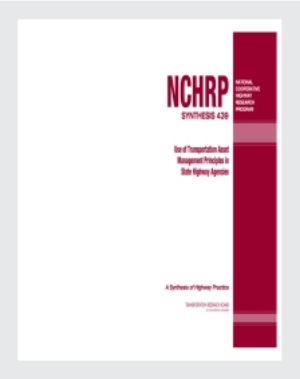

Use of Transportation Asset Management Principles in State Highway Agencies

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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

NCHRP SYNTHESIS 439

Use of Transportation Asset Management Principles in State Highway Agencies

A Synthesis of Highway Practice

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TRANSPORTATION RESEARCH BOARD

WASHINGTON, D.C.
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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 Jon M. Williams
Program Director
Transportation
Research Board

Transportation asset management is a strategic approach to managing transportation infrastructure. It focuses on business processes for resource allocation and utilization with the objective of better decision making based on quality information and well-defined objectives. This study reports the current state of practice for asset management among state departments of transportation (DOTs). It is advised by the recent *Volume 2 of the Asset Management Guide—A Focus on Implementation*, which provides a step-by-step process that enables agencies to align their investment decisions to their strategic goals.

Information for this study was acquired through literature review, a workshop, interviews, and surveys of state DOTs.

Neal Hawkins and Omar Smadi, Center for Transportation Research and Education, Ames, Iowa, 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 within 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

1 SUMMARY

5 CHAPTER ONE INTRODUCTION
- Project Background, 5
- Synthesis Objectives, 5
- Synthesis Scope, 5
- Key Definitions, 5
- Report Organization, 6

7 CHAPTER TWO LITERATURE REVIEW
- What Is Asset Management, 7
- Asset Management History, 7
- Asset Management Implementation, 8
- Asset Management and Risk, 9
- Risk Based Decision Making, 10
- Performance Measures and Asset Management, 10
- Asset Management Resources, 11

13 CHAPTER THREE SURVEY RESULTS
- Survey Methodology, 13
- General Asset Management Practices, 13
- Asset Management and Data, 15
- Asset Management Activities, 17
- Asset Management Process and Support Activities, 18
- Self-Assessment Survey Results, 20

24 CHAPTER FOUR SURVEY RESULTS ANALYSIS
- Impact of Having a Mandate on Asset Management Practices, 24
- Impact of Having an Asset Management Group on Asset Management Practices, 25
- Transportation Asset Management Program Analysis, 26
- Outreach Activities Analysis, 31

33 CHAPTER FIVE CONCLUSIONS AND RECOMMENDATIONS
- Overall Findings, 33
- Further Research, 34

35 REFERENCES

36 APPENDIX A SURVEY QUESTIONS

43 APPENDIX B SURVEY PARTICIPANTS

45 APPENDIX C AGENCY SURVEY RESPONSES

72 APPENDIX D SELF-ASSESSMENT SURVEY RESULTS

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.

USE OF TRANSPORTATION ASSET MANAGEMENT PRINCIPLES IN STATE HIGHWAY AGENCIES

SUMMARY

Roadway infrastructure within the United States includes features such as roads, bridges, signs, pavement markings, traffic signals, support commerce and mobility, and is, in essence, a shared financial public resource worthy of being managed at the highest level of efficiency.

State departments of transportation (DOTs), local transportation authorities, and federal agencies responsible for the fiscal management of the transportation system have shown a growing interest in advancing the state of practice in managing these critical assets. In addition, the recent congressional passage of Moving Ahead for Progress in the 21st Century Act (MAP-21 Act) has established an outcome-driven, performance-tracking approach that will hold states and metropolitan planning organizations accountable for improving the conditions and performance of their transportation assets. It will therefore increase agency attentiveness to these vital issues.

Transportation Asset Management (AM) is a strategic and systematic process of operating, maintaining, upgrading, and expanding physical assets effectively throughout their life cycle. It focuses on business and engineering practices for resource allocation and utilization, with the objective of better decision making based on quality information and well-defined objectives.

Advancing AM capabilities and integrating these capabilities across an organization's business units requires self-assessment, alignment, goal setting, and support. This synthesis of transportation asset management practice among state highway agencies will be a timely resource for agencies to identify their current state of practice and determine where they will direct their AM efforts.

This synthesis is based on two separate surveys, with additional input from practitioners. The initial survey requested that participants conduct a self-assessment to characterize their agency's AM practices. The survey utilized the self-assessment exercise from Section 3.2 of the 2002 *Transportation Asset Management Guide* [NCHRP 20-24(11)], which was designed to probe basic functions and capabilities that contribute to good AM regardless of an agency's particular characteristics and situation. The self-assessment results reflect current and future (5-year) business practices and the agencies' institutional, organizational, financial, and IT environments. This survey yielded 18 DOT participant responses (see Appendix D).

Based on the results of the initial survey, and input from the Topic Panel, a second survey was designed to capture the state of practice and forward looking expectations (for the next 3 to 5 years) among state DOTs. Forty-three agencies participated in this second survey.

An in-depth analysis of the survey responses regarding AM implementation processes and practices was conducted to investigate the following:

- The impact (importance) of having a mandate (internal or external) on implementing AM practices (13 had a mandate versus 30 without a mandate)
- The importance of having an AM group (26 had a group versus 17 that did not)
- Analysis of transportation asset management plan (TAMP) examples provided by agencies (five agencies provided a copy of their TAMP)
- Assessment of training and outreach activities on advancing AM practice.

A DOT summary of practice was developed and categorized according to the basic components of an AM system, which include the following:

Organization—Sixty percent of the agencies have an AM group. Even though major asset managers dominate the composition of these groups, top executives are represented in more than 30% of them. Fifteen percent of the responding agencies have created separate divisions within their organization to support AM activities. Having an AM group, executive involvement, and an AM structure within the organization is critical to support AM activity development, implementation, and practice.

Data—AM inventories have expanded beyond the traditional pavement and bridge assets (over 70% of the agencies report collecting signs, guardrail, culverts, and lighting information). In addition, over 50% of the agencies are conducting condition assessments, which lead to supporting investment analysis for project selection and resource allocation recommendations.

Decision making—Over 70% of the responding agencies noted that using AM principles has made their decisions more data driven, defensible, and performance-based. Sixty percent of the agencies are balancing AM preservation and capital improvements, which is a critical component for developing a sustainable infrastructure. Fifty percent of the agencies have developed a process to share AM information with elected and appointed officials, which is helpful for communicating investment needs and adding transparency to the decision-making process and trade-offs. Even though agencies are collecting data beyond pavements and bridges, they still need to expand the use of this information in the decision-making process. For example, more than 90% of the agencies use AM information to select bridge and pavement projects; however, for other asset decisions (e.g., maintenance, operations, and safety) this number drops below 40%.

Performance measures and risk—The primary performance measures that drive agency decision making include either physical condition (98%) or safety (90%). However, more than half of agencies reported both operations and capacity as decision-making drivers, 57% and 50% respectively. Only 27% of the respondents incorporate risk into their short-term decision making, which is normally associated with cost and schedules. Only 19% of agencies consider long-term risk in their decision making, which includes design, sustainability, and climate change.

TAMP—Of the five agencies that provided what they termed their Transportation Asset Management Plan (TAMP) documents, only two agencies (New Jersey and Georgia) provided TAMPs that show a good example of a TAMP, according to the 2002 *AASHTO Transportation Asset Management Guide*. The remaining three agencies provided more of an implementation plan or a strategic plan to initiate the practice of AM at a comprehensive level. Regardless, the content of these plans is encouraging; they focus on more than just pavement and bridges, and consider integration, communication, and effective decision making.

Other findings from the synthesis include the following:

AM Mandate—Only 30% of the agencies (13 of 43) reported having some sort of mandate to implement AM. The mandate helped the agencies develop an organization structure to support AM (70% of mandate agencies had an AM group versus 56% for no-mandate agencies). Even though the agencies' inventory practices were not much different in comparison, the agencies with an AM mandate conducted more condition assessment and checked the quality of the collected data more than the no-mandate agencies [85% conducted quality control/quality assurance (QC/QA) versus 69% for the no-mandate group].

This synthesis identified the following future research needs to support AM:

- Develop a common language for AM functions, practices, and processes. The results from the AM state-of-the-practice survey highlighted a few areas where there is no common understanding of the terminology. One good example is the TAMP. Out of the five TAMPS received through the synthesis, only two included all the required parts.
- Self-assessment tool. The 2002 *AASHTO Transportation Asset Management Guide* introduced the self-assessment so that agencies can plan their next moves in implementing AM. The self-assessment tool needs to be modified to reflect changes resulting from new research since 2002, the new *AASHTO Transportation Asset Management Guide: A Focus on Implementation* (2011), and current state DOT practices. The new self-assessment tool could be in electronic format, preferably web-based, to not only allow the agency to gather input from its staff but also provide analysis capabilities as part of the presentation of the results.
- Risk assessment. As highlighted in the AM state-of-the-practice survey, risk is an activity that needs more short- and long-term focus. A synthesis of risk assessment practices in an AM perspective would identify current activities and future research needs.
- A synthesis on the use of performance measures in AM. With the MAP-21 Act and the FHWA's recent creation of the Office of Transportation Performance Management, it is critical to start investigating this topic by developing case studies on how some agencies are utilizing this concept.
- Develop case studies on best practices addressing different categories of the maturity scale presented in this synthesis (i.e., organization structure, data, decision making, performance measures, risk).
- Develop an objective, comprehensive, and data-driven maturity scale to allow the agencies to assess their level of AM implementation and practices.
- Conduct a domestic scan of the agencies that scored high on the different maturity categories.

CHAPTER ONE

INTRODUCTION

PROJECT BACKGROUND

AASHTO recently published Volume 2 of the *AASHTO Transportation Asset Management Guide: A Focus on Implementation* (2011). The new guide builds on the principles of transportation asset management (TAM) identified in Volume 1 and provides a step-by-step process that will enable agencies to align their investment decisions with their strategic goals. It will also help agencies develop the plans, processes, and tools to support their performance management philosophy. The guide stresses the importance of a Transportation Asset Management Plan (TAMP) as well as the use of performance measurement, asset valuation, and risk assessment tools to support investment decisions.

Throughout the guide are examples of agencies that have adopted and used TAM principles to support their decision processes. However, many of the examples are from outside the United States, where these principles have been in use for many years. What is not well understood is the degree to which state highway agencies (SHAs) are using TAM principles and the advancements that have taken place since FHWA published the U.S. Domestic Scan Report in 2007. This synthesis will help document the state of practice and the extent to which agencies have shifted their organizational cultures and business processes to support performance-based decisions that consider long-term investment options based on quality data.

SYNTHESIS OBJECTIVES

This synthesis gathers and summarizes the following information:

- A self-assessment survey of asset management (AM) in 18 agencies, using Volume 1 of the *AASHTO Transportation Asset Management Guide: A Focus on Implementation* (2011).
- Input from the Asset Management Pool Fund States during the National Asset Management Workshop (San Diego, California, April 2012).
- A second state-of-the-practice survey of 43 agencies which addressed the following:
  - The degree to which performance data are driving decisions within the organization at different levels (e.g., strategic, network, project) and for different asset classes.
  - The strategies that have been used to promote AM principles among elected officials and upper executives.
  - Changes that have been made, or are planned, to apply TAM practices within and across all asset classes.
  - The availability and use of a TAMP (as defined in the AASHTO TAM guide).
  - How TAM is used for short- and long-term planning.
  - A subjective assessment of the completeness and quality of the asset inventory for assets other than pavements and bridges.
  - The use of risk assessment and management tools to evaluate investment options.
  - Next steps that agencies are planning to take within the next 5 years to advance their AM activities, including implementation plans.
  - Challenges that agencies have, or have not, overcome.

SYNTHESIS SCOPE

The surveys were conducted through the NCHRP in cooperation with AASHTO and FHWA. AASHTO provided an email distribution list to all the AM contacts, representing the 50 states and the District of Columbia. The first survey was taken directly from the 2011 *AASHTO Transportation Asset Management Guide*, Volume 1, to conduct a self-assessment for the state departments of transportation (DOTs). Information from the 18 state responses on the first survey helped the consultants compose the questions included in the second survey. The second survey questionnaire was developed by the synthesis principal investigator and pre-tested among state DOT members on the Topic Panel. The survey was revised and distributed as a web-based questionnaire. Follow-up calls and email messages were sent periodically to recipients to encourage participation. Of 51 survey requests, 44 responses were received, for an 86% response rate.

KEY DEFINITIONS

The questionnaire used the following definitions adapted from the *AASHTO Transportation Asset Management Guide: A Focus on Implementation* (2011):

- Asset: The physical transportation infrastructure (e.g., travel way, structures, other features and appurtenances, operations systems, major elements thereof); more generally, can include the full range of resources. An individual separately-managed component of the infrastructure (e.g., bridge deck, road section surface, streetlight, sign).
- Asset management: A strategic approach to managing transportation infrastructure. It focuses on business processes for resource allocation and utilization with the objective of better decision making based on quality information and well-defined objectives.
- Transportation Asset Management Plan: An essential management tool that brings together all related internal and external business processes and stakeholders to achieve a common understanding and commitment to improved performance. It is a tactical-level document that focuses its analysis, options development, programs, delivery mechanisms, and reporting mechanisms on ensuring that strategic objectives are achieved.
- Implementation plan: The process by which a state DOT implements the TAMP.

REPORT ORGANIZATION

The synthesis is organized into five chapters and four appendices. Chapter one contains introductory information, including background, objectives, and scope. Chapter two provides a literature review, which was conducted to explore different AM terms and practices covering implementation, TAMPs, and the application of risk in an AM environment, as well as a timeline of AM activities in the United States and also a list of completed, ongoing, and future research. Chapter three documents the survey results from the two surveys, and focuses on the AM state of the practice by presenting the results from the second survey first, followed by the self-assessment results. Chapter four provides an in-depth analysis of the survey responses regarding AM implementation and practices, and will cover the following topics:

- The impact (importance) of having a mandate (internal or external) on implementing AM practices (13 had a mandate versus 30 without a mandate),
- The importance of having an AM group (26 had a group versus 17 that did not),
- Analysis of TAMP examples provided by agencies (5 agencies provided a copy of their TAMP), and
- Outreach activities (TAM conferences in 2009 and 2012)

Chapter five summarizes the synthesis findings and conclusions, including future research that may be considered to advance the AM state of practice within state DOTs. Finally, the four appendixes provide survey details (questions and participants) and results (responses and self-assessment results).

CHAPTER TWO

LITERATURE REVIEW

WHAT IS ASSET MANAGEMENT

According to AASHTO, "Transportation Asset Management is a strategic and systematic process of operating, maintaining, upgrading, and expanding physical assets effectively throughout their life-cycle. It focuses on business and engineering practices for resource allocation and utilization, with the objective of better decision making based on quality information and well-defined objectives." In the transportation field, AM involves a large array of system components. Examples of these assets include "pavements, pavement markings, raised pavement markers, structures, roadside signs, traffic signals, roadway illumination, traffic barriers, guard fences, attenuators, maintenance equipment, vehicles, intelligent transportation system (ITS) equipment, traffic detection equipment, real estate, corporate data and materials" (Kuhn 2011). The items under state DOT jurisdiction vary, but most often include a large amount of linear transportation assets.

ASSET MANAGEMENT HISTORY

Even though AM science and practice is not new—agencies in Europe, New Zealand and Australia, and Canada started in the late 1980s and early 1990s—transportation agencies in the United States were focusing on the management of pavements and bridges as individual assets rather than on a comprehensive, integrated, and long-term approach to managing all assets under their jurisdiction.

In 1996, AASHTO and FHWA hosted an executive-level AM seminar in Washington, D.C., to introduce AM to the state transportation agencies. During this event, participants drawn from the leadership of AASHTO, FHWA, state transportation departments, private industry, utility companies, quasi-government organizations, and research and supplier communities shared experience and expertise to improve the quality of AM. The results are documented in FHWA's *Asset Management: Advancing the State of the Art into the 21st Century Through Public-Private Dialogue* (1997), which describes the goals, attributes, and usefulness of AM. The seminar focused on the need for integrated decision making and the idea of going beyond just pavements and bridges.

The executive seminar in the District of Columbia was followed by another executive workshop hosted by AASHTO and FHWA in October 1997 in Troy, New York. The mission of the workshop was to evaluate current AM practices, technologies, and tools, and to develop a strategy for moving forward a cooperative AM initiative. A basic definition of AM was introduced during the meeting and later adopted by AASHTO. These two events were the beginning of the ongoing biennial series of National Asset Management Conferences. The most recent conference (9th National Asset Management Conference) in San Diego attracted more than 320 attendees with 34 state DOTs represented.

The following is a timeline of national-level AM activities that started the effort to support AM development and implementation in the United States.

- 1998: Following the two successful AM executive seminars, AASHTO created their AM Task Force to develop a strategic plan for implementing AM across the state DOTs. The task force was later converted to a subcommittee under the standing committee on planning and the standard committee on highways. The task force developed a strategic plan for AM implementation in 2002 that has been updated twice since then.
- 1999: FHWA recognizes the importance of AM and creates a new office under the Infrastructure Program to support AASHTO and the state DOT's AM efforts. In helping the states, the new FHWA Office of Asset Management agreed with AASHTO that—
  - AM needs to be flexible to address the varying needs of each state.
  - AM implementation must be voluntary.
  - It is important that AM involve a great deal of communication and education.
- 1999: The 3rd Asset Management National conference was held in Scottsdale, Arizona, with a major focus on the Governmental Accounting Standards Board (GASB) statement 34. GASB 34 required state and local governments to begin reporting all financial transactions, including the value of their infrastructure assets, roads, bridges, water and sewer facilities, and dams, in their annual financial reports on an accrual accounting basis. GASB 34 included a modified plan that allowed agencies using AM to manage their assets to a defined level of service (condition level) rather than depreciate them to determine their financial value. GASB 34 required agencies to conduct asset inventories (major

assets) and, if the modified approach is used, do condition surveys.
- 2000: TRB joins both AASHTO and FHWA and creates an AM Task Force to address the research and education needs of the agencies starting the AM process. This was later changed to a full committee (ABC40), which still maintains close communication and coordination with the AASHTO and FHWA counterparts to advance AM science, practice, and implementation. In addition to the annual meeting, the TRB AM Committee holds a midyear meeting with the AASHTO AM Subcommittee.
- 2001: The 4th National Asset Management Conference was held in Madison, Wisconsin. This meeting was focused more on AM as opposed to GASB 34, given that DOTs were still focusing on pavement and bridge assets rather than the holistic approach advised by the AM process.
- 2002: AASHTO adopts the guide developed through an NCHRP project [20-24(11)] as its first *Transportation Asset Management Guide* (2002). As part of the guide, a self-assessment tool was developed to help state DOTs gauge their progress in AM implementation and identify areas that need additional effort. The self-assessment was used as the first survey as part of this synthesis that was completed by 18 state DOTs.
- 2002: The National Highway Institute introduces a 1-day AM workshop based on the *AASHTO Transportation Asset Management Guide*. The workshop would be later modified (on two occasions) to reflect changes in how state DOTs are responding to different AM principles and how some agencies are practicing AM. The workshop is still offered with an optional half-day that helps the DOT identify gaps, based on the self-assessment, and then develop steps to address those gaps on short- and long-term bases.
- 2003: 5th National AM Conference is held in two locations (Atlanta and Seattle). This conference focused on an integrated approach and discussions on investment analysis.
- 2005: 6th National AM Conference in Kansas City. The meeting was held in conjunction with the 1st National Conference on Roadway Pavement Preservation. The interaction among the two groups was very beneficial given that it introduced the concept of trade-off analysis between capital investment and asset preservation as an AM function. This synthesis survey addresses those questions and how some DOTs are dealing with those issues.
- 2007: AASHTO/FHWA Asset Management Domestic Scan report. The U.S. scan was conducted in 2006 and included six DOTs (Florida, Michigan, Minnesota, Ohio, Oregon, and Utah), two metropolitan planning organizations, and several local agencies. The purpose of this scan was to identify best case examples of the application of AM principles and practices in U.S. transportation agencies. The scan findings can be summarized as follows (U.S. Domestic Scan Program 2007):
  - The importance of having a champion within the agency to push AM forward with support from executives
  - The importance of life-cycle cost decision making versus a worst-first approach
  - The use of performance measures that affect decision making and guide investment
  - Little evidence of risk analysis and the inclusion of risk as part of the AM process
  - Data issues and the need for more cost-effective ways to collect asset data (inventory and condition).
- 2007: 7th National AM Conference in New Orleans. A transit track was added to this meeting to shift the primarily pavement and bridge-based focus to other assets. The meeting included sessions on economic analysis as well as incorporating risk and performance as part of the AM decision making process. The synthesis survey explores how state DOTs have addressed those issues as part of their decision-making process.
- 2009: 8th National AM Conference in Portland, Oregon. The Portland meeting was split into tracks that dealt with data, safety, and pavements. The data track covered performance-based and risk-based data needs for decision making. The safety track focused on how safety and AM can be integrated to support decision making and investment.
- 2012: 9th National AM Conference in San Diego. This most recent conference had the largest DOT representation to-date (34 state DOTs attended). The San Diego conference focused on AM implementation and highlighted how some state DOTs are practicing AM. An AM Pooled Fund group (11 DOT members) met as a part of the conference and provided input on the analysis of survey results for this synthesis. AASHTO and FHWA also hosted an AM Peer Exchange during the conference.

During this period, FHWA sponsored several peer exchanges on AM practices discussing Geographic Information Systems (Charleston, West Virginia, 2009), safety (Cheyenne, Wyoming, 2011), and implementation (San Diego, California, 2012). FHWA produced several case studies on data integration, economic analysis, comprehensive AM implementation, and life-cycle cost analysis. Those case studies are as an excellent resource for other agencies interested in implementing different components of their AM process. Information on all of these resources is available on the FHWA website and is listed as part of the resources section in the literature review.

ASSET MANAGEMENT IMPLEMENTATION

The AM implementation process provides a mechanism for the state DOTs to get started with AM activities. The Colo-

rado Department of Transportation (CDOT) identifies tasks as "near term" in order to determine items for immediate accomplishment. In doing this, CDOT defines organizational and procedural needs that must be accomplished to promote the implementation of an AM program. This organization allows all departments and management levels to be involved in the implementation process and lay out specific philosophies, management processes, tools, and perspectives to be applied in the future. Some of CDOT's near-term tasks listed in the 2001 Colorado DOT's *Asset Management Implementation Plan and Tiered System Process* (Markow and Racosky 2001) include the following:

- To organize a task force chaired by the CDOT deputy director to provide leadership, demonstrate executive buy-in, guide and coordinate actions department-wide, and provide a focal point for strategic direction and communication of objectives and accomplishments.
- To complete the Investment Category structure to provide the goals, targets, performance measures, and analytic tools needed to use it to full advantage in planning, program development, and system monitoring.
- To communicate "what is asset management" and related CDOT actions to CDOT employees and to the Transportation Commission, stakeholders, and the public.
- To make better use of existing information technology (IT) where possible, and to develop new IT applications and tools where needed to support AM. This objective is critical to the long-term success of AM and comprises a number of tasks that could entail significant cost for development of IT applications and tools.

CDOT is approaching AM implementation by "tiering of assets." This system breaks the assets into categories such as "Interstate highways, non-Interstate National Highway System (NHS) highways, and other highways." CDOT also devised tiers for other modes of transportation.

Texas DOT also applies the near-term task philosophy when examining AM program implementation strategies. To assist with program implementation, an "Asset Management Guidebook" and an "Asset Management Screening Tool" were developed to provide Texas DOT personnel with tools to help "define, develop, and implement asset management across all levels."

The Oregon Department of Transportation (ODOT) established a set of 10 principles upon which it bases all of its implementation and AM efforts. Every subcategory of the overall ODOT TAMP is based on the following 10 points:

- Asset Management will add value.
- Asset Management will be done well.
- Asset Management will build on ODOT's good management system work.
- Current efforts under way to gather or improve ODOT data will be supported.
- Asset Management will be part of ODOT's daily work function.
- Asset Management will use trusted and reliable data.
- Asset Management processes will be regularly monitored.
- Asset Management will support broad-based funding allocation decisions.
- Asset Management will allow readily available asset reports.
- Asset Management will foster cross-asset communication.

In the *ODOT Asset Management Program Plan*, these core principles are explained in detail and information is provided regarding the range of asset principles (ODOT 2008).

New Jersey DOT (NJDOT) has developed a two-step approach for its AM program:

- Developed an Asset Management Plan for NJDOT assets containing an inventory of specific assets, their condition, performance targets and a plan of how to achieve these targets through a mix of investments.
- Advanced an Asset Management Improvement Strategy that examined NJDOT's proficiency and maturity in Asset Management practice, identified strengths and weaknesses, looked at methodologies and practices, and set goals and objectives for improvement.

The synthesis survey examines how much progress state DOTs are making in implementing AM practices. The results are discussed in Chapters three and four.

ASSET MANAGEMENT AND RISK

Asset management and risk management go hand in hand. FHWA's *Asset Management Overview* cites that "applying risk management to look at decisions…makes it possible to identify threats and opportunities, asses and prioritize those threats and opportunities, and determine strategies so that decisions can be made on how to deal with future issues" (FHWA 2007). In other words, applying risk management concurrently with AM can assist agencies in clearly seeing the costs and benefits of an option and, in turn, make the most informed and cost-effective business decisions.

Risk analysis can be extremely useful when included in the AM process. As defined by FHWA, "risk management is the systematic identification, assessment, planning, and management of threats and opportunities faced by our programs." FHWA has developed a risk management process that allows them to track the aforementioned components of risk management. Steps taken by FHWA to manage risks include the following:

- Gathering information about future events, threats, and opportunities;

Washington State Department of Transportation

Exhibit XII-1: Risk Register Log for Business and Organizational Risks

Risk ID	Risk Description	Risk Classification Internal External	Probability 0.1 – 1.0	Impact 1 - 10	Risk Score (Pxl)	Risk Owner	Response (Accept / Avoid / Mitigate / etc.)	Risk Response Strategy and Notes
ORG01	A change in WSDOT priorities may cause a delay in obtaining funding for implementation phase	External	0.7	10	7.0	Program Steering Committee and Project Sub-committee	Avoid & Accept	• Active engagement with stakeholders and policy makers to obtain approval • Revisit budgets at each steering committee meeting; economic factors should be on agenda for discussion where appropriate. • Adjust project schedule as necessary based on timing of funding • Identify activities that could continue in the interim (process analysis, etc.) to maintain momentum
ORG02	Less funding than requested is approved for the implementation phase	External	0.7	10	7.0	Program Steering Committee and Project Sub-Committee	Avoid & Accept	• Active engagement with stakeholders and policymakers to obtain approval • Revisit budgets at each steering committee meeting; economic factors should be on agenda for discussion where appropriate • Adjustments in scope and/or project schedule as necessary based on timing of funding
BUS01	Specialized requirements or significant gaps identified	External	0.7	8	5.6	Project Sub-committee and Project Managers	Avoid and Mitigate	• Assess potential for modifying business processes slightly • Assess need for additional best of breed software and/or minor customizations • Consider custom solution for some elements (location referencing system)

FIGURE 1 Risk Register Log [*Source*: (WSDOT 2009)].

