

Transportation Asset Management Strategic Planning and Research Roadmap Development

Prepared for

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Transportation Research Board**

of

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with

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SPECIAL NOTE: This report **IS NOT** an official publication of the National Cooperative
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Disclaimer

The opinions and conclusions expressed or implied are those of the research agency that performed the research and are not necessarily those of the Transportation Research Board or its sponsoring agencies. This report has not been reviewed or accepted by the Transportation Research Board Executive Committee or the Governing Board of the National Research Council.

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Summary

Transportation Asset Management Strategic Action Plan

Transportation asset management is an area of great importance to state departments of transportation (DOT) and other transportation agencies. As defined in the transportation legislation Moving Ahead for Progress in the 21st Century (MAP-21), transportation asset management (TAM) is a “strategic and systematic process of operating, maintaining, and improving physical assets... that will achieve and sustain a desired state of good repair over the life cycle of the assets at minimum practicable cost.”

The TAM Strategic Action Plan establishes a common agenda for advancing TAM knowledge and practice for the American Association of Transportation Officials (AASHTO) Committee on Performance-Based Management (CPBM) Subcommittee on Asset Management, in coordination with the Subcommittee’s partners and stakeholders.

The plan is intended to help transportation agencies – and the national-level organizations that play a key role in setting a TAM research agenda and delivering TAM research – meet the needs of today while continuing to advance the state of practice towards a long-term vision of multi-modal transportation asset management.

A 2019 TAM Strategic Planning Workshop, held on October 17-18, 2019 in Irvine, California, provided the foundation for the plan. With over 45 attendees representing more than 35 organizations, the discussions brought together many voices and perspectives to identify, define, and prioritize the specific opportunities for TAM advancements that will deliver real value to transportation agencies.

The following vision was established by a representative group of TAM subcommittee members and partners at the 2019 TAM Strategic Planning Workshop.

Sound investments

That consider long-term needs

Data-driven decisions

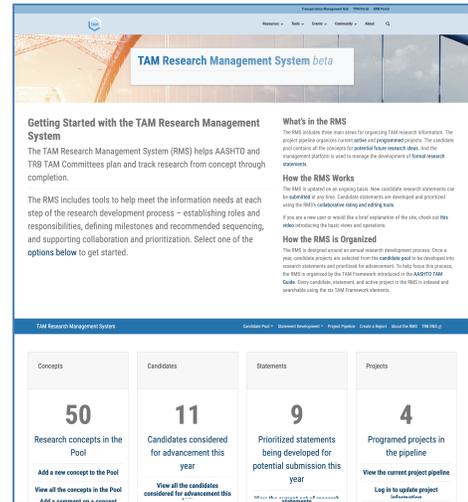
That maximize performance of our transportation system

A sustainable and inclusive framework

That recognizes the changing world we live in

Transportation Asset Management Research Management System

A TAM Research Management System (RMS) was developed as a companion to the Strategic Action Plan, in order to help AASHTO and TRB TAM Committees plan and track research from concept through completion: <https://www.tam-portal.com/rms/>



The RMS includes tools to help meet the information needs at each step of the research development process – establishing roles and responsibilities, defining milestones and recommended sequencing, and supporting collaboration and prioritization.

The RMS includes three main areas for organizing TAM research information.

1. The **candidate pool** contains all the concepts for potential future research ideas.
2. The **management platform** is used to manage the development of formal research statements.
3. The **project pipeline** organizes current active and programmed TAM-related projects.

The RMS is designed around an annual research development process. Once a year, candidate projects are selected from the candidate pool to be developed into research statements and prioritized for advancement. To help focus this process, the RMS is organized by the TAM Framework introduced in the AASHTO TAM Guide.



The AASHTO TAM Guide TAM Framework

Every candidate, statement, and active project in the RMS is indexed and searchable using the six TAM Framework elements.

1. Introduction

1.1. Project Overview

1.1.1. Background

Transportation asset management (TAM) practice is advancing in the United States. This is due to progress made in data driven decision-making, improved performance management, strengthened knowledge amongst practitioners, and the availability of resources to support TAM. The American Association of State Highway Transportation Officials (AASHTO), Federal Highway Administration (FHWA), Federal Transit Administration (FTA), Transportation Research Board (TRB), state departments of transportation (DOTs), plus Metropolitan Planning Organizations (MPOs) and local transportation agencies have worked to support this advancement.

Even as TAM practice continues to advance, much can be done at the national level to deliver greater value to transportation agencies. These actions include:

- Supporting greater collaboration across agencies
- Establishing a strategic outlook for TAM
- Developing collective objectives for TAM nationally while having distinct agency-specific objectives
- Connecting national TAM objectives with research priorities
- Prioritizing research projects using TAM objectives

1.1.2. Project Context

The AASHTO Subcommittee on Asset Management initiated this project in order to develop a strategic plan that would deliver the greatest TAM advancements in the areas of highest need for state DOTs and their partner agencies, including AASHTO, TRB, FHWA, and FTA.

A strategic planning session, held in October 2019, brought together TAM leaders from many of these organizations to develop the TAM Strategic Action Plan. This inclusive process helped to produce a plan that aligned the activities of the various entities and stakeholders in order to advance the state of practice as efficiently as possible. The workshop also provided the starting point for the development of a companion TAM Research Management System, designed to help the AASHTO and TRB TAM committees plan and track research from concept through completion.

1.1.3. Research Objectives

The objectives of NCHRP project 20-123(01) were to:

- (1) to develop a comprehensive strategic approach and action plan to coordinate ongoing asset management activities of AASHTO, TRB, FHWA, FTA, the American Public Transit Association (APTA) State of Good Repair (SGR) Working Group, and the Association of Metropolitan Planning Organizations (AMPO).
- (2) to develop a long-term research strategy to coordinate and advance the state of practice in multi-modal transportation asset management.

Additional objectives for the project were to:

- Establish a national vision for TAM in the United States
- Establish processes, governance mechanisms, and tools to align TAM activities across the country
- Connect proposed research to strategic objectives of each agency, and national objectives
- Identify roles within each organization that can support continued and inclusive collaboration.

1.2. Project Scope and Tasks

The research was structured into the following 12 tasks divided into 2 phases:

Phase 1 – TAM Strategic Action Planning Session

Task 1. Kickoff Conference Call. A 90-minute kickoff web conference call was conducted to discuss the work plan, approach, schedule and review procedure for research products. Plans for the strategic planning workshop were discussed at this meeting. Following this meeting, the project team documented comments from the panel and decisions made.

Task 2. Workshop Planning. The project team worked with the project panel and AASHTO leadership to design the TAM Strategic Action Planning Workshop. The workshop was designed to provide an opportunity for TAM leaders to share their observations, insights, and ideas in order to produce a TAM strategic action plan that recognizes existing plans and leverages them to produce a direction and set of actions for the TAM community to advance TAM practice.

Task 3. Workshop Execution. The project team facilitated a two-day strategic action planning workshop. The workshop brought together state DOT, federal, transit agency, MPO representatives and other TAM experts for the purpose of developing a strategic action plan that would build on the needs of multiple stakeholder groups

and their strategic plans in order to develop a set of actions that will deliver the greatest value to the TAM community. Following the workshop the team prepared a summary of the workshop discussions.

Task 4. TAM Strategic Action Plan. The research team synthesized what has been learned from the previous tasks into a document presenting a draft strategic approach for TAM and a set of actions. This plan captures the insights and strategies from the workshop documentation, formatted as an attractive document that communicates clearly the TAM strategic direction as well as the priority actions and how they should be executed amongst the stakeholder groups in a collaborative and coordinated fashion. A companion PowerPoint presentation was also produced that includes key elements of the TAM Strategic Action Plan for workshop participants and other TAM leaders to use in their agencies and other venues.

Task 5. Phase 1 Interim Report. In this task, all of the work in Phase 1 was synthesized into a Phase 1 Interim Report. The interim report includes the final TAM Strategic Action Plan, produced from the feedback from the project panel. Also included in the interim report is a summary of the input received from the TAM community at the start of the project, top agency performers and elements of their practice, workshop documentation, and the TAM Strategic Action Plan.

Task 6. Panel Meeting. A panel meeting was held to review results from Phase 1 and discuss plans for Phase 2 of the project. The research team summarized material from Interim Report 1 and walked through the proposed plans for the updating of the TAM Research Roadmap in Phase 2.

Phase 2 – TAM Research Roadmap Update

Task 7. TAM Research Gap Assessment. Using the direction provided by the panel at the in-person panel meeting at the end of Phase 1, and the weaknesses and opportunities identified during the development of the TAM Strategic Action Plan, the research team began this phase by conducting an assessment of what gaps exist currently for current and desired capabilities, tools, and processes to support TAM. To assess the TAM research gaps, the research team evaluated recently completed research, as well as research efforts that were then in progress or had recently been funded. This assessment also considered the availability of guidance, research, or training to address the gaps as well as gaps that could be supported by research efforts.

Task 8. Stakeholder Input. In conjunction with the previous task, stakeholder input was solicited via a web-based workshop. Stakeholders included the people who attended the strategic action planning workshop and others from their organizations. Also, as a part of this task a TAM research roadmap design specification was presented, documenting what the updated TAM research

roadmap would include.

Task 9. Update TAM Research Roadmap. The TAM Research Roadmap was updated with enhanced functionality and populated with a set of new research statements. The Roadmap was also updated to include formative or initial candidate research concepts, formally articulated and prioritized research needs, and funded projects both planned and ongoing.

Task 10. Research Roadmap Workshop. A TAM Research Workshop was held to gather feedback on the updated TAM Research Roadmap – now renamed the TAM Research Management System (TAM RMS). The workshop was designed to provide an opportunity to present, discuss, and refine the updated TAM RMS. The objective will be to establish a set of updates that can help to enhance the content, and functionality of the RMS and to actively use the RMS to prioritize and further develop a set of candidate research statements.

Task 11. Produce Final Digital Research Roadmap. The TAM RMS was updated based on the results of the Phase 2 workshop. The roadmap was be supplemented with additional draft research problem statements for the highest priority research problems identified and prioritized by the workshop attendees. The adjustments made to the content, capabilities, and format of the RMS were captured in revised administrative user documentation.

Task 12. Final Report and Communication Material. This final report for the project presents the updated TAM RMS and associated key products of this project phase. Promotional material that communicates the value to stakeholders of the TAM Strategic Action Plan and RMS are also included.

1.3. Document Overview

This is the *Draft* Final Report for NCHRP Project 20-123(01) – “Transportation Asset Management Strategic Planning and Research Roadmap Development”. It summarizes the objectives, scope, methodology and deliverables of the project.

- **This section (Section 1)** includes the project context, the research scope and tasks, and a summary of the Final Report organization.
- **Section 2** presents the full TAM Strategic Action Plan developed through this project.
- **Section 3** presents the set of candidate research statements developed and prioritized through the 2021 TAM Research Workshop
- **Section 4** includes an overview of the TAM Research Management System and a guide to the use of the RMS.
- **Section 5** provides a summary of the TAM Strategic Action Planning

Workshop through which the plan was developed.

- **Section 6** presents next steps including RMS stewardship and potential enhancements.

2. TAM Strategic Action Plan

2.1. Overview

The TAM Strategic Action Plan is presented on the following pages. The TAM Strategic Action Plan was prepared in a graphical format to clearly communicate the TAM strategic direction and the priority actions – as well as how they will be executed by key stakeholder groups in a collaborative and coordinated fashion.

The plan has been updated since its initial development in to include additional needs and priorities. Further, the plan has been updated to reflect the accomplishments of the Subcommittee and TAM stakeholders in achieving plan objectives. Key accomplishments since the initial plan was prepared include the following items.

Committee and Implementation Activities Completed

- **Establish TPM Technical Service Program.** Establish AASHTO technical services program to provide cost effective services and timely information to assist state DOTs in delivering a performance-based transportation program within their agency.
- **Develop Enhanced TAM Research Roadmap.** Develop enhanced research roadmap to facilitate coordination and management of TAM research.

Research Funded

- **Guidance on Using Performance-Based Management Approaches for Maintenance.** The objectives of this research are to develop guidance promoting the use of performance-based management strategies in maintenance and to present the resulting information in an easily-accessible format.
- **Updates to the Digital Edition of the AASHTO Transportation Asset Management Guide.** The objective of this research is to develop new and updated digital content for the online version of the *AASHTO Transportation Asset Management Guide: A Focus on Implementation*, 2nd Edition.
- **Connecting Transportation Asset Management (TAM) and Transportation System and Management Operations (TSMO).** The objective of this research is to investigate the needs and benefits from incorporating TSMO assets in TAMPs. The study will develop a guide for state DOTs to facilitate the inclusion of TSMO in TAMP without disrupting the established and on-going planning process.

TAM Strategic Action Plan

About the Plan

Transportation asset management is an area of great importance to state departments of transportation (DOT) and other transportation agencies. As defined in the transportation legislation Moving Ahead for Progress in the 21st Century (MAP-21), transportation asset management (TAM) is a “strategic and systematic process of operating, maintaining, and improving physical assets... that will achieve and sustain a desired state of good repair over the life cycle of the assets at minimum practicable cost.”

This TAM Strategic Action Plan establishes a common agenda for advancing TAM knowledge and practice for the American Association of Transportation Officials (AASHTO) Committee on Performance-Based Management (CPBM) Subcommittee on Asset Management, in coordination with the Subcommittee’s partners and stakeholders.

Plan Objectives and TAM Vision

The plan is intended to help transportation agencies – and the national-level organizations that play a key role in setting a TAM research agenda and delivering TAM research – meet the needs of today while continuing to advance the state of practice towards a long-term vision of multi-modal transportation asset management.

The following vision was established by a representative group of TAM subcommittee members and partners.

Sound investments

That consider long-term needs

Data-driven decisions

That maximize performance of our transportation system

A sustainable and inclusive framework

That recognizes the changing world we live in

The Benefits of TAM

Sustained asset condition, performance, resilience, and longevity. Asset management involves maintaining the asset condition over the asset’s lifetime. Improved condition results in improved performance and ultimately extends the life of an asset compared to the alternative of continually deferring maintenance.

Improved accountability. When asset management practices are embedded in an agency, staff are held accountable within the agency and to customers and stakeholders to follow TAM practices and consistently maintain the assets in a state of good repair

Increased efficiency and effectiveness. When assets are managed following an agreed upon management strategy, efficiency and effectiveness are improved. Regular maintenance can be planned and scheduled, reducing disruption to service.

More benefit for each dollar invested. Transportation assets cost money to build, maintain, operate, and use. By stressing the importance of life cycle planning and costs and placing agreed levels of service at the core of the asset management process, TAM helps to ensure that the benefits delivered by the network are maximized, while the costs of providing, maintaining, and using it are minimized.

Reduced risk exposure. When assets are maintained and managed consistently and resilience is improved, the agency reduces the exposure to risk.

Improved coordination and communication. TAM helps improve resource allocation and coordination between agency areas on asset management related projects and maintenance.

