U.S. Department of Transportation
Federal Highway Administration

MISSISSIPPI DIVISION

100 West Capitol Street, Suite 1062
Jackson, Mississippi 39269
(601) 965-4215
(601) 965-4231 FAX

May 13, 2022

In Reply Refer To: HDA-MS

Mr. Brad White
Executive Director
Mississippi Department of Transportation (MDOT)
P. 0. Box 1850
Jackson, Mississippi 39215-1850

Subject: 2022 Transportation Asset Management Plan (TAMP) Process Recertification

This letter serves as the Federal Highway Administration (FHWA) Mississippi Division Office's process recertification decision relative to the Mississippi Department of Transportation (MDOT's) updated TAMP.

The Mississippi DOT's updated TAMP dated May 11, 2022, was received by the Division Office on May 12, 2022. The processes you followed to develop and update your TAMP comply with the minimum requirements set forth in 23 CFR 515.13(a) and 515.13(c). Therefore, MDOT's TAMP development processes are recertified.

The FHWA Mississippi Division Office currently finds that MDOT's updated TAMP considers extreme weather and resilience as part of the life-cycle planning and risk management analyses, per the BIL/IIJA requirements. However, FHWA is expected to issue clarifying guidance in addressing the documentation expectations for extreme weather and resilience; the FHWA Mississippi Division Office may request additional documentation in advance of subsequent recertifications or TAMP consistency determinations per 23 CFR 515.13(b).

Should you have any questions, please contact Randal Jansen at (601) 965-7332.

Donald E Davis
Division Administrator

CC: Mr. Jeff Ely, P.E. - Chief of Staff, MDOT
Mr. Brian Ratliff, P.E. - Deputy Executive Director, Chief Engineer, MOOT
Mr. Jim Willis, P.E - Assistant Chief Engineer, Operations, MDOT
Mr. Evan Wright, P.E. - State Planning Engineer, MOOT
Mr. Jeff Schmidt, P.E. – Deputy Division Administrator, FHWA

2045 Mississippi Statewide Long Range Transportation Plan

MDOT
MISSISSIPPI DEPARTMENT OF TRANSPORTATION

2045
MULTIPLAN
THE FUTURE IN MOTION

Transportation Asset Management Plan

May 2022
Modified January 2023

Transportation Asset Management Plan

prepared for

Mississippi Department of Transportation

prepared by

Cambridge Systematics, Inc.

Table of Contents

List of Tables

List of Figures

Executive Summary

Introduction

The Mississippi Department of Transportation (MDOT) has been active in transportation asset management (TAM) for many years. TAM is a process to strategically manage transportation systems in a cost-effective, safe, efficient, and environmentally sensitive manner. This approach focuses on performance to manage systems for optimal results. This Transportation Asset Management Plan (TAMP) outlines the existing and planned state of TAM practice in the State of Mississippi.

The *2045 Mississippi Unified Long-Range Transportation Plan (MULTIPLAN)*, MDOT's long-range transportation plan, discusses the need for a well-performing transportation network to support Mississippi families, jobs, and businesses. It notes that inadequate infrastructure investment can result in increased costs of doing business and higher costs of living. Asset management will be a critical component of reaching the long-range goals to be established in MULTIPLAN. This TAMP will serve as a valuable counterpart to long-range goals in implementing the strategies necessary for operating, maintaining, and improving physical assets in a cost-effective manner throughout their life-cycle.

This TAMP outlines the strategies currently used to set performance targets and select projects, including the enhancements to the Pavement and Bridge Management Systems. The TAMP provides a summary of the assets maintained by MDOT, discusses strategies to manage risks, provides a 10-year financial plan with investment strategies, and concludes with a discussion of TAM enhancements. It provides a framework for the MDOT staff to carry out the strategic direction that ensures the most effective and efficient way to preserve the highway network through specific asset management goals and objectives.

MDOT has been monitoring the asset condition of the State-maintained pavements and bridges and investing in maintenance and preservation for decades. As a result of the passage of Moving Ahead for Progress in the 21st Century Act (MAP-21), Fixing America's Surface Transportation Act (FAST Act), and, subsequently, the Bipartisan Infrastructure Law (BIL), enacting new asset management requirements, efforts have been made to ensure current TAM activities meet the new Federal objectives. Some of these efforts, aiming to ensure successful implementation of Federal requirements, include:

- Maintaining a working group with technical members and members of Administration that represents all aspects of MDOT responsibilities that actively coordinates on TAM issues.
- Reviewing and improving data collection and maintenance procedures to ensure best practices are in place.

Goals

MDOT, in conjunction with its stakeholders, identified a series of goals to guide the development of strategies to preserve the transportation system.

The MDOT TAMP has the goals of:

- Informing decision-makers, both internal and external, and the public about MDOT's TAM processes and the Agency's commitment to TAM.
- Documenting detailed TAM processes and resources.
- Documenting asset needs for pavements and bridges on the National Highway System (NHS) as well as the strategies to meet those needs.

The **Mississippi Department of Transportation** is responsible for providing a safe intermodal transportation network that is planned, designed, constructed and maintained in an effective, cost efficient, and environmentally sensitive manner.

- Laying a foundation to support MDOT's goals in data access and sharing.
- Providing a resource of information on asset condition and MDOT's plans to address infrastructure condition and needs.
- Guiding MDOT decision-making to unlock the benefits of TAM, including lower long-term costs for infrastructure preservation, improved performance, and service to customers, and better cost-effectiveness and use of available resources.
- Fulfilling Federal requirements for TAMP development and implementation.

Managing Infrastructure

This plan primarily focuses on the management of pavement and bridge assets on the NHS, as required by Federal regulations, but also describes how asset management is carried out on all Mississippi roads and bridges. Mississippi has about 13,600 lane-miles of highway and more than 2,800 structures on the National Highway System (NHS). Mississippi's transportation infrastructure supports both the State's economy and the active lifestyles of residents and visitors. Highways, bridges, and other infrastructure connect people to activities and businesses to markets.

Managing Pavements

Inventory | There are about 13,600 lane-miles of NHS pavement in Mississippi. MDOT maintains about 12,800 lane-miles and the remaining 760 lane-miles are maintained by cities, counties, or other State or Federal agencies.

Federal PM2 Condition | Using the Federal measure, in 2020, 73.6 percent of Interstate lane-miles are in good condition, 25.7 percent are in fair condition, and 0.7 percent are in poor condition. Using the Federal measure, in 2020, 37.7 percent of non-Interstate-NHS lane-miles are in good condition, 58.1 percent are in fair condition, and 4.2 percent are in poor condition.

Federal PM2 Targets | The Federal rule established a minimum condition threshold of five percent poor for pavements on the Interstate. The rule did not provide a minimum threshold for non-Interstate NHS pavements. MDOT set targets, including reaching more than 55 percent good and less than five percent poor on Interstates within four years and more than 25 percent good and less than 10 percent poor on non-Interstate NHS within two years. These targets are based on the Federal pavement performance measure, which is based on the International Roughness Index (IRI) (a ride quality factor), cracking, faulting, and rutting.

State Condition | In 2020, approximately 62 percent of the 2-lane routes and 59 percent of the 4-lane routes meet state thresholds. Approximately 31 percent of all State-maintained highways are in poor condition. State-maintained highways in poor condition have increased by approximately 11 percentage points between 2010 and 2020.

State Goals | For MDOT purposes, pavement condition is assessed using the Pavement Condition Rating (PCR), a function of rut, IRI, and distress data. The PCR is represented with a number from 0 to 100, with 100 being the best possible condition. MDOT has established a goal of maintaining Interstate pavements in good condition, a PCR of 82 or greater, and all other State-maintained highways at a minimum fair condition, a PCR of 72 or greater.

Life-Cycle Planning | MDOT integrates life-cycle planning in the development of rehabilitation and reconstruction project recommendations. Since the 2019 TAMP was published, the Department has continued to refine and enhance the pavement management system (PMS). These improvements to the PMS include updated costs, deterioration models, and decision trees. It allows MDOT to minimize the whole life cost of its pavements and develop projections of pavement conditions using different budget scenarios. MDOT is currently transitioning to the new version of the PMS and this transition coincided with modifications to the methodology for predicting performance and selecting work types. The actions undertaken during the TAMP development relied on the data from within the PMS. As a bridge between the old system and the new system a tool was developed to perform the forecast.

The Research Division identifies pavement projects using the PMS; the Maintenance Division works with the Districts to generate projects off of the Interstate and the Interstate Rating Committee to generate projects on the Interstate. The Chief Engineer approves the priority list based on funding, availability of contractors, and regional equity.

Managing Risk | MDOT's priority risks impacting pavement include issues with recruiting, retaining, and training talent; the continuing impact of COVID-19 on the MDOT workforce; the timely collection of data; increase in project costs; unreliable pavement management system data and models; safety issues related to poor pavement condition; weather and postponed projects.

Performance Gap Analysis | To meet Federal PM2 targets, the MDOT will annually invest $110m in NHS-Interstate Pavements and $127m in NHS Non-Interstate Pavements. Based on the investment level and needs, there is no performance gap annually for its NHS pavements per the Federal PM2 measure. However, it should be noted that based on MDOT's PCR measure, there are performance gaps of more than $190 million for interstate pavement and more than $127

million for non-interstate pavement. Interstate pavement and non-interstate NHS pavement would each require more than $300 million annual spending to meet the targets using the PCR measure. For the Non-NHS State-maintained system, MDOT will invest $5m in Non-NHS State Owned 4-Lane Pavement and $127m in Non-NHS State Owned 2-Lane Pavement but will not meet targets which provides for a performance gap. Table 1 and Table 2 provide a summary of the pavement gap analysis.

Table 1. NHS Pavement Performance Gap Summary

	Interstate Pavement	Non-Interstate NHS Pavement
Actual Investments June 2020-May 2021	$40.3 m	$87.7 m
2020 Condition (Federal PM2 Pavement Measure)	0.7% poor 73.6% good	4.2% poor 37.7% good
Four-Year Target (Federal PM2 Pavement Measure)	<5% poor >55% good	<10% poor >25% good
Estimated 10-Year Annual Spend Based on Expected Budget	$110 m	$127 m
Condition After 10-Years Based on Expected Budget (Federal PM2 Pavement Measure)	0.0% poor 73% good	2% poor 33% good
Additional Investment Needed to Close the Performance Gap (Federal PM2 Pavement Measure)	Target Met, No Gap	Target Met, No Gap

Note: Only the investment gap using the Federal PM2 measure is shown. Investments needed to meet the target using the PCR measure is more than $300 million for both interstate and non-interstate NHS pavements.
Source: MDOT. Dollar values do not include engineering, right-of-way, preconstruction, and additional maintenance costs.

Table 2 provides a performance summary for state-maintained Non-NHS pavement.

Table 2. Non-NHS Pavement Performance Gap Summary

	State-Maintained Non-NHS 4-Lane Pavement	State-Maintained Non-NHS 2-Lane Pavement
Actual Investments June 2020-May 2021	$42.7 m[1]	$140.5 m
2020 Condition (MDOT PCR Pavement Measure)	41% poor 37% good	38% poor 23% good
Four-Year Target (MDOT PCR Pavement Measure)	<25% poor	<25% poor
Estimated 10-Year Annual Spend Based on Expected Budget	$5 m	$127 m
Condition After 10-Years Based on Expected Budget (MDOT PCR Pavement Measure)	38% poor 16% good	41% poor 33% good
Additional Investment Needed to Close the Performance Gap (MDOT PCR Pavement Measure)	$16 m	$62 m
Estimated 10-Year Annual Spend to Meet Target (Adequate Budget)	$21 m	$189 m
Condition After 10-Years Based on Adequate Budget (MDOT PCR Pavement Measure)	25% poor 29% good	25% poor 44% good

Note: Actual investments June 2020-May 2021 on the state-maintained non-NHS 4-lane pavements were funded by a BUILD grant for added capacity.
Source: MDOT 2019 TAMP Implementation Report, 2021. Dollar values do not include engineering, right-of-way, preconstruction, and additional maintenance costs.

Financial Plan | Table 3 summarizes MDOT spending by FHWA work type for June 2020–May 2021.

Table 3. MDOT Spending June 2020–May 2021, Millions of Nominal Dollars

Expenditure	Interstate Pavement	NHS Non-Interstate Pavement	State-Maintained Non-NHS 4 Lane Pavement	State-Maintained Non-NHS 2 Lane Pavement	Total
Maintenance	$0.5	$1.6	$0.0	$4.5	**$6.6**
Preservation	$26.9	$73.5	$0.0	$129.4	**$229.8**
Rehabilitation	$12.9	$12.6	$0.0	$0.3	**$25.8**
Reconstruction	$0.0	$0.0	$0.0	$6.3	**$6.3**
Construction	$0.0	$0.0	$42.7	$0.0	**$42.7**
Total	**$40.3**	**$87.7**	**$42.7**	**$140.5**	**$311.2**

Source: MDOT.

Looking to the future, MDOT expects an average annual bridge and pavement budget from 2022-2031 of $569million in 2022 dollars. Of that $569 million, MDOT targets spending on average $369 million on managing pavements. The remainder of the funds are spent on bridges, PE, ROW utilities, inspection services, and scour evaluations. Lottery funds will sunset in June 2028, reducing MDOT's revenue by about $80 million per year.

MDOT values its pavements at $34.9b.

Investment Strategies | To invest in its assets, MDOT:

- Advocates annually to the legislature for revenue adjustments required to maintain transportation assets. Throughout the annual budget request process MDOT informs and educates the legislature. It also uses MULTIPLAN to assess system investments needed to meet user expectations.

- Allocates revenue to pavements. MDOT considers how risks might impact its investments (e.g., it ensures its pavement data and management systems can provide high-quality estimates of future need); after bridges, it prioritizes Interstate pavement condition first (seeking to keep it above the minimum percent poor defined by Federal rules), followed by preservation of 4-lane roads, and then 2-lane roads. The MPOs in Mississippi also work to prioritize investments in NHS pavements. MDOT anticipates that NHS pavements will remain a priority and that the remainder of the State-maintained system will continue to deteriorate.

MULTIPLAN 2045 defined the vision of Mississippi's future transportation network and described how MDOT will strategically allocate resources to address the challenges and strive to meet its transportation goals. Based on extensive feedback received from participants and stakeholders of MULTIPLAN, MDOT selects investment strategies that achieve the desired level of asset condition and system performance.

- Allocates revenue to the five FHWA work types. MDOT ensures that each District spends at least 10 percent of its 2- and 4-lane budget on preservation. It uses its PMS to allocate resources among maintenance, preservation, and rehabilitation that minimize the life-cycle cost of its pavements.

Managing Bridges

Inventory | In the 2021 NBI submittal, Mississippi has a total of 16,307 structures subject to the National Bridge Inventory Standards (NBIS). Approximately one-third of these structures are State-maintained; the remaining two-thirds are maintained by others. Not all of the structures are addressed in the TAMP. The plan focuses only on bridges located on the NHS and Non-NHS bridges owned and maintained by MDOT.

Of the 16,307 structures subject to the NBIS, 2,725 structures are State-maintained and support the NHS; 3,089 structures are State-maintained and support non-NHS roads; 78 structures are locally-maintained and support the NHS; and 10,415 structures are locally-maintained and support non-NHS roads.

Condition | In 2021, 57.5 percent of NHS bridges (measured in deck area) are in good condition and 2.3 percent are in poor condition. In 2021, 65.4 percent of State-Maintained Non-NHS bridges (measured in deck area) are in good condition and 2.9 percent are in poor condition.

Targets | The Federal rule establishes a minimum standard for NHS bridge conditions, stating that no more than 10 percent of the total deck area on NHS bridges may be classified as poor for three consecutive years. MDOT's minimum performance target requires that more than 50 percent of bridge by deck area should be in good condition and less than five percent of bridges by deck area should be in poor condition.

Life-Cycle Planning | MDOT integrates life-cycle planning in the development of preservation, rehabilitation and reconstruction project recommendations. Since the 2019 TAMP, the Department has been working to implement a new bridge management system (BMS). The completed BMS includes updated cost models, deterioration curves and other data needed for the operation of AASHTO Bridge Management. It allows MDOT to minimize the whole life cost of its bridges and develop projections of bridge conditions using different budget scenarios. MDOT anticipates the BMS implementation to be fully complete and operational by June 2022.

Managing Risk | MDOT's priority risks impacting bridges include issues with recruiting, retaining, and training talent; the continuing impact of COVID-19 on the MDOT workforce; the maintenance of border bridges; the proper load rating of local bridges; compliance in the local bridge inspection program; increase in project costs; the quality of bridge data and models; and postponed projects.

Performance Gap Analysis | To meet Federal PM2 targets, the MDOT will annually invest $106 million in NHS bridges. To maintain the current performance in the State-Maintained Non-NHS bridges, MDOT is planning to invest $59 million annually. Overall, MDOT plans to invest $165 million in bridges. At that investment level, there is no gap for its NHS and Non-NHS state maintained bridges to meet TAMP targets. However, the goal of the FHWA Final Rulemaking for Asset Management Plans & Processes is to achieve and sustain assets in a "state of good repair". To remain consistent with this concept, MDOT has identified all bridges on its inventory that would require either repair or replacement to reach an NBI Condition Classification of "Good". This results in a total of 1,952 bridges as of the 2021 NBI Submittal date of October 26, 2021. In summary, a backlog does exist and the backlog amount is calculated by using MDOT's approach to estimating replacement value for all bridges categorized as poor, and 20 percent of replacement value to rehab all bridges categorized as fair. These 1,952 bridges result in a needs backlog of $2.5 billion, which comes from:

- Replace All Poor Bridges: $592 million.

Repair All Fair Bridges at 20 percent of Replacement Cost: $1.87 billion.

Table 4 provides a summary of the bridge gap analysis.

Table 4. Bridge Performance Gap Summary

	NHS Bridges	State-Maintained Non-NHS Bridges
Actual Investments June 2020-May 2021	$50.1 m	$43.5 m
2020 Condition (Bridge deck area)	2.3% poor 57% good	2.9% poor 65% good
Four-Year Target (Bridge deck area)	<5% poor >50% good	<5% poor >50% good
Estimated 10-Year Annual Spend Based on Expected Budget	$106 m	$59 m
Condition After 10-Years Based on Expected Budget (Bridge deck area)	2.5% poor 50% good	3.6% poor 61% good

Additional Investment Needed to Close the Performance Gap (Bridge deck area)	Target Met, No Gap	Target Met, No Gap

Source: MDOT 2019 TAMP Implementation Report, 2021. Dollar values do not include engineering, right-of-way, preconstruction, and additional maintenance costs.

Financial Plan | Table 5 summarizes MDOT spending by FHWA work type for June 2020–May 2021.

Table 5. MDOT Spending June 2020–May 2021, Millions of Nominal Dollars

Expenditure	NHS Bridges	Non-NHS Bridges	Total
Maintenance	$1.1	$0.4	**$1.5**
Preservation	$7.9	$1.4	**$9.3**
Rehabilitation	$35.1	$6.9	**$42**
Reconstruction	$6.0	$34.8	**$40.8**
Construction	$0.0	$0.0	**$0.0**
Total	**$50.1**	**$43.5**	**$93.6**

Source: MDOT.

Looking to the future, MDOT expects an average annual bridge and pavement budget from 2022-2031 of $569 million in 2022 dollars Of that $569 million, MDOT targets spending on average $165 million on managing bridges. The remainder of the funds are spent on bridges, PE, ROW utilities, inspection services, and scour evaluations. Lottery funds will sunset in June 2028, reducing MDOT's revenue by about $80m per year.

MDOT values its bridges at $15.2b.

Investment Strategies | To invest in its assets, MDOT:

- Makes the annual case for revenue to the legislature. MDOT makes an effort to educate and inform the legislative process throughout the annual budget request. It also uses MULTIPLAN to assess system investments needed to meet user expectations.
- Allocates revenue to bridges. MDOT considers how risks might impact its investments (e.g., it ensures its bridges are properly inspected and posted; consideration regarding the impacts of extreme weather); it minimizes closed bridges; it replaces all timber bridges and those posted for load limits; and it prioritizes bridges as the first priority for state of good repair work. MDOT anticipates that NHS bridges will remain a priority and that the remainder of the State-maintained system will continue to deteriorate.
- Allocates revenue to the five FHWA work types. Each District is given a weighted allocation based on vehicle miles traveled (VMT) of funds for maintenance of pavement. Preservation funds for bridges are allocated in equal portions. It uses its BMS to allocate resources among maintenance, preservation, and rehabilitation that minimize the life-cycle cost of its bridges.
- Investments at the local level will be determined by the jurisdictions with maintenance responsibility of locally-maintained NHS bridges. With the portion of locally maintained NHS

bridges being less than three percent of the overall number of NHS structures, MDOT will focus its resources on State-maintained bridges which typically carry higher traffic volumes and include larger structures.

1.0 Overview

The Mississippi Department of Transportation (MDOT) has been active in transportation asset management (TAM) for many years. This Transportation Asset Management Plan (TAMP) outlines the existing and planned state of TAM practice in the State of Mississippi. It begins with an overview of TAM and why it is important for the State. The Plan then discusses the management of pavement and bridge assets on the National Highway System (NHS) as well as the State-maintained Highway System. It discusses life-cycle planning, strategies to manage risks, provides a 10-year financial plan with investment strategies, and concludes with a discussion of TAM enhancements.

Transportation Asset Management is a process to strategically manage transportation systems in a cost-effective, safe, efficient, and environmentally sensitive manner.

This approach focuses on performance to manage systems for optimal results.

1.1 The Need for Transportation Asset Management

The United States and its States, including Mississippi, have built one of the world's most extensive transportation systems, representing trillions of dollars of public investment. This transportation network supports the economy and directly impacts the competitiveness of the Nation and the State of Mississippi. Transportation agencies turn to TAM strategies to maintain and improve the system. TAM ensures that the integrity of the infrastructure is preserved in the short- and long-term.

At its core, TAM supports the ability of transportation agencies to operate rationally and comprehensively with clear strategies to sustain the desired state of good repair over the life-cycle of the assets at a minimum practicable cost. Agencies that implement TAM principles can reap many benefits, including lower long-term costs for infrastructure preservation, improved performance, improved service to customers, and better use of available resources. TAM's focus on performance and outcomes can ultimately result in improved credibility and accountability for decisions and expenditures.

1.2 TAMP Development

The 2045 Mississippi Unified Long-Range Transportation Plan (MULTIPLAN), MDOT's long-range transportation plan (LRTP), discusses the need for a well-performing transportation network to support Mississippi families, jobs, and businesses. It notes that inadequate infrastructure investment increases the cost of doing business and the cost of living.

MULTIPLAN 2045 notes that MDOT has opportunities to use TAM to extend life of the asset; reduce cost of reconstruction; create safer roadways; reduce driving costs and improve ride quality; and support economic development.

TAM is a critical component of reaching the goals established in MULTIPLAN. This TAMP supports MULTIPLAN goals by articulating the strategies necessary to operate, maintain, and improve physical assets in a cost-effective manner throughout their life-cycle.

TAM is not new to MDOT. MDOT has been monitoring and managing its State-maintained pavements and bridges for decades. As a result of the passage of Moving Ahead for Progress in the 21st Century Act (MAP-21), Fixing America's Surface Transportation Act (FAST Act), and, subsequently, the Bipartisan Infrastructure Law (BIL), enacting new asset management requirements, efforts have been made to ensure current TAM activities meet the new Federal objectives. Some of these efforts, aiming to ensure successful implementation of Federal requirements, include:

- Maintaining a working group with technical members and members of Administration that represents all aspects of MDOT responsibilities that actively coordinates on TAM issues. The working group members are listed in Table 6.

- Reviewing and improving data collection and maintenance procedures to ensure best practices are in place.

Table 6. Asset Management Working Group

Title	Role
Chief of Staff	Administration
Assistant Chief Engineer-Operations	Administration
Assistant Chief Engineer-Preconstruction	Administration
Assistant Chief Engineer-Field Operations	Administration
Chief Information Officer	Administration
Budget Director	Financial Lead
Programming Director	Programming Lead
State Planning Engineer	Asset Management Lead
State Research Engineer	Pavement Management Lead
State Maintenance Engineer	Maintenance Lead
State Bridge Engineer	Bridge Management Lead

Note: Other technical members are designated as needed.
Source: MDOT

This risk-based TAMP fulfills the requirements of the Final Rule, which calls for State DOTs to develop and implement a risk-based asset management plan with a 10-year planning horizon for bridges and pavement on the NHS. The rule establishes the minimum process elements State DOTs must use to develop their asset management plans. These include:

- **A summary listing of assets and a description of their condition |** See Section 2.1 for pavements and Section 3.1 for bridges.

- **Discussions covering the State DOT's asset management objectives, asset management measures, and State DOT targets for asset condition |** See Section 1.3.

- **Identification of performance gaps |** See Chapter 6.
- **A life-cycle planning analysis |** See Chapter 4.
- **A risk management analysis |** See Chapter 5.
- **A discussion of the results of the financial planning process** | See Chapter 7.
- **A description of investment strategies that collectively would make or support progress toward |** See Chapters 4 (life-cycle planning), 7 (financial plan), and 8 (investment strategies).

    Achieving and maintaining a state-of-good-repair over the life cycle of the assets.

    Improving or preserving the condition of the assets and the performance of the NHS relating to physical assets.

    Achieving the State DOT targets for asset condition and performance of the NHS, as well as established national goals.

1.3 Goals

MULTIPLAN 2045 describes MDOT's transportation goals, including:

Environmental Stewardship

The expansion and modernization of the transportation network should be mindful of its effect on the environment and attempt to mitigate the impacts.

As Mississippi maintains and modernizes its transportation network to accommodate future transportation needs, it is essential to consider how natural, technological, and human-caused hazards can cause risk and create vulnerabilities to the statewide transportation infrastructure, operations, and services. Understanding the vulnerability of aging transportation infrastructure to extreme weather events and integrating resiliency planning considerations into decision-making is critical to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruption.

Awareness, Education, and Cooperative Processes

Establish effective transportation partnerships and collaborations while increasing awareness of the benefits and needs of an intermodal system.

Mississippi promotes a culture that fosters cooperation and essential partnerships to deliver a system that serves all members of the public. Collaborative processes across all transportation modes and various agencies increase public awareness, highlights unmet funding needs, and encourages innovation to improve project delivery and system performance. Collaboration between State agencies, local governments, and stakeholders helps identify partnership opportunities, investment priorities, technology, and operational efficiencies, and important safety enhancements.

Funding and Finance

Provide reliable funding and financing options for the transportation system and allocate funds efficiently.

Stable funding sources for transportation infrastructure are required to ensure adequate maintenance, modernization, and expansion of the Mississippi transportation network. Additional revenue and financing opportunities should be explored when possible. Cost efficiency and timely project delivery should be incentivized through funding allocation. Without sufficient funding to meet the most critical needs, funding allocation aims to benefit the greatest number of residents, to represent the needs of stakeholders, and to advance statewide transportation goals.

Safety

Ensure a safe transportation network for all users.

MDOT's mission is to provide a safe intermodal transportation network that is planned, designed, constructed, and maintained in an effective, cost-efficient, and environmentally sensitive manner. As the mission states, safety is of the highest importance to MDOT's transportation engineering and planning efforts. Ensuring a safe transportation network for all users requires transportation solutions that protect the general public, with particular emphasis on vulnerable populations.

Maintenance and Preservation

Preserve and maintain existing transportation infrastructure.

Over the next 25 years, the roadways, bridges, transit assets, and freight facilities within the State will require systematic up-keep to ensure safety and reliable transportation for residents and visitors. With travel expected to increase, pavement conditions and other asset preservation will play a critical role in providing a well-connected, quality transportation system that seamlessly moves people and goods within the State.

Accessibility and Mobility

Improve connectivity and travel of residents, commerce, and industry.

As the population is expected to grow, the demand for commerce, access to employment centers, access to transportation terminals, and connectivity to statewide resources will continue to increase. Maintaining the ease, ability, and quality of travel to and from key destinations within Mississippi is a priority. Mobility and accessibility investments can improve travel reliability and provide alternative routes or transportation options to meet the growing statewide need.

Economic Development

Invest in strategic transportation improvements to support the State's economy and competitiveness.