- Identifying what and how those future events trigger the threats and opportunities;
- Assessing the likelihood and impact of risks;
- Prioritizing risks by their expected value and their relative importance to a program, project, or state;
- Determining appropriate response strategies to risks; and
- Carrying out response strategies, monitoring strategies, and reevaluating risks (FHWA 2007).

This FHWA risk management process can help highlight the advantages and disadvantages of a possible decision as well as the assets that require the most and least immediate attention.

RISK BASED DECISION MAKING

The Washington State DOT (WSDOT) divided the risk analysis and management process into the following four steps in order to make the best decisions for a TAMP:

- Risk identification,
- Risk analysis and prioritization,
- Risk planning, and
- Risk control and monitoring (WSDOT 2009).

WSDOT applies this four-step process to each of their risk divisions: business/organization risks and technical risks. Business/organizational risks are risks that may affect existing WSDOT business procedures, or the procedures of other groups involved in a transportation project. Technical risks then deal with items such as system implementation or new technological needs. For each type of risks, WSDOT uses the four-step system to assign each item a "risk score," highlighting them in red (ORG01 and ORG02) or yellow (BUS01) depending on the severity of the risk. Figure 1 shows an example page from a "Risk Register Log." These risk register logs clearly allow WSDOT to see item priority, risk classification, risk owner, response options, and strategy notes when attempting to use a risk-based decision-making process.

PERFORMANCE MEASURES AND ASSET MANAGEMENT

In 2006, TRB produced *NCHRP Report 551: Performance Measures and Targets for Transportation Asset Management* (Cambridge Systematics, Inc. et al. 2006) as a review of TAM performance measures and targets. In this report, NCHRP suggested that many agencies created performance measures of a technical nature, but should also create measures regarding "security, social, environmental, and economic issues affecting transportation decisions." According to *NCHRP Report 551*, AM performance measures can revolve around multiple categories, including the following:

- Preservation
- Accessibility
- Mobility
- Operations and maintenance
- Safety

- Environmental impacts
- Economic development
- Social impacts
- Security
- Delivery (Cambridge Systematics, Inc. et al. 2006).

The Vermont Agency of Transportation (VTrans) developed its own categories of transportation assets in order to have a system of performance measures:

- Highway
- Aviation
- Public Transportation
- Rail
- Bicycling and Walking
- Maintenance
- Buildings
- Central Garage
- Department of Motor Vehicles (VTrans 2008).

VTrans also created a target level of performance for each category, and rates its assets from "Excellent" to "Very Poor," providing a clear understanding of asset condition.

Minnesota DOT has a scorecard that summarizes the progress of statewide transportation goals. This scorecard uses graphs to review progress over the past few years, and assigns a symbol (red for markedly below target, yellow for slightly below target, and green for at or above target) to clearly show whether an asset area is deficient. The 2010 scorecard may be found in its *Annual Minnesota Transportation Performance Report* (Minnesota DOT 2010).

ASSET MANAGEMENT RESOURCES

FHWA Asset Management Resources

http://www.fhwa.dot.gov/asset/projects.cfm

Transportation Asset Management Expert Task Group (2012) http://www.fhwa.dot.gov/asset/etg/index.cfm

Asset Management Peer Exchange Transportation Asset Management—A Focus on Implementation (2012)

http://www.fhwa.dot.gov/asset/pubs/hif12041.pdf

Asset Management and Safety Peer Exchange

Beyond Pavement and Bridges: Transportation Asset Management with a Focus on Safety (2011)

http://www.fhwa.dot.gov/asset/hif12005/hif12005.pdf

Asset Management and Management of Highway Performance (Peer Exchange) (2010) http://www.fhwa.dot.gov/asset/hif10006/index.cfm

Managing Pavements, Monitoring Performance, June 9–26, 2011, Australia, New Zealand, Sweden, United Kingdom, and the Netherlands

AASHTO Asset Management Subcommittee

http://tam.transportation.org/Pages/AASHTO.aspx

Research at the National Level

Completed NCHRP Projects (past 5 years)

Project 19-04, A Review of DOT Compliance with GASB 34 Requirements

http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_522.pdf

Project 20-24(11), Asset Management Guidance for Transportation Agencies

http://downloads.transportation.org/amguide.pdf

Project 20-57, Analytic Tools to Support Transportation Asset Management

http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_545.pdf

Project 20-60, Performance Measures and Targets for Transportation Asset Management

http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_551.pdf

Project 20-74, Developing an Asset Management Plan for the Interstate Highway System

http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_632.pdf

Project 20-74A, Development of National Level of Service Criteria for the Interstate Highway System

http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=1638

Synthesis of Highway Practice 371: Managing Selected Transportation Infrastructure Assets: Signals, Lighting, Signs, Pavement Markings, Culverts, and Sidewalks

http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_371.pdf

Project 08-69, Supplement to the AASHTO Transportation Asset Management Guide, Volume 2—A Focus on Implementation

Project 08-71, Methodology for Estimating Life Expectancies of Highway Assets

http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=2497

Project 08-70, Target-Setting Methods and Data Management to Support Performance-Based Resource Allocation by Transportation Agencies

http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_666.pdf

Project 20-83(03), Long-Range Strategic Issues Affecting Preservation, Maintenance, and Renewal of Highway Infrastructure

http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP20-83A_WorkshopFinalReport.pdf

Ongoing NCHRP Projects

Project 08-87, Successful Practices in GIS-Based Asset Management

NCHRP 20-90 Improving Management of Transportation Information

Future NCHRP Projects (2012–2013 program)

07-21 Guidance for the Management of Traffic and Safety Assets

08-90 Development of a Transportation Asset Management Gap Analysis Tool to Complement the AASHTO TAM Implementation Guide

08-91 Use of Cross Asset Optimization Results and the Impact on Performance Measures

08-92 Transportation Data Program Self-Assessment Guide

AASHTO Standing Committee on Planning (08-36) program to develop TAMP templates for highway agencies.

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CHAPTER THREE

SURVEY RESULTS

The financial impact of AM touches every aspect of an organization. Even with AM's astounding potential positive benefits, it is a considerable challenge to change a transportation agency's culture to initiate, embrace, and ultimately integrate TAM principles. Although there are only a few champion agencies that use TAM principles, the level of interest has been steadily increasing among state DOTs, federal agencies, professional organizations, and the research community. As an example, the 9th National Conference on Transportation Asset Management (April 2012, San Diego, California) had more than 320 attendees and 34 states represented. In addition, Congress has recently passed the Moving Ahead for Progress in the 21st Century Act (MAP-21 Act), which will be a catalyst for agencies to adopt TAM principles. MAP-21 establishes an outcome-driven approach that tracks performance and will hold states and metropolitan planning organizations accountable for improving the conditions and performance of their transportation assets.

Given the growing level of interest and performance-based reauthorization, this synthesis of TAM practice among state highway agencies is a timely resource for any agency trying to identify where it may want to focus it AM efforts.

SURVEY METHODOLOGY

The state-of-practice information in this synthesis report was obtained primarily through two separate web-based surveys, with additional input from practitioners.

The initial survey requested that participants conduct a self-assessment to characterize their agency's AM practices. The survey utilized the self-assessment exercise from Section 3.2 of the 2002 *Transportation Asset Management Guide* [NCHRP 20-24(11)], which was designed to probe basic functions and capabilities that contribute to good AM regardless of an agency's particular characteristics and situation. The self-assessment results reflect current and future (5-year) business practices and the agencies' institutional, organizational, financial, and IT environments. This survey yielded 18 DOT participant responses (see Appendix D).

From the results of the initial survey, and input from the Topic Panel, a second state-of-the-practice survey questionnaire was developed, pre-tested among state DOT members on the Topic Panel, revised, and distributed to DOTs in a web-based format. This survey was designed to capture the existing state of practice and agency expectations for the next 3 to 5 years. The survey design balanced the level of detail desired with participant time demands by providing common answers and reducing the number of open-ended questions. This second survey yielded 43 state DOT responses and 1 turnpike enterprise response. For clarity and ease of contrast among DOT agencies, the turnpike agency responses were omitted from the tables and discussion in the body of this report (results from the second survey, including the turnpike agency, are included within Appendix C).

Early results from the second survey were presented at the 9th National Conference on Transportation Asset Management as a part of the joint midyear meeting, which included TRB Transportation Asset Management (ABC40) committee members, AASHTO Asset Management Sub-Committee members, interested conference attendees, and the Asset Management Pool Fund state members. This group provided input on the survey results along with general comments on the survey findings. The group also discussed the variability in state DOT responses on AM practices, and commented that this is most likely a result of the varied understanding of TAM principles and definitions. A discussion on the survey results specific to DOT participant information follows.

GENERAL ASSET MANAGEMENT PRACTICES

The use of TAM principles was expected to vary widely among DOTs. To understand and compare these differences, agencies were asked whether they are under any type of mandate to use TAM principles. The responses help determine if there is any relationship between those agencies that are farther along in the process and the pressure placed on them to implement. As shown in Table 1, 13 of the 43 responding agencies (see the list of participants in Appendix B) reported that they are under a mandate to use TAM principles. These mandate sources were associated with three categories (Internal, Legislative, and Federal reporting requirements). Even though there is no federal mandate to use AM, two agencies (Maryland and Tennessee) reported that they consider the federal reporting requirements, such as bridge inventory and a highway performance monitoring system, as a mandate to push for AM implementation in their respective agencies. This synthesis report includes a

section on the differences in AM practices between agencies that do and do not operate under a mandate (see chapter four). The Colorado, Michigan, Virginia, Vermont, and Washington State agencies have a legislative mandate; the remaining seven agencies rely on department policy and/or a department director initiative to practice AM.

TABLE 1
AGENCY MANDATE AND SOURCE

Q1. Is your agency under any type of mandate to use transportation asset management principles?	Responses*	Percent
Yes	13	30%
No	30	70%
*43 responding agencies	43	

Specify the type of mandate:		
Internal	6	46%
Legislative	5	38%
Federal reporting requirement	2	15%
*13 responding agencies	13	

Asset management activities can be integrated broadly across an agency. One of the critical actions that any agency can take lies in the way they staff and support the TAM initiative. Table 2 shows that 60% (26 of 43) of the agencies have an AM task force or group. Agencies were asked to describe their AM task force and based on these descriptions the composition and location of the group within the organization was identified. The composition of these groups is dominated by major asset managers followed by planning and top executives. The AM groups most often reside across divisions/offices which imply no formal AM unit; however, AM activities are conducted across multiple divisions/offices.

TABLE 2
ASSET MANAGEMENT GROUP COMPOSITION

Q2. Does your agency have an asset management group (task force) to coordinate all of the asset management activities?	Responses*	Percent
Yes	26	60%
No	17	40%
*43 responding agencies	43	

AM Group Composition*:	Frequency
Asset Managers	17
Planning	12
Top Executives	9
IT	5
Finance	3
Unknown	2

*Categorized from 26 agency responses (most agencies have more than one).

Where does AM unit reside within the organization?	Frequency
Across Divisions/Offices	7
Separate Division	4
Planning	4
Maintenance	4
Highway	4
Unknown	3

Some agencies have a more structured approach to the group with defined functions, whereas others provide general guidance and support. Several agencies provided descriptions of their AM group details:

- Arkansas—Deputy Commissioner for Highways, Deputy Commissioner for Aviation, Deputy Commissioner for Marine Transportation, Chief Engineer, Statewide Maintenance & Operations Chief, Division Director – Program Development Division, Director-Administration Services Division, Director-Central Region Office.
- Alabama—It starts within the Maintenance Bureau; specifically, in the Management Section, with some responsibilities delegated down to division offices.
- California—All State Highway Operation and Protection Program (SHOPP) Divisions, as well as representatives from Strategic Planning.
- Colorado—An informal task force jointly led by staff branches under the chief engineer and the Division of Transportation Development. The group meets monthly in development of a Multi Asset Management System. Other divisions such as Finance and IT also attend. Individual asset categories, such as Bridge or Pavement, have used asset-specific groups for more than a decade. Modes included are highways.
- Connecticut—Organizationally, this task is assigned to the Infrastructure Performance Management Unit located in the Bureau of Policy and Planning. However, with limited staffing, work on this task has been limited. The department has also established a Standing Committee on Performance Measures.
- Florida Turnpike Enterprise (FTE)—Asset management group consists of a project manager (AM champion), data maintenance, annual inspection, and software maintenance as part of the Bond Requirements area under the General Engineering Consultant contract for the FTE Production Department. This group also consists of Asset Team Leaders in various departments throughout FTE who act as liaisons for their respective department to ensure the AM group meets their needs.
- Georgia—OPM (Organizational Performance Management) is a small unit created 2 years ago tasked with AM, performance management, and strategic planning. Tasks have included development of a strategic plan based on AM principles, launch of an Agency Dashboard, development of an AM strategy, and acquisition of a consultant to further AM efforts.
- Iowa—Design, Bridge Design, Traffic and Safety, Motor Vehicle, Planning, Districts, Information Technology, and Finance.
- Idaho—Effort involves several subgroups that report to the chief engineer. To date, the efforts are concentrated on highway issues (roads, bridges, and equipment).
- Indiana—There is an oversight team, made up principally of department directors who meet weekly (more often at certain times of the year's cycle, for certain events) to discuss progress, challenges and opportunities, enhancements, etc.
- Kentucky—State Highway Engineer's Office, Division of Maintenance, Division of Planning, and Division of Traffic Operations.

- Louisiana—TAM Steering Committee: Management and Finance, Engineering, Multimodal Planning, Road and Bridge Design, Statewide maintenance, ITS, IT, Districts, and Traffic Engineering.
- Maryland—Our Asset Management Steering committee includes representatives from several offices, such as, planning, maintenance, traffic, pavement and structures. The main purpose of this committee is to assist in the progress and process of using AM principals as they relate to the assets they manage.
- Michigan—The Transportation Asset Management Council (TAMC) is a legislated body of representatives from agencies who own roads or are responsible for road funding; representation is from all levels of government in Michigan. The TAMC has focused on pavements and bridges to date. The MDOT Asset Management Division provides expertise and staff support to the council with backing and guidance from MDOT director.
- Minnesota—We have a working group that is developing a framework. We have representation from data management, IT, maintenance, risk management, performance management, finance, district staff, and department leadership.
- Montana—The Project Analysis Bureau, within MDT's Planning Division, provides the primary direction for AM. However, other MDT divisions provide input (data, information, etc.) utilized in the P3 Process. Additional, all strategic initiatives route through MDT Management (director's office, etc.) and concurrence is gained through partners (FHWA, locals, etc.).
- North Dakota—The department has a division dedicated to Asset Management, similar to other divisions (Construction, Bridge, Design, etc.).
- New Hampshire—There used to be a very active AM group that was more focused on identifying critical assets to be collecting inventory and condition for. The group was made up of project development and operations managers and staff, but lacked the ability to directly assign resources to make work efforts priorities. A more recent leaner AM task force is reviewing New Hampshire's overall approach to AM in relation to other states to assess our overall approach and progress. This new group is currently made up of upper-level management staff.
- New Jersey—NJDOT has an Asset Management Steering Committee made up of senior leaders to establish AM goals and to guide policy relating to AM.
- Nevada—Strategic Data Group (various divisions) and Maintenance and Asset Management Offices.
- Ohio—The Asset Management Leadership group is a multidisciplinary group made up of the various "business owners" in the department. This group includes representation from planning, pavement, bridge, safety, hydraulics, maintenance, construction, and long-range planning (modes).
- Oregon—Asset Management Integration Section serves to facilitate and coordinate efforts across ODOT; current emphasis is on highway assets, including bicycle and pedestrian facilities; steering committee includes representation from most ODOT divisions.
- Pennsylvania—We have formed an Asset Management Division within the Bureau of Maintenance and Operations. Division is responsible for primary assets including bridges and pavements, but also overall efforts including ancillary assets and planning and programming activities. An Asset Management Steering Committee and Working Group have also been formed.
- South Dakota—Each type of asset has a task force assigned to it. Each task force is comprised of individuals from various offices as the nature of the asset would require. Individuals from Operations, Road Design, Bridge Design, Materials & Surfacing, Project Development, and Administration are included in the task forces.
- Utah—Senior management, quarterly meetings chaired by deputy director with a focus on pavements and bridges.
- Washington State—Group includes Pavement Management, Bridge, Traffic, Safety Executives, Hydraulics and Ferry Operations.
- Wisconsin—Bureau of State Highway Programs provides AM data and guidance to Wisconsin DOT regions to assist with highway program planning.

ASSET MANAGEMENT AND DATA

Inventory

AM is a strategic approach to managing infrastructure and places a premium on good information in all aspects and in all departmental units. The integration of TAM principles requires agencies to know the condition of each managed asset, which leads to the need for an asset inventory.

As shown in Table 3, all 43 responding agencies have an asset inventory. This response is of no surprise given the commonality of pavement and bridge inventories. There are seven asset categories beyond pavements and bridges, with signs being represented in 77% (33 of 48) of the inventories.

TABLE 3
ASSET INVENTORY FEATURES

Q3. Does your agency have an asset inventory?	Responses	Percent
Yes	43	100%
No	0	0%

	Inventory		
Asset	Yes	Partial	No
Pavements	43	0	0
Bridges	43	0	0
Signs	33	6	4
Guardrail	27	8	8
Culverts	26	5	12
Other	23		20
Lighting	21	9	13
Pavement Markings	14	12	17
Retaining Walls	11	10	22

*Responses from 43 agencies

Survey participants identified a variety of "other" assets in their inventories. Table 4 shows the other assets maintained within various state inventories—such as ITS, signals, and noise walls—that were listed by multiple agencies.

Condition Assessment

An essential element of AM is knowing the condition of each inventoried asset. However, selecting the frequency to collect and update this information can vary by agency, given the cost to collect the information, the methods used to manage the asset, and the ability to staff these activities. To this point, participating agencies provided the frequency at which condition surveys are conducted for eight common assets (Table 5). The results suggest the extent of collection and maturity of AM practice by asset type. For example, 100% of the pavement and bridge condition information is either collected annually or biennially (every other year). Pavement markings and signs had the highest (nonpavement/bridge) annual collection among agencies at 30% and 27%, respectively.

Managing asset condition is directly dependent on the methods used for collection and resulting data quality achieved. Each asset can have unique features which, for various reasons, favor manual or automated collection. Agencies are left to determine which method to use (automated or manual) for each inventoried asset. Choosing the collection method involves careful consideration of many factors, including manpower, accuracy, availability, and costs.

TABLE 5
FREQUENCY OF ASSET CONDITION SURVEYS

	Collection Frequency				
Asset	Annual	Biennial	Random	Other	Responses
Pavements	64%	36%	0%	0%	42
Bridges	29%	71%	0%	0%	42
Pavement Markings	30%	4%	30%	37%	27
Signs	27%	5%	8%	59%	37
Culverts	21%	14%	17%	48%	29
Lighting	18%	7%	14%	61%	28
Guardrail	13%	6%	26%	55%	31
Retaining Walls	5%	10%	10%	75%	20

Table 6 shows the variability in data collection methods among asset types and responding agencies. For example,

TABLE 4
OTHER ASSETS WITH INVENTORIES

State/Agency	Q3. AM Inventory (other assets)
AK	Ditches Vegetation
AL	Rest Areas, Paved shoulders, Mowing areas, Cable rail, Signals
AZ	Sound Wall, Fencing, Guardrail End Treatments, Cattle guards, Rest Areas
CO	ITS devices, some traffic signals, some stencils, roadway geometrics
CT	Traffic Signal Inventory
IA	Tower Lights, Sign Trusses
IL	Sign Structures and High Mast Light Poles.
IN	There are many other assets we track, too many to list individually.
LA	Signals
MI	Catch Basins, Billboards, Sound Walls, Environmentally Sensitive Areas, Mile Marker Signs, Lane Miles.
MN	County and municipal state aid system information, facilities, traffic signals, rail crossings, rest areas. All are in different systems and at different levels of maturity. We are evaluating an ""enterprise asset management system"" so we will have more assets in systems in the near future.
MS	Cable Barrier
NJ	Curb, Delineator, Detention/Retention Basins, Ditches, Fences, Guiderail, Headwalls, Inlets, Island Pavement, Manholes, Raised Pavement Markers, Noise Walls, Outfalls, Rumble Strips, Sidewalks, Signs, Sign Mount
OH	Bike & Ped Curb and Sidewalk, Noise Walls, Safety, Intermodal Facilities
OR	Sidewalks, Bicycle Facilities, ADA Ramps, Sound Barriers, Unstable Slopes, Material Sources, ITS, Wetland Mitigation Sites, Approaches, Weigh in Motion Sites, Signals
PA	ITS devices, traffic signals, etc. Some devices, such as retaining walls, lighting, etc. are not 100% (some inventory data exists, but not fully captured
RI	Traffic Signals, Fleet Equipment, Personnel, Impact Attenuators
SC	Crash attenuators, signalized intersections
SD	Equipment, Buildings, ADA facilities
TN	Mowable acres, fence, rumble stripes, delineators, etc.
VA	Curbs, Drop Inlets, Pavement Messages, Rock Slide Protection, Rumble Strips, Sidewalks, Sound Barriers, Traffic Barriers, Traffic Count Stations, Traffic Signals, Ditches
VT	Signals, small culverts, Weigh in Motion (WIMS), Long Bridges > 20 ft, Short Bridges 6ft-20ft, Retaining Walls > 3 ft ht, Sign Structures, Ped & Trail Structures, RR Structures, Highway Garages, Salt/Sand Sheds, District Offices, Cold Storage Buildings, Brine Making Facilities, Airport Terminals, Airport Hangars, Central Garage Materials & Research Lab, Traffic Shop, Runways, Taxiways, Tiedowns, Lighting Beacons, Towers, Rail Beds, Rail, Track Rail Crossings, Weigh Stations, RWIS Stations, Variable Message Boards, LPFM Stations, TOC (video wall, radio), Electronic Kiosks, Wi-Fi
WA	Traffic Signals, Utilities & Manholes, ADA features, Environmental Mitigations features for storm water treatment, Noise Walls, Park & Ride Lots, Rest Area Buildings, Water & Sewer Systems, Weigh Station features, Unstable Slopes

93% of the agencies reported collecting pavement condition information in an automated or semiautomated method. In contrast, 80% of the bridge, 83% of culverts, and roughly 60% of the signs and pavement marking condition surveys are conducted manually. The maturation of field technologies and changes in compliance requirements can influence how these condition surveys are conducted in the future. As an example, sign and pavement marking assets have traditionally been collected manually. Recent FHWA rulemaking has established minimum retroreflectivity levels for signs and introduced potential policies for pavement markings. These actions, along with advancements in the capabilities of mobile vans to acquire these types of data, are reflected in automated or semiautomated collections being 34% for signs and 32% for pavement markings.

TABLE 6
DATA COLLECTION METHODS BY ASSET

	Collection Method				
Asset	Manual	Automated	Semi-Automated	Other	Responses
Pavements	5%	51%	41%	2%	41
Bridges	80%	0%	20%	0%	41
Signs	63%	8%	26%	3%	38
Guardrail	58%	9%	27%	6%	33
Culverts	83%	0%	13%	3%	30
Lighting	78%	4%	15%	4%	27
Pavement Markings	64%	12%	20%	4%	25
Retaining Walls	55%	9%	14%	23%	22

Data Needs

"Data collection, data management, and data integration are essential parts of the Asset Management framework that are critical to its success and utilization within a highway agency. Timely and accurate data lead to information and form the basis for effective and efficient decision making" (FHWA 2009).

The success and maturity of any AM process relies on the identification of primary AM data needs across the organization. Of the responding agencies, 28 of 42 (67%) had completed this effort. This is an area where agencies need support to complete this critical activity. Identifying data needs to support AM practices streamlines the data collection process, minimizes collection costs and allows agencies to plan and allocate staff resources to accommodate access and integration needs.

The data collected to support decision making must be rigorously defined and collected under specific parameters such as a data specification, documented frequency, accuracy, and completeness to name a few. Assuring the quality of these data entails evaluating the data integrity, accuracy, and validity. Of the 42 responses, 31 (74%) reported that they have a process to assess the quality of the collected data.

Given that transportation asset data are collected at different times, groups, and methods, and are stored in varying formats and media, there is naturally a need for data integration. Data integration is essential to transform the data into information that is able to support decision making at the various management levels. Transportation agencies must organize the available data into suitable forms for applications at the different organizational levels of decision making (FHWA 2009). This venture presents a significant challenge because of the difficulty of data integration. Of the 42 responses, 37 agencies (88%) reported having a data integration effort. Of the 42 responding agencies, 22 (52%) had completed an assessment of data needs for AM, have a QA/QC process, and are conducting integration efforts. Out of these 22 agencies, 13 (60%) reported having an AM group to guide their efforts in contrast to 9 agencies (40%) that do not have a AM group.

ASSET MANAGEMENT ACTIVITIES

When agencies summarized their AM progress to date and anticipated activities over the next 2 to 5 years, it became clear that a great deal of effort and priority was being placed on development of these systems. As shown in Table 7, the majority (70%) of agencies are expanding inventories beyond bridges and pavements with considerable management capabilities and integration under future consideration. The survey results show that state DOTs have made significant advances in the implementation of AM practices because none (0 of 43 responses) selected the first two options (minimal effort or inventories for only pavements and bridges). The results also show that more progress needs to be made to move from expanding inventories (31 agencies), to comprehensive inventories and implementation (currently at 12 of 43 agencies). The *AASHTO Transportation Asset Management Guide: A Focus on Implementation* (2011) can provide those agencies with the tools and processes needed to make those advancements.

TABLE 7
ASSET MANAGEMENT PROGRESS AND ANTICIPATED GROWTH IN 2 TO 5 YEARS

AM progress to date and plans over the next 2 to 5 years	Responses*	Percent
Minimal efforts to date and little change anticipated	0	0%
Developed inventories for bridge and pavements with some management capabilities being added over time	0	0%
Expanding inventories beyond bridge and pavements with considerable management capabilities and integration under future consideration	31	70%
Complete inventories with future activities focused on advancing asset management capabilities, training, and implementation.	12	30%
*43 responding agencies	43	

Agencies were asked to report on the extent to which the AM information is being used within their organization. As shown in Figure 2, the majority of responses showed that they are integrating assets beyond pavements and bridges (90%), were working to integrate policies in resource allocation (85%), and integrating AM as part of their performance requirements (75%). Nearly 35% of the agencies are using AM at the highest level to assess return on investment for infrastructure spending.

