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Chapter 1

Introduction



Section 1.1

TAM Basics

covers the definitions used throughout the guide and discusses the high-level principles, elements and benefits of good TAM practice.



Section 1.2

About This Guide

provides an overview of the organization and features of the guide.



Section 1.3

TAM Resources

provides a brief summary of the resources used throughout the Guide and indicates how to access the resources.



Chapter 1 Introduction

Welcome to the Transportation Asset Management (TAM) Guide. Whether you are new to asset management, a seasoned practitioner or an executive, this Guide will help to further your understanding of asset management techniques and advance asset management practices at your agency.

TAM is a way of conducting a transportation agency's business to deliver more value in its activities so that the transportation system performs best with the available resources. Most agencies have elements of TAM principles in their existing practice. This guide can help with formalizing TAM practice, identifying areas for improvement, and understanding how to improve. Some of the benefits of TAM include:

- **Improved asset condition, performance, resilience, and longevity.** Asset management involves maintaining the asset condition over the asset's life time. Improved condition results in improved performance and ultimately extends the life of an asset compared to the alternative of continually deferring maintenance.
- **Improved accountability.** When asset management practices are embedded in an agency, staff are held accountable within the agency and to customers and stakeholders to follow TAM practices and consistently maintain the assets in a state of good repair. Preparing an asset management plan also ensures accountability by providing reliable information about the condition of assets.
- **Increased efficiency and effectiveness.** When assets are managed following an agreed upon management strategy, efficiency and effectiveness are improved. Regular maintenance can be planned and scheduled, reducing disruption to service as little as possible.
- **More benefit for each dollar invested.** Transportation assets cost money to build, maintain, operate, and use. By stressing the importance of life cycle planning and costs, and placing agreed levels of service at the core of the asset management process, TAM helps to ensure that the benefits delivered by the network are maximized, while the costs of providing, maintaining, and using it are minimized.
- **Reduced risk exposure.** When assets are maintained and managed consistently and resilience is improved, the agency reduces the exposure to risk.
- **Improved coordination and efficiency.** Asset management helps potential silos within an agency by improving resource allocation and improving coordination between staff on asset management related projects and maintenance.



Section 1.1

TAM Basics

For those new to asset management, this section is the place to start. In order to provide a solid foundation in asset management, this section provides definitions for key terms used throughout the guide, describes the principles of TAM, the elements of good TAM practice, and the benefits of asset management.

This section has four parts:

1. **What is TAM?** This definition and overview of TAM provides context and background on asset management and its place within transportation agencies.
2. **Definitions.** Key terms that are used throughout the Guide.
3. **TAM Principles.** A summary of the key principles of TAM.
4. **TAM Elements.** A summary of the key elements involved in TAM.



What is TAM?

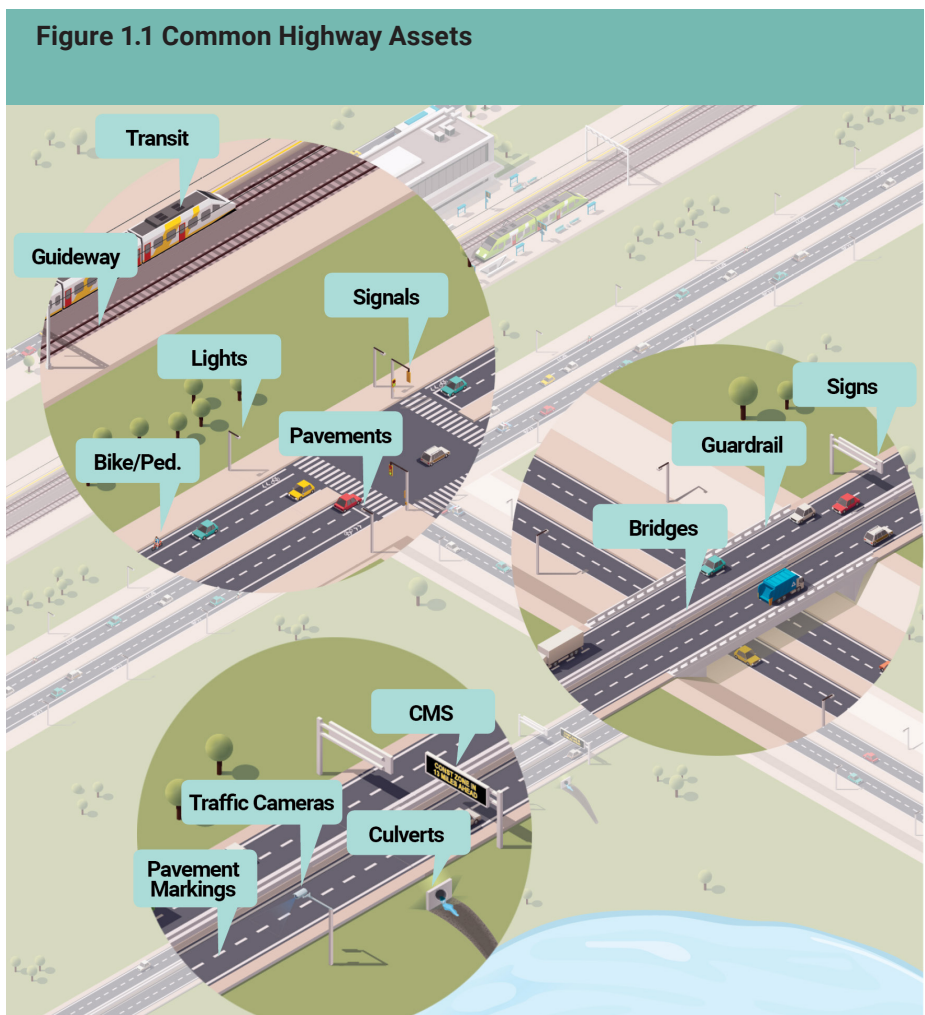
As defined by the American Association of State Highway Transportation Officials (AASHTO), TAM is a “strategic and systematic process of operating, maintaining, upgrading, and expanding physical assets effectively throughout their life cycle. It focuses on business and engineering practices for resource allocation and utilization, with the objective of better decision making based upon quality information and well defined objectives.”

TAM is important because of the size and value of the infrastructure that has been built. The total value of the existing inventory of U.S. transportation assets is staggering; based on data from FHWA Highway Statistics, the replacement value of U.S. bridges and pavement alone is over \$5 trillion. TAM offers a set of tools and techniques applicable to sustain the condition and performance of the full range of transportation assets.

