

# **Tennessee DOT Transportation Asset Management Gap Analysis and Implementation Plan**

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# 1.0 Introduction

## 1.1 BACKGROUND

The mission of the Tennessee Department of Transportation (TDOT) is to enable the safe and efficient movement of people and goods by fostering a robust multimodal transportation system, including highways, airports, public transit, bicycle/pedestrian facilities, railroads, and navigable waterways. To further this mission, TDOT is committed to integrating a risk-based asset management approach into its business practices, the primary objective being to improve the management of its transportation assets over time, increase transparency in agency decision-making, and promote accountability with Tennessee taxpayers. Of critical importance, the approach will allow the department to transition to policy-driven management strategies that clearly define what assets need to be improved, timeframes for effective improvement, and realistic priorities for the department given available revenues.

In support of the improvement process, TDOT conducted a transportation asset management (TAM) gap assessment for highway assets as part of a Federal Highway Administration (FHWA) project. The FHWA is assisting 15 state DOTs with this type of assessment. TDOT's objectives for the assessment were to compare current practices with state-of-the-art best practices used in other states, identify and prioritize gaps in these practices, and define a set of activities to address the most significant gaps. This report documents the results of the gap assessment and provides guidance for implementation.

TDOT manages a wide range of assets to meet the public's transportation needs. However, as an initial step, this implementation plan focuses only on TDOT's bridges and pavements. TDOT will expand its TAM practices to other types of assets over time.

This implementation plan was developed in four steps:

- **Step 1. Conduct self-assessment survey.** Twenty-one TDOT staff members completed a TAM self-assessment survey. The survey was based on the one provided in Volume I of AASHTO's *Transportation Asset Management Guide*. The survey defines asset management best practices and asks respondents to rate the degree to which DOT practices are consistent with these practices. Participants were also asked to rate the degree to which they should be consistent.
- **Step 2. Conduct interviews.** Nearly 20 TDOT staff members participated in a series of face-to-face interviews. The objective of these interviews was to discuss existing practices in more detail.
- **Step 3. Facilitate self-assessment workshop.** Based on the results of the self-assessment survey and the interviews, the consultant team identified an initial

set of policy and process practice gaps and presented them to TDOT staff at a workshop. The objective of the workshop was to discuss the gaps, determine priorities, and identify viable options to address them.

- **Step 4. Develop implementation plan.** This document is based on the results of the first three steps. The implementation plan is designed to provide TDOT with guidance to improve its asset management program. The plan can also be used as a component of TDOT's initial transportation asset management plan (TAMP), which is currently under development.

It is recommended that TDOT revisit this plan periodically and revise it to reflect accomplishments, emerging challenges, unexpected opportunities, and evolving priorities.

## **1.2 IMPLEMENTATION PLAN ORGANIZATION**

The remainder of this report is organized as follows:

- Section 2 defines asset management and presents a series of business needs that reflect best practices;
- Section 3 summarizes current asset management practice at TDOT;
- Section 4 establishes a vision and goals for implementing transportation asset management;
- Section 5 recommends an asset management work plan with practical implementation steps that support the vision and goals.

## 2.0 Asset Management Overview

### 2.1 WHAT IS ASSET MANAGEMENT?

The Moving Ahead for Progress in the 21<sup>st</sup> Century Act (MAP-21) defines transportation asset management (TAM) as:

A strategic and systematic process of operating, maintaining, and improving physical assets, with a focus on engineering and economic analysis based upon quality information, to identify a structured sequence of maintenance, preservation, repair, rehabilitation, and replacement actions that will achieve and sustain a desired state of good repair over the life-cycle of the assets at minimum practicable cost. (23 U.S.C. 101(a)(2), MAP-21 § 1103, July 2014.)

### 2.2 THE PRINCIPLES OF ASSET MANAGEMENT

TAM should not be considered as a separate new program or initiative, overlaid upon existing procedures, and in competition with other items on agency's agenda. Rather, it represents a way of doing business. In this view, the principles of good asset management can be visualized as affecting simultaneously, the philosophy, processes, and technical tools that underlie TDOT business practices.

The following statements describe good TAM:

- TAM is a philosophy
- TAM is a process to fuel decision making and business improvement
- TAM is a set of management tools; and
- TAM is a resource allocation and utilization process.

#### **TAM Is a Philosophy**

- Asset management represents an approach to managing infrastructure that is strategic and proactive, and places a premium on good information in all aspects and in all agency units.
- Asset management is holistic. It entails a comprehensive view across a range of assets. It encourages consideration of a full range of options to solve problems or meet needs. Tradeoffs are explicitly considered among programs, modes, or strategies.
- Asset management is driven by policy goals and objectives based upon performance. Strategies are analyzed in terms of objective assessments of costs, benefits, long-term performance, risks to both agency and system

performance, and other impacts on the transportation system and levels of service provided to transportation users.

