF: (Question #59 indicates raters are used/trained) **THEN:** Answer below.

How often are raters certified or recertified?

- ☐ Annually
- ☐ Every 2 years
- ☐ Other: _____

60) Approximately how many equivalent person-months are spent collecting this condition information in your agency (assume 20 days in a month)?

- ☐ Less than 1 person-month
- ☐ 1 to 2 person-months
- ☐ 2 to 3 person-months
- ☐ 3 to 4 person-months
- ☐ 4 to 5 person-months
- ☐ 5 to 6 person-months
- ☐ More than 6 person-months

Use of MQA Data

61) Are the results of your condition assessment surveys used to establish levels of service?

- ☐ Yes
- ☐ No

IF: (Question #61 = (“No”) **THEN:** Skip to page 53.

Use of MQA Data

62) If you have established levels of service, please indicate the scale that is used.

- ☐ Percent passing or percent failing
- ☐ A, B, C, D, F
- ☐ 1, 2, 3, 4, 5
- ☐ A combination of (a) and (b) or (a) and (c), depending on the type of asset
- ☐ Other: _____

Use of MQA Data (continued)

63) Have you established performance targets?

- ☐ Yes
- ☐ No
- ☐ Not yet, but they are under development

64) Have you established links between performance targets and the resources needed to provide that level of service? For instance, do you know what resources would be required to move from an LOS B to an LOS A?

- ☐ Yes
- ☐ No
- ☐ Not yet, but the links are under development

65) Is your performance information used as part of the budgeting process to determine funding needed to meet LOS targets?

- ☐ Yes
- ☐ No
- ☐ Not yet, but this is under development

IF: (Question #65 = ("No" or "Not yet…") **THEN:** Skip to page 54.

If the performance measures are used to develop budget needs, do you apply weights to any category of assets to place more priority on some assets over others?

- ☐ Yes—what assets have the highest weight? _____
- ☐ No
- ☐ Not yet, but this is under development

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Use of MQA Data (continued)

66) Are the results of the condition assessment used to program and schedule work activities?

- ☐ Yes
- ☐ No
- ☐ Not yet, but this is under development

67) Are the results of the condition assessment used to determine compliance on maintenance contracts?

- ☐ Yes
- ☐ No
- ☐ Not yet, but this is under development

68) Do you have a computerized maintenance management system (MMS) in place?

- ☐ Yes
- ☐ No
- ☐ Not yet, but this is under development

IF: (Question #68 = ("No" or "Not yet…") **THEN:** Jump to page 56.

Computerized MMS Details

Does your MMS use the results of the condition assessment to estimate budget needs and/or provide the information needed to evaluate different strategies?

- ☐ Yes
- ☐ No
- ☐ Not yet, but this is under development

Does your MMS use the results of the condition assessment to schedule work activities?

- ☐ Yes
- ☐ No
- ☐ Not yet, but this is under development

Is the MMS integrated with your pavement and/or bridge management systems?

- ☐ Yes
- ☐ No
- ☐ Partially
- ☐ Not yet, but this is under development

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Use of MQA Data (continued)

69) Who has access to MQA results?

- ☐ Maintenance personnel in the central office
- ☐ Maintenance personnel in field offices
- ☐ Other agency personnel
- ☐ Public (through a website, for example)
- ☐ Elected officials
- ☐ Other

70) Which of the following are used to present MQA results?

- ☐ Website
- ☐ Dashboard
- ☐ GIS
- ☐ Publicly available reports
- ☐ Internal-only reports
- ☐ Press releases
- ☐ Other

Impact of the MQA Program

71) Has your MQA program helped your agency to achieve more consistent conditions on a statewide basis?

- ☐ Yes
- ☐ No

72) Has your MQA program helped your agency to identify maintenance priorities on a statewide basis?

- ☐ Yes
- ☐ No

73) Which response best describes your agency's level of success with its MQA program?

- ☐ Our MQA program has accomplished all of the goals we established for it.
- ☐ We have had a high degree of success with our MQA program.
- ☐ We have had some success, but there is room for improvement in some areas.
- ☐ We have had some success, but it is early in the development process.
- ☐ We have had little success.

74) Which of the following factors most contributed to the success of your program? Choose all that apply.

- ☐ Upper-management support
- ☐ Buy-in from field personnel
- ☐ Simplicity of the MQA program
- ☐ Complexity of the MQA program
- ☐ Degree of confidence in data
- ☐ Ease of use
- ☐ Training
- ☐ Staffing levels
- ☐ Having a project champion
- ☐ Involvement of field personnel in developing the program
- ☐ Other

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75) What new initiatives and/or technologies are you considering for your MQA program in the future?

- ☐ New computer software
- ☐ Handheld data collection devices
- ☐ Automated surveys
- ☐ GPS
- ☐ LiDAR
- ☐ Other

Case Study Inclusion

76) The synthesis will include three to five case studies to illustrate different methodologies being used. Would your agency be interested in being considered as a case study?

☐ Yes

☐ No

IF: (Question #76 = ("No") **THEN:** Skip to page 60.

Contact Information

Please provide your contact information.

Name: _____

Agency: _____

Address: _____

City, State, Zip: _____

Phone: _____

E-mail: _____

Thank You!

Thank you for taking our survey. Your response is very important to us. If you have any questions or comments, please feel free to contact Kathryn A. Zimmerman at:

- E-mail: kzimmerman@appliedpavement.com
- Phone: (217) 398-3977
- Mailing Address: 115 West Main Street, Suite 400, Urbana, IL 61801

APPENDIX B
SURVEY RESPONSES

TABLE B1
RESPONSES TO SURVEY QUESTIONS 1 THROUGH 3

State	Approximately how many centerline miles?	Do you have a program for monitoring maintenance condition of highway assets, such as a Maintenance Quality Assurance Program? If no, is your agency planning to develop/implement a program in:
Alaska	5,745	Yes
Arizona	6,800	Yes
Arkansas	16,398	Yes
California	15,000	Yes
Colorado	9,146	Yes
Florida	12,099	Yes
Indiana	28,818	Yes
Iowa	9,400	Yes
Kansas	10,000	Yes
Kentucky	27,600	Yes
Louisiana	16,592	Yes
Maryland	5,200	Yes
Missouri	33,900	Yes
Montana	12,000	Yes
Nevada	5,400	Yes
New Jersey	4,500	Yes
New York	16,000	Yes
North Carolina	80,000	Yes
Ohio	19,236	Yes
Pennsylvania	40,000	Yes
South Carolina	41,500	Yes
Tennessee	14,000	Yes
Texas	80,000	Yes
Utah	6,000	Yes
Washington	7,000	Yes
West Virginia	36,000	Yes
Wisconsin	11,770	Yes
Wyoming	6,700	Yes
Connecticut	4,110	No, 2 to 5 years
Delaware	4,500	No, 1 to 2 years
District of Columbia	1,100	No, 2 to 5 years
Idaho	13,000	No, 2 to 5 years
Michigan	9,800	No, 1 to 2 years
Minnesota	12,000	No, 2 to 5 years
Nebraska	10,280	No, Not at this time
New Hampshire	4,200	No, 2 to 5 years
North Dakota	7,375	No, Not at this time
Oklahoma	234,200	No, 2 to 5 years
Rhode Island	1,100	No, 2 to 5 years
Virginia	57,000	No, 2 to 5 years
		Yes = 28; No = 12

TABLE B2
RESPONSES TO SURVEY QUESTION 4

State	What term is used to describe your program?
Alaska	Maintenance Quality Assurance Program
Arizona	Level of Service
Arkansas	Maintenance Management Program
California	Maintenance Management Program
Colorado	MLOS Maintenance Level of Service, a performance-based budgeting system that evaluates condition of the assets at 645 random 1/3-mi segments annually
Florida	Maintenance Rating Program (MRP)
Indiana	Maintenance Quality Assurance Program
Iowa	Maintenance Performance Measurements
Kansas	Maintenance Quality Assurance Program
Kentucky	Maintenance Rating Program
Louisiana	Maintenance Management Program
Maryland	Maintenance Quality Assurance Program
Missouri	Maintenance Performance Indicators
Montana	Maintenance Management Program
Nevada	Maintenance Achievement Program
New Jersey	We have several systems, Pavement Management, Drainage Management, Maint. Management, Asset Management
New York	Maintenance Quality Assurance Program
North Carolina	Maintenance Condition Assessment Program
Ohio	Maintenance Condition Rating
Pennsylvania	Maintenance Quality Assurance Program
South Carolina	MAP—Maintenance Assessment Program
Tennessee	Maintenance Rating Index (MRI) Program
Texas	Texas Maintenance Assessment Program (TxMAP)
Utah	Maintenance Quality Assurance Program
Washington	Maintenance Accountability Process (MAP)
West Virginia	Maintenance Management Program
Wisconsin	Compass
Wyoming	Maintenance Quality Assurance Program

TABLE B3
RESPONSES TO SURVEY QUESTIONS 5–6

State	Approximately how long has your agency's MQA program been in place?	When was the last time your agency made substantial changes to your MQA program?
Alaska	5 to 10 years	2 to 5 years
Arizona	5 to 10 years	0 to 2 years
Arkansas	More than 10 years	More than 10 years
California	More than 10 years	2 to 5 years
Colorado	More than 10 years	5 to 10 years
Florida	More than 10 years	0 to 2 years
Indiana	5 to 10 years	2 to 5 years
Iowa	More than 10 years	2 to 5 years
Kansas	More than 10 years	2 to 5 years
Kentucky	More than 10 years	2 to 5 years
Louisiana	0 to 2 years	0 to 2 years
Maryland	More than 10 years	2 to 5 years
Missouri	More than 10 years	5 to 10 years
Montana	More than 10 years	0 to 2 years
Nevada	2 to 5 years	2 to 5 years
New Jersey	More than 10 years	5 to 10 years
New York	More than 10 years	More than 10 years
North Carolina	More than 10 years	0 to 2 years
Ohio	More than 10 years	0 to 2 years
Pennsylvania	More than 10 years	2 to 5 years
South Carolina	5 to 10 years	0 to 2 years
Tennessee	More than 10 years	5 to 10 years
Texas	More than 10 years	2 to 5 years
Utah	More than 10 years	0 to 2 years
Washington	More than 10 years	2 to 5 years
West Virginia	More than 10 years	0 to 2 years
Wisconsin	More than 10 years	0 to 2 years
Wyoming	5 to 10 years	2 to 5 years

TABLE B4
RESPONSES TO SURVEY QUESTION 7

State	How was your program developed?
Alaska	A consultant or vendor developed and implemented the original program, but the agency has modified the program since that time.
Arizona	A consultant or vendor developed and implemented the program.
Arkansas	The agency worked in partnership with a consultant or vendor to develop and implement the program.
California	The agency worked in partnership with a consultant or vendor to develop and implement the program.
Colorado	The agency worked in partnership with a consultant or vendor to develop and implement the program.
Florida	The agency developed the program.
Indiana	The agency partnered with another public agency to develop the program.
Iowa	The agency developed the program.
Kansas	The agency worked in partnership with a consultant or vendor to develop and implement the program.
Kentucky	The agency developed the program.
Louisiana	A consultant or vendor developed and implemented the original program, but the agency has modified the program since that time.
Maryland	The agency developed the program.
Missouri	The agency developed the program.
Montana	The agency developed the program.
Nevada	The agency worked in partnership with a consultant or vendor to develop and implement the program.
New Jersey	Some developed in house and some by consultant.
New York	The agency developed the program.
North Carolina	The agency developed the program.
Ohio	Unknown
Pennsylvania	The agency developed the program.
South Carolina	The agency developed the program.
Tennessee	The agency developed the program.
Texas	The agency developed the program.
Utah	The agency developed the program.
Washington	The agency worked in partnership with a consultant or vendor to develop and implement the program.
West Virginia	The agency developed the program.
Wisconsin	The agency developed the program.
Wyoming	The agency developed the program.

TABLE B5

RESPONSES TO SURVEY QUESTION 8. WHICH OF THE FOLLOWING ITEMS WERE FACTORS IN ESTABLISHING YOUR MQA PROGRAM? SELECT ALL THAT APPLY.

State	A mandate	To make good use of available funding	To track and report maintenance accomplishments	To monitor performance of highway assets	To improve work activity scheduling	To develop performance-based budgets	To estimate maintenance needs	To improve agency accountability	To improve accountability of personnel	Comments
Alaska	N/A	X	N/A	X	N/A	X	X	X	N/A	To collect lane miles as a side benefit
Arizona	N/A	N/A	N/A	X	N/A	X	X	X	X	
Arkansas	N/A	N/A	X	N/A	N/A	X	X	N/A	N/A	
California	N/A	X	X	X	N/A	X	X	X	X	
Colorado	X	N/A	X	X	N/A	X	X	N/A	N/A	
Florida	N/A	X	X	X	X	N/A	X	N/A	N/A	
Indiana	N/A	X		X	X	N/A	N/A	X	X	
Iowa	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Monitor performance and track backlog
Kansas	N/A	N/A	N/A	N/A	X	N/A	X	N/A	N/A	
Kentucky	X	X	N/A	X	N/A	N/A	X	X	N/A	
Louisiana	N/A	X	X	X	N/A	X	X	X	N/A	
Maryland	N/A	X	N/A	X	X	N/A	X	X	N/A	
Missouri	N/A	N/A	X	N/A	N/A	N/A	X	N/A	N/A	
Montana	N/A	X	X	N/A	N/A	N/A	X	N/A	N/A	
Nevada	N/A	X	X	X	N/A	X	X	X	N/A	
New Jersey	X	X	X	X	X	X	X	X	X	
New York	N/A	X	N/A	X	N/A	N/A	N/A	X	N/A	
North Carolina	N/A	X	X	X	N/A	N/A	X	X	X	
Ohio	N/A	N/A	X	N/A	N/A	N/A	N/A	N/A	X	
Pennsylvania	N/A	X	N/A	X	N/A	X	N/A	X	N/A	
South Carolina	N/A	X	N/A	X	X	X	X	N/A	N/A	
Tennessee	X	N/A	N/A	X	N/A	N/A	N/A	N/A	N/A	Performance-based maintenance contract
Texas	X	X	N/A	X	N/A	N/A	X	X	X	
Utah	N/A	X	X	X	X	X	X	X	N/A	
Washington	X	N/A	N/A	N/A	N/A	X	N/A	X	N/A	
West Virginia	N/A	X	N/A	X	X	X	X	N/A	N/A	
Wisconsin	N/A	X	X	X	N/A	X	X	X	N/A	
Wyoming	N/A	X	N/A	X	X	X	X	X	N/A	
Totals	6	19	13	21	9	15	21	17	7	

N/A = Not Applicable

TABLE B6
RESPONSES TO SURVEY QUESTION 9. INDICATE IF DRAINAGE SYSTEM ASSETS INVENTORY (e.g., location, number) IS COMPLETE, PARTIALLY COMPLETE, OR IF THERE IS NO INVENTORY AVAILABLE

State	Culvert	Flume	Curb & Gutter	Sidewalk	Ditch or Slope	Drop Inlet	Underdrain & Edgedrain
Alaska	PC	N	N	PC	PC	N	N
Arizona	C	C	C	N	C	C	N
Arkansas	N	N	N	N	N	N	N
California	PC	PC	C	C	C	PC	PC
Colorado	PC	PC	PC	PC	PC	PC	N/A
Florida	C	C	C	C	C	C	C
Indiana	PC	PC	PC	N	PC	PC	PC
Iowa	PC	PC	N	N	N	PC	PC
Kansas	PC	N	PC	N	PC	N	N
Kentucky	PC	N	N	N	N	N	N
Louisiana	N	N	N	N	N	N	N
Maryland	N	N	PC	PC	N	N	N
Missouri	N	N	N	PC	N	N	N
Montana	PC	N/A	PC	PC	N/A	PC	PC
Nevada	C	N/A	N/A	N/A	N/A	C	N/A
New Jersey	PC	N	C	PC	N	C	C
New York	PC	N	N	C	N	N	N
North Carolina	C	N	N	N	N	N	N
Ohio	PC	N	N	N	N	N	N
Pennsylvania	N	N	N	N	PC	N	N
South Carolina	PC	PC	PC	PC	PC	PC	PC
Tennessee	PC	N	C	PC	PC	PC	N
Texas	PC	PC	PC	PC	PC	PC	PC
Utah	PC	PC	C	N/A	PC	C	C
Washington	PC	N	N	N	PC	PC	N
West Virginia	PC	N/A	N/A	N/A	PC	PC	PC
Wisconsin	PC	N	C	PC	N	N	N
Wyoming	PC	N	PC	PC	N	N	N
Total C	4	2	7	3	3	5	3
Total PC	19	7	8	11	11	10	7
Total N	5	16	11	11	12	13	16

C = Complete; PC = Partially Complete; N = No Inventory; N/A = Not Applicable

TABLE B7
RESPONSES TO SURVEY QUESTION 10. SELECT ALL DRAINAGE SYSTEM ATTRIBUTES THAT ARE RATED.