TAM has been a focus area for DOTs in the U.S. for over 15 years, paralleling similar efforts to improve asset management in infrastructure-intensive industries in the U.S. and abroad. Over this period, transportation agencies have worked to increase their understanding of the value and performance of existing assets; and implement improved asset management systems and approaches.

This guidance responds to the new challenges that have emerged since TAM was first recognized as a critical area in the U.S. transportation community such as: evolving business practices, technology advancements, constrained funding, changing environment, and legislative requirements.

Figure 1.1 Common Highway Assets





Definitions

It is important to establish key terms that are used throughout the Guide. While many of these terms have multiple or nuanced definitions, the definitions listed here are the assumed meanings used in the context of this Guide. Each chapter also lists important terms that expand on this list.

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

FHWA defines TAM similarly, stating, “Asset management is a strategic and systematic process of operating, maintaining, and improving physical assets, with a focus on engineering and economic analysis based upon quality information, to identify a structured sequence of maintenance, preservation, repair, rehabilitation, and replacement actions that will achieve and sustain a desired state of good repair (SOGR) over the lifecycle of the assets at minimum practicable cost.”

In the International Standards Organization (ISO) Standard 55000, asset management is defined as the “coordinated activity of an organization to realize value from assets. Realization of value involves the balancing of costs, risks, opportunities and performance benefits.” In addition, the ISO standard states that, “Asset management enables an organization to examine the need for, and performance of, assets and asset systems at different levels. Additionally, it enables the application of analytical approaches towards managing an asset over the different stages of its life cycle (which can start with the conception of the need for the asset, through to its disposal, and includes the managing of any potential post disposal liabilities).”

Performances measures are quantifiable metrics that are used to track progress toward goals, objectives, and established performance targets

A **performance target** is a level of performance desired to be achieved within a specific time frame.

State of good repair (SGR) refers to a condition in which existing physical assets, both individually and as a system, are functioning as designed within their useful service life and are kept functional through regular maintenance and replacement programs.

Levels of service are an agency’s stated commitment to deliver asset service at a specified level of quality and reliability. Service levels can be asset performance-related or customer/regulatory-related (complaints, meeting regulatory requirements). These levels of service can include, but are not limited to, the historic “level of service” used to grade traffic congestion.

Asset condition refers to an asset’s current state, as specifically defined by its appearance, perceived level of service, and observed physical state, whether or not it impacts its performance.

Risk is the positive or negative effect of uncertainty or variability upon agency objectives. [23 USC 515.6]

Life cycle planning and management is a process to estimate the cost of managing an asset class, or asset sub-group over its whole life with consideration for minimizing cost while preserving or improving asset condition. [23 CFR 515.5]



Whole-life costing is the systematic consideration of all relevant costs and revenues associated with the development, operations, and maintenance of the asset.

Reliability-centered maintenance is a structured, risk-based approach for determining the maintenance requirement for any physical asset, based on its operating context within the agency.

Resource allocation is the process of assigning scarce resources to investments in transportation assets. The assigned resources can be money, staff time, contractor capacity, equipment, or other organizational requirements for assets. The investments can be capital projects, maintenance efforts, or other projects and activities that require the use of an organization's resources through various delivery methods.



TAM Principles

The foundation of a good TAM program is a set of principles that establishes the values of the agency and the standards by which the TAM program will be carried out. TAM principles are the underpinnings of all of the activities that will be taken in an agency's TAM program and connect to its desired end results.

Policy-Driven. TAM should capture and respond to policy objectives, and provide meaningful information about how changes in the transportation system support these objectives. A TAM policy can set boundaries, clarify intent, and communicate the scope of a TAM program including types of assets that will be managed and what work activities to emphasize.. [NCHRP 551]

Performance-Based. TAM should have concrete objectives that are translated into system performance measures used for both day-to-day operation and longer-term strategic management. The use of performance data to support the management of assets enables agencies to select and deliver projects that achieve its objectives. Transparent processes allow for accountability to both internal and external stakeholders.

Risk-Based. Risk management plays a role in resource allocation, project selection, long-term planning and other essential parts of the TAM process. As such, an organization's approach to risk management and the outcomes resulting from a risk assessment have important implications for TAM. An agency must establish a risk management approach and integrate risk management in TAM planning and decision making.

Strategically Aligned with Agency Priorities. TAM measures should be aligned with agency priorities and goals to ensure that investments made to extend asset service

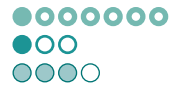
life provide the maximum impact to achieve long-term goals. Connecting performance measures to higher level strategic goals also supports an agency's ability to communicate to customers and stakeholders how technical measures relate to system performance.

Transparent. TAM planning and results should be monitored and reported for both impact and effectiveness. Feedback on actual performance should influence agency goals and objectives, as well as future resource allocation and project decisions. Transparency and agency accountability are key in ensuring the long-term support of project partners, customers and stakeholders.

Information-Driven/Evidence-Based. Strategic decisions with respect to agency goals and TAM objectives should be evaluated using credible and current data. Decision support tools such as management systems should be applied to help in accessing, analyzing and tracking data, and must be an integral part of business and decision processes. Data requirements for performance measures should be realistic and feasible. [NCHRP 551]

Option Oriented. By taking a structured and repeatable approach to TAM decision-making, an organization improves its own resilience and ensures that it will continue to succeed even as new challenges arise and personnel changes over time.

TIP Most agencies have elements of TAM principles in their existing practice. This guide can help with formalizing TAM practice, identifying areas for improvement, and understanding how to improve.



Continuously Improved. TAM processes should provide managers with sufficient information to understand problems and suggest solutions. The agency should be committed to regular, ongoing processes of monitoring and reporting results in order to identify and implement improvements to system performance or further the effectiveness of TAM. [NCHRP 551]



TAM Elements

Asset management encompasses the full set of business processes related to the management of physical assets. There are several key TAM elements listed below that offer the greatest opportunity to improve an agency's asset management efforts.

Monitoring the state of the assets and developing desired and expected Levels of Service (LoS). Performance measures are used to align agency investment decisions with organizational objectives, such as asset condition or system reliability, and to monitor progress towards achieving agency goals. In TAM, asset performance is most commonly defined in terms of asset condition or maintenance LoS. LoS provides the link between agency goals and the investments and interventions that should take priority when managing assets.

Maximizing use of available revenues. Agencies are faced with the problem of determining how to divide scarce resources between different asset types, in order to accomplish a variety of different objectives. TAM planning offers processes to help make these resource allocation decisions, such as Multi-Objective Decision Analysis (MODA), long term financial planning, and Life-Cycle Planning.

