AASHTO COMMITTEE ON PERFORMANCE-BASED MANAGEMENT

Research Roadmap

2026

Transportation Asset Management

Contents

TAM Scope

Transportation Asset Management (TAM)

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

Focus. The TAM subcommittee helps improve the state-of-the-practice of asset management in STAs. This helps them to optimize resources by utilizing performance-based goals and measures for operation, preservation, and improvement of their transportation systems.

TAM Research Themes and Needs

Transportation Asset Management (TAM)

A. **TAM Performance Measurement.** Research to develop and implement improved measures of asset condition and performance.

B. **Resource Allocation and Tradeoff Analysis.** Research to improve agencies' ability to make investment decisions that balance asset condition or state of good repair with safety, resilience, congestion, and other considerations.

C. **Asset Lifecycle Management.** Research to inform development and evaluation of life cycle treatment strategies for different asset classes.

D. **TAM Data and Information Systems.** Research to advance use of available data sources and improve information systems supporting TAM decision making.

E. **TAM Implementation and Business Integration.** Research to develop guidance on integrating TAM with related business processes and ensuring effective and sustained implementation of TAM practices.

F. **TAM Communication and Collaboration.** Research to identify effective techniques for communicating about TAM and improve methods for engaging internal and external stakeholders within TAM processes.

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Transportation Asset Management (TAM) Future Research Needs

Research Need	RRM Track	Collaborators
A. TAM Performance Measurement Research to develop and implement improved measures of asset condition and performance		
A1. Improve **national pavement performance** measures • Identify new national pavement measures that have greater value for agency-level decision making • *Build on results of NCHRP 08-168-Analysis and Assessment of the National Performance Management Data (2026)*	PM	AASHTO CPBM P&R TRB AQB13, AKN19
A2. Improve **national bridge performance** measures • Adjust based on changes to the National Bridge Inventory (NBI) • *Build on results of NCHRP 08-168-Analysis and Assessment of the National Performance Management Data (2026)*	PM	AASHTO CPBM P&R TRB AQB13, TRB AKH14
A3. Improve **pavement safety performance** measures • Improve network-level pavement friction measures • *Build on results of NCHRP 10-98-Protocols for Network-Level Macrotexture Measurement (2020)* • *Build on results of NCHRP Synthesis 20-05/Topic 56-17-Friction Management Program Practices to meet Safety and Pavement Performance (2024)*	PM	AASHTO COMP TRB AQB13, AKN19
A4. Improve network-level **pavement structural capacity** measures • Develop improved network-level measures that measure pavement strength or structural capacity • *Build on results of TPF-5(385) Pavement Structural Evaluation with Traffic Speed Deflection Devices (2024)*	PM	AASHTO COMP TRB AQB13, AKN19
A5. Improve **bridge structural capacity** measures • Develop improved measures for structural capacity, taking advantage of embedded sensor data to monitor concrete and steel deterioration, and fiber optic cables to assess axial strain patterns	PM	AASHTO COBS, TRB AQB13, AKH14
A6. Improve **geotechnical/ foundational asset structural condition** measures • Develop measures based on Non-Destructive Evaluation (NDE) for Sign and Mast Arm Foundations • *Build on results of NCHRP 20-126(03) - Advancing Practices of In Situ Nondestructive Evaluation of Highway System Asset Foundational Condition and Capability (2022)*	PM	AASHTO COMP TRB AQB13, AKH17

Research Need	RRM Track	Collaborators
A7. Provide **guidance** for agencies on selection and implementation of **asset condition assessment protocols** for different types of ancillary assets • Note: may be covered by the recent problem statement related to ancillary assets • Consider providing a "catalog" of methods for each asset type • *Build on results of NCHRP Synthesis 20-05,Topic 55-19 - Documenting the State of Practice in Managing Ancillary Transportation Assets (2023)* • *Build on results of NCHRP 20-05, Topic 54-06 - Ancillary Asset Data Stewardship and Data Models (2023)*	SE	TRB AQB13
B. Resource Allocation and Tradeoff Analysis Research to improve agencies' ability to make investment decisions that balance asset condition or state of good repair with safety, resilience, congestion, and other considerations.		
B1. Improve methodologies and practices to inform performance-based **program-level resource allocation** • Improve methods to quantify the benefits of asset investments to support cross-asset prioritization and benefit–cost analysis • Explore use of advanced computing/AI to optimize resource allocation (through generating and analyzing an expanded set of solutions) • Quantify the level of effort required for cross-asset resource allocation and identify ways to cut down on the amount of effort needed • Track outcomes from agency implementation of cross-asset resource allocation (quantifiable benefits, performance improvements, public perceptions) • *Build on results of NCHRP 08-103-Implementing NCHRP Report 806: Guide to Cross-Asset Resource Allocation and the Impact on Transportation System Performance (2018)*	DM	CPBM-Cross-Cutting TRB AQB13
B2. Improve methodologies and practices to inform performance-based **project prioritization and selection** • Develop new project scoping approaches to better address multiple asset classes and objectives. • Develop analytical methods for optimizing a portfolio of projects that expand approaches available to decision makers beyond the Analytical Hierarchical Process (AHP) and Data Envelopment Analysis (DEA) • *Build on results **of** NCHRP 08-103-Implementing NCHRP Report 806: Guide to Cross-Asset Resource Allocation and the Impact on Transportation System Performance (2018)*	DM	CPBM-Cross-Cutting TRB AQB13

Research Need	RRM Track	Collaborators
B3. Advance implementation of methodologies and practices for i**ntegrating risk and resilience considerations** into resource allocation decisions • *Build on results of NCHRP 23-32 Transportation Asset Risk and Resilience (2026)* • *Build on results of NCHRP 23-24 Methods to Allow Agencies to Incorporate Quantitative Risk Assessment at Project and Network Level (2025)*	DM	CPBM-Cross-Cutting TRB AQB13
C. Asset Lifecycle Management Research to inform development and evaluation of life cycle treatment strategies for different asset classes		
C1. Improve methodologies and practices for **life cycle management of different asset classes** • Consider capital and maintenance needs • Identify critical data elements to inform life cycle strategies for different asset classes • Consider how to account for funding limitations and project delays in applying a life cycle treatment strategy • Consider future changes to maintenance needs and asset service lives due to vehicle fleet changes and CAV technology implementation. • Demonstrate practical approaches to integrate risk and resilience within life cycle planning • *Build on results of NCHRP 19-25 Funding Needs for Maintenance and Preservation of Transportation Assets (2027)* • *Build on results of NCHRP 23-32 Transportation Asset Risk and Resilience (2026)* • *Build on results of NCHRP 02-26 Implementation of Life-Cycle Planning Analysis in a Transportation Asset Management Framework (2022)*	DM	TRB AQB13

