



Section 2.1

Developing a TAM Strategy



Section 2.2

TAM Integration



Section 2.3

TAM Assessment and
Advancement



Section 2.4

Developing a
Transportation Asset
Management Plan (TAMP)



Chapter 2

TAM Strategy and Planning



Section 2.1

Developing a TAM Strategy
provides information on creating a TAM policy and aligning it with other strategic plans within the agency.



Section 2.2

TAM Integration
explains the importance of integrating TAM within planning and programming, risk management, and information management.



Section 2.3

TAM Assessment and Advancement
offers guidance on assessing current TAM practice and prioritizing areas for improvements.



Section 2.4

Developing a Transportation Asset Management Plan (TAMP)
introduces the basic elements of a TAMP and describes ways agencies might go beyond the basic requirements.



Chapter 2

TAM Strategy and Planning

Developing TAM strategies is an agency-wide activity undertaken to ensure that the agency delivers on its vision, mission and defined asset management objectives and targets. A TAM strategy is the big-picture outlook needed to integrate TAM with existing processes and make ongoing improvements once TAM is underway. While practices in TAM strategy development vary across agencies, a strategy will generally establish agency specific TAM principles, connect to agency strategic goals, and provide a framework for how TAM will be carried out.

Key Terms

Asset Class

A type of asset (e.g. pavement, bridge, sign, signal, etc.).

Goals

Broad statements articulating a desired end state that provide strategic direction for an agency. (*TPM Guidebook*)

Information Management

The processes and framework for acquiring, distributing, and storing information at an agency.

Measures

Indicators that track progress toward goals and objectives. Used to establish targets and assess progress toward achieving established targets. (*TPM Guidebook*)

Objectives

Specific, measurable statements that support achievement of a goal. (*TPM Guidebook*)

Performance Management

A process that provides accountability and feedback to ensure that goals are met in an efficient and effective manner.

Planning

The use of agency goals and objectives to drive development of strategies and priorities in the long-range transportation plan and other plans and processes. (*TPM Guidebook*)

TAM Policy

Defines the approach the agency will take to achieve the goals and objectives set forth in the strategic plan.

Principles

From a TAM perspective, fundamental ideas that serve as a foundation for making decisions to better address infrastructure needs.

Programming

The use of strategies and priorities to guide the allocation of resources to projects that are selected to achieve goals, objectives, and targets. (*TPM Guidebook*)

Risk Management

The processes and framework for managing potential risks, including identifying, analyzing, evaluating, and addressing the risks to assets and system performance. (23.C.F.R 515.5)

Strategic Plan

Sets a vision for the future of the agency and defines the goals and objectives to achieve that vision.

TAMP

Transportation Asset Management Plan

Targets

Quantifiable levels of performance the agency wants to achieve within a specific time frame. (*TPM Guidebook*)

Section 2.1

Developing a TAM Strategy

TAM strategies and plans should be integrated within the agency's overall vision and strategy documents and other related plans. A stand-alone TAM policy can also be used to establish leadership support, define principles and communicate the purpose of TAM.

This section has two parts:

1. **Integrating TAM Within Agency Strategic Plans and Policies.** It is important to include TAM as a part of agency-wide plans and policies in order to establish the role of TAM within the agency.
2. **Creating a TAM Policy.** This section outlines the key aspects of a TAM policy and how to develop it.



Integrating TAM Within Agency Strategic Plans and Policies

Integrating TAM within existing strategic documents is key to ensuring TAM is established and sustained.

TAM is not a stand-alone practice that is only applicable to select areas of a DOT. Ideally, TAM principles and practices should be integrated within an agency's vision, mission and strategy documents (see Figure 2.1). TAM promotes accountability, preservation, data-driven decision-making and the optimization of resources; all of these are broader strategic goals often outlined in plans and policies other than a TAMP. Aligning TAM with the agency's strategic documents helps ensure an agency's vision is all encompassing and cohesive.

These documents include:

- Agency-wide strategic plan and/or business plan (including long-range plans)
- Agency-wide financial plan

- State long-range plan
- Other performance plans (safety, mobility, freight, etc.)

In addition, some agencies may choose to adopt a TAM policy with principles that the agency will follow. A TAM policy can be used to communicate the purpose of TAM and build understanding and support for TAM within the agency. It can also help to sustain a TAM approach through leadership changes. See the next section for further information on creating a TAM policy.

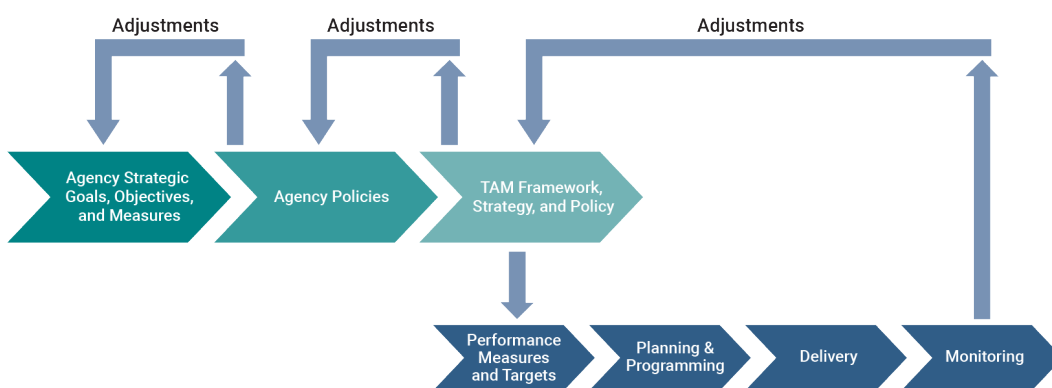
Practice Example Integrating TAM

Michigan DOT

MDOT's 2017 strategic plan has seven strategic areas of focus. A key focus area is System Focus, which aims to provide cost-effective, integrated and sustainable transportation solutions. The first strategy under this focus is to "apply asset management principles to prioritize and implement the most cost-effective transportation investment strategies." This connection between MDOT's strategic plan and their TAM program communicates the importance of asset management in how the agency conducts business. It gives TAM a seat at the agency-wide strategic plan monitoring sessions and allows for the resources needed to carry out TAM activities.

Source: Michigan DOT. 2017. *MDOT Strategic Plan*. https://www.michigan.gov/documents/mdot/MDOT_2017_StrategicPlan_553573_7.pdf

Figure 2.1 Aligning Policies and Plans



TIP 'Line of Sight' is a concept that describes alignment of an agency's asset management practice to its strategic goals and business objectives.



Creating a TAM Policy

A TAM policy describes the adoption of asset management principles for managing infrastructure. It defines the intent of the TAM program and can include how TAM will be carried out in the agency. Leadership direction on the policy helps achieve buy-in throughout the agency, making it easier to ensure it connects to and aligns with other strategic documents.

A TAM policy can be the first place an agency communicates the strategy of their TAM program. It can be thought of as a contract between the agency and its customers, partners and stakeholders that defines how TAM fits within the agency's decision making process.

Some elements of a TAM Policy can be included within a TAMP (TAM Objectives, Scope of TAM, connection of TAM to other planning initiatives, and TAM roles). However, a separate TAM Policy may provide those responsible for TAM within an organization the ability to challenge existing processes and approaches. A concise TAM Policy defines the principles that guide the decisions made during TAMP development and implementation.

A TAM Policy can outline the types of assets considered for management and identify where in the cycle of DOT work activities to emphasize asset management practices. It can also establish the high-priority initiatives on which the agency will focus their efforts. A TAM policy starts to set boundaries and clarify the intent of asset management.

A TAM policy may include:

- Definitions of services provided to customers and distinctions between service levels
- Approaches for managing assets from a whole life perspective

- Decision-making standards, based on the triple bottom line (economic, environmental, and social)
- Consideration of risk
- Approach for making transparent, data-driven decisions

For further details on developing a TAM Policy, see the how-to guide in this chapter.

TAM Goals, Objectives, Strategies

TAM goals and objectives support and communicate the policy and align with the broader agency vision, mission, goals and strategies. Goals and objectives may cover transportation system performance and desired outcomes, as well as agency decision-making approaches and practices. Some agencies have goals and objectives, while some have only goals and others have only objectives. Regardless of the terminology that is used, it is important that agencies set a vision and establish a direction to move towards. The Oklahoma DOT practice example highlights their TAM objectives.

Agencies should include a clear statement of TAM principles – either within the agency's strategic documents or as a stand-alone policy. They should also seek opportunities to strengthen the integration of TAM within the agency's strategic planning efforts.

Practice Example TAM Objectives

Oklahoma DOT

The Oklahoma DOT identified the following TAM objectives to help guide their asset management program:

- Maintain (improve) the condition of the state's bridges and roadways
- Reduce risk associated with asset performance
- Make better data driven decisions about assets
- Reduce costs and improve efficiency, including effectively delivering projects that support asset management
- Increase internal and external communications and transparency
- Improve customer service
- Improve safety on the state's transportation system
- Enhance mobility of people and goods

Ingredients for Success in Creating a TAM Policy

The following are some of the key ingredients that make a TAM policy successful.

Leadership Support



Leadership support and direction in the effort to create a TAM policy is important. Effective leadership ensures and maintains a connection across the various types of goals. A typical transportation agency has a lot of moving parts and multiple, sometimes conflicting, priorities. The nature of TAM and its success in meeting TAM goals involves actions that cut across individual business units. Leadership is a critical ingredient in creating positive change and maintaining processes across business units. See section 3.1 for more information on leadership.

Internal and External Stakeholder Engagement and Support



Involving groups and people who want a voice in the TAM program's success, whether external partners or stakeholders or internal business units, is important for creating policies that will have a positive impact and are sustainable. See section 3.2 for more on stakeholder engagement.

Consider Implementation



There may be multiple ways to accomplish policy objectives, so the policy should be simple and flexible rather than complex and rigid.

Link to Performance Management



Performance management is an underlying component of good asset management. Policies should consider the ability to define performance measures, collect data and measure performance. They should also consider the cycle of setting objectives, monitoring performance and making adjustments. See section 2.2 for more on TAM performance and monitoring.

Practice Example TAM Policy

Amtrak

Amtrak Engineering's Asset Management policy identifies guiding principles that the agency intends to use in managing the infrastructure it owns and maintains. Specifically, the policy focuses on developing asset management capability and implementing the TAMP. The policy begins with a purpose statement that defines asset management, and then lays out seven principles (or standards) to guide asset management practice. The principles highlight ownership, transparency, risk management, life cycle costs and information systems standards for Amtrak's asset management practice. In addition, the policy also identifies responsibilities and leadership commitment, calling out specific positions in the agency and their role in delivering the asset management plan. The policy is included as a section in their asset management plan and is signed by the President and CEO, EVP Chief Operating Officer, and VP Chief Engineer.

TAM Principles

FHWA Principles of Asset Management

FHWA has defined a number of basic principles for asset management as listed below. All of these ideas work together to help an agency make decisions to better address their infrastructure needs. Asset management should be:

Policy driven. Decisions reflect policy goals and objectives that define desired system condition and service levels.

Performance based. Performance information is used to establish target levels, to allocate funding, and to monitor progress.

Risk based. Risk management is used to identify, analyze, evaluate and address the risks to assets and system performance.

Option oriented. Comprehensive choices and trade-offs are examined at each level of decision making.

Data driven. Management systems and tools that utilize quality data are used to support decisions.

Transparent. There are clear criteria for making decisions.



Practice Examples

Adopting Asset Management Principles • Seattle DOT

Seattle is one of the fastest growing cities in the U.S. and the demands on the transportation system have grown dramatically. Meanwhile, the system is aging. Seattle DOT (SDOT) needed to find a way to balance infrastructure expansion, preservation, and maintenance by aligning its Asset Management practices with its service delivery strategies. All of this had to occur within the limits of available resources and ensure that SDOT strategically managed the transportation system for years to come. SDOT's Asset Management initiative provides a long-term vision of how SDOT intends to accomplish its mission. In 2007, the SDOT began implementation of a strategic and systematic process that guides decisions about construction, maintenance, and operation of SDOT infrastructure. The SDOT identified and adopted the following three key principles of asset management:

- Build, preserve, and operate transportation infrastructure services more cost effectively with improved asset performance;
- Deliver to customers the best value for public tax dollars spent; and
- Enhance the credibility and accountability of SDOT to the Mayor and City Council

These principles were intended to identify the outcome of a fully implemented asset management program at SDOT. They are supported by a longer list of asset management principles (<https://www.seattle.gov/transportation/about-sdot/asset-management>) and an Asset management Policy that identify the areas of focus. The Policy highlights the steps SDOT intends to take recognizing that achieving the key principles is a long-term effort achieved through continuous improvement.

Creating an Asset Management Policy • Colorado DOT

In 2015, the Colorado Department of Transportation (CDOT) updated Policy Directive 14 (PD 14.0) "Policy Guiding Statewide Plan Development" to reinforce the importance of TAM in the transportation budget allocation process. It includes the following objectives:

- Infrastructure Condition – Preserve the transportation infrastructure condition to ensure safety and mobility at a least life cycle cost
- Maintenance – Annually maintain CDOT's roadways and facilities to minimize the need for replacement and rehabilitation

Embedded in this policy are target-setting requirements that the Transportation Commission requested. A performance tracking mechanism is tied to this policy directive. This performance management focus is reinforced annually in a PD14 workshop hosted by the Transportation Commission where the most recent performance results are presented.