Monitoring and managing risk. In TAM, uncertainty complicates efforts to make decisions about the future and forces agencies to be nimble so as to effectively respond to unpredictable events and evolving conditions. An organization's approach to risk management and the outcomes resulting from a risk assessment have implications for TAM. It is important to establish processes

to track changes in risks over time and monitor actions taken to manage risks, through tools such as a risk register and/or a risk mitigation plan.

Investing in asset maintenance. State DOTs can specify their desired SGR, consistent with their TAM objectives, for the 10-year analysis period of their TAMP. This strategic long-term maintenance strategy helps agencies minimize the life cycle costs of preserving assets, while also managing asset performance to a defined target to the extent practicable with available resources.

Understanding the potential for asset failure and developing intervention strategies. Being aware of the potential for asset failure and making strategic investment decisions can help agencies prevent failures, reduce costs, and maintain a desired level of service. Over an asset lifecycle, a range of interventions are possible, from reactive, routine and preventative maintenance, to large investment associated with renewal, replacement and disposal.

Allocating resources and prioritizing work based on both short and long-term performance. The resource allocation process should support achieving short- and long-term goals. An agency must establish what scarce resources must be allocated, and what the constraints on these resources are. A key part of the process is to translate



goals and objectives into performance measures so the agency can set target values for key measures and/or establish a target level of service.

Continuous improvement based on feedback. An agency should have regular, ongoing processes of monitoring and reporting results in order to identify and implement improvements to system performance or further the effectiveness of the performance management process. Ongoing monitoring, improvement and/or problem identification should be incorporated into the planning process to help adjust and determine future targets and processes.

Aligning the organization. Successful TAM depends on the alignment of a diverse set of internal business units and external partners and stakeholders. Strategic coordination and communication can bring these people and groups together to achieve TAM goals. In addition, the choice of a TAM organization model is important, and should align with and support agency policies and priorities.



Checklist

Basic Requirements Checklist

This checklist describes the basic requirements of a successful TAM program. Agencies can use this checklist to identify priority areas for TAM improvement efforts.

- Leadership Support.** For TAM objectives to be understood and observed throughout the organization it is important to have access to senior leadership, and to be able to work with and get attention from leaders when needed.
- Agreement on TAM objectives and scope.** An agency's planning, programming, asset owners, project development and delivery, maintenance, and other units must coordinate to make TAM work. It is crucial to have cross-agency agreement on TAM goals and performance measures.
- Designation of key asset management roles.** Understanding what roles and responsibilities are most important for the TAM program is key to getting an agency ready and aligned to achieve TAM-related goals. Agencies must fill each TAM-related role with qualified people who possess the right competencies.
- Internal and external coordination mechanisms.** In order to deliver mobility to the public, State DOTs must coordinate internally and with other agencies that own and operate transportation facilities. It is up to the agencies to work together either by forming committees, creating partnerships with external organizations, or developing communication strategies to reach all relevant stakeholders.
- Current and reliable inventory and performance data.** TAM decision-making must be based on credible and current data. Data requirements for performance measures should be realistic, feasible and up to date with respect to asset conditions, as well as current technological requirements and advances.
- Functioning analytical tools for major assets.** Decision support tools such as management systems should be applied to help in accessing, analyzing, and tracking asset data, and must be an integral part of an agency's business and TAM decision processes.
- Work tracking processes (for system updates).** Agencies must have systems and data collection processes that are measured consistently, collected economically, and updated regularly.
- Risk monitoring and management processes.** Monitoring risks to TAM requires clear definitions of ownership for the risks, the mitigation strategies, and the risk management processes. Different mechanisms can be used to address risks, such as risk registers or risk mitigation plans.
- Performance monitoring and reporting processes.** Monitoring performance of the asset management system and the results of improvement actions can be challenging, as the cost of service delivery, quality of service levels and risk of service failures can change following implementation. For this reason, it is important that agencies select measures to monitor the effects of improvements that capture all of these aspects.
- The TAMP development process.** Agencies need to have a process for preparing a TAMP and then monitoring its implementation. Agencies can create a task group to provide oversight through regular updates, meetings, performance tracking, and schedule monitoring.
- Continuous improvement process.** It is necessary for an agency to ensure that asset management practices are reviewed on a regular basis to identify opportunities for innovation and advancement.



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Section 1.2

About This Guide

This section orients the reader to the contents of the Guide and describes the framework used to organize the document.

This section has three parts:

1. **Scope and Organization.** Describes the organizing framework for the Guide and the contents of each chapter.
2. **Intended Audiences.** Describes the different audiences for the Guide.
3. **Ways to Use this Guide.** Provides information on the features of the Guide.



Scope and Organization

This Guide is organized around the basic asset management framework illustrated in Figure 1.2. This framework is tailored for use by U.S. transportation agencies and incorporates critical areas deemed important to the daily application and advancement of TAM practice.

The framework shown in Figure 1.2 groups the components of asset management into six basic areas. The four central areas in the figure capture the business processes involved in asset management.

- **TAM Strategy & Planning.** An organization manages its assets not as an end in and of itself, but to achieve broader goals. These goals might include improving mobility, enabling economic growth, and reducing costs to travelers and the environment. It is important to place TAM in the context of an agency's broader goals and objectives, establish the scope of an agency's TAM effort, and determine how TAM integrates with the other activities performed by the agency. A Transportation Asset Management Plan (TAMP) helps establish this context, and preparing such a document is consistent with best practices in TAM. Additionally, U.S. State transportation departments and transit agencies are now required to develop TAMPs to comply with Federal requirements.
- **Maximizing the Life Cycle Performance of Transportation Assets.** This term encompasses the set of processes involved in determining how to manage an asset over its entire life, from construction or acquisition to maintenance and finally asset replacement or disposal. It addresses how to measure the level of service an asset is achieving and targets to achieve, how to best maintain an asset, and how to model the condition and performance of an asset in the future.