Research Need	RRM Track	Collaborators
C2. Improve measures and methods for **evaluating and comparing different life cycle management strategies** • Advance use of life cycle and financial performance measures such as Remaining Service Life, Asset Sustainability Ratio, Cost Accrual Ratio • Compile and share information on methods for calculating maintenance backlog for different asset classes • Compile and share information on cost savings from early intervention strategies for different asset classes • *Build on results of FHWA-HRT-23-102-Development of Next-Generation Pavement Performance Measures and Asset Management Methodologies To Support MAP-21 Performance Management Objectives (2024)*	PM	TRB AQB13
C3. Advance practical application of **life cycle cost and asset value computation** methods. • Develop improved techniques for decision making on asset treatments that better account for uncertainty in funding, asset condition, and other factors • Explore the Real Options Valuation (ROV) approach for integrating uncertainty • *Build on results of NCHRP 20-44(46) - Implementing the Asset Valuation Guide Developed Through NCHRP Project 23-06 (2025)* • *Build on results of NCHRP 23-06 - A Guide to Computation and Use of System Level Valuation of Transportation Assets (2021)*	PM	TRB AQB13

Research Need	RRM Track	Collaborators
D. TAM Data and Information Systems Research to advance use of available data sources and improve information systems supporting TAM decision making		
D1. Provide guidance on **leveraging newer technologies for asset data collection and work tracking** • Consider technologies appropriate for different asset classes • Cover AI/machine learning techniques that facilitate data collection and processing • Cover use of mobile digital devices, LiDAR, RFID, GPR, Infrared, UAV/UAS, other sensing technologies • Cover collection frequency, granularity, and visualization of results • Cover costs and implementation requirements • Incorporate case studies of how agencies have managed and used "big data" for TAM • *Build on results of NCHRP 23-41 - Using Emerging and Established Technologies for Asset Management: A Guide (2027)* • *Build on results of Synthesis 20-05/Topic 55-02 - Practices for Collecting, Managing, and Using Light Detection and Ranging (LiDAR) Data (2025)*	PM	TRB AQB13
D2. Provide guidance on **coordinating asset data collection and management across state and local transportation agencies** • Cover data standards, data sharing methods, role of data governance • *Build on results of NCHRP Project 08-115 - Guidebook for Data and Information Systems for Transportation Asset Management (2022)* • *Build on results of NCHRP Synthesis 20-05/Topic 51-05 - Collaborative Practices for Performance-Based Asset Management Between State DOTs and MPOs (2021)*	OC	TRB AQB13
D3. Provide guidance and models for **data visualization** in support of TAM • Cover "big data" visualization • *Build on results of NCHRP 08-167 - Guide for Creating Effective Transportation Visualizations (2026)* • *Build on results of NCHRP Synthesis 20-05/Topic 52-16 - Visualization of Highway Performance Measures (2021)*	PM	AASHTO CDMA TRB AED14

Research Need	RRM Track	Collaborators
D4. Advance methods to improve accuracy and use of **treatment unit cost information** within asset management systems • Advance methods for quantifying direct and indirect treatment costs • Advance methods for analyzing impacts of unit cost changes on capital program costs • Consider use of AI techniques for improvements to cost modeling • *Build on results of NCHRP 23-08 - A Guide for Incorporating Maintenance Costs into a Transportation Asset Management Plan (2022)*	DM	TRB AQB13
D5. Advance methods to improve accuracy and use of **asset deterioration models and service lives** within asset management systems • Improve methods for updating models based on condition measurements • Improve methods for identifying model sensitivity to missing data – and for mitigating impacts of data limitations • Advance use of AI techniques for predictive modeling of deterioration • *Build on results of NCHRP 23-50 - Using Artificial Intelligence to Enhance Transportation Data Quality (2028)*	DM	TRB AQB13
D6. Develop approaches to extending asset management system capabilities to **recommend specific projects** based on individual asset/section treatment recommendations • Improve capabilities to recommend projects with multiple assets	DM	TRB AQB13
D7. Develop technical and institutional approaches to pursuing **asset data standardization for integration within a BIM-for-Infrastructure framework** • *Build on results of NCHRP Synthesis 20-05/Topic 54-06 - Ancillary Asset Data Stewardship and Data Models (2023)*	OC	AASHTO COD TRB AQB13
D8. Support DOT **implementation of data and information system improvements** for TAM • Share assessment, governance, and improvement techniques covered in NCHRP Report 956 • *Build on results of NCHRP Project 08-115 - Guidebook for Data and Information Systems for Transportation Asset Management (2022)*	SE	TRB AQB13

Research Need	RRM Track	Collaborators
E. TAM Implementation and Business Integration Research to develop guidance on integrating TAM with related business processes and ensuring effective and sustained implementation of TAM practices.		
E1. Provide guidance on **improving and sustaining TAM expertise and practices** through workforce transitions and leadership changes • Consider culture change, succession management, and workforce development • Identify strategies to improve agency readiness and capacity to leverage AI techniques for application within asset management • Note: can be addressed through syntheses and research-funded peer exchanges as opposed to full NCHRP studies • *Build on results of NCHRP 23-42 - Identifying Curriculum Needs for Workforce Development in Transportation Asset Management (2027)*	OC	AASHTO CKM, CHR TRB AQB12, AQB13
E2. Share lessons learned about TAM **implementation success factors** • Consider organizational and cultural factors • Note: can be addressed through syntheses and research-funded peer exchanges as opposed to full NCHRP studies	SE	AASHTO CPBM-OE TRB AQB13
E3. Provide guidance on how to **integrate TAM with planning and programming processes** • Consider multiple objectives (mobility, safety, resiliency, etc.) • *Build on results of NCHRP 23-53 - Guide to Integrating Transportation Asset Management, Planning, and Programming (2029)*	DM	AASHTO COP TRB AQB13
E4. Provide guidance on how to **integrate TAM with transportation systems management and operations (TSMO)** practices • Consider how to integrate M&O needs into capital planning processes for different assets • *Build on results of NCHRP 08-138 - Guide to the Integration of Transportation Systems Management and Operations into Transportation Asset Management (2025)*	DM	AASHTO CTSO TRB AQB13, AKJ14