State	Culvert	Flume	Curb & Gutter	Sidewalk	Ditch or Slope	Drop Inlet	Underdrain & Edgedrain
Alaska	X	N/A	N/A	N/A	X	N/A	N/A
Arizona	X	N/A	N/A	N/A	X	N/A	N/A
California	X	X	N/A	N/A	X	X	N/A
Colorado	X	N/A	N/A	N/A	X	X	N/A
Florida	X	X	X	X	X	X	X
Indiana	X	X	N/A	N/A	X	X	X
Iowa	X	X	N/A	N/A	X	X	N/A
Kansas	X	X	X	N/A	X	X	X
Kentucky	X	N/A	X	N/A	X	X	N/A
Louisiana	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Maryland	X	N/A	X	N/A	X	X	N/A
Missouri	X	N/A	X	N/A	X	X	N/A
Montana	X	N/A	N/A	N/A	N/A	N/A	N/A
Nevada	X	N/A	X	X	X	X	N/A
New York	X	N/A	N/A	N/A	X	X	N/A
North Carolina	X	N/A	X	N/A	X	X	X
Pennsylvania	X	N/A	N/A	N/A	X	X	N/A
South Carolina	X	X	X	X	X	X	X
Tennessee	X	N/A	X	N/A	X	X	N/A
Texas	X	X	X	X	X	X	X
Utah	X	N/A	X	N/A	X	X	N/A
Washington	X	N/A	N/A	N/A	X	X	N/A
West Virginia	X	N/A	N/A	N/A	X	X	X
Wisconsin	X	X	X	N/A	X	X	X
Wyoming	X	N/A	X	X	X	X	X
Totals	24	8	13	5	23	21	9

N/A = Not Applicable

TABLE B8

RESPONSES TO SURVEY QUESTION 11. YOU INDICATED THAT YOU RATE THIS ASSET (culvert). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
Alaska	Manual Walking	Yes	Annual	Channel condition, Culvert condition
Arizona	Manual Walking	Yes	Annual	Channel condition, Culvert condition
California	Manual Walking	N/A	Every other year	Channel condition, Erosion, Culvert condition
Colorado	Manual Walking	Yes	Annual	Channel condition
Florida	Manual Walking	Yes	More than once/yr	Channel condition, Erosion
Indiana	Manual Walking; Laptop Touch Screen	Yes	Annual; 1/10-mi road segments total 3,720 segments	Channel condition, Culvert condition, Pass/fail by segment
Iowa	Manual Walking	Yes	Annual; previously done yearly, on hold for now	Channel condition, Erosion, Culvert condition
Kansas	Manual Walking	Yes	Annual	Channel condition, Erosion, Culvert condition
Kentucky	Manual Walking	Yes	Annual	Channel condition
Maryland	Manual Windshield	Yes	Annual	Channel condition
Missouri	Manual Walking	Yes	Discontinued survey after 2011	Channel condition, Erosion, Culvert condition
Montana	Manual Windshield	N/A	Annual	Channel condition, Erosion, Culvert condition
Nevada	Manual Walking	Yes	Annual	Channel condition, Erosion, Culvert condition
New York	Manual Walking	Yes	Annual	Channel condition, Erosion, Culvert condition
North Carolina	Manual Walking	No	Every other year; per NBIS standards	Channel condition, Erosion, Culvert condition, Per NBIS Standards
Pennsylvania	Manual Windshield	N/A	Every other year	N/A
South Carolina	Manual Walking	Yes	Every other year	Channel condition, Erosion, Culvert condition
Tennessee	Manual Walking	Yes	Monthly	Channel condition, Culvert condition
Texas	Manual Windshield	No	Annual	Channel condition, Erosion, Culvert condition
Utah	Manual Walking	Yes	Twice a year	Channel condition, Erosion
Washington	Manual Walking	Yes	Annual	Culvert condition
West Virginia	Manual Walking	Yes	More than once/yr	Channel condition, Culvert condition
Wisconsin	Manual Walking	Yes	Annual	Channel condition, Culvert condition, Separated
Wyoming	Manual Walking	Yes	Annual	Channel condition, Erosion, Culvert condition

N/A = Not Applicable; NBIS = National Bridge Inspection Standards

TABLE B9

RESPONSES TO SURVEY QUESTION 12. YOU INDICATED THAT YOU RATE THIS ASSET (flume). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
California	Manual Windshield	N/A	When possible	Channel condition, Flume condition
Florida	Manual Walking	Yes	More than once/yr	Channel condition, Flume condition
Indiana	Manual Windshield; Laptop;	Yes	Annual; 1/10 mile	Channel condition
Iowa	Manual Walking	Yes	Previously done yearly, on hold for now	Flume condition
Kansas	Manual Walking	Yes	Annual	Channel condition, Flume condition
South Carolina	Manual Walking	Yes	Every other year	Channel condition, Flume condition
Texas	Manual Windshield	No	Annual	Channel condition, Flume condition
Wisconsin	Manual Walking	Yes	Annual	Channel condition, Flume condition

N/A = Not Applicable

TABLE B10

RESPONSES TO SURVEY QUESTION 13. YOU INDICATED THAT YOU RATE THIS ASSET (curb & gutter). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
Florida	Manual Walking	Yes	More than once/yr	Flowline interrupted
Kansas	Manual Walking	Yes	Annual	Flowline interrupted, Structural damage/ spalling
Kentucky	Manual Walking	Yes	Annual	Flowline interrupted
Maryland	Manual Windshield	Yes	Annual	Flowline interrupted, Structural damage/ spalling, Curb/gutter cracking, Curb/gutter low curb reveal
Missouri	Manual Walking	Yes	Discontinued survey after 2011	Settlement, Flowline interrupted, Structural damage/spalling, Curb/gutter cracking
Nevada	Manual Walking	Yes	Annual	Settlement, Structural damage
North Carolina	Manual Walking	Yes	Annual	Settlement, Flowline interrupted, Curb/gutter cracking
South Carolina	Manual Walking	Yes	Every other year	Settlement, Flowline interrupted, Structural damage/spalling, Curb/gutter cracking
Tennessee	Manual Walking	Yes	Monthly	Settlement, Undermining, Flowline interrupted, Structural damage/spalling
Texas	Manual Windshield	No	Annual	Settlement, Undermining, Flowline interrupted, Structural damage/spalling, Curb/ gutter cracking, Curb/gutter low curb reveal
Utah	Manual Windshield	No	Twice a year	Settlement, Flowline interrupted, Structural damage/spalling, Curb/gutter cracking
Wisconsin	Manual Walking	Yes	Annual	Settlement, Flowline interrupted, Structural damage/spalling
Wyoming	Manual Walking	Yes	Annual	Settlement, Flowline interrupted, Structural damage/spalling, Curb/gutter cracking

TABLE B11

RESPONSES TO SURVEY QUESTION 14. YOU INDICATED THAT YOU RATE THIS ASSET (sidewalk). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
Florida	Manual Walking	Yes	More than once/yr	Cracking, Structural deterioration, Displacement/heaving, Settlement
Nevada	Manual Walking	Yes	Annual	Structural deterioration, Displacement/heaving
South Carolina	Manual Walking	Yes	Every other year	Cracking, Displacement/heaving, Settlement
Texas	Manual Windshield	No	Annual	Structural deterioration, Displacement/heaving
Wyoming	Manual Walking	Yes	Annual	Cracking, Structural deterioration, Displacement/heaving, Settlement

TABLE B12

RESPONSES TO SURVEY QUESTION 15. YOU INDICATED THAT YOU RATE THIS ASSET (ditch). PLEASE COMPLETE THE ASSOCIATED TABLES.

Ditch

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
Alaska	Manual Walking	Yes	Annual	Settlement, Inadequate drainage
Arizona	Manual Walking	Yes	Annual	Erosion
California	Manual Windshield	Yes	Annual	Inadequate drainage
Colorado	Manual Walking	Yes	Annual	Inadequate drainage
Florida	Manual Walking	Yes	More than once/yr	Erosion, Structural deterioration, Inadequate drainage
Indiana	Manual Windshield; Laptop;	Yes	Annual; 1/10 mile	Inadequate drainage
Iowa	Manual Walking	Yes	Previously done yearly, on hold for now	Erosion, Inadequate drainage
Kansas	Manual Walking	Yes	Annual	Erosion, Inadequate drainage
Kentucky	Manual Walking	Yes	Annual	Inadequate drainage
Maryland	Manual Windshield	Yes	Annual	Structural deterioration, Inadequate drainage
Missouri	Manual Walking	Yes	Discontinued survey after 2011	Erosion, Inadequate drainage
Nevada	Manual Walking	Yes	Annual	Erosion, Misalignment, Inadequate drainage
New York	Manual Walking	Yes	Annual	Settlement, Erosion, Misalignment, Structural deterioration, Inadequate drainage
North Carolina	Manual Walking	Yes	Annual	Erosion, Inadequate drainage
South Carolina	Manual Walking	Yes	Every other year	Erosion, Inadequate drainage
Tennessee	Manual Walking	Yes	Monthly	Settlement, Erosion, Misalignment, Structural deterioration, Inadequate drainage
Texas	Manual Windshield	No	Annual	Settlement, Erosion, Misalignment, Structural deterioration, Inadequate drainage
Utah	Manual Walking	No	More than once/yr	Settlement, Erosion, Structural deterioration, Inadequate drainage
Washington	Manual Walking	Yes	Annual	Erosion, Structural deterioration, Inadequate drainage
West Virginia	Manual Walking	Yes	More than once/yr	Erosion, Inadequate drainage
Wisconsin	Manual Walking	Yes	Annual	Erosion, Inadequate drainage
Wyoming	Manual Walking	Yes	Annual	Erosion, Structural deterioration, Inadequate drainage

TABLE B12 (CONTINUED)

RESPONSES TO SURVEY QUESTION 15. YOU INDICATED THAT YOU RATE THIS ASSET (slope). PLEASE COMPLETE THE ASSOCIATED TABLES.

Slope

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
Arizona	Manual Walking	Yes	Annual	Erosion
California	Manual Windshield	Yes	Annual	Erosion
Colorado	Manual Walking	Yes	Annual	Settlement, Erosion
Florida	Manual Walking	Yes	More than once/yr	Erosion, Structural deterioration, Inadequate drainage
Iowa	Manual Walking	Yes	Previously done yearly, on hold for now	Erosion
Kansas	Manual Walking	Yes	Annual	Erosion
Kentucky	Manual Walking	Yes	Annual	Inadequate drainage
Missouri	Manual Walking	Yes	Discontinued survey after 2011	Erosion, Structural deterioration
Nevada	Manual Walking	Yes	Annual	Erosion, Misalignment, Inadequate drainage
North Carolina	Manual Walking	Yes	Annual	Erosion
South Carolina	Manual Walking	Yes	Every other year	N/A
Texas	Manual Windshield	No	Annual	Settlement, Erosion, Misalignment, Structural deterioration, Inadequate drainage
Utah	Manual Walking	No	More than once/yr	Settlement, Erosion, Structural deterioration
Washington	Manual Walking	Yes	Annual	Erosion, Structural deterioration, Inadequate drainage
West Virginia	Manual Walking	Yes	More than once/yr	Settlement, Inadequate drainage
Wisconsin	Manual Walking	Yes	Annual	Erosion, Inadequate drainage
Wyoming	Manual Walking	Yes	Annual	Settlement, Erosion

N/A = Not Applicable

TABLE B13

RESPONSES TO SURVEY QUESTION 16. YOU INDICATED THAT YOU RATE THIS ASSET (drop inlet). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
California	Manual Walking	N/A	Every other year	Blockage, Grate broken/missing
Colorado	Manual Walking	Yes	N/A	Insufficient capacity, Blockage
Florida	Manual Walking	Yes	More than once/yr	Blockage, Structural deficiency, Grate broken/missing
Indiana	Manual Walking; Laptop;	Yes	Annual; 1/10 mile	Blockage, Structural deficiency, Grate broken/missing
Iowa	Manual Walking	Yes	Previously done yearly, on hold for now	Blockage, Grate broken/missing
Kansas	Manual Walking	Yes	Annual	Blockage, Structural deficiency, Grate broken/missing
Kentucky	Manual Walking	Yes	Annual	Blockage
Maryland	Manual Windshield	Yes	Annual	Blockage, Structural deficiency
Missouri	Manual Walking	Yes	Discontinued survey after 2011	Blockage, Structural deficiency, Grate broken/missing
Nevada	Manual Walking	Yes	Annual	Blockage, Structural deficiency
New York	Manual Walking	Yes	Annual	Blockage, Structural deficiency, Grate broken/missing
North Carolina	Manual Walking	Yes	Annual	Blockage, Grate broken/missing, Damage that affects function
South Carolina	Manual Walking	Yes	Every other year	Blockage, Structural deficiency, Grate broken/missing
Tennessee	Manual Walking	Yes	Monthly	Blockage, Grate broken/missing
Texas	Manual Windshield	No	Annual	Blockage, Structural deficiency, Grate broken/missing
Utah	Manual Walking	No	More than once/yr	Blockage, Structural deficiency, Grate broken/missing
Washington	Manual Walking	No	Annual	Insufficient capacity, Blockage, Structural deficiency, Grate broken/missing
West Virginia	Manual Walking	Yes	More than once/yr	Blockage, Grate broken/missing
Wisconsin	Manual Walking	Yes	Annual	Blockage, Structural deficiency, Grate broken/missing
Wyoming	Manual Walking	Yes	Annual	Blockage, Structural deficiency, Grate broken/missing

N/A = Not Applicable

TABLE B14

RESPONSES TO SURVEY QUESTION 17. YOU INDICATED THAT YOU RATE THIS ASSET (underdrain & edgedrain). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
Florida	Manual Walking	Yes	More than once/yr	End protection damage, Pipe crushed, Pipe blocked
Indiana	Manual Walking; Laptop	Yes	Annual; 1/10 mile	Pipe crushed, Pipe blocked
Kansas	Manual Walking	Yes	Annual	End protection damage, Proper marking
North Carolina	Manual Walking	Yes	Annual	End protection damage, Pipe blocked
South Carolina	Manual Walking	Yes	Every other year	End protection damage, Pipe crushed, Pipe blocked
Texas	Manual Windshield	No	Annual	End protection damage, Pipe crushed, Pipe blocked
West Virginia	Manual Walking	Yes	N/A	Pipe blocked
Wisconsin	Manual Walking	Yes	Annual	End protection damage, Pipe crushed, Pipe blocked
Wyoming	Manual Walking	Yes	Annual	End protection damage, Pipe crushed, Pipe blocked, Properly marked for locating

N/A = Not Applicable

TABLE B15

RESPONSES TO SURVEY QUESTION 18. INDICATE IF ROADSIDE SYSTEM ASSETS INVENTORY (e.g., location, number) IS COMPLETE, PARTIALLY COMPLETE, OR IF THERE IS NO INVENTORY AVAILABLE.

State	Fence	Landscaping	Plant Beds	Sound Barrier
Alaska	N	N	N	N
Arizona	C	PC	N/A	C
Arkansas	N	N	N	N
California	PC	C	PC	PC
Colorado	PC	PC	PC	PC
Florida	C	PC	PC	C
Indiana	PC	N/A	N/A	PC
Iowa	N	N	N	N
Kansas	N	N	N	PC
Kentucky	N	N	N	N
Louisiana	PC	N	N	C
Maryland	N	N	PC	N
Missouri	N	N	N	N
Montana	PC	PC	PC	PC
Nevada	N	N	N	N
New Jersey	C	N	N	N
New York	N	N	N	C
North Carolina	N	PC	PC	PC
Ohio	N	N	N	PC
Pennsylvania	N	N	N	PC
South Carolina	N	N	N	N
Tennessee	C	PC	N	N
Texas	N	PC	PC	N
Utah	C	N	N	C
Washington	N	C	N	N
West Virginia	PC	PC	PC	N
Wisconsin	N	N	N	C
Wyoming	N	N	N	N
Total C	5	2	0	6
Total PC	6	8	8	8
Total N	17	17	18	14

C = Complete; PC = Partially Complete; N = No Inventory; N/A = Not Applicable

TABLE B16
RESPONSES TO SURVEY QUESTION 19. SELECT ALL ROADSIDE SYSTEM ATTRIBUTES THAT ARE RATED.