Plan Organization

The plan is organized around the TAM Framework introduced in the *AASHTO TAM Guide* in order to clarify and reinforce alignment around common needs and objectives. The TAM Guide Framework groups the components of asset management into six areas.



TAM Strategic Action Plan

The Transportation Asset Management (TAM) Strategic Action Plan defines a common agenda for advancing TAM knowledge and practice for the AASHTO Committee on Performance-Based Management (CPBM) Subcommittee on Asset Management, in coordination with the Subcommittee's partners and stakeholders.

<< Near Term (1-3 Years) >>

Committee Activities

Integrate the Research Process into Committee Structures (XC)

Align research needs statements and committee business processes with the TAM roadmap to ensure focused results, sharing ideas and research status to capitalize on synergies. Establish mechanism to coordinate monthly knowledge transfer on research progress and accomplishments. Conduct coordination meetings with related committees, including those of the Transportation Research Board (TRB), the American Public Transportation Association (APTA), and the Association of Metropolitan Planning Organizations (AMPO).

Develop AASHTO TAM Recommended Practice (AP)

Provide guidance and examples on how to develop TAM plans for all asset classes.

Develop Methods to Assess Research Impact (XC)

Establish methods, measures, and standard criteria to assess impact of TAM research.

Connect with IAM Standards and Bodies (SP)

Align TAM with ISO/international practice including American Public Works Association (APWA) and Institute of Public Works Engineering Australasia (IPWEA). Strengthen connections to the World Road Association (PIARC).

Internal TAM Workforce Development Workshop (OP)

Develop and deliver a workshop to provide agencies with tools to enhance staff understanding and buy-in for TAM.

TAM Framework Key

TAM Strategy and Planning (SP)

Organization and People (OP)

Asset Performance (AP)

Resource Allocation (RA)

Monitoring and Adjustment (MA)

Information and Systems (IS)

Cross-Cutting Topics (XC)

>> Long Term (5-10 Years) >>

Implementation Activities

Identify Noteworthy TAM Plans and Practices (SP)

Provide a framework where states can learn from peers and noteworthy references, incorporating elements of the structure, description, and approach as desired.

Align Data with Federal Reporting Requirements (AP)

Align disparate data needs for Federal planning and reporting.

Develop TAM Committee Onboarding Procedure (OP)

Educate agency employees regarding existence, mission, opportunities for involvement, and inspire leaders to encourage participation by employees of the majority of US states and other agencies.

Develop National Database of TAM Experts (XC)

Develop and maintain web-based index of TAM experts.

Develop Asset Management Student Exercises (XC)

Integrate Asset Management into college-level courses to motivate/ expose young professionals to TAM.

Provide Training on TAM Data Visualization (IS)

Address challenges that TAM practitioners face in condensing TAM into enjoyable and understandable pieces for different audiences.

Identify Strategies to Adjust Between TAMPS (MA)

Identify strategies for making adjustments based on performance between asset classes. Ensure direct linkages between condition assessment, performance management, and project prioritization.

<< Near Term (1-3 Years)

Long Term (5-10 Years) >>

Assess Benefits Realized from TAM

(SP)

Research approaches to show quantifiable value and benefits of TAM to continue to promote and mature TAM practices.

Incorporate Risk at Project and Network Levels

(MA)

Develop methods to allow agencies to incorporate quantitative risk assessment at project and network levels. Support risk and resilience being on par with traditional performance measures.

Improve Asset Performance by Bundling Capital Projects

(RA)

Research effective corridor planning strategies that promote sustainable capital asset improvements that impact asset class performance and other performance areas.

Create Catalog of Condition Assessment Protocols

(AP)

Document and provide examples of condition assessment for all types of assets.

Support TAM and TPM Education, Training and Workforce Development

(OP)

Develop and lay the foundation for multiple tools, curriculum, and certification programs related to TAM and TPM.

Implement Guidance on System Level Asset Valuation

(RA)

Support implementation activities for the forthcoming *Guide to Computation and Use of System Level Valuation of Transportation Assets*.

Develop Corridor Planning and Allocation Approaches

(RA)

Organize a framework for corridor (or system/area) plans that can be used for efficient asset management and resource allocation.

Engage Stakeholders in TAM

(OP)

Develop communication tools designed to engage stakeholders in developing TAM strategies for various asset categories and agencies.

Establish a Risk and Resilience Research Program to Develop National Standards

(MA)

Establish a series of individual research projects born out of NCHRP 23-09 to yield a collection of tools and techniques for agencies' all-hazards risk and resilience analysis.

Evaluate Federal Measures and Metrics for Pavements

(AP)

Evaluate and assess existing national-level performance measure requirements to determine applicability and usability of these measures to state-level TAM decision making.

Develop Detailed TAM Case Studies

(XC)

Identify and develop multi-media case studies that document, in great detail, how a transportation agency implemented a TAM program or practice.

Develop Data Governance Guidebook

(IS)

Create knowledge throughout the TAM community on data governance.

Support Data Governance through BIM

(IS)

Research BIM applications to support DOTs' data governance.

Develop Detailed TAM Case Studies

(XC)

Incorporate Change Management in TAM

(OP)

Develop a framework, recommended actions, and synthesis of noteworthy practices for agencies to use in incorporating change management strategies in TAM practice.

Synthesize Internal Staff Development Best Practices

(OP)

Synthesize best practices for workforce development and training in order to enhance the capabilities of a TAM team/staff or attract internal staff to become involved in TAM program/implementation.

Advance Asset Data Collection Technology

(IS)

Research to understand what the latest technologies for asset analysis can offer an agency as well as guidance on how frequently that information needs to be generated.

Conduct Regional and National Peer Exchanges

(XC)

Continue to deliver thematic TAM peer exchanges at the regional and national levels for targeted professionals.

Develop TAM Big Data Case Studies

(IS)

Create case studies addressing noteworthy applications of big data analytics to TAM.

Integrate Required Planning and Performance Processes

(SP)

Identify noteworthy practices in how DOTs and MPOs are linking and including TAM decisions in traditional planning processes.

Assess Socio-Economic Indicators in TAM

(SP)

Research the use of equity, economic, and environmental indicators in TAM calculations and decision-making.

Assess Successful Practices for Managing Uncertainty

(SP)

Survey and interview State DOTs and others as to their practices during COVID.

TAM Strategic Action Plan

Plan Development

A 2019 TAM Strategic Planning Workshop, held on October 17-18, 2019 in Irvine, California, provided the foundation for the plan. With over 45 attendees representing more than 35 organizations, the discussions brought together many voices and perspectives to identify, define, and prioritize the specific opportunities for TAM advancements that will deliver real value to transportation agencies.

At the outset of the 2019 TAM Strategic Planning Workshop, participants defined the goals and desired outcomes to be addressed by the TAM Strategic Action Plan that would shape the continued advancement of TAM practice over a ten-year timeframe.

Timeframe	Desired Products and Outcomes
2 Years	<ul style="list-style-type: none"> • Product: High level CEO instruction in what asset management can do for an organization and its long term investment decisions • Outcome: Embedded TAM business process that are sustainable across major leadership changes
3-5 Years	<ul style="list-style-type: none"> • Product: Means and methods for before-and-after assessments • Product: Performance measures for additional assets • Outcome: Achieve greater consistency within asset classes • Outcome: Fully integrated agency asset management, performance management, and risk management
5-10 Years	<ul style="list-style-type: none"> • Product: Multimodal framework for TAM that enables consistency in language and approach across modes and assets • Outcome: TAM processes, people, and information are working systematically <ul style="list-style-type: none"> ○ Transportation programs, project scopes, and budgets are set based on outputs of TAM analyses ○ TAM is integrated into all lines of business, and job descriptions include TAM • Outcome: Increase the credibility of TAM programs by shifting from reporting-only to decisions based on investment scenarios <ul style="list-style-type: none"> ○ Optimum lifecycle strategies can be utilized on all assets ○ Increased use of multi-objective modeling techniques ○ Use greater percentage of model recommendations • Outcome: Adopt meaningful performance measures that incorporate user experience • Outcome: Implement TAM culture throughout all levels of the agency • Outcome: Advance TAM practices towards international standards • Outcome: Provide asset owners with TAM tools for addressing critical challenges • Outcome: Increase availability of human and information resources for TAM: findable, searchable, usable

Workshop survey and polling data helped establish baseline and desired future maturity levels for a variety of key TAM capabilities and competencies required to achieve these objectives.

These data were used to help identify areas with needs best addressed by three improvement action types: implementation support, general or targeted research efforts, and the coordinated activities of the national-level organizations that play a key role in setting a TAM research agenda and delivering TAM research.

The workshop culminated with the development of over 25 specific, actionable research and action statements. The action items presented in the TAM Strategic Action Plan are synthesized from these statements, organized according to the established AASHTO TAM Guide Framework, and categorized according to the three improvement action types.

Areas of Need

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

Much progress has been made in data driven decision-making, improved performance management, strengthened knowledge amongst practitioners, and the availability of resources to support TAM. The TAM Strategic Action Plan reflects these accomplishments while also highlighting the areas where future progress must break substantial new ground.

In certain areas, where the maturity of TAM practice is relatively high, there is the greatest need for implementation support. Further advancement in these areas is generally captured by the committee activities and implementation activities included in the plan. Examples include:

- Asset inventory and condition development
- TAM plan development
- Setting and reporting agency performance measures

In other areas, where maturity is generally lower, there is a greater need for general or targeted research. These needs have been translated into the research activities included in the plan. Examples include:

- Applying a structured risk management approach
- Implementing corridor-based investment strategies
- Leveraging the capabilities of big data analytics and artificial intelligence

3. TAM Research Statements

3.1. Overview

The Transportation Asset Management (TAM) Research Workshop was held on April 22nd, 2021 in order to identify and prioritize TAM research needs. Attendees included members of both the AASHTO TAM subcommittee and TRB AJE30 Committee on Transportation Asset Management. The workshop agenda featured opportunities to discuss individual research topics – collectively and in small breakout groups. The workshop concluded with a set of prioritization exercises designed to generate a set of priority topics for further development and eventual submission to AASHTO R&I in October 2021.

In preparation for the workshop, an initial set of candidate FY2023 TAM research topics was published for review on the TAM Research Management System (RMS). The set of candidate TAM research topics was developed based on input received during the 2021 TRB Annual Meeting, with further input from the AASHTO TAM subcommittee and TRB AJE30.

The workshop began with an introduction to the RMS. Next, the team used the RMS to review TAM research currently underway and to summarize the set of new research ideas and concepts. Following the summaries, attendees entered breakout rooms to discuss the new research ideas and concepts, assess the urgency and potential benefit of the research, and to identify potential champions for the research. The breakouts were organized according to the TAM Framework introduced in the revised AASHTO TAM Guide with 2-3 research concepts discussed in each group. Following a report out to all attendees at the conclusion of the breakouts, all workshop participants joined a live polling exercise to identify a set of priority research concepts. The results were entered into the RMS prior to the close of the workshop.

Workshop slides and presentation materials are included in Appendix A.

3.2. TAM Research Statements – Summary

The following set of statements were prioritized at the workshop and further developed by identified champions using the TAM RMS. For each statement, the title and objectives are provided as they appear on the TAM RMS.

3.2.1. Developing a Robust Education, Training and Workforce Development Program for TAM and TPM

Background: TAM and TPM provide the foundation for performance-based investment decisions in transportation agencies at the federal, state, and local levels. Despite the fact that many transportation agencies have embraced the implementation of robust TAM and TPM programs to support their stewardship responsibilities, these topics are not typically incorporated into traditional education programs. In many cases, practitioners working in these areas acquire the skills needed while working on the job or take advantage of training materials available through various sources with limited support. Challenges with attaining skills, building competencies in an organization are compounded by knowledge succession needs with an aging workforce, tighter budgets, and uncertain in-person opportunities during an on-going pandemic, as well as evolving career expectations from skilled candidates in a globally competitive digital economy. A more accessible, efficient and attractive landscape of offerings, programs and career paths are needed to tackle the spectrum of training needs and challenges for effective TAM and TPM.

This study will explore cross-functional, multidisciplinary competencies, training needs in the TAM and TPM areas so that funding can be sought to streamline usage of existing opportunities, better integrate TAM and TPM principles within available programs, identify new skills needs driven by emerging risks or advancing technology, develop new training programs and partnerships needed. This also includes gaining an understanding of flexible, inclusive career paths to support innovation and productivity while improving return on training investment in a time of economic recovery. The study will inform AASHTO and TRB committees of existing gaps in training and recommend a strategy for addressing the gaps through a separate research study.

It is anticipated that this scoping study would be part of a three-phase research project:

- Phase I: Scoping Study for Developing an Education, Training and Workforce Development Program for TPM and TAM (this project)
- Phase II: Prototype and Testing of TPM/TAM Education, Training and Workforce Tools and Resources
- Phase III: Formal Development and Ongoing Support of TPM/TAM Education, Training and Workforce Tools and Resources

3.2.2. Establish an All-Hazards Risk and Resilience Analysis Research Program to Develop a National Standard

Background: The US experienced 308 weather and climate related disasters since 1980 exceeding \$2.085 trillion in physical losses and the loss of 14,492 lives. Between 1980-2020 the average number of billion-dollar events per year was 7.1, that number ballooned to 16.2 billion-dollar events per year on average between 2016-2020 (adjusted for Consumer Price Index). The most billion-dollar weather and climate related disasters occurred in 2020, with 22 billion-dollar events totaling \$246.7 billion in losses and 553 deaths. As of September 2021, the current year is looking to break the record set in 2020 having experienced 18 billion-dollar events to date. In addition, the recently published TRB Consensus Study on Resilience Metrics notes that 6 of the world's 10 most costly natural disasters in 2020 occurred in the United States (TRB Resilience Metrics Consensus Study, 2021). With this level of impact on the nation's infrastructure, transportation agencies need consistent methods to support decision making to address stressors such as extreme weather and climate change in planning, design, maintenance, and operations.

The TRB Resilience Metrics Consensus Study 2021 calls for the establishment of standard methods of analysis to support benefit-cost assessment to allow agencies to understand the "buy-down" of risk from capital and maintenance investments. In addition, the study calls on Congress to consider requiring that all federal funding candidate projects that involve long-lived assets requirement undergo well defined resilience assessments that account for changing risks of natural hazards and environmental conditions stemming from climate change. The proposed project will allow AASHTO and TRB to develop industry adopted standard methods of quantitative analysis in lieu of federally developed methods.

3.2.3. BIM for Infrastructure: A Focus on Asset Management

Background: Research is needed on the importance of data governance from the conception of a project's data dictionary, through the inventory and condition assessment and continuing with the data management and integration into transportation asset management systems. A question worth pursuing is whether all aspects of language, wording, numbering, and measurement units should be standardized or if template guides could be developed for each agency to standardize their unique asset type requirements, but in a nationally recognized format for easy translation.

After establishing governance routines for asset data collection and management, the next phase of research would involve the security aspects of an agency's data as well as the quality assurance measures applicable to grow confidence in the data's quality. A full review of best practices for data security procedures could break the

barrier of IT to asset manager. Additionally, once definitions and governance procedures are established, the quality assurance process becomes more streamlined and gives better confidence to the decision makers.