Research Need	RRM Track	Collaborators
E5. Provide guidance on how to **integrate TAM and agency risk management and resilience planning** processes • Consider ways to support implementation of TAM risk assessment techniques developed in prior research • Identify and integrate what was learned about TAM program adaptation strategies from the 2021 pandemic • *Build on results of NCHRP 23-24 - Methods to Allow Agencies to Incorporate Quantitative Risk Assessment at Project and Network Level (2025)* • *Build on results of NCHRP Synthesis 20-05/Topic 56-07-Practices for Identifying and Incorporating Risk into Bridge Asset Management Planning (2024)*	DM	AASHTO CPBM-RM AASHTO CTSSR TRB ACF18
F. TAM Communication and Collaboration Research to identify effective techniques for communicating about TAM and improve methods for engaging internal and external stakeholders within TAM processes.		
F1. Provide guidance and models for **stakeholder engagement** in TAM • Cover opportunities for stakeholder engagement within different TAM processes • Cover ways that STAs can support local agencies in developing asset management capabilities	OC	TRB AQB11
F2. Provide guidance and models for **communicating** about TAM principles, practices, and value • Consider external communication about the benefit of improved asset management to transportation agencies, transportation system users, and society • Consider internal communication to build understanding of and support for TAM within an agency	OC	TRB AQB11

TAM Draft Problem Statements

CPBM TAM RRM Research Problem Statement

1. **Improving National Pavement and Bridge Performance Measures**
2. **A Guide to Communicating Transportation Asset Management Information**
3. **Data Standardization Practices for BIM-Enabled Transportation Asset Management**

1. Improving National Pavement and Bridge Performance Measures

PROBLEM STATEMENT TITLE

Improving National Pavement and Bridge Performance Measures for Decision-Relevant Asset Management

KEYWORDS / TERMS

- Pavement performance measures
- Bridge performance measures
- Transportation asset management
- National performance management
- Asset condition assessment
- Performance-based management

RESEARCH OBJECTIVE

The objective of this research is to develop improved national pavement and bridge performance measures that provide greater value for state DOT decision making while remaining suitable for national reporting and comparison. The research will identify, test, and recommend refinements or additions to existing national performance measures for pavements and bridges that better reflect asset condition, structural capacity, safety implications, and long-term performance risk.

The expected products include:

(1) a recommended set of enhanced national pavement and bridge performance measures, including clear definitions and calculation methods;
(2) guidance on how the measures can be derived from existing or emerging data sources;
(3) an assessment of how the measures can support agency-level asset management, target setting, and investment decisions; and
(4) an implementation guide describing transition considerations from current measures.

Major research tasks are expected to include:

(a) review of current national pavement and bridge performance measures and findings from recent NCHRP research on national performance management data;
(b) identification of candidate measures that better reflect decision-relevant aspects of pavement and bridge condition, safety, and structural capacity;
(c) evaluation of data availability, consistency, and burden across states;
(d) testing of candidate measures using sample state data;
(e) assessment of how improved measures could be used in asset management, tradeoff analysis, and performance reporting; and
(f) development of practical guidance and examples to support implementation.

URGENCY AND POTENTIAL BENEFITS

National pavement and bridge performance measures play a critical role in federal reporting, accountability, and communication about system condition. However, many state DOTs report that current national measures provide limited value for internal decision making, investment prioritization, and performance management. Measures that are not decision-relevant risk being treated as compliance exercises rather than tools that inform asset management and resource allocation.

Improving national pavement and bridge performance measures is important to a majority of state DOTs because pavements and bridges represent the largest share of transportation asset value and preservation investment. More meaningful measures can help agencies better understand performance trends, articulate needs, and justify investment decisions to leadership, legislators, and the public.

The benefits of this research include improved alignment between national reporting requirements and agency asset management practices; enhanced ability to link performance targets to investment decisions; better communication of asset condition, risk, and needs; and reduced duplication of effort between federal reporting and internal performance measurement. These benefits would be experienced by state DOT asset managers, planners, executives, and policy makers, as well as federal partners.

If this research is not conducted, state DOTs are likely to continue report on national measures that are poorly aligned with their decision making, limiting the value of performance-based management and undermining confidence in reported results. This may weaken the ability of agencies to demonstrate the value of asset investments and to adapt to emerging data sources and technologies.

BACKGROUND INFORMATION AND NEED FOR RESEARCH

Transportation performance management is intended to support data-driven decision making and accountability. National pavement and bridge performance measures were established to enable consistent reporting and comparison across states. While these measures have improved transparency, experience over the past decade has shown that they do not always reflect the aspects of asset performance most relevant to agency-level decisions.

Recent advances in data collection technologies, analytics, and asset management practices provide opportunities to improve how pavement and bridge performance is measured. At the same time, state DOTs face increasing expectations to integrate asset condition, safety, resilience, and risk considerations into investment decisions. Current national measures often lag these needs, focusing on limited condition indicators that do not fully capture structural capacity, safety-related attributes, or future performance risk.

The AASHTO Committee on Performance-Based Management has identified improving national pavement and bridge performance measures as a high-priority research need within its Transportation Asset Management performance measurement theme. This need builds on recent and ongoing NCHRP research assessing national performance management data and reflects widespread interest among states in measures that better support asset management and tradeoff analysis.

Targeted research is needed to identify feasible improvements that balance decision relevance with national consistency and reporting practicality. Without such research, opportunities to modernize national performance measures and align them with contemporary asset management practice may be missed.

