



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

Tennessee Division

November 4, 2025

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In Reply Refer To:
HDA-TN

Mr. Will Reid
Commissioner
Tennessee Department of Transportation
505 Deaderick Street
Nashville, TN 37243-1402

Subject: Resubmission of TDOT's Transportation Asset Management Plan (TAMP) for
Out-of-Cycle Recertification

Dear Mr. Reid:

The Federal Highway Administration (FHWA) Tennessee Division has reviewed and certifies TDOT's submittal of the TAMP dated October 31, 2025. Your TAMP resubmission complies with 23 CFR 515.13(c) and 23 CFR 515.7.

We commend and appreciate the commitment that went into this out-of-cycle TAMP recertification. The TN Division looks forward to our continued collaboration.

If you have any questions or concerns, please feel free to contact Nathan Marshall at (615) 571-7928.

Sincerely,

Boday Borres, P.E.
Acting Division Administrator

cc: Ms. Jacinda Russell, Field Operations Team Leader, FHWA TN Division
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2025 Transportation Asset Management Plan

October 31, 2025 Version 2.0



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LIST OF ACRONYMS

American Association of State Highway and Transportation Officials (AASHTO)

AASHTOWare Bridge Management (BrM)

Average Daily Traffic (ADT)

Balanced Mix Design (BMD)

Bridge Management System (BMS)

Continuously Reinforced Concrete Pavement (CRCP)

Cost-Effectiveness (C-E)

Current Value (CV)

Damage Assessment Form (DAF)

Deduct Value (DV)

Department of Transportation (DOT)

Depreciated Replacement Cost (DRC)

Empowering People, Influencing Culture (EPIC)

Federal Highway Administration (FHWA)

Fixing America's Surface Transportation (FAST)

Geographic Information System (GIS)

Governmental Accounting Standards Board (GASB)

Highway Performance Monitoring System (HPMS)

Hot Mix Asphalt (HMA)

Infrastructure Investment and Jobs Act (IIJA)

Integrated Program Delivery (IPD)

International Organization for Standardization (ISO)

International Roughness Index (IRI)

Jointed Plain Concrete Pavement (JPCP)

Life-Cycle Cost (LCC)

Life-Cycle Planning (LCP)

Long-Range Transportation Policy Plan (L RTPP)

Maintenance and Rehabilitation (M&R)

Maintenance Management System (MMS)

Metropolitan Planning Organization (MPO)

Moving Ahead for Progress in the 21st Century (MAP-21)

National Bridge Inventory (NBI)

National Bridge Inspection Standards (NBIS)

National Highway Performance Program (NHPP)

National Highway System (NHS)

Open-Graded Friction Course (OGFC)

Public Private Partnership (P3)

Pavement Distress Index (PDI)

Pavement Management System (PMS)

Pavement Performance Rating (PPR)

Pavement Quality Index (PQI)

Pavement Smoothness Index (PSI)

Quality Management (QM)

Remaining Service Life (RSL)

Rural Planning Organization (RPO)

Standard Operating Guidelines (SOG)

State of Good Repair (SOGR)

Statewide Transportation Improvement Program (STIP)

Strategic Highway Safety Plan (SHSP)

Strategic Investment Plan (SIP)

Super Air Meter (SAM)

Tennessee Department of Transportation (TDOT)

Traffic Speed Deflection (TSD)

Traffic Speed Deflection Device (TSDD)

Transportation Asset Management (TAM)

Transportation Asset Management Plan (TAMP)

Transportation Modernization Act (TMA)

Transportation Performance Measures (TPM)

Transportation Resilience Improvement Plan (TRIP)

Vehicle Miles Travelled (VMT)

CHAPTER 1

ASSET MANAGEMENT OBJECTIVES & MEASURES

What Is a TAMP, and Why Is It Needed?

TAMP PURPOSE STATEMENT

The TAMP establishes a 10-year plan for asset investments that preserve our investment in our transportation network, as TDOT strives to provide a safe and reliable transportation system that supports economic growth and quality of life.

A Transportation Asset Management Plan (TAMP) is a strategic framework that positions agencies to consider the full life-cycle cost when evaluating, managing, and investing in transportation assets and infrastructure. It establishes a business-like mindset within an agency that looks to limit long-term costs, while extending overall asset life and boosting system-wide performance of the transportation network. The purpose of a TAMP is to document transportation asset needs and outline planned investments that maintain and preserve the Department's significant investment in the transportation network. It will also serve as a strategic document supporting the

overall Tennessee Department of Transportation's (TDOT's) Mission, established in 2019, "To provide a safe and reliable transportation system that supports economic growth and quality of life."

The TAMP documents proactive approaches to managing transportation assets with systematic, data-driven processes that consider the strategic objectives for the overall transportation network. This is achieved by using cost-effective treatment strategies that extend an asset's useful life and defer the need for more costly repairs.



Tennessee's TAMP satisfies the requirements of the Moving Ahead for Progress in the 21st Century (MAP-21) Act and the Fixing America's Surface Transportation (FAST) Act. In 2021, the Infrastructure Investment and Jobs Act (IIJA) (Public Law 117-58) introduced additional TAMP requirements that were addressed in 2022. The legislation requires that TDOT develop a risk-based asset management plan for pavement and bridges on the National Highway System (NHS). The TAMP's purpose is to improve or preserve the condition of assets and the performance of the system by presenting strategies to program projects that will help TDOT meet NHS targets

for asset condition and performance consistent with national goals. The TAMP, as presented, is not a fix for short-term, emergency situations. It establishes TDOT's plan for doing business not only day to day, month to month, or even year to year, but decade to decade. The TAMP process, when used effectively, is a powerful budgeting and management methodology that can prevent major problems by prolonging the life cycle of critical assets while also planning for future investments in the transportation network.

What Is the TAMP Context?

TDOT has a number of documents that describe the Department's philosophy and its fundamental core values. These documents help provide the context for TDOT's Transportation Asset Management (TAM) efforts, including the Vision, Mission, and Values.

Vision - Commitment to excellence in managing and improving the State's transportation system, promoting the success of our employees, and strengthening the trust of our customers.

Mission - To provide a safe and reliable transportation system that supports economic growth and quality of life.

Values:

- Stewardship: TDOT takes the best possible care of the State's assets.
- Integrity: TDOT is professional, honest, and strives to do the right thing.
- Safety: TDOT identifies and mitigates hazardous conditions for employees, contractors, and the traveling public.
- Consistency: TDOT is reliable and uniform in actions and words.
- Development: TDOT continually grows and shares knowledge, expertise, and experience.
- Innovation: TDOT looks for new and emerging ways to serve customers.
- Collaboration: TDOT works together internally and with partners to share ideas, skills, and insights to get the best results.
- Family: TDOT promotes a culture of caring, concern for others, and pride in what it does.

In addition, TDOT has established Operational Goals that provide further guidance and organizational direction. Some key themes from these documents are also fundamental principles of asset management including a reliance on data-driven decisions, a strong emphasis on safety, and methods to sustain the infrastructure.

Operational Goals

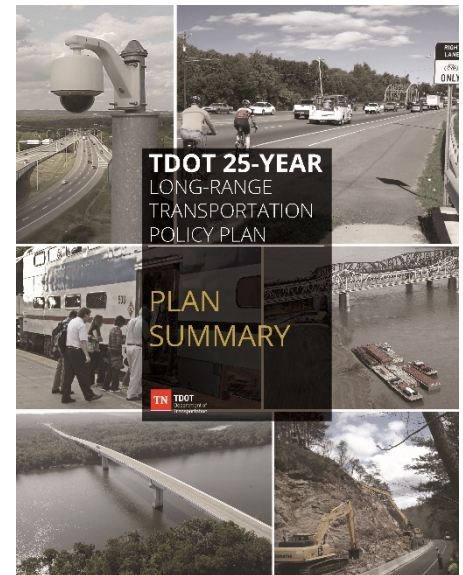
- Deliver transportation projects on schedule and within budget.
- Maintain the State transportation system to protect the long-term investment in our infrastructure.
- Operate and manage Tennessee's transportation system to provide a high level of safety and service for our customers and workers.
- Expand mobility choices to maximize access.

What Is the TAMP's Relation to Other TDOT Planning Documents?

The TAMP is not meant as a replacement to any other TDOT planning processes or priorities; rather, the TAMP builds on the existing plans, processes, and priorities described in this document to efficiently manage system performance. The following documents were essential to the creation of this TAMP by outlining goals and objectives that set the direction for the TAMP investment strategies.

25-Year Long-Range Transportation Policy Plan

The *25-Year Long-Range Transportation Policy Plan*¹ (LRTPP) consists of eight policy papers, each with recommendations. Preparation of the Plan included an extensive public engagement process, which involved citizens, advocates, industries, commerce, and transportation experts. The need to maintain and preserve system assets is reflected in the guiding principles and recommendations established in the papers. The strategic investments outlined in the TAMP address two of the seven guiding principles in the LRTPP, which is discussed in more detail later in this chapter. The Department is guided by a programmatic approach with three emphasis areas: efficiency, effectiveness, and economic competitiveness. Effectiveness deals with the success of the Department's investments, which directly influences maintaining a state of good repair. The TAMP development fulfills four actions called for in the LRTPP (see figure 1-1).



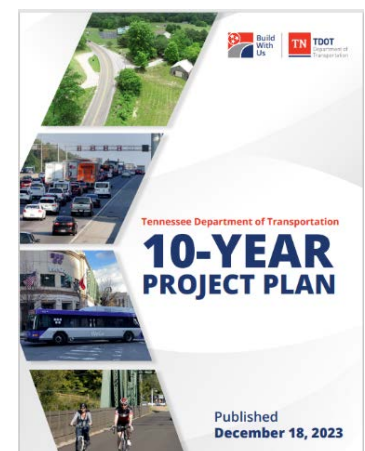
¹ Tennessee Department of Transportation (TDOT). 2021. *25-Year Long-Range Transportation Policy Plan*. Accessed June 2022. <https://www.tn.gov/tdot/long-range-planning-home/25-year-transportation-policy-plan.html>



Figure 1-1: TAMP-related actions called for in the LRTPP

10-Year Project Plan

The Tennessee Department of Transportation's *10-Year Project Plan*² provides a roadmap for \$15 billion in State and Federal funds over the next decade for surface transportation development. However, the plan acknowledges that the outstanding need is over \$30 billion. With the recent passage of the Transportation Modernization Act (TMA), the Governor and legislature have facilitated an additional \$3 billion investment in Tennessee's transportation system. In response, TDOT has been developing a new project programming prioritization process that puts each one of our Empowering People, Influencing Culture (EPIC) values to work as stewards of the additional \$3 billion in General Fund allocation. The goal of that General Fund infusion is to leverage the largest amount of private, Federal



² Tennessee Department of Transportation (TDOT). 2023. *Tennessee Department of Transportation 10-Year Project Plan*, https://www.capitol.tn.gov/Archives/Senate/113GA/committees/Transportation/2024/2024103%20TDOT%2010-Year%20Project%20Plan_Final.pdf.

and local dollars possible. It is essential that the TAMP is aligned with the 10-Year Project Plan and reflects the consequential changes in both funding and the project delivery process. Although the TAMP is not required to be updated until 2026, TDOT has chosen to accelerate its TAMP update to ensure alignment with this critical planning document.

Travel Trends and System Performance – Policy Paper

One of the key parts of the TAMP is to set performance measures and targets for the condition of the roadway pavements and bridges on Interstates, State- and locally owned NHS routes, and non-NHS State routes. The purpose of the *Travel Trends and Systems Performance Policy Paper*³ is to assist with the prioritization of TDOT's projects. The measures identified in the paper are meant to accompany those used throughout the Department for strategic and tactical management.

Evaluation of the system through specific metrics and targets helps TDOT measure the effectiveness of programs and policies for project prioritization. Measuring the existing condition and performance of the transportation system helps TDOT identify project needs and guides the Department's planned investments. The performance measures and targets help the Department prioritize projects that will benefit the transportation system and possibly extend an asset's life cycle. The performance measures and targets are discussed further in the next chapter.

How Does Asset Management Planning Fit with the LRTP Guiding Principles?

TDOT established seven guiding principles (listed in figure 1-2) as part of the LRTP that align with the overall Department's vision. These principles express TDOT's major priorities and provide tangible actions to achieve the Department's vision. The TAMP's development links two of the guiding principles:

- Preserve and Manage Existing System – Protect existing assets and maintain efficiency of the system through cost-effective management and new technologies.
- Emphasize Financial Responsibility – Maximize Tennessee's share of Federal transportation funding; select projects based on identified regional needs; allow flexibility in local management of projects where feasible.

³ Tennessee Department of Transportation (TDOT). 2021. *Travel Trends and Systems Performance Policy Paper*. https://www.tn.gov/content/dam/tn/tdot/documents/Travel_Trends_022316.pdf



Figure 1-2: TDOT's Guiding Principles from the 25-Year LRTPP

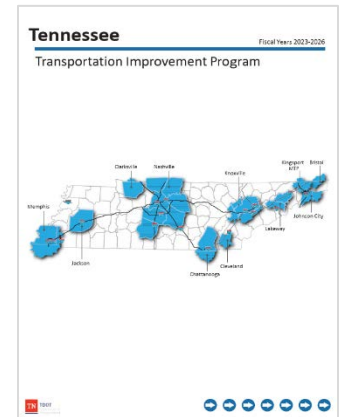
TDOT implemented an asset management framework within the organization that enables it to show responsibility for public funds, meet agency goals and objectives, and strengthen effective management strategies. This framework is shown in figure 1-3.



Figure 1-3: TDOT's Asset Management Framework

Tennessee's State Transportation Improvement Program (STIP)⁴

The STIP is developed with the purpose of carrying out the Department's LRTPP, the metropolitan transportation plans, and the planned TAMP investments. The plan is fiscally constrained, which means money must be designated and expected to be available for each of the projects listed. The STIP includes transportation projects over a 4-year time frame based on the reasonably expected funding levels. This must be prepared as a condition of Federal funding for regionally significant highway and public transit transportation projects under Title 23, United States Code for highways and Title 49, United States Code for transit. TDOT reevaluates the STIP every 3 years.



Which Assets Does TDOT Maintain and Evaluate?

TDOT is responsible for managing infrastructure assets along Interstates and State routes throughout the State of Tennessee to keep traffic moving safely and reliably. The transportation system includes over 96,000 centerline miles of roadways, over 20,000 bridges, 77 airports, 2,500 miles of Class I railroads, 23 short line railways, 976 miles of navigable waters, and two passenger ferries. Although the Tennessee transportation system includes all transportation modes (e.g., railroad, air, water, and roadway), this TAMP focuses on two key roadway assets: 14,059 centerline miles of pavement and over 8,494 bridges. TDOT relies on the central bureaus and the four regions, as depicted in figure 1-4, to accomplish its mission. A variety of customers are served by the transportation network TDOT maintains, including citizens of the State, travelers driving through the State, trucking companies, military installations, and other stakeholders.

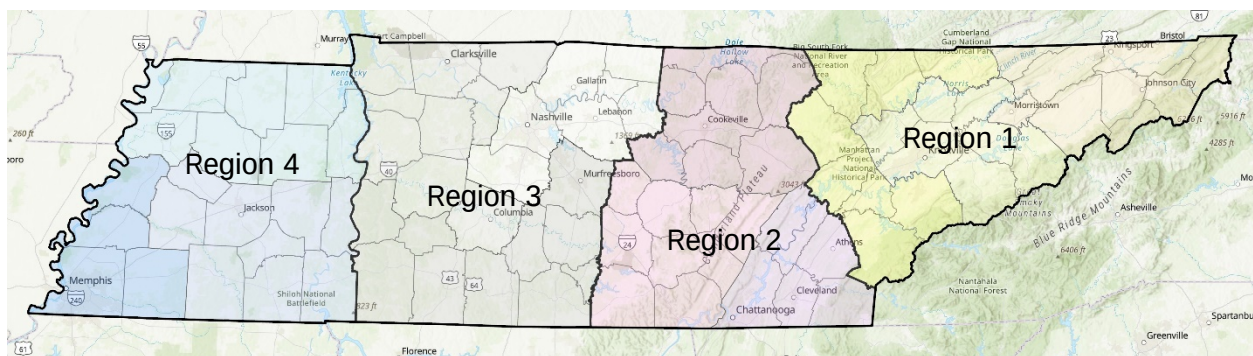


Figure 1-4: Four TDOT regions

An examination of the types of trips made by the citizens and the freight companies demonstrates how important system reliability is to the economic vitality of the State. Citizens depend on the transportation system to travel to important day-to-day activities involving businesses, schools, churches, medical facilities, shopping centers, and recreational activities. In addition to people, products travel over the

⁴ TDOT Programming Division. 2023. *Tennessee Transportation Improvement Plan: Fiscal Years 2023-2026*. <https://www.tn.gov/content/dam/tn/tdot/programdevelopment/2023-2026-stip-draft/Tennessee%20STIP%202023-2026%20Final%20R%20202-28-24.pdf>

Tennessee roadway network, providing a wide range of services to agriculture, military, commercial, and other businesses. These entities expect a safe and reliable transportation network from origin to destination.

The TAMP outlines TDOT's plans for maintaining its pavements and bridges to support economic growth and quality of life. Through annual pavement evaluation and biannual bridge evaluations, current and future problem areas can be identified. By addressing the problems found through the evaluation process, the Department can extend the life cycle of the asset and help stretch available funding further. The TAMP outlines a strategic investment plan for a 10-year horizon that will contribute to TDOT's performance goals and objectives.



Which Assets Will Be Included in the TAMP?

TDOT manages a wide array of assets as part of its multimodal transportation network. This TAMP is focused on the pavement and bridges on the Interstates, State- and locally owned NHS routes, and non-NHS State routes. Reviewing the historical condition of these assets is important to understanding performance trends. This information is used, along with the projected system needs, to budget improvements for the next 10 years. The Department has developed an investment strategy for its pavements and bridges to extend their life cycle, while providing a safe and reliable roadway network. Figures 1-5 and 1-6 display the roadways and bridges included as part of the TAMP.

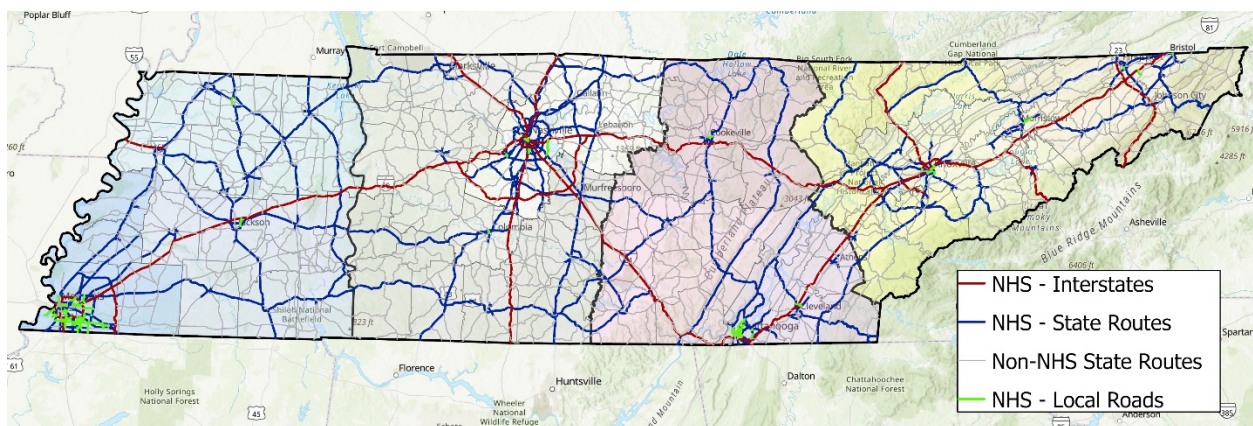


Figure 1-5: Roadways on Interstates, NHS, and Non-NHS State routes

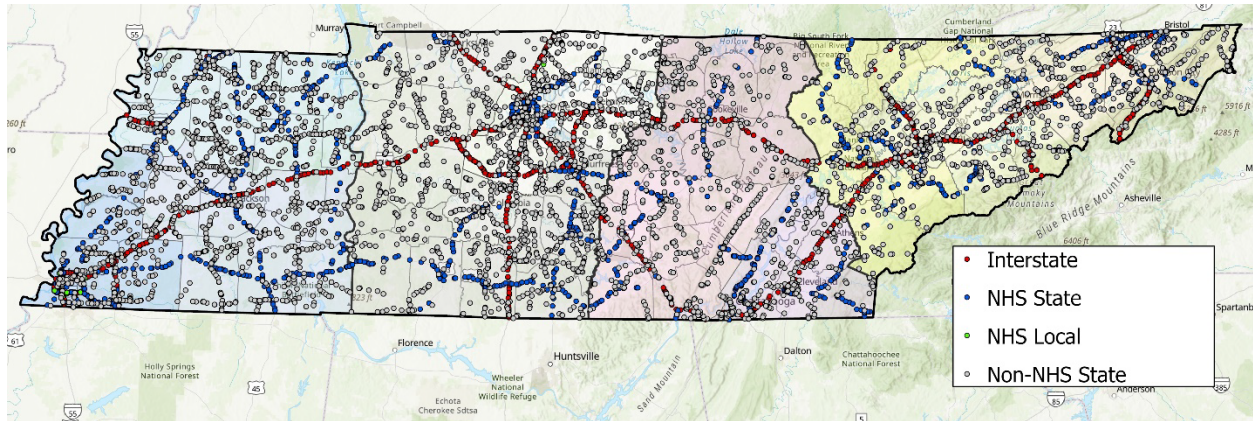


Figure 1-6: Bridges on Interstates, NHS, and non-NHS State routes

TAMP Development Process and Content

The process used to develop the TAMP involves several TDOT divisions. As shown in figure 1-7, conditions are used with forecasting models from the pavement and bridge offices and combined with project funding priorities and financial resources to predict future conditions in relation to desired performance outcomes and targets. The TAMP resulting from using this process is organized into the eight chapters described below.

TAM Process

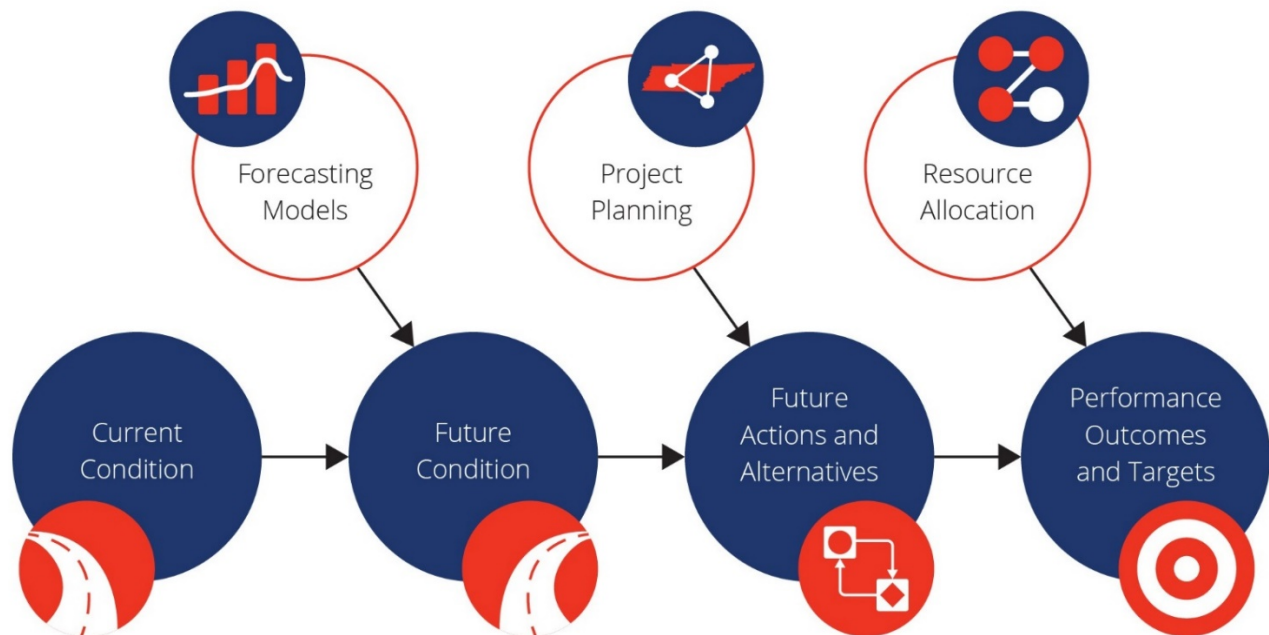


Figure 1-7: TDOT TAM process

Chapter 1: Asset Management Objectives and Measures

Included in this chapter is the purpose and foundation for preparing the TAMP. It introduces the TAMP and explains how it helps the Department reach the goals and objectives established in other reports.

Chapter 2: Asset Inventory and Condition

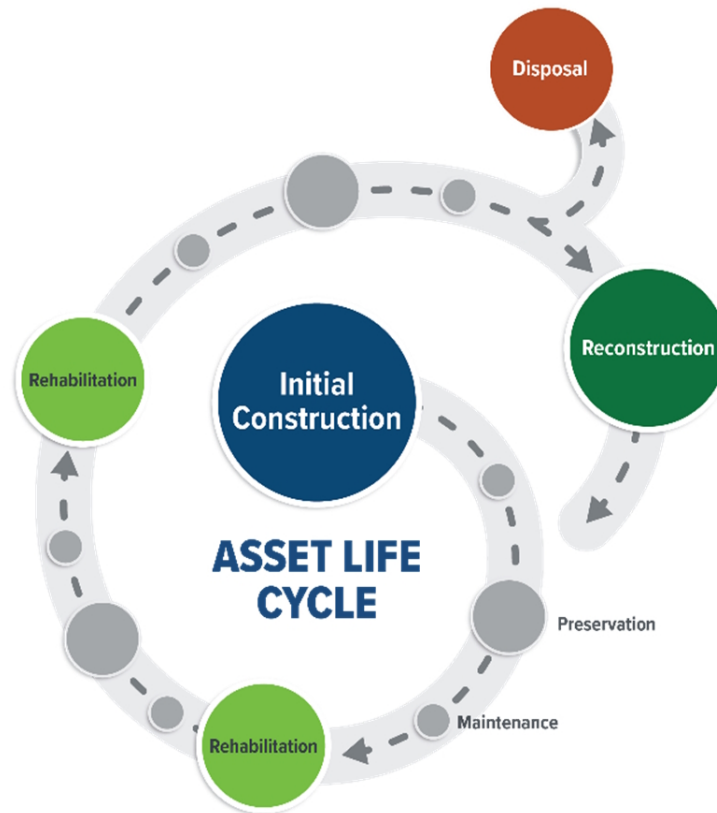
This chapter provides the historical and baseline information tracked by TDOT to determine pavement and bridge inventory and condition information on the Interstates, State- and locally owned NHS routes, and non-NHS State routes.

Chapter 3: Performance Goals and Targets

Maintaining and prolonging the life of the transportation network assets helps TDOT stretch funding dollars while providing a reliable transportation network to the users. This chapter defines the performance measures for the pavement and bridges included in the TAMP, establishes TDOT's performance targets for pavement and bridges to ensure the preservation of these assets, identifies where performance gaps exist when a target is not met, and discusses the prioritization of projects based on the evaluation criteria. The performance measure targets included in this TAMP reflect targets set in 2022 and readopted in 2024 during the mid-period performance review.

Chapter 4: Life-Cycle Planning

The amount of time that pavement and bridges can remain in a state of good repair depends on several factors, including the volume and types of vehicles that use the asset, the types of materials used to build the asset, and the climate where the asset is located. Over an asset's life cycle, different types of repairs are needed to address the deterioration that can occur, as depicted in figure 1-8. The Department uses sophisticated software systems to predict the future condition of pavements and bridges based on factors such as asset age, Average Daily Traffic (ADT) counts, and the percentage of heavy trucks using the facility. This chapter focuses on the processes that TDOT uses to consider the results from the life-cycle planning analyses conducted using the Pavement Management System (PMS) and Bridge Management System (BMS) to minimize whole life costs.



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Figure 1-8: Asset Life Cycle example

Chapter 5: Managing Risk and Resilience

Risk management is a systematic process of identifying, analyzing, and prioritizing risks so that strategies can be developed that mitigate potential threats and maximize opportunities. This chapter discusses risk management and provides an overview of how risks are considered and managed to minimize impacts on the Department's mission. Additionally, the chapter looks at historical data from past emergency events to identify locations that have qualified for repeated Federal emergency relief funding or have been addressed in the State Transportation Improvement Program (STIP) to prevent future damage.

Chapter 6: Financial Plan

Over the last century, TDOT has invested significant resources toward managing its transportation system. This chapter documents TDOT's historic funding levels for the bridge and pavement programs and its processes for allocating funding to address pavement and bridge needs. The chapter describes the amount and source of funding expected to be available for these assets over the next 10 years and describes how these funds will be allocated over the 10-year plan horizon.

Chapter 7: TDOT TAMP Investment Strategies

This chapter presents the planned 10-year investment strategies for managing pavements and bridges with planned investments. In addition, it describes funding needed to address any gaps between desired and expected performance.

Chapter 8: TAMP Process Improvement

This chapter presents opportunities for improvements to the asset management strategies being implemented by TDOT, describes the approach taken by TDOT to better align life-cycle planning models to ensure the most efficient management of the transportation infrastructure, and provides a list of additional assets, beyond pavement and bridges, that are being considered for future versions of the TAMP.

How Will TDOT Create, Implement, and Update the TAMP?

The TAMP was prepared by a team of TDOT staff and consultants, working together using available data and tools to develop planned 10-year investments. The idea was to build on the foundation that TDOT has established for evaluating asset performance and to use available tools to prioritize projects based on the funding available. Implementation of the TAMP relies on close communication and collaboration with Metropolitan and Rural Planning Organizations (MPOs & RPOs), local agencies, Federal agencies, and various divisions within TDOT. An objective in the creation of this document was to establish an easily repeatable process for future updates to be conducted.

Who Is Responsible for TAMP Development and Implementation?

While it is expected the entire agency will in some way contribute to the development and implementation of the TAMP, TDOT has identified the following three groups to provide the oversight, input, and leadership necessary to the TAMP's creation, development, and implementation:

- Executive Leadership.
- TAMP Steering Committee.
- TAMP Core Team.

In addition to these three groups, two specific roles have been identified for the management of the TDOT TAMP effort:

- Agency Sponsor/Champion: responsible for ensuring the appropriate resources of the agency are provided.
- Project Leader: responsible for coordinating activities and day-to-day development of the TAMP.

TDOT has identified the following champion and project leader for the TAMP development effort:

- Agency Sponsor/Champion: Will Reid, P.E. Commissioner
- Project Leader: Chris Harris, Statewide Transportation Engineer, Maintenance Operations Division.

Executive Leadership—The TAMP development and implementation is supported by TDOT’s Executive Leadership Team, consisting of Commissioner Reid and other senior managers within the agency. The members of the Executive Leadership Team are listed in table 1-1. This team provides overall guidance, direction, resource commitment, and approval.

Table 1-1: TDOT’s Executive Leadership team members

TDOT’s Executive Leadership Team	
Will Reid, P.E.	Commissioner
Delaine Linville	Deputy Commissioner of Administration
Natalie Krysztof	Deputy Commissioner & Chief Financial Officer
Preston Elliott	Deputy Commissioner of Planning
Lori Lange	Deputy Commissioner of Program Deployment and Delivery
Joe Deering	Bureau Chief of Field Operations and Maintenance
Bryan Ledford	Bureau Chief of Major Projects
Brian Egan	Chief of Field Operations
Chad Schulhauser	Chief of Engineering Administration
Shane Hester	Chief Engineer
James Kelley	Chief of Program Delivery
Matt Barnes	Director of Federal Affairs
Beth Emmons	Director of Communications

The **TAMP Steering Committee** consists of TDOT Directors who are key managers of the agency’s business units that will provide the data, reports, analyses, and documents that form the core information in the creation of the TAMP. This team, listed in table 1-2, provides the resources and analyses required to support the development of the TAMP and oversight to ensure the components of the plan are coordinated and accurately reflect TDOT’s processes.

Table 1-2: TAMP Steering Committee members

TAMP Steering Committee	
Justin Underwood	Director of Asset Management Division
Jamie Waller	Director of Maintenance Operations Division
Matt Meservy	Director of Planning Division
Julie Carmean	Director of Strategic Planning, Research & Innovation Division
Dexter Justis	Director of Region 1 – Knoxville
Danny Oliver	Director of Region 2 – Chattanooga
Jay Norris	Director of Region 3 – Nashville
Jason Baker	Director of Region 4 – Jackson
Steve Allen	Director of Local Programs & Community Investments Division
Josh Brown	Director of Traffic Operations Division
Ted Kniazewycz	Director of Structures Division
Ronnie Porter / John Kahle	Director of Program Operations Division
Kenitha Reed	Director of Finance Division
Jermaine Scales	Chief Information Officer
Gwen Whittaker	Director of Construction Division
Chris Harris	Maintenance Operations Division – TAMP Project Lead
Xiaoyang Jia	Asset Management Division - Pavement Management Lead
Jacinda Russell	FHWA – Technical Services Team Leader
Vacant	FHWA – Program Management Analyst
Kevonte Poole	FHWA – Area Engineer
Nathan Marshall	FHWA – Bridge Engineer

The **TAMP Core Team** consists of members of the Maintenance Division and have direct oversight, guidance, and responsibility for coordination of the TAMP effort within TDOT. This team, whose members are listed in table 1-3, is responsible for working with the various TDOT business units to assemble data, reports, and documents that will be used in the creation of the various sections of the TAMP.

Table 1-3: TAMP core team members

TAMP Core Team	
Justin Underwood	Director of Asset Management Division
Jamie Waller	Director of Maintenance Operations Division
Chris Harris	Maintenance Operations Division – TAMP Project Lead
Xiaoyang Jia	Asset Management Division – Pavement Management Section Manager
Christopher McDonald	Asset Management Division - Bridge Section Manager
Rebecca Hayworth	Structures Division - Bridge Performance Manager
Brian Hurst	Project Management Division - Program Manager Lead
John Kahle	Director of Program Operations Division
Kenitha Reed	Director of Finance Division

CHAPTER 2

ASSET INVENTORY & CONDITION

What Assets Are Included in This Chapter?

The TAMP documents inventory and condition information for pavement and bridge assets used to provide Tennesseans with a reliable transportation network. That information is used to identify cost-effective investment strategies to maintain and preserve the system as TDOT works towards providing the best transportation network in the Nation. This chapter summarizes the inventory and condition assessment procedures used to manage pavement and bridge assets and includes pavements and bridges on both the NHS and non-NHS, regardless of ownership.



How Much Pavement Does TDOT Own and Maintain?

Tennessee has more than 96,000 centerline miles of publicly owned highways; however, only about 14,000 of those miles are maintained by the Department. Figure 2-1 shows the pavement network on a map, and table 2-1 lists the pavement centerline and lane miles by highway system. Between 2020 and 2025, TDOT added 244 lane miles to the State pavement network, an annual increase of approximately 0.1 percent. It is anticipated that a similar rate of increase will continue over the next 10-year period. Additionally, a 2017 State statute added 648 lane miles of State park pavement to the TDOT-maintained system, however, the State park pavement network is not included for the purposes of the TAMP.

How Many Bridges Are on TDOT's Transportation Network?

TDOT inspects over 20,000 publicly owned bridges statewide; however, less than half of those bridges are owned by TDOT. Figure 2-2 shows the bridges that are included in the TAMP, and table 2-2 summarizes the information by highway systems. Between 2020 and 2025, TDOT added, on average, approximately 0.86 percent additional square feet of bridge deck to the NHS bridge network each year. It is anticipated that this average rate of increase will continue over the next 10-year period.

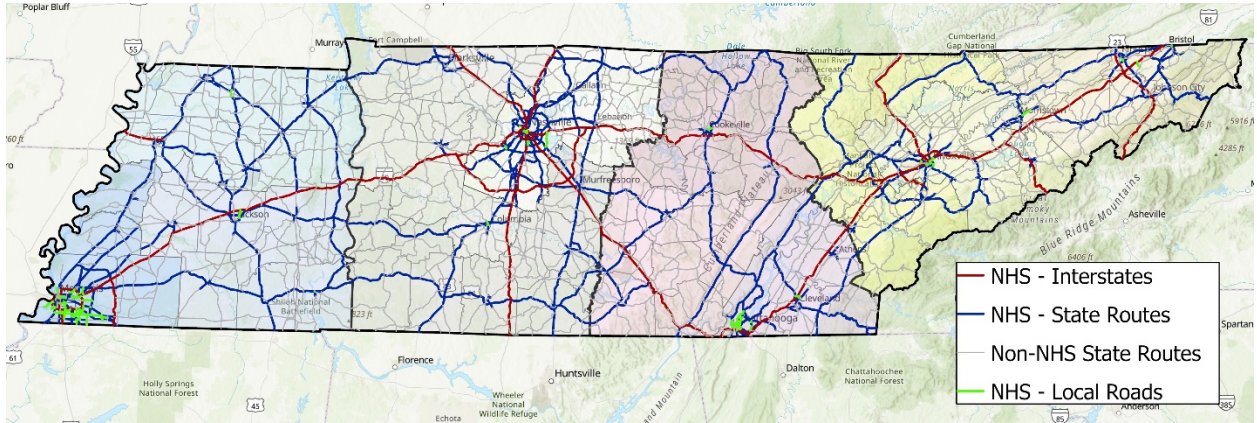


Figure 2-1: TAMP roadway inventory

Table 2-1: TAMP roadway inventory (as of 4/7/2025)

Highway System	Centerline Miles	Lane Miles
NHS Interstates	1,210	5,922
NHS State Routes	3,652	12,747
NHS Local Roads*	161	700
Total NHS	5,023	19,369
Non-NHS State Routes	9,027	19,293
Grand Total	14,050	38,652

*TDOT does not maintain NHS local roads

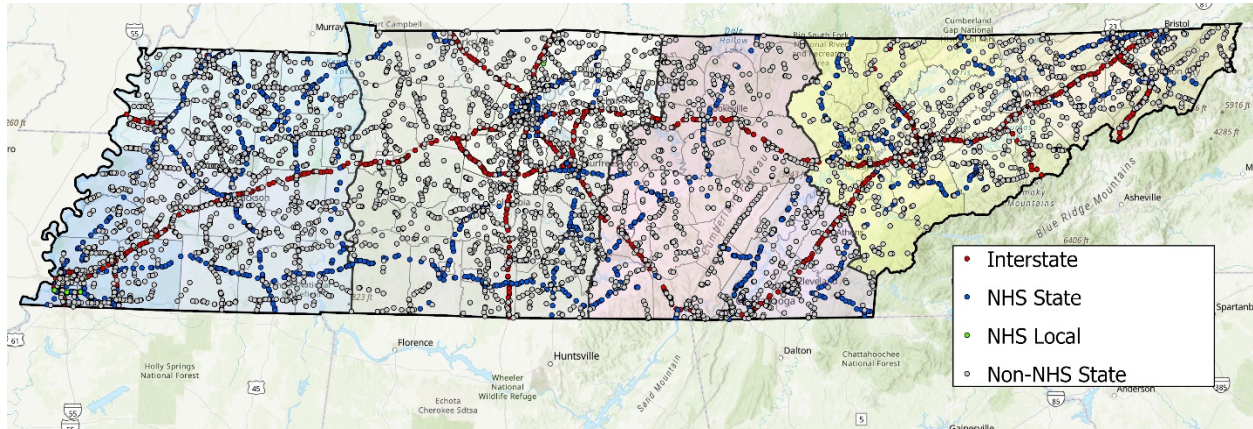


Figure 2-2: TAMP bridge inventory

Table 2-2: Bridge Inventory (as of 4/10/2025)

Highway System	Number	Deck Area (by Sq. Ft.)
NHS Interstates	1,619	26,348,000
NHS State Routes	2,640	32,621,000
NHS Local*	101	1,890,000
NHS Federal*	18	300,000
Total NHS Bridges	4,378	61,159,000
Non-NHS State Routes	4,164	26,384,000
Total TAMP Bridges	8,542	87,543,000

*TDOT does not maintain NHS local or NHS Federal bridges

What Factors Influence Asset Performance?

Pavement Performance Factors

Pavement condition deteriorates over time because of exposure to factors such as traffic volumes and configurations, environmental and weather impacts, construction quality, asphalt concrete and aggregate material properties, subgrade soil quality, maintenance magnitude and frequency, and human factors. TDOT considers the impacts of these factors in pavement life-cycle planning and performance forecasting to determine the most cost-effective investment strategies to maximize pavement life.

Bridge Performance Factors

Bridge performance depends on a variety of factors including traffic magnitude and configuration, weather impacts, maintenance magnitude and frequency, construction quality, material properties, maintenance cycles, and use of deicing salts. TDOT considers the impacts of these factors in bridge life-cycle planning and performance forecasting to determine the most cost-effective investment strategies to maximize bridge life.

How Does TDOT Measure Asset Performance?

Pavement and bridge conditions are classified into three categories: *Good*, *Fair*, or *Poor*. Pavement conditions are determined based on a Pavement Quality Index (PQI) and a Pavement Performance Rating (PPR). Bridges are inspected throughout the State of Tennessee on a 2-year cycle. A bridge rating is used to determine maintenance needs from National Bridge Inventory (NBI) inspections of the bridge deck, superstructure, and substructure.

In addition to State measures, Federal measures are also required to be reported to the Federal Highway Administration (FHWA). Both the State and Federal measures for pavements and bridges are summarized in this section. It should be noted that the years specified for historical pavement and bridge conditions refer to the year the condition data were collected rather than the reported year, which often falls in the following calendar year.

Measuring Pavement Conditions

Pavement Quality Index (PQI)

TDOT collects pavement condition data using a high-speed inertial profiling vehicle with an automated data collection system. Condition information on the NHS is collected annually. Half of the non-NHS system is collected each year resulting in a biennial update for the full non-NHS network. The condition data are used to calculate a PQI for the Interstate, NHS State routes, and non-NHS State routes for use in identifying maintenance and rehabilitation needs. The PQI scale ranges from 0 (needs resurfacing) to 5 (not a priority for maintenance). The PQI is a function of the Pavement Smoothness Index (PSI) and Pavement Distress Index (PDI). The PSI represents road roughness using a scale from 0 to 5, with 5 representing a smooth road. TDOT defines roughness as the deviations of a pavement surface from a true planar surface with characteristic dimensions that affect vehicle dynamics, ride quality, dynamic loads, and drainage (e.g., longitudinal profile, transverse profile, and cross slope). PSI is a function of the International Roughness Index (IRI), as shown in equation 1.

$$PSI = 5 * e^{(-0.0055 * IRI)} \quad (1)$$

PDI is also reported on a scale of 0 to 5, with 5 representing a road in perfect condition. TDOT considers the following distresses in the PDI calculation: fatigue, rutting, longitudinal cracks in the wheel path, patching, block cracking, transverse cracks, and longitudinal cracks (non-wheel path). Each individual distress is assigned a deduct value (DV) based on the severity and extent on a given stretch of road surface. All the DVs are given a weight and subtracted from 5 to calculate the PDI.