- Asset management takes a long-term view of infrastructure performance and cost. The benefits of different actions are assessed throughout the infrastructure service life, applying economic as well as technical criteria.
- Asset management is proactive. An agency has the latitude to make decisions based on merit and consider factors such as cost effectiveness, risks, and practical considerations, among others.
- Asset management policy is influenced and informed by good information. This information describes current and projected system condition and performance that would result from different policies or strategies. It also encompasses user perceptions of system condition and performance, as obtained through surveys or focus groups.
- Asset management is explicit and visible, and serves to clarify and communicate the process and outcomes of resource allocation and program delivery. Asset management, by virtue of its rational and objective qualities, demystifies and fosters confidence in those decision processes that influence the allocation and utilization of scarce resources. In doing so, asset management fosters increased stakeholder participation, buy-in, and adherence to adopted strategies and decisions.
- Viewed as “a way of doing business,” asset management is pervasive, affecting the business practices of every organizational element involved in the functions to which it is applied.

### **TAM is a Process to Promote Better Agency Decision-Making and Continuous Business Improvement**

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

- Investment choices and decisions on allocating and applying resources are policy and performance-driven. Procedures to reach these decisions are consistent with objective information and criteria based on merit. Performance measures consistent with policy goals and objectives are established for management review of both system performance and program delivery. TAM takes a long-term view of performance and manages assets over the whole life.
- Investment choices and decisions on allocating resources are based upon explicit tradeoffs among modes, programs, or strategies. Tradeoffs assess the impacts of more or less investment in a mode, program, or strategy, and help to craft final recommendations on how resources will be allocated across

competing needs. Managers also understand the implicit tradeoffs in their programs and budgets, and the consequences thereof.

- Asset management entails the translation of policies and plans into optimized investment strategies, and the translation of investment strategies into optimized program delivery. The essence of asset management involves a combination of resource allocation decisions and program delivery strategies that are optimized in relation to specific policy-driven criteria and these decisions/strategies consider risk over the entire life-cycle of an asset and over the entire network.
- Organizational roles and responsibilities regarding asset management are developed to encourage more strategic and integrated approaches. While strong vertical organizational units may exist to maintain core expertise, managed business processes and decisions involve wider participation.
- Asset management is interdisciplinary. Decisions on investment choices and resource allocation are based upon expertise and judgment from several quarters of an Agency. Assets are managed for delivery of the desired level-of-service for the least practical cost.
- Asset management requires effective communication within and outside the Agency. Within the Agency, strong communication channels are needed both across divisions and disciplines as well as within divisions.
- External communications need to inform policy-makers and other stakeholders of the status of transportation assets and recommended policies and their benefits.
- The Agency strives for more effective program delivery. The Agency explores innovative methods to deliver the range of projects and services required. All available methods are considered, including use of departmental employees, intergovernmental agreements, outsourcing or managed competition, and privatization.

### **TAM is a Set of Management Tools**

Effective management systems and complete, current, and accurate information on transportation infrastructure are practical necessities in meeting the policy and process requirements of asset management. Good asset management implies a systematic, integrated approach to project selection, analysis of tradeoffs, and program and budget decisions. It also implies that the right information be available to the right levels of management at the right times. The principles below support the availability and application of better information to make better decisions in asset management.

- Complete, current, and accurate information on transportation infrastructure assets, including descriptions, location, usage, unique or specialized characteristics, functional and other classification, and data needed for management systems.

- An appropriate suite of management systems and databases informs the Agency of the status, trends, and needs regarding its infrastructure assets. Typical capabilities of these systems include the following:
  - Organization of information within databases describing infrastructure inventory, condition, and performance;
  - Information ownership identifying the business group responsible for updating asset information including condition ratings, frequency of data updates, detailed condition rating methodology, and the method of data collection.
  - Metadata containing a dictionary of the data fields collected for each asset, data values, data validation rules, linear referencing system used, and data flow/integration with other information systems.
  - Analytic models that predict the rate of future change in condition or performance, enabling the agency to forecast future infrastructure needs;
  - Decision rules or procedures for applying treatments or actions to maintain, preserve, rehabilitate, replace, or expand transportation infrastructure, with analytic models of resulting costs, benefits, and other impacts including an emphasis on a preservation based approach to strategy implementation
  - Reports tailored to different organizational levels of management, including senior and executive levels, as well as for public distribution.
  - Information on system performance in terms of both proposed targets and values actually achieved in the field.
  - Specialized technical applications that support an Agency's asset management procedures. These will vary by Agency, but may include advances such as use of geographic information systems (GIS) as a system/data integration platform, economic analysis applications (e.g., generalized life-cycle benefit-cost procedure), tradeoff analysis between assets, and other decision-support tools.
  - Applications that assist in program and service delivery, including financial applications (e.g., to compute "total" or "true" cost of Agency and contracted services), and management systems for construction project pipeline and construction delivery.