2017 Policy Directive 14 Scorecard

Infrastructure Condition

Highways

PD 14.0 Objectives	2017				2016				Dedicated Funding Sources ¹	Notes
	Budget	Target	Results	Target Met	Budget	Target	Results	Target Met		
Achieve 88% High/Moderate Drivability Life for Interstates based on condition standards and treatments set for traffic volume categories		80%	88%	●		80%	94%	●	Surface Treatment Program RAMP Funding	Although targets were met in 2017, given the current planning horizons, it is anticipated that targets for pavement condition will not be met for the next several years, and will continue to remain below the target through 2027. In 2027 it is anticipated that only 88% of the state highway system will have high or moderate Drivability Life. \$207 million per year is needed annually beyond FY 2023 to achieve the target by 2027. Built will work to improve/replace the link between pavement condition and pavement condition recommendations, and evaluate the effects of pavement condition recommendations on SL to identify weaknesses. Additionally, continuing work to align current SL metric with new WIS metrics of Good/Fair/Poor pavement condition of the WIS System.
Achieve 88% High/Moderate Drivability Life for RWS, excluding Interstates, based on condition standards and treatments set for traffic volume categories	\$252.1 million	80%	84%	●	\$235.9 million	80%	88%	●		
Achieve 88% High/Moderate Drivability Life for the state highway system based on condition standards and treatments set for traffic volume categories		80%	80%	●		80%	88%	●		

Infrastructure Condition

Bridges

PD 14.0 Objectives	2017				2016				Dedicated Funding Sources ¹	Notes
	Budget	Target	Results	Target Met	Budget	Target	Results	Target Met		
Maintain the percent of 88% total bridge deck area that is not structurally deficient at or above 90%		90.0%	95.8%	●		90.0%	95.5%	●	Colorado Bridge Enterprise On-System Bridge RAMP Funding	A structurally deficient bridge is typically one where corrosion or deterioration has resulted in a portion of the bridge being in poor condition. For example, where water leaking through an expansion joint has caused the end of a steel girder to rust. Currently exceeding target and will continue to exceed target through 2027. \$2.3 million is needed to preventative maintenance to continue meeting the current target and expecting 96% not poor condition in 2017. However, the bridge program has 7 metrics geared towards mitigation of risks (delays, and more of these are not achieving their target). For the asset risk mitigation metrics not achieving their target, staff are working to identify additional strategies that can be implemented with no additional funding. Current strategies include identifying bridges that can easily be repaired or retrofitted with the most cost-effective treatment. Four critical bridges are at risk of failure during a storm event of sufficient size.
Maintain the percent of state highway total bridge deck area that is not structurally deficient at or above 90%		90.0%	95.4%	●		90.0%	95.1%	●		
Percentage of CDOT-owned bridges over waterways that are lower critical	\$167.4 million	5.0%	6.5%	●	\$164.1 million	5.0%	6.4%	●		
Percentage of bridge crossings over Interstates, U.S. routes and Colorado state highways with a vertical clearance less than the statutory maximum vehicle height of 14 feet 6 inches		1.0%	2.4%	●		0.4%	1.7%	●		
Percentage of bridge crossings over Interstates, U.S. Routes and Colorado state highways with a vertical clearance less than the minimum design requirement of 14 feet 6 inches		18.0%	21.8%	●		4.8%	19.8%	●		

¹ Additional flexible funding sources with a wide range of eligibility could be used to address multiple objectives. Examples include RPP, STP-M, CMAQ, and TAP

Source: Colorado DOT Scorecard. 2017

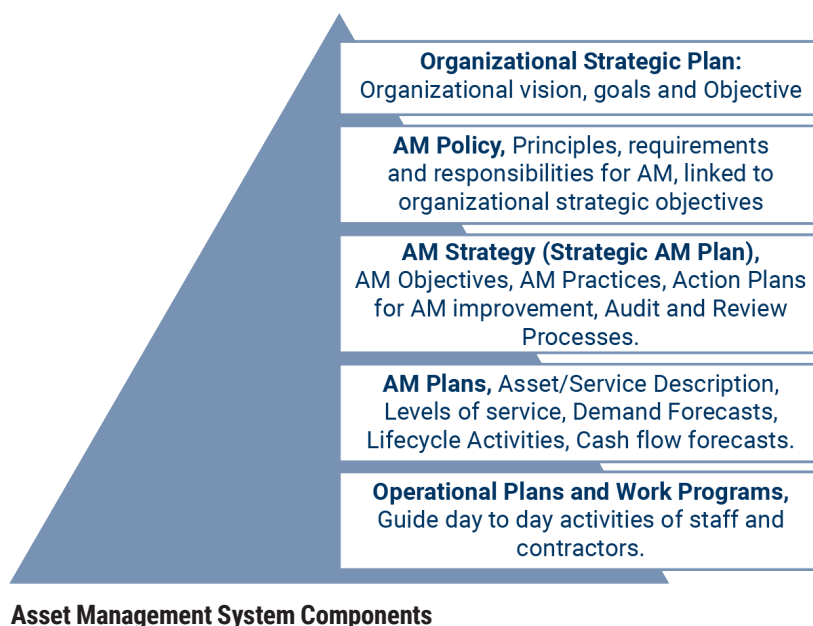
Practice Example Strategic Asset Management System

ISO 55000

ISO 55000 adopts the concept of an Asset Management System, as the figure at right illustrates, which typically consists of several components:

- An organizational strategic plan sets the overall context
- An asset management policy establishes the principles on which the agency makes decisions associated with the management of and investment in infrastructure. It seeks to link the organizational goals and objectives to the principles for management of the infrastructure portfolio.
- The Asset Management Strategy, (sometimes termed the Strategic Asset Management Plan or SAMP) establishes how the agency overall will implement asset management and implement the AM Policy. It articulates how management processes will function in managing infrastructure and delivering services, as well as how the agency will continuously improve their asset management practices over time.
- Asset management plans developed for individual asset classes (pavements, bridges, ancillary assets) are focused on their individual portfolios. However, they align with the overall agency strategy and are customized to the level of management required.
- Operational plans and work programs guide routine activities and have a line of sight to overall agency goals in this structure.

Within the ISO structure, the TAM framework includes these components but each component may vary in scope. For example, the SAMP may require all asset classes to forecast demand, establish service levels and have performance indicators, but compliant sub-asset management plans may have different levels of complexity. A bridge asset management plan may be more robust than one for network culverts. The agency can select the scope and structure appropriate for each aspect within the portfolio.



Source: IPWEA. 2015. International Infrastructure Management Manual (IIMM). <https://www.ipwea.org/publications/ipweabookshop/iimm>



How-to

Develop an Asset Management Policy

A TAM policy helps to formalize the asset management practices that an agency uses on a daily basis. It helps ensure that the goals, objectives, and strategies for TAM are unified and pursued consistently across the agency. This How-To Guide provides eight steps for developing a TAM policy.

1. Identify who will issue the primary TAM policy and who is responsible for developing the policy

As a first step, it is important to determine the roles and responsibilities for policy development. TAM policies can be developed and issued from many different groups within an agency. Often agency leadership is involved and executive staff work with planning, engineering, or another group to develop the primary policy. The policy can be issued by the agency CEO, a transportation commission, or even the state legislative body. The level of responsibility will also assist in assigning the breadth of accountability for implementation of the policy within the agency.

2. Clarify what the policy intends to achieve

Determine the objectives of the policy. Is the purpose of the policy to:

- Communicate the importance of TAM and the scope of the program?
- Ensure the TAM program is sustained through leadership changes at the agency?
- Bring different parts of the organization together?
- Other objectives?

3. Decide what the policy should include

TAM policies can include:

- Material that communicates the definition of TAM
- TAM principles (see page 2-6)
- Scope of TAM within the agency (e.g. assets included and decisions impacted)
- A vision for where the agency wants to go in the future. That vision could be to maintain all assets in a state of good repair, for example
- How TAM will be managed within the agency or region. Consider who take the lead and who will be involved. See discussion of roles and responsibilities in Section 3.1
- Elements of performance management (i.e. specific performance measures, targets, who determine the targets, who monitors, etc.)

In addition, agencies should discuss the time horizon over which the policy will govern.



Developing a TAM Policy

1

Identify who will issue the TAM policy

2

Clarify what the policy intends to achieve

3

Decide What the Policy Should Include

4

Review Peers' TAM Policies

5

Consult Stakeholders

6

Draft the policy and share with stakeholders

7

Produce the final policy and communicate it

8

Review and update the policy



How-to

Develop an Asset Management Policy

4. Review existing TAM policies at peer agencies

Agencies considering developing their first TAM policy do not have to start from scratch. There are existing policies that outline asset management principles from which agencies can draw when developing their own. When reviewing existing policies, agencies can look for elements to adapt to their specific needs and fill in any gaps with other principles they seek to prioritize in their asset management programs. Example TAM policies may be found on the AASHTO TAM Portal. [http:// www.tam-portal.com](http://www.tam-portal.com).

5. Consult stakeholders on the content of the policy

As an agency develops its TAM policy, it is important to consult internal and external stakeholders on its general contents. Different types of stakeholders may need to be involved using different methods, in order to appropriately obtain their input.

6. Draft the policy and share with stakeholders

Once a draft of the policy is available, it is important to circulate it to stakeholders to ensure the policy appropriately reflects all previous discussions and decisions.

7. Produce the final policy and communicate it across the agency

When the policy is finalized, staff should ensure that it is communicated across the agency. The TAM policy should be on the agenda at key meetings throughout the agency to promote awareness. Also, any needed changes to business processes should be implemented to ensure they support the policy.

8. Review and update the policy

Over time the policy should be reviewed and updated if necessary. The need to revisit the process may occur as implementation of the policy matures, or due to changes in roles and responsibilities within an organization, creating a desire to reaffirm a commitment to TAM through this document.



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TAM Integration

An integrated view of TAM is critical to its advancement within an agency. Integration ensures TAM is linked to other existing business processes within the agency. Integrated planning considers the life cycle of an asset comprising the “cradle-to-grave” approach. Understanding each phase of the life cycle requires coordination between planning, design and operations teams.

This section has four parts:

1. **Planning and Programming.** Decisions made during the planning and programming process establish the strategic framework for TAM choices during the delivery and implementation process.
2. **Performance Management.** Within all TAM programs, the use of performance management is critical to align investment decisions with organizational objectives.
3. **Risk Management.** Risk management is integrated with TAM processes at the strategic level. Risk can also be considered at the asset level to understand the impact of asset failure on the wider system.
4. **Information Management.** How agencies manage data and information, and how these are used, are important considerations in TAM.



Planning and Programming

Linking and aligning asset management with planning and programming activities helps strengthen an agency's delivery of projects. Planning and programming processes set strategic direction and resource allocation practices; TAM helps set priorities and encourages data-driven, performance-based decision-making.

Planning is the process of setting strategic direction through goals and objectives, then performing analysis to identify trends, strategies, and long-term investment priorities. Planning answers the questions of where to go and how to get there. Programming involves allocating resources in order to determine a program of projects the agency will pursue. Planning and programming are central to the work of any transportation agency. Integrating TAM into the planning and programming process will only strengthen and sustain the practices involved in both areas.

Developing the Long-Range Transportation Plan (LRTP) and the Statewide Transportation Improvement Plan (STIP) are two planning activities where the integration of TAM is especially relevant.

TAM principles, data and tools can help shape the LRTP and STIP by:

- Linking agency resource allocation to policy objectives.
- Defining the performance targets to be achieved.
- Identifying strategic investment choices and evaluating and analyzing tradeoffs among them at the appropriate stages.
- Providing the information and analyses to facilitate the appropriate resource allocation decisions that follow good TAM practice.

Integrating TAM approaches with planning and programming goes beyond informing and shaping the activities. Communication and coordination between activities and the people involved in them is important as well. Both planning and TAM require an understanding of the life cycle of an asset. This requires coordination with operations teams to communicate how decisions impact the expected useful life of the asset. Operations teams also need to be aware of the asset management planning horizon, performance measures and targets. These teams need to ensure the capital plan has been accounted for in the maintenance and operational plans. In addition, since planning is a network-level endeavor, teams managing each of the different asset types need to communicate with one another and coordinate with planning.

The following are some key questions to ask when considering the integration of TAM with planning and programming.

- Is the cost of maintenance and operations taken into account in the decision-making process to select capital projects?
- Are there mechanisms to directly evaluate tradeoffs between capital investment and operations and maintenance implications within the planning process?
- Are the needs and implications associated with connected and autonomous vehicles considered in the asset management plan?

Practice Example Aligning a TAMP to Broader Planning Initiatives

Montana Department of Transportation (MDT)

When developing their 2018 TAMP MDT aligned their pavement performance targets and goals to those within their planning document TranPlan 21 (now TranPlanMT).

TranPlanMT defines MDT's policy direction for operating, preserving, and improving Montana's transportation system over a 20-year period. It serves as the guiding document for MDT decisions, especially those related to investing Montana's limited transportation funds.

This type of alignment can help illustrate a link from policy objectives to investment strategies and resource allocation.

Sources:

Montana DOT. 2018. *MDT TAMP*. https://www.tamptemplate.org/tamp/030_montanadt/

Montana DOT. *TranPlanMt*. <https://www.mdt.mt.gov/tranplan/>

TIP TAM practice is most effective when linked to planning and programming activities; this is one way to ensure that TAM principles are implemented into agency decision making.



- Are future risks such as climate change fully integrated into the capital planning process (rehabilitations, renewal, service level upgrades, etc.)? Is scenario planning used to assess the risk effects of system wide external changes?

The FHWA Asset Management Financial Report Series, *Report 4 Integrating Financial Plans into the Planning, Programming, and Budgeting Processes* describes the importance of integrating planning, programming, and budgeting with asset management.

The relative timeframes of various planning and programming activities is shown in figure 2.2.

Figure 2.2 The Relative Timeframes Between Plans

Long-range plans, asset management plans, TIPs, and state budgets should be aligned.