State	Fence	Grass Mowing	Brush	Litter	Weed Control/ Noxious Weeds	Landscaping	Plant Beds	Sound Barrier
Arizona	X	N/A	N/A	X	N/A	X	N/A	N/A
California	X	X	N/A	X	X	X	N/A	X
Colorado	X	X	N/A	X	X	X	N/A	N/A
Florida	X	X	X	X	X	X	X	N/A
Iowa	X	X	X	X	X	N/A	N/A	N/A
Kansas	X	X	X	X	X	X	N/A	N/A
Kentucky	X	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Louisiana	N/A	X	N/A	X	X	N/A	N/A	N/A
Maryland	N/A	X	X	X	N/A	X	X	N/A
Missouri	X	X	X	X	X	N/A	N/A	N/A
Montana	N/A	X	N/A	N/A	X	N/A	N/A	N/A
Nevada	X	X	N/A	X	X	N/A	N/A	X
New Jersey	X	X	N/A	X	N/A	N/A	N/A	X
New York	X	X	N/A	X	N/A	N/A	N/A	N/A
North Carolina	N/A	X	X	N/A	N/A	N/A	X	N/A
South Carolina	N/A	X	X	X	N/A	N/A	N/A	N/A
Tennessee	X	X	N/A	X	N/A	X	N/A	N/A
Texas	N/A	X	X	X	X	N/A	N/A	N/A
Utah	X	N/A	X	X	X	N/A	N/A	N/A
Washington	N/A	N/A	X	X	X	X	N/A	N/A
West Virginia	N/A	X	X	X	X	N/A	N/A	N/A
Wisconsin	X	X	X	X	N/A	N/A	N/A	N/A
Wyoming	X	X	X	X	X	N/A	N/A	N/A
Totals	15	19	13	20	14	8	3	3

N/A = Not Applicable

TABLE B17

RESPONSES TO SURVEY QUESTION 20. YOU INDICATED THAT YOU RATE THIS ASSET (fence). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
Arizona	Manual Walking	Yes	Annual	Length of damaged or missing
California	Manual Windshield	Yes	N/A	Number of broken posts, Length of damaged or missing
Colorado	Manual Walking	Yes	Annual	Number of broken posts, Length of damaged or missing
Florida	Manual Walking	Yes	More than once/yr	Number of broken posts, Length of damaged or missing
Iowa	Manual Walking	Yes	Previously done yearly, on hold for now	Length of damaged or missing
Kansas	Manual Walking	Yes	Annual	Rusted fence connections, Presents a satisfactory appearance
Kentucky	Manual Walking	Yes	Annual	Provides positive barrier
Missouri	Manual Windshield	Yes	Discontinued survey after 2011	Length of damaged or missing
Nevada	Manual Walking	Yes	Annual	Length of damaged or missing
New Jersey	Manual Walking	No	Every other year	Number of broken posts, Length of damaged or missing
New York	Manual Walking	Yes	Annual	Length of damaged or missing
Tennessee	Manual Walking	Yes	Monthly	Length of damaged or missing
Utah	Manual Windshield	No	More than once/yr	Length of damaged or missing
Wisconsin	Manual Walking	Yes	Annual	Length of damaged or missing
Wyoming	Manual Walking	Yes	Annual	Number of broken posts, Length of damaged or missing, Bent stays, Missing staples/clips

N/A = Not Applicable

TABLE B18

RESPONSES TO SURVEY QUESTION 21. YOU INDICATED THAT YOU RATE THIS ASSET (grass mowing). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
California	Manual Windshield	Yes	Annual	Grass height
Colorado	Manual Walking	Yes	Annual	Grass height
Florida	Manual Walking	Yes	More than once/yr	Grass height, Presence of undesirable vegetation
Iowa	Manual Walking	Yes	Previously done yearly, on hold for now	Grass height, Presence of undesirable vegetation
Kansas	Manual Walking	Yes	Annual	Grass height
Louisiana		No		Grass height, Presence of undesirable vegetation
Maryland	Manual Windshield	Yes	Annual	Excessive mowing beyond the limits established in SHA guidelines, Blocking signs or guardrail mounted delineators, Covering over linestriping, Affecting sight distance
Missouri	Manual Windshield	Yes	Discontinued survey after 2011	Grass height
Montana		No	More than once/yr	Grass height, Presence of undesirable vegetation
Nevada	Manual Walking	Yes	Annual	Grass height
New Jersey	Manual Windshield	No	More than once/yr	Grass height, Complaints, Sight distance
New York	Manual Walking	Yes	Annual	Grass height
North Carolina	Manual Walking	Yes	Annual	Bare or erodible areas
South Carolina	Manual Walking	Yes	Every other year	Grass height
Tennessee	Manual Walking	Yes	More than once/yr	Grass height
Texas	Manual Windshield	No	Annual	Grass height, Presence of undesirable vegetation
West Virginia	Manual Walking	Yes	More than once/yr	Grass height
Wisconsin	Manual Walking	Yes	Annual	Grass height, Mowed width
Wyoming	Manual Walking	Yes	Annual	Grass height

N/A = Not Applicable; SHA = State Highway Administration

TABLE B19

RESPONSES TO SURVEY QUESTION 22. YOU INDICATED THAT YOU RATE THIS ASSET (brush). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
Florida	Manual Walking	Yes	More than once/yr	Obstructions in the clear zone, Vision obstructions
Iowa	Manual Walking	Yes	Previously done yearly, on hold for now	Obstructions in the clear zone, Dead trees
Kansas	Manual Walking	Yes	Annual	Vision obstructions, Travel way is free of tree encroachment 15 ft vertically
Maryland	Manual Windshield	Yes	Annual	Vision obstructions
Missouri	Manual Windshield	Yes	Discontinued survey after 2011	Vision obstructions
North Carolina	Manual Walking	Yes	Annual	Obstructions in the clear zone, Vision obstructions
South Carolina	Manual Walking	Yes	Every other year	Any brush in the right-of-way
Texas	Manual Windshield	No	Annual	Obstructions in the clear zone, Vision obstructions, Deadfalls
Utah	Manual Windshield	No	More than once/yr	Obstructions in the clear zone, Vision obstructions
Washington	Manual Walking	Yes	Annual	Vision obstructions
West Virginia	Manual Walking	Yes	More than once/yr	Vision obstructions
Wisconsin	Manual Walking	Yes	Annual	Obstructions in the clear zone, Vision obstructions
Wyoming	Manual Walking	Yes	Annual	Obstructions in the clear zone, Tree trunk size 4in. max. in clear zone

TABLE B20

RESPONSES TO SURVEY QUESTION 23. YOU INDICATED THAT YOU RATE THIS ASSET (litter). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
Arizona	Manual Walking	Yes	Annual	Volume within a certain length
California	Manual Windshield	Yes	Annual	Volume within a certain length
Colorado	Manual Walking	Yes	Annual	Percent of roadside area affected by litter
Florida	Manual Walking	Yes	More than once/yr	Volume within a certain length, Litter considered to be a hazard, Unauthorized graffiti
Iowa	Manual Walking	Yes	Previously done yearly, on hold for now	Volume within a certain length
Kansas	Manual Walking	Yes	Annual	Volume within a certain length
Louisiana	Manual Windshield	Yes	Annual	Volume within a certain length
Maryland	Manual Windshield	Yes	Annual	Volume within a certain length
Missouri	Manual Walking	Yes	Discontinued survey after 2011	Volume within a certain length
Nevada	Manual Walking	Yes	Annual	Volume within a certain length
New Jersey	Manual Windshield	No	More than once/yr	Volume within a certain length, Complaints
New York	Manual Walking	Yes	Annual	Volume within a certain length
South Carolina	Manual Walking	Yes	Every other year	Volume within a certain length
Tennessee	Manual Walking	Yes	More than once/yr	No. of fist-sized pieces of litter
Texas	Manual Windshield	No	Annual	Volume within a certain length
Utah	Manual Windshield	Yes	More than once/yr	Volume within a certain length
Washington	Manual Walking	Yes	Annual	Volume within a certain length
West Virginia	Manual Walking	Yes	More than once/yr	Volume within a certain length
Wisconsin	Manual Windshield	Yes	Annual	Volume within a certain length
Wyoming	Manual Walking	Yes	Annual	Volume within a certain length, No animal carcasses present on roadway or visible in right-of-way

TABLE B21

RESPONSES TO SURVEY QUESTION 24. YOU INDICATED THAT YOU RATE THIS ASSET (weed control or noxious weeds). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
California	Manual Windshield	Yes	Annual	Amount or percentage within a certain area
Colorado	Manual Walking	Yes	Annual	Amount or percentage within a certain area
Florida	Manual Walking	Yes	More than once/yr	Amount or percentage within a certain area, Amount of bare ground
Iowa	Manual Walking	No	Previously done yearly, on hold for now	Amount or percentage within a certain area
Kansas	Manual Walking	Yes	Annual	Amount or percentage within a certain area
Louisiana	Manual Windshield	Yes	Annual	Amount or percentage within a certain area
Missouri	Manual Windshield	Yes	Discontinued survey after 2011	Amount or percentage within a certain area
Montana	Manual Walking	No	N/A	Amount or percentage within a certain area
Nevada	Manual Walking	Yes	Annual	Amount or percentage within a certain area
Texas	Manual Windshield	No	Annual	Just overall
Utah	Manual Windshield	Yes	More than once/yr	Amount or percentage within a certain area
Washington	Manual Walking	Yes	Annual	Amount or percentage within a certain area
West Virginia	Manual Walking	Yes	More than once/yr	Amount or percentage within a certain area
Wyoming	Manual Walking	Yes	Annual	Amount or percentage within a certain area, Soil sterilant, No broadleaf vegetation within 15 ft of pavement

N/A = Not Applicable

TABLE B22

RESPONSES TO SURVEY QUESTION 25. YOU INDICATED THAT YOU RATE THIS ASSET (landscaping). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
Arizona	Manual Walking	Yes	Annual	Appearance, Obstructions
California	Manual Windshield	Yes	Annual	Appearance
Colorado	Manual Walking	Yes	Annual	Appearance
Florida	Manual Walking	Yes	More than once/yr	Appearance
Kansas	Manual Walking	Yes	Annual	Obstructions
Maryland	Manual Windshield	Yes	Annual	Appearance, Obstructions
Tennessee	Manual Walking	Yes	More than once/yr	Appearance
Washington	Manual Walking	No	Annual	Appearance

TABLE B23

RESPONSES TO SURVEY QUESTION 26. YOU INDICATED THAT YOU RATE THIS ASSET (plant beds). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
Florida	Manual Walking	Yes	More than once/yr	Appearance, Presence of undesirable vegetation
Maryland	Manual Windshield	Yes	Annual	Appearance, Presence of undesirable vegetation
North Carolina	Manual Walking	No	Every other year	Appearance, Presence of undesirable vegetation

TABLE B24

RESPONSES TO SURVEY QUESTION 27. YOU INDICATED THAT YOU RATE THIS ASSET (sound barrier). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
California	Manual Windshield	N/A	When possible	New inventory added
Florida	Manual Walking	Yes	More than once/yr	N/A
Nevada	Manual Walking	Yes	Annual	Structural condition
New Jersey	Manual Walking; Inspection	No	Every other year	Functionality, Visible damage or graffiti

N/A = Not Applicable

TABLE B25

RESPONSES TO SURVEY QUESTION 28. INDICATE IF PAVEMENT SYSTEM ASSETS INVENTORY (e.g., location, number) IS COMPLETE, PARTIALLY COMPLETE, OR IF THERE IS NO INVENTORY AVAILABLE.

State	Paved Shoulders	Unpaved Shoulders	Paved Roadways
Alaska	PC	PC	PC
Arizona	N/A	PC	C
Arkansas	C	C	C
California	C	PC	C
Colorado	PC	PC	PC
Florida	C	C	C
Indiana	PC	PC	C
Iowa	PC	N	C
Kansas	C	C	C
Kentucky	N	N	C
Louisiana	C	C	C
Maryland	C	C	C
Missouri	PC	PC	C
Montana	PC	PC	C
Nevada	N/A	N/A	C
New Jersey	C	C	C
New York	C	C	C
North Carolina	PC	PC	C
Ohio	PC	PC	C
Pennsylvania	C	C	C
South Carolina	N/A	PC	C
Tennessee	PC	PC	C
Texas	PC	PC	PC
Utah	C	C	C
Washington	N	N	C
West Virginia	PC	PC	C
Wisconsin	C	C	C
Wyoming	N	N	PC
Total C	11	10	24
Total PC	11	13	4
Total N	3	4	0

C = Complete; PC = Partially Complete; N = No Inventory; N/A = Not Applicable

TABLE B26
RESPONSES TO SURVEY QUESTION 29. SELECT ALL PAVEMENT SYSTEM ATTRIBUTES THAT ARE RATED.

State	Paved Shoulders	Unpaved Shoulders	Paved Roadways
Alaska	X	X	X
Arizona	N/A	X	X
Arkansas	N/A	N/A	X
California	X	N/A	X
Colorado	X	X	X
Florida	X	X	X
Indiana	X	X	X
Iowa	X	X	X
Kansas	X	X	X
Kentucky	X	X	
Louisiana	X	X	X
Maryland	X	N/A	N/A
Missouri	X	X	X
Montana	N/A	N/A	X
Nevada	N/A	N/A	X
New Jersey	N/A	N/A	X
New York	N/A	N/A	N/A
North Carolina	N/A	X	X
Ohio	N/A	N/A	X
Pennsylvania	X	X	X
South Carolina	N/A	X	X
Tennessee	X	X	X
Texas	X	N/A	X
Utah	N/A	X	N/A
Washington	X	X	N/A
West Virginia	X	X	X
Wisconsin	X	X	N/A
Wyoming	X	X	X
Totals	18	19	22

N/A = Not Applicable

TABLE B27

RESPONSES TO SURVEY QUESTION 30. YOU INDICATED THAT YOU RATE THIS ASSET (paved shoulders). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
Alaska	Manual Walking	Yes	Annual	Structural distress, Functional distress, Travel way & shoulder separation, Shoulder maintenance
California	Automated	N/A	Annual	Structural distress, Functional distress
Colorado	Manual Walking	Yes	Annual	Drop-off, Structural distress, Functional distress
Florida	Manual Walking	Yes	More than once/yr	Structural distress, Functional distress
Indiana	Manual Windshield; Laptop	Yes	Annual; 1/10 mile	Drop-off, Structural distress, Functional distress
Iowa	Manual Walking	Yes	Previously done yearly, on hold for now	Drop-off, Structural distress, Functional distress, Travel way & shoulder separation, Shoulder maintenance, General surface condition
Kansas	Manual Walking	Yes	Annual	Drop-off, Structural distress, Travel way & shoulder separation, Shoulder maintenance
Kentucky	Manual Walking	Yes	Annual	Drop-off
Louisiana	Automated	No	Every other year	Drop-off
Maryland	Manual Windshield	Yes	Annual	Drop-off, Structural distress, Functional distress, Travel way & shoulder separation
Missouri	Manual Windshield	Yes	Discontinued survey after 2011	Drop-off, Structural distress, Travel way & shoulder separation, Shoulder maintenance
Tennessee	Manual Walking	Yes	More than once/yr	Drop-off, Structural distress, Travel way & shoulder separation, Shoulder maintenance
Texas	Manual Windshield	No	Annual	Drop-off, Structural distress, Functional distress, Rumble strip not functioning, Travel way & shoulder separation, Shoulder maintenance
Washington	Manual Walking	Yes	Annual	Drop-off, Structural distress, Shoulder maintenance
West Virginia	Manual Walking	Yes	More than once/yr	Drop-off, Functional distress, Travel way & shoulder separation
Wisconsin	Manual Walking	Yes	Annual	Drop-off, Cracking, Potholes/Raveling
Wyoming	Manual Walking	Yes	Annual	Drop-off, Functional distress, Rumble strip not functioning, Travel way & shoulder separation

N/A = Not Applicable

TABLE B28

RESPONSES TO SURVEY QUESTION 31. YOU INDICATED THAT YOU RATE THIS ASSET (unpaved shoulders). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
Alaska	Manual Walking	Yes	Annual	Drop-off, Adequacy of gravel
Arizona	Manual Walking	Yes	Annual	Drop-off, Adequacy of gravel
Colorado	Manual Walking	Yes	Annual	Drop-off
Florida	Manual Walking	Yes	More than once/yr	Drop-off, Build-up
Indiana	Manual Windshield; Laptop	Yes	Annual, 1/10 mile	Drop-off
Iowa	Manual Walking	Yes	Previously done yearly, on hold for now	Drop-off, Adequacy of gravel, Cross-slope, General surface condition
Kansas	Manual Walking	Yes	Annual	Drop-off
Kentucky	Manual Walking	Yes	N/A	Drop-off
Louisiana	Automated	No	Every other year	Drop-off
Missouri	Manual Windshield	Yes	Discontinued survey after 2011	Drop-off, Distortion and Vegetation Growth
North Carolina	Manual Walking	Yes	Annual	Drop-off, Build-up (high shoulder)
South Carolina	Manual Walking	Yes	Every other year	High shoulder and low shoulder
Tennessee	Manual Walking	Yes	More than once/yr	Drop-off, Adequacy of gravel
Utah	Manual Windshield	No	More than once/yr	Drop-off, Adequacy of gravel
Washington	Manual Walking	Yes	Annual	Drop-off
West Virginia	Manual Walking	Yes	More than once/yr	Drop-off
Wisconsin	Manual Walking	Yes	Annual	Drop-off, Adequacy of gravel, 2 measures for adequacy of gravel: cross-slope and erosion
Wyoming	Manual Walking	Yes	Annual	Drop-off