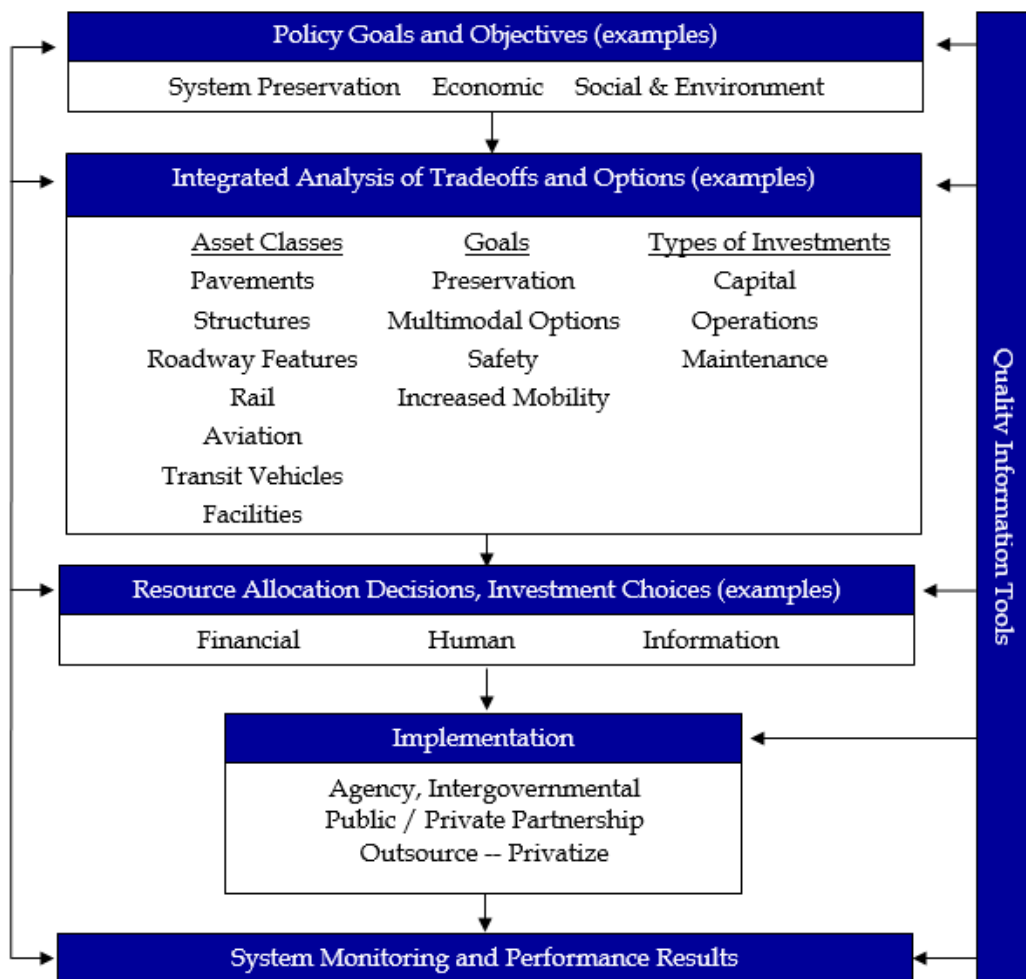
### **TAM is a Resource Allocation and Utilization Process**

Asset management is, at its core, a process of resource allocation and utilization. Resources in this context are interpreted broadly, encompassing financial, human, information, material, and equipment inputs to the management of the physical transportation infrastructure. The process of assigning or distributing these resources and applying them to the Agency's mission is likewise interpreted broadly, encompassing not only the traditionally understood functions in

planning, program development, and budget approval, but also program delivery, system monitoring, data analysis, and input to policy formulation.

Figure 2.1 illustrates a strategic, integrated, systematic, and interdisciplinary approach to asset management for physical transportation infrastructure. The approach is cast as a resource allocation and utilization process. The entries in Figure 2.1 are examples, defined broadly and comprehensively to illustrate how the process could work in a general case.

Figure 2.1. Transportation Asset Management Framework



## **2.3 ASSET MANAGEMENT BUSINESS NEEDS**

As described above, transportation asset management is a comprehensive process that spans across several agency departments, and addresses decisions that the agency makes throughout an asset's life. Given this broad reach, it is informative to break asset management practice down into a set of concrete business needs. These needs reflect state-of-the-art asset management decision making. The following needs are based on MAP-21 requirements, guidance provided through national research efforts, and best practices by DOTs throughout the U.S. They are organized around the TAMP requirements in MAP-21. The needs provide a basis for assessing existing practices at TDOT and identifying potential business process enhancements.

To have a state-of-the-art asset management program, TDOT needs to:

### **Inventory and Condition**

1. Have access to complete, current, and accurate inventory of bridges and pavements on the NHS and State-owned system.
2. Have access to historic condition information at both the network and asset levels.
3. Have access to complete and accurate information regarding current passenger and commercial vehicle traffic volumes.
4. Project future traffic volumes and assess their impact on network conditions.

### **Asset Management Objectives and Measures**

5. Document goals that guide resource allocation.
6. Understand the public's expectations for the transportation system.
7. Define performance measures to communicate system condition, assess progress being made in programmatic activities, identify and prioritize projects, and aid in the efficient and effective allocation of funds to programs.

### **Performance Gap Identification**

8. Understand the relationship between funding levels and future asset conditions.
9. Develop condition targets.

### **Life-Cycle Cost Considerations**

10. Incorporate life-cycle cost considerations when modeling future asset condition.
11. Incorporate life-cycle cost considerations when selecting maintenance activities and construction projects.
12. Define key work activities, document their typical unit costs, and detail their ideal timing and sequencing.

13. Determine the long-term cost implications of adding new assets (i.e., maintenance costs) and consider these costs when prioritizing network expansion activities (e.g., highway, pedestrian, or bicycle facilities).
14. Document how projects are prioritized and selected for construction.

