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U.S. Department
of Transportation
**Federal Highway
Administration**

Advancing Pavement and Bridge Asset Performance Through Transportation Programming

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16. Abstract This synthesis report examines how State Departments of Transportation (DOTs) and Metropolitan Planning Organizations (MPOs) consider National Highway System (NHS) pavement and bridge condition when developing Statewide and Metropolitan Transportation Improvement Programs (STIPs and TIPs). Using a review of documents from 10 State DOTs and 10 MPOs, a national literature review, practitioner interviews, and peer exchanges, the report identifies current practices, challenges, and opportunities for incorporating asset management data, needs, and priorities into the transportation programming process. Findings show that agencies vary in how they integrate performance targets, asset management plans, and data-driven tools into funding and project selection. Common challenges include balancing asset condition with other priorities, data limitations, staff capacity constraints, and funding uncertainty. The report includes four case studies, descriptions of notable practices, and actionable strategies for transportation agencies to strengthen performance-based programming and improve pavement and bridge performance nationwide.			
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Acronyms

AASHTO	American Association of State Highway and Transportation Officials
AMP	Asset Management Plan
BMS	Bridge Management System
BPI	Bridge Priority Index
BRIM	Bridge Replacement and Improvement Management
Caltrans	California Department of Transportation
CFP	Call for Projects
CFR	Code of Federal Regulations
CHIP	Capital Highway Investment Plan
CMAQ	Congestion Mitigation and Air Quality Improvement Program
CMP	Congestion Management Process
COG	Council of Governments
DOT	Department of Transportation
FDOT	Florida Department of Transportation
FHWA	Federal Highway Administration
FR	Federal Register
FTA	Federal Transit Administration
GIS	Geographic Information System
HERS-ST	Highway Economic Requirements System-State Version
HPMS	Highway Performance Monitoring System
HSIP	Highway Safety Improvement Program
INFRA	Nationally Significant Multimodal Freight & Highway Projects program
ITS	Intelligent Transportation Systems
LLCC	Lowest Life Cycle Cost
LRSTP	Long-Range Statewide Transportation Plan
MDOT	Michigan Department of Transportation
MODA	Multi-Objective Decision Analysis
MPO	Metropolitan Planning Organization
MTC	Metropolitan Transportation Commission
MTP	Metropolitan Transportation Plan
MnDOT	Minnesota Department of Transportation
MnSHIP	Minnesota State Highway Investment Plan
NBI	National Bridge Inventory
NCHRP	National Cooperative Highway Research Program
NCTCOG	North Central Texas Council of Governments
NHS	National Highway System
NOACA	Northeast Ohio Areawide Coordinating Agency
PASER	Pavement Surface Evaluation and Rating
PBPP	Performance-Based Planning and Programming
PCR	Pavement Condition Rating
PEL	Planning and Environment Linkages
PMS	Pavement Management System
RSL	Remaining Service Life

RTC	Regional Transportation Council
SEMCOG	Southeast Michigan Council of Governments
SOV	Single Occupancy Vehicle
SSMS	Statewide Systems Management Section
STBG	Surface Transportation Block Grant
STIP	State/Statewide Transportation Improvement Program
STTC	Surface Transportation Technical Committee
TAM	Transit Asset Management
TAMC	Transportation Asset Management Council
TAMS	Transportation Asset Management System
TIP	Transportation Improvement Program
TPM	Transportation Performance Management
TSMO	Transportation Systems Management and Operations
UAV	Unmanned Aerial Vehicle
U.S.C.	United States Code
USDOT	United States Department of Transportation
VMT	Vehicle Miles Traveled
WisDOT	Wisconsin Department of Transportation
WSDOT	Washington State Department of Transportation
WVDOT	West Virginia Department of Transportation

Key Definitions

The following planning concepts and documents discussed throughout this guidebook are defined under 23 CFR 450.104, unless otherwise noted:

Asset Management – A strategic and systematic process of operating, maintaining, and improving physical assets, with a focus on both engineering and economic analysis based upon quality information, to identify a structured sequence of maintenance, preservation, repair, rehabilitation, and replacement actions that will achieve and sustain a desired state of good repair over the life cycle of the assets at minimum practicable cost.

Asset Management Plan (AMP) – A document that describes how a State DOT will carry out asset management as defined in this section. This includes how the State DOT will make risk-based decisions from a long-term assessment of the National Highway System (NHS), and other public roads included in the plan at the option of the State DOT, as it relates to managing its physical assets and laying out a set of investment strategies to address the condition and system performance gaps. This document describes how the highway network system will be managed to achieve State DOT targets for asset condition and system performance effectiveness while managing the risks, in a financially responsible manner, at a minimum practicable cost over the life cycle of its assets. The term *asset management plan* under this part is the risk-based asset management plan that is required under [23 U.S.C. 119\(e\)](#) and is intended to carry out asset management as defined in [23 U.S.C. 101\(a\)\(2\)](#). (23 CFR 515.5)

Life Cycle Planning – A process to estimate the cost of managing an asset class, or asset sub-group over its whole life with consideration for minimizing cost while preserving or improving the condition. (23 CFR 515.5)

Long-Range Statewide Transportation Plan (LRSTP) – The official, statewide, multimodal, transportation plan covering a period of no less than 20 years developed through the Statewide transportation planning process.

Metropolitan Transportation Plan (MTP) – The official multimodal transportation plan addressing no less than a 20-year planning horizon that the MPO develops, adopts, and updates through the metropolitan transportation planning process.

Statewide Transportation Improvement Program (STIP) – A statewide prioritized listing/program of transportation projects covering a period of four years that is consistent with the LRSTP, MTPs, and TIPS, and required for projects to be eligible for funding under title 23 U.S.C. and title 49 U.S.C. Chapter 53.

Transportation Improvement Program (TIP) – A prioritized listing/program of projects covering a period of four years that is developed and formally adopted by an MPO as part of the metropolitan transportation planning process, consistent with the MTP, and

required for projects to be eligible for funding under 23 U.S.C. and title 49 U.S.C. Chapter 53.

National Highway System (NHS) – The United States roadway system which includes the Interstate Highway System and other roads determined to be important to the nation’s economy, defense, and mobility by the USDOT in cooperation with the states, local officials, and MPOs.¹

Transportation Performance Management (TPM) – A strategic approach that uses system information to make investment and policy decisions to achieve national performance goals.²

¹ Federal Highway Administration National Highway System website. No date.
https://www.fhwa.dot.gov/planning/national_highway_system/nhs_maps/

² Federal Highway Administration Transportation Performance Management website. No date.
<https://www.fhwa.dot.gov/tpm/>

Executive Summary

This report examines how State Departments of Transportation (DOTs) and Metropolitan Planning Organizations (MPOs) are prioritizing National Highway System (NHS) pavement and bridge condition in the development of Statewide Transportation Improvement Programs (STIPs) and Transportation Improvement Programs (TIPs). Drawing on a literature review and review of documents from 10 State DOTs and 10 MPOs, along with practitioner conversations and peer exchanges, the study identifies current practices, challenges, and notable examples in using the transportation programming process to address bridge and pavement condition.

This report provides actionable insights and examples to help transportation agencies advance the practice of performance-based programming and achieve better outcomes for bridge and pavement condition across the NHS.

Key Findings:

- **Integration of Asset Management:** State DOTs have developed risk-based asset management plans (AMPs) and established performance targets for NHS bridge and pavement condition; however, how each agency integrates these plans and targets into their improvement programs varies.
- **Project Prioritization Approaches:** While some agencies use structured scoring processes focused on performance data, qualitative information and political or geographical considerations are also included in project prioritization. Coordination between central offices and districts, as well as between State DOTs and MPOs, is critical for aligning local and statewide priorities.
- **Funding Allocation:** Agencies use a mix of scenario analysis, modeling tools, and tradeoff analyses to allocate limited funding across competing needs.
- **Stakeholder Engagement:** Effective communication and coordination with stakeholders are critical to build support for preservation-focused investment strategies and managing expectations.
- **Challenges:** Common challenges include balancing asset performance with other priorities, data limitations, lack of stakeholder understanding, staff capacity constraints, and uncertainty in funding and future conditions.
- **Opportunities to Advance the Practice:** From technical advances, such as machine learning and artificial intelligence, to strategic collaboration and communication practices, agencies have many opportunities to improve the use of the STIP and TIP to address pavement and bridge performance.

Introduction



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In response to Federal Highway Administration (FHWA) rules addressing asset management and transportation performance management (TPM), State Departments of Transportation (DOTs) have developed risk-based asset management plans (AMPs) for the National Highway System (NHS) and established performance targets for NHS bridge condition and pavement condition.

The AMP is one of the several types of transportation plans that State DOTs and Metropolitan Planning Organizations (MPOs) integrate into their statewide and metropolitan transportation planning processes. The intent of this integration is to help ensure that key performance elements and the investments strategies in the AMP are linked to the investment decisionmaking process leading to projects, particularly for National Highway Performance Program funding.

The AMP includes a financial plan for a minimum period of 10 years and shows how the investment strategies are influenced by performance gap analysis, life cycle planning, risk management analysis, anticipated available funding, and estimated costs of expected future work types. As a result, these investment plans, and financial planning elements can directly support the development of metropolitan Transportation Improvement Programs (TIPs) and Statewide Transportation Improvement Programs (STIPs). Moreover, pavement and bridge conditions and performance data can be used to support the prioritization of projects for inclusion in TIPs and STIPs.

In general, incorporating performance-based plans and performance measures into programming is still an emerging practice for many transportation agencies. According to a recent survey of State DOTs conducted for the National Cooperative Highway Research Program (NCHRP) as part of a synthesis study on integrating performance-based planning into long-range transportation plans and STIPs,³ approximately half of State DOTs reported that they consider information from a performance-based plan when selecting projects in the STIP but not with a structured scoring process. Only five State DOTs (California, Delaware, Minnesota, Nevada, and Virginia) reported using a structured scoring process focused primarily on performance data and target setting in their STIP.

MPOs typically do not develop an AMP and have historically played a limited role in asset management, in part because MPOs are typically not owners of roads and bridges. However, STIPs are developed in cooperation with MPOs, public transit providers, and nonmetropolitan local officials and include each MPO's TIP directly or by reference. Although MPOs often rely on project submittals from State DOTs and transit agencies in preparing the TIP, MPOs often have robust processes for project prioritization for their TIPs. The procedures may incorporate a broad range of goals and performance measures in their project prioritization criteria and scoring of projects, including asset management goals and needs and infrastructure condition measures.

PURPOSE

This study is designed to provide valuable information on how State DOTs and MPOs are prioritizing NHS pavement and bridge condition in the development of their STIPs and TIPs. This research identifies existing practices, notable examples, and opportunities for prioritizing infrastructure condition and supporting the attainment of pavement and bridge performance targets in the development of STIPs and TIPs.

METHODOLOGY

For this effort, the research team conducted a review of documents from 10 State DOTs and 10 MPOs. The set of documents reviewed included the TIP or STIP, AMP, and other relevant resources, such as available documents that describe the STIP/TIP process, performance reports, and AMP implementation. Each source was reviewed for concepts and examples related to a set of guiding research questions (Appendix H. Research Questions). The research team also reviewed national level research, conducted primarily by FHWA, the American Association of State Highway and Transportation Officials (AASHTO), and the Transportation Research Board (TRB), on topics of asset management planning, performance-based planning in transportation improvement programs, and overlaps in the topic areas. Each source was reviewed for concepts and examples related to the research questions (see Appendix H. Research Questions).

³ NCHRP. 2024. Integrating Performance-Based Planning into Long-Range Transportation Plans and STIPs.

Agencies included in the document review include:

State DOTs

- Florida DOT
- Kentucky DOT
- Michigan DOT
- Minnesota DOT
- Nebraska DOT
- Ohio DOT
- Pennsylvania DOT
- Texas DOT
- West Virginia DOT
- Wyoming DOT

MPOs

- Atlanta Regional Commission
- Boston Region MPO
- Chicago Metropolitan Agency for Planning
- Kalamazoo MPO
- North Central Texas Council of Governments
- North Jersey Transportation Planning Authority
- Northeast Ohio Areawide Coordinating Agency
- Oregon Metro
- Pinellas County MPO
- St. Cloud Area MPO

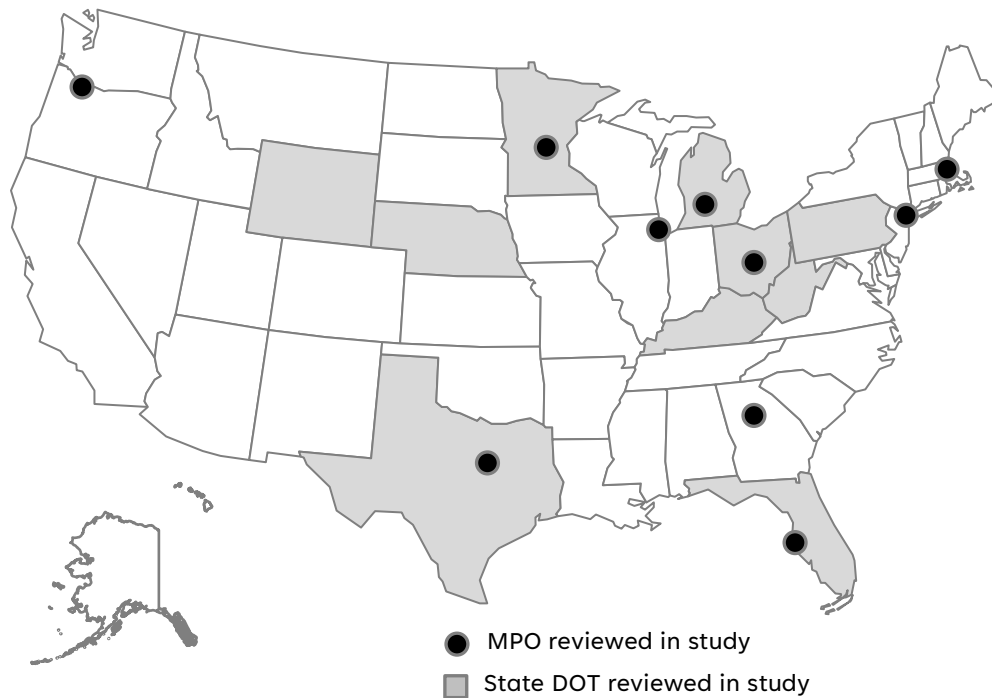


Figure 1. State DOTs and MPOs included in the document review.

PEER EXCHANGES

The research team held three virtual peer exchanges with State DOTs and MPOs. The first State DOT peer exchange focused on funding and project prioritization and included representatives from six State DOTs. The second State DOT peer exchange focused on decisionmaking and tradeoffs and included representatives from five State DOTs. The MPO focused peer exchange included discussions on funding, project prioritization, decisionmaking, and tradeoffs, and included representatives from nine MPOs. These are summarized briefly here, with full summaries in Appendices E, F, and G.