LITERATURE SEARCH SUMMARY

A review of recent and ongoing research indicates substantial investment over the past decade in pavement and bridge condition assessment, asset management systems, and national performance management reporting. Collectively, this body of work provides important insights into the strengths and limitations of existing national pavement and bridge performance measures and highlights opportunities for improvement.

Recent studies, most notably **NCHRP 08-168 (Analysis and Assessment of the National Performance Management Data)**, have found that current national pavement and bridge performance measures support federal reporting and high-level trend analysis but provide limited

value for state DOT asset management and investment decision making. As a result, many agencies rely on parallel internal measures for programming and prioritization, leading to duplication of effort and reduced confidence in national metrics as management tools.

Multiple research efforts indicate that existing national measures do not adequately reflect structural capacity, deterioration risk, remaining service life, or future performance. Pavement-focused studies such as **TPF-5(385) Pavement Structural Evaluation with Traffic Speed Deflection Devices** and bridge-focused research on sensor-based monitoring demonstrate the feasibility of more performance-relevant indicators that go beyond surface condition or simplified condition states.

The literature also shows that advances in asset data collection technologies—including LiDAR, nondestructive evaluation, embedded sensors, and improved inspection practices—have significantly expanded the data available to agencies. Projects such as **NCHRP 23-41 (Using Emerging and Established Technologies for Asset Management)** document how agencies are leveraging these technologies; however, national performance measure frameworks have not evolved to systematically incorporate these capabilities.

Research related to pavement friction and macrotexture, including **NCHRP 10-98** and **NCHRP Synthesis 20-05/Topic 56-17**, highlights clear relationships between pavement condition characteristics and safety outcomes. Despite this, safety-relevant pavement attributes are weakly represented or absent in current national pavement performance measures.

Additionally, recent changes to the **National Bridge Inventory (NBI)** have altered available data definitions and structures. While bridge-related research has documented these changes, the literature indicates that national bridge performance measures have not been comprehensively reassessed to reflect updated data or to improve their usefulness for asset management and risk-based decision making.

Overall, prior research has largely focused on data quality assessment, documentation of practice, or development of analytical tools. Few studies provide explicit, implementable recommendations for revising or augmenting national pavement and bridge performance measures themselves. This proposed research builds on the existing body of work by synthesizing findings and translating them into practical, decision-relevant improvements to national performance measures that remain suitable for consistent national reporting.

LINK TO 2021–2026 AASHTO STRATEGIC PLAN

This research supports the AASHTO Strategic Plan by advancing performance-based management practices that improve safety, sustainability, and system stewardship. By strengthening the relevance and usability of national pavement and bridge performance

measures, the research supports data-driven decision making, organizational optimization, and effective communication of transportation system performance.

IMPLEMENTATION CONSIDERATIONS AND SUPPORTERS

State DOTs, FHWA, and AASHTO can implement the research results by incorporating the recommended pavement and bridge performance measures into national performance management guidance, technical references, and reporting practices. The improved measures would be positioned as practical refinements to existing national performance frameworks, enabling more meaningful use of required performance data for asset management, target setting, and investment decision making.

At the state level, DOTs could integrate the improved measures into existing transportation asset management plans (TAMPs), asset management systems, performance dashboards, and internal performance monitoring processes. Because the recommended measures are expected to build on existing or readily obtainable data, implementation would not require wholesale replacement of current systems, but rather incremental updates to calculation methods, reporting formats, and analytical practices.

Implementation can be facilitated through established venues and processes, including AASHTO committee activities (particularly CPBM and its subcommittees), FHWA technical guidance and peer exchanges, and national forums for performance management and asset management practitioners. FHWA and AASHTO could support adoption through technical memoranda, guidance updates, webinars, and workshops highlighting the rationale, computation, and use of the improved measures.

Collectively, these steps would allow agencies to adopt improved pavement and bridge performance measures in a phased and practical manner, strengthening alignment between national reporting requirements and state DOT asset management and decision-making practices.

RECOMMENDED RESEARCH FUNDING AND RESEARCH PERIOD

[To be completed]

PROBLEM STATEMENT AUTHOR(S)

[To be completed]

POTENTIAL PANEL MEMBERS

[To be completed]

PERSON SUBMITTING THE PROBLEM STATEMENT

[To be completed]

2. A Guide to Communicating Transportation Asset Management Information

PROBLEM STATEMENT TITLE

A Guide to Communicating Transportation Asset Management Information for Decision Making and Public Accountability

KEYWORDS / TERMS

- Transportation asset management
- Performance communication
- Data visualization
- Decision support
- Stakeholder engagement
- Performance-based management

RESEARCH OBJECTIVE

The objective of this research is to develop practical, implementable guidance to help state DOTs effectively communicate transportation asset management (TAM) information to diverse audiences, including agency leadership, policy makers, technical staff, partner agencies, and the public. The research will identify communication strategies, formats, and tools that translate complex asset condition, performance, risk, and investment information into clear, decision-relevant messages that support performance-based management and accountability.

The expected products include:

(1) a practitioner-oriented guide describing principles and best practices for communicating TAM information;
(2) a typology of audiences and decision contexts, with recommended communication approaches for each;
(3) example visualizations, dashboards, and narrative formats illustrating effective communication of asset condition, risk, tradeoffs, and investment impacts; and
(4) implementation guidance describing how agencies can embed effective communication practices into existing TAM, planning, and performance management processes.

Major research tasks are expected to include:

(a) review of current TAM communication practices and challenges across state DOTs;
(b) synthesis of relevant research on data visualization, performance communication, and decision support;
(c) identification of common decision contexts and stakeholder needs related to TAM;
(d) development and testing of communication approaches and example products using real-world scenarios;
(e) validation of guidance through practitioner engagement; and
(f) preparation of implementation-ready guidance and supporting materials.

URGENCY AND POTENTIAL BENEFITS

State DOTs increasingly rely on transportation asset management to guide investment decisions, demonstrate accountability, and communicate the value of transportation infrastructure. While agencies have made significant progress in collecting and analyzing asset data, many struggle to communicate TAM information in ways that are understandable, credible, and actionable for non-technical audiences. As a result, asset management insights are not always effectively used in executive decision making, legislative discussions, or public communication.