### **Risk Management**

15. Identify agency-level risks that could impact implementation of asset management programs (e.g., funding uncertainty and major weather events).
16. Identify program-level risks that could impact implementation of specific programs, such as the bridge program (e.g., an age distribution of the bridge network that will result in a large number of bridges reaching the end of their design life at the same time).
17. Evaluate the agency- and program-level risks in terms of their likelihood of occurrence, the consequences should they occur, and use the results to prioritize the risks.
18. Identify strategies for mitigating the highest priority risks.

### **Financial Planning**

19. Have access to complete and accurate information regarding historic expenditures at the project, work type, and program levels.
20. Project future funding that will be available for asset management over a minimum timeframe of 10 years.
21. Explicitly consider the relationship between the capital and maintenance programs, and use this information to inform budgeting decisions.
22. Allocate the available funds to program areas based on the objectives from Item #5, public perception from Item #6, performance implications defined in Item #8, life-cycle cost considerations from Items #10 and #13, and risk mitigation strategies from Item #18.
23. Document the entire resource allocation process and timeline.
24. Determine the transportation network's current value, and describe how funding levels and investment strategies will impact its future value.

### **Investment Strategies**

25. Compile, prioritize, and communicate investment strategies that define how the agency will use the funds identified in Item #22.

### **Asset Management Systems**

26. Use state-of-the-art asset management systems to conduct the analysis required for the above business needs.

## 3.0 TAM at TDOT

This section summarizes current (2014) TAM practices at TDOT related to pavements and bridges. The consultant team derived the information in this section from an online survey, in-depth interviews with TDOT staff, and the results of TDOT's TAM self-assessment workshop.

Table 3.1 presents an asset management maturity scale presented in Volume II of AASHTO's *Transportation Asset Management Guide*. This scale provides a convenient mechanism for assessing existing asset management practices.

**Table 3.1 Transportation Asset Management Maturity Scale**

TAM Maturity Scale Level	Maturity Level Number	General Description
Initial	1	No effective support from strategy, processes, or tools. There can be lack of motivation to improve.
Awakening	2	Recognition of a need and basic data collection. There is often reliance on heroic efforts of individuals.
Structured	3	Shared understanding, motivation, and coordination. Development of processes and tools.
Proficient	4	Expectations and accountability drawn from asset management strategy, processes, and tools.
Best Practice	5	Asset management strategies, processes, and tools are routinely evaluated and improved.

Source: AASHTO Transportation Asset Management Guide Volume II, 2011

Table 3.2 provides an assessment of TDOT's asset management maturity using the business needs defined in Section 2. This information is used as the basis for the work plan presented in Section 5.

Table 3.2 Assessment of TDOT TAM Practices

#	Business Need	Bridge Maturity (1 to 5)	Pavement Maturity (1 to 5)	Comments
1. Inventory and Condition	Have access to complete, current, and accurate inventory of bridge and pavements on the NHS and State owned system	5	5	TDOT conducts regular element-level bridge inspections consistent with best practices. TDOT conducts pavement inspections and collects information on ride quality and pavement distresses.
2. Inventory and Condition	Have access to historic condition information at both the network and asset levels	5	5	TDOT conducts regular element-level bridge inspections consistent with best practices. TDOT conducts pavement inspections and collects information on ride quality and pavement distresses.
3. Inventory and Condition	Have access to complete and accurate information regarding current passenger and commercial vehicle traffic volumes	4	4	TDOT staff have confidence in current traffic data and future traffic projections.
4. Inventory and Condition	Project future traffic volumes and assess their impact on network conditions	4	4	TDOT staff have confidence in current traffic data and future traffic projections.
5. Asset Management Objectives and Measures	Document goals that guide resource allocation	3	3	TDOT's highest priority is to "maintain what we have." However, agency staff identified a need to better document its goals and decision making processes so that a clear line can be drawn between priorities and resource allocation decisions.
6. Asset Management Objectives and Measures	Understand the public's expectations for the transportation system	4	4	TDOT has confirmed through its customer survey that preservation is a key public priority, and that the public is largely satisfied with the current condition of the transportation network.
7. Asset Management Objectives and Measures	Define performance measures to communicate system condition, assess progress being made in programmatic activities, identify and prioritize projects, and aid in the efficient and effective allocation of funds to programs	3	3	TDOT has defined measures that are reported regularly. However, similar to item #5, there is a desire to ensure that the performance measures are used to inform asset management decisions.