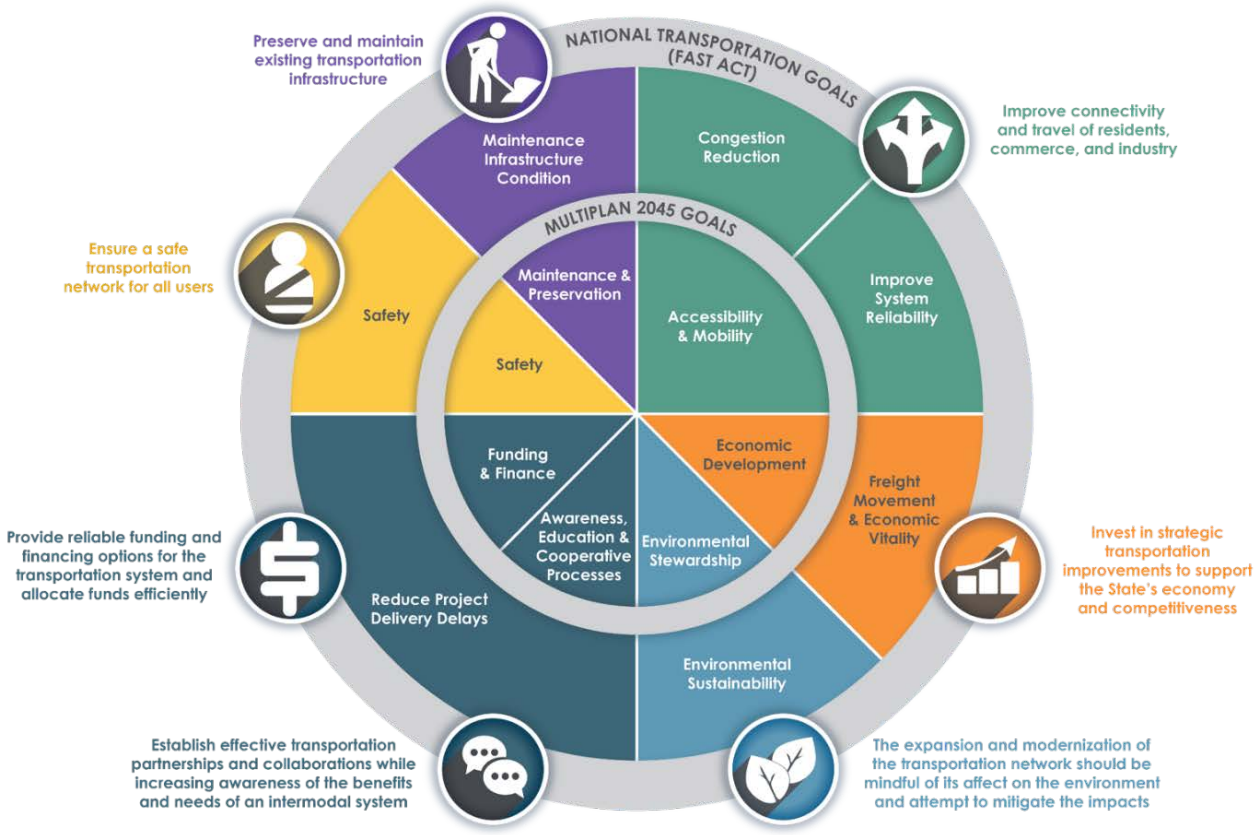
Transportation is vital to ensure the efficient movement of goods and people to, from, and throughout Mississippi. A strong transportation network supports economic development by providing reliable transportation routes that connect businesses to development opportunities while also providing residents and visitors access to major destinations. Investing in strategic transportation improvements along essential corridors and routes statewide will enhance freight efficiency, support travel and tourism needs, and boost the State's overall economic competitiveness.

In compliance with the Federal Rule, these goals relate to national transportation goals. Figure 1 displays how MDOT's goals align with national transportation goals.

The goals of this TAMP have been established not only to fulfill specific Federal initiatives but also to support the seven Statewide transportation goals previously mentioned, ensure transparency for the traveling public and policymakers, and assist in the decision-making process. These goals are:

- Informing decision-makers, both internal and external, and the public about MDOT's TAM processes and the Agency's commitment to TAM.
- Documenting detailed TAM processes and resources.
- Documenting asset needs for pavements and bridges on the NHS as well as the strategies to meet those needs.
- Laying a foundation to support MDOT's goals in data access and sharing.
- Providing a resource of information on asset condition and MDOT's plans to address infrastructure condition and needs.
- Guiding MDOT decision-making to unlock the benefits of TAM, including lower long-term costs for infrastructure preservation, improved performance and service to customers, and better cost-effectiveness and use of available resources.
- Fulfilling Federal requirements for TAMP development and implementation.

Figure 1. National and State Goals



Source: MDOT.

2.0 Pavement Inventory, Condition, and Targets

Mississippi actively manages its State-maintained pavements using a state pavement condition measure – Pavement Condition Rating (PCR). To meet Federal requirements, this plan addresses pavements on the NHS using the Federal pavement condition measure. While the approaches to analyzing the data are different, the intent is the same – to make the most efficient use of tax dollars to deliver the best transportation system.

The section details:

- The pavement inventory on the NHS and other State-maintained roads.
- How MDOT and FHWA measure pavement condition.
- Pavement goals and performance targets.

State and Federal Pavement Perspectives

Mississippi and the FHWA both work every day to deliver an efficient, effective, and safe transportation system.

Mississippi understands that there is power in measuring and managing performance. MDOT has been collecting and using its pavement condition measure to make decisions for years.

Recently, FHWA published rules requiring State DOTs to report on a different network of pavement assets using a different measure. While they are different, the purpose is the same – to manage the performance of the pavements in Mississippi and the Nation.

As a result, some of the pavement measures Mississippi has traditionally reported may look a little different when represented using the Federal measure. The actual pavement conditions have not changed – the differences reflect the differences in how the data is being collected and analyzed.

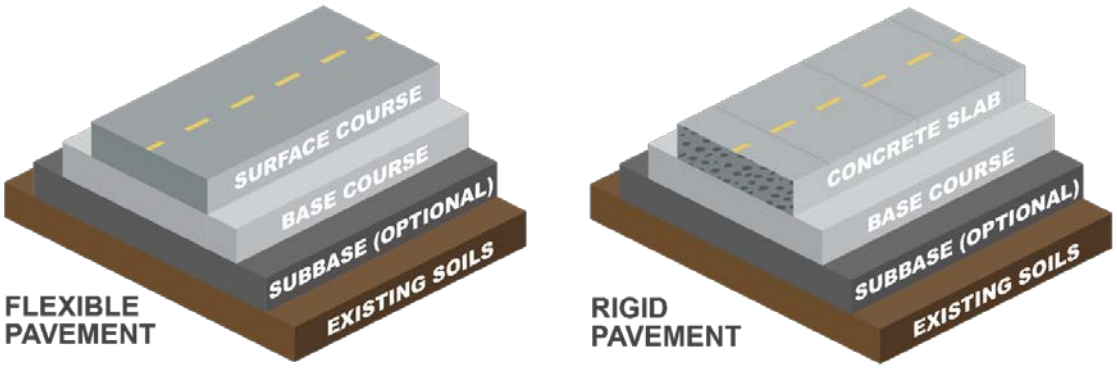
No matter what measure is reported, MDOT will use it to make the best use of tax dollars.

2.1 Pavement Inventory

There are about 162,200 lane-miles of publicly maintained roads and highways in the State of Mississippi. Of these, MDOT has maintenance jurisdiction over about 28,300 lane-miles. The remaining 133,900 miles of public roads are under the maintenance jurisdiction of cities, counties, or other State or Federal agencies. The MDOT network consists of the most critical roadways, including the Interstate system and most of the NHS. It carries 60 percent of all passenger vehicle traffic and 90 percent of all truck traffic.[1]

The major structural components of flexible and rigid pavement systems are shown in Figure 2.

Figure 2. Structural Components of Pavement



Source: Cambridge Systematics.

The NHS in Mississippi includes about 13,600 lane-miles of road:

- **Interstate:** About 850 miles and 3,500 lane-miles.
- **Non-Interstate NHS:** About 2,800 miles and 10,100 lane-miles of pavement. Of this, Mississippi maintains about 2,600 miles and 9,300 lane-miles – the other 760 lane-miles of roads are maintained by counties, towns, cities, the Mississippi Department of Wildlife, Fisheries, and Parks, or the National Park Service.

Table 7 shows the breakdown of NHS pavement lane-miles by ownership. For comparison, it includes a column that shows the Non-NHS pavement miles maintained by the State and other agencies.

[1] U.S. DOT FHWA Office of Highway Policy Information, Highway Statistics Series

Table 7. NHS and Non-NHS Pavement Lane-Miles by Ownership, 2020

Ownership	Interstate NHS	Non-Interstate NHS	Non-NHS	Total
Mississippi DOT	3,483	9,316	15,516	**28,316**
Other Local, State, and Federal Agencies	0	759	133,134	**133,893**
Total	**3,483**	**10,076**	**148,650**	**162,209**

Source: MDOT Planning Division.

2.2 Collecting Pavement Condition Data

MDOT collects pavement condition data annually for the Interstate and biennially for the non-Interstate NHS. It also is responsible for collecting and reporting pavement condition data on the 759 lane-miles of NHS that it does not maintain. This section summarizes the Quality Management Plan (QMP) of the MDOT Pavement Management Manual.[2] MDOT collects pavement inventory and condition data using in-house and contract forces. Pavement surveyors drive data collection vehicles with cameras and lasers in the rightmost through lane annually on Interstates and biannually on Non-Interstate NHS highways and other State-maintained highways. Surveyors collect the following distresses (and more):

- Transverse cracking.
- Longitudinal cracking.
- Alligator/fatigue cracking.
- Patching/potholes.
- Rutting (on asphalt).
- Faulting (on jointed concrete).
- Roughness.

The QMP details the acceptable levels of data quality, data collection procedures, quality control and acceptance criteria, roles and responsibilities for each stakeholder in the process, and reporting requirements for the pavement data program. The QMP describes the expectations for critical activities that occur before, during, and after data collection.

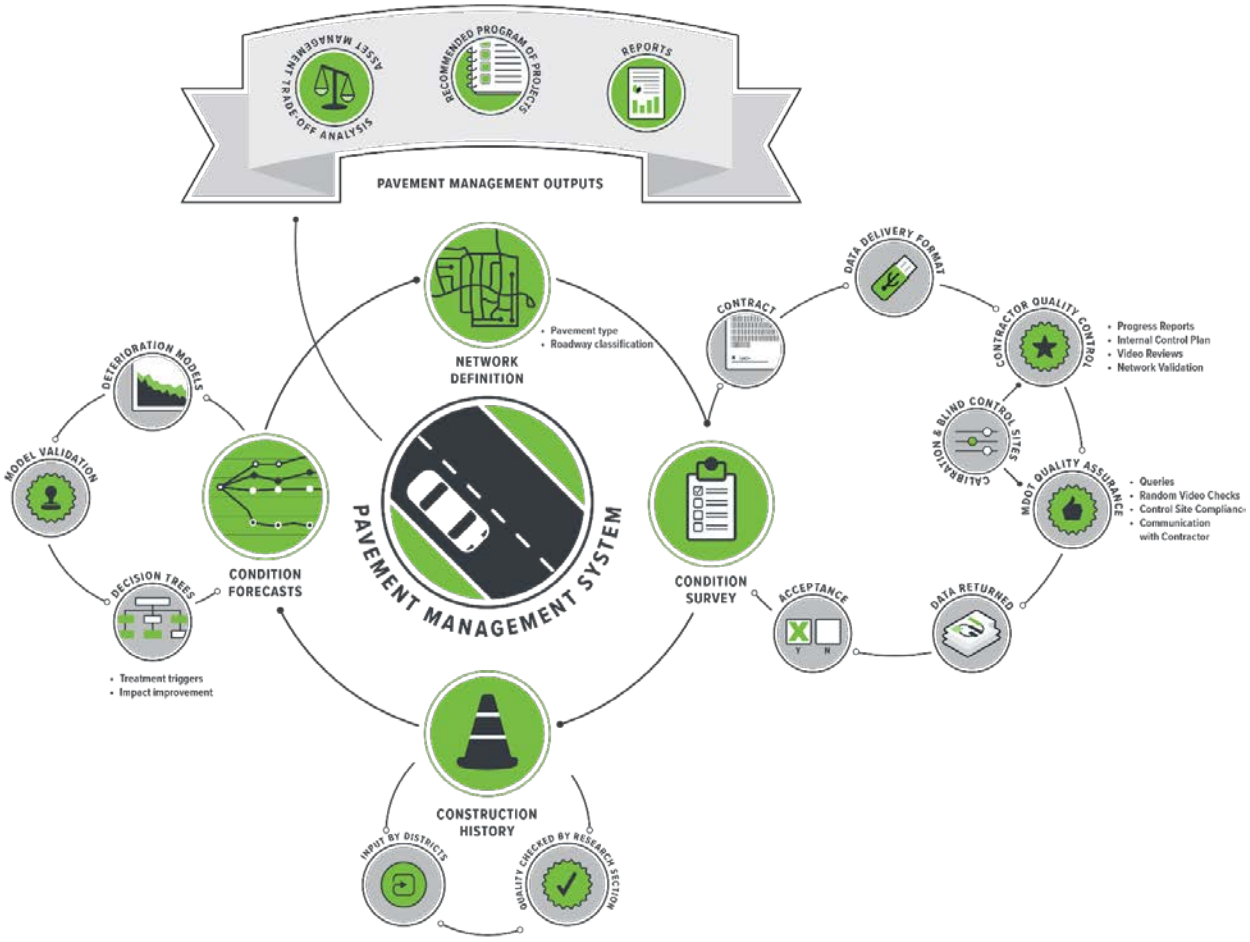
[2] https://mdot.ms.gov/documents/Research/Manuals/Supplemental%20Materials/Technical%20Brief%20-%20Development%20of%20a%20Pavement%20Management%20Manual%20and%20Data%20Quality%20Plan.pdf accessed 9/16/2021

One hundred percent of the sections collected by the data collection contractor are evaluated by MDOT and compared to the current and previous ratings. Only sections with data that falls within the limits set for each criterion are accepted, and discrepancies are re-collected by the contractor. Calibration sites also verify the accuracy of the data being collected.

Figure 3 shows the overall pavement management process. MDOT's QMP was developed following the FHWA Practical Guide for Quality Management of Pavement Condition Data Collection. Key features include:

- Protocols and quality standards for data collection deliverables.
- Quality control activities for monitoring, providing feedback, and verifying that deliverables meet the defined quality standards.
- Acceptance testing determining whether quality criteria are met and the corrective actions to be taken whenever the criteria are not met.
- Quality-related personnel roles and responsibilities per activity.
- Process and format for documenting completion of all QM activities (quality standards, quality control, acceptance, and corrective actions).

Figure 3. MDOT Pavement Management Process



Source: MDOT. "MDOT State Study 268— Development of a Pavement Management Manual and Data Quality Plan for the Mississippi Department of Transportation." June 30, 2017. Applied Pavement Technology.

2.3 Measuring Pavement Condition

State-Maintained Highway System

To manage the State-maintained highways, MDOT combines IRI with the other distresses (e.g., transverse cracking, longitudinal cracking, alligator/fatigue cracking, patching/potholes, rutting (on asphalt), and faulting (on jointed concrete)) into a composite measure called the Pavement Condition Rating (PCR). PCR is a State-specific measure tailored to Mississippi's unique weather and soil conditions. Because MDOT has been using the measure since 1991 to understand its needs and articulate how it makes decisions, it has become part of the narrative, and many in the State understand the measure intuitively.

The condition thresholds for good, fair, and poor pavement based on PCR are listed in Table 8. PCR is represented with a number from 0 to 100 with 100 being the best possible condition. PCR equations differ by pavement type because different distresses appear on different pavement types. For example, MDOT measures faulting on jointed concrete and alligator cracking and rutting on flexible asphalt. PCR serves well as a composite index for network reporting as it is easily understood and explained.

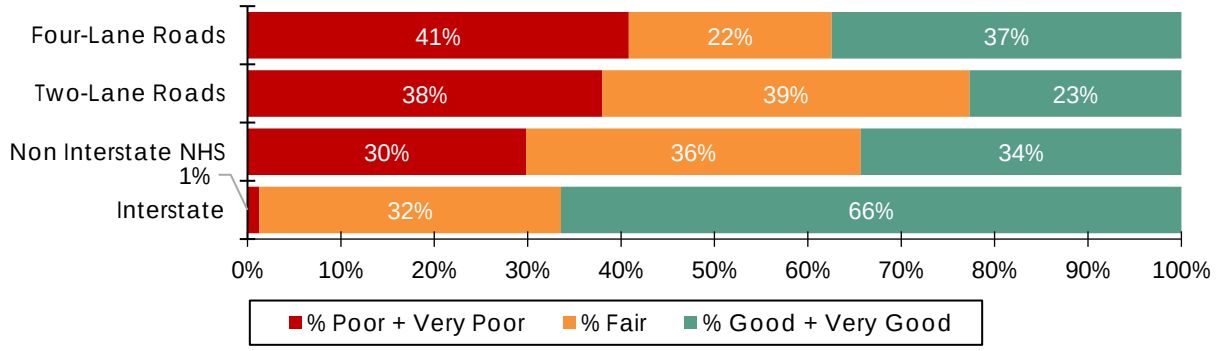
Table 8. State Pavement Condition Rating (PCR) Condition Thresholds for the State-Maintained Highway System

Pavement Condition Rating (PCR)	State-Maintained Pavement
Very Good	89≤
Good	82-89
Fair	73-81
Poor	63-72
Very Poor	<63

Source: MDOT.

Figure 4 shows the pavement condition for the State-maintained roads based on PCR, regardless of whether it is on the NHS. Interstate pavement is in much better condition than the 2- and 4-lane roads.

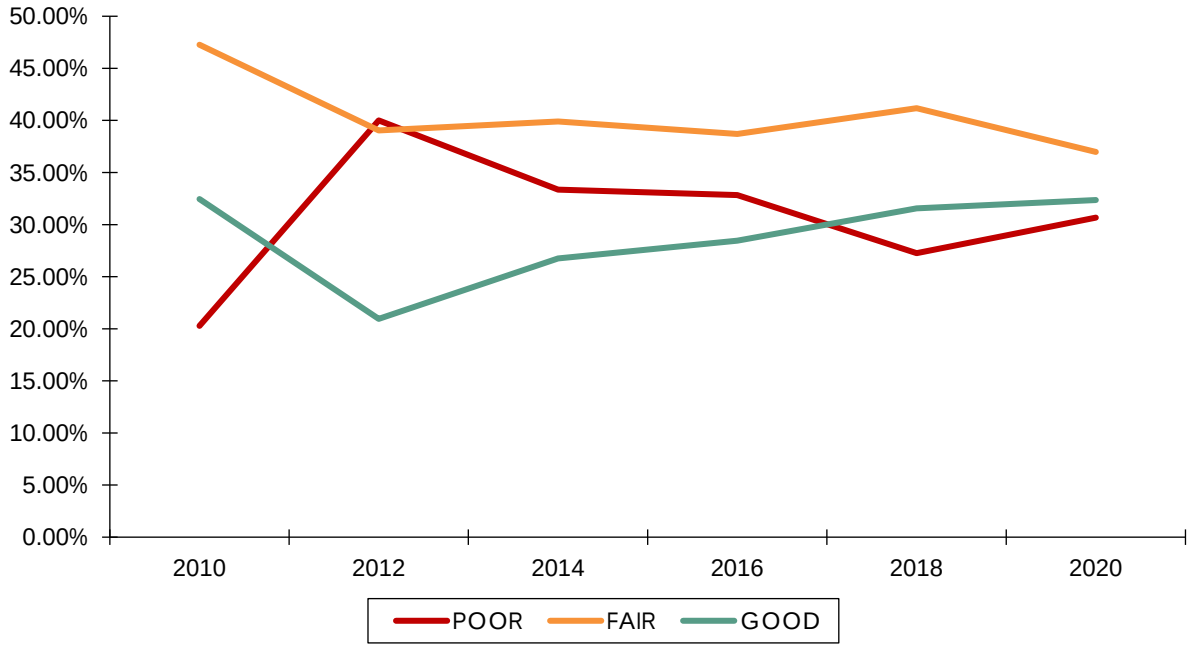
Figure 4. State-Maintained Pavement Condition Using Pavement Condition Rating (PCR), 2020

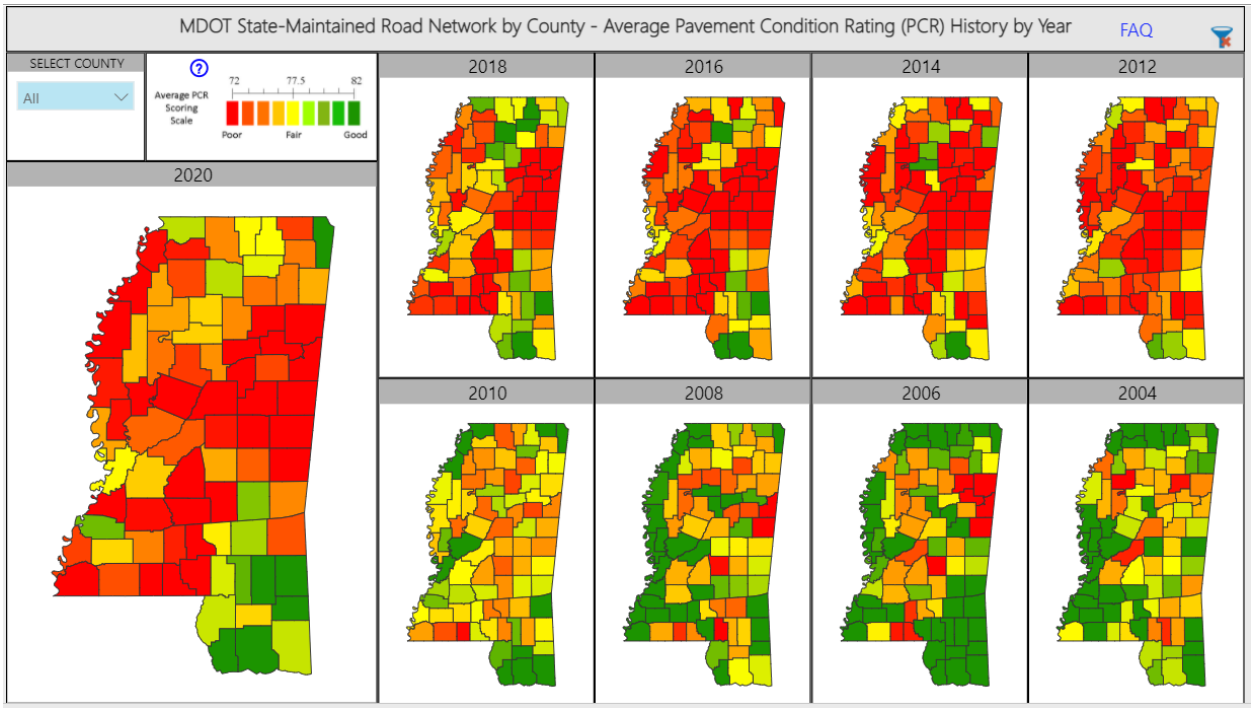


Source: MDOT.

Figure 5 shows the pavement condition trend since 2010 in trendline form (top) and by county (bottom).

Figure 5. State-Maintained Pavement Condition Using Pavement Condition Rating (PCR), 2010–2020 (top) and by county 2004–2020 (bottom)





Source: MDOT Public Accountability Transportation Hub (PATH), accessed 9/16/2021.

The National Highway System

MDOT collects pavement condition data annually for the Interstate and biennially for the non-Interstate NHS. It also is responsible for collecting and reporting pavement condition data on the 759 lane-miles of NHS that it does not maintain.

The Federal rule established national condition thresholds for good, fair, and poor pavements that are consistent across states. In order for a pavement section to be rated as good, it must be rated as good in all three categories. If two or more categories are poor, the overall condition of the pavement is considered poor. All other combinations are considered fair. Table 9 shows the condition thresholds for asphalt, jointed concrete, and continuously reinforced concrete pavement (CRCP).

State and Federal Pavement Perspectives

The Federal measure is fundamentally different from MDOT's PCR. While MDOT appreciates the need for a common Federal measure among states, it does not give the level of detail necessary to manage the State's pavements.

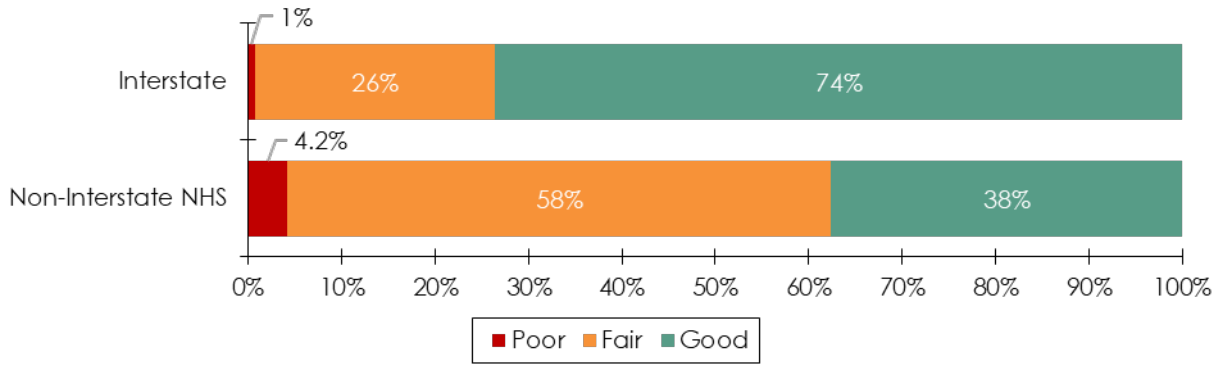
Table 9. Federal Pavement Condition Thresholds for NHS

	Asphalt			Jointed Concrete Pavement			Continuous Reinforced Concrete Pavement	
	IRI (inches/mile)	Cracking (%)	Rutting (inches)	IRI (inches/mile)	Cracking (%)	Faulting	IRI (inches/mile)	Cracking (%)
Good	<95	<5	<.20	<95	<5	<.10	<95	<5
Fair	95-170	5-20	.20-.40	95-170	5-15	.10-.15	95-170	5-10
Poor	>170	>20	>.40	>170	>15	>.15	>170	>10

Source: Federal Highway Administration.

Figure 6 shows the current percentages of Interstate NHS and Non-Interstate NHS in good, fair, and poor condition for 2020. MDOT prioritizes keeping roads on the Interstate in a state of good repair. As a result, Interstate roads are in better condition than non-Interstate routes.

Figure 6. NHS Pavement Condition Using the Federal Measure, 2020



Source: MDOT.

Table 10 details the lane-miles for the NHS by owner and condition.

Table 10. NHS Pavement Condition By Owner

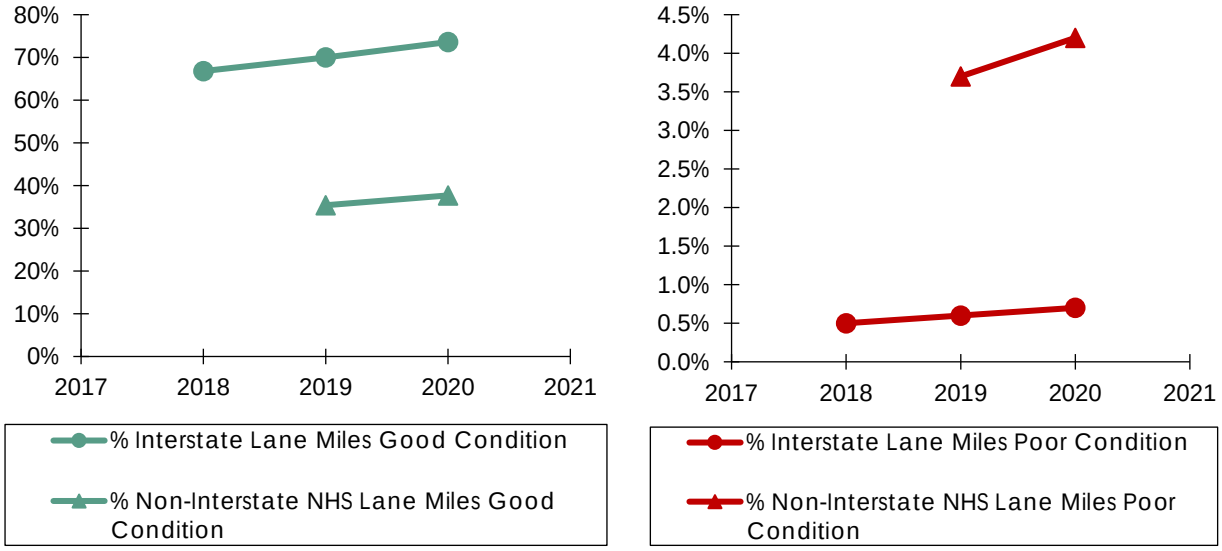
	Total	State		County		City	
	Lane-miles	Lane-miles	%	Lane-miles	%	Lane-miles	%
Poor	433	331	3%	21	15%	81	18%
Fair	6,559	6,156	49%	102	73%	301	67%
Good	6,129	6,044	48%	16	12%	69	15%
Total NHS	13,121	12,531	100%	139	100%	451	100%

Source: MDOT Research Division.

Note: Lane miles differ from the MDOT Planning Division lane miles due to how the data is collected, stored, and queried.

Figure 7 shows the history of the Federal measure on the NHS as well as the state targets.

