TRANSPORTATION ASSET MANAGEMENT PLAN

December 2022

OHIO DEPARTMENT OF TRANSPORTATION

Ohio's risk-based asset management plan for the National Highway System to improve or preserve the conditions of the assets and performance of the system pursuant to 23 U.S.C 119(e)(1)

OHIO DEPARTMENT OF TRANSPORTATION
Mike DeWine, *Governor*
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July 30th, 2022

Laurie Leffler
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Federal Highway Administration - Ohio Division
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Ms. Leffler,

The Ohio Department of Transportation (ODOT) has made a strong commitment to Transportation Asset Management (TAM). This Transportation Asset Management Plan (TAMP) represents the highest form of "Excellence in Government" and applies to all Divisions and Districts within ODOT. In addition to meeting our federal requirement for state transportation departments, this document reaffirms our commitment to using technology, collaboration, and aggressive preservation activities to preserve our system conditions as aligned with ODOT's Mission to improve safety, take care of what we have, make our system work better and to enhance capacity.

The TAMP reflects our ongoing programs wherein ODOT aligns how our people, processes and technologies collaborate to analyze road, bridge, and culvert conditions in order to make data driven decisions for investment priorities, as good stewards of taxpayer dollars.

The success of our TAMP is due to the partnerships established between ODOT's Planning, Engineering, and Operations Divisions, ODOT's Districts, contractors, Ohio's businesses, and citizens. By working together, we support millions of jobs which rely on Ohio's transportation system.

This document is being submitted to the FHWA under the authority of the Director of the Ohio Department of Transportation. The commitment of our people and resources will ensure that Ohio continues to provide the highest level of safety and reliability for the traveling public.

For more information on our commitment to TAM, I invite you to visit our website at:
transportation.ohio.gov/programs/asset-management/

Respectfully,

Jack Marchbanks, Director

Excellence in Government
ODOT is an Equal Opportunity Employer and Provider of Services

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1 INTRODUCTION

The United States Congress established regulations that require each state to develop and implement a Transportation Asset Management Plan (TAMP) by April 30, 2018, for all roadways and bridges on the National Highway System (NHS), as well as any discretionary assets each state elected to include. The TAMP documents how each state uses Transportation Asset Management, which is defined by the Federal Highway Administration (FHWA) as:

> A strategic and systematic process of operating, maintaining, and improving physical assets, with a focus on engineering and economic analysis based upon quality information, to identify a structured sequence of maintenance, preservation, repair, rehabilitation, and replacement actions that will achieve and sustain a desired State of Good Repair (SOGR) over the life cycle of the assets at minimum practicable cost[1].

The TAMP illustrates how a state is achieving the SOGR by describing the current system conditions, performance targets, and performance gaps, creating asset Life cycle plans, evaluating revenue forecasts, and identifying improvement opportunities. Each state is required to submit an updated TAMP every four years for recertification.

1.1 Ohio's Transportation System

ODOT maintains one of the largest transportation systems within the United States, containing:

- Over 43,000 lanes of roads, including the fifth-largest interstate highway network.
- Over 14,000[2] bridges, which is the second-largest inventory in the nation.
- Over 88,000 conduits (including culverts and storm drains).

The NHS[3] is a strategic network of highways that serves a vital function in moving people and goods throughout Ohio and beyond.

1.2 Ohio's Economy

Ohio's transportation system is one of the state's greatest assets. The system is composed of nearly 6,800 miles of interstate highways, 104 airports, the third-largest rail network in the nation, 127 water ports and terminals, and 13 intermodal freight facilities. Proximity to major population centers and a well-maintained transportation system make Ohio a strong business attractor. The ability to transport goods and people safely and efficiently is critical to the state's economic competitiveness.

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[1] https://www.tamguide.com/wp-content/uploads/2020/02/TAM_GuideIII_ch01-20200227.pdf

[2] 14,000 bridges = These are only the Ohio-defined bridges, 10-ft or greater, on or over a state route. This is not close to the "second largest inventory in the nation". There are 45,000 state-defined bridges in Ohio and 27,000 federally defined bridges in Ohio. This second number, 27,000, is the "second largest…" federally defined "…inventory in the nation". ODOT only manages 10,000 of these. Locals and turnpike manage the rest.

[3] The National Highway System is designated by FHWA to include Interstates, principal arterials, the strategic highway network, major strategic highway network connectors, and intermodal connectors. This designation is independent of ODOT's designation for Priority, General, Urban, or Local.

Service-based industries rely on high-quality transportation systems to provide access to employees, patrons, and distributors. Transportation infrastructure connects people to goods, services, and employment opportunities. Infrastructure investments that reduce travel time, and thus the overall cost of commuting, can have a significant impact on economic mobility.

Freight-intensive operations including advanced manufacturing, logistics and distribution, agriculture, and automotive manufacturing depend on access to the global market to optimize their supply chain and delivery of the product to market.

Whether traveling to work, school, health care, retail stores, or delivery of goods to market, the transportation system is essential to all Ohioans and Ohio's economic prosperity.

Figure 1 - 60 percent of the population of North America resides within a one-day drive of Ohio

1.3 Management of Ohio's Transportation System

Ohio Department of Transportation (ODOT) collaborates with numerous private and public partners to ensure the long-term vitality of the NHS assets and broader transportation system. This section summarizes the public institutions significantly involved in the management and operations of Ohio's transportation system. Please note this does not include the numerous public research institutions that also serve a critical role.

1.3.1 Ohio Department of Transportation

ODOT operates 12 regional Districts that work with Central Office to coordinate transportation needs. Each District oversees ODOT operations for assigned county areas where asset maintenance activities and local coordination routinely occur.

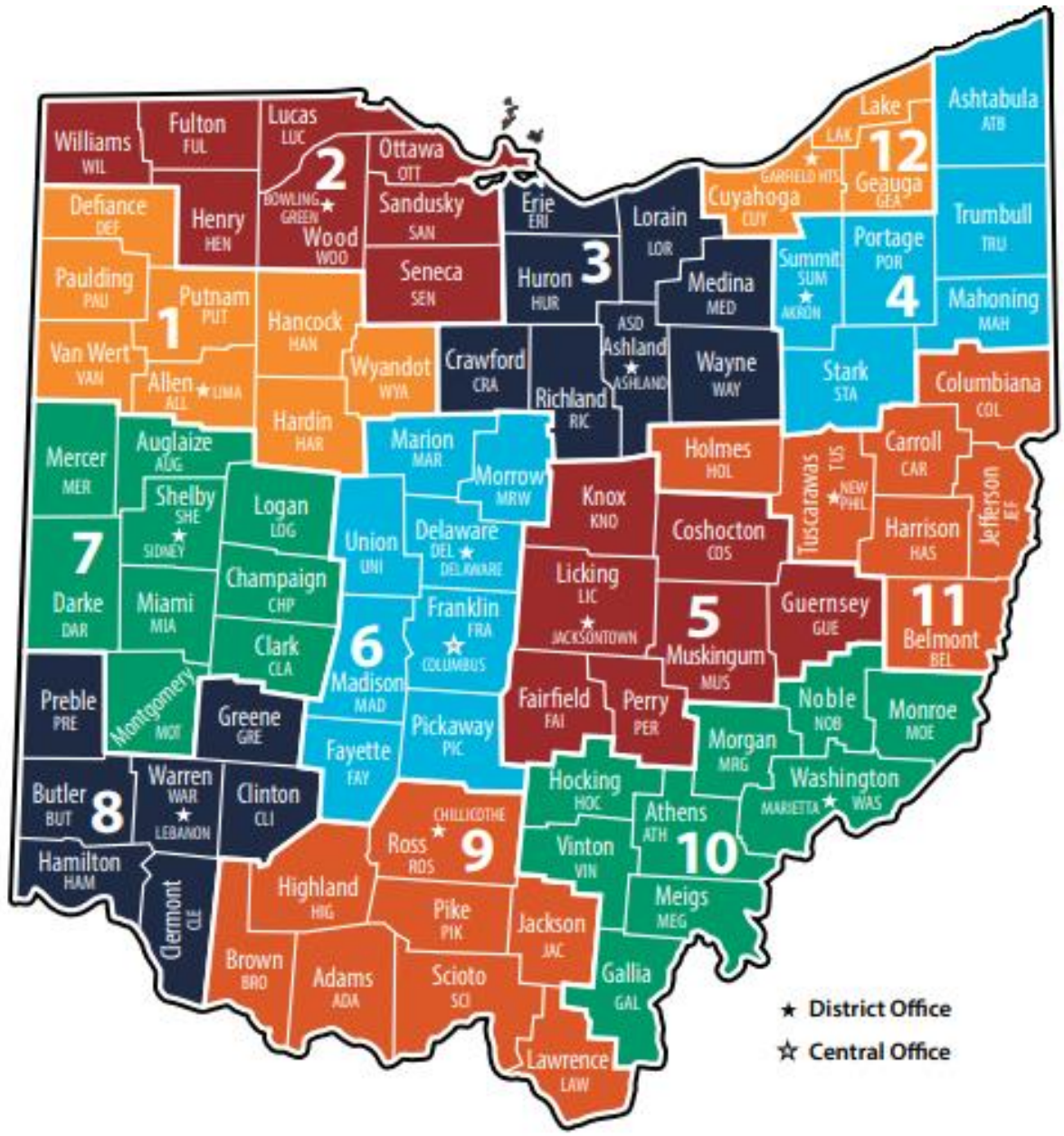


Figure 2 - Ohio District Map

1.3.2 Metropolitan Planning Organizations

There are seventeen federally mandated and funded Metropolitan Planning Organizations (MPO) operating within Ohio, representing urbanized areas with a population greater than 50,000. MPO serves a critical role in the transportation planning process, ensuring local needs are addressed and coordinated with the ODOT.

Metropolitan Planning Organizations	
Akron: ***Akron Metropolitan Area Transportation Study (AMATS)*** (330) 375-2436 | www.amatsplanning.org	Canton: ***Stark County Area Transportation Study (SCATS)*** (330) 451-7389 | www.starkcountyohio.gov
Cincinnati: ***Ohio-Kentucky-Indiana Reg. Council of Govts. (OKI)*** (513) 621-6300 | www.oki.org	Cleveland: ***Northeast Ohio Areawide Coordinating Agency (NOACA)*** (216) 241-2414 | www.noaca.org
Columbus: ***Mid-Ohio Regional Planning Commission (MORPC)*** (614) 228-2663 | www.morpc.org	Dayton: ***Miami Valley Regional Planning Commission (MVRPC)*** (937) 223-6323 | www.mvrpc.org
Huntington: ***KYOVA Interstate Planning Commission*** (304) 523-7434 | www.kyovaipc.org	Lima: ***Lima-Allen County Regional Planning Commission (LACRPC)*** (419) 228-1836 | www.lacrpc.com
Mansfield: ***Richland County Regional Planning Comm. (RCRPC)*** (419) 774-5684 | www.rcrpc.org	Newark: ***Licking County Planning Commission (LCATS)*** (740) 670-5190 | www.lcats.org
Parkersburg: ***Wood-Washington-Wirt Interstate Planning Comm. (WWWIPC)*** (304) 422-4993 | www.movrc.org/www-interstate-planning-commission	Sandusky: ***Erie Regional Planning Commission (ERPC)*** (419) 627-7792 | www.eriecounty.oh.gov/ErieRegionalPlanningCommission.aspx
Springfield: ***Clark County-Springfield Transportation Coordinating Committee (CCSTCC)*** (937) 521-2128 | www.clarktcc.com	Steubenville: ***Brooke-Hancock-Jefferson Metropolitan Planning Commission (BHJ)*** (740) 282-3685 | www.bhjmpc.org
Toledo: ***Toledo Metropolitan Area Council of Governments (TMACOG)*** (419) 241-9155 | www.tmacog.org	Wheeling: ***Bel-O-Mar Regional Council and Interstate Planning Commission (Bel-O-Mar)*** (304) 242-1800 | www.belomar.org
Youngstown: ***Eastgate Regional Council of Governments (Eastgate)*** (330) 779-3800 | www.eastgatecog.org	

Table 1 - MPO Detail

1.3.3 Regional Transportation Planning Organizations

Six Regional Transportation Planning Organizations (RTPO) operate within Ohio, representing areas with a population of fewer than 50,000, with a focus on rural transportation needs. RTPOs assist with transportation planning, and assessments, and support the statewide transportation planning processes in non-metropolitan regions.

Regional Transportation Planning Organizations	
Buckeye Hills – Hocking Valley Regional Development District (740) 374-9436 | www.buckeyehills.org	Logan Union Champaign (LUC) Regional Planning Commission (937) 666-3431 | www.lucplanning.com
Maumee Valley Planning Organization (MVPO) (419) 784-3882 | www.mvpo.org	Ohio Mid-Eastern Governments Association (OMEGA) (740) 439-4471 | www.omegadistrict.org
Central Ohio Rural Planning Organization (CORPO) (614) 233-4160 | www.morpc.org/committees/corpo/	Ohio Valley Regional Development Commission (OVRDC) (740) 947-2853 | www.ovrdc.org

Table 2 - RTPO Detail

1.3.4 MPO/RTPO Map

The below graphic illustrates the RTPOs and MPOs and their locations within the state.