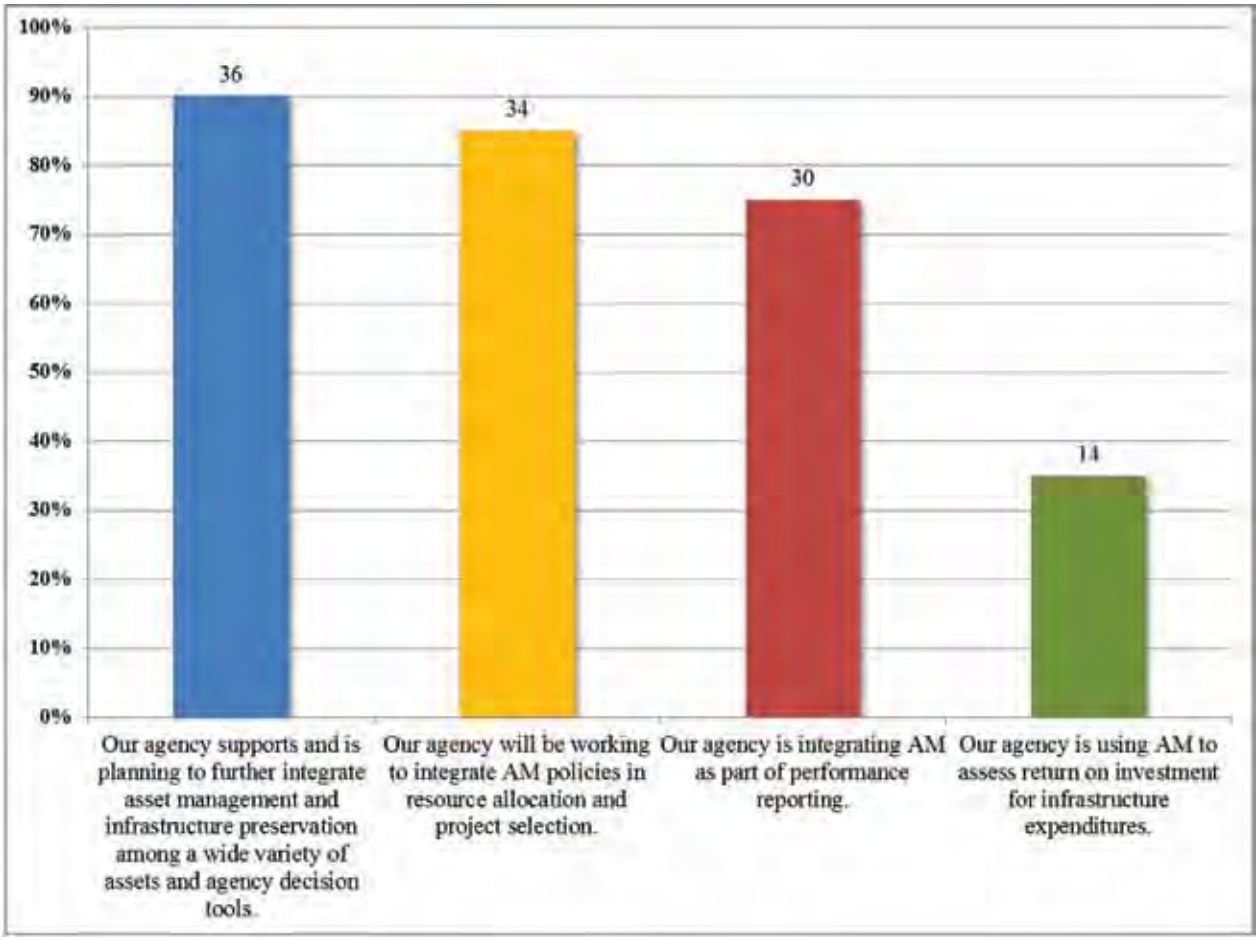

FIGURE 2 Agency use of asset management information (multiple responses allowed).

ASSET MANAGEMENT PROCESS AND SUPPORT ACTIVITIES

Agencies were asked to comment on the state of practice on the use of AM within their organization. As shown in Table 8, agency AM programs are at different points of integration, with only one (Wisconsin) agency having developed a TAMP and fully implemented it into their business process. The results show that 14% of the agencies collect data but do not perform any AM management activities, while 44% have moved to the next step of developing a TAMP. Only 31% of the agencies (13 of 42) have either developed a TAMP or are using their TAMP to manage their assets.

TABLE 8
AGENCY PROGRESS ON THE USE OF ASSET MANAGEMENT PRINCIPLES

AM Progress to date and plans over the next 2 to 5 years:	Responses*	Percent
Collect some asset information but really do not do any management.	6	14%
Have begun the process of developing a TAMP but it is not complete.	19	45%
Have developed a TAMP but have not begun implementation.	1	2%
Have developed a TAMP and in various stages of implementation.	13	31%
Have developed a TAMP and it is fully implemented into our business process.	1	2%
Other	2	5%
*42 responding agencies	42	

A TAMP is an essential management tool that brings together all related internal and external business processes and stakeholders to achieve a common understanding and commitment to improved performance. It is a tactical-level document that focuses its analysis, options development, programs, delivery mechanisms, and reporting mechanisms on ensuring that strategic objectives are achieved. Given this definition, participants were asked to identify how the TAMP is used within their organization and allowed to check all that apply.

Most of the agencies that have a TAMP (13 of 31) noted that their TAMP was used for both short- and long-term planning efforts. Eight of these 31 respondents noted that their TAMP is kept up to date and serves as a resource document on a regular basis, and 14 indicated that they would share their TAMP with the study team. Ultimately, only five agencies (Georgia, New Jersey, Nevada, Ohio, and Oregon) shared their TAMPs, which were assessed in terms of meeting the requirements of the AASHTO AM Guide and in being a TAMP rather than an implementation plan, (see chapter four). Recently, AASHTO has approved a research project as part of the AASHTO Standing Committee on Planning (08-36) program to develop TAMP templates for highway agencies.

Participants were then asked to characterize their agencies' efforts in working with decision makers and other stakeholders to incorporate the TAMP as part of their business processes. As shown in Table 9, the majority of responses show that they are active and have made efforts across multiple departments and business units.

TABLE 9
AGENCIES INCORPORATING TAMP INTO BUSINESS PROCESSES

Agency efforts to incorporate TAMP into business processes	Responses*	Percent
Minimal effort to integrate TAMP into business processes	10	26%
Status quo with no real changes or initiatives over the last couple of years	7	18%
Active with efforts across multiple departments and business units	22	56%
*39 responding agencies	39	

To gauge the benefits of using AM in the decision-making process, participants were asked to identify the resulting outcomes. As shown in Table 10, the majority indicated that their decisions are more data driven, defensible, and performance-based.

TABLE 10
INFLUENCE OF ASSET MANAGEMENT ON DECISION MAKING

Since using asset management our decisions are more:	Responses*	Percent
Data-driven	32	89%
Defensible	28	78%
Integrated	15	42%
Performance based	26	72%

*36 responding agencies (multiple answers allowed)

Participants were also asked to characterize the state of practice on staffing and support of TAMP activities. Table 11 shows the results, with an encouraging 24 of 40 agencies (60%) indicating that the AM activities are led by top-level management and 25 of 40 (63%) indicating that they have identified an AM champion in the organization. Of those agencies that have identified an AM champion, 16 of 25 (64%) said that their AM efforts are led by top-level management. In contrast, only 9 out of 25 (36%) agencies without an AM champion indicated that their AM efforts are led by top-level management. This shows the importance of having an AM champion in the organization to advance AM practices.

TABLE 11
AGENCY STAFFING AND SUPPORT OF TAMP ACTIVITIES

Agency staffing and support	Responses*	Percent
My agency has an identified AM champion	25	63%
My agency has developed strategies to promote AM	18	45%
My agency has an AM implementation task force	21	53%
Our AM efforts are led by mid-level management	24	60%
Our AM efforts are led by top-level management	24	60%

*40 responding agencies (multiple answers allowed)

When asked to identify the key asset performance data that drive decision making across the organization, the most common response was physical condition (98%) followed by safety (90%), as shown in Table 12. Items noted under the "other" category included the following:

- Data from the Maintenance Quality Assurance program
- Public perception
- Transit ridership
- Vicinity projects
- Work program funding
- Life-cycle cost and remaining life tradeoff considerations
- Balance of resources and operational capabilities (i.e., resources available may limit to mill and fill versus more ideal reconstruction).

TABLE 12
KEY PERFORMANCE DATA THAT DRIVE DECISION MAKING

Key performance data	Responses*	Percent
Physical Condition	41	98%
Safety	38	90%
Operations	24	57%
Capacity	21	50%
Risk Assessment	13	31%
Environment	11	26%
Other	6	14%

*42 responding agencies (multiple answers allowed)

Table 13 shows the functions and processes included within the TAMP for the 31 responding agencies. The most frequent answer (81%) was that the TAMP provides a process to review and update asset performance targets, along with limitations of data collection and decision making. The next most common answer, at 65%, was that the TAMP provides the ability to forecast asset performance as part of the decision-making process.

TABLE 13
TAMP CONTENTS AMONG AGENCIES

TAMP contents	Responses	Percent
A long-range plan specific asset performance criteria which guides capital program development	16	52%
A process to review and update these asset performance targets along with the limitations of data collection and decision making	25	81%
Forecasting capabilities for asset performance	20	65%
Verification process to check that forecasts provide realistic projections of system deficiencies	8	26%
Process to align asset management practices with the performance measures	16	52%

*31 responding agencies (multiple answers allowed)

Responding agencies also indicated the types of projects that are selected based on AM process and performance measures. Table 14 shows that the majority of projects selected are for pavements and bridges (more than 90%), with the remaining project types selected using AM processes being below 50%.

Table 15 shows agency decision-making processes related to performance, project selection, investment policies, tools, communications, and risk assessment. The results show

that agencies are incorporating AM practices in their decision making (49% to 57%). However, fewer than 30% of the agencies indicated that risk is being incorporated into the decision-making process for either short- or long-term periods. One of the reasons for the drop in decision making, beyond pavement and bridges, is the lack of data. To this point, 27% of the agencies that are not using AM to select maintenance and operations projects also indicated that they do not have inventory/condition data for these operational assets (e.g., signs, pavement marking, guardrail).

TABLE 14
TYPES OF PROJECTS SELECTED USING ASSET MANAGEMENT

Projects selected using AM	Responses*	Percent
Pavements	39	95%
Bridges	38	93%
Maintenance	15	37%
Safety	15	37%
Operations	10	24%
Capital improvements	9	22%
Other	3	7%

*41 responding agencies (multiple answers allowed)

TABLE 15
AGENCY DECISION-MAKING PROCESSES

Agency decision making includes:	Responses*	Percent
Policies to balance asset preservation and capital improvements	21	57%
Performance based resource allocation	20	54%
A process to share AM output information with agency/elected officials	20	54%
Defined process using AM for selecting projects and developing programs	18	49%
Adequate decision making software packages and tools to support decision making	18	49%
Adequate risk assessment and management tools to support short term decision making	10	27%
Adequate risk assessment and management tools to support long term decision making	7	19%

*37 responding agencies (multiple answers allowed)

One of the keys to advancing agency AM practices lies in identifying and addressing the primary barriers to development and implementation. Accordingly, participants were asked to identify the major barriers faced in developing and implementing their AM processes. Table 16 shows that a lack of resources and staff were the primary barriers faced, followed by resistance to change and interdepartmental interactions. Twenty-two agencies (51%) identified lack of expertise and training as a major challenge which highlights a need for additional training support at all levels. Fourteen agencies (33%) selected executive commitment as a barrier to implementing AM. As shown earlier, executive-level support had a positive effect on the utilization of AM practices. Only two (5%) of the responding agencies noted that a lack of guidance and support from FHWA and/or AASHTO was considered a barrier to progress. These challenges will be a resource for target and advance AM support activities.

TABLE 16
BARRIERS TO DEVELOPMENT AND IMPLEMENTATION

Barriers	Responses*	Percent
Lack of resources	35	81%
Lack of staff	29	67%
Resistance to change	26	60%
Inter-departmentalinteractions	25	58%
Higher/other priorities	22	51%
Lack of expertiseand training	22	51%
Staff commitment	18	42%
Executive commitment	14	33%
Staff turnover	11	26%
Availability of adequatetools in the marketplace	9	21%
Outside pressure to have anobjective approach	8	19%
Lack of guidance/support	2	5%

*43 responding agencies (multiple answers allowed)

SELF-ASSESSMENT SURVEY RESULTS

The self-assessment survey results are based on responses from 18 participating agencies (see Appendix B). Two participants that completed the self-assessment survey did not complete the second AM state-of-the-practice survey. Although the self-assessment is an optional step in AM planning, it is extremely useful to help organize thinking, develop a consensus among top-level managers as to where the agency's strengths and needs for improvement lie, and structure an agenda for AM planning.

The self-assessment survey presented lists a series of statements organized around the four key areas of AM (see Figure 3):

- Policy goals and objectives
- Planning and programming
- Program delivery
- Information and analysis.

Each statement covers a key aspect of AM practice and is stated in a declarative form (e.g., "Our agency conducts life-cycle cost analyses for project alternatives"). Respondents are asked to rate the extent to which they agree with each statement, using a scale of 1 to 4. A "4" indicates strong agreement with the statement, whereas a "1" indicates strong disagreement.

The self-assessment survey is normally undertaken by multiple staff within the agency covering different offices and different levels in terms of responsibilities, and would include all the asset managers responsible for managing the agency's portfolio of assets. In this case, only one person per participating agency completed the survey (with help from multiple staff), and the results and analysis are geared toward national trends in terms of how AM principles are practiced currently, and what is the desired level of practice in the next 5 years. The following sections briefly discuss the self-assessment survey results; Appendix D provides more detailed information and the actual data from the survey.

Self Assessment Survey		
Category	**Summary**	**Areas**
Part A. Policy Guidance	How Does Policy Guidance Benefit from Improved Asset Management Practice?	- Policy Guidance Benefiting from Good Asset Management Practice
		- Strong Framework for Performance-Based Resource Allocation
		- Proactive Role in Policy Formulation
Part B. Planning and Programming	Do Resource Allocation Decisions Reflect Good Practice in Asset Management?	- Consideration of Alternatives in Planning and Programming
		- Performance-Based Planning and Linkage Among Policy, Planning, Programming
		- Performance-Based Programming Process
Part C. Program Delivery	Are Appropriate Program Delivery Processes that Reflect Industry Good Practices Being Implemented?	- Consideration of Alternative Project Delivery Mechanisms
		- Effective Program Management
		- Cost Tracking and Estimating
Part D. Information and Analysis	Do Information Resources Effectively Support Asset Management Policies and Decisions?	- Effective and Efficient Data Collection
		- Information Integration and Access
		- Use of Decision Support Tools
		- System Monitoring and Feedback

FIGURE 3 Self-assessment AM areas.

Category	CURRENT							
	Strongly Disagree		Disagree		Agree		Strongly Agree	
	%	#	%	#	%	#	%	#
Part A. Policy Guidance	6%	1.09	37%	6.64	41%	7.36	16%	2.91
Part B. Planning and Programming	13%	2.23	30%	5.31	45%	8.15	13%	2.23
Part C. Program Delivery	7%	1.18	29%	5.18	42%	7.55	23%	4.09
Part D. Information and Analysis	19%	3.33	33%	5.87	41%	7.47	7%	1.33

Category	DESIRED IN 5 YEARS							
	Strongly Disagree		Disagree		Agree		Strongly Agree	
	%	#	%	#	%	#	%	#
Part A. Policy Guidance	0%	0.00	2%	0.36	33%	6.00	65%	11.64
Part B. Planning and Programming	0%	0.00	2%	0.38	43%	7.77	54%	9.69
Part C. Program Delivery	1%	0.09	1%	0.18	41%	7.45	57%	10.27
Part D. Information and Analysis	0%	0.00	1%	0.20	37%	6.67	62%	11.13

Category	DIFFERENCE	
	%	#
Part A. Policy Guidance	41%	7
Part B. Planning and Programming	40%	7
Part C. Program Delivery	34%	6
Part D. Information and Analysis	50%	9

FIGURE 4 Self-assessment summary results.

Figure 4 shows the results from the self-assessment summary, divided into the following three areas:

- Current: These results reflect the 18 agencies (on average) assessment of their current AM practices as it relates to the 4 parts. Part D (Information and Analysis) had the highest numbers (52% of the agencies surveyed) in the categories of "1 and 2" (Strongly Disagree and Disagree) showing the need for more effective and efficient data collection, data and information sharing and integration, and the use of decision support tools. Only 7% selected "Strongly Agree" for this part. The lowest numbers in categories "1 and 2" come from Part C (Program Delivery) at 36%, indicating that agencies have made progress when dealing with cost tracking and estimating, program management, and alternative delivery mechanisms.

- Desired in 5 years: These results reflect the desired AM practices by the 18 participating agencies. The majority of the responses (all areas above 54%) are all in category 4 (Strongly Agree), which means that those agencies are interested in making plans to further adopt AM practices as part of their decision-making process. The highest is for Part A (Policy Guidance) at 65% and the lowest was in Part B (Planning and Programming). When both categories (Agree and Strongly Agree) are combined, all areas are 98% or above. This indicates that the participating agencies agree with the need to practice AM, but are still struggling to accomplish at all levels.
- Difference: The numbers represent the difference between current AM practices and desired within 5 years. The largest difference was for Part D (Information and Analysis), with 50% of the agencies desiring improved AM practices in this area. The lowest was for Part C (Program Delivery) with only 34% of the agencies indicating that it is an area where AM is not practiced.

In addition to performing an aggregated analysis of the self-assessment, individual questions can be analyzed to identify national needs and focus areas to address training, development, and gaps in research. Table 17 shows the questions under each of the four areas that result in a difference between the current and desired level above 50% (more than half the survey participants indicated that their agencies are not practicing AM principles in these areas but that they want to do so in the next 5 years).

The majority of the issues are found in Part D (Information and Analysis). The following is a narrative for each question identified and a brief description of the findings.

Part A: Policy Guidance

- A3 (policies support a long-term life-cycle approach to evaluating investment benefits and costs): 12 of the 18 responding agencies identified this as a major area of improvement with the majority moving from "disagree" to "strongly agree." This is consistent with the AM state-of-the-practice survey where only 52% of the responding agencies indicated that they had policies to support their long-range planning process.

TABLE 17
SELF-ASSESSMENT ANALYSIS BY QUESTION

PART A. POLICY GUIDANCE

	CURRENT								DESIRED IN 5 YEARS								DIFFERENCE	
	Strongly Disagree		Disagree		Agree		Strongly Agree		Strongly Disagree		Disagree		Agree		Strongly Agree			
Question	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#
A3	5.60%	1	61.10%	11	27.80%	5	5.60%	1	0.00%	0	0.00%	0	27.80%	5	72.20%	13	67%	12
A7	5.60%	1	55.60%	10	22.20%	4	16.70%	3	0.00%	0	0.00%	0	27.80%	5	72.20%	13	61%	11

PART B. PLANNING AND PROGRAMMING

	CURRENT								DESIRED IN 5 YEARS								DIFFERENCE	
	Strongly Disagree		Disagree		Agree		Strongly Agree		Strongly Disagree		Disagree		Agree		Strongly Agree			
Question	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#
B3	22.20%	4	55.60%	10	22.20%	4	0.00%	0	0.00%	0	0.00%	0	66.70%	12	33.30%	6	78%	14
B11	11.10%	2	44.40%	8	44.40%	8	0.00%	0	0.00%	0	0.00%	0	50.00%	9	50.00%	9	56%	10
B13	35.30%	6	29.40%	5	11.80%	2	23.50%	4	0.00%	0	0.00%	0	47.10%	8	52.90%	9	65%	11

PART C. PROGRAM DELIVERY

	CURRENT								DESIRED IN 5 YEARS								DIFFERENCE	
	Strongly Disagree		Disagree		Agree		Strongly Agree		Strongly Disagree		Disagree		Agree		Strongly Agree			
Question	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#
C7	22.20%	4	38.90%	7	33.30%	6	5.60%	1	0.00%	0	5.60%	1	50.00%	9	44.40%	8	56%	10
C9	11.10%	2	55.60%	10	22.20%	4	11.10%	2	0.00%	0	0.00%	0	50.00%	9	50.00%	9	67%	12

PART D. INFORMATION AND ANALYSIS

	CURRENT								DESIRED IN 5 YEARS								DIFFERENCE	
	Strongly Disagree		Disagree		Agree		Strongly Agree		Strongly Disagree		Disagree		Agree		Strongly Agree			
Question	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#
D4	44.40%	8	33.30%	6	11.10%	2	11.10%	2	0.00%	0	11.10%	2	50.00%	9	38.90%	7	67%	12
D6	38.90%	7	22.20%	4	33.30%	6	5.60%	1	0.00%	0	0.00%	0	33.30%	6	66.70%	12	61%	11
D8	22.20%	4	38.90%	7	22.20%	4	16.70%	3	0.00%	0	0.00%	0	27.80%	5	72.20%	13	61%	11
D9	27.80%	5	33.30%	6	38.90%	7	0.00%	0	0.00%	0	0.00%	0	27.80%	5	72.20%	13	61%	11
D11	11.10%	2	44.40%	8	33.30%	6	11.10%	2	0.00%	0	0.00%	0	33.30%	6	66.70%	12	56%	10
D16	16.70%	3	50.00%	9	33.30%	6	0.00%	0	0.00%	0	0.00%	0	44.40%	8	55.60%	10	67%	12
D18	33.30%	6	27.80%	5	38.90%	7	0.00%	0	0.00%	0	0.00%	0	55.60%	10	44.40%	8	61%	11
D19	27.80%	5	38.90%	7	27.80%	5	5.60%	1	0.00%	0	0.00%	0	55.60%	10	44.40%	8	67%	12

- A7 (our agency has a business plan or strategic plan with comprehensive, well-defined goals and objectives to guide resource allocation): Even though the self-assessment did not clearly identify this as a TAMP question, this is a major function that a TAMP can address. Eleven of the 18 agencies indicated the need for improvement in this area. The results from the AM state-of-the-practice survey support this, with only 35% reporting that their TAMPs support these functions.

Part B: Planning and Programming

- B3 (capital versus operations tradeoffs are explicitly considered in seeking to improve traffic movement): Fourteen of the 18 responding agencies indicated their desire to make an improvement in this area, with the majority moving from "disagree" to "agree."
- B11 (project selection is based primarily on an objective assessment of relative merits and the ability to meet performance targets): The majority indicates the need to improve this process; the difference between current and desired processes is primarily coming from moving from "disagree" to "strongly agree."
- B13 (a maintenance quality assurance study has been implemented to define levels of service for transportation system maintenance): Even though the AM state-of-the-practice survey did not have a direct question to address this point, all of the respondents in the "strongly disagree/disagree" categories for current levels change to "agree/strongly agree" for the desired in 5 years indicating the importance of this activity.

Part C: Program Delivery

- C7 (projects with significant changes to scope, schedule, or cost are reprioritized to ensure that they are still competitive in cost and performance): Ten out of 18 agencies reported that their current practices fall short of this goal.
- C9 (external stakeholders and policy-makers believe that they are sufficiently updated on program delivery status): This question is related to communication, and 12 out of 18 agencies indicated that they are not meeting this policy, with the majority moving from "disagree" to "agree." The AM state-of-the-practice survey showed that only 54% indicated that they have processes to share AM results with external stakeholders.

Part D: Information and Analysis

A range of 56% to 67% (10 to 12 of the 18 agencies) indicated the need to make an improvement from their current level of activity to the desired levels in 5 years, with almost all of the change coming from the "strongly disagree" to the "strongly agree." These questions are very specific and have not been addressed directly in the AM state-of-the-practice survey.

- D4 (our agency regularly collects customer perceptions of asset condition and performance).
- D6 (agency managers and staff at different levels can quickly and conveniently obtain information they need about asset characteristics, location, usage, condition, or performance).
- D8 (our agency can easily produce map displays showing needs/deficiencies for different asset classes and planned/programmed projects).
- D9 (our agency has established data standards to promote consistent treatment of existing asset-related data and guide development of future applications).
- D11 (information on changes in asset condition over time is used to improve forecasts of asset life and deterioration in our AM systems).
- D16 (forecast future system performance under different mixes of investment levels by program category).
- D18 (our agency monitors actual system performance and compares these values to targets projected for its capital improvement program).
- D19 (our agency monitors actual system performance and compares these values to targets projected for its maintenance and operations program).

CHAPTER FOUR

SURVEY RESULTS ANALYSIS

This chapter provides an in-depth analysis of the survey responses regarding AM implementation processes and practices along the following parameters:

- The impact (importance) of having a mandate (internal or external) on implementing AM practices (13 had a mandate versus 30 without a mandate)
- The importance of having an AM group (26 had a group versus 17 that did not)
- Analysis of TAMP examples provided by agencies (5 agencies provided a copy of their TAMP)
- Outreach activities (TAM conferences in 2009 and 2012).

IMPACT OF HAVING A MANDATE ON ASSET MANAGMENT PRACTICES

Overall, 13 of the 43 (30%) responding agencies are under a mandate to use AM principles. Table 18 shows the agencies and their mandate type.

TABLE 18
ASSET MANAGEMENT MANDATE BY AGENCY AND SOURCE

		External	
State/Agency	Internal	Legislative	Federal Reporting
AL	Yes		
CO		Yes	
CT	Yes		
IA	Yes		
MD			Yes
MI		Yes	
MT	Yes		
NC	Yes		
ND	Yes		
TN			Yes
VA		Yes	
VT		Yes	
WA		Yes	
	6	5	2

Table 19 shows that 70% of the agencies that have a mandate also have an AM group, as opposed to only 56% of the agencies that do not have a mandate. Among the agencies with a mandate, the source of the mandate (internal versus external) influences the existence of an AM group (84% internal versus 43% external). Having an AM group that coordinates the organization's AM activities is very beneficial to adopting AM practices. The next section examines the impact of having an AM group on some of these AM practices.

TABLE 19
MANDATE VS. ASSET MANAGEMENT GROUP

Does your agency have an AM group?			
	Yes	No	Responses
All Responses	60%	40%	43
Agencies with no mandate	56%	44%	30
Agencies with a mandate:	**70%**	**30%**	13
Internal	84%	16%	6
External	43%	57%	7

When comparing agencies on inventory practices, agencies across the board (mandate or no mandate) did not differ. But when comparing condition assessment practices, agencies with an AM mandate conducted more frequent condition surveys for most of the assets they managed, with a focus on pavements and bridges. This finding indicates how agencies have placed a focus on pavements and bridges as their initial attempt at AM implementation. Over time, a maturity in AM processes will further reduce contrast between asset types. Table 20 shows the results of the comparison of condition assessment practices.

When identifying AM primary data needs, comparing agencies with an AM mandate to those that do not have one shows that there is really no difference between the two groups. However, when we look at efforts assessing the quality of the data (QC/QA), 85% (11 of 13) of the agencies under an AM mandate reported having a process to ensure data quality, compared with 69% (20 of 29 responses) of the agencies without a mandate. This shows that agencies that utilize the data for decision making put more emphasis on the quality of the data. Table 21 shows the complete results of this comparison. When comparing data integration efforts, there was no major difference between the two groups with 93% of agencies with mandate and 89% with no mandate.