N/A = Not Applicable

TABLE B29

RESPONSES TO SURVEY QUESTION 32. YOU INDICATED THAT YOU RATE THIS ASSET (paved roadway). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
Alaska	Manual Walking	Yes	Annual	We use Pavement Management survey results, Structural distress HMA, Structural distress PCC, Functional distress HMA, Functional distress PCC, Cracking/Crack Sealing HMA, Cracking/Crack Sealing PCC, Faulting PCC, Roughness HMA or PCC, Rutting HMA, Pavement Patching HMA, Pavement Patching PCC
Arizona	Manual Walking	Yes	Annual	Structural distress HMA, Functional distress HMA, Cracking/Crack Sealing HMA, Rutting HMA, Pavement Patching HMA
Arkansas	Automated	No	Every other year	We use Pavement Management survey results, Cracking/Crack Sealing HMA, Cracking/Crack Sealing PCC, Faulting PCC, Roughness HMA or PCC, Rutting HMA
California	Automated	N/A	Annual	We use Pavement Management survey results, Structural distress HMA, Structural distress PCC, Functional distress HMA, Functional distress PCC, Cracking/Crack Sealing HMA, Cracking/Crack Sealing PCC, Faulting PCC, Roughness HMA or PCC, Rutting HMA
Colorado	Manual Walking	Yes	Annual	Structural distress HMA, Structural distress PCC, Functional distress HMA, Functional distress PCC, Cracking/Crack Sealing HMA, Cracking/Crack Sealing PCC, Faulting PCC, Rutting HMA
Florida	Manual Walking	Yes	More than once/yr	Structural distress HMA, Structural distress PCC, Cracking/Crack Sealing PCC, Pavement Patching HMA, Pavement Patching PCC
Indiana	Manual Windshield; Laptop	Yes	Annual, 1/10 mile	Cracking/Crack Sealing HMA, Cracking/Crack Sealing PCC, Pavement Patching HMA, Pavement Patching PCC
Iowa	Manual Walking; We plan to incorporate existing automated data collection to reduce the existing manual	Yes	Previously done yearly, on hold for now	Structural distress HMA, Structural distress PCC, Functional distress HMA, Functional distress PCC, Cracking/Crack Sealing HMA, Cracking/Crack Sealing PCC, Faulting PCC, Roughness HMA or PCC, Rutting HMA, Pavement Patching HMA, Pavement Patching PCC, HMA - rolldown at joints
Kansas	Manual Walking	Yes	Annual	Structural distress HMA, Structural distress PCC, Cracking/Crack Sealing HMA, Cracking/Crack Sealing PCC, Faulting PCC, Rutting HMA
Louisiana	Automated	No	Every other year	We use Pavement Management survey results, Structural distress HMA, Structural distress PCC, Functional distress HMA, Functional distress PCC, Cracking/Crack Sealing HMA, Cracking/Crack Sealing PCC, Faulting PCC, Roughness HMA or PCC, Rutting HMA
Missouri	Manual Windshield	Yes	Discontinued survey after 2011	We use Pavement Management survey results, Structural distress HMA, Structural distress PCC, Cracking/Crack Sealing HMA, Cracking/Crack Sealing PCC, Roughness HMA or PCC, Rutting HMA, Pavement Patching HMA, Pavement Patching PCC
Montana	Automated	No	N/A	We use Pavement Management survey results, Cracking/Crack Sealing HMA, Cracking/Crack Sealing PCC, Faulting PCC, Roughness HMA or PCC, Rutting HMA
Nevada	Automated	Yes	Every other year	We use Pavement Management survey results
New Jersey	Automated	No	Annual	We use Pavement Management survey results, Structural distress HMA, Structural distress PCC, Functional distress HMA, Functional distress PCC, Cracking/Crack Sealing HMA, Cracking/Crack Sealing PCC, Roughness HMA or PCC, Rutting HMA
North Carolina	Manual Windshield	No	Every other year, Primary system - annual, secondary system - biannual	We use Pavement Management survey results

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
Ohio	Manual Windshield	Yes	More than once/yr	Rutting HMA, Pavement Patching HMA, Pavement Patching PCC
South Carolina	Manual Walking; We perform walking inspections on a sampling of segments and automated assessments on the entire system.	Yes	Every other year, Walking sampling is every other year and the automated inspections are on a 3-year time frame	We use Pavement Management survey results, Structural distress HMA, Structural distress PCC, Functional distress HMA, Functional distress PCC, Cracking/Crack Sealing HMA, Cracking/Crack Sealing PCC, Faulting PCC, Roughness HMA or PCC, Rutting HMA, Pavement Patching HMA, Pavement Patching PCC
Tennessee	Automated	No	Every other year	We use Pavement Management survey results, Structural distress HMA, Structural distress PCC, Cracking/Crack Sealing HMA, Cracking/Crack Sealing PCC, Roughness HMA or PCC, Rutting HMA, Pavement Patching HMA, Pavement Patching PCC
Texas	Manual Windshield	No	Annual	
West Virginia	Automated	No	Every other year	We use Pavement Management survey results, Structural distress HMA, Structural distress PCC, Cracking/Crack Sealing HMA, Cracking/Crack Sealing PCC, Faulting PCC, Roughness HMA or PCC
Wyoming	Manual Walking	Yes	Annual	Structural distress HMA, Structural distress PCC, Functional distress HMA, Functional distress PCC, Cracking/Crack Sealing HMA, Cracking/Crack Sealing PCC, Faulting PCC, Roughness HMA or PCC, Rutting HMA, Pavement Patching HMA. We also use profilometer data from Materials Program.

N/A = Not Applicable

TABLE B30

RESPONSES TO SURVEY QUESTION 33. INDICATE IF BRIDGE SYSTEM ASSETS INVENTORY (e.g., location, number) IS COMPLETE, PARTIALLY COMPLETE, OR IF THERE IS NO INVENTORY AVAILABLE.

State	Bridge
Alaska	C
Arizona	C
Arkansas	C
California	C
Colorado	C
Florida	C
Indiana	C
Iowa	C
Kansas	C
Kentucky	C
Louisiana	C
Maryland	C
Missouri	C
Montana	C
Nevada	C
New Jersey	C
New York	C
North Carolina	C
Ohio	C
Pennsylvania	C
South Carolina	C
Tennessee	C
Texas	PC
Utah	C
Washington	C
West Virginia	C
Wisconsin	C
Wyoming	C
Total C	27
Total PC	1
Total N	0

C = Complete; PC = Partially Complete; N = No Inventory

TABLE B31

RESPONSES TO SURVEY QUESTION 34. SELECT ALL BRIDGE SYSTEM ATTRIBUTES THAT ARE RATED.

State	**Bridge**
Alaska	N/A
Arizona	N/A
Arkansas	X
California	X
Colorado	X
Florida	N/A
Indiana	X
Iowa	X
Kansas	N/A
Kentucky	N/A
Louisiana	X
Maryland	X
Missouri	N/A
Montana	X
Nevada	N/A
New Jersey	X
New York	N/A
North Carolina	X
Ohio	X
Pennsylvania	X
South Carolina	X
Tennessee	X
Texas	N/A
Utah	N/A
Washington	N/A
West Virginia	X
Wisconsin	N/A
Wyoming	X
Totals	16

N/A = Not Applicable

TABLE B32

RESPONSES TO SURVEY QUESTION 35. YOU INDICATED THAT YOU RATE THIS ASSET (bridge). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
Arkansas	Manual Walking	N/A	Every other year	Bridge inspections used for bridge management, Condition ratings for decks, Condition ratings for bearings, Condition ratings for joints, Structural adequacy, Drainage
California	Manual Walking	N/A	Every other year	Bridge inspections used for bridge management, Condition ratings for decks, Condition ratings for bearings, Condition ratings for joints, Structural adequacy, Drainage
Colorado	Manual Walking	Yes	Every other year	Bridge inspections used for bridge management, Condition ratings for decks, Condition ratings for bearings, Condition ratings for joints, Structural adequacy
Indiana	Manual Windshield; Laptop	Yes	Annual, 1/10 mi	Condition ratings for decks, Condition ratings for bearings, Condition ratings for joints, Drainage
Iowa	Manual Walking	No	Every other year, Condition and repair needs are collected through the normal NBIS bridge inspection process. Contract and field repair needs are prioritized from this information.	Bridge inspections used for bridge management, Condition ratings for decks, Condition ratings for bearings, Condition ratings for joints, Structural adequacy, Drainage
Louisiana	Automated	N/A	Every other year	Bridge inspections used for bridge management
Maryland	Manual Walking	N/A	Every other year	Bridge inspections used for bridge management, Condition ratings for decks, Condition ratings for bearings, Condition ratings for joints, Structural adequacy, Drainage
Montana	Manual Walking	No	Every other year	Bridge inspections used for bridge management, Condition ratings for decks, Condition ratings for joints
New Jersey	Manual Walking; Inspection	No	Every other year, Deficient bridges get inspected annually.	Bridge inspections used for bridge management, Condition ratings for decks, Structural adequacy
North Carolina	Manual Walking	No	Every other year, per NBIS standards	Bridge inspections used for bridge management
Ohio	Manual Windshield	Yes	More than once/yr	Condition ratings for decks, Concrete parapet

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
Pennsylvania	Manual Walking	N/A	Every other year	Bridge inspections used for bridge management, Condition ratings for decks, Condition ratings for bearings, Condition ratings for joints, Structural adequacy, Drainage
South Carolina	A separate unit inspects bridges. They enter their data into the Pontis program and the roadway assessment group doesn't have an interaction with the bridge inspection group.	Bridge inspections used for bridge management, Condition ratings for decks, Condition ratings for bearings, Condition ratings for joints, Structural adequacy, Drainage		
Tennessee	Manual Walking	No	Every other year	Bridge inspections used for bridge management
West Virginia	Manual Walking	No	Every other year	Bridge inspections used for bridge management, Condition ratings for decks, Condition ratings for bearings, Condition ratings for joints, Structural adequacy
Wyoming	Manual Walking	No	Every other year	Bridge inspections used for bridge management, Condition ratings for decks, Condition ratings for bearings, Condition ratings for joints, Structural adequacy, Drainage. This is done outside our Maintenance QA program. Work is performed by Bridge Program inspectors.

N/A = Not Applicable

TABLE B33

RESPONSES TO SURVEY QUESTION 36. INDICATE IF TRAFFIC ITEM SYSTEM ASSETS INVENTORY (e.g., location, number) IS COMPLETE, PARTIALLY COMPLETE, OR IF THERE IS NO INVENTORY AVAILABLE.

State	Signal	Sign	Pavement Marking	Pavement Marker	Guardrail End Treatment	Overhead Sign Structure	Impact Attenuator	Protective Barriers	Variable Message Board	Highway Lighting
Alaska	PC	C	PC	PC	PC	PC	PC	N	N	PC
Arizona	PC	PC	PC	PC	C	PC	C	C	C	PC
Arkansas	PC	PC	N	N	N	C	N	N	C	N
California	PC	N	N	N	N	PC	PC	N	PC	PC
Colorado	C	PC	PC	PC	PC	C	PC	PC	C	N
Florida	C	C	C	C	C	C	C	C	C	C
Indiana	C	C	PC	PC	PC	C	C	C	C	C
Iowa	N	C	C	N	N	C	N	N	C	N
Kansas	N	N/A	C	C	C	N	C	C	PC	PC
Kentucky	C	PC	N	N	N	PC	N	PC	N	N
Louisiana	PC	PC	PC	N	PC	PC	PC	N	PC	N
Maryland	C	PC	PC	PC	N	C	N	N	C	C
Missouri	PC	PC	PC	PC	N	PC	N	N	PC	PC
Montana	C	C	PC	PC	PC	PC	PC	N	C	PC
Nevada	N	C	N	N	C	C	C	C	C	N
New Jersey	C	PC	C	PC	C	C	PC	C	C	C
New York	C	PC	N/A	N	PC	C	PC	PC	C	PC
North Carolina	PC	N	N	N	N	C	N	N	N	C
Ohio	C	N	C	N	C	N	C	C	C	N
Pennsylvania	PC	C	PC	PC	PC	C	PC	PC	C	C
South Carolina	C	C	PC	PC	C	C	C	C	PC	PC
Tennessee	N	C	C	C	C	C	C	C	N	N
Texas	N/A	PC	PC	PC	PC	PC	PC	PC	N/A	N/A
Utah	C	C	C	C	C	C	C	C	C	C
Washington	C	C	PC	PC	N/A	C	PC	PC	C	C
West Virginia	C	PC	C	PC	PC	C	C	PC	C	PC
Wisconsin	C	C	PC	N	PC	C	PC	C	C	PC
Wyoming	C	C	PC	N	PC	PC	PC	N	C	C
Total C	15	13	8	4	9	17	10	11	18	9
Total PC	8	11	14	13	11	9	12	7	5	10
Total N	4	3	5	11	7	2	6	10	4	8

C = Complete; PC = Partially Complete; N = No Inventory; N/A = Not Applicable

TABLE B34
RESPONSES TO SURVEY QUESTION 37. SELECT ALL TRAFFIC ITEMS SYSTEM ATTRIBUTES THAT ARE RATED.

State	Signal	Sign	Pavement Marking	Pavement Marker	Guardrail End Treatment	Overhead Sign Structure	Impact Attenuator	Protective Barriers	Variable Message Board	Highway Lighting
Alaska	N/A	X	X	X	X	X	X	N/A	N/A	N/A
Arizona	N/A	X	N/A	N/A	X	N/A	X	X	N/A	N/A
Arkansas	N/A	X	X	N/A	N/A	X	N/A	N/A	N/A	N/A
California	N/A	X	X	X	X	X	X	X	N/A	X
Colorado	X	X	X	X	X	N/A	X	X	N/A	N/A
Florida	N/A	X	X	X	X	N/A	X	X	N/A	X
Indiana	N/A	X	X	X	X	N/A	X	X	N/A	N/A
Iowa	N/A	X	X	N/A	X	X	X	N/A	N/A	N/A
Kansas	N/A	X	X	X	N/A	N/A	X	N/A	N/A	N/A
Kentucky	N/A	X	X	N/A	X	N/A	X	X	N/A	N/A
Louisiana	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Maryland	N/A	X	X	X	X	X	X	X	N/A	X
Missouri	N/A	X	X	N/A	X	X	X	X	N/A	X
Montana	N/A	X	X	X	X	N/A	N/A	N/A	N/A	X
Nevada	N/A	X	X	X	X	N/A	X	X	N/A	X
New Jersey	N/A	N/A	X	N/A	N/A	X	N/A	N/A	N/A	N/A
New York	N/A	X	X	X	N/A	N/A	N/A	X	N/A	N/A
North Carolina	N/A	X	X	X	N/A	X	N/A	N/A	N/A	N/A
Ohio	X	X	X	X	X		X	X	N/A	N/A
Pennsylvania	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
South Carolina	N/A	X	X	X	X	N/A	X	X	N/A	N/A
Tennessee	N/A	X	X	X	X	X	X	X	N/A	N/A
Texas	N/A	X	X	X	X	X	X	X	N/A	N/A
Utah	N/A	X	X	X	N/A	N/A	N/A	X	N/A	N/A
Washington	X	X	X	X	N/A	N/A	N/A	X	X	X
West Virginia	N/A	X	X	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Wisconsin	N/A	X	X	X	X	N/A	N/A	X	N/A	N/A
Wyoming	N/A	X	N/A	N/A	X	N/A	N/A	X	N/A	N/A
Totals	3	25	24	18	18	10	16	18	1	7

N/A = Not Applicable

TABLE B35
RESPONSES TO SURVEY QUESTION 38. YOU INDICATED THAT YOU RATE THIS ASSET (signal). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
Colorado	Manual Walking	Yes	Annual	Post damage, Bulbs burned out, Signal orientation
Ohio	Manual Windshield	Yes	More than once/yr	Visibility
Washington	Automated	No	Annual	Number of malfunctions