Asset managers know the data they need, and the data collection methods have been identified. What is needed is guidance on how to use the available data collection methods to meet the needs of asset managers.

BIM standards need to account for the fact that we have less data on existing assets than newer assets. However, it is existing infrastructure that has the most needs.

3.2.4. Best Practices of Linking Required Planning/Performance Documents/Processes

Background: A State DOT Transportation Asset Management Plan (TAMP) documents the investment strategies and expected outcomes from various asset classes, starting with the bridges and pavement of the National Highway System. The State DOT TAMP does not replace any existing state transportation plan (e.g., LRTP, freight plan, operations plan, etc.) but does provide critical inputs to existing plans, linking capital and maintenance expenditures related to asset preservation.

At the same time that state DOTs were developing their TAMPs, states also implemented a performance-based planning and programming approach, which applies performance management principles to transportation system policy and investment decisions. Performance-based long range transportation plans, statewide transportation improvement programs (STIPs), metropolitan planning organization (MPO) TIPs, and other performance-based plans like state freight plans must define key goals and objectives and establish measures to analyze short-, medium, and long-term implementation progress.

This Synthesis should review the advancement of State DOTs and MPOs to implement performance-based planning and programming with the help of implementation plans like the TAMP and documented processes for planning, investing, and evaluating performance outcomes. The objective of this synthesis is to identify best practices from State DOTs of how to improve processes through required performance-based planning and programming document development and implementation.

3.2.5. Implementation of NCHRP 23-06: A Guide to Computation and Use of System Level Valuation of Transportation Assets

Background: Determining the value of a transportation organization's physical assets is important for both financial reporting and transportation asset management (TAM). In financial reporting, determining asset value is a fundamental step in

preparing a balance sheet for financial statements to inform regulators and investors. For TAM, presenting data on the value of physical assets, such as pavement, bridges, and facilities, communicates what an organization owns and what it must maintain. Furthermore, information about asset value and how it is changing can help establish how the organization is maintaining its asset inventory and helps support investment decisions.

Calculating asset value for TAM is not simply good practice; it is also required of state Departments of Transportation (DOT) by Federal regulations. Title 23 of the Code of Federal Regulations (CFR) Part 515 details requirements for State DOTs to develop a risk-based Transportation Asset Management Plan (TAMP). The TAMP must include a calculation of the value of National Highway System (NHS) pavement and bridges, as well as the cost to maintain asset value.

Recently NCHRP Project 23-06 was performed to develop guidance for calculating asset value to support TAM applications. This research resulted in the development of the Asset Valuation Guide. This document is intended as a companion publication to the Transportation Asset Management Guide published by AASHTO. The Guide is accompanied by a web tool with an online version of the guidance. The guidance was developed to provide immediate support to highway and transit agencies developing their 2022 TAMPs, and to provide continuing support for other TAM-related applications.

3.2.6. Socio-Economic Indicators in TAM Processes

Background: Investments in roadways have historically been focused on safety, mobility, and system preservation considerations. As our understanding of the impacts of roadway decisions mature, other factors such as socio-economic impact, sustainability, accountability, transparency, integrity, and innovation are increasing in importance by State Departments of Transportation (DOTs). Recently, strategic initiatives related to DEI are growing in importance and need to be considered in transportation investment planning. Advancing the understanding of DEI and other related indicators can help DOTs improve the impact of TAM investment decisions, especially to underserved communities. The objective of this research is to produce guidance on how DOTs can improve the use of DEI and other related indicators in TAM investment decision making processes.

3.2.7. Successful Practices for Managing Uncertainty: Lessons Learned from the Pandemic

Background: Among the many difficulties raised by COVID-19, the pandemic does have the potential of affecting asset management practices in diverse ways. On the one hand, reduced traffic might reduce road maintenance costs; on the other hand,

ordering more goods might increase truck traffic and thus increase deterioration. Even if deterioration were the same, the road agency would always have the option of utilizing a less expensive treatment alternative and thus reduce the capital needs and maintenance budget.

3.2.8. Synthesis on Advancing Technology in Asset Data Collection

Background: Emerging technologies hold the promise of transforming asset data collection for transportation asset management (TAM). Applications of these technologies include the use of drones for inspections, LiDAR field data collection, continuous monitoring of real-time sensor data, and more. Research is needed to address the adoption and practical application of these technologies and the rapid pace of technological advancement.

While the technology has been transforming, MAP-21 and the Fast Act jump started many agencies in attaining an inventory of infrastructure assets and transportation data. At the same time, accessibility and affordability to collect high volumes of asset inventory data, such as LiDAR point cloud data, present the problem of how agencies can visualize and manage such large amounts of data and integrate the many layers for each transportation asset management plan. Now that the need for such data is federally recognized, further research is needed to understand what the latest technologies for asset analysis can offer an agency as well as how frequently that information needs to be generated.

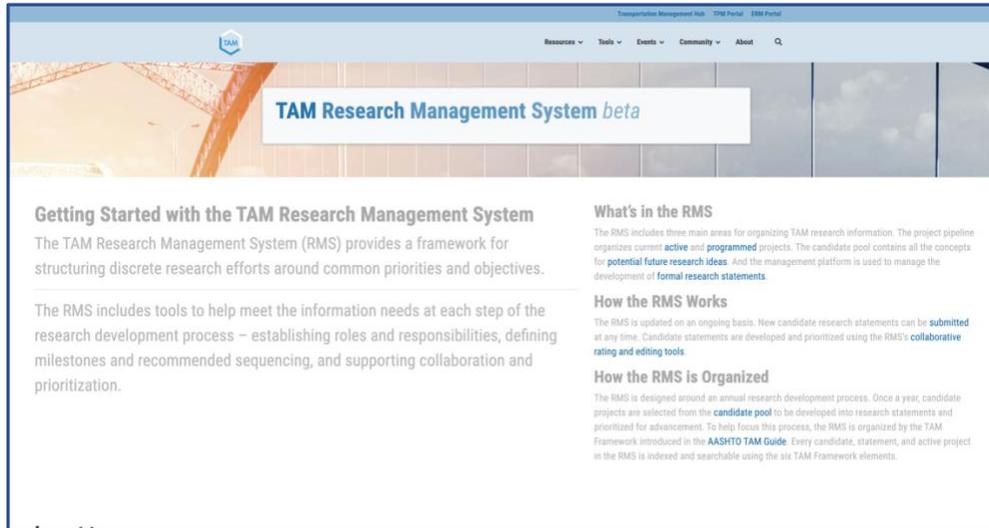
This synthesis should review the advancements of various data collection practices, document the level of utilization among DOTs, and speculate if/when/how the DOTs could utilize the technology at a cost-conscious level. Utilization would be centered around TAM practices, but current day examples can come from across industries. For example, using machine learning to extract asset locations, types, and condition for photo imagery or video logs from cell phones and/or collector applications.

4. TAM Research Management System – Introductory Guide

TAM Research Management System

Introductory Guide

This guide summarizes the primary ways for users to interact with the TAM Research Management System. The screenshots in this document serve as a guide for navigating the RMS.



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Site Users

There are three tiers of site users referenced in this guide:

- **Unregistered users.** These users can browse the RMS and make reports.
- **Registered users.** These users can leave comments on Research Candidates and Research Statements, and suggest new Research Candidates, in addition to all the capabilities of the unregistered user.
- **Administrative users.** Admins have a range of capabilities beyond those of standard users (*see Spotlight on Administrator Capabilities*)

Spotlight on Administrator Capabilities

The key capabilities of site administrators are described in this document. These include:

Add Research Statements directly to the system

- Admins can add new statements directly to the system, filling in all available information.
- Admins can see pending submissions from any user, and choose to add them to the system, edit them, or delete them

Edit and add information to Research Statements throughout the year

- Admins can use front-end forms to add more information about a Statement as the year progresses.

Rank a set of Research Statements under consideration

- Admins can add a numerical ranking to each Statement currently under consideration.
- These ranking are not binding, but rather serve as an aid to decision making

Advance Research Statements to be developed more robustly in future meetings

- At each step of the process, the admin can designate the set of Research Statements that will be discussed and developed further in the future.

Generate PDFs for Research Statement submittal in the format required by the Research and Innovation subcommittee

- Once the set of Research Statements has been narrowed to just those that will be submitted, admins will get a final opportunity to add and edit details.

Start a new research year, and connect existing candidates to the new year as Research Statements

- When Research Statements have been submitted, the admin can move the year forward
- The admin can peruse Research Candidates that are in the RMS but have not been submitted, and choose to advance them for consideration in the new year

Menu Navigation

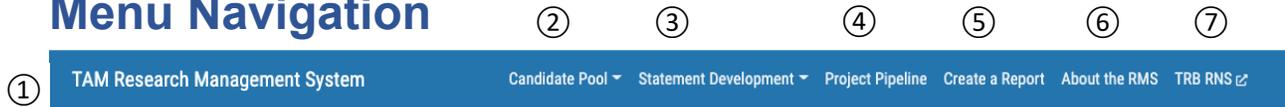


Figure 1. TAM RMS Menu

Main Menu

The RMS is navigated primarily through a persistent menu bar across the top of the screen.

① **Home link** TAM RMS link takes a user to the RMS homepage.

② **Candidate Pool Dropdown.** These links allow users to explore the current candidate pool and suggest new candidates to add to the RMS.

③ **Statement Development Dropdown.** Steps a user through the yearly development cycle. The year starts by using past projects and Candidate ideas as inspiration for the future projects. Once a list of ideas is created, the list is narrowed down over the course of four milestone meetings represented here by four Approval Steps.

④ **Project Pipeline.** A user can explore the active and programmed research projects.

⑤ **Create a Report.** A user can Create a Report of projects and candidates in the system.

⑥ **About the RMS.** A user can learn a bit about the RMS.

⑦ **TRB RNS.** We provide a link to the TRM RNS so users can see projects related to asset management currently in the Research Needs Statements database at TRB.

Candidate Pool

The page collects all research candidate statements that haven't yet been programmed as projects. In the left column, you can browse all the unprogrammed candidate statements, including statements from previous years. You can compare these to the right column, which highlights the year's research priorities, the current project pipeline, and completed research. Site administrators can select candidate statements for consideration in the next research year.

1 Filter Sidebar: A sidebar on the left containing a 'Keyword Search' input field, two sections of checkboxes for filtering candidates (related to and that will help), a section for filtering by timeline target, and 'User Login' and 'User Registration' links.

2 Candidates: A list of 13 'Short-Term Research Candidate Statement' cards, each with a title such as 'AI and Deterioration Modeling' and 'Application and Use of BIM to Support Data Governance Procedures for Transportation Agencies'.

3 Project Pipeline: A separate box on the right side of the interface.

4 User Login/Registration: A section at the bottom left of the sidebar with 'User Login' and 'User Registration' links.

5 Export Candidate Info to CSV: A blue button at the bottom of the main content area.

Main Menu

This view collects all newly entered, unranked Candidate Statements at the beginning of the year. It also collects Candidate Statements that were not chosen during the previous year.

1 Filter Sidebar. Users can narrow down the number of Candidate Statements shown using the parametric filter on the sidebar.

2 Candidates. The matching Candidate Statements are shown here.

3 Project Pipeline. A user can see the projects that are currently programmed and active by clicking the title to expand the card.

4 User Login/Registration. If a user is not already logged in, they can login here or register a new account.

5 Export. Any user can use this button to generate an Excel download of all the information for the set of Candidate Statements currently being considered.

RMS Snapshot

The screenshot shows the TAM Research Management System homepage. At the top, there is a navigation bar with the following items: TAM Research Management System, Candidate Pool, Statement Development, Project Pipeline, Create a Report, About the RMS, and TRB RMS. The main content is divided into two columns. The left column, labeled 'Statements For Advancement' (1), contains seven cards for Research Candidate Statements. Each card displays the title, funding source (NCHRP), and timeframe. The right column, labeled 'Project Pipeline' (2), is further divided into 'Programmed Projects' and 'Active Projects'. The 'Programmed Projects' section lists three projects with details on funding, start dates, and end dates. The 'Active Projects' section lists three projects with similar details.

Homepage

This page provides a snapshot of the current state of TAM research.

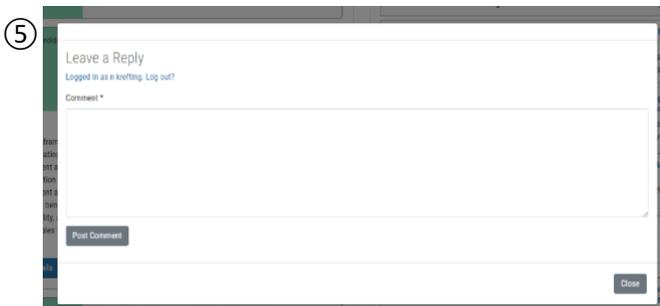
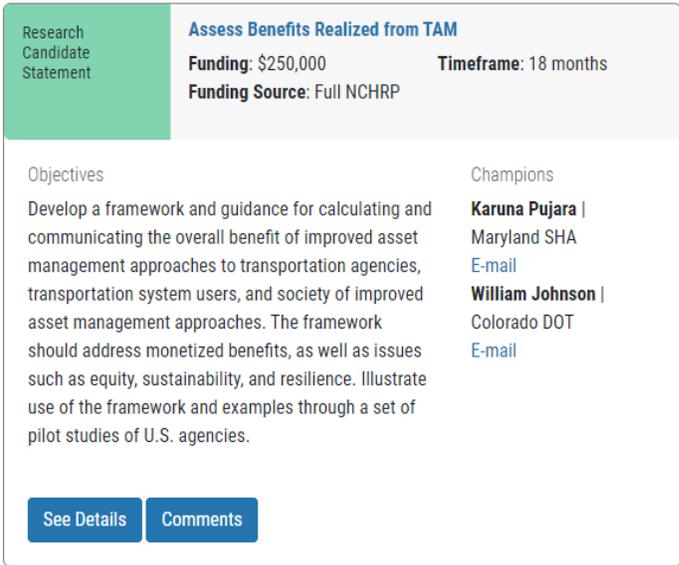
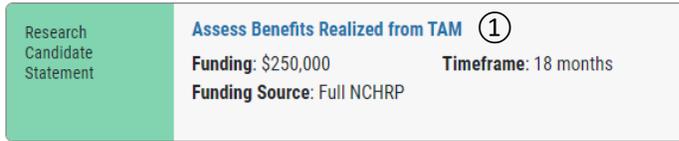
① **Statements for Advancement.** This section provides information cards about the Research Candidate Statements currently under consideration to submit in the next year. These cards show some basic information about Candidates. Clicking the title will expand the card to show more information.

② **Programmed Projects.** This section provides information cards about research projects that have been programmed.

③ **Active Projects.** This section provides information cards about research projects that are currently active.

Figure 2. TAM RMS Homepage

Research Candidate Card



Card Snapshots

Research objects like Candidate Statements and Projects are presented in these compact cards throughout the RMS.

① **Title.** The name of the Research Candidate. Clicking the title will reveal expanded info about the Candidate.