TDOT determines PQI as a function of PSI and PDI on a scale from 0 to 5 with 5 being a road in perfect condition. As shown in equation 2, PDI encompasses the largest portion of this index because pavement distresses are most representative of current and future deterioration. TDOT defines *Good*, *Fair*, and *Poor* for pavements using the PQI, as shown in table 2-3.

$$\text{PQI} = \text{PDI}^{0.7} * \text{PSI}^{0.3} \quad (2)$$

Table 2-3: Pavement *Good*, *Fair*, and *Poor* definitions using the PQI

System	Good	Fair	Poor
Interstate	> 4.0 PQI	4.0 > PQI > 2.0	< 2.0 PQI
State Routes	> 3.5 PQI	3.5 > PQI > 2.0	< 2.0 PQI

National Transportation Performance Measures (TPM) for Pavements

In addition to its State performance measures, TDOT calculates several federally required pavement metrics to report NHS pavement conditions to FHWA. The Federal metrics, shown in table 2-4, are used to assign a *Good*, *Fair*, and *Poor* rating to each 1/10-mile roadway segment. For concrete pavements, the metrics that are used include roughness (IRI), fatigue cracking, and faulting. For asphalt pavements, the rating is based on roughness (IRI), fatigue cracking, and rutting. For each segment, the overall condition rating is determined using the values in table 2-5.

Table 2-4: Federal pavement condition thresholds

Metric	Good	Fair	Poor
Roughness (IRI)	< 95 in/mi	95–170 in/mi	> 170 in/mi
Rutting (HMA Only)	< 0.20 inch	0.20–0.40 inch	> 0.40 inch
Fatigue Cracking	< 5% (All)	5%–20% (HMA) 5%–15% (JPCP) 5%–10% (CRCP)	> 20% (HMA) > 15% (JPCP) > 10% (CRCP)
Faulting (JPCP & CRCP only)	< 0.05 inch	0.05–0.15 inch	> 0.15 inch

Table 2-5: Overall pavement condition rating

Overall Metric Rating Condition	Rating
All 3 metrics "Good"	Good
All other combinations	Fair
2 or more metrics "Poor"	Poor

Performance results are then summarized and reported based on the total number of lane miles in each condition category (*Good*, *Fair*, *Poor*) on each of the highway systems. To comply with the TPM reporting requirements established by the FHWA for pavements, States must report the percentage of lane miles that are rated in *Good* and *Poor* conditions on the Interstate and non-Interstate NHS networks.

To align with historical data collection and pavement management processes, TDOT has elected to also collect pavement condition data for State routes on the NHS, local NHS routes, and non-NHS State routes in the State. TDOT will share the pavement condition data with local NHS owners on an annual basis to make them aware of the condition of their NHS-paved roads.

Measuring Bridge Conditions

TDOT conducts bridge inspections on all publicly owned highway bridges in Tennessee, except those that are federally owned, every 2 years. The Department follows the guidelines established by the NBI reporting process, using the NBI rating for deck, superstructure, and substructure. The NBI uses a scale from 1 to 9, with a rating ≤ 4 indicating a bridge in *Poor* condition, 5 or 6 indicating a bridge in *Fair* condition, and a rating of ≥ 7 representing a bridge in *Good* condition, as shown in table 2-6. Culverts greater than 20 feet along the roadway centerline are assessed using the same NBI ratings.

Table 2-6: Bridge condition thresholds

Components	Good	Fair	Poor
Deck	≥ 7	5 or 6	≤ 4
Superstructure	≥ 7	5 or 6	≤ 4
Substructure	≥ 7	5 or 6	≤ 4
Culvert	≥ 7	5 or 6	≤ 4

As part of the NBI reporting process, bridges can be rated as *Good*, *Fair*, or *Poor*. A *Poor* rating is a term used consistently by all departments of transportation. These bridges are not unsafe; instead, they are

usually functionally adequate. They do, however, require significant maintenance and repair to remain open to traffic with eventual rehabilitation or replacement. Figures 2-3 and 2-4 below show the bridges rated as *Poor* in Tennessee from 2016 to 2023 based on the number of bridges and percent of bridge deck area, respectively. In Figures 2-3 and 2-4, State/NHS Bridges include all Federally, locally and TDOT owned NHS bridges as well as all TDOT owned non-NHS bridges.

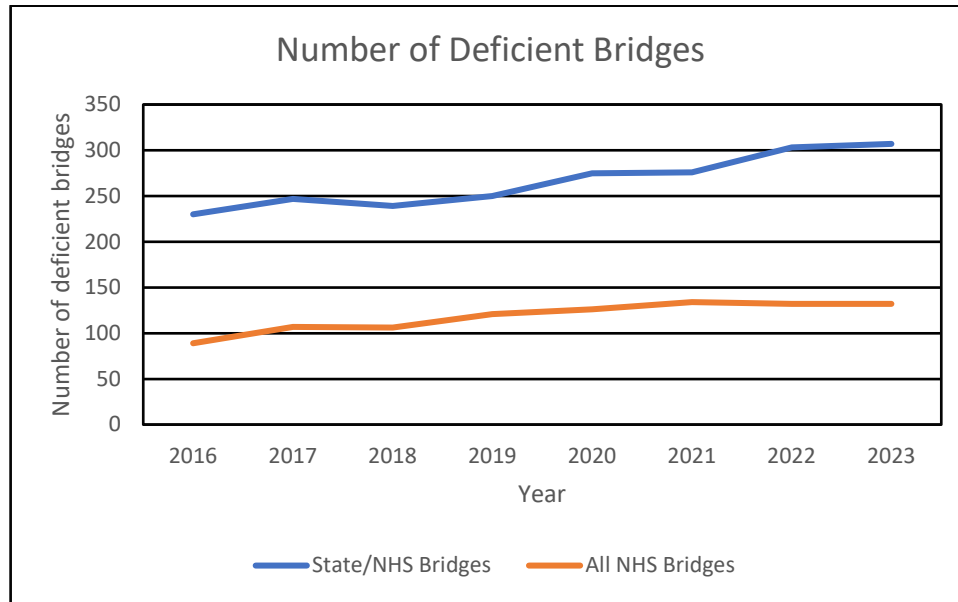


Figure 2-3: Historical number of Poor bridges in Tennessee

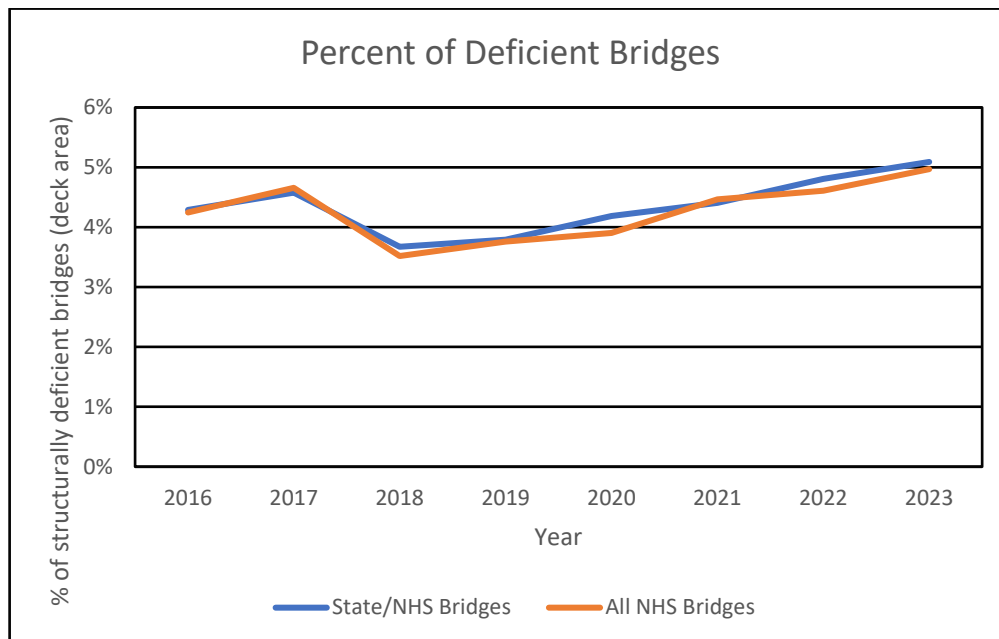


Figure 2-4: Historical percentage of Poor bridge deck area in Tennessee

National Transportation Performance Measures for Bridges

The TPM for bridges uses the same NBI ratings used by TDOT for reporting conditions. For Federal reporting purposes, each bridge is assigned an overall condition rating of *Good*, *Fair*, or *Poor* using the values shown in table 2-7.

Table 2-7: Overall condition rating for bridges

Overall Metric Ratings Condition	Rating
All metrics "Good"	Good
All other combinations	Fair
1 or more metrics "Poor"	Poor

To comply with the TPM reporting requirements established by the FHWA, States must report the percentage of bridge deck area that is rated as *Good* and *Poor* on all bridges on the Interstate and non-Interstate NHS. To align with how TDOT has historically evaluated the condition of bridges and budgeted for preservation, TDOT has elected to also include condition data for bridges on non-NHS State routes. TDOT will also include locally owned and federally owned bridges on the NHS and State highways; however, TDOT does not perform inspections on any federally owned structures. Inventory and condition data for federally owned bridges have been provided by the FHWA through the National Bridge Inventory (NBI). TDOT will share the bridge condition information with local NHS owners on an annual basis to make them aware of the condition of their NHS structures.

What Are TDOT's Data Quality Control Measures?

Pavement Condition Data

TDOT developed an extensive guide to provide Quality Management (QM) procedures for pavement condition data collection at the network level. This guide presents roles and responsibilities for administering QM procedures as well as the acceptance criteria used by the Pavement Management Engineer to accept or reject the data deliverables from the service provider. The QM guide specifies the types of pavement condition data that need to be collected, the required activities that will ensure data quality during production, the tasks that data inspection will cover, and the requirements that the data delivery will fulfill. It also specifies the content and scope of a Quality Management Report. As part of these QM procedures, TDOT performs the following steps to ensure pavement data quality:

- Personnel training.
- Equipment calibration and validation processes.
- Data format and completeness checks.
- Sensor data checks.
- Distress data checks.

- Image checks.
- Control and verification sites.
- Time-series comparisons.
- Estimation of corrective activities.

Bridge Condition Data

TDOT follows the National Bridge Inspection Standard (NBIS) procedures according to 23 CFR, Part 650 C for bridge data quality control purposes. Each inspection team leader has completed the 2-week comprehensive bridge inspection course through the National Highway Institute. Team leaders are generally required to have at least 5 years of bridge inspection experience prior to taking responsible charge of a bridge inspection team. The team leader is required to review and sign each inspection report following the inspection. At least 50 percent of the bridge inspection reports are reviewed by an evaluator in the headquarters bridge inspection and repair section to ensure accuracy and consistency and to prioritize evaluations based on condition and inspection type.

What Is the Condition of TDOT's Pavements?

Pavement Condition Trends – Using Pavement Quality Index (PQI)

Figures 2-5 through 2-8 show the historic and current PQI ratings for the Interstate, NHS State routes, NHS local routes, and non-NHS State routes, respectively.

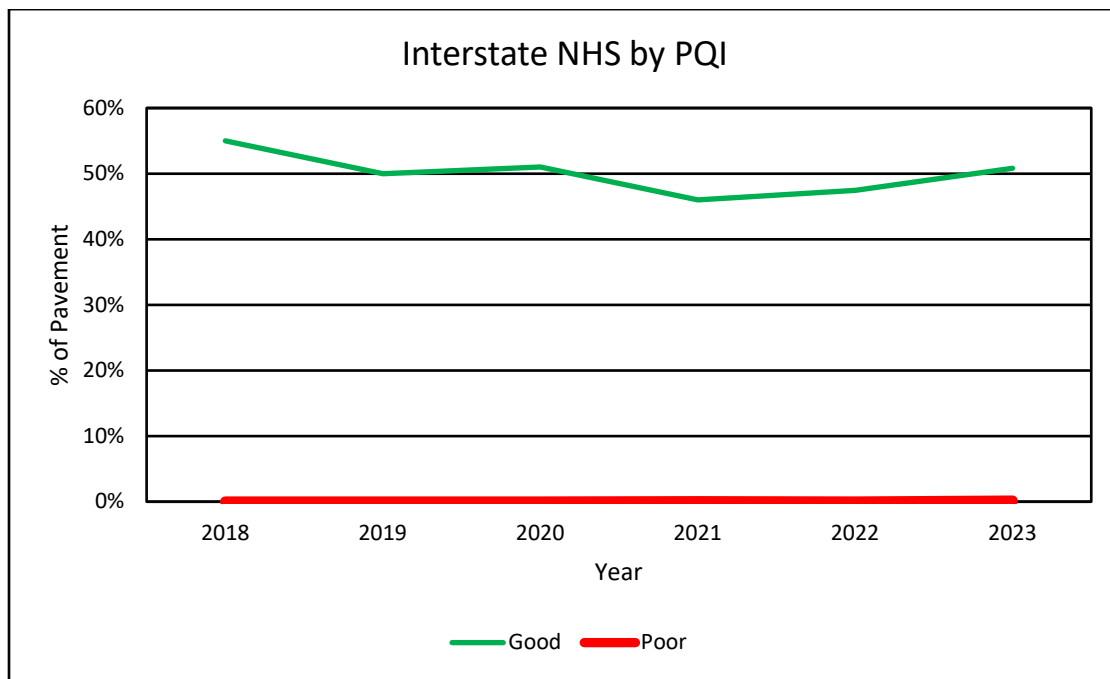


Figure 2-5: Historical pavement performance rating on Interstates based on PQI

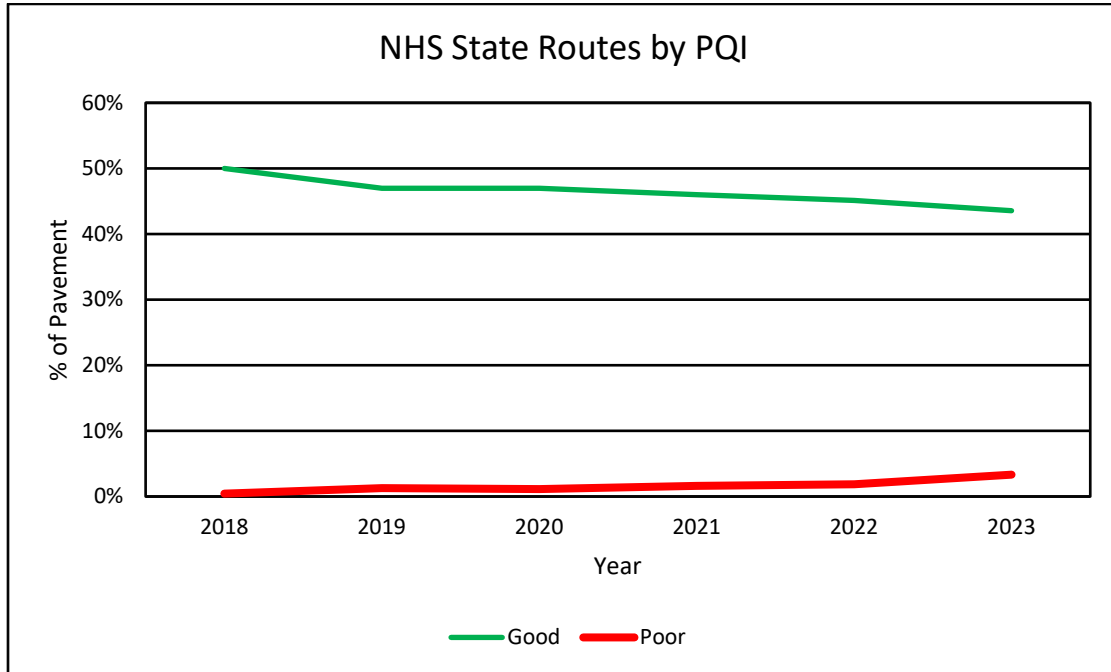


Figure 2-6: Historical pavement performance rating on NHS State routes based on PQI

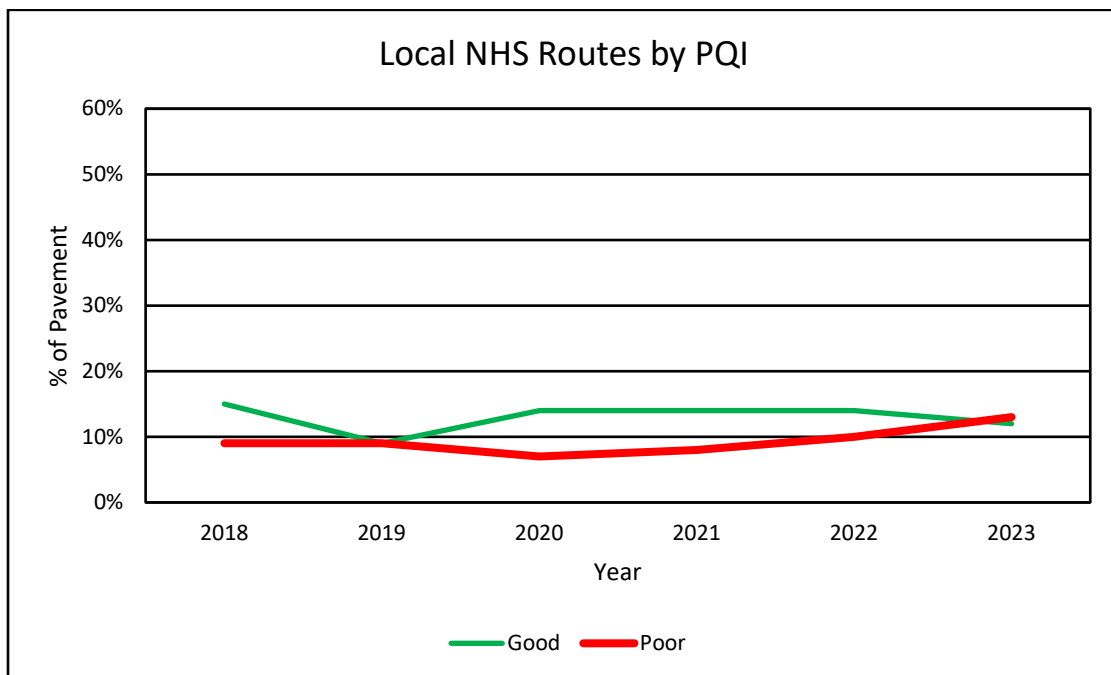


Figure 2-7: Historical pavement performance rating on local NHS routes based on PQI

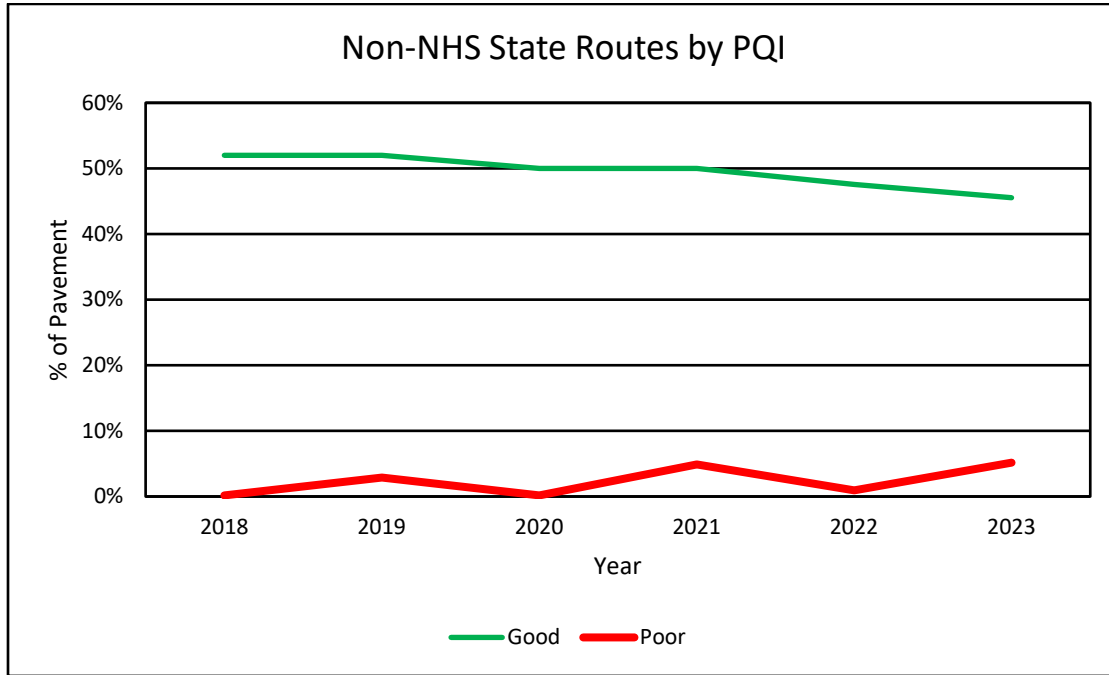


Figure 2-8: Historical pavement performance rating on non-NHS States routes based on PQI

Pavement Condition Trend – Using TPM

Historical performance rating data for the Federal ratings on the Interstate system, State NHS routes, and local NHS routes are shown below in figures 2-9 through 2-13, respectively. Interstate and non-Interstate NHS pavement information was obtained from the highway performance monitoring system (HPMS) report card provided by the FHWA. Non-NHS pavement condition was calculated from raw data. TDOT collects non-NHS pavement condition information every other year with only half of the State included. Historical condition data show a steep jump in 2016, which might be due to anomalies from data collection and Federal metric calculation. Despite this anomaly, trend data indicate that conditions on the Interstate and non-Interstate NHS are declining.

TDOT has been collecting and reporting pavement condition data to the FHWA for decades; however, in 2014, the method for collecting and rating fatigue cracking was changed by the FHWA. Therefore, only data from 2015–2022 are presented in the figures.

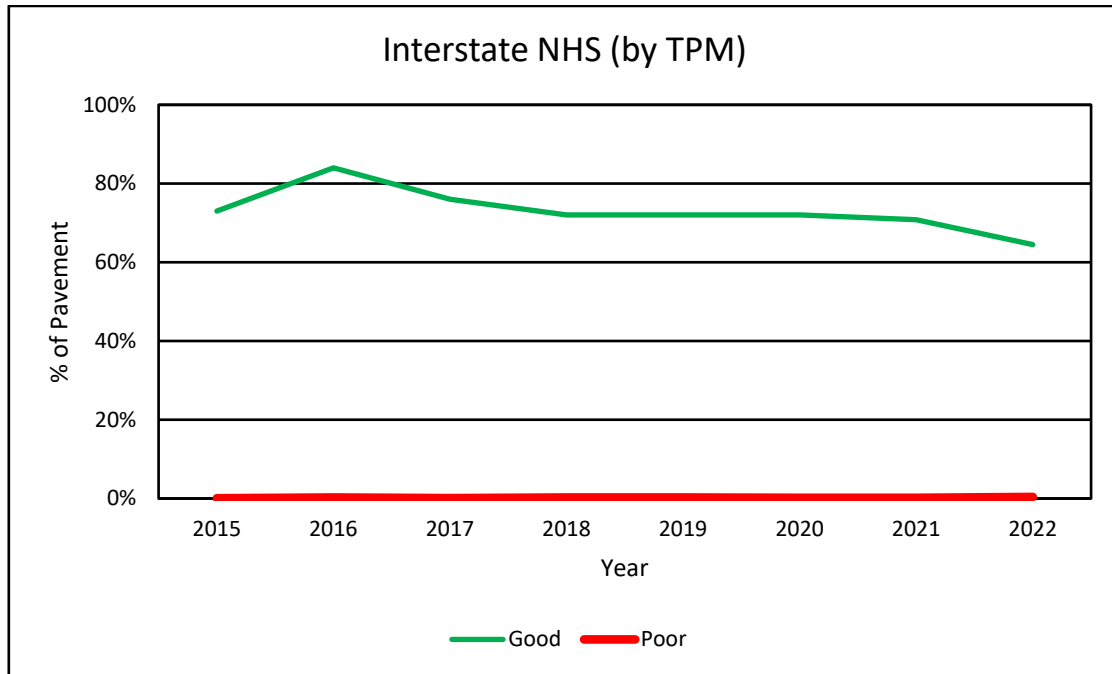


Figure 2-9: Historical pavement performance rating on Interstates based on TPM

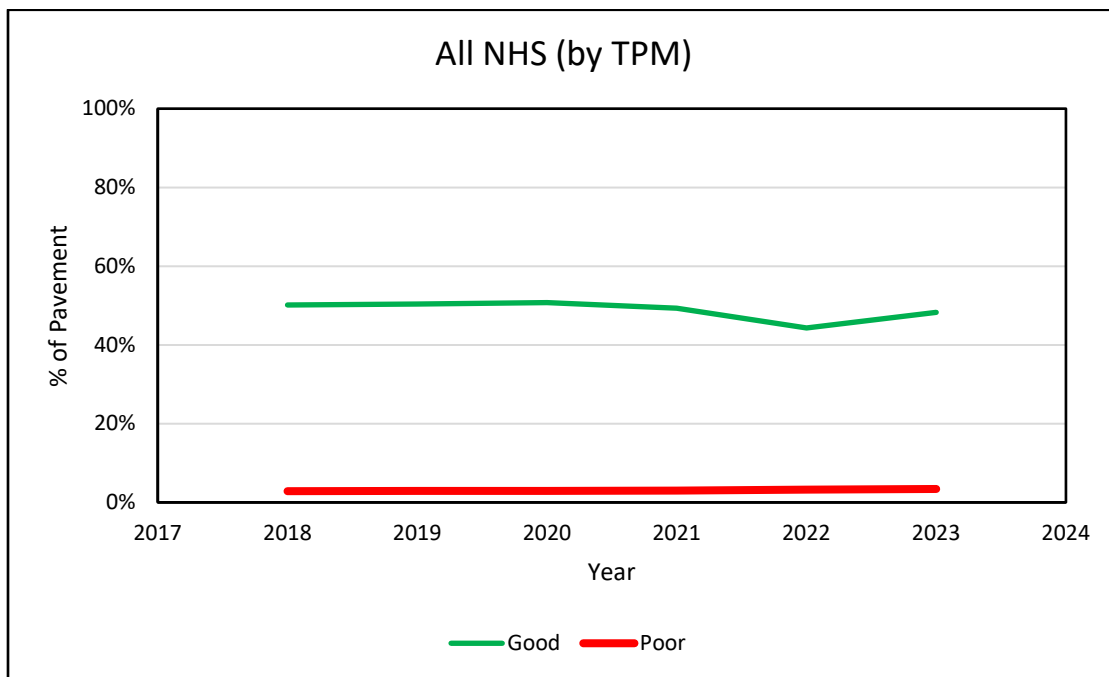


Figure 2-10: Historical pavement performance rating on all NHS routes based on TPM

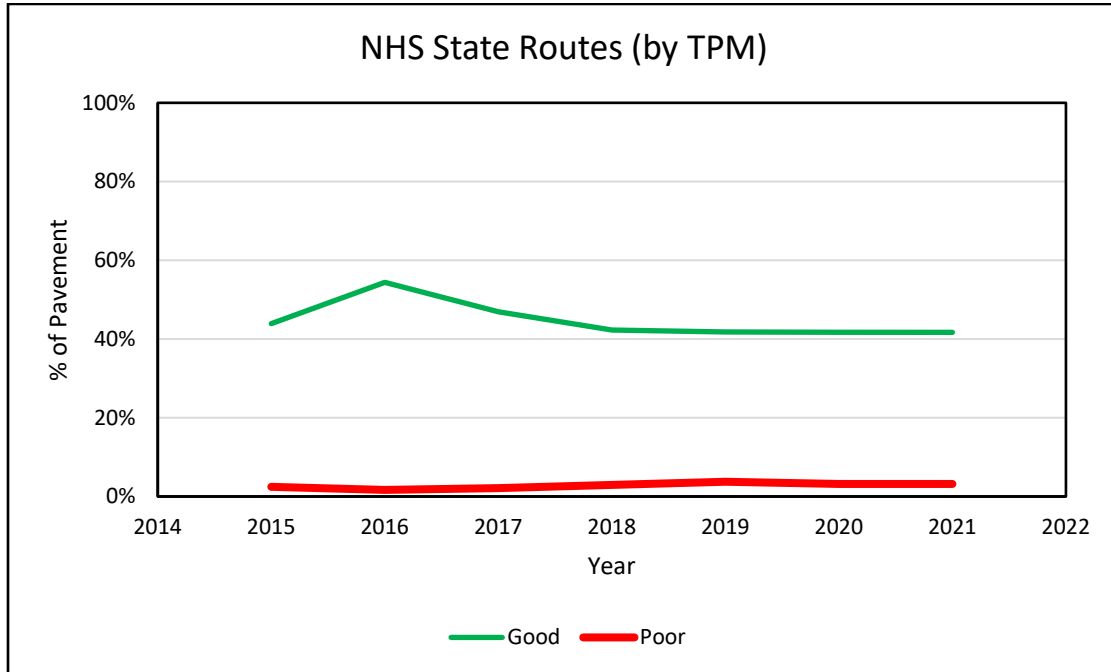


Figure 2-11: Historical pavement performance rating on NHS State routes

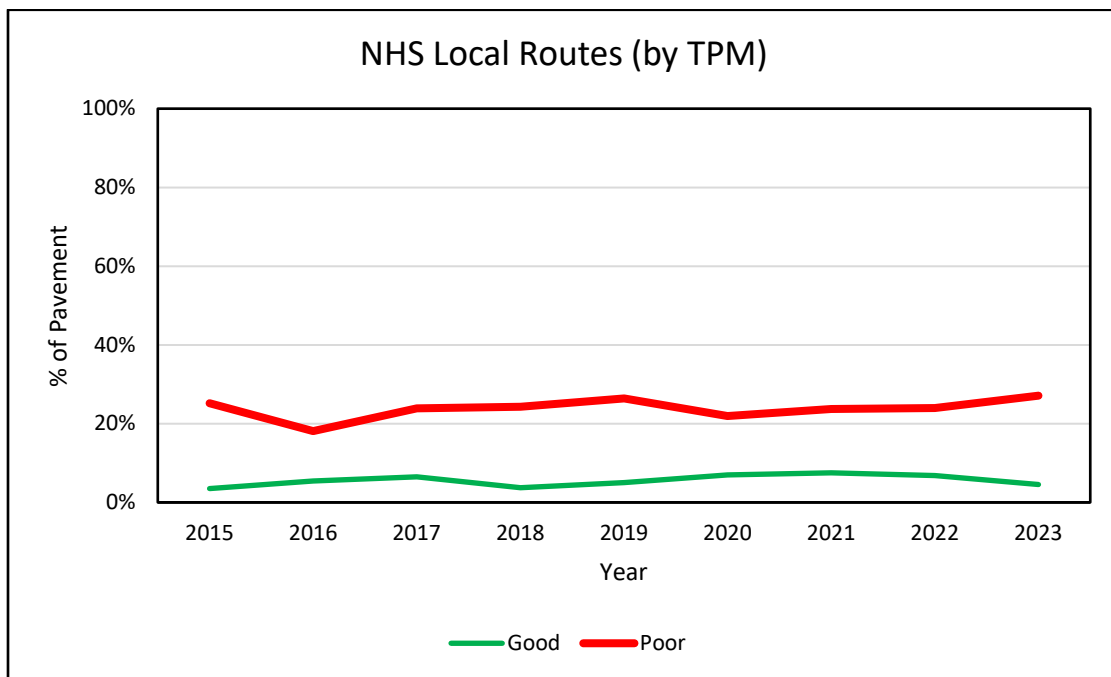


Figure 2-12: Historical pavement performance rating on NHS local routes

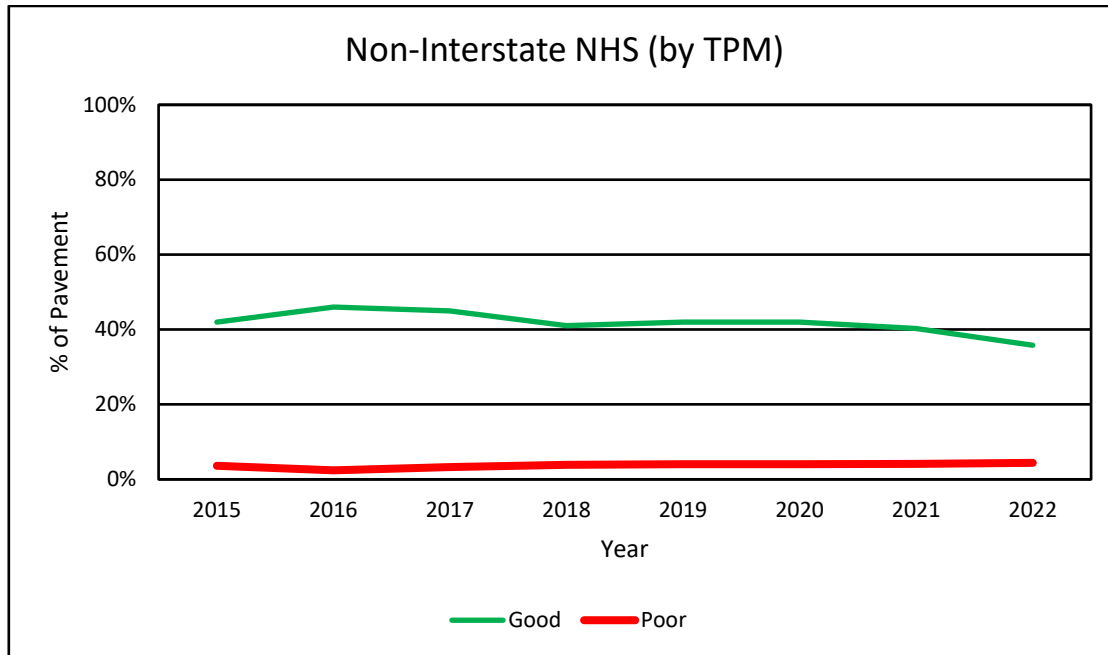


Figure 2-13: Historical pavement performance rating on non-Interstate NHS routes

Current Pavement Conditions

Table 2-8 summarizes the current pavement conditions using both the State and Federal performance measures.

Table 2-8: Current pavement conditions

2023 Pavement Condition Based on PQI		
Network	%Good	%Poor
Interstate NHS		
• Statewide	51	0.1
• Region 1	48	0.2
• Region 2	77	0.0
• Region 3	51	0.0
• Region 4	31	0.5
Non-Interstate NHS State Routes (Only 1 mi. data available)		
• Statewide	44	3.3
• Region 1	57	0.8
• Region 2	56	0.2
• Region 3	50	1.1
• Region 4	17	10.1

2023 Pavement Condition Based on PQI		
Network	%Good	%Poor
Non-NHS State Routes		
• Statewide	46	5.2
• Region 1	58	0.7
• Region 2	62	0.1
• Region 3	51	0.5
• Region 4	16	12.7
2023 Pavement Condition Based on TPM		
Network	%Good	%Poor
Interstate	74	0.2
Non-Interstate NHS	38	4.7
All NHS Routes	48	3.4
NHS State Routes	39	3.7
Local NHS	5	27.1

What Is the Condition of TDOT's Bridges?

Bridge Performance Trends

The overall condition for bridges on each highway system is calculated based on the total bridge deck area in each condition and calculating the percentage. Historical performance ratings from 2016 for all NHS routes, Interstate system, NHS State routes, non-NHS State routes, locally owned NHS bridges, and federally owned NHS bridges are shown in figures 2-14 through 2-19, respectively.