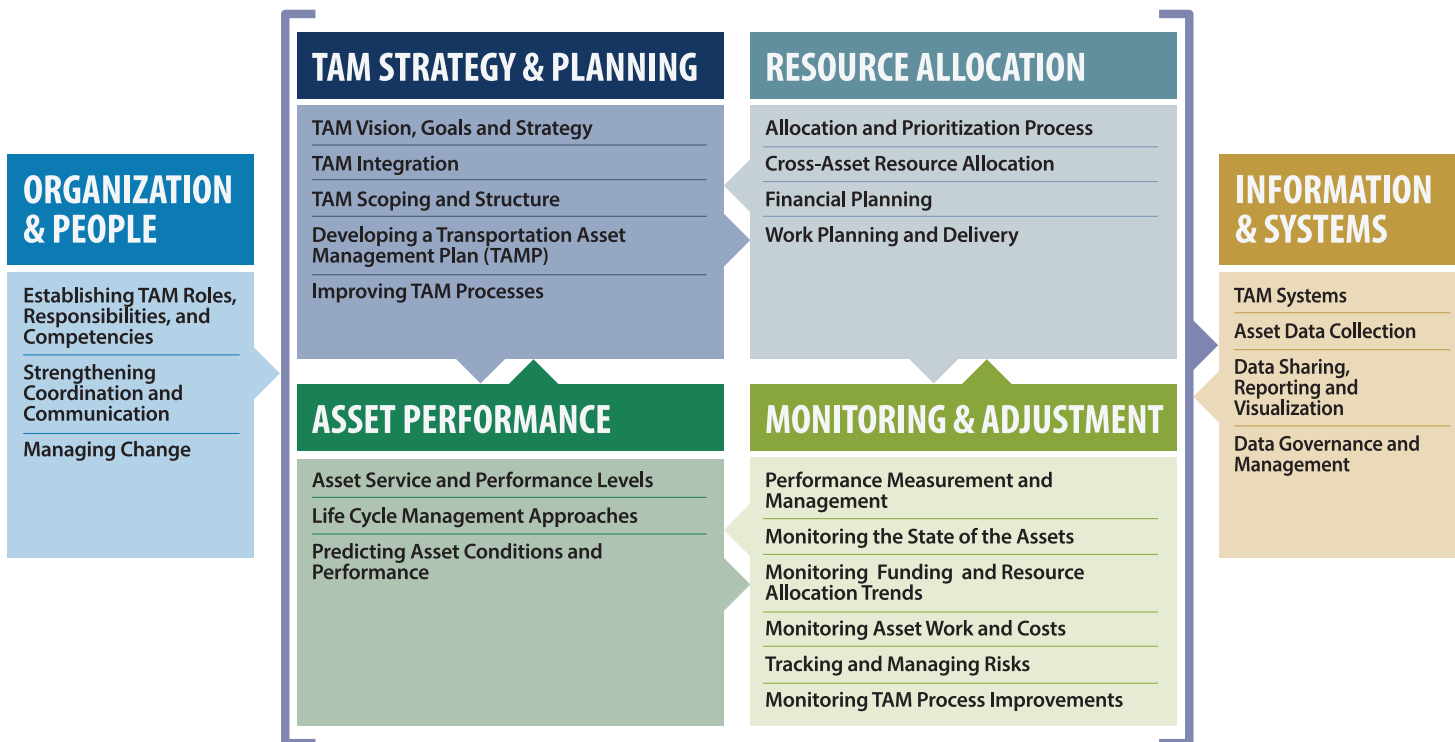
- **Resource Allocation.** Managing assets requires determining how to best deploy a set of finite resources, including staff time, equipment, and budgets for operating and capital expenses. This area includes the processes involved in making resource allocation decisions, both for a given asset class, and across multiple asset classes considering a range of different objectives and constraints. Also, it addresses the development of financial plans summarizing expected sources and uses of asset management funds. TAM financial planning takes a long-term view of resource allocation to support the delivery of strategies that address asset needs at all stages of their service lives.
- **Monitoring and Adjustment.** Ideally an organization's approach to TAM and TAM-related decisions should be dynamic, with adjustments made in response to available data on asset conditions. This area includes processes related to measuring and monitoring asset performance, assessing risk, and making adjustments to investment decisions and business process to respond to changing conditions.

The remaining two areas detail factors that enable an improved asset management approach. The two enablers of an improved asset management approach are:

- **Information & Systems.** TAM is very data intensive. It is important to have systems for tracking an organization's inventory of assets and collecting needed data



Figure 1.2 Guide Organizing Framework
 Adapted from the Institute for Asset Management (IAM)



Source:

on asset conditions. Also, systems are often needed to connect to related data, including financial data and records of maintenance work. However, collecting asset data and implementing asset management systems can be costly and time consuming. It is important to develop an approach to information management that carefully considers what data are needed to support the organization’s goals, and how best to collect needed data.

- **Organization & People.** All infrastructure-intensive organizations practice asset management in some manner. However, implementing a robust asset management approach incorporating best industry practices and a philosophy of continuous improvement requires having a robust organization and people with the correct mix of skills. Creating such an organization requires defining roles and responsibilities for TAM within an organization. Also, it is

important to evaluate needed staff skills and to implement training programs to help existing staff improve their skillsets. Another important organizational factor is developing an approach for managing change within the organization to support a culture of continuous improvement.

The remainder of this guide further details the areas illustrated in the figure, with emphasis on those areas that are specific to TAM.

A basic feature of TAM is that it is interdisciplinary, and thus overlaps with a number of other areas, including but not limited to maintenance, project selection and budgeting, performance management, information technology, and risk. To the extent that other resources are available for addressing certain aspects of TAM, the text notes these overlaps and recommends other relevant resources.



The core elements illustrated in Figure 1.2 are further detailed in corresponding chapters of the Guide:

Chapter 1. TAM Basics discusses basic information of importance to any reader who is new to the concepts of transportation asset management.

Chapter 2. TAM Strategy & Planning discusses considerations in linking asset management to agency goals and objectives, and defining performance measures and targets for tracking progress.

Chapter 3. Organization & People describes how to build an organizational structure that supports asset management, and develop processes for change management and training to build an awareness of asset management throughout the organization.

Chapter 4. Maximizing the Performance of Transportation Assets discusses developing life cycle plans that define how best to design, construct, operate, maintain and dispose of assets - and then executing those plans on a day-to-day basis.

Chapter 5. Resource Allocation details the process of making capital and maintenance investment decisions that provide the best long term performance given available resources, considering trade-offs and competing needs between different assets and investment objectives.

Chapter 6. Monitoring & Adjustment addresses topics including tracking asset health, responding to unplanned events, and managing risks to the asset inventory.

Chapter 7. Information & Systems addresses collecting needed asset data, and implementing management systems to support data collection and decision-making.



Intended Audiences: Who Should Use this Guide?