② **Basic Info.** Provides information about the funding, timeframe, and funding source of the Candidate Statement.

③ **Expanded Info.** Provides current research objectives and supporters of the research.

④ **See Details.** Displays a popup window with all information about the Candidate Statement.

⑤ **Comment Window.** Users can leave feedback on the Candidate Statement here. You will need a Registered User or Administrator account to leave a comment.

Figures 3-5. Research Card Closeups

Research Candidate Card (Admin View)

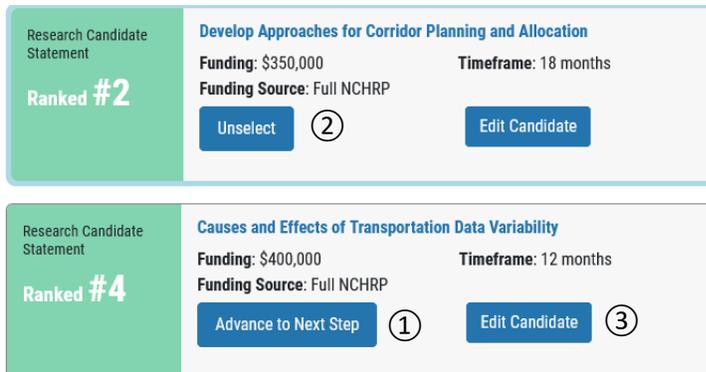


Figure 6. Research Card Close-Up (admin view)

Card Snapshot, cont.

Admins have a slightly different view of the Candidate Statement cards.

① **Advance to Next Step.** An admin can click this button to designate that this Candidate Statement should remain in consideration during the next milestone meeting.

② **Unselect.** An admin can reverse the advancement of a Candidate Statement using this button.

③ **Edit Candidate.** An admin can click this button to open a new tab containing a form they can use to edit information about the Candidate Statement.

Approval Steps (Admin View)

The screenshot displays the 'Research Candidates - Approval Step 1' interface. On the left, there are filters for 'Update Rankings' and 'Show candidates that are advanced to Step 2'. The main area shows 12 candidate cards, each with a 'Ranked' status, funding amount, and timeline. On the right, the 'Research Projects' section shows 12 project cards, each with a 'Programmed' status, funding amount, and timeline. The page is annotated with numbered circles 1 through 5, corresponding to the 'Approval Step View' text on the right.

Figure 8. TAM RMS Approval Step View

Approval Step View

At a series of milestone meetings throughout the year, the set of Candidate Statements gets narrowed down. Each of these milestones is represented in the RMS by an Approval Step page.

1 Candidates. A list of the cards for the Candidate Statements that are being considered in this approval step. These can be filtered just like in the

2 Update Rankings. This button brings up a popup window which an admin can use to assign a priority rank to each Candidate Statement.

3 Projects. A list of all currently programmed and active research projects.

4 Export. Any user can use this button to generate an Excel download of all the information for the set of Candidate Statements currently being considered.

5 Email. This popup provides a user with an email template with a link to the current page. This email can be used to invite people to give feedback on the current set of Candidate Statements.

Final Approval Step (Admin View)

Research Candidate Statement

Ranked

#1

Develop Approaches for Corridor Planning and Allocation

Funding: \$350,000 **Timeframe:** 18 months

Funding Source: Full NCHRP

Unselect
Edit Candidate

Save As Project
①

Final Approval Step Admin View

The admin is able to use a few extra functions on the final approval step page.

① **Save As Project.** This button will use the information from the Candidate Statement to make a new Research Project object.

② **Review Selections Button.** This button will open up a new tab showing all information from all Candidate Statements currently marked to be advanced to Research Projects.

Figure 9-10. TAM RMS Approval Step 4 Admin View

Edit Candidate Statements

Once you are done editing, you may close this tab.

Edit Statements

At any point in the process, an admin can edit the information in a Candidate Statement using these forms.

①

Title
Develop Approaches for Corridor Planning and Allocation

Research Funding: 350000 Research Period: 18 months

Background

- Asset conditions are typically determined currently in separate silos - leading to asset treatments that are applied on varied schedules by asset (pavement, bridges, culverts) even over the same corridor.
- Significant resources may be misallocated on treatments applied at the wrong time due to lack of coordinated corridor planning.
- Corridor planning can organize the asset treatments - while also looking at environmental issues, congestion, and safety
- There may be other issues such as operation needs in a corridor as well.
 - "Project delivery" can be achieved more efficiently because projects are organized into a corridor delivery strategy. Projects can be beefed off as funding is available

Literature Search Summary

- Basdi, Richard S; Anekaluz, Adjo A. Risk-Based Corridor Asset Management: Applying Multiattribute Utility Theory to Manage Multiple Assets. Transportation Research Record: Journal of the Transportation Research Board, Issue 2354, 2013, pp 95-106 -> href="https://trid.lib.org/view/1241973">https://trid.lib.org/view/1241973/
- Anderson, Scott A; Rivers, Benjamin S. Corridor Management: A Means to Elevate Understanding of Geotechnical Impacts on System Performance. Transportation Research Record: Journal of the Transportation Research Board, Issue 2349, 2013, pp 6-15 -> href="https://trid.lib.org/view/1241789">https://trid.lib.org/view/1241789/

Research Objectives

Develop guidance on an asset management/corridor planning process to prioritize and schedule project delivery for cost effectiveness while also considering mobility/accessibility issues, drainage, and more.

Urgency & Potential Benefits

Implementation Considerations

Submitter Name: _____ Submitter Email: _____

Submitter Affiliation: _____ Submitter Phone: _____

Notes

Save

① **Text Fields.** These fields can be edited directly through a text input field.

②

Note: Please save any changes made to the fields above before adding new authors, supporting organizations, or potential panel members to this statement.

Author(s) **Please add at least one author.**
Add author

Others Supporting Problem Statement

NMDOT
Fake Person
drl@mvcl.gle
2945645298 Remove This Supporter

AASHTO
The Person 2
email@internet.biz
1234567890 Remove This Supporter

AASHTO
The Person
email@internet.biz
1234567890 Remove This Supporter

Add supporter

Potential Panel Members **Please add at least one potential panel member.**
Add potential panel member

② **Add People.** Adding a person to a Statement requires filling in four fields at once. Clicking a button to add a person will bring up a separate four-field form to submit.

Leave a Reply

Logged in as nke1ting329ic. Log out?

Comment *

Post Comment

Figure 11. Edit Research Candidate form

Review Statements for Submittal

Please review the statements below and use the forms to ensure that all necessary fields are completed.

Develop Approaches for Corridor Planning and Allocation

1

Funding	500000	Research Period	18 months
Description	<p>*Award cost based on an initial assessment to verify a transportation-related problem, determine the need for a research project, and determine the project's scope and objectives.</p> <p>*Project objectives to be achieved through the project's research and development activities.</p> <p>*Project goals to be achieved through the project's research and development activities.</p> <p>*Project outcomes to be achieved through the project's research and development activities.</p> <p>*Project deliverables to be achieved through the project's research and development activities.</p> <p>*Project milestones to be achieved through the project's research and development activities.</p> <p>*Project risks to be identified through the project's research and development activities.</p> <p>*Project budget to be approved through the project's research and development activities.</p> <p>*Project timeline to be approved through the project's research and development activities.</p> <p>*Project report to be approved through the project's research and development activities.</p>		
Literature Search Summary	<p>*Award cost based on an initial assessment to verify a transportation-related problem, determine the need for a research project, and determine the project's scope and objectives.</p> <p>*Project objectives to be achieved through the project's research and development activities.</p> <p>*Project goals to be achieved through the project's research and development activities.</p> <p>*Project outcomes to be achieved through the project's research and development activities.</p> <p>*Project deliverables to be achieved through the project's research and development activities.</p> <p>*Project milestones to be achieved through the project's research and development activities.</p> <p>*Project risks to be identified through the project's research and development activities.</p> <p>*Project budget to be approved through the project's research and development activities.</p> <p>*Project timeline to be approved through the project's research and development activities.</p> <p>*Project report to be approved through the project's research and development activities.</p>		
Objectives	<p>Develop a plan for an active management corridor planning process to provide and address project to help to cost-effectively address a transportation-related problem.</p>		
Urgency and Potential Benefits	<p>2</p> <p>Please describe the urgency and potential benefits of the project.</p> <p>Edit urgency and potential benefits</p>		
Implementation Considerations	<p>Please describe the implementation considerations of the project.</p> <p>Edit implementation considerations</p>		
Author(s)	<p>Please add at least one author.</p> <p>Add author</p>		
Others Supporting Problem Statement	<p>INDOT New River 23404228 Review This Statement</p> <p>AASHTO The Project 1244101042 1244101042 Review This Statement</p> <p>AASHTO The Project 1244101042 1244101042 Review This Statement</p> <p>AASHTO The Project 1244101042 1244101042 Review This Statement</p>		
Potential Panel Members	<p>Please add at least one potential panel member.</p> <p>Add potential panel member</p>		
Person Submitting Statement	<p>Please add at least one user to the project team for the statement.</p> <p>Add person submitting the statement</p>		
Notes	<p>500000</p>		

Ready to submit this statement? Generate a PDF for submittal here. 3

Figure 12. Review Research Candidates

Review

Before submitting a set of Candidate Statements, admins are given this final editing screen to ensure all Candidate Statements contain all information required by the Research and Innovation subcommittee.

- 1 **Edit Fields.** Each field can be edited by clicking the Edit link next to the title of the field.
- 2 **Highlight Empty Fields.** If a field is empty, there is a reminder in red text that the field needs to be filled in.

3 **Link to Create PDF for Submittal.** Once all information is added, an admin can click this button for directions on creating a PDF to submit.

Urgency and Potential Benefits

Please describe the urgency and potential benefits of the project.

Edit urgency and potential benefits

4

Urgency and Potential Benefits

4 **Fill in Fields.** Clicking the Edit link will make an editable text field appear, which can be used to add or edit information in that field.

Potential Panel Members

Please add at least one potential panel member.

Add potential panel member

5

Panel Member Name

Panel Member Organization

Panel Member Phone Number

Panel Member Email

Submit

5 **Add Person.** Clicking an “add person” link will bring up a four-field form to add all the necessary information about that person.

Figures 13-14. Edit Research Candidate form close-ups

Create Report

1 Use the filters below to specify which candidate statements to include in your report.

Research Statements | **Projects**

Research Framework Element

- Asset Performance
- Information & Systems
- Monitoring & Adjustment
- Organization & People
- Resource Allocation
- TAM Strategy & Planning

Categories of Funding

- AASHTO Committee Support
- FHWA
- Full NCHRP
- Implementation
- Other CRP
- Pooled Fund/TSP
- Synthesis

Research Years

- 2015
- 2016
- 2019
- 2020
- 2021

Submit Reset

TAM Research Management System Candidate Pool Statement Development Project Pipeline Create a Report About the RMS TRB RNS

Here are your results. You can use the filters below to update the view, or [print the results](#).

Research Framework Element

- Asset Performance
- Information & Systems
- Monitoring & Adjustment
- Organization & People
- Resource Allocation
- TAM Strategy & Planning

Categories of Funding

- AASHTO Committee Support
- FHWA
- Full NCHRP
- Implementation
- Other CRP
- Pooled Fund/TSP
- Synthesis

Project Status

- Active
- Complete
- Programmed
- Proposed

Submit Reset

3 Print Your Results

Showing 12 projects and candidate statements.

2 Fix It, Sign It, or Close It: State of Good Repair in an Era of Budget Constraints

Research Project

Description

The condition of the transportation infrastructure in the United States is an issue of national importance. State Departments of Transportation (DOTs) and transit agencies are facing tough choices with limited finances. These transportation agencies are having to make decisions about how and when to keep the assets safely open to the public. Transportation agencies that are recipients of federal formula grant dollars may need the funding agency to be involved in any decision to repair the asset(s) or whether to improve, rebuild, or close them.

Research is needed on the legal ramifications to transportation agencies that are faced with deciding whether to repair, improve, or rebuild assets that are in poor repair.

Report

This page allows a user to see all Research Statements and Projects that match a set of parameters.

1 Filters & Submit. The user can use this set of parameters to narrow down the set of Candidates and Projects.

2 Matching Statements and Projects. All information about matching Statements and Projects is shown once the filters have been submitted.

3 Print. The print button will print up a print dialog. Results will print, one per page.

Figure 16-17. Research Report views

Suggest a New Candidate

TAM Research Management System Develop Candidates Create a Report Suggest a New Candidate About the RMS TRB RMS

Use the form below to suggest a new Research Candidate. Please fill in as much information as you can. Once you hit the Submit button, your Candidate will be reviewed and added to the pool of Candidate projects for the year.

①

Title

Description

Literature Search Summary

Objectives

Urgency and Potential Benefits

Implementation Considerations

Toggle Advanced Fields

② Note: Once this candidate has been added to the system, you will be able to add authors, potential panel members, supporting organizations, and the name of the submitter.

Submit

Suggest a New Candidate

Any user can fill out this form to suggest a new Candidate Statement to be added to the RMS.

① **Fields to Fill in.** A user can use these fields to enter information about their suggested Candidate Statement.

② **Note.** People can be added to a Statement by an admin once that Statement has been added to the system.

Figure 18. Submit a Candidate Form

5. TAM Strategic Action Plan Workshop – Summary

TAM Strategic Action Planning Workshop Summary

1. Introduction

Overview

The 2019 Transportation Asset Management (TAM) Strategic Planning Workshop was held on October 17-18, 2019 in Irvine, California. The purpose of the workshop was to support the development of a TAM strategic action plan defining a common agenda for advancing TAM knowledge and practice for the American Association of State Highway Transportation Officials (AASHTO) Committee on Performance-Based Management (CPBM) Subcommittee on Asset Management, in coordination with the Subcommittee's partners and stakeholders.

With close to 50 attendees representing more than 35 organizations, the discussions brought together many voices and perspectives – including representatives of AASHTO, the Transportation Research Board (TRB), the Federal Highway Administration (FHWA), the Federal Transit Administration (FTA), the American Public Transit Association (APTA) State of Good Repair (SGR) Working Group, and the Association of Metropolitan Planning Organizations (AMPO) – to help develop a long-term research strategy to coordinate and advance the state of practice in multi-modal transportation asset management. See Appendix E for the full roster of workshop attendees.

Workshop Organization

The workshop began at midday on October 17 with welcoming remarks from Tim Henkel (Minnesota DOT, CPBM Chair), Matt Haubrich (Iowa DOT, CPBM TAM Subcommittee Chair), Steve Gaj (FHWA), Alexandra Galanti (FTA), Matt Hardy (AASHTO), Elizabeth Lovinggood (APTA), and Larry Goldstein (TRB). At the outset of the workshop, participants worked collaboratively to develop goal statements establishing a shared vision for TAM advancement over a ten-year period. The results are summarized in Section 2 of this document.

Following the visioning exercise and a set of context-building presentations, an interactive polling session helped establish baseline and desired future maturity levels for a variety of key TAM capabilities and competencies, organized around the TAM Framework developed for the *AASHTO TAM Guide*. These results are presented in Appendix D. The day's activities concluded with a session devoted to developing a unified national vision statement for TAM. This statement, as revised on the workshop's second day, is presented in Section 2 of this document.