This research is important to a majority of state DOTs because effective communication is essential to realizing the benefits of TAM. Clear communication can improve leadership understanding of asset condition and risk, support informed tradeoff decisions, strengthen justification for preservation investments, and enhance transparency with external stakeholders. Improved communication practices can also reduce misinterpretation of performance information and increase confidence in asset management processes.

If this research is not conducted, DOTs are likely to continue relying on ad hoc or inconsistent approaches to communicating TAM information, limiting the influence of asset management on decisions and weakening the connection between technical analysis and policy outcomes.

BACKGROUND INFORMATION AND NEED FOR RESEARCH

Transportation asset management has matured significantly over the past two decades, supported by federal requirements, AASHTO guidance, and extensive NCHRP research. Agencies develop transportation asset management plans (TAMPs), performance measures, and analytical tools to assess asset condition, performance, and investment needs. However, less attention has been given to how TAM information is communicated and used outside of technical asset management communities.

Research and practice indicate that communication challenges—rather than analytical limitations—often constrain the effectiveness of TAM. Decision makers may be overwhelmed by technical detail, unclear about uncertainty and risk, or unable to connect asset condition metrics to policy objectives and funding choices. Existing guidance largely focuses on what information to analyze and report, not how to tailor messages, visuals, and narratives to different audiences and decision contexts.

The AASHTO Committee on Performance-Based Management has identified communication and stakeholder engagement as critical elements of effective TAM implementation. Targeted research is needed to synthesize existing knowledge, identify effective practices, and provide practical guidance that helps agencies communicate TAM information in ways that support decision making, accountability, and public trust.

LITERATURE SEARCH SUMMARY

A review of relevant literature indicates that substantial research has been conducted on transportation asset management (TAM) methods, performance measurement, data systems, and reporting requirements; however, comparatively limited research has focused on how TAM information is communicated to support decision making and accountability.

Foundational guidance such as the **AASHTO Transportation Asset Management Guide**, including recent digital update **NCHRP 08-137 (Updates to the Digital Edition of the AASHTO Transportation Asset Management Guide)**, provides extensive direction on asset management concepts, analytical methods, and planning requirements. While this guidance emphasizes what information agencies should develop and analyze, it provides limited, high-level discussion of how TAM information should be communicated to different audiences or tailored to specific decision contexts.

Several NCHRP studies have identified communication challenges as a recurring barrier to effective performance-based management. For example, **NCHRP 08-168 (Analysis and Assessment of the National Performance Management Data)** and related performance management research note that performance information is often perceived as compliance-oriented and insufficiently tailored for executive or policy decision making. These studies highlight gaps between technical analysis and practical use of performance information but do not provide implementable guidance on improving communication of TAM information.

Research specifically addressing visualization and performance communication—including **NCHRP 08-167 (Guide for Creating Effective Transportation Visualizations)** and **NCHRP Synthesis 20-05/Topic 52-16 (Visualization of Highway Performance Measures)**—demonstrates the importance of clear visual design, narrative framing, and audience awareness. However, these efforts address visualization broadly across transportation performance areas and do not focus on communicating asset condition, risk, and investment tradeoffs in a TAM context.

Additional research on integrating performance management and decision-making processes, such as **NCHRP 23-37 (Integrating Performance Management, Risk Management, and Process Improvement: A Guide)**, emphasizes the need for communication across organizational levels but does not address how TAM information should be communicated to non-technical audiences, policy makers, or the public.

Overall, the literature indicates that while state DOTs possess increasingly sophisticated TAM data and analytical capabilities, there is no consolidated, implementation-ready resource focused on communicating TAM information in ways that support executive decision making, legislative policies, and public accountability. This proposed research builds on existing TAM, performance management, and visualization research by synthesizing relevant findings and translating them into practical, audience-focused communication guidance tailored specifically to transportation asset management contexts.

LINK TO 2021–2026 AASHTO STRATEGIC PLAN

This research supports the AASHTO Strategic Plan by strengthening performance-based management, improving transparency and accountability, and enhancing communication with stakeholders. By improving how asset management information is communicated, the research advances data-driven decision making and supports organizational effectiveness and public trust.

IMPLEMENTATION CONSIDERATIONS AND SUPPORTERS

State DOTs can implement the research results by incorporating the guidance into existing TAM, planning, and performance management processes, including TAMP development, capital programming, executive briefings, and public reporting. Asset management, planning, and performance management staff would be primary users, with benefits extending to agency leadership and communications staff.

Implementation can be supported through AASHTO committee activities, FHWA technical assistance and peer exchanges, and professional development forums. Supporting materials such as example templates, case studies, webinars, and workshops would facilitate adoption and adaptation by agencies of different sizes and maturity levels.

RECOMMENDED RESEARCH FUNDING AND RESEARCH PERIOD:

[To be completed]

PROBLEM STATEMENT AUTHOR(S):

[To be completed]

POTENTIAL PANEL MEMBERS:

[To be completed]

PERSON SUBMITTING THE PROBLEM STATEMENT:

[To be completed]

3. Data Standardization Practices for BIM-Enabled Transportation Asset Management

PROBLEM STATEMENT TITLE

Data Standardization Practices for BIM-Enabled Transportation Asset Management

KEYWORDS / TERMS

- Building Information Modeling (BIM)
- Transportation asset management
- Data standards
- Information systems integration
- Asset data governance
- Performance-based management

RESEARCH OBJECTIVE

The objective of this research is to develop practical, implementation-ready guidance for state DOTs on data standardization practices that enable effective use of Building Information Modeling (BIM) across the transportation asset life cycle in support of transportation asset management (TAM). The research will identify priority data elements, standards, governance practices, and institutional approaches needed to integrate BIM-enabled data from planning, design, and construction into asset management systems used for operations, maintenance, and performance-based decision making.

Expected products include:

(1) a practitioner-oriented guide describing recommended data standards and data governance practices for BIM-enabled TAM;
(2) a framework illustrating how BIM data can be structured, transferred, and maintained across asset life-cycle phases;
(3) example data schemas and workflows illustrating integration between BIM, asset inventories, and asset management systems; and
(4) implementation guidance describing phased adoption strategies for agencies with varying levels of BIM and TAM maturity.

