Managing Risks Associated with Major Funding Uncertainty

Michigan Department of Transportation (MDOT) Case Study

Federal Highway Administration

Office of Infrastructure
1200 New Jersey Avenue, SE
Washington, DC 20590

April 2023

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

NOTICE

This document is disseminated under the sponsorship of the U.S. Department of Transportation (USDOT) in the interest of information exchange. The U.S. Government assumes no liability for the use of the information contained in this document.

The U.S. Government does not endorse products or manufacturers or outside entities. Trademarks or manufacturers' names appear in this report only because they are considered essential to the objective of the document. They are included for informational purposes only and are not intended to reflect a preference, approval, or endorsement of any one product or entity.

NON-BINDING CONTENTS

The contents of this document do not have the force and effect of law and are not meant to bind the public in any way. This document is intended only to provide clarity to the public regarding existing requirements under the law or agency policies. However, compliance with applicable statutes or regulations cited in this document is required.

QUALITY ASSURANCE STATEMENT

The Federal Highway Administration (FHWA) provides high-quality information to serve Government, industry, and the public in a manner that promotes public understanding. Standards and policies are used to ensure and maximize the quality, objectivity, utility, and integrity of its information. FHWA periodically reviews quality issues and adjusts its programs and processes to ensure continuous quality improvement.

CREDITS

Unless otherwise noted, FHWA is the source for all images in this document.

Cover photo, a view of Detroit, taken by Nicholas Letarte/Wirestock - stock.adobe.com

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA-HIF-23-017	None.	None.

4. Title and Subtitle	5. Report Date
Managing Risks Associated with Major Funding Uncertainty: Michigan Department of Transportation (MDOT) Case Study	April 25, 2023
	6. Performing Organization Code
	None.

7. Author(s)	8. Performing Organization Report No.
William Robert, Lori Richter, Hyun-A Park, Brad Allen	None.

9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Applied Pavement Technology, Inc. 115 West Main Street Suite 400 Urbana, IL 61801 — Spy Pond Partners, LLC 37 Broadway Arlington, MA 02474	None.
	11. Contract or Grant No.
	693JJ319D000023 / 693JJ321F000194

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
Federal Highway Administration 1200 New Jersey Ave., SE Washington, DC 20590	Case Study January 2022 – September 2022
	14. Sponsoring Agency Code
	None.

15. Supplementary Notes

FHWA Lead is Tashia Clemons, tashia.clemons@dot.gov.

16. Abstract

This case study focuses on MDOT's investment strategy development process, including its asset condition forecasting methodology. It explores MDOT's use of asset condition forecasting and its efforts to identify alternative strategies. It describes how the agency conducts strategy selection, target-setting, and the Call for Projects process.

This case study also highlights MDOT's revenue and cost monitoring and provides an overview of how the Department performs ongoing monitoring. It describes MDOT's approach to revising the capital plan and its treatment of inflation and cost escalation.

This case study examines the agency's communication approaches, including actively using the *Roads and Bridges Annual Report* (TAMC 2021), the *MiScorecard* (MDOT 2019b), the annual *5-Year Transportation Program (5YTP)* (MDOT 2022), and the *TAMP* (MDOT 2019a) to advance asset management. It also describes various TAMC products, including dashboards, interactive maps, and the Investment Reporting Tool.

17. Key Words	18. Distribution Statement
Risk, Finance, Asset Management, TAMP	No restrictions. This document is available to the public through the National Technical Information Service, Springfield, VA 22161.

19. Security Classify. (of this report)	20. Security Classify. (of this page)	21. No of Pages	22. Price
Unclassified.	Unclassified.	19	None.

Form DOT F 1700.7   (8-72) Reproduction of completed page authorized

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

5YTP	5-Year Transportation Program
BCFS	Bridge Condition Forecasting System
BIL	Bipartisan Infrastructure Law
CFP	Call for Projects
CAO	Chief Administration Officer
COO	Chief Operations Officer
EV	Electric Vehicle
FHWA	Federal Highway Administration
IHS	Interstate Highway System
IRI	International Roughness Index
ISTEA	Intermodal Surface Transportation Efficiency Act
MDOT	Michigan Department of Transportation
MPO	Metropolitan Planning Organization
MTF	Michigan Transportation Fund
MTPP	Michigan Transportation Program Portal
NHS	National Highway System
PASER	Pavement Surface Evaluation Rating
RQFS	Road Quality Forecasting System
RSL	Remaining Service Life
SOGR	State of Good Repair
SLRTP	State Long-Range Transportation Plan
STIP	Statewide Transportation Improvement Program
TAM	Transportation Asset Management
TAMC	Transportation Asset Management Council
TAMP	Transportation Asset Management Plan
TAP	Transportation Alternatives Program
TEDF	Transportation Economic Development Fund
TAP	Transportation Alternatives Program
TSC	Transportation Service Center
USDOT	United States Department of Transportation

BACKGROUND

The Michigan Department of Transportation (MDOT) is responsible for designing, constructing, and maintaining the State trunkline, highway bridges, pedestrian bridges, and trails. The agency also administers aviation, intercity passenger services, rail freight, and transit services. It also oversees the Michigan Transportation Economic Development Fund (TEDF) and the Transportation Alternatives Program (TAP). The Michigan DOT has seven regional offices. Each region manages its own construction and maintenance programs. Multiple Transportation Service Centers (TSCs) within each region handle local needs, such as permitting and responding to urgent transportation needs. The agency's Central Office is in Lansing, Michigan.

While the Michigan DOT manages much of the highway infrastructure in the State, a variety of Federal and local agencies manage portions of the network. Figure 1 summarizes the ownership of the State's road inventory, and figure 2 summarizes the bridge inventory. As shown in these figures, MDOT owns a relatively small portion of Michigan's road network; however, it oversees a large portion of Michigan's National Highway System (NHS) roads and all of the State's Interstate Highway System (IHS), and other freeways. Specifically, MDOT owns approximately 81 percent of the State's NHS roads.