TABLE B36

RESPONSES TO SURVEY QUESTION 39. YOU INDICATED THAT YOU RATE THIS ASSET (sign). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
Alaska	Manual Walking	Yes	Annual	Panels damaged, Visibility at standard distance, Standard height, Post damage, Legibility, Obstructions
Arizona	Manual Windshield	Yes	Annual	Post damage, Legibility, Sign orientation
Arkansas	Manual Windshield	No	10 years	Panels damaged, Age
California	Manual Windshield	Yes	Annual, Sampling done for daytime survey and comprehensive for nighttime survey.	Panels damaged, Retroreflectivity at standard distance, Visibility at standard distance, Legibility, Obstructions
Colorado	Manual Walking	Yes	Annual	Panels damaged, Standard height, Post damage, Legibility, Sign orientation, Breakaway features functional
Florida	Manual Walking; Manual Windshield	Yes	More than once/yr	Panels damaged, Retroreflectivity at standard distance, Visibility at standard distance, Standard height, Post damage, Legibility, Sign orientation, Obstructions
Indiana	Manual Windshield; Laptop	Yes	Annual, 1/10 mi	Panels damaged, Post damage, Legibility, Age
Iowa	Manual Walking	No	Annual	Panels damaged, Retroreflectivity at standard distance, Visibility at standard distance, Standard height
Kansas	Manual Walking	Yes	Annual	Panels damaged, Standard height, Post damage, Legibility, Sign orientation, Obstructions
Kentucky	Manual Walking	Yes	Annual	Panels damaged, Standard height, Post damage, Legibility, Sign orientation, Obstructions
Maryland	Manual Windshield	Yes	Annual	Panels damaged, Visibility at standard distance, Legibility, Sign orientation
Missouri	Manual Windshield	Yes	Survey discontinued after 2011	Panels damaged, Standard height, Post damage, Sign orientation
Montana	Manual Windshield	No	Annual	Retroreflectivity at standard distance, Obstructions
Nevada	Automated	No	More than once/yr	Panels damaged, Post damage, Legibility
New York	Manual Walking	Yes	Annual	Panels damaged, Post damage, Legibility, Sign orientation, Obstructions
North Carolina	Manual Windshield	No	Annual	Panels damaged, Legibility, Obstructions
Ohio	Manual Windshield	Yes	More than once/yr	Panels damaged, Post damage, Legibility, Obstructions
South Carolina	Manual Walking	Yes	Every other year	Panels damaged, Visibility at standard distance, Post damage, Legibility, Sign orientation, Obstructions
Tennessee	Automated	No	Every other year	Visibility at standard distance, Legibility, Obstructions

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
Texas	Manual Windshield	No	Annual	Panels damaged, Visibility at standard distance, Standard height, Post damage, Legibility, Sign orientation, Obstructions
Utah	Manual Windshield	No	More than once/yr	Panels damaged, Visibility at standard distance, Standard height, Post damage, Legibility, Sign orientation
Washington	Manual Windshield	No	Every other year	Panels damaged, Retroreflectivity at standard distance, Visibility at standard distance, Post damage, Legibility, Sign orientation
West Virginia	Manual Windshield	Yes	Annual	Panels damaged, Retroreflectivity at standard distance, Visibility at standard distance, Legibility, Sign orientation, Obstructions
Wisconsin	Manual Walking	Yes	Annual	Panels damaged, Post damage, Sign orientation
Wyoming	Manual Walking	Yes	Annual	Panels damaged, Visibility at standard distance, Standard height, Post damage, Legibility, Sign orientation, Obstructions. Traffic program conducts additional signing evaluations outside MQA. This includes retroreflectivity.

TABLE B37

RESPONSES TO SURVEY QUESTION 40. YOU INDICATED THAT YOU RATE THIS ASSET (pavement marking). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
Alaska	Manual Walking	Yes	Annual	Day visibility, Missing/damaged
Arkansas	Manual Windshield	No	Every other year	Day visibility, Night retroreflectivity
California	Manual Windshield	Yes	Annual, Sampling done for daytime survey and comprehensive for nighttime survey.	Night retroreflectivity
Colorado	Manual Walking	Yes	Annual	Day visibility, Night retroreflectivity
Florida	Manual Walking; Manual Windshield	Yes	More than once/yr	Day visibility, Night retroreflectivity, Missing/damaged
Indiana	Manual Windshield; Laptop	Yes	Annual, 1/10 mi	Missing/damaged
Iowa	Manual Windshield	Yes	Annual	Day visibility, Night retroreflectivity, Missing/damaged
Kansas	Manual Walking	Yes	Annual	Day visibility, Missing/damaged
Kentucky	Manual Walking	Yes	Annual	Retroreflectometer readings
Maryland	Manual Windshield	Yes	Annual	Day visibility, Missing/damaged
Missouri	Manual Windshield	Yes	Survey discontinued after 2011	Missing/damaged
Montana	Manual Windshield		Annual	Day visibility, Night retroreflectivity, Missing/damaged
Nevada	Manual Walking	Yes	Annual	Day visibility, Missing/damaged
New Jersey	Automated	Yes	Annual	Day visibility, Night retroreflectivity, Missing/damaged
New York	Manual Walking	Yes	Annual	Day visibility, Missing/damaged, Alignment of multiple striping applications
North Carolina	Manual Walking	Yes	Annual	Day visibility, Missing/damaged
Ohio	Manual Windshield	Yes	More than once/yr	Missing/damaged
South Carolina	Manual Walking	Yes	Every other year	Day visibility, Night retroreflectivity, Missing/damaged
Tennessee	Manual Walking	Yes	More than once/yr	Day visibility, Missing/damaged
Texas	Manual Windshield	No	Annual	Day visibility, Missing/damaged
Utah	Automated	Yes	More than once/yr	Retro van data collection.
Washington	Manual Walking	Yes	Annual	Day visibility, Night retroreflectivity
West Virginia	Automated	Yes	Annual	Night retroreflectivity, Missing/damaged
Wisconsin	Manual Walking	Yes	Annual	Missing/damaged

TABLE B38

RESPONSES TO SURVEY QUESTION 41. YOU INDICATED THAT YOU RATE THIS ASSET (pavement marker). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
Alaska	Manual Walking	Yes	Annual	Number missing, damaged, or obstructed
California	Manual Windshield	Yes	Annual, Sampling done for daytime survey and comprehensive for nighttime survey.	Number missing, damaged, or obstructed
Colorado	Manual Walking	Yes	Annual	Same criteria as for markings
Florida	Manual Walking; Manual Windshield	Yes	More than once/yr	Number missing, damaged, or obstructed
Indiana	Manual Windshield; Laptop	Yes	Annual, 1/10 mi	Number missing, damaged, or obstructed
Kansas	Manual Walking	Yes	Annual	Number missing, damaged, or obstructed
Maryland	Manual Windshield	Yes	Annual	75% of every pavement marking must be intact, 90% threshold for RR Crossing or school pavement marking
Montana	Manual Windshield	No	Annual	Number missing, damaged, or obstructed
Nevada	Manual Walking	Yes	Annual	Number missing, damaged, or obstructed
New York	Manual Walking	Yes	Annual	Number missing, damaged, or obstructed
North Carolina	Manual Walking	Yes	Annual	Number missing, damaged, or obstructed
Ohio	Manual Windshield	Yes	More than once/yr	Number missing, damaged, or obstructed
South Carolina	Manual Walking	Yes	Every other year	Number missing, damaged, or obstructed
Tennessee	Manual Walking	Yes	More than once/yr	Number missing, damaged, or obstructed
Texas	Manual Windshield	No	Annual	Number missing, damaged, or obstructed
Utah	Manual Windshield	No	More than once/yr	See MMQA+ manual.
Washington	Manual Walking	Yes	Annual	Number missing, damaged, or obstructed
Wisconsin	Manual Walking	Yes	Annual	Number missing, damaged, or obstructed

TABLE B39

RESPONSES TO SURVEY QUESTION 42. YOU INDICATED THAT YOU RATE THIS ASSET (guardrail end treatment). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
Alaska	Manual Walking	Yes	Annual	End treatment damage, End treatment alignment, Post damage, Functionality
Arizona	Manual Walking	Yes	Annual	End treatment damage, Post damage, Functionality
California	Manual Windshield	Yes	Annual	End treatment damage, End treatment alignment, Post damage
Colorado	Manual Walking	Yes	Annual	End treatment damage, End treatment alignment, Post damage, Functionality
Florida	Manual Walking	Yes	More than once/yr	End treatment damage, End treatment alignment, Post damage, Functionality
Indiana	Manual Windshield; Laptop	Yes	Annual, 1/10 mi	End treatment damage, End treatment alignment, Post damage
Iowa	Manual Walking	No	Every other year	End treatment damage, Post damage, Functionality
Kentucky	Manual Walking	Yes	Annual	End treatment damage, Post damage, Functionality
Maryland	Manual Windshield	Yes	Annual	End treatment damage, End treatment alignment, Post damage
Missouri	Manual Walking	Yes	Survey discontinued after 2011	End treatment damage, End treatment alignment, Post damage
Montana	Manual Windshield	No	More than once/yr	End treatment damage, Functionality
Nevada	Manual Walking	Yes	Annual	End treatment damage, Functionality
Ohio	Manual Windshield	Yes	More than once/yr	End treatment damage, Post damage, Functionality
South Carolina	Manual Walking	Yes	Every other year	End treatment damage, End treatment alignment, Post damage
Tennessee	Manual Walking	Yes	More than once/yr	End treatment damage
Texas	Manual Windshield	No	Annual	End treatment damage, End treatment alignment, Post damage, Functionality
Wisconsin	Manual Walking	Yes	Annual	End treatment damage, Post damage
Wyoming	Manual Walking	Yes	Annual	End treatment damage, End treatment alignment, Post damage, Functionality

TABLE B40

RESPONSES TO SURVEY QUESTION 43. YOU INDICATED THAT YOU RATE THIS ASSET (overhead sign structure). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
Alaska	Manual Walking	Yes	Annual	Structural integrity
Arkansas	Manual Walking	No	Every other year	Structural integrity
California	Manual Walking	Yes	5 yr	Structural integrity
Iowa	Manual Walking; The NBIS bridge inspection crews inspect/review overhead sign structures.	No	Every other year	Structural integrity, Anchor bolts clear of debris
Maryland	Manual Walking			Structural integrity
Missouri	Manual Windshield	Yes	Inspection of sign trusses separate from MQA program	Structural integrity, Anchor bolts clear of debris
New Jersey	Manual Walking; Inspection	No	Less than annual	Structural integrity
North Carolina	Manual Walking	No	Every other year	Structural integrity, Anchor bolts clear of debris, Per bridge program standards
Tennessee	Automated	No	Every other year	N/A
Texas	Manual Windshield	No	Annual	Structural integrity

N/A = Not Applicable

TABLE B41

RESPONSES TO SURVEY QUESTION 44. YOU INDICATED THAT YOU RATE THIS ASSET (impact attenuator). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
Alaska	Manual Walking	Yes	Annual	Misaligned, Structurally damaged, Functionality
Arizona	Manual Walking	Yes	Annual	Structurally damaged, Functionality
California	Manual Walking	Yes	Annual	Misaligned, Structurally damaged, Functionality
Colorado	Manual Walking	Yes	Annual	Misaligned, Structurally damaged, Functionality
Florida	Manual Walking	Yes	More than once/yr	Misaligned, Structurally damaged, Functionality
Indiana	Manual Windshield; Laptop	Yes	Annual, 1/10 mi	Structurally damaged
Iowa	Manual Walking	No	Every other year	Misaligned, Structurally damaged, Functionality
Kansas	Manual Walking	Yes	Annual	Structurally damaged, Functionality
Kentucky	Manual Walking	Yes	Annual	Structurally damaged, Functionality
Maryland	Manual Windshield	Yes	Annual	Misaligned, Structurally damaged, Functionality
Missouri	Manual Walking	Yes	Survey discontinued after 2011	Misaligned, Structurally damaged, Functionality
Nevada	Manual Walking	Yes	Annual	Structurally damaged, Functionality
Ohio	Manual Windshield		More than once/yr	Structurally damaged, Functionality
South Carolina	Manual Walking	Yes	Every other year	Misaligned, Structurally damaged, Functionality
Tennessee	Manual Walking	Yes	More than once/yr	Structurally damaged, Functionality
Texas	Manual Windshield	No	Annual	Misaligned, Structurally damaged, Functionality

TABLE B42

RESPONSES TO SURVEY QUESTION 45. YOU INDICATED THAT YOU RATE THIS ASSET (protective barriers). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
Arizona	Manual Walking	Yes	Annual	Structurally damaged, Functionality
California	Manual Walking	Yes	Annual	Misaligned, Structurally damaged, Functionality
Colorado	Manual Walking	Yes	Annual	Misaligned, Structurally damaged, Functionality
Florida	Manual Walking	Yes	More than once/yr	Misaligned, Structurally damaged, Functionality
Indiana	Manual Windshield; Laptop	Yes	Annual, 1/10 mi	Structurally damaged
Kentucky	Manual Walking	Yes	Annual	Structurally damaged, Functionality
Maryland	Manual Windshield	Yes	Annual	Misaligned, Structurally damaged, Functionality
Missouri	Manual Walking	Yes	Survey discontinued after 2011	Misaligned, Structurally damaged, Functionality
Nevada	Manual Walking	Yes	Annual	Structurally damaged, Functionality
New York	Manual Walking	Yes	Annual	Misaligned, Structurally damaged
Ohio	Manual Windshield	Yes	More than once/yr	Structurally damaged, Functionality
South Carolina	Manual Walking	Yes	Every other year	Misaligned, Structurally damaged, Functionality
Tennessee	Manual Walking	Yes	More than once/yr	Structurally damaged, Functionality
Texas	Manual Windshield	No	Annual	Misaligned, Structurally damaged, Functionality
Utah	Manual Windshield	No	More than once/yr	Misaligned, Structurally damaged, Functionality
Washington	Manual Walking	Yes	Annual	Misaligned, Structurally damaged
Wisconsin	Manual Walking	Yes	Annual	Structurally damaged
Wyoming	Manual Walking	Yes	Annual	Misaligned, Structurally damaged, Functionality

TABLE B43

RESPONSES TO SURVEY QUESTION 46. YOU INDICATED THAT YOU RATE THIS ASSET (variable message board). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
Washington	Automated	No	Annual	Number of malfunctions

TABLE B44

RESPONSES TO SURVEY QUESTION 47. YOU INDICATED THAT YOU RATE THIS ASSET (highway lighting). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
California	Manual Windshield	No	More than once/yr, 30 days	Percent operational
Florida	Manual Walking; Manual Windshield	Yes	More than once/yr	Percent operational, Structural integrity, Anchor assembly clear of debris and all wiring enclosed
Maryland	Manual Windshield		More than once/yr	Percent operational
Missouri	Manual Windshield	Yes	Survey discontinued after 2011	Percent operational, Structural integrity, Anchor assembly clear of debris and all wiring enclosed
Montana	Manual Windshield	No	N/A	Percent operational
Nevada	N/A	Yes	More than once/yr	Percent operational
Washington	Automated	No	Annual	Percent operational

N/A = Not Applicable

TABLE B45

RESPONSES TO SURVEY QUESTION 48. INDICATE IF SPECIAL FACILITIES SYSTEM ASSETS INVENTORY (e.g., location, number) IS COMPLETE, PARTIALLY COMPLETE, OR IF THERE IS NO INVENTORY AVAILABLE.

State	Rest Areas	Tunnels	Weigh Stations	Traffic Monitoring Systems
Alaska	C	C	C	N
Arizona	C	C	N	N
Arkansas	C	C	C	C
California	C	C	C	PC
Florida	C	C	C	C
Indiana	C	N	C	C
Iowa	C	N	N	N
Kansas	C	C	C	PC
Kentucky	PC	N	N	N
Louisiana	C	C	C	C
Maryland	C	N	N	N
Missouri	PC	PC	PC	N/A
Montana	C	C	C	C
Nevada	C	C	N/A	N/A
New York	C	C	C	C
North Carolina	C	C	C	C
Ohio	C	N	C	C
South Carolina	C	C	C	C
Tennessee	C	C	C	N
Utah	C	N	C	C
Washington	C	C	N	N
West Virginia	C	C	C	C
Wisconsin	C	N/A	C	C
Wyoming	C	C	C	C
Total C	22	16	17	13
Total PC	2	1	1	2
Total N	0	6	5	7

C = Complete; PC = Partially Complete; N = No Inventory; N/A = Not Applicable

TABLE B46
RESPONSES TO SURVEY QUESTION 49. SELECT ALL SPECIAL FACILITIES SYSTEM ATTRIBUTES THAT ARE RATED.