Major research tasks are expected to include:

(a) review of current BIM and asset data standards relevant to transportation assets;
(b) assessment of state DOT practices and challenges related to BIM–TAM data integration;
(c) identification of priority data elements needed to support asset management and performance reporting;
(d) development of recommended data governance and standardization approaches;
(e) validation of recommendations through practitioner engagement; and
(f) preparation of implementation-ready guidance and supporting examples.

URGENCY AND POTENTIAL BENEFITS

State DOTs are increasingly adopting BIM for infrastructure delivery, while simultaneously expanding asset management and performance-based management practices. However, lack of consistent data standards and governance across life-cycle phases often limits the ability of agencies to reuse BIM data for asset management, resulting in duplicated data collection, inconsistent inventories, and lost opportunities to improve decision making.

This research is important to a majority of state DOTs because effective data standardization is foundational to realizing the value of BIM beyond design and construction. Benefits include improved data continuity across the asset life cycle, reduced data re-creation costs, improved asset inventories and condition tracking, enhanced analytical capabilities, and stronger integration between capital delivery and asset management. Without this research, agencies are likely to continue implementing BIM and TAM in parallel, limiting return on investment and progress toward data-driven asset management.

BACKGROUND INFORMATION AND NEED FOR RESEARCH

Advances in BIM for infrastructure have created new opportunities to improve how transportation assets are planned, designed, constructed, and managed. Many state DOTs are investing in BIM to support digital delivery, improve project coordination, and enhance construction quality. At the same time, federal requirements and AASHTO guidance have driven increased use of TAM to support performance-based investment decision making and accountability.

Despite these advances, significant gaps remain in how BIM-generated data are standardized, transferred, and maintained for use in asset management systems. Existing practices vary widely across agencies, asset classes, and project phases. Without consistent data standards and governance, BIM data are often not structured in ways that align with asset inventories, condition assessment, or performance reporting needs.

The AASHTO Committee on Performance-Based Management has identified data standardization and information system integration as priority research needs within the TAM Data and Information Systems theme. Targeted research is needed to provide practical guidance that helps agencies align BIM-enabled data practices with TAM requirements and performance management objectives.

LITERATURE SEARCH SUMMARY

A review of relevant literature indicates growing research and guidance on Building Information Modeling (BIM) for infrastructure delivery, transportation asset management (TAM), and asset data governance; however, limited research addresses data standardization practices that explicitly link BIM-enabled data to TAM and performance-based management needs.

FHWA guidance on **BIM for Infrastructure and Digital As-Builts** emphasizes the potential for BIM to improve project delivery, data quality, and life-cycle information management. Similarly, FHWA's **Transportation Asset Management Plan (TAMP) guidance** outlines data requirements needed to support asset inventories, condition assessment, and performance management. While these resources highlight the importance of life-cycle data, they do not provide detailed guidance on how BIM data should be standardized, governed, and maintained for use in TAM systems.

NCHRP research has addressed related aspects of asset data and information systems. **NCHRP 08-115 (Guidebook for Data and Information Systems for Transportation Asset Management)** provides foundational guidance on asset data governance, system architecture, and data stewardship, but does not focus on BIM-enabled data or digital delivery workflows. Similarly, **NCHRP Synthesis 20-05/Topic 54-06 (Ancillary Asset Data Stewardship and Data Models)** documents current data models and stewardship practices but highlights wide variability in data structures and limited standardization across agencies.

Research on emerging technologies for asset management, including **NCHRP 23-41 (Using Emerging and Established Technologies for Asset Management: A Guide)**, identifies BIM as a promising data source but notes challenges related to interoperability, data standards, and integration with existing asset management systems. International standards such as **ISO 19650** and industry data schemas provide partial solutions, yet their applicability to U.S. state DOT asset management practices remains inconsistent and insufficiently documented in the literature.

Overall, the literature indicates that while BIM adoption and TAM practices are advancing in parallel, there is no consolidated, implementation-ready guidance focused on data standardization practices that enable BIM data to be effectively reused for transportation asset management and performance-based decision making. This proposed research builds on existing FHWA guidance, NCHRP research,

and industry standards by synthesizing relevant findings and translating them into practical, agency-focused guidance tailored to BIM-enabled TAM.

LINK TO 2021–2026 AASHTO STRATEGIC PLAN

This research supports the AASHTO Strategic Plan by advancing data-driven decision making, organizational optimization, and effective stewardship of transportation assets. Improved data standardization enables better integration of digital delivery and asset management, strengthening long-term system performance and accountability.

IMPLEMENTATION CONSIDERATIONS AND SUPPORTERS

State DOTs can implement the research results by incorporating recommended data standards and governance practices into BIM execution plans, asset management system requirements, and data management policies. Asset management, information technology, engineering, and construction offices would be primary users.

Implementation can be supported through AASHTO committee activities, FHWA technical guidance, peer exchanges, and pilot applications on selected projects. Supporting materials such as example data schemas, templates, and training resources would facilitate phased and practical adoption.

RECOMMENDED RESEARCH FUNDING AND RESEARCH PERIOD:

[To be completed]

PROBLEM STATEMENT AUTHOR(S):

[To be completed]

POTENTIAL PANEL MEMBERS:

[To be completed]

PERSON SUBMITTING THE PROBLEM STATEMENT:

[To be completed]

Appendix: Research Projects Related to TAM Scope

Projects are listed in reverse chronological order by end date. End years for pending projects were estimated based on fiscal year and duration.