TABLE 20
ASSET MANAGEMENT MANDATE VS. CONDITION ASSESSMENT PRACTICES

		Annual	Biennial	Random	Other	Responses	Percent
Mandate	Pavements	85% 11	15% 2	0% 0	0% 0	13	100%
	Bridges	31% 4	69% 9	0% 0	0% 0	13	100%
	Culverts	22% 2	11% 1	22% 2	44% 4	9	69%
	Signs	17% 2	8% 1	17% 2	58% 7	12	92%
	Pavement Markings	27% 3	0% 0	45% 5	27% 3	11	85%
	Guardrail	10% 1	0% 0	40% 4	50% 5	10	77%
	Roadway Lighting	11% 1	0% 0	11% 1	67% 6	9	69%
	Earth Retaining Walls	0% 0	17% 1	17% 1	67% 4	6	46%

		Annual	Biennial	Random	Other	Responses	Percent
No Mandate	Pavements	55% 16	45% 13	0% 0	0% 0	29	100%
	Bridges	28% 8	72% 21	0% 0	0% 0	29	100%
	Culverts	20% 4	15% 3	15% 3	50% 10	20	69%
	Signs	32% 8	4% 1	4% 1	60% 15	25	86%
	Pavement Markings	31% 5	6% 1	19% 3	44% 7	16	55%
	Guardrail	14% 3	10% 2	19% 4	57% 12	21	72%
	Roadway Lighting	20% 4	10% 2	15% 3	55% 11	20	69%
	Earth Retaining Walls	7% 1	7% 1	7% 1	79% 11	14	48%

TABLE 21
ASSET MANAGEMENT MANDATE IMPACT ON DATA QUALITY

Is your agency under any type of a mandate to use transportation asset management principles?	QC/QA Process? Yes	No
Yes	11	2
	85%	15%
No	20	9
	69%	31%
TOTAL	31	11
	74%	26%

42 responding agencies

When mandate and no-mandate agencies are compared for AM progress to date and future short-term anticipated activities (2 to 5 years), 32% of the mandate agencies indicated that they have complete inventories with future activities focused on advancing AM capabilities compared with 26% for the no-mandate agencies. Even though the difference is not substantial, when combined with other survey questions, this finding presents evidence that agencies with an AM mandate have made more progress in implementing AM activities. Table 22 shows the complete comparison.

IMPACT OF HAVING AN ASSET MANAGEMENT GROUP ON ASSET MANAGEMENT PRACTICES

In total, 26 agencies had an AM group, compared with 17 that had none. The agencies with an AM group are ahead in incorporating AM principles and practices to resource allocation, project selection, decision support tools, and performance reporting. Table 23 shows that, on average, the agencies that had an AM group were ahead of the others by 12%. This finding shows the impact of having an AM group that guides an organization's AM activity development and implementation. The existence of the AM group appears to have more influence on AM activities. Agencies with an AM group exhibit more maturity in AM implementation.

Thirty-one percent of the agencies without an AM group do not use AM principles, although they have asset inventories. In contrast, only 4% of the agencies that have an AM group report not using AM principles. Table 24 shows the complete comparison for the different categories. The remaining categories (on an increasing maturity scale) show more agencies in each category when the agency has an AM group. Most agencies with an AM group are either ahead in planning and have a TAMP, or are at various stages of implementation. This finding provides further evidence of the benefit of having a group to coordinate an organization's AM activities.

Having an AM group within the organization helps the agency become more AM oriented when making decisions. Table 25 shows that agencies with an AM group score higher on every category of decision-making characteristics by an average of 18%.

TABLE 22
ASSET MANAGEMENT PROGRESS AND FUTURE ACTIVITIES (MANDATE VS. NO MANDATE)

Is your agency under any type of a mandate to use transportation asset management principles?	Minimal efforts to date and little change anticipated	Developed inventories for bridge and pavements with some management capabilities being added over time	Expanding inventories beyond bridge and pavements with considerable management capabilities and integration under future consideration	Complete inventories with future activities focused on advancing asset management capabilities, training, and implementation.
Yes	0	0	9 68%	4 32%
No	0	0	22 74%	8 26%
TOTAL	0	0	31 72%	12 28%

TABLE 23
ASSET MANAGEMENT PROGRAM COMPARISON (GROUP VS. NO GROUP)

	Increasing Maturity Level			
Does your agency have an asset management group (task force) to coordinate all of the asset management activities?	Our agency supports and is planning to further integrate asset management and infrastructure preservation among a wide variety of assets and agency decision tools.	Our agency will be working to integrate AM policies in resource allocation and project selection.	Our agency is integrating AM as part of performance reporting.	Our agency is using AM to assess return on investment for infrastructure expenditures.
Yes	23 88%	22 85%	20 77%	9 35%
No	13 76%	12 71%	10 59%	5 29%
TOTAL	36 84%	34 79%	30 70%	14 33%

43 responding agencies (multiple answers allowed)

TABLE 24
STATE OF THE PRACTICE USING ASSET MANAGEMENT PRINCIPLES (GROUP VS. NO GROUP)

	Increasing Maturity Level				
Does your agency have an asset management group (task force) to coordinate all of the asset management activities?	Collect some asset information but really do not do any management.	Have begun the process of developing a TAMP but it is not complete.	Have developed a TAMP but have not begun implementation.	Have developed a TAMP and in various stages of implementation.	Have developed a TAMP and it is fully implemented into our business process.
Yes	1 4%	13 50%	1 4%	9 35%	1 4%
No	5 31%	6 38%	0 0%	4 25%	0 0%
TOTAL	6 14%	19 45%	1 2%	13 31%	1 2%

42 responding agencies

TABLE 25
DECISION-MAKING DESCRIPTION (ASSET MANAGEMENT GROUP VS. NO GROUP)

Does your agency have an asset management group (task force) to coordinate all of the asset management activities?	**Data-driven**	**Defensible**	**Integrated**	**Performance-based**
Yes	21 **91%**	19 **83%**	12 **52%**	19 **83%**
No	11 **85%**	9 **69%**	3 **23%**	8 **62%**
TOTAL	32 89%	28 78%	15 42%	26 72%

36 responding agencies (multiple answers allowed).

When comparing the AM decision-making process between agencies with an AM group versus no AM group, the agencies with an AM group have made more progress in implementing performance-based resource allocation (58% versus 35%), AM processes (46% versus 41%), and balancing preservation and capital expenditures (58% versus 41%). Table 26 provides the results for the different aspects of the decision-making process. The results show that agencies with an AM group have made greater progress when considering short- or long-term risk as part of the decision-making process.

TRANSPORTATION ASSET MANAGEMENT PROGRAM ANALYSIS

A TAMP is an essential management tool that brings together all related business processes and internal and external stake-

TABLE 26
DECISION-MAKING PROCESS (ASSET MANAGEMENT GROUP VS. NO GROUP)

Does your agency have an asset management group (task force) to coordinate all of the asset management activities?	Performance-based resource allocation	Defined process using AM for selecting projects and developing programs	Policies to balance asset preservation and capital improvements	Adequate decision making software packages and tools to support decision making	A process to share AM output information with agency/elected officials	Adequate risk assessment and management tools to support short-term decision making	Adequate risk assessment and management tools to support long-term decision making
Yes	14 58%	11 46%	14 58%	11 46%	11 46%	9 38%	6 25%
No	6 35%	7 41%	7 41%	7 41%	9 53%	1 6%	1 6%
TOTAL	20 49%	18 44%	21 51%	18 44%	20 49%	10 24%	7 17%

41 responding agencies (multiple answers allowed).

holders to achieve a common understanding and commitment to improved performance. It is a tactical-level document that focuses its analysis, options development, programs, delivery mechanisms, and reporting mechanisms on ensuring that strategic objectives are achieved (AASHTO 2011).

Of the 31 agencies having a TAMP, when asked if the participant could share their TAMP with the study team, 14 of 31 indicated that they would. Ultimately, only five agencies (Georgia, New Jersey, Nevada, Ohio, and Oregon) shared their TAMPs. When discussing the TAMP with other agencies, it was evident that even though they said that they have a TAMP, they did not have a single document describing the TAMP. Instead, they had bits and pieces of a TAMP that existed in different offices within the organization. This section provides an assessment of the provided TAMPs in terms of meeting the requirements of the 2002 *AASHTO Transportation Asset Management Guide* and in being a TAMP and not just an AM implementation plan. It does not assess whether the TAMP is satisfactory.

The 2011 *AASHTO Transportation Asset Management Guide: A Focus on Implementation* presented a typical structure for an initial TAMP that is consistent with the 2002 *AASHTO Transportation Asset Management Guide* recommendations. This structure can change depending on the available content and ultimate use of the document. The TAMP concludes not only with a TAM improvement plan for the agency, but also in identifying short- and long-term financial program needs linked to the expected life-cycles of each asset:

- Executive summary
- Introduction
- Levels of service
- Life-cycle management
- Growth and demand
- Financial management
- TAM practices
- Improvement plan
- Appendices.

A summary of the TAMPs provided by the five agencies follows.

Nevada DOT (NDOT 2009)

NDOT provided two documents as part of their AM plan. Even though NDOT stated on the survey that it had a TAMP, the documents provided were more of an AM implementation plan. The two documents (TAM Implementation Plan and TAM Strategic Plan) covered some aspects of a TAMP and included the following components:

- Executive summary
- Introduction to AM
- Improvement plan
- Gap analysis using the 2002 *AASHTO Transportation Asset Management Guide* self-assessment tool.

The NDOT AM implementation plan will consider resource allocation utilizing AM principles. Figure 5 shows the process.

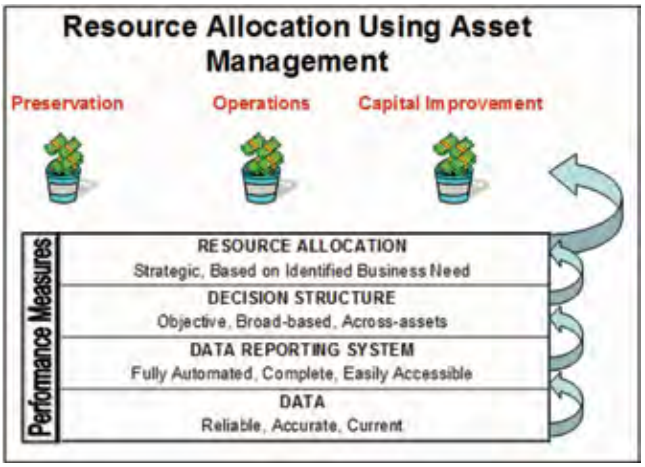

FIGURE 5 NDOT resource allocation process [*Source*: (NDOT 2011)].

This approach is in line with information gathered from other DOTs, where the TAMP does not exist as a single document that can be easily accessed, updated, and communicated. The NDOT documents are a good start, but fall short of a TAMP because they lack levels of service discussion, a life-cycle management section, and a financial management section.

Ohio DOT (Ohio DOT 2011)

The Ohio DOT is developing a TAMP; its current document is basically an AM plan. The AM plan lists eight recommendations to help the department develop and implement an AM process:

- Adopt TAM as its business process for managing critical assets and making capital investment decisions.
- Establish Asset Task Committees sponsored by the appropriate Central Office Division to establish statewide standards, procedures, and formats for a centralized asset inventory database.
- Develop a centralized AM platform for integration of all asset inventory databases to reside in a geospatial environment.
- Make a concerted effort to collect AM data directly related to supporting a "Safety First" philosophy in all aspects of transportation system development and operation.
- Leverage existing resources and new technology to enhance asset inventory collection with improved safety, efficiency, and data quality.
- Implement management systems around critical assets, with a focus on developing an integrated AM process.
- Require as-built plans and data for all future projects and establish a work order-based asset inventory updating process to ensure that the centralized asset database remains updated.
- Utilize the Department's Research and Development Program to support TAM activities.

As per the recommendations, Ohio DOT is focusing on critical assets as shown in Table 27. The list of critical assets includes pavements, bridges, safety assets (e.g., signs, guard rail, signals), and multimodal assets such as railways and ports, which shows that Ohio DOT is no longer focusing only on pavements and bridges as part of its AM plan.

As was the case with the NDOT, the Ohio DOT TAMP does not really fulfill all of the requirements as discussed in the 2002 *AASHTO Transportation Asset Management Guide* and fails to include any financial or level of service information. However, the document is a good start for an implementation plan. The focus on developing an integrated AM process will be key for further improvements.

Oregon DOT (ODOT 2011)

The updated ODOT AM strategic plan (from November 2011) is provided here: (http://www.oregon.gov/ODOT/TD/asset_mgmt/docs/plans/04-amsp-10-111711_final.pdf). An updated vision for the future of Asset Management efforts was adopted in 2010 by the Asset Management Steering Committee: ODOT makes decisions and allocates funds for stewardship of transportation infrastructure strategically, maximizing the life-cycle of each component to make the best use of constrained resources. These decisions are supported by reliable data that are collected once for use by many. Table 28 assesses the data available in terms of statewide accessibility, and shows that ODOT has been making improvements since 2005 in terms of data availability and coverage to other asset categories. ODOT is also focused on developing a technology strategy to guide the integration of asset data and decision making, as shown in Figure 6. However, this document is still more of an AM implementation plan than a TAMP.

TABLE 27
OHIO DOT CRITICAL ASSETS

Table 1: ODOT Critical Assets

HIGHWAY ASSETS	STRUCTURE ASSETS
▸ Pavement ▸ Interchanges (including ramps) and intersections ▸ Livability and environmental items, i.e., adopt-a-highway; gateway communities; endangered species; wetlands; vegetation (no mowing zones); etc.	▸ Bridges ▸ Culverts ▸ Mechanically Stabilized Earth (MSE) retaining walls ▸ Ditches ▸ Catch basins ▸ Under/edge drains
SAFETY ASSETS	**MULTIMODAL ASSETS**
▸ Barriers, i.e. Guard rails ▸ Signals ▸ Signs ▸ Lighting Systems, i.e., fixtures; poles; controllers; etc. ▸ Pavement markings, i.e., raised pavement markers (RPMs); stripping; rumble strips and stripes; sidewalks; ADA assets; etc.	▸ Railways and Yards ▸ Ports ▸ Bikeways ▸ Airport runways and Heliports ▸ Intermodal Facilities
REAL ESTATE ASSETS	
▸ Excess land (vacant parcels) ▸ Right-of-way	

[*Source:* (Ohio DOT 2011)].

TABLE 28
ODOT STATEWIDE ASSET DATA AVAILABILITY

Asset	Statewide data available in 2005?	Statewide data available now?	Required for 1R Roadside Inventory
Bridges	X	X	X
Tunnels		X	
ITS	X	X	
Pavement	X	X	
Right of Way	X	X	
Signs		X	X
Traffic Barriers		X	X
Sidewalks		X	X
ADA Ramps		X	X
Bike Facilities		X	X
Culverts 6ft and over	NBI	In progress	X
Culverts under 6ft		In progress	X
WIM Sites		X	
Sound Barriers	X	X	
Wetland Mitigation Sites		X	
Material Sources		X	
Signals and Beacons	Tri-color only	Tri-color only	
Retaining Walls		In progress	
Unstable Slopes		In progress	
Approaches		In progress	
Major Traffic Support		Just starting	
Storm Water Facilities		Just starting	
Illumination			

Statewide Accessibility	
Limited Accessibility/ Availability	
Not Available, but Efforts Underway	
Required for 1R Roadside Program	

[*Source:* (ODOT 2011)].

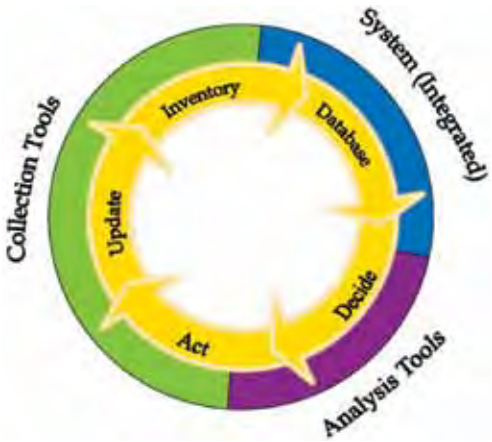

FIGURE 6 Oregon DOT AM technology strategy/integration [*Source*: (ODOT 2011)].

New Jersey DOT (NJDOT 2010)

The NJDOT document is the highest-level summary that is supported by a number of more detailed documents for each subject matter area (in some cases, asset specific), which are called tactical plans. The NJDOT is looking to update its TAMP in the near future to reflect the changes that have taken place since 2010 and to assess the impact of its 2011–2020 investment plan.

The NJDOT TAMP includes all the components discussed in the 2002 *AASHTO Transportation Asset Management Guide*, and includes the following sections:

- Executive summary
- Introduction
- Assets owned
- Level of service provided (by asset)
- Demand/growth (utilizing regional planning models)
- Life-cycle management plan
- Financial summary.

Figure 7 shows the NJDOT Capital Investment Strategy targets, with projected and actual programmed dollars for all categories: bridge assets, road assets, congestion relief, mass transit, local support, multimodal, airports, and safety.

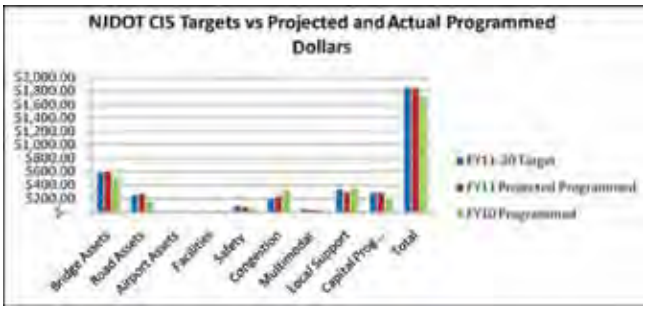

FIGURE 7 NJDOT programmed dollars [*Source*: (NJDOT 2010)].

NJDOT developed a life-cycle management plan for each class of assets. The life-cycle management plan is a strategy to reach or maintain desired or targeted performance levels while minimizing long-term costs. These strategies outline maintenance, rehabilitation, and replacement plans. The life-cycle management plan should also consider the system expansion needs, though it does not apply to service invest-

ments such as safety and congestion. Table 29 shows the life-cycle management plan for structures and roads.

TABLE 29
NJDOT LIFE-CYCLE MANAGEMENT PLAN BY ASSET

Asset Class	Subclass	Service Life	Lifecycle Management Strategy Maturity Level	Asset Replacement Value
Structural Assets	Major Viaducts	50 years	Developing	$6.2 B
	Movable Bridges	50 years	Developing	$12 B
	Standard Bridges	50 years	Developing	$10 B
	Minor Bridges	50 years	Non-existent	$221 M
	Dams	50 years	Non-existent	$62 M
	Overhead Sign Structures		Non-existent	$285 M
	High Mast Light Poles		Non-existent	$16 M
Road Assets	Pavements	20 years	Developing	$19 M
	Drainage	N/A	Developing	N/A
	Guiderail	12 years	Developing	$132 M
	Signs	7 years	Developing	$34 M
	Traffic Signals	25 years	Developing	$461 M

[*Source:* (NJDOT 2010)].

NJDOT's annual capital program totals approximately $2.1 billion. About $2.0 billion of the capital revenues are provided through federal and state formula funding, and the remaining $0.1 billion is provided through special federal high-priority project funding or other sources. These funding levels are not predictable over an extended period.

NJDOT assumes for its 10-year capital planning process that the federal funding act will be renewed in federal fiscal year 2010, and also assumes a 3% per year increase. As for the State Transportation Trust Fund, NJDOT is projecting that it will be renewed in state fiscal year 2012 at the same level with no annual inflation increase.

Given these assumptions, NJDOT established a 10-year annual revenue level of $2.101 billion, as shown in Table 30. The table shows the investment category, annual investment target, and percentage of the budget for each category. It is part of the NJDOT financial summary, as described in the TAMP.

TABLE 30
NJDOT INVESTMENT STRATEGY FOR 2011 TO 2020

Investment Category	Annual Investment Target	Percent
Structural Assets	$605,000,000	33%
Local System Support	$340,000,000	19%
Capital Program Delivery	$290,000,000	14%
Road Assets	$257,000,000	14%
Congestion	$200,000,000	11%
Safety Investments	$97,000,000	5%
Multimodal Investments	$45,000,000	2%
Transportation Support Facilities	$20,000,000	1%
Aviation	$7,000,000	1%

[*Source:* (NJDOT 2010)].

In summary, the NJDOT document is a true representation of what a TAMP should include. This assessment does not cover whether the level of service targets or investment plans are adequate; rather, it assesses the TAMP components recommended by the 2002 *AASHTO Transportation Asset Management Guide.*

Georgia DOT 2011

The Georgia DOT TAMP is available online (http://www.dot.ga.gov/aboutGeorgiadot/Documents/Asset%20Management/TAM.pdf), and an updated edition will be available online by the end of 2012 (http://www.dot.ga.gov/aboutGeorgiadot/Pages/AssetManagement.aspx). It addresses all aspects of what a TAMP might include:

- Executive summary
- Introduction
- Levels of service
- Risk management
- Life-cycle management (pavements, bridges, and signs)
- Financial summary.

Table 31 shows the Georgia DOT TAMP's broad asset groups and values. The groups are not limited to physical assets; the summary includes facilities, vehicle and equipment, and IT equipment in addition to ITS infrastructure. The data provide a summary of the quantity, measure, and financial worth. This is part of the report's stewardship and life-cycle management section.

TABLE 31
GEORGIA DOT BROAD ASSET GROUPS AND THEIR VALUES

ACTIVITY	ASSET COMPONENTS	QUANTITY	MEASURE	FINANCIAL WORTH
Vehicle Network	Road Pavements	18,903	Miles	
	Road Bridges	6,602	Number	
	Freight Track	540	Miles	
Facilities[1]	Welcome Centers	12	Number	$ 14,617,105
	Rest Areas	22	Number	$ 21,130,891
	District Offices	96	Number	$156,516,312
	Area Offices	79	Number	$ 45,627,537
	Maintenance Offices	275	Number	$ 93,782,884
	Storage facilities	683	Number	$ 8,480,965
	TMCs	2	Number	$ 38,973,409
Network Control and Management	Traffic Signals	8.5 (est.)	Pieces	$350,000,000
	Traffic Signs			
	Road Markings			
Parking	Park & Ride Lots	14	Locations	$ 48,465,804
	Xpress Stations			
Vehicles and Equipment	Vehicles and Equipment	8,657	Pieces	$ 39,586,908
IT Equipment	Server Equipment	640	Pieces	$ 1,544,992
	Network Equipment	369	Pieces	$ 682,640
	Workstations	5,100	Pieces	$ 5,387,408
	Printers	684	Pieces	$ 237,695
	VoIP	1,357	Pieces	$ 450,000

[*Source:* (Georgia DOT 2011)].

As part the life-cycle management plan, the TAMP addresses the following aspects for each asset:

- Asset description
- Performance and service levels
- Plan to achieve performance levels
- Asset inventory
- Key issues
- Asset value (Table 32 shows the asset value for pavements by strategic objective. This helps the DOT

TABLE 32
GEORGIA DOT ASSET VALUE FOR PAVEMENTS

Strategic Objective	Total centerline (miles)	Total lane miles	Cost per lane mile	Total asset value (total lane miles) *
Interstates with 50,000 or more ADT at a COPACES Rating of 80 or more	536 (assumed 8 lanes)	4,288	$1,214,500 (major rehab)	**$5,207,776,000**
All other Interstates at a COPACES Rating of 75 or more	707 (assumed 4 lanes)	2,828	$1,214,500 (major rehab)	**$3,434,606,000**
Multi-lane non-interstate routes with an ADT of 25,000 or more at a COPACES Rating of 75 or more	651 (assumed 4 lanes)	2,604	$553,805 (major rehab)	**$1,442,108,220**
Other routes at a COPACES Rating of 70 or more	16,083 (assumed 2 lanes)	32,166	$553,805 (major rehab)	**$17,813,691,630**

** The Worth and Asset Value columns consider asphalt rehab only. Total asset values as of September 2010.*
[*Source*: Georgia DOT 2011].

in determining their needs that become part of their investment strategy)
- Remaining life
- Risk
- Revenue plan (Figure 8 shows the bridges revenue plan from 2001 to 2010. The figure shows how annual revenue needs far exceed budget for multiple years in this period.)
- Data reliability
- Improvement plan.

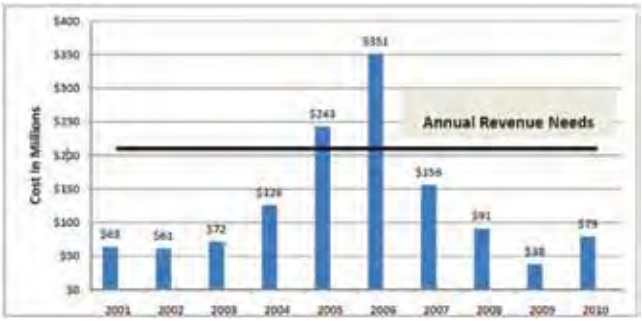

FIGURE 8 Georgia DOT revenue plan for bridges [*Source*: (Georgia DOT 2011)].

Summary

Out of the five agencies that provided what they termed their TAMP documents, only two (New Jersey and Georgia) provided TAMPs that are a good example of what a TAMP should be, according to the 2002 *AASHTO Transportation Asset Management Guide*. The remaining three agencies provided documents that are closer to implementation plans or strategic plans to initiate comprehensive AM practices within their agencies. The material in these plans is encouraging as they are focusing on more than pavement and bridges, and consider integration, communication, and effective decision making.

OUTREACH ACTIVITIES ANALYSIS

To assess the impact of training and outreach activities on advancing AM practice among the state agencies, a comparison was made among agencies that attended the most recent AM conference in San Diego in April 2012 and the previous AM conference in Portland, Oregon, in 2009. A total of 26 DOTs attended the Portland meeting, compared with 34 that attended the San Diego meeting. Of the 36 DOTs represented in San Diego in 2012, 24 attended the 2009 Portland meeting.

Table 33 shows the comparison between agencies attending the AM conferences and AM state of the practice. It is interesting to observe that all but one of the agencies (11 of 12) that reported that they have complete inventories with future activities focused on advancing AM capabilities, training, and implementation have attended one or both conferences.

When looking at AM implementation, Table 34 shows that among the six agencies that have not attended either of the last two AM conferences, four (66%) reported that they "collect some asset information but don't do any management." Only two (5%) of the agencies that attended the AM conference have reported the same thing. In constrast, 10 of the 13 agencies that have developed a TAMP and are in various staging of implementing AM have attended the AM conference.

Those differences may indicate that agencies that are developing and implementing AM look to these events to share knowledge, seek expert advice from other attendees, and learn what other agencies are doing to implement AM. An increasing level of awareness of AM at all levels leads to increased interest in AM, which helps agencies further understand the basic concepts of AM and why it is important. This in turn leads to more agencies adopting AM as a way of doing business.