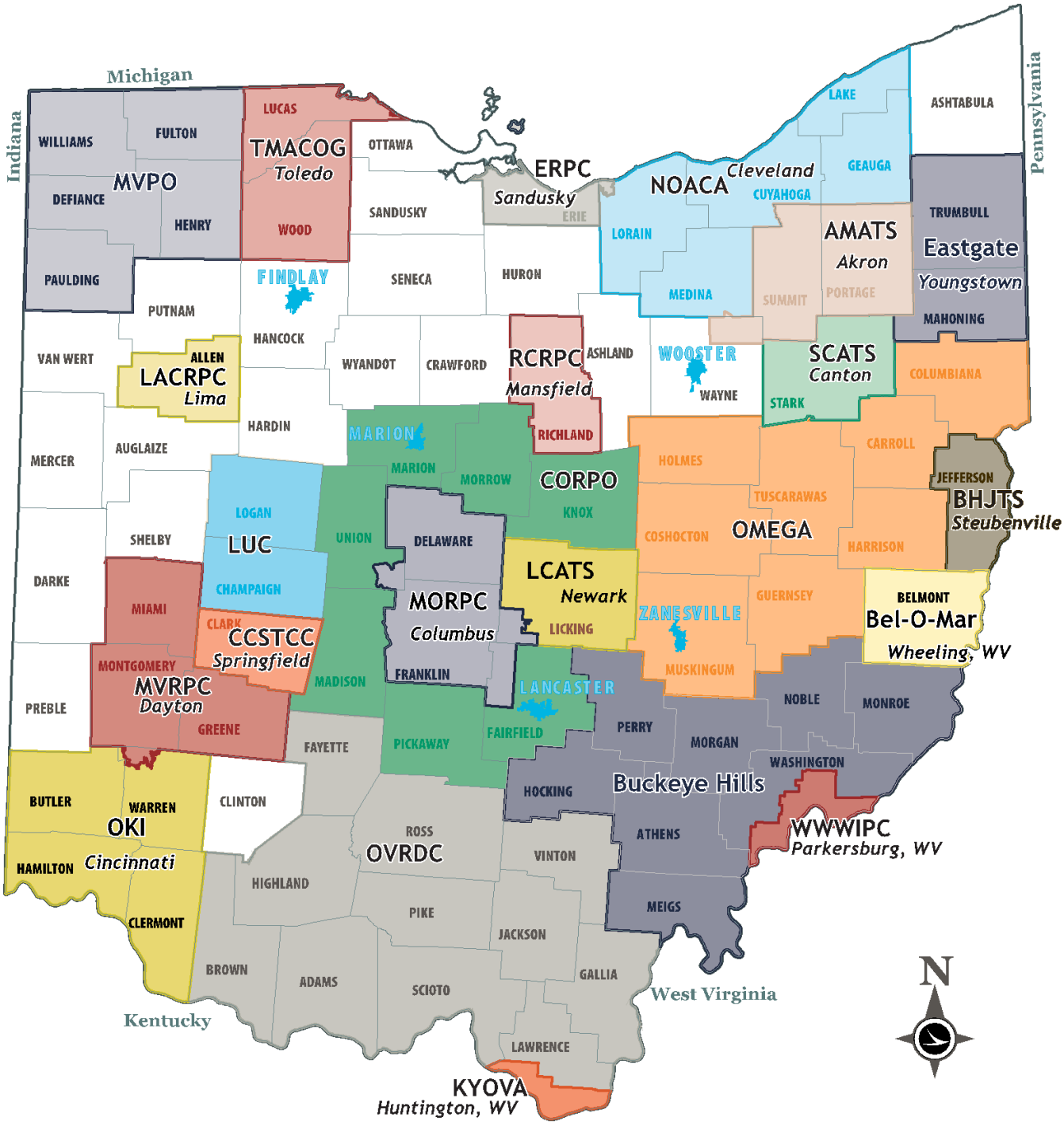


Figure 3 - RTPOs and MPOs within Ohio

1.3.5 County Governments

Ohio includes 88 county jurisdictions with a County Engineer as required by Ohio Revised Code to report Certified Mileage to ODOT and support the National Bridge Inventory (NBI) regulations.

1.3.6 Ohio Turnpike

The Ohio Turnpike Commission (OTC) is established by Ohio Revised Code (ORC 5537). It authorizes the OTC to operate and manage the 241-mile limited access toll road across northern Ohio along interstates 80 and 76. The entire length of the Ohio Turnpike is designated as NHS.

Figure 4 - Ohio Turnpike

1.4 Asset Management at ODOT

Asset Management at ODOT is guided by several initiatives and involves nearly every employee at the agency. The overall ODOT TAM program is guided by the following Federal programs and department criteria. While each program provides a specific focus related to TAM objectives, the targets and implementation of each often overlap.

Figure 3 - ODOT Asset Management

1.4.1 Transportation Asset Management Plan

The TAMP is a key requirement of federal regulation 23 CFR 515, requiring states to create and implement a risk-based asset management strategy for pavements and bridges on the NHS. A TAMP includes information about the current system conditions, and condition targets, quantifies condition gaps, evaluates risk and reliability concerns, outlines asset life cycle planning strategies, describes funding and spending projections, and identifies improvement opportunities for the broader management of transportation assets and supporting processes.

1.4.2 Transportation Performance Management

Transportation Performance Management (TPM) is a federal program established under federal regulation 23 CFR 490. TPM outlines six elements for DOTs, including:

- **National Goals**: Congressionally established goals or program purpose to focus the Federal-aid highway program into specific areas of performance.
- **Measures**: FHWA-established measures to assess performance/condition in carrying out performance-based Federal-aid highway programs.
- **Targets**: Targets established by Federal-aid highway funding recipients for the measures to document future performance expectations.
- **Plans**: Development of strategic and/or tactical plans by Federal funding recipients to identify strategies and investments that address performance needs.
- **Reports**: Development of reports by Federal funding recipients that document progress toward target achievement, including the effectiveness of Federal-aid highway investments.
- **Accountability and Transparency**: FHWA-developed requirements for Federal funding recipients to use to achieve or make significant progress toward targets.

TPM AND TAMP RELATIONSHIP

TAMPs are required to ensure the performance measures established through TPM are achieved by aligning overall TAMP strategies to sustain a desired SOGR.

This overall SOGR is facilitated through the TAMP items including investment strategies, targets, data quality, analysis tools, and life cycle planning methodologies.

ODOT formally manages TPM Goals through the long-range plan, Access Ohio. The current plan, AO45, guides Ohio's transportation policies and investment strategies for the next 20 years and has been developed based on input from the public and subject matter experts. AO45 is a critical component of ODOT's TAM outreach and engagement process, through a Steering Committee comprised of the following organizations:

AO45 Steering Committee Members	
Akron-Canton Airport	Ohio Contractor's Association
American Council of Engineering Companies	Ohio County Engineers Association
Benchmark River and Rail Terminals, LLC	Ohio Mid-Eastern Governments Association
Brooke Hancock Jefferson Metropolitan	Ohio Municipal League
Planning Commission	Ohio Public Transit Association
Buckeye Hills Regional Council	Ohio Public Works Commission
Clark County-Springfield Transportation	Ohio Rail Development Commission
Coordinating Committee	Ohio Railroad Association
Federal Highway Administration	Ohio Township Association

AO45 Steering Committee Members	
Greater Ohio Policy Center	Ohio Trucking Association
Maumee Valley Planning Organization	Ohio Turnpike and Infrastructure Commission
McDaniel's Construction	Ohio Kentucky Indiana Regional
Miami Valley Regional Planning Commission	Council of Governments
Mid-Ohio Regional Planning Commission	Policy Matters Ohio
Northeast Ohio Areawide Coordinating Agency	Sierra Club of Ohio
Ohio Association of Regional Councils	Toledo-Lucas County Port Authority
Ohio Aviation Association	Transportation Research Center
Ohio Chamber of Commerce	

Table 3 - AO45 Steering Committee Members

AO45 Primary Goals	
Safety	Reduce fatalities and serious injuries. Enhance transportation system security. Support effective response to and recovery from natural disasters, emergencies, and incidents.
Preservation	Maintain transportation assets in a state of good repair.
Efficiency & Reliability	Increase the efficiency and reliability of moving people and freight. Improve the efficiency of connections between modes.
Mobility & Accessibility	Enhance public transportation and other mobility services. Improve mobility for individuals who lack access to or are unable to use a motor vehicle.
Economic Competitiveness	Improve access to job clusters. Enhance freight mobility. Improve transportation access to attractions.
Quality of Life	Coordinate transportation policy and investments with community visions. Advance transportation policy and investments that improve public health.
Environmental Stewardship	Reduce air quality emissions related to transportation. Avoid, minimize, or mitigate impacts of transportation on built and natural environments.

Table 4 - AO45 Primary Goals

1.4.3 TPM Performance Measures and Federal Targets

MAP-21 and the FAST Act require States to set 2- and 4-year performance targets for Pavements and Bridges on the NHS[4]. While the legislation establishes these requirements, rules were established by FHWA that define the performance measures and the process for setting the State targets. In addition, the legislation and rules established minimum condition levels for NHS Bridges and Interstate Pavement that are evaluated based on Federal performance measures.

The work ODOT has done to prepare this TAMP allowed the agency to quickly establish acceptable targets before the required reporting date. Although Federal performance targets are required only for Pavements and Bridges, ODOT also established these 2- and 4-year targets for Conduits. ODOT exceeded the Targets established in 2019 TAMP for all the assets.

Each of the two minimum condition requirements, and ODOT's 2- and 4-year Federal targets, are described in Chapters 2 and 3 respectively.

1.4.4 ODOT Critical Success Factors

ODOT uses its Critical Success Factors (CSF) for gauging the performance of the organization. These targets help track and report progress, both internally and to outside stakeholders. In addition, these CSFs help identify areas of needed improvement and areas of excellence. The CSFs are updated quarterly.

ODOT has five categories of CSFs, with one focused specifically on assets.

- Promote Safety
- Preserve Our Assets
- Program Stewardship
- Value Employees
- System Efficiency

Please refer to this website for a full description of the CSF categories and metrics. Below is a summary of the asset CSF, and are a good indicator for ODOT's NHS SOGR.

Preserve Our Assets		
Metric	**Description**	**Goal**
Bridge Condition	Percent of bridge deck area in good or fair condition, meaning that both the deck and general appraisal ratings are at least 5 on a scale of 0-9.	97%
Conduit Condition	Percent of conduits in good or fair condition, meaning that the general appraisal ratings are at least 5 on a scale of 0-9.	95%
Priority System Pavements	Average pavement conditions for interstates and 4-lane divided highways. Ratings are on a scale of 0-	PCR 85

[4] The NHS is designated by FHWA to include Interstates, principal arterials, the strategic highway network, major strategic highway network connectors and intermodal connectors. This designation is independent of ODOT's designation for Priority, General, Urban, or Local.

Preserve Our Assets		
Metric	**Description**	**Goal**
	100 and conditions are weighted based on lane miles & average daily traffic.	
General System Pavements	Average pavement conditions for rural, two-lane US and State routes outside of cities. Ratings are on a scale of 0-100 and conditions are weighted based on lane miles & average daily traffic.	PCR 80
Maintenance Condition Rating	New Measure TBD.	TBD

Table 5 - CSF Asset Summary

Please note the Bridge Condition CSF accounts for non-major state bridges (10' and greater, carrying a state route or over a state route) and excludes major bridges (structures greater than 81,000 square feet or crossing the Ohio River). Major bridges are not included in the CSF because funding decisions for major bridges are made separately from the remaining non-major state bridges. A separate CSF for Major Bridges does not exist, with these assets managed on an individual structure need basis.

The Office of Hydraulics has created program-level Key Performance Indicators (KPI) for Conduits, using inventory and inspection results. These KPIs are used by the districts to keep track of the data.

These metrics have not been established at the same agency level as the primary five. For Asset Management purposes, the Conduit KPIs are significant to note. They are:

Conduit KPI		
Metric	**Description**	**Goal**
Quality	This measure focuses on illustrating the percentage of conduits that have critical data elements.	95%
Inspection	Ensure the minimum number of assets are inspected every calendar year. This may vary district by district and the inspection cycle.	Varies based on condition (1, 5, 10-year inspection frequency).

Table 6 - Conduit KPI

1.4.5 Asset Management Program

ODOT actively manages many assets in addition to the TAMP required NHS pavements, bridges, and discretionary included conduits. Leveraging data-driven and risk or performance-based approaches remains a key tenant of the broader agency TAM program. The TAM Program is aligned across how people, processes, and technology interact and collaborate to achieve a reliable and sustainable transportation system. Program elements:

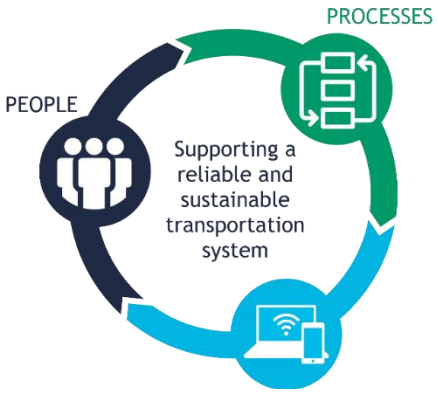


Figure 4 - Asset Management Program

- Provide ODOT employees with the training and tools needed to be successful in their jobs.
- Update business processes to foster greater Statewide consistency, help ensure Statewide goals are achieved, reduce costs, ensure accountability, and better coordinate capital and maintenance activities.
- Expand the use of technology to evaluate investment options and improve system performance.

1.4.6 People

Every ODOT employee has a role in the agency's success in realizing Asset Management. ODOT has implemented a knowledge management plan for each enterprise asset to help ensure continuity as changes occur in the workforce, and to adapt to changing agency needs.

Coordinating asset management across such a large organization requires a clear understanding of roles and responsibilities to ensure communication and consistency. The following table outlines the key groups, group members, and their high-level responsibilities as it pertains to asset management.

TAM Governance Structure

Group	Members	Responsibilities
Governance Board	Director, Assistant Directors	Establish strategic direction and focus.
TAM Program Team	Representatives of District Deputy Directors, Highway Maintenance Administrators, Capital Program Administrators, Central Office Program Areas	Prioritize strategy implementation, and objectives.
Asset Management Leadership Team (AMLT)	DBOs, SMEs, District TAM Coordinators, Central Office Program Areas, DDD, HMA, CPA	Implement program activities and identify program needs.

TAM Governance Structure		
Group	**Members**	**Responsibilities**
Districts	Lead by the District Deputy Directors, this includes all ODOT District and County personnel	Support and implement Planning, Operations, and Maintenance activities.
District TAM Coordinators	The primary point of contact for the TAM program at each District	Support day-to-day TAM operations.
Data Business Owners (DBO)	Central Office asset owner	Establish asset objectives, and performance goals.
SME	District asset specialist	Implement asset program in assigned district. Coordinates with DBO.
Data Governance Office	Data Governance Office team: The TAMAG and GIS Services Team resides within this office	Coordinate TAM program across the department.
TAMAG	Transportation Asset Management Audit Group (TAMAG); DGO Staff	Provide business relationship management services for creating asset requirements and assist with supporting TAM solutions.
GIS Services Team	DGO Staff	Develop and implement TAM solutions based on requirements provided by the TAMAG.
Technology Council	Includes rotating voting and non-voting members from across the Department	Guide Technology Investments; collaborate with TAMAG on TAM solution needs.

Table 7 - TAM Governance Structure

Role of the ODOT Districts

ODOT Districts have a crucial role in the implementation of the business processes outlined in the TAMP. District personnel has direct, regular interactions with the public and first-hand knowledge of what's happening on ODOT-maintained roads, bridges, and Conduits. District participation is integral to the development and implementation of Asset Management principles. The involvement of District staff helps to ensure that ODOT's planning efforts result in practical, cost-effective Work Plans that provide the best possible return on investment. Districts can also work together to share observations and best practices to help ODOT continue to improve system performance.

District personnel help ensure the TAMP's success by:

- **Managing strategically**. District Work Plans establish the link between Statewide Asset Management strategies and what projects are delivered.
- **Keeping watch**. District personnel serve as the eyes on the road, letting others know where conditions pose a concern and making sure quality work is being done.
- **Leading up**. District personnel share observations and best practices with other Districts and the Department.
- **Preparing roads for paving**. District personnel ensures surfaces are ready to pave with replaced Conduits and other necessary pre-surfacing repairs.
- **Adjusting to new practices**. District personnel recognizes everyone's contributions to achieving the long-term, big picture plan of taking care of ODOT's transportation system.