The Michigan DOT has well-established asset management systems and processes. MDOT's efforts to implement Transportation Asset Management (TAM) practices date back to 1997. At that time, Michigan DOT began to implement the management systems then required by Federal rules initiated by the 1991 Intermodal Surface Transportation Efficiency Act (ISTEA) (Pub. L. No. 102-240). While these rules are no longer applicable, MDOT has continued its use of asset management systems and an asset management approach to comply with current Federal asset management requirements (23 U.S.C. 119(e); 23 CFR part 515).

MDOT's process for predicting future pavement and bridge performance is an important aspect of its asset management approach. This allows MDOT to set specific performance targets, given available funding. MDOT's approach was established using state-specific performance measures prior to the adoption of Federal performance measures for pavements and bridges (MDOT 2019a).

Michigan's Transportation Asset Management Council (TAMC) was created in 2002 to support the statewide implementation of TAM. It comprises representatives from state and local governments as well as Metropolitan Planning Organizations (MPOs). Since its creation, the TAMC has continued to guide the State's overall asset management strategy and provide tools and resources to assist state and local transportation agencies in administering TAM practices (TAMC 2022).
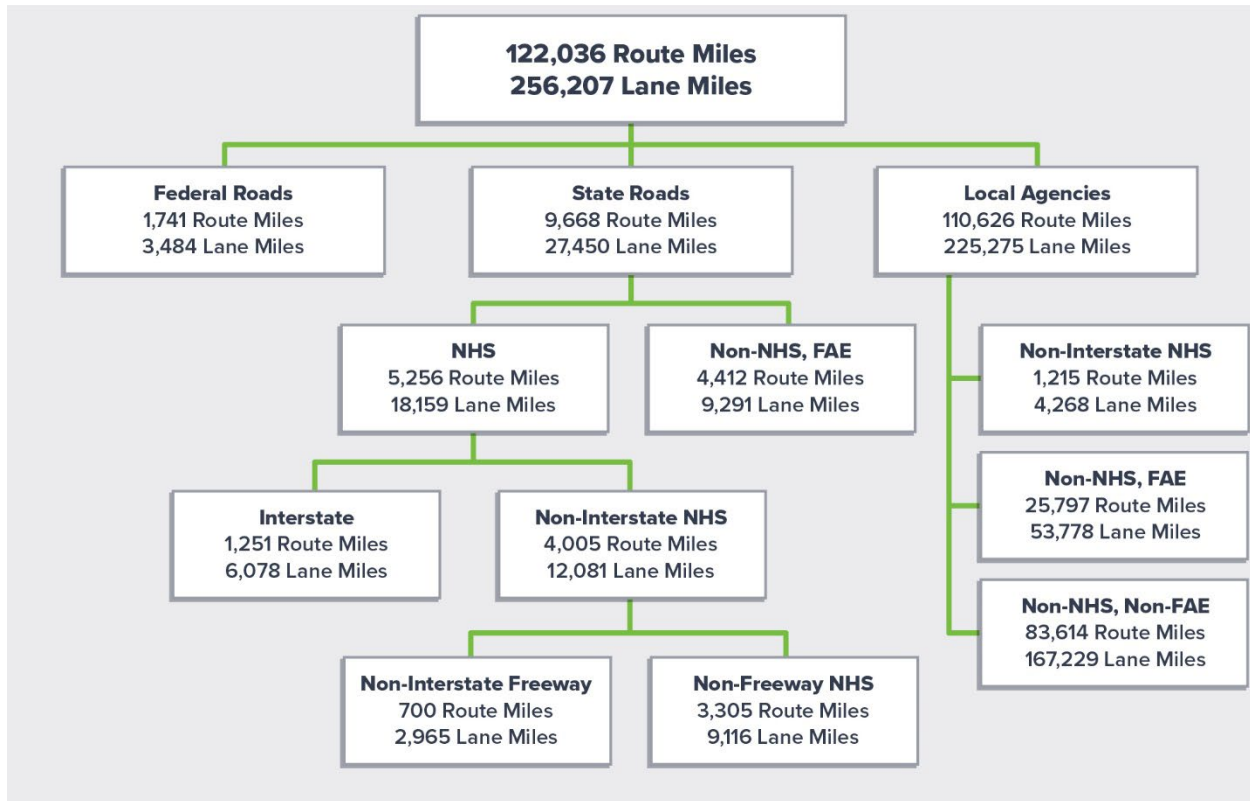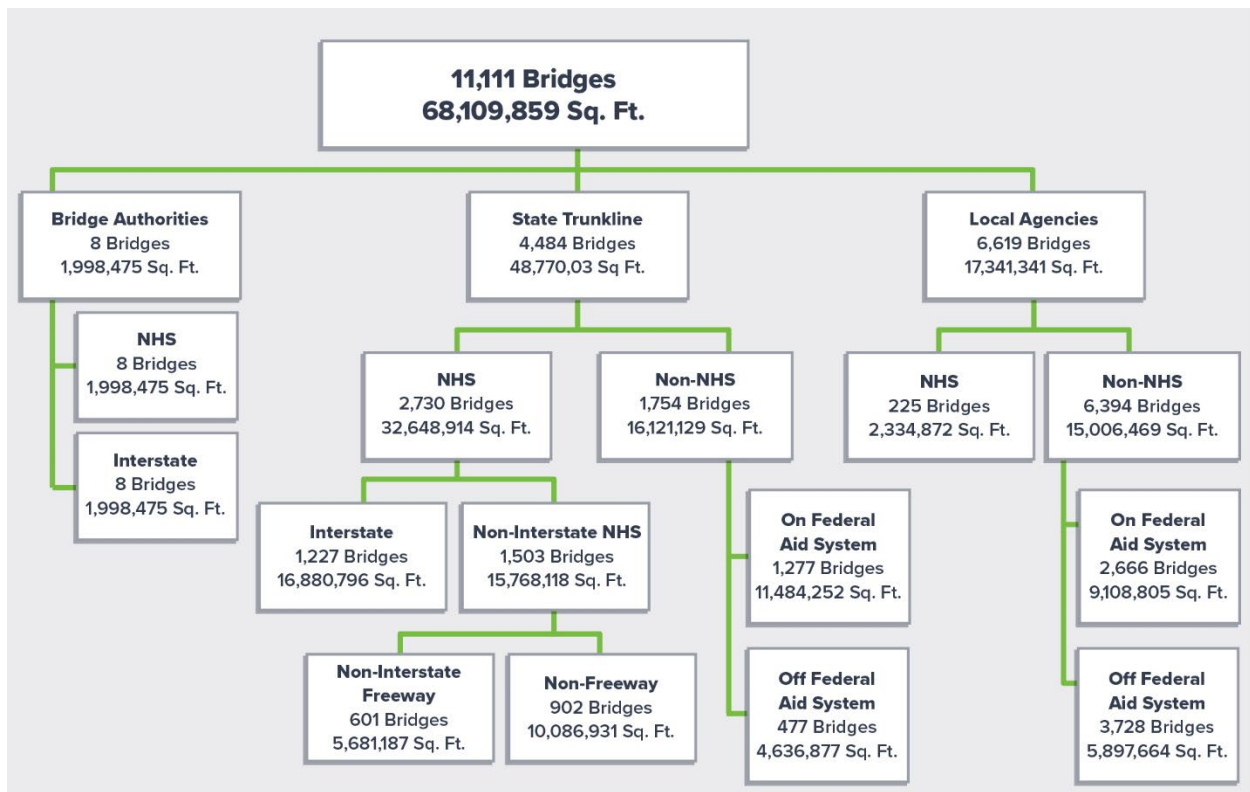
Figure 1. Michigan's road network (MDOT 2019a).