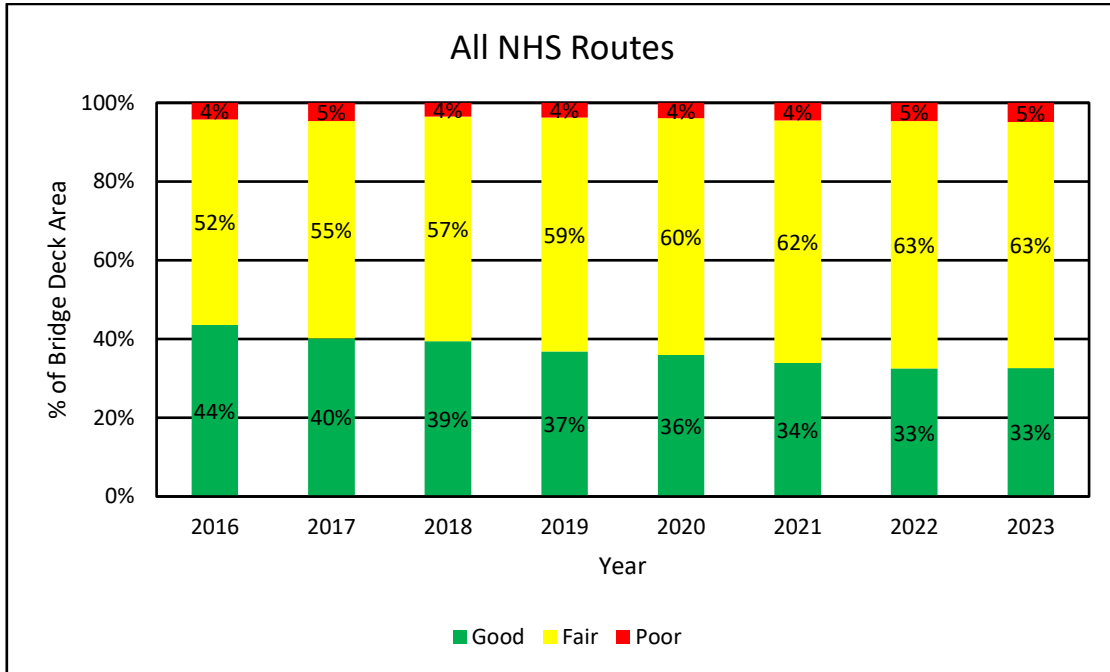


Figure 2-14: Historical bridge performance rating on all NHS routes

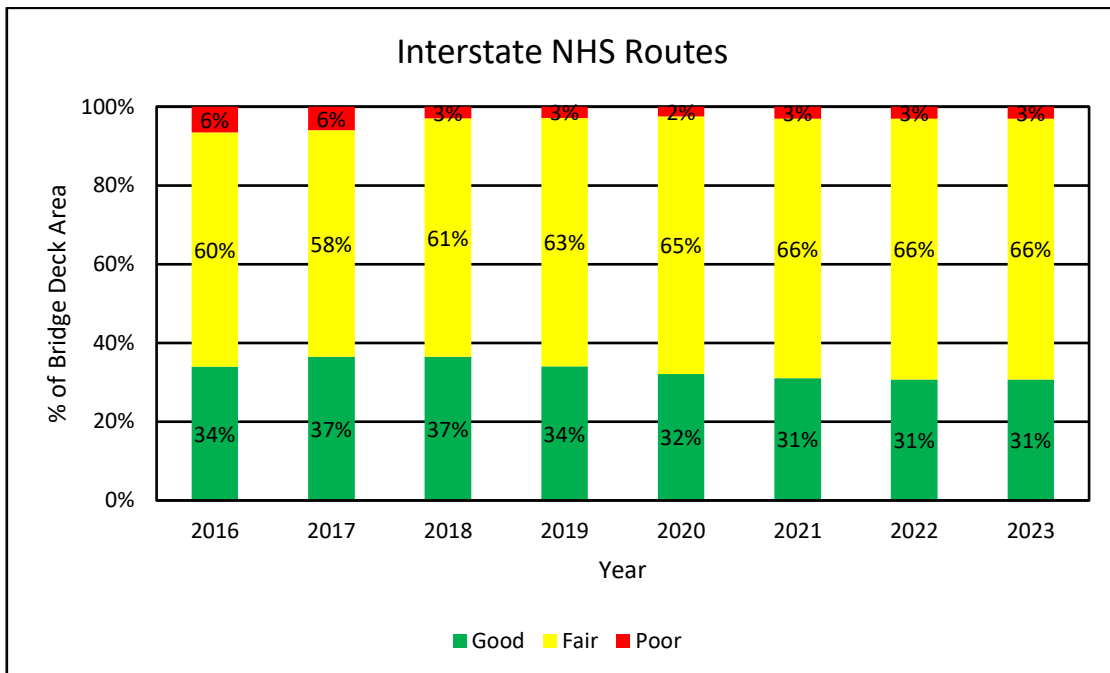


Figure 2-15: Historical bridge performance rating on Interstates

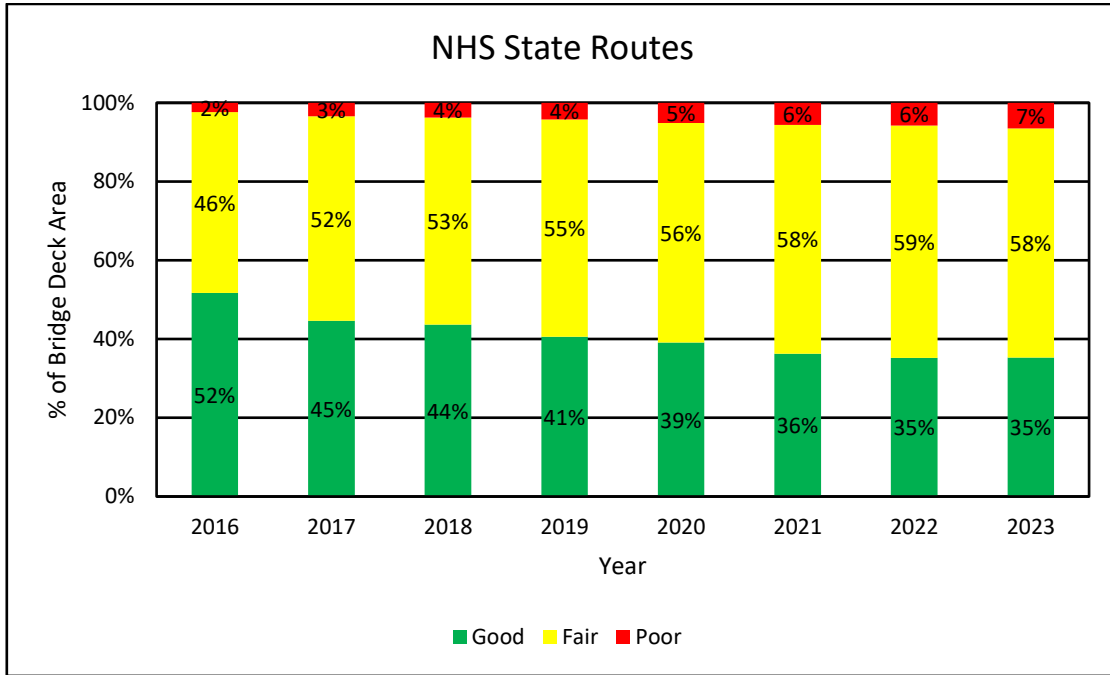


Figure 2-16: Historical bridge performance rating on NHS State routes

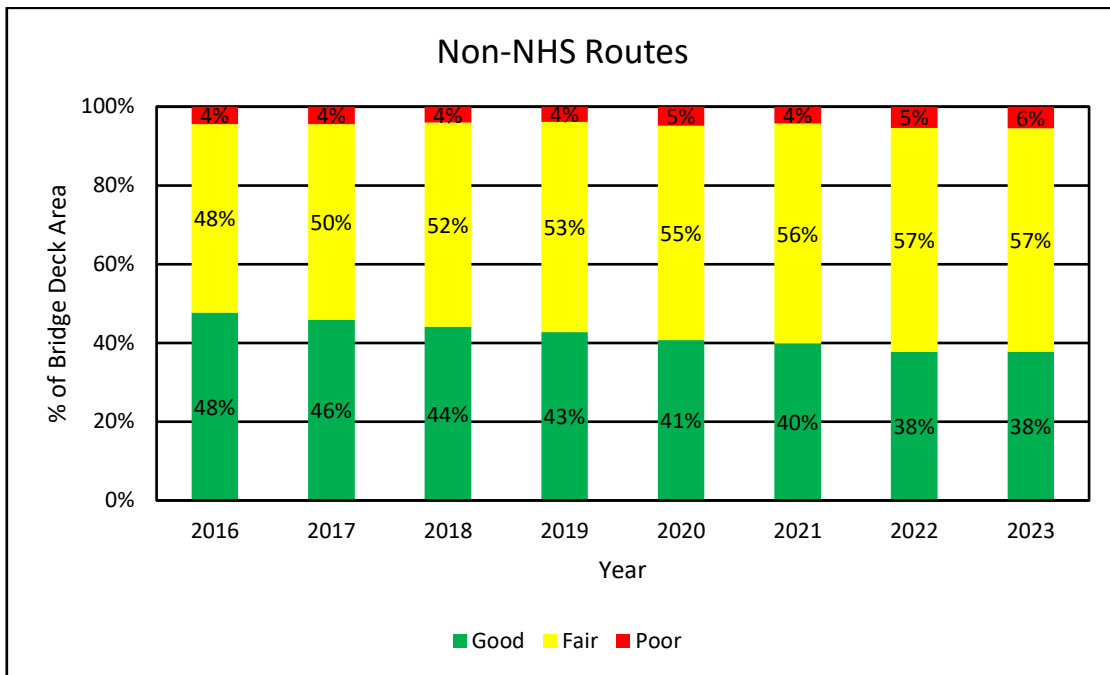


Figure 2-17: Historical bridge performance rating on non-NHS State routes

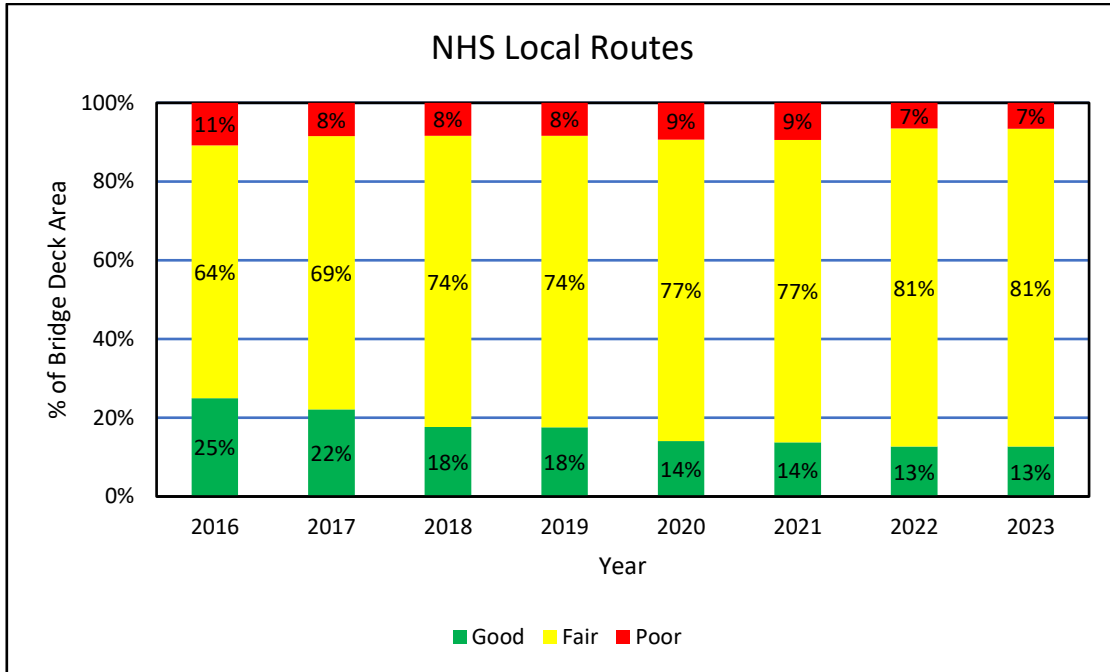


Figure 2-18: Historical bridge performance rating on NHS local routes

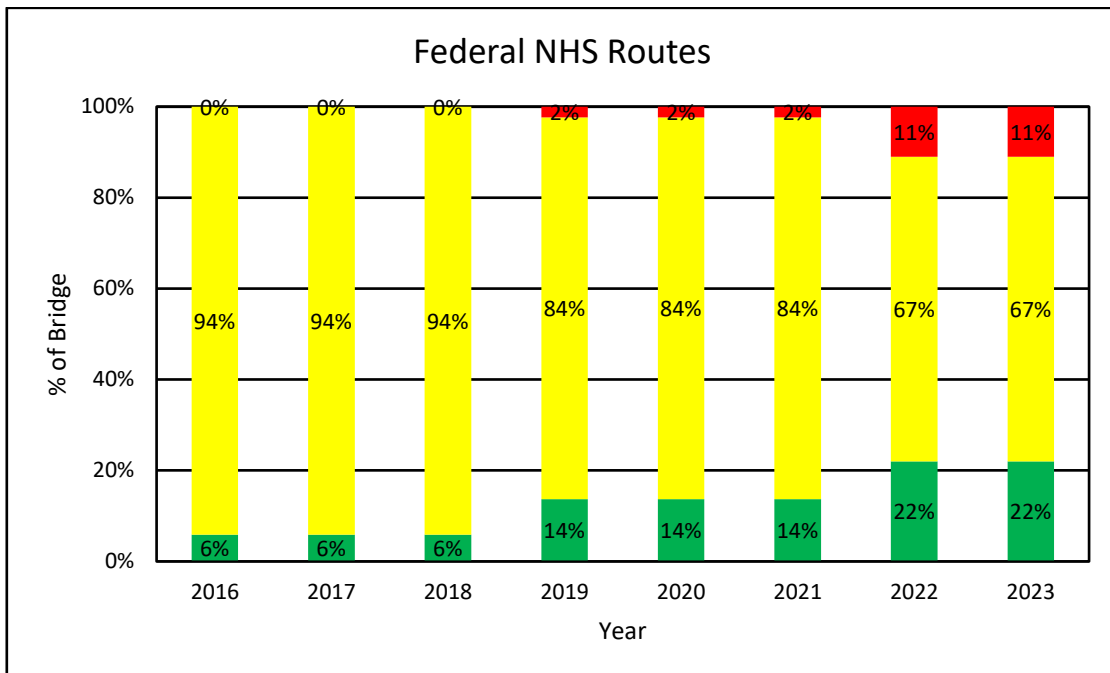


Figure 2-19: Historical bridge performance rating on NHS Federal routes

Current Bridge Conditions

Table 2-9 summarizes the current bridge conditions.

Table 2-9: Current bridge conditions by deck area

2023 Bridge Condition based on NBI			
Network	%Good	%Fair	%Poor
Interstate NHS	30.7	66.28	3.02
All NHS Routes	32.6	62.5	4.9
NHS State Routes	35.3	58.2	6.5
Federal NHS	22	67	11
Local NHS	12.7	80.7	6.6
Non-NHS State Routes	37.8	56.7	5.5

CHAPTER 3

PERFORMANCE GOALS AND TARGETS

What Are Performance Goals and Targets?

TDOT has historically tracked the condition of pavements and bridges throughout the State in order to evaluate the transportation system's performance. Performance measures and targets were established based on the operations, future conditions, and maintenance of the roadway system in conjunction with customer input. These performance measures have served as a good basis for TDOT to determine investment strategy, funding amounts, and project identification and provide a good foundation for the TAMP.

The national performance management measures and targets required by MAP-21 to address the condition of pavements and bridges on both the Interstate system and the non-Interstate NHS are discussed in this chapter. TDOT has defined specific performance targets that constitute the agency's state of good repair (SOGR) for pavements and bridges on the NHS. In addition to these requirements, TDOT has established performance measures and targets for State-owned pavement and bridges not on the NHS.

Establishing performance measures and targets is fundamental to creating an asset management plan that supports the management and performance of the transportation system as well as to identifying the need for preservation, maintenance, rehabilitation, or construction of new facilities. Tracking measurable conditions for pavements and bridges in relation to targets is a useful tool for TDOT to determine if the agency's goals for performance are being achieved at a network level as well as at a regional or a local level. It is also a transparent tool for TDOT to identify where funds benefit the NHS both on and off Interstates.

TDOT tracks pavement and bridge conditions in a pavement management system and a bridge management system, respectively. The historic condition for each of the measurable conditions tracked are shown in Chapter 2. For pavement metrics, TDOT collects data based on ride quality (Pavement Serviceability Index) and condition (Pavement Distress Index). These two indexes are consolidated to calculate a PQI that is used to gauge the overall condition of pavements. The schedule for pavement evaluation is annually on the Interstate and non-Interstate NHS State routes and biennially on non-NHS State routes. For bridges, TDOT tracks the sufficiency rating of the bridge, which is determined from the condition of the bridge deck, superstructure, and substructure, and uses it for prioritization of bridge repairs and replacement. For large culverts (greater than 20 feet along the centerline of the highway), TDOT tracks the overall condition. Bridges (including large culverts) are inspected biennially.

It is important to note that TDOT historically meets or exceeds the national performance minimum standards established by MAP-21 for pavement and bridge conditions, as will be shown in the following sections of this chapter.

What Are the Minimum Standards for Pavements and Bridges?

Pavements

Through MAP-21 and the FAST Acts, national performance goals have been established for pavements and bridges to maintain the condition of these assets in a state of good repair. The National Performance Management Measures for pavements identified in 23 CFR Part 490 have established four measures to assess pavement condition:

1. Percentage of pavements (Lane Miles) on the Interstate system in *Good* condition.
2. Percentage of pavements (Lane Miles) on the Interstate system in *Poor* condition (less than or equal to 5 percent of Interstate pavements in *Poor* Condition).
3. Percentage of pavements (Lane Miles) on the NHS (excluding the Interstate system) in *Good* condition.
4. Percentage of pavements (Lane Miles) on the NHS (excluding the Interstate system) in *Poor* condition.

Within the national rules, performance ratings of *Good*, *Fair*, and *Poor* condition for pavements have been established by the FHWA based on a combination of several metrics typically collected by every State DOT, including TDOT. The FHWA uses these metrics to quantify the condition of pavements in terms of roughness (IRI), cracking, rutting (asphalt), and faulting (concrete). Table 3-1 below summarizes the metrics and the performance ratings, as identified by the FHWA.

Table 3-1: TPM pavement metrics and performance ratings

Metric	Pavement Type	Good	Fair	Poor
IRI	ALL	< 95	95 to 170	> 170
Cracking	Asphalt	< 5%	5% to 20%	> 20%
Cracking	Jointed Concrete	< 5%	5% to 15%	> 15%
Cracking	CRCP	< 5%	5% to 10%	> 10%
Rutting	Asphalt	< 0.20 in.	0.20 in. to 0.40 in.	> 0.40 in.
Faulting	Jointed Concrete	< 0.10 in.	0.10 in. to 0.15 in.	> 0.15 in.

Using this criterion, an asphalt pavement is considered to be in *Good* condition only if all three metrics—IRI, percent cracking, and rutting—meet the criteria for *Good*. The pavement is considered to be in *Poor* condition if any two of the three metrics—IRI, percent cracking, and rutting—are determined to be in *Poor* condition. Finally, the pavement is classified as *Fair* if it does not meet the criteria of *Good* or *Poor* conditions.

Similarly, a jointed concrete pavement is considered to be in *Good* condition only if all three metrics—IRI, percent cracking, and faulting—meet the criteria for *Good*. The pavement is considered to be in *Poor* condition if any two of the three metrics—IRI, percent cracking, and faulting—are determined to be in *Poor* condition. Finally, the pavement is classified as *Fair* if it does not meet the criteria of *Good* or *Poor* classifications.

Continuously Reinforced Concrete Pavement (CRCP) is evaluated only on two metrics: IRI and cracking. The CRCP is considered to be in *Good* condition if both metrics of IRI and cracking are determined to meet the criteria for *Good*. It is considered to be in *Poor* condition if both IRI and cracking are determined to meet the criteria for *Poor*. The CRCP is considered to be in *Fair* condition if it does not meet the criteria of *Good* or *Poor* classifications. The following table 3-2 provides a summarization of this information along with the applicable Federal rule, and the minimum standard for Interstate pavements.

Table 3-2: TPM *Good/Fair/Poor* determination for Interstate pavements and minimum standard

Rule	23 CFR Part 490.313 (c)				23 CFR Part 490.315(a)
Pavement Type	Metrics	Good	Poor	Fair	Minimum Standard (Interstate)
Asphalt	IRI, Cracking, Rutting	All 3 = Good	2 of 3 = Poor	All other combinations	< 5% in Poor condition
Jointed Concrete	IRI, Cracking, Rutting	All 3 = Good	2 of 3 = Poor	All other combinations	
CRCP	IRI, Cracking	All 2 = Good	2 of 2 = Poor	All other combinations	

Bridges

The process for determining the condition of bridges is similar in concept to the process for pavements. The national performance management measures for bridges identified in 23 CFR Part 490 have established three classifications for the purpose of assessing bridge condition (based on the square foot of deck area):

1. Percent of NHS bridges classified as *Good* condition.
2. Percent of NHS bridges classified as *Fair* condition.
3. Percent of NHS bridges classified as *Poor* condition.



Within the national rule, performance ratings of *Good*, *Fair*, and *Poor* conditions for bridges have been established by the FHWA based on a combination of three metrics that are collected by every State DOT, including TDOT. The FHWA will use these metrics on a 0-to-9 condition scale to quantify the condition of bridges in terms of bridge deck, superstructure, and substructure. Culverts are evaluated based on their overall condition. The following tables 3-3 and 3-4 summarize the metrics and the performance ratings.

Condition is determined by the lowest rating of deck, superstructure, substructure, or culvert. If the lowest rating is greater than or equal to 7, the bridge is classified as *Good*; if the lowest rating is less than or equal to 4, the classification is *Poor*. Federally mandated standards require less than or equal to 10 percent *Poor* NHS deck area. Bridges rated below 7 but above 4 will be classified as *Fair* but are not reported to the FHWA.

Table 3-3: TPM components and performance ratings

Component	Good	Fair	Poor
Deck	7 to 9	5 to 6	0 to 4
Superstructure	7 to 9	5 to 6	0 to 4
Substructure	7 to 9	5 to 6	0 to 4
Culverts	7 to 9	5 to 6	0 to 4

Table 3-4: TPM *Good/Fair/Poor* determination for NHS bridges and minimum standard

Rule	23 CFR Part 490.409(b)				23 CFR Part 490.411(a)
Structure Type	Component	Good	Poor	Fair	Minimum Standard (NHS Bridges)
Bridge	Deck, Super-structure, Sub-structure	All components = Good	1 or more components = Poor	All other combinations	≤ 10% of total deck area rated as <i>Poor</i>
Culvert	Overall Condition Rating	Rating = Good	Rating = Poor	Rating = Fair	

What Are TDOT's TPM Targets for Pavements and Bridges?

TDOT has established performance targets for the National Transportation Performance Management Measures identified in 23 CFR Part 490 as indicated in table 3-5. An Oversight Committee consisting of key TDOT managers and senior leadership was established to provide oversight and coordination for the implementation of all MAP-21 and FAST Act final rules, including development of performance targets. During the 2022–2025 performance cycle for the TPM, MPOs supported TDOT's targets for the NHS network including for locally owned NHS roadways and bridges.

Table 3-5 displays Pavement and Bridge targets for the 2022–2025 performance period.

Table 3-5: TDOT National Transportation Performance Management targets

Asset	System	% Good			% Poor		
		2021 Baseline	2-year	4-year	2021 Baseline	2-year	4-year
Pavements	Interstate	70.8%	> 58%	> 58%	.02%	< 1%	< 1%
	Non-Interstate NHS	40.3%	> 36%	> 36%	4.1%	< 6%	< 6%
Bridges*	NHS (Interstate and Non-Interstate)	32.5%	> 32%	> 32%	5%	< 6%	< 6%

*Based on square feet of bridge deck

Basis for Interstate and Non-Interstate NHS Pavement Targets

The national TPM pavement targets represent anticipated performance outcomes for the full extent of the Interstate and non-Interstate NHS regardless of ownership. Target development included building models to predict specific pavement conditions, conducting network analysis based on FY25 funding levels (including 3 percent budget growth and 7 percent inflation), draft performance targets, and the feasibility/probability of achieving targets with current funding. Target considerations included baseline data, trend analysis, and an assessment of influencing factors. Identified target projections place a heavier emphasis on cost-effective projects that are expected to maximize *Good* condition ratings. However, a worst-first approach was also considered and integrated into target selection in order to minimize *Poor* conditions on high-priority routes.

TDOT has projected a continued decline in %*Good* on the non-Interstate NHS system. Factors contributing to this decline include inflation and increased costs, which limit the buying power of investments over the full analysis period.

Basis for NHS Bridge Targets

Bridges in *Good* condition have been declining from 2016 to 2021 with a minimal increase realized in 2022, while bridges in *Poor* condition have been increasing since 2018. The average age of TDOT-maintained bridges is approximately 48 years, which is a typical age for bridges rated in *Fair* condition. The TDOT Oversight Committee approved 2-year and 4-year targets of 32.0 percent for NHS bridges in *Good* Condition and 6.0 percent for NHS bridges in *Poor* condition for the 2022-2025 target-setting performance cycle.

Targets were set using age-based deterioration modeling, which has been improved since targets were set previously, and model predictions agree with the current condition of the bridges. Investment strategies based on these newer projections are expected to aid in meeting the new targets. Deployment of preservation strategies, such as the use of epoxy coated reinforcing steel, increased concrete cover

over steel, continuous spans without deck joints, among others, will extend the life of the bridges, keep them in a state of good repair longer, and contribute to the performance goals. Additionally, widening and improvement projects on I-40, I-24/I-75, and I-65 include multiple bridges that will be improved or replaced during the upcoming performance cycle. Despite the analysis, strategies, and projects identified in this TAMP, it may still be challenging for TDOT to continue realizing positive results through the next performance cycle given the current economic climate and rising costs the State is experiencing. Current target-setting approaches consider a 5 percent cost increase. TDOT re-evaluated the 4-year targets at the midpoint to assess bridge condition ratings, funding levels, and other influencing factors and determined that the 4-year targets remained appropriate.

How Has TDOT Defined State of Good Repair (SOGR) for Pavement and Bridges?

TDOT has a long-standing history of maintaining the State's pavement and bridges in *Good* condition, which are serviceable to Tennesseans based on the traffic they serve. The agency's long-term goals are to maintain pavement and bridges in a state of good repair throughout the asset's lifetime at the lowest possible cost.

TDOT has established long-term performance targets for pavements and bridges based on their importance and functional need. For example, Interstate highways are the most important facilities since they provide the backbone for the movement of people, freight, and commerce within the State as well as across the Nation. Historically, TDOT has not differentiated between State routes that are on the NHS and those that are not part of the NHS. Tables 3-6 and 3-7 provide the SOGR performance measures and targets for the agency's pavements and bridges based on highway system. It should be noted that, for bridges, TDOT has established the same performance measures and targets for the State's SOGR as for the national performance management measures. For pavements, the SOGR is based on the PQI.

Table 3-6: Pavement and bridge SOGR performance measures

Asset	System	Performance Measure	Good	Poor
Pavements	Interstate	PQI	PQI > 4.0	PQI < 2.0
	Non-Interstate NHS	PQI	PQI > 3.5	PQI < 2.0
	Non-NHS State	PQI	PQI > 3.5	PQI < 2.0
Bridges*	Interstate	Condition ratings for Deck, Superstructure, Substructure	All three ≥ 7	One or more ≤ 4
	Non-Interstate NHS	Condition ratings for Deck, Superstructure, Substructure	All three ≥ 7	One or more ≤ 4
	Non-NHS State	Condition ratings for Deck, Superstructure, Substructure	All three ≥ 7	One or more ≤ 4

*Based on square feet of bridge deck

Table 3-7: TDOT SOGR targets

Asset	System	Good	Poor
Pavements	Interstate	> 45%	< 1.0%
	Non-Interstate NHS	> 40%	< 2.0%
	Non-NHS State	> 40%	< 2.0%
Bridges*	Interstate	> 32%	< 6%
	Non-Interstate NHS	> 32%	< 6%
	Non-NHS State	> 32%	< 6%

*Based on square feet of bridge deck

What Is the Gap Between Pavement Performance and SOGR Targets?

TDOT calculates and reports pavement performance per number of lane miles using the PQI. These results are used to assist the Department in determining funding amounts, allocations to the four TDOT regions, and appropriate work types to minimize whole-life costs, which include a combination of maintenance, preservation, rehabilitation, or reconstruction needed for the roadways.

Figures 3-1 through 3-3 below show the PQI rating for each roadway system from 2018 to 2023. As shown, in 2023, 51 percent of lane miles on the Interstates had a PQI > 4.0, which is above the SOGR target of 45 percent. In 2023, 44 percent of NHS State routes and 46 percent of non-NHS State routes had a PQI > 3.5, which are both above the SOGR target of 40 percent for non-Interstate State routes.

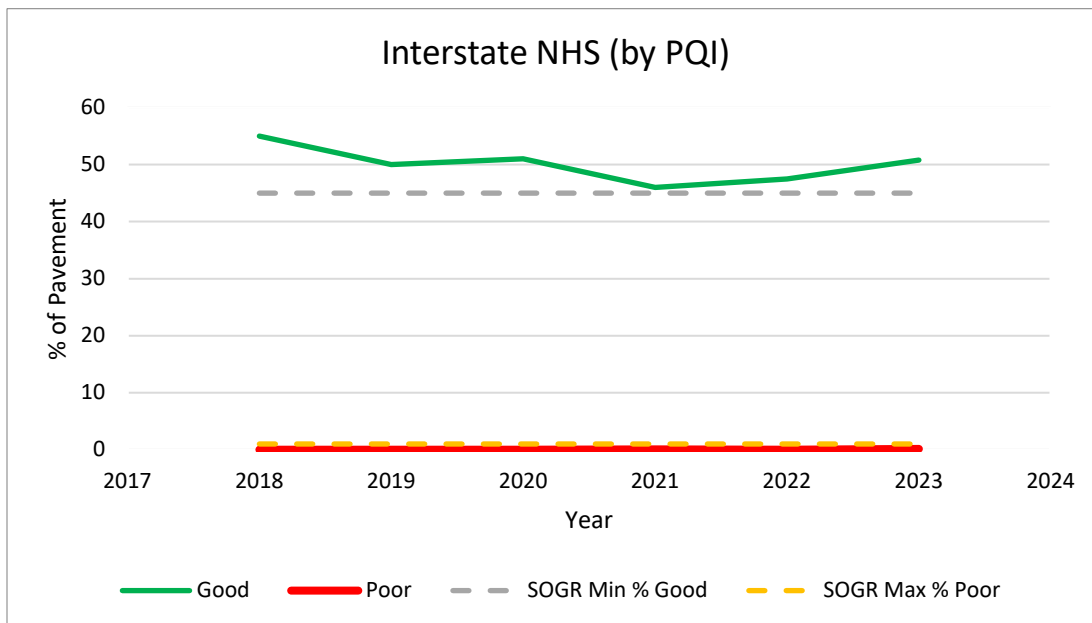


Figure 3-1: Historical pavement performance rating and SOGR target on Interstates

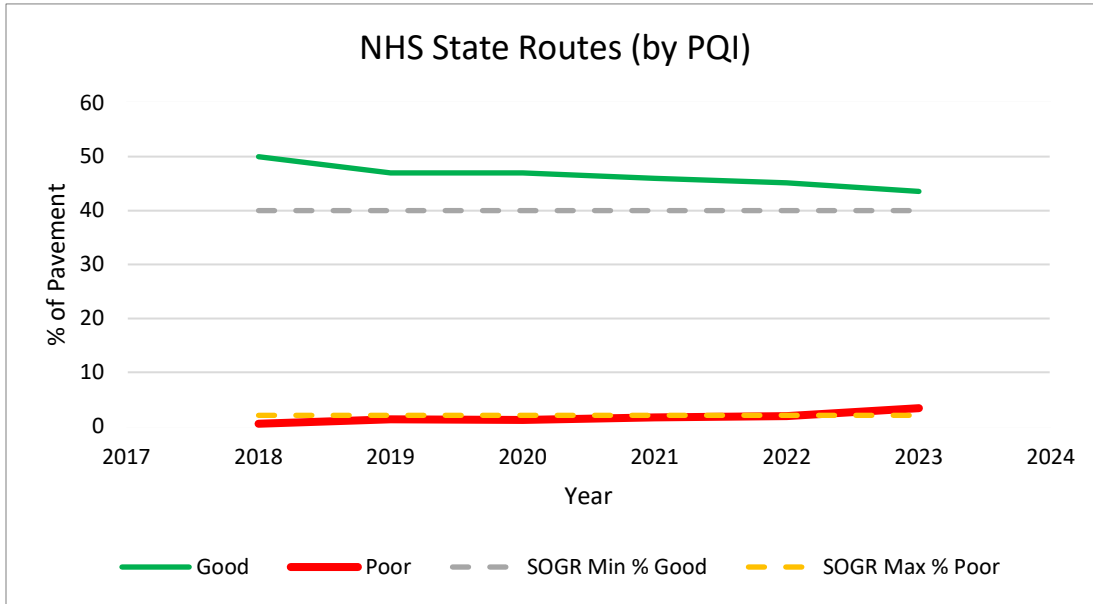


Figure 3-2: Historical pavement performance rating and SOGR target on NHS State routes

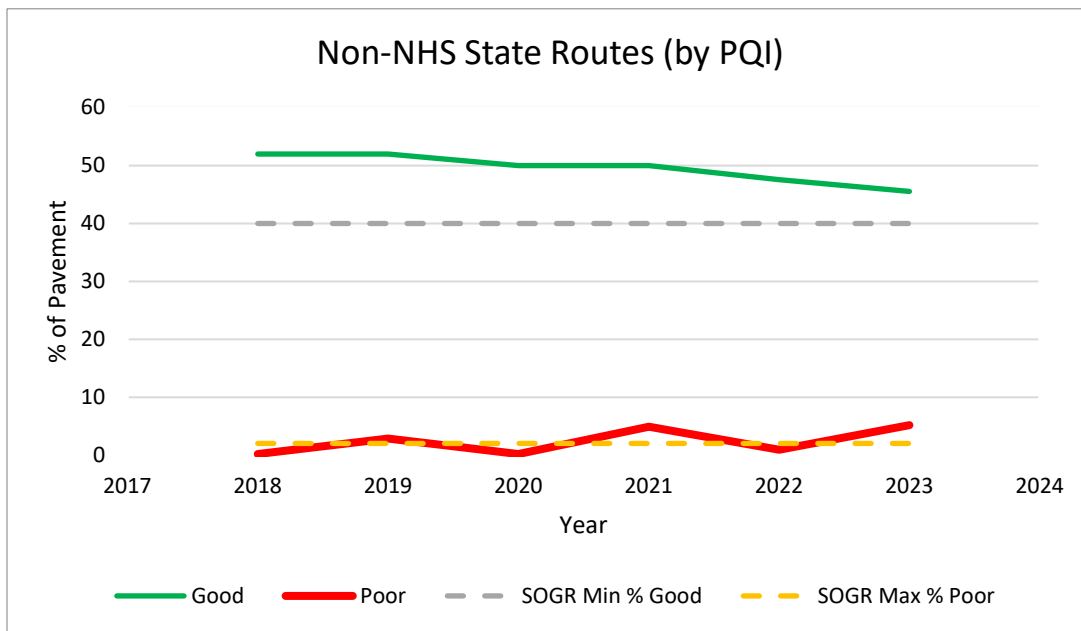


Figure 3-3: Historical pavement performance rating and SOGR target on non-NHS State routes

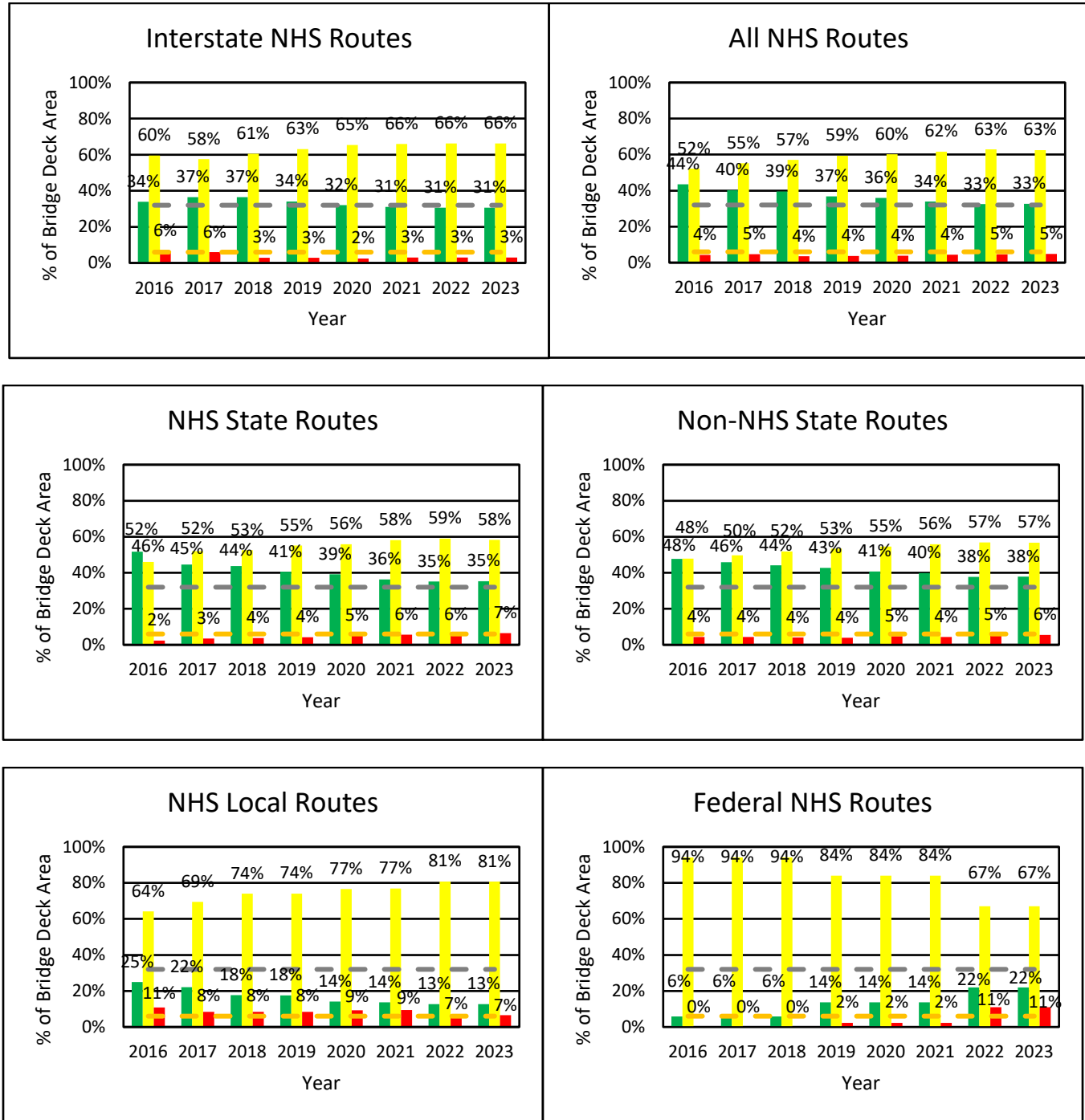
What Is the Gap Between Bridge Performance and Targets?



rehabilitation, or replacement.

Since TDOT has established a dependable bridge management process using the NBIS inspection reports to determine program and project needs, the Department has made a smooth transition to the TAMP requirements. The inspection program requires an in-depth evaluation of the deck, substructure, superstructure for bridges, and key features of large culverts based on the NBI standards. The results from the inspections are used to determine the type of work activity required for the bridge or large culvert, including maintenance, preservation,

Figure 3-5 shows the *Poor* rating for the bridge inspections conducted in 2016–2023 on each system. The 2023 data indicate that conditions for most of the systems meet TDOT’s established SOGR targets. Interstate bridges at 31 percent *Good* have dipped below the agency’s SOGR target of 32 percent, and NHS State Route bridges at 7 percent *Poor* have exceeded the 6 percent ceiling. The preliminary 2024 data show Interstate bridges staying steady at 31.09 percent *Good* and an improving trend with 5.41 percent of NHS State Route bridges in *Poor* condition, which again satisfies the SOGR condition target. In terms of how Tennessee’s bridges compare with the national performance minimum standard (less than or equal to 10 percent of deck area rated *Poor*), the “All NHS” graphic in figure 3-5 shows that 33 percent of all bridges on the NHS are rated as *Good* with 5 percent rated *Poor*. This is within the agency’s targets of at least 32 percent in *Good* condition and no more than 6 percent in *Poor* condition.



32% Good Threshold — — —

6% Poor Ceiling — — —

Figure 3-4: Bridge condition rating (green-Good; yellow-Fair; red-Poor)

How Does TDOT Stay Ahead of the Performance Targets?

As described by the performance measures and targets, TDOT is currently meeting or exceeding the Federal minimum performance standards for NHS pavements and bridges. To enhance TDOT's ability to maintain this high standard of bridge conditions that has been historically established, the agency has recently implemented a new bridge management system (BMS). The new BMS assists the agency in predicting the future needs to preserve the system and maximize the use of their assets at minimum cost. The BMS is used to track bridge and large culvert metrics as described in Chapter 2. This same system was used to evaluate future needs through life-cycle analysis. Similarly, the Pavement Management System (PMS) is the engine that stores the results of the pavement condition survey and provides the analysis to assist TDOT managers with the information and data to develop pavement management programs to meet TDOT's goals and objectives using life-cycle cost processes discussed more in detail in Chapter 4.

It is difficult to predict what will happen over the course of the next 10 years and even more difficult to predict future traffic growth on a statewide level. While there is no perfect method for predicting future growth, traffic models are used to provide the best possible information for growth scenarios. The industry standard for a small study area is to review the historical growth in an area and assume the same amount of growth continues for the foreseeable future. However, to predict traffic growth for a 10-year horizon statewide, the statewide model was reviewed to predict growth for specific metropolitan areas in the State and for the remaining rural areas of Tennessee. The percentage of vehicle miles travelled (VMT) growth expected to be seen in the next 10 years is shown in the table below.

Table 3-8: Estimated annual VMT growth rate

Area	VMT Growth Rate, percent (Tennessee Statewide Model v_4)
Greater Chattanooga	0.5
Greater Knoxville	0.7
Jackson	0.3
Memphis	0.5
Middle TN	1.3
Tri-Cities	0.3
Statewide	0.9

These growth rate factors can be applied to each area of Tennessee using the PMS and BMS to help with the future analysis of the pavement and bridge conditions. The Department can use this analysis to plan for the maintenance and repair of the pavement and bridges over the next 10 years.

What is TDOT's Predicted Pavement Condition (10 years)?

Based on PQI Measures

Using the PMS, TDOT has projected the percentage of lane miles in *Good* and *Poor* condition for the years 2024–2033 on each of the systems shown in figures 3-5 through 3-7. Figure 3-5 shows that, with current available funding levels (\$119 million), the pavement conditions for the Interstate system are expected to achieve TDOT's target of at least 45 percent of lane miles with a PQI > 4.0 over the next 10 years. The percentage of Interstate lane miles with a PQI < 2.0 are expected to stay below the target maximum of 1 percent. Figure 3-7 shows that, with current available funding levels (\$250 million), the NHS State route pavement condition is predicted to remain above the target of 40 percent of lane miles with a PQI > 4.0 over the next 10 years. However, the percentage of NHS State routes with a PQI < 2.0 is projected to get as high as 18 percent at current funding, which is far above TDOT's target of 2 percent.

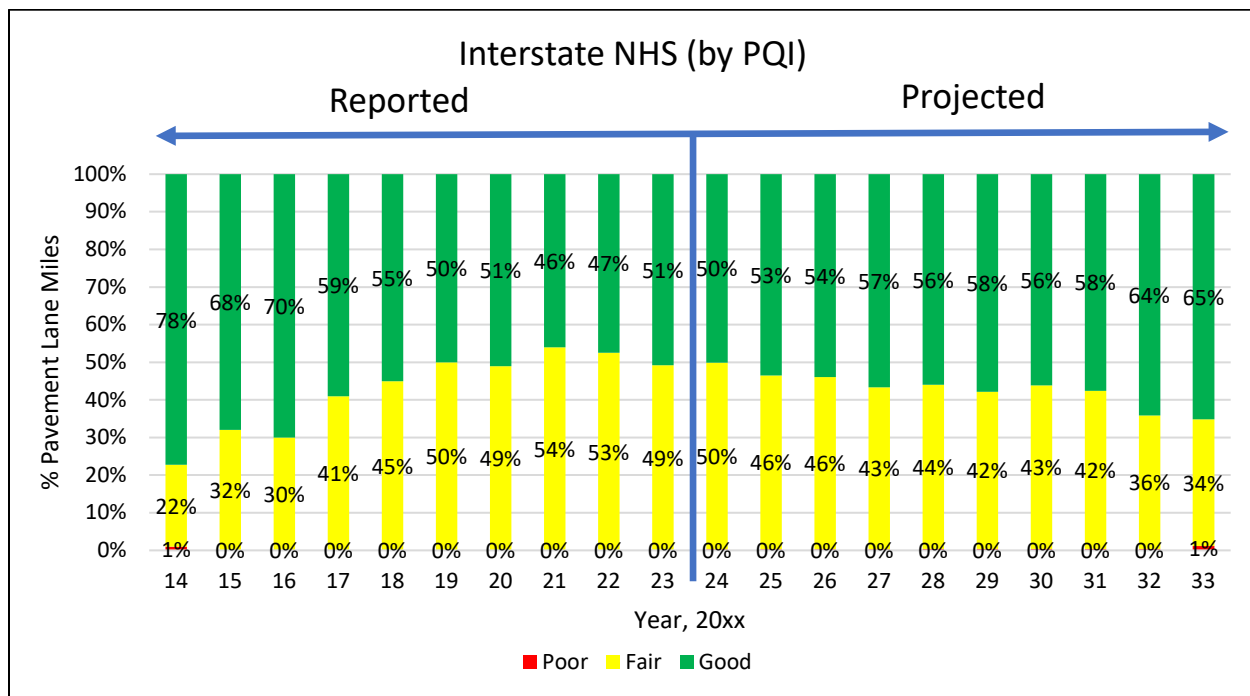


Figure 3-5: Pavement condition (based on PQI)—Interstates (% of lane miles)

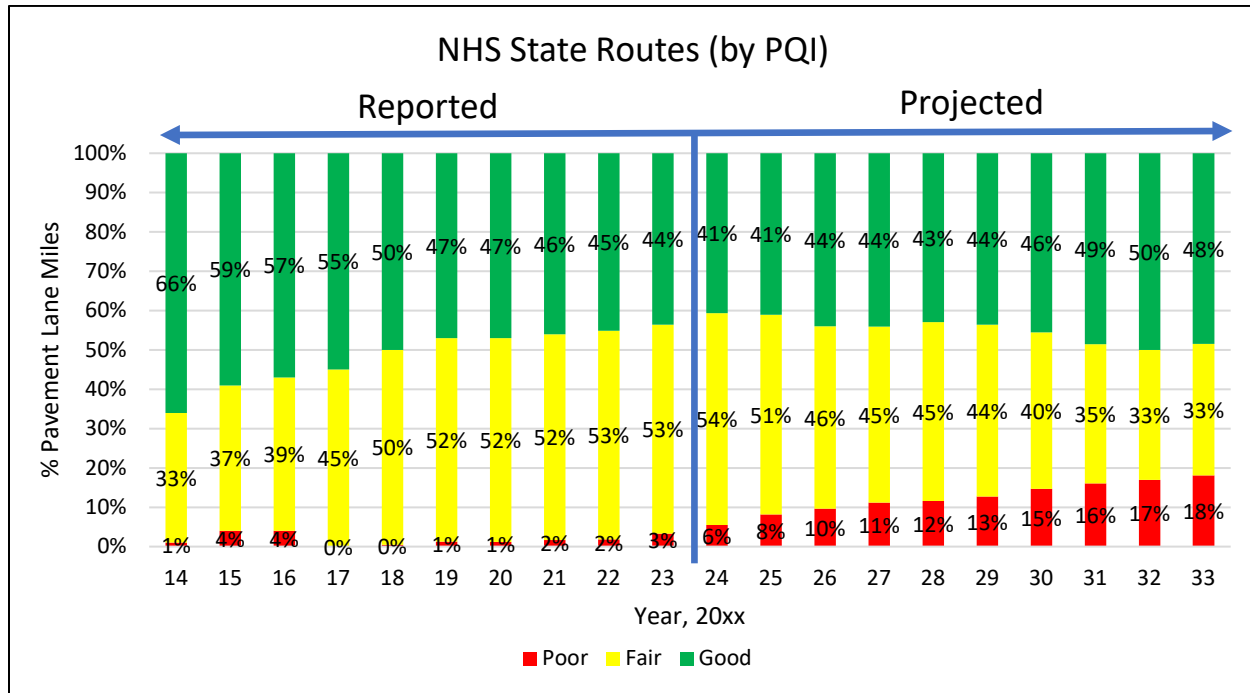
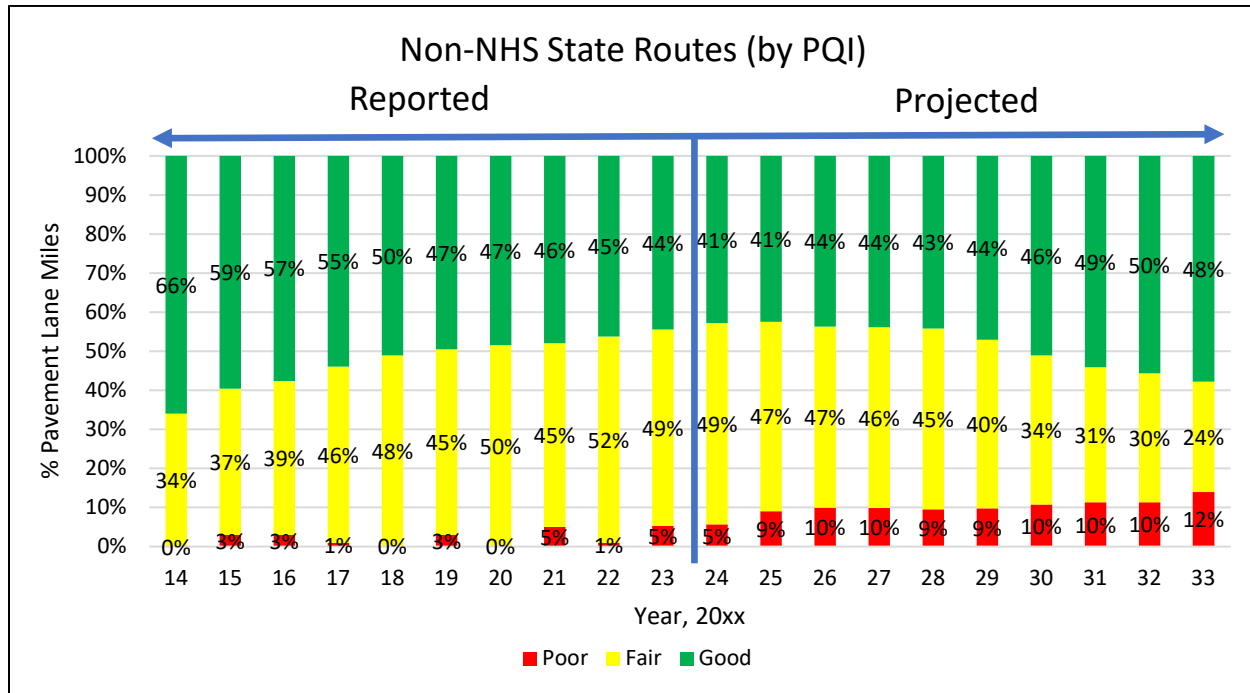


Figure 3-6: Pavement condition (based on PQI)—NHS State routes (% of lane miles)

Figure 3-8 shows the projection of pavement performance on State routes that are not part of the NHS. Although this group makes up the majority of the lane miles in TDOT's inventory (60 percent), these data indicate that the condition has historically been well above the target and is expected to remain at or above the target within the 10-year analysis period. The percentage of non-NHS State routes with a PQI < 2.0 is projected to get as high as 18 percent at current funding levels, which is far above TDOT's target of 2 percent.