The workshop's second day opened with a small group exercise to identify and prioritize areas of improvement for national organizations that undertake or support TAM research. These results are summarized in Section 3 of this document and presented in full in Appendix C.

Workshop Flow



Figure 1. Workshop Flow

Next, building on the first day’s polling results, attendees participated in a whole-group activity to identify specific opportunities for TAM advancement. In this “fishbowl-style” activity, attendees delivered brief statements addressing a series of topics organized according to the AASHTO TAM Guide Framework. The results of this activity are included in Appendix B. The TAM Guide Framework is summarized in Section 4.

After lunch, participants worked in small groups to further define and prioritize the opportunities for TAM advancement identified through the previous whole-group activity. Following an additional prioritization exercise, the priority items were then developed into full action and research statements. Through the final workshop activities, 26 distinct action and research statements were developed, addressing the priority topics previously identified.

The day concluded with closing remarks from the workshop leadership team. The full workshop agenda is included as Appendix F.

Document Organization

This document presents the final results of the workshop and summarizes the key interim products and discussion points that informed the final set of action and research statements. The document is organized as follows:

- **Section 1. Introduction.** This section provides an introduction and overview of the workshop.
- **Section 2. TAM Vision.** The TAM vision developed through the activities of the workshop’s opening day defined a shared goal for asset management in the United States. The research and action statements –and other products of the workshop – were developed in recognition and support of this vision.

- **Section 3. Collaboration Across Agencies and Organizations.** The workshop included an activity to develop improvement actions targeting the national-level organizations that play a key role in setting a TAM research agenda and delivering TAM research. The results are summarized in this section.
- **Section 4. TAM Guide Framework.** The forthcoming revision of *The AASHTO TAM Guide* describes a framework for TAM composed of six areas critical to the daily application and advancement of TAM practice. This framework was used throughout the workshop to structure workshop activities and organize the resulting products. The framework is briefly described with respect to its six areas.
- **Section 5. Summary of Action and Research Statements.** The TAM Strategic Action Planning Workshop culminated with the development of specific, actionable research and action statements. The set of research statements and action statements is summarized in the document and presented in full in Appendix A. The statements are organized around the TAM Guide Framework to clarify and reinforce alignment around common needs and objectives.
- **Section 6. Next Steps.** A summary of next steps for the development of the TAM Strategic Action Plan.
- **Appendix A. Research and Action Statements.** The full set of research and action statements, condensed and edited for clarity, is included as an appendix.
- **Appendix B. Improvement Ideas.** The results of the workshop fishbowl exercise are presented in this section, organized according to the TAM Guide Framework.
- **Appendix C. Collaboration Across Agencies and Organizations.** This appendix includes the suggestions made to improve the collaboration between national agencies and organizations involved in TAM research.
- **Appendix D. Poll Results.** The results from the workshop polling exercises targeted at identifying baseline and future desired maturity levels are included in this appendix.
- **Appendix E. Workshop Attendees.** The full workshop attendee list is included in this appendix.
- **Appendix F. Workshop Agenda.** This appendix includes a copy of the full workshop agenda.

2. TAM Vision

Ahead of the TAM Strategic Planning Workshop, a practitioner survey was conducted addressing transportation agency needs in the area of asset management. Highlights from the results of the survey were presented at the outset of the workshop. These included summary results discussing respondents' anticipated drivers of advancement in TAM practice over the next ten years. The key drivers include:

- Better data, more automated
- Reduced burden on agencies
- Technological advancements
- More emphasis on data-driven decisions
- More of a systems approach
- More local agencies using TAM
- More assets included
- More integrated into practices
- Aligned with ISO/IAM

Notably, respondents indicated that underlying these changes, fundamental TAM concepts are not anticipated to undergo significant alteration.

At the outset of the workshop, participants worked in small groups to define goals and desired outcomes for TAM over that same ten-year timeframe. The results are condensed for clarity and summarized in this section.

Timeframe	Desired Outcome
2 Years	<ul style="list-style-type: none">• High level CEO instruction in what asset management can do for an organization and its long-term investment decisions• Embedded business process to endure across major leadership changes
3-5 Years	<ul style="list-style-type: none">• Achieve greater consistency within asset classes• Provide means for before-and-after assessments to determine effectiveness• Assign performance measures to additional assets• Fully integrate asset management, performance management, and risk management: Incorporation of risk into processes
5-10 Years	<ul style="list-style-type: none">• Define a multimodal framework for TAM that enables consistency in language and approach across modes• TAM processes, people, and assets are functioning systematically<ul style="list-style-type: none">– Transportation budgets and project scoping and programming are set based on outputs of TAM analyses– All job descriptions include TAM and TAM is integrated into all lines of business

- Increase the credibility of TAM practices to shift from reporting to investment decisions
 - Optimum lifecycle strategies can be utilized on all assets
 - Use 50% of management system recommendations
- Adopt meaningful performance measures that incorporate user experience
- Implement TAM culture throughout all levels of the agency
- Advance TAM practices towards international standards
- Provide asset owners with TAM tools for addressing critical challenges (e.g. how the competition for real estate assets can diminish the transportation network)
- Increase availability of human and information resources for TAM

Together, these initial activities and discussions provided critical context for the collaborative effort to define a vision statement for TAM. The resulting vision statement was generated through general discussion, selected by a poll of participants, and refined through further whole-group dialog to read:

Sound investments

That consider long-term needs

Data-driven decisions

That maximize performance of our transportation system

A sustainable and inclusive framework

That recognizes the changing world we live in

3. Collaboration Across Agencies and Organizations

National-level organizations — including TRB, AASHTO, FHWA, FTA, and others — play leading roles in establishing a TAM research agenda and delivering TAM research. At the mid-point of the workshop, participants worked in small groups to generate candidate improvement actions for supporting coordination and collaboration across these organizations and U.S. transportation agencies. The results are condensed for clarity and summarized in this section.

Committee Operations and Collaboration	Research Management & Coordination	Disseminating Research and Determining Impact
<ul style="list-style-type: none"> • Align TRB & AASHTO Structures with respect to Risk • Conduct Regional & National Peer Exchanges • Establish a Performance-Based Technical Services Program (TSP)* • Identify meaningful and active participation and engagement • Develop TAM onboarding resources • Support Committee Operations With additional small but meaningful roles • Expand coordination with international organizations • Develop a national database of TAM experts • Develop best practices for collaboration 	<ul style="list-style-type: none"> • Improve research roadmap linked to TRID • Conduct coordination meetings with similar committees to describe their research topics • Implement tools and processes to monitor research progress* • Establish a mechanism to coordinate monthly knowledge transfer on research coordination 	<ul style="list-style-type: none"> • Develop an Implementation Roadmap that tracks stages of readiness for research product implementation • Identify “product” readiness for current research efforts • Conduct strategic outreach, marketing awareness (both executive level and working level) • Highlight success stories (product reviews) • Invest in developing tools (link to TSP) • Establish standard criteria for TAM areas of impact and develop methods and measurements • Require projects to identify expected impact up front and incentivize implementation

In addition, three action statements developed in later workshop exercises largely recapitulate

or otherwise overlap with one or more of the organizational improvement actions listed above. These three action statements are summarized here and included in full in Appendix A.

- **AASHTO Transportation Performance Management Technical Service Program.** The AASHTO TPM Technical Service Program would provide cost effective services and timely information to assist state DOTs in delivering a performance-based transportation program within their agency
- **Monitoring and Implementing Research.** Derive greater value from AASHTO (CPBM) sponsored research through more intensive monitoring and implementation activities
- **Integrate the Research Process into Committee Structures (TRB-AASHTO-APTA-AMPO).** Align research needs statements and committee business processes with the TAM roadmap to ensure focused results, sharing ideas and research status to capitalize on synergies

4. TAM Framework

The forthcoming revision of *The AASHTO TAM Guide* describes a framework for TAM; this framework was used to structure workshop activities and organize the resulting products. The framework and its elements are described briefly in this section.

The AASHTO TAM Guide Framework groups the components of asset management into six basic areas. The four central areas in the figure capture the business processes involved in asset management. The remaining two areas detail factors that enable an improved asset management approach.



Figure 2. TAM Framework

TAM Strategy & Planning

An organization manages its assets not as an end in and of itself, but to achieve broader goals. These goals might include improving mobility, enabling economic growth, and reducing costs to travelers and the environment. It is important to place TAM in the context of an agency's broader goals and objectives, establish the scope of an agency's TAM effort, and determine how TAM integrates with the other activities performed by the agency. A Transportation Asset Management Plan (TAMP) helps establish this context, and preparing such a document is consistent with best practices in TAM. Additionally, U.S. State transportation departments and transit agencies are now required to develop TAMPs to comply with Federal requirements.

Asset Performance

This encompasses the set of processes involved in determining how to manage an asset over its entire life, from construction or acquisition to maintenance and finally asset replacement or disposal. It addresses how to measure the level of service an asset is achieving and targets to achieve, how to best maintain an asset, and how to model the condition and performance of an asset in the future.

Resource Allocation

Managing assets requires determining how to best deploy a set of finite resources, including staff time, equipment, and budgets for operating and capital expenses. This area includes the processes involved in making resource allocation decisions, both for a given asset class, and across multiple asset classes considering a range of different objectives and constraints. Also, it addresses the development of financial plans summarizing expected sources and uses of asset management funds. TAM financial planning takes a long-term view of resource allocation to support the delivery of strategies that address asset needs at all stages of their service lives.

Monitoring and Adjustment

Ideally an organization's approach to TAM and TAM-related decisions should be dynamic, with adjustments made in response to available data on asset conditions. This area includes processes related to measuring and monitoring asset performance, assessing risk, and making adjustments to investment decisions and business process to respond to changing conditions.

Information & Systems

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

Organization & People

All infrastructure-intensive organizations practice asset management in some manner. However, implementing a robust asset management approach incorporating best industry practices and a philosophy of continuous improvement requires having a robust organization and people with the correct mix of skills. Creating such an organization requires defining roles and responsibilities for TAM within an organization. Also, it is important to evaluate needed staff skills and to implement training programs to help existing staff improve their skillsets. Another important organizational factor is developing an approach for managing change within the organization to support a culture of continuous improvement.

5. Summary of Research and Action Statements

The TAM Strategic Action Planning Workshop concluded with the development of specific, actionable research and action statements. Participants worked individually and in small groups to draft detailed statements addressing, at a minimum, the objective, work steps, and desired outcome/products for each. These statements built on the identified needs and desired actions identified and iteratively refined through the preceding workshop activities.

The set of research statements and action statements is summarized in this section and presented in full in Appendix A. In total, 26 statements were developed. These are categorized using the TAM Guide Framework as shown below. Note that while several address multiple elements of the TAM Guide Framework, each statement is assigned to a single element. A 'General' category accounts for statements that are broadly cross-cutting.

In this section, the statements are presented using the following convention:

- **Research statements, which represent longer-term efforts, are shown in black text.**
- **Action statements, which address current implementation needs, are shown in blue text.**

TAM Strategy and Planning

- **Benefits Realized from TAM.** Conduct research to show quantifiable value and benefits of TAM to continue to promote and mature Asset Management practices
- **Synthesis of the Benefits of Transportation Asset Management.** Show cost benefits of TAM to further the “way to do business” for organizations
- **Connect with IAM Standards and Bodies (IPWEA and APWA).** Align TAM with ISO/international practice
- **Noteworthy Practices in Writing a Transportation Asset Management Plan.** Provide a framework where states can learn from peers and noteworthy references, incorporating elements of the structure, description, and approach as desired

Organization and People

- **Synthesize Best Practices for Internal Staff Development.** Synthesize best practices for workforce development and training in order to enhance the capabilities of a TAM team/staff or attract internal staff to become involved in TAM program/implementation
- **Engaging Stakeholders in TAM.** Develop communication tools designed to engage stakeholders in developing TAM strategies for various asset categories
- **Framework for Incorporating Change Management in TAM Implementation.** Develop a framework, recommended actions, and synthesis of noteworthy practices for agencies to use in incorporating change management strategies in TAM practice
- **Develop TAM Onboarding Procedure and Inspire Agency Leaders to Encourage Staff Participation.** Educate agency employees regarding existence, mission, opportunities for

involvement, and encourage participation by employees of the majority of US states and other agencies

- **Internal TAM Workforce Development Workshop.** Conduct a workshop to provide agencies with tools to enhance staff understanding and buy-in for TAM

Asset Performance

- **Catalog of Condition Assessment Protocols for All Asset Classes.** Document and provide examples of condition assessment for all types of assets
- **Revise Federal Measures and Metrics for Pavements.** Identify metrics that better reflect pavement failure mechanisms
- **Exploring the Possibility of Developing AASHTO Recommended Practice for TAM.** Provide guidance and examples on how to incorporate other asset classes into a TAMP
- **Alignment of Data Need with Federal Reporting Requirements.** Align disparate data needs for Federal planning and reporting

Resource Allocation

- **Develop Approaches for Corridor Planning and Allocation.** Organize a framework for corridor plans that can be used for better asset management and resource allocation
- **Capital Project Bundling to Improve Asset Performance.** Research effective corridor planning strategies that promote sustainable capital asset improvements that impact asset class performance as well as other performance areas

Monitoring and Adjustment

- **Develop Methods to Allow Agencies to Incorporate Quantitative Risk Assessment at Project and Network Level.** Allow risk and resilience to be on par with traditional performance measures
- **Identify Strategies for Making Adjustments Actively Based on Performance between TAMP Investments.** Ensure direct linkages between condition assessment, performance management, and project/program prioritization. Ensure investments are informed by changing performance information

Information and Systems

- **Data Governance Implementation Support.** Provide support to implement the practices and processes recommended through NCHRP 08-115, *Guidebook for Data and Information Systems for Transportation Asset Management*
- **Data Governance Guidebook.** Create knowledge throughout the TAM community on data governance
- **Training on Data Visualization with a Focus on TAM Communications.** Address challenges that TAM practitioners face in condensing TAM into understandable/enjoyable pieces for different audiences

General

- **Develop Detailed TAM Implementation Case Studies.** Identify and develop detailed case studies that document, in great detail, how a transportation agency implemented a TAM program
- **Develop Asset Management Student Exercises.** Integrate Asset Management into college-level courses to motivate/expose young professionals to TAM
- **TAM Student Challenge.** Motivate new graduates and non-traditional disciplines to work in asset management
- **AASHTO Transportation Performance Management Technical Service Program.** Provide cost effective services and timely information to assist state DOTs in delivering a performance-based transportation program within their agency
- **Monitoring and Implementing Research.** Derive greater value from AASHTO (CPBM) sponsored research through more intensive monitoring and implementation activities
- **Integrate the Research Process into Committee Structures (TRB-AASHTO-APTA-AMPO).** Align research needs statements and committee business processes with the TAM roadmap to ensure focused results, sharing ideas and research status to capitalize on synergies.

