

Transportation Asset Management Guide

November 2002

prepared for
**National Cooperative Highway Research Program
(NCHRP) Project 20-24(11)**



American Association of State Highway and Transportation Officials
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prepared by

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with

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FOREWORD

State transportation officials at all levels face the task of managing a wide range of assets to meet public, agency, and legislative expectations. These assets include the physical transportation infrastructure (e.g., guideways, structures, and associated features and appurtenances) as well as other types of assets: e.g., an agency's human resources, financial capacity, equipment and vehicle fleets, materials stocks, real estate, and corporate data and information.

Recognizing its growing importance to transportation agencies worldwide, the American Association of State Highway and Transportation Officials (AASHTO) in 1998 adopted transportation asset management as a priority initiative. AASHTO created a Task Force, reporting to the Board of Directors, to guide this national initiative and to develop and implement a *Transportation Asset Management Strategic Plan*. To respond to several tasks in this *Strategic Plan*, the National Cooperative Highway Research Program (NCHRP) awarded Project 20-24(11) to a study team headed by Cambridge Systematics, Inc. The goal of this NCHRP project is to develop information on transportation asset management and to apply these findings in producing a *Transportation Asset Management Guide* for use by AASHTO members and other transportation agencies. The *Guide* is designed to help agencies develop and apply the principles, techniques, and tools that can advance the management of their transportation assets.

The overall management framework that has been developed in this study is flexible enough to be adapted and refined for use with, respectively, each type of transportation agency asset listed above. To develop the depth as well as breadth of material needed to build a meaningful first-edition *Transportation Asset Management Guide*, however, the scope of this study has focused on the particular set of assets that constitutes an agency's **transportation infrastructure**. This concentration enables asset management principles, methods, examples, and research recommendations to be developed in a concrete, practical, and understandable way. It facilitates comparisons with corresponding work by transportation agencies overseas and by the private sector, which have for the most part adopted a similar scope in their studies. It provides a specific frame of reference within which differences among state departments of transportation (DOT) can be addressed by particular business management models, approaches, and procedures.

This study therefore interprets transportation asset management as a **strategic approach to managing physical transportation infrastructure**. Transportation asset management in this context promotes more effective resource allocation and utilization based upon quality information. This concept covers a broad array of DOT functions, activities, and decisions: e.g., transportation investment policies; institutional relationships between DOTs and other public and private groups; multimodal transportation planning; program development for capital projects and for maintenance and operations; delivery of agency programs and services; and real-time and periodic system monitoring. All of these management processes have important implications for an agency's attainment of its goals in public policy, financial resource availability, engineering standards and criteria, maintenance and operations levels of service, and overall system performance.

A number of support activities are involved as well. Information technology can inform many of these management processes, and agencies have already expended considerable sums to develop asset management systems, databases, and other analytic tools. These systems must, however, complement the decision-making processes and organizational structures of individual agencies if they are to operate effectively and support good asset management at all organizational levels. Effective communication of information on asset management between an agency and its governing bodies, stakeholders, and customers is likewise critical to success.

The objectives of this study have been to gather information on asset management practices in the United States and overseas, develop a framework for transportation asset management, and apply this framework to produce a *Transportation Asset Management Guide*. The study has been organized in two phases:

- **Phase I** encompassed information gathering, framework development, and recommendation of a research program; and
- **Phase II** has produced this *Guide*.

Foreword

The work in Phase I has been documented in three reports:

1. A comprehensive framework for transportation asset management that established the basis for developing this *Guide*;
2. A synthesis of current information and practices in asset management; and
3. A prioritized program of research in asset management.

This *Guide* builds on this earlier work to provide state DOTs and other transportation agencies guidance on implementing asset management concepts and principles within their business processes. At its core, asset management deals with an agency's decisions in resource allocation and utilization in managing its system of transportation infrastructure. Asset management is a way of looking at an agency's "way of doing business" to see if there are better ways to reach decisions in infrastructure management – e.g., by basing decision methods and criteria on current policy guidance, considering a range of alternatives, focusing on outcomes of decisions, and applying more objective information to decisions.

Asset management therefore relates to existing agency functions – e.g., participating in and informing the development of transportation policies, long-range planning, priority programming and development of the statewide transportation improvement program (STIP), delivering programs and services, and monitoring system condition. It is not a separate function on its own, nor is it a complete departure from current practice. In fact, while all agencies reflect good asset management to some degree in their daily operations, all have room for improvement: "Everyone is doing something, but no one is doing everything." The intent of this *Guide* is to provide individual agencies with the flexibility to tailor and customize their asset management efforts to their particular needs and situations, with an effort as broad or as narrow as they choose to undertake. The *Guide* provides a self-assessment exercise to assist agencies in identifying where they may wish to focus their asset management efforts.

This edition is the initial version of the *Transportation Asset Management Guide*. It will assist transportation agencies in becoming familiar with the ideas and techniques by which asset management can influence

their resource allocation and utilization processes and decisions. Since transportation asset management is a continually and rapidly evolving field, the AASHTO *Strategic Plan* envisions periodic updates of this *Guide* to reflect changes in transportation policy and to be able to report current DOT experiences and practices. The *Strategic Plan* also recommends a number of tasks and research efforts, results of which will likewise be useful additions to future versions of this *Guide*.

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SUMMARY

S.1 STRATEGIC INFRASTRUCTURE MANAGEMENT

Transportation asset management represents a strategic approach to managing transportation infrastructure assets. It focuses on a department of transportation's (DOT) business processes for resource allocation and utilization with the objective of better decision-making based upon quality information and well-defined objectives. Recognizing its growing importance to transportation agencies worldwide, the American Association of State Highway and Transportation Officials (AASHTO) in 1998 adopted asset management as a strategic initiative, and formed a Task Force to develop and implement a *Strategic Plan for Transportation Asset Management*.¹ This NCHRP Project 20-24(11) has completed several tasks in the AASHTO *Strategic Plan*:

- **Task 2-1-1** – Identify and document the state-of-the-art in asset management, specifically applicable to the state departments of transportation.
- **Task 2-2-1** – Identify and document the state-of-the-practice in asset management among the AASHTO member states.
- **Task 2-3-1** – Identify knowledge and technology gaps and define future research projects.
- **Task 2-4-1** – Propose a generic framework for transportation asset management that can be adopted by member states to meet their individual needs.
- **Task 5-1-1** – Develop an AASHTO *Guide for Transportation Asset Management*.

S.2 GOALS AND BENEFITS OF ASSET MANAGEMENT

The value of asset management will be reflected in its outcomes and benefits to transportation agencies and their customers. The key principles of asset management represent a way of doing business – a perspective that a department can adopt in looking at its current procedures and seeing how better decisions on

infrastructure management can be made with better information. The goals of asset management are to:

- Build, preserve, and operate facilities more **cost-effectively** with **improved asset performance**;
- Deliver to an agency's customers the **best value** for the public tax dollar spent; and
- Enhance the **credibility and accountability** of the transportation agency to its governing executive and legislative bodies.

Asset management can touch nearly every aspect of a transportation agency's business, including planning, engineering, finance, programming, construction, maintenance, and information systems. Asset management should not be viewed, however, as yet another new program, requiring another new bureaucracy. Rather, asset management is a "way of doing business." It brings a particular perspective to how an agency conducts its existing procedures, reaches decisions, and applies its IT capabilities. It suggests principles and techniques to apply in policy-making, planning, project selection, program trade-offs, program delivery, data gathering, and management system application. This *Guide* is designed to help you identify where improvements in these processes can be made, and to suggest ideas and methods to do so. It will enable you to answer the following questions:

- How can your agency improve the way it currently is managing its assets?
- Are current and planned initiatives sufficient, or do they require modification, addition, or redirection?
- What approaches may work well in your agency or have worked well in other agencies similar to yours?

The benefits of asset management may be seen in many different ways, depending upon an agency's transportation system, management philosophy, and current resources and priorities. Following are some possible outcomes when an agency takes action to improve its asset management practices:

- Lower long-term costs for infrastructure preservation;
- Improved performance and service to customers;

¹This *Strategic Plan* was adopted by the AASHTO Board of Directors in December 2000.

- Improved cost-effectiveness and use of available resources;
- A focus on performance and outcomes; and
- Improved credibility and accountability for decisions and expenditures.

S.3 PRINCIPLES OF ASSET MANAGEMENT

- **Asset Management Is a Strategic Approach.** A strategic perspective takes a long view of infrastructure performance and cost, and considering options in a comprehensive, proactive, and informed way. It is driven by policy goals and objectives and relies on systematic assessments of asset performance and cost in making decisions on future actions.
- **Asset Management Encompasses Multiple Business Processes.** Asset management encompasses a number of business processes related to infrastructure management in DOTs, including those related to planning, program development and recommendation, engineering of projects and services, and program delivery. Decisions on allocating resources are policy-driven and performance-based, consider a range of alternatives, have clear criteria for decision-making, and investigate the most cost-effective solutions through analyses of tradeoffs. The business processes are managed to elicit effective contributions from all levels of the organization, and to foster communications on asset management needs and accomplishments both within and outside the agency.
- **Asset Management Relies on Good Information and Analytic Capabilities.** Quality information – accurate, complete, timely – is important at all stages of asset management. Information technology is a practical necessity in supporting asset management, although there are many ways in which automated techniques can be beneficially applied.