State	Rest Areas	Tunnels	Weigh Stations	Traffic Monitoring Systems
Alaska	N/A	N/A	N/A	N/A
Arizona	X	N/A	N/A	N/A
Arkansas	X	X	X	N/A
California	X	X	X	N/A
Colorado	N/A	N/A	N/A	N/A
Florida	N/A	N/A	N/A	N/A
Indiana	N/A	N/A	N/A	N/A
Iowa	X	N/A	N/A	N/A
Kansas	N/A	N/A	N/A	N/A
Kentucky	N/A	N/A	N/A	N/A
Louisiana	N/A	X	N/A	N/A
Maryland	N/A	N/A	N/A	N/A
Missouri	N/A	N/A	N/A	N/A
Montana	X	N/A	N/A	N/A
Nevada	X	N/A	N/A	N/A
New Jersey	N/A	N/A	N/A	N/A
New York	X	N/A	N/A	N/A
North Carolina	X	N/A	N/A	N/A
Ohio	N/A	N/A	N/A	N/A
Pennsylvania	N/A	N/A	N/A	N/A
South Carolina	N/A	N/A	N/A	N/A
Tennessee	N/A	N/A	N/A	N/A
Texas	N/A	N/A	N/A	N/A
Utah	X	N/A	N/A	N/A
Washington	X	X	N/A	N/A
West Virginia	X	X	N/A	N/A
Wisconsin	N/A	N/A	N/A	N/A
Wyoming	N/A	N/A	N/A	N/A
Totals	11	5	2	0

N/A = Not Applicable

TABLE B47

RESPONSES TO SURVEY QUESTION 50. YOU INDICATED THAT YOU RATE THIS ASSET (rest areas). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
Arizona	Manual Walking	No	More than once/yr	Graffiti, Facilities working properly, Appearance, Landscaping, Odor, Cleanliness
Arkansas	Manual Walking	No	Every other year	Graffiti, Facilities working properly, Appearance, Mowing, Landscaping, Odor, Cleanliness
California	Manual Walking	No	Annual	Graffiti, Facilities working properly, Appearance, Cleanliness
Iowa	Manual Walking	No	Monitored nearly continuously during the course of business by rest area maintenance staff	Graffiti, Facilities working properly, Mowing, Landscaping, Odor, Cleanliness
Montana	Manual Walking	No	More than once/yr	Graffiti, Facilities working properly, Appearance, Mowing, Landscaping, Odor, Cleanliness
Nevada	Manual Walking	No	Annual	Graffiti, Facilities working properly, Appearance, Mowing, Landscaping, Cleanliness
New York	Manual Walking	Yes	Annual	Handicap accessibility, Structural conditions, Parking lot conditions, Vending machine conditions, Telephone conditions, Appearance, Mowing, Landscaping, Odor, Cleanliness
North Carolina	Manual Walking	No	N/A	Facilities working properly, Appearance, Mowing, Landscaping
Utah	Manual Walking	No	More than once/yr	Graffiti, Facilities working properly, Appearance, Mowing, Landscaping, Odor, Cleanliness
Washington	Manual Walking	Yes	Annual	Facilities working properly, Appearance, Mowing, Landscaping, Cleanliness
West Virginia	Manual Walking	No	Annual	Graffiti, Facilities working properly, Appearance, Mowing, Landscaping, Odor, Cleanliness

N/A = Not Applicable

TABLE B48

RESPONSES TO SURVEY QUESTION 51. YOU INDICATED THAT YOU RATE THIS ASSET (tunnels). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
Arkansas	Manual Walking	No	Annual	Lighting, Debris, Drainage
California	Manual Walking	No	Every other year	Lighting, Debris, Drainage, Structural condition, Mechanical and electrical
Louisiana	Manual Walking	No	Annual	Lighting, Debris, Drainage
Washington	Automated	No	Annual	Number of tunnel closures to flammable loads
West Virginia	Manual Windshield	No	Annual	Lighting, Debris, Drainage

TABLE B49

RESPONSES TO SURVEY QUESTION 52. YOU INDICATED THAT YOU RATE THIS ASSET (weigh stations). PLEASE COMPLETE THE ASSOCIATED TABLES.

State	Method of Collection	Sampling Used?	Frequency of Survey	Condition Assessment Attributes
Arkansas	Manual Walking	No	Every other year	Functionality, Appearance
California	Manual Walking; Testing systems	No	Every other year	Functionality, Perform functional tests

TABLE B50

RESPONSES TO SURVEY QUESTION 53. YOU INDICATED THAT YOU RATE THIS ASSET (traffic monitoring systems). PLEASE COMPLETE THE ASSOCIATED TABLES.

No responses to this question.

TABLE B51

RESPONSES TO SURVEY QUESTION 54

State	Which of the following best describes the rating method used to assess the performance of maintenance activities?
Alaska	A combination of the two approaches is used, depending on the type of asset.
Arizona	Other (respondent did not specify)
Arkansas	The number of performance deficiencies is recorded for each asset inspected.
California	Raters determine whether an asset passes or fails based on predefined criteria.
Colorado	A combination of the two approaches is used, depending on the type of asset.
Florida	Raters determine whether an asset meets or does not meet predefined criteria.
Indiana	A combination of the two approaches is used, depending on the type of asset.
Iowa	A combination of approaches is used. The staff performing the assessment follows the guidelines in a department document "Maintenance Performance Measurements - Surveyor Manual."
Kansas	Raters determine whether an asset passes or fails based on predefined criteria.
Kentucky	A combination of the two approaches is used, depending on the type of asset.
Louisiana	A combination of the two approaches is used, depending on the type of asset.
Maryland	Raters determine whether an asset passes or fails based on predefined criteria.
Missouri	Raters determine whether an asset passes or fails based on predefined criteria.
Montana	A combination of the two approaches is used, depending on the type of asset.
Nevada	Raters determine whether an asset passes or fails based on predefined criteria.
New Jersey	A combination of the two approaches is used, depending on the type of asset.
New York	Directly rated 0–4 based on criteria. 0 = failed, 4 = new
North Carolina	A combination of the two approaches is used, depending on the type of asset.
Ohio	A combination of the two approaches is used, depending on the type of asset.
South Carolina	The number of performance deficiencies is recorded for each asset inspected.
Tennessee	Raters determine whether an asset passes or fails based on predefined criteria.
Texas	A combination of the two approaches is used, depending on the type of asset.
Utah	A combination of the two approaches is used, depending on the type of asset.
Washington	The number of performance deficiencies is recorded for each asset inspected.
West Virginia	A combination of the two approaches is used, depending on the type of asset.
Wisconsin	A combination of the two approaches is used, depending on the type of asset.
Wyoming	A combination of the two approaches is used, depending on the type of asset.

TABLE B52
RESPONSES TO SURVEY QUESTION 55

State	Who conducts your maintenance condition assessment surveys?
Alaska	District/region personnel, Consultant or vendor
Arizona	District/region personnel
Arkansas	Central office maintenance personnel
California	District/region personnel
Colorado	District/region personnel
Florida	District/region personnel, Consultant or vendor
Indiana	Central office maintenance personnel
Iowa	District/region personnel
Kansas	District/region personnel
Kentucky	District/region personnel
Louisiana	District/region personnel, Consultant or vendor
Maryland	Central office maintenance personnel, District/region personnel
Missouri	District/region personnel
Montana	District/region personnel
Nevada	Consultant or vendor
New Jersey	Central office maintenance personnel, District/region personnel, Consultant or vendor
New York	District/region personnel
North Carolina	Central office maintenance personnel, Consultant or vendor
Ohio	Consultant or vendor
Pennsylvania	Central office maintenance personnel, District/region personnel, Consultant or vendor
South Carolina	Central office maintenance personnel
Tennessee	District/region personnel
Texas	Central office maintenance personnel
Utah	District/region personnel
Washington	District/region personnel
West Virginia	District/region personnel
Wisconsin	District/region personnel, County personnel
Wyoming	District/region personnel, Central office does verification surveys to check consistency

TABLE B53
RESPONSES TO SURVEY QUESTION 56

State	Approximately how many roadway segments are evaluated as part of a complete survey cycle?
Alaska	1,000
Arizona	3,000
California	20%
Colorado	645 randomly generated 1/3-mi segments, ROW fence to ROW fence.
Florida	8,568 per year
Indiana	3,720 random 1/10-mi segments
Iowa	900
Kansas	3,360
Kentucky	4,200
Maryland	3,200
Missouri	1,500
Montana	All
Nevada	1,000
New Jersey	100%
New York	600
North Carolina	22,000
Ohio	15% of the centerline miles in each county twice/yr for a total of 30% of system
South Carolina	1,440—0.2-mi segments
Tennessee	7,000
Texas	10% overall
Utah	Depends on the measured asset. MMQA+ manual provided.
Washington	2,000
West Virginia	100
Wisconsin	1,200
Wyoming	850

TABLE B54

RESPONSES TO SURVEY QUESTION 57. PLEASE MARK EACH TYPE OF EQUIPMENT USED DURING THE CONDUCT OF THE CONDITION ASSESSMENT SURVEYS.

State	Pen/pencil/ paper	Handheld computers	GPS equipment	Vans with cameras and lasers	LiDAR	Voice recording devices	Other
Alaska	X	X	X	N/A	N/A	N/A	N/A
Arizona	X	N/A	N/A	N/A	N/A	N/A	N/A
Arkansas	X	X	N/A	X	N/A	N/A	N/A
California	X	N/A	X	X	N/A	N/A	N/A
Colorado	X	N/A	N/A	N/A	N/A	N/A	N/A
Florida	X	N/A	N/A	N/A	N/A	N/A	N/A
Indiana	N/A	N/A	X	N/A	N/A	N/A	X
Iowa	X	N/A	N/A	X	N/A	N/A	X
Kansas	X	N/A	N/A	N/A	N/A	N/A	N/A
Kentucky	N/A	X	X	N/A	N/A	N/A	N/A
Louisiana	X	N/A	N/A	X	N/A	N/A	N/A
Maryland	N/A	X	N/A	N/A	N/A	N/A	N/A
Missouri	X	N/A	N/A	N/A	N/A	X	N/A
Montana	X	X	X	X	N/A	N/A	N/A
Nevada	X	X	N/A	N/A	N/A	N/A	N/A
New Jersey	X	N/A	X	X	X	N/A	N/A
New York	X	N/A	N/A	N/A	N/A	N/A	N/A
North Carolina	X	X	X	X	N/A	N/A	N/A
Ohio	N/A	X	X	N/A	N/A	N/A	X
Pennsylvania	X	X	X	X	N/A	N/A	N/A
South Carolina	X	N/A	N/A	N/A	N/A	N/A	N/A
Tennessee	X	N/A	N/A	X	X	N/A	N/A
Texas	N/A	X	N/A	N/A	N/A	N/A	N/A
Utah	X	X	X	X	N/A	N/A	N/A
Washington	N/A	X	N/A	N/A	N/A	N/A	N/A
West Virginia	X	N/A	X	N/A	N/A	N/A	N/A
Wisconsin	X	N/A	N/A	N/A	N/A	N/A	N/A
Wyoming	X	N/A	N/A	N/A	N/A	N/A	N/A
Totals	22	12	11	10	2	1	3

N/A = Not Applicable

TABLE B55

RESPONSES TO SURVEY QUESTION 58. DOES YOUR AGENCY USE SAMPLING TO COLLECT CONDITION INFORMATION ON ANY ASSETS?

State	Yes/No
Alaska	Yes
Arizona	Yes
Arkansas	No
California	Yes
Colorado	Yes
Florida	Yes
Indiana	Yes
Iowa	Yes
Kansas	Yes
Kentucky	Yes
Louisiana	Yes
Maryland	Yes
Missouri	No
Montana	Yes
Nevada	Yes
New Jersey	No
New York	Yes
North Carolina	Yes
Ohio	Yes
Pennsylvania	No
South Carolina	Yes
Tennessee	Yes
Texas	No
Utah	Yes
Washington	Yes
West Virginia	Yes
Wisconsin	Yes
Wyoming	Yes
Yes	23
No	5

TABLE B56

SAMPLING DETAILS. PLEASE SELECT THE LENGTH OF YOUR SAMPLE SIZE.

State	Length
Alaska	0.10 mi
Arizona	0.10 mi
California	1 mi
Colorado	645 0.33-mile segments
Florida	0.10 mi
Indiana	0.10 mi
Iowa	0.10 mi
Kansas	0.10 mi
Kentucky	0.10 mi
Louisiana	0.10 mi
Maryland	0.50 mi
Montana	0.50 mi
Nevada	0.10 mi
New York	1 mi
North Carolina	0.10 mi
Ohio	15% of centerline miles in each county twice/yr for a total of 30%
South Carolina	0.20 mi
Tennessee	0.10 mi
Utah	0.10 mi
Washington	0.10 mi
West Virginia	0.10 mi
Wisconsin	0.10 mi
Wyoming	0.20 mi

TABLE B57

SAMPLING DETAILS. AT WHICH OF THE FOLLOWING LEVELS DO YOU CONSIDER YOUR MQA RESULTS TO BE A STATISTICALLY VALID REPRESENTATION OF SYSTEM CONDITIONS?

State	Level
Alaska	At a statewide level
Arizona	At a statewide level, At the region level, District
California	At a statewide level, District
Colorado	At a statewide level, At the region level
Florida	At a statewide level, At the region level
Indiana	At a statewide level, At the region level, At the roadway corridor level
Kansas	At a statewide level, At the region level
Kentucky	At a statewide level, At the region level
Maryland	At a statewide level, At the region level, At the county level, At the roadway corridor level
Montana	At a statewide level, At the region level, At the roadway corridor level
Nevada	At a statewide level, At the region level
North Carolina	At the county level
Ohio	At the county level
South Carolina	At a statewide level, At the county level
Tennessee	At a statewide level, By route system classification (interstate and state route)
Utah	At a statewide level, At the region level, At the roadway corridor level
Washington	At a statewide level, At the region level
West Virginia	At the county level, At the county level
Wisconsin	At a statewide level, At the region level
Wyoming	At a statewide level, At the region level, At the roadway corridor level

TABLE B58

SAMPLING DETAILS. DOES THE SAMPLE INCLUDE BOTH DIRECTIONS FOR DIVIDED HIGHWAYS?

State	Yes/No
Alaska	Yes
Arizona	Yes
California	Yes
Colorado	Yes
Florida	Yes
Indiana	Yes
Iowa	Yes
Kansas	Yes
Kentucky	No
Maryland	No
Montana	Yes
Nevada	No
New York	Yes
North Carolina	Yes
Ohio	Yes
South Carolina	Yes
Tennessee	Yes
Utah	Yes
Washington	Yes
West Virginia	Yes
Wisconsin	Yes
Wyoming	Yes
Yes	19
No	3

TABLE B59
SAMPLING DETAILS. HOW IS THE NUMBER OF SAMPLES DETERMINED?

State	Determination
Alaska	Specified number or percent of inventory
Arizona	Statistical formula based on an inventory, current condition, confidence interval, etc.
California	Specified number or percent of inventory
Colorado	Specified number or percent of inventory
Florida	Thirty sample points per facility type for each cost center/region
Indiana	Statistical formula based on an inventory, current condition, confidence interval, etc.
Iowa	Specified number or percent of inventory
Kansas	Specified number or percent of inventory
Kentucky	Statistical formula based on an inventory, current condition, confidence interval, etc.
Louisiana	Statistical formula based on an inventory, current condition, confidence interval, etc.
Maryland	Specified number or percent of inventory
Montana	Based on miles of road
Nevada	Statistical formula based on an inventory, current condition, confidence interval, etc.
New York	Statistical formula based on an inventory, current condition, confidence interval, etc.
North Carolina	Statistical formula based on an inventory, current condition, confidence interval, etc.
Ohio	Specified number or percent of inventory
South Carolina	Statistical formula based on an inventory, current condition, confidence interval, etc.
Tennessee	Statistical formula based on an inventory, current condition, confidence interval, etc.
Utah	Specified number or percent of inventory
Washington	Statistical formula based on an inventory, current condition, confidence interval, etc.
West Virginia	Specified number or percent of inventory
Wisconsin	Specified number or percent of inventory
Wyoming	Specified number or percent of inventory

TABLE B60
SAMPLING DETAILS. IF SAMPLING IS BASED ON A CONFIDENCE INTERVAL, WHAT INTERVAL IS USED?

State	Interval
Arizona	95% ± 5
California	90% ± 5
Florida	95% ± 5
Indiana	95% ± 5
Iowa	90% ± 5
Kansas	95% ± 5
Kentucky	90% ± 5
Louisiana	95% ± 5
Nevada	95% ± 5
New York	95% ± 5
North Carolina	90% ± 5 for primary and I routes, 80% ± 5 for secondary
South Carolina	90% ± 5
Tennessee	95% ± 5
Utah	95% ± 5
Washington	95% ± 5
West Virginia	95% ± 5
Wisconsin	95% ± 5

TABLE B61

RESPONSES TO SURVEY QUESTION 59. HOW DO YOU ENSURE THE QUALITY OF THE DATA YOU RECEIVE FROM THE SURVEYS? SELECT ALL THAT APPLY.