#	Business Need	Bridge Maturity (1 to 5)	Pavement Maturity (1 to 5)	Comments
8. Performance Gap Identification	Understand the relationship between funding levels and future asset conditions	2	4	<p>TDOT estimates future bridge conditions based on historic trends.</p> <p>TDOT uses a pavement management system to forecast future pavement conditions. Agency staff identified opportunities to improve this modeling capability at the project level but generally expressed confidence in the results when aggregated at the network-level.</p>
9. Performance Gap Identification	Develop condition targets	4	4	<p>Although TDOT has established condition targets, there was discussion throughout the gap assessment indicating a desire to revisit them. Examples of suggested updates to the targets include: 1) revising the relative targets between the Interstates and the rest of the system, 2) developing two sets of targets – a fiscally constrained set, and an aspirational set, and 3) setting targets based on a tradeoff assessment of preservation and other needs. Of these options, TDOT staff are most interested in pursuing a tradeoff based target setting approach.</p>
10. Life-Cycle Cost Considerations	Incorporate life-cycle cost considerations when modeling future asset condition	2	4	<p>Similar to #8. TDOT models future bridge conditions based on extrapolating historic data, and future pavement conditions using a pavement management system. The pavement management system considers life-cycle costs.</p>
11. Life-Cycle Cost Considerations	Incorporate life-cycle cost considerations when selecting asset management projects	2	3	<p>Historically, TDOT has focused on bridge replacements. However, given the overall condition of the network that has resulted from this approach, TDOT is now transitioning to more preservation and preventive maintenance. Much of the proactive actions relate to decks. For example, TDOT has policies for resurfacing bridge decks whenever adjacent pavements are resurfaced or when structural work is performed.</p> <p>TDOT has developed funding targets for pavement preventive maintenance activities and guidance on what types of treatments should be considered over a pavement's serviceable life. Regional engineers use this guidance when selecting projects based on current conditions.</p>

#	Business Need	Bridge Maturity (1 to 5)	Pavement Maturity (1 to 5)	Comments
12. Life-Cycle Cost Considerations	Define key work activities, and document the typical unit cost and ideal timing	3	4	<p>Bridge activities are based on inspector recommendations. TDOT has not documented typical bridge activities or guidance on their ideal timing.</p> <p>Pavement activities are based on a combination of current conditions and guidance that TDOT has developed regarding when to apply pavement treatments.</p>
13. Life-Cycle Cost Considerations	Determine the long-term cost implications of adding new assets and consider these costs when prioritizing network expansion activities	2	2	TDOT's capital program is focused primarily on the preservation of the existing network, so improvement in this area was not flagged as a priority.
14. Life-Cycle Cost Considerations	Document how projects are prioritized and selected for construction	3	2	<p>The processes used to identify and select pavement projects vary by Region. The need for improved documentation to inform project prioritization decisions was cited by TDOT staff through the gap assessment effort.</p> <p>While bridge prioritization is largely centralized, there is still a desire for better documentation of the prioritization criteria and considerations.</p>
15. Risk Management	Identify agency-level risks that could impact implementation of asset management programs	2	2	TDOT staff considers risk informally as part of the project development process. However, TDOT does not have a systematic, formal process for evaluating risks associated with its asset management programs.
16. Risk Management	Identify program-level risks that could impact implementation of specific programs	2	2	TDOT staff considers risk informally as part of the project development process. However, TDOT does not have a systematic, formal process for evaluating risks associated with its asset management programs.
17. Risk Management	Evaluate the agency- and program-level risks in terms of their likelihood of occurrence, the consequences should they occur, and use the results to prioritize the risks	2	2	TDOT staff considers risk informally as part of the project development process. However, TDOT does not have a systematic, formal process for evaluating risks associated with its asset management programs.
18. Risk Management	Identify strategies for mitigating the highest priority risks	2	2	TDOT staff considers risk informally as part of the project development process. However, TDOT does not have a systematic, formal process for evaluating risks associated with its asset management programs.

#	Business Need	Bridge Maturity (1 to 5)	Pavement Maturity (1 to 5)	Comments
19. Financial Planning	Have access to complete and accurate information regarding historic expenditures at the project, work type, and program levels	3	3	TDOT has information on historic spending at the project level. It would take a significant effort to update the accounting system and business practices to track expenditures by work type, program, or asset. Of these three categorization options, TDOT staff are most interested in understanding expenditures by asset.
20. Financial Planning	Project future funding that will be available for asset management over a minimum timeframe of 10 years	2	2	TDOT uses future revenue projections for 1 year. TDOT staff flagged extending these projections as a priority.
21. Financial Planning	Explicitly consider the relationship between the capital and maintenance programs, and use this information to inform budgeting decisions	3	3	TDOT considers these tradeoffs implicitly during the programming and budgeting process. There is a desire on the part of TDOT staff to better understand and formally conduct this type of tradeoff analysis.
22. Financial Planning	Allocate the available funds to program areas based on the objectives from Item #5, public perception from Item #6, performance implications defined in Item #8, life-cycle cost considerations from Items #10 and #13, and risk mitigation strategies from Item #18	3	3	TDOT staff expressed a desire to explicitly consider program-level tradeoffs, future conditions, and risk when allocating funds between program areas.
23. Financial Planning	Document the entire resource allocation process	2	3	The need for improved documentation was cited several times by TDOT staff throughout the gap assessment effort.
24. Financial Planning	Determine the transportation network's current value, and describe how funding levels and investment strategies will impact its future value	3	3	TDOT assesses network value through the GASB-34 process based on the modified approach, which accounts for current and target conditions.