S.4 MANAGEMENT FRAMEWORK AND SELF-ASSESSMENT

This *Guide* formalizes the principles above within a management framework that agencies can apply to

guide improvement in their asset management practice. This framework is organized within a set of evaluation matrices that structure the concepts, principles, and “ideal” practices of asset management in four major areas:

- **Policy goals and objectives**, including the role of policy formulation in asset management and ways in which policy guidance can benefit from improved asset management;
- **Planning and programming**, focusing on best practices in reaching decisions on resource allocation for investments in transportation infrastructure;
- **Program delivery**, looking at options in resource utilization and management methods to deliver programs and services; and
- **Information and analysis**, including use of information technology (IT) at each stage of asset management; monitoring of asset performance and feedback of this information to improve decision processes in the future; and reporting and communication of key information and results.

In each of these areas the matrices build the management framework through descriptions of the following information:

- Basic **characteristics** of good asset management practice applicable to transportation agencies;
- Specific **evaluation criteria** for each characteristic; and
- The current **state-of-the-art** practice for each criterion.

While the specific entries in these matrices reflect the organizational, institutional, and financial setting of state DOTs in the United States, the underlying principles of asset management are applicable more generally to other transportation agencies.

These matrices are the foundation of the approach to transportation asset management presented in this *Guide*. Subsequent chapters in the *Guide* develop more specific information in each of the major areas above, illustrating how the concepts, principles, and techniques of asset management can apply to a particular agency.

In addition to this management framework, the *Guide* also provides a method for agencies to assess current

asset management practices within their own organizations and to determine what areas of asset management may need improvement or be given priority. While the evaluation matrices describe state-of-the-art, or “benchmark,” practices as guidelines, DOTs may elect to focus on specific areas for improvement, to work toward benchmark practices in stages, or to adopt practices that differ from the benchmarks to accommodate particular agency needs, priorities, or constraints. This method consists of a self-assessment that can be conducted with the agency’s executives and senior managers in functional areas that will be critical to asset management implementation. The self-assessment can be used to identify existing agency functions that conform well to asset management best-practice; to identify other areas where improvement may be beneficial; to build agreement on priorities in asset management improvement; and to reach a consensus among organizational units on an agenda for asset management implementation.

The self-assessment is structured in very simple statements that managers can respond to, and does not take long to complete. The self-assessment exercise can then suggest other portions of the *Guide* that agency managers can consult for additional information.

- **Chapters 5 through 8** describe asset management concepts, principles, and techniques that apply to several agency functions in managing transportation infrastructure and decisions in resource allocation and utilization:
 - Policy formulation;
 - Planning and priority programming;
 - Program delivery; and
 - Information and analytic support, including the role of information technology, transportation system performance monitoring and feedback, and communication and reporting.
- **Chapter 9** concludes the *Guide* with a discussion of implementation issues.

S.5 ORGANIZATION OF THE GUIDE

The *Guide* is structured in the following parts:

- **Chapters 1 and 2** define transportation asset management, provide background information on past work in the field, and develop a framework for asset management of transportation infrastructure that is appropriate to U.S. DOTs.
- **Chapter 3** contains the self-assessment exercise that agencies can apply to identifying areas where asset management improvement may be helpful.
- **Chapter 4** describes how to develop an asset management implementation strategy and plan, based on the results of the self-assessment above. It stresses that the role of the *Guide* is to help an agency shape its own asset management implementation plan, tailoring and customizing the principles and techniques in the *Guide* to its particular situation, capabilities, and expectations.

1. INTRODUCTION

1.1 TRANSPORTATION ASSET MANAGEMENT

1.1.1 BACKGROUND

WELCOME!

This *Transportation Asset Management Guide* has been developed for you – a transportation agency executive or manager. This *Guide* helps you to examine, strategically and systematically, how investment decisions affecting your transportation infrastructure are made. It helps you to identify areas and priorities for possible improvement through initial and periodic self-assessment and benchmarking. It provides ideas, methods, and examples to accomplish more effective resource allocation and utilization. It does all of this by developing and applying the principles and practices of what is referred to as “transportation asset management.”

This *Guide* has been structured to help you address your asset management needs in several ways. Some pointers on different ways to use this *Guide* are provided in Section 1.4. First, though, some basics on the format of the *Guide* and its features:

- Discussions and explanations of asset management are normally in the double-column format illustrated on this page. Tables and figures are interspersed as needed.
- Points of special attention or importance are emphasized by calling them out in text boxes.
- Examples or case studies that illustrate useful lessons in asset management are described in a text box (see below).

Case Study Example

Examples of agency practice that illustrate useful lessons in asset management will be described in a format like this.

- Annotations and citations of sources are listed in footnotes.
- Chapters covering technical material may include a section at the end labeled “Further Information.” These sections include additional bibliographic and web site references where you

can obtain additional information on related topics or examples of agency practice.

MANAGING MANY “ASSETS”

Transportation officials manage a wide range of “assets” to meet public, agency, and legislative expectations. These assets include the physical infrastructure of the transportation system (e.g., guideways, structures, and associated features, utilities, and appurtenances) as well as other types of assets: e.g., an agency’s human resources, financial capacity, equipment and vehicle fleets, materials stocks, real estate, and corporate data and information. The overall management framework that is developed in this *Guide* is flexible enough to be adapted and refined for use with each type of transportation agency asset listed above.

To provide the depth needed for meaningful explanations and examples, however, the scope of this *Guide* focuses on the particular set of assets that constitutes an agency’s **transportation infrastructure**. This concentration enables asset management principles, methods, and examples to be developed in a concrete, practical, and understandable way. It facilitates comparisons with corresponding work by transportation agencies overseas and by the private sector, which have for the most part adopted a similar scope in their studies. It provides a specific frame of reference within which differences among state departments of transportation (DOT) can be addressed by particular business management models, approaches, and procedures.

Transportation infrastructure provides critical national lifelines for commerce, commuting and pleasure travel, support of national defense, and disaster response. Transportation facilities account for a major share of public-sector investment, and are among the most highly valued financial assets of state and local governments. Among transportation modes, the U.S. highway infrastructure itself represents an estimated \$1 trillion in replacement value.¹ Expenditures to build, operate, preserve, and improve transportation infrastructure are critical to meeting national goals of economic progress, social welfare, national defense, domestic security, environmental protection, and emergency preparedness. Transportation officials at all levels are faced with the responsibility of making the

¹Anthony R. Kane, “Why Asset Management is More Critically Important Than Ever Before,” **Public Roads**, March-April 2000.

1. Introduction

best possible use of limited resources to manage a wide range of transportation assets in a way that responds to these important objectives and satisfies the needs of transportation users – their customers.

As Used in this Guide...

Asset Management is a strategic approach to managing transportation infrastructure.

1.1.2 A STRATEGIC APPROACH

This *Guide* therefore defines and treats transportation asset management as a set of concepts, principles, and techniques leading to a **strategic approach to managing transportation infrastructure**. Transportation asset management enables more effective resource allocation and utilization, based upon quality information and analyses, to address facility preservation, operation, and improvement. This concept covers a broad array of DOT functions, activities, and decisions: e.g., transportation investment policies and priorities; relationships and partnerships between DOTs and other public and private groups; long-range, multimodal transportation planning; program development for capital projects and for maintenance and operations; delivery of agency programs and services; and real-time and periodic system monitoring and data processing. All of these actions are accomplished within the limits of available funding.

A number of support activities are involved as well. Information technology (IT) can inform many of these management processes, and agencies have already expended considerable sums to develop asset management systems, databases, and other analytic tools. These systems must, however, complement decision-making processes and organizational roles and responsibilities if they are to operate effectively and support good asset management at all organizational levels. Effective communication of information on asset management between an agency and its governing bodies, stakeholders, and customers is likewise critical to success.

The definition of asset management above is intentionally broad. It recognizes that there are differences in needs and priorities across agencies in how they manage their infrastructure. For example, those agencies with mature transportation systems may concentrate asset management on strategies to facilitate preserva-

tion (e.g., through preventive maintenance, or new materials and technology) and to gain greater operations efficiencies (e.g., by deploying intelligent transportation systems (ITS) devices and building urban operations centers). Those agencies facing strong population and economic growth may need to include system capacity improvement (including construction of new facilities), together with preservation and operations, in their implementation of asset management. Regardless of the scope and areas of priority with which transportation agencies view asset management, all agencies will benefit from having a strong, performance-based approach backed by credible information. A basic premise of this *Guide* is that “good asset management” involves applying general principles smartly, effectively to resource allocation and utilization – the heart of asset management. Actions can be tailored to particular situations, but generally will include core elements such as the following:

- Well-defined policies that can be related to clear objectives and measures of performance;
- Organizational roles and responsibilities and business processes that reflect these policy and performance objectives;
- A reliance on good information at all stages of infrastructure management, and the capability to develop and continually update this information base;
- Examination of a range of options for solving infrastructure problems;
- A comprehensive decision-making approach to transportation investment, viewing the transportation system as an integrated whole, and considering tradeoffs among modes and categories of investment;
- An ability to deliver capital, maintenance, and operations programs in terms of time, cost, engineering quality, and effective use of departmental and outside resources; and
- Management emphasis on customer service and accountability for system performance and cost-effectiveness.

In summary, the notion of asset management as a “strategic approach to managing transportation infrastructure” can be understood as “getting the best results or performance for the preservation, improvement, and operation of infrastructure assets given the resources

available.” The specific concepts, principles, and practices that characterize the asset management approach to achieve these ends are developed in Chapter 2.

1.2 BENEFITS AND OUTCOMES

The goals of asset management are to:

- Build, preserve, and operate facilities more **cost-effectively** with **improved performance**;
- Deliver to an agency’s customers the **best value** for the public tax dollar spent; and
- Enhance the **credibility and accountability** of the transportation agency.