State DOT Peer Exchange #1

State DOT peer exchange participants discussed decisionmaking and tradeoffs in bridge and pavement programming over the course of the exchange. Participants reported using a mix of centralized and decentralized approaches to prioritize and select projects for their STIPs. Prioritization approaches included considering State DOT district input, calls for projects, planning level funding targets, and bridge and pavement management models to align project lists with performance goals. State DOTs also used scenario planning and spreadsheet tools to evaluate tradeoffs across investment areas, with an emphasis on maintaining assets and addressing high-risk corridors. Challenges reported included lack of staff capacity for new data analysis methods, limited coordination with MPOs and local partners, and inconsistent understanding of processes across internal departments.

State DOT Peer Exchange #2

State DOT peer exchange participants discussed funding processes and project prioritization practices over the course of the exchange. Participants reported using a mix of inputs, including long-range plans, optimization models, and staff expertise to set funding levels for pavement and bridge needs. State DOTs prioritize projects based on NHS condition goals, using tools such as pavement models and multi-objective decision analysis (MODA) tools, while balancing district input and performance targets. Large or unique bridges often require special funding approaches. Agencies are also adopting emerging technologies—including satellite imagery, unmanned aerial vehicles (UAVs), machine learning, and artificial intelligence—to improve condition assessments and support data-driven prioritization.

MPO Peer Exchange

MPO peer exchange participants discussed the programming decisionmaking process for bridge and pavement projects and the role MPOs play over the course of the exchange.

Participants reported determining funding levels for pavement and bridge projects using guidance from their State DOTs, metropolitan transportation plans, and regional inputs. In prioritizing TIP projects, many MPOs incorporate pavement condition, bridge condition, among other criteria. Challenges reported included limited technical resources, data inconsistencies, stakeholder communication, and perceptions of fairness. MPOs discussed

working with local agencies by providing technical assistance and facilitating coordination with State DOTs. Communicating life cycle based asset management approaches to stakeholders and decisionmakers is a noted challenge.

CASE STUDY INTERVIEWS

In addition to the peer exchanges, the research team held interviews with two State DOTs (Michigan and Minnesota) and two MPOs (Northeast Ohio Areawide Coordinating Agency (NOACA) and North Central Texas Council of Governments(NCTCOG)) to develop the case studies in this report. Interviews were held with multiple staff members from the agency to represent perspectives from TIP/STIP development, AMP development, and performance management. These are summarized briefly here, with full summaries available in Appendices A,B,C, and D.

Michigan Department of Transportation

For over 30 years, the Michigan DOT has been programming Federal-Aid highway projects through their “Call for Projects” (CFP) process. The Michigan DOT, along with other asset owners, monitor bridge conditions and performance metrics to inform the establishment of performance targets, goals, and funding levels. Once funding is allocated, the Michigan DOT’s regional offices, in collaboration with MPOs and rural planning entities, have substantial autonomy to define selection criteria and choose projects for consideration.

The Michigan DOT’s programming framework emphasizes performance outcomes, using modeling, established funding categories, and scenario-based planning across major program categories. Initiatives like the Rebuilding Michigan bond program have strengthened statewide pavement condition, though funding constraints, data inconsistencies across local agencies, and stakeholder expectations continue to create challenges. The agency addresses these challenges through transparent communication, public engagement, and coordinated planning efforts. Over time, Michigan has built broader understanding and support for preservation-focused strategies, supported by the Transportation Asset Management Council, regional, and local partners.

Northeast Ohio Areawide Coordinating Agency (NOACA)

For almost a decade, NOACA has used a strategic, data-driven methodology aimed at improving regional asset performance. This approach involves a two-tiered analysis, where the Pavement Management System (PMS) first identifies candidate projects based on the cost-effectiveness of treatment options followed by a project prioritization assessment tool involving Regional Significance Criteria and Project Readiness Analysis.

This evolution marks NOACA’s transition from a reactive, application-driven process to a proactive, performance-based planning framework that prioritizes cost-efficiency and directs funding towards the most critical projects, regional impact, and consistency with long-term transportation objectives. NOACA has also improved the integration of planning and programming efforts by incorporating the MTP into the TIP process and encouraging engagement with stakeholders throughout project selection.

Minnesota Department of Transportation

The Minnesota DOT (MnDOT) and its family of plans guide the programming process and reflect the DOT's desire for interdepartmental coordination. At the center of the State's family of plans is Minnesota GO, which establishes a 50-year vision for the transportation system. In particular, Minnesota GO guides Minnesota's State Highway and Investment Plan (MnSHIP) and its 20-year vision for highway investment and statewide capital funding. The direction established by MnSHIP then informs the Capital Highway Investment Plan (CHIP), which the State's Districts consider in selecting their projects.

To select projects for inclusion in the STIP, Districts utilize the PMS and Bridge Management System (BMS) and use local knowledge, coordination with other projects, and political consideration. Districts will then attend regular check-in meetings with the MnDOT Central office to review and discuss the CHIP and STIP. MnDOT's investment direction, informed by the AMP, prioritizes NHS pavement and bridge condition within financial constraints. Strong internal coordination supports this process, with Districts and central offices collaborating through a structured annual cycle to develop and refine the CHIP and STIP. MnDOT also improves scoping efficiency by assigning project managers once projects enter the STIP and using a comprehensive scoping database to identify opportunities to address multiple needs within a single project.

North Central Texas Council of Governments (NCTCOG)

NCTCOG has been elevating the region's progress towards bridge and pavement goals through their prioritization process, coordination with local agencies and the Texas DOT (TxDOT), and use of competitive grant funding. To select projects for inclusion in the TIP, the MPO uses a scoring system that emphasizes a project's potential to improve mobility, reliability, and asset condition. Throughout this process, NCTCOG holds regular meetings with Districts and local agencies to coordinate programming and provide funding and technical assistance. In particular, the MPO supports local governments on improving the high percentage of locally owned arterial roads on the NHS network that are in "poor condition." This process includes technical assistance as well as coordination between local governments and TxDOT in programming and funding locally owned pavement projects. NCTCOG has led grant applications and partnered with TxDOT to secure funding for local governments in bridge and pavement maintenance and reconstruction. Between 2018 and 2025, the MPO has received over \$500 million in competitive grants through these efforts.

SYNTHESIS REPORT

This synthesis report is the product of research conducted for the literature and document reviews, peer exchanges, and case study development. Strategies and notable practices for advancing bridge and pavement condition through programming are described in the following chapters, organized by three key areas: Funding for Programs and Projects, Project Prioritization, and Communication and Coordination. Challenges and opportunities identified through the research are documented in the Challenges, and Advancing the Practice chapters.

Funding for Programs and Projects



Photo: Getty Images

Transportation agencies are tasked with managing their transportation systems within a limited budget. The overall amount of available funding and the allocation of funding to address bridge and pavement condition make a significant impact on how agencies can address needs, meet goals, and deliver projects to serve their communities.

Transportation agencies can prioritize bridge and pavement condition by allocating funds to initial construction, maintenance, preservation, rehabilitation, and reconstruction programs, and projects that help meet bridge and pavement condition goals. The amount of funding allocated to programs and projects that impact bridge and pavement condition may be influenced by several factors, including State and regional policies, long-range planning and forecasting of needs, and stakeholder and decisionmaker priorities related to programmatic funding levels.

As the NHS ages, transportation agencies are increasingly facing maintenance and repair backlogs. Some transportation agencies have developed policies to prioritize system preservation and state of good repair before capacity expansion. This priority shift may help justify increased funding or higher prioritization for preservation projects.⁴ For example, California, Michigan, and New Jersey all have policies to prioritize funding for pavement and bridge preservation over capacity expansion projects.

⁴ NCHRP. 2017. Resource Allocation of Available Funding to Programs of Work.

State DOTs conduct bridge and pavement forecasting as part of the AMP development process, to evaluate how asset conditions are expected to change over time, with available funding. AMPs typically include a scenario analysis of how these conditions would be expected to change based on differing levels or types of investment. Transportation agencies can refer to the investment level required to achieve and sustain its bridge and pavement condition goals, and use this data to influence the amount of funding allocated toward programs and projects that will improve bridge and pavement condition in the TIP and STIP. The Wisconsin DOT (WisDOT) used performance condition data and analysis to make a case to obtain additional funding from the State legislature. Using the pavement condition model, WisDOT compared the amount of proposed funding for maintenance to the amount needed to maintain current conditions on the highway. WisDOT then used this analysis to defend its request to the State legislature for more funding, securing an additional \$185 million for its budget.⁵

Once an overall budget is set, transportation agencies make decisions about the use of those funds within a constrained budget. Given parameters for funding of a specific asset management program, agencies can decide how to best allocate the funds to different projects or work types in order to meet bridge and pavement condition goals and targets. Pavement and bridge management systems are useful tools for this exercise as well. The systems can be used to identify specific projects or allocations of funding between work types to optimize pavement and bridge conditions over the term of the analysis. The results of analyses consisting of ten or more years often result in different mixes of recommended projects than shorter-term analyses. For this reason, states such as Arizona use analyses as long as 20 years to support development of their 10-year investment strategies.⁶

Many agencies are conducting scenario analyses that consider the impacts of investments on bridge and pavement condition, among other performance goals. These analyses may be conducted as part of developing the AMP, LRSTP, MTP, STIP, or TIP. Increasingly, agencies are incorporating multiple future scenarios that encompass uncertainties, such as demographic shifts, revenue changes, and environmental conditions, in addition to various funding allocation strategies. Agencies use pavement/bridge management systems to develop scenarios and forecast the impacts of different funding strategies as well as different maintenance and preservation methods. Some agencies have also developed spreadsheet or software tools to analyze alternative scenarios. In addition, agencies use tradeoff analyses to help make investment decisions between project types across different performance goals and policy objectives. For example, the West Virginia DOT (WVDOT) AMP includes an in-depth funding scenario analysis using inputs from the PMS and BMS. The analysis shows performance condition for bridges and pavement across nine funding scenarios, which specify funding levels on preservation, rehabilitation and replacement. Based on the outputs of the analysis, WVDOT identified preferred

⁵ FHWA. 2021. Assessment on the Effectiveness of PBPP in Transportation Decision-Making for State DOTs and MPOs.

⁶ Arizona DOT. 2025. Transportation Asset Management Plan.

funding scenarios for bridge and pavement investment with a higher percentage dedicated to bridges than historical percentages.⁷

State DOTs can find support in State legislatures to help ensure funding for asset condition is prioritized. This can come from establishing taxes or fees to support ongoing asset condition programs or specific projects, or by instituting requirements for funding allocation for system preservation. The Florida DOT (FDOT) has taken steps to manage the risk of funding shortages, due to reduced revenues, extreme weather events, construction cost increases, unfunded mandates, and supply chain disruptions. The agency worked with the Florida State legislature to establish supporting agency policies to prioritize safety and preservation first, deferring capacity expansion projects as needed. FDOT is required by State Statute to preserve and maintain 80 percent of the State Highway System and 90 percent of FDOT bridges at State-set condition targets.⁸

Similarly, the California Department of Transportation (Caltrans) pays for its State Highway Operation and Protection Program (a four-year program of projects that improves the condition and operation of the State Highway System) from a dedicated State funding stream, established in the California Legislature as the Road Repair and Accountability Act. As another example, in 2023, the West Virginia legislature passed a bill (House Bill 3214) to create the Road Optimization and Assessment Data Pilot Project, a 5-year pilot project to incorporate machine learning and artificial intelligence into the WVDOT asset management data collection and analysis strategies. WVDOT worked with the State legislature to rewrite the bill to make the law more applicable to current practices and overall objectives.⁹

State DOTs can also use funding to influence local agencies' approaches to asset management. The Washington State DOT is providing financial incentives to local NHS owners willing to adopt asset management practices to preserve and improve the condition of locally owned NHS pavements and bridges.¹⁰

Finally, transportation agencies can evaluate how their programmed projects are aligned with asset management investment recommendations. The Missouri DOT developed the Tracker: Measures of Departmental Performance¹¹ to compare the projects identified in the Districts' AMPs¹² and the projects programmed in the STIP. The State analyzes a number of categories such as investment assumptions and actual investment values, the number of lane miles treated, and the number of bridges treated by treatment type. The Tracker helps Missouri better align the AMPs and the STIP – particularly funding and investment levels.

⁷ West Virginia DOT. 2022. Transportation Asset Management Plan.

⁸ FHWA. 2023. Case Study – Managing Risks Associated with Major Funding Uncertainty.

⁹ FHWA. 2023. Asset Management Integration Case Study: West Virginia Department of Transportation.

¹⁰ Washington DOT. No date. Local Bridge Program website.

¹¹ Missouri DOT. No date. Tracker website.

¹² The Missouri DOT Districts each have developed an individual AMP for their districts since 2016.