#	Business Need	Bridge Maturity (1 to 5)	Pavement Maturity (1 to 5)	Comments
25. Investment Strategies	Compile, prioritize, and communicate investment strategies that define how the agency will use the funds identified in Item #22	4	4	Same as item #11. TDOT has developed policies or guidance documents indicating when certain types of bridge and pavement treatments should be applied.
26. Investment Strategies	Use state-of-the-art asset management systems to conduct the analysis required for the above business needs	2	4	TDOT uses a bridge management system to store inspection data but not to forecast future bridge conditions or optimize the selection of bridge activities based on life-cycle cost analysis. TDOT currently has a mature pavement management system that considers life-cycle costs, but the capability is not utilized in choosing pavement projects.

## 4.0 TAM Vision and Goals

This section defines a vision for risk-based TAM at TDOT, and presents a set of goals to guide its implementation.

### 4.1 TAM VISION STATEMENT

The following vision statement combines TDOT's mission statement with MAP-21's definition of asset management.

"Transportation asset management at TDOT is a strategic and systematic process of operating, maintaining, and improving Tennessee's transportation system. TDOT will identify a structured sequence of actions that will enable it to cost effectively achieve and sustain a desired state of good repair, and to provide a safe and efficient transportation network."

The TAM program will provide a bridge between TDOT's long range plan and its shorter term Bridge and Pavement Program. The structured evaluation of system conditions, performance targets, life-cycle cost considerations, risks, and funding scenarios will inform the development of the Bridge and Pavement Program, and enable TDOT to achieve its mission most cost effectively.

### 4.2 TAM GOALS

The goals of the TAM program over the period 2015-2020 are as follows:

- Strengthen a culture through training and communication where TAM is viewed as the way of doing business.
- Use data and analytical tools to support asset management decisions.
- Improve the coordination between the various program areas that impact Tennessee highways.
- Define and work towards an enterprise asset management system architecture.

## 5.0 TAM Work Plan

This section presents an asset management work plan for TDOT. It describes the following practical steps that support the vision and goals defined above.

- Initiative 1. Develop a TAM Strategic Plan;
- Initiative 2. Enhance the Ability to Analyze Bridges;
- Initiative 3. Incorporate Performance Data into the Planning and Programming Process;
- Initiative 4. Transition to a multi-year Bridge and Pavement Program
- Initiative 5. Improve Coordination between Maintenance and Capital Programs
- Initiative 6. Integrate Risk Management into the Asset Management Process
- Initiative 7. Expand Asset Management Practices to Assets Beyond Bridges and Pavements.
- Initiative 8. Develop an Enterprise Asset Management System Strategy

The plan also includes a timetable and a preliminary cost estimate for each activity. Implementing the work plan will require a mixture of indirect and direct costs. Indirect costs cover the resources required for current TDOT staff to perform work. Direct costs cover the resources required to engage consultants. Consultants may be brought in to add expertise or to address workload constraints within TDOT. This work plan represents one implementation scenario, which combines both internal and outsourced work. For the majority of the initiatives, the plan provides a preliminary cost estimate (low < \$100K, medium = \$100-\$500K, and high > \$500K) associated with engaging a consultant. Indirect costs are not included. The total implementation cost would decrease as the amount of work kept in-house increases relative to the amount outsourced to a consultant.

The work plan makes no presumption of the relative priority of this initiative with respect to other ongoing initiatives at TDOT. Rather, it presents activities, timeframes, and budgets as if the implementation of asset management at TDOT has full financial backing.

Implementing TAM will take patience. In some cases, the recommendations will result in a fundamental shift in the way TDOT does business. TAM at its core is an ever evolving continuous improvement process. To that end, several of the initiatives involve initial steps in the development of approaches, frameworks and strategies that will be implemented on an ongoing basis.

## 5.1 RECOMMENDED INITIATIVES

### Initiative 1. Develop a TAM Strategic Plan

The objective of Initiative 1 is to document how TAM will be implemented at TDOT. The Strategic Plan should be brief and build from this document and from TDOT's TAMP. The plan should provide items listed below. TDOT has developed many of these items already as part of its initial TAMP effort. The purpose of this initiative is to formalize them in a stand-alone document that can be distributed throughout the agency.

- Include the goals and objectives for TDOT's asset management program, building from Section 4 of this document.
- List the assets to be included in the initial TAM effort and a schedule for incorporating other assets over time.
- Define the role of the TAM champion who will serve to ensure executive support for the effort.
- Define the role of the TAM coordinator who will provide day-to-day oversight and coordination of the TAM implementation activities.
- Define the role of the TAM steering committee, looking beyond the role of the committee members during the TAMP development effort. The role of this committee during TAM implementation is to provide direction and enable coordination throughout TDOT.
- Develop a TAM training plan that identifies the personnel who require TAM training, the type of training required, and an approach for conducting the training. For example, TDOT may develop specific training materials or take advantage of those already available from the FHWA National Highway Institute (NHI), among other options.

**Timing:** 24 months

**Preliminary Cost Estimate:** Indirect / Consultant (Medium)

### Initiative 2. Enhance the Ability to Analyze Bridges

The objective of Initiative 2 is to enhance TDOT's ability to analyze bridge conditions and needs. TDOT currently uses a bridge system for storing and managing inventory and condition data. The bridge management process could be significantly improved by understanding the relationship between potential funding levels and future conditions, and identifying bridge activities that reduce life-cycle costs.