Asset management can touch nearly every aspect of a transportation agency’s business, including planning, engineering, finance, programming, construction, maintenance, and information systems. Asset management should not be viewed, however, as yet another new program, requiring another new bureaucracy. Rather, asset management is a “way of doing business.” It brings a particular perspective to how an agency conducts its existing procedures, reaches decisions, and applies its IT capabilities. It suggests principles and techniques to make better decisions based on better information in policy and planning, capital programming and project selection, maintenance budgeting, program delivery and management, data gathering, and management system application. This *Guide* is designed to help you identify where improvements in your existing processes can be made, and to suggest ideas and methods to do so. It will enable you to answer the following questions:

- How can your agency improve asset performance?
- Are current and planned agency initiatives in infrastructure management sufficient, or do they require modification, addition, or redirection?
- What infrastructure management approaches and techniques have worked well in other agencies similar to yours?

The benefits of asset management may be seen in many different ways, depending upon an agency’s transportation system, management philosophy, and current resources and priorities. Following are some possible outcomes when an agency takes action to improve its asset management practices:

- Lower long-term costs for infrastructure preservation;
- Improved performance and service to customers;
- Improved cost-effectiveness and use of available resources;
- A focus on performance and outcomes; and
- Improved credibility and accountability for decisions.

What “Quick Gains” Can Asset Management Provide?

- *A snapshot of current infrastructure condition and performance – its status, what has been accomplished, areas of need.*
- *A framework for understanding investment needs – whether for structural repair, congestion mitigation, preservation of asset value, safety, operational improvements, environmental protection (e.g., at what locations and relative values?)*
- *A direct way to tie public perceptions of agency performance to your agency’s methods of identifying and selecting projects and prioritizing services.*
- *Something better than anecdotal stories – facts, figures, and systematic methods by which to justify needed investments or additional resources.*
- *A “key to competition” – helping your agency to compete for scarce program funding, helping your staff to compete with other potential service providers in the quality and cost-effectiveness of their actions, and helping your organizational units to “sharpen their thinking” in looking for new ways to solve problems and delivering quality services cost-effectively.*

Achieving these benefits requires a willingness to evaluate current business practices and to take steps to improve where needed. Successful business process improvement will require:

- Strong executive leadership;
- Buy-in by managers and staff at all organizational levels;
- A multi-disciplinary perspective within the agency; and
- A sustained and consistent commitment through implementation.

1. Introduction

1.3 BUILDING ON PREVIOUS WORK

This *Guide* is an outgrowth of earlier work by the American Association of State Highway and Transportation Officials (AASHTO) and the Federal Highway Administration (FHWA) to promote the understanding and application of asset management in the U.S. transportation industry. It also complements work by transportation and public works agencies abroad and by private-sector firms to develop and apply concepts and techniques of asset management for their respective inventories of infrastructure.

Other Useful Resources

Asset Management Primer. Published by FHWA Office of Asset Management. Explains how early asset management concepts relate to U.S. transportation organizations.

AASHTO's Strategic Plan for Transportation Asset Management. Establishes AASHTO's agenda for advancing asset management practice over the next 10 years.

Asset Management for the Roads Sector. Published by Organization for Economic Cooperation and Development (OECD). Documents asset management efforts by 13 member countries.

NCHRP Transportation Asset Management Guidance Phase I Study Reports, NCHRP Project 20-24(11): www4.nas.edu/trb/onlinepubs.nsf/web/nchrp_web_documents

"Transportation Asset Management Today" – a Community of Practice web site:
<http://assetmanagement.transportation.org>

FHWA Office of Asset Management web site:
<http://www.fhwa.dot.gov/infrastructure/asstmgmt/>

TRB Research & Technology Forum web site:
www4.nas.edu/trb/homepage.nsf/web/r&t_forum

1.3.1 AASHTO

In 1998 AASHTO formed a Task Force to develop and implement a 10-year *Strategic Plan on Transportation Asset Management*.² This *Strategic Plan* has five goals:

1. To establish partnerships with other agencies and stakeholders in pursuing asset management;
2. To promote a better understanding of asset management and how it can be used by member states;
3. To foster the development of better asset management techniques, tools, and associated research;
4. To communicate with and inform the leadership of member states on how they can use asset management; and
5. To assist member states as they evaluate and use asset management.

AASHTO's Board of Directors approved this *Strategic Plan* in December 2000. The AASHTO Task Force now continues its active involvement in promoting a wider understanding and use of transportation asset management among its member agencies:

- It meets several times each year to review progress on its *Strategic Plan* and to identify next steps.
- It reviews research priorities annually and recommends specific topics supporting asset management to AASHTO's Standing Committee on Research (SCOR).
- Its members have participated in the Pilot offering of a National Highway Institute (NHI) training course on this *Guide*, and provided key input to the final versions of both the NHI course and the first edition of this document.

1.3.2 FHWA

The FHWA has established its Office of Asset Management to provide leadership, technical assistance, and advocacy for more systematic management of highway infrastructure as a public investment. It plays a strong role in promoting several concepts and methods useful to asset management:

- System preservation;
- Management systems for pavements, bridges, tunnels, and road hardware;
- Economic analysis of system investments;
- New technology;

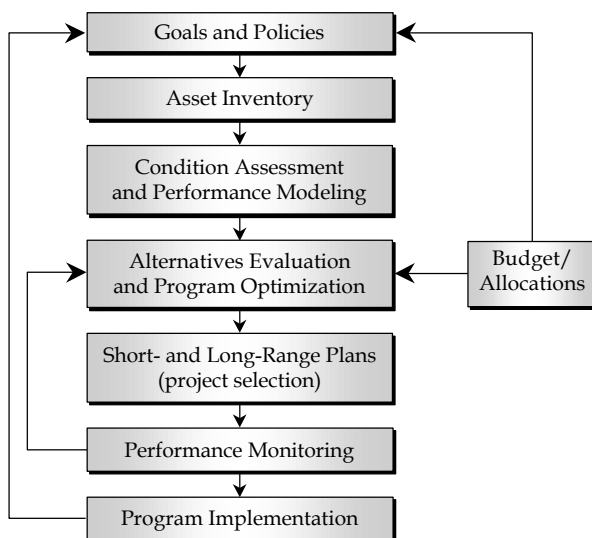
²AASHTO Task Force on Transportation Asset Management, *Strategic Plan 2000-2010*, adopted December 2000.

- Training and research; and
- Outreach and partnering activities.

It works with the public and private sector and academia to conduct nationwide programs in asset management.

An *Asset Management Primer* developed by the FHWA in 1999 describes transportation asset management as a systematic, fact-based, and reproducible decision-making approach to analyzing the tradeoffs between investments and improvement decisions at the system and project levels. (See Figure 1.1.)

Figure 1.1 FHWA's Overview of Transportation Asset Management



The *Primer's* definition of assets includes physical infrastructure, operational hardware, equipment, vehicles, real estate, materials, human resources, and data. The FHWA has produced several other documents on matters useful to transportation asset management, including primers on data integration and on the financial reporting standards of the Governmental Accounting Standards Board's Statement 34 (GASB 34).³

³The documents produced by FHWA's Office of Asset Management include: **Asset Management Primer** (December 1999), **Primer: GASB 34** (November 2000), and **Data Integration Primer** (August 2001).

1.3.3 ASSET MANAGEMENT WORKSHOPS

In 1996 AASHTO and the FHWA began co-sponsoring a series of workshops on asset management practice that have become major forums for exchanges of ideas and updates of progress in the field.⁴

- The September 1996 workshop in Washington, D.C., helped crystallize asset management as a concept in the United States. It defined asset management as "a systematic process of maintaining, upgrading, and operating physical assets cost-effectively." It recognized that principles, practices, and tools of good asset management practice exist. It noted that asset management can apply to public as well as private organizations.
- A second workshop was held in October 1997 at the Center for Infrastructure and Transportation Studies at Rensselaer Polytechnic Institute. This session built upon the findings of the earlier seminar to explore in greater depth the practices, processes, and tools of asset management as they apply to state DOTs. Presentations were given in several relevant areas to describe current practice and identify areas of potential improvement: e.g., the need for higher-level systems and integration of single-focus systems, for stronger forecasting and analytic tools to evaluate scenarios and tradeoffs, for new metrics to support strategic, performance-based decision-making, and for more effective application of technology and information systems.
- Subsequent workshops have focused on updates in latest knowledge and practice in asset management by transportation agencies, researchers, and industry experts. A peer exchange was held in Scottsdale, Arizona, in December 1999 to share ideas and experiences among DOT managers and to increase understanding of tools and

⁴The first three asset management workshops are documented in reports produced under the sponsorship of AASHTO and the FHWA: **Asset Management: Advancing the State of the Art Into the 21st Century Through Public-Private Dialogue** (September 1996); **21st Century Asset Management - Executive Summary** (October 1997); and **Asset Management Peer Exchange: Using Past Experience to Shape Future Practice** (December 1999). The fourth workshop is described on the Midwestern Regional University Transportation Center web site: www.mrutc.org

1. Introduction

processes that can improve their asset management practice. A national workshop on transportation asset management was held at the University of Wisconsin in September 2001, jointly sponsored by AASHTO, the FHWA, the Midwest Regional University Transportation Center, and the Midwest Transportation Consortium. This workshop brought together representatives of public and private sector groups interested in transportation asset management at a state and local level for discussion of the latest research and applied techniques.

- Asset management continues to be a subject of strong interest at national and regional meetings sponsored, for example, by AASHTO and the Transportation Research Board (TRB).