ODOT has staffed each District with professional Transportation Asset Management Coordinators (TAM Coordinators), who serve as liaisons between the Districts and the Central Office. The primary function of this new position is to support Asset Management activities and functions by ensuring that the TAMP is being implemented according to ODOT guidelines. These professionals are well-versed in areas such as Geographic Information Systems (GIS), information technology, and communications. TAM Coordinators are a valuable agency investment that will generate huge benefits in terms of ensuring consistent and cost-effective program delivery, solidifying the TAM culture in the Districts, and guiding the implementation of technology and policy from the Central Office.

1.4.7 Processes

ODOT's Asset Management effort is executed through a five-step business process.

Figure 5 - Asset Management Process

Step 1: Maintain Asset Inventories and Conditions

The availability of reliable, comprehensive asset data is a fundamental requirement of a performance-driven approach to managing assets. ODOT has maintained an inventory of Pavement and Bridge assets for years and is adding other highway assets to the inventory regularly. ODOT has taken a risk-based approach to developing asset inventories, meaning that Department staff prioritized its assets based on their importance to achieving agency goals. Tier 1 assets were identified as being the most critical, including Pavements, Bridges, and Conduits.

In addition to the FHWA TAMP assets (Pavements, Bridges, Conduits), ODOT regularly collects inspection and/or condition information on many assets. The condition information is used to identify and prioritize investment needs, establish performance targets, monitor progress, and communicate with both internal and external stakeholders.

Step 2: Establish Performance Targets and Funding Needs

Leveraging TAMP performance targets and ODOT-specific CSF, funds are allocated to the Districts to match Statewide performance targets and investment priorities based on candidate projects suggested by ODOT's asset management systems. Districts are held accountable for utilizing the funding as recommended by the asset management systems. For example, the Pavement projects in a District's Annual Work Plan are expected to match at least 75 percent of the recommendations from the Pavement Management System.

Step 3: Develop Work Plans

ODOT's NHS Pavements, Bridges, and Conduits are managed through the Work Plan development process. This process combines the planning for capital and maintenance activities to enable better coordination across programs and resources. This coordinated effort focuses on the increased use of preservation treatments to slow the rate of asset deterioration. The Work Plan process leverages the following guidelines:

- Aligning capital project and maintenance activities for resource optimization.
- Coordinating District work activities to ensure Statewide performance goals.
- Increasing the use of low-cost maintenance treatments.
- Using performance data to guide funding allocations.

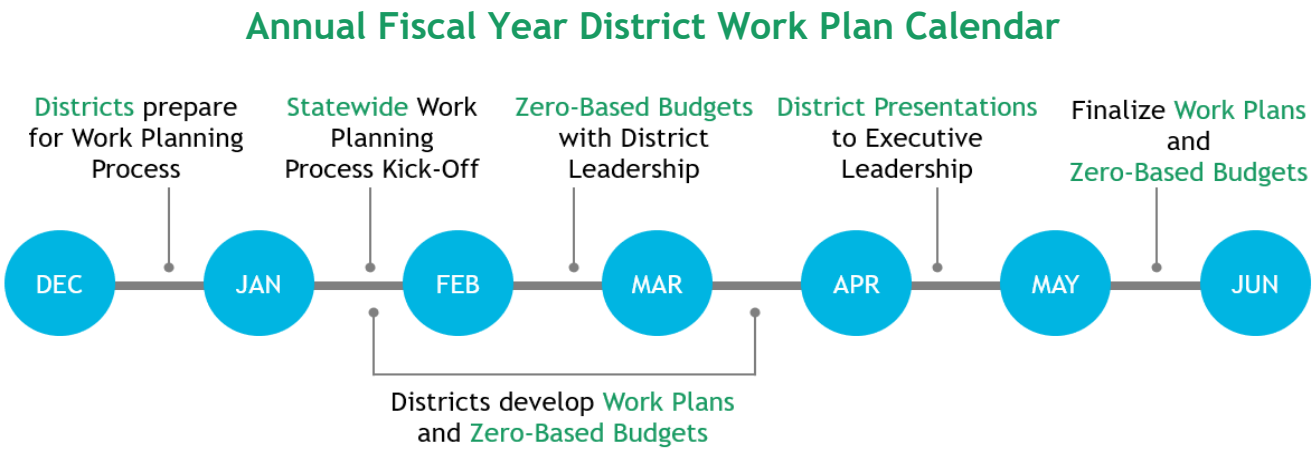


Figure 6 - Annual Fiscal Year District Work Plan Calendar

Work Plan Guidelines

The Department's Multi-Year Work Plan outlines the planned activities associated with a more than $2 billion annual program for preserving transportation assets in a sustainable condition that meets the Department's Critical Success Factors. In support of the Multi-Year Work Plan, each of the 12 Districts is responsible for developing a Capital Work Plan that represents the contracted portion of ODOT's long-term plan, listing the rehabilitation and maintenance projects that will be awarded over a 6-year planning horizon. The 6-year District Capital Work Plans are entered into the Ellis Project Development System by March of each calendar year. The Division of Planning, Office of Program

Management, acts as the administrator of the District Capital Work Plans. In this role, they provide guidance and resources to assist the districts in the development of their work plans.

In addition to the Capital Work Plan, Districts develop an Operations Work Plan that represents the maintenance.

The Operations Work Plan serves two purposes. First, it identifies the work planned for the upcoming fiscal years. Second, it establishes a rental equipment and materials budget to perform the work for the upcoming year. The Division of Operations, Office of Maintenance Operations, acts as the administrator of the Operations Work Plan. In this role, they provide guidance and resources to assist the Districts in the development of their Work Plans.

The combined Work Plans are fiscally constrained and meet the performance goals established by Executive Management. ODOT established Asset Management Coordinator positions in each of the Districts to further strengthen the collaborative process, and to ensure that ODOT's Asset Management objectives are met.

Quarterly Major Project Meetings

Once the Annual District Work Plan is finalized, ODOT Central Office and District Leadership hold Quarterly Major Project Meetings whose main objectives are to monitor the performance of the Work Plans. These quarterly meetings are key risk management activities of the TAM Program. Items commonly tracked during these meetings include:

- Pavement, Bridge, and Conduit inspection cycle progress
- Program Delivery (i.e., construction project status, project risk, maintenance/operations performance)
- Asset Metrics (i.e., condition targets, unexpected issues)

The Major Project Meetings ensure consistent communication across the agency enabling proactive refinement to any risk which may arise.

Step 4: Monitor Progress for Continuous Improvement

Asset Management is a dynamic process, requiring continual monitoring analysis, and improvement. ODOT focuses on four areas for ensuring continuous improvement:

Personnel Development and Capacity Building

ODOT employees have a vital role in implementing the TAMP, requiring a skilled workforce committed to seeing ODOT succeed in taking better care of its existing transportation assets. This has led to the development and implementation of a Knowledge Management Plan intended to help employees develop the skills necessary to support ODOT's initiatives and to better transfer knowledge within the organization as employees retire. The Knowledge Management Plan is designed to ensure that employees are prepared to identify when actions are needed and share what they've learned with others.

A central component of ODOT's Knowledge Management plan is the creation of core process documents that outline an asset's workflows. This is primarily achieved through the TAMAG. This group provides business relationship management services to asset owners seeking to create or improve an asset management solution. The deliverables of the TAMAG process include:

- Asset Life Cycle Diagrams.
- Business Requirements documents (if applicable).
- Data Glossaries.
- Data Models.
- Inventory and Inspection Manuals.

These artifacts ensure institutional knowledge is captured consistently and is leveraged during staff onboarding and training.

Additionally, the TAM program partners with the Transportation Systems Management and Operations (TSMO) team to determine how to leverage data to make Ohio's transportation system work better and stretch limited resources. This is coordinated through monthly TAM-TSMO meetings with executive leadership, and periodic workshops with Central Office, District, and County subject matter experts to share new best practices and identify risks and new opportunities.

Business Process Change

Efforts to reduce the overall life cycle cost of maintaining Pavements, Bridges, and Conduits require the increased use of preservation activities and a more unified approach to maintenance and capital planning. ODOT continues to identify and implement improvements that are targeted at lowering the total life cycle cost of asset preservation through proactive measures such as:

- Developing and implementing guidance and training to improve the construction quality of preservation treatments.
- Reviewing preservation treatment specifications at least annually to identify changes that extend treatment performance and promote good practices.
- Monitoring analysis models to ensure that predicted conditions match field performance.

Data Integration and Governance

The foundation of ODOT's performance-based analysis approach is the availability of reliable asset data. Because of the importance of its business processes, ODOT has taken steps to manage its asset data to ensure that that data is complete, current, and collected consistently across the State.

In 2019, ODOT formally created the Data Governance Office and appointed a Chief Data Officer. This office has created a Data Governance Framework to establish the guidelines and rules of engagement for business and management activities of enterprise data. The framework formalizes interactions among people, processes, and technology to support positive outcomes.

ODOT Data Governance Framework

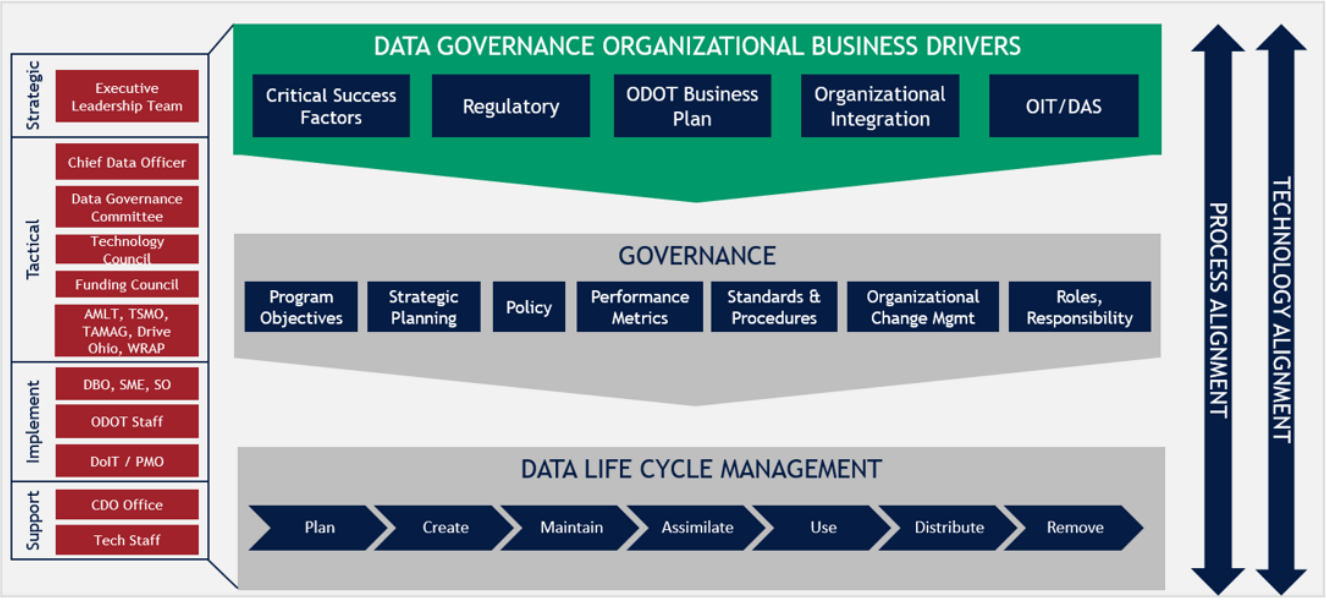


Figure 7 - Data Governance Framework

The Data Governance Office Strategic Plan identifies three overall goals:

Data Governance Strategic Goals	
Standards	Standards provide detailed instructions on how to properly manage data, such as how data is created, maintained, distributed, used, and ultimately purged through the data life cycle. Standards enable process consistency.
Quality	The usability of data is only as good as the quality of data, and quality data is necessary for strategic decision-making. Data quality requirements will be established, checked, and tracked.
Integration	Enterprise data integration enables holistic decision-making capabilities. Achieving this requires identifying the single source for enterprise data and establishing assimilation protocols to enable business intelligence technologies.

Table 8 - Data Governance Strategic Goals

The Data Governance Strategic Goals will be accomplished through the following eight objectives:

1. Data Business Plans.
2. Define Resources, Skills, Roles, and Responsibilities.
3. Enterprise Data Warehouse.
4. Enterprise standards, policy, and procedure.
5. Master Data Management (data catalog suite of tools).
6. Manage Unstructured Data.
7. Monitor Implemented Standards.

8. Systems Integrations and reduced silos.

ODOT believes by formalizing a data governance strategy, the overall asset management program will result in more consistent, reliable, and valuable information for its decision-makers.

Technology and Management Systems

ODOT's management strategies depend on the availability of analysis models and computerized tools to effectively evaluate the long-term impacts of investment options. ODOT currently uses a state-of-the-art Pavement management system (dTIMS) for managing its Pavement investments and is in the process of linking its new maintenance management processes, which include maintenance work planning, and reporting, to its Asset Management program.

ODOT has fully implemented AssetWise for the inventory and inspection data collection process for Ohio's Bridges. A project was initiated to implement the AASHTOWare Bridge Management System (BrM), however, it is currently postponed due to a lack of resources. ODOT has an implementation schedule defined to deliver BrM in 2023 for use by the district's 2024 work plans.

The AASHTOWare™ BrM software was first developed under an NCHRP project sponsored by the FHWA in the early 1990s and soon thereafter was transferred to AASHTO for further development, maintenance, and support. For over 20 years BrM has seen dramatic improvements due to technological changes, product innovations, and, most importantly, direct user feedback. As a key product in the AASHTOWare software suite, BrM continues to be widely used as the primary bridge management software by transportation agencies across the U.S., and internationally.

Step 5: Communicate Strategic Direction and Progress

Internal and external stakeholders have a vested interest in ODOT's success. In many instances, they also have a role in making that success a reality. Therefore, ODOT must communicate plans for moving forward to all stakeholders and garner their understanding of, and support for, the changes ahead. To that end, a Communication Plan has been developed to engage employees and partners. The plan consists of two avenues, Strategic Communication and Operational Communication.

Strategic Communication

ODOT created a public Asset Management website communicating the strategic direction of the asset management strategy. This site includes videos describing ODOT's asset preservation strategy, an Asset Management Playbook, Emergency Relief application process information, and other vision-related information.

Operational Communication

Coordinating asset management across a 5,000-person organization requires a consistent protocol to ensure issues, advancements, needs, and decisions can be made in a timely fashion. ODOT has implemented the following tools to ensure internal communication:

Internal Asset Management Leadership Team SharePoint Site

ODOT's AMLT SharePoint aggregates all enterprise asset management activities. This includes repositories for meeting minutes, TAMP artifacts, and several working group pages with links to key systems, inventory and inspection manuals, inventory dashboards, or other items.

While primarily an internal site, access to the AMLT SharePoint site can be made available through secure connections to other partners, such as FHWA, MPO, or County agencies as desired.