State	Data Quality
Alaska	Our agency conducts training classes for the raters before each survey.
	Our agency has a rating manual to assist the raters.
	Our agency conducts independent checks of data from representative samples.
	Approximately 5% of the samples are checked.
	Raters do not inspect assets they are responsible for maintaining.
	A team of raters is used to reduce bias.
	Ratings are compared to previous surveys.
	Equipment checks and calibration are performed.
	Test sites are used to verify quality.
	We conduct checks of data reasonableness upon submittal.
Arizona	Our agency conducts training classes for the raters before each survey.
	Our agency has a rating manual to assist the raters.
	Our agency conducts independent checks of data from representative samples.
	Approximately 10% of the samples are checked.
	We conduct checks of data reasonableness upon submittal.
Arkansas	Our agency does not check the quality of the data from the surveys.
California	Our agency conducts training classes for the raters before each survey.
	Our agency has a rating manual to assist the raters.
	Our agency conducts independent checks of data from representative samples.
	Approximately 7% of the samples are checked.
	Ratings are compared to previous surveys.
	Equipment checks and calibration are performed.
	We conduct checks of data reasonableness upon submittal.
Colorado	Our agency does not check the quality of the data from the surveys.
	Our agency conducts training classes for the raters before each survey.
	Our agency has a rating manual to assist the raters.
	Raters do not inspect assets they are responsible for maintaining.
	A team of raters is used to reduce bias.
	We conduct checks of data reasonableness upon submittal.
Florida	Our agency has a rating manual to assist the raters
	A team of raters is used to reduce bias.
	Equipment checks and calibration are performed.
	Annual training for raters, a quality control check and quality assurance review for each rating team annually.
Indiana	Our agency conducts training classes for the raters before each survey.
	Our agency has a rating manual to assist the raters.
	A team of raters is used to reduce bias.
	Equipment checks and calibration are performed.
	Test sites are used to verify quality.

State	Data Quality
Iowa	Our agency conducts training classes for the raters before each survey.
	Our agency has a rating manual to assist the raters.
	Our agency conducts independent checks of data from representative samples.
	Approximately _____% of the samples are checked.
	A team of raters is used to reduce bias.
	Ratings are compared to previous surveys.
	Central office oversight or field work.
Kansas	Our agency conducts training classes for the raters before each survey.
	Our agency has a rating manual to assist the raters.
	Our agency conducts independent checks of data from representative samples.
	Approximately 5% of the samples are checked.
Kentucky	Our agency conducts training classes for the raters before each survey.
	Our agency has a rating manual to assist the raters.
	Our agency conducts independent checks of data from representative samples.
	Approximately 10% of the samples are checked.
	A team of raters is used to reduce bias.
	We conduct checks of data reasonableness upon submittal.
Louisiana	Our agency conducts training classes for the raters before each survey.
	Our agency has a rating manual to assist the raters.
	Test sites are used to verify quality.
	We conduct checks of data reasonableness upon submittal.
	Some of the data are from ARAN van.
Maryland	Our agency conducts training classes for the raters before each survey.
	Our agency has a rating manual to assist the raters.
	Raters do not inspect assets they are responsible for maintaining.
	A team of raters is used to reduce bias.
	Ratings are compared to previous surveys.
	Equipment checks and calibration are performed.
	Test sites are used to verify quality.
	We conduct checks of data reasonableness upon submittal.
Missouri	Our agency conducts training classes for the raters before each survey.
	Our agency has a rating manual to assist the raters.
	A team of raters is used to reduce bias.
	Ratings are compared to previous surveys.
	We conduct checks of data reasonableness upon submittal.
Montana	Our agency conducts training classes for the raters before each survey.
	Our agency has a rating manual to assist the raters.
Nevada	Our agency conducts training classes for the raters before each survey.
	Our agency has a rating manual to assist the raters.
	Our agency conducts independent checks of data from representative samples. Approximately 10% of the samples are checked.
New Jersey	Our agency has a rating manual to assist the raters.
	Equipment checks and calibration are performed.
	Calibration of devices.
New York	Our agency has a rating manual to assist the raters.
	Approximately 10% of the samples are checked.
	Our agency conducts independent checks of data from representative samples.
	We conduct checks of data reasonableness upon submittal.

State	Data Quality
North Carolina	Our agency conducts training classes for the raters before each survey.
	Our agency has a rating manual to assist the raters.
	Raters do not inspect assets they are responsible for maintaining.
	A team of raters is used to reduce bias.
	Ratings are compared to previous surveys.
	Test sites are used to verify quality.
	We conduct checks of data reasonableness upon submittal.
	Electronic forms with validation scripts.
Ohio	Our agency has a rating manual to assist the raters.
	A team of raters is used to reduce bias.
Pennsylvania	Our agency has a rating manual to assist the raters.
	Our agency conducts independent checks of data from representative samples.
	Approximately _____% of the samples are checked
South Carolina	Our agency has a rating manual to assist the raters.
	Our agency conducts independent checks of data from representative samples.
	Raters do not inspect assets they are responsible for maintaining.
	Approximately 0.50% of the samples are checked.
	A team of raters is used to reduce bias.
	Equipment checks and calibration are performed.
Tennessee	Our agency has a rating manual to assist the raters.
	Our agency conducts independent checks of data from representative samples.
	Approximately 10% of the samples are checked.
	We conduct checks of data reasonableness upon submittal.
Texas	Our agency has a rating manual to assist the raters.
	Our agency conducts independent checks of data from representative samples.
	Approximately 10% of the samples are checked.
	Raters do not inspect assets they are responsible for maintaining.
	A team of raters is used to reduce bias.
	Ratings are compared to previous surveys.
	We conduct checks of data reasonableness upon submittal.
Utah	Our agency conducts training classes for the raters before each survey.
	Our agency has a rating manual to assist the raters.
	Our agency conducts independent checks of data from representative samples.
	Approximately _____% of the samples are checked.
	A team of raters is used to reduce bias.
	Ratings are compared to previous surveys.
	Equipment checks and calibration are performed.
Washington	Our agency conducts training classes for the raters before each survey.
	Our agency has a rating manual to assist the raters.
	Our agency conducts independent checks of data from representative samples.
	Approximately 200 of the samples are checked.
	Raters do not inspect assets they are responsible for maintaining.
	A team of raters is used to reduce bias.
	We conduct checks of data reasonableness upon submittal.
West Virginia	Our agency has a rating manual to assist the raters.
	Raters do not inspect assets they are responsible for maintaining.
	Ratings are compared to previous surveys.

State	Data Quality
Wisconsin	Our agency conducts training classes for the raters before each survey.
	Our agency has a rating manual to assist the raters.
	Our agency conducts independent checks of data from representative samples.
	Approximately 5% of the samples are checked.
	A team of raters is used to reduce bias.
	We conduct checks of data reasonableness upon submittal.
Wyoming	Our agency has a rating manual to assist the raters.
	Our agency conducts independent checks of data from representative samples.
	Approximately 5% of the samples (50 samples) are checked.
	Raters do not inspect assets they are responsible for maintaining.
	A team of raters is used to reduce bias.
	Equipment checks and calibration are performed.
	We conduct checks of data reasonableness upon submittal.

TABLE B62
HOW OFTEN ARE RATERS CERTIFIED OR RECERTIFIED?

State	How often are raters certified or recertified?
Alaska	Annually
Arizona	Annually
California	Annually
Colorado	No certifications, training as needed
Florida	Annually
Indiana	Annually
Iowa	Annually
Kansas	Annually
Kentucky	Every 2 years
Louisiana	Every 2 years
Maryland	Evaluators are trained in the MQA program but do not receive a certification.
Missouri	New inspectors trained as needed
Montana	As needed
Nevada	Currently there is no certification program.
New Jersey	Not certified
New York	No certification
North Carolina	Annually
Ohio	Raters are provided a manual, no certification.
Pennsylvania	We QC contractor data.
South Carolina	No formal certification process
Tennessee	As required
Utah	Annually
Washington	Every 2 years
West Virginia	As needed
Wisconsin	Annually
Wyoming	Yearly meetings are held to discuss and review the process with team leaders.

TABLE B63
RESPONSES TO SURVEY QUESTION 60. APPROXIMATELY HOW MANY EQUIVALENT PERSON-MONTHS ARE SPENT COLLECTING THIS CONDITION INFORMATION IN YOUR AGENCY (assume 20 days in a month)?

State	Person-Months
Alaska	4 to 5 person-months
Arizona	More than 6 person-months
Arkansas	1 to 2 person-months
California	More than 6 person-months
Colorado	More than 6 person-months
Indiana	4 to 5 person-months
Iowa	More than 6 person-months
Kansas	More than 6 person-months
Kentucky	4 to 5 person-months
Maryland	2 to 3 person-months
Missouri	4 to 5 person-months
Montana	Less than 1 person-month
Nevada	5 to 6 person-months
New Jersey	More than 6 person-months
New York	More than 6 person-months
North Carolina	More than 6 person-months
Ohio	More than 6 person-months
Pennsylvania	1 to 2 person-months
South Carolina	More than 6 person-months
Tennessee	More than 6 person-months
Texas	More than 6 person-months
Utah	4 to 5 person-months
Washington	1 to 2 person-months
West Virginia	3 to 4 person-months
Wisconsin	More than 6 person-months
Wyoming	More than 6 person-months

TABLE B64

RESPONSES TO SURVEY QUESTION 61. ARE THE RESULTS OF YOUR CONDITION ASSESSMENT SURVEYS USED TO ESTABLISH LEVELS OF SERVICE?

State	Yes/No
Alaska	Yes
Arizona	Yes
Arkansas	No
California	Yes
Colorado	Yes
Florida	Yes
Indiana	Yes
Iowa	No
Kansas	Yes
Kentucky	Yes
Louisiana	Yes
Maryland	Yes
Missouri	Yes
Montana	No
Nevada	Yes
New Jersey	Yes
New York	Yes
North Carolina	Yes
Ohio	No
Pennsylvania	Yes
South Carolina	Yes
Tennessee	No
Texas	No
Utah	Yes
Washington	Yes
West Virginia	No
Wisconsin	Yes
Wyoming	Yes
Yes	21
No	7

TABLE B65

RESPONSES TO SURVEY QUESTION 62. IF YOU HAVE ESTABLISHED LEVELS OF SERVICE, PLEASE INDICATE THE SCALE THAT IS USED.

State	Scale
Alaska	A, B, C, D, F
Arizona	A, B, C, D, F
California	Pass/Need 1 or Need 2
Colorado	A, B, C, D, F
Florida	Percent meeting the desired maintenance conditions
Indiana	Percent passing or percent failing
Kansas	Score—begins as percent pass/fail but after some weighted averaging it cannot strictly be called a “percent”
Kentucky	A, B, C, D, F
Louisiana	A, B, C, D, F
Maryland	Percent passing or percent failing
Missouri	Percent passing or percent failing
Nevada	A, B, C, D, F
New Jersey	Good, Fair, Poor and %
New York	1, 2, 3, 4, 5
North Carolina	A, B, C, D, F
Pennsylvania	A combination of (a) and (b) or (a) and (c), depending on the type of asset
South Carolina	A, B, C, D, F
Utah	A, B, C, D, F
Washington	A, B, C, D, F
Wisconsin	A combination of (a) and (b) or (a) and (c), depending on the type of asset
Wyoming	Percent passing or percent failing

TABLE B66
RESPONSES TO SURVEY QUESTION 63. HAVE YOU ESTABLISHED PERFORMANCE TARGETS?

State	Yes/No
Alaska	Yes
Arizona	Yes
Arkansas	No
California	Yes
Colorado	Yes
Florida	Yes
Indiana	Yes
Iowa	Yes
Kansas	Yes
Kentucky	Yes
Louisiana	Yes
Maryland	Yes
Missouri	Yes
Montana	Yes
Nevada	Not yet, but they are under development
New Jersey	Yes
New York	No
North Carolina	Yes
Ohio	Yes
Pennsylvania	Not yet, but they are under development
South Carolina	Yes
Tennessee	Not yet, but they are under development
Texas	Yes
Utah	Yes
Washington	Yes
West Virginia	Yes
Wisconsin	Yes
Wyoming	Yes
Yes	23
No	2
Not yet	3

TABLE B67
RESPONSES TO SURVEY QUESTION 64. HAVE YOU ESTABLISHED LINKS BETWEEN PERFORMANCE TARGETS AND THE RESOURCES NEEDED TO PROVIDE THAT LEVEL OF SERVICE? FOR INSTANCE, DO YOU KNOW WHAT RESOURCES WOULD BE REQUIRED TO MOVE FROM AN LOS B TO AN LOS A?

State	Yes/No
Alaska	Yes
Arizona	Yes
Arkansas	No
California	Not yet, but the links are under development
Colorado	Yes
Florida	Yes
Indiana	Not yet, but the links are under development
Iowa	Yes
Kansas	Not yet, but the links are under development
Kentucky	No
Louisiana	Not yet, but the links are under development
Maryland	Not yet, but the links are under development
Missouri	No
Montana	Not yet, but the links are under development
Nevada	Not yet, but the links are under development
New Jersey	Yes
New York	No
North Carolina	Yes
Ohio	No
Pennsylvania	Not yet, but the links are under development
South Carolina	Yes
Tennessee	Not yet, but the links are under development
Texas	No
Utah	Yes
Washington	Yes
West Virginia	Not yet, but the links are under development
Wisconsin	Yes
Wyoming	Not yet, but the links are under development
Yes	11
No	6
Not yet	11

TABLE B68

RESPONSES TO SURVEY QUESTION 65. IS YOUR PERFORMANCE INFORMATION USED AS PART OF THE BUDGETING PROCESS TO DETERMINE FUNDING NEEDED TO MEET LOS TARGETS

State	Yes/No
Alaska	Yes
Arizona	Yes
Arkansas	Yes
California	Not yet, but this is under development
Colorado	Yes
Florida	Yes
Indiana	No
Iowa	No
Kansas	No
Kentucky	Not yet, but this is under development
Louisiana	Not yet, but this is under development
Maryland	Yes
Missouri	No
Montana	No
Nevada	Not yet, but this is under development
New Jersey	No
New York	No
North Carolina	Yes
Ohio	No
Pennsylvania	Not yet, but this is under development
South Carolina	Yes
Tennessee	Not yet, but this is under development
Texas	No
Utah	Yes
Washington	Yes
West Virginia	Not yet, but this is under development
Wisconsin	Yes
Wyoming	Not yet, but this is under development
Yes	11
No	9
Not yet	8

TABLE B69

EXTENSION OF SURVEY QUESTION 65. IF THE PERFORMANCE MEASURES ARE USED TO DEVELOP BUDGET NEEDS, DO YOU APPLY WEIGHTS TO ANY CATEGORY OF ASSETS TO PLACE MORE PRIORITY ON SOME ASSETS OVER OTHERS? IF SO, WHAT ASSETS HAVE THE HIGHEST WEIGHT?

State	Yes/No
Alaska	Yes, Safety
Arizona	No
Arkansas	No
Colorado	Yes, Snow and ice control, traffic services, roadway surface
Florida	Yes, Assets or routine maintenance activities related to safety and preservation
Maryland	Yes, Traffic and safety assets
North Carolina	Yes, Safety related
South Carolina	Not yet, but this is under development
Utah	Yes, Safety-related assets
Washington	Yes, Operations-type of activities (e.g., snow and ice control)
Wisconsin	Yes, 7 “critical safety” assets
Yes	8
No	3
Not yet	1

TABLE B70

RESPONSES TO SURVEY QUESTION 66. ARE THE RESULTS OF THE CONDITION ASSESSMENT USED TO PROGRAM AND SCHEDULE WORK ACTIVITIES?

State	Yes/No
Alaska	Yes
Arizona	Yes
Arkansas	Yes
California	Yes
Colorado	No
Florida	Yes
Indiana	Not yet, but this is under development
Iowa	Not yet, but this is under development
Kansas	Yes
Kentucky	No
Louisiana	Not yet, but this is under development
Maryland	Not yet, but this is under development
Missouri	No
Montana	Yes
Nevada	No
New Jersey	Yes
New York	No
North Carolina	Yes
Ohio	No
Pennsylvania	Not yet, but this is under development
South Carolina	Yes
Tennessee	Yes
Texas	Yes
Utah	Yes
Washington	No
West Virginia	Not yet, but this is under development
Wisconsin	No
Wyoming	Yes
Yes	14
No	8
Not yet	6

TABLE B71

RESPONSES TO SURVEY QUESTION 67. ARE THE RESULTS OF THE CONDITION ASSESSMENT USED TO DETERMINE COMPLIANCE ON MAINTENANCE CONTRACTS?