Figure 2. Michigan's bridge network (MDOT 2019a).

CASE STUDY FOCUS

This case study focuses on MDOT's investment strategy development process, including its asset condition forecasting methodology. It explores the agency's use of asset condition forecasting and its efforts to identify alternative strategies. It describes how the agency conducts strategy selection, target-setting, and the Call for Projects process.

This case study also highlights MDOT's revenue and cost monitoring and provides an overview of how the agency performs ongoing monitoring. It describes MDOT's approach to revising the capital plan and its treatment of inflation and cost escalation.

This case study covers the MDOT's communication approaches, including the active use of *Michigan's Roads and Bridges Annual Report* (TAMC 2021), the *MiScorecard* (MDOT 2019b), the annual *5-Year Transportation Program (5YTP)*(MDOT 2018a; 2022), and the Transportation Asset Management Plan (TAMP) (MDOT 2019a) to advance asset management. It also describes various TAMC products, including dashboards, interactive maps, and the Investment Reporting Tool.

FUNDING CHALLENGES

The major source of State funds for transportation is the Michigan Transportation Fund (MTF), created in 1951 (State of Michigan 1951). Approximately one-third of State transportation funding deposited into the fund comes from gas and diesel fuel sales and road-use fees. Michigan's constitution dictates the use of State fuel and vehicle taxes for transportation purposes (Michigan Legislature 2021). Other funding sources include vehicle-related sales tax (explicitly used for public transportation) and vehicle registration tax and title fees. The balance of transportation funding for highways and public transit comes from Federal aid.

MDOT faces several funding challenges due to declining State funding and future funding uncertainty. Since fiscal year (FY) 2004, the State fuel tax revenues have declined in real terms for various reasons, including increasing fuel efficiency, changing travel patterns, implementation of electric vehicles (EV), and increasing inflation and commodity costs.

State user fees increased in 2017, generating an additional $630 million in revenue. Also, in recent years, the Michigan Legislature has infused the MTF with additional funds from an influx in revenues from income taxes and general funds (MDOT 2021). Despite these revenue infusions, constrained funding and declining MTF revenues indicate infrastructure conditions will continue to worsen over the near term. Indeed, the State's road system (municipal, county, and State) is losing an average value of $1.1 billion per year (MDOT 2021).

Michigan's most recent Transportation Asset Management Plan (TAMP) shows the gap between current funding levels and what would be needed to maintain the state of good repair (SOGR) for the remaining service life (RSL) of pavements and bridges, as shown in figures 3, 4, and 5. The TAMP indicates the additional annual funds needed to close the gap —$32 million for NHS bridges, $179 million for Interstates, and $821 million for non-Interstate NHS roads.
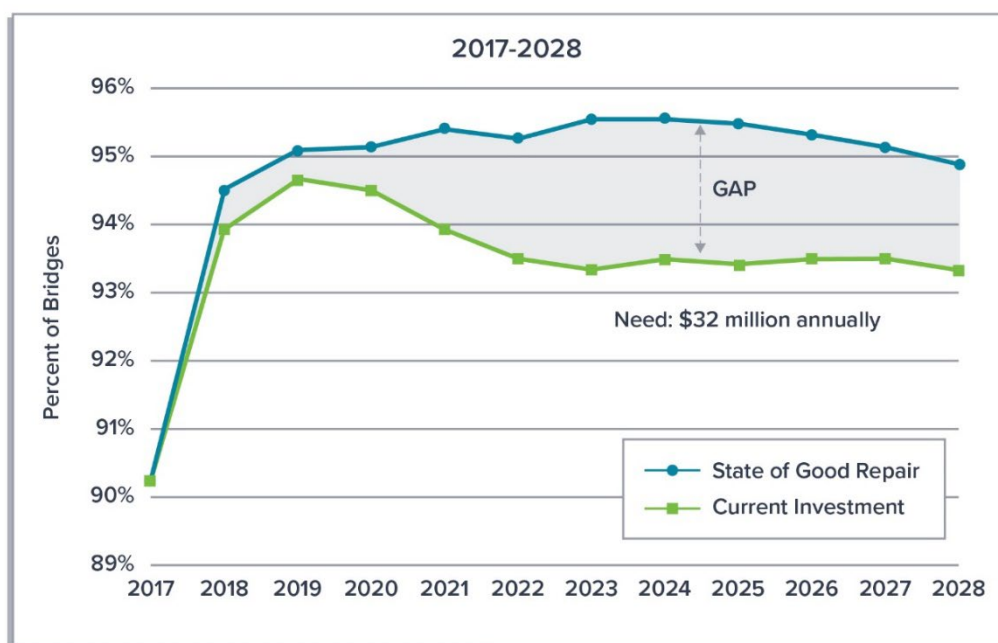
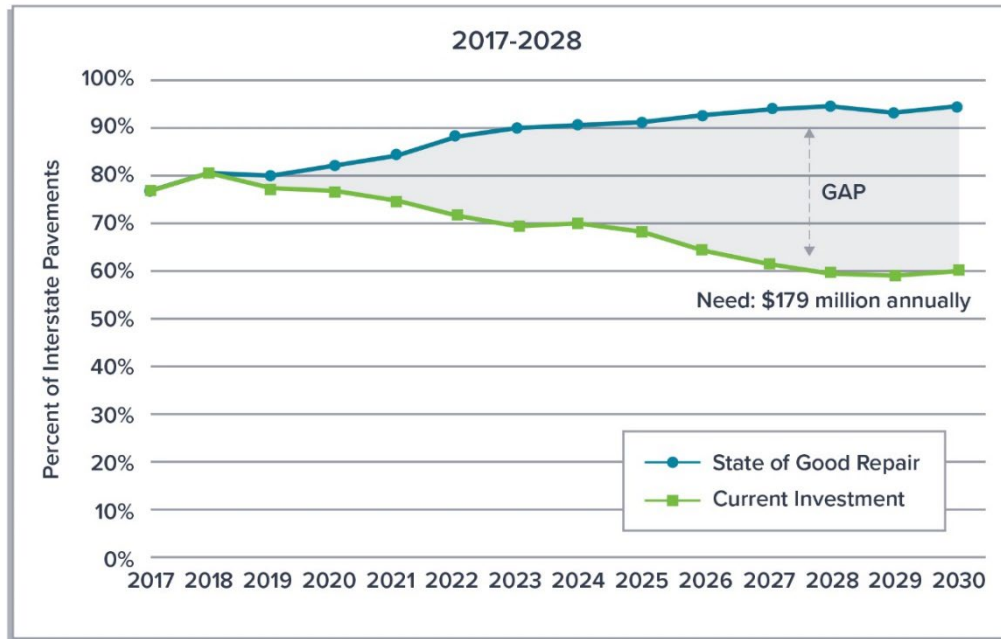