Source: FHWA. 2017. <https://www.fhwa.dot.gov/asset/plans/financial/hif16001.pdf>

TIP Involving internal and external stakeholders in the TAM process early can encourage or enhance their buy-in when the time comes to make important decisions.



Performance Management

Asset management utilizes performance management to set objectives, define measures, establish targets, and monitor results. Transportation Performance Management (TPM) relies on the TAM principles and process to help achieve the agency's broader goals and objectives.

Relationship to Federal TPM Activities

The MAP-21 Act (2012) established a performance-based program intended to focus Federal Aid highway program and public transportation system (e.g., bus, light rail, and ferry) investments on national transportation goals. It was also intended to increase accountability and transparency in the use of federal transportation funds, as well as improve project decision-making through the strategic use of system performance information. The performance-based provisions of MAP-21 were retained in the FAST Act in 2015.

TPM is defined by FHWA as a strategic approach to making investment and policy decisions to achieve national performance goals using system information in accordance with rules established by the Department of Transportation (see Figure 2.3). The FHWA recognizes asset management as the application of TPM to manage the condition of infrastructure assets needed to provide for mobility and safety in the nation's transportation system. In short, the FHWA refers to asset management as the engine driving infrastructure performance.

Figure 2.3. FHWA's Strategic Approach to TPM



Source: FHWA TPM Homepage. 2019. <https://www.fhwa.dot.gov/tpm/>



Asset management plans document the processes and investment strategies developed by an agency to manage its infrastructure assets. These asset management plans support an agency's performance-based planning and programming processes for making long-term investment decisions and feed shorter-term project and treatment selection activities. Together, these activities ensure the investment decisions of an agency are aligned with performance objectives and goals.

TPM Regulations

The TPM provisions for highways included in federal law are implemented in accordance with rulemakings organized around the following six elements:

- **National goals** – focusing the Federal Aid highway program on the seven areas listed below:
 - Congestion reduction
 - System reliability
 - Environmental sustainability
 - Freight and economic vitality
 - Infrastructure condition
 - Reduced project delivery delays
 - Safety
- **Measures** – assessing performance or condition in carrying out the TPM-based Federal Aid highway program
- **Targets** – funding recipients are required to document future performance expectations under a fiscally-constrained environment
- **Plans** – identifying strategies and investments for addressing performance needs
- **Reports** – documenting progress toward target achievement and investment effectiveness
- **Accountability and transparency** – requiring federal funding recipients to achieve or make significant progress toward targets

TPM Relationship with TAM

There is a close relationship between TPM and TAM, since both consider asset and system performance, risks and available resources to achieve desired objectives over time. Both rely on a strategic approach, using data to make investment and policy decisions in order to achieve performance objectives. Internationally, there is less distinction between asset management and performance management, with the IAM defining asset management as encompassing the “balancing of cost, opportunities and risks against the desired performance of assets to achieve the organizational objectives.” In the United States, TAM applies to the technical and financial decisions, plans and actions related to physical infrastructure, while TPM considers a broad range of system performance categories.

A graphic illustrating the integration of asset management and performance management is provided in Figure 2-4. In the figure, the circle on the left represents the interconnection of the various performance areas that transportation agencies are concerned with throughout their planning processes. Flowing into the performance circle is the asset management circle, representing an agency's infrastructure needs to support system performance.

Practice Example Alignment Between Policies, Investments, and Practices

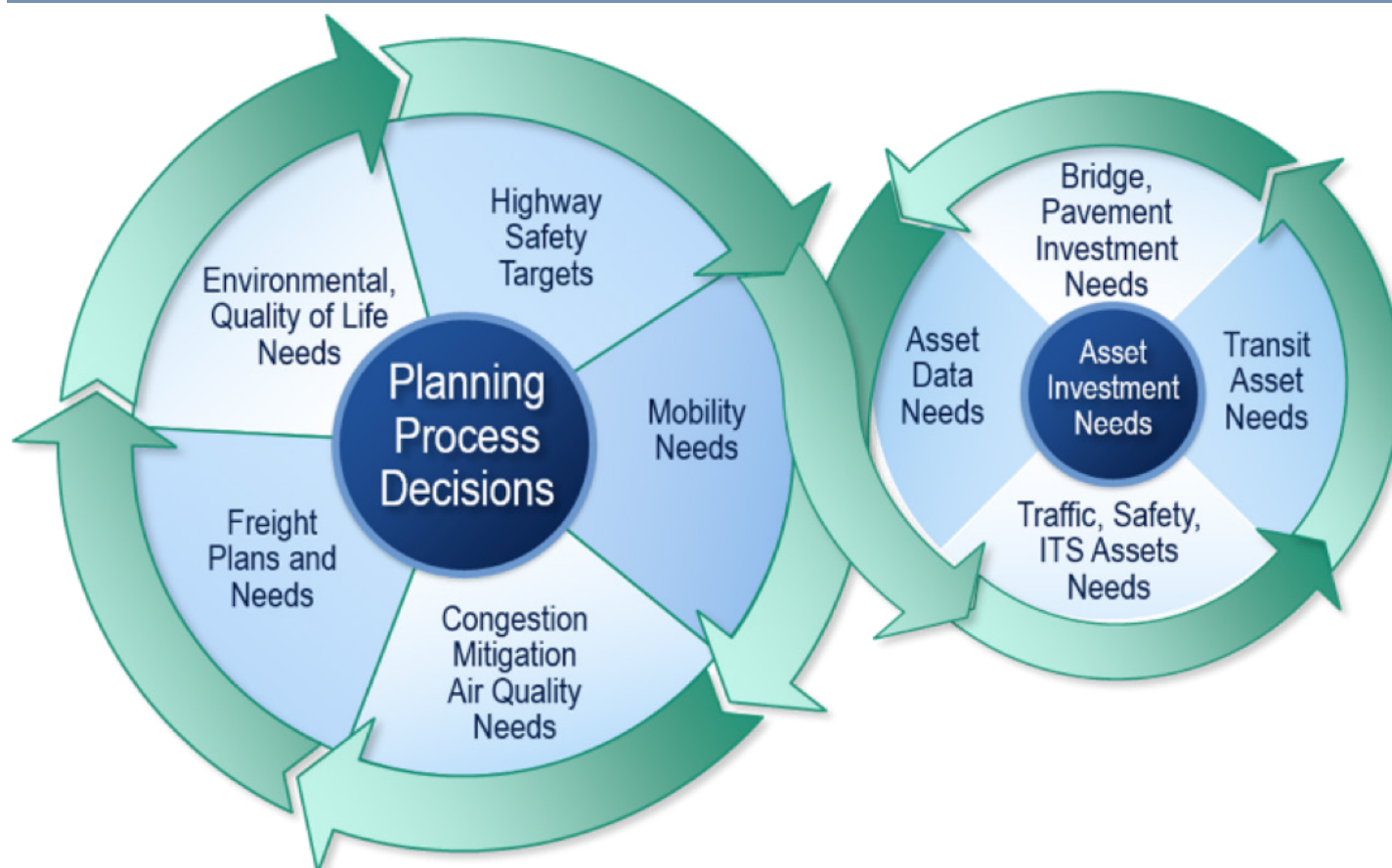
British Columbia

To support the alignment of agency policies, objectives and day-to-day practices, the Province of British Columbia established the tiered structure shown in Figure 6.3 for a design-build-finance-operate project. The highest of the three levels, Key Performance Measures, defines the high-level outcomes for service delivery in terms of a few key strategic areas. The second level, Asset Preservation Performance Measures, defines the minimum acceptable condition levels for each of the individual assets to preserve their value. The third level, Operational Performance Measures, corresponds to the many specific requirements for operating and maintaining the highway in a safe manner on a day-to-day basis. The tiered approach helped align stakeholders at all levels and clarified priorities for all parties.

The FHWA’s Expert Task Group (ETG) published a white paper explaining the relationship between asset management and performance management. It acknowledges the performance of a transportation system is dependent on many factors, including operational characteristics, and system usage and demand, in addition to the physical condition of the infrastructure assets. The paper explains that “performance management focuses on how policies, resource allocation, and other deci-

sions affect all aspects of system performance including safety, operations, environmental stewardship, and infrastructure condition.” (FHWA 2012) Asset management is described as an application of performance management principles with a long-term focus to manage the performance of infrastructure assets, the resources allocated to operate a transportation system, and the investments made to achieve the agency’s long-term goals and objectives.

Figure 2.4. Integration of Performance Management and TAM



Source: NHI 136106A, *Introduction to Transportation Asset Management*. 2019

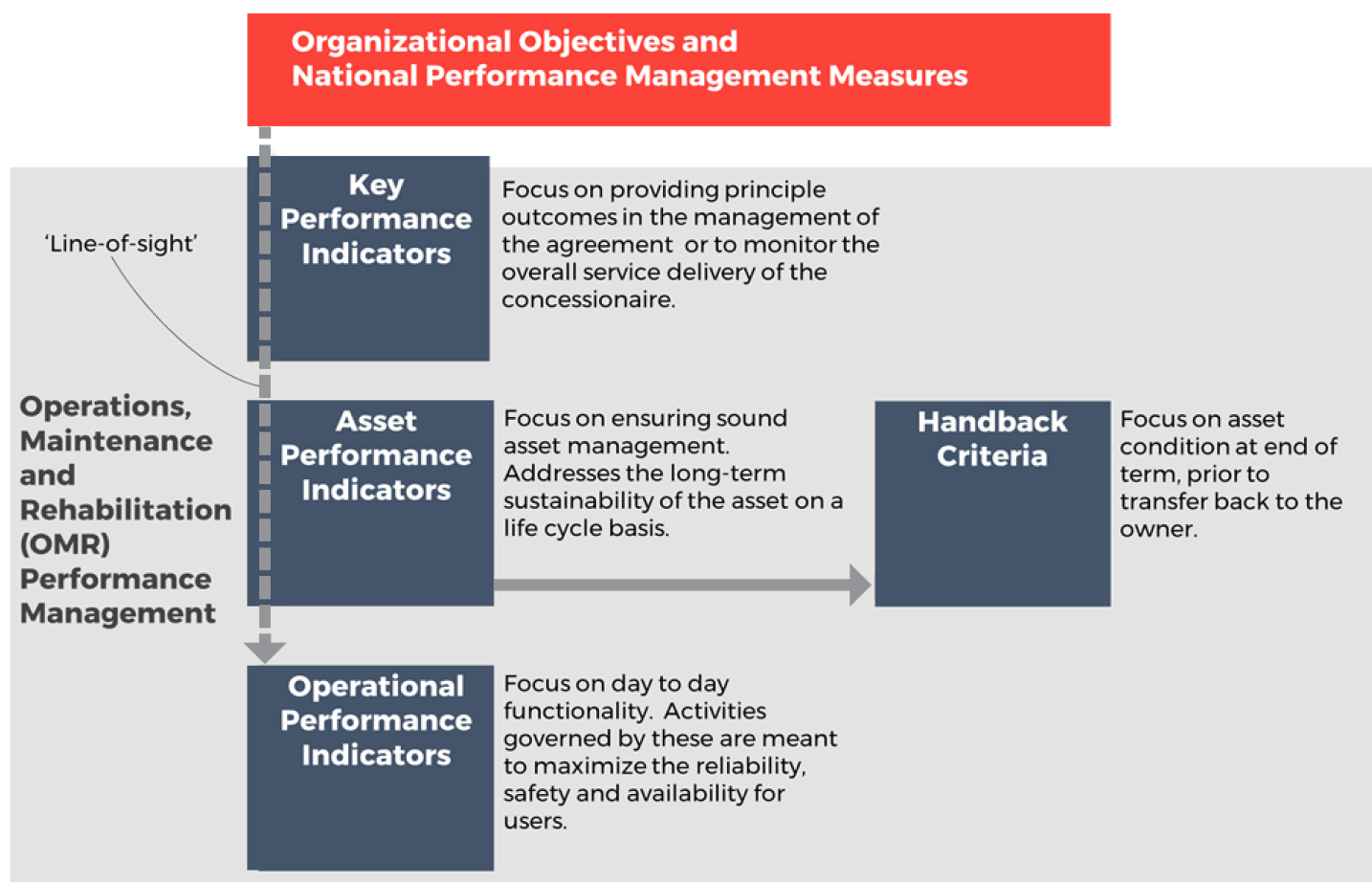
Performance Management Framework

To support the alignment of agency policies, objectives and day-to-day practices, agencies may establish a tiered performance management framework, such as the example illustrated below for a model Design-Build-Finance-Maintain-Operate (DBFMO) project (Figure 2.5). The highest of the three levels, Key Performance Measures, defines the high-level outcomes for service delivery in terms of a few key strategic areas. The second level, Asset Preservation Performance Measures, defines the minimum acceptable

condition levels for each of the individual assets to preserve their value. The third level, Operational Performance Measures, corresponds to the many specific requirements for operating and maintaining the highway in a safe manner on a day-to-day basis.

Further discussion on Performance Management Frameworks, defining Performance Measures and Performance Targets is included in Chapter 6.

Figure 2.5. Typical Performance Management Framework used in a DBFMO Project





Risk Management

Managing transportation assets entails managing risk. This includes day-to-day concerns, such as addressing the risk that assets will deteriorate faster than expected or projects will cost more than budgeted. However, managing risk also involves enterprise-level risks with widespread impacts.