It is recommended that TDOT implement a bridge management system so that it can: evaluate the relationship between funding levels and future conditions, identify bridge treatments based on an analysis of life-cycle costs, and determine

the optimal split between proactive, preservation and reactive activities aimed at addressing bridges that are already classified as Structurally Deficient.

Key steps required for this initiative include:

1. Defining the analytical capabilities required to support TDOT's bridge management program;
2. Evaluating Bridge Management System (BMS) options for addressing these needs;
3. Implementing the preferred option; and
4. Updating existing business processes to take advantage of the new capabilities.

It is further recommended that TDOT assess the potential to use FHWA's National Bridge Inventory Analysis System (NBIAS) as an interim tool for bridge system modeling until the preferred BMS options is fully implemented.

**Timing:** 18 months

**Preliminary Cost Estimate:** Indirect/consultant (low) for steps 1, 2 and 4. The cost of implementing the preferred approach will vary significantly depending on the option pursued (medium to high).

### **Initiative 3. Incorporate Performance Data into the Planning and Programming Processes**

The objective of this initiative is to encourage a performance-based approach to the overall planning and programming functions at TDOT. In this context, "planning and programming" refers to an agency-wide process rather than a project specific process. To meet this objective, it is recommended that TDOT complete the following activities:

- Use its pavement management system and the bridge management system described in Initiative 2 to analyze future asset conditions based on various funding scenarios. With the output from this analysis, develop materials that explain the relationship between future funding levels and performance.
- Communicate the need for adequate preservation funding levels to policy-makers and the implications of underfunding these needs.
- Conduct similar analysis to define the relationship between funding and performance in other priority areas such as congestion reduction.
- Use these materials to conduct a formal tradeoff analysis between the bridge, pavement, and capacity programs. The outcome of this analysis would be a set of funding and performance targets. TDOT may decide to develop two types of targets – fiscally constrained based on what can be realistically achieved given the available budget, and fiscally unconstrained based on ideal performance levels.

- Use the pavement and bridge management systems to develop work recommendations. Provide the pavement recommendations to the Regions along with the other targets and materials currently provided.
- Develop a process for tracking the extent to which selected projects are consistent with the management system recommendations.

**Timing:** Interim modeling approaches may be needed depending on the timing of this effort and the management system activities described in Initiative 2. From there, the process is ongoing, so that TDOT can make adjustments to its measures, targets, and business process over time as its management system capabilities improve.

**Preliminary Cost Estimate:** Indirect/consulting (medium).

#### **Initiative 4. Transition to a Multi-Year Bridge and Pavement Program**

TDOT uses a year budget estimate developed by the Tennessee Department of Revenue during its annual programming process. As a result, TDOT does not have a formal list of planned pavement or bridge projects that looks out beyond a single year. Projecting out the budget to additional years (for example 3 or 4) and identifying specific bridge and pavement projects over that time frame would enable TDOT to improve the coordination between program areas. (Improved coordination is discussed in more detail in Initiative 5.) It also would help TDOT communicate how it manages its assets and how this approach supports a whole life view that focuses on optimizing the use of available funds.

Given the uncertainty in the budget from year to year, TDOT will need to maintain flexibility in its ability to update the out years of the program. However, it is recommended that TDOT find a balance between maintaining flexibility and providing a stable program that it can plan around.

TDOT currently maintains a list of planned bridge replacement projects, and a 2-year list of pavement projects. In addition, some regions maintain a longer list of pavement projects. It is recommended that TDOT identify which project lists currently exist, expand upon them as necessary, and share the combined list throughout the agency.

**Timing:** This initiative represents a change in how TDOT operates. The transition to a multi-year Bridge and Pavement Program could be phased in over two programming cycles.

**Preliminary Cost Estimate:** Internal (low)

#### **Initiative 5. Improve Coordination between the Maintenance and Capital Programs**

At its core, asset management is about identifying the right treatment for the right asset at the right time. In some cases, the “right” treatment will fall within the

maintenance program. In others, it will fall within the capital program. This initiative is aimed at taking a comprehensive view of treatments, and minimizing budget and organizational constraints to implement them. It involves the following activities:

1. Update the tool kit of strategies for most effectively managing bridges and pavements throughout their whole life. TDOT has already developed this toolkit for pavements, but TDOT staff indicated a need to identify less intensive/lower cost pavement treatments.
2. Determine the most efficient way to implement each strategy. These types of treatments could be implemented through the maintenance program and/or through the capital program on a regular basis or as-needed based on asset condition. They could also be implemented with internal forces and/or contractor forces.
3. For strategies flagged for implementation through the maintenance program, pursue targeted funding and ensure that TDOT staff have the training, equipment, and resource capacity to implement them.
4. Develop integrated maps showing current deficiencies, planned strategic projects, and projects on the multi-year bridge and pavement program described in Initiative 4. These maps would provide a basis for improved coordination between the maintenance, bridge, pavement, and strategic project programs.

The first steps could be accomplished through a series of workshops where TDOT staff share and compare maintenance and capital strategies, and discuss the ideal asset management approach. The final step would require a sustained effort. Developing and communicating the updated toolkit will provide TDOT with the groundwork required for this effort.