In the TAMP, TDOT does not include the prediction for local NHS routes due to the lack of work history and MPO financial plans required to predict future conditions. However, TDOT annually collects local NHS conditions and plans to continue coordinating with MPOs to obtain this information for forecasting in future TAMPs.



*Figure 3-7: Pavement condition (based on PQI)—Non-NHS State routes
(% of lane miles)*

Pavement management analyses can be conducted many different ways, each with their own particular benefits and inaccuracies. The figures shown in this chapter are designed to maximize the cost-effectiveness of treatment selections. According to the analysis shown, TDOT's Interstate and State routes are projected to remain within the SOGR targets for percent *Good* with current funding, but projections indicate targets may likely not be met for percent *Poor* on non-NHS routes. An alternative analysis known as a "worst-first" approach, also now produces projections where TDOT does not meet its targets for percent *Poor*. Worst-first analyses from previous versions of the TAMP achieve percent *Poor* targets but do not achieve targets for percent *Good*. This suggests that updated cost models for treatments outpace available funding inputs, such that heavy treatments implemented through a worst-first scenario use up available funding and delay treatment of subsequent sections past their optimum timing. A review of the treatment type distributions from the projections using cost-effectiveness indicate heavier than usual treatments are being recommended. This suggests that the final actual treatments TDOT has implemented may be lighter and less expensive, potentially making more funds available. Processes are currently being implemented to review PMS projections when establishing pavement programs. Through this process, future iterations of projections are expected to improve in treatment accuracy, implementation costs, and condition projections.

While those State routes that are not part of the NHS may not carry as much traffic as those designated as NHS routes, they still carry a substantial portion of vehicular traffic in the State and are an important part of our transportation network. While this may not have implications regarding TDOT's ability to comply with MAP-21 requirements, it is still an important consideration for the agency going forward,

which could impact how State dollars are invested in other areas of concern (safety, bridges, capacity, transit, etc.).

Based on TPM Measures

Recently, TDOT updated the PMS to project the percentage of lane miles in *Good* and *Poor* condition for the years 2024–2033 on each of the systems based on the TPM measures, as shown in figures 3-8 through 3-10. Based on current funding levels, by 2033, 74 percent, 43 percent, and 51 percent of TDOT’s Interstate NHS, non-Interstate NHS State routes, and non-NHS State routes, respectively, will have *Good* ratings based on TPM measures. In addition, by 2033, 2 percent, 5 percent, and 4 percent of TDOT’s Interstate NHS, non-Interstate NHS State routes, and non-NHS State routes pavement network will be marked as *Poor* based on TPM projections.

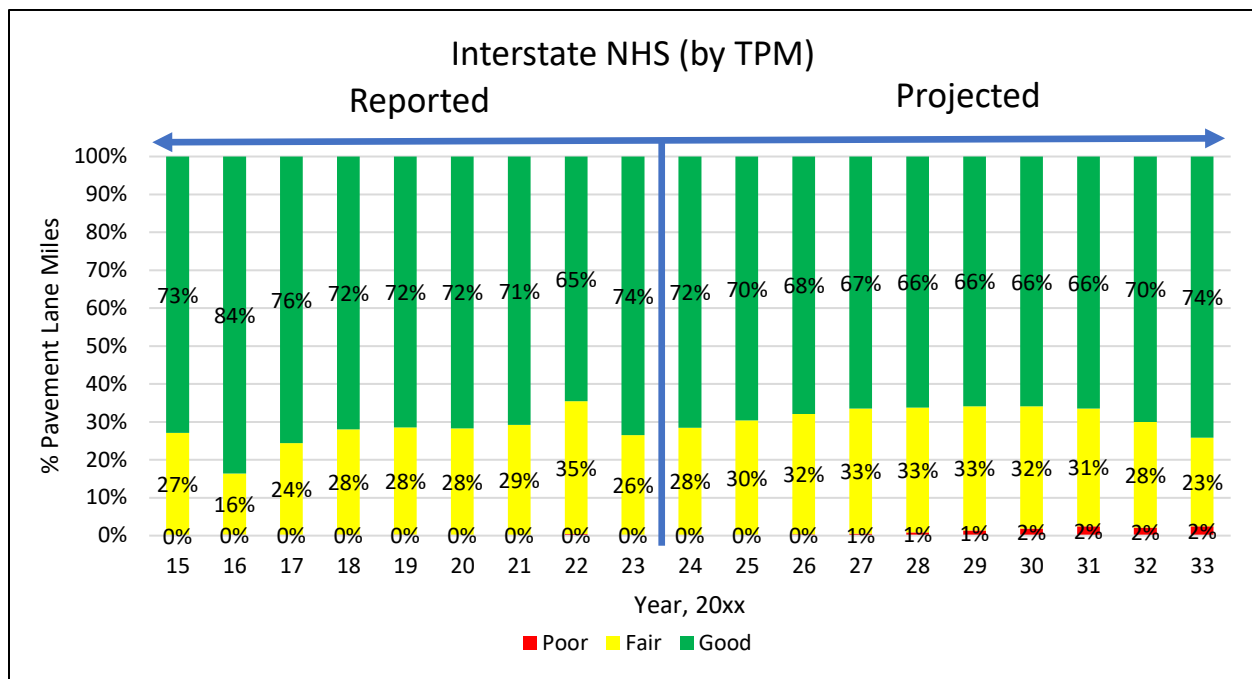


Figure 3-8: Pavement condition (based on TPM)—Interstates (% of lane miles)

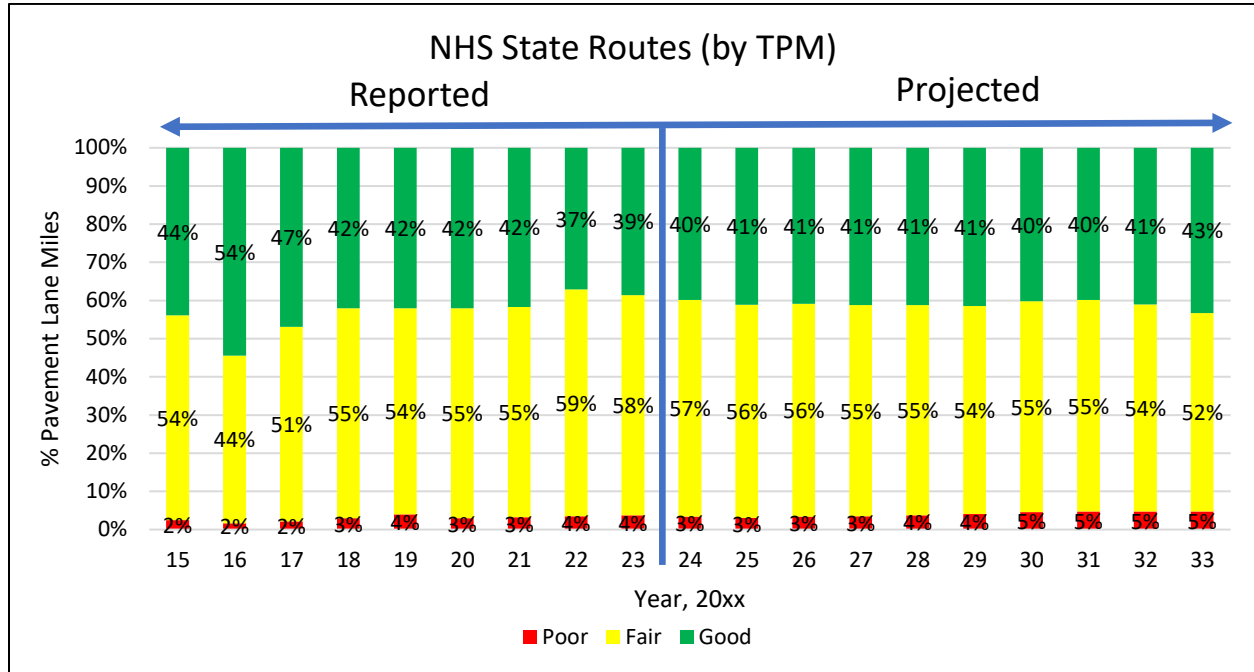


Figure 3-9: Pavement condition (based on TPM)—Non-Interstate NHS State routes (% of lane miles)

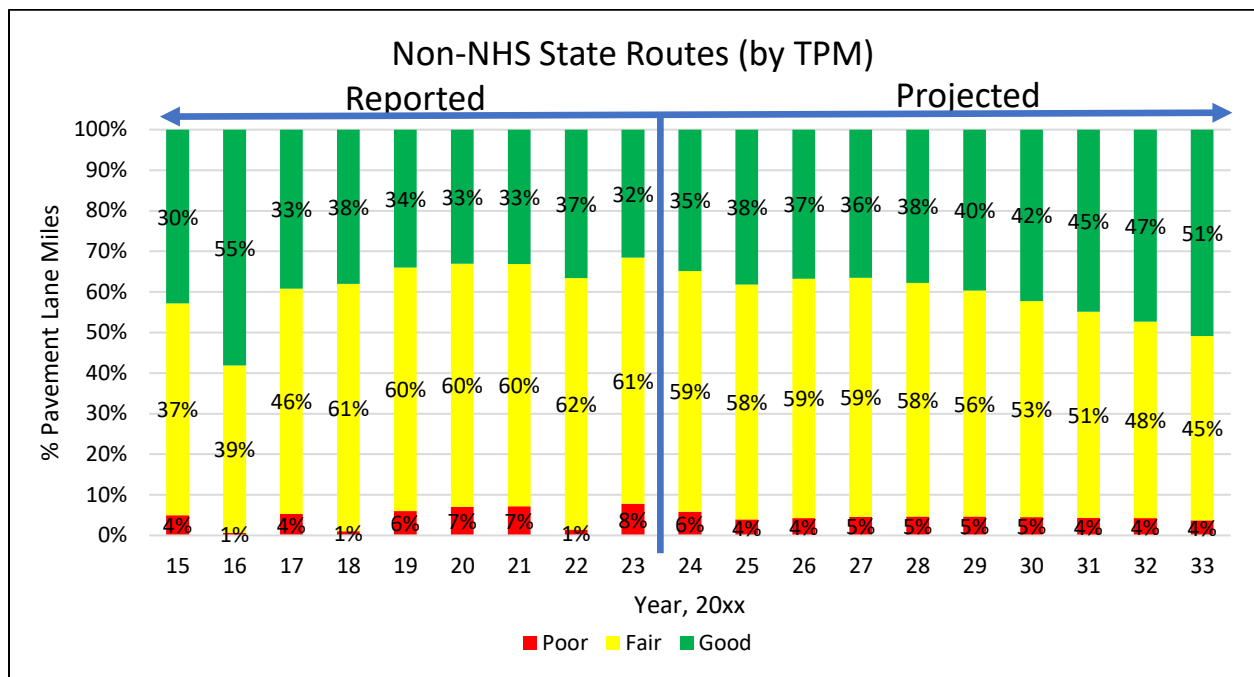


Figure 3-10: Pavement condition (based on TPM)—Non-NHS State routes (% of lane miles)

What Is TDOT's Predicted Bridge Condition (10 years)?

Since funding decisions for bridges are based on the entire State-owned bridge network rather than being broken down by system to prioritize repairs and replacements, the Department has chosen to show predicted condition of the bridges, from 2024 to 2033, using AASHTOWare Bridge Management software (BrM) forecasting models. TDOT continues to review and improve the condition forecasting capabilities in its BMS. The results of the current forecast are broken down for each facility type in figures 3-11 through 3-14.

Figure 3-11 shows that the percentage of Interstate bridges in *Poor* condition is projected to increase to 6 percent over the next 10 years, which remains well below the national performance minimum standard of no more than 10 percent in *Poor* condition. It just exceeds TDOT's SOGR target of less than 6 percent *Poor* while also remaining a little below at least 32 percent *Good*. Figure 3-12 shows that all NHS bridges are expected to perform similarly with the percent *Poor* just above the threshold of less than 6 percent and the percent *Good* falling below the 32 percent target.

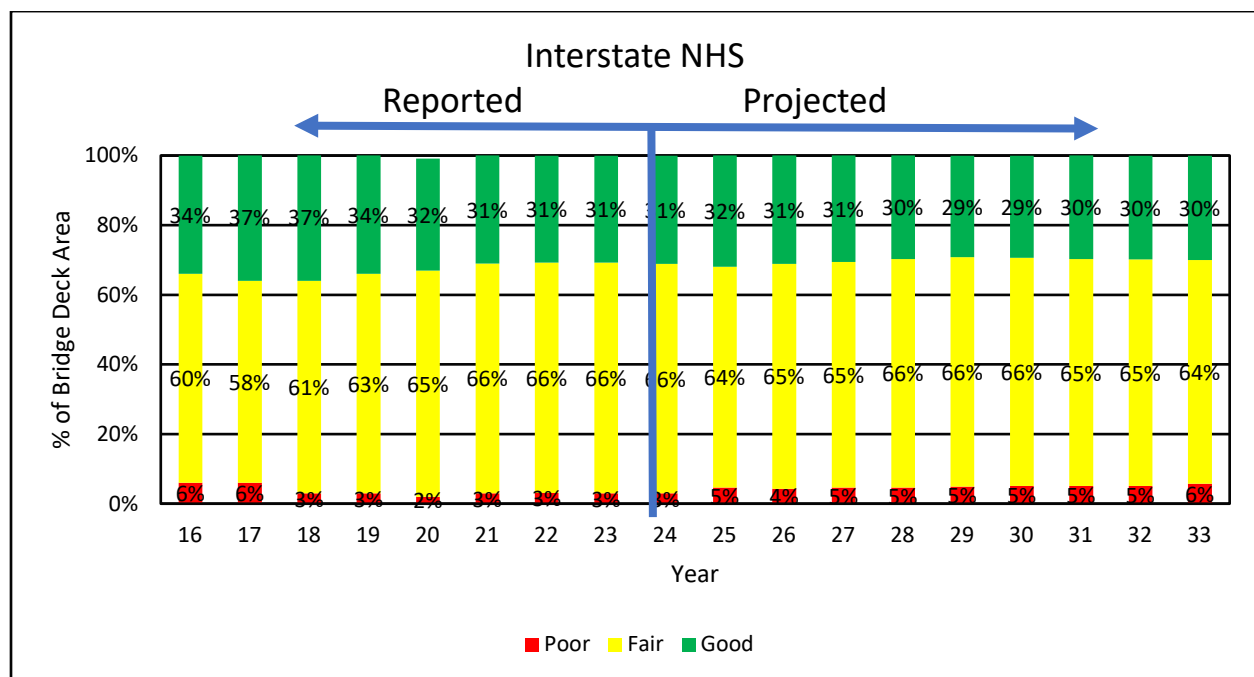


Figure 3-11: Predicted bridge condition – Interstates (% of deck area)

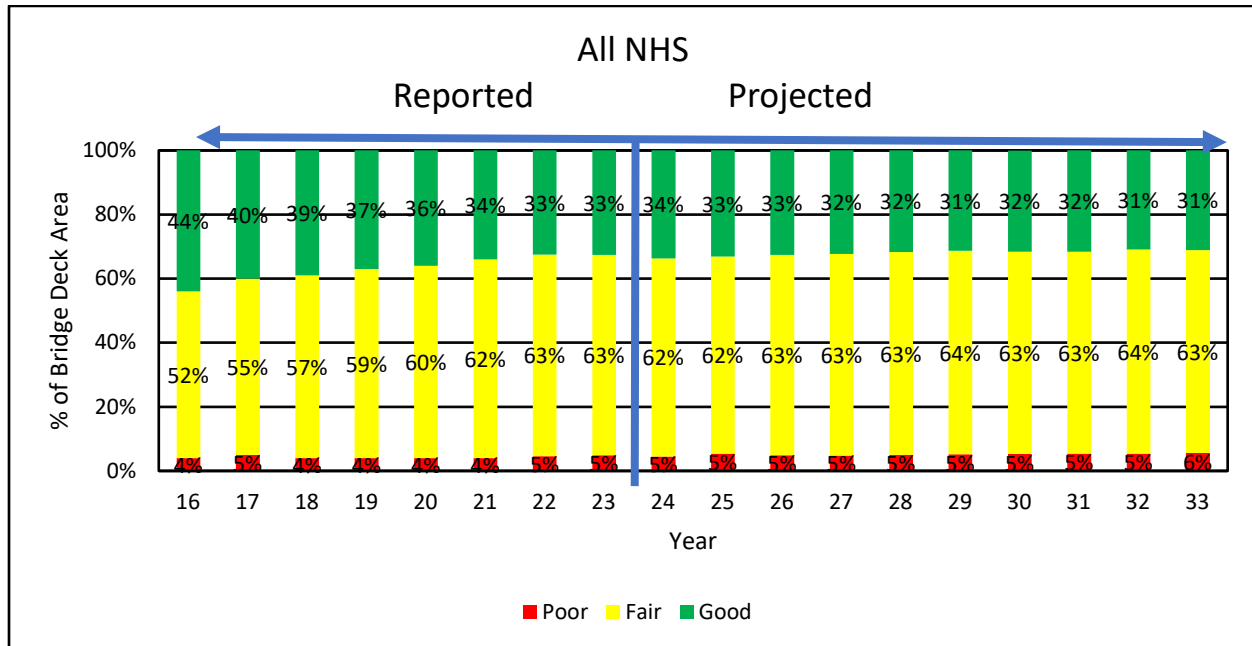


Figure 3-12: Predicted bridge condition—All NHS (% of deck area)

In figure 3-13, State-owned non-NHS bridges are predicted to increase to 7 percent *Poor*, while in figure 3-14, the percent *Poor* for local NHS bridges is anticipated to decrease from 7 percent to 4 percent from 2023 to 2033. MPO's have supported the State DOT's State of Good Repair targets of 32 percent *Good* and 6 percent *Poor* bridge deck area for the 2022–2025 performance cycle.

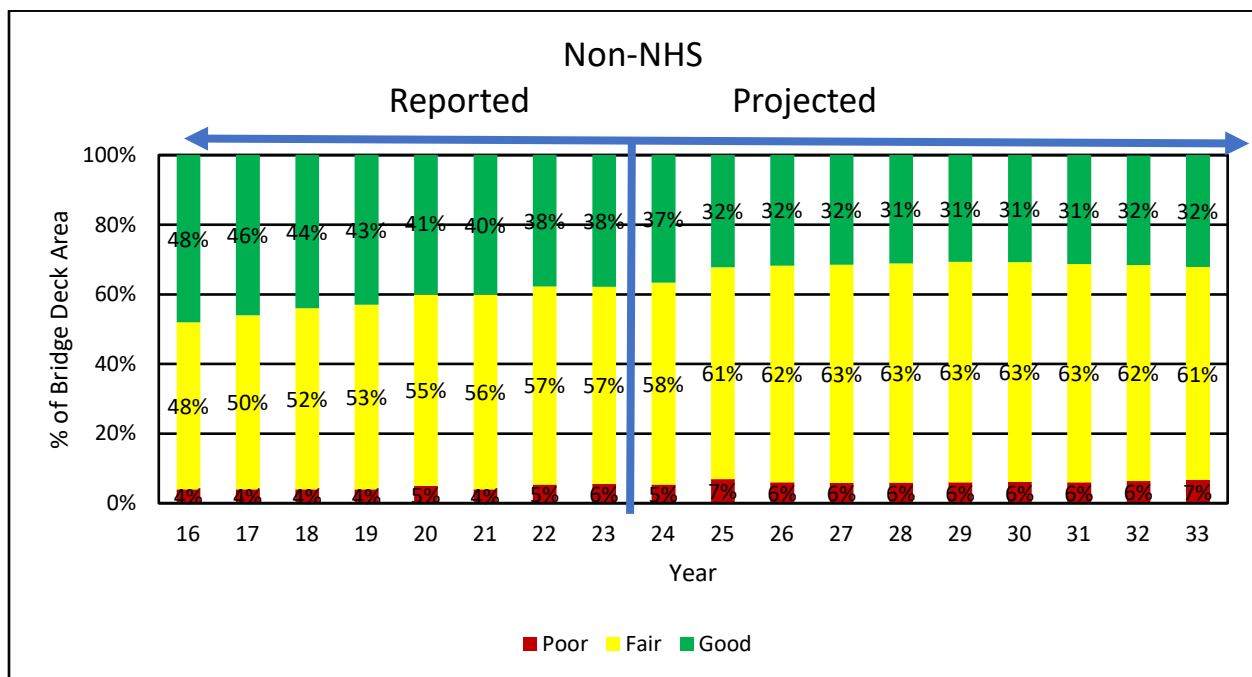


Figure 3-13: Predicted bridge condition—Non-NHS (% of deck area)

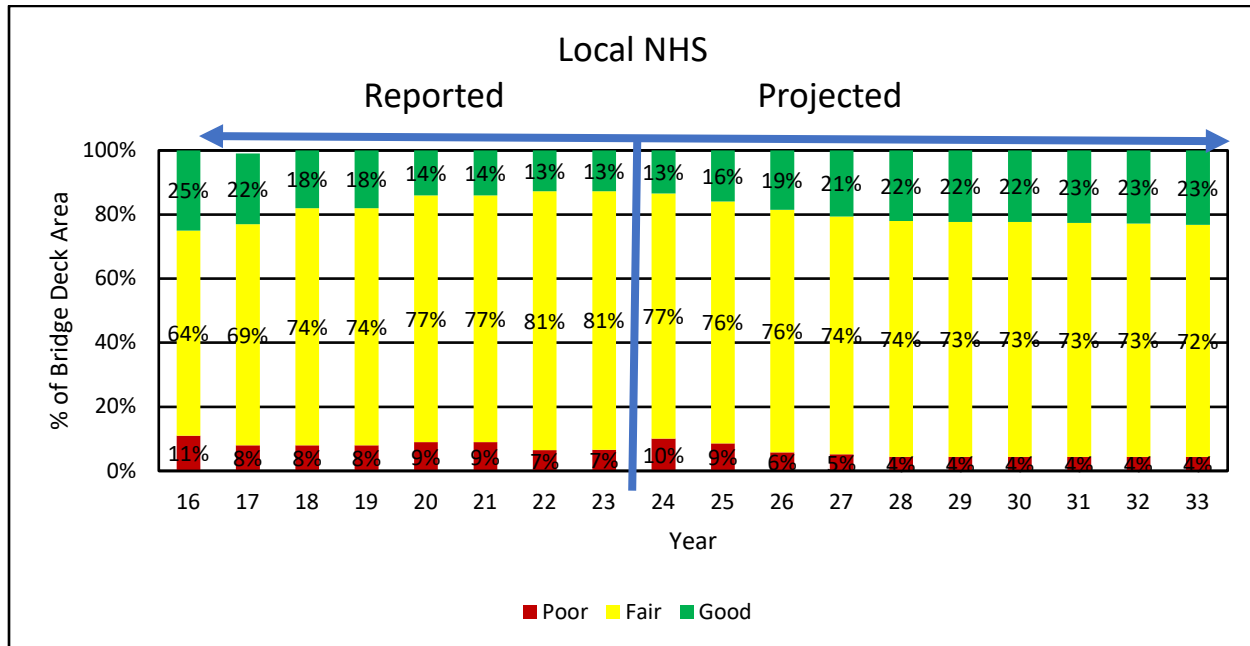


Figure 3-14: Predicted bridge condition—Local NHS (% of deck area)

The estimated funding to achieve these SOGR targets for bridges is approximately \$181 million per year with an assumed 75 percent dedicated to NHS facilities. Around \$85 million per year is expected to fund reconstruction of deficient bridges, and approximately \$68 million will be used for rehabilitation projects with \$24 million reserved for bridge preservation treatments. The remaining \$4 million will fund the bridge maintenance program.

The bridge management budget was recently increased by \$16 million annually to keep up with inflation and to allow for additional preservation projects to be completed each year. Although TDOT does not assign funding for bridges by system, certain factors are considered during the project selection process, which impacts where those bridges carrying higher volumes of traffic will end up on the priority list. Since the Interstate and NHS routes tend to carry the most traffic, they tend to be prioritized for repair, rehabilitation, or replacement before the lower volume bridges. This ensures that the NHS and Interstate bridges continue to remain in a state of good repair and keeps Tennessee's bridges among the best in the Nation.

What Factors Outside of Physical Condition Affect TDOT's Gap Analysis?

TDOT plans for the operations of the transportation system in multiple ways. Many factors affecting the operations are part of the project selection process for the State Transportation Improvement Plan (STIP). Locations that commonly experience bottleneck or congestion problems, report elevated crash rates, see heavy truck traffic, or experience traffic growth due to new developments are all issues that receive priority as part of the selection process.

The items included in the project selection process are categorized to align with the Guiding Principles (see figure 3-15) established as part of TDOT's LRTPP.

TDOT's Guiding
Principles

Figure 3-15: TDOT's Guiding Principles for developing the STIP

Following the passage of the Transportation Modernization Act (TMA) in 2023, TDOT has re-envisioned its project programming evaluation and prioritization process. This is a new mindset and philosophy for TDOT, which will provide improved communication and accountability for taxpayers.

The new project evaluation process considers three important aspects for prioritizing investments:

- Project Performance.
- Project Delivery.
- Project Cost.

Guiding the process are six goals that define the desired long-term outcomes for TMA investment:

1. Maximize traveler safety and system reliability.
2. Reduce congestion and manage travel demand to support an efficient system for people, goods, and services.
3. Support the State's economy.
4. Preserve and protect the transportation system.
5. Support livable and sustainable communities through multimodal integration.
6. Accelerate project delivery.

TDOT used eight evaluation criteria to reflect these goals. Each selected criterion included whether it is currently in use (and working well) in practice, what data are available, and the level of effort required to apply the information across a large number of projects. TDOT avoided redundant or overlapping criteria so each metric would provide a unique assessment of project performance. It should be noted that a goal area for infrastructure preservation was added to account for the condition of the pavement and bridges and to ensure that TDOT is able to meet the state of good repair targets.

Table 3-9: Project selection and prioritization criteria

Goal Area	Evaluation Criteria
Safety	• Crash Reduction
Congestion	• Volume to Capacity Ratio • Travel Time Reliability
Economic Growth	• Percent Truck • Supports Intermodal Access and Connectivity • Economic Status
System Preservation	• Address Bridge or Pavement Need
Livability and Sustainability	• Supports Integrated Multimodal System

The resulting project section and prioritization criteria weighting is displayed in figure 3-16. This illustrates TDOT's commitment to System Preservation as it is the most heavily weighted goal area after Economic Growth.

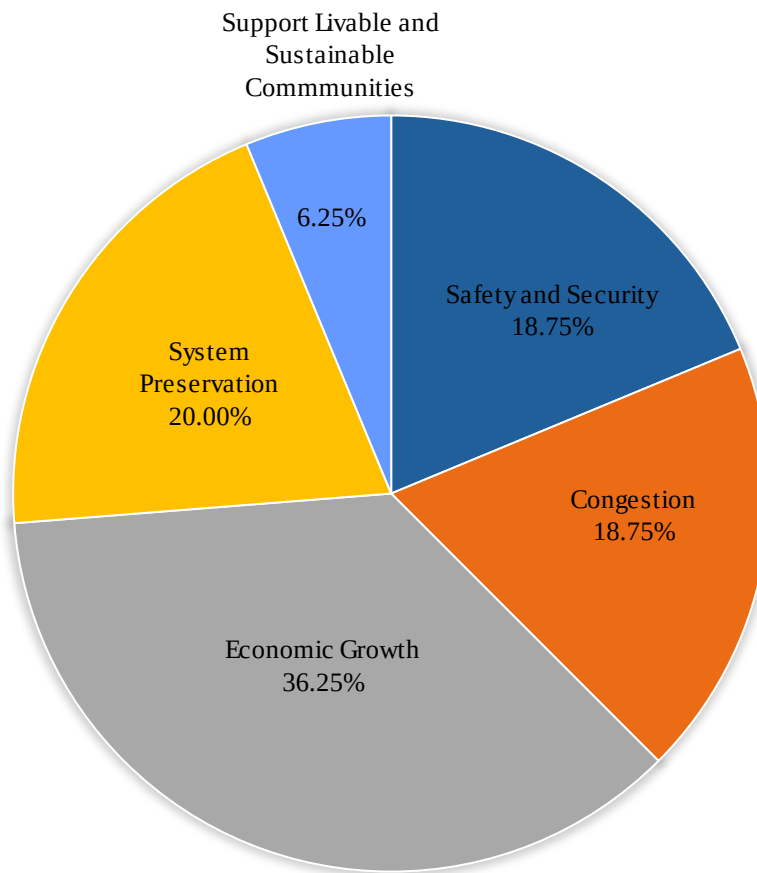


Figure 3-16: STIP Project selection prioritization matrix weighting

How Will TDOT Monitor the Performance of Pavement and Bridges?

As explained in earlier portions of this section, TDOT has a number of processes in place to monitor the condition of pavements and bridges to determine if the investment strategy and program of projects are in line with the objectives of the agency and the long-term state of good repair targets. Below is a summary of TDOT processes to identify potential problems, gaps, and development of strategies to prevent issues.

- On an annual basis, pavement condition results will be extracted from the pavement condition survey and reported to TDOT senior management. Additionally, pavement condition performance will be estimated based on current condition and budgetary amounts. Results will be compared to TDOT's long-term state of good repair targets and the targets TDOT will establish as a part of 23 USC 150(d) for the NHS. As described in Chapter 7, the results of the annual pavement performance report will be used to identify issues in TDOT's pavement management program, determination of funding amounts, or other gaps. Adjustments in program strategy and funding will be considered by senior management within the context of the overall vision and funding needs of the Department.

- On an annual basis, bridge condition results will be extracted from the bridge management system and reported to TDOT senior management. Additionally, bridge performance will be estimated based on current conditions and budgetary amounts. Results will be compared to TDOT's long-term state of good repair targets and the targets TDOT will establish as a part of 23 USC 150(d) for the NHS. As described in Chapter 7, the results of the annual bridge performance report will be used to identify issues in TDOT's bridge management program, determination of funding amounts, or other gaps. Adjustments in program strategy and funding will be considered by senior management within the context of the overall vision and funding needs of the Department.
- TDOT will also evaluate funding needs and effectiveness of the programming of projects, services, and efforts to meet the performance requirements of other sections of MAP-21 on safety, system performance/congestion, freight movement, congestion mitigation, and air quality. All of these various performance expectations will be considered by TDOT's senior management as annual budgets are developed in conjunction with the STIP and 3-Year construction program. With well-defined pavement and bridge programs and systems in place to evaluate the condition and future performance based on life-cycle cost planning, TDOT will be able to make informed decisions based on reliable data and state-of-the-practice analysis.

CHAPTER 4

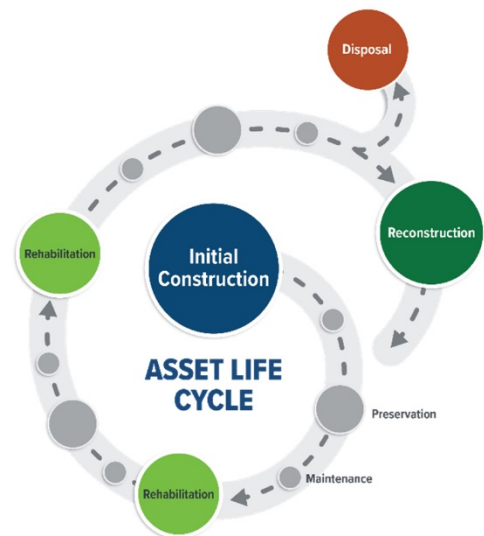
LIFE-CYCLE PLANNING

What Is Life-Cycle Planning (LCP)?

TDOT has a long history of providing a well-maintained roadway system for its users. The Interstates and State routes have high-quality pavement resulting from the State's commitment to preservation practices that extend the life of the pavement network. These pavement preservation methods are embedded within the pavement management system (PMS) analysis, and the Department has solidified its commitment to extending the asset's useful life through policies that promote pavement management principles. TDOT also has a regular bridge inspection program to identify preservation and maintenance needs in a timely manner on its bridges that extend the life cycle. TDOT has recently implemented a modern BMS that provides the ability to perform in-depth life-cycle cost analysis to ensure the State's bridges are managed as cost effectively as possible within funding constraints. As required by the Federal rules, the following section identifies the process TDOT uses to satisfy the requirements of MAP-21 for life-cycle planning (LCP).

In general, an LCP analysis considers all the relevant costs incurred throughout the whole life of an asset (as illustrated in figure 4-1), not just the initial construction cost. To keep an asset functioning adequately, achieve the performance targets established by the agency, and provide users with the level of service that meets their expectations, there are certain actions that must be performed throughout the asset's life. The LCP process begins with the development of different alternatives to fulfill the structural and performance objectives for an asset. A key component of this analysis is the use of deterioration modeling tools to estimate an asset's condition as it ages. This estimation is based on factors such as environment, weather, and, in the case of pavements and bridges, the size and number of vehicle loadings over the life of the asset. The schedule of initial and future activities to maintain an asset's condition at a predetermined performance level is defined, and the costs of these activities are estimated. Direct agency expenditures (e.g., construction, maintenance, preservation, and rehabilitation activities) are typically included in the analysis. The predicted schedule of activities and their associated costs form the projected life-cycle cost of managing the asset network over the selected analysis period.

A key goal of an LCP analysis is to maintain a desired condition at a minimum practicable life-cycle cost. Conceptually, this "happy medium" point (illustrated in figure 4-2) exists where maintenance expenditures are neither too frequent nor delayed too long. Typically, a properly maintained pavement



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Figure 4-1: Typical asset life cycle stages

or bridge, when maintained at a level that minimizes costs in the long term, is continuously kept in relatively *Good* condition. Over the life of these assets, preservation activities that are optimally timed are estimated to cut long-term life-cycle costs roughly in half, compared to a policy where no preservation activities are performed at all.

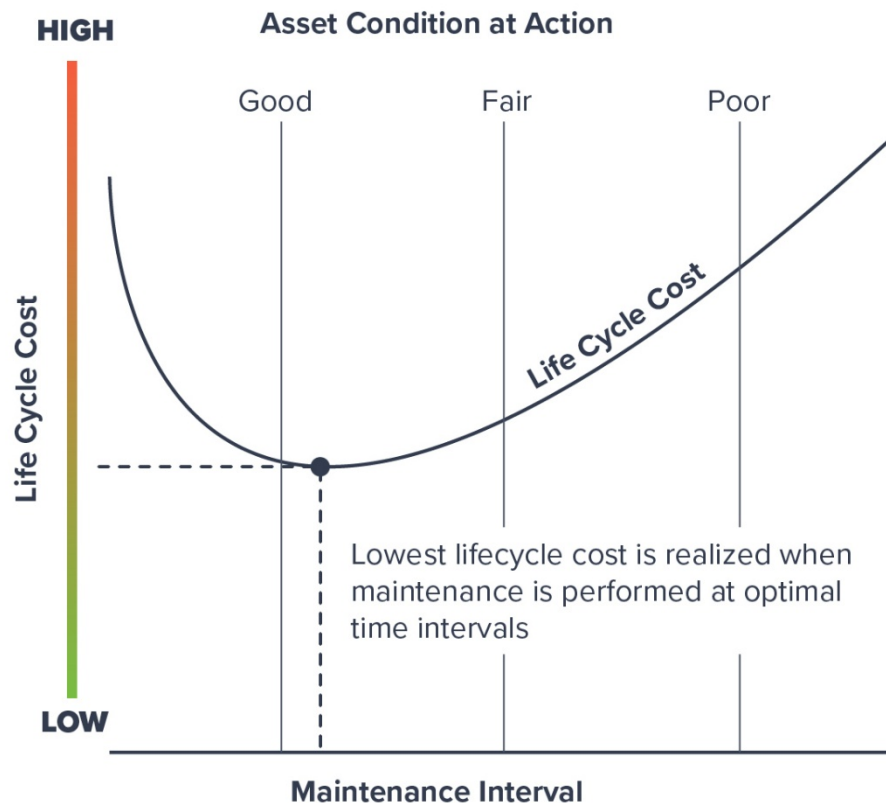


Figure 4-2: Illustration of the life-cycle cost analysis concept

What Are the MAP-21 and IIJA Requirements?

Life-cycle cost and life-cycle planning are defined in 23 CFR Part 515.5 as follows:

Life-Cycle Cost (LCC): The cost of managing an asset class or asset sub-group for its whole life, from initial construction to its replacement.

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

According to 23 CFR Part 515.7, State DOTs are required to develop a risk-based asset management plan to include specific minimum processes including the following section on life-cycle planning identified in subsection (b):

“A State DOT shall establish a process for conducting life-cycle planning for an asset class or asset subgroup at the network level (network to be defined by the State DOT). As a State DOT develops its life-cycle planning process, the State DOT should include future changes in demand;

information on current and future environmental conditions including extreme weather events, climate change, and seismic activity; and other factors that could impact whole-life costs of assets. The State DOT may propose excluding one or more asset sub-groups from its life-cycle planning if the State DOT can demonstrate to FHWA the exclusion of the asset sub-group would have no material adverse effect on the development of sound investment strategies due to the limited number of assets in the asset sub-group, the low level of cost associated with managing the assets in that asset sub-group, or other justifiable reasons. A life-cycle planning process shall, at a minimum, include the following:

1. The State DOT targets for asset condition for each asset class or asset sub-group.
2. Identification of deterioration models for each asset class or asset sub-group, provided that identification of deterioration models for assets other than NHS pavements and bridges is optional.
3. Potential work types across the whole life of each asset class or asset sub-group with their relative unit cost.
4. A strategy for managing each asset class or asset sub-group by minimizing its life-cycle costs, while achieving the State DOT targets for asset condition for NHS pavements and bridges under 23 U.S.C. 150(d)."

Additionally, State DOTs are required to consider extreme weather and resilience as a part of the LCP analyses within the TAMP (resulting from Section 11105 of the IIJA changes to Title 23, USC 119(e)(4) that took effect on October 1, 2021).

What Is TDOT's Approach to Managing Transportation Infrastructure Assets?

TDOT has a long history of effectively managing State-owned assets to extend service life, especially of pavements and bridges. A key feature of the success of using asset management principles is understanding the connection between funding and maintaining asset performance at an established target. In order to successfully manage the agency's assets, formal and informal practices have been implemented that rely on quality data, systematic processes, and analytical evaluation that complement the technical expertise in the Maintenance Operations and Structures Divisions. Below are examples of approaches used by TDOT to effectively manage the pavement and bridge assets:

Pavements

1. **Standard Operating Guidelines (SOG):** TDOT has developed an SOG manual for pavement management that establishes the vision, objectives, and procedures for managing the agency's pavements. The SOG provides guidance in the selection of candidates for maintenance, preservation, resurfacing, and rehabilitation projects for both rigid (concrete) and flexible (asphalt) pavement with an emphasis on employing preventive maintenance treatments until repair costs exceed the benefit (i.e., using LCP concepts). Visit [Pavement Project Selection](#) for more information.
2. **Remaining Service Life (RSL) & Lane-Mile-Year analysis:** RSL is defined as the life of a pavement from the present time (or initial construction date if a new pavement) until it deteriorates to a

specific condition, which would trigger a significant, costly repair treatment. The basic concept behind this metric is a quick evaluation to determine if the agency is programming a suite of projects that, at a minimum, offset the annual loss in pavement life. Each region is required to perform this quick analysis to ensure that the type of projects recommended for the annual program will satisfy budget allocations, treatment options by type and percentage, and the remaining service life concept.