Project Prioritization

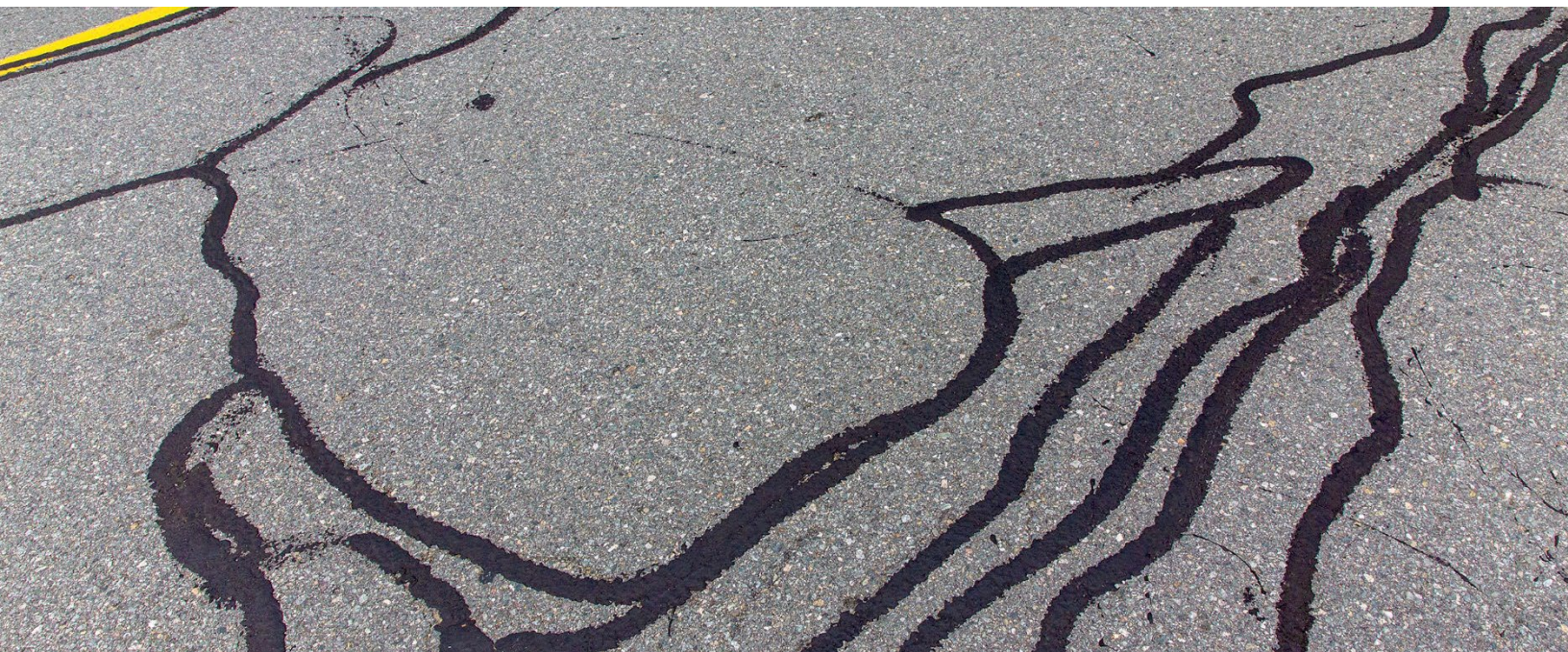


Photo: Getty Images

State DOTs and MPOs can use project prioritization and selection processes to advance projects that will make progress toward asset condition goals and targets. With this approach projects recommended for inclusion in the STIP or TIP are subject to a scoring process, which evaluates projects and awards points based on a variety of factors. Some State DOTs, such as the Virginia DOT, Hawaii DOT, and North Carolina DOT, use criteria to evaluate a project's ability to address bridge and pavement condition goals and targets before inclusion into the STIP. Asset condition criteria may also be included in project prioritization for MPOs. For example, the Memphis MPO allocates points for projects that address bridge, pavement, or transit asset condition.¹³

Some agencies document alignment of the STIP with Federal, State, or regional asset management goals, or use the AMP to inform the project selection process for the STIP or TIP. As another example, MnDOT uses objective criteria to assign numeric scores for all State highway construction projects eligible for STIP inclusion. MnDOT evaluates and scores projects for inclusion in the STIP using criteria assigned to project categories, such as Asset Management, Targeted Safety Improvements, and Mobility and Capacity Expansion. While the numeric scores guide the selection process, MnDOT also considers other factors when making final decisions.

¹³ Memphis MPO. 2022. 2023-2026 Transportation Improvement Program.

Most transportation projects will address multiple performance areas — for example, an updated intersection with new pavement, crosswalks, and signals may make progress toward pavement condition, safety, and reliability goals and targets. Some transportation agencies are exploring how performance-based evaluation criteria can be used to prioritize projects that address multiple performance areas, which may increase the impact and efficacy of investments.¹⁴ As transportation agencies work to balance investments across priority areas, MODA tools can help optimize a mix of projects to meet performance targets. The Texas DOT, Indiana DOT, and Caltrans all use types of MODA tools in their prioritization processes.

Proposed project locations matter in prioritization practices. Some State DOTs may give points for pavement or bridge repair or maintenance on priority corridors, or on roads that will impact the performance of the regional system. In addition, State DOTs are increasingly considering bundling or packaging projects of similar work in the same project area.

State DOTs commonly coordinate with district offices to develop lists of pavement projects for programming. Many State DOTs adopt a decentralized approach to prioritizing pavement projects. In this approach, State DOT districts will develop an initial list, which may be constrained by funding allocations and targets prescribed by the State DOT central office. This list will then be reviewed and adjusted by the State DOT central office. Strong coordination and transparent reviews and decisionmaking are critical to select projects that will meet State targets and also consider both statewide analysis and local input from the districts. The districts may use a combination of technical analysis, public and stakeholder input, and local knowledge from experience working within their communities. State DOTs may also conduct regular monitoring of district work toward meeting performance targets. For example, the West Virginia DOT checks in monthly with its Districts on implementing projects that address pavement performance and runs a quarterly analysis to help ensure the Districts are on track. Bridge projects are often managed more closely by the State DOT central office, which develops the list of projects for programming. Although the central office will coordinate with the districts, bridge performance management is often managed primarily by a bridge team.

MPOs can use bridge and pavement condition as a factor in project screening or project prioritization for the TIP. Bridge and pavement criteria may be considered for asset management projects specifically or for a larger program of projects. For example, the Chicago Metropolitan Agency for Planning includes pavement condition needs as a scoring criteria for certain types of projects, including road reconstruction and truck route improvements.¹⁵ The Boston Region MPO includes project evaluation criteria for capital projects, which include points for addressing infrastructure condition deficiencies.¹⁶

¹⁴ NCHRP. 2017. Resource Allocation of Available Funding to Programs of Work.

¹⁵ Chicago Metropolitan Agency for Planning. 2024. 2026-2030 STIP Shared Fund Program Application Booklet.

¹⁶ Boston MPO. 2024. 2025-2029 TIP Appendices.

Communication and Coordination



Photo: Getty Images

Many agencies, departments, and stakeholders play a role in asset management and programming transportation projects. Effective communication and coordination among these players are critical to deliver projects that will address bridge and pavement condition goals, along with other State, regional, and local goals. Research conducted for this study found four main strategies for transportation agencies to share and solicit information with and from stakeholders and decisionmakers: communication, coordination, technical assistance, and tool development.

COMMUNICATION

State DOTs and MPOs can share technical information on bridge and pavement condition through commonly produced documents, including the LRSTP/MTP, system performance report, STIP/TIP narratives, and performance progress reports.¹⁷ Some State DOTs and MPOs use interactive digital maps to communicate existing conditions and forecasted scenarios to stakeholders. These maps not only help to visualize existing conditions but also have been used to compare no-build to build scenarios and forecast future weather or other hazards. Performance reports are typically shared with localities to help guide decisionmaking. For example, NOACA develops Roadway Pavement Maintenance Reports for all counties in its jurisdiction. The reports include information about preservation techniques, an example of a decision tree applied for pavement maintenance, a map of

¹⁷ FHWA. 2023. Linking Transportation Asset Management, TPM, and PBPP.

current conditions, a recommended timeline for preservation work, and a description of preservation approach scenarios.

As agencies shift from a “worst-first” asset management approach to a preservation-focused approach, stakeholders may have questions or concerns about how road and bridge projects are prioritized, and which methods are used to address condition. Asset management practitioners who participated in the peer exchanges noted that preservation has begun to become a mainstream concept; however, many stakeholders and communities still voice concerns when roads in seemingly good condition receive treatments before roads in worse shape. Similarly, when an agency conducts maintenance on a road that recently received treatment, some members of the public or other stakeholders express concern that the agency may not have applied the first treatment appropriately, or else they would not have to return so soon for a second treatment. State DOTs often describe the benefits of a preservation approach in their AMPs or LRSTPs, while some agencies have developed additional educational material that can be used for internal use, stakeholder communication, or public engagement. The New Jersey DOT developed an educational video describing its pavement preservation approach, using clear language and describing the overall concept of preservation, as well as information on different treatments.¹⁸ The Pennsylvania DOT produced a fact sheet on lowest life cycle cost, which can be used to explain the concept of a preservation approach to asset management, using plain language and graphics.¹⁹

COORDINATION

Many State DOTs and MPOs engage in extensive coordination with internal and external stakeholders to gain support in asset management and to help prioritize projects for inclusion in the STIP or TIP. This includes internal boards, technical advisory committees, State legislators, interagency working groups, transit agencies, regional/district offices, local governments, and the general public.²⁰

Shared online mapping tools can help multiple asset owners coordinate. The Southeast Michigan Council of Governments (SEMCOG) has used geospatial mapping to conduct risk assessments related to flooding, and to coordinate potential projects across State and regional agencies. The Flood Risk tool shows road risk ratings in the region to support SEMCOG with investment decisions that help ensure the transportation network is safe, efficient, and resilient.²¹ SEMCOG also developed the Capital Improvement Project coordination tool, a web portal that allows public and private utilities, communities, broadband, transportation, and water and sewer providers to enter planned projects onto a map and coordinate projects in close proximity to each other.²² Similarly, the Rhode Island DOT is developing a geospatial tool that will identify opportunities to overlap

¹⁸ New Jersey DOT. July 20, 2020. Pavement Preservation Treatments at NJDOT.

¹⁹ Pennsylvania DOT. No date. Lowest Lifecycle Cost Infographic.

²⁰ FHWA. 2022. Example Practices for Performance-Driven Programming.

²¹ FHWA. 2024. Case Study – Asset Management Integration.

²² FHWA. 2024. Case Study – Asset Management Integration.

projects to improve efficiency. As an example, planned projects that are also identified as high priority for resurfacing may have their timeline advanced to address both needs.²³ The Pima Association of Governments in Arizona hosts a web-based portal that maps projects and provides project sponsors with information on system performance. Project sponsors can use this portal to perform a network screening of performance conditions within a proposed project area.²⁴

Regular or targeted meetings with partners on the topics of asset management and programming can help ensure all parties are aligned with addressing statewide asset performance goals while respecting regional priorities. In the development of the STIP, pavement and bridge condition targets, and the programmed projects, the New Hampshire DOT hosted an interagency working group with FHWA and the State's four regional planning commissions. This working group, "Partnering for Performance in NH," ultimately helped identify and prioritize transportation projects that not only supported the established targets but fit within the context and funding allotments of the four regional planning commissions.^{25 1}

Third-party facilitators or specific technical groups can be helpful in leading coordination efforts among partners, creating a sense of trust and objectivity. Michigan's Transportation Asset Management Council (TAMC) supports the Michigan DOT (MDOT) and local agencies as an advisor and facilitator for asset owners to collaborate on management strategies and projects. This independent, nonprofit agency has been building partnerships across agencies to coordinate projects for bridges, roads, water, utilities, and other infrastructure. The TAMC is currently developing guidance for local agencies to collect location and condition information on culverts to contribute to a statewide database. The Washington State DOT (WSDOT) maintains Target Setting Technical Teams of WSDOT and MPO subject matter experts for each asset management performance measure. The teams provide initial recommendations for State targets and evaluate recommendation feasibility, resource impacts, and information gaps. They also collaborate with MPOs and local agencies by providing regional data and collecting input.

TECHNICAL ASSISTANCE

State DOTs and MPOs provide technical assistance to project sponsors/localities through a variety of resources to help streamline and standardize the project identification process and other processes, and help ensure that candidate projects support agency and/or statewide goals and priorities. Resources include informational or guidance materials, project solicitation forms and applications, web-based project portals, and preliminary project reviews and feedback.²⁶ Caltrans offers training through its Local Technical Assistance Program for city and county staff on asset management topics,

²³ FHWA. 2021. Assessment on the Effectiveness of PBPP in Transportation Decision- Making for State DOTs and MPOs.

²⁴ FHWA. 2022. Example Practices for Performance-Driven Programming.

²⁵ FHWA. 2017. SHRP2 Technical Report: Partnering for Performance NH.

²⁶ FHWA. 2022. Example Practices for Performance-Driven Programming.

including Life Cycle Cost Analysis, Pavement Management Systems & Preservation Strategies, and Pavement Sustainability.

MPOs can provide valuable technical assistance to member jurisdictions, especially as local agencies (small agencies in particular) may lack the staff resources or technical skills to perform sophisticated types of analysis for prioritization. The Metropolitan Transportation Commission (MTC), the MPO for the San Francisco Bay Area, operates a program that funds planning and technical assistance for local road management. MTC hires consultants to survey local jurisdictions every 2-3 years and upload data to a PMS that prioritizes investments. Local jurisdictions are then required to demonstrate how they prioritized assets to apply for regional competitive funding for pavement projects.²⁷

Training may also be applicable to advance regional priorities. For example, the Washoe County Regional Transportation Commission in Nevada works with local agencies to implement Complete Streets projects in conjunction with its preventive maintenance program on regional roads to improve safety. The agency notes that “the Complete Streets design approach has reduced crashes on many regional roads by between 31 and 46%,” slows vehicle speeds, and provides dedicated spaces for people walking, bicycling, or taking transit.²⁸

Transportation agencies can provide training across multiple areas of the planning and programming process, as it relates to asset management, not just technical analysis. For example, MnDOT developed a Communication Action Plan that identifies key internal audiences, what type of information is important to them and why it is important, and when and how to share that information. The Communication Action Plan establishes recommendations such as defining asset management and explaining its importance along with communicating the roles and responsibilities to key audiences. The plan also identifies different communication methods and what type of information best suits the method.

TOOL DEVELOPMENT

Some State DOTs have sought to develop tools to aid in the project prioritization process and to better communicate information to stakeholders, including maps, dashboards, and infographics. These tools allow State DOT districts to take advantage of centralized research and analysis while maintaining autonomy and flexibility in selecting projects. TxDOT provides a MODA-based software tool to MPOs and Districts that can be used to rank proposed projects on a variety of metrics, including bridge and pavement preservation, safety, economic development, and environmental impact, among others. Final project selection considers the benefits of each candidate to the Texas highway system using these criteria, along with other factors such as project costs, scheduling

²⁷ Metropolitan Transportation Commission. No date. Pavement Management Technical Assistance Program website.

²⁸ FHWA. 2024. Asset Management Integration Case Study: Washoe County Regional Transportation Commission.

considerations, and public feedback. In alignment with the 10-year Unified Transportation Plan (UTP), TxDOT Districts collaborate with MPOs to assign funding from relevant UTP categories to priority projects in their regions. A project may receive funding from multiple UTP categories if eligible, though funding targets set limits on the amount each District or MPO can program from specific UTP categories.²⁹ As another example, MnDOT is developing a dashboard for Districts to review scenarios for preservation approaches and their impacts on condition. Approaches include Minimum Maintenance, Current Approach, Desired Approach, and Resilience Based Approach. All approaches can be reviewed simultaneously on a comparison tab.³⁰

²⁹ Texas DOT. No date. Developing the UTP website.

³⁰ Interview with MnDOT staff. 2025.

Challenges



Photo: Getty Images

State DOTs and MPOs face several challenges in their work to use their transportation improvement programs to meet asset performance goals.

Major challenges found in the research among State DOTs and MPOs included the following:

- Balancing asset performance with other priorities.
- Lack of support or understanding among stakeholders.
- Lack of support or understanding among decisionmakers.
- Lack of adequate data or analysis tools.
- Lack of funds to support needed data collection.
- Lack of MPO ownership over assets limits MPO control.
- Uncertainty in funding, performance, priorities, policies and other key drivers of investment decisions.
- Staff capacity.

As part of the virtual peer exchanges for this effort, the research team asked participants to rank a set of identified challenges in prioritizing bridge and pavement conditions. “Balancing asset performance with other priorities” was determined to be the biggest challenge for both State DOT and MPO participants, followed by a “lack of understanding among stakeholders” and “lack of understanding among decisionmakers.” Rankings are shown in Figure 2 and Figure 3.