Figure 7. NHS Pavement Condition Using Federal Measure, 2018–2020

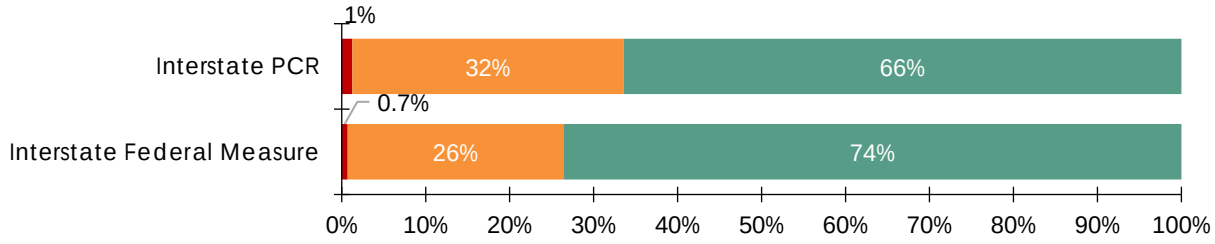


Source: FHWA, https://www.fhwa.dot.gov/tpm/reporting/state/condition.cfm?state=Mississippi, Accessed September 16, 2021 and HPMS 8.0.1 Pavement Report Card for Mississippi accessed June 15, 2021.

Comparing PCR and The Federal Measure

For many States, the Federal measure tends to increase the percentage of fair pavements and reduce the percent of good and poor pavements when compared to the State's measure. For Mississippi Interstates in 2020, the percent of pavement in good, fair, and poor condition is similar when using PCR or the Federal measure (Figure 8).[3]

Figure 8. Comparison of PCR and the Federal Measure, Interstates

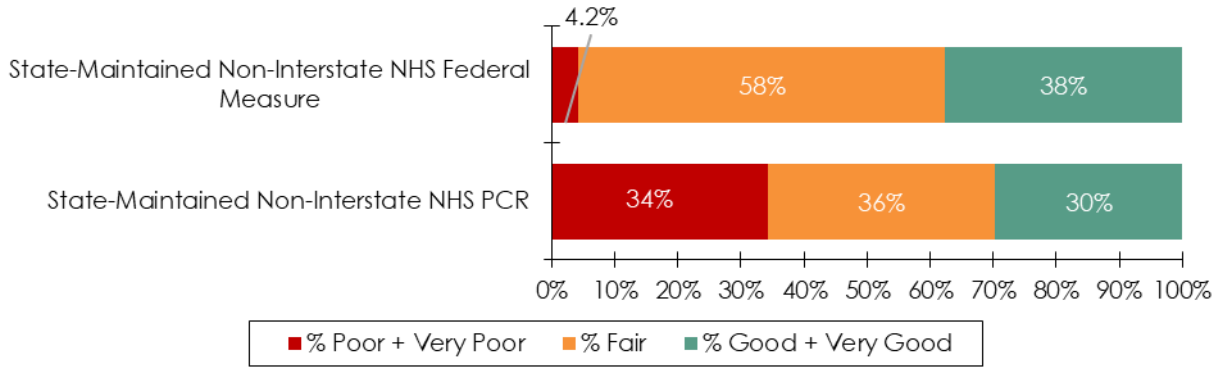


Source: Cambridge Systematics using MDOT 2020 pavement data for PCR and HPMS 8.0.1 Pavement Report Card for Mississippi accessed June 15, 2021.

[3] PCR is documented in the MDOT Pavement Condition Survey Book (2022)maintained by the Research Division.

For Mississippi two- and 4-lane roads in 2020, the percent of pavement in good and poor condition looks substantially different. While the actual condition of the pavements has not changed on the facility, the Federal measure indicates that four percent of facilities are in poor condition while PCR indicates that there 34 percent are in poor condition. Similarly, the Federal measure indicates that 38 percent of pavements are in good condition while PCR indicates that 30 percent are in good condition. Figure 9 compares the condition of the Non-Interstate NHS by the PCR and the Federal Measure. *Note: the results for the Federal measure include non-State-maintained NHS roads while the results for PCR only include State-maintained roads.*

Figure 9. Comparison of PCR and the Federal Measure, Non-Interstate NHS



Source: Cambridge Systematics using MDOT 2020 pavement data for PCR and HPMS 8.0.1 Pavement Report Card for Mississippi accessed June 15, 2021. Pavement Performance Targets

2.4 Pavement Performance Targets

Target Review and Update Process

MDOT updates its pavement targets regularly using the following process:

Who: MDOT Maintenance, Finance, and the Research Divisions work with the Districts to collect pavement condition data, track trends in pavement performance, plan investments, and develop target recommendations. As part of the Asset Management Working Group, the Research (the State Research Engineer), Maintenance (State Maintenance Engineer), and Planning (the State Planning Engineer) Divisions review and update the performance targets and present them to the Administration for final approval.

When: MDOT reviews and updates the performance target in line with the Federal performance reporting cycle. It reviews the pavement performance targets every two years as part of the Mid Performance Period Progress Report and Full Performance Period Progress Report and formally updates the targets if needed. It documents the targets or expected targets in the LRTP and the TAMP.

Method: MDOT considers the following as it sets its targets:

- Trends: MDOT reviews the historical pavement condition data to understand the impact of its decisions, investments, and risks over time.
- Tradeoff analysis: As part of the LRTP, MDOT performed a tradeoff analysis that married MDOTs revenue projections, two different budget scenarios, and its investment strategies together to understand the impact of these investments on performance in the future.
- PMS and Whole Life Costs: The PMS is capable of updating the pavement element of the tradeoff analysis used in the LRTP, upgrading the model from the nationally-calibrated Highway Economic Requirements System (HERS) model to a Mississippi-calibrated PMS. The PMS includes updated costs aligned with the FHWA work types, deterioration curves, decision trees, and minimizes the whole life cost of its investments. The results of the model are used to understand the performance impacts of the three LRTP budget scenarios and refine pavement targets. It also allows MDOT to better predict the condition of the pavements in two- and four-years, aligning with the target timeline.
- Projected revenue and inflation of construction costs: As part of the LRTP, MDOT developed a revenue projection that includes a discount factor of 2.3%, based on the Consumer Price Index, to account for rising construction costs over time. The LRTP also explored which factors would be the most disruptive to revenue (e.g., e-commerce, electrification) as a way to understand the uncertainty of MDOT's future revenues.
- Influence of risk: MDOT prioritizes meeting its Federally mandated minimum thresholds (i.e., <5% poor on Interstate pavements). Although MDOT anticipates meeting Federal targets, some risks could cause MDOT to miss them. These risks include poor weather, changes in funding, issues with rising project costs, and issues with staff retention and training.

MULTIPLAN 2045 Budget Scenarios

MDOT explored two scenarios:

Expected budget: Assumes funding levels remain the same. MDOT would meet Federal FAST Act requirements first, then proportionately disperse funds to preserve and maintain the State's transportation assets, and maintain existing funding levels for non-preservation categories.

Adequate budget: Assumes funding levels needed to fully fund Mississippi's basic transportation needs. MDOT would meet Federal FAST Act requirements, expand on key corridors as needed, maintain investment for non-preservation modes, and spend remaining funds proportionately on the preservation of the non-interstate state-owned system. This scenario requires additional funding sources.

State and Federal Targets

MDOT has established a goal of maintaining Interstate pavement in good condition, a PCR of 82 or greater, and all other State-maintained highways at a minimum Fair condition, a PCR of 72 or greater. MDOT defines state of good repair as achieving its state and Federal targets. The MDOT

Public Accountability Transportation Hub (PATH) site provides an interactive visual analysis of historical and current conditions of roads and bridges throughout the state.[4] Table 11 lists the performance targets for State-maintained roads.

Table 11. State-Maintained Pavement Performance Targets

Road Category	MDOT Target
Interstate	≥ 82 PCR
Two- and 4-lane Roads	≥ 72 PCR

Source: MDOT.

The Federal rule sets a minimum condition threshold for Interstate pavements, requiring that no more than five percent of Interstate lane-miles are in poor condition. There is no analog requirement for Non-Interstate NHS pavements. The rule also requires States to develop performance two- and four-year performance targets for the entire NHS. Table 12 enumerates MDOT's adopted Federal targets.

Table 12. Federal Pavement Performance Targets (Federal Measure)

Road Category	Federal Minimum Threshold	Two-Year Target	Four-Year Target
Interstate	<5% Poor	>55% Good <5% Poor	>55% Good <5% Poor
Non-Interstate NHS	No Federal Requirement	>25% Good <10% Poor	>25% Good <10% Poor

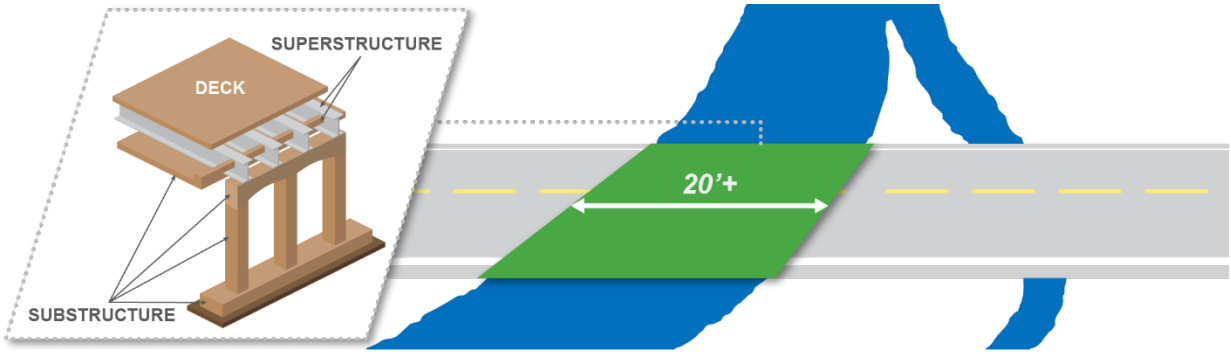
Source: MDOT.

[4] MDOT PATH site, https://path.mdot.ms.gov/.

3.0 Bridge Inventory, Condition, and Targets

To meet Federal requirements, this plan addresses National Bridge Inventory (NBI) bridges on the NHS. NBI bridges are bridges or culverts that span more than 20 feet, regardless of ownership. Each NBI bridge includes either a deck, superstructure and substructure rating or a culvert rating. This definition of a bridge is illustrated in Figure 10.

Figure 10. Definition of a Bridge



Source: Cambridge Systematics.

The section details:

- The bridge inventory on the NHS and other State-maintained bridges.
- How MDOT and FHWA measure bridge condition.
- Bridge goals and performance targets.

Since Federal regulations only require this TAMP to include NHS bridges, any discussion of non-NHS State-maintained bridges is included for illustrative purposes only. Unless otherwise noted, the data in this plan reflects the NHS using Mississippi's submission of its 2021 National Bridge Inventory (NBI) dataset which is the best available data. The TAMP uses this data because it is the same data that FHWA will use to report on its Federal measures.

3.1 Bridge Inventory

Mississippi has 16,307 NBI bridges. Approximately one-third of these structures are State-maintained and two-thirds are maintained by other agencies. There are about 2,800 structures on the NHS and 3,000 Non-NHS structures maintained by the State. Table 13 provides a summary of the number of bridges by owner and facility and Table 14 summarizes the bridges by deck area.

Table 13. Number of NBI Bridges by Owner and Facility Category

Maintenance Responsibility	Interstate	Non-Interstate NHS	State-Maintained Non-NHS	Total Number of Structures
State	957	1,768	3,089	5,815
County	0	18	0	18
City	0	60	0	60
Others*	0	0	0	0
Total Bridges	957	1,846	3,089	5,892

Source: FHWA 2021 NBI.

Table 14. NBI Bridge Deck Area by Owner and Facility Category

Maintenance Responsibility	Interstate	Non-Interstate NHS	State-Maintained Non-NHS	Total Deck Area (sq.ft.)
State	19,032,005	28,344,397	23,622,240	70,998,642
County	0	78,681	0	78,681
City	0	746,332	0	746,332
Others*	0	0	0	0
Total Deck Area (sq.ft.)	19,032,005	29,169,410	23,622,240	71,823,655

Source: FHWA 2021 NBI.

3.2 Collecting Bridge Condition Data

This section also summarizes the MDOT Bridge Safety Inspection Policy and Procedure Manual.[5] MDOT inspects the condition of the State-maintained bridges while local governments inspect the locally-maintained bridges in Mississippi according to the National Bridge Inspection Standards (NBIS) – 23 CFR Part 650, Subpart C. MDOT submits both state and local data annually to FHWA as its contribution to the National Bridge Inventory (NBI).

In support of the development of a new bridge management system (BMS), MDOT has updated its inspection procedures to include bridge element detail.

Structures subject to the NBIS are inspected at least every two years. If needed, bridges are inspected more regularly, including:

- When required by the MDOT Bridge Inspection Program Manager (BIPM), structures are inspected more frequently. This allows MDOT to identify issues and ensure the stability of structural elements proactively.

[5] https://mdot.ms.gov/documents/Bridge%20Design/Manuals/Bridge%20Safety%20Inspection%20Policy%20and%20Procedures.pdf accessed 9/16/2021

- When bridges are posted or include fracture critical elements, they are inspected every 12 months.
- When bridges are posted with a timber superstructure, they are inspected every 6 months.

The MDOT Bridge Safety Inspection Policy and Procedure Manual details the state's quality control and quality assurance process for assuring the accuracy of the state's bridge inspection program. The manual specifies:

- Qualifications, roles, and responsibilities of all bridge inspection personnel.
- Annual meeting requirements.
- Annual review process.
- Disqualification and re-qualification procedures.
- Training and continuing education requirements.

The state program specifies qualifications, roles, and responsibilities for the bridge inspection program manager and the bridge load rating engineer. At the district level, the roles and responsibilities for the district bridge inspection engineer, the bridge inspection team coordinator, and the district bridge inspector are also specified.

Annually, the MDOT field inspection staff including each district bridge inspection engineer, the bridge inspection program manager, and the bridge load rating engineer meet at MDOT headquarters. At the annual meeting, the team is briefed on the latest developments in bridge safety inspection. The bridge inspection program manager reviews comments and observations with each district bridge inspection engineer, provides feedback for improvements, and reviews the qualifications and training needs for all of the district bridge inspection personnel. Additional meetings are considered when significant issues or concerns arise.

The bridge inspection program manager performs the MDOT Bridge Division annual review in conjunction with the FHWA annual review. The review team audits a total of 12 NBI bridges annually, split between two districts. Each year the districts that are audited vary so that each district is reviewed at least once every four years. The manual specifies in detail how bridges are selected for audit. The audits consist of a field inspection which is compared to the ratings from the original inspection.

In addition to the audit, the BIPM visits the district offices to review the personnel qualifications, the audited bridge records, the bridge master lists, the district bridge inspection procedures, and the critical finding procedures. The annual review is closed-out with a district meeting and forum to discuss the findings of the annual review. The team also discusses the rating analyses, posting evaluations and other bridge inspection-related issues. The meeting encourages communication between the review team and inspectors, identifies improvements, emphasizes training requirements, and initiates needed changes to the program. The bridge inspection

program manager prepares a summary report that details the results of the annual review, recommendations, and conclusions.

The annual audit also determines the performance of the bridge division individuals, and the manual specifies procedures for disqualifying an individual and for re-qualifying an individual.

Training and continuing education are required for all personnel involved in bridge safety inspections. MDOT offers several bridge inspection training courses, a bridge inspection certification program, and a refresher course for its bridge safety inspectors and supervisors. The bridge inspection program manager maintains a centralized database of all bridge inspection personnel experience and training.

3.3 Measuring Bridge Condition

FHWA defines bridge condition using the nine-point NBIS scale shown in Table 15, where higher values indicate better condition. "Good" condition begins at a rating of seven, and "Poor" is defined as a rating of four or lower. The full deck area of the bridge will be counted as good, fair, or poor according to the rating of the lowest-scoring component (deck, superstructure, substructure or culvert). The process used to assign these ratings is illustrated in Table 16 and Figure 11 (a flowchart of component and structure condition thresholds).

Table 15. NBI Condition Rating Scale for Bridge Components

Condition Category	Score	Description	
		Structure	Channel
Good	9	Pristine condition	No deficiencies
	8	No problems noted	Banks, river control stable
	7	Insubstantial flaws	Minor damage to banks
Fair	6	Minor deterioration	Banks slumping
	5	Elements sound, some defects	Banks eroding, flow restricted
Poor	4	Advanced defects	Banks undermined, debris
	3	Serious defects to primary structural components, local failures, fatigue cracking	Banks failed, flow shifting
	2	Advanced deterioration to primary structural components, substructure support failure, closure possible	Channel has moved such that the bridge is near a state of collapse
	1	Imminent failure, elements moving, bridge closed	Bridge closed due to channel failure
	0	Out of service, beyond repair	Out of service, beyond repair

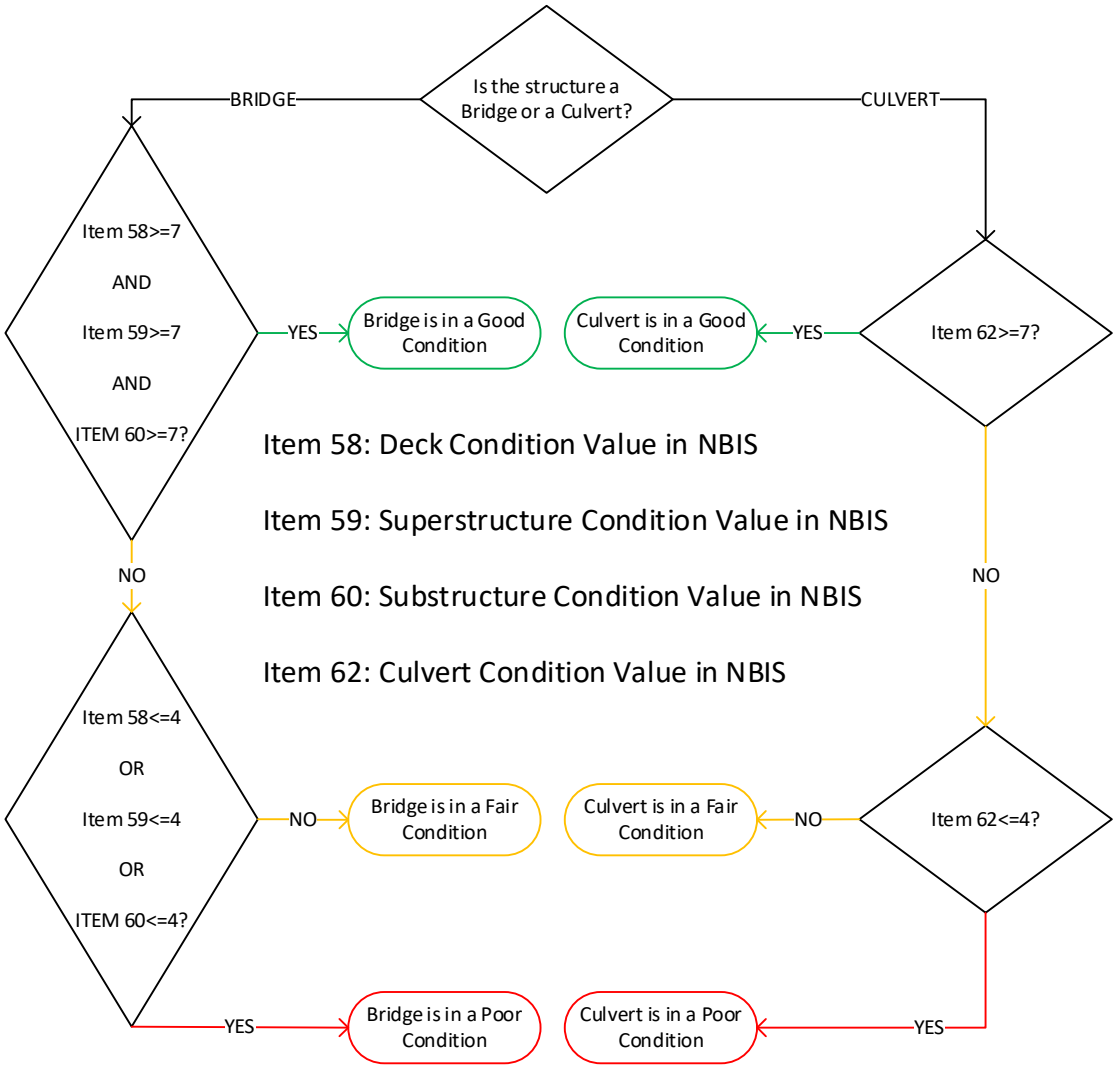
Source: Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges, FHWA PD 96-001, 1995.

Table 16. NBI Condition Classification for Bridges

NBI Condition Rating	Condition Classification
Bridges: All of the 3 NBI items for a bridge are ≥7. **Culverts:** The NBI Culvert Condition item is ≥7.	Good
Bridges: Lowest rating of any of the 3 NBI items for a bridge is 5 or 6. **Culverts:** The NBI Culvert Condition item is 5 or 6.	Fair
Bridges: Lowest rating of any of the 3 NBI items for a bridge is ≤4. **Culverts:** The NBI Culvert Condition item is ≤4.	Poor

Source: FHWA.

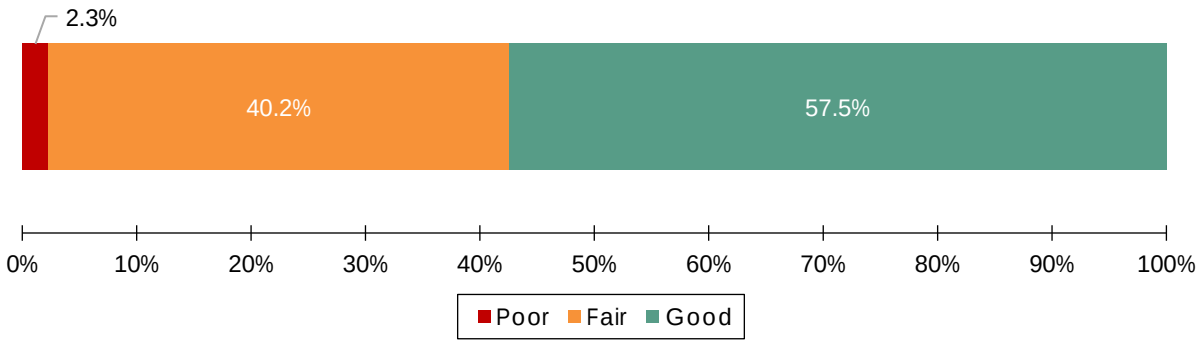
Figure 11. Flow Chart of NBI Condition Classification Process



Source: Cambridge Systematics visualization of process.

Figure 12 shows the current condition of NBI bridges on the NHS and **Error! Reference source not found.**Table 17 shows the condition of the bridges by owner on the NHS.

Figure 12. NHS Bridge Condition By Deck Area



Source: FHWA 2021 NBI.

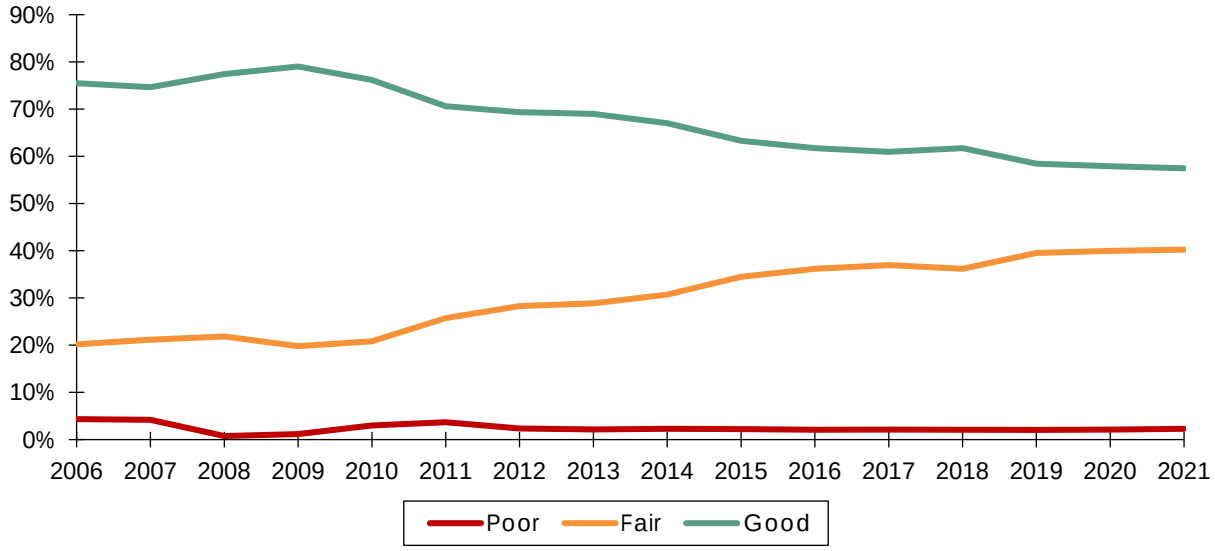
Table 17. NHS Bridge Condition By Owner

	Total	State		County		City	
	Deck Area (ft²)	Deck Area (ft²)	%	Deck Area (ft²)	%	Deck Area (ft²)	%
Poor	1,110,631	1,058,674	2%	17,702	22%	34,255	5%
Fair	19,393,486	18,786,461	40%	34,150	43%	572,874	77%
Good	27,697,298	27,531,267	58%	26,828	34%	139,203	19%
Total NHS	**48,201,415**	**47,376,402**	**100%**	**78,681**	**100%**	**746,332**	**100%**

Source: FHWA 2021 NBI.

Figure 13 shows the history of NHS bridge condition by deck area from 2006 to 2021. Over time, the percent good has declined while the percent fair has increased.

Figure 13. NHS Bridge Condition By Deck Area, 2006–2021



Source: FHWA 2006-2021 NBI.

3.4 Bridge Performance Targets

Target Review and Update Process

Who: MDOT Maintenance, Finance, and the Bridge Divisions work with the Districts to collect bridge condition data, track trends in bridge performance, plan investments, and develop target recommendations. As part of the Asset Management Working Group, the Bridge (the State Bridge Engineer), Maintenance (State Maintenance Engineer), and Planning (the State Planning Engineer) Divisions review and update the performance targets and present them to the Administration for final approval.

When: MDOT reviews and updates the performance target in line with the Federal performance reporting cycle. It reviews the bridge performance targets every two years as part of the Mid Performance Period Progress Report and Full Performance Period Progress Report and formally updates the targets if needed. It documents the targets or expected targets in the LRTP and the TAMP.

Method: MDOT considers the following as it sets its targets:

- Trends: MDOT reviews the historical bridge condition data to understand the impact of its decisions, investments, and risks over time.
- Tradeoff analysis: As part of the LRTP, MDOT performed a tradeoff analysis that married MDOTs revenue projections, three different budget scenarios, and its investment strategies together to understand the impact of these investments on performance in the future.

- BMS and Whole Life Costs: The BMS is capable of updating the bridge element of the tradeoff analysis used in the LRTP, upgrading the model from the nationally-calibrated NBIAS model to a Mississippi-calibrated BMS. The BMS includes updated costs aligned with the FHWA work types, deterioration curves, and minimizes the whole life cost of its investments. The results of the model are used to understand the performance impacts of the three LRTP budget scenarios and refine bridge targets. It also allows MDOT to better predict the condition of the bridges in 2- and 4-years, aligning with the target timeline.

- Projected revenue and inflation of construction costs: As part of the LRTP, MDOT developed a revenue projection that includes a discount factor of 2.3% to account for rising construction costs over time. The LRTP also explored which factors would be the most disruptive to revenue (e.g., e-commerce, electrification) as a way to understand the uncertainty of MDOT's future revenues.

- Influence of risk: MDOT prioritizes meeting its Federally mandated minimum thresholds (i.e., <10% bridges in poor condition). Although MDOT anticipates meeting Federal targets, some risks could adversely impact condition possibly causing MDOT to not meet targets. These risks include neighboring states not maintaining border bridges, changes in funding, issues with rising project costs, extreme weather, and issues with staff retention and training.

Federal Targets

The Federal rule sets a minimum condition threshold for NHS bridges, requiring that no more than 10 percent of bridges by deck area are in poor condition. The rule also requires States to develop two- and four-year performance targets for the entire NHS. MDOT defines state of good repair as achieving its Federal targets. Table 18 enumerates MDOT's adopted targets.

Table 18. Bridge Performance Targets

Category	Federal Minimum Threshold	2-Year Target	4-Year Target
All NHS	<10% Poor	>50% Good	>50% Good
		<5% Poor	<5% Poor

Source: MDOT.

4.0 Life-Cycle Planning

Life-cycle management applies data and analytics to develop a long-term strategy for managing an asset or group of similar assets at the lowest possible whole-life costs. This is accomplished by addressing all phases of an asset's life-cycle and applying the most effective treatment at each point in an asset's life. The emphasis is on long-term preservation and sustainability without sacrificing system performance or public safety.