3. **Pavement Quality Index (PQI):** The PQI is a composite number based primarily on the ride quality of the pavement (Pavement Serviceability Index) and the condition of the pavement (Pavement Distress Index) and is measured on a 0-to-5 scale. An Interstate pavement with a PQI of 4.0 or greater is classified in the *Good* condition category, while an Interstate pavement with a PQI of less than 2.0 is in *Poor* condition. For State routes, pavements with a PQI of 3.5 or greater are classified in the *Good* category, while pavements with a PQI of less than 2.0 are classified as *Poor*. TDOT tracks this number for the regional and statewide network conditions to monitor the health of the system and to ensure the Department is meeting its performance goals and targets discussed in Chapter 3.

Bridges

1. **Review of NBIS Inspection Reports:** The Structures Division conducts bridge inspections on all the bridges in the State, with the exception of federally owned bridges, on a 2-year schedule. The Division reviews each bridge inspection report to identify potential candidates for improvement. Identified bridges are included on a repair list and given a priority rating of 1 to 3 (1 is highest priority) for funding consideration. Once funding is determined, bridges with the highest priority are programmed for improvement. The review and creation of the repair list ensures that no bridge is overlooked. The overall process is illustrated in figure 4-3.

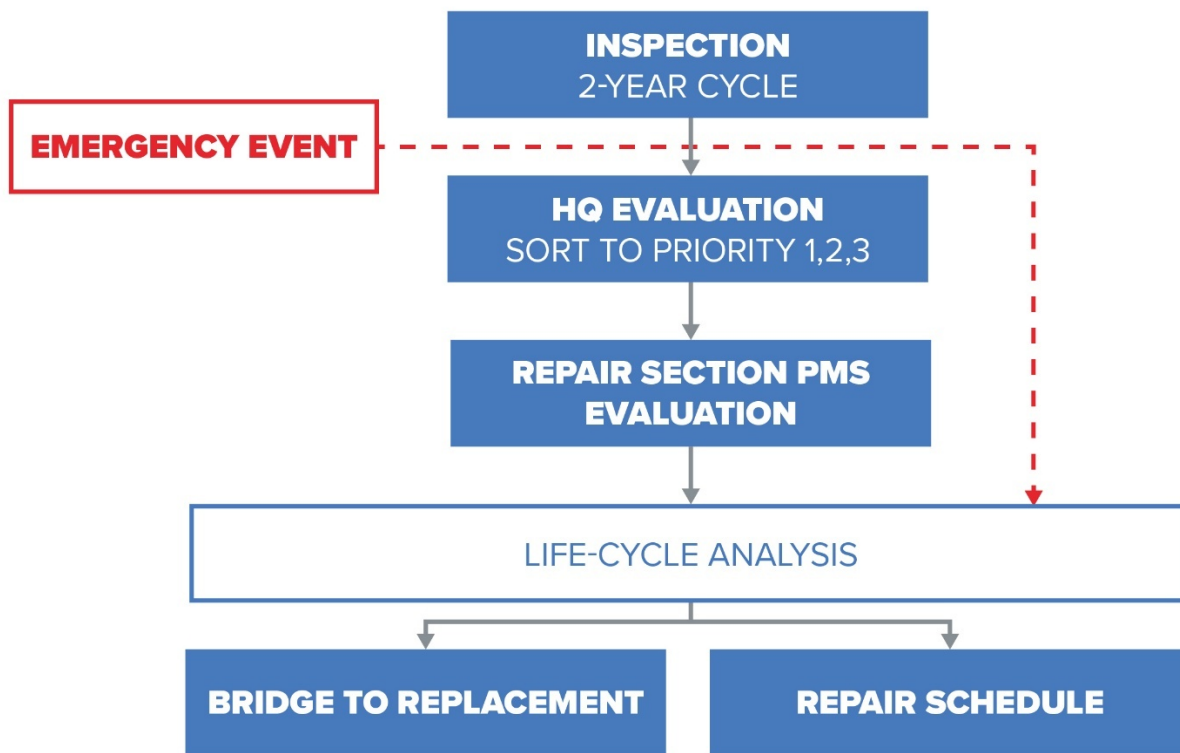


Figure 4-3: Bridge inspection and evaluation process

2. **Smart Project Scoping and Selection:** If a bridge is a candidate for replacement within the next 10 to 20 years, the Structures Division reviews the project repair scope and costs. If a bridge is scheduled for repair but is also in a program to be replaced in the future, the repairs are scaled appropriately to match the projected life of the bridge (replacement letting plus 2 years for construction) to the life cycle of the repair(s).
3. **Focus on Preservation:** TDOT has placed an emphasis on holding the number of *Poor* bridges down to less than 6 percent on the State-maintained system by a program of preservation that emphasizes the maintenance of bridge decks and joints. These elements tend to deteriorate more quickly and lead to other maintenance concerns.



What Are TDOT's Treatments for Pavements and Bridges?

Pavement Treatments

TDOT uses a systematic approach in developing the annual pavement management program consisting of a multitude of treatments (work types). The suite of treatments is a key input into the PMS's optimization program using life-cycle cost analysis. Typical work types can be classified into four major

categories: Preventive Maintenance, Preservation, Rehabilitation, and Reconstruction, as identified in table 4-1 and as follows:

1. **Preventive Maintenance:** Preventive Maintenance includes the day-to-day pavement maintenance activities that are scheduled or whose timing is within the control of maintenance personnel. This includes routine maintenance activities such as shallow patching and concrete joint replacement.
2. **Preservation:** A proactive or preventive approach entails the application of a series of low-cost, preservation treatments that individually last for a few years and extend the life cycle. This is accomplished with chip seals, thin asphalt overlays, microsurfacing, crack sealing, concrete joint sealing, and cape seals, and mill and fill overlays less than 1.5 inches in depth. This is typically the most cost-effective approach when applied to pavements in *Good* or *Fair* condition to delay the need for rehabilitation.
3. **Rehabilitation:** Rehabilitation occurs when the pavement section deteriorates to a *Fair-to-Poor* condition in terms of both ride quality and structural condition. At this point, structural damage has occurred, and the objective of the rehabilitative treatment is to repair that damage and restore the pavement. Thus, the approach is reactive and can be a costly and time-consuming process. This is accomplished with full-depth patching or concrete slab replacement.
4. **Reconstruction:** Reconstruction of a pavement is rarely done at TDOT and only in extreme circumstances where a pavement's structure is not sufficient to carry the design loads. This is typically done through the replacement or recycling of the existing pavement structure. This is by far the costliest approach to managing the pavement assets.

Table 4-1: Typical pavement work types, treatments, and unit costs

WORK TYPES	TREATMENTS	UNIT COST PER LANE MILE*
Maintenance	Shallow patching	Asphalt: \$104 to \$192/ton Concrete: \$442 to \$900/CY
	Skin patching	
	Partial-depth patching	
	Repair concrete corner breaks	
	Concrete joint repair	
	Other thin patching	
Preservation	Thin asphalt overlay (1.5 in. or less)	\$47,000 to \$350,000
	Microsurfacing	
	Scrub Seals	
	Chip seals	
	Cape seals	

	Crack sealing	
	Concrete joint sealing	
	Mill and fill asphalt overlays (1.5 in. or less)	
	Open Graded Friction Course	
Rehabilitation	Full-depth patching	\$160,000 to \$435,000
	Repair/replacing concrete slabs	
	Cold in-place Recycling and Overlay	
	Hot-in-place recycling with 1.25 in. overlay	
	Thick asphalt overlay (2 to 4 in.)	
Reconstruction	Rubblization and overlay of concrete pavement	\$557,000 to \$1,554,700
	Full-depth replacement of asphalt pavement	

*Note: Unit cost values reported in the table are typical statewide ranges. Actual treatment cost will vary based on the scope of the work, region, contractor, and other site-specific conditions.

It should be noted that less than 5 percent of Interstate lane miles and less than 1 percent of State routes currently have a concrete riding surface and are not currently included in the LCP analysis. A need for inclusion of proper concrete pavement maintenance within the State resurfacing program has been identified but has not yet been incorporated into the program. The Pavement Office and the regional resurfacing staff are in the process of identifying potential work types and proper timing for each. Potential work types being discussed include resealing joints, partial depth repair, full-depth repair, and diamond grinding. Historical cost data for each is minimal and considered to be non-representative. A draft program will be developed based on national recommendations from industry and academia. The program will be incorporated on a trial basis over the next few years with the intention of eventually including in pavement analysis decision trees.

It should also be noted that approximately less than 4 percent of the NHS system are non-TDOT assets and are the responsibility of either local or Federal governments; therefore, these assets are not included in the LCP analysis.

Bridge Treatments

Similar to pavement management, TDOT uses a systematic approach in developing the annual bridge management program consisting of a multitude of treatments (work types). The suite of treatments is a key input into the BMS's optimization program using life-cycle cost analysis. Typical treatments can be classified into four major categories: Preventive Maintenance, Preservation, Rehabilitation, and Reconstruction. These are identified in table 4-2 and as follows:

1. **Preventive Maintenance:** Preventive Maintenance includes the day-to-day bridge maintenance activities that are scheduled or whose timing is within the control of maintenance personnel. This includes routine maintenance activities, such as filling potholes in decks, minor structure repairs (minor spall repairs, cleaning expansion joints), and major structure repairs (parapet wall repairs).
2. **Preservation:** Preservation is a proactive or preventive approach that entails the application of a series of preservation treatments that individually last for a few years and extend the life cycle. This is accomplished with repainting structural steel, vegetation removal, sweeping, deck repairs, waterproofing deck surfaces (with membrane, thin epoxy overlay, polymer modified concrete, or a 4.5-inch reinforced concrete overlay), navigation light maintenance/replacement, guardrail protection at bridge ends, object marker replacement, cleaning and sealing, or replacement of expansion joints.
3. **Rehabilitation:** Rehabilitation occurs when structural damage or deterioration has occurred, and the objective of the rehabilitative treatment is to repair that damage or deterioration and restore the bridge. Rehabilitation includes bridge deck and expansion joint repairs, spall repairs and steel repairs on superstructure, scour prevention, and bearing replacements. For bridges which are not within the extents of a planned widening or realignment project, these treatments are often bundled with preventative measures, such as waterproofing the deck or repainting structural steel, in the same project in order to maximize the life of the bridge rehabilitation efforts. A repair project may also include the replacement of the full superstructures of bridges.



4. **Reconstruction:** Bridge candidates are considered for replacement if it is rated *Poor*. Other bridges may be replaced if they are within the limits of a large roadway improvement project.

It should be noted that 111 bridges (as of April 2025), less than 3 percent of bridges on the NHS, are non-TDOT bridges, which are the responsibility of either local or Federal governments and are not included in the LCP analysis.

Table 4-2: Typical bridge work types, treatments, and unit costs

Category	Treatments	Average Unit Cost Per Sq. Ft.*
Maintenance	Filling potholes in deck	\$25
	Minor structure repair	
	Major structure repair	
	Cleaning structure	
Preservation	Repainting structural steel	\$125
	Sweeping	
	Deck repairs	
	Deck waterproofing	
	Deck epoxy overlay	
	Polymer modified concrete deck overlay	
	Cleaning and resealing expansion joints	
Rehabilitation	Replacement of expansion joints	\$175
	Concrete spall repairs	
	Structural steel repairs	
	Scour prevention	
	Bearing replacement	
Reconstruction	Bridge replacement	\$300
	Bridge widening	

* Includes only bridge item costs without ancillary project costs

What Is TDOT's Process for Conducting an LCP Analysis?

TDOT performs a thorough and systematic LCP analysis on all State-owned pavement and bridge assets, regardless of highway system class, using the agency's PMS and BMS. The agency has established performance targets for the TPM identified in 23 CFR Part 490. An Oversight Committee consisting of key TDOT managers and senior leaders was established to provide oversight and coordination for implementation of all MAP-21, FAST Act, and IIJA final rules including development of performance targets. Additionally, TDOT developed other performance measures and targets for pavements that are supplemental to the National Measures and Minimum Conditions. These are based on historical agency practice and more applicable to the way TDOT manages its transportation infrastructure assets.

A key component of asset management is the creation and institution of a performance management culture within all levels of an organization. The performance management program identifies performance measures and targets, which link the agency's overall goals and objectives to the available funds. Modern computerized management systems allow agencies to perform multiple "what-if" scenarios to analyze the future condition of an asset network. These scenarios are based on different funding levels and investment strategies, (e.g., strategies based on preservation, maintenance, rehabilitation, reconstruction, or a combination of all work types). Within the core functionality of both a PMS and BMS is the presence of complex computer algorithms, deterioration models, and the ability to predict the future condition of a pavement or bridge based on a number of variables such as weather, climate, environment, age, traffic loading, treatments, and funding. Another core function is a cost effectiveness analysis component whereby tailored treatments are applied to a pavement or bridge based on their condition. The concept behind this approach is to minimize the whole-life cost by applying low-cost treatments to an asset early in its life and extending the service life while minimizing investments.

With the establishment of performance measures and targets for pavements and bridges, TDOT performs an evaluation using the PMS and BMS. At the network level, the PMS and BMS provides several reports to enable TDOT managers to gauge success in meeting the agency's goals. Examples of the type of reports are:

- Historical reports of expenditures, type of treatments (work types), and resulting performance by highway system (Interstate, Non-Interstate NHS, non-NHS State routes).
- Condition by highway system (Interstate, Non-Interstate NHS, non-NHS State routes).
- Estimated funding levels to achieve specific condition, by highway system, for a 10-year period.
- Estimated condition based on various funding scenarios by highway system, for a 10-year period.
- Treatment work types (preservation, maintenance, rehabilitation, reconstruction), by highway system, with 10-year cost and quantity projections.

The Department strives for continual process improvement in the cost-effective management of the State's pavement and bridge assets. TDOT has historically used a combination of formal and informal processes, including LCP analysis, in the allocation of funds. While the Department's PMS is a mature system and has provided reliable analysis for a number of years, the BMS (formerly Pontis) was upgraded in 2018 to the AASHTO BrM software program and since then has undergone multiple analysis and data revisions in order to more closely achieve analysis results the Department desires to perform reliable life-cycle cost analysis.

This TAMP uses the best information available to address LCP analysis for the bridge program realizing that additional process improvements will be achieved as improvement to the data collection techniques are made and staff gains more experience and confidence in the BMS's analysis functionality. The BMS is a complex computerized software system and requires significant amounts of input data to run the models that perform the LCP analysis. While the results of the program are not intended to be the sole data used in such decision making, the analysis has improved to where it is considered a valuable tool in making investment and program decisions for a large bridge program of TDOT's size. The TAMP will help

to solidify the process to provide greater transparency, consistency, and clarity. The following outline is a generalization of TDOT's process in using LCP in the development of its annual pavement and bridge management programs.

Pavement Management Program

Pavement condition survey results are uploaded to the PMS as segments are completed. The PMS Network Maintenance & Rehabilitation (M&R) Optimization/Work Program Development function is run to determine feasible maintenance, preservation, and rehabilitation strategies for each pavement section. (Pavement work types examples and typical costs are listed in table 4-1.) The PMS will also perform network optimization based on performance and funding constraints. This process provides a life-cycle analysis of costs and performance based on decision trees for treatment selection and performance prediction models. The system has the capability to perform multiple optimization scenarios based on user-defined constraints. Optimization scenarios are capable of suggesting work plans that include multiple treatments on a given section within the analysis period. A theoretical best treatment is identified when the greatest projected benefit is achieved.

Once the Pavement Office is satisfied with the M&R output, the results are provided to TDOT's senior management for review and funding consideration. These analyses, along with other records and reports on accomplishments, network pavement conditions, historical funding allocations, expenditures, type of pavement treatments, regional allocations and results, and so on, provide a comprehensive overview of TDOT's pavement management program effectiveness. The outcome of this review is a proposed funding allocation for the annual pavement management program. Funds for the pavement management program come from the Federal-aid highway apportionment and from TDOT State funds. The Federal-aid portion is included in the STIP as a part of the National Highway Performance Program (NHPP) while the State-funded portion is included in the State budget. The estimated amount for the pavement management program is shown in Chapter 6, Financial Plan.

Once the statewide pavement management program funding amount is determined, funds are allocated to each TDOT region based on their respective lane miles. Each region, in concert with their district management, develops an annual pavement management work program to address as many pavement needs as the funding will allow. Each of TDOT's four regions is responsible for achieving TDOT's goals for pavement condition, treatment percentages, and remaining service life. The regions submit their proposed program to the Programming Office and Pavement Management Office for final approval before project development is permitted to begin.

Bridge Management Program

TDOT is using AASHTO's BrM for bridge life-cycle planning. The BrM satisfies all the MAP-21 requirements and provides enhanced features, such as deterioration modeling, life-cycle cost analysis, asset valuation forecasting, and funding value modeling.

Bridge inspections are performed in accordance with the Federal National Bridge Inspection Standards (NBIS), and results are uploaded to the BMS on completion of each bridge inspection. The BMS program is used to determine feasible maintenance and rehabilitation strategies and perform network optimization based on performance and funding constraints. This analysis provides a life-cycle analysis of

costs and performance based on TDOT's defined strategies. The system has the capability to perform multiple optimization scenarios based on user-defined constraints.

It should be noted that the BrM analysis includes only bridge item costs for estimating bridge needs. This is done to maintain the integrity of the treatment selection and prioritization analyses regardless of the location of the structure, final project scope, or funding source. For instance, the majority of NHS bridges are replaced as part of much larger widening projects. Including the entire cost of a widening project in the unit cost for bridge replacement work would not be appropriate for other bridge projects. Ancillary costs vary significantly by location and do not contribute to improving the bridge condition. Similar issues arise on bridge rehabilitation and preservation projects. Keeping the unit treatment costs isolated to bridge items allows the BrM to determine bridge needs based on bridge condition and the estimated cost to improve those specific conditions. If other items are added to a bridge project when it is programmed, funding for those additional costs is acquired to supplement the bridge budget.

The Structures Division uses the results from the BMS analysis in conjunction with information contained in the bridge inspection reports to develop short- and long-term bridge management programs. Bridges are placed on a repair list, if needed, and are given a priority rating of 1 to 3 (1 is highest priority). Repair section engineers (project managers) review repair lists and further prioritize bridges for projects. Several factors are considered when recommending a bridge for replacement rather than repair. These include the percentage of deck area requiring repairs, the bridge's size and type, and whether it lies on a route slated for future widening or realignment. Additionally, the cost comparison between repair and replacement plays a key role in the decision-making process. Bridge replacement projects may require a repair project in the interim to keep the bridge operational until replacement. If repairs are feasible and cost-effective, the bridge is added to the repair schedule. These projects include minor repairs, major repairs, and complete rehabilitations. Other repair projects due to vehicle collision, flood damage, or other unanticipated events are added to the repair schedule as necessary. Emergency projects often take precedence over other schedules and are delivered in a shorter time span.

Risks such as scour, long-term maintenance, Average Daily Traffic (ADT), seismic vulnerability, bridge type, approach alignment, and detour routes are all considered during the evaluation of the bridge replacement list by the Structures Division. Seismic vulnerability is a concern in West Tennessee and is taken into consideration during the evaluations.

Approximately 48 percent of the budget is dedicated to bridge replacement, while the remaining 52 percent is spent on bridge preservation and repairs. For the past several years, the annual budget for bridge management has hovered around \$165 million. In 2026, the Bridge funding level was increased to \$181 million to continue to maintain a general steady-state of the square feet of bridge deck area on the NHS. The additional \$16 million is being directed to preservation activities to help preserve conditions. Once the Structures Division is satisfied with the output of the reports, the results are provided to TDOT's senior management for review and funding consideration. These analyses, along with other records and reports on accomplishments, network bridge conditions, historical funding allocations, and expenditures, provide a comprehensive overview of TDOT's Bridge Management Program effectiveness. The outcome of this review is a proposed funding allocation for the bridge management program.

Generally, funds for bridge maintenance, preservation, and repair come from TDOT State funds and are included in the State budget whereas bridge replacements and major rehabilitation projects are funded using Federal dollars. The estimated amount for the bridge management program is shown in Chapter 6, Financial Plan. Once the statewide bridge management program funding amount is determined, the Structures Division is responsible for finalizing the annual work plan and developing contracts to accomplish the work.

What Are the Results of the LCP Analysis?

Pavement LCP Analysis

TDOT evaluated the impact of two LCP strategies using its PMS:

- **Current Strategy:** This strategy represents TDOT's existing preservation-focused approach for managing its pavement network. Pavements in generally good condition are candidates for maintenance and preservation activities. Pavements that exhibit more structural distresses are candidates for rehabilitation or reconstruction actions.

This strategy uses a cost-effectiveness analysis approach in which the effectiveness of a treatment strategy is measured in terms of the area between the treated and untreated performance curves. The effectiveness divided by the total present worth represents the cost-effectiveness (C-E) ratio. The optimization routine within the PMS seeks to maximize the C-E ratio for the funding level specified for the analysis.

- **Worst-First Strategy:** This strategy represents a traditional "worst-first" approach in which pavements in *Poor* condition are prioritized for funding.

TDOT's PMS has configured treatment decision trees that are used to determine the right type of treatment based on current and projected conditions over the chosen analysis period. In addition to pavement condition, other factors, such as age of rehabilitation treatment, speed limit, and roadway classification, are also used to determine suitable treatment actions.

For the pavement LCP analysis, a 10-year analysis period was used. While TDOT's PMS is capable of conducting the analysis over longer time periods, TDOT elected not to do it for this TAMP due to the uncertainty associated with the long-term condition projections using the performance models. The performance models were developed by TDOT using approximately 10 years of data and using the same models to extrapolate performance over a longer timeframe could potentially result in unrealistic outcomes. TDOT will continue making routine updates to the models in the future as more performance data become available through future pavement condition inspection cycles.

Table 4-3 summarizes LCP scenarios evaluated by TDOT. LCP Scenario #1 does not consider annual treatment cost increases over the analysis period. While this scenario is not realistic, it provides a basis for comparing the expected impacts of treatment cost increase over time. Since 2016, TDOT has been closely monitoring treatment unit costs and has observed an average annual unit cost increase of 7 percent for the major treatments used in multiple years. This observation was the basis for LCP Scenario #2 that considers annual treatment cost increases over the analysis period. LCP Scenario #3 represents a hypothetical scenario where the baseline budget receives a one-time increase in 2026 plus a recurring

increase across the entire 10-year analysis period. All the LCP scenarios evaluated consider a 3 percent increase in annual budget.

Table 4-3: LCP scenarios evaluated

LCP Scenario	Scenario Detail	LCP Strategies Evaluated
1	Current budget with 3% annual budget increase	Current Strategy and Worst-First
2	Current budget with 3% annual budget increase and 7% annual treatment cost increase	Current Strategy
3	Current budget with a one-time increase in baseline budget of \$108 million for 2026, a 3% annual budget increase, and an additional recurring \$16 million budget increase.	Current Strategy

Figure 4-4 presents the annual budget levels used for the analysis. For the first year of the analysis (2026), the baseline budget was assumed to be \$369 million, and a 3 percent annual budget increase was assumed.

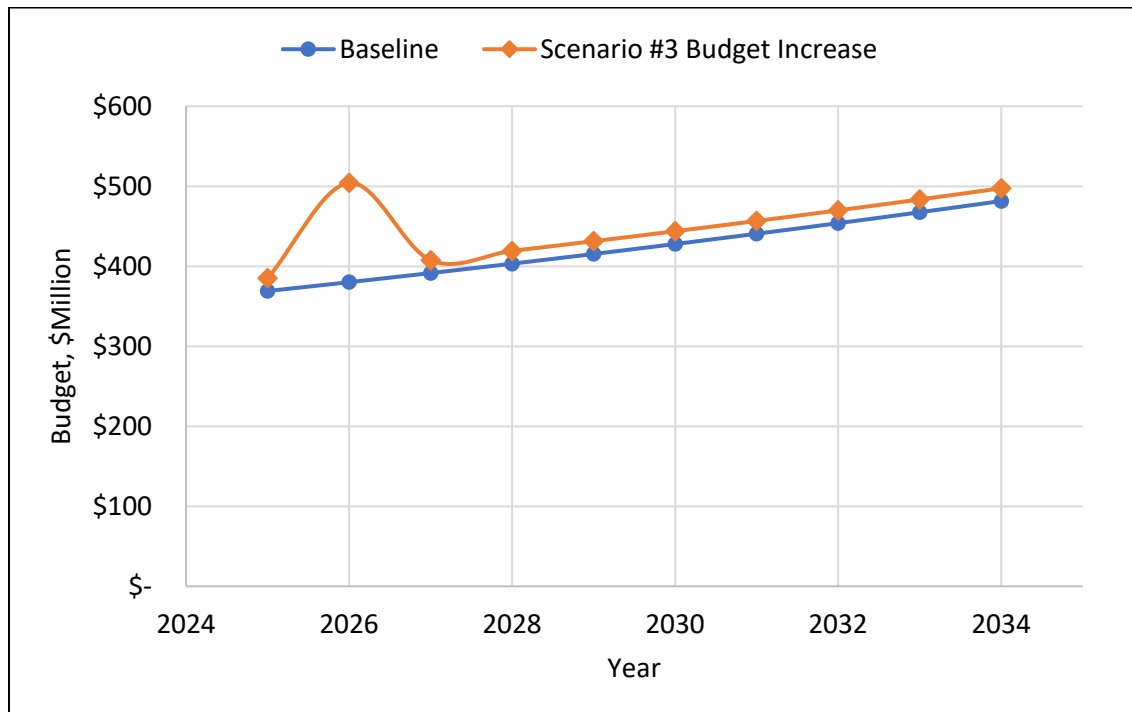


Figure 4-4: Annual budget levels used in the pavement analysis

Figure 4-5 illustrates the budget distribution across Interstates and State routes in each region. For the State routes in each region, the budget is allocated based on the total lane miles.

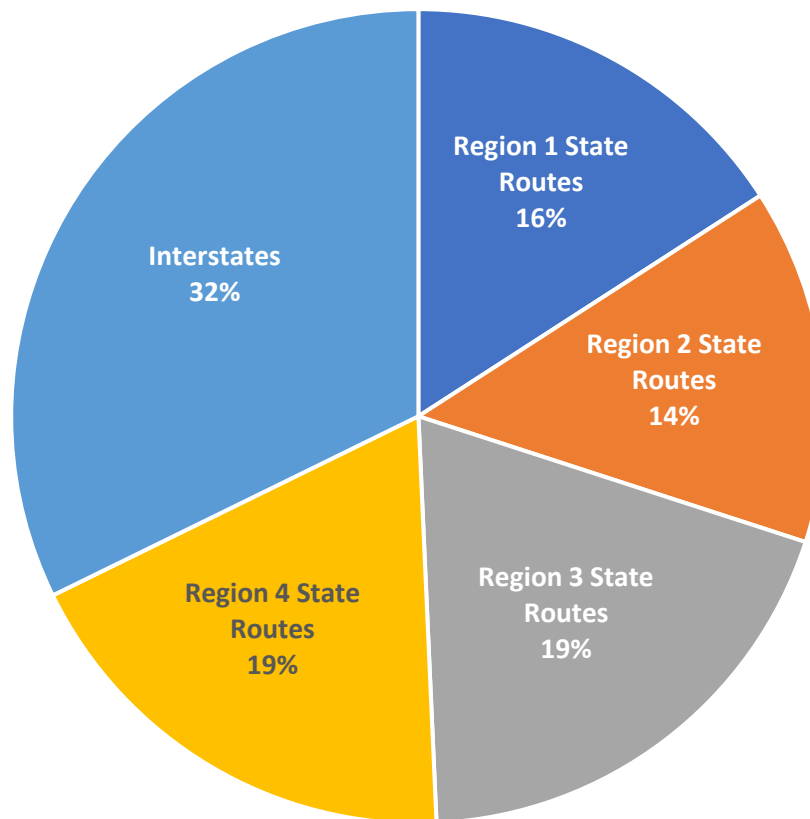


Figure 4-5: Budget allocation across Interstates and State Routes in each TDOT region

How Does TDOT's Current Pavement Strategy Compare to the Worst-First Strategy?

LCP Scenario #1 (current budget with 3 percent annual increase) was used to illustrate the benefits associated with TDOT's existing preservation-centric strategy of managing its pavement network over the worst-first strategy. As seen in figure 4-6, TDOT's current strategy results in a higher percentage of the network in *Good* condition since the preservation-focused approach prioritizes treatments based on maximizing the cost-effectiveness ratio at the network level. On the other hand, while a worst-first scenario sometimes results in a lower percentage of pavements in *Poor* condition, this was not achieved in these scenarios. It is expected that the increased unit cost of treatments will result in a worst-first scenario output that invests in higher cost treatments each year, ultimately postponing investments on other sections past their optimum timing. It is evident that this strategy is not financially sustainable in the long-term as the fraction of pavements in *Poor* condition increase over time. Hence, this strategy was not evaluated under LCP Scenarios #2 and #3.

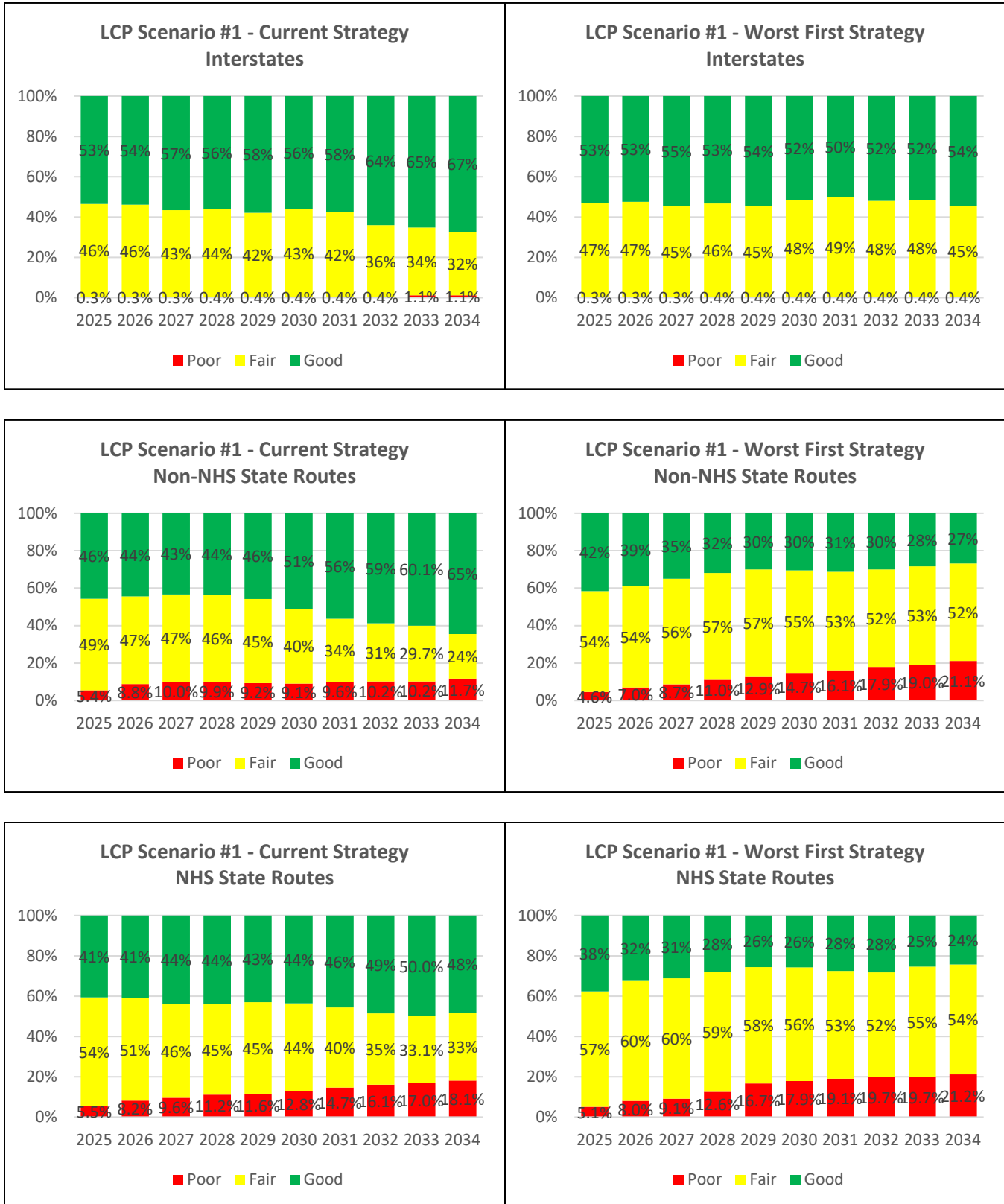


Figure 4-6: Pavements—Current Strategy vs. Worst-First Strategy

What is the Impact of Each Pavement LCP Scenario on Projected Pavement Conditions?

The current pavement condition and 10-year projected pavement conditions for each LCP scenario evaluated are illustrated in figures 4-7 through 4-9.

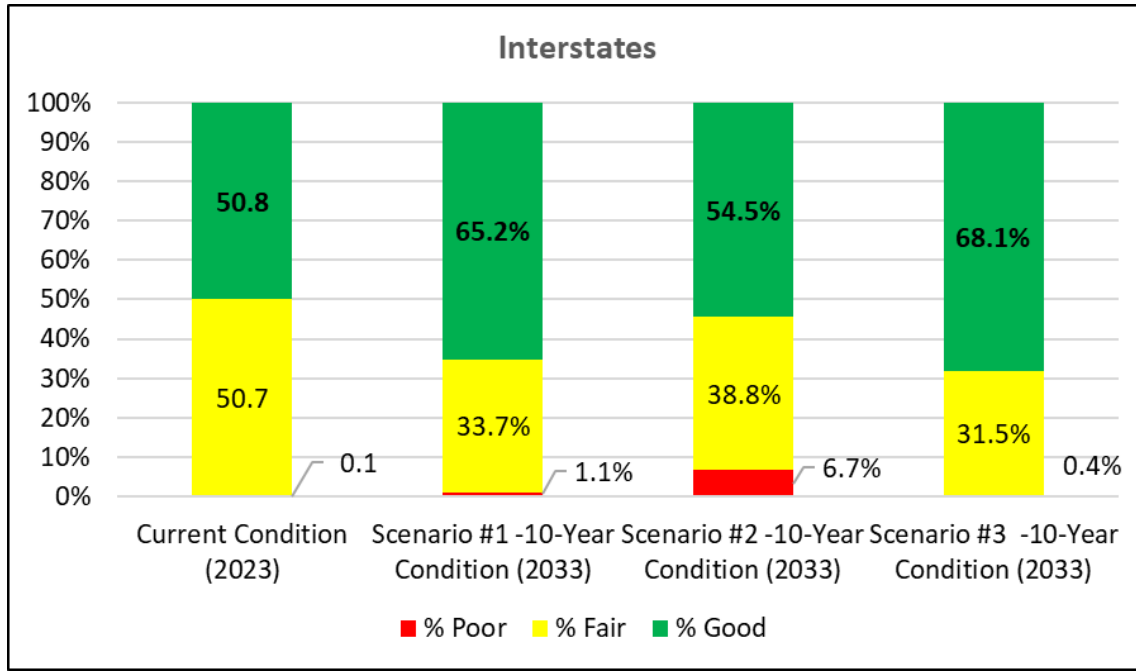


Figure 4-7: Initial and projected pavement condition—Interstates

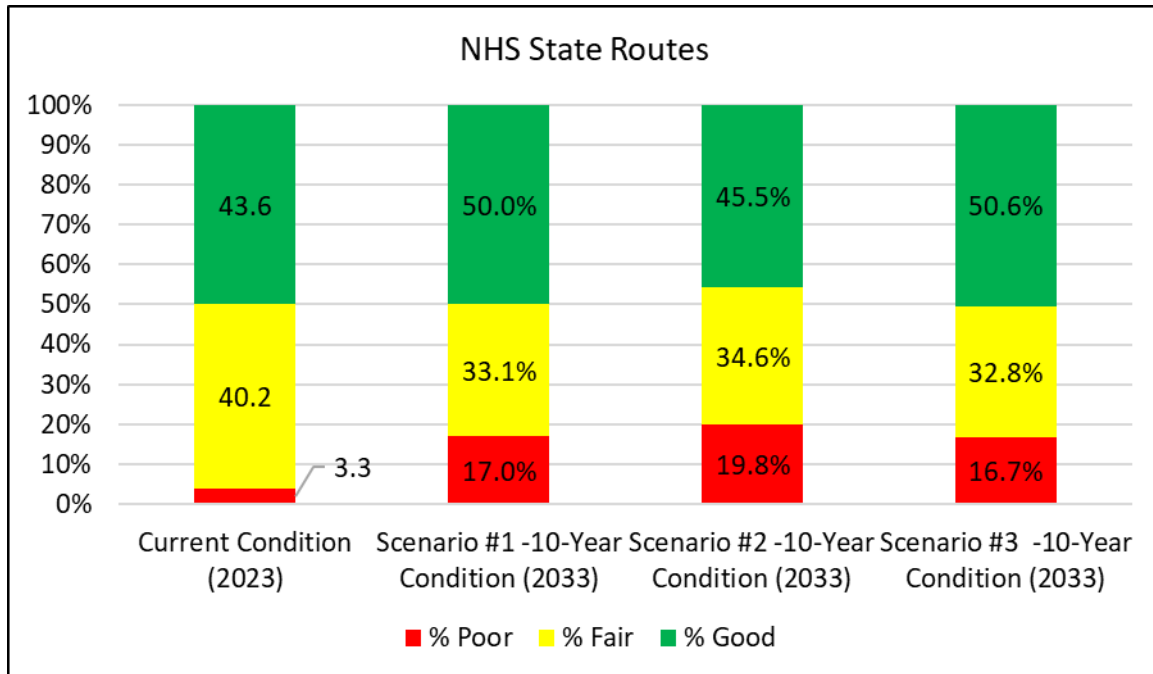


Figure 4-8: Initial and projected pavement condition—NHS State Routes

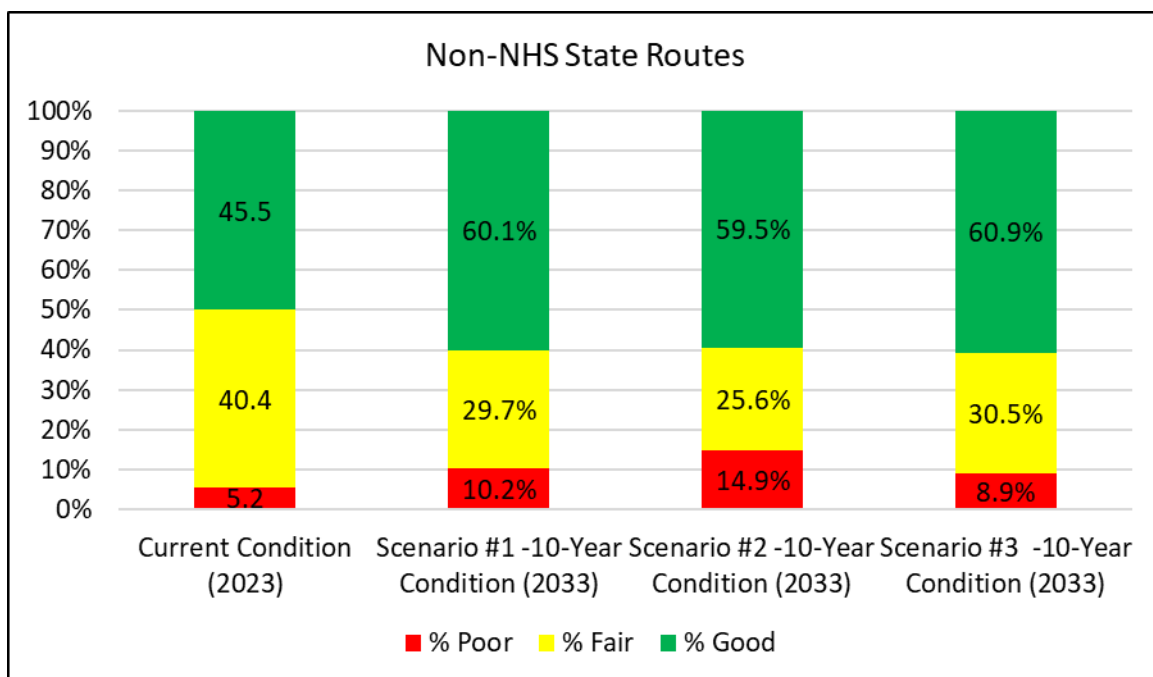


Figure 4-9: Initial and projected pavement condition—Non-NHS State Routes

Key takeaways from figures 4-7 through 4-9 are summarized below:

- Scenario #1 results in the best condition outcomes at the end of the analysis period. However, it is important to note that this scenario is not a realistic one since it does not consider treatment cost increases over time.

- If the trend in the annual treatment cost increase that TDOT has been experiencing over the last 5 years continues, the current budget level, even with a 3 percent annual increase, is not adequate to offset loss in purchasing power that TDOT is expected to experience over the next 10 years.
- As seen from the 10-year performance outcomes for LCP Scenario #3, a combination of a one-time increase in baseline budget and a recurring annual increase improves projected conditions compared to Scenario #1. It is expected that, if this same budget scenario was performed and treatment cost increases were considered, a similar small improvement would be observed as compared to Scenario #2.

With higher-than-expected inflation rates, TDOT's pavement network will continue to decline in condition under the current economic climate unless the annual funding increases are able to offset the projected treatment cost increase over time.

Are There Significant Differences in Pavement Performance in Each TDOT Region?

TDOT also investigated performance differences by region, and the results of the pavement condition outcomes under LCP Scenario #2 for the NHS and non-NHS State routes are illustrated in figures 4-10 and 4-11, respectively.