TABLE 33

IMPACT OF TRAINING/OUTREACH ON AM STATE OF PRACTICE

State	2009 Portland	2012 San Diego	Q9. Our AM progress to date and anticipated activities over the next two to five years can be best summarized by ... Expanding inventories beyond bridge and pavements with considerable management capabilities and integration under future consideration	Q9. ... Complete inventories with future activities focused on advancing asset management capabilities, training, and implementation.
AK	Yes	Yes	Yes	
AL			Yes	
AR	Yes		Yes	
AZ			Yes	
CA	Yes	Yes		Yes
CO		Yes	Yes	
CT	Yes	Yes	Yes	
DE		Yes		Yes
FL		Yes		Yes
GA		Yes	Yes	
IA	Yes	Yes	Yes	
ID		Yes	Yes	
IL	Yes	Yes	Yes	
IN	Yes	Yes	Yes	
KS		Yes	Yes	
KY	Yes	Yes	Yes	
LA	Yes	Yes	Yes	
MD	Yes	Yes		Yes
MI	Yes	Yes	Yes	
MN	Yes	Yes	Yes	
MO	Yes	Yes		Yes
MS	Yes	Yes	Yes	
MT		Yes		Yes
NC	Yes	Yes		Yes
ND	Yes	Yes	Yes	
NE			Yes	
NH			Yes	
NJ			Yes	
NY	Yes	Yes	Yes	
OH	Yes	Yes	Yes	
OR	Yes	Yes		Yes
PA		Yes		Yes
RI		Yes	Yes	
SC			Yes	
SD	Yes		Yes	
TN				Yes
TX		Yes	Yes	
UT	Yes	Yes		Yes
VA	Yes	Yes	Yes	
VT	Yes	Yes	Yes	
WA	Yes	Yes	Yes	
WI	Yes	Yes		Yes
WY	Yes	Yes	Yes	
	Yes	26	34	31	17

TABLE 34

IMPACT OF TRAINING/OUTREACH ON PROGRESS WITH ASSET MANAGEMENT IMPLEMENTATION

State	2009 Portland	2012 San Diego	Q11. My state highway agency's status of progress on the use of asset management principles can be best summarized by ... Collect some asset information but really do not do any management.	Q11. ... Have begun the process of developing a TAMP but it is not complete.	Q11. ... Have developed a TAMP but have not begun implementation.	Q11. ... Have developed a TAMP and is in various stages of implementation.	Q11. ... Have developed a TAMP and it is fully implemented into our business process.	Q11. Other
AK	Yes	Yes		Yes				
AL						Yes		
AR	Yes			Yes				
AZ				Yes				
CA	Yes	Yes		Yes				
CO		Yes		Yes				
CT	Yes	Yes		Yes				
DE		Yes	Yes					
FL		Yes						Yes
GA		Yes			Yes			
IA	Yes	Yes		Yes				
ID		Yes		Yes				
IL	Yes	Yes						
IN	Yes	Yes				Yes		
KS		Yes		Yes				
KY	Yes	Yes	Yes					
LA	Yes	Yes		Yes				
MD	Yes	Yes				Yes		
MI	Yes	Yes						Yes
MN	Yes	Yes		Yes				
MO	Yes	Yes				Yes		
MS	Yes	Yes	Yes					
MT		Yes				Yes		
NC	Yes	Yes				Yes		
ND	Yes	Yes		Yes				
NE						Yes		
NH				Yes				
NJ						Yes		
NY	Yes	Yes				Yes		
OH	Yes	Yes				Yes		
OR	Yes	Yes				Yes		
PA		Yes		Yes				
RI		Yes	Yes					
SC			Yes					
SD	Yes			Yes				
TN			Yes					
TX		Yes		Yes				
UT	Yes	Yes				Yes		
VA	Yes	Yes		Yes				
VT	Yes	Yes		Yes				
WA	Yes	Yes		Yes				
WI	Yes	Yes					Yes	
WY	Yes	Yes				Yes		
	Yes	26	34	4	19	1	13	1	2

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

OVERALL FINDINGS

The financial impact of asset management (AM) touches every aspect of an organization. Even with the potential positive benefits, it is a considerable challenge to change a transportation agency's culture to initiate, embrace, and ultimately integrate transportation asset management (TAM) principles. Although the emergence of champion agencies using TAM principles is limited, the level of interest among state departments of transportation (DOTs), federal agencies, professional organizations, and the research community has been steadily increasing. Given the growing level of interest, and the recent Moving Ahead for Progress in the 21st Century Act (MAP-21 Act) performance-based reauthorization, this synthesis of TAM practice among state highway agencies is a timely resource for any agency trying to identify where it may want to focus its AM efforts.

The state-of-the-practice information in this synthesis report was obtained primarily through two separate web-based agency surveys, with additional input from practitioners. The initial survey requested that participants conduct a self-assessment to characterize their AM practices. The self-assessment results provide a reflection on current and future (5 years) business practices and the agencies' institutional, organizational, financial, and information technology environments. This survey yielded 18 DOT participant responses.

Based on the results of the initial survey and input from the Topic Panel, a second state-of-the-practice survey questionnaire was developed, pre-tested among state DOT members on the Topic Panel, revised, and distributed to DOTs in a web-based format. This survey was designed to capture the existing state of the practice and the agency's forward-looking expectations (for the next 3 to 5 years). This second survey yielded 43 state DOT responses.

The survey results can be summarized based on the basic building blocks for an AM system, which were used in this report to develop a maturity scale.

Organization

Sixty percent of the agencies have an AM group. Even though the composition of these groups is dominated by major asset managers, top executives are represented in more than 30% of the groups. Fifteen percent of the responding agencies have created separate divisions within their organization to support AM activities. Having an AM group, executive involvement, and an AM structure within the organization is helpful to support AM activity development, implementation, and practice.

Data

AM inventories have expanded beyond the traditional pavement and bridge assets; over 70% of the agencies report collecting signs, guardrail, culverts, and lighting information. In addition, over 50% of the agencies are conducting condition assessments, which can support investment analysis for project selection and resource allocation recommendations.

Decision Making

Over 70% of the responding agencies noted that since they have started using AM principles, their decisions are more data-driven, defensible, and performance-based. Sixty percent of the agencies are balancing AM preservation and capital improvements, which is a critical component of developing a sustainable infrastructure. Fifty percent of the agencies have developed a process to share AM information with elected and appointed officials, which is critical for communicating investment needs and adding transparency to the decision-making process and trade-offs. Even though agencies are collecting data beyond pavements and bridges, they continue to need to use this information in the decision-making process. For example, more than 90% of the agencies are using AM information to select bridge and pavement projects; however, for other assets (e.g., maintenance, operations, safety), this number drops below 40%.

Performance Measures and Risk

The primary performance measures that drive agency decision making are physical condition (98%) and safety (90%). However, both operations and capacity were reported as decision-making drivers in more than half of the agencies, 57% and 50%, respectively. Only 27% of the respondents incorporate risk into their short-term decision making, and it is normally associated with costs and schedules. Only 19% of agencies consider long-term risk in their decision making, which includes design, sustainability, and climate change.

Transportation Asset Management Plan

Of the five agencies that provided what they termed their Transportation Asset Management Plan (TAMP) documents, only two (New Jersey and Georgia) have provided TAMPs that are a good example what a TAMP, should be according to the 2002 *AASHTO Transportation Asset Management Guide*. The remaining three agencies provided more of an implementation plan or a strategic plan to initiate the practice of AM at a comprehensive level within their agencies. Regardless, content within these plans is encouraging as they are focusing on more than just pavement and bridges, and are considering integration, communication, and effective decision making.

FURTHER RESEARCH

Work on this synthesis has identified several gaps in current knowledge that could be addressed by the following research:

- A common language is needed for AM functions, practices, and processes. The results from the AM state-of-the-practice survey highlighted a few areas where there is no common understanding of the terminology. One example is the TAMP; of the five received through the synthesis, only two were actual TAMPs with all required parts.
- Self-Assessment Tool. The 2002 *AASHTO Transportation Asset Management Guide* introduced the self-assessment so that agencies can plan their next moves in implementing AM. The self-assessment tool needs to be modified to reflect changes resulting from new research since 2002, the new *AASHTO Transportation Asset Management Guide*: A Focus on Implementation (2011), and current state DOT practices. The new self-assessment tool should be in electronic format, preferably web-based, that not only allows the agency to gather input from their staff but also provides analysis capabilities as part of the presentation of the results. Future NCHRP Project 08-90, "Development of a Transportation Asset Management Gap Analysis Tool to Complement the *AASHTO TAM Implementation Guide*," could address some of the research issues listed here.
- Risk assessment. As highlighted in the AM state-of-the-practice survey, risk is an activity that needs more short- and long-term focus. A synthesis of risk assessment practices in an AM perspective would help identify current agency practices and future research needs in this area.
- A study of the use of performance measures in AM. With MAP-21 and the recent creation of the FHWA Office of Transportation Performance Management, it will be useful to investigate this topic by developing case studies on how some agencies are using this concept.
- Develop case studies on best practices addressing different categories of the maturity scale presented in this synthesis (i.e., organization structure, data, decision making, performance measures, risk).
- Conduct a domestic scan of the agencies that scored high on the different maturity categories.

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APPENDIX A

Survey Questions

NCHRP Synthesis 43-01: Use of TAM Principles in State Highway Agencies—Main Survey

About the Survey

Dear *[contact("first name")] [contact("last name")],*

The Transportation Research Board (TRB) is preparing a synthesis on the "Use of Transportation Asset Management (TAM) Principles in State Highway Agencies." This is being done for the NCHRP synthesis program, under the sponsorship of the American Association of State Highway and Transportation Officials, in cooperation with the Federal Highway Administration.

This synthesis will help document TAM state of practice and the extent to which agencies have shifted their organizational cultures and business processes to support performance-based decisions that consider long-term investment options based on quality data.

To complete the synthesis of TAM practices, two questionnaires will be conducted. The initial covered the self-assessment from the first volume of the AASHTO AM Guide. The second survey, attached, is a comprehensive questionnaire on the use of TAM covering a variety of assets other than just pavements and bridges.

The synthesis report will focus on the practices of state highway agencies from the questionnaires results, follow-up interviews, and a focus group meeting at the TAM Conference in San Diego in April of 2012. The report will include examples of how mature practices have been used for a variety of assets, including roadway hardware (e.g., signs and guardrails), ITS, bridges, and pavements.

This questionnaire is being sent to all of the state DOT's AM contact list. If you are not the appropriate person at your agency to complete this questionnaire, please forward it to the correct person. This should represent a collective response from each DOT. If needed, please consult other staff from different offices. Your cooperation in completing the questionnaire will ensure the success of this effort.

Please complete and submit this questionnaire by *March 20, 2012*. We estimate that it should take approximately *30 minutes* to complete the questionnaire. If you have any questions, please contact our principal investigator, Omar Smadi at smadi@iastate.edu or 515 294-7110. Any supporting materials can be sent directly to Omar Smadi by e-mail or at the address shown at the end of the questionnaire.

Thank you very much for your time and cooperation.

Jon Williams

NCHRP Topic 43-01 Survey Questionnaire

Asset management principles have been used by several highway agencies, but there is little information on comparative experience or on best practices to help other states with developing/implementing these principles. This questionnaire is part of the effort in NCHRP Synthesis Topic 43-01 to gather information on state highway agencies' perspectives on the use of asset management principles. Trial use in a survey pre-test shows that the questionnaire can be easily completed within 30 minutes.

The following definitions are used in this questionnaire (AASHTO Asset Management Guide: A Focus on Implementation):

Asset: the physical transportation infrastructure (e.g., travel way, structures, other features and appurtenances, operations systems, and major elements thereof); more generally, can include the full range of resources. An individual separately managed component of the infrastructure; e.g., bridge deck, road section surface, streetlight, sign, etc.

Asset Management: a strategic approach to managing transportation infrastructure. It focuses on business processes for resource allocation and utilization with the objective of better decision making based upon quality information and well-defined objectives.

Transportation Asset Management Plan (TAMP): is an essential management tool which brings together all related business processes and stakeholders, internal and external, to achieve a common understanding and commitment to improved performance. It is a tactical-level document, which focuses its analysis, options development, programs, delivery mechanisms, and reporting mechanisms on ensuring that strategic objectives are achieved.

Implementation Plan: is the process by which a state DOT starts implementing the TAMP.

Please enter your contact information.

First Name*: _____

Last Name*: _____

Title*: _____

Agency/Organization*: _____

Street Address*: _____

Suite: _____

City*: _____

State*: _____

Zip Code*: _____

Country: _____

E-mail Address*: _____

Phone Number*: _____

Fax Number: _____

Mobile Phone: _____

URL: _____

The information provided in this survey will be shared as a part of the NCHRP 20-05/43-01 report on "Use of Asset Management Principles in State Highway Agencies."

In case of questions and for NCHRP to send you a link to the final report, please provide:

Tel: _____

E-mail: _____

State of the Practice—General

1) Is your agency under any type of a mandate to use transportation asset management principles?

( ) Yes

( ) No

Please specify the type of mandate you have to use transportation asset management principles (Legislature, Department head, etc.)

_____

2) Does your agency have an asset management group (task force) to coordinate all of the asset management activities?

( ) Yes

( ) No

Please provide a brief description of the task force (offices involved, modes included, etc.):

_____

State of the Practice—Inventory

3) Does your agency have an asset inventory?

( ) Yes

( ) No

_____

If so, please indicate which assets are currently included within the inventory (check all that apply).

[ ] Pavements

[ ] Bridges

[ ] Culverts

[ ] Signs

[ ] Pavement Markings

[ ] Guardrail

[ ] Roadway Lighting

[ ] Tunnels

[ ] Earth Retaining Walls

[ ] Other

Other Assets in the Inventory

_____

4) How often do you conduct condition surveys for each asset?

	Annual	Semi-annual	Random	Other
Pavements	( )	( )	( )	( )
Bridges	( )	( )	( )	( )
Culverts	( )	( )	( )	( )
Signs	( )	( )	( )	( )
Pavement Markings	( )	( )	( )	( )
Guardrail	( )	( )	( )	( )
Roadway Lighting	( )	( )	( )	( )
Tunnels	( )	( )	( )	( )
Earth Retaining Walls	( )	( )	( )	( )

---

5) How are the data collected for each asset?

	Manual	Automated	Semi-Automated	Other
Pavements	( )	( )	( )	( )
Bridges	( )	( )	( )	( )
Culverts	( )	( )	( )	( )
Signs	( )	( )	( )	( )
Pavement Markings	( )	( )	( )	( )
Guardrail	( )	( )	( )	( )
Roadway Lighting	( )	( )	( )	( )
Tunnels	( )	( )	( )	( )
Earth Retaining Walls	( )	( )	( )	( )

6) Has your agency identified primary AM data needs across the organization?

( ) Yes

( ) No

7) Does your agency have a process to assess the quality of the collected data (QC/QA)?

( ) Yes

( ) No

8) Does your agency have a data integration effort?

( ) Yes

( ) No

State of Practice—AM Activities

9) Our AM progress to date and anticipated activities over the next two to five years can be best summarized by:

( ) Minimal efforts to date and little change anticipated

( ) Developed inventories for bridge and pavements with some management capabilities being added over time

( ) Expanding inventories beyond bridge and pavements with considerable management capabilities and integration under future consideration

( ) Complete inventories with future activities focused on advancing asset management capabilities, training, and implementation.

10) Our AM program includes the following (check all that apply):

[ ] Our agency supports and is planning to further integrate asset management and infrastructure preservation among a wide variety of assets and agency decision tools.

[ ] Our agency will be working to integrate AM policies in resource allocation and project selection.

[ ] Our agency is integrating AM as part of performance reporting.

[ ] Our agency is using AM to assess return on investment for infrastructure expenditures.

State of Practice—Management Process

11) My state highway agency's state of practice on the use of asset management principles can be best summarized by:

( ) Collect some asset information but really do not do any management.

( ) Have begun the process of developing a TAMP, but it is not complete.

( ) Have developed a TAMP but have not begun implementation.

( ) Have developed a TAMP and in various stages of implementation.

( ) Have developed a TAMP and it is fully implemented into our business process.

( ) Other

12) Some of the major barriers faced toward development and implementation of a AM process (current or in the past) include(s) (check all that apply):

[ ] Executive commitment

[ ] Staff commitment

[ ] Resistance to change

[ ] Lack of resources (data, equipment, etc.)

[ ] Lack of staff

[ ] Staff turnover

[ ] Lack of expertise and training

[ ] Lack of guidance/support from FHWA and/or AASHTO

[ ] Inter-departmental interactions

[ ] Higher/other priorities

[ ] Outside pressure to have a subjective approach

[ ] Availability of adequate tools in the marketplace

---

13) A TAMP is an essential management tool which brings together all related business processes and stakeholders, internal and external, to achieve a common understanding and commitment to improved performance. It is a tactical-level document, which focuses its analysis, options development, programs, delivery mechanisms, and reporting mechanisms on ensuring that strategic objectives are achieved.

Given the above definition, please check all that apply:

[ ] Our TAMP is kept up to date and serves as a resource document on a regular basis

[ ] Our TAMP is used for both short- and long-term planning efforts

[ ] Neither

14) Can you share a copy of your TAMP with the research team?

( ) Yes

( ) No

---

15) Please characterize your agency's efforts in working with decision makers and other stakeholders to incorporate the TAMP as part of your business processes.

( ) Minimal effort to integrate TAMP into business processes

( ) Status quo with no real changes or initiatives over the last couple of years

( ) Active with efforts across multiple departments and business units

16) Since using AM our agencies decisions are more (please check all that apply):

[ ] Data-driven

[ ] Defensible

[ ] Integrated

[ ] Performance-based

State of Practice—Staffing

17) My state highway agency's state of practice on staffing and support for TAMP activities can be best summarized by (please check all that apply):

[ ] My agency has an identified AM champion

[ ] My agency has developed strategies to promote AM

[ ] My agency has an AM implementation task force

[ ] Our AM efforts are led by mid-level management

[ ] Our AM efforts are led by top-level management

State of Practice—Performance Measures

18) The key asset performance data, which drive decision making across the organization, include (check all that apply):

[ ] Physical condition

[ ] Safety

[ ] Environment

[ ] Operations

[ ] Capacity

[ ] Risk Assessment

[ ] Other

_____

Other key asset performance data

Please list the other key asset performance data, which drive decision making:

_____

19) Our agency's TAMP includes the following (please check all that apply):

[ ] A long-range plan specific asset performance criteria which guides capital program development

[ ] A process to review and update these asset performance targets along with the limitations of data collection and decision making

[ ] Forecasting capabilities for asset performance

[ ] Verification process to check that forecasts provide realistic projections of system deficiencies

[ ] Process to align asset management practices with the performance measures

_____

State of Practice—Decision Making

20) Which types of projects are selected based on AM systems and performance measures (check all that apply):

[ ] Pavements

[ ] Bridges

[ ] Maintenance

[ ] Operations

[ ] Safety

[ ] Capital Improvements

[ ] Other

21) Our current agency decision making includes (check all that apply):

[ ] Performance-based resource allocation

[ ] Defined process using AM for selecting projects and developing programs

[ ] Policies to balance asset preservation and capital improvements

[ ] Adequate decision-making software packages and tools to support decision making

[ ] A process to share AM output information with agency/elected officials

[ ] Adequate risk assessment and management tools to support short-term decision making

[ ] Adequate risk assessment and management tools to support long-term decision making

_____

APPENDIX B

Survey Participants

SELF-ASSESSMENT SURVEY (18 agencies)

Agencies marked with the ▶ completed only the self-assessment survey

California Department of Transportation
Colorado Department of Transportation
Connecticut Department of Transportation
Idaho Transportation Department
Iowa Department of Transportation
Louisiana Department of Transportation and Development
Maryland State Highway Administration
Michigan Department of Transportation
Minnesota Department of Transportation
New York State Department of Transportation ▶
North Carolina Department of Transportation
North Dakota Department of Transportation
Oklahoma Department of Transportation ▶
Oregon Department of Transportation
Pennsylvania Department of Transportation
Vermont Agency of Transportation
Virginia Department of Transportation
Wyoming Department of Transportation

AM PRACTICES SURVEY (43 agencies)

*Agencies marked with the * completed both surveys*

Alabama Department of Transportation
Alaska Department of Transportation
Arizona Department of Transportation
Arkansas State Highway and Transportation Department
California Department of Transportation*
Colorado Department of Transportation*
Connecticut Department of Transportation*
Delaware Department of Transportation
Florida Department of Transportation
Georgia Department of Transportation
Idaho Transportation Department*
Illinois Department of Transportation

Indiana Department of Transportation*
Iowa Department of Transportation
Kansas Department of Transportation
Kentucky Transportation Cabinet
Louisiana Department of Transportation and Development*
Maryland State Highway Administration*
Michigan Department of Transportation*
Minnesota Department of Transportation*
Mississippi Department of Transportation
Missouri Department of Transportation
Montana Department of Transportation
Nebraska Department of Roads
Nevada Department of Transportation
New Hampshire Department of Transportation
New Jersey Department of Transportation
North Carolina Department of Transportation*
North Dakota Department of Transportation*
Ohio Department of Transportation
Oregon Department of Transportation*
Pennsylvania Department of Transportation*
Rhode Island Department of Transportation
South Carolina Department of Transportation
South Dakota Department of Transportation
Tennessee Department of Transportation
Texas Department of Transportation
Utah Department of Transportation
Vermont Agency of Transportation*
Virginia Department of Transportation*
Washington Department of Transportation
Wisconsin Department of Transportation
Wyoming Department of Transportation*

APPENDIX C

Agency Survey Responses

State/Agency	Q1. AM Mandate	Q2. AM Task Force
AK	No	Yes
AL	Yes	Yes
AR	No	No
AZ	No	No
CA	No	Yes
CO	Yes	Yes
CT	Yes	Yes
DE	No	No
FL	No	No
GA	No	Yes
IA	Yes	Yes
ID	No	Yes
IL	No	No
IN	No	Yes
KS	No	No
KY	No	Yes
LA	No	Yes
MD	Yes	Yes
MI	Yes	Yes
MN	No	Yes
MO	No	No
MS	No	No
MT	Yes	Yes
NC	Yes	No
ND	Yes	Yes
NE	No	No
NH	No	Yes
NJ	No	Yes
NV	No	Yes
OH	No	Yes
OR	No	Yes
PA	No	Yes
RI	No	No
SC	No	No
SD	No	Yes
TN	Yes	No
TX	No	No
UT	No	Yes
VA	Yes	No
VT	Yes	No
WA	Yes	Yes
WI	No	Yes
WY	No	No

Total	43	43
Yes	13	26
No	30	17

State/Agency	Q1. AM Mandate (description)
AL	Self-imposed within the Maintenance Bureau of ALDOT to better manage and inventory our assets.
CO	FASTER legislation in Colorado requires that CDOT - through its Bridge Transportation Enterprise - repair or reconstruct bridges in poor condition with dedicated user fees.
CT	Department Policy Statements: Policy on Roadway Pavement Management, and Policy on Transportation Infrastructure Performance Management
IA	Department Director
MD	Federal Funds for some programs require an Asset Management Data Driven Approach
MI	Legislated mandate on the formation of a Transportation Asset Management Council (TAMC) in 2007 (PA 199, 2007). The Transportation Asset Management Council (TAMC) was established to expand the practice of asset management statewide to enhance the productivity of investing in Michigan roads and bridges. Part of the TAMC's mission is to collect physical inventory and condition data on all roads and bridges in Michigan.
MT	MDT's asset management program (termed the Performance Programming Process) was created to address numerous "mandates" from state, federal and local entities. As such, it serves as a linkage between various long range plans, federal directives, state laws and other interests.
NC	Entire state government moving toward performance based management. NCDOT was doing performance based maintenance before this mandate and became a model for other state agencies. NCDOT's performance based maintenance approach also became a model for the Department leaders as they pushed asset management principles throughout the organization.
ND	NDDOT Director
TN	Required to participate in National Bridge Inventory and Highway Condition Survey for FHWA. We also use remaining service life in our pavement management analysis.
VA	Code of Virginia Statutory Requirements (State Law): Section 33.1-23.2 provides the definition of maintenance, operations, and asset management and requires VDOT to adopt an asset management approach to assess its
VT	Legislative
WA	Legislative Direction in Revised Code of Washington, Chapter 47, Section 05 - Priority Programming for Highway Development

State/Agency	Q2. AM Task Force (description)
AK	Deputy Commissioner for Highways, Deputy Commissioner for Aviation, Deputy Comm. for Marine Transportation, Chief Engineer, Statewide Maint. & Operartions Chief, Division Director - Program Development Division Director - Admin. Services Division Director - Central Region Office
AL	It starts within the Maintenance Bureau specifically in the Management Section with some responsibilities delegated down to division offices.
CA	All State Highway Operation and Protection Program (SHOPP) Divisions, as well as representatives from Strategic Planning.
CO	An informal task force jointly led by Staff Branches under the Chief Engineer and the Division of Transportation Development meet monthly in development of a Multi Asset Management System. Other divisions such as Finance and IT also attend. Individual asset categories, such as Bridge or Pavement, have used asset-specific groups for more than a decade. Modes included are highways.
CT	Organizationally this task is assigned to the Infrastructure Performance Management Unit located in the Bureau of Policy and Planning. However, with limited staffing, work on this task has been limited. The Department has also established a Standing Committee on Performance Measures.
GA	OPM (Organizational Performance Management) is a small unit created 2 years ago tasked with Asset Management, Performance Management and Strategic Planning. Task have include development of Strategic Plan based on AM principles, launch of an Agency Dashboard, development of an AM strategy and acquisition of consultant to further efforts.
IA	Design, Bridge Design, Traffic and Safety, Motor Vehicle, Planning, District, Information Technology, Finance
ID	Effort involves several sub-groups that report to the Chief Engineer. To date the efforts are concentrated on highway issues (roads, bridges, equipment).
IN	There is an oversight team, made up principally of Department directors who meet weekly -- more often at certain times of the year's cycle, for certain events -- to discuss progress, challenges & opportunities, enhancements, etc.
KY	State Highway Engineer's Office, Division of Maintenance, Division of Planning, Division of Traffic Operations
LA	TAM Steering Committee: Management and Finance, Engineering, Multimodal Planning, Road and Bridge Design, Statewide maintenance, ITS, IT, Districts, Traffic Engineering,
MD	Our Asset Management Steering committee includes representatives from several offices, such as, planning, maintenance, traffic, pavement and structures. The main purpose of this committee is to assist in the progress and process of using asset management principals as they relate to the assets they manage.
MI	TAMC is a legislated body of representatives from agencies who own roads or are responsible for road funding; representation is from all levels of government in Michigan. The TAMC has focused on pavement and bridge to date. The MDOT Asset Management Division provides expertise and staff support to the council with backing and guidance from MDOT director.
MN	We have a working group that is developing a framework. We have representation from data management, IT, maintenance, risk management, performance management, finance, district staff, and department leadership.
MT	The Project Analysis Bureau, within MDT's Planning Division, provides the primary direction for asset management. However, other MDT Divisions provide input (data, information, etc.) utilized in the P3 Process. Additional, all strategic intiatives route through MDT Management (Director's Office, etc.) and concurrence is gained through partners (such as FHWA, locals, etc.).
ND	The Department has a Division dedicated to Asset Management, similar to other divisions (Construction, Bridge, Design, etc.)
NH	There used to be a very active asset management group that was more focused on identifying critical assets to be collecting inventory and condition for. The group was made up project development and operations managers and staff, but lacked the ability to directly assign resources to make work efforts priorities. A more recent leaner Asset Management task force is reviewing NH's overall approach to asset management in relation to other states to assess our overall approach and progress. This new group is currently made up of upper level management staff.
NJ	NJDOT has an Asset Management Steering Committee made up of Senior Leaders to establish Asset Management goals and to guide policy relating to Asset Management.
NV	Strategic Data Group (various divisions) and Maintenance and Asset Management. Office
OH	The Asset Management Leadership group is a multi-disciplinary group made up of the various ""Business Owners"" in the department. This group includes representation from, planning, pavement, bridge, safety, hydraulics, maintenance, construction, long range planning (modes) etc.
OR	Asset Management Integration Section serves to facilitate and coordinate efforts across ODOT; current emphasis is on highway assets, including bicycle and pedestrian facilities; steering committee includes representation from most ODOT divisions.
PA	We have formed an Asset Management Division within the Bureau of Maintenance and Operations. Division is responsible for primary assets including bridges and pavements, but also overall efforts including ancillary assets and planning and programming activities. Asset Management Steering Committee and Working Group have also been formed.
SD	Each type of asset has a task force assigned to it. Each task force is comprised of individuals from various offices as the nature of the asset would require. Individuals from Operations, Road Design, Bridge Design, Materials & Surfacing, Project Development, and Administration are included in the task forces.
UT	Senior management, quarterly meetings chaired by deputy director with a focus on pavements and bridges
WA	Group includes Pavement Management, Bridge, Traffic, Safety Executives, Hydraulics and Ferry Operations
WI	Bureau of State Highway Programs provides asset management data and guidance to WisDOT regions to assist with highway program planning.