Life-Cycle Planning

Life-cycle planning is an approach to maintaining an asset during its whole life, from construction to disposal.

Life-cycle planning emphasizes maintaining existing system performance at a constant desired level while minimizing resource consumption over the long-term.

4.1 Managing Pavements

It is important to note that much of this section describes the process for life-cycle planning and pavement project selection for the State-maintained highway system. While MDOT is responsible for nearly 95 percent of the NHS pavements, it is the responsibility of local jurisdictions to preserve and maintain the condition of the remaining five percent. In order to ensure NHS routes remain in a state of good repair, MDOT encourages local programs that support the NHS.

Of the remaining five percent of locally maintained NHS facilities in Mississippi, Metropolitan Planning Organizations (MPOs) coordinate funding on a total of 69 percent all locally maintained NHS facilities. The remaining facilities are supported by funding from the Mississippi Office of State Aid and local jurisdictions.

Several MPOs prioritize investments using the NHS as criteria, including:

- **Jackson MPO |** According to the MPO's project submittal guidelines "In the event that two or more projects rank equally, priority shall be given to the project located on the National Highway System." This tie-breaking criterion encourages jurisdictions to consider projects on NHS bridges or roadways in order to secure funding.
- **Gulf Regional Planning Commission |** The agency will emphasize the NHS regarding mobility and accessibility in their next TIP update. As part of that, they will give priority to projects on the NHS: "The NHS includes principal arterials and other connectors important to the economy, defense, and mobility. The NHS was developed by the Department of Transportation (DOT) in cooperation with the states, local officials, and metropolitan planning organizations (MPOs). MDOT reports on pavement conditions annually to determine if the State and the Gulf Coast MPO are meeting their targets. Therefore, GRPC steers pavement resources to roadways on the National Highway System."
- **Memphis MPO |** NHS facilities are considered during the project prioritization process in determining the Memphis MPO TIP for several project types. All STBG Resurfacing Projects

located on NHS facilities in fair or poor condition receive additional points through the project prioritization process.

Pavement condition data collection of all NHS facilities is conducted by MDOT, regardless of the facility owner. Locally-owned NHS facilities outside of the MPOs boundaries are eligible for a variety of funding sources through MDOT, the Mississippi Office of State Aid, county governments, and local municipal governments including:

- **Mississippi State Aid Road Program[6] |** The Office of State Aid Road Construction administers the Mississippi State Aid Road Program to assist Mississippi's 82 counties in the construction and maintenance of secondary, non-state owned roads and bridges. Approximately 61 percent of locally-owned NHS pavement is eligible for funding through the program. Each County's Board of Supervisors are responsible for designating the roads to be included in the county's State Aid System, adopting annual construction programs, acquiring rights-of-way for State Aid projects, advertising for bids, awarding contracts, and maintaining completed projects after construction.

- **MDOT Multimodal Transportation Improvement Program (MTIP)[7] |** Annual funding opportunities for capital improvements of intermodal facilities are available through the MDOT MTIP. Intermodal connectors are eligible for MTIP funds depending on the proximity of a project to an intermodal facility.

Identification and Selection of Pavement Projects

MDOT has a structured process for using the pavement condition data it collects to assess needs and make project recommendations.

The Project Identification and Selection Process

This project generation process makes no distinction between NHS and non-NHS. To identify and select pavement projects, MDOT:

- **Organizes pavement inventory and condition data.** The MDOT Research Division uses a pavement management system (PMS) to save and organize the pavement inventory and condition.

---

[6] The Mississippi State Aid Program was established in 1949 as contained in Section 65-9-[1-33] of the Mississippi Code of 1972.

[7] The Multimodal Transportation Improvement Program is funded through the Multimodal Transportation Improvement Fund (MTIF), established by the 2001 Mississippi Legislature contained in Sections 65-1-701 through 65-1-711 of the Mississippi Code of 1972.

- **Develops analysis sections.** The MDOT Research Division uses its PMS to divide the roadways into homogeneous pavement analysis sections of various lengths using geometric characteristics, county, route, and construction history. As of 2020, there were approximately 6,100 analysis sections.

- **Generates decision trees.** The MDOT Research Division has simplified the decision trees developed in 2011-2013 by collapsing some of the treatment options from the previous trees.

- **Generates projects for 2- and 4-lane roads.** The MDOT Maintenance Division works with the Districts to generate projects as follows:

  The MDOT Research Division uses decision trees to recommend treatments analysis sections based on the pavement type and the distresses observed in the field.

  The MDOT Research Division sends the treatment recommendations to the Districts and the Interstate Rating Committee (IRC) for their use in developing the three-year plans.

  The Districts develop three-year plans for 2- and 4-lane roads. The Districts are not required to follow the Research Division treatment recommendations (e.g., the pavement condition may have changed since the last data collection cycle), but they do need to justify why they wish to treat a pavement section if the recommendation is to 'do nothing.'

  The Maintenance Division approves the project list.

- **Generates projects for Interstates.** The MDOT Maintenance Division works with the IRC to develop projects. The IRC includes staff from the Construction Division, the Research Division, FHWA, and Districts (non-voting). It is chaired by the State Maintenance Engineer. To develop projects on the Interstate:

  The Interstate Rating Committee (IRC) drives the Interstates with data sheets informing them of the segment's PCR, rutting, IRI, and faulting. As they drive, they take notes and record a visual condition rating for comparison. Once complete, the IRC sends the notes to the Maintenance Division.

  The Maintenance Division generates a recommended project list from the segment condition ratings and IRC notes. The IRC reviews the recommendations, makes changes as needed, and sends the prioritized list of project recommendations to upper management and FHWA for validation.

- **Approves the project list.** The Chief Engineer approves the priority list based on funding, availability of contractors, and regional equity.

Decision Trees and Treatments

The decision trees recommend treatments based on each pavement section's characteristics, condition, and distresses. There are decision trees for each pavement surface type, and route type. There are over 200 unique treatment combinations.

MDOT has created decision trees for the following facility types:

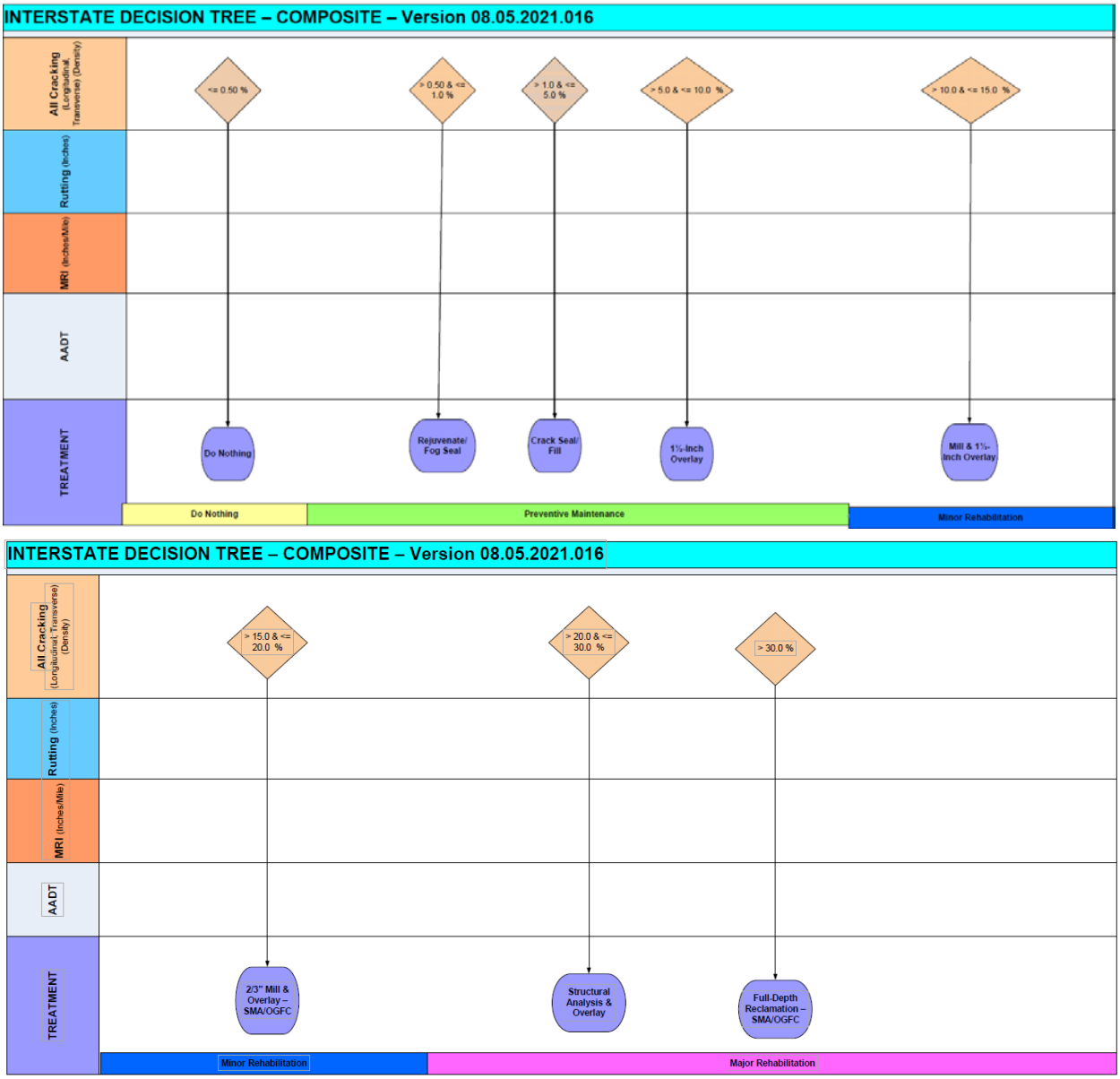
- Interstates.
- 4-lane roads.
- 2-lane roads.

For each facility type, MDOT has created decision trees for the following "families":

- Flexible (FLEX).
- Composite (COMP), asphalt over concrete.
- Jointed Concrete (JCP), including jointed plain and jointed reinforced concrete (JCP/JRCP).
- Continuously Reinforced Concrete (CRCP).

Figure 14 illustrates a sample decision tree for an Interstate composite (COMP). The trees recommend treatments based on parameters such as levels of rutting, faulting, several types of cracking, and roughness.

Figure 14. Example Interstate Composite (COMP) Decision Tree



Source: MDOT.

Table 19 details the MDOT treatments in each of FHWA's five work types:

Table 19. Pavement Maintenance Treatments

Category	Type of Maintenance	Treatments
Asphalt Roadways	Maintenance	Spot premix patching Crack sealing Base repair Joint trimming Blow up repair
	Preservation	Fog Seal Chip Seal Scrub Seal Micro-Surface Ultra-Thin / Thin Lift Asphalt Overlays Open Graded Friction Course (OGFC) Single Lift Asphalt Overlays up to two (2) inch lift thickness Chip Seal and Single Lift Asphalt Overlays
	Reconstruction	Full Depth Reclamation (FDR)
	Rehabilitation	Asphalt treatments with multiple lifts and/or a lift thickness greater than two (2) inches
	Construction	New alignments or new lanes (not through PMS)
Concrete Roadways	Preservation	Diamond Grinding Punchout & Joint/Spall Repairs Dowel Bar Repairs
	Rehabilitation	Any asphalt overlay or any preservation treatment in conjunction with an asphalt overlay.
	Reconstruction	Rubblization of the underlying concrete layers for asphalt rehabilitations
	Construction	New alignments or new lanes

Source: MDOT.

Pavement Management System (PMS)

MDOT integrates life-cycle planning in the development of rehabilitation and reconstruction project recommendations. Since the 2019 TAMP was published, the Department has continued to refine and enhance the pavement management system (PMS). These improvements to the

PMS include updated costs, deterioration models, and decision trees. It allows MDOT to minimize the whole life cost of its pavements and develop projections of pavement conditions using different budget scenarios. MDOT is currently transitioning to the new version of the PMS and this transition coincided with modifications to the methodology for predicting performance and selecting work types. The actions undertaken during the TAMP development relied on the data from within the PMS. As a bridge between the old system and the new system a tool was developed to perform the forecast.

The Research Division identifies pavement projects using the PMS; the Maintenance Division works with the Districts to generate projects off of the Interstate and the Interstate Rating Committee to generate projects on the Interstate. The Chief Engineer approves the priority list based on funding, availability of contractors, and regional equity.

Concurrent to this TAMP update MDOT is undergoing significant upgrades to the PMS application as well as modification to the performance forecasting methodology. MDOT uses Deighton's dTIMS product. MDOT has chosen to upgrade the PMS to improve reporting capability, streamline data retrieval, and to accommodate directly using 1/10-mile data provided from pavement surveys. As part of this upgrade process MDOT has also decided to modify the methodology employed for performance forecasting and modeling. Previously the performance models were based on Markov Transition Probability Matrices and Monte Carlo Simulations. This methodology proved too complex and time consuming to be carried forward to the new version of the software: the new methodology is based upon deterministic models buil from historic PMS and HPMS data.

Since the initial TAMP MDOT has improved the ability the PMS to support life-cycle management activities in three stages:

- Stage 1 – Develop Deterministic Performance Curves: Profiler data from 2014-2020 was used to develop PCR performance curves and HPMS data was used to develop curves for FHWA distresses. The data was filtered using interquartile ranges to eliminate outliers, and only the curves that were statistically significantly different were used.

- Stage 2 – Develop Life Cycle Cost Planning (LCCP) Framework: Using the developed curves, various combinations of treatments and timings were evaluated to maximize asset performance at a minimum cost over a 50-year timeframe. Multiple treatment strategies were generated for each analysis segment (the former process only allowed for one potential treatment). An equivalent annual cost per lane-mile was estimated for each asset class. The equivalent annual costs per lane-mile were used to estimate minimum funding requirements. Figure 15 illustrates an example of the life cycle cost analysis.

Figure 15. Example of Life Cycle Cost Analysis

Treatments and Discount Rate Inputs:

NOTES:

Discount Rate (%): 2.3%

Analysis Parameter	Treatment	Year	Min Time to Next	Desired Min. PCI	Check Benefit, Timing, Min.PCI
Baseline Treatment:	4-Lane Flex New	0			
Initial Treatment:	4-Lane Flex New	0	5	75	Good
Treatment #1:	4-Lane Flex PM	14	3	75	Good
Treatment #2:	4-Lane Flex PM	21	3	75	Good
Treatment #3:	4-Lane Flex Minor	28	5	75	Good
Treatment #4:	4-Lane Flex PM	36	5	75	Good
Treatment #5:	4-Lane Flex PM	43	5	75	Good
Treatment #6:	4-Lane Flex Major	50	5	75	Good
Treatment #7:					N/A

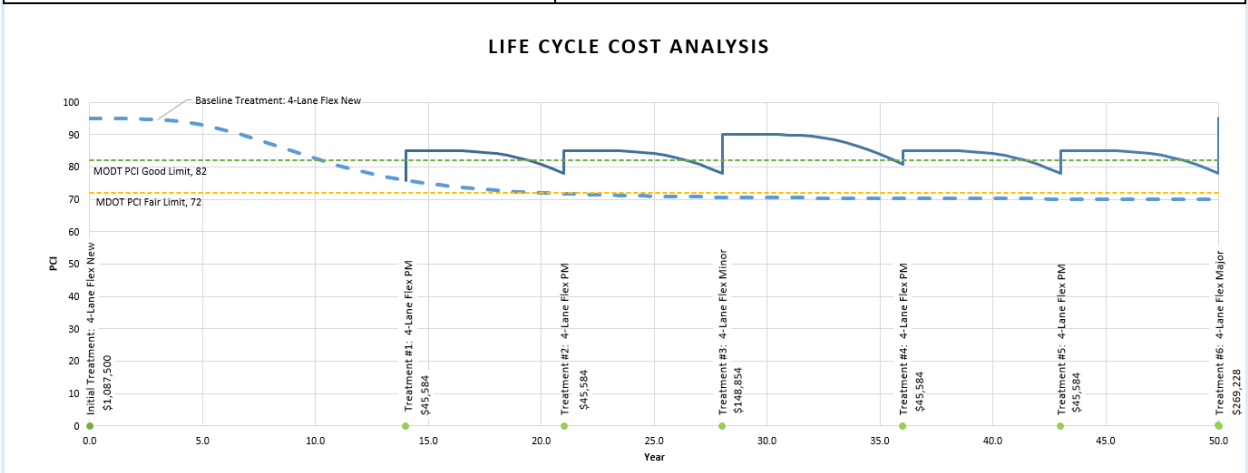
Last Year of Analysis: 50

Constraint Check: All Constraints Satisfied

Results:

Baseline Treatment:	Benefit	Current $ Cost	NPV	EAC per LM	B/C Ratio *1000	Ave PCI	Max PCI	Min PCI	PCI Delta	Good Years	Fair Years	Poor Years
	3785	$1,087,500	$1,087,500	$21,750	3.48	76	95	70	-	10	10	30

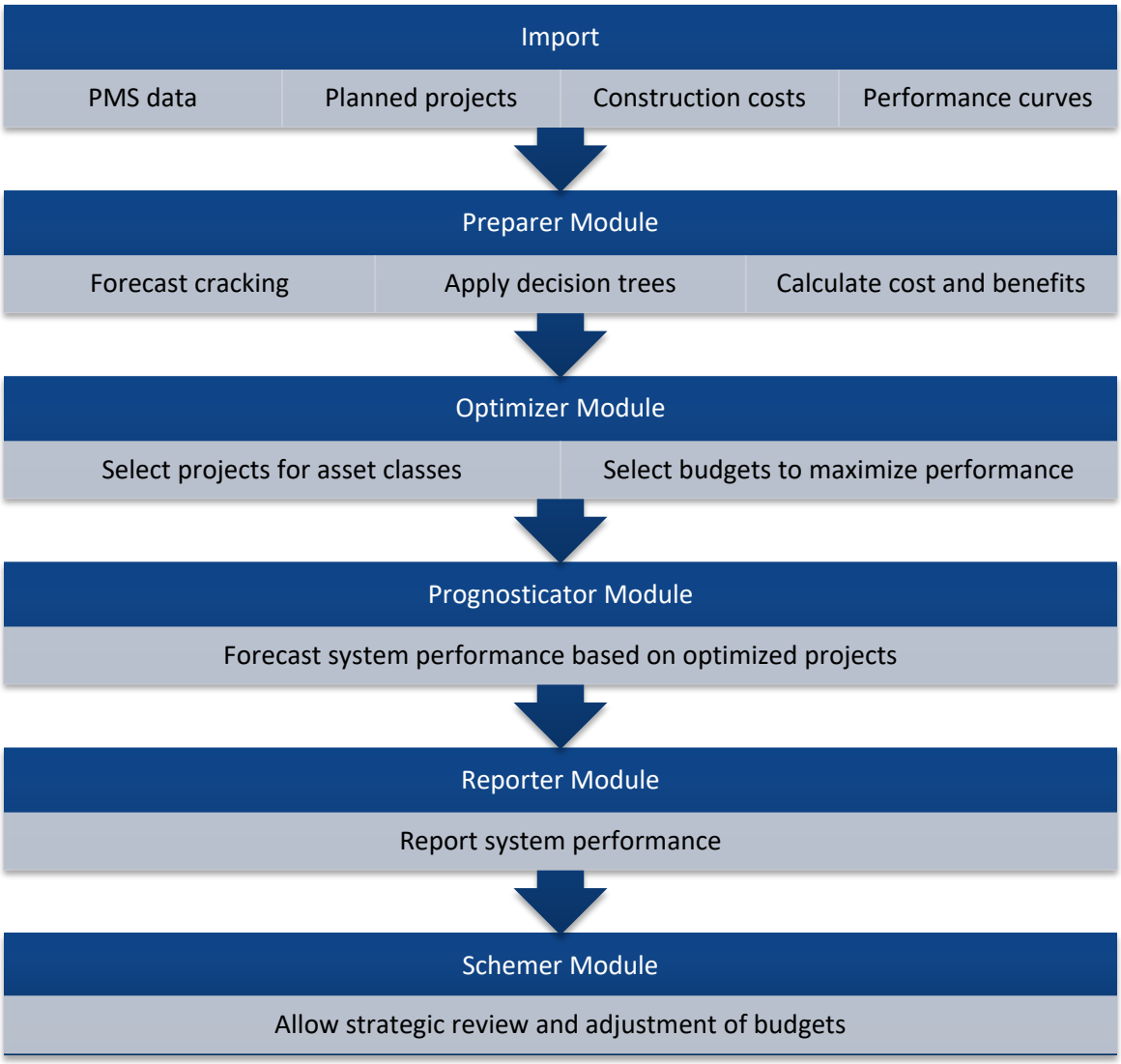
Analysis:	Differential Benefit	Current $ Cost	NPV	EAC per LM	B/C Ratio *1000	Ave. PCI	Max PCI	Min PCI	PCI Delta	Good Years	Fair Years	Poor Years
Initial Treatment:		$1,087,500		$21,750		88	95	76	-	11	4	0
Treatment #1:	46	$45,584	$32,410	$648	1.41	83	85	78	9	5	2	0
Treatment #2:	44	$45,584	$27,641	$553	1.60	83	85	78	7	5	2	0
Treatment #3:	115	$148,854	$76,978	$1,540	1.50	88	90	81	12	8	1	0
Treatment #4:	70	$45,584	$19,652	$393	3.54	83	85	78	4	5	2	0
Treatment #5:	68	$45,584	$16,760	$335	4.07	83	85	78	7	5	2	0
Treatment #6:	6	$269,228	$84,423	$1,688	0.07	95	95	95	17	1	0	0
Treatment #7:	-	-	-	-	-	-	-	0	-	-	-	-
Residual Value:		-$269,228	-$86,365	-$1,727								
TOTALS:	349	$1,418,690	$1,260,941	$25,219	3.28	86	89	71	9	39	13	0



Source: MDOT.

- Stage 3 – Forecast Performance: As an intermediary step to the PMS upgrade implementation a suite of tools was developed using open source code and Microsoft Excel to optimize treatments on existing pavement data with various funding levels and report performance. This suite of tools emulated what the PMS will ultimately need to perform and proved the viability of the revised forecasting methodology. There were several separate processes used to produce performance forecasts. Figure 16 summarizes the forecast performance processes. The performance forecasts considered programmed work and discount rates, and allowed strategic analysis across asset classes.

Figure 16. Forecast Performance Processes



Source: MDOT.

4.2 Managing Bridges

This section describes the process for life-cycle planning and bridge project identification and selection for structures on the State-maintained highway system. MDOT is responsible for over 97 percent of the NHS bridge structures, it is the responsibility of local jurisdictions to preserve and maintain the condition of the remaining three percent. In order to ensure NHS structures remain in a state of good repair, MDOT encourages local programs that support the NHS.

MPOs coordinate funding for a total of 69 percent all locally-owned NHS structures in Mississippi. The remaining structures are supported through funding from the Mississippi Office of State Aid and local jurisdictions.

Several MPOs prioritize investments using the NHS as criteria, including:

- **Jackson MPO |** According to the MPO's project submittal guidelines "In the event that two or more projects rank equally, priority shall be given to the project located on the National Highway System." This tie-breaking criterion encourages jurisdictions to consider projects on NHS bridges or roadways in order to secure funding.

- **Gulf Regional Planning Commission |** The agency will emphasize the NHS regarding mobility and accessibility in their next TIP update. As part of that effort, they will give priority to projects on the NHS.

- **Memphis MPO |** NHS facilities are considered during the project prioritization process in determining the Memphis MPO TIP for several project types. All Surface Transportation Block Group (STBG) Bridge Projects located on the non-interstate NHS are also awarded additional points for the project prioritization process.

Locally-owned NHS bridge structures outside of MPO area boundaries are eligible for resources and funding through the Mississippi Office of State Aid, county governments, and local municipal governments including:

- **Mississippi State Aid Road Program[8] |** The Office of State Aid Road Construction administers the Mississippi State Aid Road Program to assist Mississippi's 82 counties in the construction and maintenance of secondary, non-state owned roads and bridges. As of 2022, approximately 13 percent of locally-owned NHS bridge structures are eligible for funding through the program. Each County's Board of Supervisors are responsible for designating the facilities to be included in the county's State Aid System, adopting annual construction programs, acquiring rights-of-way for State Aid projects, advertising for bids, awarding contracts, and maintaining completed projects after construction.

- **National Bridge Inspection and Inventory Program |** The Office of State Aid Road Construction administers the FHWA's National Bridge Inspection and Inventory Program for the county and municipal government owned bridges in Mississippi. The bridge inspection data is submitted to the Office of State Aid Road Construction for review and compilation. The Office of State Aid Road Construction submits the data to MDOT for reporting to FHWA. The Office of State Aid Road Construction provides training related to National Bridge Inspection Standards.

[8] The Mississippi State Aid Program was established in 1949 as contained in Section 65-9-[1-33] of the Mississippi Code of 1972.

- **State Aid Bridge Replacement and Rehabilitation |** Historically, MDOT transferred has approximately 30 percent of the Federal Bridge Replacement funds apportioned to the State Aid program for replacement of deficient bridges on county roads.[9]

- **MDOT Multimodal Transportation Improvement Program (MTIP)[10] |** Annual funding opportunities for capital improvements of intermodal facilities are available through the MDOT MTIP. Intermodal connectors are eligible for MTIP funds depending on the proximity of a project to an intermodal facility.

The MDOT Bridge Division is responsible for developing the annual MDOT Bridge Replacement Prioritization Program, the Bridge Preventive Maintenance Program, the Bridge Inspection Program, and developing and maintaining the Bridge Management System for the State-maintained highway system. The sections below outline the processes MDOT uses to manage State-maintained bridges.

Identification and Selection of Bridge Projects

The Project Identification and Selection Process

MDOT has a structured process for using the bridge condition data it collects to assess needs and make project recommendations. The process applies to all State-maintained bridges. MDOT does not model treatments for locally-owned NHS bridges. MDOT:

- **Organizes bridge inventory and condition data.** The MDOT Bridge Division uses its records of bridge inventory and condition as the first step.

- **Identifies replacement projects.** To develop a project list for bridge replacements, the MDOT has formed a Bridge Priority List Team. The team includes the Assistant Chief Engineer – Pre-Construction, Director of Structures – State Bridge Engineer, Deputy Director of Structures – Assistant State Bridge Engineer, State Bridge Inspection Program Manager, Bridge Management Engineer, Bridge Design Section Engineers, and the State Hydraulics Engineer. The Bridge Priority List Team and Districts work together to develop and refine the list.

  The Initial Priority List Team calculates the bridge Replacement Index (RI) and sorts bridges from high to low into the Initial Bridge Replacement Priority List. The RI is

[9] Office of State Aid Road Construction Annual Report, FY 2014. https://www.osarc.ms.gov/Docs/annual_reports/Office_of_State_Aid_Road_Construction-FY_2014_Annual_Report.pdf

[10] The Multimodal Transportation Improvement Program is funded through the Multimodal Transportation Improvement Fund (MTIF), established by the 2001 Mississippi Legislature contained in Sections 65-1-701 through 65-1-711 of the Mississippi Code of 1972.

intended to show the relative importance of a bridge to the traveling public. The method used to calculate RI is described later in this section.

The Initial Priority List Team describes the reason for/against replacing every structure. In some cases, the team also will recommend repairs, maintenance, or other treatments.

The Initial Priority List Team develops an Initial Bridge Replacement Priority List. The team sorts the projects into fiscal years to match anticipated funding. It also considers any special structural issues not quantifiable by RI, updated inspection reports, or other supporting documentation. The list extends for five fiscal years.

The Initial Priority List Team sorts the Initial Bridge Priority List and truncates the list to include only bridges that fall within the five fiscal years. The team sends the list to MDOT Districts for review as the Recommended Bridge Replacement Priority List. The team supplements the RI with information from the State Bridge Inspection Program Manager and the District Bridge Inspection Engineers to ensure that bridges in similar structural condition on the same route are considered for replacement in the same fiscal year.

The Districts provide information that cannot be calculated, such as anticipated growth areas, corridor improvement initiatives, environmental issues that may delay construction, and socioeconomic factors. Districts are required to provide documentation, such as traffic data and accident reports to support recommended deviations from the projects provided in the Recommended Bridge Replacement Priority List. The District sends the list back to the Initial Bridge Priority List Team.

The Priority list team reviews the District recommendations and develops a Final Bridge Replacement Priority List. The Team drafts a Final Bridge Replacement Priority Report that combines the Final List with District recommendations and supporting documentation. This report indicates the replacement indices for each bridge, as well as relevant information for bridge replacement projects such as the programmed cost.

- **Identifies maintenance and preservation projects.** Regular maintenance on bridges can extend the bridge service life, reducing the life-cycle cost. To identify maintenance work, the MDOT Bridge Division:

  Identifies **Interstate bridges for widening and preservation** projects. The State has funds for Interstate bridge widening and preservation.

  Identifies **bridge painting** projects by prioritizing a Statewide list of painting needs.