6. Next Steps

The material from the TAM Strategic Action Planning Workshop combined with the following information collected for this project will be used to draft a TAM Strategic Action Plan.

- Existing strategic plans from stakeholder organizations
- TAM community survey conducted for the workshop and next year's TRB TAM Conference
- FHWA TPM National Implementation Review survey results
- Summary of recently completed TAMPs
- Sources of TAM research and activities funding

The TAM Strategic Action Plan will be designed to guide AASHTO's Subcommittee on Asset Management and coordinate with the other TAM stakeholders. It will synthesize what has been learned from the previous tasks into a document that presents a draft strategic approach for the TAM community and a set of actions. It will take the insights and strategies from the workshop documentation and produce an attractive document that communicates clearly the TAM strategic direction and the priority actions and how they will be executed amongst the stakeholder groups in a collaborative and coordinated fashion.

A PowerPoint presentation will also be produced that includes key elements of the TAM Strategic Action Plan and a printable PDF of the summary document for workshop participants and other TAM leaders to use in their agencies and other venues. The goal is to have a draft of the TAM Strategic Action Plan before the TRB Annual Meeting so that an in-person discussion of it can occur at the meeting. After the TRB Annual Meeting, a web-based panel call will be scheduled and conducted to review the content and format.

Appendix A. Research and Action Statements

Research Statements

Data Governance Implementation Support

Objective

Provide support to implement the practices and processes recommended through NCHRP 08-115, *Guidebook for Data and Information Systems for Transportation Asset Management*.

Proposed Research Activities (work steps)

- Lead peer exchanges on data governance
- Identify and support pilot states in establishing a data governance structure or policy and document results in case studies
- Establish peer-to-peer support groups

Estimated Timeframe and Funding

- 2 years
- \$200K

Background/Related Research

- Synthesis 508 Data Management and Governance Practices
- NCHRP Report 920 Management and Use of Data for Transportation Performance Management: Guide for Practitioners
- NCHRP 08-115 Guidebook for Data and Information Systems for Transportation Asset Management

Capital Project Bundling to Improve Asset Performance

Objective

Research effective corridor planning strategies that promote sustainable capital asset improvements that impact asset class performance as well as other performance areas.

Proposed Research Activities (work steps)

- Literature review
- Survey states to determine what corridor planning and management tools are in use or under development. Document what is needed to develop and support tool development/implementation across DOTs
- Document supporting contracting procedures that facilitate the goal of corridor planning
- Develop case studies of leading states, alternatively a description of lessons learned could be advanced
- Identify necessary or critical data sources
- Identify and associate typical asset treatments with a particular performance measure
- Identify what assets are included in which asset class
- Quantify benefits and link to specific performance
- Define value of typical asset improvements

Desired Products

- State DOT survey of corridor planning and management tools
- Crosswalk of corridor management and planning tools for ease of development, implementation, and planning
- Preferred or recommended corridor management strategies
- Literature review

Related Research

- Purdue has done some interesting work on project bundling

Estimated Timeframe & Funding

- 2-3 years
- \$350K

Connect with College Courses

Objective

Integrate asset management into college-level courses to motivate/expose young professionals to asset management

Proposed Research Activities (work steps)

- Develop stand-alone, accessible to all, closed-ended problems applicable to college-level, senior-level, or graduate-level courses
- Gather real-world data sets/prepare for student consumption-use
- Prepare problem objectives
- Prepare results to assist with grading

Desired Products

- Multiple stand-alone asset management student exercises to facilitate integration of real-world asset management problems into curriculum

Related Research

- ITE course developed by Mike Kyte for Traffic Signal Modeling and Analysis

Estimated Timeframe and Funding

- 9-12 months
- \$50,000 with help from DOTs in Data Sets and Objectives

Background/Research Problem Statement

- MUST: A Hands-On Approach to Traffic Signal Timing Education

Synthesize Best Practices for Internal Staff Development

Objective

Synthesize best practices for workforce development and training in order to enhance the capabilities of your TAM team/staff or attract internal staff to become involved in TAM program/implementation

Proposed Research Activities (work steps)

- Survey
- Literature review
- Case studies
- Research into workforce development

Desired Products

- Best practices for internal training to enhance TAM capabilities
- Menu of training, organization structures and programs for agencies to choose from

Develop a Catalog of Condition Assessment Protocols for All Asset Classes

Objective

Document and provide examples of condition assessment for all types of assets

Proposed Research Activities (work steps)

- Synthesis of condition protocols for pavement and bridge in the context of asset management including emerging technologies and international practices
- Synthesis of conditional protocols for other asset classes
- Transit (revenue vehicles, signals/backcircuits, track, power [buses, trains], bike/ped), roadside, ITS, etc. including international practices
- Identify next steps — synergies, gaps, opportunities, best practices

Desired Products

- Catalog indexed by asset, technology, etc.
- Include frequency, sampling, QA/QC, cost range
- Opportunities and challenges for integration for TAM
- Catalog of examples/best practices

Related Research

- NCHRP Synthesis 531 Automated Pavement Condition Surveys
- NCHRP Document 259 (web-only) Guidelines to Improve the Quality of Element-Level Bridge Inspection Data
- NCHRP 08-36 Task 114 Transportation Asset Management for Ancillary Structures

Estimated Timeframe and Funding

- \$75K
- Year 1 - Two syntheses
- Year 2 - Next steps

Background/Research Problem Statement

- This project would support many issues related to asset performance and information and systems including:
 - Developing approaches and taxonomies for pedestrian and bike assets
 - Encouraging collection of data on multiple asset types

- Understanding different methods helps to ensure data meets the needs for decision making related to cross-asset tradeoffs, specific types of assets (e.g. narrow roads) and specific types of assets (e.g. bike/ped, transit, ITS); and is collected at the appropriate level of detail and frequency
- The syntheses serve as a foundation and then as an opportunity to build on the work and disseminate the results

Revise Federal Measures and Metrics for Pavements

Objective

Identify metrics that better reflect pavement failure mechanisms. Percentage of wheel path cracking particularly has been problematic; determine if it could be revised to provide more consistent results across pavement types (e.g. composite, concrete) and pavement widths (e.g. <12 ft.)

Proposed Research Activities (work steps)

- Poll states to quantify extent of issue with current TPM metrics, and alternative procedures states are using to determine failure by cracking
- Evaluate alternate methods of quantification
- Recommend revised metric
- Implement revised metric through FHWA final rule

Desired Products

- Revised Cracking Metric
- Updated HPMS Field Manual

Related Research

- Any prior research to establish current metrics

Estimated Timeframe and Funding

- 12 to 18 months

Background/Research Problem Statement

- Many, if not all, states are finding a discrepancy between pavement conditions as determined by the PM2 measures as compared to their internal, state-developed measures. This hampers the adoption of the PM2 cracking measure as a prioritization input and reporting tool. This results in a large discrepancy between state metric-determined network condition and federal metric-determined conditions. This creates confusion among the public, senior executive staff, and legislative bodies, along with non-DOT owners of NHS assets

Benefits Realized from TAM

Objective

Show value and benefits of TAM to continue to promote and mature Asset Management practices. Include corporations that perform private side concession modeling

Proposed Research Activities (work steps)

- Synthesis Based on TAM Guide Topics
- What decisions have improved business?
- How far has the bar moved?
- How did you do it?
- What drives the concession modeling approach and benefits from TAM?

Desired Products

- Models of business from concession modeling for state DOT's to put into practice
- Could this be a part of TAMP consistency review and/or TAMP

Related Research

- NCHRP Report 866 - (Project 20-100) Return on Investment in TAM System and Practices
- TCRP Research Report 198 The Relationship Between Transit Asset Condition and Service Quality

Estimated Timeframe and Funding

- 18 months
- \$250,000

Background/Research Problem Statement

- Agency leaders and stakeholders, including the public, are not seeing all the benefits and values of TAM

Engaging Stakeholders in TAM

Objective

To develop communication tools designed to engage stakeholders in developing TAM strategies for various asset categories

Proposed Research Activities (work steps)

- A synthesis of best practices used by various agencies to communicate successfully the importance and need of TAM.
- Note: APTA published two recommended practices in September 2019 on exactly this topic. The titles are 1) Building Internal Stakeholder Support for AM Program and 2) Communication and Coordination with External Stakeholders for TAM. They can be found at www.apta.com/standards

Desired Products

- Communication portfolio that allows asset owners/managers to draw on best practices from others to implement/improve TAM methodologies for a cross section of assets

Estimated Timeframe and Funding

- 24 months
- Could be funded by NCHRP/FHWA/FTA

Data Governance / NCHRP 08-115

Objective

- Already have NCHRP 08-115 (10/31/19)
- Evaluate FHWA data governance
- Recommend a top-down approach
- Data stewards roles and responsibilities
- Be a service

Proposed Research Activities (work steps)

- Peer Exchange/Pilot 5 States that are more developed in data and IS governance
- 5 observer states
- Don't start until data collected

Desired Products

- How-to-Guide

Develop Detailed TAM Implementation Case Studies

Objective

Identify and develop detailed case studies that document, in great detail, how a transportation agency implemented a TAM program.

Proposed Research Activities (work steps)

- Identify candidate case studies from existing TAMPs (highway and transit)
- Document keys to success, political climate, overarching information about the agency
- Develop case studies other agencies can use to help them do a similar implementation

Desired Products

- Detailed case studies

A Framework for Incorporating Change Management in TAM Implementation

Objective

To develop a framework and recommended actions for agencies to use in incorporating change management strategies in TAM practice

Proposed Research Activities (work steps)

- Literature review on change management frameworks and strategies
- Identify best/good practices in agencies (transportation or other)
- Develop a framework
- Specify/identify actions for how to implement the framework
- Pilot framework at a few agencies
- Present experience and how-to steps

Desired Products

- Framework and implementation action recommendations

Practices for Incorporating Change Management in TPM

Objective

To synthesize agency experience or strategies for incorporating change management in TAM planning and implementation. This could be NCHRP (DOTs) or TCRP (transit agencies) or both.

Proposed Research Activities (work steps)

- Literature review on change management strategies
- Survey of agencies and if they used any strategies (and which ones)
- Follow-up interview to develop case studies of practice
- ID gaps/opportunities

Desired Products

- Synthesis of state of practice with examples of good practice

Related Research

- NCHRP research on organizational structures

Estimated Timeframe and Funding

- 1yr - 1.5yrs

Background/Research Problem Statement

- There are several organization change management frameworks
- Few have been approved to transportation agencies and TAM
- There may be opportunity to enhance TAM implementation by first understanding what agencies have (or have not) done

Develop Methods to Allow Agencies to Incorporate Quantitative Risk Assessment at Project and Network Level

Objective

Allow risk and resilience to be on par with traditional performance measures

Proposed Research Activities (work steps)

- Fundamental, quantitative research models to understand how recognized threats (risks) affect assets (bridges, culverts, roadway, walls, etc.).
- What is expected performance?
- How vulnerable are assets to relevant threats?

Desired Products

- Models, methods, metrics for estimating rise/potential losses
- Models, methods, metrics for estimating resilience of highway systems

Related Research

- FHWA risk management lays out standard definitions

Estimated Timeframe and Funding

- Dependent on the number of threats and assets to be analyzed

Develop Approaches for Corridor Planning and Allocation

Objective

- Organize a framework for corridor plans that can be used for better asset management and resource allocation
- Asset conditions are determined currently in separate silos - leading to asset treatments that are on varied schedules (pavement, bridges, culverts). There may be other issues such as operation needs in a corridor as well.
- The objective of this study would be to identify a corridor planning process to align asset management within a corridor - along with any congestion issues, drainage, etc. in order to prioritize and schedule project delivery for cost effectiveness.

Proposed Research Activities (work steps)

- Identify steps for DOT
 - Asset inventory in corridor and proposed treatment schedule
 - Drainage issues
 - Traffic volume analysis/Transit?
 - Land use inventory and future land use
- Identify financial resources
- Identify possible project areas - Are needs larger than project budget?
 - Is this the best time to deliver the project?

Desired Products

- Document how-to guide steps for DOT
- Plan workshops for corridor planning in DOT/MPO
- Case studies targeting specific scenarios

Related Research

- Corridor plans that have brought together asset components
- NCDOT did 55 corridor plans recently

Estimated Timeframe and Funding

- 1 year

Background/Research Problem Statement

- Lots of money wasted on treatments at wrong time due to lack of planning a corridor.

- Planning can organize the asset treatments — while also looking at environmental issues, congestion, and safety
- “Project delivery” achieved more efficiently because projects are organized into a corridor delivery strategy. Projects can be peeled off as funding is available
- Public can be engaged all at once instead of multiple times for multiple projects.
- Minimize contractor costs

Action Statements

Identify Strategies for Making Adjustments Actively Based on Performance between Investments

Purpose

- Ensuring direct linkages between condition assessment, performance management, and project/program prioritization
- Providing greater and more defined cause and effect relationships between project types and mitigation measures
- Enable reasonable "apples-to-apples" comparisons between actions and change responses across states per each asset

Key Objectives

- Outline critical steps and decision points for investment adjustments
- Highlight example issues, benefits, and potential consequences for changes
- Identify optimum review schedules and communication protocols for changes needed/warranted
- Establish standardized and defensible benchmarking

Lead Entity

- AASHTO, AMPO

Other Contributors

- FHWA, FTA, DOTs, MPOs

Specific Steps

- Peer review to discuss potential thresholds and responses
- Surveys to account where actions have occurred and where not
- Conduct case studies to examine how and why adjustments occurred and what outcomes resulted
- Prepare new or updated coding/calculations for benchmarking tool

Desired Products

- Case studies
- Peer exchange report

- Policy guidance fact sheet
- Benchmarking Tool (updated from High Street consulting model)

Estimated Timeframe

- 2-3 years (prior to next TAMP development)

Exploring the Possibility of Developing AASHTO Recommended Practice for TAM

Purpose

- Other organizations develop recommended practices and procedures for their members: APTA has their "Recommended Practices"; IPWEA has their "Practice Notes." AASHTO CPBM should explore a similar approach to developing recommended practices.

Key Objectives

- States have asked for guidance and examples on how to incorporate other asset classes into their TAMPs or how to address other aspects of transportation planning in their TAMPs (e.g. future technologies and innovations). This action could lead to a new process where the CPBM committee/subcommittee develops recommended practices for and by agency peers.

Lead Entity

- AASHTO CPBM Subcommittee on AM

Estimated Timeframe

- Consider as part of broader TPM TSP

Develop TAM Onboarding Procedure and Inspire Agency Leaders to Encourage Staff Participation

Purpose

- Educate agency employees regarding existence, mission, opportunities for involvement, and encourage participation by employees of the majority of US states and other agencies (transit, MPOs, etc).

Key Objectives

- New employees have an awareness of existence and opportunities for involvement.
- Increase the size of the pool from which committee members and volunteers can be drawn.