1.3.4 ASSET MANAGEMENT COMMUNITY OF PRACTICE WEB SITE

AASHTO and FHWA collaborated on an Asset Management Community of Practice web site, “Transportation Asset Management Today”.⁵ This web site contains links to information on asset management, provides a forum for discussions and collaboration on documents-in-progress, and organizes resources in several topic areas relevant to asset management and GASB 34. This web site is evolving continually, particularly during this fast-paced period in transportation asset management development and implementation nationwide. Please check it periodically for new and updated material.

1.3.5 RESEARCH AND TECHNOLOGY FORUM

The Research and Technology (R&T) Forum is a cooperative effort organized by TRB, AASHTO, and the FHWA to provide “a new framework for coordinating highway research and technology activities among research sponsors, practitioners, researchers, and other stakeholders in highway transportation.”⁶ The intent is not to duplicate existing mechanisms for conducting, managing, and disseminating research, but rather to provide a way to coordinate the investments in highway-related research, recognizing the numerous

and diverse stakeholders in highway transportation. Goals of this effort include more effective and efficient R&T investment, greater awareness of research underway, fostering of research partnerships, and demonstration of the needs and opportunities for research and resulting benefits.

Five Working Groups have been organized in the following areas: Safety, Infrastructure Renewal, Operations and Mobility, Planning and Environment, and Policy Analysis and System Monitoring. Each of these groups is drafting a report outlining research needs that advance good asset management practice within its respective area.

1.3.6 TRANSPORTATION RESEARCH BOARD

The Transportation Research Board has recently instituted a Task Force to undertake activities in transportation asset management. This group is looking at asset management across all transportation modes, considering its application to agencies and service providers at different levels of government. Its focus includes gathering and disseminating information on asset management practice, developing research recommendations, and recommending ways in which the subject can best be addressed through TRB.

1.3.7 JOINT TASK FORCE RECOMMENDATIONS

The AASHTO and the TRB Task Forces and FHWA held a joint meeting in Providence, Rhode Island, in June 2002 to recommend an action plan for the next two years, 2002-2004, on “Asset Management: ‘Making It Reality.’”⁷ A draft of these recommendations is now being reviewed for consideration at the AASHTO Annual Meeting in October 2002. While this action plan has not yet been formally adopted, many of its recommendations represent specific proposed implementations of tasks already included in AASHTO’s *Strategic Plan for Transportation Asset Management*. The plan recommends that AASHTO assume the leadership of transportation asset management activities by pursuing the following actions:

⁵http://www4.nas.edu/trb/homepage.nsf/web/r&t_forum.⁵ <http://assetmanagement.transportation.org>

⁶http://www4.nas.edu/trb/homepage.nsf/web/r&t_forum

⁷ **Asset Management: “Making It Reality,”** Working Draft, 2002-2004 Joint Recommended Action Plan, TRB Asset Management Task Force, AASHTO/TRB/FHWA Joint Meeting, Providence, Rhode Island, July 12, 2002.

- Taking the lead in forming a national partnership to support and promote transportation asset management;
- Convening a national summit on asset management;
- Adopting and maintaining this *Transportation Asset Management Guide* and subsequent products being developed through NCHRP;
- Developing an implementation support plan for near-term actions in the period 2002-2004;
- Developing an outreach and promotion plan;
- Seeking to enlist the support of critical stakeholder associations;
- Advocating an asset-management emphasis in the 2003 reauthorization of federal transportation legislation;
- Creating organizational capacity within AASHTO to foster programs called for in the Strategic Plan through creation of an Asset Management Institute; and
- Securing commitment of a sustainable level of funding of \$30 million over six years through reauthorization and/ or joint agreement with the U.S. DOT/FHWA and partner associations.

1.3.8 PHASE I STUDY FINDINGS

This *Guide* builds on the findings of Phase I of NCHRP Project 20-24(11). These results are documented in three companion volumes⁸ that provide additional information on transportation asset management:

1. **Transportation Asset Management Framework** describes the concepts and principles of asset management and provides examples of state-of-the-art practice. The management approach established in this report provides the basis of the guidance in Chapter 2 of this *Guide*.
2. **Synthesis of Asset Management Practice** summarizes asset management practices and techniques used by public agencies throughout the United States and abroad, and by the private sector.

⁸The Phase I reports of NCHRP Project 20-24(11) are available on NCHRP's web page: <http://www4.trb.org/trb/crp.nsf>

Sources of information additional to those cited above can be found in this report.

3. **Recommended Research Program** outlines a 10-year, prioritized program of research in the following areas to advance the practice of asset management in U.S. transportation agencies: policy and institutional aspects; information, analytic tools, and technology; planning, program development, and program delivery; training and information sharing; and academic programs and materials.

1.4 GETTING STARTED

1.4.1 YOUR CURRENT RESOURCES WILL WORK

You can start to implement better asset management practices **with the resources you already have**. The key to realizing immediate benefits is to utilize the best available people and tools to apply the underlying principles to current practices. Asset management principles will help guide the evolution of new processes, information technology (IT), and institutional relationships in the future. Work to begin investigating where improvements are needed, and with what priority, can begin immediately. Similarly, while upgraded IT capabilities may be recommended as part of improved asset management practice, substantial up-front software investments are not necessary. For example, you do not need a fully integrated "asset management system" to begin taking advantage of the concepts and best practices outlined in this *Guide*.

What is needed at all organizational levels is a shared desire to improve current ways of doing business, a willingness to deal with change where needed, and a continuing focus on outcomes in terms of improved transportation system performance and service to the customer. Asset management is not a "silver bullet" that magically overcomes existing problems and constraints; rather, it is a framework within which you can look at these existing problems and constraints to see how to deal with them better. Many constraints are imposed on transportation agency procedures and decisions from outside, whether by statute, regulation, or political necessity. Practically and realistically, these constraints often cannot be easily or quickly removed. What asset management concepts and

1. Introduction

principles can provide, however, is a focus on the desired result, emphasis on options to achieve this result, and recommended techniques to pursue and measure attainment of this result.

1.4.2 HOW THIS GUIDE CAN HELP

Applying the principles presented in this *Guide* to your current situation will enable you to **get started quickly**. This *Guide* describes steps that are helpful for improving asset management at your agency:

1. **Motivation** – Review asset management principles and framework – *Chapters 1 and 2*.
2. **Self-assessment** – Identify strengths and weaknesses and prioritize areas needing improvement – *Chapter 3*.
3. **Approach** – Define the scope of asset management at your agency and establish roles and responsibilities – *Chapter 4*.
4. **Potential Initiatives** – For each of the four topic areas of transportation asset management (policy goals and objectives, planning and programming, program delivery, and information and analysis) review key topics, best practices, and practical implementation steps – *Chapters 5-8*.
5. **Action Plan** – Identify areas needing improvement, formulate tasks, and set priorities and timeframes – *Chapter 4*.
6. **Implementation** – Perform tasks identified in the asset management action plan, track progress, and update the plan as fundamental changes occur – *Chapter 9*.

1.4.3 WHAT THIS GUIDE ADDRESSES

This *Guide* covers many aspects of an agency's resource allocation and utilization functions in describing how asset management "best practices" may apply to planning, priority programming, program delivery, infrastructure maintenance management, system monitoring, and IT applications. It explains and illustrates how asset management principles, techniques, and tools apply to each of these functions. It is not intended to be a primer on these individual functional areas, however. A wide variety of literature exists in each area for those desiring

general information on planning, programming, maintenance management, and so forth. This *Guide's* purpose is only to show how an asset management perspective may influence an agency's management philosophy, methods and techniques, organizational roles, and IT applications as they may apply to one or more of these functional areas.

2. FRAMEWORK AND PRINCIPLES

2.1 DEVELOPING THE CONCEPT

2.1.1 RESOURCE ALLOCATION AND UTILIZATION

Asset management is, at its core, a process of resource allocation and utilization. In this *Guide*, the term “resource” is used to refer to all of the ingredients at an agency’s disposal that can be applied to managing the physical transportation infrastructure. Resources include revenues, human resources, equipment, materials, real estate, and corporate information, to name the most familiar.

These resources also can be viewed in their own right as “assets” that likewise need to be managed effectively. For clarity and to provide meaningful examples and detail, this *Guide* focuses exclusively on *physical transportation infrastructure* as “the asset.” The general principles in this *Guide* could be applied to managing other types of assets in the appropriate context. Supporting explanations and examples of good practice could be developed in a manner corresponding to this *Guide* for managing human, financial, real, information, and other classes of assets listed above.

Figure 2.1 presents a strategic, integrated, systematic, and interdisciplinary approach to asset management as a resource allocation and utilization process. The “best-practice benchmark” represented by this diagram embodies the following elements:

- **The approach is policy-driven.** Policies include system performance goals as well as broader guidance, such as economic development or social or environmental initiatives, that affect transportation. Ideally, customer perceptions of the priority and quality of agency services also are factored into policy guidance. Other elements of resource allocation – e.g., planning methodology, program prioritization factors, and system performance measures – are consistent with these policy goals.
- **The identification and analysis of options, evaluation of candidate projects, and tradeoffs is strategic, interdisciplinary, and integrated.** It potentially encompasses a number of modes and their associated infrastructure, rather than focusing solely on individual classes of assets (as in pavement or bridge management, for

example). Policy goals and objectives are explicitly considered in evaluating investment and funding alternatives to meet transportation needs. Tradeoffs among asset classes or modes, program investments, and funding availability are conducted to seek the best performance at the lowest life-cycle cost. Resource allocation decisions consider a range of agency resources: e.g., human resources and corporate information, as well as financial resources. Quality information is applied throughout these processes.