Develops a list of bridges with specific deteriorated elements for **cyclical maintenance**. Examples of cyclical maintenance would be joint repair at five to ten years and painting at 20 to 25 years, if warranted and depending on the condition of these elements.

Develops a list of **condition-based** treatments based on bridge inspection data. Corrective maintenance involves repairs to deteriorated elements of bridges that are otherwise in good structural condition. During the bridge prioritization process, if it is determined that a structure can be repaired using corrective actions at no more than 20 percent of the replacement cost and result in an extension of service life, then this strategy may be employed instead of replacement.

The Bridge Prioritization Committee works together to prioritize bridge projects:

- **Deputy Executive Director, Chief Engineer.** Serves as the final approver of the annual MDOT Bridge Replacement Prioritization Program. Moreover, the Chief Engineer decides the final course of action to be taken in the event that a conflict exists regarding bridges recommended for replacement.

- **Assistant Chief Engineer, Preconstruction.** Serves as one of the team members responsible for the annual MDOT Bridge Replacement Prioritization Program. If a conflict exists regarding bridges recommended for replacement, the Assistant Chief Engineer, Preconstruction will provide a recommendation to the Chief Engineer. Once all revisions to the Bridge Replacement Priority List are complete, it is provided to the Assistant Chief Engineer, Preconstruction for concurrence as the Final Bridge Replacement Priority List.

- **Director of Structures, State Bridge Engineer.** Serves in a supervisory role to the team members responsible for the annual MDOT Bridge Replacement Prioritization Program. The Director of Structures oversees all other prioritization and funding efforts administered by the MDOT Bridge Division, including the MDOT Bridge Preventive Maintenance program, which encompasses both cyclical and condition-based activities. Moreover, this position works directly with the Assistant Chief Engineer, Preconstruction to program all new bridge replacement, preservation, and maintenance projects. The State Bridge Engineer plays an active role in the development and maintenance of the language and data contained in the Bridge Section of MDOT's Statewide Transportation Asset Management Plan (TAMP).

- **Bridge Inspection Program Manager.** The Bridge Inspection Program Manager is responsible for the management and reporting of bridge inventory data. This position plays a supervisory role in ensuring the safety of bridges owned and maintained by MDOT by confirming that structures are inspected according to the National Bridge Inspection Standards (NBIS), which secures continuous federal funding for bridge replacements, rehabilitation and maintenance. The Bridge Inspection Program Manager plays an active role in the development and maintenance of the language and data contained in the Bridge Section of MDOT's Statewide Transportation Asset Management Plan (TAMP).

- **Bridge Management Systems Engineer.** The Bridge Management Systems Engineer is responsible for reporting performance data from our Bridge Management System for the TAMP and providing input regarding the use of life-cycle optimization modeling as it relates to bridge performance targets set forth in the TAMP. This position is required to submit inspection data annually to the Federal Highway Administration as part of the National Bridge Inventory and plays a primary role in working to develop bridge element deterioration models and incorporate life-cycle cost optimization models.

- **Preventive Maintenance Program Manager.** Oversees the planning, estimating, and managing of all federally and state funded projects under the MDOT Bridge Preventive Maintenance program, which encompasses both cyclical and condition-based activities.

Bridge Replacement Index

The Replacement Index (RI) represents the significance of a bridge to the traveling public relative to the significance of all other bridges in the State inventory. MDOT calculates the RI based on average daily traffic (ADT), bypass/detour length, and structural evaluation. A higher value indicates a higher priority to the public, which makes it a higher priority for replacement. The various components of the Replacement Index Model are discussed further here.

Traffic-Detour Factor

For the first part of the model, MDOT accounts for the effects of the traffic and how far the traffic would have to travel to detour the bridge if it was closed. This is accomplished by multiplying the bridge's Average Daily Traffic (ADT) (NBI item 29) with the bridge's bypass detour length (NBI item 19). However, the result of this product varies widely. To keep providing both practical and manageable values, MDOT created the Traffic-Detour Factor which varies from 0 to10. A range of factors for the product of the ADT and Bypass Detour Length was established (Table 20), and interpolations are used to obtain an actual Traffic-Detour Factor.

Table 20. Traffic Detour Factor

(ADT) X (Bypass Detour Length)	Traffic-Detour Factor
0	0
3,000	2.5
10,000	5
30,000	7.5
90,000	10

Source: MDOT.

Bridges with a product of ADT and Bypass Detour Length greater than 90,000 have a Traffic-Detour Factor of 10. As an example of the interpolations that are used, for a bridge with an ADT of 1,500 and Bypass Detour Length of 10 miles, the interpolated Traffic-Detour Factor is 5.625.

Traffic Weight and Structure Evaluation Weight

The "Replacement Index" is computed considering a combination of the effects of the Traffic-Detour Factor and the Structure Evaluation (NBI item 67). In computing this, MDOT decided that for bridges in worse structural condition, the "traffic effects" should take on more significance. This means that as a bridge's structural condition worsens, traffic has an exponential effect on the bridge's deterioration and possible failure. In order to model this behavior, a range of weights was established for the effects that the Traffic-Detour Factor and Structure Evaluation can have on the Replacement Index based on a range of Structural Evaluation values (Table 21). As with the Traffic-Detour Factor, interpolation is required to obtain the actual Traffic Weight and Structure Evaluation Weight.

Table 21. Traffic Weight and Structure Evaluation Weight

Structure Evaluation	Traffic Weight	Structure Evaluation Weight
0	35	65
3	30	70
5	25	75
7	10	90
10	10	90

Source: MDOT.

For example, for a bridge with a Structure Evaluation of 4, the Traffic Weight is 27.5 and the Structure Evaluation Weight is 72.5.

The "Replacement Index" is computed as follows:[11]

$$RI = (TDF \times \left(\frac{TW}{100}\right) + (10 - SE) \times (\frac{SEW}{100})) \times 10$$

RI = Replacement Index

TDF = Traffic-Detour Factor

TW = Traffic Weight (e.g., 27.5)

SE = Structure Evaluation

SEW = Structure Evaluation Weight (e.g., 72.5)

For example, a bridge with an ADT of 1,500, Bypass Detour Length of 10 miles, and Structure Evaluation of 4:

[11] MDOT Bridge Prioritization Process Overview.

$$RI = \left(5.625 \times \left(\frac{27.5}{100}\right) + (10-4) \times \left(\frac{72.5}{100}\right)\right) \times 10 = 58.97$$

Bridge Maintenance Treatments

Table 22 lists the MDOT preservation, rehabilitation, and maintenance bridge treatments by element.

Table 22. Bridge Maintenance Treatments

Element	Type of Work	Treatments
Deck	Preservation	Joint repair or replace 5 to 10 years. Deck healer/sealer treatments 15 years. Deck overlays (new and replacement) 20 to 25 years.
	Rehabilitation	Deck replacement (to current width). Replace or repair damaged elements.
	Maintenance	Drainage system cleaning and repair (including bridge scuppers) Annually. Bridge washing annually. Minor deck rehabilitation. Crack sealing or patching. Approach slab replacement or repair.
Superstructure	Preservation	Bearing restoration or replacement 50 years.
	Rehabilitation	Retrofit of fatigue-prone details. Retrofit of fracture critical members. Replace or repair damaged elements. Beam strengthening.
	Maintenance	Bearing reset. Bearing lubrication. Concrete sealing.
Substructure	Rehabilitation	Replace or repair damaged elements. Scour remediation/countermeasures.
	Maintenance	Clean bridge seats and abutments 5 years. Concrete sealing.
Painting	Preservation	Bridge painting (full, zone or spot) 20 to 25 years.
Miscellaneous	Maintenance	Vegetation removal. Erosion/scour control. Flood debris removal.
	Rehabilitation	Cathodic Protection (CP), Electrochemical Chloride Extraction (ECE) Treatment.
	Reconstruction	Complete bridge replacement

Source: MDOT.

Bridge Management System (BMS)

To aid in making further improvements to the prioritization process, MDOT is in the process of implementing AASHTOWare Bridge Management (BrM) and developing bridge element deterioration models and life-cycle cost optimization models. BrM is an AASHTOWare application designed to store, maintain and analyze bridge inspection data. The primary purpose of the software is to model the deterioration of bridge elements, assist in determining where available replacement/rehabilitation/preservation funds should be used and predicting future condition of the bridge inventory.

BrM is designed to use element-level condition ratings, probability, cost data, deterioration models, benefit/cost analysis, and optimization algorithms to help MDOT select the right treatments at the right time to minimize the life-cycle cost of its network of bridges. Element Level Bridge Inspection breaks down each structure into individual elements that provide a more detailed assessment of the bridge. By using element-level data, structure performance can be more accurately analyzed by predicting structure deterioration based on the average condition ratings collected for each bridge component.

MDOT began setting up the software and developing deterioration curves and cost models at the end of 2020 and the configuration, testing and validation of results is ongoing. MDOT is working towards fully customizing the large number of user definable settings to their purposes. A modification to one of the settings has a cascading affect throughout the analysis. Each setting modification requires the results be carefully examined to understand the effect of the modification. Running the system for a 10-year analysis of the bridge inventory has a system processing time of about 12 hours.

Mississippi shares several very large border bridges with neighboring states, and these border bridges represent a significant percentage of the bridge inventory's overall deck area. Under current FHWA guidance, the total deck areas of those border bridges are counted toward both states' good/fair/poor percentages even if completely managed by one state. Mississippi has 11 of these border bridges, of which 5 are maintained by states other than Mississippi. BrM is currently programmed to prevent work recommendations for the 5 border bridges not managed by Mississippi. Border bridges are often extremely large, and a change in their condition from good to fair or fair to poor can have a significant impact on MDOT's bridge performance measures despite MDOT being allowed limit influence on the maintenance of border bridges.

As mentioned, the settings are being continuously improved. Some of the more significant settings include:

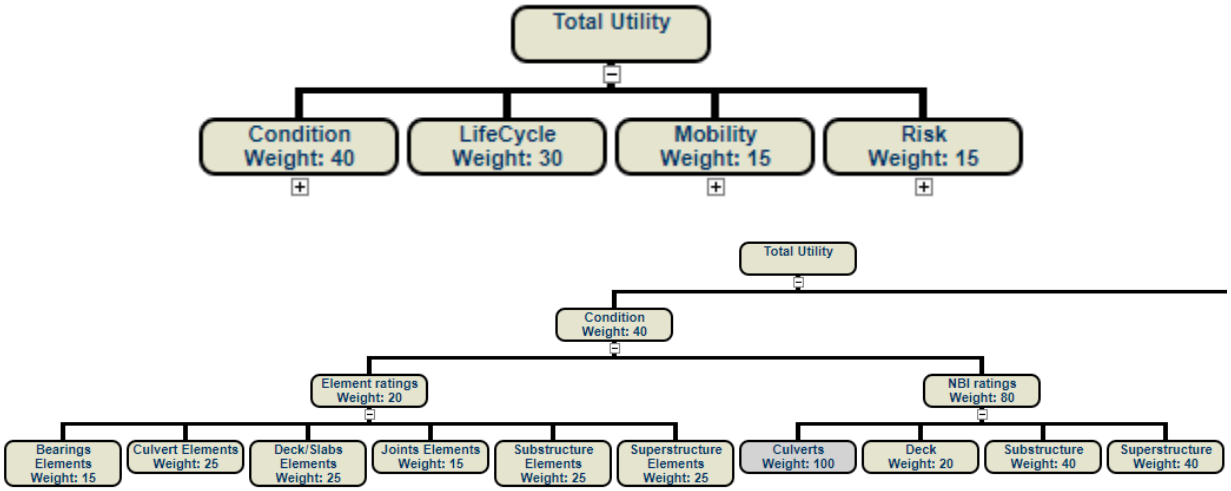
- Structure Weight
- Utility
- Deterioration Profiles
- Other Major Configurations

Structure Weight is used by the BrM software to give preference to particular types, conditions, and classifications of structures. When evaluating benefit/cost ratios, small projects are generally favored, so a structure weight can be applied to assign a higher priority to larger structures that might otherwise be deferred in favor of lower cost work. Projects are chosen by ranking the weighted benefit/cost ratio (structure weight multiplied by the benefit/cost ratio). In general terms, the Structure Weight is computed as follows:

$$Structure\ Weight = Bridge\ Deck\ Area \times \begin{cases} 30, NHS \\ 0, \quad NonNHS \end{cases} + \begin{cases} 10, Interstate \\ 0, \quad NonInterstate \end{cases} + (40 - 8 \times Posting\ Rating) + \begin{cases} 20, Poor \\ 10, Fair \\ 0, Good \end{cases} + \begin{cases} 30, Condition\ Rating \leq 2 \\ 0, Condition\ Rating > 2 \end{cases}$$

Utility scales and weights the criteria used to evaluate bridge performance. The utility quantifies the benefit of the work done on a bridge. The top-level nodes of the utility tree are shown in 17. Also shown are how these nodes can be further subdivided below the top-level nodes. The value shown in the node label is its weight relative to the other nodes in its tier.

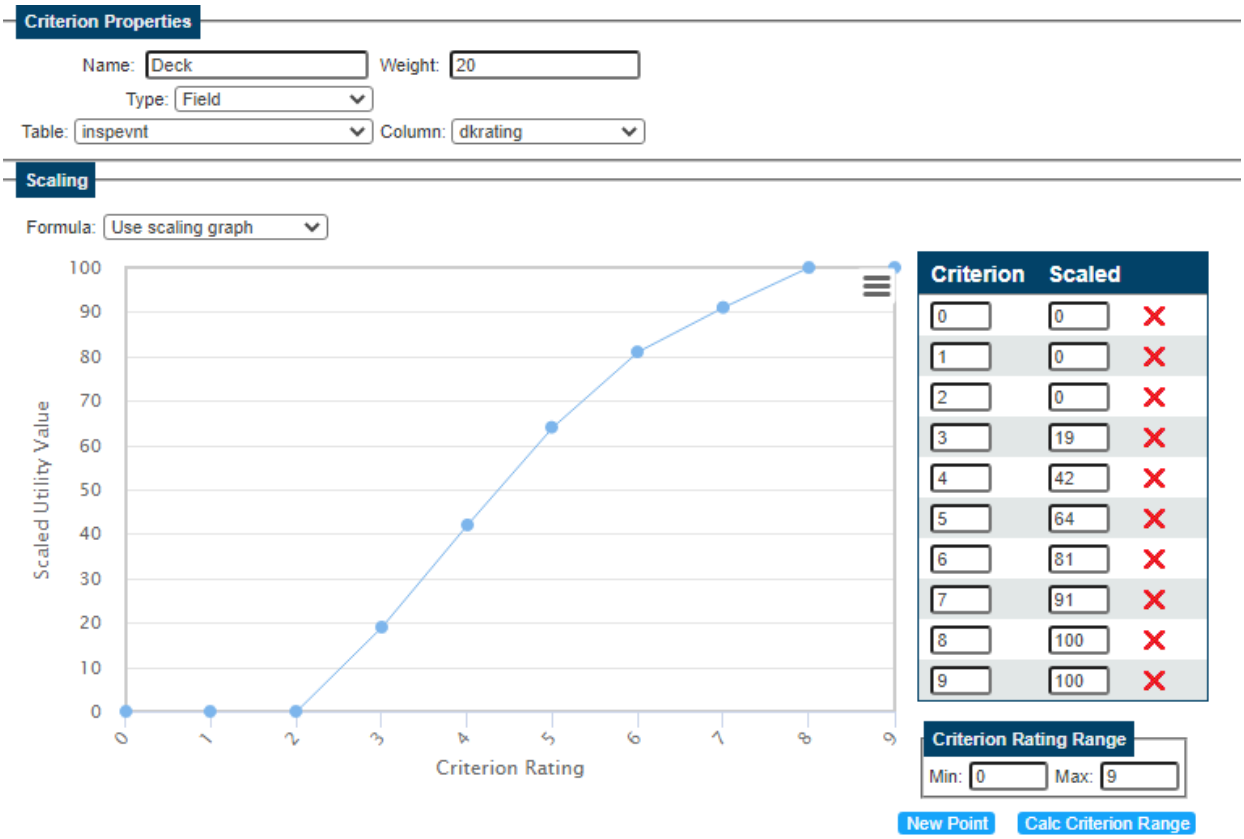
Figure 17. Example of Utility Nodes



Source: MDOT.

Each utility node criterion is then further defined to identify how it will be scaled. As an example, the scaling for the Deck Weight is shown in Figure 18.

Figure 18. Example of Utility Node Scaling



Source: MDOT.

Deterioration profiles define the duration the NBI deck, superstructure, substructure and culvert condition ratings are expected to remain at each rating value. The BrM software uses these profiles to predict when bridges will transition between good, fair and poor conditions. BrM's initial distribution of good, fair and poor may not exactly match the actual percentages as there are bridges which have remained in a particular category for longer than the profiles predict. When BrM begins its analysis, it immediately applies the profiles. If a bridge has been at a particular condition rating longer than the profile allowance then it will be immediately lowered which could result in the bridge falling to the next condition category regardless of the current inspection data. The deterioration profiles as they are currently configured are shown in Table 23.

Table 23. Structure Deterioration Profile Transition Times, in Years

NBI Rating	Bridge Deck	Bridge Superstructure	Bridge Substructure	Culvert
9	4	11	10	10
8	24	27	26	19
7	24	24	24	20

6	24	24	22	18
5	20	24	20	16
4	10	16	16	10
3	16	4	10	8
2	1	1	1	6
1	0	0	0	0

Source: MDOT.

The other remaining major configurations for BrM's analysis are the benefits, actions and network policies. A brief synopsis of each policy is below:

- **Benefits** are the results from work on a structure. For example, improving the NBI condition ratings, improving/replacing elements, improving the load posting rating, reducing scour criticality, etc. The benefit values are assigned by the utility nodes, and then used as the benefit in the benefit/cost ratio.

- **Actions** define the work available to be performed on a structure. For example, deck repair, deck rehabilitation, joint rehabilitation, bridge replacement, etc. Each action has benefits that are produced by the action and user-defined costs necessary to accomplish the action.

- **Network Policies** have three main functions:

  - 1) Defining when an action is allowed (for example, a deck rehabilitation might only be allowed if the NBI superstructure and substructure ratings are greater than five).

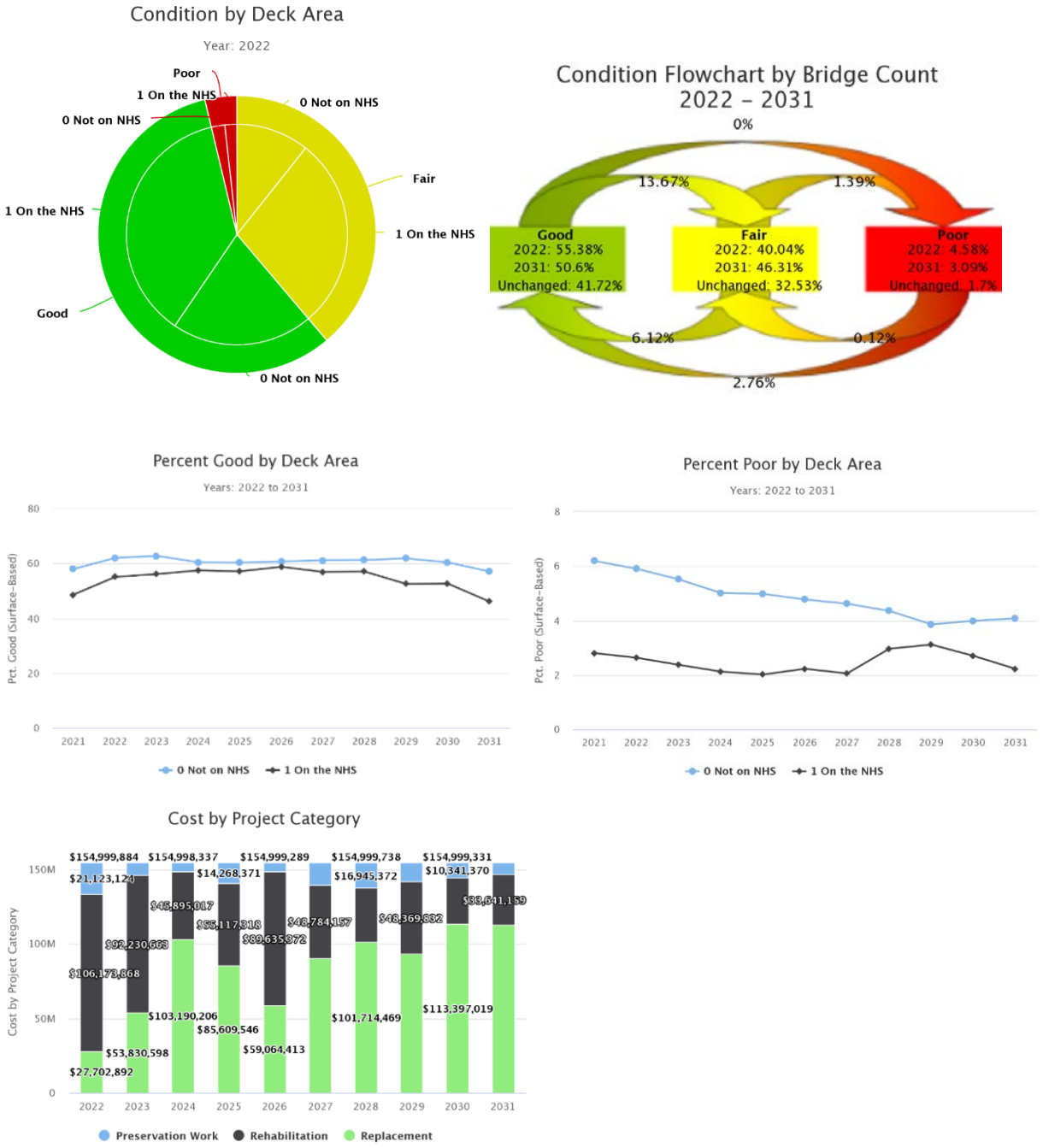
  - 2) Assigning deferment rules. Deferment rules allow the user to defer future actions for a specified time period after some action is completed. For example, it might be logical to defer any deck rehabilitation work for 10 years after a deck replacement action. Doing this not only tailors the work recommended to the agency's methodology, but it also reduces computing time since that action no longer has to be considered for the given time period.

  - 3) Defining which actions may be performed in conjunction with other actions. It would not be logical to consider repairing a deck when that deck is already being considered for replacement. Likewise, the agency might have policies prescribing how deck construction and substructure construction are performed via separate projects. Limiting the actions that are allowed in conjunction with each other not only allows for tailoring the projects recommended but also can have a significant impact on computing time.

After inputting the configurations, the user can run the program. The program includes parameters such as a duration, funding allocation and subset of bridges to be included. Multiple funding options can be created within Scenarios which allow the same program to be run against varying funding amounts. Once a program is submitted for analysis, the Optimizer

analyzes each possible action for each bridge then ranks the results by the weighted benefit/cost ratio. The Optimizer then applies the budget for that year to the top ranked projects until the available funds are exhausted. The results from the first year's projects are incorporated back into the bridge inventory's condition and the process is rerun for the next year. This continues through the end of the program's duration. A spreadsheet of recommended projects is provided at the end of the analysis. Additionally, the software produces numerous graphs depicting the results of the analysis. Examples of the outputs are shown in Figure 22.

Figure 19. Example of BMS Outputs



Source: MDOT.

MDOT will continue to adjust the software's parameters and refine the analyses. In conjunction with other states and the AASHTOWare BrM software contractor, MDOT Participates in improving the software's capabilities and functionality. Ongoing use and adjustment will continue to enhance BrM's usefulness in helping to effectively manage MDOT's bridge inventory.

5.0 Managing Risk

Risk refers to events, such as performance failure, extreme weather events, cost controls, the selection of suboptimal preservation projects, regulatory delays, construction delays, etc., which have the potential to interfere in MDOT's ability to perform its mission and reach SOGR targets.

As part of the development of a comprehensive risk register, MDOT has:

- **Established a risk working group.** The working group is a subset of the Asset Management Working Group. Members include Administration (Assistant Chief Engineer – Operations), Budget (Budget Director), Research (State Research Engineer), Maintenance (State Maintenance Engineer), Bridge (State Bridge Engineer) and Planning (State Planning Engineer).
- **Established a risk context.** The statewide goals, objectives, and targets defined in the LRTP were considered to ensure they were supported by risk management efforts. The LRTP also provided different inflation-aware revenue projections, two different budget scenarios, and an exploration of the potential for revenue disruptors in the future.
- **Identified risks.** MDOT identified events that could impact MDOT's ability to manage Mississippi's bridges and pavements effectively.
- **Assessed risks.** MDOT assessed the likelihood of an event happening and the consequences if that event does occur.
- **Prioritized risks.** MDOT determined, based on the risk assessment, where to focus attention and resources.
- **Established a risk appetite.** MDOT considered its risk appetite based on the risk scores in the register. It accepts (but will work to mitigate) risks that score below a six. It will proactively mitigate risks that score a six or above. Risks with a score above nine have a more detailed treatment plan associated with the risk. The detailed plan includes treatment actions, team, milestones, and a monitoring plan.
- **Identified risk treatments.** MDOT identified a strategy or set of strategies to address each priority risk, ensuring that the mitigation will bring the risk within acceptable risk tolerance by reducing either the likelihood or the consequence. MDOT uses a rubric to categorize its risk treatments:
  - Avoid: by not starting or discontinuing the activity that gives rise to the risk.
  - Transfer or share: by having another party take all or some responsibility.
  - Enhance: in order to pursue an opportunity.

- Accept: by informed decision that your business as usual will be sufficient for dealing with a risk OR that if your risk does occur you will have a contingency plan for dealing with the consequences.
- Mitigate: by removing the risk or changing the impact/likelihood.

- **Monitored risks.** MDOT assigned risk monitoring and review duties to ensure MDOT is monitoring and responding to possible events, evaluating the effectiveness of treatments, and periodically updating risk priorities.

5.1 Risk Register

There are two elements in the quantitative assessment of risk: likelihood and consequence. The likelihood of an event occurring was determined to be within one of four categories: unlikely, possible, likely, and almost certain. The consequences of an event occurring were determined to be minor, moderate, major, and catastrophic. An overall risk score was calculated by multiplying the quantitative values assigned to each consequence and likelihood category (a simple one to four range).

Figure 20 shows how overall risk score is a factor of both likelihood and consequences. The lowest risks are in the bottom left with a likelihood category of Unlikely and a consequences category of Minor. The highest theoretical risk would have a likelihood category of almost certain and a consequences category of catastrophic. Risks shown in red are above MDOT's risk tolerance.

Figure 20. Risk Assessment Scoring

Consequence \ Likelihood	Unlikely (1)	Possible (2)	Likely (3)	Almost Certain (4)
Catastrophic (4)	4	8	12	16
Major (3)	3	6	9	12
Moderate (2)	2	4	6	8
Minor (1)	1	2	3	4

Source: MDOT.

MDOT considered risks at three levels, including:

- **Enterprise risks** affect the mission, vision, and overall results of MDOT's asset management efforts.
- **Program risks** affect MDOT's ability to successfully deliver the capital program and meet performance targets.
- **Asset risks** These risks involve damage to bridges and pavement and can potentially disrupt travel patterns. Examples include weather (both extreme and routine), natural disasters, vehicle impacts and incidents, and impact damage to bridges and pavement resulting from the failure of other nearby assets.

Table 24 contains the risks, their level, the asset it relates to, their quantitative rating, MDOT's summary treatment plan, the impact of the treatment, and the post-treatment risk rating. The list is ordered from **highest to lowest risk** based on its risk rating. In the tables, "L" refers to likelihood, "C" refers to consequences, and "V" refers to the value or overall risk score. The risks beyond MDOT's risk appetite (risk score above 9) are highlighted in bold and have a summary-level mitigation plan documented in the table.