Figure 3. Bridge condition funding gap (MDOT 2019a).
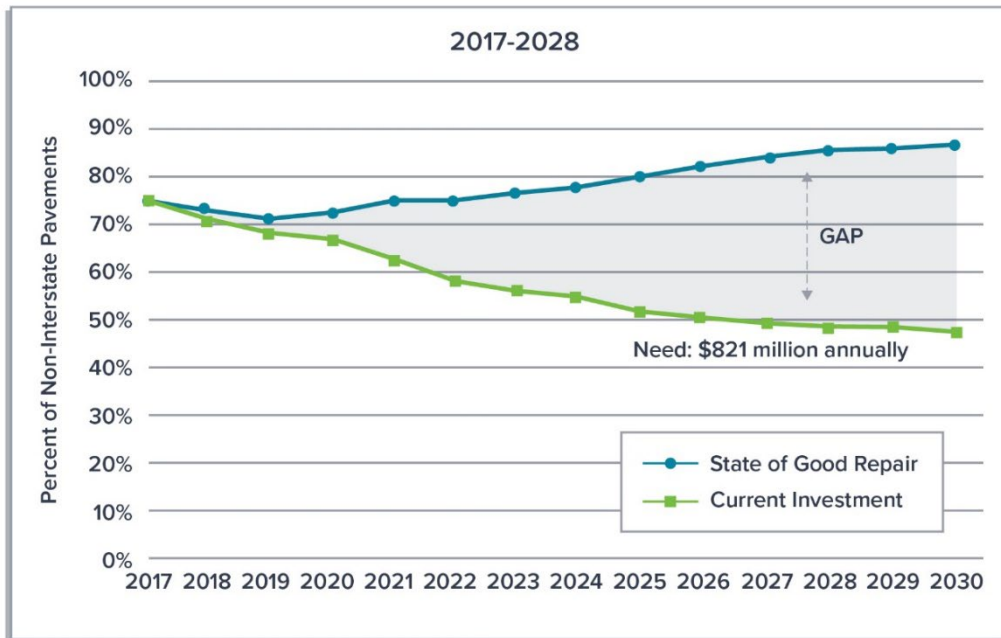
Figure 4. IHS RSL condition funding gap (MDOT 2019a).

Figure 5. Non-Interstate NHS RSL condition funding gap (MDOT 2019a).

INVESTMENT STRATEGY DEVELOPMENT PROCESS

MDOT's investment strategy development process includes asset condition forecasting, identification of alternative strategies, strategy selection, and a call for projects (CFP) process. The process helps support the policies, goals, and objectives established by the State Transportation Commission (STC) to achieve SOGR, improve or preserve roadway assets, and meet asset condition targets and national minimum conditions (MDOT 2019a; State of Michigan 2022).

Figure 6. MDOT investment strategy using an asset management approach (MDOT 2019a).

Asset Condition Forecasting

MDOT uses the Road Quality Forecasting System (RQFS) and the Bridge Condition Forecasting System (BCFS) to perform asset condition forecasting. Both models predict future condition, assuming a specified life-cycle strategy and budget. These tools are used to test different life-cycle strategies and support target setting. The network level data are based on minimum condition ratings. Probabilistic deterioration models are applied using assumptions regarding what treatments may be performed at different condition levels. The result is a simulation of future conditions based on the available budget and treatment strategy.