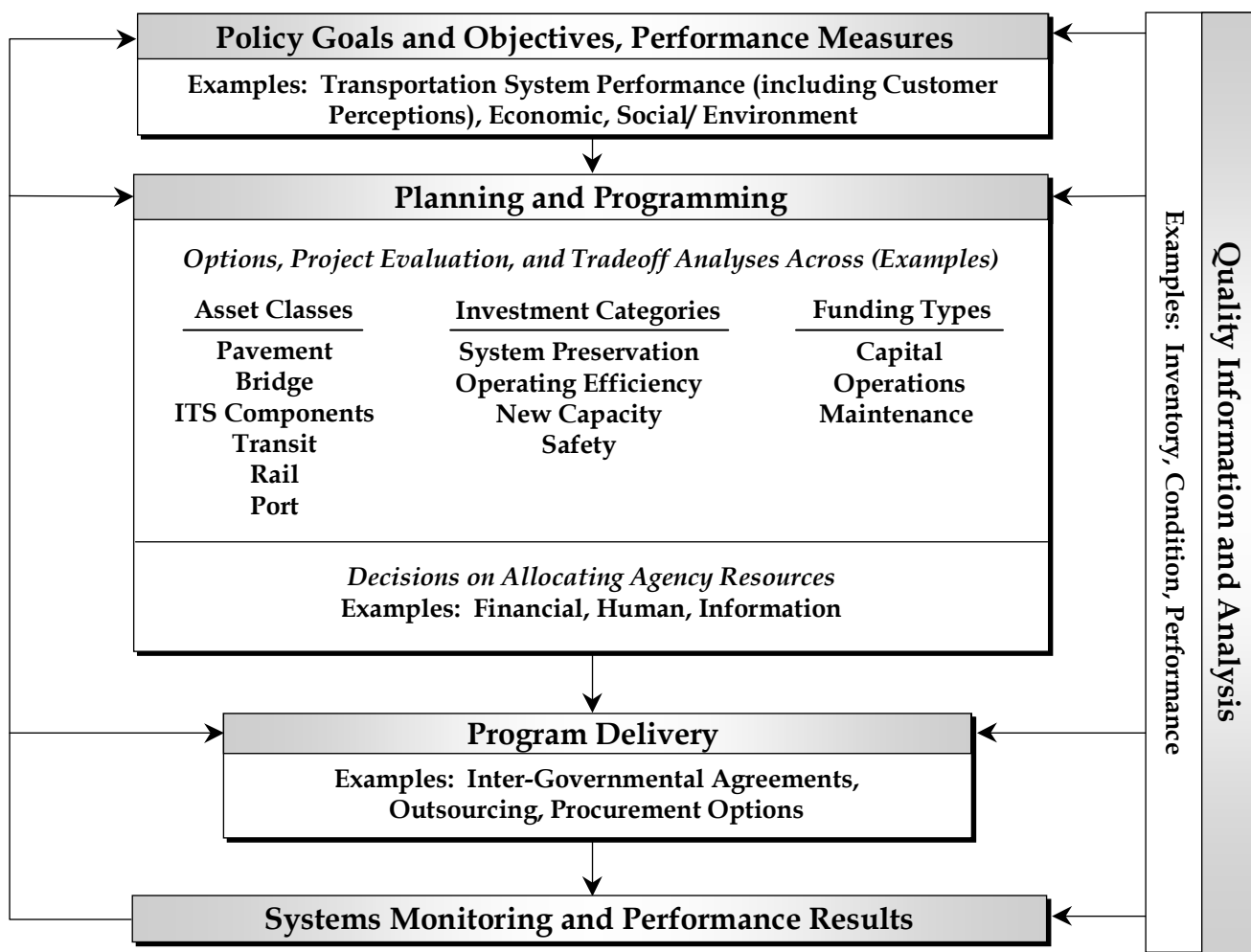
- **Programs, projects, and services are delivered in the most effective way available.** Options for delivery are periodically evaluated in terms of the agency’s own labor, financial, and information resources, and those of other service providers in the public or private sectors.
- **Decisions at each step are based upon quality information.** The various steps in Figure 2.1 are based upon current, complete, and accurate information on system condition, performance, and forecast trends. Management systems and supplementary analytic tools (e.g., for benefit/cost analyses or tradeoff analyses) are applied to these decisions, not as “black-box” solutions, but rather as aids to managers and executives in diagnosing problems and identifying the most effective projects and services. Value is placed on the capabilities and resources to provide this quality information.
- **The information base for asset management is continually renewed, with feedback for updates and improvement.** Working upward from the bottom in Figure 2.1 to consider the several feedback loops shown:
 - Program delivery monitoring documents whether projects and services have been delivered on time and budget, and identifies causes of problems that may require remedy.
 - System performance monitoring quantifies the results of past investment decisions in planning and priority programming, establishes baselines for future decisions, and identifies updates needed in project selection and resource allocation criteria. System and customer surveys update information on current asset inventory, condition, and performance, and the cost and effectiveness of project treatments and service delivery methods for use in future analyses.

2. Framework and Principles

- Performance trends and comparisons to target values and customer expectations provide information on the status of program accomplishments, needed adjustments (either

in areas of program emphasis, or in the target goals and objectives), providing a basis for future policy formulation.

Figure 2.1 Example Resource Allocation and Utilization Process in Asset Management



The framework presented in Figure 2.1 can be refined to meet the needs of organizations in different policy, institutional, organizational, technological, and financial settings. Later sections of this *Guide* will help you customize this general framework and apply it to your agency.

2.1.2 WHY SUCH A BROAD VIEW?

Figure 2.1 encompasses several major transportation agency functions in which many departmental units participate. It is a purposefully broad view. Improving your agency's asset management does not mean, how-

ever, that you must mount a massive effort to address all of the functions in Figure 2.1. Rather, the broad scope of coverage indicated by Figure 2.1 is to serve the needs of different agencies better:

- State DOTs differ from one another substantially in how they perceive the scope and priority of needed improvements in asset management.¹

¹These differences were revealed qualitatively in interviews with several DOTs during Phase I of this study. More quantitative indicators of the considerable variation in perception and practice among state agencies are presented in Chapter 3.

This *Guide* covers its subject broadly to meet the diverse needs of its constituency.

- Senior managers may wish to focus on high-priority areas for asset management improvement, but may not be sure which needs are most important. A broad treatment of the subject, including the self-assessment exercise in Chapter 3, allows managers to assess information on different aspects of asset management and to make more informed judgments on where to start.
- Agency needs and priorities in asset management may change over time. A DOT that perceives its top priority today, for example, in analytic support for its preservation program may experience future growth that refocuses its attention on system expansion and operational improvements. A broadly based *Guide* maintains its usefulness.
- Managers may wish to use the *Guide* as a source book for ideas on asset management as it applies to a range of agency functions. The broad view of resource allocation and utilization in the *Guide* serves this purpose well.

Agencies may tailor their implementation of asset management to the scope, depth, and timetable that is best suited to their needs and available staffing and budget. The breadth of the *Guide* is intended to give agencies flexibility in how they approach their individual exercises, not to direct them to an effort that is larger or more diffuse than they intended. Suggestions on ways to tailor and focus transportation asset management are given in Chapters 3 and 4.

2.1.3 HALLMARKS OF THIS APPROACH

The definition of transportation asset management in Chapter 1 as “a strategic approach to managing transportation infrastructure” can now be elaborated upon through descriptions of typical “best practice” characteristics and examples. In Sections 2.2 and 2.3 these characteristics will be formalized to build a framework for asset management of transportation infrastructure. The characteristics of asset management include the following:

- Transportation asset management is a policy-driven, performance-based approach with a focus on outcomes or results:
 - Resource allocation decisions are driven by policy goals and objectives and related to performance;
 - Clear measures of performance are defined;
 - Both customer service and efficiency/effectiveness are recognized; and
 - Progress is tracked and communicated.
- An integrated approach is applied across asset classes, investment categories, and funding mechanisms:
 - Common analytic approaches are established across asset types: e.g., a life-cycle view of performance and cost; benefit/cost analysis; valuation of assets; and consideration of alternative strategies and investments.
 - Resource allocation decisions are based upon explicit tradeoffs among modes and their asset classes, types of investments, and available funding sources: e.g., preservations versus expansion alternatives; capital improvements versus maintenance activities versus operations enhancements; rural economic development versus urban congestion relief; and highway versus non-highway modes.
 - Business processes, evaluation procedures and criteria, and analytic information are consistent with, and inform judgments about, policy objectives and values of associated performance measures.
 - Organizational roles are developed to encourage integration across departmental units (Figure 2.2).

Transportation Asset Management ...