Table 24. Pavement and Bridge Risk Register

Risk Statement	Level	Asset(s)	Risk Rating	Risk Treatment Plan Summary	Treatment Impact	Post- Treatment Risk Rating
If MDOT has issues recruiting, retaining, and training talent (e.g., limited skills, lack of competitive wage), it may be difficult to staff the pavement and bridge management programs.	Program	Pavement and Bridge	L: 3 C: 3 V: 9	Mitigate: • Introduce new staff to pavement and bridge management • Train staff • Continue to develop the MDOT knowledge management program	MDOT has staff capable of managing its pavements and bridges.	L: 2 C: 2 V: 4
If states responsible for maintenance of border bridges fall behind causing a reduction in performance, MDOT may not be able to meet performance targets.	Program	Bridge	L: 3 C: 3 V: 9	Mitigate: • Monitor bridge inspection data to determine whether border bridge condition will adversely affect performance targets. • Communicate with neighboring states when bridge condition merits the need for funding maintenance activities.	Neighboring states are aware of MDOT's risk appetite for the shared asset. Lawmakers consider when prioritizing needs.	L: 3 C: 2 V: 6
Extreme weather affects asset conditions or effectiveness of the NHS assets, especially in areas prone to multiple hazards as identified in the Part 667 section.	Asset	Pavement and Bridge	L: 3 C: 3 V: 9	Mitigate: • Continue to monitor areas prone to damage and evaluate mitigation strategies and invest in more resilient infrastructure. • Continue to use Load and Resistance Factor Design (LRFD) to design structures considering extreme events such as flooding and seismic activity.	Mitigate the impact of natural hazards with infrastructure investments.	L: 3 C: 2 V: 6

Risk Statement	Level	Asset(s)	Risk Rating	Risk Treatment Plan Summary	Treatment Impact	Post- Treatment Risk Rating
If local bridges are not properly load rated, posted, and closed, then the potential for bridge failure could put the motoring public at risk.	Asset	Bridge	L: 2 C: 3 V: 6	Mitigate: • Ensure local bridge annual NBI data submittal is updated in a timely manner to reflect current postings and closings. • Review/refine tracking system to ensure local bridges are posted and closed in a timely manner. • Continue to implement State Aid's Load Rating Plan of Action (POA).	Mitigates the risk of bridge failure.	L: 1 C: 2 V: 2
If the local bridge inspection program does not comply with the Federal regulations, then the condition of the bridges could potentially put the motoring public at risk, and a loss of Federal funds could occur.	Program	Bridge	L: 2 C: 4 V: 8	• Continue to implement State Aid's NBIS Improvement Plan; • Conduct Annual NBIS Review of State Aid's bridge program as required by FHWA	Mitigates the risk of losing Federal funding.	L: 1 C: 2 V: 2
If quality pavement management data is not collected in a timely manner, then selection, prioritization, and programming of pavement projects may be adversely affected.	Program	Pavement	L: 4 C: 2 V: 8	Mitigate: • Apply the pavement data quality management plan (DQMP) • Use the Pavement Quality App (PQA) for pavement data quality assurance • Expand pavement condition survey as needed • Use Project Tracker to keep project history up-to-date. • Reconcile LRS data in the PMS. • Monitor data collection timelines and milestones.	The PMS is updated with high quality pavement condition and project data, enabling MDOT to make effective decisions.	L: 1 C: 2 V: 2

Risk Statement	Level	Asset(s)	Risk Rating	Risk Treatment Plan Summary	Treatment Impact	Post- Treatment Risk Rating
If quality bridge condition data is not collected in a timely manner, then selection, prioritization, and programming of bridge projects may be adversely affected.	Program	Bridge	L: 2 C: 2 V: 4	Mitigate: • Monitor bridge inspections to ensure they meet the requirements of the NBIS. • Ensure inspectors are following FHWA's Bridge Inspector's Reference Manual. • Perform an annual bridge inspection audit.	The BMS is updated with high quality bridge condition and project data, enabling MDOT to make effective decisions.	L: 1 C: 2 V: 2

Risk Statement	Level	Asset(s)	Risk Rating	Risk Treatment Plan Summary	Treatment Impact	Post- Treatment Risk Rating
If project costs continue to rise (because of increasing labor and materials costs), the condition of the State-maintained pavements and bridges will continue to deteriorate.	Program	Pavement and Bridge	L: 3 C: 2 V: 6	Accept: • Effectively communicate to the public and lawmakers how construction costs change over time even as funding continues to be flat (e.g., through the LRTP). • (Pavement) Continue to participate in the National Center for Asphalt Technology (NCAT) and MnROAD pooled fund studies and other pavement-related studies to ensure MDOT is using the most cost-effective pavement mixes. • (Bridge) Continue to participate in the AASHTO Committee on Bridges & Structures (COBS), AASHTO TSP2 Bridge Preservation, and MDOT-funded research studies to promote innovative material and construction practices. Utilize cyclical and condition-based preventive maintenance practices to slow the deterioration of our highway structures and extend their service life.	MDOT and its stakeholders understand the impact of rising costs of construction, especially given flat funding. Lawmakers consider impacts when prioritizing needs.	L: 3 C: 2 V: 6

Risk Statement	Level	Asset(s)	Risk Rating	Risk Treatment Plan Summary	Treatment Impact	Post- Treatment Risk Rating
If the data and models in the PMS and BMS are not well-tuned, the 10-year pavement and bridge condition predictions will be unreliable.	Program	Pavement and Bridge	L: 3 C: 2 V: 6	Mitigate: • Adjust predictions as part of LRTP and TAMP update cycle. • Continue to improve the PMS model logic (e.g., improve deterioration models, simplify decision trees, track recommended and actual projects, track planned and actual performance). • Develop crosswalk of MDOT work types to FHWA work types.	Prediction is still uncertain but the PMS and BMS produce results that are useful for decision-making.	L: 2 C: 2 V: 4

Risk Statement	Level	Asset(s)	Risk Rating	Risk Treatment Plan Summary	Treatment Impact	Post- Treatment Risk Rating
If safety issues emerge (e.g., rutting, friction, potholes), the pavement condition could be hazardous to the traveling public.	Asset	Pavement	L: 3 C: 2 V: 6	Mitigate: • Design decision trees in the PMS to rehab pavements with rutting issues, prioritizing this investment strategy. • Collect projects that need improvements in friction (e.g., Federal Aid projects and through special request from the Districts). • Track emerging technology for continuous friction testing through a pooled fund study. Consider deploying when available. • Track maintenance issues using Accountability in MDOT Maintenance Operations (AMMO) and fix potholes through a routine maintenance program.	Pavement is safe for travelers.	L: 3 C: 1 V: 3
If a project is postponed, MDOT may not be able to meet its performance targets.	Program	Pavement and Bridge	L: 3 C: 2 V: 6	Mitigate: • Craft state accurate state estimates and work with the contractor community to submit reasonable bids. • Ensure plans and permits are delivered on-time • Ensure utilities are located in a timely manner	Projects are let when anticipated	L: 3 C: 1 V: 3

Risk Statement	Level	Asset(s)	Risk Rating	Risk Treatment Plan Summary	Treatment Impact	Post- Treatment Risk Rating
COVID-19 continues to evolve and become more contagious, potentially causing MDOT employees to become ill, miss work, and disrupt MDOT services.	Enterprise	Pavement and Bridge	L: 2 C: 3 V: 6	Mitigate: • Encourage staff to follow recommendations from qualified medical providers to avoid contracting Covid Explore remote working options.	MDOT employees are more likely to remain at work and productive.	L: 2 C: 2 V: 4
If the public and elected officials take data from different reports and are not aware of why the data differ, people could lose faith in the data and MDOT's credibility will suffer.	Enterprise	Pavement and Bridge	L: 2 C: 2 V: 4	Mitigate: • Document data sources and responsibilities (HPMS, PMS, State-maintained/NHS, etc.). • Educate TAM staff in committee meetings. • Keep upper management aware. • Use the PATH hub to communicate condition trends.	Public and elected officials will understand what data means.	L: 2 C: 1 V: 2
If funding increases (e.g., due to Lottery funds or Federal infrastructure legislation), there may be an opportunity for MDOT to expand or accelerate its pavement and/or bridge program.	Program	Pavement and Bridge	L: 2 C: 2 V: 4	Enhance: • Review the Infrastructure Investment and Jobs Act and new Federal transportation bill for bridge and pavement funding opportunities. • Prepare a list of shovel-ready projects.	MDOT is able to take advantage of new funding to increase asset condition.	L: 3 C: 3 V: 9

Risk Statement	Level	Asset(s)	Risk Rating	Risk Treatment Plan Summary	Treatment Impact	Post- Treatment Risk Rating
If an unexpected event occurs that reduces funding (e.g., a temporary funding cut due to COVID-related revenue reductions), deterioration of pavement and bridge condition will accelerate (e.g., the overlay program may need to be halted temporarily).	Program	Pavement and Bridge	L: 2 C: 2 V: 4	Accept: • Conduct performance-based needs analyses to estimate the impact of reduced funding. • Effectively communicate to the public and lawmakers the consequences of unexpected funding cuts.	MDOT and its stakeholders understand the impact of unexpected funding cuts. Lawmakers consider impacts when prioritizing needs.	L: 2 C: 2 V: 4
If the program increases in size, there may be an imbalance in supply and demand for contractors, leading to an increase in cost of design and construction of projects and a reduction in the ability for MDOT to deliver its planned program.	Program	Pavement and Bridge	L: 2 C: 2 V: 4	Accept: • Monitor bids and adjust letting if cost is too high. • Communicate with engineering community about increase in capital spending.	MDOT ensures that costs are not inflated due to increased demand. Contractor community prepares for increased workload.	L: 2 C: 2 V: 4
If the minimum condition level established by the FAST Act on NHS bridges is not met for three consecutive years, Federal funding flexibility will be reduced.	Program	Bridge	L: 1 C: 2 V: 2	Mitigate: • Conduct performance-based needs analyses to estimate the minimum investment level to meet FAST Act requirements.	MDOT retains flexibility in Federal funding.	L: 1 C: 2 V: 2

Source: MDOT.

5.2 Risk in the TAMP

MDOT uses risk to assess performance gaps, set targets, and develop its investment strategy. This section provides a summary. There is more detail in each related section.

- **Targets:** Building on the LRTP, MULTIPLAN 2045, MDOT explored how declining buying power and different budget levels would impact MDOT's ability to meet its performance targets in 2045, assuming the targets remain the same over time. Using different budgets allowed MDOT to understand the risks of underinvestment on the condition of its NHS pavements and bridges. MDOT provided conservative targets based on its assessed risks identified in Section 5.0 and its expected budget forecast, assuming all funding levels remain the same.

- **Investment strategies:** MDOT prioritized its expected resources to meet all percent poor targets for pavement and maintaining the current condition on bridges.

- **Performance gaps:** MDOT explored the gap between the expected performance given the expected budget and the performance at an adequate budget. The adequate budget assumes the funding needed to fully fund Mississippi's basic transportation needs.

5.3 Evaluating Assets Repeatedly Damaged by Emergency Events

Federal regulations require that each State conduct statewide evaluations to determine if there are reasonable alternatives to roads, highways, and bridges that have required repair and reconstruction activities on two or more occasions due to emergency events since January 1, 1997. The likelihood of these events occurring is minimal but could have a major impact. According to FHWA, evaluation is defined as "an analysis that includes identification and consideration of any alternative that will mitigate, or partially or fully resolve, the root cause of the recurring damage, the costs of achieving the solution, and the likely duration of the solution." According to the regulations "emergency event means a natural disaster or catastrophic failure resulting in an emergency declared by the Governor of the State or an emergency or disaster declared by the President of the United States" and "reasonable alternatives include options that could partially or fully achieve the following:

1. Reduce the need for Federal funds to be expended on emergency repair and reconstruction activities.

2. Better protect public safety and health and the human and natural environment.

3. Meet transportation needs as described in the relevant and applicable Federal, State, local, and tribal plans and programs."

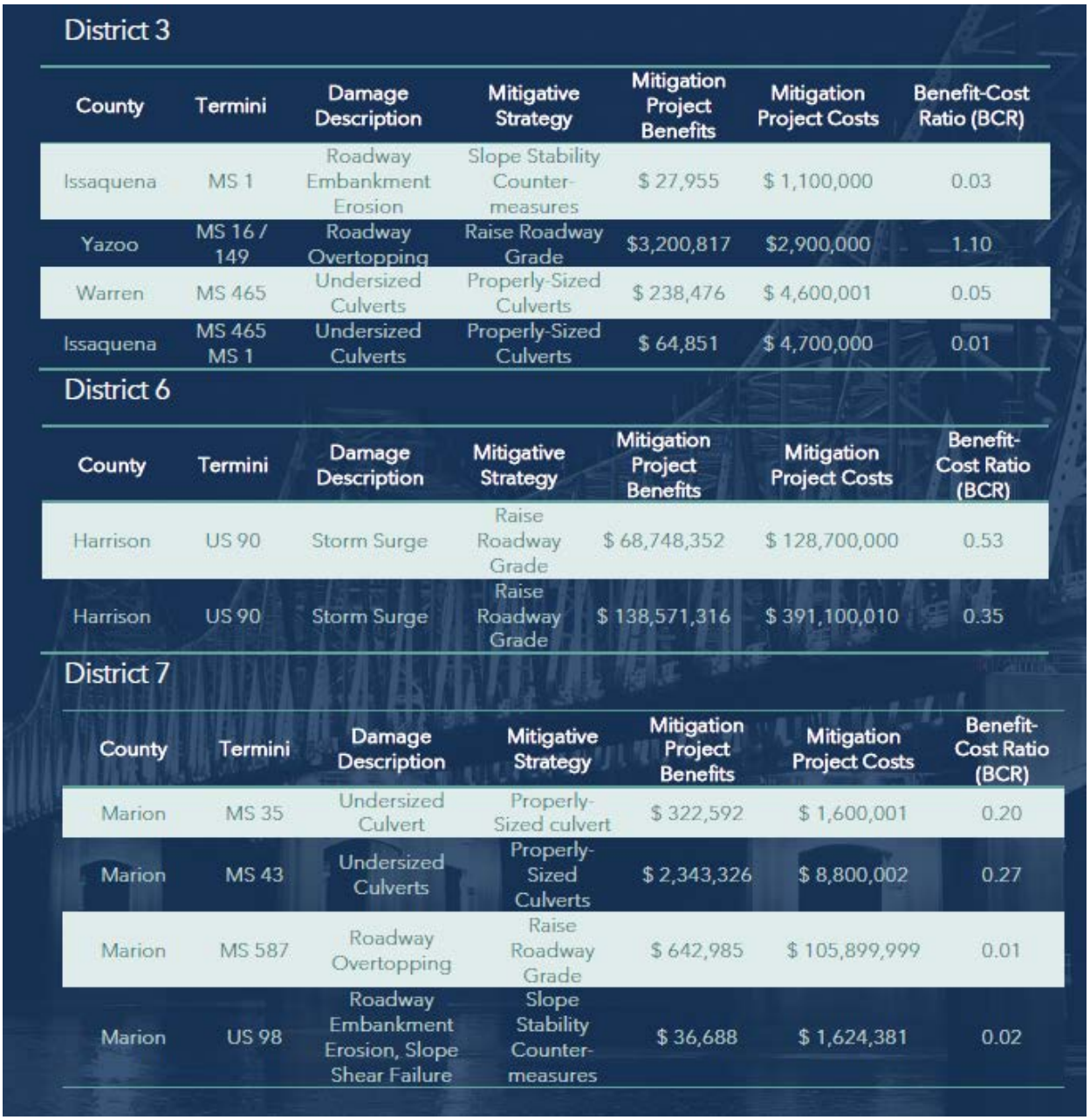
It is required that the risk management plan within the TAMP provide "a summary of the evaluations of facilities repeatedly damaged by emergency events."

Since January 1, 1997, 55 Major Disaster or Emergency Declarations have been issued for one or more counties within the State of Mississippi (see Table 25). Major Disaster or Emergency Declarations are requested by the governor, through the regional FEMA office, and approved by the President of the United States if it is shown that "the disaster is of such severity and magnitude that effective response is beyond the capabilities of the State and the local governments and that Federal assistance is necessary" (Federal Emergency Management Agency (FEMA)).

Both declaration types authorize the President to provide Federal disaster assistance. The total amount of assistance offered through an Emergency Declaration is limited to $5 million. Smaller incidents that can be managed by State or local officials are not included on this list.

Although there are many FEMA disaster types, including chemical/biological, industry hardship, radiation leak, and terrorism, the only declared major disasters in Mississippi until 2021 have been natural in origin. Going back to 1953, only one non-natural incident is listed as a declared Major Disaster, the Mississippi Chlorine Barge Accident of 1962 (a barge carrying over 1,000 tons of chlorine gas sunk near Natchez). Most recently, in 2020, two biological disasters/emergencies were declared due to the COVID-19 global pandemic. The year 2020 was an exceptional year for natural disasters as well. Between 1997 and 2019, yearly natural declarations ranged between one and four per year. In 2020 alone, there were nine major disaster or emergency declarations. There were three declarations in 2021 with one resulting from a winter storm and two from Hurricane Ida.

MDOT has developed and will continue to refine a process to identify all NHS and state maintained assets that have been repeatedly damaged on 2 or more occasions. It uses this information to identify projects for evaluation for reasonable alternatives before a project can be programmed or added to the State Transportation Improvement Program (STIP). Repeatedly damaged assets and the corresponding planning level mitigation strategies to be considered in project planning and development have been documented in a standalone report titled *23 CFR Part 667 Statewide Evaluations of Assets Repeatedly Damaged by Emergency Events Dated January 2023*. A summary of the locations and proposed mitigation strategies are below:



District 3

County	Termini	Damage Description	Mitigative Strategy	Mitigation Project Benefits	Mitigation Project Costs	Benefit-Cost Ratio (BCR)
Issaquena	MS 1	Roadway Embankment Erosion	Slope Stability Counter-measures	$ 27,955	$ 1,100,000	0.03
Yazoo	MS 16 / 149	Roadway Overtopping	Raise Roadway Grade	$3,200,817	$2,900,000	1.10
Warren	MS 465	Undersized Culverts	Properly-Sized Culverts	$ 238,476	$ 4,600,001	0.05
Issaquena	MS 465 MS 1	Undersized Culverts	Properly-Sized Culverts	$ 64,851	$ 4,700,000	0.01

District 6

County	Termini	Damage Description	Mitigative Strategy	Mitigation Project Benefits	Mitigation Project Costs	Benefit-Cost Ratio (BCR)
Harrison	US 90	Storm Surge	Raise Roadway Grade	$ 68,748,352	$ 128,700,000	0.53
Harrison	US 90	Storm Surge	Raise Roadway Grade	$ 138,571,316	$ 391,100,010	0.35

District 7

County	Termini	Damage Description	Mitigative Strategy	Mitigation Project Benefits	Mitigation Project Costs	Benefit-Cost Ratio (BCR)
Marion	MS 35	Undersized Culvert	Properly-Sized culvert	$ 322,592	$ 1,600,001	0.20
Marion	MS 43	Undersized Culverts	Properly-Sized Culverts	$ 2,343,326	$ 8,800,002	0.27
Marion	MS 587	Roadway Overtopping	Raise Roadway Grade	$ 642,985	$ 105,899,999	0.01
Marion	US 98	Roadway Embankment Erosion, Slope Shear Failure	Slope Stability Counter-measures	$ 36,688	$ 1,624,381	0.02

Table 25. Major Disaster and Emergency Declarations in Mississippi, 1997–2021

Disaster/Emergency	Date Declared
Mississippi Hurricane Ida (4626-DR-MS)	10/22/2021
Mississippi Hurricane Ida (3569-EM-MS)	8/28/2021
Mississippi Severe Winter Storms (DR-4598)	5/4/2021
Mississippi Hurricane Zeta (DR-4576)	12/31/2020
Mississippi Hurricane Zeta (EM-3550)	10/28/2020
Mississippi Hurricane Delta (EM-3548)	10/8/2020
Mississippi Hurricane Sally (EM-3544)	9/14/2020

Disaster/Emergency	Date Declared
Mississippi Hurricane Marco and Tropical Storm Laura (EM-3539)	8/23/2020
Mississippi Severe Storms, Tornadoes, Straight-line Winds, And Flooding (DR-4551)	7/9/2020
Mississippi Severe Storms, Flooding, And Mudslides (DR-4538)	4/23/2020
Mississippi Severe Storms, Tornadoes, Straight-line Winds, And Flooding (DR-4536)	4/16/2020
Mississippi COVID-19 Pandemic (DR-4528)	4/5/2020
Mississippi COVID-19 (EM-3474)	3/13/2020
Mississippi Severe Storms, Tornadoes, Straight-line Winds, And Flooding (DR-4478)	3/12/2020
Mississippi Severe Storms, Tornadoes, Straight-line Winds, And Flooding (DR-4470)	12/6/2019
Mississippi Severe Storms, Tornadoes, Straight-line Winds, And Flooding (DR-4450)	6/20/2019
Mississippi Severe Storms, Straight-line Winds, Tornadoes, and Flooding (DR-4429)	4/23/2019
Mississippi Severe Storms, Flooding, and Tornado (DR-4415)	2/14/2019
Mississippi Hurricane Nate (DR-4350)	11/22/2017
Mississippi Hurricane Nate (EM-3393)	10/7/2017
Mississippi Severe Storms, Tornadoes, Straight-line Winds, and Flooding (DR-4314)	5/22/2017
Mississippi Severe Storms, Tornadoes, Straight-line Winds, and Flooding (DR-4295)	1/25/2017
Mississippi Severe Storms and Flooding (DR-4268)	3/25/2016
Mississippi Severe Storms, Tornadoes, Straight-line Winds, and Flooding (DR-4248)	1/4/2016
Mississippi Severe Storms and Tornadoes (DR-4205)	1/6/2015
Mississippi Severe Storms, Tornadoes, and Flooding (DR-4175)	4/29/2014
Mississippi Severe Storms, Tornadoes, and Flooding (DR-4101)	2/12/2013
Mississippi Hurricane Isaac (DR-4081)	8/28/2012
Mississippi Tropical Storm Isaac (EM-3348)	8/28/2012
Mississippi Flooding (DR-1983)	5/10/2011
Mississippi Flooding (EM-3320)	5/4/2011
Mississippi Severe Storms, Tornadoes, Straight-line Winds, and Associated Flooding (DR-1972)	4/28/2011
Mississippi Severe Storms, Tornadoes, and Flooding (DR-1916)	5/13/2010
Mississippi Severe Storms, Tornadoes, and Flooding (DR-1906)	4/28/2010
Mississippi Severe Storms, Flooding, and Tornadoes (DR-1837)	5/11/2009
Mississippi Hurricane Gustav (DR-1794)	9/21/2008
Mississippi Hurricane Gustav (EM-3291)	8/30/2008
Mississippi Severe Storms and Tornadoes (DR-1764)	5/27/2008
Mississippi Severe Storms and Flooding (DR-1753)	5/7/2008
Mississippi Hurricane Katrina (DR-1604)	8/28/2005
Mississippi Hurricane Katrina (EM-3213)	8/28/2005
Mississippi Hurricane Dennis (DR-1594)	7/9/2005
Mississippi Hurricane Ivan (DR-1550)	9/14/2004
Mississippi Severe Storms, Tornadoes, and High Winds (DR-1470)	5/22/2003
Mississippi Severe Storms, Tornadoes and Flooding (DR-1459)	4/23/2003
Mississippi Severe Storms and Tornadoes (DR-1443)	11/13/2002
Mississippi Tropical Storm Isidore (DR-1436)	9/30/2002
Mississippi Severe Storms and Tornadoes (DR-1398)	12/6/2001

Disaster/Emergency	Date Declared
Mississippi Tropical Storm Allison (DR-1382)	6/20/2001
Mississippi Severe Storms and Flooding (DR-1365)	4/16/2001
Mississippi Tornadoes and Severe Storms (DR-1360)	2/22/2001
Mississippi Severe Winter Storms, Ice, and Freezing Rain (DR-1265)	1/24/1999
Mississippi Hurricane Georges (DR-1251)	9/30/1998
Mississippi Hurricane Georges (EM-3132)	9/28/1998
Mississippi Flooding (DR-1178)	6/12/1997

Source: MDOT and FEMA, March 2022.

6.0 Performance Gap Analysis

The gap analysis compares future performance with current funding levels against four-year performance targets. The difference between the two is a performance gap. Section 2.1 and 3.1 detail the current performance and historical performance trends for pavements and bridges, respectively.

Performance Condition Analytics

MDOT currently is in the process of implementing AASHTOware BrM for bridge management and dTIMS for pavement management. The systems give MDOT the analytical engines it needs to predict asset condition with any investment level.

The AASHTOware BrM was operational for the development of this TAMP. Results shown here are subject to change as the MDOT systems are refined and calibrated.

6.1 Pavement Performance Gap Analysis

Mississippi will continue to prioritize Interstates and Non-Interstate NHS roads. Beyond the Federal Targets, MDOT strives to maintain the existing performance of its NHS assets. This strategy recognizes the efficiencies of maintaining NHS assets rather than allowing the assets to decline requiring significant investment. With remaining funds, it will invest in non-NHS State-maintained 4-lane and 2-lane roads. With planned expenditures, MDOT anticipates the following performance gaps:

Interstates

For Interstate pavements:

- The current condition is 0.7% poor and 74% good based on the Federal Measure.
- MDOT anticipates making an investment of $110 million per year over the next 10 years.
- At this investment level, the future condition will be 0% poor and 73% good.
- The four-year target performance (based on the Federal measure) is <5% poor and >55% good.
- Based on the PMS analysis, $110 million annual investments in the Interstate will lead to a slight decrease in the amount of good pavement and an increase in the amount of fair pavement. This investment level will lead to a decrease in poor pavement.
- Based on the PMS analysis, an annual investment of $110 million appears to sustain current conditions (based on the federal measure), which are exceeding performance goals.

Non-Interstate NHS

For Non-Interstate NHS:

- The current condition is 4% poor and 38% good, based on the Federal measure.
- MDOT anticipates making an investment of $127 million per year over the next 10 years.
- At this investment level, the future condition will be 2% poor and 33% good.
- The target performance for Non-Interstate NHS (based on the Federal measure) is <10% poor and >25% good.
- A $127 million annual investments in Non-Interstate NHS will lead to a decline in the amount of good and poor pavement and an increase in the amount of fair pavement

Based on the investment level and needs, there is no performance gap annually for its NHS pavements based on the Federal PM2 measure. However, it should be noted that based on MDOT's PCR measure, there are performance gaps of more than $190 million for interstate pavement and more than $127 million for non-interstate pavement. Interstate pavement and non-interstate NHS pavement would each require more than $300 million annual spending to meet the targets using the PCR measure. Table 26 summarizes the findings of the pavement performance gap analysis.

Table 26. NHS Pavement Performance Gap Summary

	Interstate	Non-Interstate NHS
Actual Investments June 2020-May 2021	$40.3 m	$87.7 m
2020 Condition (Federal PM2 Pavement Measure)	0.7% poor 73.6% good	4.2% poor 37.7% good
Four-Year Target (Federal PM2 Pavement Measure)	<5% poor >55% good	<10% poor >25% good
Estimated 10-Year Annual Spend Based on Expected Budget	$110 m	$127 m
Condition After 10-Years Based on Expected Budget (Federal PM2 Pavement Measure)	0.0% poor 73% good	2% poor 33% good
Additional Investment Needed to Close the Performance Gap (Federal PM2 Pavement Measure)	Target Met, No Gap	Target Met, No Gap

Note: Only the investment gap using the Federal PM2 measure is shown. Investments needed to meet the target using the PCR measure is more than $300 million for both interstate and non-interstate NHS pavements.
Source: MDOT. Dollar values do not include engineering, right-of-way, preconstruction, and additional maintenance costs.

State-Maintained Non-NHS 4-Lane

For State-Maintained Non-NHS 4-Lane pavement:

- The current condition is 41% poor and 37% good, based on PCR.
- MDOT anticipates making an investment of $5 million per year over the next 10 years.
- At this investment level, the future condition will be 38% poor and 16% good.
- The target performance for State-Maintained Non-NHS 4-lane (based on PCR) is <25% poor.
- A $5 million annual investment in State-Maintained Non-NHS 4-lane will lead to a decline in the amount of poor pavement and good pavement and an increase in the amount of fair pavement.
- The performance gap for this category is $16 million annually.

State-Maintained Non-NHS 2-Lane

For State-Maintained Non-NHS 2-Lane pavement:

- The current condition is 38% poor and 23% good, based on PCR.
- MDOT anticipates making an investment of $127 million per year over the next 10 years.
- At this investment level, the future condition will be 41% poor and 33% good.
- The target performance for State-Maintained Non-NHS 2-lane (based on PCR) is <25% poor.
- An $127 million annual investment in State-Maintained Non-NHS 2-lane will lead to an increase in the amount of poor and good pavement and an decrease in the amount of fair pavement.
- There is a large performance gap for this category. An estimate of the total gap is $62 million annually.

Table 27 presents the performance summary of the non-NHS pavement.

Table 27. Non-NHS Pavement Performance Summary

	State-Maintained Non-NHS 4-Lane Pavement	State-Maintained Non-NHS 2-Lane Pavement
Actual Investments June 2020-May 2021	$42.7 m	$140.5 m
2020 Condition (MDOT PCR Pavement Measure)	41% poor 37% good	38% poor 23% good
Four-Year Target (MDOT PCR Pavement Measure)	<25% poor	<25% poor
Estimated 10-Year Annual Spend Based on Expected Budget	$5 m	$127 m
Condition After 10-Years Based on Expected Budget (MDOT PCR Pavement Measure)	38% poor 16% good	41% poor 33% good

Additional Investment Needed to Close the Performance Gap (MDOT PCR Pavement Measure)	$16 m	$62 m
Estimated 10-Year Annual Spend to Meet Target (Adequate Budget)	$21 m	$189 m
Condition After 10-Years Based on Adequate Budget (MDOT PCR Pavement Measure)	25% poor 29% good	25% poor 44% good

Note: Actual investments June 2020-May 2021 on the state-maintained non-NHS 4-lane pavements were funded by a BUILD grant for added capacity.
Source: MDOT 2019 TAMP Implementation Report, 2021. Dollar values do not include engineering, right-of-way, preconstruction, and additional maintenance costs.