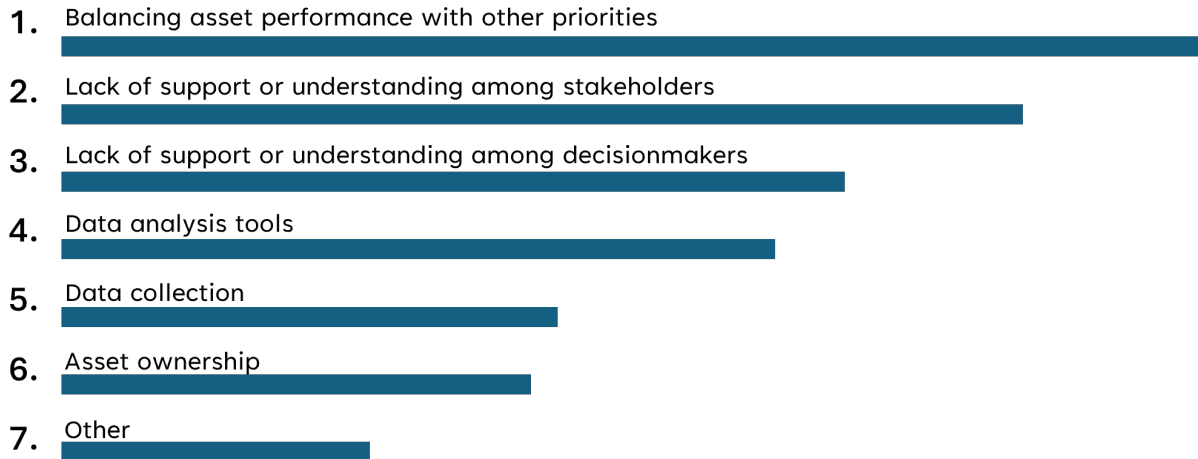


Figure 2. State DOT responses to the question “How would you rank the following challenges in prioritizing bridge and pavement conditions in the STIP?” among peer exchange participants.

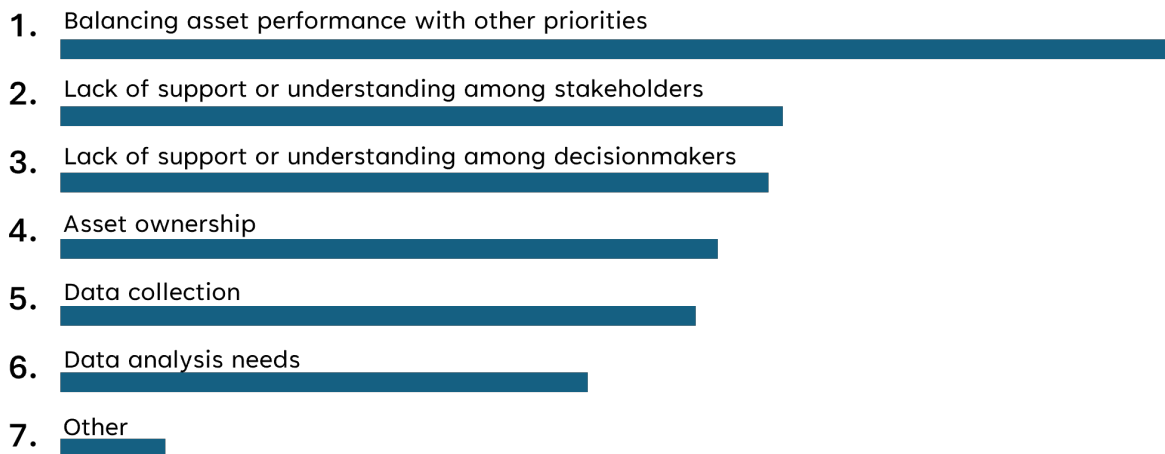


Figure 3. MPO responses to the question “How would you rank the following challenges in prioritizing bridge and pavement conditions in the TIP?” among peer exchange participants.

BALANCING ASSET PERFORMANCE WITH OTHER PRIORITIES

Fundamentally, a transportation agency seeks to sustain or improve mobility and access for all while optimizing the safety of the transportation system, minimizing negative impacts to the environment and society, and making best use of limited funds and other resources. Transportation agencies need to make decisions about distributing funding across programs and projects that support different performance goals and targets. Challenges may also arise if objectives of local, regional, State, and Federal jurisdictions differ or agencies measure performance differently.

Understanding tradeoffs with investment decisions can be especially challenging for MPOs, due to limited technical resources, data discrepancies among local agencies. There is also not a common method for determining which tradeoffs are acceptable and best aligned with regional priorities, which can change over time. Achieving and sustaining a state of good repair over the long term requires a steady commitment to maintenance and preservation activities to keep assets from falling out of good repair. Many of these activities are either not eligible for assistance under the Federal-Aid highway program (e.g., cleaning drainage systems to avoid failure) or provide little immediate measurable impacts to conditions (i.e., if an asset is already in good condition, performing maintenance to keep it in good condition does not change the system's measurable condition). Therefore, these treatments often do not compete well for funding, and as a result, most of these activities are funded by owner agencies with fund sources outside of the TIP.

State DOTs with decentralized structures and systems allow for a level of autonomy among district offices and regional/local agencies. However, this approach also can pose challenges to achieving performance targets based on the types of projects that are prioritized for implementation. Furthermore, districts or MPOs may advance projects with competitive funding or alternative sources of funding that may be aligned with different goals.

Bridge performance programs tend to be more centralized than pavement performance programs, and participants in the virtual peer exchanges conducted as part of this research noted challenges balancing the needs of the districts with the needs of the bridge program. In some cases, the departments or offices managing bridge projects are fairly isolated from other groups within a DOT, creating challenges for collaboration.

DATA LIMITATIONS

A structured approach to resource allocation requires data. Ideally, an agency has detailed, quantitative data on existing conditions, the scope of a proposed investment, and what the effects of an investment are likely to be. However, obtaining the necessary data and projecting future conditions can be challenging and costly, and the decision to proceed with an investment must sometimes be made before detailed data are available.

State DOTs face challenges aligning State approaches to asset management with Federal performance measures. State DOTs may have years of historical measures and established processes they continue to use to evaluate system condition; however, these evaluation methods often differ from Federal measures. In some cases, State asset conditions are performing well in terms of State performance measures but, are trending downward when quantified using Federal performance measures, and vice versa.³¹

Transportation agencies often cited that they have gaps in the data needed to support performance measurement. Reported gaps include:

- Obtaining the necessary data to forecast future asset conditions.³² Forecasting asset conditions requires the development of mathematical models to consider how assets deteriorate without investment and how they benefit from investments of different types. Collecting and analyzing this data takes time and resources. Understanding the cause and effect between various actions and resulting system conditions is key, but often not well understood.³³
- Retrieving adequate cracking data on NHS Interstates and non-Interstate roadways. The cracking metrics used to calculate the national performance measures are not commonly used by agencies to manage pavement conditions. For flexible pavement, the measure only considers cracking that occurs in the wheel paths. Cracking generally does not form in the wheel path unless the pavement structure has failed. This makes the metric useful to identify poor pavement, but not useful for identifying pavement for treatment to prevent it from failing.³⁴

In outlining notable data gaps, agencies also suggested a need for the development and use of more advanced tools. Tools include: 1) more accurate deterioration models,³⁵ 2) improved reporting tools,³⁶ 3) advanced options for forecasting asset conditions and understanding the cause and effect relationships between strategies and performance,³⁷ and 4) incorporating the uncertainties of future project costs into longer-term scenario analyses.³⁸

Finally, some State or regional priorities cannot be measured quantitatively or forecasted, and they may not fit into quantitative tradeoff models. Bringing these measures into the prioritization analysis can be challenging for agencies or stakeholders who may be focused on a quantitative output.

³¹ AASHTO. 2023. Transportation Asset Management Peer Exchange: The Art of Selecting Projects.

³² NCHRP. 2019. Analyzing Data for Measuring Transportation Performance by State DOTs and MPOs.

³³ NCHRP. 2022. Developing a Guide for Managing Performance to Enhance Decision-Making.

³⁴ NCHRP. 2019. Analyzing Data for Measuring Transportation Performance by State DOTs and MPOs.

³⁵ NCHRP. 2019. Analyzing Data for Measuring Transportation Performance by State DOTs and MPOs.

³⁶ NCHRP. 2019. Analyzing Data for Measuring Transportation Performance by State DOTs and MPOs.

³⁷ NCHRP. 2022. Developing a Guide for Managing Performance to Enhance Decision-Making.

³⁸ FHWA. 2024. Integrating Highway Asset Management into Planning and Programming Peer Exchange Summary.

LACK OF SUPPORT AMONG STAKEHOLDERS AND DECISIONMAKERS

Asset management decisions may be challenging for stakeholders and decisionmakers to understand, especially when agencies are working on a lifecycle approach to managing the state of good repair instead of adopting a worst-first approach. Coordination with multiple asset owners, and a loss of institutional knowledge among agencies, were also reported challenges among the peer exchange participants.

Some State DOTs grapple with a lack of support or understanding among stakeholders when it comes to balancing asset performance with other priorities. One agency that took part in the virtual peer exchanges conducted as part of this research noted that many stakeholders struggle with qualitative data, saying they can't trust the qualitative data and think it is used to "game the system." In some cases, this skepticism is found among internal DOT stakeholders.

STAFF CAPACITY

Agencies expressed that although AMPs have helped agencies allocate resources to address asset condition performance, they still may not be able to achieve condition targets, in part due to staff capacity. State DOTs reported challenges with staff unwilling to adopt new analysis and prioritization methods, inadequate coordination with MPOs and local organizations, and a lack of understanding across departments within the State DOT. According to a survey conducted in 2020, transportation agencies reported lacking the staff needed to conduct essential functions across all performance areas. Among agencies, a lack of staff capacity was identified as the most common limitation on TPM implementation. Seventy-five percent of agencies reported this limitation, regardless of agency type or performance measure area. In the survey results, both State DOTs and MPOs say that a lack of available staffing most significantly limits their ability to conduct TPM provisions.³⁹

Political changes can also affect institutional knowledge and staff capacity. Some agencies reported the need to educate new leadership on asset management processes and needs, which can require a significant investment of time. Agencies have noted the need to be better "story-tellers" about asset management, performance, and return on investment.

UNCERTAINTY

Transportation investments are intended to make improvements in the future, but there is always uncertainty concerning future asset and system conditions, demographics, revenue streams, preservation technology, construction costs, maintenance costs, and hazardous weather events.⁴⁰

³⁹ NCHRP. 2021. Collaborative Practices for Performance-Based Asset Management Between State DOTs and MPOs.

⁴⁰ AASHTO. No date. TAM Guide: Challenges in Cross-Asset Resource Allocation.

Inadequate funding for improvements was one of the more commonly referenced challenges among State DOTs and MPOs. Agencies have cited short- and long-term funding shortfalls due to factors such as more frequent and extreme weather events, and revenue losses. As a result, agencies are faced with tough decisions and have had to postpone or cancel planned investments — further contributing to deteriorating and inadequate asset conditions.

The Michigan DOT (MDOT) reported significant improvements achieved through its investment strategy development, revenue and cost monitoring, and communication with stakeholders. By employing revenue forecasting models and continuous monitoring, MDOT has reduced funding uncertainty and improved its ability to adjust programs based on financial conditions. Over the years, the agency has also enhanced credibility with the State legislature and the public by consistently sharing documentation. A focus on state of good repair and asset management principles has helped MDOT navigate through periods of financial uncertainty and support their infrastructure management programs.⁴¹

⁴¹ FHWA. 2023. Case Study – Managing Risks Associated with Major Funding Uncertainty.

Advancing the Practice



Photo: Getty Images

How can State DOTs and MPOs advance the practice of using STIPs and TIPs to achieve pavement and bridge performance goals? This section lists ideas, some currently in practice among transportation agencies, some identified by subject matter experts, and some suggested by agencies through the course of this research. In addition, this section includes suggestions for improvements that may require further research or iteration on current practices.

COLLABORATION AND COMMUNICATION

- Identify opportunities for State DOTs and MPOs to collaborate more effectively on asset management goals and targets.⁴²
- Collaborate between State and local agencies, including smaller governments, in performance-based planning to assist, train, and raise awareness for local agencies in asset management practices.
- Leverage AASHTO and other professional associations to develop consistency in methods to link asset management to programming.⁴³

⁴² FHWA. 2019. Integrating Asset Management and Planning.

⁴³ AASHTO. 2023. Transportation Asset Management Peer Exchange: The Art of Selecting Projects.

- Evaluate opportunities for the AMP 10-year financial plan to influence both MTPs and LRSTPs.⁴⁴
- Celebrate bridge and pavement preservation or maintenance projects to highlight the importance of maintaining the system (e.g., ribbon cuttings).

STAFF CAPACITY

- Develop easy-to-use educational materials for modeling and technical analysis, along with support for staff.⁴⁵
- Diversify communication techniques to share information with distinct types of stakeholders.
- Invest in resources for target setting (e.g., training, workshops).

DATA COLLECTION

- Use more advanced technology and data collection methods.⁴⁶
- Explore new tools for collection, analysis, and reporting, including lidar, synthetic aperture radar, Building Information Modeling, spatial analysis, and visual tools.
- Develop automated tools for data collection such as cracking detection and forecasting, without needed historical data.
- Consider how inclusion of ancillary assets improves the condition of the system. Many State DOTs include ancillary assets, such as culverts, lighting, and intelligent transportation systems (ITS) equipment, into their asset management program.
- Consider use of UAVs to inspect bridges and culverts, especially for ancillary assets. MnDOT is currently working on this effort.
- Consider how non-NHS pavement and bridge condition may be included in AMPs.⁴⁷ Further collaboration with local agencies on locally owned roads could support overall condition improvement.
- Identify best practices in monitoring impacts of investments in bridge and pavement condition over time.

⁴⁴ FHWA. 2019. Integrating Asset Management and Planning.

⁴⁵ NCHRP. 2017. Resource Allocation of Available Funding to Programs of Work.

⁴⁶ AASHTO. 2023. Transportation Asset Management Peer Exchange: The Art of Selecting Projects.

⁴⁷ Brookings Institute. 2024. Connecting the DOTs: A survey of state transportation planning, investment, and accountability practices.

DATA ANALYSIS

- Consider use of machine learning and artificial intelligence in asset management prediction models, such as a step function to estimate bridge deterioration. The Colorado DOT is currently working on this research, along with research to use artificial intelligence to incorporate asset management into corridor planning.⁴⁸ Similarly, the West Virginia DOT (WVDOT) is incorporating machine learning and artificial intelligence into the WVDOT asset management data collection and analysis strategies.⁴⁹
- Incorporate cross-asset frameworks into asset models.
- Conduct research on incorporation of risk, improved prioritization approaches, level of effort quantification, and use of the NCHRP Cross-Asset Resource Allocation Spreadsheet Tool or AASHTO's Multiple Objective Decision Analysis Tool.⁵⁰
- Quantify the benefits of asset investments to support application of cross-asset prioritization and benefit–cost analysis to the evaluation of asset investments.
- Improve monitoring of inflation and other cost pressures to reduce future cost risks.