Identification of Alternative Strategies

Next, MDOT tests specific strategies with different budget levels in the RQFS and BCFS. The four strategies defined in 2019 for pavement were: constrained investment, national minimum condition level, achieving SOGR, and preserving the current condition. Two strategies were defined for bridges: constrained investment and SOGR. Budget levels, target performance, and lifecycle planning were then applied to each of these strategies. Additional details on evaluating the four investment strategies can be seen in the 2019 TAMP (MDOT 2019a). Also, FHWA has described MDOT's investment strategy development approach in recent TAM case studies (Varma and Proctor 2020).
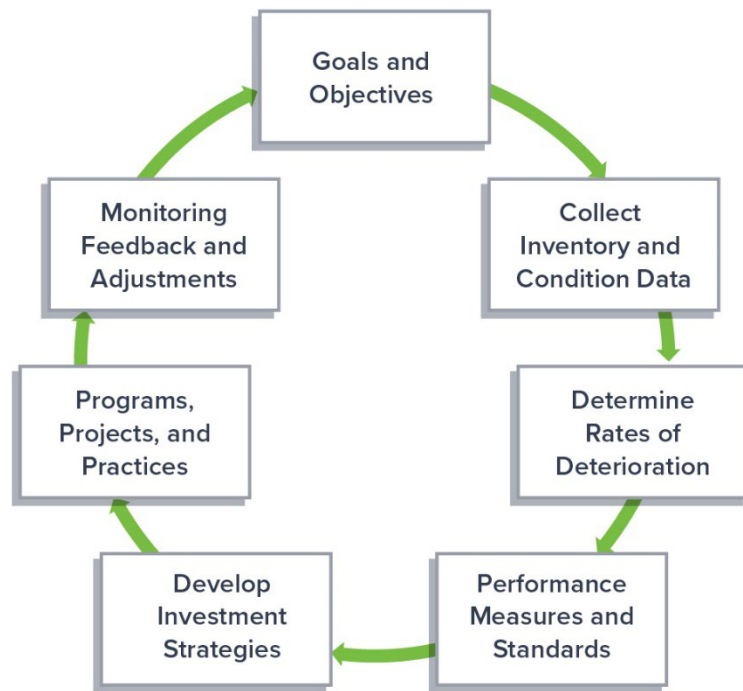
Strategy Selection

In selecting a strategy, MDOT makes explicit choices concerning the investment strategy to solidify budget assumptions and achieve projected performance targets. This information is then incorporated into the TAMP and other communication documents. It serves as an input to the annual CFP process as well as the selection of projects for both the 5-Year Transportation Program (5YTP) (MDOT 2022) and the State Transportation Improvement Program (STIP). In the 2019 process described above, the agency ultimately selected the constrained environment pavement and bridge investment strategies.

Call for Projects

Once the investment strategies have been determined, the CFP identifies and selects the specific highway preservation projects, including reconstruction, resurfacing, and preventive maintenance projects. As part of MDOT's overall TAM approach, shown earlier in figure 6, the CFP process translates the overall investment strategy into a specific list of projects that will make progress toward its goals, objectives, measures, and targets. MDOT prepares an investment and project selection direction, incorporating life cycle planning consistent with the selected investment strategy.

The MDOT regions and agency program areas identify candidate projects based on the investment direction and target funding levels provided. Regions then scope and select projects for inclusion in the 5YTP. The MDOT Chief Operations Officer (COO) and Chief Administrative Officer (CAO) provide the final executive approval of the projects.

Five-Year Transportation Program (5YTP)

The 5YTP covers all components of the transportation network for which MDOT is responsible, including highways, bridges, bus, rail, aviation, marine, and active transportation. The plan covers the next 5 years in each of MDOT's seven regions and includes information about MDOT's:

- Funding picture.
- Performance measures.
- Highway and multimodal program investment strategies.
- System conditions.
- Specific transportation projects selected through the Highway CFP.

Figures 7 and 8 show examples of information provided in the 5YTP. Figure 7 shows expected funding levels and investment categories from 2022 through 2026. Figure 8 shows historic and expected bridge conditions from 2010 through 2030.
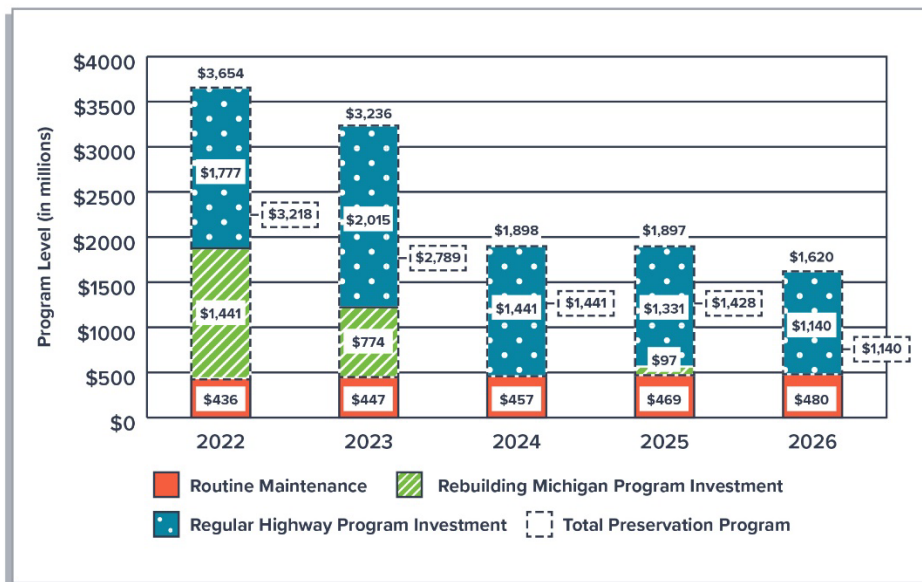
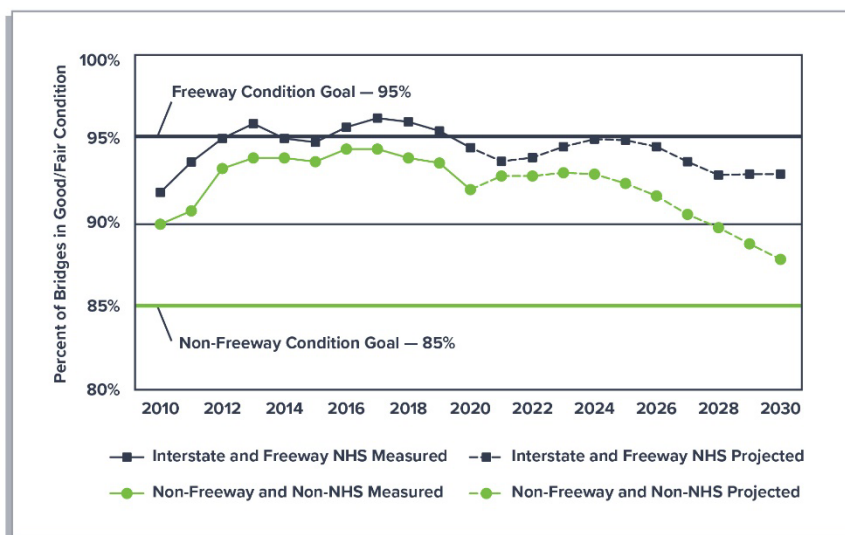Figure 7: Highway Program Investment for FY's 2022-2026 as Published in the 2022-2026 5YTP (MDOT 2022).