Investments by Work Type

For the proposed spending scenarios, the investment by work type for the NHS and non-NHS pavements are summarized in Table 28, Table 29, Table 30, and Table 31. Maintenance costs were estimated based on the current spend 2020-2021 found in the Implementation Report which was derived from an internal maintenance tracking system called AMMO. These spending amounts were assumed to be a typical year. Derivation of preservation, rehabilitation, and reconstruction estimated costs are described in Appendix B.

Table 28. Estimated Pavement Investments by Work Type, NHS Interstate

Year	Preservation	Rehabilitation	Reconstruction	Maintenance	Total
2022	$90.0 m	$0.0 m	$0.0 m	$0.5 m	$90.5 m
2023	$0.9 m	$0.0 m	$0.0 m	$0.5 m	$1.4 m
2024	$109.3 m	$0.0 m	$0.0 m	$0.5 m	$109.8 m
2025	$137.7 m	$0.0 m	$0.0 m	$0.5 m	$138.3 m
2026	$134.5 m	$0.0 m	$0.0 m	$0.5 m	$135.0 m
2027	$131.3 m	$0.0 m	$0.0 m	$0.5 m	$131.8 m
2028	$128.4 m	$0.0 m	$0.0 m	$0.5 m	$128.9 m
2029	$125.5 m	$0.0 m	$0.0 m	$0.5 m	$126.0 m
2030	$122.5 m	$0.1 m	$0.0 m	$0.5 m	$123.1 m
2031	$119.8 m	$0.0 m	$0.0 m	$0.5 m	$120.3 m
Total	**$1099.9 m**	**$0.1 m**	**$0.0 m**	**$5.1 m**	**$1105 m**

Source: MDOT.

Table 29. Estimated Pavement Investments by Work Type, NHS Non-Interstate

Year	Preservation	Rehabilitation	Reconstruction	Maintenance	Total
2022	$57.4 m	$0.0 m	$0.0 m	$1.6 m	$59.0 m
2023	$76.4 m	$0.0 m	$0.0 m	$1.6 m	$78.0 m
2024	$85.1 m	$0.1 m	$0.0 m	$1.6 m	$86.8 m
2025	$11.0 m	$149.9 m	$0.0 m	$1.6 m	$162.6 m
2026	$10.3 m	$146.8 m	$0.0 m	$1.6 m	$158.8 m
2027	$4.3 m	$149.3 m	$0.0 m	$1.6 m	$155.2 m

2028	$14.4 m	$135.6 m	$0.0 m	$1.6 m	$151.6 m
2029	$16.1 m	$130.4 m	$0.0 m	$1.6 m	$148.2 m
2030	$2.7 m	$140.3 m	$0.0 m	$1.6 m	$144.6 m
2031	$0.2 m	$139.7 m	$0.0 m	$1.6 m	$141.6 m
Total	**$277.8 m**	**$992.2 m**	**$0.0 m**	**$16.4 m**	**$1286.4 m**

Source: MDOT.

Table 30. Estimated Pavement Investments by Work Type, State-Maintained Non-NHS 4-Lane Pavement

Year	Preservation	Rehabilitation	Reconstruction	Maintenance	Total
2022	$2.7 m	$1.5 m	$0.0 m	$0.0 m	$4.2 m
2023	$2.9 m	$1.4 m	$0.0 m	$0.0 m	$4.3 m
2024	$2.0 m	$1.1 m	$0.0 m	$0.0 m	$3.1 m
2025	$0.0 m	$5.5 m	$0.0 m	$0.0 m	$5.5 m
2026	$0.0 m	$6.0 m	$0.0 m	$0.0 m	$6.0 m
2027	$0.0 m	$4.8 m	$0.0 m	$0.0 m	$4.8 m
2028	$0.0 m	$5.8 m	$0.0 m	$0.0 m	$5.8 m
2029	$0.0 m	$5.6 m	$0.0 m	$0.0 m	$5.6 m
2030	$0.0 m	$5.5 m	$0.0 m	$0.0 m	$5.5 m
2031	$0.0 m	$5.2 m	$0.0 m	$0.0 m	$5.2 m
Total	**$7.6 m**	**$42.4 m**	**$0.0 m**	**$0.0 m**	**$50.0 m**

Source: MDOT.

Table 31. Estimated Pavement Investments by Work Type, State-Maintained Non-NHS 2-Lane Pavement

Year	Preservation	Rehabilitation	Reconstruction	Maintenance	Total
2022	$59.3 m	$0.2 m	$0.0 m	$4.6 m	$64.0 m
2023	$76.6 m	$0.2 m	$0.0 m	$4.6 m	$81.4 m
2024	$47.5 m	$0.1 m	$0.0 m	$4.6 m	$52.1 m
2025	$39.6 m	$126.7 m	$0.0 m	$4.6 m	$170.9 m
2026	$56.9 m	$105.6 m	$0.0 m	$4.6 m	$167.1 m
2027	$30.4 m	$128.2 m	$0.0 m	$4.6 m	$163.2 m
2028	$18.1 m	$136.9 m	$0.0 m	$4.6 m	$159.6 m
2029	$36.0 m	$115.3 m	$0.0 m	$4.6 m	$156.0 m
2030	$81.9 m	$66.2 m	$0.0 m	$4.6 m	$152.6 m
2031	$10.5 m	$134.1 m	$0.0 m	$4.6 m	$149.2 m
Total	**$456.7 m**	**$813.3 m**	**$0.0 m**	**$46.0 m**	**$1316 m**

Source: MDOT.

MULTIPLAN 2045 provides guidance for allocating resources for all State-maintained pavements. Pavement needs for the entire state-maintained highway system were estimated in 2020 at approximately $18.7 billion over the 26-year planning horizon, totaling over $723 million

annually. This is due to the large amount of non-NHS mileage in a largely rural state. The $723 million figure has likely increased with more pavement falling into Poor or Very Poor condition.

6.2 Bridge Performance Gap Analysis

The FAST Act establishes a minimum standard for NHS bridge conditions as no more than 10 percent of the total deck area may be in poor condition. Consequently, MDOT's performance target exceeds this standard and requires that no more than 5 percent of the total deck area may be in poor condition on NHS bridges. As of the 2021 NBI data submittal to FHWA, the total deck area of NHS bridges in Mississippi in poor condition is 2.3 percent, which indicates that there is no condition gap for this asset at this time using the established targets.

For NHS bridges:

- The current condition is 2% poor and 57% good by deck area.
- MDOT anticipates making an investment of $106 million per year over the next 10 years on the NHS bridge system.
- At this investment level, the future condition will be 3% poor and 50% good.
- The target performance for NHS bridges is <5% poor and >50% good.
- A $106 million annual investment in NHS bridges will enable MDOT to meet its targets, and there is no performance gap.

For State-Maintained Non-NHS bridges:

- The current condition is 3% poor and 65% good by deck area.
- MDOT anticipates making an investment of $59 million per year on State-maintained Non-NHS bridges.
- At this investment level, the future condition will be 4% poor and 61% good.
- The target performance for Non-NHS bridges is <5% poor and >50% good.
- A $59 million annual investment in Non-NHS bridges will enable MDOT to meet its targets, and there is no performance gap.

Table 32 summarizes the findings of the bridge performance gap analysis for NHS bridges. MULTIPLAN 2045 allocated resources for all State-maintained bridges. The goal of the FHWA Final Rulemaking for Asset Management Plans & Processes is to achieve and sustain assets in a "state of good repair". To remain consistent with this concept, we have identified all bridges on our inventory that would require either repair or replacement to reach an NBI Condition Classification of "Good". This results in a total of 1,952 bridges as of the 2021 NBI Submittal date of October 26, 2021. In summary, a backlog exists and the backlog amount is calculated by using MDOT's approach to estimating replacement value for all bridges categorized as poor, and 20 percent of replacement value to rehab all bridges categorized as fair. These 1,952 bridges result in a needs backlog of $2.5 billion, which comes from:

- Replace All Poor Bridges: $592 million.
- Repair All Fair Bridges at 20 percent of Replacement Cost: $1.87 billion.

Table 32. NHS and Non-NHS Bridge Performance Gap Summary

	NHS Bridges	State-Maintained Non-NHS Bridges
Actual Investments June 2020-May 2021	$50.1 m	$43.5 m
2020 Condition (Bridge deck area)	2.3% poor 57% good	2.9% poor 65% good
Four-Year Target (Bridge deck area)	<5% poor >50% good	<5% poor >50% good
Estimated 10-Year Annual Spend Based on Expected Budget	$106 m	$59 m
Condition After 10-Years Based on Expected Budget (Bridge deck area)	2.5% poor 50% good	3.6% poor 61% good
Additional Investment Needed to Close the Performance Gap (Bridge deck area)	Target Met, No Gap	Target Met, No Gap

Source: MDOT 2019 TAMP Implementation Report, 2021. Dollar values do not include engineering, right-of-way, preconstruction, and additional maintenance costs.

Investments by Work Type

For the proposed spending scenarios, the investment by work type for the NHS and non-NHS bridges are summarized in Table 33 and Table 34. Derivation of preservation, rehabilitation, reconstruction, and maintenance costs are described in Appendix B.

Table 33. Estimated Bridge Investments by Work Type, NHS

Year	Preservation	Rehabilitation	Reconstruction	Maintenance	Total
2022	13.6 m	79.1 m	13.6 m	5.0 m	111.3 m
2023	6.1 m	80.4 m	17.3 m	5.0 m	108.9 m
2024	3.0 m	42.3 m	42.8 m	5.0 m	93.1 m
2025	11.2 m	51.6 m	44.6 m	5.0 m	112.4 m
2026	2.1 m	83.1 m	36.5 m	5.0 m	126.7 m
2027	10.3 m	37.7 m	51.1 m	5.0 m	104.0 m
2028	9.3 m	13.7 m	33.0 m	5.0 m	61.1 m
2029	9.7 m	21.1 m	9.7 m	5.0 m	45.5 m
2030	8.1 m	23.1 m	112.6 m	5.0 m	148.9 m
2031	6.4 m	27.9 m	108.7 m	5.0 m	148.0 m
Total	**80.0 m**	**460.0 m**	**469.9 m**	**50.0 m**	**1059.9 m**

Source: MDOT.

Table 34. Estimated Bridge Investments by Work Type, Non-NHS

Year	Preservation	Rehabilitation	Reconstruction	Maintenance	Year Total
2022	7.5 m	27.1 m	14.1 m	5.0 m	53.7 m
2023	2.8 m	11.8 m	36.5 m	5.0 m	56.1 m
2024	2.9 m	3.6 m	60.4 m	5.0 m	71.9 m
2025	3.1 m	3.5 m	41.0 m	5.0 m	52.6 m
2026	4.2 m	6.6 m	23.0 m	5.0 m	38.7 m
2027	5.2 m	11.1 m	39.2 m	5.0 m	60.6 m
2028	7.6 m	22.6 m	68.7 m	5.0 m	103.9 m
2029	3.4 m	27.3 m	83.8 m	5.0 m	119.5 m
2030	2.2 m	8.1 m	0.8 m	5.0 m	16.1 m
2031	1.7 m	5.8 m	4.5 m	5.0 m	17.0 m
	40.6 m	**127.4 m**	**372.1 m**	**50.0 m**	**590.1 m**

Source: MDOT.

7.0 Financial Plan

This financial plan illustrates the financial state of MDOT and identifies financial needs for the 10-year period. It explains the funding sources and available revenues to support TAM, funding needs to achieve MDOT's goals, objectives, and targets, and an estimated value of MDOT's pavements and bridges. MDOT has developed a more detailed revenue forecast that serves as the basis for this chapter.

7.1 Revenue Acquisition

Transportation in Mississippi is primarily funded from Federal funds and State revenues collected from taxes and fees related to the transportation sector. In total, MDOT received more than a billion dollars in FY2020. Of that billion, about 56 percent of funds come from the Federal government ($592.4m) and the remaining 44 percent from dedicated State taxes and fees ($463.3m).[12]

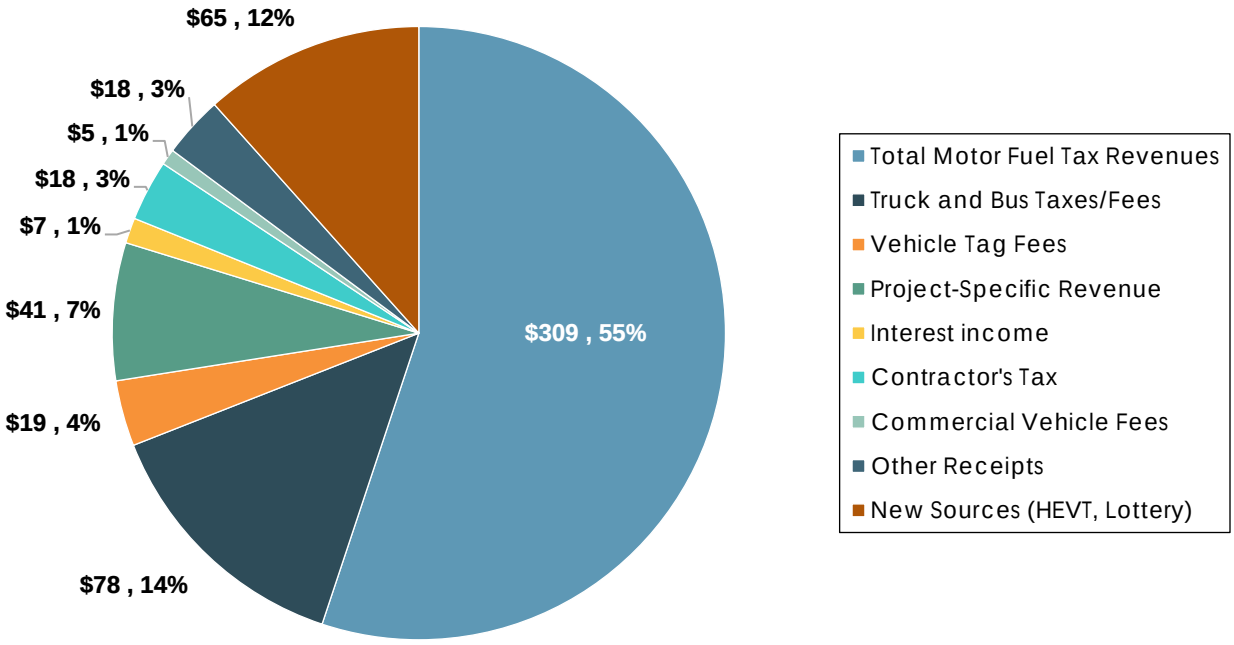
Under the Mississippi statutes, MDOT receives funding through dedicated State taxes and fees derived from several sources, including:

- **Motor fuel tax** (at 18 cents per gallon, it is the major revenue source of which MDOT receives about 70 percent).
- **Truck and bus taxes/fees**, including truck and privilege tax, weight and size permits, and trip permits.
- **Vehicle tag fees** of $5 per vehicle.
- **Other revenue sources**:
  - Contractor's tax assessed at 3.5 percent of certain highway construction contracts.
  - Other receipts (including transfers from other funds; receipts for other licenses, fees, and permits; reimbursements and donations; lubricating oil tax; sales of supplies and services; and others.).
  - Interest income.
  - Project-specific revenue.
  - Commercial vehicle fees.
- **New sources** (including lottery funds and the hybrid electric vehicle tax (HEVT)).

[12] MDOT Annual Report

Figure 21 shows the distribution of revenue streams available to MDOT in FY2021. Motor fuel taxes account for 55 percent, truck and bus fees account for 14 percent, and new sources account for 12 percent.

Figure 21. FY2021 State Fund Revenues for MDOT (millions)



Source: MDOT Annual Report and Statement of Appropriations (FY2021).

7.2 Overall Distribution of Revenue

In FY2020, MDOT's actual expenditures were **$1,165 million.** As presented in Table 35, **$907.3 million** was spent on State-maintained roads and bridges. Expenditures not related to State-maintained roads and bridges include:

- **Transfers for other purposes** were for state-mandated transfers which include harvest permit revenues and overweight fines to counties, beaver control to the Mississippi Department of Agriculture and Commerce (MDAC), welcome center operations to the Mississippi Development Authority (MDA), antilitter to Keep MS Beautiful, and Multimodal Fund transfers.
- **Federal grant pass-throughs** included Federal Transit Administration grants to public transit providers and Federal Aviation Administration payments.
- **Transfers for local road and bridge systems** included Federal Highway Administration pass-throughs to State Aid and local governments for local road and bridge systems.

- **Business support** included support and oversight functions including executive management, financial management, budget, procurement, asset management, audit, human resources, public affairs, and information systems.
- **Debt service** includes payments for financing transportation using bond proceeds.

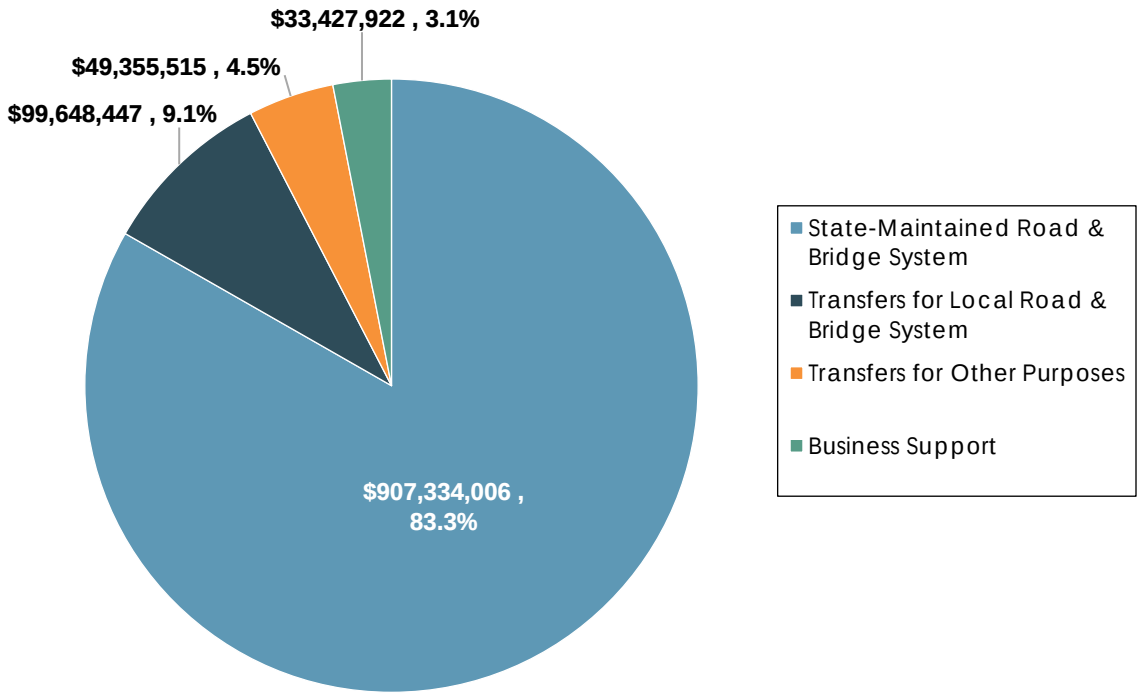
Table 35. MDOT FY2020 Disbursements (Nominal millions)

Expenditure	FY2020 ($ millions)
State-maintained Road & Bridge System	$907.3
Transfers for Local Road & Bridge System	$99.6
Transfers for Other Purposes	$49.4
Business Support	$33.4
Debt Service	$74.4
Total Disbursements	**$1,164.1**

Source: MDOT Annual Reports.

Figure 22 displays the allocations of MDOT's FY 2020 funds.

Figure 22. FY2020 MDOT Funding Allocation



Source: MDOT Annual Report and Statement of Appropriations (2020).

Table 36 describes how MDOT invested the revenue on NHS pavements and bridges, categorized by the FHWA work types.

Table 36. MDOT Spending June 2020–May 2021, Millions of Nominal Dollars

Expenditure	Interstate Pavement	NHS Non-Interstate Pavement	State-Maintained Non-NHS 4 Lane Pavement	State-Maintained Non-NHS 2 Lane Pavement	NHS Bridges	Non-NHS Bridges	Total
Maintenance	$0.5	$1.6	$0.0	$4.5	$1.1	$0.4	**$8.1**
Preservation	$26.9	$73.5	$0.0	$129.4	$7.9	$1.4	**$239.1**
Rehabilitation	$12.9	$12.6	$0.0	$0.3	$35.1	$6.9	**$67.8**
Reconstruction	$0.0	$0.0	$0.0	$6.3	$6.0	$34.8	**$47.1**
Construction	$0.0	$0.0	$42.7	$0.0	$0.0	$0.0	**$42.7**
Total	**$40.3**	**$87.7**	**$42.7**	**$140.5**	**$50.1**	**$43.5**	**$404.8**

Source: MDOT.

7.3 Future Funding Levels

This section provides a summary of the data sources and assumptions used to generate the financial revenue forecasts for transportation investments in Mississippi. Revenue forecasts are presented for the programming tier: 2022-2031 as well as to 2047 to align with the planning horizon in the MDOT MULTIPLAN 2045.

The forecasts are based on current state and Federal funding programs projected into the future. Emphasis was placed on two primary Federal funding sources: the FHWA and FTA programs as administered through the Fixing America's Surface Transportation (FAST) Act (Pub. L. No. 114-94) and two major State revenue sources: motor fuel excise tax (MFT) revenues and truck/bus tax revenues.

Federal Revenue Forecast

FHWA provides funding for a variety of surface transportation programs, while the FTA provides financial and technical assistance to support the local public transit systems. Federal funding, although higher in some years based on project needs and other reimbursements such as hurricane relief, has remained fairly constant, averaging $562 million per year (2011-2021).

Table 37 presents the estimated Federal funding (FHWA and FTA) for 2022-2047. The escalation rate of 0.53 percent per year was used to forecast Federal funding out to 2047.

Table 37. Projected Federal Funding (FHWA and FTA) to the State of Mississippi, (Nominal and 2022 millions)

	Gross Revenue	
Programming Tiers	Nominal Dollars	2022 Dollars
2022-2031	$6,132	$5,529

Programming Tiers	Gross Revenue	
	Nominal Dollars	2022 Dollars
2032-2041	$6,465	$4,619
2042-2047	$4,046	$2,398
Total	**$16,643**	**$12,546**

Source: Cambridge Systematics from MDOT Annual Reports

Total Federal funding is estimated at $16,643 million nominal for the 2022-2047 period ($640 average per year) or $12,546 million in 2022 dollars for the 2022-2047 period ($483 average per year).

State Revenue Forecast

MDOT revenues from State sources increased in nominal dollars from $504 million in 2011 to $566 million in 2021, a compound average increase of 1.2 percent per year (Table 38). State revenues are subject to changes in statutory fee, tax rates, and the use of fuels or the transportation system. To account for this, the revenue forecasts calculate annual growth rates in revenue based on statistical trends of historical revenues from 2011-2021, except where noted. R*evenue from interlocal proceeds ended in 2021 and project-specific revenue streams started in 2019.*

Table 38. Historic State Revenues to MDOT (Nominal millions)

State Revenues	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Trend or Assumed Annual Growth Rate for Forecast
Total Motor Fuel Tax Revenues	$289.39	$288.88	$283.27	$286.18	$283.35	$315.77	$303.80	$300.30	$306.10	$292.30	$308.50	0.62%
Truck and Bus Taxes/Fees	$60.58	$63.24	$64.50	$67.15	$70.28	$69.05	$68.60	$70.20	$75.10	$72.30	$78.00	1.53%
Vehicle Tag Fees	$14.91	$15.41	$15.49	$15.41	$15.75	$15.91	$14.20	$19.50	$18.30	$17.70	$19.40	1.71%
Interest income	$6.26	$5.76	$5.59	$4.64	$5.78	$5.94	$5.92	$6.01	$7.03	$4.72	$7.49	0%
Project Specific Revenue									$40.94	$44.80	$40.62	0%*
Contractor's Tax	$9.12	$3.12	$5.86	$4.01	$21.46	19.45	$16.26	$14.86	$17.05	$14.13	$18.49	4.27%
Commercial Vehicle Fees	$4.25	$1.32	$4.21	$2.66	$7.06	$4.66	$4.58	$4.38	$7.67	$3.83	$4.86	3.86%
Other Receipts									$12.49	$9.98	$18.09	1.00%*
New Sources (HEVT, Lottery)										$5.00	$70.44	see note[13]

*Note: * Growth rate assumed*

Source: Cambridge Systematics from MDOT Annual Reports and correspondence with MDOT.

[13] EV/HEV Growth average 4.49% annual increase; Sports betting 1% annual increase; Lottery revenue $80 million annually 2022-2028.

MDOT Net Revenue Forecast

Table 39 summarizes the financially constrained or expected revenue estimates (in nominal dollars) for highway programs from 2022-2047. The net funding (after debt obligations and other non-construction program expenditures are subtracted) expected to be available from Federal and State sources is estimated at $20,554 million in nominal or "current year" dollars. This represents the amount available for the construction program. Of the $20,554 million available for construction projects, $17,898 is available for bridge and pavement projects (average of $688 million per year).

In constant FY2022 dollars (using a 2.3% annual discount rate)[14], the net funding expected to be available from Federal and State sources available for the construction program is estimated at $15,379 million of which $13,401 is available for bridge and pavement projects (Table 40)-an average of $515 million annually for bridge and pavement projects (Table 41).

Table 39. Mississippi Expected Transportation Revenue Projections (Nominal Millions)

	MDOT Funding					
Programming Tiers	Federal	State	Total Gross Funding	Net Funding for Construction	Safety, Operations, Capacity Programs	*Net Funding for Bridge and Pavement Condition Programs
2022-2031	$6,132	$6,227	$12,359	$7,301	$1,023	$6,278
2032-2041	$6,465	$6,258	$12,723	$7,828	$1,075	$6,753
2042-2047	$4,046	$4,313	$8,359	$5,424	$558	$4,866
Total	**$16,643**	**$16,798**	**$33,441**	**$20,554**	**$2,656**	**$17,898**

*These amounts include approximately $25m - $35m for PE, ROW, utilities, inspection services, and scour evaluations

[14] Discount rate is based on log-term inflation forecasts for the U.S. https://knoema.com/kyaewad/us-inflation-forecast-2021-2022-and-long-term-to-2030-data-and-charts

Table 40. Mississippi Expected Transportation Revenue Projections, (2022 millions)

MDOT Funding						
Programming Tiers	Federal	State	Total Gross Funding	Net Funding for Construction	Safety, Operations, Capacity Programs	*Net Funding for Bridge and Pavement Condition Programs
2022-2031	$5,529	$5,628	$11,157	$6,589	$901	$5,688
2032-2041	$4,619	$4,467	$9,086	$5,584	$751	$4,833
2042-2047	$2,398	$2,547	$4,945	$3,206	$327	$2,879
Total	**$12,546**	**$12,643**	**$25,189**	**$15,379**	**$1,978**	**$13,401**

*These amounts include approximately $25m - $35m for PE, ROW, utilities, inspection services, and scour evaluations

Table 41. Mississippi Average Annual Transportation Net Revenue Projections ($millions)

	*Average Annual Net MDOT Funding Available for Bridge and Pavement Condition Programs	
Programming Tiers	Nominal Dollars	2022 Dollars
2022-2031	$628	$569
2032-2041	$675	$483
2042-2047	$811	$480
Total	**$688**	**$515**

*These amounts include approximately $25m - $35m for PE, ROW, utilities, inspection services, and scour evaluations

7.4 Valuation of Assets

MDOT uses the replacement cost method to estimate the value of its pavement assets. This method measures the cost to replace the existing asset with a new one. Average reconstruction unit costs were applied to the assets by lane-miles.

To evaluate the value of the structures in Mississippi, MDOT used an adjusted value with respect to condition threshold method. The replacement cost of the structures was first calculated, then using the current condition of the structures, the value was reduced. Structures with an overall structure condition of nine were valued at 100 percent of the replacement cost. Structures with an overall structure condition of three or less were valued at zero percent of the replacement costs. Between structure conditions of nine and three, the replacement cost was linearly reduced. The formulas and reference tables for the structure replacement cost and adjustment factor calculations are shown in Table 42.

$$\text{Replacement Cost} = \frac{\text{Existing Bridge Deck Area} \times \text{New Length Factor} \times \text{Unit Cost}}{\text{Bridge Cost Fraction}}$$

Table 42. Structure Replacement Cost Reference Tables

Existing Bridge Length	New Length Factor	Bridge Cost Fraction
1	2	0.30
60	2	0.32
100	1.3	0.35
2000	1.05	0.40

Highway System	Unit Cost ($/ft^2)
NHS	102
Non-NHS	81

https://www.fhwa.dot.gov/bridge/nbi/sd2020.cfm

$$\text{Adjusted Value} = \text{Replacement Cost} \times \frac{\text{Current Condition} - \text{Worst Acceptable Condition}}{\text{Best Condition} - \text{Worst Acceptable Condition}}$$

Where:

Worst Acceptable Condition = 3

Best Condition = 9

MDOT estimates the value of the TAMP assets at $50.1 billion in 2022 dollars (Table 43). This value covers all existing pavements, bridges on the NHS, and bridges on the Non-NHS and maintained by the Department.