Project	CPBM Area(s)	Timing Start	End	Funding	Program	Research Question	Tags
NCHRP 23-53 Aligning Relationships Between Transportation Asset Management (TAM), Planning, and Programming	TAM, RM, EPA	Pending	2029	$400,000	NCHRP	How to integrate resilience and mobility into TAM, P&P	Mobility, Resilience
NCHRP 23-42 Scoping Study to Identify Curriculum Development Needs for Workforce Development in Transportation Asset Management (CY2023)	TAM, OE	Pending	2027	$250,000	NCHRP	What are the expected competencies and skills for TAM professionals, and associated curriculum development needs	Workforce
NCHRP 23-41 Using Emerging and Established Technologies for Asset Management: A Guide	TAM	Nov-24	May-27	$500,000	NCHRP	How to best use existing and emerging technologies to capture and update changes to transportation assets	Emerging Technologies
NCHRP 23-38 Incorporating Risk Management into Roadway Infrastructure Maintenance Practices	RM, TAM	Oct-24	Apr-27	$500,000	NCHRP	How to integrate risk models that include the impact of climate change into inspection, maintenance, and repair and replacement cycles	Climate Change, Maintenance

Project	CPBM Area(s)	Timing Start	End	Funding	Program	Research Question	Tags
NCHRP 23-32 Transportation Asset Risk and Resilience	RM, TAM	Nov-23	Nov-26	$3,500,000	NCHRP	How to assess risk from extreme weather, climate change and other threats/hazards to traveling public and agency assets	Resilience
NCHRP 23-24 Methods to Allow Agencies to Incorporate Quantitative Risk Assessment at Project and Network Level	RM, TAM	Mar-23	Dec-25	$500,000	NCHRP	What quantitative, repeatable techniques can be used to assess the vulnerability of physical transportation assets and incorporate them into life-cycle analysis and planning efforts?	Lifecycle Analysis
NCHRP 08-138 Guide to the Integration of Transportation Systems Management and Operations into Transportation Asset Management	TAM	Aug-23	Dec-25	$500,000	NCHRP	How to integrate TSMO assets into TAMP processes and plans	TSMO
NCHRP 20-44(46) NCHRP Implementation Support Program. Implementing the Asset Valuation Guide Developed Through NCHRP Project 23-06	TAM	Mar-23	Nov-25	$300,000	NCHRP Implementation	How can asset valuation techniques be integrated into practice within STAs?	Asset Valuation
NCHRP 08-168 Analysis and Assessment of the National Performance Management Data	TAM	Apr-24	Oct-25	$550,000	NCHRP	How to analyze and communicate results of state-reported national performance measures	

Project	CPBM Area(s)	Timing Start	End	Funding	Program	Research Question	Tags
NCHRP 19-25 Funding Needs for Maintenance and Preservation of Transportation Assets	TAM	Nov-25	May-25	$450,000	NCHRP	How to estimate and justify funding requirements for asset maintenance and preservation?	Funding
NCHRP Synthesis 20-05,Topic 55-19 Documenting the State of Practice in Managing Ancillary Transportation Assets	TAM	Oct-23	May-25	$55,000	NCHRP Synthesis	How are STAs managing their ancillary assets?	Ancillary Assets
NCHRP Synthesis 20-05, Topic 56-07 Practices for Identifying and Incorporating Risk into Bridge Asset Management Planning	TAM	May-24	May-25	$55,000	NCHRP Synthesis	How are STAs incorporating risk into bridge asset management planning?	Bridges
TCRP J-07, Topic SE-08 Defining and Measuring "State of Good Repair" for Public Transit Assets and Infrastructure	TAM	May-24	May-25	$55,000	TCRP Synthesis	How are STAs defining and measuring "state of good repair" for transit assets?	Transit
NCHRP 20-05, Topic 55-17. Practices to Enhance Resiliency of Existing Roadway and Embankment Culverts	TAM	Apr-23	May-25	$55,000	NCHRP Synthesis	What management and maintenance practices are STAs using to enhance resiliency of existing roadway and embankment culverts	Culverts
NCHRP Synthesis 20-05, Topic 55-03. Asset Management Practices for Mechanically Stabilized Earth Walls	TAM	Apr-23	Apr-25	$55,000	NCHRP Synthesis	What asset management practices are STAs using for mechanically stabilized earth walls?	Geotechnical Assets

Project	CPBM Area(s)	Timing Start	End	Funding	Program	Research Question	Tags
NCHRP 23-09 Developing a Highway Framework to Conduct an All-Hazards Risk and Resilience Analysis	RM, TAM	Oct-25	Apr-25	$250,000	NCHRP	What research is needed to create a quantitative all-hazards risk and resilience analysis of transportation assets	Research Needs, Resilience
NCHRP 23-26 Measuring Impacts and Performance of State DOT Resilience Efforts	RM, TAM	Oct-22	Dec-24	$300,000	NCHRP	How to develop and use resilience measures for different asset classes	Resilience
NCHRP 14-47 Tools and Technology for Roadside Landscape Asset Management	TAM	Nov-22	Nov-24	$350,000	NCHRP	How can STAs implement performance-based management strategies for highway roadside landscape asset management?	Roadside Assets
NCHRP Synthesis 20-05/Topic 52-02 Bridge Element Data Collection and Use (Synthesis 585)	TAM	Sep-22	Sep-24	$45,000	NCHRP Synthesis	How are STAs collecting and using bridge element-level inspection data	Bridges, Inspection
NCHRP 08-136 Guidebook on Using Performance-Based Management Approaches for Maintenance	TAM	Nov-22	Jun-24	$500,000	NCHRP	How to use performance-based management strategies for maintenance planning and investment	Maintenance
NCHRP 20-05, Topic 54-06 Ancillary Asset Data Stewardship and Data Models	TAM	Jan-23	May-24	$55,000	NCHRP Synthesis	What data models and stewardship approaches are currently in use at STAs for ancillary assets?	Ancillary Assets

Project	CPBM Area(s)	Timing Start	End	Funding	Program	Research Question	Tags
NCHRP 08-137 Updates to the Digital Edition of the AASHTO Transportation Asset Management Guide	TAM	Apr-22	Jan-24	$450,000	NCHRP	How to implement transportation asset management	TAM Guide
ACRP 09-21 Asset Information Handover Guidelines: From Planning and Construction to O&M	TAM	Aug-21	Feb-23	$300,000	ACRP	How to develop and maintain an airport asset information handover process from planning & construction to operations & maintenance	Airports, BIM
NCHRP 03-140 Guidelines for Applications of RFID and Wireless Technologies in Highway Construction and Asset Management: A Guide (NCHRP Research Report 1063)	TAM	Aug-20	Feb-23	$370,000	NCHRP	How to make use of RFID and wireless technologies for highway construction and infrastructure asset management	Emerging Technologies
NCHRP 08-115 Guidebook for Data and Information Systems for Transportation Asset Management	TAM	Aug-18	Dec-22	$400,000	NCHRP	How can STAs advance practices for using data and information systems for asset management?	Information Systems
NCHRP 09-20 Quantifying the Impacts of Delayed Maintenance of Airport Assets	TAM	Jan-21	Oct-22	$300,000	ACRP	What process can airports use to quantify the consequences of delayed maintenance of airport assets, considering cost, operational impacts, and users?	Airports