Figure 8 - AMLT SharePoint Site

Strategic Meetings

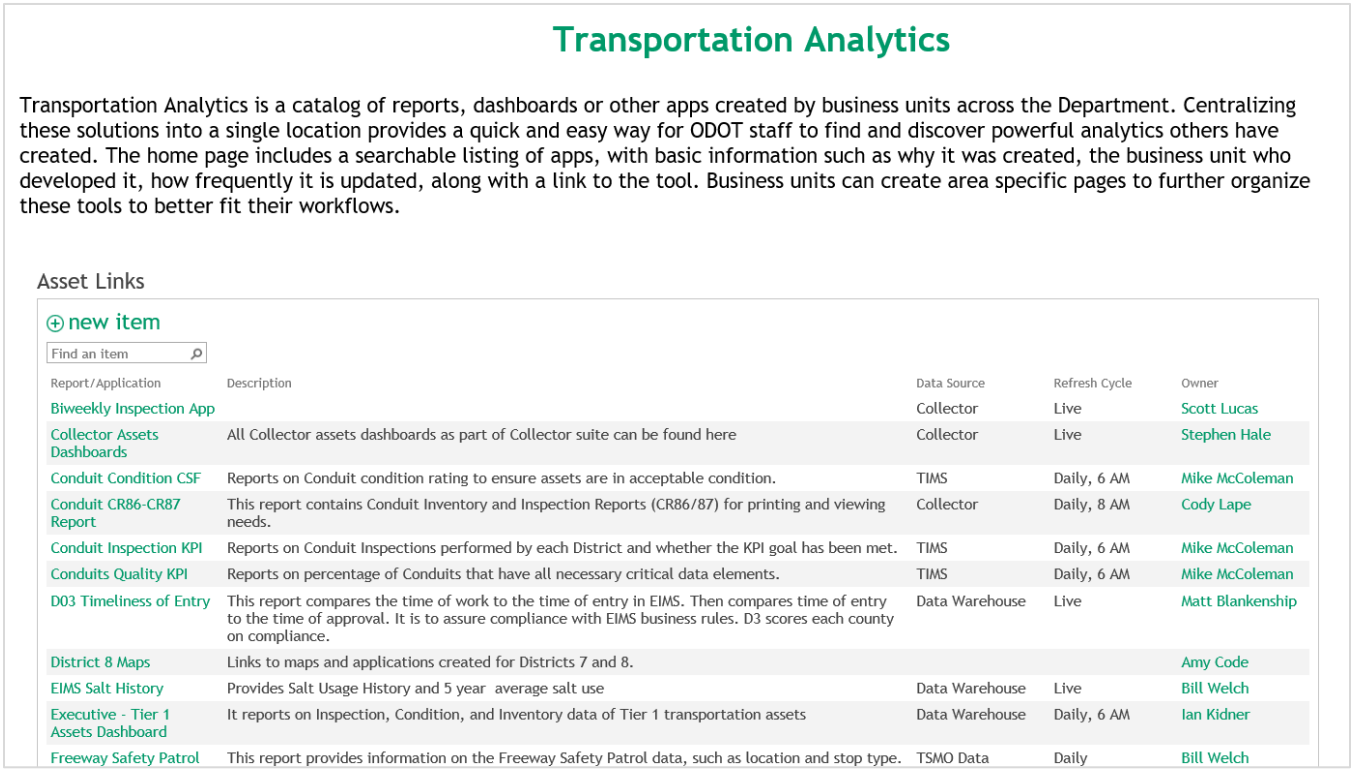
ODOT holds numerous discussions across stakeholder groups to monitor and communicate activities.

Group	Frequency	Purpose
Governance Board	As Needed	TAM Program requests a Governance Board meeting as necessary to review strategic direction.
TAM Program Team	Quarterly	Review progress and prioritizes activities.
AMLT	Monthly	Communicate operational activities and progress.
Capital Planning Administrators	Monthly	Communicate capital program progress.
Highway Maintenance Administrators	Monthly	Communicate maintenance and operation progress.
District TAM Coordinators	Monthly	CO TAM team and District TAM Coordinators identify workflow improvement opportunities and best practices.
Technology Council	Monthly	Review new technology project requests/needs.
District TAM Meetings	Varies	District TAM Coordinators monitor progress with District SMEs.
CO TAM Team	Bi-Weekly	Data Governance Office personnel internal meeting for advancing all TAM program items.
TAMAG	Weekly	Review business relationship management activities/progress.
Collector Incidents	Weekly	A short meeting between TAM Coordinators and the GIS team to resolve any technology or process issues.

Table 9 - Strategic Group Detail

Dashboards

ODOT has created numerous dashboards to monitor the overall progress of the TAMP and broader TAM program. These dashboards are critical for understanding the current state and identifying potential improvement opportunities. Several of these dashboards are maintained by the Central Office TAM Team in the Data Governance Office, though many are also created by personnel throughout the department. To eliminate redundancy of efforts, ODOT has created the Transportation Analytics internal SharePoint site for cataloging these tools:



Transportation Analytics

Transportation Analytics is a catalog of reports, dashboards or other apps created by business units across the Department. Centralizing these solutions into a single location provides a quick and easy way for ODOT staff to find and discover powerful analytics others have created. The home page includes a searchable listing of apps, with basic information such as why it was created, the business unit who developed it, how frequently it is updated, along with a link to the tool. Business units can create area specific pages to further organize these tools to better fit their workflows.

Asset Links

⊕ new item

Find an item

Report/Application	Description	Data Source	Refresh Cycle	Owner
Biweekly Inspection App		Collector	Live	Scott Lucas
Collector Assets Dashboards	All Collector assets dashboards as part of Collector suite can be found here	Collector	Live	Stephen Hale
Conduit Condition CSF	Reports on Conduit condition rating to ensure assets are in acceptable condition.	TIMS	Daily, 6 AM	Mike McColeman
Conduit CR86-CR87 Report	This report contains Conduit Inventory and Inspection Reports (CR86/87) for printing and viewing needs.	Collector	Daily, 8 AM	Cody Lape
Conduit Inspection KPI	Reports on Conduit Inspections performed by each District and whether the KPI goal has been met.	TIMS	Daily, 6 AM	Mike McColeman
Conduits Quality KPI	Reports on percentage of Conduits that have all necessary critical data elements.	TIMS	Daily, 6 AM	Mike McColeman
D03 Timeliness of Entry	This report compares the time of work to the time of entry in EIMS. Then compares time of entry to the time of approval. It is to assure compliance with EIMS business rules. D3 scores each county on compliance.	Data Warehouse	Live	Matt Blankenship
District 8 Maps	Links to maps and applications created for Districts 7 and 8.			Amy Code
EIMS Salt History	Provides Salt Usage History and 5 year average salt use	Data Warehouse	Live	Bill Welch
Executive - Tier 1 Assets Dashboard	It reports on Inspection, Condition, and Inventory data of Tier 1 transportation assets	Data Warehouse	Daily, 6 AM	Ian Kidner
Freeway Safety Patrol	This report provides information on the Freeway Safety Patrol data, such as location and stop type.	TSMO Data	Daily	Bill Welch

Figure 9 - Transportation Analytics SharePoint Site

The Transportation Analytics site has helped many ODOT staff find information and insights, saving the agency significant time and effort.

Technology

ODOT has made significant investments in technology to supplement and advance the overall asset management program. ODOT's TAM Technology stack achieves strategic maturity by focusing on Foundational solutions for the critical components of the transportation system. The Capacity Building layer expands ODOT's understanding of the transportation system by collecting information on more assets, maintenance activities, or other usage factors. Several systems make up the Information Discovery layer, whose purpose is to provide easy access to the wealth of data being generated. Finally, the Business Intelligence layer seeks to transform data into wisdom through data-driven decision-making processes.

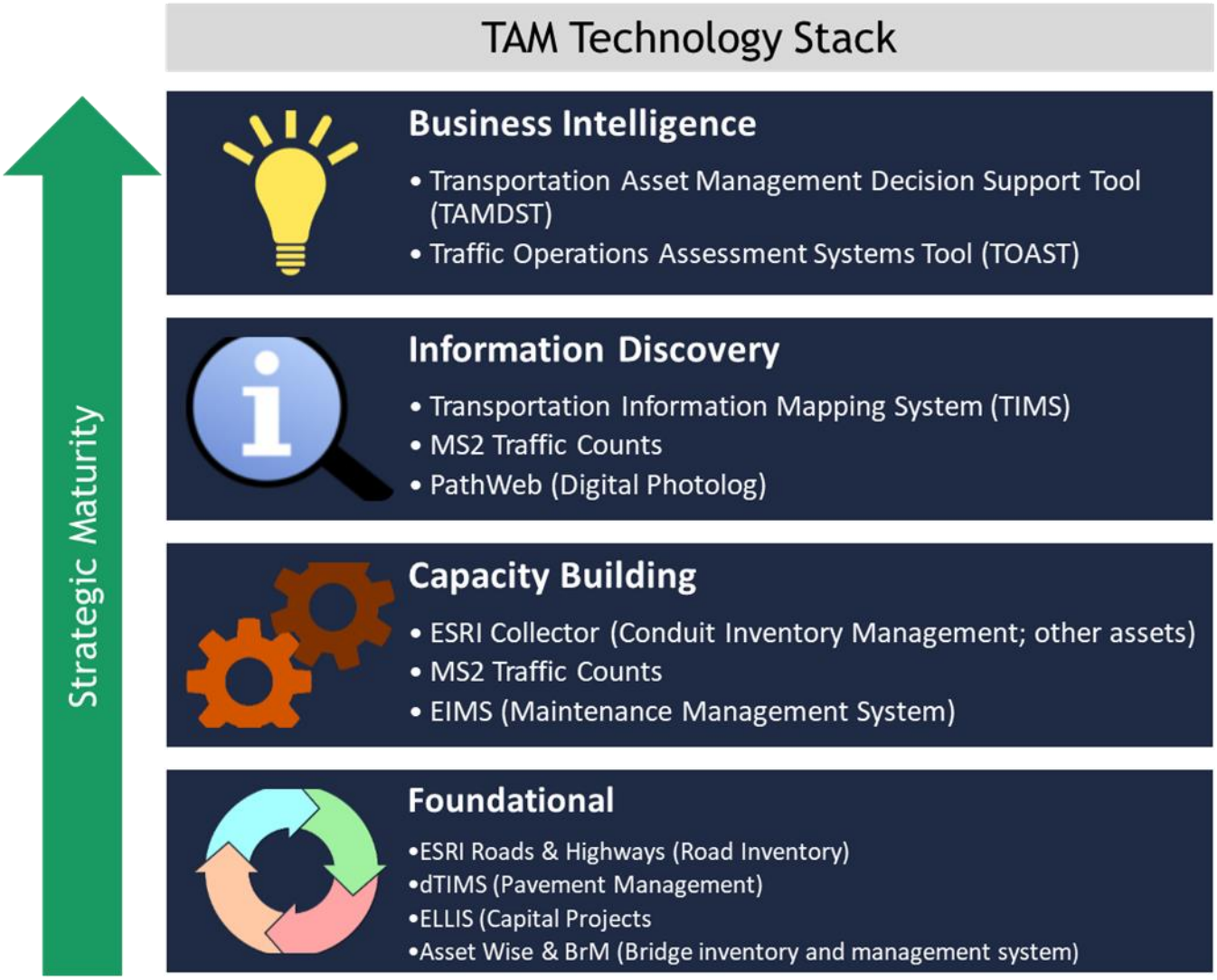


Figure 10 - TAM Technology Stack

For the core TAMP assets (Pavement, Bridges, and Conduits), inventory and inspection systems, as well as management systems for performing life cycle analysis, have been implemented. These three assets are only part of the overall TAM story at ODOT, and several other assets are actively maintained by the Department through the Collector Program. ODOT has implemented inventory and/or inspection solutions to actively manage the following additional assets: ADA Rights of Way, Barriers, BMP, Geohazards, Highway Lighting, ITS, Outfalls, Signals, Retaining Walls, Signs and Supports, and Underdrain Outlets.

Since implementing these solutions beginning in 2016, ODOT has created almost one million inventory or inspection records for these additional assets, greatly adding to the business intelligence abilities of the organization. The TAMAG and District TAM Coordinators continue to develop enterprise and non-enterprise solutions to improve efficiency.

ODOT Asset Tiers

ODOT categories assets in a two-tier, risk-based approach to help focus and coordinate department efforts and resource allocation.

Tier	Definition	Criteria	Resource-Priority
Tier 1	Infrastructure assets critical to the core function and operation of the transportation system.	Has a Federal or State regulatory mandate, required inspection frequency, or deemed critical for safety.	Tier 1 Assets shall receive resource priority to ensure compliance with mandates or functional operation.
Tier 2	Infrastructure assets that support and enhance the core function and operation of the transportation system.	All other assets not assigned Tier 1 classification.	Tier 2 Assets shall receive resource priority following successful management of Tier 1 assets.

Table 10 - Asset Tiers

ODOT Tier 1 Assets

Asset	Regulatory	Inspection Frequency	Performance Target	Replacement Strategy
Pavement	FHWA	1-yr	Priority: 85 PCR Avg General: 80 PCR Avg	Life Cycle
Bridges	FHWA/State	1, 2-yr	97% GA>=5	Life Cycle
Conduits		1, 5,10-yr	95% GA>=5	Life Cycle
Overhead Sign Supports		5, 1-yr	N/A	Age Based / Damaged
Post Construction BMP	EPA	1-yr	Maintenance completes within 365 days	Replace if damaged
ADA Curb / ROW	FHWA	1x	N/A	If non-compliant
Geohazards	FHWA	1, 3, 5, 10-yr	N/A	N/A
Barrier / Guardrail	FHWA	N/A	N/A	Replace if damaged
Underdrains		3-yr	N/A	Replace if damaged
Signals		1-yr	N/A	Life Cycles
ITS		Varies	N/A	Life Cycles
Tower Lighting		8-yr	N/A	Replace if damaged

Table 11 - Tier 1 Assets

2 ASSET INVENTORY AND CONDITIONS

Asset inventory and condition information are critical for TAM planning processes. ODOT maintains inventory and condition data for pavements, bridges, and conduits to enable effective investment strategies necessary to sustain the desired state of good repair for these assets. The following section details the current inventory and condition status.

2.1 Federal Requirements

The FHWA specifies that a state's TAMP must include a summary listing of NHS pavements and bridges along with inventory and conditions for these assets. In addition to providing inventory and condition data, states must also have documented procedures for collecting, processing, storing, and updating inventory and condition data for NHS pavement and bridge assets. NHS pavements and bridges are defined as:

- Interstate System pavements.
- Non-Interstate NHS pavements.
- NHS bridges carrying the NHS.

Interstate pavements are part of the Interstate Highway System, a highway network that is part of the NHS. NHS bridges carrying the NHS also include on- and off-ramps connecting to the NHS within a State, and bridges carrying the NHS that cross a State border. States are encouraged to include other assets on the NHS or other public roads in the TAMP. States are required to use pavement and bridge management systems that, in addition to other capabilities, collect, process, store, and update inventory and condition data.