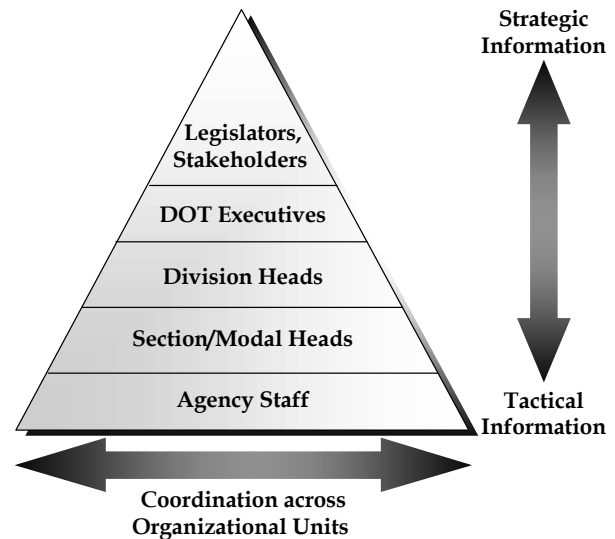
- *Is policy-driven;*
- *Is performance-based;*
- *Considers alternatives or options;*
- *Evaluates competing projects and services based on cost-effectiveness and anticipated impact on system performance;*
- *Considers tradeoffs among programs;*

- *Employs systematic, consistent business processes and decision criteria; and*
- *Makes good use of information and analytic procedures.*

- Good asset management implies that the right information is available to the right levels of management at the right times:
 - Complete, current, and accurate information on asset condition and performance, and on customer perceptions of the quality of infrastructure condition and the provision of services;
 - An appropriate suite of management systems and databases that informs the agency of the status, trends, and needs regarding its infrastructure assets;
 - Tools that predict future system performance, and support what-if analyses to understand the relationship between investment levels and resulting performance;
 - Information on condition, performance, and investment need that is integrated across asset types; and
 - Effective decision support tools for managers at different levels in the organizational structure.
- Principles of good asset management can suggest ways in which an agency's current business processes should be strengthened. It is a "way of doing business," not a separate business line or function:
 - Clear linkages exist among goals, policies, plans, investment strategies, operating procedures and delivery approaches;
 - A proactive rather than reactive approach is taken, seeking constant improvement to ensuring the best use of available resources for improved performance;
 - Strong top-down and bottom-up communication ensure that strategic decisions are well-informed by tactical information, and that tactical decisions are aligned with strategic direction (Figure 2.2);
 - Interdisciplinary decisions are coordinated across different agency divisions; and

- Clearly defined organizational roles and responsibilities provide accountability for decisions and resulting system performance.

Figure 2.2 Managed Business Process



2.1.4 HOW MIGHT YOUR AGENCY IMPROVE?

Several examples of how an agency may improve in moving from a "conventional" management approach to one based on the best practices inherent in asset management are illustrated in Table 2.1. These examples are not meant to be prescriptive, but only to express the typical characteristics of asset management above in a more tangible way. The principles to guide change of this nature are formalized in the following section.

2.2 PRINCIPLES OF GOOD PRACTICE

2.2.1 ASSET MANAGEMENT IS A STRATEGIC APPROACH

Asset management represents an approach to managing infrastructure that is strategic and proactive, and places a premium on good information in all aspects and in all departmental units.

- **Asset management is comprehensive.** It entails a broad view across a range of assets. It encourages consideration of a full range of options to meet

problems or needs. Tradeoffs are explicitly considered among programs, modes, or strategies.

- **Asset management as a philosophy** may be applied broadly to virtually all functional areas of an organization or targeted to particular areas. Increasingly, asset management is being seen as a comprehensive approach that may be successfully applied at virtually all levels and across virtually all functions of an infrastructure-based organization. However, in its evolution, asset management also may be focused on particular areas of emphasis, such as system preservation or, alternately, system improvement and operations. This need for adaptability in responding to the current policy objectives and priorities of different agencies explains why the term “transportation asset management” is often interpreted differently. It also explains why asset management is simultaneously powerful, rigorous, yet flexible.
- **Asset management is driven by policy goals and objectives based upon performance.** Strategies are analyzed in terms of objective assessments of costs, benefits, and other impacts on the transportation system and levels of service provided to transportation users.
- **Asset management takes a long-term view of infrastructure performance and cost.** The costs and benefits of different actions are assessed throughout the infrastructure service life, applying economic as well as technical criteria.
- **Asset management is proactive.** An agency has the latitude to make decisions based on merit. Preventive strategies are encouraged where they are cost-effective.
- **Asset management policy is influenced and informed by good information.** This information includes current and projected system condition and performance that would result from different policies or strategies. It also encompasses user perceptions of system condition and performance, as obtained through surveys or focus groups.
- **Asset management is explicit and visible,** and serves to clarify and communicate the process and outcomes of resource allocation and program delivery. Asset management, by virtue of its rational and objective qualities, demystifies and fosters confidence in those decision proc-

esses that influence the allocation and utilization of scarce resources. In doing so, asset management fosters increased stakeholder participation, buy-in, and adherence to adopted strategies and decisions.

- **Viewed as “a way of doing business,”** asset management can influence the business practices of virtually every organizational element involved in the functions to which it is applied.

2.2.2 ASSET MANAGEMENT ENCOMPASSES MULTIPLE BUSINESS PROCESSES

The principles of good asset management can suggest ways in which an agency’s business processes and organizational roles and responsibilities can be strengthened. These process improvements can occur in those activities prior to budget approval (i.e., planning and program development) and in the program delivery and system performance monitoring phases subsequent to budget approval. Major principles governing process improvements are listed below.

- **Investment choices and decisions on allocating and applying resources are policy- and performance-driven.** Procedures to reach these decisions are consistent with objective information and criteria based on merit. Performance measures consistent with policy goals and objectives are established for management review of both system performance and program delivery.

Table 2.1 Examples of How Asset Management May Influence Current Business Practices

Practices That May Exist Now	Asset Management Best Practice
POLICY GOALS AND OBJECTIVES	
Policy statements “say all the right things” but do not differentiate what are the true priorities.	Policy goals and objectives are clearly defined and can be translated into explicit performance measures and targets.
The policy framework expresses a very broad and idealized vision of the transportation mission. The implications of this policy framework are not analyzed directly, but rather are left to specific planning and programming stages later.	The agency proactively influences policy formulation with realistic estimates of agency resources that are needed to achieve specific goals. It works with its governing bodies to instill this realistic vision in resulting policy statements and objectives, as well as measurable performance targets.
Policies are developed in the context of “guidance” from governing bodies to the transportation agency, and have little or no input from outside sources.	Policy formulation seeks input from customers and other stakeholders, and reflects customer priorities and concerns in resulting policy statements and objectives, and performance targets.
Policies are used essentially in an attempt to “micromanage” outcomes.	The policy framework gives an agency the latitude to frame alternative solutions to problems and to decide among these based on their merits.
PLANNING AND PROGRAMMING	
Transportation options that are considered in the long-range plan reflect primarily the choices included in the current transportation program.	The long-range plan identifies transportation options broadly in terms of potential modes and intermodal linkages, types of investments, and program or funding alternatives.
Methods, formulas, and criteria to prioritize projects reflect an historical evolution of engineering, financial, and political factors.	Methods, formulas, and criteria to prioritize projects reflect stated policy objectives and performance measures and targets.
Projects are evaluated largely in terms of initial cost and judgment as to potential benefit.	Projects are evaluated in terms of realistic estimates of life-cycle costs, benefits, and performance impacts.
Programming is based mainly on intuitive judgment.	Programming is based to the degree possible on objective information, supported by sound analytical procedures.
Management systems and condition surveys are used as engineering or research tools, but are not applied to program building or budgeting.	Information from condition surveys and management systems directly informs the process that builds the recommended program and budget.
Management systems are used only to rank the condition of assets; needs are programmed based on “worst first.”	Management systems guide the programming of projects based on valid engineering and economic criteria.
PROGRAM DELIVERY	
Project delivery issues are dealt with only as emerging problems are brought to management’s attention.	Well-understood project delivery measures and procedures are used to track adherence to scope, schedule, and budget.
Project changes and resulting program adjustments are dealt with as ad hoc processes that “keep things in balance” as situations arise.	A process exists and is enforced to approve changes in project scope, schedule, and cost, and make related program adjustments.
Traditional methods of program delivery are used from year to year, with no perceived need to consider alternatives or compare costs among different methods.	An agency periodically evaluates availability, relative cost, and potential use of different methods of program delivery.

Table 2.1 Examples of How Asset Management May Influence Current Business Practices (continued)

Practices That May Exist Now	Asset Management Best Practice
INFORMATION AND ANALYSIS	
Collection of data on transportation inventory, condition, and performance is accomplished only occasionally or incompletely. Processing of these data occurs when funds are available.	Collection of data on transportation inventory, condition, and performance is accomplished by a statistical sampling technique of acceptable precision that is designed to be affordably maintained annually.
Management system reports provide detailed information on asset engineering and materials characteristics, life-cycle performance, and life-cycle costs.	Management system reports are designed for a range of management needs, encompassing items listed to the left, but also including information on trends in performance versus cost (scenario testing), prioritization of projects, value and timing of preventive and corrective maintenance needed, and benefits of proposed investments.
Surveys of customer perceptions are conducted for information and public relations purposes, but are not applied in program decision processes.	Information on customer perceptions of asset condition and performance is routinely applied to assist in capital and maintenance program development.

- **Investment choices and decisions on allocating resources are based upon explicit tradeoffs among modes, programs, or strategies.** You can assess the tradeoffs and impacts of more or less investment in a mode, program, or strategy, and help to craft final recommendations on how resources will be allocated across competing needs. Managers also understand the implicit tradeoffs in their programs and budgets, and the consequences thereof.
- **Asset management entails the translation of policies and plans into cost-effective investment strategies, and the translation of investment strategies into cost-effective program delivery.** The essence of asset management involves a combination of resource allocation decisions and program delivery strategies that reflect policy-driven criteria and the resources available.
- **Organizational roles and responsibilities regarding asset management are developed to encourage more strategic and integrated approaches.** While strong vertical organizational units may exist to maintain core expertise, business processes and decisions involve wider participation, as noted below.
- **Asset management is interdisciplinary.** Decisions on investment choices and resource allocation

tion are based upon expertise and judgment from several quarters of an agency.