The Guide is an important tool that should be actively used as a reference by the transportation community. The principles and implementation techniques described here are universally applicable to all agencies managing transportation assets. While the target audience is primarily State Departments of Transportation (DOTs), local agencies managing metropolitan, county, or mixed transportation networks will also find it useful and appropriate to their needs.

The Guide is structured so that the reader can use a particular chapter, section, or topic as a source of advice; or use the whole in order to drive a systematic agency-wide implementation of asset management.

For those new to asset management who want to learn more. This Guide is a great starting point for DOT staff new to the field of asset management. Recent college graduates and new DOT employees hired in asset management roles, as well as DOT staff who have transferred to an asset management role from elsewhere in the agency will benefit from the overview of asset management provided in this Guide.

For practitioners. This Guide can help advance asset management practice at an agency. The framework is designed to provide information on all different aspects of asset management, so practitioners can easily access information specific to the challenges they are currently facing. Practitioners can also learn about how peer agencies approach different aspects of asset management through the numerous practice examples throughout the Guide.

For executives. This Guide is intended to raise awareness among senior executives about the wider role TAM plays within the agency and how it can be implemented to improve organizational performance and achieve better outcomes in terms of cost and service to the public. Agency-wide TAM implementation needs to be led by top management using the principles of effective leadership. TAM is an organizational culture and professional discipline that should not be switched on and off with the regular election cycle – it needs continuity and support even as leadership within the organization changes. Implementation needs to transcend administration.



Ways to Use this Guide

The Guide provides an overview of TAM topics and also includes practice examples, how-to guides, checklists, and references.

Basic Overview of TAM

A general overview of TAM is provided below in Section 1.2. This is a great place for people who are new to asset management to learn the basic fundamentals and benefits of TAM before getting into the details in the remaining chapters.

Topical Guidance

Each chapter of Guide provides topical guidance for the practitioners looking to advance a particular aspect of TAM within their agency. While there are certainly cross-cutting topics in TAM that are mentioned in more than one chapter, each chapter is meant to be a stand-alone topic that a practitioner will find useful without having to read the entire Guide.

Practice Examples

There are numerous practical examples in each chapter of the Guide that illustrate how particular aspects of TAM are applied in real world situations. A diverse range of DOTs, MPOs, and international agencies are featured in the practice examples. These illustrate the varying priorities and wide array of challenges facing agencies of all sizes.

Maturity Scale

Each chapter concludes with a summary of the typical level of practice of a generic Department of Transportation for three levels of maturity: emerging, strengthening, and advanced. The maturity examples are meant to provide some context for the concepts discussed within the chapter, and

How-To Guides and Checklists

Each chapter of the Guide features How-To Guides and Checklists.

How-to Guides

How-to Guides provide step-by-step guidance on achieving a specific aspect of TAM. The following How-To Guides are featured in the Guide:

Chapter 2

- Develop an Asset Management Policy (2-9)
- Develop a Risk Register (2-21)
- Prioritize Assets for TAM Advancement (2-31)

Chapter 3

- Recruit Individuals for Asset Management Roles (3-9)
- Establish a TAM Steering Committee (3-23)
- Develop a Communications Plan (3-30)
- Manage Change and Prepare for a System Replacement (3-40)

Chapter 4

- Establish Customer-Based Service Level Targets (4-14)
- Life Cycle Planning for Pavements (4-33)
- Determine What Data Is Needed to Support Life Cycle Management (4-41)

Chapter 5

- Implementing a Multi-Objective Decision Analysis Approach (5-24)

Chapter 6

- Benchmark Performance (6-18)
- Use RACI to Create a Responsibility Assignment (6-49)

TIP Readers of the TAM Guide can reach out to specific agencies for further details on the practices highlighted in the practice examples.



the degree to which an agency adopts them in how they conduct service delivery.

Emerging. The agency is beginning to improve their asset management practices and is emerging to a new way of conducting service delivery. The agency has initiated early steps to advance practices and has a plan for future improvements.

Strengthening. The agency has established many aspects of a functioning asset management system, achieved several important improvements in how it embeds asset management leading practice into the agency, and continues to strengthen its practices to achieve future goals.

Advanced. The agency is a role model among its peer agencies and has fully implemented asset management practices across the organization. TAM has become how the agency does business, with a commitment to continuous improvement over time. The agency is advanced relative to most of its peers.

Tips

Where applicable, helpful Tips are included at the bottom of the page in each chapter. These short and practical items help reinforce the concepts discussed in the chapter. They can also indicate key points to remember when applying the guidance

References

At the end of each individual section of the Guide references are provided for more details on specific topics. Practitioners who want to learn more are encouraged to access these references and take advantage of the various resources that are currently available.

Checklists

Checklists address items that should be place to advance TAM practice in a specific way within an agency. The following Checklists are featured in the Guide:

Chapter 1

- Basic Requirements Checklist (1-12)

Chapter 2

- Ingredients in an Implementation Plan (2-34)

Chapter 3

- TAM Roles (3-10)
- Assessing an Organization's Change Readiness (3-39)

Chapter 4

- Considerations to Support the Successful Implementation of a Life Cycle Approach to Managing Assets (4-44)

Chapter 5

- Preparing a TAM Financial Plan (5-33)

Chapter 6

- Characteristics of Strong Performance Measures for Managing the Condition of Ancillary Assets (6-13)
- Monitoring External Considerations in Risk (6-41)
- Risk Management Process (6-48)

Chapter 7

- Data Items to Standardize for TAM (7-15)
- Asset Data Collection Readiness Checklist (7-26)
- Preparing Data for Sharing, Reporting, and Visualization (7-36)



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Section 1.3

TAM Resources

This section provides the information on accessing some of the key references used throughout the guide. Each sub-section briefly describes the reference and notes how to access the document or information.

This section has four parts:

1. **Frameworks and Guidance.** Provides a summary of the existing frameworks and guidance documents, primarily those available internationally.
2. **Legislation and Regulations.** Summarizes the federal legislation related to asset management.
3. **Assessment Tools and Maturity Models.** Summarizes the existing assessment tools and maturity models available.
4. **Communities.** Provides information on communities involved in asset management.



Frameworks and Guidance

There are numerous existing frameworks, models, and guidance documents related to asset management. This Guide is intended to build upon these existing resources and provide updated information where necessary.