**Timing:** 12 months for steps 1 and 2; ongoing for steps 3 and 4.

**Preliminary Cost Estimate:** Internal/ consultant (low) for steps 1 and 2; internal (low) for steps 3 and 4. **(Total Cost - medium)**

## **Initiative 6. Integrate Risk Management into the Asset Management Process**

Risk considerations, among many other factors, influence the decision of what work to perform on an asset. As such, the objective of this initiative is to formally integrate risk management into TDOT's asset management processes to account for agency-level and program-level risks pertaining to highway and bridge infrastructure. TDOT's TAMP will include an initial risk register that identifies risks related to the asset management program. This is an important first step.

It is recommended that TDOT work from the existing register, prioritize the risks, identify which risks it will address as part of the asset management program, and develop mitigation strategies for them. The mitigation strategies should list the

timing, an owner responsible for its implementation, and guidance on how to fund implementation activities.

It is further recommended that TDOT develop an approach for tracking the implementation of the risk mitigation strategies, and plan for periodically updating the risk register.

**Timing.** 12 months

**Preliminary Cost Estimate.** Internal/consultant (low)

## **Initiative 7. Expand TAM Practices to Assets Beyond NHS Bridges and Pavements**

TDOT's asset management practices are most developed for bridges and pavements. Its initial TAMP will focus on NHS bridges and pavements. The objective of Initiative 7 is to extend these practices to other assets. The first step will be to expand the TAMP to all of TDOT's bridges and pavements.

The second step will be to expand to assets beyond bridges and pavements. During the gap assessment effort, TDOT staff identified as priorities the development of asset management capabilities for drainage and sign structures.

Initiative 7 involves the following activities:

1. Finalize the list of priority asset types for asset management.
2. For each asset type, determine which elements of TAM should be addressed and how. These elements include: inventory, performance measures, current condition, performance target setting, risk assessment, life-cycle cost considerations, funding, and investment strategies.

The approach for each element could vary by asset. For example, it may be preferred to capture inventory and condition information on a sampling basis for some assets, and to complete a 100 percent survey on others. The frequency of the updates may also vary. For example, in some cases, annual or biannual data may be required. In others, TDOT may wish to extend the updates to a longer cycle.

3. Implement the approaches defined in step 2.

**Timing:** 12 months to identify the assets and develop an asset management approach for each; then ongoing

**Preliminary Cost Estimate:** Internal/consultant (low) for activities 1 and 2; internal/consultant (medium) for step 3.

## **Initiative 8. Develop an Enterprise Asset Management System Strategy**

TDOT has a mature suite of databases and analytical tools that support its asset management program. In addition, it has several ongoing efforts aimed at further improving these resources. Overall, TDOT staff have confidence in the quality of

the data and their ability to access it. However, several participants in the gap assessment identified an opportunity to improve how these data sets and systems interact with one another. The objectives of Initiative 8 are to make TDOT's IT resources more efficient, and to ensure that decision makers can continue to access data and information needed to support asset management decisions. This initiative includes the following activities:

1. Identify and document the data and information needed to support asset management processes. What data is needed? How often? In what format?
2. Develop a data governance plan that assigns responsibility for collecting, managing and updating core data items, defines a source of record for each item, and documents a data QA/QC process.
3. Develop a systems architecture that illustrates how core systems interact and relate to each other so that no additional geocoding is necessary when moving data from one system to another.
4. As new systems come on line, such as a bridge management system, ensure they are implemented in a way that supports the overall systems architecture.
5. Evaluate options for combining data and results from the pavement, bridge, and maintenance management systems into a tool that supports tradeoff analysis across assets.
6. Develop a process for evaluating the accuracy of management system predications, and enhance the modeling capabilities as needed to increase confidence in them.
7. Develop a web-based Geographic Information System (GIS) that enables staff to query data from multiple sources and generate custom maps that combine inventory, condition, and project information.

TDOT plans to conduct this type of assessment for the entire agency. Given TDOT's "maintain what we have" culture, TDOT could begin the process by first integrating the data and systems related to asset management and later expanding to incorporate other key agency functions.

**Timing:** Variable depending upon the scope and complexity of the implementation strategy. At least 24 to 36 months.

**Preliminary Cost Estimate:** Internal/consultant (high)

## 5.2 SUMMARY

Table 5.1 summarizes the initiatives described above. It also documents the anticipated duration and a preliminary cost estimate (low < \$100K, medium = \$100-\$500K, and high > \$500K) associated with engaging a consultant. Indirect costs are not included in these estimates. Taken collectively, these initiatives

would enable TDOT to make significant improvements to its asset management program over the next couple of years.

**Table 5.1 Implementation Summary**

#	Initiative	Preliminary Cost Estimate	Timing (Months)
1	Develop a TAM Strategic Plan	Medium	12
2	Enhance the Ability to Analyze Bridges	Medium to High	18
3	Incorporate Performance Data into the Planning and Programming Process	Medium	24
4	Transition to a Multi-Year Bridge and Pavement Program	Internal resources only - Low	24
5	Improve Coordination between the Maintenance and Capital Programs	Medium	12
6	Integrate Risk Management into the Asset Management Process	Low	12
7	Expand TAM Practices to Assets Beyond Bridges and Pavements	Medium	12
8	Develop an Enterprise Asset Management System Strategy	High	36