Project	CPBM Area(s)	Timing Start	End	Funding	Program	Research Question	Tags
NCHRP 23-08 A Guide for Incorporating Maintenance Costs into a Transportation Asset Management Plan (NCHRP Research Report 1076)	TAM	Sep-20	Oct-22	$350,000	NCHRP	How to incorporate maintenance costs into a risk-based TAMP	Maintenance
NCHRP 14-42 Connected and Autonomous Vehicle Technology: Determining the Impact on State DOT Maintenance Programs (NCHRP Research Report 1084)	TAM	Jun-19	Jul-22	$450,000	NCHRP	What is the impact of CAV technologies on roadway and transportation systems management and operations asset maintenance programs	Emerging Technologies, Workforce, Maintenance
NCHRP 13-06A Guide for the Formulation of Long-Range Plans and Budgets for Replacement of Highway Operations Equipment	TAM	May-22	May-22	$324,998	NCHRP	How to develop long-range (20-25 year) plans and budgets for replacement of highway operations equipment	Equipment Management
Project TFRS-02 Lifecycle BIM for Infrastructure: A Business Case for Project Delivery and Asset Management	TAM	Apr-20	Dec-21	$500,000	NCHRP	What is the business case for BIM, based on its potential to increase agency efficiencies and foster advanced, comprehensive lifecycle management of enterprise assets?	BIM
NCHRP 20-123(01) Support for AASHTO Committees and Councils. Transportation Asset Management Strategic Planning and Research Roadmap Development	TAM	Sep-19	Dec-21	$220,000	NCHRP	What research is needed on transportation asset management?	Research Needs

Project	CPBM Area(s)	Timing Start	End	Funding	Program	Research Question	Tags
Project 20-05, Topic 51-05. Collaborative Practices for Performance-Based Asset Management Between State DOTs and MPOs	TAM	Sep-19	Dec-21	$45,000	NCHRP Synthesis	How are STAs collaborating with MPOs on target setting, investment decisions, and performance monitoring of pavement and bridge assets	Target Setting
NCHRP 23-06 A Guide to Computation and Use of System Level Valuation of Transportation Assets	TAM	Jul-20	Nov-21	$600,000	NCHRP	How to calculate asset value, use asset valuation within asset management, and communicate about asset value?	Asset valuation
NCHRP 02-26 Life-Cycle Planning Analysis in a Transportation Asset Management Framework (NCHRP Research Report 1065)	TAM	Apr-19	Nov-21	$500,000	NCHRP	How to implement life cycle planning within an asset management framework	Lifecycle Analysis
NCHRP 08-118 Risk Assessment Techniques for Transportation Asset Management	RM, TAM	May-19	Jun-21	$600,000	NCHRP	How can transportation agencies better consider and evaluate asset management-related risks as part of investment decision-making practices, and mitigate and track these risks?	Risk Management

Project	CPBM Area(s)	Timing Start	End	Funding	Program	Research Question	Tags
NCHRP 20-65, Task 77 Research for the AASHTO Standing Committee on Public Transportation. Lessons Learned and Impacts to Date of State DOT Implementation of New Federal Transit Asset Management and Public Transportation Agency Safety Requirements	TAM	Apr-18	Dec-19	$100,000	NCHRP	How are STAs implementing federal transit asset management requirements and what have the impacts been on asset condition, safety performance and the investment of federal transit funds?	Federal Regulations, Transit
NCHRP 20-24(124) Administration of Highway and Transportation Agencies. Performance Management Reporting Peer Exchange	TAM	Aug-18	Apr-19	$125,000	NCHRP	What are the differences between state and FHWA reports of pavement and other asset condition information, and how can these differences be better explained?	Federal Regulations
Project 20-59(53) FloodCast: A Framework for Enhanced Flood Event Decision Making for Transportation Resilience	TAM, RM	Sep-14	May-18	$498,162	NCHRP	How can granular, spatially explicit weather, climate, hydrologic, and hydraulic data be integrated with transportation asset information to support STA flood response and hazard mitigation decision making?	Resilience

Project	CPBM Area(s)	Timing Start	End	Funding	Program	Research Question	Tags
NCHRP 24-46 Development of an Implementation Manual for Geotechnical Asset Management for Transportation Agencies	TAM	Jul-16	Sep-18	$500,000	NCHRP	How can STAs develop and implement a geotechnical asset management program?	Geotechnical Assets
NCHRP 08-103 Implementing NCHRP Report 806: Guide to Cross-Asset Resource Allocation and the Impact on Transportation System Performance	TAM	Jun-16	Sep-18	$398,300	NCHRP	How to implement cross-asset resource allocation?	Resource Allocation
NCHRP 08-109 Updating the AASHTO Transportation Asset Management Guide—A Focus on Implementation, Phase 1	TAM	Mar-17	Jul-18	$100,000	NCHRP	How should guidance on transportation asset management be updated based on the evolution of practice and methods?	TAM Guide
NCHRP 20-05, Topic 47-10 Synthesis on: Resource Allocation of Available Funding to Programs of Work	TAM	Nov-15	May-17	$45,000	NCHRP Synthesis	What processes, techniques, tools, and data do DOTs use to evaluate and select funding allocations to different programs?	Funding
NCHRP 07-21 Asset Management Guidance for Traffic Control Devices, Barriers, and Lighting	TAM	Apr-13	Dec-15	$550,000	NCHRP	How can STAs approach development of an asset management program for traffic and safety assets?	Ancillary Assets