International Organization for Standardization (ISO)

ISO

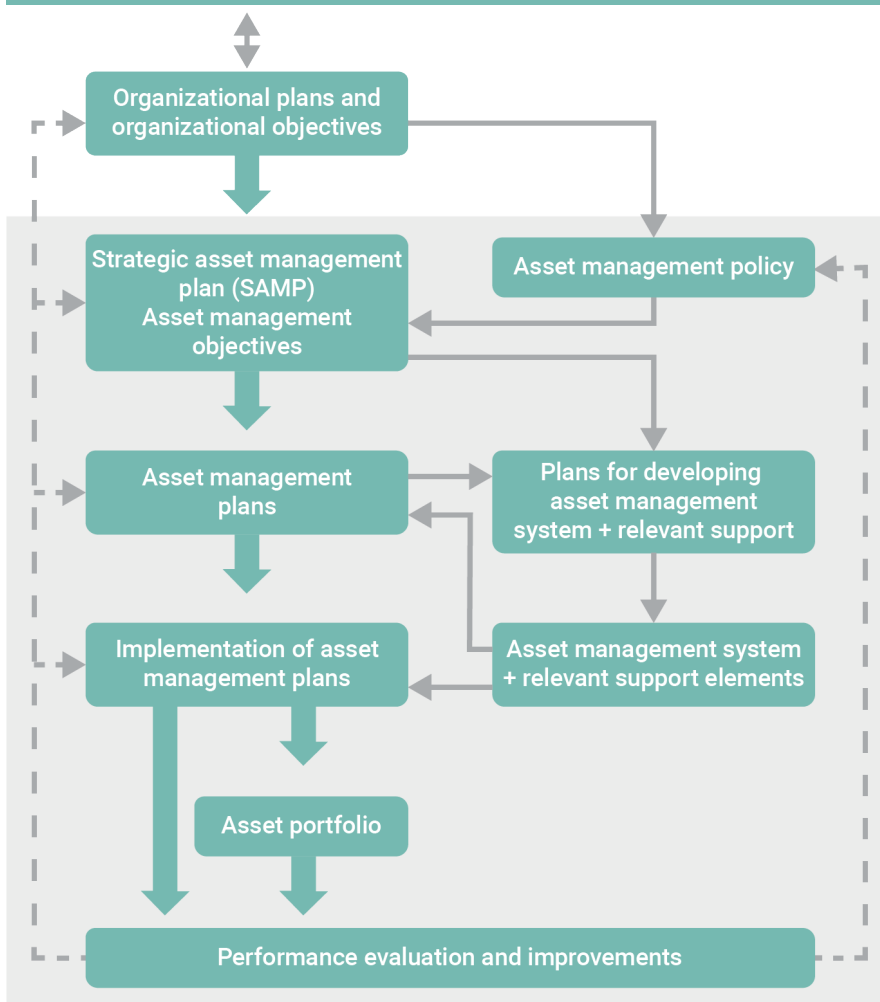
ISO has published a set of standards on asset management. Standard 55000 provides an overview of asset management and asset management systems (i.e. management systems for the management of assets). It also provides the context for ISO 55001 and ISO 55002. International cooperation in the preparation of these standards has identified common practices that can be applied to the broadest range of assets, in the broadest range of organizations, across the broadest range of cultures. The adoption of this International Standard enables an organization to achieve its objectives through the effective and efficient management of its assets. The application of an asset management system provides assurance that those objectives can be achieved consistently and sustainably over time.

Additional standards related to asset management include ISO 55010 which covers guidance on alignment of asset management, finance and accounting; and ISO 55011 which covers guidance on the development of government asset management policy.

For more information, the standard is available to purchase: <https://www.iso.org/standard/55088.html>

Figure 1.3 Relationship between key elements of an asset management program

The gray box designates the boundary of the asset management system



Source: Adapted from ISO 55000. 2016

TIP Each asset management framework may emphasize the elements of asset management differently, but they all have the same underlying principles.



Publicly Available Standard (PAS) 55

Prior to the development of ISO 55000, the Publicly Available Standard (PAS) 55 was released by the British Standards Institute. This standard contains terms and definitions; information on asset management policy, strategy, and objectives; discussion on implementing asset management plans; as well as performance assessment and improvement information.

The standard is available to purchase: <https://www.iso.org/obp/ui/#iso:std:iso:55000:ed-1:v2:en>

Institute of Asset Management (IAM)

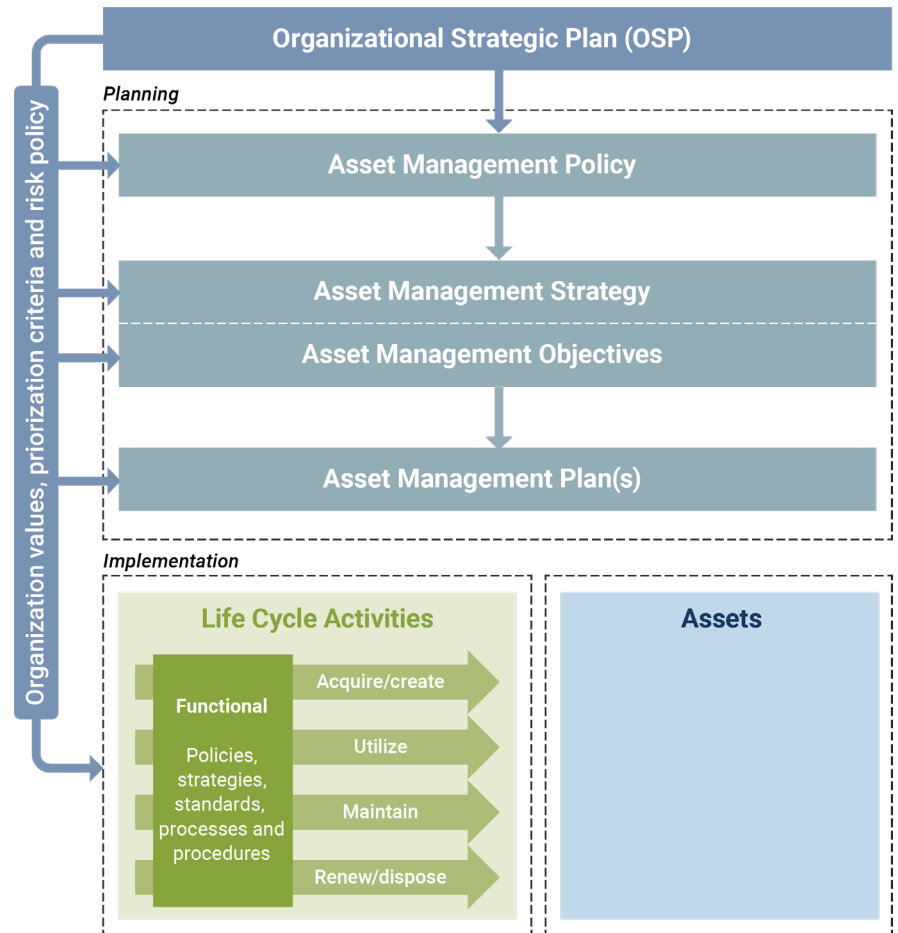
The IAM publication, *Asset Management – An Anatomy* (2015), provides a basic overview of asset management and its benefits. It also provides a discussion of six asset management subject areas: Strategy and Planning, Asset Management Decision-Making, Life Cycle Delivery, Asset Information, Organization and People, and Risk and Review. These subject areas are reflected in the framework shown in Figure 1.5.