FHWA defines risk and risk management, in the context of transportation asset management, as follows:

- **Risk:** The positive or negative effects of uncertainty or variability upon agency objectives. (23 CFR 515.5)
- **Risk Management:** The processes and framework for managing potential risks, including identifying, analyzing, evaluating, and addressing the risks to assets and system performance. (23 CFR 515.5)

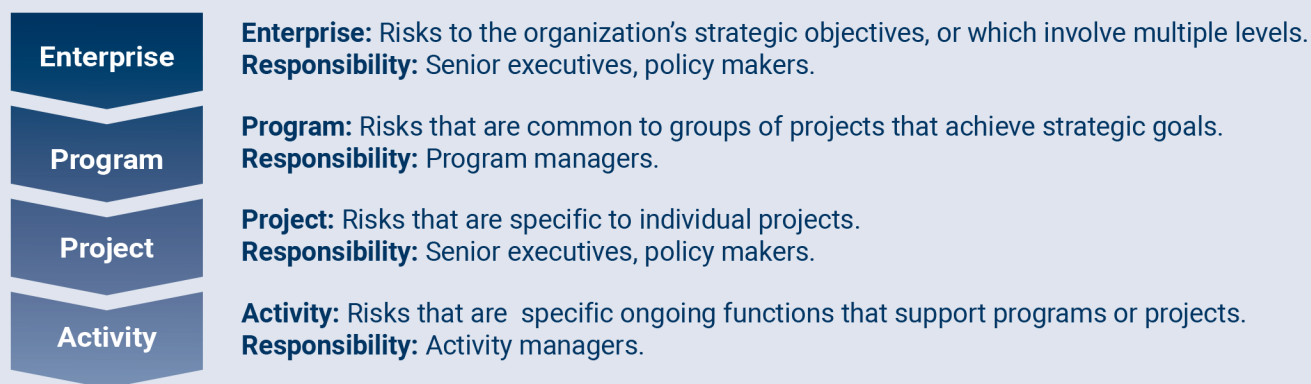
Considering risk is important in developing TAM strategies, because transportation agencies often must spend significant resources responding to and/or mitigating risks. Reacting to the uncertainty presented by risks can be more expensive than proactive management. Risk management strengthens asset management by explicitly recognizing that any objective faces uncertainty, and by identifying strategies to reduce uncer-

tainty and its effects. Being proactive, rather than reactive, in managing risk and avoiding “management by crisis,” helps agencies best use available resources to minimize and respond to risk as well as further build public trust.

Given the importance of risk management for supporting asset management, agencies should formally identify and manage risks at all organizational levels. Figure 2.6 shows four levels at which risks can be identified within an agency, and the individuals who may be responsible for the risks at each level.

Typically agencies manage risk every day. They are well-equipped to hand risks at the project and activity levels, and regularly consider risks on a larger scale. Formally considering and documenting potential risks at all levels can help bring greater attention to them and improve risk management.

Figure 2.6 Levels of Risk within an Organization



Source: TRB. 2016. *NCHRP Project 08-93 Final Report*. http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP08-93_FullGuide.pdf

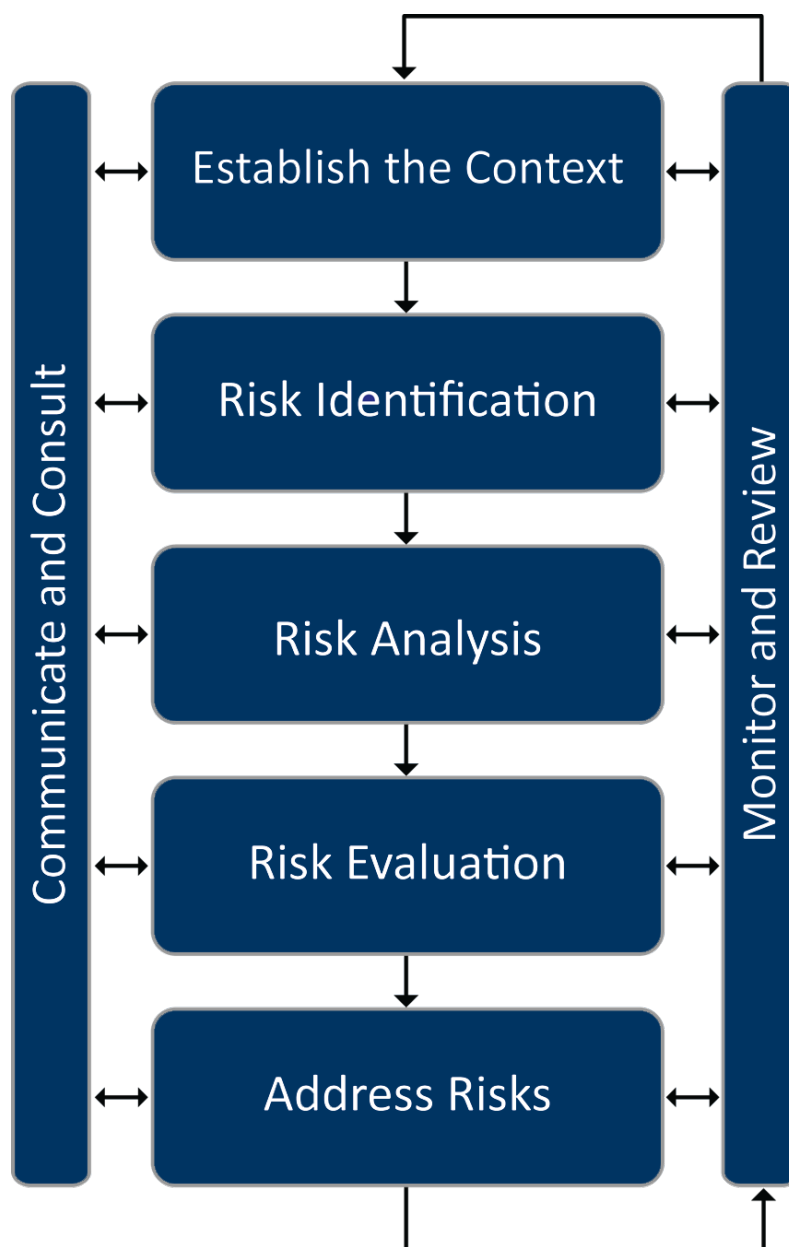
TIP Risk management workshops or discussions should involve as many people in as many different parts of the agency as possible. This ensures that a broader range of risks and categories of risks are included.

Risk Management Process

Figure 2.7 depicts a risk management process. While it may not be necessary to walk through each discrete step in this process for every risk an agency faces, this process is helpful for understanding how to incorporate risk into TAM.

- The process starts with **establishing the context** for risk management. In the case of risk management for a TAMP, the context is largely defined through other TAMP development steps.
- The second step involves **identifying the risks** that affect the assets in the TAMP. Ideally, in this step the agency considers the full set of asset-related risks, even those that may appear insignificant.
- The third step, **risk analysis**, involves identifying the cause of the risk, the outcomes or consequences (impact), and the likelihood of the risk occurring.
- The fourth step, **risk evaluation**, entails prioritizing and ranking risks.
- Fifth, the **address risks** step is the response the agency takes to the risk. DOTs can choose to tolerate the risk or treat the risk in some manner.
- The left side of the figure shows a continuous **communication and consultation** activity. Agencies need to communicate the risks to both internal and external stakeholders, as well as monitor and review the risks.
- The right side of the figure shows an iterative **monitoring and review** process. Once the risks are identified, analyzed, and a mitigation plan is in place agencies need to monitor the risks and update the risk management documentation accordingly.
- More on risk monitoring and management is discussed in Chapter 6 Monitoring and Adjustment.
- This process is generally consistent with ISO Standard 31000, as well as FHWA's requirements for state DOTs to assess risks to NHS assets in developing a TAMP.

Figure 2.7 Risk Management Process



Source: Adapted from FHWA. 2017. *Incorporating Risk Management into Transportation Asset Management Plans: Final Document*. https://www.fhwa.dot.gov/asset/pubs/incorporating_rm.pdf



Risk Register

It is common practice to develop a register identifying major risks and assess each based on expert judgment. In this fashion, the process is valuable for identifying “non-programmatic” risks, or risks not previously addressed in any one program. The How-To Guide in this section describes the steps in developing a risk register to identify such risks. Once a risk has been identified and assessed, formal processes may be required to perform a more detailed assessment and manage the risk programmatically, as illustrated in the Arkansas practice example.

Practice Example Risk Register Development

Arkansas DOT

As part of the process of developing its 2018 TAMP, ARDOT developed a risk register and mitigation plan compliant with FHWA TAMP requirements. As part of this effort, ARDOT first reviewed and documented its existing controls for asset-related risks incorporated in its design specifications, and approaches for addressing specific risks to bridges (e.g., scour). The agency then developed an initial register through a risk workshop. In the workshop, ARDOT staff identified specific risks not otherwise addressed programmatically, classifying risks by type:

- Asset Performance
- External Threats
- Business Operations
- Highway Safety
- Finances
- Project and Program Management
- Information and Decision Making

For each risk ARDOT used expert judgment to classify the risk in terms of its likelihood and impact. An initial priority was determined based on this classification. Next, ARDOT defined potential mitigation strategies for each of the 14 high-priority asset management risks in the register. A total of 12 strategies were identified, with each helping to mitigate one or more different risks. ARDOT next prioritized the mitigation strategies, and developed mitigation and monitoring plans detailing actions to be undertaken, and the approach for monitoring the risks and updating the register moving forward.

Source: Arkansas DOT. 2018. ArDOT Risk-Based Transportation Asset Management Plan. http://www.tamtemplate.org/wp-content/uploads/tamps/037_arkansasdot.pdf



How-to

Develop a Risk Register

Risks may have important implications for an agency's resource allocation decisions. A risk register is a way to identify, analyze, and monitor risks that transportation agencies face. Developing a risk register helps accomplish a number of the steps in the risk management process and keeps the risk management process organized. This How-To Guide provides nine steps for developing a risk register.

1. Review Existing Resources

Review what programs or initiatives the organization has already established for risk management. This may include agency-wide enterprise risk management efforts, as well as programs to mitigate specific risks such as risks to bridges, or procedures for minimizing risks of project cost and schedule overruns.

2. Determine Register Scope

Next determine the scope of the risk register. What types of risks will be included? What assets are being considered? Are there specific risks that should be excluded because they are already being addressed through a separate program?

3. Identify Risks

Prepare master list of risks. It is often helpful to identify risks in a workshop setting. Classify the risks according to the type/scopes identified in Step 2. For each risk prepare a risk statement describing the risk and the consequence to the agency if the risk is realized as an "if-then" statement.

Likelihood	Very High (>1x/Year)	Medium	Medium	High	Very High	Ultra High
	High (~1x/Year)	Medium	Medium	Medium	High	Very High
	Medium (1x/3 Years)	Low	Medium	Medium	High	High
	Low (1x/10 Years)	Very Low	Low	Medium	Medium	High
	Very Low (<1x/10 Years)	Very Low	Very Low	Low	Medium	Medium
		Very Low (Insignificant)	Low (Minor)	Medium (Moderate)	High (Major)	Very High (Catastrophic)
Impact						

How-to Develop a Risk Register

4. Analyze Risks

For each risk that is identified, calculate or estimate the likelihood the risk will occur, and the consequence or impact of the risk if it does occur. Often this step is performed qualitatively using a risk matrix. An example matrix is shown on the previous page. In this example risk likelihood is depicted on the vertical axis, and impact or consequence is shown on the horizontal axis.

5. Perform Initial Prioritization

Determine an initial priority for each risk to help determine where to focus further effort identifying treatment strategies. In the matrix above, an initial priority is defined for each combination of likelihood and consequence.

6. Evaluate Potential Risk Management Strategies

For high priority risks (or all risks if time allows), determine potential strategies for mitigating the negative effects of a risk, and/or leveraging the positive effects. Strategies might include treating the risk in some manner, transferring the risk to another party, avoiding the risk altogether, or accepting the risk with treatment. Evaluate the potential for reducing the negative impacts of each risk.

7. Prioritize Risk Management Strategies

Prioritize the risk management strategies developed in the previous step. The prioritization should consider the severity of the risk, the potential for treating the risk, and the cost of the strategy. For example, a treatment may have low priority if it does little to reduce the likelihood or impact of a risk, even if the risk itself has high priority. In some cases the strategy may entail collecting additional data, and/or performing a more detailed analysis to better characterize a risk and determine the investments needed to best address it.

8. Develop Mitigation Plan

Given the prioritized set of risk management strategies, prepare a mitigation plan that describes the actions needed to implement the highest priority strategies. This may include a mix of process improvements, data collection efforts, and/or projects to treat or avoid risks.

9. Establish Monitoring Approach

Determine how the organization will monitor the risks moving forward. The plan should describe the approach for implementing the mitigation plan, as well as for reviewing and updating the risk register.

Developing a Risk Register

- 1 Review existing resources
- 2 Determine register scope
- 3 Identify risks
- 4 Analyze risks
- 5 Perform initial prioritization
- 6 Evaluate potential strategies
- 7 Prioritize risk management strategies
- 8 Develop mitigation plan
- 9 Establish monitoring approach



Information Management

Planning and Programming, Performance Management and Risk management are activities that form components of the asset management framework within an agency. They are necessary to manage the infrastructure portfolio, and the services it supports.

Asset management relies on good data and tools to guide investment decision-making. Indeed many agencies have a wealth of data about their infrastructure, but are challenged to leverage information to make better decisions. Information management is the discipline that delivers foundational capabilities for asset management results. Asset management systems connect inventory and condition with analytical capabilities to predict asset condition under various funding and action scenarios. Other information and tools allow for the ability to relate asset actions across assets and with other transportation areas, such as safety and mobility. This section provides a brief overview of information management and how it supports the implementation of the concepts discussed in this guide. More detail can be found in subsequent Chapters. Each section has been crafted to illustrate how data, information and analysis can be leveraged to create better outcomes, and enable agencies to improve how they deliver services.