	Q2. AM Task Force Composition					
State/Agency	Top Executives	Asset Managers	IT	Finance	Planning	Unknown
AK	Yes					
AL		Yes				
AR						
AZ						
CA		Yes			Yes	
CO		Yes	Yes	Yes	Yes	
CT					Yes	
DE						
FL						
GA						Yes
IA		Yes	Yes	Yes	Yes	
ID		Yes				
IL						
IN	Yes					
KS						
KY		Yes			Yes	
LA	Yes	Yes	Yes		Yes	
MD		Yes			Yes	
MI	Yes					
MN	Yes	Yes	Yes	Yes	Yes	
MO						
MS						
MT		Yes			Yes	
NC						
ND						Yes
NE						
NH	Yes					
NJ	Yes					
NV		Yes				
OH		Yes	Yes		Yes	
OR		Yes			Yes	
PA		Yes				
RI						
SC						
SD	Yes	Yes				
TN						
TX						
UT	Yes					
VA						
VT						
WA		Yes				
WI		Yes			Yes	
WY						

Total	26					
Yes	9	17	5	3	12	2

	Where does AM unit reside within the organization?					
State/Agency	Separate Division	Planning	Maintenance	Highway	Across Divisions/Offices*	Unknown
AK				Yes		
AL			Yes			
AR						
AZ						
CA					Yes	
CO						Yes
CT		Yes				
DE						
FL						
GA		Yes				
IA	Yes					
ID			Yes			
IL						
IN					Yes	
KS						
KY				Yes		
LA					Yes	
MD						Yes
MI				Yes		
MN					Yes	
MO						
MS						
MT		Yes				
NC						
ND	Yes					
NE						
NH					Yes	
NJ					Yes	
NV			Yes			
OH					Yes	
OR	Yes					
PA	Yes					
RI						
SC						
SD				Yes		
TN						
TX						
UT			Yes			
VA						
VT						
WA						Yes
WI				Yes		
WY						

Total	26					
Yes	4	3	4	5	7	3

*Across Divisions/Offices - No formal asset management unit, however, AM activities are conducted across multiple divisions/offices.

State/Agency	Q3. Asset Inventory	Pavements	Bridges	Culverts	Signs	Pavement Markings	Guardrail	Lighting	Retaining Walls	Other
AK	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes
AL	Yes	Yes	Yes	Partial	Yes	Partial	Yes	Partial	Partial	Yes
AR	Yes	Yes	Yes							
AZ	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes
CA	Yes	Yes	Yes							
CO	Yes	Yes	Yes	Yes	Yes	Yes	Yes			Yes
CT	Yes	Yes	Yes	Yes	Yes	Partial	Yes	Yes	Yes	Yes
DE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
FL	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
GA	Yes	Yes	Yes							
IA	Yes	Yes	Yes		Yes	Yes				Yes
ID	Yes	Yes	Yes	Partial	Yes	Partial	Yes	Partial	Partial	
IL	Yes	Yes	Yes	Yes	Partial	Partial	Yes	Partial	Yes	Yes
IN	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Partial	Yes
KS	Yes	Yes	Yes	Yes	Partial	Yes	Partial	Yes	Yes	
KY	Yes	Yes	Yes		Yes					
LA	Yes	Yes	Yes	Partial	Yes	Partial	Partial	Partial	Partial	Yes
MD	Yes	Yes	Yes	Yes	Yes	Partial	Yes	Yes	Partial	
MI	Yes	Yes	Yes	Yes	Yes	Partial	Yes	Partial	Partial	Yes
MN	Yes	Yes	Yes	Yes	Yes	Yes	Partial	Partial	Partial	Yes
MO	Yes	Yes	Yes	Yes	Partial	Yes	Partial	Yes	Partial	
MS	Yes	Yes	Yes	Partial	Yes	Partial	Yes	Yes	Partial	Yes
MT	Yes	Yes	Yes	Yes	Yes	Yes	Yes			
NC	Yes	Yes	Yes	Yes	Partial	Partial	Partial	Partial		
ND	Yes	Yes	Yes		Partial	Partial				
NE	Yes	Yes	Yes						Yes	
NH	Yes	Yes	Yes	Yes	Yes		Yes	Yes		
NJ	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
NV	Yes	Yes	Yes	Yes	Yes	Partial	Partial	Partial		
OH	Yes	Yes	Yes	Yes	Yes		Yes	Yes		Yes
OR	Yes	Yes	Yes	Yes	Yes		Yes		Yes	Yes
PA	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes
RI	Yes	Yes	Yes	Partial	Partial	Partial	Partial	Yes	Partial	Yes
SC	Yes	Yes	Yes		Yes		Yes			Yes
SD	Yes	Yes	Yes	Yes	Yes		Yes	Yes		Yes
TN	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
TX	Yes	Yes	Yes		Yes					
UT	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Partial	Yes	
VA	Yes	Yes	Yes		Yes		Yes	Yes		Yes
VT	Yes	Yes	Yes	Yes	Yes	Partial	Yes	Yes	Yes	Yes
WA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes
WI	Yes	Yes	Yes	Yes	Yes	Yes	Partial	Yes		
WY	Yes	Yes	Yes		Yes		Yes	Yes		

Total	43									
Yes	43	43	43	26	33	14	27	21	11	23
Partial		0	0	5	6	12	8	9	10	
No		0	0	12	4	17	8	13	22	20

State/Agency	Q3. AM Inventory (other assets)
AK	Ditches Vegetation
AL	Rest Areas, Paved shoulders, Mowing areas, Cable rail, Signals
AZ	Sound Wall, Fencing, Guardrail End Treatments, Cattle guards, Rest Areas
CO	ITS devices, some traffic signals, some stencils, roadway geometrics
CT	Traffic Signal Inventory
IA	Tower Lights, Sign Trusses
IL	Sign Structures and High Mast Light Poles.
IN	There are many other assets we track, too many to list individually.
LA	Signals
MI	Catch Basins, Billboards, Sound Walls, Environmentally Sensitive Areas, Mile Marker Signs, Lane Miles.
MN	County and municipal state aid system information, facilities, traffic signals, rail crossings, rest areas. All are in different systems and at different levels of maturity. We are evaluating an ""enterprise asset management system"" so we will have more assets in systems in the near future.
MS	Cable Barrier
NJ	Curb, Delineator, Detention/Retention Basins, Ditches, Fences, Guiderail, Headwalls, Inlets, Island Pavement, Manholes, Raised Pavement Markers, Noise Walls, Outfalls, Rumble Strips, Sidewalks, Signs, Sign Mount
OH	Bike & Ped Curb and Sidewalk, Noise Walls, Safety, Intermodal Facilities
OR	Sidewalks, Bicycle Facilities, ADA Ramps, Sound Barriers, Unstable Slopes, Material Sources, ITS, Wetland Mitigation Sites, Approaches, Weigh in Motion Sites, Signals
PA	ITS devices, traffic signals, etc. Some devices, such as retaining walls, lighting, etc. are not 100% (some inventory data exists, but not fully captured
RI	Traffic Signals, Fleet Equipment, Personnel, Impact Attenuators
SC	Crash attenuators, signalized intersections
SD	Equipment, Buildings, ADA facilities
TN	Mowable acres, fence, rumble stripes, delineators, etc.
VA	Curbs, Drop Inlets, Pavement Messages, Rock Slide Protection, Rumble Strips, Sidewalks, Sound Barriers, Traffic Barriers, Traffic Count Stations, Traffic Signals, Ditches
VT	Signals, small culverts, Weigh in Motion (WIMS), Long Bridges > 20 ft, Short Bridges 6ft-20ft, Retaining Walls > 3 ft ht, Sign Structures, Ped & Trail Structures, RR Structures, Highway Garages, Salt/Sand Sheds, District Offices, Cold Storage Buildings, Brine Making Facilities, Airport Terminals, Airport Hangars, Central Garage Materials & Research Lab, Traffic Shop, Runways, Taxiways, Tiedowns, Lighting Beacons, Towers, Rail Beds, Rail, Track Rail Crossings, Weigh Stations, RWIS Stations, Variable Message Boards, LPFM Stations, TOC (video wall, radio), Electronic Kiosks, Wi-Fi
WA	Traffic Signals, Utilities & Manholes, ADA features, Environmental Mitigations features for storm water treatment, Noise Walls, Park & Ride Lots, Rest Area Buildings, Water & Sewer Systems, Weigh Station features, Unstable Slopes

	Q4. Condition Surveys							
State/Agency	Pavements	Bridges	Culverts	Signs	Pavement Markings	Guardrail	Lighting	Retaining Walls
AK	Annual	Biennial	Annual	Annual	Annual	Annual	Other	
AL	Annual	Biennial	Annual	Annual	Annual	Annual	Annual	Other
AR	Biennial	Biennial						
AZ	Annual	Annual	Annual	Annual		Annual	Annual	Annual
CA								
CO	Annual	Annual	Annual		Random	Other		
CT	Annual	Biennial	Other	Other	Random	Other	Other	Random
DE	Biennial	Annual	Other	Other	Other	Other	Other	
FL	Annual	Biennial	Random	Other	Random	Other	Annual	
GA	Biennial	Biennial						
IA	Biennial	Biennial		Other				
ID	Annual	Annual	Other	Other	Annual	Other	Other	Other
IL	Annual	Biennial	Biennial	Annual	Annual		Annual	Biennial
IN	Annual	Biennial	Other	Other	Other	Other	Other	Other
KS	Annual	Biennial	Other	Other	Other	Other	Other	Other
KY	Biennial	Biennial		Other				
LA	Biennial	Biennial	Random	Random	Random	Random	Random	Other
MD	Annual	Annual	Biennial	Random	Random	Random	Other	Other
MI	Annual	Biennial	Random	Other	Other	Other	Other	Other
MN	Annual	Annual	Other	Other	Other	Other	Other	Other
MO	Annual	Biennial	Biennial	Annual	Annual	Random	Annual	Other
MS	Biennial	Biennial	Other	Annual	Annual	Annual	Other	Other
MT	Annual	Annual	Other	Other	Other	Other		
NC	Biennial	Biennial	Other	Random	Random	Random	Random	
ND	Annual	Biennial		Annual	Other			
NE	Annual	Biennial						Other
NH	Annual	Biennial						
NJ	Biennial	Biennial		Other	Other	Other		Other
NV	Annual	Biennial	Other	Other	Random	Random	Random	
OH	Annual	Annual	Other	Other		Other	Other	
OR	Biennial	Biennial	Random	Annual				
PA	Biennial	Biennial	Annual	Other		Biennial	Random	Random
RI	Biennial	Annual	Biennial	Biennial	Biennial	Random	Biennial	Other
SC	Biennial	Biennial		Annual		Other		
SD	Annual	Biennial	Other	Other		Other	Other	
TN	Annual	Biennial	Other	Other	Random	Random		Biennial
TX	Annual	Annual		Annual				
UT	Annual	Annual	Annual	Other	Other	Other	Other	Other
VA	Annual	Biennial		Other			Other	
VT	Annual	Biennial		Other	Annual	Random	Other	Other
WA	Annual	Annual	Random	Biennial	Annual	Other	Other	
WI	Biennial	Biennial	Other	Other	Other	Other	Other	
WY	Biennial	Biennial		Other		Biennial	Biennial	

	Q5. Collection Method by Asset							
State/Agency	Pavements	Bridges	Culverts	Signs	Pavement Markings	Guardrail	Lighting	Retaining Walls
AK	Automated	Manual	Manual	Semi-Automated	Manual	Manual	Manual	
AL	Semi-Automated	Manual	Manual	Manual	Manual	Manual	Manual	Other
AR	Automated	Manual						
AZ	Semi-Automated	Semi-Automated	Semi-Automated	Semi-Automated		Semi-Automated	Semi-Automated	Semi-Automated
CA								
CO	Automated	Manual	Manual		Manual	Manual		
CT	Semi-Automated	Manual	Manual	Manual	Manual	Manual	Manual	Manual
DE	Automated	Manual	Manual	Manual	Manual	Manual	Manual	
FL	Automated	Manual	Manual	Manual	Manual	Manual	Manual	
GA								
IA	Semi-Automated	Manual		Manual				
ID	Semi-Automated	Manual	Manual	Manual	Manual	Semi-Automated	Manual	Manual
IL	Automated	Manual	Manual	Manual	Manual	Manual	Manual	Manual
IN	Automated	Manual	Manual	Manual	Manual	Manual	Manual	Manual
KS	Other	Manual	Manual	Other	Manual	Other	Manual	Manual
KY	Semi-Automated	Semi-Automated		Manual				
LA	Automated	Manual		Manual				
MD	Semi-Automated	Manual	Manual	Semi-Automated		Semi-Automated	Semi-Automated	Other
MI	Automated	Manual	Manual	Manual	Other	Other	Manual	Manual
MN	Semi-Automated	Manual	Manual	Semi-Automated	Manual	Manual	Manual	Manual
MO	Automated	Manual	Manual	Manual	Automated	Manual	Manual	Other
MS	Semi-Automated	Semi-Automated	Other	Semi-Automated	Semi-Automated	Semi-Automated	Other	Other
MT	Automated	Manual	Manual	Manual	Manual	Manual		
NC	Semi-Automated	Semi-Automated	Semi-Automated	Semi-Automated	Semi-Automated	Semi-Automated	Semi-Automated	Semi-Automated
ND	Semi-Automated	Manual		Manual	Manual			
NE	Automated	Semi-Automated						Semi-Automated
NH	Semi-Automated	Manual	Manual	Manual		Semi-Automated	Manual	
NJ	Automated	Manual		Automated	Automated	Automated		Automated
NV	Semi-Automated	Manual	Manual	Semi-Automated	Manual	Manual	Manual	Manual
OH	Manual	Manual	Manual	Semi-Automated		Semi-Automated	Manual	
OR	Semi-Automated	Manual	Manual	Manual		Semi-Automated		Manual
PA	Automated	Semi-Automated	Semi-Automated	Manual		Manual	Manual	Manual
RI	Semi-Automated	Semi-Automated	Semi-Automated	Semi-Automated	Semi-Automated		Semi-Automated	Other
SC	Semi-Automated	Manual		Manual		Manual		
SD	Semi-Automated	Manual	Manual	Manual		Manual	Manual	
TN	Automated	Manual	Manual	Semi-Automated	Semi-Automated	Semi-Automated		Manual
TX	Manual	Manual		Manual				
UT	Automated	Semi-Automated	Manual	Automated	Automated	Automated		Automated
VA	Automated	Manual		Automated		Automated	Manual	
VT	Automated	Manual	Manual	Manual	Manual	Manual	Manual	Manual
WA	Automated	Manual	Manual	Manual	Semi-Automated	Manual	Automated	
WI	Automated	Manual	Manual	Manual	Manual	Manual	Manual	
WY	Automated	Manual		Manual		Manual	Manual	

State/Agency	Q6. AM Data Needs	Q7. QA/QC	Q8. Integration
AK	Yes	Yes	Yes
AL	Yes	Yes	Yes
AR	No	Yes	Yes
AZ	No	Yes	No
CA	No	No	Yes
CO	Yes	Yes	Yes
CT	Yes	Yes	Yes
DE	No	Yes	No
FL	Yes	Yes	Yes
GA			
IA	No	Yes	Yes
ID	No	Yes	Yes
IL	Yes	Yes	Yes
IN	Yes	Yes	Yes
KS	Yes	No	Yes
KY	No	Yes	Yes
LA	Yes	No	Yes
MD	Yes	Yes	Yes
MI	Yes	Yes	No
MN	Yes	No	Yes
MO	Yes	Yes	Yes
MS	No	No	Yes
MT	Yes	Yes	Yes
NC	No	Yes	Yes
ND	Yes	No	Yes
NE	Yes	Yes	Yes
NH	Yes	No	Yes
NJ	Yes	Yes	Yes
NV	Yes	No	Yes
OH	Yes	Yes	Yes
OR	Yes	Yes	Yes
PA	Yes	Yes	Yes
RI	No	No	No
SC	No	Yes	No
SD	Yes	Yes	Yes
TN	Yes	Yes	Yes
TX	Yes	Yes	Yes
UT	No	No	Yes
VA	Yes	Yes	Yes
VT	No	Yes	Yes
WA	No	No	Yes
WI	Yes	Yes	Yes
WY	Yes	Yes	Yes

Total	42		
Yes	28	31	37
No	14	17	5

	Q9. Our AM progress to date and anticipated activities over the next two to five years can be best summarized by	
State/Agency	Expanding inventories beyond bridge and pavements with considerable management capabilities and integration under future consideration	Complete inventories with future activities focused on advancing asset management capabilities, training, and implementation.
AK	Yes	
AL	Yes	
AR	Yes	
AZ	Yes	
CA		Yes
CO	Yes	
CT	Yes	
DE		Yes
FL		Yes
GA	Yes	
IA	Yes	
ID	Yes	
IL	Yes	
IN	Yes	
KS	Yes	
KY	Yes	
LA	Yes	
MD		Yes
MI	Yes	
MN	Yes	
MO		Yes
MS	Yes	
MT		Yes
NC		Yes
ND	Yes	
NE	Yes	
NH	Yes	
NJ	Yes	
NV	Yes	
OH	Yes	
OR		Yes
PA		Yes
RI	Yes	
SC	Yes	
SD	Yes	
TN		Yes
TX	Yes	
UT		Yes
VA	Yes	
VT	Yes	
WA	Yes	
WI		Yes
WY	Yes	

Total	43	
Yes	31	12

	Q10. Our AM program includes the following (check all that apply):			
State/Agency	Our agency supports and is planning to further integrate asset management and infrastructure preservation among a wide variety of assets and agency decision tools.	Our agency will be working to integrate AM policies in resource allocation and project selection.	Our agency is integrating AM as part of performance reporting.	Our agency is using AM to assess return on investment for infrastructure expenditures.
AK	Yes	Yes	Yes	
AL	Yes	Yes	Yes	
AR	Yes	Yes		
AZ	Yes	Yes		
CA	Yes	Yes	Yes	
CO	Yes	Yes	Yes	
CT		Yes	Yes	
DE	Yes	Yes	Yes	Yes
FL	Yes	Yes	Yes	Yes
GA	Yes		Yes	
IA	Yes	Yes	Yes	Yes
ID			Yes	
IL				
IN	Yes	Yes	Yes	Yes
KS	Yes		Yes	
KY		Yes		
LA	Yes	Yes		
MD	Yes	Yes	Yes	Yes
MI	Yes	Yes		
MN	Yes	Yes	Yes	Yes
MO	Yes	Yes		Yes
MS	Yes			Yes
MT	Yes			
NC	Yes	Yes	Yes	Yes
ND	Yes	Yes		
NE	Yes	Yes	Yes	
NH	Yes	Yes	Yes	Yes
NJ	Yes	Yes	Yes	
NV	Yes		Yes	
OH	Yes	Yes	Yes	Yes
OR	Yes	Yes	Yes	Yes
PA	Yes	Yes	Yes	
RI				
SC				
SD	Yes	Yes		
TN	Yes	Yes	Yes	
TX		Yes	Yes	
UT	Yes	Yes	Yes	
VA	Yes	Yes	Yes	
VT	Yes	Yes	Yes	
WA	Yes	Yes	Yes	Yes
WI	Yes	Yes	Yes	Yes
WY	Yes	Yes	Yes	

Total	40			
Yes	36	34	30	14

	Q11. My state highway agency's state of practice on the use of asset management principles can be best summarized by:					
State/Agency	Collect some asset information but really do not do any management.	Have began the process of developing a TAMP but it is not complete.	Have developed a TAMP but have not begun implementation.	Have developed a TAMP and in various stages of implementation.	Have developed a TAMP and it is fully implemented into our business process.	Other
AK		Yes				
AL				Yes		
AR		Yes				
AZ		Yes				
CA		Yes				
CO		Yes				
CT		Yes				
DE	Yes					
FL						Yes
GA			Yes			
IA		Yes				
ID		Yes				
IL						
IN				Yes		
KS		Yes				
KY	Yes					
LA		Yes				
MD				Yes		
MI						Yes
MN		Yes				
MO				Yes		
MS	Yes					
MT				Yes		
NC				Yes		
ND		Yes				
NE				Yes		
NH		Yes				
NJ				Yes		
NV				Yes		
OH				Yes		
OR				Yes		
PA		Yes				
RI	Yes					
SC	Yes					
SD		Yes				
TN	Yes					
TX		Yes				
UT				Yes		
VA		Yes				
VT		Yes				
WA		Yes				
WI					Yes	
WY				Yes		
Total	42					
Yes	6	19	1	13	1	2

	Q12. Some of the major barriers faced towards development and implementation of a AM process (current or in the past) include(s) (check all that apply):											
State/Agency	Lack of resources	Lack of staff	Resistance to change	Inter-departmental interactions	Higher/other priorities	Lack of expertise and training	Staff commitment	Executive commitment	Staff turnover	Availability of adequate tools in the marketplace	Outside pressure to have a subjective approach	Lack of guidance/support
Barriers sorted from the highest number to the lowest and no in state order	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	
	Yes	Yes	Yes	Yes	Yes	Yes	Yes					Yes
	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes			
	Yes	Yes	Yes	Yes	Yes							
	Yes	Yes	Yes	Yes		Yes	Yes	Yes				Yes
	Yes	Yes	Yes	Yes		Yes				Yes		
	Yes	Yes	Yes	Yes			Yes	Yes	Yes			
	Yes	Yes	Yes	Yes								
	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	
	Yes	Yes	Yes		Yes		Yes					
	Yes	Yes	Yes					Yes				
	Yes	Yes	Yes									
	Yes	Yes	Yes									
	Yes	Yes	Yes									
	Yes	Yes		Yes	Yes	Yes	Yes		Yes			
	Yes	Yes		Yes	Yes	Yes		Yes				
	Yes	Yes		Yes	Yes	Yes			Yes	Yes		
	Yes	Yes		Yes	Yes							
	Yes	Yes		Yes		Yes	Yes					
	Yes	Yes			Yes	Yes	Yes	Yes				
	Yes	Yes			Yes	Yes	Yes					
	Yes	Yes			Yes	Yes				Yes		
	Yes		Yes	Yes	Yes	Yes				Yes		
	Yes		Yes	Yes		Yes	Yes		Yes			
	Yes		Yes	Yes		Yes					Yes	
	Yes			Yes						Yes		
	Yes				Yes		Yes					
	Yes				Yes						Yes	
	Yes						Yes					
	Yes							Yes				
	Yes									Yes		
	Yes											
	Yes											
		Yes	Yes	Yes	Yes	Yes		Yes	Yes		Yes	
		Yes	Yes	Yes		Yes	Yes					
		Yes	Yes	Yes		Yes						
		Yes	Yes		Yes	Yes	Yes	Yes				
		Yes			Yes	Yes		Yes				
			Yes	Yes	Yes					Yes	Yes	
			Yes	Yes					Yes			
			Yes	Yes							Yes	
Total	43											
Yes	35	29	26	25	22	22	18	14	11	9	8	2

	Q13. My DOT TAMP can be best summarized by:		
State/Agency	Our TAMP is kept up to date and serves as a resource document on a regular basis	Our TAMP is used for both short and long-term planning efforts	Neither
AK			Yes
AL	Yes		
AR			Yes
AZ		Yes	
CA			Yes
CO			Yes
CT			Yes
DE			Yes
FL			Yes
GA			Yes
IA			Yes
ID		Yes	
IL			
IN		Yes	
KS			Yes
KY			Yes
LA			Yes
MD		Yes	
MI			Yes
MN	Yes	Yes	
MO		Yes	
MS			Yes
MT		Yes	
NC		Yes	
ND			Yes
NE	Yes	Yes	
NH			Yes
NJ	Yes		
NV			Yes
OH	Yes		
OR	Yes	Yes	
PA			Yes
RI			Yes
SC			Yes
SD			Yes
TN			Yes
TX			Yes
UT			Yes
VA			Yes
VT			Yes
WA		Yes	
WI	Yes	Yes	
WY	Yes	Yes	

Total	42		
Yes	8	13	26

	Q15. My DOT TAMP and decision making.		
State/Agency	Minimal effort to integrate TAMP into business processes	Status quo with no real changes or initiatives over the last couple of years	Active with efforts across multiple departments and business units
AK		Yes	
AL			Yes
AR		Yes	
AZ	Yes		
CA	Yes		
CO	Yes		
CT		Yes	
DE	Yes		
FL		Yes	
GA			Yes
IA			Yes
ID			Yes
IL			
IN			Yes
KS		Yes	
KY	Yes		
LA			
MD			Yes
MI	Yes		
MN			Yes
MO			Yes
MS	Yes		
MT			Yes
NC			Yes
ND		Yes	
NE			Yes
NH			Yes
NJ			Yes
NV			Yes
OH			Yes
OR			Yes
PA			Yes
RI	Yes		
SC		Yes	
SD			Yes
TN	Yes		
TX			Yes
UT			Yes
VA			
VT			
WA	Yes		
WI			Yes
WY			Yes