- **The agency strives for more effective program delivery.** The agency explores innovative methods to deliver the range of projects and services required. All available methods are considered, including use of departmental employees, inter-governmental agreements, outsourcing, managed competition, and privatization.
- **Asset management requires effective communication within and outside the agency.** Within the agency, strong communication channels are needed both vertically and horizontally. External communications need to inform policy-makers and other stakeholders of the status of transportation assets and recommended policies and their benefits.

2.2.3 ASSET MANAGEMENT RELIES ON GOOD INFORMATION AND ANALYTIC CAPABILITIES

Effective management systems and complete, current, and accurate information on transportation infrastructure are practical necessities in meeting the policy and process requirements of asset management. Good asset management implies a

systematic, integrated approach to project selection, analysis of tradeoffs, and program and budget decisions. It also implies that the right information be available to the right levels of management at the right times. The principles below support the availability and application of better information to make better decisions in asset management.

- **Complete, current, and accurate information** on transportation infrastructure assets, including descriptions, location, usage, unique or specialized characteristics, functional and other classification, and data needed for management systems as discussed below.
- **An appropriate suite of management systems and databases** informs the agency of the status, trends, and needs regarding its infrastructure assets. Typical capabilities of these systems include the following:
 - **Organization of information within databases** describing infrastructure inventory, condition, performance, and cost;
 - **Analytic models** that predict the rate of future change in condition or performance, enabling the agency to forecast future infrastructure needs;
 - **Decision rules or procedures** for applying treatments or actions to maintain, rehabilitate, replace, or expand transportation infrastructure, with analytic models of resulting costs, benefits, and other impacts; and
 - **Reports** tailored to different organizational levels of management, including senior and executive levels, as well as for public distribution.
- **Information on system performance** in terms of both proposed targets and values actually achieved in the field. These data may be obtained in a number of ways:
 - Periodic surveys and assessments of system condition or levels of service;
 - Customer surveys of satisfaction with system condition and agency performance; and
 - Incorporation of performance measures and associated backup information within management systems.

- **Specialized technical applications** that support an agency's asset management procedures. These will vary by agency, but may include capabilities such as use of geographic information systems (GIS) as a system/data integration platform, economic analysis applications (e.g., generalized life-cycle benefit/cost procedure), and other decision-support tools.
- **Applications that assist in program and service delivery**, including financial applications (e.g., to compute "total" or "true" cost of agency and contracted services), and management systems for construction project pipeline and construction delivery.

2.3 MANAGEMENT FRAMEWORK

Key concepts, principles, and state-of-the-art techniques have been organized within a set of four evaluation matrices in Tables 2.2 through 2.5. These matrices lay out a range of options in improved asset management and identify "ideal" practices to which your agency can strive.

- **Policy Goals and Objectives** – How does policy guidance benefit from improved asset management?
- **Planning and Programming** – Do resource allocation decisions reflect good practice in asset management?
- **Program Delivery** – Are appropriate options and management methods used to delivery the program?
- **Information and Analysis** – Do information resources effectively support asset management policy and decisions?

The information in each matrix is organized into three columns:

- The first column identifies the most important basic characteristics of good asset management practice applicable to transportation agencies.
- The second column lists specific evaluation criteria for each characteristic.
- The third column describes the current state-of-the-art for each criterion. These ideal practices define benchmarks that agencies can aim toward in seeking to improve their current approach.

Table 2.2 Policy Goals and Objectives

How Does Policy Guidance Benefit from Improved Asset Management Practice?

Characteristics	Criteria	Benchmark – State-of-the-Art
1. Policy goals and objectives reflect a comprehensive, long-term view of asset performance and cost.	Defined goals and objectives Asset management as a catalyst for decision and action Life-cycle perspective	Goals and objectives are comprehensive, integrated with other statewide policy objectives, and supported by quantitative and measurable performance measures or criteria. Principles of good asset management are articulated in an agency business plan and clearly recognized throughout the agency as the driving force for resource allocation and utilization. Goals and objectives embody the perspective of life-cycle economic analyses of asset performance and cost, and encourage strategies with long-term benefits.
2. Goals and objectives embody the public interest in good stewardship of transportation assets.	Recognition of asset condition, performance, and public acceptance in policy formulation Public reporting and accountability	This recognition entails the following characteristics: ➤ Policy goals and objectives encourage a business-model, customer-oriented approach to asset management. ➤ Reliable information on asset condition and public perceptions thereof is accounted for in updating policy objectives. System performance is measured against policy goals and objectives.
3. Policy formulation allows the agency latitude in arriving at performance-driven decisions on resource allocation.	Political process Agency decision-making	Political decisions on resource allocation among modes or programs are strongly influenced by objective information on expected performance. The agency makes resource allocation decisions among programs and across geographic regions/ districts based on expected performance rather than by historical splits or formulas that do not correlate with an objective indication of system condition.
4. The agency proactively helps to formulate effective asset management policy.	Engagement with policy-makers Provision of information	The agency actively engages with political leaders and other policy-makers to define expectations of system performance, frame alternative approaches, and outline the consequences of decisions and courses of action relative to these expectations. The agency's asset management systems are designed and applied to yield meaningful information on policy choices and consequences.

Table 2.3 Planning and Programming
Do Resource Allocation Decisions Reflect Good Practice in Asset Management?

Characteristics	Criteria	Benchmark – State-of-the-Art
1. Planning and programming procedures and criteria are consistent and reinforce policy goals and objectives.	Fiscally responsible planning	Development of statewide and urban-area long-range plans can be demonstrated to be consistent with policy goals and objectives and with realistic projections of future revenue.
	Program prioritization	Funding allocation and project prioritization criteria are consistent with and support the state's and the agency's policy goals and objectives.
	Updates and revisions	Updates and revisions to the planning and program development process are performed regularly to reflect changes affecting asset management priorities in the areas of: ➤ Policy (e.g., preserving existing investments, economic development) ➤ Technology (e.g., new design procedures or materials) ➤ Emerging Issues (e.g., updated environmental regulations; identification of potentially catastrophic risks to asset condition or performance).
2. Planning and program development consider a range of alternatives in addressing system needs or deficiencies.	Planning alternatives	Long-range planning identifies and evaluates a range of program alternatives and, as appropriate, modal alternatives to meet present and future transportation demand.
	Project scope, cost, benefits, impact on performance	Program development, guided by adopted plans, formulates projects of appropriate scope and develops realistic estimates of their costs, benefits, and impacts on system performance.
3. Performance-based concepts guide planning and program development.	Performance-based budgeting	Recommended programs and budgets relate costs to levels of service or performance measures.
	Benchmark achievement	The planning and programming processes identify the resources required to maintain existing assets at target performance levels and at least life-cycle cost.
4. Resource allocations and program tradeoffs are based on relative merit and an understanding of comparative costs and consequences.	Program building	Organization of projects within programs (program building) results from statewide competition among projects based on objective criteria.
	Consistency	Projects being designed and built respond to, and are consistent with, overall policy guidance for system performance.
	Program tradeoffs	Tradeoffs between programs (e.g., Preservation versus Improvement, or System Expansion versus Operations) are based upon analyses of life-cycle benefits and costs, rather than arbitrary formulas or historical splits.
	Communication	The implications of more or less resources allocated to each program are clearly communicated in terms of selected performance measures.

Table 2.4 Program Delivery
Are Appropriate Options and Management Methods Used to Deliver the Program?

Characteristics	Criteria	Benchmark – State-of-the-Art
1. The agency considers all available methods of program delivery.	Cost tracking	The agency knows its costs for delivering its programs and services (e.g., by activity, bid item, or resource class).
	Options for delivery	The agency periodically evaluates its options for delivering programs and services (e.g., agency employees, inter-governmental agreements, partnering, outsourcing, managed competition).
2. The agency tracks program outputs and outcomes.	Feedback mechanism	The agency has the ability to easily track actual project and service delivery against the program plan so that adjustments can be made.
	Change process	A formal program change process exists to make needed adjustments in cost, schedule, and scope; document causes; and reallocate funds.
3. Reports on program delivery accomplishments are communicated and applied.	Internal	Department executives and program managers are regularly informed of progress; a well-understood mechanism exists to make needed adjustments.
	External	Policy-makers and key stakeholders are kept informed of program status and adjustments.
4. The approved program is delivered efficiently and effectively.	Delivery measures	Measures are defined and tracked to gauge successful program delivery in terms of schedule, cost, and scope.
	Project and program adjustments	The agency has a process to review and approve project changes and resulting program adjustments.

Table 2.5 Information and Analysis
Do Information Resources Effectively Support Asset Management Policies and Decision?

Characteristics	Criteria	Benchmark – State-of-the-Art
1. The agency maintains high-quality information needed to support asset management.	Asset inventory	The agency maintains an inventory of assets that is a complete, accurate, and current description of infrastructure for which the agency is responsible or in which it has a statewide transportation interest.
	Asset condition	Asset condition data (including data that affect condition, such as usage, environment, etc.) are updated on a predetermined schedule sufficient to provide timely and accurate information on status and performance.

Customer perceptions

Information on customer perceptions is updated regularly through surveys, focus groups, complaint tracking, or other means, to gauge public perception of asset condition and agency performance, and to respond thereto.

Table 2.5 Information and Analysis (continued)
Do Information Resources Effectively Support Asset Management Policies and Decision?