FHWA developed national-level condition performance measures for NHS pavements and bridges as outlined in the Pavement and Bridge Performance Management Final Rule (23 CFR Part 490).

Minimum Pavement Conditions:

FHWA and the TAM program require minimum condition levels to be established for pavements on the Interstate System to be maintained by State DOTs. Because of the importance of the Interstate System to demonstrate progress toward the national goals in 23 U.S.C. 119(f), the final rule requires that State DOTs have at least 95 percent of the Interstate pavement data available and demonstrate that no more than 5 percent of the pavements are in poor condition. Pavements are determined to fall into a Good or Poor category based on defined metrics for smoothness (in terms of the International Roughness Index (IRI), percent cracking, rutting (asphalt pavements only), and faulting (concrete pavements only).

Minimum Bridge Conditions:

State DOTs are required to maintain bridges so that the percentage of the deck area of bridges classified as in poor condition does not exceed 10.0 percent. This minimum condition level applies to bridges carrying the NHS, which includes on- and off-ramps connecting to the NHS within a State, and bridges carrying the NHS that cross a State border. A bridge will be classified as in poor condition when one of its NBI Items, 58—Deck, 59—Superstructure, 60—Substructure, or 62—Conduits, is 4 or less.

2.2 Pavement Inventory and Condition

ODOT is responsible for nearly 50,000 lane miles of roads divided into three systems: Priority, General, and Urban. ODOT is responsible for maintaining Priority and General System roadways, which total over 43,000 lane miles. The Priority System carries the highest traffic volumes since it is made up of Interstates and multilane-divided highways. The General System is the largest of the three systems by mileage. It includes all the two-lane State-maintained highways. The Urban System includes any US or State highways that fall within the jurisdiction of a local agency with a population of 5,000 or more. Since Ohio is a "home rule" State that promotes governance at the local level, the maintenance of Urban routes is ultimately the responsibility of the municipalities. However, through its collaboration with its Local Partners, ODOT participates in investments in the local system. The OTC is also responsible for managing 1,285 lane miles that make up the east-west toll road located in the northern part of the State.

2.2.1 PCR Defined and Usage

ODOT monitors pavement conditions by using a 100-point Pavement Condition Rating (PCR) in which a score of 100 represents the condition of a new road. PCR considers surface distresses, such as cracking, as well as ride quality to provide a comprehensive rating of Pavement condition. The complete PCR Manual can be found here. It describes all distresses and measurement methods.

ODOT measures the average Pavement conditions for all Priority, General, and Urban routes each year and compares conditions to the CSF to gauge Statewide system quality and set investment priorities. Every segment of roadway in Ohio (except for local roads) is given a PCR as a method of rating the overall condition on a scale of 0 to 100. The system average PCR is weighted by Annual Average Daily Traffic (AADT), segment length, and the number of lanes. Each system's average weighted PCR is calculated separately with the target being above the goal of 85 on the Priority System and 80 on the General System.

ODOT's Office of Pavement Engineering PCR teams drive every mile of ODOT roadway annually, assigning PCR values in their vehicle's computer systems as they go. The data is collected monthly during the PCR collection season (April – December). The PCR data is integrated with the dTIMS pavement management system in the Central Office to support pavement life cycle planning.

ODOT has utilized PCR for several decades with the measure becoming tightly integrated with planning processes, including funding determination and project selection criteria.

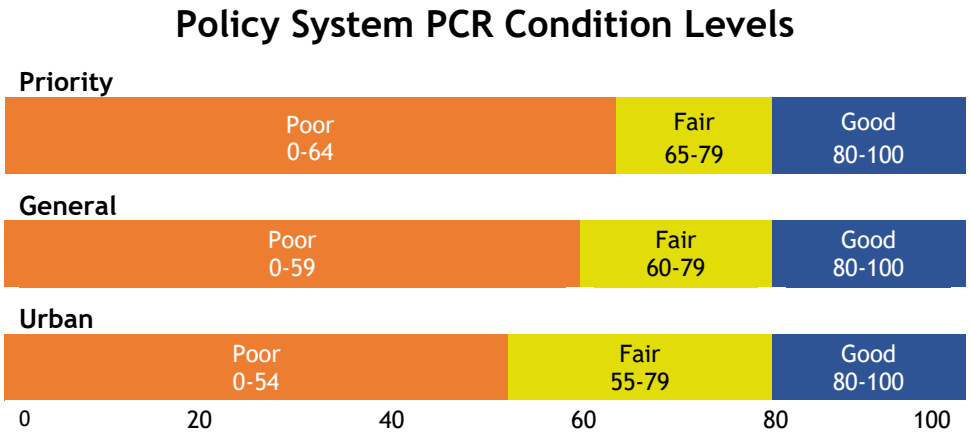


Table 12 - PCR Condition Levels

The following table summarizes the number of lane miles in each of the Priority, General, and Urban systems. ODOT is also responsible for reporting inventory and condition information to FHWA for the NHS. For that reason, ODOT's Pavement inventory is further sub-divided into NHS and non-NHS Pavements, including statistics indicating what portion of the NHS consists of Interstate Pavement. All mileage is based on lane miles, which represent the centerline length (in miles) multiplied by the number of lanes. These tables reflect PCR data available in March 2022.

PAVEMENT POLICY SYSTEM (LANE MILES)

	Route Type	Lane Miles	Average Weighted PCR	Good	Fair	Poor
Priority	IR	7,080	87	77.20%	20.15%	2.65%
	US	3,943	84	64.23%	29.47%	6.29%
	SR	2,857	83	66.50%	27.76%	5.74%
General	US	5,173	84	70.39%	25.53%	4.09%
	SR	24,398	83	63.05%	32.08%	4.87%
Urban	US	1,921	81	48.21%	49.20%	2.59%
	SR	4,073	80	48.07%	49.18%	2.74%
Total		**49,445**	**86**	**64.33%**	**31.30%**	**4.37%**

Table 13 - Pavement Policy -Lane Miles

PAVEMENT INVENTORY and CONDITION (LANE MILES)

	Lane Miles	Average Weighted PCR	Good	Fair	Poor
NHS					
Interstate	7,080	88	77.20%	20.15%	2.65%
U.S. Route	6,717	83	63.71%	30.27%	6.02%
State Route	5,758	83	62.78%	33.07%	4.15%
Turnpike	1,285	85	62.96%	37.04%	0.00%
Local	918	81	55.06%	36.93%	8.01%
No PCR data	120	NA	-	-	-
TOTAL	**21,881**	**NA**	**67.44%**	**28.40%**	**4.16%**
NON-NHS					
U.S. Route	4,318	83	65.30%	32.27%	2.43%
State Route	25,569	82	61.11%	34.10%	4.79%

PAVEMENT INVENTORY and CONDITION (LANE MILES)					
	Lane Miles	Average Weighted PCR	Good	Fair	Poor
Local	26,866	80	55.56%	35.37%	9.07%
Local No PCR	177,660	NA	-	-	-
TOTAL	**234,414**	**NA**	**58.80%**	**34.57%**	**6.63%**
GRAND TOTAL	**256,295**	**NA**	**61.20%**	**32.86%**	**5.95%**

Table 14 - Pavement Condition - Lane Miles

In the above table, there are 120 NHS Lane Miles where there is no PCR data. This is because some of the lanes are very short routes, and some are Bridge locations where PCR data is not collected. Some of the Lane miles are in the Construction zone, which makes it difficult for inspectors to collect PCR data.

The PCR information is published quarterly and presented in ODOT's Critical Success Factor Dashboard. Maps are also prepared for each District showing their average PCR scores to illustrate progress towards targeted Statewide conditions. The Pavement program is established from a Statewide optimization analysis; therefore, there are some Districts with scores above the target and others with scores below the target. However, on a Statewide basis, ODOT is currently exceeding its targets for the Priority and General Systems.

2.2.2 The Ohio Turnpike Commission - Pavement Condition Rating

The OTC uses the same rating systems as ODOT for pavements and bridges. ODOT performs the PCR inspection annually and reports the results to the OTC. The PCR is obtained annually and used as the main determining factor in the prioritization of pavement rehabilitation. OTC uses a benchmark of an average PCR rating of 85, and any sections that are below the benchmark are prioritized for project funding.

2.3 Bridge Inventory and Condition

Ohio has over 44,000 Bridges. ODOT is responsible for maintaining over 10,000 of these Bridges on the Priority and General systems. The Ohio Turnpike maintains 531 additional Bridges. The Bridge inventory includes all structures with a span greater than or equal to 10 feet.

2.3.1 ODOT Bridge Inventory and Condition

ODOT inspects bridges on a 1 or 2-year cycle depending on the most recent condition rating, based on Ohio Revised Code Section 5501.47. Each inspection provides a rating for the major elements of the Bridge (superstructure, substructure, deck, and conduit) on a 0 to 9 scale, with 9 representing an element in *Excellent* condition and 0 representing a *Failed* element. Any element rated below 5 is considered *Poor*. To provide an overall assessment of the Bridge condition that takes all major components into account, the lowest rating from these primary elements is reported as General Appraisal (GA). In addition to these primary condition ratings, some Bridges require more detailed inspections if they have fracture-critical members, underwater components, or are complex structures. On a Statewide basis, more than 98.3 percent of the Bridges maintained by ODOT are in *Fair* or better condition (GA of 5 or more).

2.3.2 The Ohio Turnpike Commission – Bridge Condition Ratings

The OTC utilizes a Consulting Engineer (AECOM), a requirement of the Master Trust Agreement, to inspect the bridges annually, and such inspections are performed by following FHWA requirements. Those results are reported to ODOT.

The Ohio Turnpike's bridges are inspected and scored annually using FHWA's National Bridge Inspection Standards. A GA is scored for each bridge and considers the physical condition of major parts. The GA for each bridge is measured on a scale from 0 (closed) to 9 (new/excellent condition). The GA is defined as: 0 (failed condition), 1 (imminent failure condition), 2 (critical condition), 3 (serious condition), 4 (poor condition), 5 (fair condition), 6 (satisfactory condition), 7 (good condition), 8 (very good condition), and 9 (excellent condition) respectively. These correlate to the Performance Measure Classification as follows: 0 to 4 is Poor Condition, 5 and 6 are Fair Condition, and 7 to 9 are Good Condition.

Overall Bridge Condition Ratings

In the below table, Bridge conditions are reported based on the lowest component rating. The lowest rating for the three major elements of the Bridge (superstructure, substructure, and conduit) is calculated. Below are the levels to identify when a Bridge is in Good, Fair, or Poor Condition.

- Good (7-9)
- Fair (5-6)
- Poor (0-4)

BRIDGE INVENTORY AND CONDITION[5]

	Count	Deck Area (sq. ft)	Good	Fair	Poor
NHS					
Interstate	2,157	34,999,520	69.22%	29.25%	1.53%
U.S. Route	1,895	16,687,849	66.65%	32.19%	1.16%
State Route	1,468	16,175,499	61.78%	36.38%	1.84%
Turnpike	380	5,178,028	57.63%	41.84%	0.53%
Local	185	1,700,059	51.35%	43.78%	4.86%
TOTAL	**6,085**	**74,740,955**	**65.29%**	**33.21%**	**1.50%**
NON-NHS					
U.S. Route	978	4,692,639	62.88%	35.58%	1.53%
State Route	6,457	21,236,103	62.95%	34.77%	2.28%
Turnpike	151	1,094,554	61.59%	37.09%	1.32%
Local	29,826	54,942,785	57.44%	35.70%	6.87%

[5] The analysis was run in March 2022, which would include all condition information approved at that time.

TOTAL	37,412	81,966,081	58.50%	35.53%	5.93%
GRAND TOTAL	43,497	156,707,036	59.44%	35.27%	5.29%

Table 15 - Bridge Inventory and Condition

2.4 Conduit Inventory and Condition

ODOT is responsible for over 88,000 State-maintained Conduits. These include conduits and storm sewers located under Pavements and paved shoulders with spans ranging from 12 inches to less than 120 inches.

Conduits are rated using a GA rating like the one used for Bridges. A conduit is considered in good condition if rated at least 7 on the 0-to-9 scale. If the conduit condition is rated 5 or 6, the conduit is considered in fair condition. A conduit is considered in poor condition if rated 4 or less. For the Conduits that were never inspected or partially inspected, the Condition value will be NULL. Those are reported as No Condition conduits in the table below. Conduits are a discretionary asset included in the TAMP, and the information provided represents the Best Available Data for this asset.

CONDUIT INVENTORY AND CONDITION[6]

	Count	Good	Fair	Poor	No Condition
NHS					
Interstate	10,937	63.38%	25.13%	0.79%	10.70%
U.S. Route	10,100	74.75%	21.94%	1.13%	2.18%
State Route	6,803	68.57%	25.67%	1.46%	4.31%
Turnpike	470	82.34%	16.60%	0.64%	.43%
TOTAL	28,310	68.78%	24.11%	1.07%	6.05%
NON-NHS					
U.S. Route	6,279	59.10%	36.55%	2.21%	2.13%
State Route	51,549	63.98%	32.15%	1.94%	1.93%
Other	3,469	66.96%	22.48%	0.89%	9.66%
TOTAL	61,297	63.65%	32.06%	1.91%	2.39%
GRAND TOTAL	89,607	65.06%	29.60%	1.78%	3.56%

Table 16 - Conduit Inventory and Condition

[6] The analysis was run in March 2022, which would include all condition information approved at that time.

The following table illustrates the conduit inventory by span

CONDUIT INVENTORY BY SPAN	
Length in Feet	**Count**
12 to 36	74,838
>36 to 48	5,846
>48 to 60	3,225
>60 to 84	3,283
>84 to 102	1,335
>102 to <120	515
Turnpike*	470
Inventory in Progress	95
GRAND TOTAL	**89,607**

Table 17 - Conduit Inventory by Span

*Size of 470 Turnpike conduits listed above is between 30 and 120 feet.

2.5 Use of Best Available Data

ODOT's approach to managing assets is dependent on the availability of reliable asset data. ODOT has implemented processes and protocols to ensure data is complete, current, and collected consistently across the state. Chapter 1 of this document highlighted the formal establishment of ODOT's Data Governance Program in 2019. That program is currently implementing the following strategies to mature previous data quality practices.

2.5.1 Data Standards

ODOT has established a data standard classification system to ensure that core data is standardized across all enterprise systems to enable integration and consistency, and a method for identifying critical data to the agency. There are three data standard categories:

Data Standard Categories	
Enterprise Data Elements	Standardized data elements that are used by all (or nearly all) datasets in the organization.
Critical Data Elements	Created in primary business systems; used throughout the organization to make important decisions.
Functional Data Elements	Data elements that are sourced or created in primary business systems or collections and only used in those systems.

Table 18 - Data Standard Categories

2.5.2 Data Business Plans

ODOT is beginning the process to create Data Business Plans (DBP) for all major enterprise systems, including the pavements, bridges, and conduit solutions. The goal of a DBP is to document the activities, key items, or other pertinent aspects of each phase in the Data Life Cycle (DLC).