IAM also has information on developing and maintaining a Strategic Asset Management Plan (SAMP). All of their resources can be found on their website: <https://theiam.org/>

Institute of Public Work Engineering Australasia (IPWEA)

IPWEA has produced the *International Infrastructure Management Manual* (IIMM). This guide provides checklists, process, guidance, and case studies on asset management practice from agencies globally. The manual contains guidance for all infrastructure types and is suitable for agencies of all levels of maturity. The manual is written to align with ISO 55000 with a focus on how to implement asset management concepts.

Figure 1.4 Planning and implementation elements of an asset management system



Source: Adapted from PAS 55

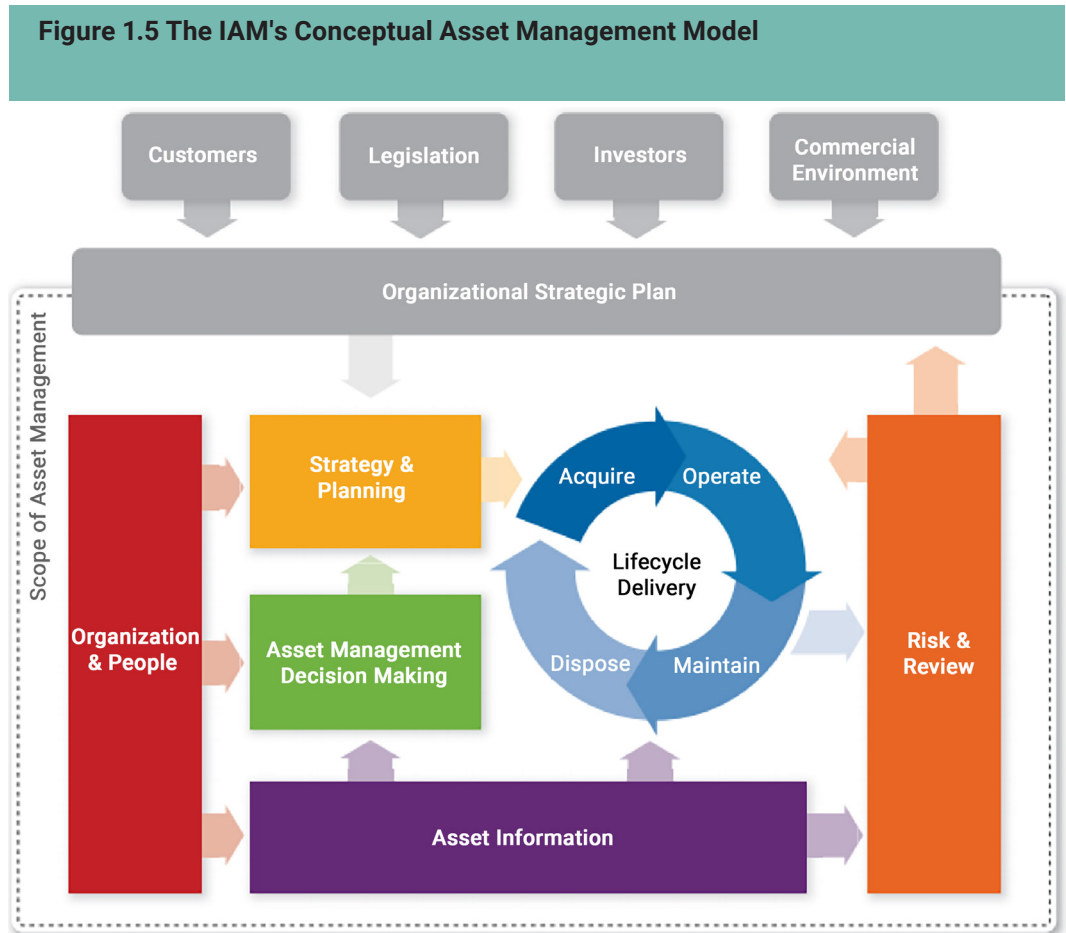
The IIMM must be purchased from the IPWEA online bookshop which can be accessed here: <http://www.nams.org.nz/pages/273/international-infrastructure-management-manual-2011-edition.htm>



UK Road Liaison Group

The UK Road Liaison Group developed the publication titled *Well-Managed Highway Infrastructure: A Code of Practice*. This code is designed to support and promote the adoption of an integrated asset management approach to highway infrastructure based on the establishment of levels of service through risk based assessment. The code is broken into four sections: Overarching Principles, Highways, Structures, and Lighting. The Code also summarizes 36 recommendations put forward to the Department for Transport to enhance asset management across UK highway networks.

A PDF of this document is available online: <http://www.ukroadsliaisongroup.org/en/utilities/document-summary.cfm?docid=4F-93BA10-D3B0-4222-827A8C-48401B26AC>



Source: Adapted from IAM Asset Management – An Anatomy. 2015



Legislation and Regulations

The federal government recognizes the importance of asset management practice and requires states to develop transportation asset management plans. Many state governments also have implemented laws related to asset management.

Federal Legislation

The transportation authorization legislation Moving Ahead for Progress in the 21st Century (MAP-21) signed into law in 2012 includes a number of provisions related to asset management and performance management for both highway and transit modes. The requirements established in MAP-21 were continued in the subsequent legislation Fixing America First Act (FAST) signed into law in 2015. For the highway mode MAP-21 defines asset management in the context of transportation and requires that State DOTs develop risk-based transportation asset management plans (TAMPs) for assets on the National Highway System (NHS). The law also includes a number of requirements related to performance management. Regarding transit MAP-21 requires that U.S. transit agencies develop TAMPs that detail asset conditions and include a prioritized list of state of good repair (SGR) investments.