Data Collection Standards and Processes

Standards and processes for data collection are two important aspects of integrating asset management practices across the agency. Collecting a standard set of data elements for each asset ensures consistency, and better enables analysis and reporting across assets.

Standard data elements can include a unique asset identifier, designated asset category and asset type. Geospatial referencing standards are also important. In order to see assets on a map and integrate them spatially, agencies need a standard way to locate them. It is also important to consider the data collection intake process. Before data is collected, agencies should determine if specific data already exists in order to prevent duplication. If the data does not exist and needs to be collected, agencies should consider how new data will integrate with what is available currently. This ensures the data is used in the most effective way possible. Finally, responsibility needs to be assigned to an Asset Data Steward who is responsible for ensuring data standards and processes are followed.

Asset Information Across the Life Cycle

TAM integration also relies on collecting and updating asset information across the life cycle of the asset. It is important to think holistically about the asset life cycle, from the initial design phase and through future maintenance and rehabilitation activities. Technologies and processes are becoming available to extract asset information from design and as-built plans to populate inventories. Many agencies have processes in place to think holistically about assets during the project scoping and design phase.



Agencies face challenges in integrating asset information across the life cycle of the asset, because there is often a disconnect between maintenance activities, planning/ programming and the assets. For example, maintenance divisions may not know about planned projects on particular assets that have been scheduled for repairs. Better linkage between the work an agency is planning for the future, the work they are doing currently and the general condition of the assets is important to cultivate. Maturing agencies are working hard to bridge this gap. Chapter 6 provides more information on updating asset information and connecting with maintenance activities.

work. Different tools might also use different assumptions for inflation. In order to bring all this information together in a TAMP, agencies need to make sure their reporting and assumptions are consistent.

Common Set of Asset Management Reporting Processes

Another aspect of information management strategy that can help integrate TAM across an agency is to develop a common set of asset management reporting processes. Many agencies are successfully mapping different types of assets and making this information available on a GIS portal. Typically, these portals have different layers for each asset. This is one example of a consistent process for sharing information about assets.

As agencies seek to make cross-asset tradeoffs and scope projects considering multiple types of needs, having a common set of reporting processes and consistency across different tools becomes even more important. An example of the challenge agencies face in doing this is seen in the TAMP development process. Developing a TAMP requires information about the needs of different assets. This information must then be communicated with a common set of definitions and combined with funding information. Practitioners have to be aware of the funding and cost assumptions used in every tool before they can report numbers in the TAMP. For instance, the pavement management system might only include costs for the pavement work, whereas other planning tools might incorporate guardrail costs and other costs related to the

Practice Example Transportation Information Mapping System (TIMS)

Ohio DOT

Ohio DOT (ODOT) has focused on data and information management improvements as a foundational element of their asset management program. As part of this they have strengthened their geographic information system (GIS) and linked it to over 100 data sets. The agency's TIMS allows users to make collaborative decisions based on shared access to the same data sets.

TIMS TRANSPORTATION INFORMATION MAPPING SYSTEM

Q Search by PID

Better Data. Better Decisions.

TIMS is ODOT's web-mapping portal where you can discover information about Ohio's transportation system, create maps, and share information.

PROJECT SEARCH Q CREATE A MAP MAPVIEWERS DATA DOWNLOAD DATA GLOSSARY

STANDARD PDF MAPS CRASH DATA SEARCH Q

Q Search by PID

The Ohio Department of Transportation 1980 West Broad Street, Columbus Ohio 43223
No warranties, expressed or implied, concerning the accuracy, reliability or suitability of this data have been made by the Ohio Department of Transportation or any other state agency.

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Source: Ohio DOT. TIMS. <https://gis.dot.state.oh.us/tims/>



Section 2.3

TAM Assessment and Advancement

Developing and implementing asset management can follow an incremental approach that helps shape processes over time. Asset management processes should be appropriate to the organization, the type of decision being made and the accuracy required in the decision-making process. Agencies may not always be ready for full-scale implementation of TAM, and incremental implementation can help make the best use of limited resources for managing assets while supporting management of the change introduced with improved asset management practice. A primary step in incremental asset management implementation is understanding the current strengths, weaknesses, achievable improvements and the areas where the most benefit can be gained.

This section has four parts:

1. **Assessing Current Practice.** When assessing current practice, it is beneficial to use a framework providing an industry recognized reference that defines aspects of practice requiring evaluation.
2. **Defining and Prioritizing Improvement in TAM Approaches.** When defining improvement areas it is necessary to prioritize the extent to which assets will be managed.
3. **Developing a TAM Implementation Plan.** Once improvement actions are agreed upon, an implementation plan must define, communicate and empower change.
4. **Monitoring TAM Program Improvements.** Monitoring progress enables reporting of success, identifying areas of further focus and enabling adjustments.



Assessing Current Practice

An assessment of current agency competency against industry-leading practice enables an agency to assess a desired future performance level. It can also help to identify the steps required to reach that goal.

TAM is an evolving process; ongoing improvement is an important component for a TAM program. In fact, the ISO 55001 Asset Management certification requires ongoing assessment and continual improvement.

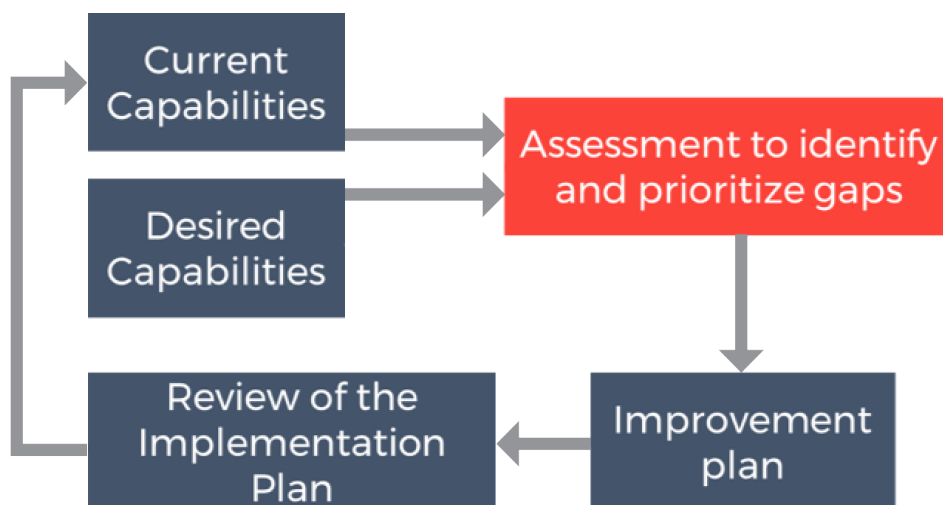
A gap assessment process is used to understand how well an agency aligns with an established asset management framework. The gap assessment can be conducted internally or by a third party. Organizations seeking or wanting to maintain ISO certification will also undergo a formal third party audit.

The results of a gap assessment can help agencies identify changes in business pro-

cesses needed to better link plans and decisions and better align to leading practice.

NCHRP Project 08-90 led to the development of a gap analysis tool, available through AASHTO and the TAM Portal. Figure 2.8 illustrates how this assessment tool is intended to be used. There are several other frameworks that can be used, including ISO 55001 and the Institute of Asset Management (IAM). A range of gap assessment framework's are discussed further in Figure 2.9. Each framework, process or tool will enable an agency to assess current performance and, from this, identify a desired capability level.

Figure 2.8 TAM improvement cycle
 Modified from original in NCHRP Project 08-90



TIP Factors to consider when prioritizing advancement in TAM approaches will vary from agency to agency. Consider those factors that are of most importance to you and are well-aligned to your strategic goals.



Table 2.1 Frameworks for Assessing Current Practice

Framework	NCHRP 08-90 Gap Analysis Tool	ISO 55001 Asset Management Gap Analysis	International Infrastructure Manual (IIMM)	IAM Self-Assessment Methodology
Background	<p>This tool was developed based on the previous tool and process created through development of the 2011 AASHTO TAM Guide.</p> <p>Uses a point scale for evaluating current and desired capabilities.</p> <p>https://www.tam-portal.com/resource/aashto-transportation-asset-management-gap-analysis-tool-users-guide/</p>	<p>This is the most widely adopted standard for asset management globally. It is generic to accommodate many contexts. Describes a management system approach to asset management.</p> <p>https://www.iso.org/standard/55089.html</p>	<p>Recognizing that the ISO Standards for asset management are very much the "What to do," the IIMM provides the "How to do it."</p> <p>Identifies an Asset Maturity Index (Aware, Basis, Core, Intermediate, Advanced) to identify the current and an appropriate level of asset management for each asset.</p> <p>https://www.ipwea.org/publications/ipweabookshop/iimm</p>	<p>As an aid to the application of ISO 55001, the IAM decided to update their methodology into one that enables organizations in all sectors to measure their capabilities against the requirements of both PAS 55 and ISO 55001.</p> <p>https://theiam.org/knowledge/Knowledge-Base/sam/</p>
Assessment or Focus Areas	<ul style="list-style-type: none"> • Policy goals and objectives • Asset management practices • Planning, programing, and project delivery • Data management • Information systems • Transparency and outreach • Performance Results • Workforce capacity and development 	<ul style="list-style-type: none"> • Leadership • Planning • Support • Operation • Performance Evaluation • Improvement 	<ul style="list-style-type: none"> • Understanding and Defining Requirements • Life cycle Planning • Asset Management Enablers 	<ul style="list-style-type: none"> • Organizational Strategic Plan • Organization and People • Strategy and Planning • Asset Management Decision Making • Life cycle Delivery • Risk and Review • Asset Information
Why use this framework?	<p>This framework is best for an agency that wants to work explicitly within a US-defined context that adopts wider influences. Since this tool can be fully customized by an agency, an agency that wants to tailor the analysis to their particular needs will find this useful. Finally, the tool facilitates the analysis of data, and can generate graphs and charts using the data imported into it.</p>	<p>This framework is ideal for agencies that want to adopt a world-recognized approach to asset management that provides a developed asset management lexicon. This is currently the most internationally-recognized standard in the world.</p>	<p>This framework has been refined over time with many examples that illustrate successful application of concepts by organizations. Public agency focused, and largely written for the asset management practitioner responsible for civil assets.</p>	<p>This standard is well recognized internationally, is applicable to all infrastructure asset classes, and has applicability to infrastructure owners in both the private and public sector. It has many other resources developed along with the framework including training materials, reference guides and courses to improve agency skills.</p>

In some cases, agencies also seek benchmarks that reflect how peers are performing to help them decide on the level of maturity and complexity to which they should aspire. ISO 55001 trends away from this. It encourages agencies to check against a framework of practices and process, and select what is best for the agency. Chapter 6 addresses benchmarking and related topics.

Actions to close gaps between desired and actual performance should be addressed within a TAM improvement or implementation plan.

Undertaking a gap assessment can form an important part of a change management process by aligning those within the agency on current performance, opportunities and targets for improvement.

Practice Example • Assessing Current Practice

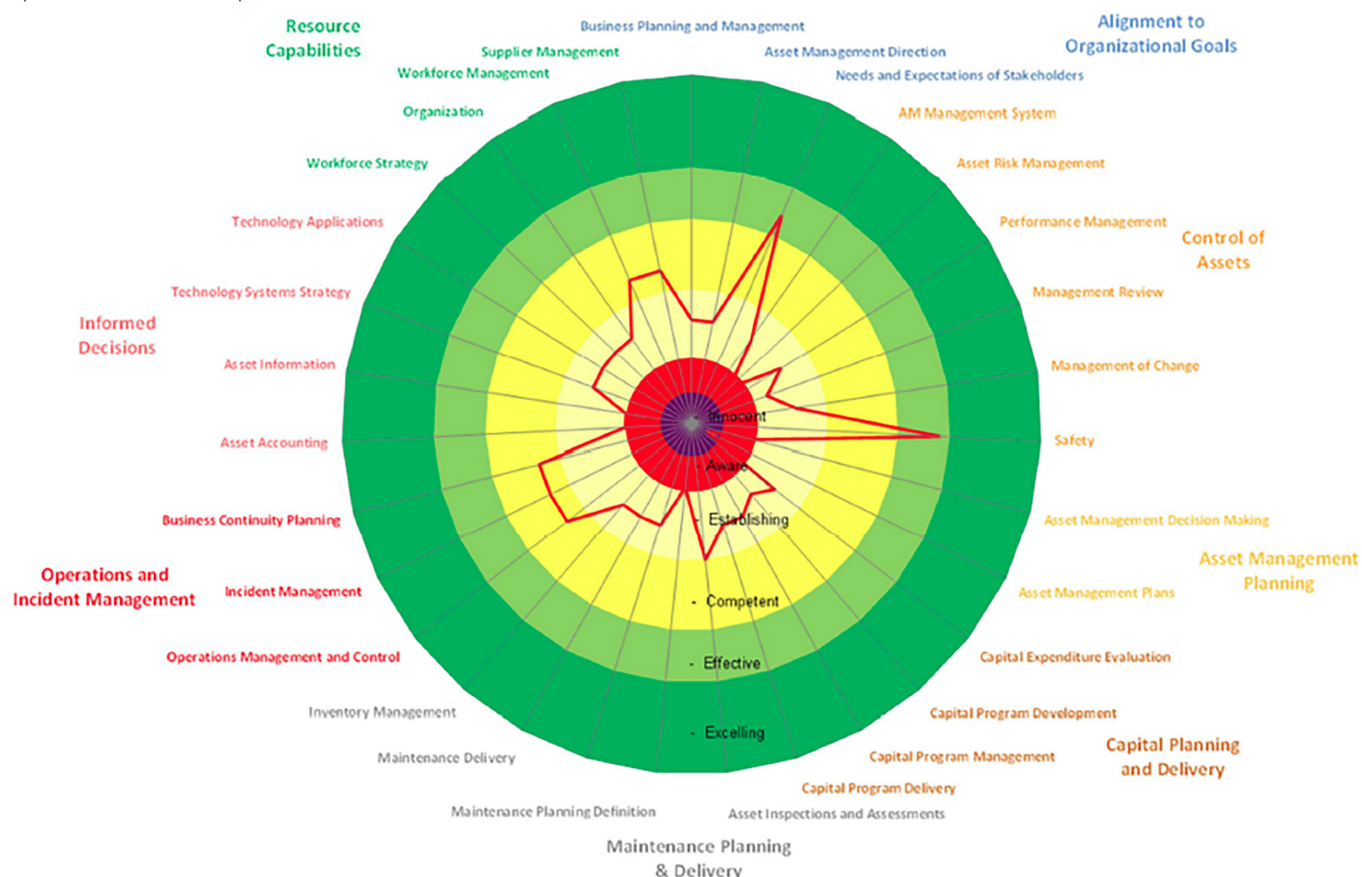
Amtrak Engineering Asset Management Capability Assessment

In 2016, Amtrak Engineering undertook an Asset Management Capability Assessment which bases maturity on the degree of formality and optimization of processes. The assessment uses several questions grouped into eight assessment areas, which describe operational processes necessary for asset management success. This maturity methodology is aligned with emerging guidance from the Institute of Asset Management (IAM), ISO 55001 standards, and requirements of the US FAST Act.