Figure 8: Bridge Condition Forecast as Published in the 2022-2026 5YTP (MDOT 2022).

The 5YTP plays an important role in the statewide planning process by informing the federally required STIP (23 U.S.C. 135; 23 CFR part 450) and providing the foundation for short-range fiscal constraint and future planning and program development. The investment strategies, goals, and projects are established to be consistent with State Long-Range Transportation Plan (SLRTP) and STC goals and priorities (State of Michigan 2022). This consistency ensures a comprehensive approach to decision-making that prioritizes preservation of the transportation network and a safe, connected system.

The document is delivered to the Michigan Legislature by March 1 of each year[1]. Typically, in July, the 5YTP is presented to the STC. The Commission ensures the investment strategies contained therein align with current priorities and policies. Following a presentation to the Commission, approval is requested, and the document is posted online and open a 30-day public comment period.

To support the public review, the 5YTP team works with the Office of Communications as well as local entities and seven MDOT regional offices (Bay, Grand, Metro, North, Southwest, Superior, and University). These offices help to distribute announcements about the review and comment opportunity. MDOT also leverages several types of media to collect input directly, including an interactive map called the Michigan Transportation Program Portal (MTPP). The MTPP allows users to select and submit a comment form on specific highway projects in the program.

Comments received throughout the 30-day period are collected, evaluated, and forwarded to the appropriate region and/or Transportation Service Center (TSC) for response and consideration. Comments and responses are then summarized in the final program document. The revised 5YTP is presented again to the STC in October or November for final approval to submit to the Legislature. The approval is announced through a news release, and the document is uploaded to the MDOT 5YTP webpage for public access.

Revenue and Cost Monitoring

Another approach MDOT uses to manage funding uncertainty is actively monitoring revenues and costs. Estimated funding is based on historical trends and anticipated State and Federal revenues. Costs are estimated using cost-per-lane mile assumptions to project and adjust costs for various construction types.

As described previously, the MTF includes gas taxes, registrations, and other revenues. MDOT routinely prepares forecasts of future revenue. MDOT and the State Department of Treasury work together to develop a short-range forecast. Separately, MDOT performs longer-range forecasts for its planning. The longer-range forecast incorporates the short-term forecast and MDOT's best estimates of future Federal funding.

Over the course of the year, MDOT monitors both revenues and project costs. If revenues or costs differ from MDOT's plans, MDOT will adjust its capital program as needed. Typically, MDOT will either accelerate projects if additional funds are available or defer them based on reductions in revenue or increases in costs.

Communication Approaches

Another way MDOT manages funding uncertainty is to communicate clearly to its stakeholders the best available data on current asset conditions, predicted future performance, and any changes in conditions or funding that may impact achieving MDOT's targeted conditions. This

[1] Michigan Public Act 499 of 2022 (HR 5396) requires the TAMC to submit to the STC, the legislature, and the transportation committees of the house and senate by May 2 of each year (State of Michigan 2002). The 2022-2026 Five-Year Transportation Program specifies delivery by the agency to the legislature shall occur by March 1 each year (MDOT 2022).

enables closer coordination among stakeholders and increases support for prioritizing the achievement of asset condition targets over other objectives if there are changes in funding.

MDOT uses several communication approaches to share the coordinated asset management efforts and challenges of Michigan's State and local transportation agencies. The TAMC publishes these documents to provide information to the STC and the Michigan Infrastructure Council (MIC). These materials have built trust and accountability with the State Legislature and transportation stakeholders and have historically helped support requests for increased funding. They include State and local agencies' resources to assist in implementing asset management. The following section describes the content of these publications and shows some of the graphical elements used to communicate TAM statuses, processes, and gaps.

Roads & Bridges Annual Report

The *Roads & Bridges Annual Report* (TAMC 2021) provides information about the budget, capacity-building efforts, and other activities of the TAMC. As described in the 2021 annual report, the TAMC provided eight training events attended by 220 participants. The overall budget for FY2021 for TAMC was almost $1.9 million.