CORRIDOR PLANNING

- Integrate asset management with corridor planning. For example, the Colorado DOT is working to extend current asset management models, which cover about 1/10 of a mile, and the agency is developing treatment recommendations that consider the corridor's conditions over a more substantial distance. MnDOT is developing a corridor risk tool, which project managers can use to identify asset condition needs during a corridor study.
- Incorporate Complete Streets projects with pavement preservation or repair. Many agencies are already working to advance Complete Streets elements as part of repaving or other maintenance projects. For example, the Washoe County Regional Transportation Commission in Nevada works with local agencies to implement Complete Street projects in conjunction with its preventive maintenance program on regional roads to improve multimodal safety.

⁴⁸ Interview with Colorado DOT staff. 2025.

⁴⁹ FHWA. 2024. Case Study – Asset Management Integration.

⁵⁰ NCHRP. 2020. Case Studies in Cross-Asset, Multi-Objective Resource Allocation.

Conclusion



Photo: Getty Images

State DOTs and MPOs have numerous opportunities to incorporate asset management and performance-based planning principles into the STIP and TIP. The findings from this study show that agencies are using data, performance targets, and structured processes to inform decisions; however, the degree of integration varies across states and regions. Data availability, analytical capabilities, funding constraints, staff capacity, and organizational structures impact how agencies can use the programming process to address pavement and bridge condition.

Agencies are taking steps to link AMPs, long-range plans, and performance reports to programming decisions. State DOTs are using risk-based asset management approaches and integrating life cycle planning and scenario analysis into funding decisions. MPOs are strengthening their project prioritization processes by incorporating pavement and bridge condition measures and criteria. These efforts have contributed to more transparent, consistent, and data-supported decisionmaking.

While agencies have adopted practices for using the programming process to advance pavement and bridge condition, challenges remain. Limitations in analytical tools, and inconsistent data collection practices across jurisdictions affect agencies' ability to forecast conditions, assess tradeoffs, and communicate long-term needs. Many agencies experience staff capacity constraints, and changes in leadership or political priorities can

further complicate efforts to implement consistent, preservation-focused strategies. Uncertainty about future funding levels, costs, and risks—such as weather, demand, inflation, or supply-chain pressures—can pose challenges to long-term planning and decisionmaking.

Even with these challenges, there are many opportunities to advance the practice today and in the future. New data collection technologies, enhanced modeling capabilities, and improved communication tools can strengthen agencies' technical processes and support clearer communication with stakeholders. Strengthening linkages across internal agency departments, along with expanding collaboration among State DOTs, MPOs, and local agencies can also enhance consistency and support strategic investments.

To continue advancing the use of STIPs and TIPs to support pavement and bridge performance, the following recommended actions may be considered by practitioners, decisionmakers, and policymakers.

Strategies for Transportation Agencies

- **Strengthen connections between AMPs and programming decisions** by ensuring investment strategies and risk considerations in the AMP are clearly reflected in STIP and TIP development.
- **Expand the use of forecasting tools, scenario analyses, and multi-objective prioritization methods** to evaluate funding strategies, understand tradeoffs, and support the selection of projects that advance asset condition goals.
- **Improve the consistency and quality of condition data** by adopting standardized data formats and collection methods, where possible, and using new technologies, including artificial intelligence, to collect, clean, or standardize data.
- **Enhance communication with stakeholders and decisionmakers** by developing educational materials, interactive tools, and performance dashboards that clearly explain preservation strategies, expected outcomes, and long-term benefits.
- **Expand coordination across internal agency departments and external partners** to align priorities, share data, and provide technical support where needed.
- **Invest in staff capacity** related to the integration of asset management, performance-based planning, target setting, and analytical tools.
- **Integrate asset condition goals and strategies into corridor-level planning** to help ensure that pavement and bridge needs are considered alongside safety, mobility, access, and multimodal system needs.

Improving pavement and bridge performance across the NHS and other roadways will continue to require advanced data analysis, strong coordination, and clear

communication across transportation agencies, internal departments, decisionmakers, stakeholders, and the public. Critically, transportation agencies can use this data analysis, coordination, and communication to intentionally program projects in the STIP and TIP that support asset condition goals in a strategic, cost-effective manner reflective of Federal, State, and regional priorities.

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Appendix A. Case Study: Michigan Department of Transportation

The State of Michigan has over 85,000 lane miles of Federal-Aid highways. The NHS in Michigan consists of 6,456 lane miles and 2,964 bridges. This network is owned and operated by a range of Federal, State, and local agencies, including over 600 roadway agencies, more than 75 transit agencies, and a range of other asset owners. Managing this extensive infrastructure network requires significant coordination across agencies, systems, practices, and capabilities. The Michigan DOT (MDOT) maintains approximately 80% of assets on the NHS.⁵¹

For more than 30 years, MDOT has continuously refined its processes, practices, and activities to align broad transportation planning efforts with programming and project delivery. This work is currently organized through the “Call for Projects” (CFP) process. This process is coordinated by MDOT’s Bureau of Transportation Planning and supported by several other bureaus, including Development, Field Services, and Bridges and Structures.

MDOT, in coordination with other statewide asset-owning agencies, regularly monitors pavement and bridge conditions. These assessments inform the agency’s performance targets, strategic goals, and funding allocations. Once central funding levels are established for the CFP, MDOT’s seven regional offices, working in collaboration with local entities, such as MPOs and rural transportation agencies, are given significant autonomy to identify and prioritize projects based on the CFP criteria. The CFP process is, therefore, a comprehensive and collaborative planning and programming effort.

This case study offers an overview of Michigan’s approach, highlighting organizational structure, performance management, funding strategies, technology, and key challenges. The insights provided can help other State DOTs seeking examples of data-driven, practice-ready models for integrating transportation planning, asset management, and programming efforts. A central focus of this case study is how MDOT identifies, evaluates, and approves Federal-Aid eligible highway projects in alignment with agency policies, goals, and strategic direction.

ROLES AND RESPONSIBILITIES

Asset management, transportation planning, and project programming activities for Federal-Aid highways in Michigan are coordinated through multiple internal units within MDOT, in collaboration with various external asset owners. The roles and responsibilities for each internal unit and external partner are clearly defined and structured within the CFP process.

⁵¹ Michigan DOT. 2022. Transportation Asset Management Plan.

- The Bureau of Transportation Planning issues the CFP instructions, coordinates the overall process, and establishes regional funding allocations. It also oversees asset management, system management, the Geographic Information System (GIS), and the Highway Performance Monitoring System (HPMS), and provides pavement data.
 - MDOT's Statewide Systems Management Section (SSMS), a section within the Bureau of Transportation Planning, works in coordination with key decisionmakers and executives to evaluate available revenue for the fiscal year. This evaluation includes an analysis of historical funding distribution and consultation with major stakeholders.
 - Based on this collaborative process, MDOT finalizes funding allocations for each region.
 - It is important to note that this allocation process applies regardless of the asset's Federal-Aid eligibility. All relevant data are considered to help ensure a balanced distribution of funding across programs, regions, and asset types.
- Several internal units within MDOT contribute to developing the CFP instructions.
 - The Bureau of Bridges and Structures provides data to support the development of performance criteria for highway bridges.
 - The Bureau of Field Services coordinates highway construction, traffic operations, maintenance, and pavement activities.
 - The Bureau of Development is responsible for design, system management coordination, and the establishment of performance metrics and management practices.
 - Other key contributors include the Enterprise Information Management Office, other transportation modes, and the Regions' Transportation Service Centers.
- Once finalized, regional offices receive the CFP instructions, their funding allocations for the STIP, and statewide targets for pavement and bridge performance.
 - Each region reviews and adopts pavement and bridge targets through coordination with local agencies.
 - Regions are empowered with substantial autonomy for selecting and prioritizing projects based on network-level needs, ensuring alignment with strategic objectives, and managing project development and maintenance activities.
- Local agencies, including cities, counties, and villages as defined under Michigan Public Act 51 of 1951, are represented in the Transportation Asset Management Council (TAMC).

- The TAMC is a part of the Michigan Infrastructure Council, which supports MDOT in infrastructure data collection, prioritization, and other asset management activities. The TAMC maintains dashboards with data on road and bridge inventory and condition, as well as infrastructure investment. Together with transit, rail, and aviation agencies, the TAMC collaborates closely with regional offices during project prioritization, regional target setting, and development to ensure effective programming and project delivery.

PROJECT SELECTION PROCESS

Based on feedback from the regions, MDOT central office publishes the rolling Five-Year Transportation Program, which is updated annually. At the start of each year, the Bureau of Transportation Planning coordinates the review of funding templates (budgets for categories of projects) and associated performance targets. These targets are determined based on asset condition goals and the total available funding. Specific templates are used to guide investment in pavement and bridge conditions, which include: Road Rehabilitation and Reconstruction (R&R) and Capital Preventive Maintenance (CPM), Bridge R&R and CPM, and Culverts.

For each program category, MDOT sets template targets and encourages regional program managers to strategically combine funding streams to deliver more comprehensive projects. There are eight major program categories under the CFP:

- Road R&R.
- Road CPM.
- Bridge.
- Safety.
- Carpool Parking Lots.
- Operations.
- Intelligent Transportation Systems.
- Traffic Signal Modernization.

Combining projects, such as bundling safety improvements with asset condition upgrades, allows the agency to increase efficiency and maximize performance outcomes. However, challenges remain in some cases, such as when regional program managers are hesitant to merge funds from other programs. MDOT promotes open communication and local involvement for conflict resolution measures. Once the Bureau of Transportation Planning finalizes funding allocations across program templates, project prioritization is conducted at the regional level using CFP processes. The proposed projects are assessed using

forecasting models for pavement and bridge conditions and compared against the established performance targets. This helps ensure alignment with strategic goals and can be amended as needed in collaboration with local support.

INTEGRATION OF TARGET SETTING AND PROGRAMMING

MDOT has set up dedicated teams to manage the development of performance targets associated with the Federal Transportation Performance Measure (TPM) regulations (23 CFR 490). These teams evaluate relevant performance measures and metrics to establish realistic and data-driven statewide targets for each category. When setting statewide targets, MDOT coordinates closely with MPOs, explaining the rationale behind selected targets and sharing supporting data. Once statewide targets are established, MPOs may then either adopt the State's targets or establish their own. The performance target information is incorporated into the system performance reports for both the State Long-Range Transportation Plan and the MPOs' MTPs.

To align programs with established plans, MDOT structures its programming through the roadway systems defined under the AMP, which are Interstates, Non-Interstate Freeways, Non-Freeway NHS routes, and Non-NHS Trunklines. This is a shift from previous practices, where programming was categorized only as Freeway and Non-Freeway.

TOOLS AND METHODS

Centrally, MDOT employs a range of forecasting systems for analysis and scenario planning to evaluate future infrastructure conditions and select projects that maximize the percentage of pavement and bridge assets in *Good* or *Fair* condition. For pavements, the Road Quality Forecasting System is used to estimate the remaining service life (RSL) for State trunklines, while the Pavement Condition Forecasting System forecasts Pavement Surface Evaluation and Rating (PASER) scores primarily for local roads. For bridges, the Bridge Condition Forecasting System provides projections for all National Bridge Inventory (NBI) structures. Additionally, the Ancillary Structures Condition Forecasting System is currently under development, which covers 15 ancillary assets (including culverts, retaining walls, dynamic message sign support structures, and communication towers, among others) and is beginning to undergo testing.

Recognizing the inefficiencies in this fragmented structure, MDOT has conducted extensive background work to develop a unified platform that integrates all local, regional, and MDOT systems, allowing for streamlined communication and coordination. At the regional level, MDOT collaborates with over 600 roadway agencies, several of which have developed useful tools to support transportation planning and project prioritization. For example, in 2019, the Southeast Michigan Council of Governments (SEMCOG) partnered with MDOT to develop a regional [flood risk assessment tool](#). This interactive tool evaluates roads, bridges, culverts, and pump stations, assigning a flood risk score based on factors such as precipitation data, historical flood events, and current road conditions. The tool's development aligns with the FHWA vulnerability assessment methodology. MDOT has cited this tool on its website as a foundational resource in its efforts to enhance risk preparedness.

FUNDING

MDOT does not allocate funding based on the extent of infrastructure managed by each regional office. Instead, the focus is on achieving performance outcomes. For pavement, SSMS develops a funding strategy aimed at achieving and sustaining statewide condition goals through analytical modeling, which is outlined in the Tools and Methods section. Each region is expected to meet a minimum investment threshold to support progress toward the statewide goal of maintaining 90 percent of Freeway and Non-Freeway pavements in *Good* or *Fair* RSL condition.

For bridges, long-term regional strategies align with the broader statewide strategy. Funding targets for replacement, rehabilitation, and preventive maintenance are based on the deck area of candidate bridges in each region, along with the prioritization of tier levels and their associated weightings. The long-term strategy for each region is determined by averaging these funding targets with current programmed projects. As regions approach or exceed the statewide bridge condition goal, their strategies are adjusted to place greater emphasis on preventive maintenance to preserve the network's overall condition.

In 2020, MDOT launched its Rebuilding Michigan Initiative⁵², which leveraged \$3.5 billion in bond proceeds to fund 52 transportation projects, focusing investments on longer-term fixes and high-volume roads. This strategic use of bond funding led to significant improvements in pavement condition across the State, bringing the State network to the highest percentage of Federal-Aid roads in “good” condition since 2002—a result largely attributed to this initiative.

CHALLENGES AND NEXT STEPS

Although MDOT has confidence in its CFP process, the available funding is still insufficient to meet the State's transportation needs. In some cases, the total funding level is not the primary issue, but rather the restrictions on the use of various funding sources (i.e., earmarking for specific projects or programs) that prevent the DOT's ability to maximize the performance outcomes in the highest priority areas. Another persistent challenge for MDOT comes from a common public perception: the expectation of system improvements without a corresponding increase in revenue sources and fees.

When financial resources fall short of what is needed to meet performance targets, MDOT relies on a prioritization process guided by a feedback loop that allows for regional autonomy. Transparent communication with the public has been vital in managing expectations and demonstrating that MDOT is delivering the best possible outcomes within its budget constraints. Communication includes maintaining a publicly available interactive map with proposed projects for the Five-Year Transportation Program, sharing information with agency partners to distribute to their stakeholders, and sharing updates and other information on social media. In addition, MDOT must coordinate with over 600 roadway agencies, each of which may differ in terms of staff capacity, technical tools,

⁵² Michigan DOT. No date. Rebuilding Michigan Initiative website.

asset data collection methods, and overall capabilities. This variability often leads to inconsistencies in asset data between owners, complicating the STIP development process. Establishing a standardized approach to asset data collection and management would significantly enhance the efficiency and accuracy of STIP preparation.