The assessment used a six-point scale, scoring Amtrak at the Establishing level, indicative of an agency that is actively developing asset management capabilities and establishing them to be consistent, repeatable, and well-defined.

Based on the 2016 assessment results, key challenges were identified and a series of improvement recommendations were developed and integrated into an Asset Management Improvement Roadmap.

In addition, Amtrak established a target position, driving process implementation priorities, with the intention of continuous monitoring by repeating the capabilities assessment process on an annual basis.



2016 Amtrak Asset Management Capabilities Assessment Results

Source: Amtrak Engineering 2019



Defining and Prioritizing Improvement in TAM Approaches

Agencies managing different types of assets are faced with the decision of where to prioritize advancing formal asset management. Determining where to improve the organizations effort can depend on different factors, but should always align with the organizational context and priorities.

For transportation agencies, asset management typically begins with the high-visibility, high-value assets, such as pavements and bridges. However, operating the transportation system requires a supporting cast of assets, typically referred to as ancillary assets, that include lighting structures, roadway signs, ITS assets or even operations facilities and technology hardware components. Establishing the appropriate management approach, and future desired approach for each asset is an essential step in strategic planning for asset management, defining boundaries around the effort. Furthermore, for each type of asset, it is important to determine how broadly to define the inventory of assets, such as the decision to include only arterial roads initially or all roads in a network.

Defining Appropriate Management Approaches for Different Asset Categories

An appropriate approach to manage and monitor each asset governed by the TAM framework needs to be established. Depending on the nature of the asset and the level of risk involved, different approaches can be selected by an agency.

Structuring asset management also involves evaluating different management approaches and defining the appropriate level of maturity. There are several approaches to

managing highway assets, each with different data needs, and several ways to structure and implement asset management processes. These include:

- **Reactive-Based.** Treatment is performed to fix a problem after it has occurred.
- **Interval-Based.** The asset is treated based on a time or usage basis whether it needs it or not.
- **Condition-Based (Life Cycle Approach).** Select intervention based on a forecasted condition exceedance interval.

Chapter 4 provides more details on these different approaches to managing assets.

Processes and approaches can range in their level of detail and complexity. This is what forms the foundation of some asset management maturity levels. Much like deciding on the scope of assets to manage, the level of advancement of the asset management processes an agency adopts should depend on the context and readiness of the agency, as well as the problem being addressed. Consideration should be given to the data, processes and tools available to support the asset management approaches and processes, as well as resource availability and capability. It is common for an agency to begin at a simple level and mature over time towards more complex asset management that integrates processes and decision-making.

Practice Example Asset Class Tiers

Utah DOT

To accomplish the objective of allocating transportation funding toward the most valuable assets and those with the highest risk to system operation, UDOT developed a tiered system of asset management. Asset Management tiers range from one to three with tier one being the most extensive management plan for those assets having the highest combination of system level risk and asset value.

Tier 1. Performance-based management

- Accurate and sophisticated data collection
- Targets and measures set and tracked
- Predictive modeling and risk analysis
- Dedicated funding

Tier 2. Condition-based management

- Accurate data collection
- Condition targets
- Risk assessment primarily based on asset failure

Tier 3. Reactive management

- Risk assessment primarily based on asset failure
- General condition analysis
- Repair or replace when damaged

Source: Utah DOT. 2018. *Utah TAMP*.
https://www.tamtemplate.org/tamp/053_utahdot/



Prioritizing TAM Improvements

Deciding on the appropriate management approach and level of asset management is a strategic decision that should consider several factors:

Organizational Strategic Goals

The decision of which assets to prioritize should be driven by the organization's strategic goals. A desire to focus on one aspect of the transportation system over another in order to meet a larger objective can present a good reason for prioritizing some assets over others.

Asset Value

A common consideration for selecting assets to include is the financial value. Monetizing value provides a consistent way of comparing asset classes. In general, assets that are the most expensive to replace or cause the greatest financial concern for an organization fall into the highest priority. Strategic management of these assets means strategic investments over the life cycle of the asset, which will prevent or delay the need for significant additional investment, help avoid premature failure, and allow time to plan for appropriate replacement.

Data Availability

TAM as a concept is heavily dependent on data. Deciding on which assets to focus on based on existing data collection and management practices and will often support achievement of "quick wins." Data availability does not always indicate strategic priority or risk exposure of the asset, but can still be an important factor in selecting assets to include the cost of collecting and analyzing data to form the basis for more advanced TAM decision making can in some instances be significant, and require new skills and training.

It should be recognized that data does not need to be comprehensive and complete as a basis for TAM decision making. An accepted approach is to group assets into classes (age, type, function) and then inspect a sample set. This can

provide important insights to guide long-term planning at minimal initial expense/time. It can also highlight any issues with particular types of assets and allow for more detailed inspections to be undertaken if required. A gap analysis to define future data requirements and determine how to collect this data should be considered for long term TAM outcomes.

Risk of Failure

Often, it can be necessary to consider including assets if the probability and consequence of failure is significant. Assets with a high risk of failure can be a high priority due to the potential losses to the agency and its stakeholders should they fail. Asset management can alleviate or prevent the impact of failure.

Asset Criticality and Network Reliability

Decisions to formally manage certain assets can be based on their importance to the service provided, such as operations, or the importance of the travel paths under consideration. Defining criticality is context specific, but is important, since user experience is based on the journey, not the specific assets. Considering criticality in selecting assets to include in TAM will ensure that the most important assets—those necessary to maintain network reliability—are managed first.

Stakeholder Influence

In general, the scope of TAM should be agreed to in coordination with leadership and influenced by stakeholders. Stakeholders can be any asset owners, metropolitan planning organizations (MPOs), cities, tolling authorities, P3 concessions, federal (mandated requirements), and others. The public can also be stakeholders who influence which assets to include, especially when high-profile incidents potentially attributed to the state of good repair occur.

Practice Example Selecting Assets to Include

Aurizon Network Asset Management Scoping

Aurizon is Australia's largest freight rail operator, transporting more than 500 million tons of coal to markets including Japan, China, South Korea, India, and Taiwan, in addition to over 800 million tons of freight through an extensive network throughout the country. Aurizon Network manages the largest heavy-haul rail infrastructure network in the country. The network is economically regulated by the State through a process that sets investment levels and tariffs. Asset management practice is well-entrenched in the organization, with a focus on "optimizing the life of assets, keeping a tension between investment in maintenance and capital." The scope of the Aurizon Network asset base, known as the Regulated Asset Base, includes all assets used in the provision of the rail infrastructure service. Management is informed by external engineering standards and legislative and regulatory obligations including:

- Prevention and intervention levels specified in an Asset Maintenance and Renewals Policy.
- Commitments to the Central Queensland Coal Network.
- A Safety Management System aimed to minimize safety risks.
- Network Strategic Asset Plan models which are based on asset age, predicted condition and historical and forecasted usage.

Source: Aurizon. 2019. *Network: Planning and Development*. <https://www.aurizon.com.au/what-we-deliver/network#planning---development>



How-to

Prioritize Assets for TAM Advancement

There are several ways to prioritize assets for advancement in TAM. Agencies can adopt analytical prioritization approaches, such as multi-criteria decision-making, or a more informal approach based on best judgment. In either case, the following How-To can guide the selection of assets to prioritize. Priorities should be periodically evaluated to phase in new assets and capabilities over time.

1. Understand the existing approach for each asset

A gap assessment process enables definition of an existing position with regard to assets, ownership, condition, management approach and risks and the most appropriate next steps in advancing TAM practice.

2. Determine the assets to prioritize

Consider the following questions when deciding which assets should be advanced:

- Which assets merit the greatest level of management attention? What are the current priority areas?
- Which assets, if they fail, would present the greatest risk to the service provided by the network? Which assets represent a significant percentage of the total replacement cost of the portfolio? Which assets consume most the O&M budget or have the greatest impact on network availability/reliability?
- Which assets would involve the least effort to advance? Where is the most readily available data?

3. Determine how much of each asset to consider

Road users travel on routes/corridors rather than specific assets. Consider how the asset-class priorities translate to network priorities. To do this, consider the following:

- Are the most critical end-to-end routes/strategic corridors covered? Are the most critical paths through the network and the assets on these routes covered?
- Are the appropriate road classifications (Interstate highways/National Highway System/state/primary) covered?

4. Communicate priorities

A TAM improvement or implementation plan defines an agency's next priorities for advancement and the actions to be taken. This should be widely understood by all relevant stakeholders in the organization to help foster buy-in and leverage the contributions of those able to help advance the plan.



Prioritizing Assets for TAM Advancement

1

Understand the existing approach for each asset

2

Determine the assets to prioritize

3

Determine how much of each asset to consider

4

Communicate priorities



Developing a TAM Implementation Plan

A TAM implementation plan can clearly communicate an agency's next steps for TAM and define responsibilities for implementation.

The product of a gap assessment will often take the form of an implementation plan for TAM improvements. These improvements can involve changing behaviors across many business units within an organization. The actions should, therefore, be prioritized and staged to advance one step at a time. When defining actions, it is important to understand the purpose and outcome to be achieved, who is responsible, how long it will take and how many resources are required for it to happen.

Note that a TAM Implementation Plan is different from a Transportation Asset Management Plan (TAMP) described further in Section 2.4. An implementation plan focuses on business process improvement, while a TAMP focuses on an organization's assets and how it is investing in and managing them. However, the implementation plan may be included as a section of a larger TAMP.

The improvements identified need to recognize potential barriers to implementation. As an example, improving decision-making tools will likely require improvements in data practices. The implementation plan should consider any foreseeable obstacles, including staff resistance to new business procedures, lack of support from agency leadership, inadequate skills among staff, data integration issues or outdated analytical tools.

Communicating the Implementation Plan

Effective, organization-wide communication can serve as a powerful tool to facilitate smooth and swift adoption of the TAM implementation plan. At the start of implementation, communicating the future vision and benefits can help build awareness and buy-in. Throughout the duration of the implementation initiative, communication about milestones and accomplishments can help sustain or regain momentum. Additionally, as different projects are initiated, delivered and completed, agencies will want to ensure that the resulting changes in processes, systems and tools are adopted and used consistently to achieve the intended outcomes and objectives. As illustrated in Figure 2.10, the TAM communication strategy should cover six key elements – why, who, what, when, how and how well.

Objectives. Why communicate?

Establishing early buy-in to the implementation plan by providing an upfront explanation of why execution of the TAM implementation plan is needed—the anticipated benefits for the organization as well as for different stakeholder groups—will help jumpstart success of the implementation.

Stakeholders. Who delivers and receives the communication?

To make sure the right people are receiving the right information, it is key to develop and categorize a complete list of internal and external



stakeholders who will be impacted by the TAM implementation plan and its resulting changes. In determining stakeholders, consider who needs to receive different types of information and who best to deliver that information to support achievement of implementation plan objectives.

Messages. What are the messages to communicate?

In developing the key messages to communicate, consider intent – what should stakeholders know, think or do as a result of the message? Key messages should promote awareness, desire and reinforcement of the implementation plan and its associated changes. They should also align with

objectives of the implementation plan as well as organizational objectives.

Timing & Frequency. When will the communication occur?

Communication about the TAM implementation plan and corresponding changes should be timely, frequent enough to keep stakeholder groups well informed about approaching milestones and key dates of impact, and not so frequent that they lose value. Take into account what is being communicated and to whom, as different stakeholder groups receiving different types of messages often require different delivery frequency.

Practice Example Implementation Plan

Clackamas County Department of Transportation and Development

Based on their gap assessment, Clackamas County Department of Transportation and Development established a Transportation Asset Management Strategic Plan (TAMSP), which documents its methods to implementing a comprehensive transportation asset management program over a 5 year period. This TAMSP was accompanied by an asset management implementation strategy that identified the key actions to be undertaken.