The report also shows the current and forecasted conditions of roads and bridges. These include all roads and bridges in the State, not just those under MDOT's jurisdiction. Figure 9 shows the latest projected declines in road condition between 2023-2033. Figure 10 shows the projected declines in bridge condition over the same period.
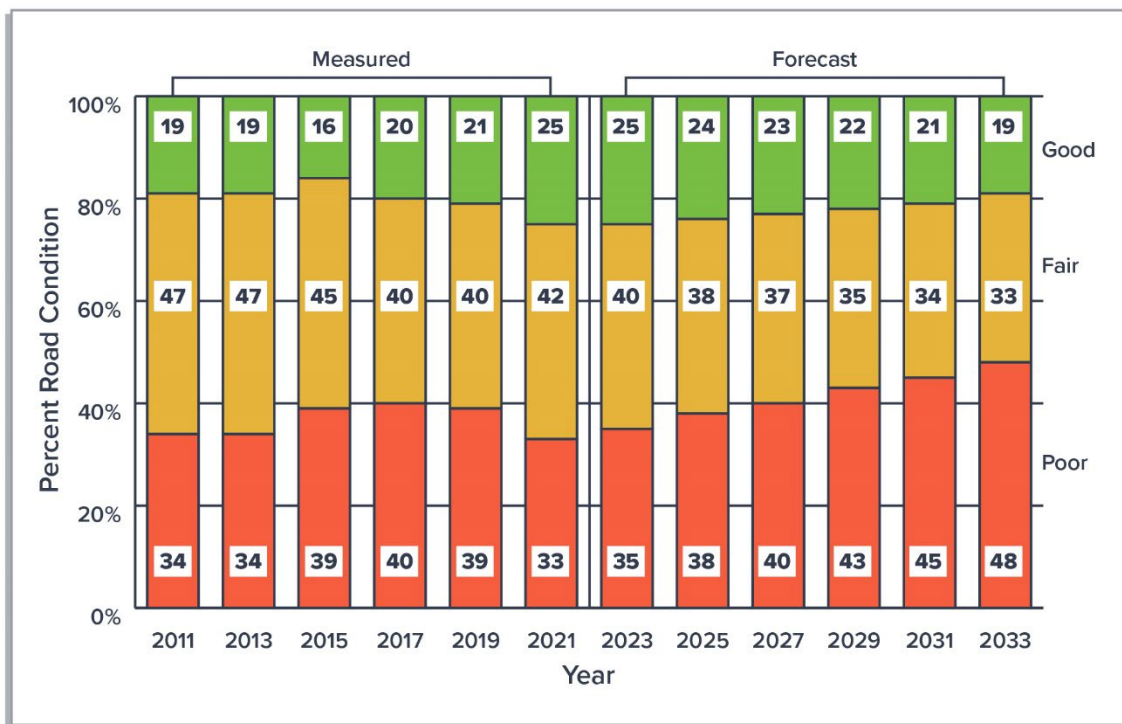

Figure 9. Pavement condition forecast (2023-2033)
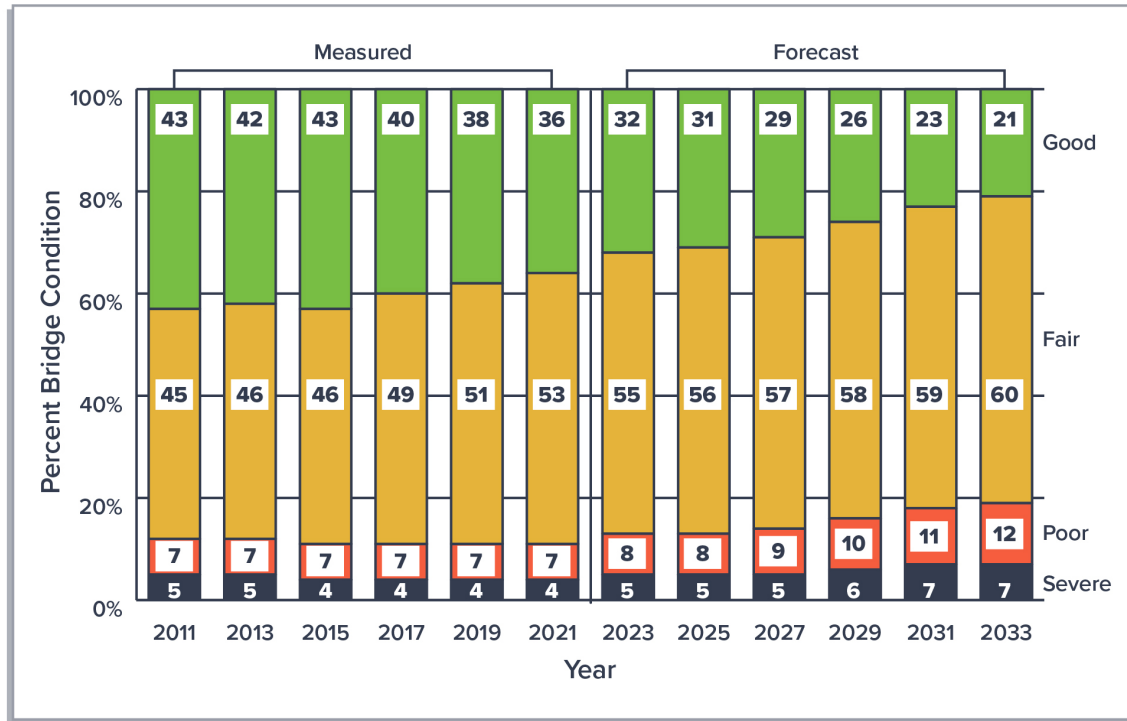(TAMC 2021).

Figure 10. Bridge condition forecast (2023-2033)
(TAMC 2021).

In addition to reporting on Michigan's infrastructure, the *Roads & Bridges Annual Report* provides pavement and bridge condition comparisons with peer states within the Great Lakes Region, including Illinois, Indiana, Minnesota, Ohio, and Wisconsin (TAMC 2021).