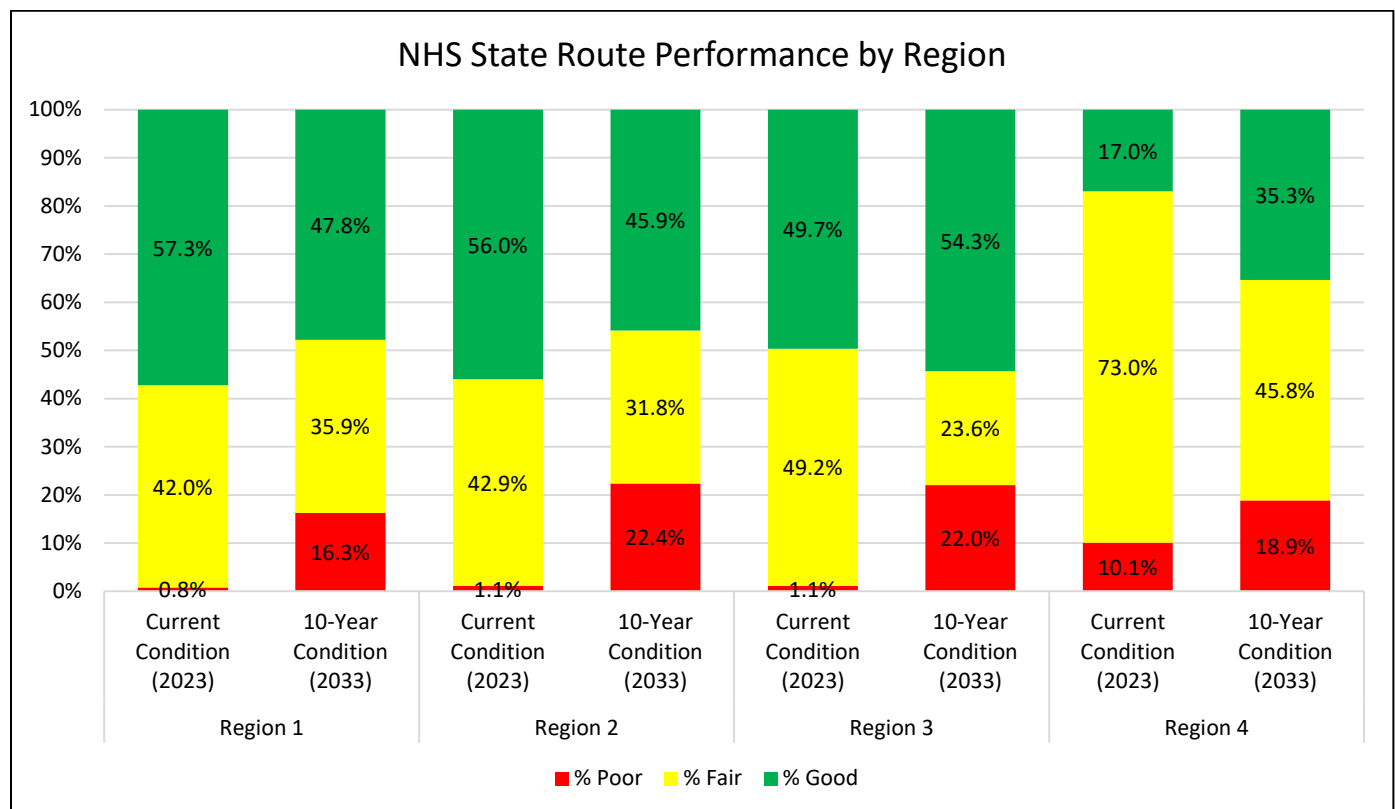


Figure 4-10: NHS State routes—Performance by TDOT region for scenario 2

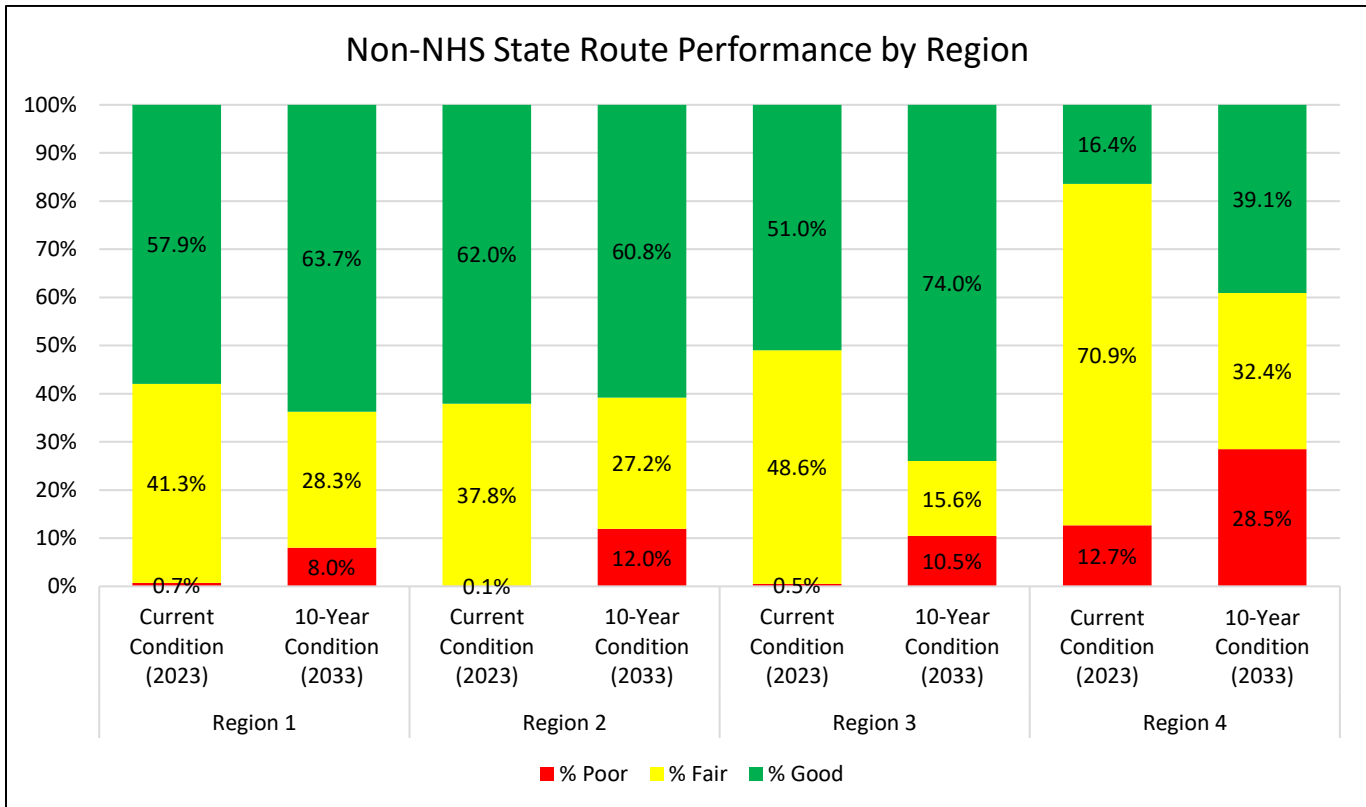


Figure 4-11: Non-NHS State routes—Performance by TDOT region for scenario 2

It is evident from figures 4-10 and 4-11 that pavements in Region 4 are projected to be in significantly worse condition when compared to the pavements in the other TDOT regions. During a 2022 effort to update performance models, it was observed that the deterioration rate of the main treatments used by TDOT is significantly higher in Region 4 when compared to Regions 1, 2, and 3. As an example, the PQI deterioration curves for TDOT's primary resurfacing treatment, a 1.25-inch mill and inlay, is shown in figure 4-12. The performance curve represents treatments on non-Interstate urban routes.

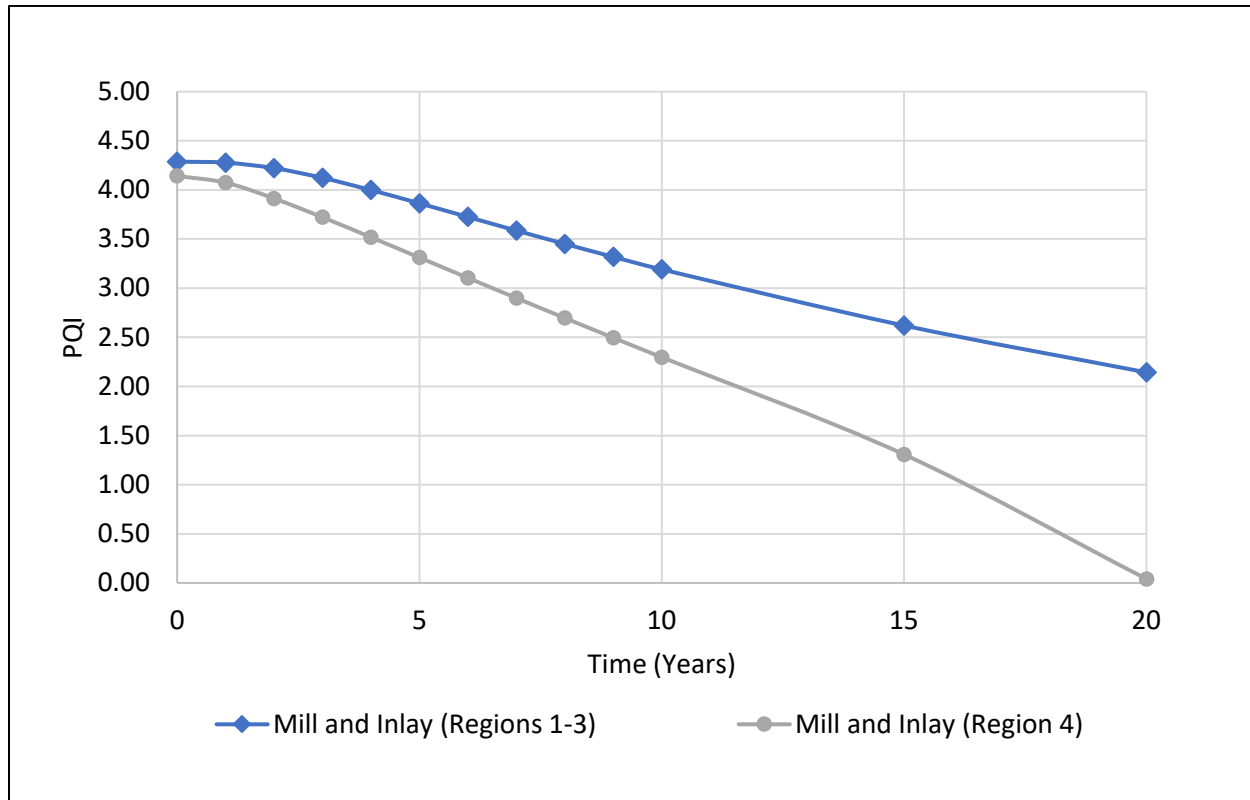


Figure 4-12: PQL performance curves for mill and inlay treatment

The higher rate of pavement deterioration in Region 4 cannot be addressed simply through repeated application of preservation treatments since the fundamental cause of the deterioration may be in the underlying pavement layers. Investments in heavier rehabilitation treatments that include the strengthening of the subgrade and/or the base layers may be needed to enhance the structural capacity of the pavement structure and reduce the rate of deterioration. TDOT is continuing to work to identify life-cycle treatment strategies to address performance concerns in Region 4. TDOT is also investigating the use of traffic speed deflection (TSD) testing for assessing the structural condition of pavements. In the coming years, TDOT is looking to integrate the structural condition data within the PMS and enhance the treatment decision trees to consider structural condition in addition to other pavement condition parameters currently being assessed.

Bridge LCP Analysis

An LCP analysis was conducted using TDOT's BMS to identify the best opportunities for long-term cost savings and to prioritize investments appropriately to ensure that the right amount of preservation work is completed in a timely manner.

The analysis is based on an overall rating for each bridge and uses historical data in modeling deterioration rates to forecast future conditions given distributions of funding between preservation, rehabilitation, and replacement project types in a way that closely aligns with the preservation strategy currently employed by TDOT.

As an illustration of the analysis, a strategy that implements TDOT's preservation policy can be compared to several other LCP strategies, including varied levels of preservation investment and a scenario where no bridge treatments of any kind are considered. Each scenario uses the same total funding with alternative investment levels in different treatment strategies. The resulting outcomes are presented in two separate figures. Figure 4-13 displays the percentage of bridge deck area predicted to be in *Good* condition over the 10-year analysis period while figure 4-14 displays the percentage of bridge deck area to be in *Poor* condition.

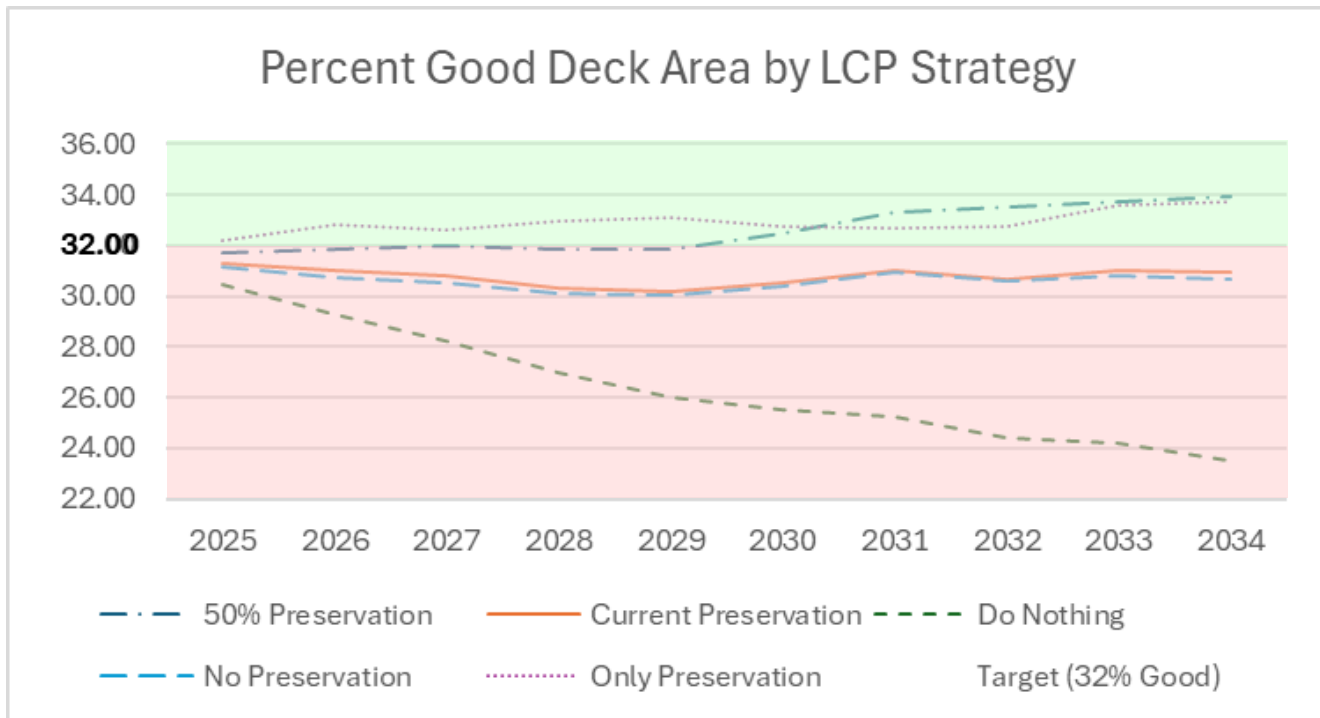


Figure 4-13: Comparison of projected systemwide (NHS and non-NHS) bridge deck area in Good condition based on varied LCP strategies

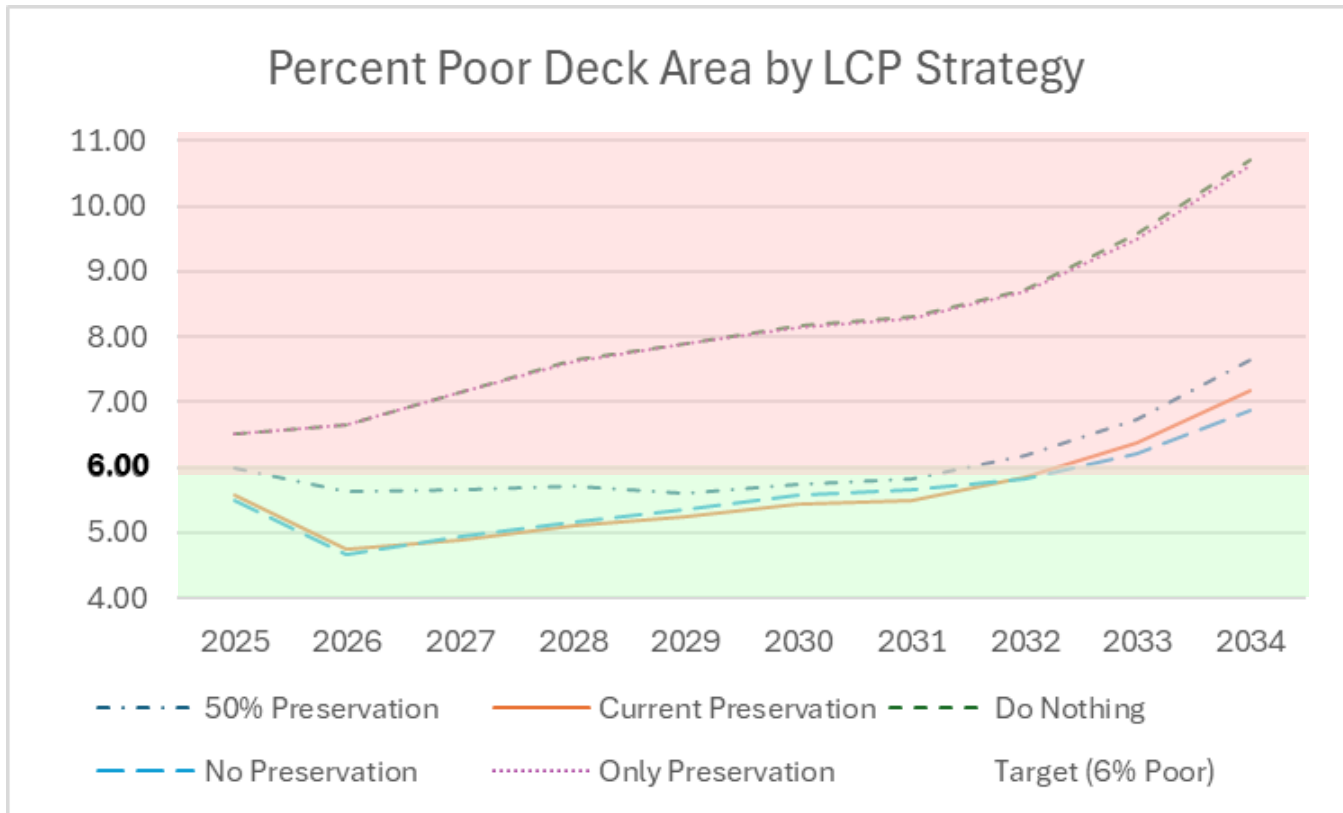


Figure 4-14: Comparison of projected systemwide (NHS and non-NHS) bridge deck area in Poor condition based on varied LCP strategies

It should be noted that, with a fixed budget, increasing preservation funding at the expense of rehabilitation funding will increase the percentage of deck area in *Good* condition over time by keeping *Good* bridges in *Good* condition. The risk is that this strategy will also potentially increase the percentage of bridges in *Poor* condition if rehabilitation funding that restores structures from *Poor* to *Good* condition is decreased. For this reason, TDOT has adopted a balanced approach that includes a moderate level of investment in preservation, while maintaining a strong focus on rehabilitation to address bridges in *Poor* condition. Using this strategy, the percentage of *Poor* bridges will continue to stay below the 6 percent target through 2032. Although it will not achieve the 32 percent *Good* target, it maintains the percentage of *Good* deck area in a steady-state for the 10-year analysis period.

What Is TDOT's Approach to Improving System Resilience?

Improving Pavement System Resilience

The main environmental risks that impact the resilience of TDOT's pavement assets include:

- Temperature extremes (high and low).
- Snow and ice storms.
- More extreme rainfall events.
- Increased number of flooding events.

- Droughts.

For the key risks identified, some of the main pavement vulnerabilities include the following:

- Increased rate of asphalt binder aging.
- Reduced pavement structural capacity of unbound base layers and subgrade.
- Reduced surface friction.

TDOT considers a range of adaptation strategies that can be implemented at various stages of the pavement life cycle. These strategies include adaptations to:

- **Material selection:** Use of pavement materials that are less susceptible to extreme temperature and moisture variations. TDOT recently completed the following studies that developed procedures to improve performance of asphalt and concrete materials used by TDOT:
 - [Mitigating Stripping in Asphalt Mixtures](#):⁵ This study investigated the mechanism of moisture damage, evaluated moisture resistance of different asphalt-aggregate combinations, and assessed the effect of asphalt aging and antistripping agents on moisture susceptibility.
 - [Enhancing Freeze-Thaw Resistance of Tennessee Concrete Mixes Through Improved Air Void Testing](#):⁶ This study investigated the applicability of Super Air Meter (SAM) to TDOT concrete mixes and the suitability of SAM number as a QC/QA tool for freeze-thaw resistance and determines the acceptance criterion for the SAM number if it can be adopted for QC/QA purposes.
- **Design approaches:** Use of design standards that result in improved structural support and drainage.
- **Construction procedures:** Provision of flexibility in construction schedule to accommodate precipitation events that may impact the overall project schedule and improvement of finishing and curing practices.
- **Maintenance and operation activities:** Increased efforts to seal cracks and joints in existing pavements, adjustment of spring thaw load restrictions, use of asphalt pavement preservation techniques that reduce surface course binder aging (e.g., chip seals, fog seals, microsurfacing), maintenance of high friction pavement surfaces, and employment of nondestructive methods to determine pavement structural adequacy in inundated/flood condition to determine structural loading restrictions after inundation events.

⁵ Tennessee Department of Transportation (TDOT). 2022. *Mitigating Stripping in Asphalt Mixtures*. https://www.tn.gov/content/dam/tn/tdot/research/final-reports/2020-final-reports-and-summaries/RES2020-07_Final_Report_Approved.pdf

⁶ Tennessee Department of Transportation (TDOT). 2022. *Enhancing Freeze-thaw Resistance of Tennessee Concrete Mixes Through Improved Air Void Testing*. https://www.tn.gov/content/dam/tn/tdot/research/final-reports/2020-final-reports-and-summaries/RES2020-09_Final_Report_Approved.pdf

In addition to agencywide resilience initiatives (discussed in Chapter 5), TDOT is currently working on the following research activities to help improve the resilience of pavement systems:

- **The Effect of Extreme Climate Shifts to Pavement Infrastructure in Tennessee**: The overall goal of this ongoing study is to help identify a comprehensive approach to evaluate the status of pavement conditions and maintenance needs for smooth operation of transportation infrastructure. Specific objectives of this study are to:
 - Quantify historic weather and projected weather parameters for pavement design parameters.
 - Recommend criteria for the use of pavement materials that are resilient to projected weather.
 - Recommend weather parameters and maintenance plans for design, implementation, and maintenance of future pavement infrastructure.
- **Development of a Balanced Mix Design (BMD) Procedure for Tennessee Mixtures**: Based on the results of this ongoing benchmarking study, TDOT's implementation of BMD tests and specification criteria is expected to improve mixture performance and extend the service life of asphalt pavements. This is also expected to contribute to reduced maintenance and rehabilitation costs.
- **Maintenance Strategies for Open-graded Friction Course (OGFC)**:⁷ This study developed specific recommendations on winter maintenance practices for OGFC pavements that are expected to improve overall treatment performance and expected service life.
- **Evaluation of Traffic Speed Deflectometer for Collecting Network-Level Pavement Structural Data in Tennessee**:⁸ The purpose of this study was to develop traffic speed deflectometer data collection and analysis guidelines for pavement structural evaluation. The study also developed a methodology for incorporating TSD data into TDOT's PMS. This study will help TDOT establish a pavement structure database in the PMS and make network-level treatment decisions that considers structural capacity.
- **MEPDG Climate Data Input for the State of Tennessee**:⁹ The goal of this study was to select candidate sites, collect related climate data sources, and predict pavement performance on the selected sites with different pavement structures, materials, and traffic levels. This study provided TDOT with climate data source inputs for the Mechanistic Empirical Design method and enabled TDOT to develop pavement designs that consider climate indicators.

⁷ Tennessee Department of Transportation (TDOT). 2019. *Maintenance Strategies for Open-graded Friction Course (OGFC)*. <https://www.tn.gov/content/dam/tn/tdot/research/final-reports/res2016-final-reports/RES2016-14%20OGFC-FR-Revision%20-%20Approved.pdf>

⁸ Tennessee Department of Transportation (TDOT). *Evaluation of Traffic Speed Deflectometer for Collecting Network Level Pavement Structural Data in Tennessee*. https://www.tn.gov/content/dam/tn/tdot/research/researchsummary/two-page-summaries-from-final-reports/res2020-two-pagers/RES2020-08_Summary_Report.pdf

⁹ Tennessee Department of Transportation (TDOT). 2022. *MEPDG Climate Data Input for the State of Tennessee*. https://www.tn.gov/content/dam/tn/tdot/research/final-reports/2020-final-reports-and-summaries/RES2020-13_Final_Report_Approved.pdf

Improving Bridge System Resilience

In the past 30 years, TDOT has been active in developing programs to enhance the resiliency of its bridge system. In the 1990s, TDOT developed a scour assessment program. All State & local bridges had a scour analysis or assessment performed to determine scour vulnerability. Bridges determined to be scour critical had countermeasures installed or were placed on a monitoring program. BRIDGEWATCH is a program that TDOT uses to monitor storm events and alert to threshold events at bridge locations. The program generates email alerts to the bridge owners (with TDOT receiving all alerts) to indicate a scour inspection is needed based on predicted flows from the storm event. Evidence of scour is also checked for and noted during regular bridge inspections, and scour repair and countermeasure projects are developed as needed as part of the repair program. All new bridges are designed for calculated scour based on generally accepted hydraulic analysis methods, including HEC-18.

In the 1990s, TDOT also initiated a seismic retrofit program for bridges. Beginning with bridges identified in TDOT's Earthquake Preparedness Plan as critical for recovery after an event, bridges deemed vulnerable were retrofitted with seismic restrainers and other modifications, such as column strengthening. This was later expanded to all Interstate and State route bridges in areas of high seismic vulnerability (mainly in the western part of the State). All new bridges are designed for anticipated earthquake events in accordance with AASHTO guidelines.

The policy for TDOT bridge designs includes several elements that lead to more resilient structures, as well as structures that minimize long term maintenance concerns. These elements include:

1. Continuous structures and integral abutments (elimination of superstructure joints preferred wherever possible).
2. Use of epoxy steel in bridge decks and other elements.
3. Design for earthquake loads.
4. Design for calculated scour.
5. Use of concrete sealers on substructures (especially under superstructure joints).

CHAPTER 5

RISK MANAGEMENT ANALYSIS

What Is TDOT's Plan for Risk Management Analysis?

TDOT has implemented a risk management approach modeled after the International Organization for Standardization (ISO) 31000. The process involves identifying uncertainties that could impact TDOT's ability to achieve its asset management objectives. This includes both threats and opportunities to the condition of TDOT's pavements and bridges or TDOT's ability to manage those assets. The process results in a risk register that incorporates the highest priority risks, including descriptions of strategies to mitigate threats and enhance opportunities.

This chapter describes the Federal requirements for risk management analysis, the process TDOT used to satisfy those requirements, and the results of the analysis. The chapter also describes TDOT's ongoing practices for monitoring and addressing risks, including risks posed by extreme weather, and TDOT's ongoing efforts to improve infrastructure resilience.

What Are the MAP-21 and IIJA Final Rule Requirements?

Risk management analysis requirements are identified in 23 CFR Part 515.7 (c) as follows:

"A State DOT shall establish a process for developing a risk management plan. This process shall, at a minimum, produce the following information:

1. Identification of risks that can affect condition of NHS pavements and bridges and the performance of the NHS, including risks associated with current and future environmental conditions, such as extreme weather events, climate change, seismic activity, and risks related to recurring damage and costs as identified through the evaluation of facilities repeatedly damaged by emergency events carried out under part 667 of this title. Examples of other risk categories include financial risks such as budget uncertainty; operational risks such as asset failure; and strategic risks such as environmental compliance.
2. An assessment of the identified risks in terms of the likelihood of their occurrence and their impact and consequence if they do occur;
3. An evaluation and prioritization of the identified risks;
4. A mitigation plan for addressing the top priority risks;
5. An approach for monitoring the top priority risks; and
6. A summary of the evaluations of facilities repeatedly damaged by emergency events carried out under part 667 of this title that discusses, at a minimum, the results relating to the State's NHS pavements and bridges."

Additionally, State DOTs are required to consider extreme weather and resilience as a part of the risk management analysis within the TAMP (resulting from Section 11105 of the IIJA changes to Title 23, USC 119(e)(4) that took effect on October 1, 2021).

Risk Management Definitions

For the purposes of this section, the following definitions are listed to provide the framework and context for the discussion of risk and risk management, as it applies to the TAMP at TDOT.

Agency/Enterprise Risk: Risks that are high-level issues and can impact the achievement of the agency's goals and objectives involving a multitude of issues (e.g., budgets, legislative requirements, regulatory reforms, public sentiment, broad managerial and personnel decisions).

Consequence: The outcome of an event impacting the Department's objectives.

Likelihood: The probability that a specific event might occur.

Mitigation: Actions taken to address or reduce risk. Generally, it refers to the entire process of responding to risks.

Programmatic Risk: Risks that are typically a collection of related projects or program delivery issues that may be attributed to an entire sub-unit or business unit (e.g., bridge program, preservation program, maintenance program, program budgets).

Project/Asset Risk: Risks that are associated with an individual project, location, or individual asset class; can be associated with providing continuity of service of a bridge or highway and system resilience and asset failure.

Risk: The impact of uncertainty on TDOT's ability to deliver its programs, projects, and services. Risk is an event that is a deviation from the expected outcome. Risk can either be positive or negative and is measured in terms of a combination of the likelihood of an event occurring and the consequence if the event did occur.

Risk Analysis: A process to understand the potential impact of various risks in terms of likelihood and consequence.

Risk Assessment: The process of identifying risks, analyzing risks, and evaluating risks.

Risk Context: The social, cultural, legal, regulatory, economic, and natural environment in which an entity operates that is unique to the Department.

Risk Evaluation: The process of reviewing the results from the Risk Analysis and comparing the impact with the Department's risk tolerance.

Risk Identification: The process of finding, recognizing, and describing risks.

Risk Management: A systematic process of identifying, analyzing, and prioritizing risks with the development of strategies to respond to potential threats and opportunities.

Risk Register: A formal listing of risks identified by the Department, which may include information such as priority, type, likelihood, consequence, impact, and mitigating actions.

Risk Levels: The different levels of risk which can be categorized into three major risk areas: Agency/Enterprise, Programmatic, and Project/Asset. They can be distinct or overlapping from one level to the next.

Risk Tolerance: The capacity of the Department to accept or tolerate risk.

Risk Treatment: A process to determine how a department will respond to an identified risk.

What Steps Has TDOT Taken Toward Risk Management?

TDOT initiated a comprehensive approach to assess risk across the agency in accordance with asset management concepts over a decade ago, following the passage of the MAP-21 highway bill. This overall approach has remained in place and supported the development of this TAMP. With each update to the TAMP, TDOT selects a group of managers to serve on the Risk Management Committee. The committee members perform a risk assessment and make recommendations to senior management on managing risk. In addition, many of the divisions consider risk within their area of responsibility on an annual basis.

From October to December 2024, the risk management committee came together for three virtual workshops to conduct the risk management effort of identifying, evaluating, and analyzing risks based on the steps shown in figure 5-1.

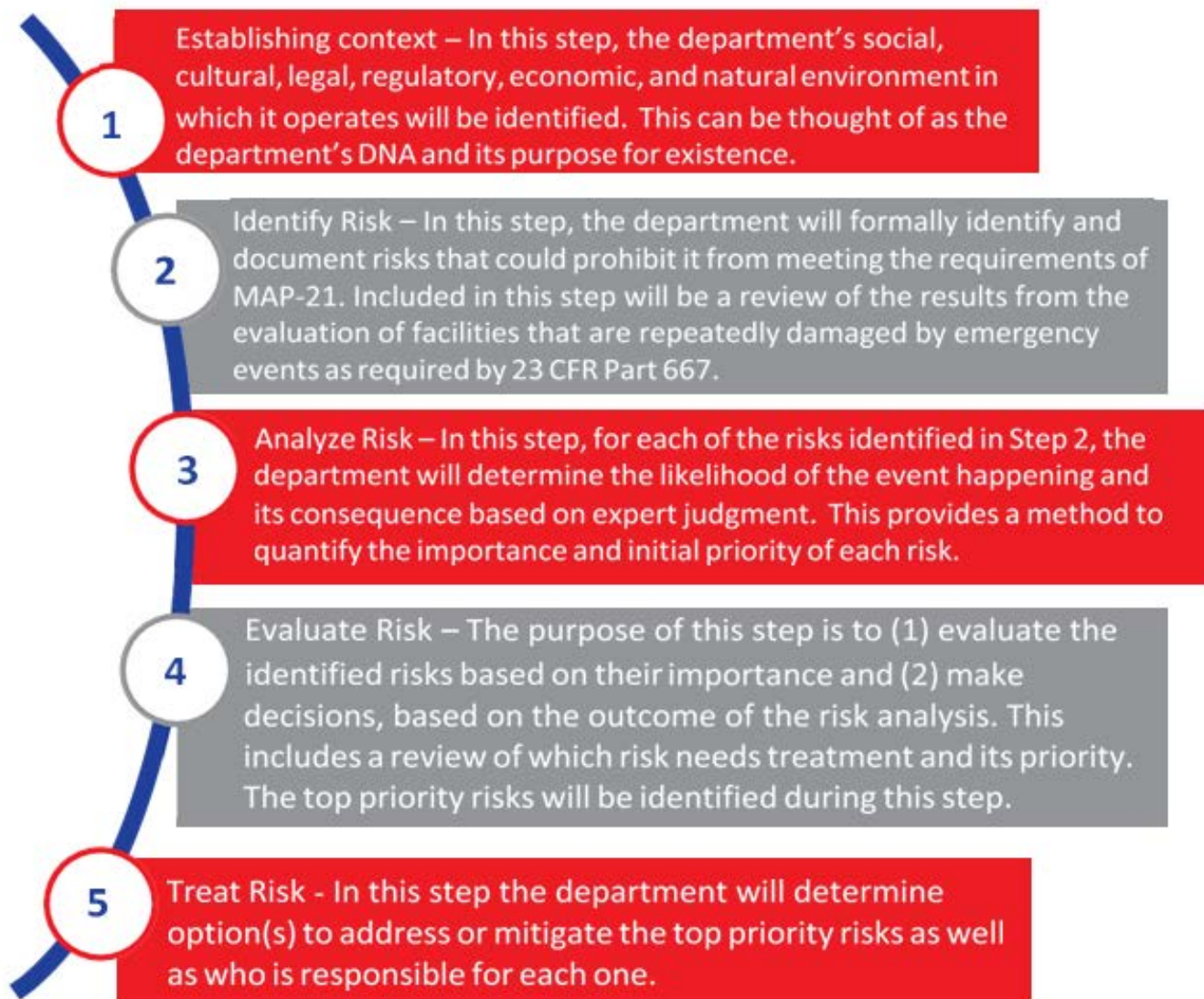


Figure 5-1: TDOT's risk management process

This process is based on ISO 31000 on “Risk Management – Principles and Guidelines” and FHWA’s publication, “Risk-Based Transportation Asset Management Report 1: Evaluating Threats, Capitalizing on Opportunities.” The ISO 31000 process is shown in figure 5-2, which identifies two additional components: 1) Monitoring and Review, and 2) Communication and Consultation. Monitoring and Review is a planned part of the process that is accomplished on an established frequency, as determined by the Risk Management Committee and identification of who is responsible for monitoring each risk. Communication and Consultation provides an avenue to keep internal and external stakeholders abreast of the issues where risk problems and events are known throughout the Department. This information is then shared with the public, legislature, media, and oversight bodies.

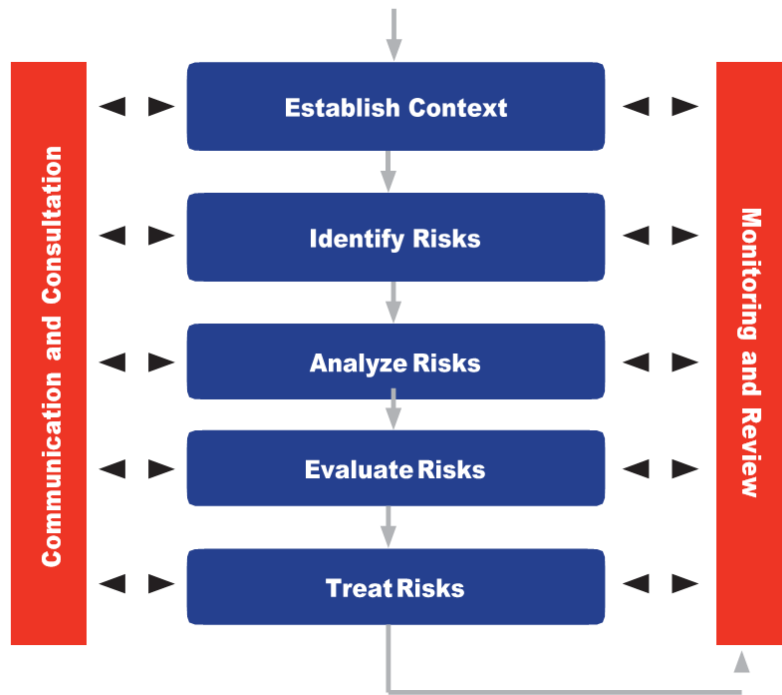


Figure 5-2: Risk Management Framework, modified from ISO 31000:2009

Collectively, the TDOT Risk Management Committee represents each of the major business units within the Department that contribute to the TAMP's vision and guiding principles for pavement and bridges. The members of the committee were selected based on their position in the Department. As the individuals change positions or leave the Department, replacement members are appointed to represent the identified areas and positions. Additional members may be added to the committee, based on the needs of the Department or to address additional areas of risk. Representatives from the divisions and regions presented in table 5-1 are members of the committee.

Table 5-1: Risk Management Committee representation

Maintenance Operations Division	Environmental Policy Office
Strategic Planning Division	FHWA-Tennessee Division
Planning Division	TDOT Region 1
Information Technology Division	TDOT Region 2
Program Operations Division	TDOT Region 3
Structures Division	TDOT Region 4
Strategic Planning, Research & Innovations Division	Chief Engineer's Office
Finance Division	Asset Management Division

How Was the Risk Management Framework Applied?

Risk Identification

The Risk Management Committee followed the risk management framework to identify and evaluate risks that would affect TDOT's ability to meet its asset management objectives. During an initial brainstorming session with the Risk Management Committee, each member was asked to compile a list of risks within their respective areas of responsibility, along with any broader area that could potentially affect the Department as a whole. To help participants consider a broad range of risks, they were asked to consider each of the following six risk categories:

- Agency.
- Bridge.
- Financial.
- Pavement.
- Programming.
- Extreme Weather/Emergency.

The initial effort produced a list with over 100 different risks.

Risk Analysis

The Risk Management Committee then analyzed each risk in terms of potential likelihood and impact, using the rating scales shown in figures 5-3 and 5-4, respectively. Once the likelihood and impact were assessed, the values were multiplied together to get an overall risk score. The risks were ranked based on their score (high to low) to provide a preliminary prioritization. These preliminary scores did not explicitly determine the final ranking for each risk. The initial scores only reflected the individual ratings provided by each committee member during the analysis process.

Enterprise Risk Management Plan

Risk Assessment Scorecard: Likelihood

LIKELIHOOD: Likelihood or Probability of the Event Happening

Rank	Score	Probability %	DESCRIPTION OF LIKELIHOOD RANK
High HIGH	9	90%	Event Fully Expected to Occur
Medium HIGH	8	80%	Event Very Likely to Occur / Event Occurs Repeatedly
Low HIGH	7	70%	Event Likely to Occur / Event Likely to Occur Frequently
High MEDIUM	6	60%	Event Will Probably Occur / Event Will Probably Occur Periodically or Randomly
Medium MEDIUM	5	50%	Event Could Occur
Low MEDIUM	4	40%	Event May Occur / Event May Occur Periodically / Event May Occur Randomly
High LOW	3	30%	Event Might Happen / Event Might Happen Infrequently
Medium LOW	2	20%	Event Not Likely to Occur / Event Would Seldom Occur
Low LOW	1	10%	Event Not Expected to Occur
N/A	0	0%	Will Never Happen

Figure 5-3: Risk Likelihood Guidance

 Enterprise Risk Management Plan Risk Assessment Scorecard: Impact 		
IMPACT: The Potential Consequences or Results of the Event		
<u>Types of Impacts to Consider:</u>		
Inability to Achieve Mission or Objectives	Regulatory / Compliance	
Threat to Health & Safety / Loss of Life	Financial / Safeguarding Assets	
Regulatory / Compliance	Public Trust & Perception	
Damage to the Environment	Fraud, Waste or Abuse	
DESCRIPTION OF IMPACT RANKING	SCORE	RANK
Perilous / Catastrophic	9	High HIGH
Critical / Very Serious	8	Medium HIGH
Serious / Substantial	7	Low HIGH
Major / Significant	6	High MEDIUM
Important / Moderate	5	Medium MEDIUM
Of Concern	4	Low MEDIUM
Small	3	High LOW
Minimal	2	Medium LOW
Very Small / Negligible	1	Low LOW
None	0	N/A

Figure 5-4: Risk Impact Guidance

Risk Evaluation

Using the initial risk register as a starting point, committee members worked cooperatively to review the initial prioritized results from the risk analysis and provide recommendations to the TAMP Core Team for prioritization adjustments. Committee members were asked to rely on their own background and experience with the caveat that the ranking should be aligned with the priorities and needs of the Department. Based on the outcome of this step, the list of risks was reprioritized to form the revised risk register. That register was submitted to TDOT senior management for consideration and adjustment. The final accepted risk register is shown in table 5-2, which is later in this chapter.

Risk Mitigation

The TAMP Core Team, in consultation with senior leadership, developed mitigation strategies for each of the 12 risks included in the risk register. Table 5-2 lists these risks, the team's designation of the type of risk, mitigation activities, and a designated point of contact for each one.