2.2. Develop the Ability to do Benefit Cost Analysis



Description			Draft, develop, document, and distribute process to complete BCR analysis		
Strategy Owner			Karen Buehrig, Randy Harmon, Rick Nys		
Key Stakeholders			Maintenance, Capital, Safety, TS, AMST		
Deliver Mechanism			Delivered Internally with support from external providers		
Timeframe	Start		Financial Year 2022 /23 Q4		
	Finish		Financial Year 2023/ 24 Q2		
	Duration		1 year		
Sequencing	Prerequisite(s)		Life cycle strategies / linking TAM outcomes to strategic goals, data warehouse and enhanced GIS analytical tool, any other relevant policies and procedures, TAM systems (for full implementation)		
	Dependent(s)		TAM systems can be developed without this, but it should be considered in their development.		
Considerations			This process relies heavily on prior tasks.		
Specific Actions			<ul style="list-style-type: none">◆ Define current processes (if any).◆ Identify activities that are needed to address any gaps.◆ Define discount factors, how benefits will be evaluated and costs to be included (internal and external).◆ Identify existing processes and determine which process is most applicable.◆ Define TAM system requirements that support BCR analysis (if applicable — such as InfoHansen).◆ Document process and circulate for review. Finalize and implement.		
Level of Effort	Hours	Internal Support	300.00	to	600.00
	Cost	Support		to	
		Software, purchases, and configuration	\$ 60,000.00		\$ 120,000.00
Enabler(s)			<ul style="list-style-type: none">◆ Financial / Accounting to understand and evaluate cost factors.◆ Project specialists to understand benefits from each intervention.◆ TS support with system development.		
Outputs			◆ Ability to complete BCR analysis supported with process and systems.		
Notes on Estimate					

Source: Clackamas County DOT. *Transportation Asset Management Strategic Plan*.



Tactics & Channels. How will information be communicated?

Depending on the duration of the TAM implementation plan and the number of associated changes, communication needs often shift over the course of its execution. Agencies should determine the most effective types of communication and delivery channels as they progress through change. By including stakeholder categories, messages and frequency as inputs when determining the most effective channels, the communications strategy remains agile, which facilitates continuous improvement.

Continuous Improvement. How well is the communications strategy working?

Assessing the effectiveness or performance of any strategy is important for achieving objectives. Including a stakeholder feedback loop into the communications strategy is one way to accomplish this. Agencies can use surveys, polls, focus groups or meetings to gather information and gauge opposition and support. This crucial feedback serves as guidance for subsequent content and can lead to changes in the communications strategy.

Figure 2.10 Communicating the Plan

Key questions to answer in communicating your implementation plan





Ingredients in an Implementation Plan

Agencies can use this checklist when developing and communicating a TAM Implementation Plan. Completing the items on this checklist ensures that the key ingredients are included in the Implementation Plan and lays the foundation for successful improvement.

- ☐ Have owners been assigned to the individual improvement items?
- ☐ Have the benefits of change been identified?
- ☐ Have tasks in the implementation plan been prioritized based on potential benefit to the asset management processes?
- ☐ Do the prioritized improvement items consider whether the supporting processes have been developed?
- ☐ Have the relevant stakeholders been identified?
- ☐ Have timelines for change been specified and agreed to between those undertaking and implementing the task?
- ☐ Have risks such as interdependencies with other tasks been identified and a mitigation strategy agreed upon?
- ☐ Is the level of effort quantified and agreed upon?



Monitoring TAM Program Improvements

Measuring TAM improvement is important for understanding if the plan needs adjustment, and to communicate success and motivate those responsible for implementation.

Once a commitment to make improvements has been made, the improvement process needs to be managed and monitored.

Regular updates, meetings, performance tracking (monitoring improving performance against the selected framework) and scheduled reviews by the TAM Governance Groups will help provide oversight to those responsible for undertaking the improvements.

This process also helps remove roadblocks by involving leaders from across the organization.

When to Re-Assess Performance

A regular commitment to monitor progress is important. This assessment will compare progress from the initial benchmark toward the desired level of competency. There is no set recommendation for when to assess progress; some agencies find it more important in the early stages of implementation, while others do not.

When considering the timing of progress assessments, it is important to consider:

- **Process checkpoints.** The frequency could be aligned with reporting requirements, but should also consider appropriate points where progress will be noticeable.
- **Commitment.** Undertaking an assessment will take time and resources, so it is important this is balanced against progressing with implementation.
- **Champions and change agents.** As these individuals are critical to the overall success of TAM implementation, if they

change or need to monitor their own performance, then a review of progress can help motivate and reset goals.

Measuring Performance Improvements

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 may shift over time, and can change following the implementation of an improvement action. The IIMM suggests some of the following potential TAM system performance indicators:

- Financial performance
- Data management performance
- Timeliness relative to target response times
- Productivity and utilization of resources
- Skills availability relative to planned requirements
- Adherence to quality procedures

Chapter 6 provides more information on performance measures, targets, and monitoring asset performance. Self assessment can focus both on service / asset outcomes experienced by users, as well as be internally focused to determine how well the agency is aligned with desired practices. It is important that agencies consider and select the appropriate level and focus of self-assessment for their requirements.



Practice Example Monitoring TAM Program Improvements

New Zealand Treasury Investment Management Using Asset Management Maturity and Asset Performance

The New Zealand Treasury stewards the NZ government's Investment Management System to optimize value from new and existing investments and assets for current and future generations of New Zealanders. One of the tools the system uses is the Investor Confidence Rating (ICR), which illustrates the confidence that government leadership (i.e. Ministers) can have in an agency's ability to deliver investments that produce the desired results.

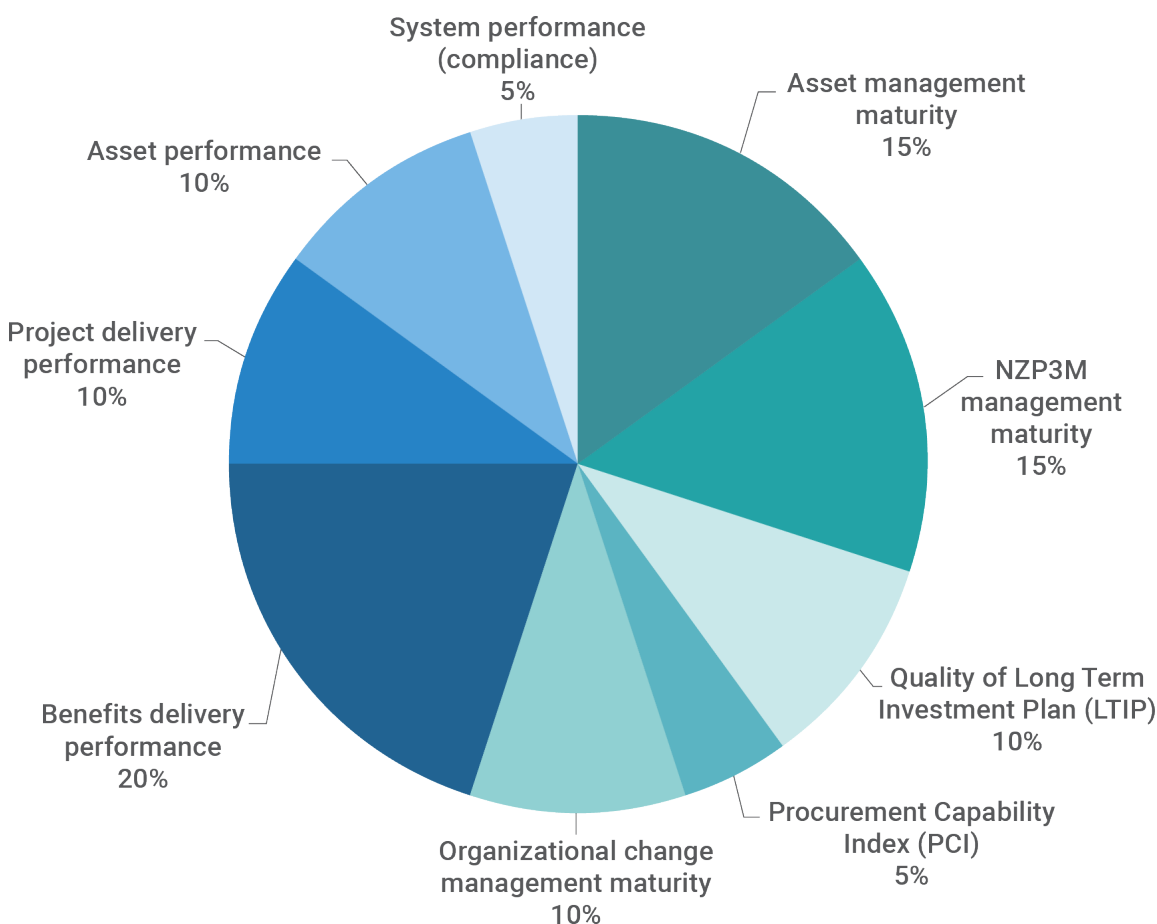
The ICR also promotes and provides a pathway for capability uplift. One element of the ICR evaluates the gap between current and target asset management maturity levels on the basis that good asset management practice provides the foundation for good investment management. The Treasury recommends periodic self-assessments using a methodology based on international asset management guidelines and the ISO 55001 standard.

The ICR assessment is conducted every 3 years, resulting in more decision-making autonomy for agencies that obtain a good rating and potential flexibility over investment assurance arrangement.

The ICR uses 9 elements to assess performance

Lag Indicators (45%)

Lead Indicators (55%)



Source: Adapted from New Zealand Treasury. *Investor Confidence Rating (ICR)*. <https://treasury.govt.nz/information-and-services/state-sector-leadership/investment-management/review-investment-reviews/investor-confidence-rating-icr>



Section 2.4

Developing a Transportation Asset Management Plan (TAMP)

A Transportation Asset Management Plan (TAMP) is a document that describes an agency's assets and how they will be maintained over time. Developing a TAMP is consistent with best practice in TAM. Also, U.S. transportation departments and transit agencies are required to develop TAMPs to comply with Federal requirements. This section summarizes the elements of a TAMP.

This section has two parts:

1. **The Basic TAMP.** A TAMP should, at a minimum, include a number of basic elements.
2. **Beyond the Basic TAMP.** There are a number of ways agencies may choose to expand the scope of their TAMP and address advanced topics.

Note this section is not intended as a guide for preparation of a TAMP that is in compliance with Federal requirements for TAMP preparation. Separate resources are available detailing requirements for TAMPs including NHS assets to comply with FHWA requirements, and for TAMPs including transit assets to comply with FTA requirements. These resources are listed at the end of the section.



The Basic TAMP

A TAMP describes an agency's goals and objectives for maintaining its assets over time. It describes an agency's most critical assets, and their current condition. It also describes the agency's strategy for preserving its assets, predicts future conditions given the agency's planned investments, formulates and delivers an investment plan, and discusses how the agency manages risks to its assets.

TAMP Requirements

This section discusses the requirements for a TAMP that is consistent with TAM leading practice. A TAMP includes:

- TAM Policies, Goals and Objectives
- Asset Inventory and Condition
- Life Cycle Planning Approach
- Predicted Asset Conditions
- Investment Plan
- Risk Management

Note there are additional specific requirements for a TAMP that is prepared to comply with Federal requirements. State DOTs are required to prepare a TAMP with a 10-year horizon that includes, at a minimum, NHS pavements and bridges. Transit agencies that receive Federal funds are required to prepare a TAMP with a four-year horizon that includes their revenue vehicles, facilities, infrastructure, and equipment (including service vehicles). FHWA provides a checklist of elements of TAMPs compliant with Federal requirements: <https://www.fhwa.dot.gov/asset/guidance/certification.pdf>. A similar FTA document is available at: https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/regulations-and-guidance/asset-management/55371/compliancechecklistfy2018_0.pdf.

TAM Policies, Goals and Objectives

A TAMP summarizes an agency's policies, goals, and objectives and describes how its approach to TAM helps support these. For instance, the document might discuss how maintaining assets in good repair supports the organization's broader goals for strengthening mobility and supporting economic development. It may also describe how the organization defines the desired state of repair of its assets, or criteria for evaluating whether or not an asset is in good repair. A clear linkage between TAM objectives and the achievement of wider agency goals should be directly illustrated within the TAMP.

Asset Inventory and Condition

In preparing the TAMP, the agency must decide which asset classes to include in the document, and the level of detail in which the assets are described. For a highway plan, critical assets include pavements and bridges. A TAMP that is prepared to comply with Federal requirements must include these assets on the National Highway System at a minimum. Other assets addressed in a highway TAMP may include, but are not limited to: drainage assets such as culverts; traffic and safety assets such as signs,

TIP: The biggest benefit of developing a TAMP can come from the process as opposed to the product itself. Developing a TAMP can give agency staff a greater awareness of what assets they own, what condition they are in, and how their performance can be influenced by factors and decisions in other parts of the agency.



signals, and lighting; maintenance facilities; and Intelligent Transportation System (ITS) devices. For a transit plan, critical assets include revenue vehicles, facilities, infrastructure (for agencies that operate fixed guideway) and additional equipment, such as service vehicles.

A TAMP should provide a listing, typically in summary form, of the assets the agency has identified for inclusion. For each asset class the document should describe the physical extent of the asset, and current asset conditions. Chapter 3 of this document describes approaches for measuring asset condition and performance. Note that FHWA and FTA have developed specific requirements for reporting asset conditions for highway and transit assets, respectively. However, agencies are not limited to these measures, and may include multiple measures of condition in their TAMP to help provide a complete description of asset conditions.

Often it is helpful to place the data on an agency's asset portfolio's current condition into some context. For instance, the TAMP may include photographs of representative asset condition to help illustrate what is meant by a given value for a performance measure. Also, a TAMP may include historic data on asset conditions to help illustrate condition trends.