State	Yes/No
Alaska	No
Arizona	No
Arkansas	No
California	No
Colorado	No
Florida	Yes
Indiana	No
Iowa	No
Kansas	No
Kentucky	Yes
Louisiana	Not yet, but this is under development
Maryland	No
Missouri	No
Montana	No
Nevada	No
New Jersey	No
New York	No
North Carolina	No
Ohio	No
Pennsylvania	Not yet, but this is under development
South Carolina	Not yet, but this is under development
Tennessee	Yes
Texas	No
Utah	Yes
Washington	No
West Virginia	No
Wisconsin	No
Wyoming	No
Yes	4
No	21
Not yet	3

TABLE B72

RESPONSES TO SURVEY QUESTION 68. DO YOU HAVE A COMPUTERIZED MAINTENANCE MANAGEMENT SYSTEM (MMS) IN PLACE?

State	Yes/No
Alaska	Yes
Arizona	Yes
Arkansas	Yes
California	Yes
Colorado	No
Florida	Yes
Indiana	No
Iowa	Yes
Kansas	Yes
Kentucky	Yes
Louisiana	Yes
Maryland	No
Missouri	No
Montana	Yes
Nevada	Yes
New Jersey	Yes
New York	Yes
North Carolina	Yes
Ohio	Yes
Pennsylvania	Not yet, but this is under development
South Carolina	Yes
Tennessee	Yes
Texas	Yes
Utah	Yes
Washington	No
West Virginia	Not yet, but this is under development
Wisconsin	No
Wyoming	Yes
Yes	20
No	6
Not yet	2

TABLE B73

MMS DETAILS. DOES YOUR MMS USE THE RESULTS OF THE CONDITION ASSESSMENT TO ESTIMATE BUDGET NEEDS AND/OR PROVIDE THE INFORMATION NEEDED TO EVALUATE DIFFERENT STRATEGIES?

State	Yes/No
Alaska	Yes
Arizona	No
Arkansas	Yes
California	No
Florida	Yes
Iowa	No
Kansas	Yes
Kentucky	No
Louisiana	Not yet, but this is under development
Montana	Not yet, but this is under development
Nevada	No
New Jersey	No
New York	No
North Carolina	Yes
Ohio	No
South Carolina	No
Tennessee	No
Texas	No
Utah	Yes
Wyoming	Not yet, but this is under development
Yes	6
No	11
Not yet	3

TABLE B74

MMS DETAILS. DOES YOUR MMS USE THE RESULTS OF THE CONDITION ASSESSMENT TO SCHEDULE WORK ACTIVITIES?

State	Yes/No
Alaska	Yes
Arizona	No
Arkansas	Yes
California	No
Florida	Yes
Iowa	No
Kansas	No
Kentucky	No
Louisiana	Not yet, but this is under development
Montana	Not yet, but this is under development
Nevada	No
New Jersey	Yes
New York	No
North Carolina	Yes
Ohio	No
South Carolina	No
Tennessee	No
Texas	Yes
Utah	No
Wyoming	No
Yes	6
No	12
Not yet	2

TABLE B75

MMS DETAILS. IS THE MMS INTEGRATED WITH YOUR PAVEMENT AND/OR BRIDGE MANAGEMENT SYSTEMS?

State	Yes/No/Partially
Alaska	Partially
Arizona	No
Arkansas	No
California	No
Florida	Yes
Iowa	No
Kansas	Partially
Kentucky	Yes
Louisiana	Partially
Montana	No
Nevada	Partially
New Jersey	No
New York	No
North Carolina	Yes
Ohio	No
South Carolina	Not yet, but this is under development
Tennessee	No
Texas	Yes
Utah	Partially
Wyoming	Yes
Yes	5
No	9
Partially	5
Not yet	1

TABLE B76
RESPONSES TO SURVEY QUESTION 69. WHO HAS ACCESS TO MQA RESULTS?

State	Access
Alaska	Maintenance personnel in the central office
	Maintenance personnel in field offices
	Other agency personnel
	Public (through a website, for example)
	Elected officials
Arizona	Maintenance personnel in the central office
	Maintenance personnel in field offices
	Other agency personnel
Arkansas	Maintenance personnel in the central office
California	Maintenance personnel in the central office
	Maintenance personnel in field offices
	Internal web access
Colorado	Maintenance personnel in the central office
	Maintenance personnel in field offices
	Other agency personnel
Florida	Maintenance personnel in the central office
	Maintenance personnel in field offices
	Other agency personnel
	Public (through a website, for example)
	Elected officials
Indiana	Maintenance personnel in the central office
	Maintenance personnel in field offices
Iowa	Maintenance personnel in the central office
	Maintenance personnel in field offices
	Other agency personnel
Kansas	Maintenance personnel in the central office
	Maintenance personnel in field offices
	Other agency personnel
Kentucky	Maintenance personnel in the central office
	Maintenance personnel in field offices
	Other agency personnel
	Public (through a website, for example)
	Elected officials
Louisiana	Maintenance personnel in the central office
	Maintenance personnel in field offices
	Other agency personnel
Maryland	Maintenance personnel in the central office
	Maintenance personnel in field offices
Missouri	Maintenance personnel in the central office
	Maintenance personnel in field offices
Montana	Maintenance personnel in the central office
	Maintenance personnel in field offices
	Elected officials
Nevada	Maintenance personnel in the central office
	Maintenance personnel in field offices
	Other agency personnel
New Jersey	Maintenance personnel in the central office
	Maintenance personnel in field offices
	Budget staff, Communications staff
New York	Maintenance personnel in the central office
	Maintenance personnel in field offices
	Other agency personnel
North Carolina	Maintenance personnel in the central office
	Maintenance personnel in field offices
	Other agency personnel
	Public (through a website, for example)
	Elected officials
Ohio	Maintenance personnel in the central office
	Maintenance personnel in field offices
	Other agency personnel
Pennsylvania	Maintenance personnel in the central office
	Maintenance personnel in field offices
South Carolina	Maintenance personnel in the central office
	Maintenance personnel in field offices
	Other agency personnel
Tennessee	Maintenance personnel in the central office
	Maintenance personnel in field offices
	Other agency personnel
	Elected officials
Texas	Maintenance personnel in the central office
	Maintenance personnel in field offices
	Other agency personnel
	Public (through a website, for example)
	Elected officials
Utah	Maintenance personnel in the central office
	Maintenance personnel in field offices
	Other agency personnel
	Elected officials
Washington	Maintenance personnel in the central office
	Maintenance personnel in field offices
	Other agency personnel
	Public (through a website, for example)
	Elected officials

State	Access
West Virginia	Maintenance personnel in the central office
	Maintenance personnel in field offices
	Other agency personnel
Wisconsin	Maintenance personnel in the central office
	Maintenance personnel in field offices
	Other agency personnel
	Public (through a website, for example)
	Elected officials
	County personnel
Wyoming	Maintenance personnel in the central office
	Maintenance personnel in field offices

TABLE B77

RESPONSES TO SURVEY QUESTION 70. WHICH OF THE FOLLOWING ARE USED TO PRESENT MQA RESULTS?

State	Method
Alaska	Website, Dashboard, GIS
Arizona	Internal-only reports
Arkansas	Internal-only reports
California	Website, Internal-only reports
Colorado	Website, Dashboard, Internal-only reports
Florida	Website, Dashboard, Publicly available reports
Indiana	Internal-only reports
Iowa	Internal-only reports
Kansas	GIS, Internal-only reports, Results are presented to field personnel
Kentucky	Website, Publicly available reports
Maryland	Website, Dashboard, GIS, Internal-only reports
Missouri	Internal-only reports
Montana	Internal-only reports
Nevada	Website, GIS, Internal-only reports
New York	Website, Internal-only reports
North Carolina	Website, Dashboard, GIS, Publicly available reports
Ohio	Internal-only reports
Pennsylvania	Dashboard, Internal-only reports
South Carolina	Website, Publicly available reports, Internal-only reports
Tennessee	Internal-only reports
Texas	Website, Internal-only reports
Utah	Dashboard, Internal-only reports
Washington	Website, Publicly available reports
West Virginia	Internal-only reports
Wisconsin	Website, Dashboard, Publicly available reports
Wyoming	Internal-only reports, intranet site. Post some results publicly on balanced scorecard.

TABLE B78

RESPONSES TO SURVEY QUESTION 71. HAS YOUR MQA PROGRAM HELPED YOUR AGENCY TO ACHIEVE MORE CONSISTENT CONDITIONS ON A STATEWIDE BASIS?

State	Yes/No
Alaska	Yes
Arizona	No
Arkansas	Yes
California	Yes
Colorado	Yes
Florida	Yes
Indiana	Yes
Iowa	Yes
Kansas	Yes
Kentucky	No
Louisiana	Yes
Maryland	Yes
Missouri	No
Montana	Yes
Nevada	No
New Jersey	Yes
New York	Yes
North Carolina	Yes
Ohio	Yes
Pennsylvania	Yes
South Carolina	Yes
Tennessee	No
Texas	Yes
Utah	Yes
Washington	Yes
West Virginia	Yes
Wisconsin	Yes
Wyoming	Yes
Yes	23
No	5

TABLE B79

RESPONSES TO SURVEY QUESTION 72. HAS YOUR MQA PROGRAM HELPED YOUR AGENCY TO IDENTIFY MAINTENANCE PRIORITIES ON A STATEWIDE BASIS?

State	Yes/No
Alaska	Yes
Arizona	Yes
Arkansas	Yes
California	Yes
Colorado	Yes
Florida	Yes
Indiana	Yes
Iowa	Yes
Kansas	Yes
Kentucky	Yes
Maryland	Yes
Missouri	No
Montana	Yes
Nevada	No
New Jersey	Yes
New York	Yes
North Carolina	Yes
Ohio	Yes
Pennsylvania	Yes
South Carolina	Yes
Tennessee	Yes
Texas	Yes
Utah	Yes
Washington	Yes
West Virginia	Yes
Wisconsin	Yes
Wyoming	Yes
Yes	25
No	2

TABLE B80
RESPONSES TO SURVEY QUESTION 73. WHICH RESPONSE BEST DESCRIBES YOUR AGENCY'S LEVEL OF SUCCESS WITH ITS MQA PROGRAM?

State	Level of success
Alaska	We have had some success, but there is room for improvement in some areas.
Arizona	We have had some success, but there is room for improvement in some areas.
Arkansas	We have had some success, but there is room for improvement in some areas.
California	We have had some success, but there is room for improvement in some areas.
Colorado	We have had a high degree of success with our MQA program.
Florida	We have had a high degree of success with our MQA program.
Indiana	We have had some success, but there is room for improvement in some areas.
Iowa	We have had some success, but there is room for improvement in some areas.
Kansas	We have had a high degree of success with our MQA program.
Kentucky	We have had some success, but there is room for improvement in some areas.
Louisiana	We have had some success, but it is early in the development process.
Maryland	We have had a high degree of success with our MQA program.
Missouri	We have had some success, but there is room for improvement in some areas.
Montana	We have had some success, but there is room for improvement in some areas.
Nevada	We have had some success, but there is room for improvement in some areas.
New Jersey	We have had a high degree of success with our MQA program.
New York	We have had a high degree of success with our MQA program.
North Carolina	We have had some success, but there is room for improvement in some areas.
Ohio	We have had some success, but there is room for improvement in some areas.
Pennsylvania	We have had some success, but there is room for improvement in some areas.
South Carolina	We have had a high degree of success with our MQA program.
Tennessee	We have had some success, but there is room for improvement in some areas.
Texas	We have had some success, but there is room for improvement in some areas.
Utah	We have had some success, but there is room for improvement in some areas.
Washington	We have had some success, but there is room for improvement in some areas.
West Virginia	We have had some success, but there is room for improvement in some areas.
Wisconsin	We have had a high degree of success with our MQA program.
Wyoming	We have had some success, but there is room for improvement in some areas.

TABLE B81

RESPONSES TO SURVEY QUESTION 74. WHICH OF THE FOLLOWING FACTORS MOST CONTRIBUTED TO THE SUCCESS OF YOUR PROGRAM? CHOOSE ALL THAT APPLY.

State	Contributing factors
Alaska	Upper-management support, Degree of confidence in data, Training, Having a project champion
Arizona	Training
Arkansas	Upper-management support, Staffing levels
California	Simplicity of the MQA program, Degree of confidence in data, Ease of use, Training, Involvement of field personnel in developing the program
Colorado	Upper-management support, Buy-in from field personnel, Simplicity of the MQA program, Ease of use, Training, Having a project champion
Florida	Upper-management support, Buy-in from field personnel, Simplicity of the MQA program, Degree of confidence in data, Ease of use, Training, Staffing levels, Involvement of field personnel in developing the program
Indiana	Upper-management support, Buy-in from field personnel, Simplicity of the MQA program, Degree of confidence in data, Ease of use, Training, Having a project champion, Involvement of field personnel in developing the program
Iowa	Upper-management support, Training
Kansas	Upper-management support, Buy-in from field personnel, Simplicity of the MQA program, Training, Involvement of field personnel in developing the program
Kentucky	Upper-management support, Simplicity of the MQA program, Degree of confidence in data
Louisiana	Upper-management support, Buy-in from field personnel, Simplicity of the MQA program, Degree of confidence in data, Ease of use, Training
Maryland	Upper-management support, Buy-in from field personnel, Simplicity of the MQA program, Degree of confidence in data, Training, Staffing levels, Having a project champion, Involvement of field personnel in developing the program
Montana	Upper-management support, Buy-in from field personnel, Simplicity of the MQA program, Ease of use, Training
Nevada	Simplicity of the MQA program, Degree of confidence in data, Training, Staffing levels
New Jersey	Upper-management support, Buy-in from field personnel, Degree of confidence in data, Training
New York	Upper-management support, Simplicity of the MQA program, Degree of confidence in data
North Carolina	Buy-in from field personnel, Training, Involvement of field personnel in developing the program
Ohio	Simplicity of the MQA program, Ease of use, Involvement of field personnel in developing the program
Pennsylvania	Upper-management support, Buy-in from field personnel, Simplicity of the MQA program, Degree of confidence in data, Ease of use, Training, Involvement of field personnel in developing the program
South Carolina	Upper-management support, Buy-in from field personnel, Simplicity of the MQA program, Degree of confidence in data, Ease of use, Training, Staffing levels, Having a project champion
Tennessee	Upper-management support, Simplicity of the MQA program
Texas	Upper-management support, Simplicity of the MQA program, Degree of confidence in data, Ease of use
Utah	Upper-management support, Buy-in from field personnel, Degree of confidence in data, Training
Washington	Upper-management support, Buy-in from field personnel, Training, Having a project champion, Involvement of field personnel in developing the program
West Virginia	Upper-management support, Simplicity of the MQA program, Ease of use
Wisconsin	Upper-management support, Buy-in from field personnel, Simplicity of the MQA program, Degree of confidence in data, Ease of use, Training, Involvement of field personnel in developing the program, Involvement of county personnel in developing the program
Wyoming	Upper-management support, Buy-in from field personnel, Simplicity of the MQA program, Degree of confidence in data, Having a project champion, Involvement of field personnel in developing the program

TABLE B82
RESPONSES TO SURVEY QUESTION 75. WHAT NEW INITIATIVES AND/OR TECHNOLOGIES ARE YOU CONSIDERING FOR YOUR MQA PROGRAM IN THE FUTURE?

State	New initiatives and/or technologies
Alaska	New computer software, Handheld data collection devices, Automated surveys, GPS
Arkansas	New computer software
California	New computer software, Handheld data collection devices, Automated surveys
Colorado	New computer software, Automated surveys
Florida	Handheld data collection devices, GPS
Indiana	New computer software, Handheld data collection devices
Iowa	Handheld data collection devices, Automated surveys, GPS
Kansas	New computer software, Handheld data collection devices
Louisiana	Handheld data collection devices
Montana	New computer software, Handheld data collection devices, GPS
Nevada	New computer software
New Jersey	New computer software, Handheld data collection devices, GPS, LiDAR
New York	New computer software, Handheld data collection devices, GPS
North Carolina	Automated surveys
Ohio	Reevaluating entire program
Pennsylvania	New computer software, Handheld data collection devices, Automated surveys
South Carolina	New computer software, Handheld data collection devices, Interstate inspections
Tennessee	New computer software, Handheld data collection devices, Moving from pass/fail to LOS
Utah	Handheld data collection devices, Automated surveys, GPS, LiDAR
Washington	Just upgraded to handheld data collection devices
West Virginia	New computer software, Handheld data collection devices, GPS
Wisconsin	LiDAR
Wyoming	Handheld data collection devices, Incorporating public survey results

Abbreviations used without definitions in TRB publications:

A4A	Airlines for America
AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI–NA	Airports Council International–North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
HMCRP	Hazardous Materials Cooperative Research Program
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
MAP-21	Moving Ahead for Progress in the 21st Century Act (2012)
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
PHMSA	Pipeline and Hazardous Materials Safety Administration
RITA	Research and Innovative Technology Administration
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation

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