NOTABLE PRACTICES

Integration of Target Setting and Programming. MDOT has changed how it structures its programming to use the roadway systems defined under the AMP. This approach helps align programs with established plans.

Public Engagement. Notably, MDOT has made substantial efforts in public engagement, which is an important avenue for gathering early input from stakeholders and the general public. These efforts include consistent public education, supportive State legislation prioritizing preservation, agency policy changes, and ongoing coordination with local partners. One significant public outreach success involves addressing misconceptions around the agency's new preservation-based investment strategies versus its historic "worst-first" approach. While it may initially seem counterintuitive to prioritize roads with minor cracks over severely deteriorated ones, over time, Michigan residents have come to understand the engineering and asset management rationale behind this approach. As a result, MDOT staff today receive fewer public requests to prioritize visibly damaged roads over those needing preventive maintenance.

Performance-Based Allocations. MDOT allocates funding to regional offices with a focus on achieving statewide performance outcomes. For pavements, each region is expected to meet a minimum investment threshold to support progress toward the statewide goal of maintaining 90 percent of Freeway and Non-Freeway pavements in *Good* or *Fair* RSL condition. For bridges, as regions approach or exceed the Statewide bridge condition goal, their strategies are adjusted to place greater emphasis on preventive maintenance to preserve the network's overall condition.

Asset Management Systems. MDOT employs a range of forecasting systems for analysis and scenario planning to evaluate future infrastructure conditions and select projects. In addition to pavement and bridge management systems, MDOT is currently developing a third analysis tool, which will cover 15 ancillary assets. Recognizing the inefficiencies in this fragmented structure, MDOT has conducted extensive background work to develop a unified platform that integrates all local, regional, and MDOT systems, allowing for streamlined communication and coordination.

Appendix B. Case Study: Minnesota Department of Transportation

The State of Minnesota has over 142,000 lane miles of public roadways (the fourth largest system in the United States), of which 60,531 are Federal-Aid highways, and 27,953 of which are part of the NHS.⁵³ Minnesota has 21,148 bridges of a 10-foot span or larger. Roads are owned and maintained primarily by the Minnesota DOT (MnDOT), Minnesota counties, and Minnesota municipalities. MnDOT is comprised of a central office and eight District offices, which manage highway construction and maintenance within their regional District.

MnDOT uses a performance-based planning and programming process to maintain or improve the State's transportation system and address other statewide goals, such as livability, economic prosperity, and environmental stewardship, through transportation improvement projects. Like most State DOTs, MnDOT develops a family of transportation plans, with its statewide policy plan, Minnesota GO, serving as the umbrella plan and setting an overall vision for the State's transportation system. Bridge and pavement condition is addressed through the Minnesota State Highway Investment Plan (MnSHIP), which outlines a 20-year strategy for highway investments and directs capital funding within the State. MnSHIP establishes investment priorities across various categories, including system stewardship (condition and roadside infrastructure), safety, and livability. The plan is developed through engagement with both internal and external stakeholders, presenting different investment options and scenarios within a constrained 20-year budget. MnDOT conducts a robust stakeholder and public engagement process to determine how communities would allocate the available resources across programs.

Highway construction projects are programmed for implementation in the 10-year Capital Highway Improvement Plan (CHIP), which is directly influenced by the investment direction set in MnSHIP. The first four years of the CHIP serve as the MnDOT STIP, where projects move forward from years 5-10 of the CHIP and are assigned a project manager, scoped, and implemented with committed funds from the STIP.

MnDOT updates its AMP, which guides the Districts on how to manage asset classes, every four years. The AMP outlines multiple scenarios and strategies to maintain the State network, helping Districts determine treatments and timing for bridge and pavement performance needs. For the 2026 AMP, MnDOT is looking at various investment scenarios and will have different funding options for non-NHS assets. MnDOT aspires to prolong non-NHS reconstructions and extend their service life.

This case study provides an overview of Minnesota's approach, highlighting organizational structure, performance management, funding strategies, technology, and

⁵³ FHWA. 2024. Highway Statistics 2022.

key challenges. The case study describes the close collaboration between the MnDOT Central office and District offices to select projects for implementation, and the data-rich performance-based planning process used to help ensure constructed projects help MnDOT meet State and Federal performance goals.

ROLES AND RESPONSIBILITIES

Asset management, transportation planning, and project programming activities for Federal-Aid eligible highways in Minnesota are managed by MnDOT Central Office and MnDOT Districts.

- **Statewide Planning and Program Management Division** manages programming at MnDOT, supported by internal MnDOT offices and committees, and the development and updates of the AMP.
 - **Asset Management Project Office** manages the Transportation Asset Management System (TAMS).
 - **Office of Transportation System Management** leads the development of the Statewide Multimodal Transportation Plan and the STIP.
 - **Office of Materials and Roads Research** supports asset management tool development and maintenance and manages the collection and analysis of pavement on the Minnesota Trunk Highway System.
- **District Offices** develop a project list for the MnDOT 10-Year CHIP, based on funding targets, performance targets, AMP guidance, and local knowledge.

PROJECT SELECTION

MnDOT establishes both Federal and State targets for bridge and pavement condition. While Federal targets are used for two- and four-year condition goals, MnDOT State targets are used for a longer-term (10-year) outlook. Federal bridge and pavement targets are set based on anticipated outcomes of the projects programmed in the STIP, while MnDOT's State bridge and pavement condition targets are aligned with traveler expectations, according to the MnDOT SHIP and AMP.

MnDOT uses a standard selection process, adopted in 2018, to help identify projects to add to its 10-year CHIP. The process was developed in response to a 2017 directive by the Minnesota Legislature to increase the transparency of how projects are selected for implementation. Projects are proposed to MnDOT by the Districts and MPOs; the projects are then evaluated and scored based on established criteria, which will inform the decisionmaking process. Criteria vary by project categories, which include pavement condition, bridge condition, highway mobility, freight, and pedestrian and bicycle infrastructure, among others.

Each District develops a program of projects for inclusion in the CHIP to address pavement and bridge condition annually. The CHIP is informed by investment targets, State and Federal bridge and pavement condition targets, and guidance from the MnDOT

AMP, and includes assets both on and off the NHS, which are scored and prioritized separately.

MnDOT Districts create a list of projects based on guidance from MnSHIP, performance targets, and their individual funding allocations. Each District has Bridge and Pavement staff members, who use various tools and local knowledge to identify projects that perform the following:

- Address the performance of the network at the District level.
- Leverage opportunities to coordinate with other projects.
- Address specific needs identified by stakeholders and local communities.

The bridge and pavement staff members make decisions to meet targets and review the overall program annually, incorporating performance measures into their decisionmaking process. The team uses modeling and a professional understanding of deterioration to guide their decisions.

This list is sent to the MnDOT Materials and Bridges Offices, which model the proposed projects to determine how their outcomes, when implemented, will address system needs and statewide targets. If the Materials and Bridges Offices have proposed changes to the list, the staff will meet with the Districts to finalize the list, taking local, regional, and statewide needs into consideration.

Projects move from the CHIP to the STIP after the scoping procedure. This process is led by project managers in coordination with staff from District functional areas, such as safety, water resources, and transit. MnDOT is actively working to begin scoping projects earlier to better coordinate among functional areas.

FUNDING

Investment direction for project programs (pavement condition, bridge condition, mobility, etc.) is determined in the 20-Year MnSHIP. The plan outlines the total expected revenue for MnDOT and total costs to meet needs, which are determined by Federal and State requirements, MnDOT policies, investment required to maintain the highway system in a state of good repair, risk management, and public and stakeholder input, among others. This investment direction is used to identify projects for programming.

MnDOT Capital Project Policy Statement

The Minnesota Department of Transportation (MnDOT) will use objective and transparent processes to: evaluate, prioritize, and select all capital projects, except those exempted by this policy in the applicability section below; evaluate, prioritize, and select construction projects on the State highway system to be included in the Capital Highway Investment Plan (CHIP) and State Transportation Improvement Program (STIP); award grants for capital projects; and allocate funding or resources for capital projects, including trunk highway and general obligation bonds.

MnDOT will document and make publicly available for each selection process or program: criteria and process for assigning a numeric score and selecting projects; list of candidate projects considered; scores assigned to projects and reasoning behind selection decisions not included in the score.

The 20-Year MnSHIP investment direction is also used to guide spending decisions for the CHIP. The MnDOT Capital Planning and Programming Unit issues funding targets, which come from the MnSHIP, for each of the Districts annually. The Capital Planning and Programming Unit reviews expected revenues and fund streams, and performance across investments areas (including asset condition).

For projects in years 5-10 of the CHIP, funding targets are broken down into investment categories, while projects in years 1-4, which comprise the STIP, are organized by funding sources rather than investment categories.

Until 2017, MnDOT developed funding targets for Districts based primarily on the size of the system in each District. Following the passage of the Minnesota legislation for MnDOT to develop a transparent scoring process for STIP project selection, MnDOT moved to a more performance-focused approach that determines funding allocations based on various factors, including need, asset density (average road length/mile) for roadside infrastructure, differences in operation, traffic control, and mitigation for road closures, maintenance, and the variability in maintenance costs, as well as system size. Funding allocations for Districts include both capital and operation/maintenance projects.

Funding for projects in the STIP primarily comes from the Federal Highway Administration, Federal Transit Administration, and the Minnesota State Trunk Highway Fund. The Minnesota State Trunk Highway Fund is supported by fuel taxes, vehicle taxes, and vehicle registration fees.

The MnDOT AMP provides investment strategies to inform funding allocations used in the CHIP. These investment strategies are developed based on funding scenarios using pavement treatment decision trees and performance prediction models.

TOOLS AND METHODS

MnDOT has several primary tools to support project selection, described as follows.

- **Transportation Asset Management System (TAMS).** MnDOT uses TAMS to track the condition of NHS and non-NHS roads and deterioration models to identify specific road segments whose condition is poor or forecasted to become poor.
- **Highway Pavement Management Applications.** MnDOT uses this decision tree management system to recommend the fix type and timing for the pavement network. As of 2025, MnDOT was in the process of transitioning the Pavement Management System (PMS) to the TAMS.
- **Pavement Investment Evaluator.** MnDOT Districts use this planning tool to evaluate investment strategies and understand impacts of individual projects on pavement performance. The MnDOT Central office uses this tool to evaluate proposed pavement investment programs from the Districts and propose changes to meet performance targets, if needed.

- **Pavement and Bridge Dashboard.** This internal tool helps District staff develop lifecycle and risk assessments at the District level for bridge and pavement condition performance. The dashboard compares investment needs to maintain performance using worst-first and preservation-focused approaches. The tool also allows Districts to select an asset and propose a strategy to address bridge or pavement condition within a specified timeframe. The dashboard highlights current and potential conditions, costs for capital maintenance, and impacts on Districts or the State, and can be used to compare multiple approaches. Districts can use a slider tool to adjust the budget for an asset class, showing deterioration curves and the funding level where conditions improve from poor to good.
- **Pavement Lifecycle Cost Analysis Worksheet.** The agency maintains a Pavement Lifecycle Cost Analysis worksheet, which shows the impact of different strategies on asset classes in the AMP. Districts use it to propose activities for the CHIP, identify costs of treatment, and evaluate impacts on condition. Each District has its own unique spreadsheet, which corresponds to local costs.
- **Structure Information Management System.** MnDOT collects and maintains condition data on all Minnesota bridges in this database, including NHS and non-NHS bridges.
- **Bridge Replacement and Improvement Management (BRIM) System.** MnDOT uses its BRIM system to inform project type decisions and financial needs. The BRIM system uses lifecycle cost principles to help ensure maintenance/repair/replacement decisions are made strategically to meet performance targets in a cost-efficient manner.

CHALLENGES AND NEXT STEPS

MnDOT's decentralized approach allows for a level of autonomy among Districts and regional/local agencies, but it also can pose challenges to meeting performance targets based on the types of projects that are prioritized for implementation. MnDOT prioritizes a balance of projects to achieve performance targets within funding constraints. Districts and MPOs may advance projects with competitive funding, or alternative sources of funding, which may be aligned with different goals.

Corridor planning is an emerging priority for MnDOT, which launched a corridor risk tool in late 2025. This tool integrates asset condition layers into a GIS portal, helping to identify asset needs for projects already in the CHIP. The corridor risk tool includes data at four maturity levels: risk, inventory, condition, and inspection, allowing for cross-asset risk tradeoffs. The tool also identifies the riskiest assets in a corridor with the highest potential for impact and failure. Districts can draw polygons in the GIS platform to query condition data for all the underlying assets and develop cost estimates for capital projects and distinct types of maintenance.

MnDOT is actively working to improve its data maturity to better forecast future conditions and evaluate tradeoffs among strategies. This includes conducting research on how capital investments impact maintenance and operational needs, developing new performance models for bridges and pavements, and developing preventive maintenance performance measures for key highway assets.

NOTABLE PRACTICES

Long-Term Planning. MnDOT develops Federal performance targets based on anticipated outcomes of projects programmed in the STIP; however, the agency also uses longer-term State performance targets to guide investments over a 10-year period. MnDOT develops assumptions for bridge and pavement conditions for the six-year period following the four-year STIP to guide investment and project selection.

Investment Direction Influenced by Asset Management Plan. MnDOT's investment strategy (the MnSHIP) is clearly influenced by identified needs and the financial assessment in the Asset Management Plan. While the MnSHIP is financially constrained and does not have the ability to meet all identified needs and all performance targets, it prioritizes bridge and pavement condition, especially on the NHS. The 2023 MnSHIP Investment Direction anticipates meeting NHS Interstate targets and NHS bridge condition targets by 2042.

Internal Coordination. MnDOT closely coordinates between central offices and Districts to identify project selections for the CHIP and STIP. MnDOT annually coordinates with Districts in three phases:

1. December – April: Districts coordinate with program offices and the public on development of draft STIP and CHIP.
2. April – May: Investment impact analysis on draft list of projects on MnSHIP outcomes and performance targets.
3. May – July: Finalize leadership approval of STIP and CHIP.

Scoping Process Efficiencies. Projects in the CHIP are assigned a project manager once they are added to the STIP, which kicks off the scoping process. MnDOT maintains a scoping database that maps needs identified by all functional areas. As project managers are determining specific elements for their project, they use this database and work with MnDOT functional areas to identify opportunities to address multiple needs within a single project.