Life Cycle Planning Approach

A critical component of a TAMP is a discussion of how an agency maintains its assets over their life cycle. Ideally the agency's approach to life cycle planning should help maintain assets at a target level of service over their life cycle in the most efficient manner possible, while supporting agency goals and objectives. This section of the TAMP should describe the treatments the agency typically performs on its assets, and detail the analytical approaches it uses to assess investment needs, prioritize work, and predict future asset conditions. If the agency has implemented specific management systems for one or more of its asset classes, such as pavement, bridge or enter-

prise asset management systems, this section should describe those systems and how they are used to support decision making. Chapter 4 of this document provides further detail on life cycle planning.

Predicted Asset Condition

This section of the TAMP should describe how an agency's assets are predicted to perform in the future. The horizon of the predictions should be commensurate with the horizon in the investment plan described in the next section. Typically the planning horizon is at least four years, but may be up to 20 years.

This sections should show what conditions are predicted given expected funding, as well as any gaps between predicted performance and the agency's goals for its assets. This section may include results for multiple funding scenarios, particularly if there is uncertainty concerning future funding, or if including results for multiple scenarios helps document the process used to prioritize funding. For instance, the document might show predicted asset conditions over time given the current funding level, predicted future funding, and scenarios with more or less funding than the predicted level.

Investment Plan

The TAMP should detail planned investments given expected funding. Depending upon the agency size and assets included in the plan, the document might include specific investments the agency plans to make or projected funding levels by asset class and type of work. This section may provide additional details on sources of funding, and the agency's specific strategy for investing in its assets considering available resources.

Risk Management

Managing transportation assets also entails managing risk. Considering risk is important in developing a TAMP, for the simple reason that there are various risks that, if they occur, may impact an agency's ability to follow its TAMP. For instance, the occurrence of a natural hazard may require an agency to



spend significant resources in response, to address or mitigate damage. Employing risk management strengthens asset management programs by explicitly recognizing that any objective faces uncertainty, and identifying strategies to reduce that uncertainty and its effects. This section of the TAMP should describe the agency's approach to risk management. It should identify major TAM-related risks and describe the agency's approach to addressing these.

Practice Example

Colorado DOT

To ensure alignment with the requirements of MAP-21, Colorado DOT developed a requirements checklist that provides a quick reference/summary of the legislation requirements. The checklist is based on FHWA guidance (Transportation Asset Management Plan Annual Consistency Determination Final Guidance) that was issued in February, 2018. Its content was provided to help DOTs ensure their TAMPs are compliant and consistent with statute and regulatory requirements.

Required Elements	Indicators the TAMP Meets Element Requirements in 23 U.S.C. 119(e) and 23 CFR part 515
TAMP approved by head of State DOT (23 CFR 515.9(k))	Does the TAMP bear the signature of the head of the State DOT?
State DOT has developed its TAMP using certified processes (23 CFR 515.13(b))	Do the process descriptions align with the FHWA-certified processes for the State DOT? [If the process descriptions do not align with the FHWA-certified processes, the State DOT must request recertification of the new processes as amendments unless the changes are minor technical corrections or revisions with no foreseeable material impact on the accuracy and validity of the processes, analyses, or investment strategies. State DOTs must request recertification of TAMP development processes at least 30 days prior to the deadline for the next FHWA TAMP consistency determination as provided in 23 CFR 515.13(c).] Do the TAMP analyses appear to have been prepared using the certified processes?
TAMP includes the required content as described in 23 CFR 515.9(a)-(g) (23 CFR 515.13(b))	Does the TAMP include a summary listing of NHS pavement and bridge assets, regardless of ownership? Does the TAMP include a discussion of State DOT asset management objectives that meets requirements? Does the TAMP include a discussion of State DOT measures and targets for asset condition, including those established pursuant to 23 U.S.C. 150, for NHS pavements and bridges, that meets requirements? Does the TAMP include a summary description of the condition of NHS pavements and bridges, regardless of ownership, that meets requirements? Does the TAMP identify and discuss performance gaps? Does the TAMP include a discussion of the life-cycle planning that meets requirements, including results? Does the TAMP include a discussion of the risk management analysis that meets requirements? Does the TAMP include the results of the evaluations of NHS pavements and bridges pursuant to 23 CFR part 667? Does the TAMP include a discussion of a 10- year Financial Plan to fund improvements to NHS pavements and bridges? Does the TAMP identify and discuss investment strategies the State intends to use for their NHS pavements and bridges? Does the TAMP include a discussion as to how the investment strategies make or support progress toward achieving and sustaining a desired state of good repair over the life cycle of the assets? Does the TAMP include a discussion as to how the investment strategies make or support progress toward improving or preserving the condition of the assets and the performance of the NHS related to physical assets? Does the TAMP include a discussion as to how the investment strategies make or support progress toward achieving the State's targets for asset condition and performance of the NHS in accordance with 23 USC 150(d)? Does the TAMP include a discussion as to how the investment strategies make or support progress toward achieving the national goals identified in 23 USC 150(b)? Does the TAMP include a discussion as to how the TAMP's life-cycle planning, performance gap analysis, and risk analysis support the State DOT's TAMP investment strategies?
Inclusion of Other Assets in the TAMP in 23 CFR 515.9 (l):	If applicable, does the TAMP include a summary listing of other assets, ² including a description of asset condition? If applicable, does the TAMP identify measures and State DOT targets for the condition of other assets? If applicable, does the TAMP include a performance gap analysis for other assets? If applicable, does the TAMP include a discussion of life cycle planning for other assets? If applicable, does the TAMP include a discussion of a risk analysis for other assets that meets requirements in 23 CFR 515.9(l)(5)? If applicable, does the TAMP include a financial plan to fund improvements of other assets? If applicable, does the TAMP include investment strategies for other assets?

Source: FHWA. *Transportation Asset Management Plan Annual Consistency Determination Final Guidance*. <https://www.fhwa.dot.gov/asset/guidance/consistency.pdf>



Beyond the Basic TAMP

This section contains suggestions for developing a TAMP that goes beyond the basic elements of a TAMP described in the previous section. An agency can expand the scope of the TAMP to include additional asset types and systems. An agency may further tailor their TAMP to address specific needs.

TAMP Scope

A highway agency focused on complying with Federal requirements will typically focus on including its NHS pavements and bridges in its TAMP. While these assets make up the greatest portion of a typical state highway agency, an agency may wish to include additional assets in its TAMP. Also, the agency may wish to extend the network scope of the TAMP. In updating a TAMP with NHS pavement and bridges, an agency may include other assets, such as drainage assets, traffic and safety features, or the agency may wish to include all of the assets it owns.

For transit TAMPs, the initial focus is on revenue vehicles, facilities and infrastructure, as these are the assets that require the greatest investment. An agency may wish to expand its TAMP to include additional assets that are important to the systems, albeit less costly, such as bus shelters and signage.

TAM Implementation Plan

As described in Section 2.3, it is often helpful to prepare an implementation plan describing a set of planned business process improvements that an agency intends to undertake to strengthen its approach to TAM. There are many examples of TAMPs that focus specifically on an agency's TAM approach and how it plans to improve its approach. Ideally a TAMP should both describe an agency's assets and planned investments, and detail how it intends to improve its TAM approach. Where an agency has developed both a TAMP and TAM implementation plan, the implementation plan can be incorporated as a section of the TAMP.

TAM-Related Business Processes

An agency may wish to include a discussion of one or more of the business processes related to TAM in its TAMP. Alternatively, there may be other agency documents that provide more detail on these issues that can be referenced in the TAMP. These areas include:

- **Performance Targets.** As described in Chapter 5, setting performance targets can help guide the resource allocation process. However, agencies often have broader efforts to establish and track performance beyond the scope of TAM.



- **Financial Planning.** While developing a TAM investment plan is central to developing a TAMP, often the revenue forecast used to support developing the investment plan is developed separately and used for other purposes beyond the scope of TAM. It may be valuable to document the agency's approach to forecasting future revenues for TAM and other applications. Chapter 5 describes provides additional detail on this topic.
- **Work Planning and Delivery.** As described in Chapters 4 and 5, work delivery approaches can impact how assets are

maintained over their life cycle, and how resource allocation decisions are made. Some agencies have adopted formalized approaches for evaluating and selecting different work delivery approaches.

- **Data Management.** Chapter 7 discusses the importance of implementing an approach to data management and governance. Some TAMPs include additional information on this topic given its relationship to TAM.

AASHTO TAMP Builder

AASHTO TAMP Builder

The AASHTO TAMP Builder website (available at <https://www.tamptemplate.org/>) hosts annotated plan outlines to assist agencies in preparing TAMPs. The site also provides resources to customize an outline in order to meet agency-specific objectives and requirements. The website integrates a database of TAMPs, dating from 2005, that support the functionality of the outlines created using the site.

The screenshot shows the AASHTO TAMP Builder website. At the top, there's a navigation bar with 'Tools' and 'About' links, and a search icon. The main header area has a large orange banner with the text: 'Use this site to build a MAP-21-compliant transportation asset management plan.' Below this is a 'GET STARTED NOW' button. A secondary banner below the orange one says: 'Don't see your agency's TAMP? Add it to the AASHTO TAMP Builder.' The main content area has a light gray background with a paragraph explaining the federal MAP-21 requirements and the site's purpose. Below this are three columns of links: 'Build a Custom Outline' (with a gear icon), 'Download a Basic Outline' (with a document icon), and 'Download an Existing TAMP' (with a magnifying glass icon). Each link has a brief description. At the bottom of this section are four statistics: '66 Plans in the database', '51 US TAMPs', '56 Highway TAMPs', and '9 Transit TAMPs'. Below these is a section titled 'Browse the latest Highway TAMPs' with a link: 'Don't see your agency's TAMP? Add it to the AASHTO TAMP Builder here.' This section displays four TAMP covers: 'Arkansas DOT TAMP / 2018', 'California TAMP / 2018', 'Connecticut DOT TAMP / 2018', and 'Florida DOT TAMP and Technical'.

Maturity Scale

This table provides an example maturity scale for some of the key TAM practices described in this chapter.

Aspect of Practice	Level of Maturity	Typical Agency Status
Creating a TAM Policy	Emerging	<ul style="list-style-type: none"> An Asset Management Policy has been drafted or adopted by elected officials and is guiding in-progress changes to investment and operational decision making in the organization Policy principles are providing a basis for change and action in the delivery of services with infrastructure.
	Strengthening	<ul style="list-style-type: none"> An Asset Management Policy has been adopted and influences capital investment decision making in the organization The Policy is implemented at high levels within the organization, and its principles help determine overall focus on improving the asset management system action in the delivery of services with infrastructure.
	Advanced	<ul style="list-style-type: none"> An Asset Management Policy has been adopted by elected officials and it strongly influences investment and operational decision making in the organization The Policy is implemented across the organization, and its principles strongly guide process, and action in the delivery of services with infrastructure.
Integrating TAM Within Agency Strategic Plans and Policies	Emerging	<ul style="list-style-type: none"> Asset management principles are adhered to by some asset management advocates within the agency, but adherence to them is not universal. Investment is allocated within service areas (Transit, Highways, Active Transportation, Multi-model Systems) and the asset portfolios (pavements, bridges, transit fleet and facilities) that support them, based on the performance management targets that have been set.
	Strengthening	<ul style="list-style-type: none"> Asset management principles such as inter-generational equity, triple bottom line decision making, whole of life and service driven decision making can be found in some strategic plans, agency goals and high-level, long term planning documents. Investment is sometimes evaluated between asset portfolios (pavements, bridges, transit fleet and facilities), and funding is partially allocated based on a linkage to stated objectives.
	Advanced	<ul style="list-style-type: none"> Asset management principles such as inter-generational equity, triple bottom line decision-making, whole life and service driven decision making are embedded within strategic plans, agency goals and high-level, long term planning documents. Investment is systematically allocated between service areas (Transit, Highways, Active Transportation, Multi-model Systems) and the asset portfolios (pavements, bridges, transit fleet and facilities) that support them, based on the requirements to achieve stated objectives and service level commitments.

References

Creating a TAM Policy

Australia State Government Asset Management Accountability Framework. Australia State Government.

Year: 2016

Link: <https://www.dtf.vic.gov.au/infrastructure-investment/asset-management-accountability-framework>

Balanced Scorecard. Balanced Scorecard Institute.

Year: 2017

Link: <https://www.balancedscorecard.org/BSC-Basics/About-the-Balanced-Scorecard>

City of Townsville Strategic Asset Management Plan. City of Townsville (Queensland, Australia).

Year: 2015

Link: n/a

How to Develop an Asset Management Policy, Strategy and Governance Framework. Federation of Canadian Municipalities.

Year: 2018

Link: <https://data.fcm.ca/documents/programs/LAMP/how-to-develop-asset-management-policy-strategy-en.pdf>

Georgia DOT Asset Management Policy. Georgia DOT.

Year: 2018

Link: <http://mydocs.dot.ga.gov/info/gdotpubs/Publications/4B-1.pdf>

TAM Integration

Building a Better Tomorrow: An Infrastructure Planning, Financing and Procurement Framework.

Ontario's Public Sector.

Year: 2004

Link: <http://www.ontla.on.ca/library/repository/mon/7000/10319145.pdf>

Integrated Planning and Reporting Manual. New South Wales Division of Local Government, Department of Premier and Cabinet.

Year: 2013

Link: <http://www.olg.nsw.gov.au/sites/default/files/Integrated-Planning-and-Reporting-Manual-March-2013.pdf#page=74>

Performance-Based Planning and Programming Guidebook. FHWA.

Year: 2013

Link: https://www.fhwa.dot.gov/planning/performance_based_planning/pbpp_guidebook/

Enterprise Risk Management

Guide. AASHTO. Guide discusses the range of risks a transportation agency faces and details how to establish an enterprise risk management program.

Year: 2016

Link: <https://erm-portal.com>