Total	39		
Yes	10	7	22

	Q16. Since using AM our decisions are more:			
State/Agency	Data-driven	Defensible	Integrated	Performance based
AK		Yes		
AL	Yes	Yes	Yes	Yes
AR	Yes	Yes		
AZ				
CA				
CO	Yes	Yes		Yes
CT	Yes			Yes
DE	Yes			
FL				Yes
GA				
IA	Yes	Yes		
ID	Yes	Yes	Yes	Yes
IL				
IN	Yes	Yes	Yes	Yes
KS	Yes	Yes		Yes
KY	Yes			
LA				
MD	Yes	Yes	Yes	Yes
MI	Yes	Yes		Yes
MN			Yes	Yes
MO	Yes	Yes	Yes	Yes
MS	Yes	Yes	Yes	Yes
MT	Yes	Yes	Yes	Yes
NC	Yes			Yes
ND	Yes	Yes		
NE	Yes	Yes	Yes	Yes
NH	Yes	Yes	Yes	Yes
NJ	Yes	Yes	Yes	Yes
NV	Yes	Yes		
OH	Yes	Yes	Yes	Yes
OR	Yes	Yes	Yes	Yes
PA	Yes	Yes		Yes
RI				
SC	Yes	Yes		
SD	Yes	Yes	Yes	Yes
TN	Yes	Yes		Yes
TX	Yes	Yes		
UT	Yes			Yes
VA				
VT		Yes		
WA	Yes	Yes		Yes
WI	Yes	Yes	Yes	Yes
WY	Yes			Yes

Total	36			
Yes	32	28	15	26

	Q17. AM staffing and support for TAMP activities can be best summarized by:				
State/Agency	My agency has identified an AM champion	My agency has developed strategies to promote AM	My agency has an AM implementation task force	Our AM efforts are led by mid-level management	Our AM efforts are led by top-level management
AK	Yes		Yes	Yes	
AL		Yes		Yes	
AR				Yes	Yes
AZ					
CA			Yes		Yes
CO	Yes		Yes	Yes	
CT		Yes		Yes	
DE	Yes	Yes			
FL				Yes	Yes
GA	Yes		Yes		
IA	Yes		Yes		Yes
ID			Yes		Yes
IL					
IN	Yes	Yes	Yes	Yes	
KS					Yes
KY			Yes		Yes
LA	Yes		Yes		Yes
MD	Yes	Yes	Yes	Yes	Yes
MI	Yes	Yes	Yes	Yes	Yes
MN	Yes		Yes	Yes	
MO	Yes				
MS	Yes	Yes			Yes
MT					Yes
NC		Yes		Yes	
ND	Yes		Yes	Yes	Yes
NE	Yes		Yes		Yes
NH		Yes			Yes
NJ	Yes	Yes	Yes	Yes	Yes
NV	Yes		Yes	Yes	
OH	Yes	Yes	Yes	Yes	Yes
OR	Yes	Yes	Yes	Yes	Yes
PA	Yes	Yes	Yes	Yes	Yes
RI				Yes	
SC					
SD	Yes		Yes		Yes
TN				Yes	
TX		Yes		Yes	
UT	Yes	Yes		Yes	Yes
VA	Yes			Yes	
VT				Yes	
WA	Yes	Yes			Yes
WI	Yes	Yes	Yes	Yes	Yes
WY	Yes	Yes			Yes

Total	40				
Yes	25	18	21	24	24

	Q18. The key asset performance data driving decision making include:						
State/Agency	Physical Condition	Safety	Environment	Operations	Capacity	Risk Assessment	Other
AK	Yes	Yes				Yes	
AL	Yes	Yes		Yes			
AR	Yes	Yes					
AZ	Yes	Yes					
CA							
CO	Yes	Yes					
CT	Yes	Yes		Yes			Yes
DE	Yes	Yes					
FL	Yes	Yes		Yes	Yes		
GA	Yes	Yes		Yes	Yes	Yes	
IA	Yes	Yes	Yes	Yes	Yes		
ID	Yes	Yes		Yes	Yes	Yes	
IL	Yes	Yes	Yes	Yes	Yes	Yes	
IN	Yes	Yes		Yes	Yes		
KS	Yes	Yes		Yes	Yes		Yes
KY	Yes	Yes			Yes		
LA	Yes	Yes					
MD	Yes	Yes	Yes				
MI	Yes	Yes	Yes	Yes			
MN	Yes	Yes	Yes	Yes	Yes	Yes	
MO	Yes	Yes		Yes	Yes		
MS		Yes		Yes	Yes		
MT	Yes	Yes	Yes	Yes	Yes	Yes	
NC	Yes	Yes	Yes	Yes	Yes		
ND	Yes						
NE	Yes	Yes		Yes	Yes		
NH	Yes	Yes		Yes		Yes	
NJ	Yes	Yes		Yes	Yes		
NV	Yes	Yes	Yes	Yes	Yes	Yes	
OH	Yes	Yes		Yes	Yes		
OR	Yes	Yes				Yes	
PA	Yes	Yes				Yes	Yes
RI	Yes	Yes					Yes
SC	Yes	Yes			Yes		
SD	Yes	Yes	Yes		Yes	Yes	
TN	Yes						
TX	Yes	Yes		Yes			
UT	Yes						
VA	Yes			Yes			
VT	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WA	Yes	Yes	Yes	Yes	Yes	Yes	
WI	Yes	Yes					Yes
WY	Yes	Yes					

Total	42						
Yes	41	38	11	24	21	13	6

	Q19. Our TAMP includes the following:				
State/Agency	A long-range plan specific asset performance criteria which guides capital program development	A process to review and update these asset performance targets along with the limitations of data collection and decision making	Forecasting capabilities for asset performance	Verification process to check that forecasts provide realistic projections of system deficiencies	Process to align asset management practices with the performance measures
AK	Yes	Yes			
AL		Yes			Yes
AR					
AZ			Yes		
CA		Yes			
CO					
CT		Yes	Yes		
DE					
FL	Yes	Yes	Yes		Yes
GA		Yes			
IA					
ID	Yes	Yes	Yes	Yes	Yes
IL	Yes	Yes	Yes	Yes	
IN	Yes	Yes	Yes	Yes	Yes
KS		Yes	Yes		Yes
KY					
LA					
MD					Yes
MI		Yes	Yes		
MN	Yes	Yes	Yes	Yes	Yes
MO					
MS		Yes			Yes
MT	Yes	Yes	Yes	Yes	Yes
NC	Yes	Yes	Yes		Yes
ND		Yes			
NE		Yes	Yes		Yes
NH		Yes	Yes	Yes	Yes
NJ	Yes		Yes		
NV					
OH	Yes	Yes	Yes		
OR		Yes	Yes		
PA	Yes				Yes
RI					
SC					
SD					
TN					
TX		Yes			
UT	Yes	Yes	Yes		Yes
VA					
VT	Yes	Yes	Yes	Yes	
WA	Yes				
WI	Yes	Yes	Yes	Yes	Yes
WY	Yes	Yes	Yes		Yes

Total	31				
Yes	16	25	20	8	16

	Q20. Types of projects selected based on AM systems and performance measures:						
State/Agency	Pavements	Bridges	Maintenance	Operations	Safety	Capital Improvements	Other
AK	Yes	Yes	Yes	Yes			
AL	Yes	Yes	Yes	Yes			
AR	Yes	Yes					
AZ	Yes	Yes					
CA	Yes	Yes					
CO	Yes	Yes	Yes				
CT	Yes	Yes					
DE	Yes	Yes	Yes		Yes		
FL	Yes	Yes	Yes	Yes			
GA	Yes	Yes	Yes				
IA					Yes		
ID	Yes	Yes	Yes				
IL	Yes	Yes	Yes	Yes	Yes	Yes	
IN	Yes	Yes		Yes	Yes	Yes	
KS	Yes	Yes	Yes	Yes	Yes	Yes	
KY	Yes	Yes					
LA	Yes	Yes					
MD	Yes	Yes					
MI	Yes	Yes					
MN	Yes	Yes					
MO							
MS	Yes	Yes	Yes		Yes	Yes	
MT	Yes	Yes		Yes	Yes	Yes	
NC	Yes	Yes			Yes	Yes	
ND	Yes	Yes					
NE	Yes	Yes		Yes			
NH	Yes	Yes					
NJ	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NV							
OH	Yes	Yes			Yes		
OR	Yes	Yes	Yes				
PA	Yes	Yes			Yes		
RI							Yes
SC	Yes	Yes					
SD	Yes	Yes					Yes
TN	Yes						
TX	Yes	Yes	Yes				
UT	Yes	Yes	Yes				
VA	Yes	Yes					
VT	Yes	Yes			Yes		
WA	Yes	Yes		Yes	Yes	Yes	
WI	Yes	Yes			Yes		
WY	Yes	Yes	Yes		Yes	Yes	

Total	41						
Yes	39	38	15	10	15	9	3

	Q21. Current agency decision-making process includes:						
State/Agency	Performance based resource allocation	Defined process using AM for selecting projects and developing programs	Policies to balance asset preservation and capital improvements	Adequate decision making software packages and tools to support decision making	A process to share AM output information with agency/elected officials	Adequate risk assessment and management tools to support short term decision making	Adequate risk assessment and management tools to support long term decision making
AK	Yes						
AL	Yes			Yes		Yes	
AR				Yes			
AZ							
CA	Yes		Yes				
CO				Yes	Yes		
CT			Yes		Yes		
DE							
FL	Yes	Yes	Yes		Yes		
GA					Yes		
IA			Yes				
ID	Yes	Yes		Yes	Yes	Yes	Yes
IL	Yes	Yes	Yes	Yes	Yes		
IN	Yes	Yes	Yes	Yes	Yes	Yes	Yes
KS	Yes	Yes	Yes	Yes	Yes		
KY			Yes	Yes			
LA							
MD	Yes	Yes	Yes				
MI	Yes	Yes	Yes		Yes	Yes	Yes
MN	Yes		Yes			Yes	Yes
MO							
MS			Yes	Yes	Yes		Yes
MT	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NC				Yes	Yes		
ND			Yes	Yes			
NE		Yes		Yes			
NH				Yes	Yes		
NJ	Yes	Yes					
NV							
OH	Yes		Yes	Yes	Yes	Yes	
OR		Yes	Yes				
PA		Yes	Yes		Yes	Yes	
RI							
SC		Yes			Yes		
SD	Yes		Yes				
TN			Yes			Yes	
TX	Yes		Yes				
UT	Yes	Yes		Yes	Yes		
VA	Yes		Yes		Yes		
VT		Yes		Yes	Yes		
WA	Yes	Yes					
WI		Yes		Yes		Yes	Yes
WY	Yes	Yes			Yes		
Total	37						
Yes	20	18	21	18	20	10	7

Turnpike Enterprise Survey Results

2. State of the Practice - General

1. Is your agency under any type of a mandate to use transportation asset management principles?

Yes

3. State of the Practice - General

Please specify the type of mandate you have to use transportation asset management principles (Legislature, Department head, etc...)

Adoption of the GASB 34 - Modified Approach methodology by the Florida's Turnpike Enterprise (FTE) Finance department in determination of transportation infrastructure depreciation value. Also required by the bond requirements identified by the bonding agencies when utilizing bonds to fund FTE transportation projects.

4. State of the Practice - General

2. Does your agency have an asset management group (task force) to coordinate all of the asset management activities?

Yes

5. State of the Practice - General

Please provide a brief description of the task force (offices involved, modes included, etc...):

Asset management group consists of a project manager (asset management champion), data maintenance, annual inspection, and software maintenance as part of the Bond Requirements area underthe General Engineering Consultant (GEC) contract for the FTE Production Department. This group also consists of Asset Team Leaders (ATL) in various departments throughout FTE who act as liasions for their respective department to ensure the asset management group meets their needs.

6. State of the Practice - Inventory

3. Does your agency have an asset inventory?

Yes

7. State of the Practice - Inventory

If so, please indicate which assets are currently included within the inventory (check all that apply)

Pavements
Bridges
Culverts
Signs
Guardrail
Roadway Lighting
Earth retaining Walls
Other

8. Other Assets in the Inventory

Please list the other assets that are currently included within your inventory:

ITS Assets (Closed Circuit Television Cameras, Dynamic Message Signs, etc.), Building Assets (Buildings, Generators, HVACs, etc..), Environmental Assets (Fuel Storage Tanks, Backflow Preventers, etc..), Roadway Assets (Cable Barrier, Barrier Walls, Fencing, etc...), High Mast Light Towers, Communication Assets (Microwave Towers, Microwave Battery Banks, PBX UPS, etc..)

9. State of the Practice - Inventory

4. How often do you conduct condition surveys for each asset?

	annual	semi-annual	random	other
Pavements	✓			
Bridges	✓			
Culverts				✓
Signs	✓			
Pavement Markings				
Guardrail	✓			
Roadway Lighting	✓			
Tunnels				
Earth Retaining Walls	✓			

10. State of the Practice - Inventory

5. How are the data collected for each asset?

	Manual	Automated	Semi-Automated	Other
Pavements			✓	
Bridges	✓			
Culverts	✓			
Signs	✓			
Pavement Markings				
Guardrail	✓			
Roadway Lighting	✓			
Tunnels				
Earth Retaining Walls	✓			

11. State of the Practice - Inventory

6. Has your agency identified primary AM data needs across the organization?

Yes

7. Does your agency have a process to assess the quality of the collected data (QC/QA)?

Yes

8. Does your agency have a data integration effort?

Yes

12. State of Practice-AM Activities

9. Our AM progress to date and anticipated activities over the next two to five years can be best summarized by:

Complete inventories with future activities focused on advancing asset management capabilities, training, and implementation.

10. Our AM program includes the following (check all that apply):

Our agency supports and is planning to further integrate asset management and infrastructure preservation among a wide variety of assets and agency decision tools.
Our agency will be working to integrate AM policies in resource allocation and project selection.
Our agency is integrating AM as part of performance reporting.
Our agency is using AM to assess return on investment for infrastructure expenditures.

13. State of Practice-Management Process

11. My state highway agency's state of practice on the use of asset management principles can be best summarized by:

Have developed a TAMP and in various stages of implementation.

12. Some of the major barriers faced towards development and implementation of a AM process (current or in the past) include(s) (check all that apply):

[redacted]

14. State of Practice-Management Process

13. A TAMP is an essential management tool which brings together all related business processes and stakeholders, internal and external, to achieve a common understanding and commitment to improved performance. It is a tactical-level document, which focuses its analysis, options development, programs, delivery mechanisms, and reporting mechanisms on ensuring that strategic objectives are achieved.

Given the above definition, please check all that apply:

Our TAMP is used for both short and long-term planning efforts

14. Can you share a copy of your TAMP with the research team?

Yes

15. State of Practice-Management Process

15. Please characterize your agency's efforts in working with decision makers and other stakeholders to incorporate the TAMP as part of your business processes.

Active with efforts across multiple departments and business units

16. Since using AM our agencies decisions are more (please check all that apply):

Data-driven
Defensible
Performance based

16. State of Practice-Staffing

17. My state highway agency's state of practice on staffing and support for TAMP activities can be best summarized by (please check all that apply):

My agency has an identified AM champion
Our AM efforts are led by mid-level management

17. State of Practice-Performance Measures

18. The key asset performance data, which drive decision making across the organization, include (check all that apply):

Physical condition
Safety
Operations
Other

18. Other key asset performance data

Please list the other key asset performance data, which drive decision making:

Vicinity Projects, Work Program Funding

19. State of Practice-Performance Measures

19. Our agency's TAMP includes the following (please check all that apply):

A long-range plan specific asset performance criteria which guides capital program development
Forecasting capabilities for asset performance
Process to align asset management practices with the performance measures

20. State of Practice-Decision Making

20. Which types of projects are selected based on AM systems and performance measures (check all that apply):

Pavements
Bridges
Maintenance
Operations
Safety
Capital improvements
Other

21. Our current agency decision-making includes (check all that apply):

Performance based resource allocation
Defined process using AM for selecting projects and developing programs
Policies to balance asset preservation and capital improvements
Adequate decision making software packages and tools to support decision making
A process to share AM output information with agency/elected officials
Adequate risk assessment and management tools to support short term decision making
Adequate risk assessment and management tools to support long term decision making

APPENDIX D

Self-Assessment Survey Results

The self-assessment survey results are based on responses from 18 participating agencies. The results are presented in two different formats. The first presents the result by the areas of emphasis according to the colors below for current and future (5 years) desired levels. The numbers on the right-hand side represent the difference between the desired future level and the current level summarized by area and question number. The higher the number (or percentage), the larger the difference between current and desired future levels, which means the agencies still require more effort to fully implement asset management practices.

The second set presents the raw data from the survey for each question by area and for current and future (5-year) levels.

Key

Part A. Policy Guidance
Part B. Planning and Programming
Part C. Program Delivery
Part D. Information and Analysis

PART A. POLICY GUIDANCE

POLICY GUIDANCE BENEFITING FROM GOOD ASSET MANAGEMENT PRACTICE

	CURRENT								DESIRED IN 5 YEARS								DIFFERENCE	
	Strongly Disagree		Disagree		Agree		Strongly Agree		Strongly Disagree		Disagree		Agree		Strongly Agree			
Question	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#
A1	0.00%	0	0.00%	0	61.10%	11	38.90%	7	0.00%	0	0.00%	0	16.70%	3	83.30%	15	0%	0
A2	0.00%	0	50.00%	9	44.40%	8	5.60%	1	0.00%	0	5.60%	1	27.80%	5	66.70%	12	45%	8
A3	5.60%	1	61.10%	11	27.80%	5	5.60%	1	0.00%	0	0.00%	0	27.80%	5	72.20%	13	67%	12
A4	11.10%	2	44.40%	8	27.80%	5	16.70%	3	0.00%	0	0.00%	0	61.10%	11	38.90%	7	56%	10
A5	16.70%	3	38.90%	7	27.80%	5	16.70%	3	0.00%	0	16.70%	3	44.40%	8	38.90%	7	39%	7

STRONG FRAMEWORK FOR PERFORMANCE-BASED RESOURCE ALLOCATION

	CURRENT								DESIRED IN 5 YEARS								DIFFERENCE	
	Strongly Disagree		Disagree		Agree		Strongly Agree		Strongly Disagree		Disagree		Agree		Strongly Agree			
Question	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#
A6	5.60%	1	33.30%	6	55.60%	10	5.60%	1	0.00%	0	0.00%	0	44.40%	8	55.60%	10	39%	7
A7	5.60%	1	55.60%	10	22.20%	4	16.70%	3	0.00%	0	0.00%	0	27.80%	5	72.20%	13	61%	11
A8	5.60%	1	44.40%	8	38.90%	7	11.10%	2	0.00%	0	0.00%	0	27.80%	5	72.20%	13	50%	9

PROACTIVE ROLE IN POLICY FORMULATION

	CURRENT								DESIRED IN 5 YEARS								DIFFERENCE	
	Strongly Disagree		Disagree		Agree		Strongly Agree		Strongly Disagree		Disagree		Agree		Strongly Agree			
Question	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#
A9	5.60%	1	33.30%	6	44.40%	8	16.70%	3	0.00%	0	0.00%	0	38.90%	7	61.10%	11	39%	7
A10	5.60%	1	27.80%	5	50.00%	9	16.70%	3	0.00%	0	0.00%	0	33.30%	6	66.70%	12	33%	6
A11	5.60%	1	16.70%	3	50.00%	9	27.80%	5	0.00%	0	0.00%	0	16.70%	3	83.30%	15	22%	4

PART B. PLANNING AND PROGRAMMING

CONSIDERATION OF ALTERNATIVES IN PLANNING AND PROGRAMMING

	CURRENT								DESIRED IN 5 YEARS								DIFFERENCE	
	Strongly Disagree		Disagree		Agree		Strongly Agree		Strongly Disagree		Disagree		Agree		Strongly Agree			
Question	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#
B1	0.00%	0	50.00%	9	44.40%	8	5.60%	1	0.00%	0	5.60%	1	38.90%	7	55.60%	10	45%	8
B2	16.70%	3	22.20%	4	44.40%	8	16.70%	3	0.00%	0	0.00%	0	33.30%	6	66.70%	12	39%	7
B3	22.20%	4	55.60%	10	22.20%	4	0.00%	0	0.00%	0	0.00%	0	66.70%	12	33.30%	6	78%	14

PERFORMANCE-BASED PLANNING AND A CLEAR LINKAGE AMONG POLICY, PLANNING, AND PROGRAMMING

	CURRENT								DESIRED IN 5 YEARS								DIFFERENCE	
	Strongly Disagree		Disagree		Agree		Strongly Agree		Strongly Disagree		Disagree		Agree		Strongly Agree			
Question	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#
B4	0.00%	0	22.20%	4	61.10%	11	16.70%	3	0.00%	0	0.00%	0	44.40%	8	55.60%	10	22%	4
B5	16.70%	3	22.20%	4	44.40%	8	16.70%	3	0.00%	0	11.10%	2	50.00%	9	38.90%	7	28%	5
B6	16.70%	3	16.70%	3	61.10%	11	5.60%	1	0.00%	0	11.10%	2	44.40%	8	44.40%	8	22%	4
B7	5.60%	1	27.80%	5	55.60%	10	11.10%	2	0.00%	0	0.00%	0	44.40%	8	55.60%	10	33%	6

PERFORMANCE-BASED PROGRAMMING PROCESS

	CURRENT								DESIRED IN 5 YEARS								DIFFERENCE	
	Strongly Disagree		Disagree		Agree		Strongly Agree		Strongly Disagree		Disagree		Agree		Strongly Agree			
Question	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#
B8	5.60%	1	27.80%	5	55.60%	10	11.10%	2	0.00%	0	0.00%	0	44.40%	8	55.60%	10	33%	6
B9	0.00%	0	22.20%	4	50.00%	9	27.80%	5	0.00%	0	0.00%	0	44.40%	8	55.60%	10	22%	4
B10	5.60%	1	22.20%	4	55.60%	10	16.70%	3	0.00%	0	0.00%	0	17.60%	3	82.40%	14	28%	4
B11	11.10%	2	44.40%	8	44.40%	8	0.00%	0	0.00%	0	0.00%	0	50.00%	9	50.00%	9	56%	10
B12	27.80%	5	22.20%	4	38.90%	7	11.10%	2	0.00%	0	0.00%	0	38.90%	7	61.10%	11	50%	9
B13	35.30%	6	29.40%	5	11.80%	2	23.50%	4	0.00%	0	0.00%	0	47.10%	8	52.90%	9	65%	11

PART C. PROGRAM DELIVERY

CONSIDERATION OF ALTERNATIVE PROJECT DELIVERY MECHANISMS

	CURRENT								DESIRED IN 5 YEARS								DIFFERENCE	
	Strongly Disagree		Disagree		Agree		Strongly Agree		Strongly Disagree		Disagree		Agree		Strongly Agree			
Question	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#
C1	5.60%	1	27.80%	5	50.00%	9	16.70%	3	5.60%	1	5.60%	1	50.00%	9	38.90%	7	22%	4
C2	11.10%	2	38.90%	7	44.40%	8	5.60%	1	0.00%	0	0.00%	0	66.70%	12	33.30%	6	50%	9

EFFECTIVE PROGRAM MANAGEMENT

	CURRENT								DESIRED IN 5 YEARS								DIFFERENCE	
	Strongly Disagree		Disagree		Agree		Strongly Agree		Strongly Disagree		Disagree		Agree		Strongly Agree			
Question	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#
C3	0.00%	0	16.70%	3	66.70%	12	16.70%	3	0.00%	0	0.00%	0	44.40%	8	55.60%	10	17%	3
C4	11.10%	2	27.80%	5	44.40%	8	16.70%	3	0.00%	0	0.00%	0	44.40%	8	55.60%	10	39%	7
C5	0.00%	0	38.90%	7	33.30%	6	27.80%	5	0.00%	0	0.00%	0	33.30%	6	66.70%	12	39%	7
C6	5.60%	1	16.70%	3	44.40%	8	33.30%	6	0.00%	0	0.00%	0	33.30%	6	66.70%	12	22%	4
C7	22.20%	4	38.90%	7	33.30%	6	5.60%	1	0.00%	0	5.60%	1	50.00%	9	44.40%	8	56%	10
C8	0.00%	0	16.70%	3	33.30%	6	50.00%	9	0.00%	0	0.00%	0	22.20%	4	77.80%	14	17%	3
C9	11.10%	2	55.60%	10	22.20%	4	11.10%	2	0.00%	0	0.00%	0	50.00%	9	50.00%	9	67%	12

COST TRACKING AND ESTIMATING

	CURRENT								DESIRED IN 5 YEARS								DIFFERENCE	
	Strongly Disagree		Disagree		Agree		Strongly Agree		Strongly Disagree		Disagree		Agree		Strongly Agree			
Question	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#
C10	0.00%	0	11.10%	2	38.90%	7	50.00%	9	0.00%	0	0.00%	0	27.80%	5	72.20%	13	11%	2
C11	5.60%	1	27.80%	5	50.00%	9	16.70%	3	0.00%	0	0.00%	0	33.30%	6	66.70%	12	33%	6

PART D. INFORMATION AND ANALYSIS

EFFECTIVE AND EFFICIENT DATA COLLECTION

	CURRENT								DESIRED IN 5 YEARS								DIFFERENCE	
	Strongly Disagree		Disagree		Agree		Strongly Agree		Strongly Disagree		Disagree		Agree		Strongly Agree			
Question	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#
D1	11.10%	2	16.70%	3	61.10%	11	11.10%	2	0.00%	0	0.00%	0	33.30%	6	66.70%	12	28%	5
D2	0.00%	0	11.10%	2	61.10%	11	27.80%	5	0.00%	0	0.00%	0	22.20%	4	77.80%	14	11%	2
D3	0.00%	0	27.80%	5	61.10%	11	11.10%	2	0.00%	0	0.00%	0	44.40%	8	55.60%	10	28%	5
D4	44.40%	8	33.30%	6	11.10%	2	11.10%	2	0.00%	0	11.10%	2	50.00%	9	38.90%	7	67%	12
D5	5.60%	1	11.10%	2	72.20%	13	11.10%	2	0.00%	0	0.00%	0	33.30%	6	66.70%	12	17%	3

INFORMATION INTEGRATION AND ACCESS

	CURRENT								DESIRED IN 5 YEARS								DIFFERENCE	
	Strongly Disagree		Disagree		Agree		Strongly Agree		Strongly Disagree		Disagree		Agree		Strongly Agree			
Question	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#
D6	38.90%	7	22.20%	4	33.30%	6	5.60%	1	0.00%	0	0.00%	0	33.30%	6	66.70%	12	61%	11
D7	11.10%	2	33.30%	6	33.30%	6	22.20%	4	0.00%	0	0.00%	0	22.20%	4	77.80%	14	45%	8
D8	22.20%	4	38.90%	7	22.20%	4	16.70%	3	0.00%	0	0.00%	0	27.80%	5	72.20%	13	61%	11
D9	27.80%	5	33.30%	6	38.90%	7	0.00%	0	0.00%	0	0.00%	0	27.80%	5	72.20%	13	61%	11