2.5.3 ODOT Data Life Cycle Phases

Figure 11 - Data Life Cycle Phases

Once established, a DBP will be reviewed on a regular frequency with the Data Business Owner to determine if any updates to the data life cycle are necessary. This enables ODOT to identify impacted stakeholders, establish methods for tracking processes, establish data quality metrics and serve as a knowledge management plan to create sustainable and consistent processes.

2.5.4 Master Data Management

In 2022, ODOT plans to procure and implement a data catalog suite of tools to enable Master Data Management (MDM) capabilities for the agency. MDM is an established industry best practice whose goal is to determine the authoritative view of an agency's data, and track distribution and usage throughout the technology enterprise to ensure systems and applications are utilizing the correct information in the decision-making processes. This suite of tools typically includes functions to audit systems for data standard compliance, implement data quality metric reporting, data lineage tracking, business data glossary, and many other functions.

2.5.5 Pavement Data Quality Management

ODOT's Highway Infrastructure Management (HIM) team maintains and operates vehicles to collect IRI, Rutting, Cracking, and Faulting pavement data. This team collects data across the entire State system (Interstate, US Highways, and State Routes) in Ohio, along with any local NHS on a regular cycle. Data quality for the HIM team begins with high standards for equipment and processes, including:

- Vehicle maintenance and regular vendor equipment/software maintenance for data collection systems.
- Data collection vehicles are taken to a profiler certification course, where software is verified through comparative analysis.
- All vehicle equipment and software certification results are documented for historical trending and reporting.
- The use of GIS mobile maps to track collection progress.

All HIM team members maintain a Commercial Driver's License and have been trained extensively on vehicle operations and data quality assessments.

Additionally, the HIM team deployed the Highway Network Data Application (HDNA) in 2020 to streamline importing and validating the IRI, Rutting, Cracking, and Faulting (RCF) pavement data collected in the field, to further ensure high-quality pavement data. The following diagram illustrates the primary HDNA workflow:

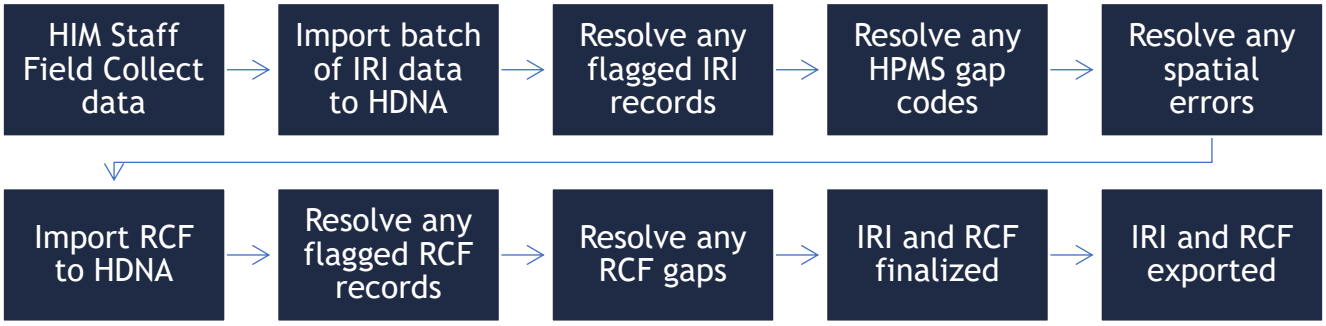


Figure 12 - HDNA Workflow

The HDNA flags records for potential issues including but not limited to:

- IRI Start/End of Route Resolution resulting in Highway Performance Monitoring System (HPMS) Gap due to Construction, Closure, Disaster, and Deterioration.
- Invalid IRI values, overlapping IRI values, Linear Reference System (LRS) spatial assignment corrections.
- Rutting Average values, the difference between left / right rutting, rutting collection on concrete.

Nearly all flagged records can be resolved in this data post-processing, but this also enables the HIM team to pinpoint any larger concerns which may require additional field data collection. The HDNA establishes a documented and semi-automated process for importing and validating IRI and RCF data. The resulting datasets are of high quality and spatially reconciled with the current LRS.

2.5.6 Bridge Data Quality Management

Data Quality

ODOT follows the below processes and methodology in ensuring that the bridges and structure's data quality is of the highest order:

1. The Office of Structural Engineering (OSE) performs the following data checks and balances:
    a. Monthly Data checks: NBI Data Checks (dot.gov).
    b. OSE performs Quarterly Element Data checks (adhering to the granularity required on NHS NBIS bridges): Element Data Errors and Flags (dot.gov).
    c. Data quality checks are also performed using the Base Transportation Referencing System (BTRS). BTRS is an ODOT-developed database workflow process that perpetuates the LRS and Roadway information changes to other ODOT enterprise systems. This process is designed to discover and detail data anomalies, if they exist, so that appropriate action can be taken based on the result of the completed process.
2. ODOT staff perform a significant percentage of the inventory and inspection of Ohio's bridges and rely on numerous local partner agencies to complete this work on their respective structures.

a. OSE evaluates bridge inspection frequencies as compared to Federal regulatory requirements outlined in the NBIS Metrics 6 -10. Data is then gathered and analyzed from approved inspection reports.
b. Monthly Frequency Checks are performed for Routine, Dive, and Fracture Critical inspections. This is to ensure inspections occur at timely intervals.
c. OSE utilizes the AssetWise application for bridge inspection notes, details, and reference guidelines for inspection reporting. AssetWise Inspection.

3. The OSE enables training and certification for ODOT and local agency bridge inspectors. Many of these training programs are offered through ODOT's Local Technical Assistance Program (LTAP), as well as NHI courses. A full list of the Structural Engineering Training is available here:

   OSE understands the importance of training and best practices by scheduling the following training opportunities:
   a. A two-day inspectors' Meeting (yearly refresher).
   b. An In-house two-week training (once a year).
   c. Refresher Training (five times a year).
   d. Online Refresher training (ongoing).
   e. Bridge Specialist series.

4. Ohio's fundamental approach to ensuring a highly performing Structures program, both in asset performance and data quality, focuses on enabling the people managing these assets to be adequately suited for the role. To this end, the State of Ohio has established a Bridge Specialist position Classification Series. Creating this dedicated bridge specialist role ensures a high standard for data consistency and quality. All ODOT staff performing bridge inspections meet the minimum position classification requirements for the Bridge Specialist position.

Quality Assurance

The current quality assurance process is the use of sampling and other measures to assure the adequacy of quality control procedures to verify or measure the quality level of the entire bridge inspection, inventory, and load rating program. QA is performed by FHWA, ODOT Central Office, and County Engineers Associations (CEAO) to ensure that the programs are compliant with State and Federal regulations. Program compliance is achieved by fulfilling legal requirements and updating SMS data per the Manual of Bridge Inspection, Bridge Inventory and Appraisal Coding Guide, Bridge Design Manual Section 900, and the 23 NBIS Metrics from FHWA. 23 Metrics (23 CFR 650.315)

The OSE also meets QA requirements through regular Field and Office Visits. The current schedule is four Districts a year (including townships)

2.5.7 Conduit Data Quality Management

ODOT's Conduit inventory and inspection solution were developed by ODOT staff with a combination of GIS applications and processes. This solution is comprised of the following primary components:

Conduit Inventory and Inspection Solution Components	
Mobile iOS Application	The mobile program is used in the field by highway technicians or other Subject Matter Experts (SMEs) to perform inventory and inspections on tablet devices.
Inventory Manual	A PDF manual documenting all aspects of the inventory and inspection process.
Dashboard	An operational dashboard provides real-time tracking at the District and County level, monitoring items such as inventories created, inspections completed, and needed.
Automated Reports	Nightly reports monitor whether required data fields need attention.
Web Application	A web browser-based application to allow users to view and edit data outside of the mobile device.
Training	All staff performing inventory and inspection must attend a solution and process training session.

Table 19 - Conduit Inventory and Inspection Solution Components

This inventory is led by the Central Office Hydraulics Office, with collaboration across multiple Central Office Divisions and all 12 ODOT Districts that implement the day-to-day inventory management activities. Given this complexity, a Life Cycle handoff workflow has been documented to identify which business unit is responsible for each step of the process.

Conduit Life Cycle Handoff Diagram

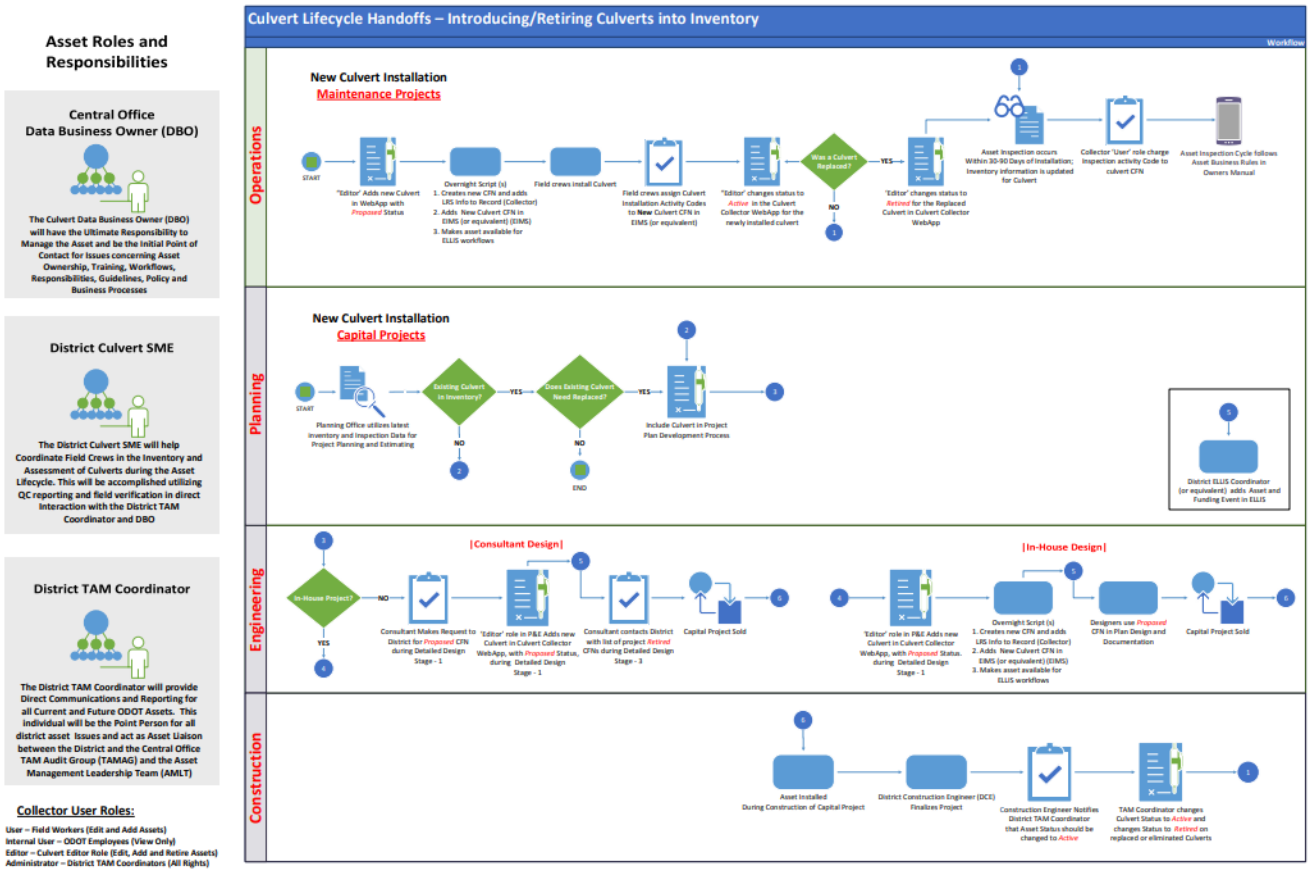


Figure 13 - Conduit Life Cycle Handoff Diagram

Data Quality KPI

In late 2021, the Office of Hydraulics established a Critical Data KPI for the conduit solution. This KPI monitors the percentage of Active-State Maintained Conduits that have all necessary Critical Data Elements (CDE). The KPI Target is to ensure that 95 percent of all Districts Conduits Assets have the CDE available.

2.5.8 Modeling & Forecasting

ODOT also considers potential changes to demographics and travel patterns in determining system performance and investment priorities. The Statewide Planning & Research Office Modeling & Forecasting team operates four scenarios to assess how uncertainties or changes in various factors might impact future system performance. This information is leveraged by ODOT planners, engineers, and MPOs. More information about this program can be found here.

2.6 Obtaining Data from Other NHS Owners

As part of the Federal reporting requirements, ODOT is responsible for reporting the condition of all Pavements and Bridges on the NHS, regardless of ownership. To ensure consistency in the reported data, ODOT includes all locally maintained Pavements and Bridges on the NHS in its ongoing Pavement and Bridge inspection processes using the same rating procedures used to manage the

State-maintained assets. The information collected on the locally maintained Pavements and Bridges is included in the reports provided to FHWA and distributed to the regional planning organizations for consideration in distributing Federal funding to local agencies.

ODOT is proud of the relationships it has with our local partners, which include counties, MPO, municipalities, and the Ohio Turnpike. To capture the data needed to support the development of the TAMP, ODOT collects the following data:

- Automated profiler ride quality data: IRI, rutting, cracking, and faulting on all NHS, including the Ohio Turnpike.
- Manual Pavement Condition Rating (0-100 scale) on all NHS and Federal aid routes, including the Ohio Turnpike.
- GA ratings for all Conduits on the State system.

ODOT also oversees all Bridge inspections and ratings on the entire State system, including the NHS. NHS Conduits that are not on the State system are managed by their local partners and submitted to the Office of Technical Services located in the Division of Planning at ODOT.

To coordinate these activities, ODOT makes the data available through its Transportation Information Mapping System (TIMS), which is a public-facing GIS data portal that allows customers to view, use, and distribute data. ODOT also utilizes its LTAP to train its local partners on a host of topics, including the data and applications ODOT uses to ensure local partners have access to and understand how to use, the data.

ODOT will continue to coordinate activities by working closely with the Ohio Association of Regional Councils (OARC), which represents 1,500 municipalities, villages, townships, counties, and MPO within the State.

3 ASSET PERFORMANCE TARGETS

Transportation Asset Management has its foundation in performance management and a focus on achieving measurable objectives through sound investment strategies. It requires a forward-looking, continual improvement approach. While Asset Management has allowed ODOT to achieve its asset condition goals in the past, the practice requires the Department to continually adjust to changing fiscal, legislative, and political environments to ensure that this success will continue.

3.1 Critical Success Factors

ODOT uses CSF for maintaining system conditions and gauging the quality of the organization. These factors help track and report progress, both internally and to outside stakeholders. In addition, the CSF help to identify areas of needed improvement and areas of excellence. They provide the tools needed to set agency goals, adjust priorities, establish best practices, develop policies, and celebrate outstanding achievements.