Risk mitigation is intended to make Tennessee's highway infrastructure more resilient. This can be accomplished through hardening assets to withstand extreme weather or other natural events. Resilience may also be addressed through enhancing TDOT's ability to respond to and recover from emergencies or changing trends. TDOT's mitigation strategies for prioritized risks are summarized in table 5-2.



What Risks Emerged from the Process?

Table 5-2 summarizes the results from the risk workshops. The risks are ranked based on their overall score and potential consequences are identified. Suggested mitigation strategies are also presented with a point of contact listed to monitor changes in risk likelihood or consequence over time.

Table 5-2: TDOT Risk Register

Rank	Risk	Type	Score	If	Then	Mitigation	Point of Contact
1	Inadequate State Funding	Financial	48.5	There is not adequate funding to deliver the necessary programs to maintain our assets in a state of good repair,	1. TDOT will not be able to deliver the full program of projects. 2. Projects will be delayed or removed from the program. 3. TDOT may not be able to preserve SOGR. 4. Public opinion of the State will decline due to worsening highway conditions. 5. TDOT may not be able to meet strategic objectives or performance targets.	1. With flattening revenues and inflation, Executive Leadership consistently monitors revenues and cash projections. 2. DOT consistently testifies in legislative committees to the impact of flat revenues vs. rising costs such as payroll and Federal match. 3. Expenditures are analyzed against budgets to address overruns throughout the fiscal year, based on certain metrics. By doing this, TDOT ensures that the agency does not have administrative expense overruns take away from projects. 4. The financial position of the Department is monitored to identify any potential shortfalls and operations are adjusted, as needed.	Chief Financial Officer and Director of Finance
2	Population & Employment Growth (Development)	Agency	47.5	The State of Tennessee continues to experience population growth at historic rates,	1. Existing infrastructure will deteriorate more quickly due to increased loading. 2. Additional funding will be needed to add capacity and maintain the desired level of service/SOGR.	1. Identify current and potential network deficiencies using a number of available traffic monitoring and forecasting tools. 2. Based on the analysis, recommend various improvements that could feed into future 10-year plans. 3. Identify new or underutilized funding mechanisms (when applicable).	Director of Planning

Rank	Risk	Type	Score	If	Then	Mitigation	Point of Contact
3	Uncertainty About Future Funding	Financial	46.6	There is uncertainty about future funding levels, including reauthorization of a long-term surface transportation bill when the current bill expires in 2026 and risk to State and Federal revenues as gas/diesel powered vehicles migrate to alternative fuels,	1. TDOT will not be able to properly plan projects. 2. Projects may be delayed or reprogrammed. 3. TDOT may not have sufficient "shelf" projects to make use of surplus revenue. 4. TDOT may be forced to reprogram projects, and that may lead farther away from a Transportation Asset Management (TAM) strategy and may not achieve targets for SOGR. 5. Infrastructure constructed with these funds may over-extend the available maintenance and preservation in the future, leading to lower asset conditions and reduced system performance.	Actively engage with elected officials to support a robust Federal transportation funding bill that adequately supports the transportation needs of Tennessee.	Chief Financial Officer and Director of Finance

Rank	Risk	Type	Score	If	Then	Mitigation	Point of Contact
4	High Staff Turnover/Lack of Qualified Personnel/Lack of Proper Training	Agency	44.2	The Department is going through a reorganization that is schedule to be completed by the end of 2025 that is restructuring role & responsibilities, creating a matrix organization and increasing span of control. In the interim, the department is experiencing retirements and vacancies in some areas.	1. Inexperienced staff may be given additional responsibilities. 2. Institutional knowledge may not be shared between stakeholders. 3. TDOT production roles will decrease, while maintaining oversight and quality assurance 4. Consultant costs may increase at a faster rate than expected.	1. State salaries increased to align with market value. 2. Provide additional training options for new employees. 3. Develop data & knowledge management strategies and tools. 4. ProPath and proficiency development to train staff & increase employee retention. 5. Increase use of consultants & contractors in Pre-Construction and Operations 6. Director/Managers will take on additional responsibilities in the short term.	Human Resources Division Director and Director of Engineering Technical Training

Rank	Risk	Type	Score	If	Then	Mitigation	Point of Contact
5	Inflation	Programming	41.6	Inflation is greater than expected,	1. TDOT would be able to deliver fewer projects, and there would be a reduction in the overall program delivery. 2. Less work would likely be accomplished by TDOT. 3. Authorized budgets would cover less program. 4. Overruns will increase.	1. Recommend reprogramming or phasing projects that have a significant cost increase. 2. Use an inflation factor on project estimates in future budget years. 3. Monitor trends for major resource items such as labor, equipment, and materials. 4. Include a projection of expected cost increases on items in projects being let to construction for both utility and TDOT costs. 5. Coordinate between pre-construction and construction to review inflation data from various sources yearly.	Construction Division Director and Program Operations Director

Rank	Risk	Type	Score	If	Then	Mitigation	Point of Contact
6	Proactive Approach to Work Planning (Opportunity)	Agency	39.7	TDOT is able to better connect performance measures with strategic plans and initiatives,	The agency may be better able to meet strategic goals and leverage innovation to improve the efficient use of resources.	1. Use the leadership dashboard and monthly meetings to discuss and adjust program status. 2. MVV Communication plan started in 2024 to develop line of sight between strategic direction, goals, and daily work. This has resulted in the MVV MVP program and a session related to the organization's MVV being introduced in TDOT Experiences. 3. Effort has been focused on developing the line of sight between governor's priorities, TDOT strategic direction, annual CFG goals, and IPPs. 4. As part of EPIC reorganization, Strategic Planning was merged with the Research Office to incorporate new information into planning processes. 5. Assessment of performance measurement framework to better align with TDOT plans to be undertaken in 2025. 6. Development of 10-year and 3-year asset plans help focus organization on priority projects.	Strategic Planning, Research & Innovations Division Director

Rank	Risk	Type	Score	If	Then	Mitigation	Point of Contact
7	Stability/ Leadership Changes	Agency	39.4	There are significant changes at the higher level and TDOT sees significant changes in focus areas,	1. Agency priorities may change from the strategies described in the TAMP. 2. Projects may be delayed or cancelled. 3. TDOT may not be able to demonstrate consistency with TAMP investment strategies.	1. Federal Affairs Director appointed to keep organization apprised of updates and priorities at the Federal level. 2. American Association of State Highway and Transportation Officials (AASHTO) involvement helps the organization maintain awareness on national trends and topics. 3. Continually scanning the environment for risks - This includes tracking market conditions on products to be able to adjust cost estimates and quantities. 4. Planning (LRTPP, SHSP, Strategic Plan) and programming structure (10-year plan, 3-year asset plans) as well as Federal and State budget cycles overlap State level administration changes to bring continuity to departmental priorities. 5. TDOT is taking a focused approach to elevate Asset Management through EPIC reorganization.	Strategic Planning, Research & Innovations Division Director
8	Bridge Deterioration	Bridge	38.0	The average bridge age increases,	There may be: 1. Increased frequency and severity of repairs. 2. Increased inspection frequency. 3. Road user impacts during inspection and/or repairs. 4. More funding required to maintain. 5. More bridge postings affecting freight movement.	1. Increase funding for bridge preservation efforts. 2. Maintain bridge joint seals. 3. Maintain bridge deck overlays. 4. Use advanced materials that offer protection to structural elements. 5. Replace older simple span structures with continuous structures.	Structures Division Director

Rank	Risk	Type	Score	If	Then	Mitigation	Point of Contact
9	Natural Disasters	Weather/ Emergency	30.1	The State of Tennessee experiences major damage from flooding, rockslides, slope failures, seismic events, extreme heat events, or other natural disasters,	1. Road closure and damage may occur. 2. Decreased mobility is likely to occur. 3. Long-term impacts to roadway stability due to the saturation of the subgrade may be possible. 4. Injury/Death may occur. 5. Maintenance/reconstruction costs may increase. 6. Litigation from private property owners may occur. 7. Funding and other resources will need to be diverted from the current program for response and recovery. 8. Projects may be reprogrammed or delayed.	1. Commit necessary resources to response preparedness. 2. Develop strategies to support needed response and recovery with minimal impact to the program. 3. Establish proactive strategies to build a more resilient transportation system. 4. Develop a systematic framework to manage preparedness, response, and recover efforts. 5. Establish an emergency fund to support the first instance of funds for emergency response and recovery.	Maintenance Operations Division Director and Regional Operations Directors
10	Accelerated Pavement Deterioration	Pavement	34.7	Pavement deterioration is more severe than expected,	1. May result in (work type) consistency determination issues as a part of the annual TAMP review process. 2. TDOT will be unable to identify imminent base/subbase issues. 3. Repairs cannot be implemented in a timely fashion. 4. Project scope changes/postponement are more likely to occur. 5. Project cost escalation is likely to occur.	1. Use PMS data to identify potential projects early and commission early testing. 2. Implement use of network-level Traffic Speed Deflection Device (TSDD) testing to evaluate pavement structural capacity and determine suitable treatment needs.	Maintenance Operations Division Director (Adjunct pavement staff)

Rank	Risk	Type	Score	If	Then	Mitigation	Point of Contact
11	Meeting Customer Expectations for Maintenance Based on Limited Funding	Agency	36.3	TDOT is not able to meet customers' expectations regarding the quality of maintenance work,	Public outreach to political stakeholders could lead to TDOT being forced into a less efficient use of maintenance funds, further reducing the effectiveness of maintenance investments.		Maintenance Operations Division Director and Regional Operations Directors
12	Outdated Software (MMS)	Agency	34.2	TDOT can replace outdated systems with modern approaches, such as subscription-based software, avoiding obsolescence and major update costs,	TDOT will be able to: 1. Make better use of its IT funding. 2. Avoid the need for massive infusions of funding to replace systems. 3. Improve knowledge transfer since systems will not have to be replaced with "big-bang" roll outs.	1. Dedicate needed resources to replacing the MMS. 2. Support implementation of TDOT's data governance process.	Maintenance Operations Division Director and CIO

What Considerations Are Being Made for Facilities Repeatedly Requiring Repair and Reconstruction Due to Emergency Events?

TDOT provides support for responding to and recovering from emergency events that impact the operation and condition of the highway network. This work commonly involves repair or reconstruction of highways and bridges that are damaged during an event. TDOT records information for each location where repairs or reconstruction are performed including the specific location, the type of work performed and the costs to deliver the work. The costs for these response and recovery activities are funded through a combination of State and Federal funds, depending on the size and location of each emergency.

To comply with Federal requirement [23 CFR Part 667](#), *Periodic Evaluation of Facilities Repeatedly Requiring Repair and Reconstruction Due to Emergency Events*, TDOT periodically evaluates its emergency response data to identify any locations have that have required repair or reconstruction on two or more occasions from emergency events declared by the Governor or the President of the United States since January 1, 1997. This process is outlined in table 5-3.

Table 5-3: Business process to support 23 CFR Part 667 requirements

Step	NHS Highways and Bridges	Non-NHS Highways and Bridges
Documentation	After a qualifying emergency event has been declared, the TDOT Regional and District Operations staff will assess the situation and evaluate the damage on roads, highways, and bridges on the Federal Aid Highway System. Once the situation has been assessed, a Detailed Damage Assessment Form (DAF) will be completed for each site and submitted to the FHWA. The DAFs will be input into a GIS system for documenting the location, asset(s) damaged, and extent of damage.	
Evaluation	Following the qualifying event, TDOT will perform a statewide evaluation of the NHS, using the GIS database, to identify recurring incidents of repair or reconstruction in particular locations. If recurring events (more than two events at a given location) are identified for a location on the NHS, TDOT will develop an action plan for addressing the issue.	Prior to requesting Federal aid for any highway or bridge project, TDOT will compare all locations included in the project with its records of locations damaged by qualifying emergency events using the GIS database.
Implementation	Asset managers will meet with subject matter experts to evaluate the most suitable repair and rehabilitation strategies. A funding request will be submitted to the appropriate authorities. The selected repair and rehabilitation strategy will be communicated to the responsible parties. The permanent repairs will be documented in the GIS database for future assessments.	TDOT considers the outcomes of these evaluations during the development of transportation plans and programs, including TIPs and STIPs, and during the environmental review process under 23 CFR Part 771 .

The listing of emergency events evaluated are listed in table 5-4. More information is available for review by the FHWA on request. During the evaluation, TDOT identified seven specific locations that have had two or more disaster repairs during the evaluation period of January 1, 1997, to September 30, 2024. These locations are listed in table 5-5 and shown in figure 5-5. It should be noted that not all locations that have been identified have been impacted by similar types of events or have sustained similar damage.



Table 5-4: Summary of Data for Declared Disaster Sites (Re: 23 CFR Part 667)

Event Number	Event Dates	Type of Event	Number of Counties	Number of Sites Affected
ER-TN09-1	January 28, 2009	Ice storm	2	12
ER-TN10-1	November 10, 2009	Rockslide	1	1
ER-TN10-2	January 19, 2010	Rockslide	1	1
ER-TN10-3	January 25, 2010	Rockslide	1	1
ER-TN10-4	March 14, 2010	Rockslide	1	1
ER-TN10-5	Apr 30 to May 2, 2010	Flooding/Slides	41	24
ER-TN11-1	February 20, 2011	Rockslide	1	1
ER-TN11-2	April 5, 2011	Rockslide	1	1

Event Number	Event Dates	Type of Event	Number of Counties	Number of Sites Affected
ER-TN11-3	April 19, 2011	Flooding	17	17
ER-TN12-1	January 31, 2012	Rockslide	1	1
ER-TN12-2	March 8, 2012	Landslide	1	1
ER-TN16-2	February 10, 2016	Rockslide	1	1
ER-TN16-1	February 26-29, 2016	Rockslide	1	1
ER-TN17-1	April 23, 2017	Rockslides	3	3
ER-TN18-1	March 2, 2018	Bridge Strike	1	1
ER-TN18-2	April 27, 2018	Bridge Strike	1	1
ER-TN19-1	November 27, 2018	Rockfall	1	1
ER-TN19-2	February 6 - March 2, 2019	Flooding/Slides	83	229
ER-TN19-3	July 11, 2019	Slope Failure	1	1
ER-TN20-1	January 1 - February 24, 2020	Flooding/Slides	13	19
ER-TN21-1	August 21, 2021	Flooding	4	13
ER-TN22-1	April 18, 2022	Slope Failure	1	1
ER-TN22-2	August 5, 2022	Rockslide	1	1
ER-TN24-2	May 8, 2024	Sinkhole	1	1
ER-TN24-3	September 27, 2024	Roadway and Bridge Failures	6	34

Table 5-5: Locations identified as repeated ER repairs

Date Damaged	Event Name	Region	District	County	Route	Begin LM	End LM	Begin Lat	Begin Long	End Lat	End Long	Type Damage
4/30/2010	ER-TN10-5-9	3	38	Hickman	SR230	11.47	11.47	35.870211	87.500464	35.870211	87.500464	Bridge Damage
8/21/2021	ER-TN21-1	3	38	Hickman	SR230	11.514	11.514					Bridge Damage
2/20/2019	ER-TN19-2	2	29	Hamilton	SR-148	2.4	2.4	35.00646	-85.338393			Roadway Crack/Slope Failure
3/1/2020	ER-TN20-1	2	29	Hamilton	SR-148	2.4	2.4	35.00646	-85.338393			Roadway Crack
5/1/2010	ER-TN10-5	3	38	Maury	SR-7	25.5	25.5	35.747071	-87.138704			Roadway Failure
3/2/2019	ER-TN19-2	3	38	Maury	SR-7	25.5	25.5	35.747071	-87.138704			Roadway Settlement
2/26/2016	ER-TN16-1	1	19	Campbell	I-75	142.5	142.5	36.39460	-84.25860			Landslide
7/11/2019	ER-TN19-3	1	19	Campbell	I-75	142.5	142.5	36.39460	-84.25860			Landslide
2/25/2019	ER-TN19-2	1	18	Cocke	I-40	443	443	35.842483	-83.181899			Sinkhole
9/16/2024	ER-TN24-3	1	18	Cocke	I-40	443	443	35.842483	-83.181899			Sinkhole

Part 667 Map Locations: Site Locations Sustaining Repeated Disaster Events



Legend

- ▲ Disaster Locations
- County Boundary

Esri, CGIAR, USGS, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NPS

Figure 5-5: Locations in Tennessee with two or more disaster repairs

The locations identified were in Hickman, Hamilton, Maury, Campbell, and Cocke counties. The site in Hickman County is a bridge on SR230 that has been repeatedly damaged by flooding. This location is being replaced with a new structure. In Hamilton County, heavy rainfall has caused a recurring crack of 2 to 3 inches in the roadway caused by underlying slope instability. In Maury County, significant cracking, leading to a slope failure, has caused the paved shoulder to completely separate from the travel lane. In Campbell County, heavy rainfall has caused a landslide above I-75 in the same location. Crews addressed the slide most recently by installing wire mesh and soil nails. In Cocke County, severe weather caused a sinkhole in the median of I-40 at the same location on multiple occasions, most recently in 2024.

How Does TDOT Consider Extreme Weather and Resilience in Risk Management?

During September 2024, heavy rainfall caused by Hurricane Helene closed 49 sections of roadway and eight bridges, highlighting that transportation assets are vulnerable to extreme weather.



Figure 5-6: Damage on I-26 in Unicoi County that occurred because of Hurricane Helene

Since 2015, TDOT has completed three planning projects that resulted in the first Transportation Resilience Improvement Plan (TRIP). The three projects that led to this overall plan are described below.

- TDOT completed an extreme weather vulnerability assessment that included all major transportation infrastructure assets located within the State. This vulnerability assessment served as a screening tool to better understand the impacts of extreme weather on the State's transportation assets. It also served as a foundation that TDOT could build on by performing follow-on activities based on study results.
- A second phase of this effort identified 16 critical assets as highly vulnerable to extreme weather. These locations were studied to identify recommendations for adaptation strategies. Although roads make up a significant portion of the identified list, site selection criteria included consideration of different transportation asset types and geographical locations. Detailed information was collected about the physical asset and its location, using site-specific maps, photos, published literature, and conversations with people knowledgeable about the site. For each location, a variety of candidate adaptation strategies worthy of consideration were identified, ranging from lower cost solutions to initiatives that require more substantial investment. The attractiveness of these alternative strategies depends on resource availability, estimated benefit/cost associated with strategy implementation, and the expected lifetime of strategy effectiveness.
- The third phase of research addressed the integration of resilience into agency decision-making processes and operating procedures. To achieve this objective, four specific activities were pursued:
 - Form a TDOT Extreme Weather Resilience Task Force for the purpose of maintaining an ongoing engagement to encourage adoption and collaboration across TDOT's offices and divisions.
 - Design and administer a resilience self-assessment survey for TDOT senior management to complete.
 - Analyze survey results, identify needs, and begin facilitating development of resilience activities to address identified needs.
- Develop and operate a Resilience website to serve as a knowledge resource for TDOT and its stakeholders.

These efforts led to publishing the Transportation Resilience Improvement Plan for Tennessee in 2024. The plan lists strategic areas and actions that could strengthen TDOT's approach. Actions were identified in the following three areas:

- Structures and Processes.
- Tools and Technology.
- Technical Capacity and Collaboration.

The TRIP recognizes the paired relationship between resilience planning and several aspects of the TAMP (i.e., Part 667 location tracking, life-cycle planning considering resilience, and risk identification and mitigation strategies). From the 16 critical locations identified in the second phase noted above, a pilot resilience study was conducted in Lawrence County using PROTECT funds to evaluate and rank locations that should receive any funding approved for betterments in line with resilience needs.

Other strategies and programs used by TDOT that improve resilience include the rockfall management program and the culvert condition assessment program. The rockfall management program purpose is to inventory and evaluate potential rockfall locations, prioritize those locations with the highest risk and impact, and implement engineered mitigation strategies to either minimize the risk of the rockfall event or reduce the impact of the failure. An expansion of this program is currently being developed to inventory and evaluate unstable slopes affecting highway infrastructure in Tennessee. The culvert condition assessment program purpose is to provide an inventory and condition assessments for drainage pipes to prioritize repair and replacement of these important drainage structures across Tennessee. The program focuses on locations located inside project limits scheduled for repaving within the next 3 years to avoid unnecessary open cutting of freshly paved roadways.

CHAPTER 6

FINANCIAL PLAN

What Is TDOT's Financial Plan?

This financial plan describes the revenue available to TDOT to deliver its programs, fulfill its mission, and achieve its asset management objectives. TDOT is responsible for programs across multiple transportation modes, including highways, transit, and aeronautics. This plan describes how funding is allocated to supporting different aspects of TDOT's mission and, more specifically, what levels of funding are expected to be made available to support asset management of pavements and bridges over the next 10 years.

This financial plan is required by Federal statute (23 USC 119) and rule (23 CFR 515). The following sections provide details of these requirements and explain how TDOT meets them. Finally, this chapter describes the outcome of the financial planning process, in terms of 10-year funding forecasts for managing TDOT's pavement and bridge assets.

What Are the MAP-21 and Final Rule Requirements?

Requirements for an asset management financial plan were first established through the MAP-21 legislation. The IIJA extended these requirements through 23 USC 119(e)(4)(E), requiring each asset management plan to contain a financial plan. This statute was further detailed through the final asset management rule, 23 CFR 515.

Definitions for this section are found in 23 CFR Part 515.5 and repeated here as follows:

- "Financial plan means a long-term plan spanning ten (10) years or longer, presenting a State DOT's estimates of projected available financial resources and predicted expenditures in major asset categories that can be used to achieve State DOT targets for asset condition during the plan period, and highlighting how resources are expected to be allocated based on asset strategies, needs, shortfalls, and agency policies."
- "Work type means initial construction, maintenance, preservation, rehabilitation, and reconstruction."

According to 23 CFR Part 515.7(d), State DOTs are required to establish a process for developing a financial plan that, at a minimum, produces:

1. "The estimated cost of expected future work to implement investment strategies contained in the asset management plan, by State fiscal year and work type;
2. The estimated funding levels that are expected to be reasonably available, by fiscal year, to address the costs of future work types. State DOTs may estimate the amount of available future funding using historical values where the future funding amount is uncertain;

3. Identification of anticipated funding sources;
4. An estimate of the value of the agency's NHS pavement and bridge assets and the needed investment on an annual basis to maintain the value of these assets."

What Is TDOT's Process for Developing a Financial Plan?

To satisfy the requirements of MAP-21 and the final rule, TDOT uses information from the annual budget process and the STIP development process to:

- Cover a 10-year period.
- Include cost estimates to implement asset management investment strategies by year and work type.
- Estimate available funding levels by revenue sources for the 10-year period.
- Determine asset valuation for NHS pavement and bridges and annual investments to keep assets in a state of good repair.

The State of Tennessee is a fiscally conservative State where annual budgets are prepared based on a pay-as-you-go philosophy. The Governor is required to present a proposed budget to the General Assembly on an annual basis. The General Assembly, in consideration of the Governor's recommendations, passes an appropriation act, which is the financial plan for all State agencies. The annual fiscal year budget begins on July 1 and ends on June 30. Once the fiscal year begins, the budget staff starts making plans for the next fiscal year.

TDOT has its own budget separate from the State's General Fund. Tennessee's annual State budget identifies sources of revenue and estimated amounts to contribute to TDOT's Highway Fund. Budgetary control is maintained by the Department in conjunction with the Department of Finance and Administration.

At TDOT, the process for creating an annual budget has been refined over time and evolved into a systematic methodology based on historical information and performance data. The current process estimates the amount of funds available to the Department by funding source and allocation of these funds to agency programs. In order to develop a financial plan that covers a 10-year period, TDOT will rely on work that has already been done, such as the *25-Year Long-Range Transportation Policy Plan*, the *10-Year Strategic Investment Plan*, *State Transportation Improvement Program 2020-2023*, the *Fiscal Year 2022 Budget for the State of Tennessee*, and the TDOT TAMP Investment Strategy. These documents, along with subsequent State budgets, provide the basis for developing a 10-year estimate of the funds available to TDOT to implement the TAMP investment strategy. Each of the major revenue sources, which contribute to TDOT's annual budget, will be analyzed to estimate future dollars.

What Is TDOT's Revenue Forecast?

Tennessee passed the current highway funding bill in 2024. TDOT's budget has been bolstered by the creation and passage of the Transportation Modernization Act in 2024 (one-time infusion of \$3.3 billion). Given all the recent uncertainty in the State's revenue trends, TDOT cannot expect to receive similar

transfers in the future. However, the Tennessee Governor and Legislature have made it clear that funding transportation needs is a priority. Based on these assumptions, TDOT expects State revenue to increase by approximately 0.5 percent per year during the 10-year period of this TAMP through slight increases in the user fees collected. Table 6-1 provides an overview of the current and forecasted State highway funding by major revenue source.

Table 6-1: TDOT 10-year State revenue forecast (dollars)

State Fiscal Year	Gasoline & Petroleum	Motor Fuel Tax (Diesel)	Gasoline Inspection Tax	Motor Vehicle Registration Tax	Additional Revenue and General Fund Transfers	Total Estimated Revenue
2024	439,100,000	245,000,000	38,800,000	311,800,000	3,579,103,500	4,613,803,500
2025	456,900,000	232,900,000	39,100,000	307,500,000	295,272,500	1,331,672,500
2026	459,184,500	234,064,500	39,295,500	309,037,500	295,626,827	1,337,208,827
2027	461,480,423	235,234,823	39,491,978	310,582,688	295,981,579	1,342,771,489
2028	463,787,825	236,410,997	39,689,437	312,135,601	296,336,757	1,348,360,617
2029	466,106,764	237,593,052	39,887,885	313,696,279	296,692,361	1,353,976,340
2030	468,437,298	238,781,017	40,087,324	315,264,760	297,048,392	1,359,618,791
2031	470,779,484	239,974,922	40,287,761	316,841,084	297,404,850	1,365,288,101
2032	473,133,381	241,174,797	40,489,199	318,425,290	297,761,736	1,370,984,403
2033	475,499,048	242,380,671	40,691,645	320,017,416	298,119,050	1,376,707,830
2034	477,876,544	243,592,574	40,895,104	321,617,503	298,476,793	1,382,458,517
2035	480,265,926	244,810,537	41,099,579	323,225,591	298,834,965	1,388,236,598

Revenue forecasting is dependent on many external variables and can fluctuate from year to year. While the forecast in table 6-1 provides useful information on the outlook of revenue sources, its projections become less accurate when economic factors change.

What Level of Funding Will Be Available to Address Pavement and Bridge Conditions?

State highway funds are used to support many functions in addition to the needs of infrastructure assets. Table 6-2 provides a breakdown of the uses of State revenue from fiscal year 2025 and forecasted for fiscal year 2026. This is used as the basis for determining the amount of State revenue expected to be available for addressing the needs of NHS pavements and bridges during the TAMP period.

Table 6-2: Revenue available for asset management (dollars)

	2025	2026
Total State Revenue	\$4,613,803,500	\$1,331,672,500
Less:		
Admin	\$122,168,300	\$130,451,500
HQ Operations	\$61,006,800	\$60,298,200
Field Operations	\$89,019,700	\$115,848,600
Garage & Fleet Operations	\$34,491,000	\$26,339,300
Capital Improvements	\$3,698,000	\$17,995,000
Mass Transit	\$46,862,100	\$54,526,800
Planning & Research	\$8,550,000	\$6,437,000
Multimodal Access Grant	\$18,000,000	\$7,681,300
Air, Water, & Rail	\$109,500,000	\$136,100,000
Beer & Bottle Dedicated Rev.	\$6,700,000	\$6,800,000
General Fund Transfer for Non-Road/Bridge	\$117,200,000	\$113,300,000
State Revenue Available for Project Development and Delivery, including TAM	\$3,996,607,600	\$655,894,800

While the amount of State funding shown in table 6-2 is available for use to improve asset conditions, most of that funding will be used on assets located off the NHS. This is because Federal NHPP funds must be spent on the NHS while other sources of Federal and State funding may be spent on any type of

highway. In 2021, the Federal government passed the Bipartisan Infrastructure Law which provides a significant increase in Federal aid for NHS and other assets. Table 6-3 shows the total State and Federal funding estimated for establishing the investment strategies for NHS pavements and bridges. The estimate for State and Other funds is bolstered by a one-time investment of \$719 million for three high-priority economic development projects that will not have a significant impact on statewide asset conditions. The majority of these funds are programmed in the years 2026 and 2027. As a conservative estimate, TDOT is assuming the level of investment will remain relatively flat from 2028 through 2034.

Table 6-3: TDOT 10-year transportation program funding (dollars)

Year	State Funds Plus Other Funds	Federal Funds	Total TDOT Funds
2025	\$606,721,661	\$981,907,751	\$1,588,629,412
2026	\$983,707,821	\$1,013,712,242	\$1,997,420,063
2027	\$821,292,545	\$1,019,312,242	\$1,840,604,787
2028	\$438,892,545	\$969,212,242	\$1,408,104,787
2029	\$618,221,008	\$969,212,242	\$1,587,433,250
2030	\$302,892,545	\$969,212,242	\$1,272,104,787
2031	\$208,892,545	\$969,212,242	\$1,178,104,787
2032	\$187,892,545	\$969,212,242	\$1,157,104,787
2033	\$187,892,545	\$969,212,242	\$1,157,104,787
2034	\$218,892,545	\$969,212,242	\$1,188,104,787
Total	\$4,575,298,305	\$9,799,417,929	\$14,374,716,234

The totals shown in table 6-3 are reflective of the agency's current transportation program. This funding is distributed between projects to implement TDOT's investment strategies, as described in Chapter 7 and the capital projects, which do not substantially contribute to the state of good repair of TDOT's pavement and bridge assets. These totals do not include maintenance funding that is used for routine repairs, such as pothole patching of pavements. Expected levels of maintenance funding are included in the investment strategies described in Chapter 7.

What Is the Value of TDOT's NHS Pavements and Bridges?

A quick gauge to determine if an agency is maintaining its assets at a steady, declining, or improving state is to look at the monetary value of the asset inventory over a defined time frame. If the value of the assets is increasing or staying the same from year to year, it is an indication that the agency's level of investment has been large enough to offset any decline in condition such as depreciation. This type of strategy is typically consistent with maintaining an asset in a state of good repair. Likewise, if the value of the assets is declining, it is an indication that investment levels are not sufficient to account for deterioration.

There are many different ways to determine the monetary value of an asset. Based on the current data available to TDOT, the agency has decided to use two different methods to estimate the value of its pavements and bridges:

- For pavements, TDOT has opted to use the process established for development of the Governmental Accounting Standards Board (GASB) Statement Number 34, commonly referred to as "GASB-34."
- For bridges, TDOT has chosen to use a depreciated replacement cost (DRC) approach, as outlined in *A Guide to Developing Financial Plans and Performance Measures for Transportation Asset Management*.¹⁰

Pavement Valuation

GASB-34 is a set of requirements aimed at making government financial statements consistent between agencies. Included in the standard is a method for estimating asset value based on the total replacement value minus depreciation based on the "Life Ratio." The Life Ratio is calculated by dividing the predicted remaining service life by the total service life. Remaining service life values were determined using the PMS based on a trigger PQI value of 2.5. Total service life is determined by adding the age since last resurfacing and the remaining service life. For each individual pavement segment, the average resurfacing unit cost per lane mile was depreciated by this approach. The information for 2021 and 2025 GASB-depreciated maintenance cost is shown below in table 6-4.

More than 95 percent of TDOT Interstates and 99 percent of State routes are surfaced with asphalt. Thus, valuation methods are currently based on total replacement and maintenance costs of asphalt pavements. It is considered beneficial to eventually consider actual concrete rehabilitation and maintenance costs in this valuation process. This will be done in future years as maintenance costs are gathered for concrete-surfaced pavements.

Using the GASB methodology, it is estimated that the current value of all TDOT pavements on the NHS is \$13.2 billion, which is 41.5 percent of the cost to replace the pavement assets, compared to \$8.6 billion

¹⁰ Spy Pond Partners, LLC, KPMG, and University of Texas at Austin. 2018. *NCHRP 19-12: A Guide to Developing Financial Plans and Performance Measures for Transportation Asset Management*. TRB.

and 36 percent in 2021. One key factor contributing to the change for 2025 is the increased replacement cost resulting from higher unit prices.

Table 6-4: 2018 & 2021 Valuation of TDOT pavements on the NHS system (M=millions of dollars)

System & Year	Lane Miles	Total Replacement Cost (M)	Total Maintenance Cost (M)	Total GASB Straight line Maintenance Cost (M)	Current Value (M)	% of Replacement Value
NHS - Interstate						
2021	5,645.0	\$8,991.6	\$1,183.8	\$475.9	\$3,396.3	37.8%
2025	5,620.4	\$12,081.5	\$1,697.4	\$846.9	\$6,040.1	50.0%
NHS - State Routes						
2021	12,321.0	\$14,958.8	\$1,330.6	\$482.0	\$5,241.1	35.0%
2025	12,329.0	\$19,791.2	\$2,656.7	\$1,726	\$7,174.7	36.3%
Total NHS (2021)	17,966.0	\$23,950.4	\$2,514.4	\$957.9	\$8,637.4	36.1%
Total NHS (2025)	17,949.4	\$31,872.7	\$4,354.1	\$2,572.9	\$13,214.8	41.5%

Bridge Valuation

The basic approach in using the method described below is to estimate the total replacement cost of an asset in current dollars and then reduce that value based on lost value due to deterioration of the bridge. This approach is described in detail as follows.

The value of TDOT's bridges is determined based on the replacement value in current dollars and then discounted using a weighted value for each component of the bridge—30 percent for substructure condition, 30 percent for superstructure condition, and 40 percent for deck condition—based on each component's condition rating (0-to-9-point scale). Since the agency has a variety of different types and sizes of bridges, the replacement value is based on a weighted average of the various bridge types in the TDOT inventory according to the main type of material and span length. The average unit prices are based on 2021 cost data that have been inflation-adjusted for prior years. The replacement value is calculated using the area of the deck in square feet, multiplied by the current construction replacement unit cost. The replacement value is discounted based on the bridge's component condition rating. The condition rating of each component of the structure is a nationally recognized numerical value from 0 to 9, where 9 is the best condition rating. The following formula is used to calculate the current bridge value.

$$\text{Current Value (CV)} = \text{Deck Area (in Sq Ft)} \times \text{Unit Cost Per Sq Ft} \times [(0.4) \times \text{Deck Condition Rating/9} + (0.3) \times \text{Superstructure Condition Rating/9} + (0.3) \times \text{Substructure Condition Rating/9}] \quad (3)$$

Using this methodology, it is estimated that the current value of all TDOT bridges on the NHS is \$8.892 billion, which is 71.54 percent of the total replacement value of \$12.431 billion for all TDOT bridges. Table 6-5 and Figure 6-1 provide an overview of how the value of TDOT's NHS bridges has changed over the last 7 years.

The current strategy is losing an average of 0.39 percent of the replacement value of the NHS bridges per year. However, the value of the agency's NHS bridge assets has increased each year, and the current value of the NHS bridges has been consistently retained at a high percentage of the replacement cost. This serves as an indicator that TDOT's Financial Plan and Investment Strategy is adequately funding the bridge program to meet their performance targets and offset significant loss in value based on condition.

Table 6-5: 2017-2024 Valuation of TDOT bridges on the NHS system (\$M=millions of dollars)

Year	2017	2018	2019	2020	2021	2022	2023	2024
Area (millions of Sq Ft)	57.794	58.026	58.286	58.414	58.635	58.844	60.485	60.254
Bridge Count	4,148	4,175	4,180	4,187	4,211	4,211	4,373	4,374
Replacement Cost (\$M)	\$9,247	\$9,864	\$10,608	\$11,391	\$12,431	\$13,534	\$15,121	\$15,967
Cost per Sq Ft	\$ 160	\$ 170	\$182	\$195	\$212	\$230	\$250	\$265
Current Value (\$M)	\$6,760	\$7,182	\$7,691	\$8,231	\$8,892	\$9,667	\$10,803	\$11,417
% of Replacement Cost	73.11%	72.81%	72.50%	72.26%	71.54%	71.43%	71.44%	71.50%
% Change	N/A	-0.30%	-0.31%	-0.24%	-0.72%	-0.11%	0.01%	0.06%

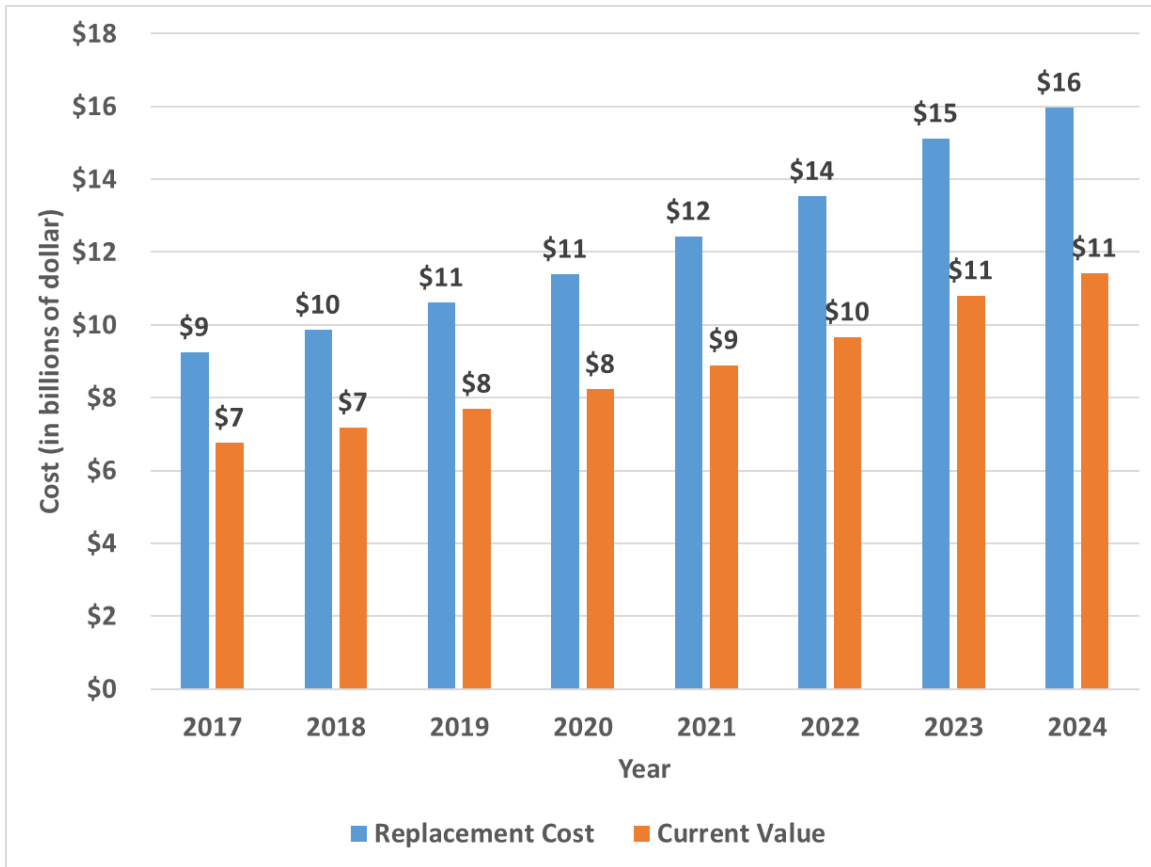


Figure 6-1: Valuation of TDOT owned NHS bridges

CHAPTER 7

TDOT TAMP INVESTMENT STRATEGIES

This chapter discusses TDOT's process for developing investment strategies and the expected outcomes of that process. As required by the final rule, the following sections identify the process TDOT will use to satisfy the requirements of MAP-21 for investment strategy.

What Is TDOT's Investment Strategy?

TDOT's investment strategies are developed using historical investment and performance data to evaluate the impact of different investment scenarios on asset conditions and system performances. This holistic approach allows TDOT to establish funding needs for all modes of transportation that fall under TDOT's purview (see figure 7-1). While the TAMP focuses mainly on NHS pavement and bridges, the remaining six national goals identified in 23 USC 150(b): Safety, Congestion Reduction, System Reliability, Freight Movement and Economic Vitality, Environmental Sustainability, and Reduced Project Delivery Delays are being addressed by TDOT's capital program.

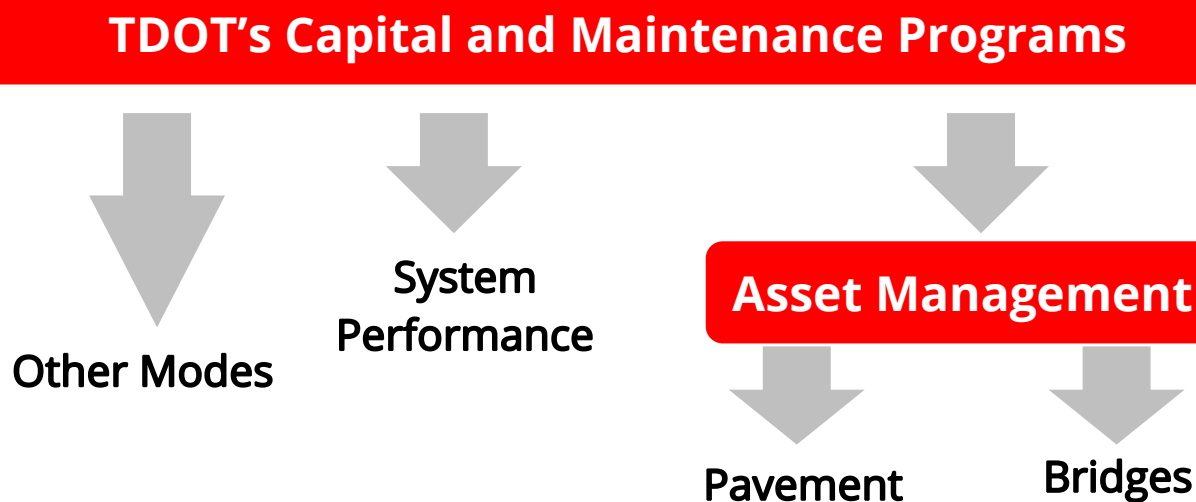


Figure 7-1: Funding breakdown for TDOT's major financial commitments

With an understanding of funding needs, TDOT can identify investment strategies and funding levels that meet system needs and sustain a state of good repair for pavement and bridge assets. The investment strategy drives the allocation of funding between programs. Within each asset management program, life-cycle plans drive the project identification and selection process. This approach ensures funding is adequate to achieve performance goals and projects are selected to provide the best long-term solutions to Tennessee's infrastructure needs.