Following passage of MAP-21 and FAST the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) developed rules detailing the TAM requirements for highways and transit, respectively. In 2016 FHWA finalized § 23 Code of Federal Regulations (CFR) Part 515 – Asset Management Plans. FHWA's requirements specify that a TAMP should detail asset inventory, current conditions, and predicted future conditions over a 10-year period, using performance measures detailed in FHWA's

performance management regulations. The TAMP should include the following elements:

- Asset Management Objectives
- Asset Management Measures and Targets
- Inventory and Conditions
- Performance Gap Identification
- Life-Cycle Planning
- Risk Management Analysis
- Financial Plan
- Investment Strategies

In 2016, the FTA finalized asset management requirements U.S. transit agencies must follow. These requirements are detailed in §49 CFR Parts 625 and 630. The FTA requirements detail that transit agencies must prepare TAMPs covering a four-year period and including their revenue vehicles, infrastructure, facilities, and equipment (including service vehicles). Agencies must use a decision support tool to help analyze SGR investment needs and develop a prioritized list of needs. Larger agencies (with rail systems and/or 100 or more vehicles in peak revenue service) must include additional materials in their TAMP, such as a TAM/SGR policy, TAM implementation strategy, evaluation plan, and identification of resources required to implement the plan.

TIP While regulations do exist, TAM benefits are best achieved when not implemented as a "box-checking" activity.



Assessment Tools and Maturity Models

Assessing asset management maturity helps establish goals and encourages improvement. This section provides information on existing assessment tools and maturity models agencies can use as resources.

TAM Gap Analysis Tool

This Excel-based gap analysis tool was developed under National Cooperative Highway Research Program (NCHRP) Project 08-90 and builds on the gap analysis tool introduced in the *AASHTO Transportation Asset Management Guide – A Focus on Implementation*. The tool helps agencies identify and prioritize needed enhancements to their asset management programs. The tool is available on the AASHTO TAM Portal: <https://www.tam-portal.com/re-source/aashto-transportation-asset-management-gap-analysis-tool-users-guide/>

IAM Maturity Scale and Guidance

The IAM Maturity Scale and Guidance document provides a generic maturity scale for agencies looking to assess their current asset management practice and determine ways to grow and mature. This guidance is available for purchase here: <https://theiam.org/knowledge/Knowledge-Base/asset-management-maturity-scale-and-guidance/>

Data Gap Assessment Tool

To assess data and information maturity, agencies can use *NCHRP Report 814, Data to Support Transportation Agency Business Needs: A Self-Assessment Guide*. This report provides steps to prepare for the assessment, conduct the assessment, and improve and monitor the agency's data and information maturity over time. The assessment approach presented is flexible and scalable to many different agency needs. The Guide helps agencies determine if they have the right data, if their data is good enough, if they are getting full value from their data, and what they need to do to improve.

TPM Assessment Tool

The self-assessment available on the Transportation Performance Management (TPM) Toolbox (www.tpmtools.org) is available to agencies looking to assess their level of performance management maturity. Three different assessment options are available: a quick, 2-minute assessment, a standard assessment, and an assessment by component of the TPM framework presented in the TPM Guidebook.

TIP Repeated or frequent maturity assessments can be useful for mid-course corrections; however they should be spaced out enough to avoid over-burdening the department or agency.



Communities

There are numerous opportunities available for practitioners to interact with people from peer agencies. The following committees and groups provide a way for agencies to share ideas, overcome challenges, and advance asset management practice.

American Association of State Highway and Transportation Officials (AASHTO)

AASHTO is a nonprofit, nonpartisan association representing highway and transportation departments in the 50 States, the District of Columbia, and Puerto Rico. It represents all transportation modes including: air, highways, public transportation, active transportation, rail, and water. It aims to foster the development, operation, and maintenance of an integrated national transportation system. AASHTO is an international leader in setting technical standards for all phases of highway system development. <https://www.transportation.org>

The AASHTO Committee on Performance-Based Management (CPBM) is dedicated to providing State DOTs the expertise and resources to support performance-based management and to create a results-driven environment to maximize the performance of both transportation systems and organizations. The committee is focused on Organizational Management, Systems Performance, and Federal Policy, Regulations and Programs.

The CPBM's Subcommittee on Asset Management was created to help improve the State-of-the-practice of asset management in State DOTs. The Subcommittee works to help States optimize resources with per-

formance-based goals and measures for operation, preservation, and improvement of their transportation systems. Transportation Research Board (TRB)

TRB provides innovative, research-based solutions to improve transportation. TRB is a program unit of the National Academy of Sciences, Engineering and Medicine, a non-profit organization that provides independent, objective, and interdisciplinary solutions. TRB manages transportation research by producing publications and online resources. It convenes experts that help to develop solutions to problems and issues facing transportation professionals, and provides advice through its policy studies that tackle complex and often controversial issues of national significance. <http://www.trb.org/Main/Home.aspx>

TRB Committee on Transportation Asset Management. The Committee seeks to advance the State of the art and State of the practice in asset management. Asset management is a process to strategically manage the transportation system in a cost-effective and efficient manner. Asset management by its nature is a collaborative process, and the Asset Management Committee works with other TRB Committees across all modes, with the AASHTO Asset Management Subcommittee, and other partners.



Federal Highway Administration (FHWA)

FHWA is an agency within the U.S. Department of Transportation that supports State and local governments in the design, construction, and maintenance of the Nation's highway system, and various Federal and tribal owned lands. Through financial and technical assistance to State and local governments, the FHWA is responsible for ensuring that America's roads and highways continue to be among the safest and most technologically sound in the world. <https://www.fhwa.dot.gov>

FHWA TAM Expert Task Group (ETG).

TAM ETG was formed as a forum to discuss changes in the way highway agencies are managing assets. The structure and membership of the TAM ETG were intentionally designed to ensure interaction with key AASHTO and TRB committees. Among its objectives, the TAM ETG aims to identify strategies for advancing asset management practice and influencing change within State DOTs and partnering with transportation agencies.

IAM

The IAM is the international professional body for asset management professionals. The IAM develops asset management knowledge and best practice, and generates awareness of the benefits of the asset management discipline for the individual, organizations and wider society. Established in 1994, the IAM has over 22,000 members in 158 different countries. <https://theiam.org>

IAM US Patron Group. The Patrons of the IAM are a special group of Corporate Members who have committed to a high level of activity and engagement with the Institute, and on that basis, have been invited to become a Patron. The Patrons include leading asset managers, who, in exchange for significant support to the Institute, have great influence not only on the development of the IAM itself but also on the development on the discipline.

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