Table 43. Value of Transportation Assets

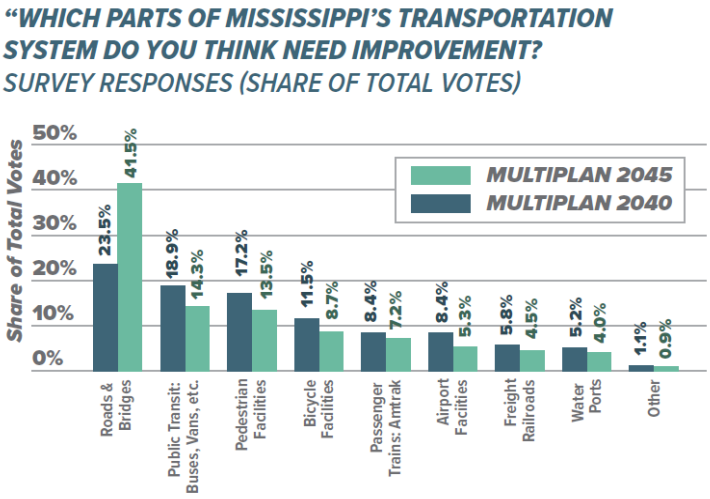
TAMP Asset	Value (2022 dollars)[1]
Pavements	$34.9 billion
Bridges	$15.2 billion
Total	$50.1 billion

[s1] *Estimate excludes Preliminary Engineering (PE), Construction Engineering and Inspection (CE&I) services, and right-of-way (ROW). Source: MDOT.*

8.0 TAMP Investment Strategies

MULTIPLAN 2045, the statewide long range transportation plan, determined the vision of Mississippi's future transportation system. The plan describe how MDOT will strategically allocate resources to address the challenges and strive to meet its transportation goals. Based on extensive feedback received from participants and stakeholders of MULTIPLAN, MDOT determined investment strategies to achieve the desired level of asset condition and system performance. This feedback is summarized in Figure 23.

Figure 23. MULTIPLAN 2045 Improvement Needs



Source: MULTIPLAN Public Opinion Survey Results, March 2019

The MULTIPLAN 2045 planning process resulted in a focus on the maintenance and preservation of the transportation system. Several funding scenarios were considered, an expected budget and an adequate budget, to facilitate a discussion on priorities and tradeoffs with the community. NHS bridges and pavements remained a priority and that the remainder of the State-maintained system was envisioned to continue to deteriorate, under constrained budget expectations.

Due to restricted funding, MDOT has minimal resources to invest in locally-maintained pavements. Therefore, local programs that support improvements to the NHS are encouraged. One practice that MDOT recognizes as supporting the Federal requirements by a local entity is the adoption of selection criteria by the Jackson, Gulf Regional Planning Commission and Memphis MPOs that emphasizes NHS routes. Project submittal guidelines for these MPOs give NHS priority, either serving as a tie-breaker or additional points received for projects located on the NHS. These practices encourages jurisdictions to consider projects on NHS bridges or roadways to secure funding. Local-owned NHS pavement and bridges outside of the MPO are supported by the Mississippi State Aid Road Program and the MDOT Multimodal Transportation Improvement Program where applicable.

This section describes MDOT's decision process for making investments in its assets. To invest in its assets, MDOT:

- **Makes the annual case for revenue to the legislature.** State funds available to MDOT are appropriated by the Mississippi State legislature. Over the past several years, MDOT has made an effort to educate and inform the legislative process through the submission of annual budget requests and meetings to explain the agency's needs. The budget request is typically a level-request, with the total funding request in line with the anticipated Federal appropriations and State tax revenue receipts.

  There also have been recent bond issues authorized by the Legislature, including $162 million to replace bridges in 2015, and the Emergency Road & Bridge Repair Funds, which are tax-exempt bonds issued in 2018 and awarded through a competitive grant process to repair bridges. In 2021, the Mississippi Legislature established the Emergency Road and Bridge Repair Fund to revitalized public roads and bridges across the state. The Legislature provided up to $250 million to fund the program and another $89 million were earmarked from the federal Coronavirus Response and Relief Supplemental Appropriations Act of 2021. The fund awarded over $112 million focused on improving the conditions of bridges.

- **Allocates revenue to pavements, bridges, and other programs.** MDOT conducts performance and tradeoff analyses among competing needs to develop performance-based funding allocations. For constrained funding scenarios, MDOT selects the asset management investment strategy that best aligns with State and Federal performance targets; public and stakeholders' desire for asset condition; and MDOT's priority to maximize overall system performance and achieve the highest return on investments. Some general rules govern resource allocation among asset classes:

  MDOT is risk-aware. Section 5 presents MDOTs comprehensive risk register. The register identifies risks that could impede the department to achieve its asset management objectives. MDOT has assigned responsibility for oversight of the risk registers to each of the asset types' leads. They will be responsible for the integration of the risk registers into ongoing decision-making.

  MDOT uses FHWA funds and the State match to make safety investments.

  MDOT minimizes closed bridges. Bridge funding decisions are driven by the condition of the bridge, and the desire to minimize the closure of bridges. There are currently over 350 closed bridges in the State; about 11 of the closed bridges are State-maintained. Eight of the closed State-maintained bridges is due to an active replacement. Following the bond issues in 2015, 2018, and 2021, bridge conditions improved and have allowed MDOT to shift focus toward preservation work.

  MDOT replaces all timber bridges and those that are – under current guidelines – posted for load limits. Currently, MDOT has 233 posted bridges and 8 timber

structures. Posted bridges impact the State's economy by limiting the efficient movement of goods. Timber structures require more maintenance to ensure their structural integrity. MDOT timber bridge program has significantly reduced the number of timber bridges.

MDOT makes bridges the first priority for state of good repair work. MDOT recognizes that a bridge failure is more critical than a pavement failure, so it prioritizes bridges while making sure pavement condition remains acceptable.

MDOT makes Interstates the second priority for state of good repair, followed by 4-lane roads, and then 2-lane roads. Because Interstates provide the mobility infrastructure in the State, MDOT prioritizes them over four- and 2-lane roads. MDOT invests in Interstates to maintain the existing condition, then invests in 4-lane roads (most of which are on the NHS), and finally invests in 2-lane roads.

MDOT makes other investments during project work. MDOT makes investments in safety, bicycle, pedestrian infrastructure during its bridge and pavement reconstruction work.

MDOT does not typically make investments in capacity expansion projects unless the project is written into the funding bill by the Legislature or awarded a grant.

- **Allocates revenue to replacement, preservation, and maintenance.** Chapter 4 provides a detailed description of how the Research, Maintenance, and Bridge Divisions work with the Districts to make decisions about project work. There are some general rules that MDOT and its Districts follow when allocating resources among work types:

  The State selects one or two Interstate bridges every year for widening and preservation work.

  Each District must spend at least 10 percent of its 2-lane and 4-lane budget for pavements on preventive maintenance treatments. This 10 percent mandate is specifically for pavement preservation and maintenance treatments, however, due to issues of deterioration, Districts at times, often incorporate more than the required 10 percent to stretch their sub-allocated money further. It is important to note that there is no preservation requirement for the remaining 90 percent.

  Each District is given an equal portion of bridge preventive maintenance funds. Preventive maintenance funding is set aside and split evenly among the Districts. Bridge preventive maintenance activities include cyclical maintenance (e.g., bridge washing) and corrective maintenance (e.g., Bearing area restoration or replacement).

9.0 TAMP Implementation and Integration

This TAMP is the product of an ongoing commitment to asset management for MDOT. MDOT's TAM Working Group has been meeting regularly for several years to coordinate on TAM issues and lay the foundation for the TAM processes, strategies, and goals documented within this TAMP. MDOT will use the TAM Working Group as the foundation for implementation of the TAMP. The group will continue to meet regularly.

Implementation of the TAMP occurs in coordination with the Statewide Transportation Investment Plan (STIP), a four-year investment strategy for MDOT. Both the TAMP and the STIP are guided by the statewide Long Range Transportation Plan, MULTIPLAN 2045, providing the vision and goals for transportation investments over a 25-year horizon. The alignment of these plans, across short-, mid-, and long-term timeframes ensures that the community's goals for transportation are reflected in the investment decisions.

MDOT and the TAM Working Group document progress and consistency with these goals, and the TAM investment strategies, each year through the Annual Consistency Determination process with FHWA. That annual process documents the planned and actual levels of investments are aligned and explain any differences, if those arise.

MDOT's major TAM enhancements include:

- **Pavement Management System Refinement.** As noted in Section 4.0, MDOT is implementing dTIMS as its PMS. The development and use of a PMS greatly strengthens MDOT's ability to develop treatments and strategies that account for the whole life-cycle of State-maintained pavement assets. MDOT used TAM to guide the development of its workflows as it implements the PMS. Future refinement of the PMS will support MDOT's TAM efforts.

- **Bridge Management System Refinement.** As noted in Section 4.0, MDOT is implementing AASHTOWare BrM as its BMS. The BMS enables MDOT to assess bridge deterioration at the element level and make optimal recommendations for maintenance, preservation, and replacement work.

- **Strengthening Processes to Monitor Non-State-maintained NHS Assets.** MDOT identified non-State-maintained assets on the NHS as a potential risk. MDOT has limited oversight and management responsibilities on these assets and, therefore, has limited ability to ensure data are reliable and that performance issues are addressed effectively. MDOT will be required to report performance on these assets and will, as part of this process, look for opportunities to improve monitoring.

- **Local NHS Owner Coordination.** MDOT has developed written agreements with the MPOs that outline the responsibilities for collecting, sharing, and reporting data. Further assessment of opportunities to coordinate with the Office of State Aid, counties and cities outside of the urbanized areas will be an ongoing process as performance issues are identified.

- **Create New Tools to Support Asset Data Integration and Develop an Information Portal.** MDOT has been looking for opportunities to strengthen data and information across asset groups. Improvements to data management systems are continuously evaluated to improve asset management practices in the areas of data collection and management, life-cycle cost analysis, improved project and maintenance cost estimating, as well as other benefits.

- **Optimize Linkages between the LRTP, the TAMP, and the STIP.** This TAMP has evolved from an LRTP effort. Through the LRTP implementation, MDOT ensures the connection between the TAMP and LRTP remain strong. MDOT will work to ensure the TAMP plays a role in shaping the STIP and, over time, develop a planning cycle that ensures these three major planning efforts are consistent and effective in supporting Mississippi's goals.

- **Continue Use of Asset Information Portal.** MDOT has developed a Public Accountability Transportation Hub (PATH) site to provide an interactive visual analysis of historical and current conditions of roads and bridges throughout the state of Mississippi. It is available online at https://path.mdot.ms.gov/. MDOT will work to keep this portal updated to keep the public and interested stakeholders informed on the inventory and condition of MDOT's infrastructure.

- **Amend or modify the Plan as Needed.** MDOT will continue to evaluate this plan against current information and the documented processes it contains throughout the life of the plan. Amendments or modifications will be completed as needed in coordination with FHWA.

APPENDIX A. REQUIRED ELEMENTS

Table 44. Development and Implementation Consistency Required Elements and Corresponding TAMP Content Locations

Indicators the TAMP Meets Element Requirements in 23 U.S.C. 119(e) and 23 CFR Part 515	Chapter	Page Number	Notes
TAMP approved by head of State DOT (23 CFR 515.9(k))			
Does the TAMP bear the signature of the head of the State DOT?	See attached letter bearing Executive signature requesting certification		Approval and adoption of TAMP May 10
State DOT has developed its TAMP using certified processes (23 CFR 515.13(b))			
Do the process descriptions align with the FHWA-certified processes for the State DOT? [If the process descriptions do not align with the FHWA-certified processes, the State DOT must request recertification of the new processes as amendments unless the changes are minor technical corrections or revisions with no foreseeable material impact on the accuracy and validity of the processes, analyses, or investment strategies. State DOTs must request recertification of TAMP development processes at least 30 days prior to the deadline for the next FHWA TAMP consistency determination as provided in 23 CFR 515.13(c).]	1.2, 3.3, 4.1, 4.2	2, 24, 30, 36	
Do the TAMP analyses appear to have been prepared using the certified processes?	1.2, 3.3, 4.1, 4.2	2, 24, 30, 36	
TAMP includes the required content as described in 23 CFR 515.9(a)–(g) (23 CFR 515.13(b))			
Does the TAMP include a summary listing of NHS pavement and bridge assets, regardless of ownership?	ES, 2.1, 3.1	ES-2-6, 9, 21	
Does the TAMP include a discussion of State DOT asset management objectives that meets requirements?	1.3	4	
Does the TAMP include a discussion of State DOT measures and targets for asset condition, including those established pursuant to 23 U.S.C. 150, for NHS pavements and bridges, that meets requirements?	2.4, 3.4	18, 28	
Does the TAMP include a summary description of the condition of NHS pavements and bridges, regardless of ownership, that meets requirements?	2.3, 3.3	12-18, 24-28	
Does the TAMP identify and discuss performance gaps?	6	68-76	
Does the TAMP include a discussion of the life-cycle planning that meets requirements, including results?	4	30-51	
Does the TAMP include a discussion of the risk management analysis that meets requirements that includes weather and resiliency as required by Bipartisan Infrastructure Law (BIL)?	5	52-67	

Indicators the TAMP Meets Element Requirements in 23 U.S.C. 119(e) and 23 CFR Part 515	Chapter	Page Number	Notes
Does the TAMP include the results of the evaluations of NHS pavements and bridges pursuant to 23 CFR Part 667?	5.1, 5.3	55, 63	
Does the TAMP include a discussion of a 10-year Financial Plan to fund improvements to NHS pavements and bridges?	ES, 6-8	ES-4, ES-7, 68-88	
Does the TAMP identify and discuss investment strategies the State intends to use for their NHS pavements and bridges?	ES, 6-8	ES-4, ES-7, 68-88	
Does the TAMP include a discussion as to how the investment strategies make or support progress toward achieving and sustaining a desired state of good repair over the life cycle of the assets?	4	30-51	
Does the TAMP include a discussion as to how the investment strategies make or support progress toward improving or preserving the condition of the assets and the performance of the NHS related to physical assets?	ES, 6, 8	ES-4, ES-7, 68-88	
Does the TAMP include a discussion as to how the investment strategies make or support progress toward achieving the State's targets for asset condition and performance of the NHS in accordance with 23 USC 150(d)?	ES, 6, 8	ES-4, ES-7, 68-88	See Table 1, 19, 21
Does the TAMP include a discussion as to how the investment strategies make or support progress toward achieving the national goals identified in 23 USC 150(b)?	ES, 6, 8	ES-4-7, 68-88	See Table 1, 19, 21
Does the TAMP include a discussion as to how the TAMP's life-cycle planning, performance gap analysis, and risk analysis support the State DOT's TAMP investment strategies?	8	86-88	
Inclusion of Other Assets in the TAMP in 23 CFR 515.9 (l)			
Inclusion of Other Assets in the TAMP in 23 CFR 515.9 (l):	2-3	8-29	
If applicable, does the TAMP include a summary listing of other assets, including a description of asset condition?	ES, 2, 3	ES-2-6, 8-29	
If applicable, does the TAMP identify measures and State DOT targets for the condition of other assets?	2-3	8-29	No other NHS assets are included in the plan. However non NHS state maintained pavements and bridges are included.
If applicable, does the TAMP include a performance gap analysis for other assets?	6	68-76	Includes verbiage that addresses the performance gaps
If applicable, does the TAMP include a discussion of life cycle planning for other assets?	4	30-51	

Indicators the TAMP Meets Element Requirements in 23 U.S.C. 119(e) and 23 CFR Part 515	Chapter	Page Number	Notes
If applicable, does the TAMP include a discussion of a risk analysis for other assets that meets requirements in 23 CFR 515.9(l)(5)?	3	21-29	
If applicable, does the TAMP include a financial plan to fund improvements of other assets?	ES, 6-8	ES-4, ES-7, 68-88	See Table 2, 20, 21
If applicable, does the TAMP include investment strategies for other assets?	ES, 6-8	ES-4, ES-7, 68-88	See Table 2, 20, 21
Integration of TAMP into transportation planning processes that lead to the Statewide Transportation Improvement Program (STIP) (23 CFR 515.9(h))			
Do State DOT planning documents or records of planning activities show that the TAMP was integrated into its transportation planning processes that lead to the STIP?	See STIP and Implementation Report		
TAMP available to the public (23 CFR 515.9(i))			
Has the State DOT made its TAMP available to the public by posting on its website, or distributing in public meetings, or by some other means?	https://mdot.ms.gov/portal/documents		
State DOT demonstrates through current and verifiable documentation that it has implemented a TAMP meeting requirements of 23 U.S.C. 119 and 23 CFR Part 515 and that the State DOT is following the investment strategies in the TAMP (23 CFR 515.13(b)(2)).			
Has the State DOT documented evidence that the State DOT is using the TAMP investment strategies? (23 CFR 515.13(b)(2)). The best evidence is that, for the 12 months preceding the consistency determination, there was alignment between the actual and planned levels of investment (in the TAMP) for various work types as defined in 23 CFR 515.5 (i.e., initial construction, maintenance, preservation, rehabilitation and reconstruction) (23 CFR 515.13(b)(2)(i))?	Appendix C		Submitted to FHWA before the June 30, 2021 deadline.
If the State DOT deviated from the TAMP investment strategies, did they document reasons the deviation(s) were necessary due to extenuating circumstances beyond the State DOT's reasonable control3 (23 CFR 515.13(b)(2)(ii)).	Appendix C		The Implementation report illustrates that the investment strategy in the initial TAMP was implemented for June 1, 2020 – May 31, 2021.
Division Assessment			
The TAMP was developed using certified processes, includes the content required by 23 CFR 515.9, and is consistent with other applicable requirements in 23 CFR part 515.(23 CFR 515.13(b)(1)).	1.2, 3.3, 4.1, 4.2	2, 24, 30, 36	

Indicators the TAMP Meets Element Requirements in 23 U.S.C. 119(e) and 23 CFR Part 515	Chapter	Page Number	Notes
The State DOT implemented the TAMP (23 CFR 515.13(b)(2)).	Appendix C		The Implementation report illustrates that the investment strategy in the initial TAMP was implemented for June 1, 2020 – May 31, 2021.

APPENDIX B. WORK TYPE UNIT COSTS

The unit costs used as inputs to the PMS and BMS are shown in Table 45 and Table 46. These costs are shown in current dollars ($2022) and are derived from historical project costs let by MDOT. Mississippi monitors changes in project costs using their Mississippi Highway Construction Indexes. In a memorandum dated December 22, 2020 from the State Estimator to the Chief Engineer, the MDOT Construction Cost Indexes were reported for each calendar year from 1987 through 2020. The construction price trends are tracked for six items: roadway excavation, hotmix asphalt pavement, concrete pavement, reinforcing steel, structural steel, and bridge concrete. These items are tracked individually and compositely. At the composite level, the index increased 40 percent between 2018 and 2019 and 5 percent between 2019 and 2020. Using the National Highway Construction Cost Index (NHCCI), prices have increased 12 percent between the third quarter of 2021 and the fourth quarter of 2020.[15]

Table 45. Bridge Unit Costs

Action	Element	Element Description	Cost	Units	Condition	Cost Adjustment *
Deck Replacement	12	Reinforced Concrete Deck	$150	sq ft	Replace	1.1
	13	Prestressed Concrete Deck	$150	sq ft	Replace	1.1
	15	Prestressed Concrete Top Flange	$150	sq ft	Replace	1.1
	16	Reinforced Concrete Top Flange	$150	sq ft	Replace	1.1
	300	Strip Seal Joint Seal	$52	ft	Replace	1.1
	301	Pourable Joint Seal	$52	ft	Replace	1.1
	302	Compression Joint Seal	$52	ft	Replace	1.1
	303	Assembly Joint w/ Seal	$66	ft	Replace	1.1
	304	Open Expansion Joint	$52	ft	Replace	1.1
	305	Assembly Joint w/o Seal	$66	ft	Replace	1.1
	306	Other Joint	$51	ft	Replace	1.1
	320	Prestressed Concrete Approach Slab	$55	sq ft	Replace	1.1

[15] FHWA National Highway Construction Cost Index (NHCCI) https://www.fhwa.dot.gov/policy/otps/nhcci/

Action	Element	Element Description	Cost	Units	Condition	Cost Adjustment *
	321	Reinforced Concrete Approach Slab	$55	sq ft	Replace	1.1
	331	Reinforced Concrete Bridge Rail	$55	ft	Replace	1.1
Deck Repair	12	Reinforced Concrete Deck	$25	sq ft	Improve	1.1
	13	Prestressed Concrete Deck	$25	sq ft	Improve	1.1
	15	Prestressed Concrete Top Flange	$25	sq ft	Improve	1.1
	16	Reinforced Concrete Top Flange	$25	sq ft	Improve	1.1
Deck Rehab	12	Reinforced Concrete Deck	$50	sq ft	Improve	1.1
	13	Prestressed Concrete Deck	$50	sq ft	Improve	1.1
	15	Prestressed Concrete Top Flange	$50	sq ft	Improve	1.1
	16	Reinforced Concrete Top Flange	$50	sq ft	Improve	1.1
	300	Strip Seal Joint Seal	$52	ft	Replace	1.1
	301	Pourable Joint Seal	$52	ft	Replace	1.1
	302	Compression Joint Seal	$52	ft	Replace	1.1
	303	Assembly Joint w/ Seal	$66	ft	Replace	1.1
	304	Open Expansion Joint	$52	ft	Replace	1.1
	305	Assembly Joint w/o Seal	$66	ft	Replace	1.1
	306	Other Joint	$51	ft	Replace	1.1
Deck Healer/Sealer	510	Wearing Surface	$5	sq ft	Create	1.1
Joint Rehab	300	Strip Seal Joint Seal	$52	ft	Replace	1.1
	301	Pourable Joint Seal	$52	ft	Replace	1.1
	302	Compression Joint Seal	$52	ft	Replace	1.1
	303	Assembly Joint w/ Seal	$66	ft	Replace	1.1
	304	Open Expansion Joint	$52	ft	Replace	1.1
	305	Assembly Joint w/o Seal	$66	ft	Replace	1.1
	306	Other Joint	$51	ft	Replace	1.1

Action	Element	Element Description	Cost	Units	Condition	Cost Adjustment *
Bearing Replacement	310	Elastomeric Bearing	$2,500	each	Replace	1.1
	311	Moveable Bearing	$5,000	each	Replace	1.1
	312	Enclosed Bearing	$8,000	each	Replace	1.1
	313	Fixed Bearing	$5,000	each	Replace	1.1
	314	Pot Bearing	$5,000	each	Replace	1.1
	315	Disk Bearing	$5,000	each	Replace	1.1
	316	Other Bearing	$2,500	each	Replace	1.1
Spot Paint	515	Steel Protective Coating	$12	sq ft	Improve	1.1
Paint	515	Steel Protective Coating	$15	sq ft	Replace	1.1
Superstructure Repair	102	Steel Closed Box Girder	$500	ft	Improve	1.1
	104	Prestressed Concrete Closed Box Girder	$800	ft	Improve	1.1
	105	Reinforced Concrete Closed Box Girder	$800	ft	Improve	1.1
	107	Steel Open Girder/Beam	$500	ft	Improve	1.1
	109	Prestressed Concrete Open Girder/Beam	$350	ft	Improve	1.1
	110	Reinforced Concrete Open Girder/Beam	$350	ft	Improve	1.1
	113	Steel Stringer	$500	ft	Improve	1.1
	115	Prestressed Concrete Stringer	$80	ft	Improve	1.1
	116	Reinforced Concrete Stringer	$80	ft	Improve	1.1
	120	Steel Truss	$1,000	ft	Improve	1.1
	143	Prestressed Concrete Arch	$80	ft	Improve	1.1
	144	Reinforced Concrete Arch	$80	ft	Improve	1.1
	152	Steel Floor Beam	$500	ft	Improve	1.1
	154	Prestressed Concrete Floor Beam	$80	ft	Improve	1.1
	155	Reinforced Concrete Floor Beam	$80	ft	Improve	1.1
	202	Steel Column	$8,000	each	Improve	1.1

Action	Element	Element Description	Cost	Units	Condition	Cost Adjustment *
Substructure Repair	204	Prestressed Concrete Column	$8,000	each	Improve	1.1
	205	Reinforced Concrete Column	$8,000	each	Improve	1.1
	210	Reinforced Concrete Pier Wall	$215	ft	Improve	1.1
	215	Reinforced Concrete Abutment	$215	ft	Improve	1.1
	220	Reinforced Concrete Pile Cap/Footing	$215	ft	Improve	1.1
	225	Steel Pile	$4,500	each	Improve	1.1
	226	Prestressed Concrete Pile	$4,500	each	Improve	1.1
	227	Reinforced Concrete Pile	$4,500	each	Improve	1.1
	228	Timber Pile	$3,500	each	Improve	1.1
	229	Other Pile	$4,500	each	Improve	1.1
	233	Prestressed Concrete Pier Cap	$215	ft	Improve	1.1
	234	Reinforced Concrete Pier Cap	$215	ft	Improve	1.1
Culvert Rehab	241	Reinforced Concrete Culvert	$500	ft	Improve	1.1
Bridge Replacement			Calculated **		Replace	1.25
Culvert Replacement			Calculated **		Replace	1.25

*Note: * Cost estimates were determined pre pandemic. A multiplier was added to bring the costs closer to todays expected values.*
*** Cost is calculated based on projected replacement length/width.*

Source: MDOT.

Table 46. Pavement Unit Costs

Facility	Pavement Type	Treatment	TAMP Category	Cost per Lane-Mile
Interstate	FLEX	New	Reconstruction	$1,322,500.00
		Major	Rehabilitation	$575,074.00
		Minor	Preservation	$148,855.00
		PM	Preservation	$-

Facility	Pavement Type	Treatment	TAMP Category	Cost per Lane-Mile
FOURLANE	COMP	New	Reconstruction	$1,322,500.00
		Major	Rehabilitation	$575,074.00
		Minor	Preservation	$148,855.00
		PM	Preservation	$-
	JCP	New	Reconstruction	$1,500,000.00
		Major	Rehabilitation	$750,000.00
		Minor	Preservation	$750,000.00
		PM	Preservation	$-
	JRCP	New	Reconstruction	$1,500,000.00
		Major	Rehabilitation	$1,520,875.00
		Minor	Preservation	$661,335.10
		PM	Preservation	$-
	CRCP	New	Reconstruction	$1,520,875.00
		Major	Rehabilitation	$661,335.10
		Minor	Preservation	$500,000.00
		PM	Preservation	$-
	FLEX	New	Reconstruction	$1,087,500.00
		Major	Rehabilitation	$269,228.00
		Minor	Preservation	$148,854.00
		PM	Preservation	$45,584.00
	COMP	New	Reconstruction	$1,087,500.00
		Major	Rehabilitation	$269,228.00
		Minor	Preservation	$148,854.00
		PM	Preservation	$45,584.00
	JCP	New	Reconstruction	$1,500,000.00
		Major	Rehabilitation	$750,000.00
		Minor	Preservation	$500,000.00
		PM	Preservation	$-
	JRCP	New	Reconstruction	$171,183.00
		Major	Rehabilitation	$1,500,000.00
		Minor	Preservation	$661,335.00
		PM	Preservation	$-
	CRCP	New	Reconstruction	$1,500,000.00

Facility	Pavement Type	Treatment	TAMP Category	Cost per Lane-Mile
TWOLANE	FLEX	Major	Rehabilitation	$1,500,000.00
		Minor	Preservation	$661,335.00
		PM	Preservation	$-
		New	Reconstruction	$350,000.00
		Major	Rehabilitation	$269,228.00
		Minor	Preservation	$148,854.00
		PM	Preservation	$45,584.00
	COMP	New	Reconstruction	$350,000.00
		Major	Rehabilitation	$269,228.00
		Minor	Preservation	$148,854.00
		PM	Preservation	$45,584.00
	JRCP	New	Reconstruction	$180,000.00
		Major	Rehabilitation	$1,500,000.00
		Minor	Preservation	$661,335.00
		PM	Preservation	$-
	CRCP	New	Reconstruction	$661,335.00
		Major	Rehabilitation	$-
		Minor	Preservation	$661,335.00
		PM	Preservation	$-

Source: MDOT.

APPENDIX C. IMPLEMENTATION REPORT

APPENDIX D. FINANCIAL REVENUE FORECASTS, METHODOLOGY, AND ASSUMPTIONS