3.1.1 Pavement

ODOT's existing CSF for Pavements is shown in the following table. By continuing to implement the business process changes described in the TAMP, ODOT expects to be able to continue to achieve its Pavement performance targets over the 10-year period addressed in this TAMP.

Policy System	Measure	Critical Success Factor
Priority	Weighted average Pavement Condition Rating (PCR) on a 0 – 100 scale	85
General System		80
Urban System		N/A*

Table 20 - Pavement CSFs

* ODOT no longer establishes a CSF for the Urban system but is monitoring the condition of this system using State metrics.

3.1.2 Bridges

Ohio Revised Code requires all bridges with over a 10-foot span to be inspected every year. This is more restrictive than the FHWA requirement for all bridges with over a 20-foot span to be inspected every 24 months.

The CSF used to manage Bridges is that 97% of the Bridges maintained by ODOT be classified as Good or Fair. ODOT is currently exceeding this target. This CSF excludes major bridges (bridges with a deck area greater than 81,000 square feet or bridges over the Ohio River).

The condition of the Bridges on the Ohio Turnpike is rated using the same 0 to 9 rating scale used by ODOT. All Bridges maintained by the Ohio Turnpike are in Fair or better condition.

3.1.3 Conduits

There are three main categories of Conduit KPI that ODOT measures:

1. Quality KPI -- Ensures the data that is used to calculate Conduit Funding and GA ratings is collected for 95 percent of the Total District Conduits.
2. Condition KPI -- Ensures assets are in acceptable condition with a GA Rating greater than 4. The goal of the condition KPI is that 95 percent of conduits should have a GA rating >4.

3. Inspection KPI -- Ensures a minimum number of assets are inspected every calendar year. This may vary by district and inspection cycle. The assets are inspected on a 1-, 5-, and 10-year frequency based on the size of the Conduit and its condition.

3.2 Asset Performance Requirements and Targets

Federal transportation asset management legislation requires States to set 2- and 4-year performance targets for Pavements and Bridges on the NHS. While the legislation establishes these requirements, rules were established by FHWA that define the performance measures and the process for setting the State targets. In addition, the legislation and rules established minimum condition levels for NHS Bridges and Interstate Pavement that are evaluated based on the Federal performance measures.

3.2.1 Federal Targets

State DOTs are required to establish 2- and 4-year Statewide performance targets for Interstate and non-Interstate NHS Pavements, and all Bridges on the NHS using performance measures defined in 23 CFR Part 490. State DOT targets are expected to align with performance projections in the State's TAMP. ODOT has established the following 2- and 4-year targets for its NHS Pavements and Bridges. Although Federal performance targets are not required for Conduits, ODOT also established 2- and 4-year targets for this asset.

The Federal targets were developed by ODOT's Statewide Planning team, with local input, through an analysis of Pavement, Bridge, and Conduit conditions over the last five years. Using Federal performance targets that were set in the previous TAMP (2018-2022) as a baseline, the team evaluated performance data and trending information over the last five years for these assets. The review confirmed that ODOT is currently exceeding its targets. The resulting 2-year and 4-year targets established by the Statewide Planning team have been reviewed and approved by MPO and ODOT executive management. The 2-year and 4-year targets set for the Performance Period 2022 – 2026 surpass the targets set in the previous TAMP. The rules require that separate performance targets be established for Interstate and non-Interstate NHS Pavements, but only 4-year targets were required for Interstate Pavements. For both Pavements and Bridges, targets for percent Good and Poor were required.

Pavements are determined to fall into a Good or Poor category based on defined TPM metrics, in terms of the International Roughness Index (IRI), percent cracking, rutting (asphalt pavements), and faulting (concrete pavements). These measures are shown in the following tables.

TPM Pavement Condition Thresholds			
	Good	Fair	Poor
IRI (inches/mile)	<95	95 – 170	>170
Rutting (inches)	<0.2	0.20 - 0.40	>0.40
Faulting (inches)	<0.10	0.10 – 0.15	>0.15
Cracking (%)	<5	5 – 20 (asphalt) 5 – 15 (JCP) 5 – 10 (CRCP)	>20 (asphalt) >15 (JCP) >10 (CRCP)
PSR	PSR ≥ 4.0	2.0 ≤ PSR ≤ 4.0	P SR ≤ 2.0

Table 21 - TPM Pavement Condition Thresholds

NHS Pavement Performance Targets (Performance Period 2022 – 2026)				
	Previous Target (2018 - 2022)	Current Performance	2 Yr. Target (2024)	4 Yr. Target (2026)
Percentage of Interstate Pavements in Good Condition	50%	70.5%	N/A	>55%
Percentage of Interstate Pavements in Poor Condition	1%	0.1%	N/A	<1%
Percentage of Non-Interstate NHS Pavements in Good Condition	35%	46.9%	>40%	>40%
Percentage of Non-Interstate NHS Pavements in Poor Condition	3%	1.8%	<2%	<2%

Table 22 - NHS Pavement Targets – IRI, Rutting, Cracking, Faulting

The above pavement (Both NHS and Non-NHS performance targets) was compared against the 4-year targets documented in the 2021 -2024 Statewide Transportation Improvement Program (STIP). The results were that the performance targets listed in the TAMP met and exceeded the targets listed in the STIP.

NHS Bridge Performance Targets (Performance Period 2022 – 2026)				
	Previous Target (2018 - 2022)	Current Performance	2 Yr. Target (2024)	4 Yr. Target (2026)
Percentage of NHS Bridges by deck area in Good Condition	50%	63.3%	>55%	>55%
Percentage of NHS Bridges by deck area in Poor Condition	5%	1.7%	<3%	<3%

Table 23 - NHS Bridge Targets

The above bridge (Both NHS and Non-NHS) performance targets were compared against the 4-year targets documented in the 2021 -2024 STIP. The results were that the performance targets listed in the TAMP met and exceeded the targets listed in the STIP.

NHS Conduit Performance Targets (Performance Period 2022 – 2026)				
	Previous Target (2018 - 2022)	Current Performance	2 Yr. Target (2024)	4 Yr. Target (2026)
Percentage of NHS Conduits in Good Condition	50%	68.6%	>55%	>55%
Percentage of NHS Conduits in Poor Condition	5%	1.0%	<5%	<5%

Table 24 - NHS Conduit Targets

4 LIFE CYCLE PLANNING

Life Cycle Planning (LCP) is a central focus of ODOT's approach to managing its transportation network. This approach involves a significant portion of low-volume roads and bridges targeted to receive the recommended treatment for preventive maintenance. Another key component of this approach involves the collaborative work plan development with the Districts and the percent match requirements with the pavement management recommendations.

This section introduces LCP as a whole-life approach to managing transportation assets. The legislation defines LCP as "a process to estimate the cost of managing an asset class or asset sub-group over its whole life with consideration for minimizing cost while preserving or improving the condition (23 CFR 515.5)." LCP considers the many factors that impact asset performance, such as changes in asset condition over time that may be caused by traffic loads and volumes, environmental conditions, material properties, or construction practices. It considers treatment strategies over an analysis period that address expected deterioration cost-effectively.

4.1 Federal Requirements

The Federal Requirements for LCP Analysis (23 CFR 515.7(b)) include:

- Incorporating the State DOT targets for asset conditions for each asset class or asset sub-group into the analysis.
- Modeling deterioration for NHS bridges and pavements for each asset class or asset sub-group.
- Analyzing potential work types across the whole life of each asset class or asset sub-group with the general unit costs identified.
- Identifying management strategies for each asset class or asset subgroup to minimize the life cycle costs while achieving the 23 U.S.C. 150(d) performance targets for asset conditions.
- Identifying any subgroups that have been excluded, with justification for their exclusion.

Additionally, the new Bipartisan Infrastructure Law (BIL) updates, State DOTs are required to:

- Consider extreme weather and resilience as part of the life cycle cost and risk management analyses within a State TAMP (23 U.S.C. 119(e)(4)(D)).

4.2 Factors Impacting Life Cycle Costs

All transportation assets deteriorate over time. For example, the life of a Pavement is influenced by its original design, traffic volume, truck loads, freeze-thaw cycles, moisture in underlying layers, and many other factors. Similarly, Bridges and Conduits are impacted by many of the same factors that impact Pavements; however, material properties have a significant impact on performance. For instance, steel and concrete provide strength to a Bridge or Conduit if they are fully intact. Once they begin to corrode or crack, they start to lose their strength. This can be very expensive to repair, so ODOT avoids these expensive repairs with preservation activities, such as bridge cleaning, deck sealing, and deck sweeping.

The type and amount of deterioration can vary from one part of the State to another, so ODOT uses the results of its Pavement condition surveys and Bridge/Conduit inspections to monitor changes in condition over time. Mathematical models are used to establish deterioration rates for Pavements and Bridges so ODOT can plan for needed investments. This planning allows ODOT to determine the

appropriate timing for preservation activities, which cost-effectively extend the life of existing assets and have enabled ODOT to continue meeting its CSF.

4.3 Preservation Strategies

Preserving highway assets through long-term financial investments in timely preservation activities is similar to investments individuals make in car maintenance to preserve the car's value and keep it in working condition.

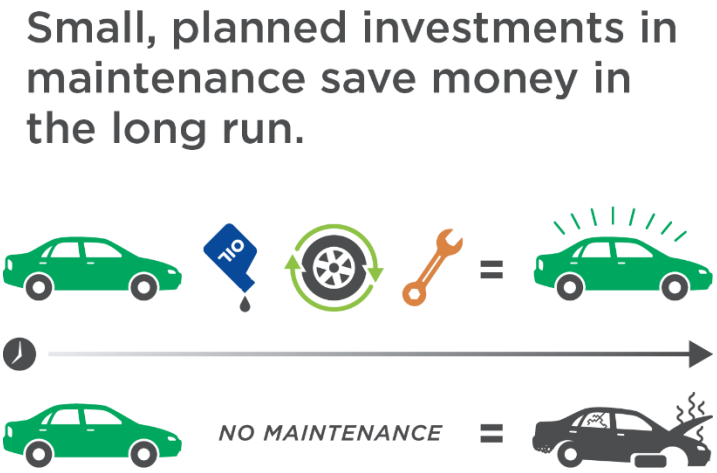


Figure 14 - Maintenance Saves Money

Similar to maintaining vehicles with properly timed oil changes and tune-ups, a long-term strategy based on routine, low-cost preservation treatments are a cost-effective way to maximize the service lives of highway assets. For Pavements, Bridges, and Conduits, the strategy requires the regular application of preservation treatments that delay the need for more costly rehabilitation and replacement. The timing of these treatments is critical to the success of the long-term preservation strategy since these treatments must be applied before significant deterioration has occurred.

4.4 Life Cycle Planning for Pavement

ODOT utilizes the dTIMS Pavement management system to model the deterioration of its Pavement network and to evaluate the long-term impacts of different maintenance and rehabilitation strategies based on factors such as the overall condition of the Pavement, the type, and severity of distress observed on the Pavement surface, and traffic levels. The Pavement management system serves as the foundation for the life cycle planning analysis that was conducted and continues to be used to develop and optimize strategies to keep the Districts accountable through percent match requirements.

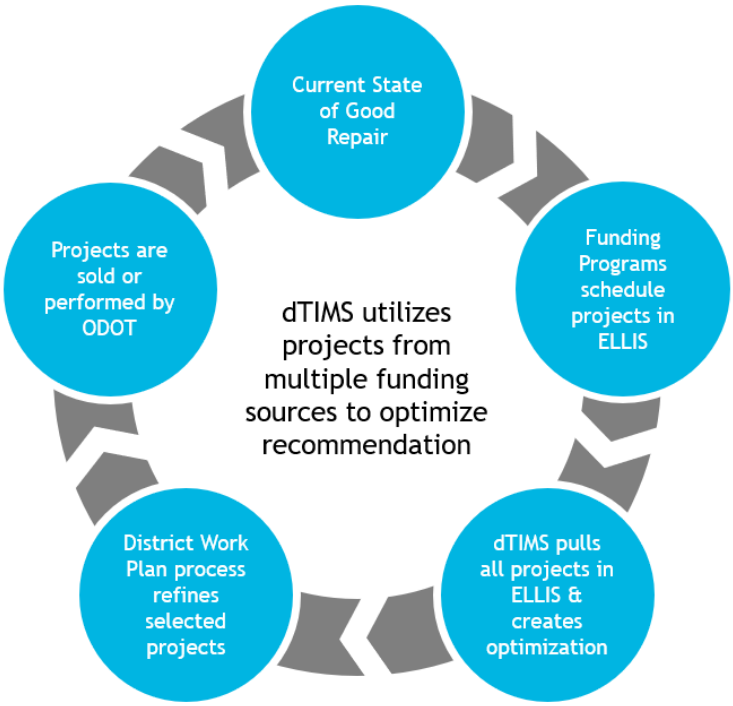


Figure 15 - dTIMS Life Cycle Planning

The Pavement management system predicts the rate of deterioration for each Pavement section using probabilistic performance models developed by the University of Toledo. Different models have been developed for each of the three highway systems (Priority, General,

and Urbanized State System), representing different traffic levels and rates of deterioration. The models were developed using over 15 years of historical Pavement condition survey results.

Excluded from the life cycle planning analysis are:

- The Urban system pavement network is excluded from dTIMS because the municipalities in those areas have oversight of the funding and investment decisions.
- Ramps, as they do not carry condition information.
- Some collector and distributor roads, as Districts have specified to exclude some.

In addition to deterioration models, the Pavement management system includes treatment rules that define the conditions under which different types of treatments are considered feasible. Traditionally, the Pavement management system treatment rules established recommendations for when to apply crack sealing, chip sealing (on low-volume roadways), and asphalt mill and overlays. The Pavement management recommendations were then provided to the Districts for consideration in developing their annual work plans and the Districts then determine the most appropriate treatments for the available funding, based on their knowledge of local conditions. Historically, asphalt mill and overlays were the most used treatment strategy for maintaining the system.

Typical Pavement preservation strategies vary based on system and traffic levels. Example Pavement preservation strategies used by ODOT on existing flexible and composite roads are presented below.

- General System – Low volume Pavements are typically treated with several chip seals applied on a 6- or 7-year interval, followed by a mill and fill around year 20. Additional repairs are applied as needed and crack sealing is applied every 5 years.
- Priority Routes (including the Interstate System) – These Pavements are repaired and resurfaced every 10 years, with crack sealing applied at year five.

In addition to the Pavement Management System, a report in the Transportation Asset Management Decision Support Tool (TAMDST) called the Poor Performers List is utilized. The Poor Performers List identifies Pavement that is deteriorating more quickly than expected but may be outside the scope of recommendation for treatment by dTIMS. Districts have some discretion to address various risk concerns and reviewing Pavement that is on the Poor Performers List may be considered for maintenance as part of the Annual District Work Plan process.

4.4.1 Pavement Life Cycle Planning Analysis

ODOT's pavement program continues to be focused on Preservation and the logic within dTIMS was developed to optimize this strategy. The dTIMS preservation strategies received extensive testing and refinement during the 2018 TAMP development, with proven results during the 2018 – 2022 performance period, achieving both the TPM and ODOT CSF goals.