Appendix C. Case Study: Northeast Ohio Areawide Coordinating Agency

The Northeast Ohio Areawide Coordinating Agency (NOACA) serves as the MPO for Northeast Ohio, covering the counties of Cuyahoga, Geauga, Lake, Lorain, and Medina, including their municipalities and townships. The total population within NOACA's five-county region exceeds 2.05 million. NOACA is responsible for overseeing approximately 3,293 centerline miles of Federal-Aid highways. Additionally, NOACA oversees more than 13.3 million square feet of bridge deck area on the NHS and 7.4 million square feet on the non-NHS network, encompassing a total of over 3,000 bridges across the region. This transportation network carries over 50 million riders each year.

One of NOACA's core responsibilities is to help ensure that current and future transportation project investments are guided by its regional planning approach. NOACA's Metropolitan Transportation Plan (MTP), AIM Forward 2040, establishes the decisionmaking framework for transportation investments in the Northeast Ohio metropolitan planning area. AIM Forward 2040 establishes a 20-year vision for the region's transportation system, including long-term goals and planning principles. This plan aims to direct more than 90 percent of NOACA's available funding to projects that maintain existing highway and transit infrastructure and improve livability in Northeast Ohio.

NOACA's primary tool for delivering on its long-term goals is the Transportation Improvement Program (TIP). The TIP is a prioritized list of proposed transportation projects for four years that includes all expected funding from the FHWA, the Federal Transit Administration (FTA), and the Ohio DOT.

Approximately a decade ago, NOACA redesigned its TIP development process to incorporate asset management principles and data. Previously, project selection was based on an application-driven process that largely prioritized projects on a first-come-first-served basis. This process proved to be inefficient and did not effectively serve regional needs. Recognizing the need for a more strategic approach, NOACA underwent organizational and procedural changes that led to the development of a more data-driven project selection process. This process is based on performance data related to asset condition, safety, regional significance, and cost-effectiveness.

This case study highlights NOACA's evolution from a reactive, application-based process to a proactive, performance-based planning framework. The current approach emphasizes cost-efficiency, regional impact, and alignment with long-term transportation goals, ensuring that the most critical and beneficial projects receive funding. It also underscores the importance of integrating the MTP into the TIP process and engaging local stakeholders throughout project selection. NOACA is one of the few MPOs that maintains and operates a Pavement Management System (PMS) and uses

output from that system to drive the TIP development process. This approach makes NOACA a valuable case study for other MPOs looking to implement more data-driven processes.

ROLES AND RESPONSIBILITIES

Several internal units, along with coordination, communication, and feedback from community partners and local stakeholders, play crucial roles in integrating the planning and programming process. NOACA has clearly defined and structured roles across three primary levels: policy, planning, and programming. Beyond these internal units, NOACA distinctly outlines the involvement of the Ohio DOT and community members/local stakeholders in the development of the TIP.

Internal Units:

- The MPO Policy Board consists of the NOACA Board of Directors, which approves the MTP and the TIP.
- The Executive Director establishes the strategic direction and oversees the coordination and integration of planning and programming efforts.
- The Director of Planning oversees the PMS scenario analysis for all 80 communities and identifies candidate projects through cost-effectiveness evaluation. The PMS scenario analysis is performed every two years.
- The Director of Programming leads the project prioritization and manages the TIP development process, conducting a detailed analysis of the initial PMS candidate outputs. The TIP is updated biennially.

External Collaborations:

- The Ohio DOT collects Pavement Condition Rating (PCR) data for Federal-Aid eligible roadways, as well as component-level bridge condition data. NOACA uses this information for the development of the TIP.
- Community partners, such as city and county representatives and officials, take part in various NOACA committees and offer input throughout the TIP development process. NOACA also encourages feedback from the general public through mail, email, telephone hotline, website, social media, and other channels during the TIP process.

INTEGRATION OF PROGRAMMING AND TARGET SETTING

Programming

The TIP outlines a prioritized list of pavement, bridge, public transit, enhancement, and other transportation projects. These initiatives are supported by Federal funds

administered by NOACA, the Ohio DOT, public transit agencies, and other governmental entities, including regional Metroparks systems. The set of projects considered for NOACA funding is developed through a robust planning and needs assessment process. This process incorporates projects from NOACA's strategic plans, including the Transportation Asset Management, Safety, Congestion Management, Multimodal, Enhancement, and Transportation Alternatives plans, as well as project proposals submitted by local communities and transit agencies that were informed by their Transit Asset Management plans. The TIP reflects the priorities established in NOACA's MTP and aligns with State and Federal performance management frameworks.

Performance-Based Programming

NOACA programs projects aimed at increasing and maintaining the percentage of NHS pavements and bridges in *Good* condition while reducing the percentage in *Poor* condition. NOACA measures bridge and pavement performance in the TIP using the Ohio DOT's 2- and 4-year targets, as well as the MPO's 2- and 4-year targets, which are more aggressive than the State targets. TIP investments are directed toward achieving these targets through a data-driven, performance-based approach.

Pavement Maintenance Reports

NOACA prepares individual Roadway Pavement Maintenance Reports for counties and communities within the region. These reports assess the condition of Federal-Aid roadways using data provided by the Ohio DOT and include cost estimates for bringing the roads to a state of good repair. These reports are separate from the TIP document, and NOACA does not use these reports for TIP development. The member agencies use the reports to inform pavement maintenance activities that are funded with local revenues.

TOOLS AND METHODS

NOACA employs a two-tiered analysis process to integrate planning and programming activities. The PMS first calculates the cost-effectiveness of various potential pavement treatments to identify candidate projects. This cost-effectiveness analysis considers the functional importance of the transportation facility (e.g., traffic volume, classification), the type of improvement proposed, and associated costs. This evaluation process initially results in a list of 500 to 1,000 potential projects per year.

The initial list is then reduced to approximately the top 25 percent of projects, which are included in the next step. The reduced list of candidate projects then undergoes a comprehensive performance-based prioritization process in coordination with local member agencies. Pavement segments are prioritized based on expected improvements in other performance areas, such as safety, freight movement, system reliability, congestion mitigation, and air quality. Other prioritization factors include regional significance and access to employment, education, government, and intermodal connectivity.

Once a project is selected for inclusion in the TIP, additional developmental steps continue such as preliminary engineering and environmental studies. During these phases, unforeseen issues may emerge that can impact project scope, cost estimates, and timelines. Prior to being programmed into the four-year TIP for construction, NOACA evaluates how such issues are addressed.

NOACA applies several different analysis tools to support the TIP development process, described in the following section.

Cost-Effectiveness Analysis Tools

The PMS evaluates cost-effectiveness to identify candidate projects by analyzing the cost of treatment in relation to its impact on asset performance. It uses a third-party software for this assessment to evaluate projects of all types. The PMS helps ensure the correct balance of work types as well as fair geographic distribution of projects between the area's urbanized and rural areas.

Project Prioritization Tools

The project prioritization process consists of two key components: Regional Significance Criteria and Project Readiness Analysis. The methodology used during this development process identifies projects that best provide regional benefit and connectivity, as well as address local needs, which are measured against criteria that align with the goals of the regional strategic plan.

- Regional Significance Criteria assess the level of impact a project has, categorized as high (multi-county or regional), medium (county), or low (community).

Evaluation is based on several factors, including:

- Transportation Alternatives project or Interstate projects.
 - Access to job centers.
 - Access to educational, governmental, or medical facilities.
 - Access to cultural, sports, or entertainment venues.
 - Access to intermodal facilities.
 - Alignment with NOACA Plans, including safety and congestion priority locations, freight plan priority routes, public transit priority corridors, transit-oriented development projects, bicycle and pedestrian networks, and recommendations from the Transportation for Livable Communities Initiative or Safe Routes to School studies.
- Project Readiness Analysis evaluates whether planning review issues have been adequately resolved and helps ensure that a complete and committed funding plan is in place for the scheduled implementation year.

Financial Methods

To maintain a balanced program across the four fiscal years of the TIP, NOACA manages project timing through techniques such as advancing projects from out-years, exchanging funds with other MPOs, and using State Infrastructure Bank loans. These methods provide fiscal flexibility and allow NOACA to accommodate projects in the TIP in the year requested by sponsors.

Bridge Considerations

NOACA's bridge inventory data includes general appraisal ratings, ranging from 0 to 9 in alignment with the National Bridge Inventory (NBI) rating system, as well as sufficiency ratings, which range from 0 to 100. However, for the purpose of project programming and prioritization, NOACA uses an index that incorporates not only appraisal and sufficiency ratings, but also the functional classification of the roadways and traffic demand.

To better assess the urgency and immediacy of necessary improvements, NOACA developed the Bridge Priority Index (BPI). The BPI ranks bridges in order of priority for repair or reconstruction based on a combination of key categorical elements. Each element is assigned a weighted value and a significance factor to reflect their relative importance. A higher BPI score indicates a more urgent or compelling need for intervention to address the bridge's condition and functionality.

FUNDING

The Ohio DOT sub-allocates approximately \$35 million in Federal highway funding to NOACA, annually. NOACA administers these sub-allocated funds for projects that are eligible under Federal-Aid transportation programs. This funding does not include direct allocations managed by the Ohio DOT. NOACA typically manages four main programs:

- Surface Transportation Block Grant (STBG)—the largest portion of NOACA's funding.
- STBG Set-Aside for Transportation Alternatives projects.
- Carbon Reduction Program.
- Congestion Mitigation and Air Quality Improvement (CMAQ) Program.

While NOACA oversees the first three programs directly, CMAQ funds are administered through the Ohio Statewide Urban CMAQ Committee. Historically, CMAQ funds were allocated by the Ohio DOT to MPOs based on the population of air quality nonattainment areas. However, in 2012, the Ohio DOT directed the Ohio Association of Regional Councils and its eight largest MPOs to establish a Statewide CMAQ program, replacing the individual MPO-administered programs.

NOACA's planning unit develops annual funding allocations and four-year forecasts based on the funding received. Funding is primarily focused on pavement projects in *Poor*

condition that also demonstrate regional significance. Projects must meet certain threshold conditions and are evaluated based on regional priorities and local input.

Funding may become available within a fiscal year for several reasons, including unspent carry-forward funds, project bids coming in under estimates, scope or cost adjustments, delayed or canceled projects, or new revenue sources. When additional funds become available, NOACA prioritizes their use in the following order:

1. Fulfill prior project commitments that were delayed.
2. Ensure fiscal constraint of the Board-approved TIP.
3. Reduce planned debt obligations.
4. Advance future TIP projects.
5. Fund new eligible projects.
6. Reserve funds for potential cost increases.

CHALLENGES AND NEXT STEPS

One ongoing challenge NOACA faces is that, despite having a robust process and system in place, the overall funding needs continue to exceed annual revenue. As a result, to fully leverage the enhanced capabilities of its improved processes, the agency is actively seeking more funding to support the delivery of more projects.

NOTABLE PRACTICES

Standardizing Regional Pavement Condition Reporting. Historically, pavement condition assessments across NOACA's jurisdiction varied widely, with different counties using diverse standards. Some aligned with the Ohio DOT, and others relied on independent metrics. To address this inconsistency, NOACA established a regional policy more than a decade ago to standardize PCRs across cities, counties, and townships, thereby establishing a backbone for a unified and coordinated planning and programming process.

Integrating Asset Management and Programming. NOACA uses a PMS to apply asset management concepts at the local level. Such practice is a relatively unique approach for an MPO. The data are used in a two-way process between the pavement maintenance reports and the TIP.

- Pavement maintenance reports are developed for individual counties and other jurisdictions based on local data. This approach enables local jurisdictions to use the pavement reports to understand their own asset management efforts.
- PMS community-level scenario analyses and forecasts are conducted biennially which forecast infrastructure performance over a 15-year horizon. This data is further analyzed and the outcomes of these analyses, combined with local stakeholder input, directly inform the development of NOACA's region-wide, four-year TIP, which is updated every two years.

Strategic Stakeholder and Community Involvement. NOACA places strong emphasis on public education and engagement in its planning, programming, and project prioritization processes. The agency developed a communication and public participation plan to gather meaningful input from both stakeholders and the public. Meeting materials are made available for public review and comment, and public involvement is sought through a variety of channels including email, direct mail, telephone hotline, website updates, and social media. For TIP development specifically, NOACA's public participation process includes formal approval by the Board of Directors followed by a period of public comment, ensuring transparency and community involvement throughout.

Appendix D. Case Study: North Central Texas Council of Governments

The North Central Texas Council of Governments (NCTCOG) is the regional council for the local governments in the Dallas/Fort Worth region, which serves as a central coordinator for regional planning. The NCTCOG Transportation Department and the Regional Transportation Council (RTC), the independent policy body, comprise the MPO for the 12-county Dallas-Fort Worth area. Within the NCTCOG planning area are 12,000 lane miles of Federal-Aid highways on the NHS. Approximately 70 percent of the roadways are maintained by the Texas DOT (TxDOT), while the remaining are managed by counties and local agencies. The NCTCOG planning area includes over 3,900 bridges on the NHS network, approximately 87% of which are managed by TxDOT, while the remaining are managed by counties and local agencies.

NCTCOG produces the metropolitan transportation plan (MTP), which outlines policies, programs, and projects to meet regional, local, and State goals, and the transportation improvement program (TIP), which lists approved projects with committed funding over a four-year period. In addition to the TIP, NCTCOG produces a 10-year capital plan, which feeds into the TIP. The plan development is in response to the Texas legislature requiring the creation of a 10-year capital project plan from the State DOT and all MPOs in Texas, developed using a performance-based process that considers congestion, safety, economic development, available funding, air quality, and socioeconomic effects. NCTCOG also works to secure more funding for projects, often inclusive of bridge and pavement work, through Federal competitive grant programs.

NCTCOG coordinates pavement analysis services for local agencies through the TXShare Program. TXShare is a cooperative purchasing program that allows NCTCOG members to contract with one of four pavement analysis vendors at a discounted rate, made possible by contracting for the region as a whole.

This case study illustrates how NCTCOG uses long-term planning, regional coordination, project prioritization, and external funding solicitation to address bridge and pavement condition on State and locally owned NHS roads in its region. Although MPOs are limited in their ability to influence bridge and pavement condition by the lack of ownership of highway assets, this case study presents strategies for how MPOs can use their resources and role as a regional coordinator to prioritize bridge and pavement condition.

ROLES AND RESPONSIBILITIES

Several internal and external units play a role in implementing projects in the NCTCOG region. While each unit has its unique responsibility, coordination across these teams is critical in determining the right mix of projects for programming.

Internal Units:

- The RTC, made up of 45 local elected officials and representatives, is the designated MPO and transportation policymaking body. This council meets monthly to oversee the planning process.
- The Surface Transportation Technical Committee (STTC) is a subcommittee of the RTC that conducts technical reviews of transportation policies, programs, and project proposals. STTC also develops and applies evaluation criteria for TIP project selection.
- Within the Transportation Department, there are multiple Program Areas that coordinate together to address project development and implementation. The Transportation Funding Program Area manages and conducts quarterly modifications to the TIP. The Congestion Management and Systems Operations Program Area manages the Congestion Management Process (CMP), of which asset condition is one of the performance criteria evaluated in the corridor-level analyses. The Transportation Planning Program Area manages the development and delivery of the MTP, with specialized teams devoted to the advancement of roadway, transit, and freight-oriented projects. The Transportation Planning Program Area also includes the Streamlined Project Delivery team, which is primarily responsible for Federal/State competitive grant coordination, as well as asset management data collection, analysis, and engineering support. The Air Quality Management Program Area contains the GIS/Data Solutions team.
- The Public Works Council consists of public works staff and engineers from NCTCOG member agencies who support NCTCOG in developing regional pavement design guidance and other related subjects.