Characteristics	Criteria	Benchmark – State-of-the-Art
1. The agency maintains high-quality information needed to support asset management, continued.	Program outputs	Information on actual costs and accomplishments by project, program, network, asset category, work type, and location are maintained in a form that can be used to track program delivery. Cost estimation techniques are continually improved.
	System monitoring	Performance measures or levels of service are defined and regularly applied to quantify the impacts of program decisions and actions.
	Reporting	Progress toward stated transportation system performance targets is measured and reported regularly for each program.
	Feedback	Performance measures provide feedback for future planning and program priorities, or consideration of adjustments in policy objectives.
2. The agency collects and updates asset management data in a cost effective manner.	Data collection technology	The agency applies the appropriate mix of data collection technology (e.g., visual, automated, remote sensing) to ensure high quality data and to provide cost-effective coverage needed to maintain the quality information base discussed above.
	Sampling methodology	The sampling methodology is demonstrated to be appropriate in terms of network coverage, sample size, and frequency, and in the training and team assignments needed to ensure objectivity, consistency, and repeatability.
3. Information is automated and on platforms accessible to those needing it – relates to both databases and systems.	System technology and integration	Managers at various organizational levels are provided the information and the tools needed for effective asset management. Often this is accomplished by sharing data among information systems.
	Data administration	Information requirements and/or standards for asset management are in place to ensure that future system and database development efforts within the agency can communicate with existing systems and meet asset management information and analysis improvement needs.
	Geo-referencing	Systems and information use a common geographic referencing system and a common map-based interface for analysis, display, and reporting.
4. Effective decision-support tools are available for asset management.	Strategy analysis	The agency has decision-support tools that facilitate exploration of strategic tradeoffs such as between capital actions and maintenance, or among modes, types of facilities, and types of activities.
	Project analysis	The agency has tools that support consistent analysis of project costs and impacts, using a life-cycle cost perspective.

Table 2.5 Information and Analysis (continued)
Do Information Resources Effectively Support Asset Management Policies and Decision?

Characteristics	Criteria	Benchmark – State-of-the-Art
4. Effective decision-support tools are available for asset management, continued.	Program analysis	The agency has tools that provide an understanding of the system performance implications of a proposed program of projects.
	Program tradeoff analysis	The agency has tools to help explore the system performance implications of different levels or mixes of investments across program categories or subcategories.
5. Financial value of assets.	Conformity with GASB statement 34	The agency reports the value and condition of its transportation capital assets in a manner that conforms to the modified approach specified in GASB standards.
	Information support for condition and financial reporting	Information on asset condition and the level of expenditure needed to meet target condition is available from the agency's asset management systems.

2.4 CUSTOMIZING AN ASSET MANAGEMENT APPROACH

The previous section presented a detailed management framework for asset management, including examples of best practices in several key agency functions. The question now is: How can your agency implement this management framework in a practical way? Chapters 3 and 4 address this question in terms of a self-evaluation that your agency can conduct, and steps to developing an implementation plan. The management framework, self-evaluation, and implementation plan are adaptable to many different agency situations – agencies with various organizational structures, management cultures, business processes, funding environments, and technological capabilities.

While the asset management framework and principles presented in this chapter are relevant to transportation agencies generally, this *Guide* recognizes that there is no single asset management approach that is appropriate for all agencies. Your approach to implementing these ideas and concepts within your agency will likely differ from the approach of other agencies. Therefore, Chapters 3 and 4 also will explain how to customize the principles in Tables 2.2 through 2.5 to your particular agency's situation.

3. SELF-ASSESSMENT

3.1 INTRODUCTION TO SELF-ASSESSMENT

3.1.1 OVERVIEW

This chapter will help your agency characterize its asset management practices and identify specific opportunities for improvement. While the self-assessment is an optional step in asset management planning, it is extremely useful to help organize thinking, develop a consensus among top-level managers as to where your agency's strengths and needs for improvement lie, and structure an agenda for asset management planning. Section 3.1 introduces the asset management self-assessment process; Section 3.2 presents the self-assessment survey; and Section 3.3 provides a series of quick reference figures that list state-of-the-art benchmarks and possible gaps. These figures provide you a point of reference from which to evaluate your agency and to link the results of your agency's self-assessment to pertinent sections of the *Guide*.

3.1.2 OBJECTIVES

The asset management self-assessment exercise presented in this chapter has the following objectives:

- Develop a consensus among managers within your agency regarding the status of asset management.
- Assist your agency to identify asset management strengths, weaknesses, constraints, and opportunities for improvement.
- Develop priorities and recognize critical areas that need immediate attention.
- Provide a foundation for implementing your agency's asset management improvement strategy.

Self-assessment is a quick diagnostic tool that yields an overall impression, not a precise analytic measure, of where your agency is now regarding asset management practice. The statements in each survey form are designed to probe basic functions and capabilities that contribute to good asset management regardless of the particular characteristics and situation of your agency. They should prompt you to reflect on current business practices with a broad view.

“Even if we are constrained to do business or report information in a certain way, is there a better approach that satisfies asset management principles more closely?”

The self-assessment results will reflect your agency's individual institutional, organizational, financial, and IT environments. Involving top managers in this exercise will provide needed context for interpretation of the results. *Because the results are specific to your agency's management environment and financial, organizational, institutional, and technological situations, they do not provide a meaningful basis for comparisons with peer agencies.* The value of self-assessment is to help you move beyond possible preconceptions of where you are in asset management, and to provide a broad perspective from which you can plan asset management improvements more comprehensively.

3.1.3 THE EXERCISE

The self-assessment survey presented in Section 3.2 lists a series of statements organized around the four key areas of asset management:

- Policy Goals and Objectives;
- Planning and Programming;
- Program Delivery; and
- Information and Analysis.

Each statement covers a key aspect of asset management 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.

3.1.4 THE PROCESS

Clearly, there are several ways by which you can apply the self-assessment process. The following is a suggested approach.

1. Appoint leader. It is recommended that the leader of the self-assessment effort have a broad understanding of asset management issues across the entire agency.

3. Self-Assessment

2. Establish core group. It is highly recommended that the group responsible for completing the self-evaluation comprise the CEO, deputy CEO, and senior executives from different disciplines (e.g., key asset managers, finance, planning, maintenance, operations, information technology, and so forth).

3. Complete assessment form. Distribute the assessment form in Section 3.2 to each member of the group and ask them to complete it individually. The exercise is designed to take about a half-hour to complete. It may be helpful to review the diagnostic figures in Section 3.3 beforehand to understand better the intent of each set of questions.

4. Compile the responses. At a minimum, it is recommended that the leader calculate the average response and identify the high and low responses for each statement (e.g., responses to statement A4 ranged from 2 to 3 and had an average of 2.75). The leader also may choose to calculate summary scores. Guidelines for a simple scoring tabulation are described at the end of Section 3.2. This scoring method is optional, and is provided for those who may find it useful to have a “bottom-line” indicator. The scoring also can be useful in framing the discussion that should occur as part of defining future strategies and directions for asset management. Of course, alternative scoring methods also could be used. For example, the leader may calculate the percentage of statements in each area receiving a 3 or 4. Again, the purpose is not to try to translate results into a precise measure. Rather, the result is an approximate indicator of how your managers see your agency’s performance of each function or capability described in the statements.

5. Discuss results. It is recommended that the leader facilitate a discussion among core group members to review the results. Two types of results in particular should be highlighted in the review:

- a. Statements where managers’ assessments of current agency practice are significantly lower than the state-of-the-art benchmark, which is scored as 4 (i.e., areas uniformly receiving a low score – say, in the range of 1 to 2).
- b. Statements where managers’ assessments of an agency’s current practice vary widely from one another (i.e., some respondents strongly agree with a statement, while others strongly disagree). Where there are significant differences it is recommended that the group discuss their

varying perspectives, focusing on underlying reasons for differences and strategic options for addressing them.

In the case labeled a, the group should identify potential needs for improvement. In the case labeled b, the group should discuss the variance in responses and try to reconcile different perspectives by exploring the institutional, organizational, IT-related, or other factors that may help explain these differences. From this discussion, any potential improvements in asset management practice should be identified and added to those identified for a) above.

6. Identify priorities. To conclude the discussion, the leader should work with the group to identify a set of priority areas for development of asset management improvements. Buy-in at this point by your agency’s executives and line managers is essential for the success of future efforts.

3.2 SELF-ASSESSMENT EXERCISE

3.2.1 PART A. POLICY GUIDANCE

How Does Policy Guidance Benefit from Improved Asset Management Practice?

		Strongly Disagree		Strongly Agree	
POLICY GUIDANCE BENEFITING FROM GOOD ASSET MANAGEMENT PRACTICE					
A1.	Policy guidance supports preservation of existing infrastructure assets.	1	2	3	4
A2.	Policy guidance encourages resource allocation and project selection based on cost-effectiveness or benefit/ cost analysis.	1	2	3	4
A3.	Policies support a long-term, life-cycle approach to evaluating investment benefits and costs.	1	2	3	4
A4	Policy guidance considers customer perceptions and expectations.	1	2	3	4
A5	Our customers contribute to the process that formulates policy goals and objectives.	1	2	3	4
STRONG FRAMEWORK FOR PERFORMANCE-BASED RESOURCE ALLOCATION					
A6.	Policy guidance on resource allocation allows our agency sufficient flexibility to pursue a performance-based approach.	1	2	3	4
A7.	Our agency has a business plan or strategic plan with comprehensive, well-defined goals and objectives to guide resource allocation.	1	2	3	4
A8.	Our agency’s goals and objectives are linked to specific performance measures and evaluation criteria for resource allocation.	1	2	3	4
PROACTIVE ROLE IN POLICY FORMULATION					
A9.	Our agency estimates the resources needed to accomplish particular objectives as part of policy development.	1	2	3	4
A10.	Our agency regularly communicates to customers and other stakeholders our accomplishments in meeting policy objectives.	1	2	3	4
A11.	Our agency works with political leaders and other stakeholders to present funding options and consequences as part of our budget proposal.	1	2	3	4