Lead Entity

- AASHTO Asset Management Subcommittee

Other Contributors

- APTA, AMPO, TRB

Specific Steps

- Approach Step A
 - Directly connect with targeted senior leaders at subject organizations
 - Determine organizational culture/attitude toward participation
 - Inform of goals, promo materials available, and seek support and commitment to encourage agency personnel to participate
- Approach Step B
 - Research/prepare list (contacts) of HR leadership at target agencies
 - Prepare promotional materials, exhibits, videos, other communications tools geared toward target employed classes.
 - Accomplish distribution agreement to incorporate into agency HR processes where appropriate and practical

Desired Products

- Informational/promotional materials
- Contact summaries
- Rollup of any reasons for agency resistance

Estimated Timeframe

- Could be completed in six months to one year
- \$200K

Training on Data Visualization - Focus on Communicating TAM

Purpose

- Teach good practice in data visualization
- Develop library of examples (using materials developed during training)
- Get hands-on help crafting your TAM communications
- Address challenge that TAM practitioners face in condensing TAM into understandable/enjoyable pieces for different audiences

Key Objectives

- Improve/develop good practice for communicating TAM topics.

Lead Entity

- TRB Performance Management or Asset Management Committee or AASHTO/APTA

Specific Steps

- Have a workshop at annual TRB, Boston TAM TRB, or AASHTO/APTA meetings where participants send in ahead of time examples of their communication materials. First half of session is reviewing good practice, second half is applying good practice to refine actual materials. Ann K. Emery did a similar training for WMATA, WSSC, and others. It was well received.
- Suggest holding multiple sessions of this at a conference

Desired Products

- Data visualization guide (training materials)
- Library of examples

Estimated Timeframe

- ~\$10K cost for one session

Identify Strategies for Making Adjustments Based on Performance

Purpose

- Provide approaches to create a feedback loop to inform investment decisions.
- Provide strategies that demonstrate processes for using change in performance to modify project selection criteria or resource allocation.

Key Objectives

- Ensure investments are informed by changing performance information.
- Project development process has touch points to ensure the projects are appropriate, given updated performance

Other Contributors

- AASHTO/AMPO

Specific Steps

- Review project selection processes of 52 DOTs and Large MPOs
- Identify practices of using performance to adjust project selection process
- Identify case study DOT and/or MPO

Desired Products

- Case Studies
- Report Including Case Studies

Student Challenge

Purpose

- Motivate new graduates and non-traditional disciplines to work in asset management

Key Objectives

- Increase future workforce

Lead Entity

- AASHTO/TRB (ABC 40)/APTA/AMPO

Other Contributors

- FHWA

Specific Steps

- Develop student competition aligned with asset management annual meeting
- 1-2 sample databases/datasets (state DOT, MPO, Transit)
- Objectives/needs of student analysis
- Develop rules for competition
- Fund prize \$
- Establish oversight committee/panel
- Establish “judge” panel
- Advertise
- Publicize best projects (e.g. poster at TRB, invitation to attend TRB annual meeting or AM conference)

Desired Products

- Student competition
- Interest in TAM practices
- Improved pipeline of future leaders

Estimated Timeframe

- Approximately \$20,000 - \$50,000
- Ideally hold first competition in Boston 2020

Internal TAM Workforce Development Workshop

Purpose

- A workshop to provide agencies with tools to enhance staff understanding and buy-in for TAM

Key Objectives

- Share ideas around workforce development for TAM (both conceptual and in practice)
- Begin developing a plan for implementing the ideas showed in each participants' agency

Lead Entity

- TRB/AASHTO/APTA

Other Contributors

- AMPO

Specific Steps

- Presentation of a workforce development strategy/tool (e.g. rotation program, TAMbassadors, etc.)
- Participants develop a plan for what that would look like at their agency

AASHTO TPM Technical Service Program

Purpose

- The AASHTO TPM Technical Service Program provides cost effective services and timely information to assist state DOTs in delivering a performance-based transportation program within their agency. This would include asset management programs, risk management, organizational management, and system performance in emerging technologies.

Key Objectives

- Support member departments asset management efforts
- Develop resources related to developing and implementing transportation asset management plans:
 - Condition assessment techniques
 - Data governance
 - Etc.
- Bring together member departments to share experiences through webinars, conferences, and peer exchanges
- Develop/provide tools member departments can use
- Identify training opportunities
- Conduct key research and analysis

Lead Entity

- AASHTO Committee on Performance-based Management

Other Contributors

- Federal Highway Administration

Specific Steps

- Work with CPBM leadership to fully develop and define the TPM TSP concept
- Get approval of CPBM membership to offer the TSP
- Transition current TPM Pooled Fund to TSP model
- Encourage and market TSP to member states
- Execute TPM TSP program

Desired Products

- An ongoing technical service program that can support the state DOTs to implement a robust performance-based transportation program

Estimated Timeframe

- Initial set up and funding: 6 months
- Ongoing afterwards

Connect with IAM Standards and Bodies (IPWEA and APWA)

Purpose

- Create a closer connection between TAM and IAM by:
 - Working to have a transportation track at the IAM-US annual conference
 - Sponsoring IAM certification classes/tests
 - Incorporating links to IAM materials (anatomy, competency framework) on AASHTO/APTA website and in any trainings and advertising IAM-US local chapter meetings
 - Inviting IAM to have a table at the Boston TAM conference
 - Learning from American and international public work organizations

Key Objectives

- Align TAM with ISO/International practice
- Learn from other industries who are further along in their asset management journey
- Professionalize practice

Lead Entity

- AASHTO/APTA

Specific Steps

- Reach out to IAM conference organizers and ask to join planning committee/float idea of transportation track
- Invite to purchase a table at Boston TAM conference
- Reach out to internal/HQ of IAM to identify North-American based certified instructors. Learn process for AASHTO/APTA staff to become certified trainers
- Develop training calendar and advertise to members/committees
- Revise websites to add links to IAM materials and IPWEA, APWA
- Identify contacts at international and American public works and materials that could be disseminated to networks

Desired Products

- Library of international practice
- Networking opportunities
- Training/certification courses

Estimated Timeframe

- Most are 0 cost
- Training/getting certified as a trainer will cost \$

Integrate Research Process into Committee Structure (TRB-AASHTO-APTA-AMPO)

Purpose

- Ongoing status of research
- Sharing ideas and statuses of all the research to capitalize on synergy
- Align research needs statements and committee business with roadmap to ensure focused results

Key Objectives

- Change roadmap to support or something like it. Roadmap assumes we know where we are going and what the destination is
- Create a model of business practice that all committee structures can use

Lead Entity

- TRB

Other Contributors

- Leadership of AASHTO and AMPO and APTA

Monitoring and Implementing Research

Purpose

- To get more value out of AASHTO (CPBM) sponsored research through more intensive monitoring and implementation activities

Key Objectives

- Better research, better results

Lead Entity

- AASHTO

Other Contributors

- TRB, AMPO, APTA

Specific Steps

- Better define role of research monitor/panel membership
- Set expectations for AASHTO monitors and panel members from AASHTO agencies to follow through on implementation activities including projects under NCHRP 20-44 Moving Research into Practice

Desired Products

- Training on expectations for AASHTO members

Estimated Timeframe

- Immediate, no funding necessary

Alignment of Data Needs with Required Reporting

Purpose

- To align data needs of federal planning and reporting used for disparate needs. For example: FMIS federal improvement type codes do not help with reporting by TAM work types, but they could.

Key Objectives

- Assess required reports and plans to identify where similar data is/could be used.
- Identify system modifications/refinements
- Make logical changes

Lead Entity

- FHWA

Other Contributors

- AASHTO/DOTs

Desired Products

- Maximized Referential Integrity between Report/Plan Data Sets

Data Governance

Purpose

- Create knowledge throughout TAM community about data governance

Key Objectives

- Review states that have developed data governance plans
- Create a cookbook/guidelines

Lead Entity

Other Contributors

- NCHRP 08-115
- William Johnson

Specific Steps

- Self-assessment
- Organizational structural governance policies and procedures
- Identify people
- Define roles/responsibilities

Desired Products

- Guidebook to quickly implement a data governance process within your DOT

Estimated Timeframe

- 12 months

Best Practices in Writing the TAMP

Purpose

- Identify 3 case examples for each required section of the TAMP that the FHWA or reviewing agencies found particularly good. Organize a webinar, invite states to presentations on their section of the TAMP that has been identified as a really good example
- The same can be done for the compliance documentation

Key Objectives

- States can learn from peers and reference structure, description, and approach from these documents as they see applicable
- Disseminate information that FHWA believes is good

Lead Entity

- FHWA resource centers

Desired Products

- Webinar series (recorded)

Estimated Timeframe

- 12 months

Appendix B. Improvement Ideas

The results of the workshop fishbowl exercise are presented in this section, organized according to the TAM Guide Framework.

Strategy and Planning

- Incorporating consideration of climate adaptation - research to improve data collection related to infrastructure resilience and events
- Asset management plan development - demonstrate benefits of the plan
- Asset management plan development - add feedback loop to verify performance predictions, planned work
- Asset management plan implementation - focus on communicating best practices and encourage adoption of best practices
- Asset management plan development - start mapping recently completed research to TAMP requirements
- Asset management plan development - identify good practices from existing TAMPs - detail policy, data and process needed to incorporate these
- More cross-state collaboration concerning how to coordinate with MPOs and other stakeholders
- TAMP implementation - more explanation, communication regarding the purpose of a TAMP relative to other planning documents
- Assessing maturity - more specific criteria for assessment reflecting shared understanding of what constitutes "TAM Maturity" - perhaps update FHWA TAM maturity assessment tool
- MPO/DOT targets - address how to handle an MPOs' critical infrastructure - approach of having set MPO funding share may overlook this
- Develop approach for assessing degree of resiliency
- Encourage including other assets besides pavement and bridges in the TAMP to help encourage stakeholder engagement
- Encourage use of life cycle planning for other assets besides pavement and bridge to help calculate total cost of ownership
- Review TAMP improvements to identify common areas, research needs
- Document cases where states link performance plans to investments (financial plans) in their TAMP
- Research effective use of risk management in preparing a TAMP - ideally identify cases where consideration of risk impacted investments
- Identify lessons learned from TAMP development, e.g. what funding scenarios are needed
- Improve guidance for TAMP implementation to better address agencies of different sizes
- Change management process and tools for TAMP implementation
- 3rd party scorecard to evaluate executives on their ability to implement TAM

- Align different timelines for performance measure targets (4-year vs. 1-year vs. longer term)
- Consistency review - standardized approach for annual reporting of TAM achievements

Asset Performance

- Utilize data on environmental conditions and loading for pavement to improve pavement deterioration models
- Document approaches for measuring legal risk and liability associated with assets (e.g., case of curb ramps)
- Standardize condition assessment approach/taxonomy for pedestrian assets
- Improve access to maps, summaries of asset inventory and condition for assets crossing into multiple jurisdictions
- Research ways for approaching TAM at the corridor level incorporating historic data on the performance of multiple asset types along a corridor to integrate TAM concerns and encourage focus on other assets besides pavement and bridges
- Encourage collection of data on multiple types of assets
- Explore opportunities for data visualization beyond GIS
- Maintaining bike/ped infrastructure - develop guidance for how to assess condition and maintain leveraging international experience and low-cost approaches
- SHRP 2 assessment of different companies for collection of asset data - need to update assessment performed previously
- Develop tools for performing a modified gap analysis annually as part of a consistency review
- Develop standard approaches for life cycle planning for traffic and safety assets
- Develop standard language for addressing life cycle cost/life cycle planning concepts
- Aligning model and project inputs for life cycle planning
- Develop approaches for incorporating risk and resilience into life cycle planning including identification of need for identifying changes in performance requirements
- Asset condition assessment - review approach for collecting data for narrower roads
- Guidance for determining level of detail needed for asset data collection
- Guidance and common tools for condition assessment of transit assets (beyond facilities)
- Determine how best to measure conditions for transit wayside assets
- Treat data as an asset in TAMPs to encourage better consideration needs across modes
- Include ITS infrastructure in TAMPs
- For transit: allow for use of additional grants for addressing transit state of good repair
- Incorporate consideration of implications of embedded technology, issues related to obsolescence of assets considering life expectancy of software/technology.

Resource Allocation

- ❑ Develop cost models for predicting total cost to maintain assets at different condition levels to support budgeting
- ❑ Expand TAMP scope to include consideration of project delivery - may be realistic limits on what can be delivered
- ❑ Expand TAMP scope to include additional asset types to better consider cross-asset resource allocation tradeoffs and interdependency between assets.
- ❑ Asset valuation - improve approaches to facilitate comparisons of investments in different assets
- ❑ Document best practices for using asset value as a communication tool
- ❑ Improve alignment of resource allocation plans within an agency (e.g., through developing maintenance activity-based plans)
- ❑ Perform post-mortems to determine whether targeted resource allocation was achieved
- ❑ Develop guidance for communicating resource allocation tradeoffs to executives using a scenario-based approach
- ❑ Define analyses required to perform an assessment of the overall value/viability of a system
- ❑ Develop common language and improved models for cross-asset resource allocation
- ❑ Improve coordination of research results considering TAM is an area of continuous improvement
- ❑ Corridor planning - develop approaches for considering all of the assets in the corridor - and streamlining asset investments on a corridor
- ❑ Develop guidance for incorporation of multiple asset classes in project delivery
- ❑ Improve calculation of asset value as a tool for cross-asset, corridor-based approaches
- ❑ Asset valuation - plan for implementation of upcoming NCHRP research on this topic
- ❑ Document best practices for packaging asset improvements into larger projects (e.g., for transit SGR projects)

Monitoring and Adjustment

- Develop approaches for target monitoring better addressing uncertainty of predictive models - what are the risks and consequences of missing targets
- Adapt market research approaches to better define user perceptions of/expectations for the highway network
- Incorporate data on user expectations using handheld devices, other technologies
- Define approach for measuring behavior of boards/commissions
- Develop approaches for applying consideration of risk to specific TAM objectives
- Perform additional research on and summarize international best practices for risk management in TAM
- Communicating TAM results - define best practices for tailoring the message to different audiences
- Document approaches for achieving short-term improvement in communication, tools, process improvement
- Define best practices for using performance results to make adjustments
- Make link between TAM and operations
- Adapt marketing principles for use in communicating
- Develop approaches for better communicating importance of maintenance
- Setting performance targets for transit - need additional operational performance measures
- Define ride quality measure for transit
- Develop measures for communicating consequences of not achieving transit SGR
- Measure internal and external benefits of TAM
- Develop approaches for measuring overall economic benefit assets provide
- Develop tools for dynamically illustrating investment consequences
- Define best practices for relating investments to personal experience - making TAM investments more tangible to the public

Information and Systems

- Develop approaches for critical assessment of the potential benefits of new technology
- Research variability in asset condition data, and the implications of using a small number of measures for characterizing underlying asset conditions
- Improving data management, viewing data as an asset
- Documenting current/best practices in data integration
- Define best practices for BIM and its relationship to TAM
- Improving approaches for integrating and sharing asset data leveraging improved technologies in this area
- Identify skill sets required to leverage data collection, analysis and management opportunities
- Establish ownership of data and the degree to which asset data should be considered a public good
- Leverage research in BI and data governance for TAM
- Utilize emerging technologies to better assess risk in TAM
- Define best practices for utilization of integrated asset data for specific types of analyses (e.g., programming decisions, environmental justice analysis)
- Incorporate consideration of user needs for investment prioritization (e.g., evacuation routes, proximity to emergency facilities)