External Collaborations:

- TxDOT provides bridge and pavement condition data for all NHS roads in the region, including facilities owned and operated by the DOT as well as those owned and operated by local agencies.
- TxDOT Districts meet monthly with NCTCOG to coordinate programming for the TIP.
- Local governments provide asset condition data, local priorities, and proposed projects for inclusion in the TIP.

INTEGRATION OF PROGRAMMING AND TARGET SETTING

NCTCOG adopts the TxDOT Federal performance targets for bridge and pavement condition, as the majority of roadways in the NCTCOG region are owned and operated by TxDOT. Although NCTCOG expects that TxDOT targets could be met for State-owned facilities, locally owned NHS arterial roads were found to have a higher percentage of roads in “poor condition,” creating challenges for NCTCOG to meet the high State targets. With this in mind, NCTCOG approved a policy statement whereby the MPO could work

with local governments on pavement conditions on locally owned arterial roads on the NHS network. This support comes from technical assistance, coordination between local governments and TxDOT on locally owned pavement projects, and grant application support to fund projects.

NCTCOG develops a 10-Year Plan of Projects, updated annually, which feeds into the TIP. The plan is developed in response to 2015 Texas legislation mandating that the State DOT and MPOs create a 10-year project plan, developed using performance-based methods. Projects included in the 10-Year Plan of Projects include all projects expected to be funded by three categories of funding: Metropolitan and Urban Area Corridor Projects, Statewide Connectivity Corridor Projects, and Strategic Priority Projects. Projects funded by other categories are added to the TIP but not the 10-Year Plan.

TOOLS AND METHODS

NCTCOG evaluates bridge and pavement condition data received from TxDOT's Highway Performance Monitoring System, along with data from local agencies that own and operate NHS facilities, when developing its MTP, 10-Year Plan of Projects, and TIP.

Bridge and pavement conditions are not evaluated in a vacuum. Although NCTCOG reviews bridge and pavement condition data when determining system needs, each project requires an understanding of the needs and goals for that particular facility. In some cases, older bridges may have outlived both their condition and purpose and may not be candidates for repair or replacement. Additionally, facilities in need of repair or reconstruction also present opportunities to integrate other improvements, such as accessible ramps, bicycle lanes, or Complete Streets elements.

NCTCOG is expanding its data collection activities within its mapping systems to include bridges and culverts in addition to roadway pavement.

In addition to current and forecasted bridge and pavement condition, NCTCOG evaluates external risks to assets and the durability or vulnerabilities of facilities. The MPO is in the process of developing a vulnerability and susceptibility index for the region to allow the agency to see what facilities on the roadway system (along with surrounding areas) are most vulnerable and susceptible to major flood events or extreme weather conditions.

FUNDING

Funding for bridge and pavement projects is largely outside the MPO's function. TxDOT uses State funds for maintenance and preservation activities on State-owned facilities, while county and local agency public works departments typically manage preservation on locally owned facilities with local funds.

NCTCOG can influence spending on bridge and pavement projects through the TIP and competitive grant funding, where available. Projects considered for inclusion in the TIP are evaluated and scored based on criteria representing State and regional goals and targets, including bridge and pavement performance.

NCTCOG has been proactive in applying for Federal competitive grants. As one example, NCTCOG worked with TxDOT Districts to bundle 12 projects as a proposal for a grant through the Nationally Significant Multimodal Freight & Highway Projects (INFRA) grant program, in 2019. The work has been awarded, funded, and completed. In this example, NCTCOG did not own or operate any of the facilities and was required to submit on behalf of TxDOT. As another example, NCTCOG worked with Dallas County on a successful application for a \$25 million Federal competitive grant, which included the reconstruction of pavement and bridges along Belt Line Road, an NHS arterial segment.

CHALLENGES AND NEXT STEPS

NCTCOG would like to improve its understanding of needs across jurisdictions and better compare projects to each other. Counties and local governments collect pavement data using different systems, which are difficult to compile and analyze on a regional basis. The data collected/shared by TxDOT is based on the metrics used for Federal target setting. Conversion from HPMS factors to Pavement Condition Record (PCR) ratings and/or other platforms for monitoring/managing pavement condition is not always compatible.

The MPO is limited in its role of bridge and pavement preservation to projects applicable for TIP inclusion, which includes reconstruction projects, but not pavement preservation or maintenance.

NOTABLE PRACTICES

Identifying Revenue through Competitive Grants. NCTCOG has been proactive and successful in leading grant applications for local governments as well as partnering with TxDOT to secure funds for projects, including facilities in need of bridge or pavement reconstruction. Between 2018 and 2025, NCTCOG was awarded over \$500 million in competitive grants.

10-Year Plan of Projects. In addition to developing the 4-year TIP, NCTCOG looks ahead by developing a 10-year list of capital projects for implementation. This longer-term list allows the agency to better link the MTP with the implementation process and begin work planning and developing partnerships for implementation earlier in the process.

Policy Statement to Work with Local Agencies on Arterials. With the understanding that pavement condition on locally owned arterial roads is a critical need for safety and mobility goals in the region, NCTCOG works with local agencies to address pavement condition on those roads by assisting with maintenance support. This official policy institutionalizes the support the MPO gives local agencies on managing pavement condition.

Policy Bundle Incentive. NCTCOG incentivizes local agencies to adopt policies that will advance regional goals by providing an offset of local funds for transportation projects.

One policy, “Support Asset Management,” awards points to local agencies that provide documentation of funding and efforts to support asset management. NCTCOG provides two options to receive up to a maximum of three points:

- **Option One** (two points available): Submit documentation showing asset management funding through bond program or capital improvement program.
- **Option Two** (one point available): Submit copy of ordinance or resolution devoting exclusive efforts or funds toward transportation maintenance and preservation.

Performance Communication. For the past decade, the RTC has produced *Progress North Texas*, an annual performance report, reporting on State and regional performance measures, as well as other conditions in the region.

Appendix E. State DOT Peer Exchange #1: Funding and Project Prioritization

Peer Participants: William Johnson (Colorado DOT), Toby Manthey (Colorado DOT), Gehan Elsayed (West Virginia DOT), Eric Frempong (Maryland DOT), Geoff Hall (Maryland DOT), Scott Zainhofsky (North Dakota DOT), Britni O'Connor (Missouri DOT), Shaker Rabban (Minnesota DOT)

Date: July 1, 2025

Summary

State DOT peer exchange participants discussed funding processes and project prioritization practices over the course of the exchange.

Funding: States use various approaches to set funding for pavement and bridge conditions in the STIP, including LRSTPs, optimization models, and decentralized or centralized programming processes. For example, Maryland uses an optimization model combined with decisions made at the Governor's office, while Minnesota relies on a 20-year capital program with public and stakeholder input.

Project Prioritization: State DOTs incorporate NHS pavement and bridge conditions into project prioritization within the STIP, using performance goals aligned with NHS standards for major routes, while varying goals for minor and low-volume roads. States varied in the use of centralized and decentralized approaches. Some DOTs developed project lists through a central department, while others incorporated project lists developed by districts, constrained by funding targets and formulas. Several states employ pavement management models for pavement prioritization and Multi-Objective Decision Analysis (MODA) for bridge projects to optimize funding allocation and project selection, with adjustments made based on district inputs and performance targets.

Major bridges, particularly those exceeding 1,000 feet, present funding and prioritization challenges due to their scale and timing, often requiring top-down funding approaches that compete with other asset needs.

New Technology: State DOTs are integrating innovative technologies, such as satellite imagery, lidar, synthetic aperture radar, drones, machine learning, and artificial intelligence, to enhance condition assessments and project prioritization, addressing challenges in integrating dynamic data into existing models.

Appendix F. State DOT Peer Exchange #2: Decisionmaking and Tradeoffs

Peer Participants: Gehan Elsayed (West Virginia DOT), Scott Zainhofsky (North Dakota DOT), Britni O'Connor (Missouri DOT), Shaker Rabban (Minnesota DOT), Laura Mester (Michigan DOT)

Date: July 9, 2025

Summary

State DOT peer exchange participants discussed decisionmaking and tradeoffs in bridge and pavement programming over the course of the exchange.

Project Prioritization: State DOTs reported various coordination methods and processes to prioritize and select projects for the STIP, including:

- Districts decide on projects and coordinate with the State DOT headquarters to meet performance targets, using models to help determine needs and funding amounts.
- The Call for Projects process coordinated by the Planning division, involving multiple actors, with targets and funding set by the central office and approved by an executive committee. Regions often have autonomy to select projects that fit criteria developed by a central office.
- Planning division sets funding levels for pavement and bridge conditions, and the State DOT uses management models to vet district-recommended projects, with the central office creating STIP priorities and determining affordability.
- Decentralized processes where districts make project decisions using a planning framework involving regional partners and asset management plans, with the central office working with the STIP team for statewide programming.

Investment Tradeoffs: State DOTs reported use of scenario planning and spreadsheet tools to evaluate investments across functional areas. Participants also discussed high level prioritization of funding for asset management to maintain the system and focus on high-risk corridors for prioritization.

Challenges: State DOTs reported challenges with staff unwilling to adopt new analysis and prioritization methods, coordination with MPOs and local organizations, and a lack of understanding across departments within a State DOT.

Appendix G. MPO Peer Exchange

Peer Participants: Michelle Fedorowicz (Southeastern Michigan Council of Governments), Jeffrey Neal (North Central Texas Council of Governments), Grace Gallucci and Ed May (Northeast Ohio Areawide Coordinating Agency), Jesse Buerk (Delaware Valley Regional Planning Commission), Laurel Joseph and Michael Zonyk (Grand Valley Metropolitan Council), Elizabeth Johnson and Vanessa Koenigkramer (North Jersey Transportation Planning Authority), Eileen Singleton (Baltimore Metropolitan Council), Adam Crenshaw (Metropolitan Transportation Commission), Connor Trejos-MacDonald (Hillsborough Transportation Planning Organization).

Date: August 4, 2025

Summary

MPO peer exchange participants discussed the programming decisionmaking process for bridge and pavement projects and the role MPOs play over the course of the exchange.

Funding: MPOs use guidance from their State DOT, metropolitan transportation plans (MTPs), and regional agencies, to determine funding amounts for the transportation improvement program (TIP). For example, Pennsylvania uses a formula based on deck area for NHS and non-NHS bridges. The MTP and local agency input are important in developing needs assessments.

Project Prioritization: MPOs noted the importance of the MTP in developing project lists. Some MPOs include specific criteria for pavement condition, bridge condition, and resiliency in their scoring sheets for the TIP. Challenges include technical resources for understanding tradeoffs, communication with the public, and perception of fairness among local agencies with regard to investment. All MPOs in the peer exchange adopt the State targets for bridge and pavement, though some use regional targets for other performance areas. There are opportunities for adopting advanced technology for data collection and analysis, including use of artificial intelligence, though this is in initial stages.

Investment Tradeoffs: Achieving a state of good repair is a top priority for most MPOs, along with safety. Understanding tradeoffs with investment decisions can be challenging for MPOs, due to limited technical resources, data discrepancies among local agencies, and determining which tradeoffs are acceptable and best aligned with the region's priorities, which can change over time.

Coordination: MPOs support local agencies with technical assistance and tools to help agencies evaluate and make decisions about their local assets. Some MPOs also facilitate project coordination between the State DOT and local agencies.

Challenges: Asset management decisions may be challenging for stakeholders and decisionmakers to understand, especially when agencies are working on a lifecycle approach to managing the state of good repair instead of adopting a worst-first approach. Coordination with multiple asset owners, and a loss of institutional knowledge among agencies were also reported as challenges among the group.

Appendix H. Research Questions

- 1) How are State DOTs and MPOs prioritizing NHS pavement and bridge condition and performance in the processes, activities, and decisions that lead to the development of their STIPs and TIPs?
 - a) Establishing investment programs, strategies, and scenarios, and available funding sources and amounts
 - b) Analyzing alternative scenarios and strategies for investment priorities related to costs, benefits, risks, and tradeoffs
 - c) Linking risk management and life cycle planning to investment strategies, candidate projects, and project work types (e.g., maintenance, preservation, rehabilitation, reconstruction)
 - d) Identifying candidate projects and soliciting project proposals and applications
 - e) Screening, evaluating, scoring, and ranking candidate projects
 - f) Analyzing alternative scenarios and strategies for candidate projects related to costs, benefits, risks, and tradeoffs
 - g) Selecting candidate projects for programming
 - h) Geospatially mapping projects (candidate and selected) and infrastructure condition and performance (existing and forecasted)
 - i) Sharing technical information with decisionmakers, stakeholders, and the public
- 2) How are State DOTs and MPOs analyzing and documenting:
 - a) The funding, programs, projects, and project work types that support NHS pavement and bridge condition and performance and established targets (including FHWA defined and State or MPO defined performance measures)?
 - b) The consistency of selected projects with the long-range transportation plan?
 - c) The anticipated benefits and return on investment?
 - d) The anticipated effect of the STIP/TIP toward achieving the NHS pavement and bridge condition performance targets and the State or MPO State of Good Repair goal?
 - e) The actual achievement of the NHS pavement and bridge condition performance targets for the first performance period (i.e., January 1, 2018, to December 31, 2021)?
- 3) What challenges are State DOTs and MPOs encountering, and how are they addressing these challenges?

- 4) Are there any discernable differences in approach between MPOs that support statewide targets and MPOs that establish their own regional targets? If so, what are they?
- 5) Are there any discernable differences in how State DOTs and MPOs prioritize pavement and bridge condition and performance for the NHS and the non-NHS? If so, what are they?
- 6) What is the “next level” in the state of the practice, and how can State DOTs and MPOs attain that level? What do they need in order to be successful?
- 7) Which State DOTs and MPOs have noteworthy practices, examples, or resources?
- 8) Are there any noteworthy practices, examples, or resources related to the following concepts, frameworks, and innovations?
 - a) Life cycle planning
 - b) Risk management analysis and resilience
 - c) Pavement management systems and bridge management systems
 - d) Cross-asset resource allocation and multi-objective decision analysis
 - e) Automated or rapid data collection
 - f) Artificial intelligence and machine learning
 - g) Geographic information systems, geospatial analysis, and digital mapping
 - h) Scenario planning
- 9) From an organizational and staffing perspective, who is involved in these noteworthy practices and how are they involved?

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