The report summarizes road and bridge projects reported in the TAMC's Investment Reporting Tool and describes MDOT's accountability for investment decisions. It shares information about how Michigan uses asset management principles to maximize investments by applying the appropriate investment level based on the assets' age and condition, as shown in figure 11.
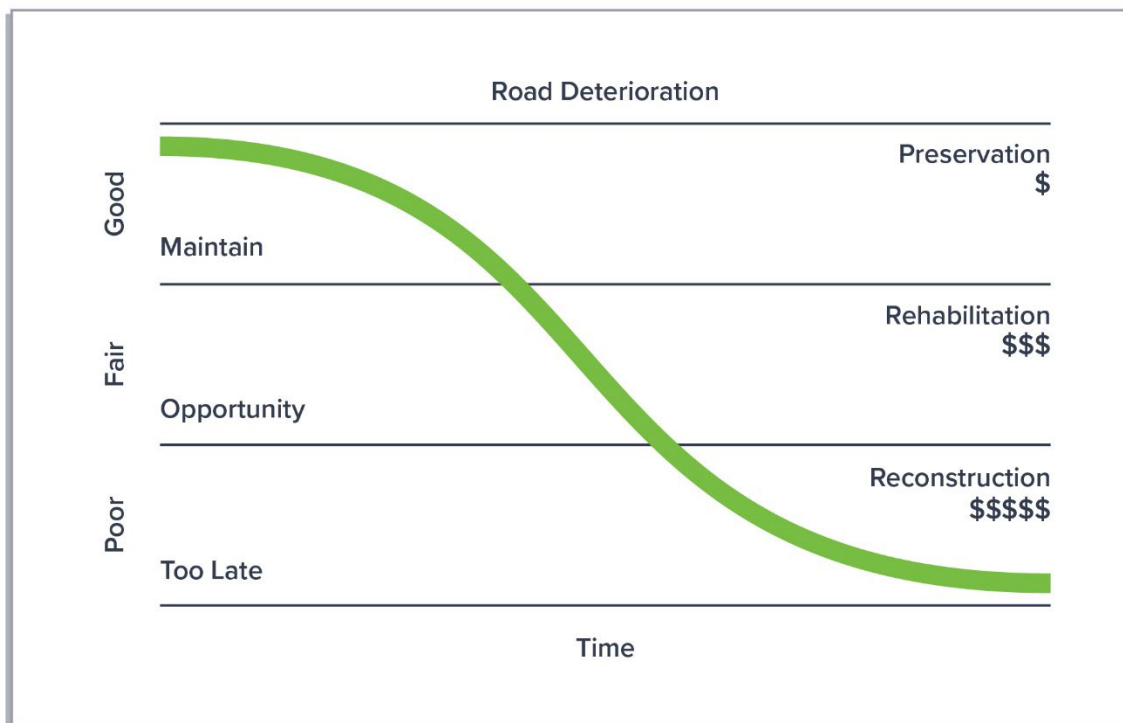
Figure 11. Applying the appropriate investments based on deterioration
(modified from TAMC 2021).

MiScorecard

The *MiScorecard* shows a range of measures, with targets and current values for each. TAM-related measures include the percent of trunkline highways in good or fair condition based on the International Roughness Index (IRI), the percent of trunkline highways with a remaining service life (RSL) of 3 years or more, the percent of Federal-aid pavement in good or fair condition based on their Pavement Surface Evaluation Rating (PASER), the percent of freeway bridges in good or fair condition, and the percent of non-freeway bridges in good or fair condition. The scorecard is published electronically on an annual basis (MDOT 2019b).

Investment Reporting Tool

The Investment Reporting Tool is an online tool used by State and local transportation agencies to report on their completed and planned projects. This tool incorporates a suite of resources, including a dashboard, customized maps, data downloads, and reports. It is also used by local agencies to submit their PASER condition data. This resource provides multiple layers of information that can be processed in various ways to provide insights into the responsible management of the State's infrastructure.

RESULTS OBTAINED

Employing an investment strategy development process, performing revenue and cost monitoring, and communicating with transportation stakeholders have resulted in several significant enhancements for MDOT, as summarized in figure 12. MDOT reduces funding uncertainty by using revenue forecasting to establish a solid estimate for future funding. Ongoing monitoring ensures revenue and cost adjustments are made when needed. MDOT asserts that it increases credibility and trust with the State Legislature and the traveling public by consistently sharing data, reports, and documents to communicate over 20 years of TAM accountability. By focusing on SOGR and an asset management approach, the agency has maintained its infrastructure management consistent with its plans, even as emerging issues arise and funding shifts.

Figure 12. Summary of MDOT results.

NEXT STEPS/FUTURE CHALLENGES

MDOT is positioned to continue building upon its legacy of implementing best practices in transportation asset managements. The agency will continue monitoring inflation, the increasing cost of oil and other commodities, and their impact on TAM. Given current funding levels, infrastructure aging will likely continue to outpace required maintenance. Still, established asset management processes will help maximize available resources and extend RSL at the lowest possible cost.

The agency plans to continue expanding its asset management approaches and improve the use of TAM by local agencies. Almost all local agencies now need to develop TAMPs (TAMC 2021), but this is an evolving area, and improvements will be made to continue maturing and evolving practices and monitoring outcomes. At the same time, MDOT will continue improving its asset management approaches for other highway assets and modes.

REFERENCES

Michigan Department of Transportation (MDOT). 2018a. *2019-2023 Five-Year Transportation Program*. MDOT, Lansing, MI.

Michigan Department of Transportation (MDOT). 2019a. *Transportation Asset Management Plan*. MDOT, Lansing, MI.

Michigan Department of Transportation (MDOT). 2019b. *MiScorecard* (Performance Summary). Webpage. Accessed August 2022.

Michigan Department of Transportation (MDOT). 2021. *The Official Guide to MDOT: Everything You Need to Know About the Michigan Department of Transportation (MDOT)*. MDOT, Lansing, MI.

Michigan Department of Transportation (MDOT). 2022. *2022-2026 Five-Year Transportation Program*. MDOT, Lansing, MI.

Michigan Legislature. Revised 2021. *Michigan Constitution*. Michigan Legislature, Lansing, MI

Michigan Transportation Asset Management Council (TAMC). 2021. *Michigan's Roads & Bridges Annual Report*. TAMC, Lansing, MI.

Michigan Transportation Asset Management Council (TAMC). 2021. Policy for the Submittal and Review of Asset Management Plans for Roads, Bridges and Transportation Infrastructure. TAMC, Lancing, MI.

Michigan Transportation Asset Management Council (TAMC). 2022. *Transportation Asset Management Council (TAMC) Homepage*. Webpage. Accessed August 2022.

State of Michigan. 1951. *Public Act 51*. State of Michigan, Lansing, MI.

State of Michigan. 2002. *Public Act 499*. State of Michigan, Lansing, MI.

State of Michigan. 2022. *State Transportation Commission Homepage*. Webpage. Accessed August 2022.

U. S. Congress. 1991. *Intermodal Surface Transportation Efficiency Act (ISTEA)*. Pub. L. 102-240. U. S. Congress, Washington, DC.

Varma, S. and Proctor, G. 2020. *Transportation Asset Management Plans Case Study 5 – Financial Planning and Investment Strategies*. FHWA-HIF-20-085. Federal Highway Administration, Washington, DC.