USE OF DECISION-SUPPORT TOOLS

	CURRENT								DESIRED IN 5 YEARS								DIFFERENCE	
	Strongly Disagree		Disagree		Agree		Strongly Agree		Strongly Disagree		Disagree		Agree		Strongly Agree			
Question	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#
D10	22.20%	4	27.80%	5	50.00%	9	0.00%	0	0.00%	0	0.00%	0	44.40%	8	55.60%	10	50%	9
D11	11.10%	2	44.40%	8	33.30%	6	11.10%	2	0.00%	0	0.00%	0	33.30%	6	66.70%	12	56%	10
D12	5.60%	1	27.80%	5	61.10%	11	5.60%	1	0.00%	0	0.00%	0	27.80%	5	72.20%	13	33%	6
D13	0.00%	0	27.80%	5	61.10%	11	11.10%	2	0.00%	0	0.00%	0	27.80%	5	72.20%	13	28%	5
D14	16.70%	3	33.30%	6	38.90%	7	11.10%	2	0.00%	0	5.60%	1	33.30%	6	61.10%	11	44%	8
D15	5.60%	1	33.30%	6	50.00%	9	11.10%	2	0.00%	0	5.60%	1	33.30%	6	61.10%	11	33%	6
D16	16.70%	3	50.00%	9	33.30%	6	0.00%	0	0.00%	0	0.00%	0	44.40%	8	55.60%	10	67%	12

SYSTEM MONITORING AND FEEDBACK

	CURRENT								DESIRED IN 5 YEARS								DIFFERENCE	
	Strongly Disagree		Disagree		Agree		Strongly Agree		Strongly Disagree		Disagree		Agree		Strongly Agree			
Question	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#
D17	22.20%	4	27.80%	5	44.40%	8	5.60%	1	0.00%	0	5.60%	1	33.30%	6	61.10%	11	44%	8
D18	33.30%	6	27.80%	5	38.90%	7	0.00%	0	0.00%	0	0.00%	0	55.60%	10	44.40%	8	61%	11
D19	27.80%	5	38.90%	7	27.80%	5	5.60%	1	0.00%	0	0.00%	0	55.60%	10	44.40%	8	67%	12
D20	16.70%	3	22.20%	4	55.60%	10	5.60%	1	0.00%	0	0.00%	0	55.60%	10	44.40%	8	39%	7

Self-Assessment Survey Results (raw data)

1.1. (CURRENT) POLICY GUIDANCE BENEFITING FROM GOOD ASSET MANAGEMENT PRACTICE

	Strongly Disagree (1)	Neutral (2)	Agree (3)	Strongly Agree (4)	Responses
A1. Policy guidance supports preservation of existing infrastructure assets.	0.0% 0	0.0% 0	61.1% 11	38.9% 7	18
A2. Policy guidance encourages resource allocation and project selection based on cost-effectiveness or benefit/cost analysis.	0.0% 0	50.0% 9	44.4% 8	5.6% 1	18
A3. Policies support a long-term, life-cycle approach to evaluating investment benefits and costs.	5.6% 1	61.1% 11	27.8% 5	5.6% 1	18
A4. Policy guidance considers customer perceptions and expectations.	11.1% 2	44.4% 8	27.8% 5	16.7% 3	18
A5. Our customers contribute to the process that formulates policy goals and objectives.	16.7% 3	38.9% 7	27.8% 5	16.7% 3	18

1.2. (DESIRED LEVEL IN 5 YEARS) POLICY GUIDANCE BENEFITING FROM GOOD ASSET MANAGEMENT PRACTICE

	Strongly Disagree (1)	Neutral (2)	Agree (3)	Strongly Agree (4)	Responses
A1. Policy guidance supports preservation of existing infrastructure assets.	0.0% 0	0.0% 0	16.7% 3	83.3% 15	18
A2. Policy guidance encourages resource allocation and project selection based on cost-effectiveness or benefit/cost analysis.	0.0% 0	5.6% 1	27.8% 5	66.7% 12	18
A3. Policies support a long-term, life-cycle approach to evaluating investment benefits and costs.	0.0% 0	0.0% 0	27.8% 5	72.2% 13	18
A4. Policy guidance considers customer perceptions and expectations.	0.0% 0	0.0% 0	61.1% 11	38.9% 7	18
A5. Our customers contribute to the process that formulates policy goals and objectives.	0.0% 0	16.7% 3	44.4% 8	38.9% 7	18

1.3. (CURRENT) STRONG FRAMEWORK FOR PERFORMANCE-BASED RESOURCE ALLOCATION

	Strongly Disagree (1)	Neutral (2)	Agree (3)	Strongly Agree (4)	Responses
A6. Policy guidance on resource allocation allows our agency sufficient flexibility to pursue a performance-based approach.	5.6% 1	33.3% 6	55.6% 10	5.6% 1	18
A7. Our agency has a business plan or strategic plan with comprehensive, well-defined goals and objectives to guide resource allocation.	5.6% 1	55.6% 10	22.2% 4	16.7% 3	18
A8. Our agency's goals and objectives are linked to specific performance measures and evaluation criteria for resource allocation.	5.6% 1	44.4% 8	38.9% 7	11.1% 2	18

1.4. (DESIRED LEVEL IN 5 YEARS) STRONG FRAMEWORK FOR PERFORMANCE-BASED RESOURCE ALLOCATION

	Strongly Disagree (1)	Neutral (2)	Agree (3)	Strongly Agree (4)	Responses
A6. Policy guidance on resource allocation allows our agency sufficient flexibility to pursue a performance-based approach.	0.0% 0	0.0% 0	44.4% 8	55.6% 10	18
A7. Our agency has a business plan or strategic plan with comprehensive, well-defined goals and objectives to guide resource allocation.	0.0% 0	0.0% 0	27.8% 5	72.2% 13	18
A8. Our agency's goals and objectives are linked to specific performance measures and evaluation criteria for resource allocation.	0.0% 0	0.0% 0	27.8% 5	72.2% 13	18

1.5. (CURRENT) PROACTIVE ROLE IN POLICY FORMULATION

	Strongly Disagree (1)	Neutral (2)	Agree (3)	Strongly Agree (4)	Responses
A9. Our agency estimates the resources needed to accomplish particular objectives as part of policy development.	5.6% 1	33.3% 6	44.4% 8	16.7% 3	18
A10. Our agency regularly communicates to customers and other stakeholders our accomplishments in meeting policy objectives.	5.6% 1	27.8% 5	50.0% 9	16.7% 3	18
A11. Our agency works with political leaders and other stakeholders to present funding options and consequences as part of our budget proposal.	5.6% 1	16.7% 3	50.0% 9	27.8% 5	18

1.6. (DESIRED LEVEL IN 5 YEARS) PROACTIVE ROLE IN POLICY FORMULATION

	Strongly Disagree (1)	Neutral (2)	Agree (3)	Strongly Agree (4)	Responses
A9. Our agency estimates the resources needed to accomplish particular objectives as part of policy development.	0.0% 0	0.0% 0	38.9% 7	61.1% 11	18
A10. Our agency regularly communicates to customers and other stakeholders our accomplishments in meeting policy objectives.	0.0% 0	0.0% 0	33.3% 6	66.7% 12	18
A11. Our agency works with political leaders and other stakeholders to present funding options and consequences as part of our budget proposal.	0.0% 0	0.0% 0	16.7% 3	83.3% 15	18

2.1. (CURRENT) CONSIDERATION OF ALTERNATIVES IN PLANNING AND PROGRAMMING

	Strongly Disagree (1)	Neutral (2)	Agree (3)	Strongly Agree (4)	Responses
B1. Our agency's long-range plan includes an evaluation of capital, operational, and modal alternatives to meet system deficiencies.	0.0% 0	50.0% 9	44.4% 8	5.6% 1	18
B2. Capital versus maintenance expenditure tradeoffs are explicitly considered in the preservation of assets like pavements and bridges.	16.7% 3	22.2% 4	44.4% 8	16.7% 3	18
B3. Capital versus operations tradeoffs are explicitly considered in seeking to improve traffic movement.	22.2% 4	55.6% 10	22.2% 4	0.0% 0	18

2.2. (DESIRED LEVEL IN 5 YEARS) CONSIDERATION OF ALTERNATIVES IN PLANNING AND PROGRAMMING

	Strongly Disagree (1)	Neutral (2)	Agree (3)	Strongly Agree (4)	Responses
B1. Our agency's long-range plan includes an evaluation of capital, operational, and modal alternatives to meet system deficiencies.	0.0% 0	5.6% 1	38.9% 7	55.6% 10	18
B2. Capital versus maintenance expenditure tradeoffs are explicitly considered in the preservation of assets like pavements and bridges.	0.0% 0	0.0% 0	33.3% 6	66.7% 12	18
B3. Capital versus operations tradeoffs are explicitly considered in seeking to improve traffic movement.	0.0% 0	0.0% 0	66.7% 12	33.3% 6	18

2.3. (CURRENT) PERFORMANCE-BASED PLANNING AND A CLEAR LINKAGE AMONG POLICY, PLANNING, AND PROGRAMMING

	Strongly Disagree (1)	Neutral (2)	Agree (3)	Strongly Agree (4)	Responses
B4. Our agency's long-range plan is consistent with currently established policy goals and objectives.	0.0% 0	22.2% 4	61.1% 11	16.7% 3	18
B5. Our agency's long-range plan includes strategies that are consistent with plausible projections of future revenues.	16.7% 3	22.2% 4	44.4% 8	16.7% 3	18
B6. Our agency's long-range plan provides clear and specific guidance for the capital program development process.	16.7% 3	16.7% 3	61.1% 11	5.6% 1	18
B7. Our agency periodically updates its planning and programming methods to keep abreast of current policy guidance, customer expectations, and critical performance criteria.	5.6% 1	27.8% 5	55.6% 10	11.1% 2	18

2.4. (DESIRED LEVEL IN 5 YEARS) PERFORMANCE-BASED PLANNING AND A CLEAR LINKAGE AMONG POLICY, PLANNING, AND PROGRAMMING

	Strongly Disagree (1)	Neutral (2)	Agree (3)	Strongly Agree (4)	Responses
B4. Our agency's long-range plan is consistent with currently established policy goals and objectives.	0.0% 0	0.0% 0	44.4% 8	55.6% 10	18
B5. Our agency's long-range plan includes strategies that are consistent with plausible projections of future revenues.	0.0% 0	11.1% 2	50.0% 9	38.9% 7	18
B6. Our agency's long-range plan provides clear and specific guidance for the capital program development process.	0.0% 0	11.1% 2	44.4% 8	44.4% 8	18
B7. Our agency periodically updates its planning and programming methods to keep abreast of current policy guidance, customer expectations, and critical performance criteria.	0.0% 0	0.0% 0	44.4% 8	55.6% 10	18

2.5. (CURRENT) PERFORMANCE-BASED PROGRAMMING PROCESS

	Strongly Disagree (1)	Neutral (2)	Agree (3)	Strongly Agree (4)	Responses
B8. Criteria used to set program priorities, select projects, and allocate resources are consistent with stated policy objectives and defined performance measures.	5.6% 1	27.8% 5	55.6% 10	11.1% 2	18
B9. Our agency's programs are consistent with realistic projections of future revenues.	0.0% 0	22.2% 4	50.0% 9	27.8% 5	18
B10. Our agency's programs are based on realistic estimates of costs, benefits, and impacts on system performance.	5.6% 1	22.2% 4	55.6% 10	16.7% 3	18
B11. Project selection is based primarily on an objective assessment of relative merits and the ability to meet performance targets.	11.1% 2	44.4% 8	44.4% 8	0.0% 0	18
B12. The preservation program budget is based upon analyses of least life- cycle cost rather than exclusive reliance on worst-first strategies.	27.8% 5	22.2% 4	38.9% 7	11.1% 2	18
B13. A maintenance quality assurance study has been implemented to define levels of service for transportation system maintenance.	35.3% 6	29.4% 5	11.8% 2	23.5% 4	17

2.6. (DESIRED LEVEL IN 5 YEARS) PERFORMANCE-BASED PROGRAMMING PROCESS

	Strongly Disagree (1)	Neutral (2)	Agree (3)	Strongly Agree (4)	Responses
B8. Criteria used to set program priorities, select projects, and allocate resources are consistent with stated policy objectives and defined performance measures.	0.0% 0	0.0% 0	44.4% 8	55.6% 10	18
B9. Our agency's programs are consistent with realistic projections of future revenues.	0.0% 0	0.0% 0	44.4% 8	55.6% 10	18
B10. Our agency's programs are based on realistic estimates of costs, benefits, and impacts on system performance.	0.0% 0	0.0% 0	17.6% 3	82.4% 14	17
B11. Project selection is based primarily on an objective assessment of relative merits and the ability to meet performance targets.	0.0% 0	0.0% 0	50.0% 9	50.0% 9	18
B12. The preservation program budget is based upon analyses of least life- cycle cost rather than exclusive reliance on worst-first strategies.	0.0% 0	0.0% 0	38.9% 7	61.1% 11	18
B13. A maintenance quality assurance study has been implemented to define levels of service for transportation system maintenance.	0.0% 0	0.0% 0	47.1% 8	52.9% 9	17

3.1. (CURRENT) CONSIDERATION OF ALTERNATIVE PROJECT DELIVERY MECHANISMS

	Strongly Disagree (1)	Neutral (2)	Agree (3)	Strongly Agree (4)	Responses
C1. Our agency periodically evaluates the use of alternative delivery options such as maintenance outsourcing, intergovernmental agreements, design-build, design-build-maintain, and similar options.	5.6% 1	27.8% 5	50.0% 9	16.7% 3	18
C2. Our agency has an incentive program for recognizing or rewarding outstanding performance in improving upon schedule, quality, and cost objectives.	11.1% 2	38.9% 7	44.4% 8	5.6% 1	18

3.2. (DESIRED LEVEL IN 5 YEARS) CONSIDERATION OF ALTERNATIVE PROJECT DELIVERY MECHANISMS

	Strongly Disagree (1)	Neutral (2)	Agree (3)	Strongly Agree (4)	Responses
C1. Our agency periodically evaluates the use of alternative delivery options such as maintenance outsourcing, intergovernmental agreements, design-build, design-build-maintain, and similar options.	5.6% 1	5.6% 1	50.0% 9	38.9% 7	18
C2. Our agency has an incentive program for recognizing or rewarding outstanding performance in improving upon schedule, quality, and cost objectives.	0.0% 0	0.0% 0	66.7% 12	33.3% 6	18

3.3. (CURRENT) EFFECTIVE PROGRAM MANAGEMENT

	Strongly Disagree (1)	Neutral (2)	Agree (3)	Strongly Agree (4)	Responses
C3. Our agency solicits input from all affected parties to ensure that project scope is consistent with objectives of the project.	0.0% 0	16.7% 3	66.7% 12	16.7% 3	18
C4. Our agency uses well-defined program delivery measures to track adherence to project scope, schedule, and budget.	11.1% 2	27.8% 5	44.4% 8	16.7% 3	18
C5. Our agency has a well-established and functioning process to approve project changes and program adjustments.	0.0% 0	38.9% 7	33.3% 6	27.8% 5	18
C6. When adding projects or changing project schedules, our agency considers effects on the delivery of other projects in the program.	5.6% 1	16.7% 3	44.4% 8	33.3% 6	18
C7. Projects with significant changes to scope, schedule, or cost are reprioritized to ensure that they are still competitive in cost and performance.	22.2% 4	38.9% 7	33.3% 6	5.6% 1	18
C8. Agency executives and program managers are regularly kept informed of program delivery status.	0.0% 0	16.7% 3	33.3% 6	50.0% 9	18
C9. External stakeholders and policy-makers feel that they are sufficiently updated on program delivery status.	11.1% 2	55.6% 10	22.2% 4	11.1% 2	18

3.4. (DESIRED LEVEL IN 5 YEARS) EFFECTIVE PROGRAM MANAGEMENT

	Strongly Disagree (1)	Neutral (2)	Agree (3)	Strongly Agree (4)	Responses
C3. Our agency solicits input from all affected parties to ensure that project scope is consistent with objectives of the project.	0.0% 0	0.0% 0	44.4% 8	55.6% 10	18
C4. Our agency uses well-defined program delivery measures to track adherence to project scope, schedule, and budget.	0.0% 0	0.0% 0	44.4% 8	55.6% 10	18
C5. Our agency has a well-established and functioning process to approve project changes and program adjustments.	0.0% 0	0.0% 0	33.3% 6	66.7% 12	18
C6. When adding projects or changing project schedules, our agency considers effects on the delivery of other projects in the program.	0.0% 0	0.0% 0	33.3% 6	66.7% 12	18
C7. Projects with significant changes to scope, schedule, or cost are reprioritized to ensure that they are still competitive in cost and performance.	0.0% 0	5.6% 1	50.0% 9	44.4% 8	18
C8. Agency executives and program managers are regularly kept informed of program delivery status.	0.0% 0	0.0% 0	22.2% 4	77.8% 14	18
C9. External stakeholders and policy-makers feel that they are sufficiently updated on program delivery status.	0.0% 0	0.0% 0	50.0% 9	50.0% 9	18

3.5. (CURRENT) COST TRACKING AND ESTIMATING

	Strongly Disagree (1)	Neutral (2)	Agree (3)	Strongly Agree (4)	Responses
C10. Our agency maintains and uses information on the full unit costs of construction activities.	0.0% 0	11.1% 2	38.9% 7	50.0% 9	18
C11. Our agency maintains and uses information on the full unit costs of maintenance activities.	5.6% 1	27.8% 5	50.0% 9	16.7% 3	18

3.6. (DESIRED LEVEL IN 5 YEARS) COST TRACKING AND ESTIMATING

	Strongly Disagree (1)	Neutral (2)	Agree (3)	Strongly Agree (4)	Responses
C10. Our agency maintains and uses information on the full unit costs of construction activities.	0.0% 0	0.0% 0	27.8% 5	72.2% 13	18
C11. Our agency maintains and uses information on the full unit costs of maintenance activities.	0.0% 0	0.0% 0	33.3% 6	66.7% 12	18

4.1. (CURRENT) EFFECTIVE AND EFFICIENT DATA COLLECTION

	Strongly Disagree (1)	Neutral (2)	Agree (3)	Strongly Agree (4)	Responses
D1. Our agency has a complete and up-to-date inventory of our major assets.	11.1% 2	16.7% 3	61.1% 11	11.1% 2	18
D2. Our agency regularly collects information on the condition of our assets.	0.0% 0	11.1% 2	61.1% 11	27.8% 5	18
D3. Our agency regularly collects information on the performance of our assets (e.g., serviceability, ride quality, capacity, operations, and safety improvements).	0.0% 0	27.8% 5	61.1% 11	11.1% 2	18
D4. Our agency regularly collects customer perceptions of asset condition and performance.	44.4% 8	33.3% 6	11.1% 2	11.1% 2	18
D5. Our agency continually seeks to improve the efficiency of data collection (e.g., through sampling techniques, use of automated equipment, other methods appropriate to our transportation system).	5.6% 1	11.1% 2	72.2% 13	11.1% 2	18

4.2. (DESIRED LEVEL IN 5 YEARS) EFFECTIVE AND EFFICIENT DATA COLLECTION

	Strongly Disagree (1)	Neutral (2)	Agree (3)	Strongly Agree (4)	Responses
D1. Our agency has a complete and up-to-date inventory of our major assets.	0.0% 0	0.0% 0	33.3% 6	66.7% 12	18
D2. Our agency regularly collects information on the condition of our assets.	0.0% 0	0.0% 0	22.2% 4	77.8% 14	18
D3. Our agency regularly collects information on the performance of our assets (e.g., serviceability, ride quality, capacity, operations, and safety improvements).	0.0% 0	0.0% 0	44.4% 8	55.6% 10	18
D4. Our agency regularly collects customer perceptions of asset condition and performance.	0.0% 0	11.1% 2	50.0% 9	38.9% 7	18
D5. Our agency continually seeks to improve the efficiency of data collection (e.g., through sampling techniques, use of automated equipment, other methods appropriate to our transportation system).	0.0% 0	0.0% 0	33.3% 6	66.7% 12	18

4.3. (CURRENT) INFORMATION INTEGRATION AND ACCESS

	Strongly Disagree (1)	Neutral (2)	Agree (3)	Strongly Agree (4)	Responses
D6. Agency managers and staff at different levels can quickly and conveniently obtain information they need about asset characteristics, location, usage, condition, or performance.	38.9% 7	22.2% 4	33.3% 6	5.6% 1	18
D7. Our agency has established standards for geographic referencing that allow us to bring together information for different asset classes.	11.1% 2	33.3% 6	33.3% 6	22.2% 4	18
D8. Our agency can easily produce map displays showing needs/deficiencies for different asset classes and planned/programmed projects.	22.2% 4	38.9% 7	22.2% 4	16.7% 3	18
D9. Our agency has established data standards to promote consistent treatment of existing asset-related data and guide development of future applications.	27.8% 5	33.3% 6	38.9% 7	0.0% 0	18

4.4. (DESIRED LEVEL IN 5 YEARS) INFORMATION INTEGRATION AND ACCESS

	Strongly Disagree (1)	Neutral (2)	Agree (3)	Strongly Agree (4)	Responses
D6. Agency managers and staff at different levels can quickly and conveniently obtain information they need about asset characteristics, location, usage, condition, or performance.	0.0% 0	0.0% 0	33.3% 6	66.7% 12	18
D7. Our agency has established standards for geographic referencing that allow us to bring together information for different asset classes.	0.0% 0	0.0% 0	22.2% 4	77.8% 14	18
D8. Our agency can easily produce map displays showing needs/deficiencies for different asset classes and planned/programmed projects.	0.0% 0	0.0% 0	27.8% 5	72.2% 13	18
D9. Our agency has established data standards to promote consistent treatment of existing asset-related data and guide development of future applications.	0.0% 0	0.0% 0	27.8% 5	72.2% 13	18

4.5. (CURRENT) USE OF DECISION-SUPPORT TOOLS

	Strongly Disagree (1)	Neutral (2)	Agree (3)	Strongly Agree (4)	Responses
D10. Information on actual work accomplishments and costs is used to improve the cost-projection capabilities of our asset management systems.	22.2% 4	27.8% 5	50.0% 9	0.0% 0	18
D11. Information on changes in asset condition over time is used to improve forecasts of asset life and deterioration in our asset management systems.	11.1% 2	44.4% 8	33.3% 6	11.1% 2	18

4.6. (DESIRED LEVEL IN 5 YEARS) USE OF DECISION-SUPPORT TOOLS

	Strongly Disagree (1)	Neutral (2)	Agree (3)	Strongly Agree (4)	Responses
D10. Information on actual work accomplishments and costs is used to improve the cost-projection capabilities of our asset management systems.	0.0% 0	0.0% 0	44.4% 8	55.6% 10	18
D11. Information on changes in asset condition over time is used to improve forecasts of asset life and deterioration in our asset management systems.	0.0% 0	0.0% 0	33.3% 6	66.7% 12	18

4.7. (CURRENT) USE OF DECISION-SUPPORT TOOLS (CONTINUED) Our agency uses asset management decision-support tools to:

	Strongly Disagree (1)	Neutral (2)	Agree (3)	Strongly Agree (4)	Responses
D12. Calculate and report actual system performance;	5.6% 1	27.8% 5	61.1% 11	5.6% 1	18
D13. Identify system deficiencies or needs;	0.0% 0	27.8% 5	61.1% 11	11.1% 2	18
D14. Rank candidate projects for the capital program;	16.7% 3	33.3% 6	38.9% 7	11.1% 2	18
D15. Forecast future system performance given a proposed program of projects; and	5.6% 1	33.3% 6	50.0% 9	11.1% 2	18
D16. Forecast future system performance under different mixes of investment levels by program category.	16.7% 3	50.0% 9	33.3% 6	0.0% 0	18

4.8. (DESIRED LEVEL IN 5 YEARS) USE OF DECISION-SUPPORT TOOLS (CONTINUED) Our agency uses asset management decision-support tools to:

	Strongly Disagree (1)	Neutral (2)	Agree (3)	Strongly Agree (4)	Responses
D12. Calculate and report actual system performance;	0.0% 0	0.0% 0	27.8% 5	72.2% 13	18
D13. Identify system deficiencies or needs;	0.0% 0	0.0% 0	27.8% 5	72.2% 13	18
D14. Rank candidate projects for the capital program;	0.0% 0	5.6% 1	33.3% 6	61.1% 11	18
D15. Forecast future system performance given a proposed program of projects; and	0.0% 0	5.6% 1	33.3% 6	61.1% 11	18
D16. Forecast future system performance under different mixes of investment levels by program category.	0.0% 0	0.0% 0	44.4% 8	55.6% 10	18

4.9. (CURRENT) SYSTEM MONITORING AND FEEDBACK

	Strongly Disagree (1)	Neutral (2)	Agree (3)	Strongly Agree (4)	Responses
D17. Our agency monitors actual system performance and compares these values to targets projected for its capital preservation program.	22.2% 4	27.8% 5	44.4% 8	5.6% 1	18
D18. Our agency monitors actual system performance and compares these values to targets projected for its capital improvement program.	33.3% 6	27.8% 5	38.9% 7	0.0% 0	18
D19. Our agency monitors actual system performance and compares these values to targets projected for its maintenance and operations program.	27.8% 5	38.9% 7	27.8% 5	5.6% 1	18
D20. We periodically distribute reports of performance measures relevant to customer/stakeholder satisfaction with transportation system and services.	16.7% 3	22.2% 4	55.6% 10	5.6% 1	18

4.10. (DESIRED LEVEL IN 5 YEARS) SYSTEM MONITORING AND FEEDBACK

	Strongly Disagree (1)	Neutral (2)	Agree (3)	Strongly Agree (4)	Responses
D17. Our agency monitors actual system performance and compares these values to targets projected for its capital preservation program.	0.0% 0	5.6% 1	33.3% 6	61.1% 11	18
D18. Our agency monitors actual system performance and compares these values to targets projected for its capital improvement program.	0.0% 0	0.0% 0	55.6% 10	44.4% 8	18
D19. Our agency monitors actual system performance and compares these values to targets projected for its maintenance and operations program.	0.0% 0	0.0% 0	55.6% 10	44.4% 8	18
D20. We periodically distribute reports of performance measures relevant to customer/stakeholder satisfaction with transportation system and services.	0.0% 0	0.0% 0	55.6% 10	44.4% 8	18

Abbreviations used without definition in TRB Publications:

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	Air Transport Association
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
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
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
SAE	Society of Automotive Engineers
SAFETY-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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