Organization and People

- Broaden TAM as a means for developing future leaders
- Define robust organizational structures that reduce cases where there are single points of failure
- Resource sharing/knowledge management - identify opportunities for sharing asset analyses/models across organizations
- Improve data governance approaches
- Develop executive training for TAM to increase awareness
- Synthesize practices regarding TAM organizational structure
- Develop resources for applying proven approaches for change management to TAM
- Communicate results from ongoing NCHRP research on workforce issues
- Improve communication of what TRB research is planned and ongoing
- Develop resources for relating different business areas to TAM (e.g., implications of TAM for freight)
- Improve resources for training students in TAM
- Define best practices/synthesize examples of application of strategic planning to improve organizations and outcomes

Appendix C. Coordinating National Organizations and Agencies

1. Committee Operations

Align TRB & AASHTO Structure (Risk)

What's Included

- Add a committee or sub-committee that addresses risk management

Why It's Needed

- Risk-based asset management is required by federal law
- AASHTO Reorganization includes risk

Desired Outcome

- Risk management included as a topic (focus) of TRB via a committee structure

Regional & National Peer Exchanges

What's Included

Peer exchanges within AASHTO regions to dig deeper in TAM implementation

- Look at organizational structure/culture methodologies
- Expand to national meetings grouping similar peers to dig deeper

Why It's Needed

- To enhance integration and sustain TAM within organizations
- Share experiences that are beyond tools and technical aspects of TAM

Desired Outcome

- Start regional peer exchanges
- Continue national peer exchanges
- Start with an initial topic that includes experience gained in developing the first TAMP, identifying what can help with next iteration

Establish a Performance-Based Technical Services Program

What's Included

- An AASHTO TSP that states pay into to develop resources, tools, information, etc. to improve and elevate performance-based management practices within their organizations

Why It's Needed

- Need to provide more support and resources to the state DOTs which cannot be funded through existing resources

Desired Outcome

- Peer-to-peer assessment program/opportunities for states to have smaller/more in-depth conversations on TAM priorities
- Technical resources and tools to improve performance management practices
- Sponsor/fund/develop conferences and regional meetings
- TAM help line
- State-to-state support line

Meaningful and Active Participation and Engagement

What's Included

Reach out to TAM leads to discuss:

- What would get them engaged
- Who else on their staff or in the industry should be engaged on committees
- How to reach out to states/agencies who are not engaged

(all committees should do this)

Why It's Needed

- Committees tend to hear from the same people/agencies and lack active participation from those on the committees or missing completely from the committee
- We need to understand why TAM people are not engaged in committees and whether the activities or actions the committees are putting out are helpful

Desired Outcome

- Robust committees with useful and inclusive activities to grow the peer-to-peer exchange of best practices and challenges

TAM Onboarding Resource

What's Included

- A communications and marketing pitch to entice active participation and awareness of volunteer opportunities for engagement

Why It's Needed

- Introduce organizations and resources to help current roles and future professional development
- Increase awareness of national resources, state of the practice, individual's role in industry

Desired Outcome

- Active participation by next generation of leaders

Committee Operations – Additional Small but Meaningful Roles

What's Included

- Create small roles such as liaisons, vice-chairs, etc. to break up tasks and expose additional folks to leadership roles (ABC40 / CPBM-AM)

Why It's Needed

- Important to provide volunteers with opportunities to get involved but at small-enough scale to as not to appear overwhelming

Desired Outcome

- Broaden participation and develop next generation of leaders

Expand Coordination with International Organizations

What's Included

- Develop formal and informal interactions between U.S. based committees and international organizations like international asset management

Why It's Needed

- As national organizations, TRB, AASHTO, and APTA are naturally focused on domestic needs and methods.

Desired Outcome

- Connections with international organizations that allow improved understanding of asset management standards, practices, and approaches

2. Coordination and Collaboration

Coordination & Collaboration

What's Included

- Develop a national database of TAM experts / asset owners
 - Federal agencies
 - DOTs
 - MPOs
 - Transit agencies
 - Locals
- Example MOUs / LPAs
- Stakeholder map
- Develop best practices for collaboration

Why It's Needed

- Need to include everyone in the conversation
- Understand the barriers for locals to participate in the TAM effort
- Need a more formal way to collaborate (MOU / LPA)
- Not always sure who to contact at all levels
- Establish more organized governance / protocols
- Encourage FHWA / FTA division leads to actively participate / educate

Desired Outcome

- Everyone collaborates and TAM works for everyone
- FHWA or a national organization like AMPO owns and maintains the database
- Incentivize local involvement
- Potential mechanism to elicit cross asset planning

3. Research Management

Determining Research Needs

What's Included

- Improve research roadmap

Why It's Needed

- No expiration date on ideas
- Not updated with funded/completed

Desired Outcome

- Tracking system (people or system) linked to TRiD

Generating Research Scopes

What's Included

- Generating research scopes
- Prioritization
- Selecting funding research (using all available funding sources)

Why It's Needed

- Redundant scopes, not coordinated with other committees
- Want to ensure most efficient use of funds
- Need to track research according to funding type

Desired Outcome

- A coordination meeting with similar committees describe their research topics (off the shelf research project needs) and vote on all projects, rated 1-5. (for states' SRR\$)

Monitoring Research Progress

What's Included

- Tools and process to monitor research progress

Why It's Needed

- Research takes longer than expected
- Some researchers good, some bad with respect to updating
- Moving fast: Scopes get resubmitted while research is being completed

Desired Outcome

- Projects in TRiD - % Deliverable
- Dashboard to show research project status
- AASHTO to review quarterly progress reports provided to TRB project committees
- AASHTO to update database with %\$, %time

Closing Research Projects

What's Included

- Tools and process to monitor research progress

Why It's Needed

- Finalization process takes too long (draft 2-3 months, editorial process)

Desired Outcome

- Continue to encourage draft submissions by contractor/researchers

4. Coordinating Research Projects

Research Coordination

What's Included

- Monthly knowledge transfer on research coordination
- Mechanism to coordinate
- Engage state research managers

Why It's Needed

- Need access to what has been done – how can we apply it to our problem

Desired Outcome

- Asset management research roundtable – meets 1-2 times per year
 - Coordinate efforts
 - TRB Annual Meeting
 - TAM Conference
- ETG
- UTC – is there a primary UTC for AM
- AASHTO will play a key coordinating role
- Communication needs to be better for projects

5. Disseminating Research Products

Research Dissemination

What's Included

- Implementation Roadmap – tracks stage of implementation readiness for research products
- ID “product” readiness for current research efforts
- Strategic outreach, marketing awareness
 - Executive level; working level
- Highlighting success stories (product reviews)
- Investing in developing tools (TSP)
- More than methodology is needed to put into practice

Why It's Needed

- Because we need to achieve our new ‘vision’
- Address Gaps
 - Research without implementation is ineffective

Desired Outcome

- Faster implementation of research products
- Capitalize on the value of prior and ongoing research

6. Determining Research Impact

Measuring Research Impact

What's Included

- Identify upfront what impact will be:
 - Establish standard criteria for TAM areas of impact
 - National goals
 - Strategic measures for TAM guidebook
 - Target audience
 - Require projects to identify expected impact up front
 - using RFP
 - Develop methods and measurements
 - Dissemination measurement: # of downloads / hits.
 - Behavior change measurement: send a follow up survey
 - Incentivize implementation
 - Withhold 5% of research funds until proven results
- Theory of change

	Complete research according to objective	Disseminate research	Behavior change	TAM goals	National goals
Measure	Scope, schedule, budget	# downloads, # views	Survey those who download the research	Progress towards TAM targets	...
Who Measures	Organization hosting the research	Organization hosting the research	Organization hosting the research	AASHTO	...

Why It's Needed

- Ensure research is advancing industry to meet goals and vision

Desired Outcome

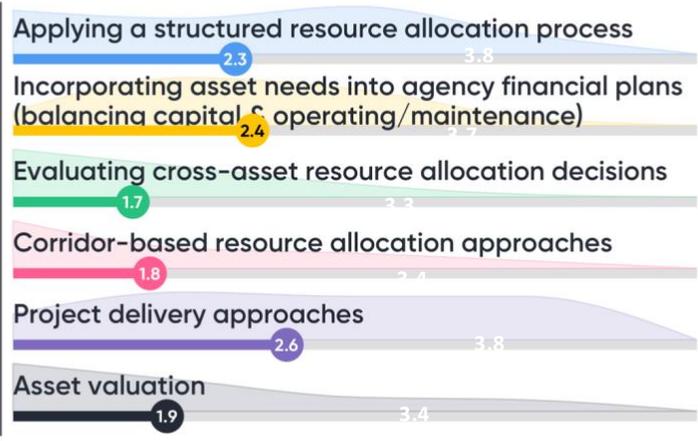
- TAM Guidebook targets are met; especially for areas that need research

Appendix D. Poll Results

Polling exercise results showing the current national baseline and 5-year goal (0-5 scale).



Resource Allocation



- Research & implementation opportunity
- Research & implementation opportunity
- Research opportunity
- Research opportunity
- Research & implementation opportunity
- Research opportunity

Monitoring and Adjustment

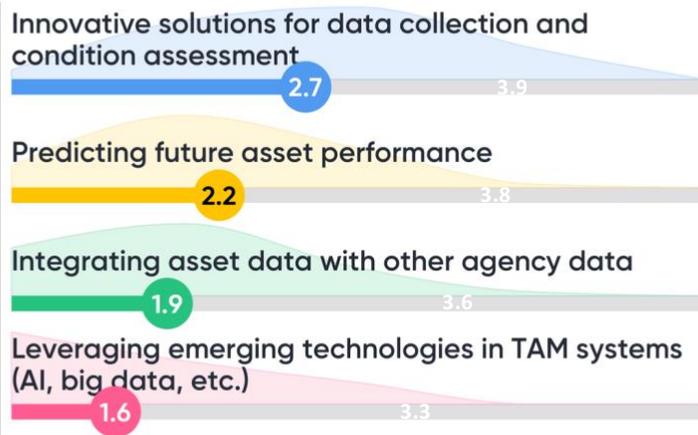
5-Year Goal



Primary Opportunities for Action

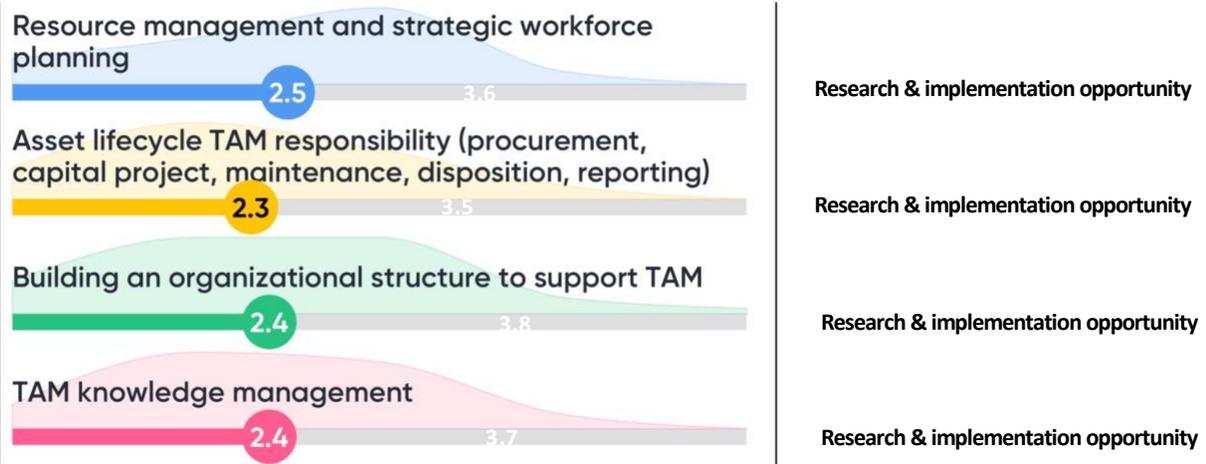
- Implementation support opportunity
- Research & implementation opportunity
- Research opportunity
- Research opportunity

Information and Systems



- Research & implementation opportunity
- Research & implementation opportunity
- Research opportunity
- Research opportunity

Organization and People



6. Next Steps

6.1. Overview

This section presents next steps for extending the NCHRP Project 20-123(01) research products after the conclusion of the project. The TAM Strategic Action Plan developed through the 2019 workshop was updated at the conclusion of the project to reflect recent progress and priorities. The plan has been developed such that it can easily be updated on a regular basis as ongoing initiatives are completed and new priorities emerge. The following section addresses the ongoing stewardship of the TAM Research Management System and the inclusion of additional features outside the scope of this initial development effort

6.2. Website Stewardship

The AASHTO CPBM TAM Subcommittee has agreed to take the lead in disseminating the products of this research and stewarding the use of the products. At the conclusion of NCHRP Project 20-123(01), the hosting and administration of the RMS will be transferred to AASHTO. This transferal can be effected immediately upon the formal conclusion of the project, based on the priorities of AASHTO CPBM. In order to support this capability, the RMS has been developed and is currently maintained as a web application integrated with the AASHTO TAM Portal. All files necessary for the ongoing maintenance of the resource access platform are currently collected online as part of the TAM Portal.

The RMS and each of its key components have been designed to be easily maintained and updated by AASHTO. The introductory guide included in this report provides instructions on maintenance and upkeep and is also available directly via the site. These instructions have been drafted in a clear style and at a level of detail sufficient to ensure that site maintenance can be managed by non-technical staff, as appropriate.

Ongoing maintenance will help ensure the site kept is in good working order and that the contents of the site remain relevant, accurate, and up-to-date. Equally important to achieving this goal are efforts to promote the site to the DOT community. Whether lead by AASHTO TAM Subcommittee, TRB TAM Committee, AASHTO staff, or project team members, such effort could include: updates and calls for submissions at relevant committee meetings (e.g. AASHTO CPBM, TRB Asset Management Committee); outreach via established mailing lists (e.g. TPM Pooled Fund, CPBM); and more targeted email outreach to practitioners who have previously submitted a research topic.

Once the ongoing stewardship model is well established the resource access platform will require minimal maintenance. However, the value to practitioners of the RMS will increase as research concepts are added and the range of available research concepts is expanded. Because the RMS is a database-driven web application, it is possible to load additional research concepts and candidates with no system configuration, using a simple graphical interface. This option is available to any site user with log-in access.

6.2.1. Additional Features

One limitation of the RMS is that the system is only configured to support the planning and tracking of asset management-related research. However, many of the key stakeholders who support this process share responsibility for research development in the areas of performance management, risk management, and/or other closely-related topic areas. Furthermore, individual research projects may be developed jointly by two or more CPBM subcommittees or work groups. While some initial steps have been taken to allow the RMS to support a more holistic view of the research supported by AASHTO CPBM and its subcommittees, fully supporting this functionality would require an additional development effort.