What Are the MAP-21 and Final Rule Requirements?

Investment strategy is defined in 23 CFR Part 515.5 as a set of strategies that result from evaluating various levels of funding to achieve State DOT targets for asset condition and system performance effectiveness at a minimum practicable cost while managing risks.

23 CFR Part 515.7(e) and 515.9(f) requires each State DOT to develop a risk-based asset management plan that includes processes for developing an investment strategy as listed in the following subsections:

- 515.7(e): A State DOT shall establish a process for developing investment strategies meeting the requirements in § 515.9(f). This process must result in a description of how the investment strategies are influenced, at a minimum, by those items listed in figure 7-2.

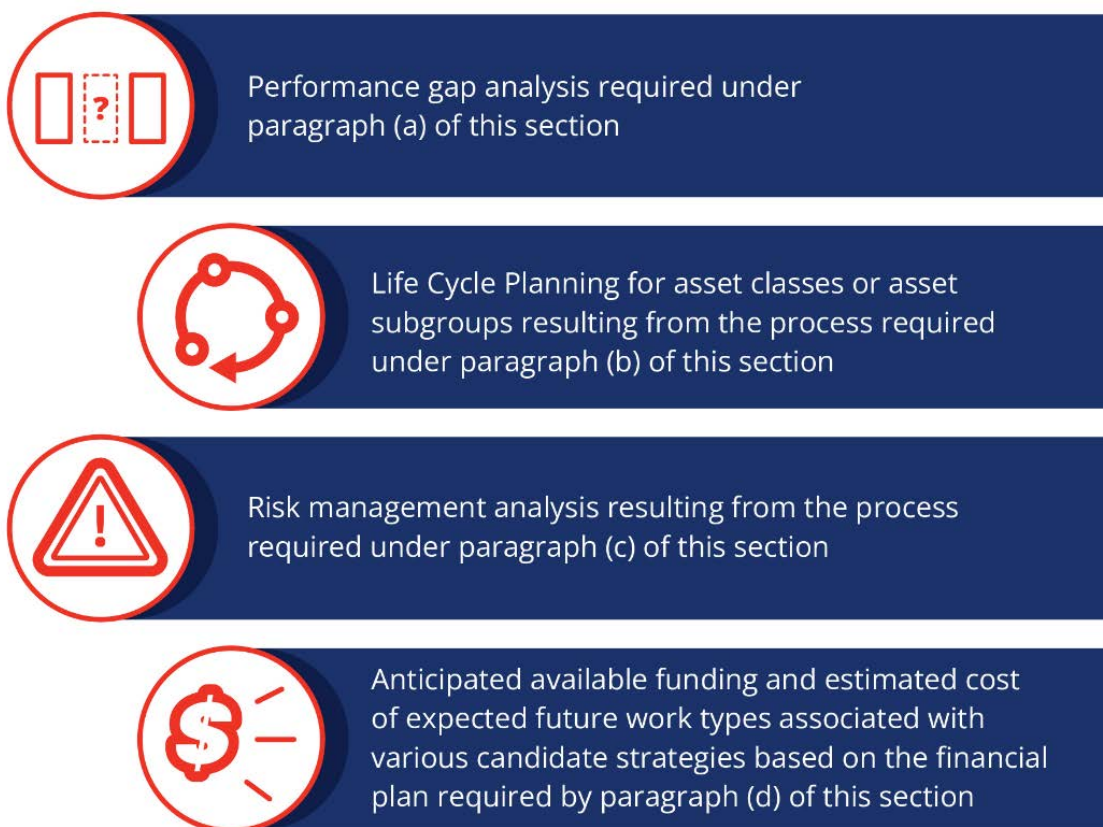


Figure 7-2: Influences on investment strategies

- 515.9(f) An asset management plan shall discuss how the plan's investment strategies collectively would make or support progress toward items listed in figure 7-3.



Achieving and sustaining desired 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 State DOT targets for asset condition and performance of the NHS in accordance with 23 U.S.C. 150 (d)



Achieving the national goals identified in 23 U.S.C. 150 (b)

Figure 7-3: TAMP investment strategies support progress towards these values

What Is TDOT's Process for Developing an Asset Management Investment Strategy?

TDOT's investment strategy is based on the policies established in the 25-Year Long-Range Transportation Policy Plan, which provides guidance and recommendations to help accomplish the agency's vision "to serve the public by providing the best multimodal transportation system in the nation." The plan consists of two main components, a 25-Year Policy Plan and a 10-Year Strategic Investment Plan (SIP). The 25-Year Policy Plan provides recommendations to guide the department towards the vision statement and guiding principles over the next 25 years while the SIP provides a framework for the projection and allocation of the dollars available to the agency for the first 10 years of the plan.

To develop asset management investment strategies, TDOT applies the overall system goals established in the 25-year LTTTP along with analyses described in earlier chapters of this TAMP to determine how best to allocate funding between asset classes and programs.

Life-Cycle Planning

Life-cycle plans developed for pavements and bridges are used to configure the asset management systems. Using similar processes as described in Chapter 4, TDOT staff evaluate different funding scenarios to determine the best balance of work types to achieve and sustain the desired state of good repair with available funding. The process TDOT uses for life-cycle cost analysis and to determine funding allocations for pavements and bridges is discussed in Chapter 4, “Life-Cycle Cost Process.” TDOT uses an analytical approach using the agency’s PMS and BMS. The agency uses well-proven strategies to manage pavement and bridge assets as identified in Chapter 4 and listed below.

Risk Management Analysis

Risks identified in Chapter 5, “Risk Management,” are considered when establishing TDOT’s investment strategies. Additionally, engineering and operations staff contribute to identifying system and location-specific vulnerabilities when identifying, prioritizing, and developing projects. This helps ensure that construction projects lead to a more resilient highway infrastructure.

Anticipated Available Funding

Investment strategies are based on the funding that is expected to be available during the TAMP period. The first 4 years of funding are based on estimates established through the STIP development process. These are updated annually and may vary from the revenue forecasts. The revenue projections described in Chapter 6, “Financial Plan,” are used to establish budgets for the years beyond the 4-year STIP.

Pavement Management Strategies

The Pavement Management program area provides the funds for sustaining the condition of TDOT’s highest valued asset, pavements. These funds are allocated to activities such as hot-mixed asphalt resurfacing, mill and overlay, micro surfacing, surface seals, and crack and joint sealing, using a comprehensive pavement management treatment philosophy. There are three main strategies that comprise TDOT’s pavement management philosophy. These are applied annually to identify investments on the roadway network. The main strategies include:

1. Standard Operating Guidelines (SOG).
2. Remaining Service life (RSL) Lane-Mile Year Analysis.
3. PQI Trend Review.

Standard Operating Guidelines (SOG)

TDOT has developed an SOG manual for the Pavement Management Program, which establishes the vision, objectives, and procedures for managing the agency’s pavements. The SOG provides guidance in the selection of candidates for maintenance, preservation, resurfacing, and rehabilitation projects for both rigid (concrete) and flexible (asphalt) pavement with an emphasis on employing preventive maintenance treatments until repair costs exceed the benefit, (i.e., using LCC concepts).

Remaining Service Life (RSL) Lane-Mile-Year Analysis

RSL is defined as the life of a pavement from the present time (or initial construction date of a new pavement) until it deteriorates to a specific condition which would trigger a significant costly repair treatment. The basic concept behind this metric is a quick evaluation to determine if the agency is programming a suite of projects which, at a minimum, offset the annual loss in pavement life. Each region is required to perform this quick analysis to ensure that the type of projects recommended for the annual program will satisfy budget allocations, treatment options by type and percentage, and the remaining service life concept.

PQI Trend Analysis

The PQI, as defined in Chapter 2 of this plan, is a composite index based primarily on the ride quality of the pavement (Pavement Serviceability Index) and the surface condition of the pavement (Pavement Distress Index) and is measured on a 0-to-5 scale. TDOT tracks the average PQI for each region and Statewide network conditions to monitor the health of the system and to ensure the Department is meeting its performance goals and targets discussed in Chapter 3.

Bridge Management Strategies

The Bridge Management Program has four strategies to determine where to allocate funding. The four programs TDOT is currently using for funding allocation strategies are explained in more detail below and include Review of NBIS Inspection Reports, Smart Project Scoping and Selection, Hold the Line, and Not a Worst-First Program. TDOT's bridge management strategies combine network level goals with evaluation of the individual needs of each bridge. The bridge management program area funds the activities that maintain and keep TDOT's bridges in a state of good repair (see figure 7-4). The work types under this program area include bridge reconstruction, rehabilitation, and preservation. Some example treatments in these work types are repainting steel beam bridges, deck overlays, expansion joint replacement, concrete repairs, steel repairs, and bridge replacements.

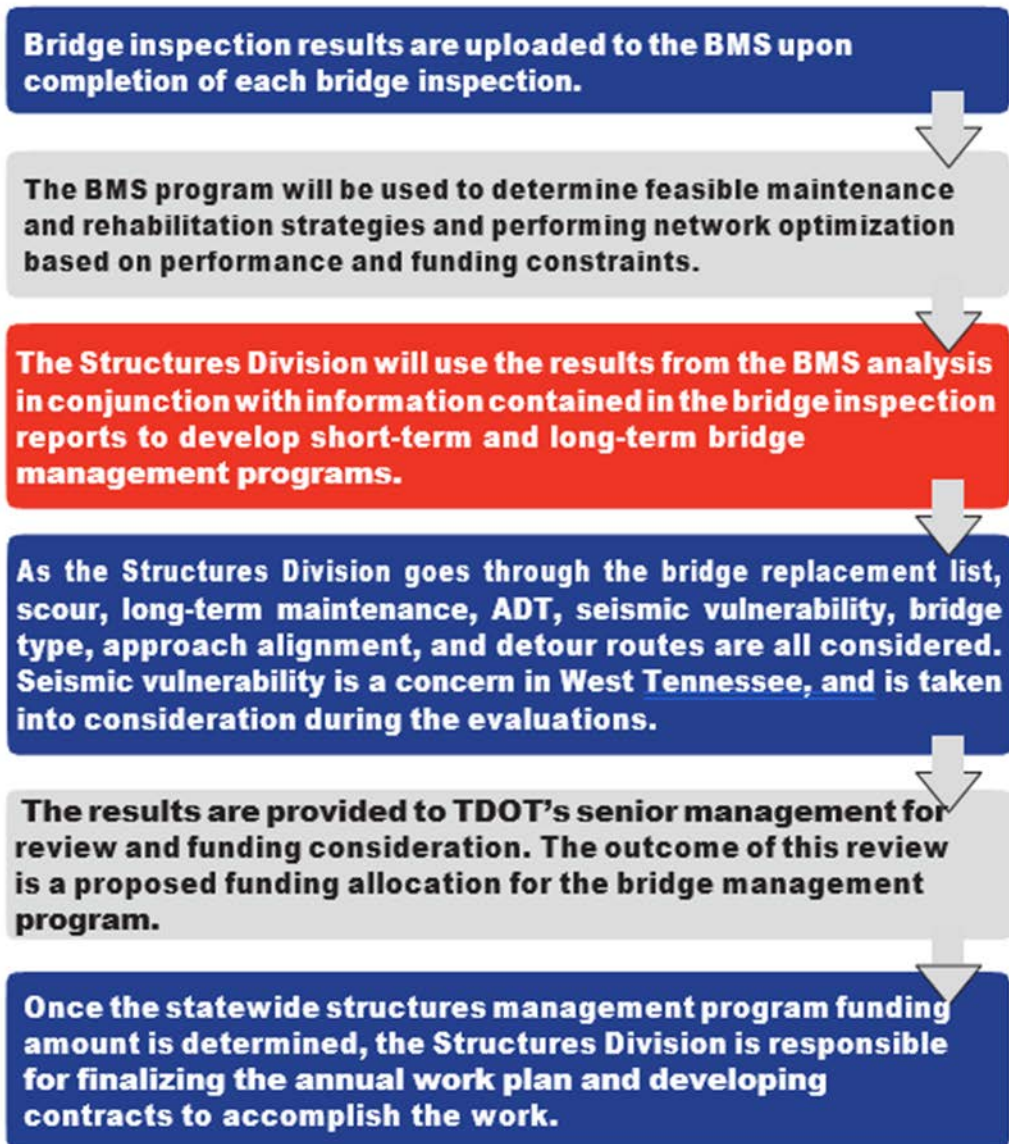
TDOT's Process to Develop Bridge Management Program

Figure 7-4: Bridge management process

Review of NBIS Inspection Reports

The Structures Division conducts bridge inspections on all the bridges in the State (except federally owned bridges) on a 2-year schedule and reviews each bridge inspection report to identify potential candidates for improvement. Identified bridges are included on a repair list and given a priority rating of 1 through 4 (1 is highest priority) for funding consideration. Once funding is determined, bridges with the highest priority are programmed for improvement. The review and creation of the repair list ensures that no bridge is overlooked.

Smart Project Scoping and Selection

If a bridge is a candidate for replacement within the next 10 to 20 years, then the Structures Division reviews the project repair scope and costs. If a bridge is scheduled for repair but is also in a program to be replaced in the future, the repairs are scaled appropriately to match the projected life of the bridge (replacement letting plus 2 years for construction) to the life cycle of the repair(s).

Hold the Line

In recent years, TDOT has placed an emphasis on holding the number of *Poor* bridges down to less than 4 percent on the State-maintained system by programming enough funds to maintain the low percentage target. TDOT has historically directed approximately 75 percent of bridge funding to the NHS network. Condition data reflects that this approach has maintained NHS and non-NHS bridges in a similar condition with comparable condition trends.

Focus on Preservation

Approximately 48 percent of the budget for bridge management is allocated to bridge replacement, while the remaining 52 percent is spent on bridge repairs and preservation.

How Much Will TDOT Invest in Pavements and Bridges over the Next 10 Years?

The TDOT asset management program for pavements and bridges is fully supported by available revenue, as shown in table 7-1. The capital funding beyond the pavement and bridge needs will be used to support other program needs, including system enhancements. As can be seen in table 7-1, the funding available for these other purposes is expected to decline as the annual cost for addressing pavement and bridge needs is expected to grow faster than available revenue. Without changes to the current 10-year program, this will lead to a future funding gap.

Table 7-1: TDOT 10-year estimated program funding (\$ millions)

Year	Pavement Management*	Bridge Management**	Capital Projects	Total TDOT Funds (from table 6-3)
2025	\$383	\$165	\$1,041	\$1,589
2026	\$393	\$181	\$1,423	\$1,997
2027	\$403	\$181	\$1,257	\$1,841
2028	\$415	\$181	\$812	\$1,408
2029	\$427	\$181	\$979	\$1,587
2030	\$440	\$181	\$651	\$1,272
2031	\$452	\$181	\$545	\$1,178
2032	\$466	\$181	\$510	\$1,157
2033	\$479	\$181	\$497	\$1,157
2034	\$494	\$181	\$513	\$1,188
Total	\$4,350	\$1,794	\$8,230	\$14,374
Average	\$435	\$179	\$823	\$1,437

* - Includes funding from TDOT's 10-year capital program and an additional Maintenance budget of \$26 million, which includes \$20 million for pavement preservation.

** - Includes funding from TDOT's 10-year capital program and an additional Maintenance budget of \$4 million.

How Will TDOT Invest Its Funding in Pavements and Bridges?

One of the requirements of the final rule is to estimate the cost of expected future work by the MAP-21 work types, (i.e., by construction, maintenance, preservation, rehabilitation, and reconstruction). It should be noted that TDOT's pavement and bridge treatment types are slightly different from those identified in the MAP-21 final rule. To provide clarity between the two, table 7-2 is provided to show how TDOT's treatment types align with the MAP-21 work types.

Table 7-2: Crosswalk between TDOT treatment types and FHWA work types

FHWA Work Types	TDOT Pavement Treatments	TDOT Bridge Treatments
Maintenance	Maintenance Activities, including: - Shallow patching skin patching - Partial-depth patching - Repair concrete corner breaks - Concrete joint repair - Other thin patching	Preventive Activities, including: - Filling potholes in deck - Minor structure repair - Major structure repair - Cleaning structure
Preservation	Preservation Activities, including: - Thin asphalt overlay (1.5 in. or less) - Microsurfacing - Chip/scrub seals - Cape seals - Crack sealing - Concrete joint sealing - Mill and fill asphalt overlays (1.5 in. or less)	Preservation Activities, including: - Repainting structural steel - Sweeping - Deck repairs - Deck waterproofing - Deck epoxy overlay - Polymer modified concrete deck overlay - Cleaning and resealing expansion joints
Rehabilitation	Rehabilitation Activities, including: - Full-depth patching - Repair/replacing concrete slabs - In-place recycling with overlay	Rehabilitation Activities, including: - Replacement of expansion joints - Concrete spall repairs - Structural steel repairs - Scour prevention - Bearing replacement
Reconstruction	Reconstruction Activities, including: - Rubblization and overlay of concrete pavement - Full-depth replacement of asphalt pavement	Reconstruction Activities, including: - Bridge replacement - Bridge widening
Construction	Construction Activities, including: - Highway widening - Highway realignments - New highway construction	Construction Activities, including: New bridge construction

In table 7-3, TDOT's estimated budget for pavements is shown by work type over the next 10 years. The fund type that has a significant impact on the health of TDOT pavements is the annual resurfacing program allocation. While TDOT does not currently budget resurfacing funds by specific work type, treatment selection is driven by recommendations from the PMS that follow the life-cycle strategy described in Chapter 4.

TDOT prioritizes management of the existing system over enhancement and expansion. Therefore, the expected expenditures on initial construction are highly dependent on the needs of pavements, bridges, and other assets. The programming of system enhancement projects is beyond the scope of asset management investment strategies and is therefore not addressed in this document. TDOT will work through existing planning and Federal aid authorization processes to balance the full capital program with available revenue, while delivering the commitments to pavement and bridge state of good repair summarized in tables 7-3 and 7-4.

Table 7-3: TDOT 10-year estimated budget for pavements by work type (dollars in millions)

Year	Maintenance	Preservation	Rehabilitation	Reconstruction	Construction	Total
2025	\$6	\$336	\$41	N/A	N/A	\$383
2026	\$6	\$345	\$42	N/A	N/A	\$393
2027	\$6	\$354	\$43	N/A	N/A	\$403
2028	\$6	\$365	\$44	N/A	N/A	\$415
2029	\$6	\$375	\$46	N/A	N/A	\$427
2030	\$6	\$387	\$47	N/A	N/A	\$440
2031	\$6	\$398	\$48	N/A	N/A	\$452
2032	\$6	\$410	\$50	N/A	N/A	\$466
2033	\$6	\$422	\$51	N/A	N/A	\$479
2034	\$6	\$435	\$53	N/A	N/A	\$494
Total	\$60	\$3,827	\$465	N/A	N/A	\$4,352
Average	\$6	\$383	\$46	N/A	N/A	\$435

Table 7-4 presents TDOT's bridge management budget projections over the next 10 years, broken down by the various work types. TDOT is not currently budgeting by system for bridges. Instead, each bridge is treated equally regardless of system and the priority for repairs is based on the bridge condition ratings. The treatment selection process leads to a balance of project types based on the preferred life cycle plan established in Chapter 4.

Table 7-4: TDOT 10-year estimated bridge management budget by work type (dollars in millions)

Year	Maintenance	Preservation	Rehabilitation	Reconstruction	Construction	Total
2025	\$4	\$13	\$46	\$102	N/A	\$165
2026	\$4	\$24	\$68	\$85	N/A	\$181
2027	\$4	\$24	\$68	\$85	N/A	\$181
2028	\$4	\$24	\$68	\$85	N/A	\$181
2029	\$4	\$24	\$68	\$85	N/A	\$181
2030	\$4	\$24	\$68	\$85	N/A	\$181
2031	\$4	\$24	\$68	\$85	N/A	\$181
2032	\$4	\$24	\$68	\$85	N/A	\$181
2033	\$4	\$24	\$68	\$85	N/A	\$181
2034	\$4	\$24	\$68	\$85	N/A	\$181
Total	\$40	\$229	\$658	\$867	N/A	\$1,794
Average	\$4	\$23	\$66	\$86	N/A	\$179

The expected expenditures shown in table 7-3 reflect an expected annual increase of three percent for pavement preservation, while the values shown in table 7-4 do not include an expected annual increase for bridges. This increase is included to account for expected cost increases rather than program enhancement. The rate of increase for pavement is greater than what is assumed for revenue, as described in Chapter 6, which is 0.5 percent for State revenue and 0 percent for Federal revenue. As a result, the funding available for major capital improvements is expected to decline by this same amount unless additional revenue is identified. The bridge funding of \$181 million includes funding for the bridge inspection program which currently averages approximately \$8 million annually. This cost is expected to increase to \$12–\$14 million as TDOT plans to outsource this work.

Will TDOT's Investment Strategies Achieve the Desired State of Good Repair for Pavement and Bridges?

Figures 7-5 through 7-10 provide a 10-year projection of the condition of TDOT's pavements and bridges. Based on this data, pavements are expected to continue to meet SOGR targets. However, bridges are at risk of not meeting targets if conditions deteriorate as these forecasts indicate. These forecasts deviate significantly from TDOT's historical conditions. TDOT will continue to monitor conditions and may adjust allocations between SOGR and system enhancement projects as needed to maintain conditions.

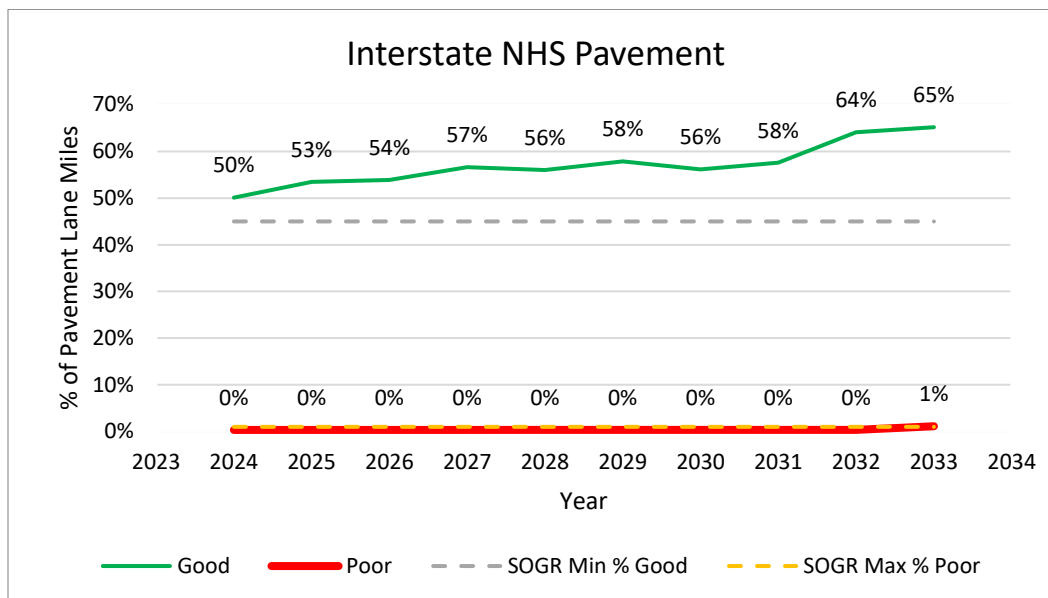


Figure 7-5: TDOT Interstate NHS pavement condition – SOGR

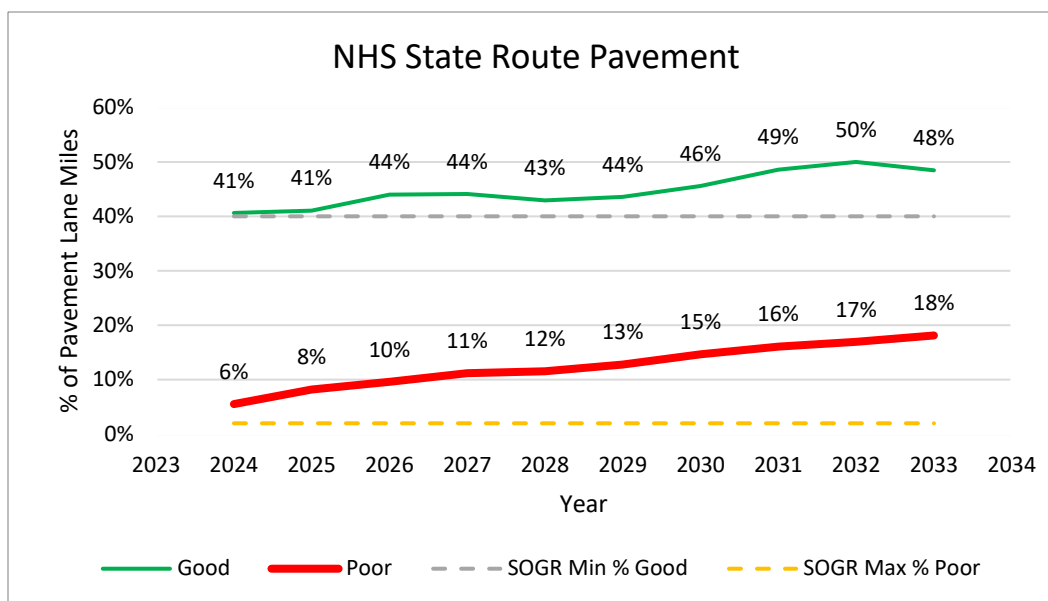


Figure 7-6: TDOT NHS State routes pavement condition – SOGR

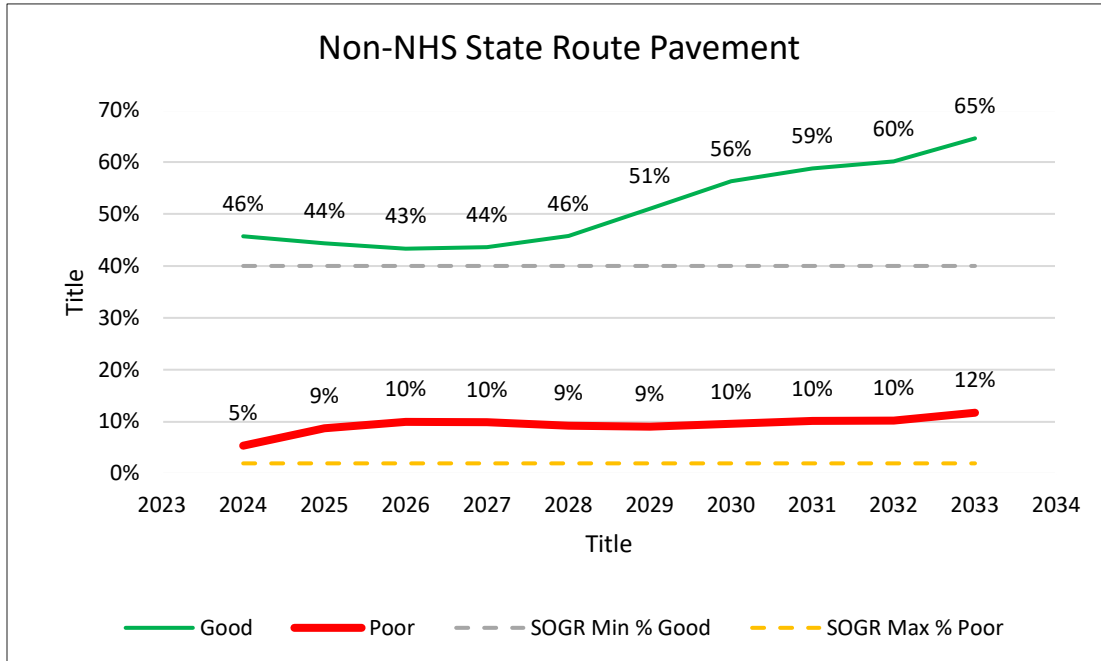


Figure 7-7: TDOT non-NHS State routes pavement condition – SOGR

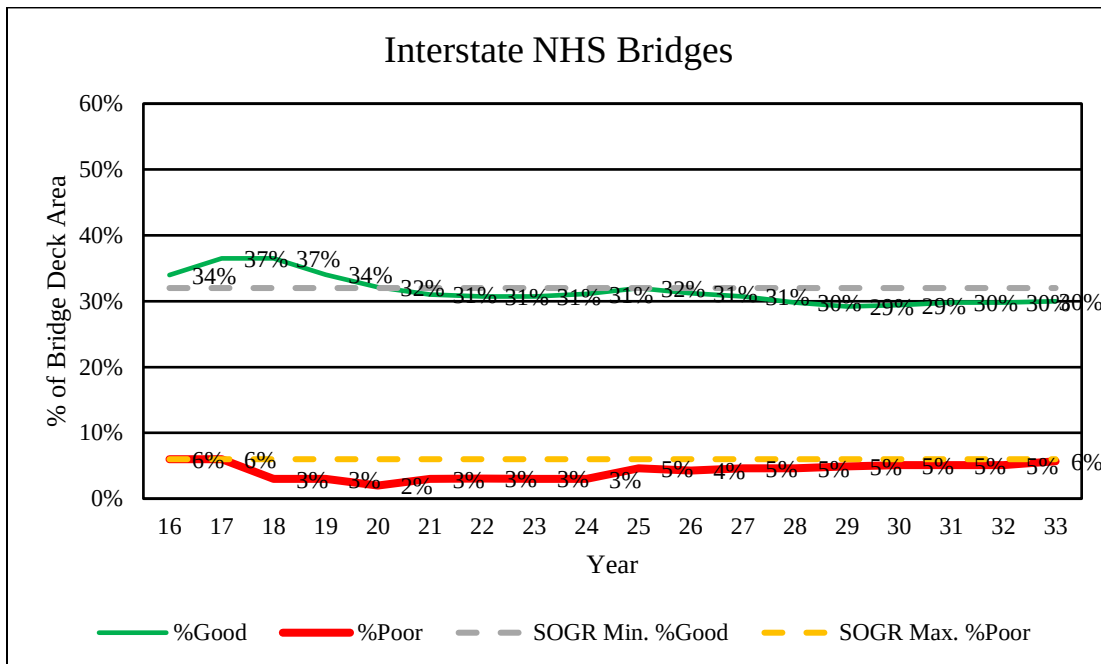


Figure 7-8: TDOT Interstate bridge condition – SOGR

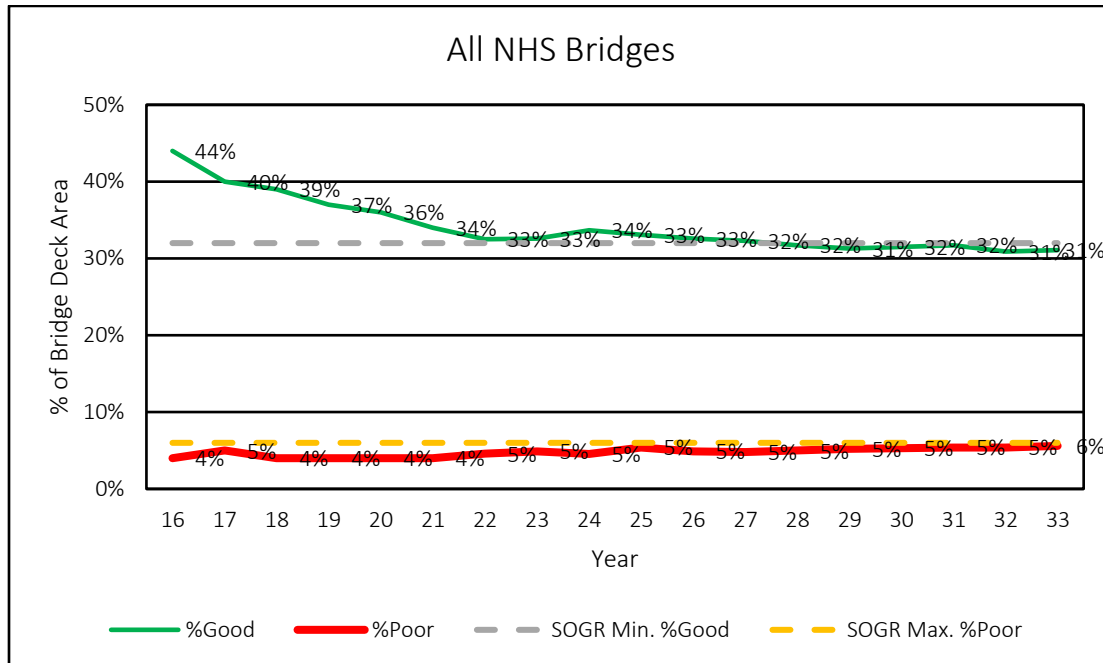


Figure 7-9: All NHS routes bridge condition – SOGR

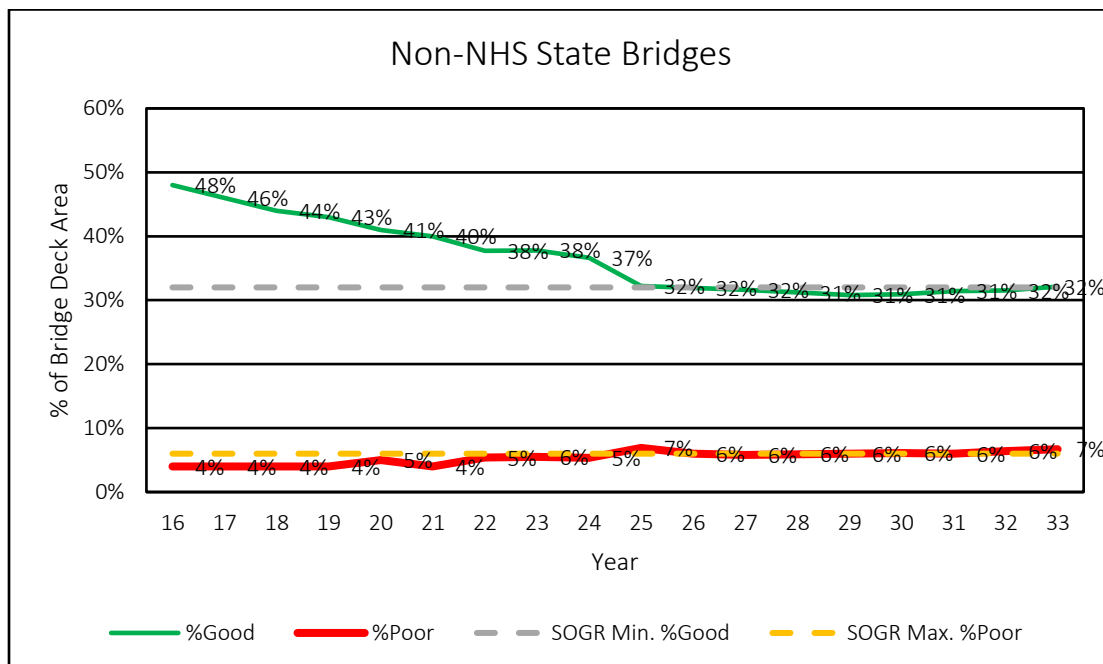


Figure 7-10: Non-NHS State routes bridge condition – SOGR

The pavement and bridge conditions achieved, as depicted in figures 7-5 through 7-10, are based on TDOT's "fix it first" philosophy using life-cycle cost concepts and practices described in Chapter 4. Current programming is expected to maintain bridge conditions above the threshold of the desired state of good repair. However, pavement conditions are expected to decline.

The declining pavement conditions are primarily due to the impact of escalating paving project costs. As explained in Chapter 4, paving projects have been increasing in cost at an annual rate of approximately 7 percent. With budgets increasing at only 3 percent annually, this is leading to fewer miles of paving each year. Additionally, TDOT has a significant number of lane miles that, without treatment, will transition from *Fair* to *Poor* condition in the next 5 years. These factors combine to put TDOT's pavement system at risk of a rapid decline in condition over the next 10 years.

TDOT will continue to monitor conditions and adjust investment priorities as needed to protect the State's investment in highway infrastructure. There is a chance, and historic precedence, that paving costs will stabilize after the past few years of significant increases. Tennessee is a "pay-as-you-go" State and not handicapped by heavy bond repayments; and thus, TDOT has the flexibility to adjust budgets and allocations to meet the vision and guiding principles of the agency. If costs continue to rise, TDOT will adjust investment priorities accordingly to support infrastructure conditions that support delivery of the agency's mission and facilitate the safe and effective transport of goods and people within and across the State.

CHAPTER 8

TAMP PROCESS IMPROVEMENT

What TAMP Components Have Been Improved Since 2022?

Each TAMP development is an opportunity to evaluate how the process works within the agency and with the stakeholders. Improvements have taken place since the previous TAMP was produced in 2022, and additional enhancements are planned during the next cycle. Enhancements that have been achieved since 2022 include the following:

- TDOT has implemented a new project programming prioritization process based on a data-driven model that considers performance, delivery, and cost. A new project selection and prioritization matrix was developed that now includes weighting criteria for system preservation along with other goal areas such as safety and congestion ensuring asset management needs are routinely considered. More details are available in TDOT's 10-Year Project Plan.¹¹
- The Structures Division has grown more proficient with the BrM Bridge Management System and has subsequently improved reliability in forecasting the alternative funding scenarios to be able to use it as the primary tool to determine the best approach for life-cycle planning for structures. The forecasted condition data provided in this document reflects historic deterioration rates that the Tennessee network experiences with the current balance of preservation, rehabilitation, reconstruction, and maintenance methods, where previously straight-line estimations had been considered. The process has also been streamlined to use the results alongside traditional budgeting processes to estimate budget needs over the projected 10-year bridge management program horizon.

How Will TDOT Enhance the TAMP Process?

As TDOT has developed the 2025 TAMP, there have been various aspects of the process that the Department has identified to simplify the development, analysis, implementation, and updates to the asset management plan. The TAMP team has discovered gaps and potential enhancements to their current processes, which would improve the Department's ability to meet the current Federal requirements and foster an asset management culture within the agency. For the Department to expand on the foundational principles and concepts created through the TAMP development process, the following key process improvements have been identified for consideration in future updates to the TAMP.

¹¹ Tennessee Department of Transportation (TDOT). 2023. *Tennessee Department of Transportation 10-Year Project Plan*, https://www.capitol.tn.gov/Archives/Senate/113GA/committees/Transportation/2024/2024103%20TDOT%2010-Year%20Project%20Plan_Final.pdf

Including Ancillary Assets

TDOT continues its initiative for developing supplemental documents covering several families of ancillary assets operated by stakeholder units within the agency. The process is guided by the FHWA *Handbook for Including Ancillary Assets in Transportation Asset Management Programs* (FHWA-H IF-19-068). These assets include:

- ITS components.
- Culverts and small structures.
- Geohazards (rockfall & landslides).
- Signs.

Supplemental documents may also be developed for additional asset families in the future based on the maturity and availability of the data required to manage the assets. These may include underdrains, guardrails, sidewalks, curb ramps, retaining walls, and overhead sign structures.

Pavement Model Update

TDOT is currently implementing a process for identifying project candidates and selecting treatments, which begins with PMS output. It is anticipated that these process improvements will produce more reliable treatment selection decisions, improve the effectiveness of pavement investments, and increase the accuracy of PMS predictions.

Local NHS Pavement Modeling

A weakness was identified during the life-cycle planning analysis for pavements because no construction history for locally owned NHS routes is included in the TDOT PMS. An opportunity exists as local agencies in metropolitan areas (e.g., Nashville, Knoxville, and Memphis) are investing in pavement management systems to better manage pavement assets under their jurisdiction. TDOT will approach agencies owning local NHS segments and coordinate with them to include locally owned NHS system components in the next analysis. The data translation may not be congruent with the TDOT PQI system; however, construction history and pavement condition information can assist in developing condition predictions.

Consistency Determination Integration

Process improvements are continuing in how TDOT gathers information for the consistency determination. This requires filtering the data by system location, asset type, and type of work in accordance with the five Federal types of work. The agency has adapted programming practices to identify the system where the work will take place, and the specific type of work that will be done during the allotment process. Additionally, the asset type for the project and allotment line is being identified. Changing this process takes multiple iterations of communication and training involving both the TAMP Core Team and the TDOT Programming Office. It is hoped that the process to develop the consistency



determination will continue to be streamlined and result in reliable information produced in a timely manner. Currently, significant quality assurance efforts are required within the 1-month period between the end of the data collection cycle on May 31 and the consistency determination being submitted to the FHWA Tennessee Division Office on June 30.

TDOT intends to separate investments for capital projects from the resurfacing and bridge management programs. Capital projects require significant funding but have an insignificant impact on improving the overall network asset condition levels compared to the resurfacing and bridge management programs. This strategy will also improve consistency between the way unit costs are considered in the bridge management system and the bridge program funding.

Bridge Management System Refinements

Significant improvements have occurred during the 2025 TAMP development in BMS implementation. The staff assigned to administer the BrM BMS have developed policies and decision trees within the system to emulate the business processes that TDOT currently uses. To further improve reliability and confidence in the BMS results, staff will continue to refine the data collection practices, policy considerations, and decision trees within the model to reflect system operations in Tennessee.

How Often Will the TAMP Be Updated?

TDOT's first TAMP was certified by the FHWA in 2018 and the second in 2022. DOTs are required to update the TAMP at least once every 4 years, however, the TAMP must be updated more frequently if there are changes to the processes described in the certified TAMP. Several significant changes have triggered this off-cycle update to the TDOT TAMP.

In 2023, Governor Lee and the General Assembly passed the Transportation Modernization Act (TMA). The law provides an additional \$3 billion in General Fund allocations for investment in Tennessee's transportation infrastructure. The TMA is a bold step toward filling the gap between transportation needs and inadequate Federal and State funding.

Additionally, TDOT is undergoing significant organizational changes to create a team-based approach and facilitate growth, communication, and collaboration both internally and externally. This is being accomplished through the adoption of an Integrated Program Delivery (IPD) process that integrates project teams, systems, and business structures to leverage resources including insights and innovation, to improve efficiency and maximize outcomes. This 6-year effort started in 2020 and will be fully implemented in 2026. The reorganization effort is being guided by the EPIC initiative, which, by offering competitive, market-rate wages and benefits, creates a workplace where everyone has a feeling of accomplishment through knowing how they contribute to TDOT's success.



Based on the recent and ongoing changes to funding, organization, and the project delivery process, TDOT has initiated this update to its asset management plan to ensure the best alignment with its evolving asset management investments and practices.

TDOT will continue to review the TAMP on an annual basis. Part of the annual review will include the determination of additional assets to be considered for inclusion in the plan. The processes used to prepare the TAMP, such as life-cycle planning, risk management, and investment strategy development, will be updated based on current methodologies, Federal requirements, and available data.