The analysis performed in preparation for this performance period examined the established treatment strategies at three different funding levels over 10 and 20 years. A lower-than-expected funding level, a typical or average funding level, and an above-average funding level were leveraged to model different funding scenarios to account for different potential risk factors. The following discussion will examine the 10-year results.

4.4.2 General System

This analysis projected annual funding levels of $200M, $260M, and $300M over the analysis period, leveraging the existing treatment strategies. On average, 60 percent of the budget is spent on Rehabilitation, 30 percent on Preservation, and 10 percent on Reconstruction.

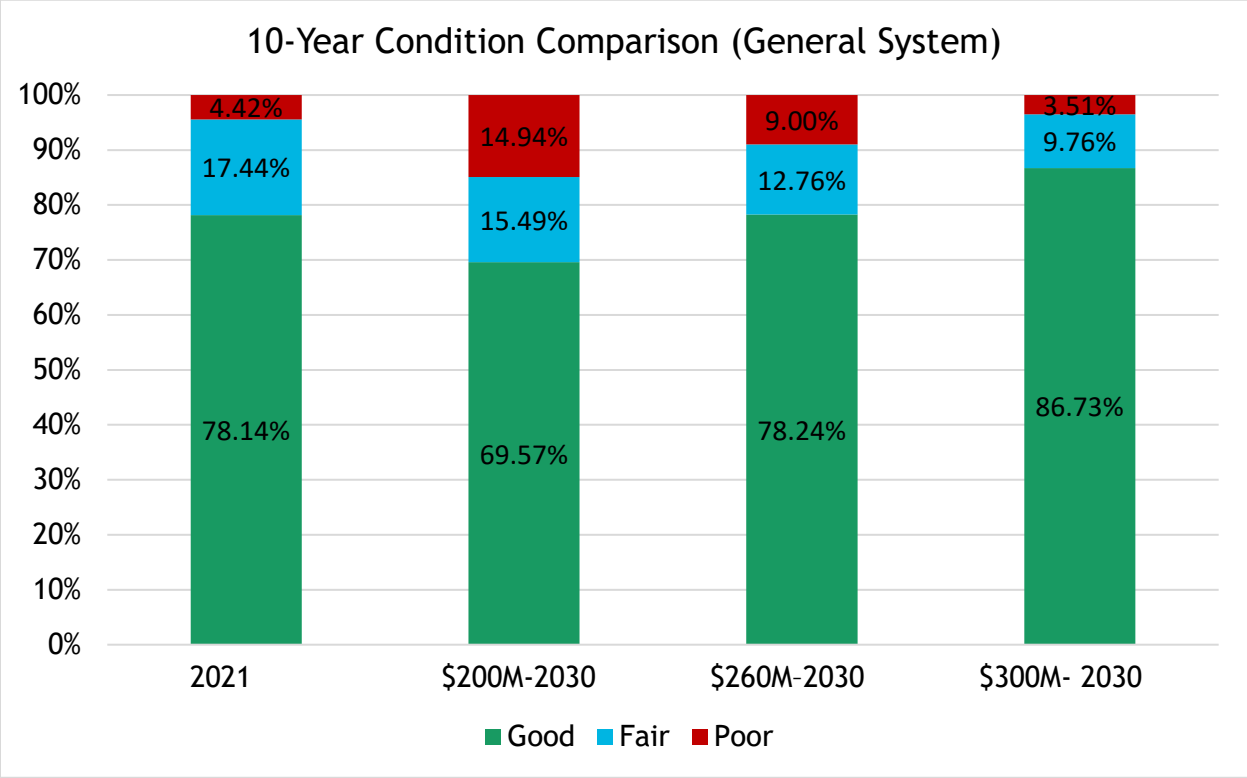


Table 25 - General System 10-Year Condition Comparison

As shown in the graph above, the $260M budget scenario can sustain the pavements in Good condition over the next ten years, however, the pavements in Poor condition are expected to increase to 9 percent. The $300M budget scenario can increase the percentage of pavements in Good condition by approximately 8 percent.

4.4.3 Priority System

This analysis projected annual funding levels of $200M, $260M, and $300M for the priority system over the analysis period, leveraging the existing treatment strategies. 48 percent of the budget is spent on Rehabilitation, 37 percent on Preservation, and 15 percent on Reconstruction. The budget allocation trend on the Priority System is similar to the General system, but in comparison spends 7 percent more on Preservation and 12 percent less on Rehabilitation.

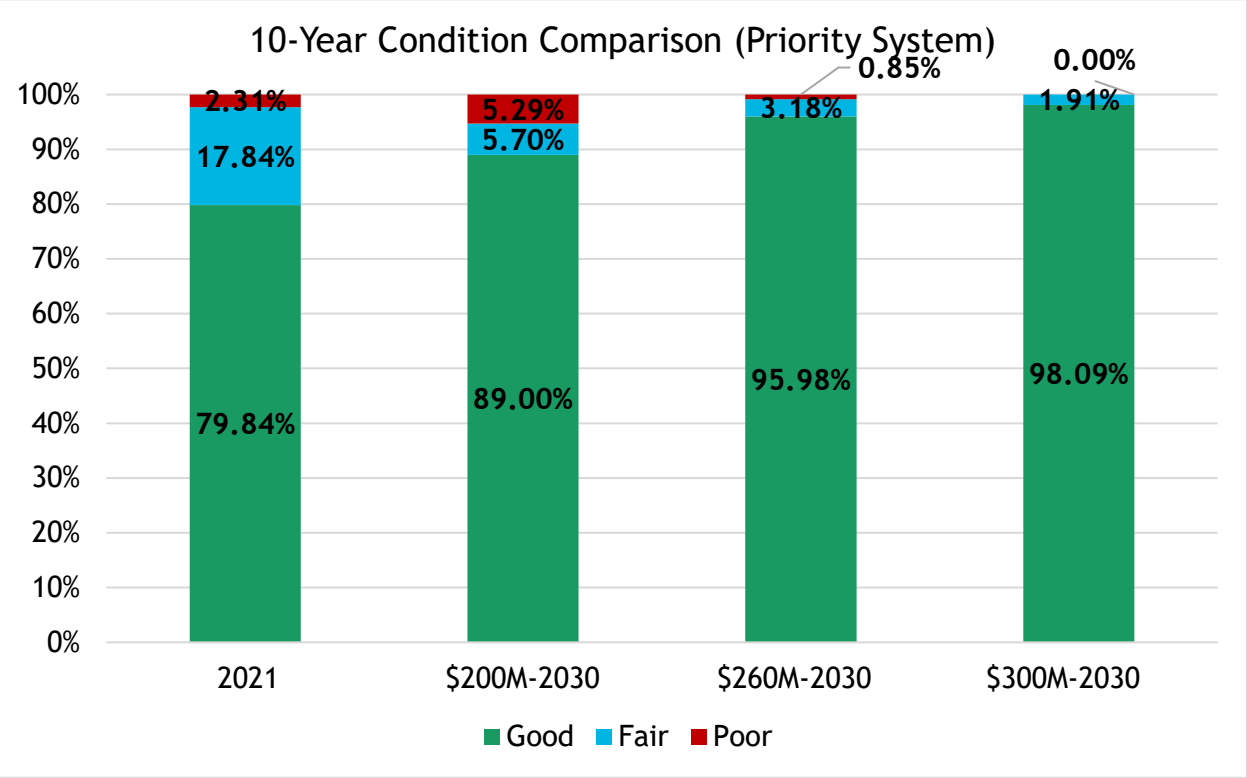


Table 26 - Priority System 10-Year Condition Comparison

Both the $260M and $300M budget scenarios result in over 95 percent of pavements being in Good condition over the 10 years.

4.4.4 Weighted Average PCR by Analysis Year

The PCR values are projected to remain steady until 2031 and are expected to meet performance targets.

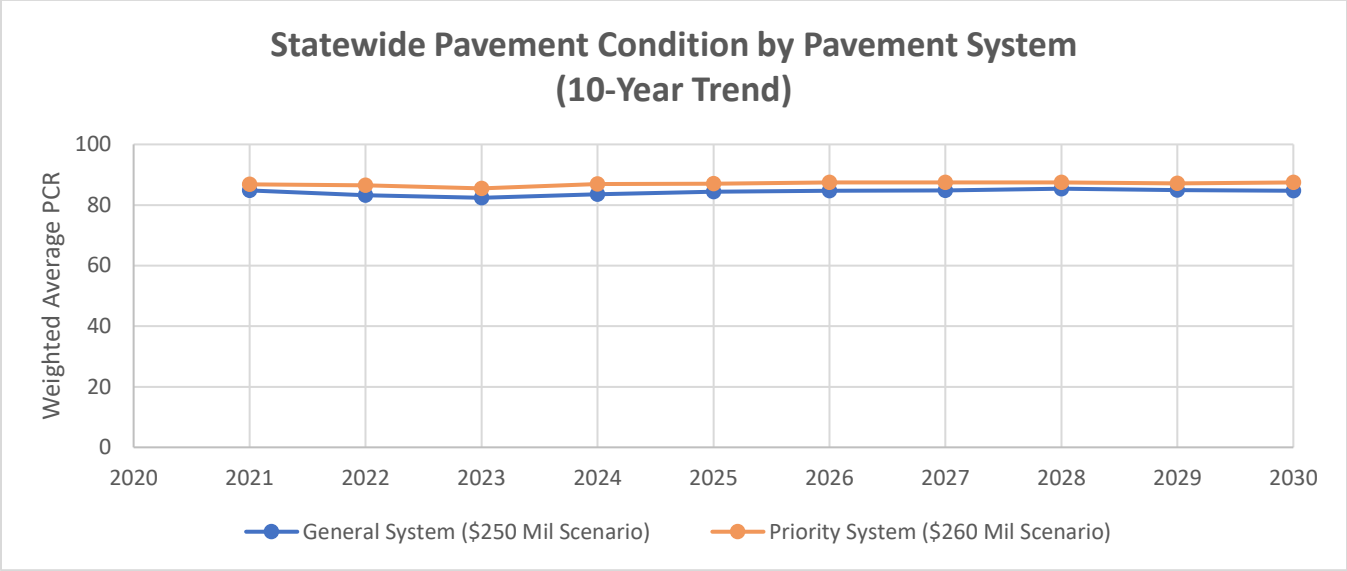


Table 27 - 10-Year Trend Statewide PCR Pavement Condition by Pavement System

4.4.5 Percentage Deficient Lane miles on each Pavement System by Analysis Year

As shown in the graph below, the General System has a higher percentage of deficient lane miles in comparison to the Priority System. This is expected due to the lower ODOT PCR KPI for the General System. On the General system, the current strategy sustains 5 percent deficient lane miles until 2024, when it begins to steadily increase to 9 percent deficient lane miles by 2028. The Priority System shows that the current strategy will support 3 percent deficient lane miles until 2025 when a steady decline in the percentage of deficient pavements is apparent until 2031.

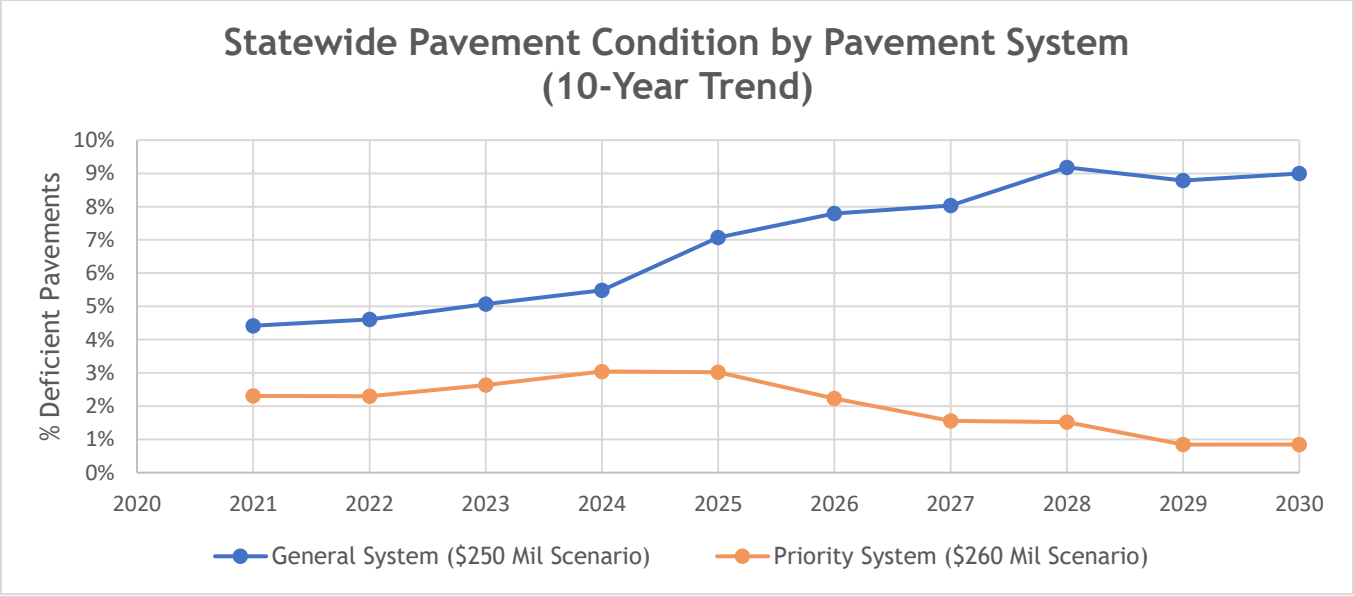


Table 28 - 10-Year Statewide Pavement Deficient Percentage Condition by Pavement System

4.5 Life Cycle Planning for Bridge

ODOT currently utilizes a spreadsheet analysis tool to conduct the life cycle analysis required for the bridge network. This analysis leverages representative rates of deterioration for bridge conditions, and various treatment cycles with a comparison of a traditional rehabilitation approach (which predominately includes deck replacement and bridge replacement in a worst-first prioritization) with a strategy that increased the amount of preservation work, with each strategy aiming to maintain current condition levels.

4.5.1 The Trade-off of Funding and Condition

Note for the below graphics, "Long-term" is based on a 200-year analysis period of computing life cycle costs. Because of discounting, future costs are given less weight, which increases the benefit of delaying big costs by utilizing preservation work. Since replacement costs are considerable, this calculation ensures we account for the future cost of keeping each transportation network link in operation by replacing bridges at the end of their economic life, even though it is far in the future. This long-term calculation ensures we capture those future costs in the calculation.

Below is the general appraisal information for the NBI NHS, Non-NBI NHS, Non-NHS, and Turnpike NHS. Additionally, the Deck, Wearing Surface, and Protective Coating information are shown for NBI NHS. To see this information for the other networks, please refer to Appendix C.

Ohio Bridge NBI NHS (All Owners) Analysis:

General Appraisal:

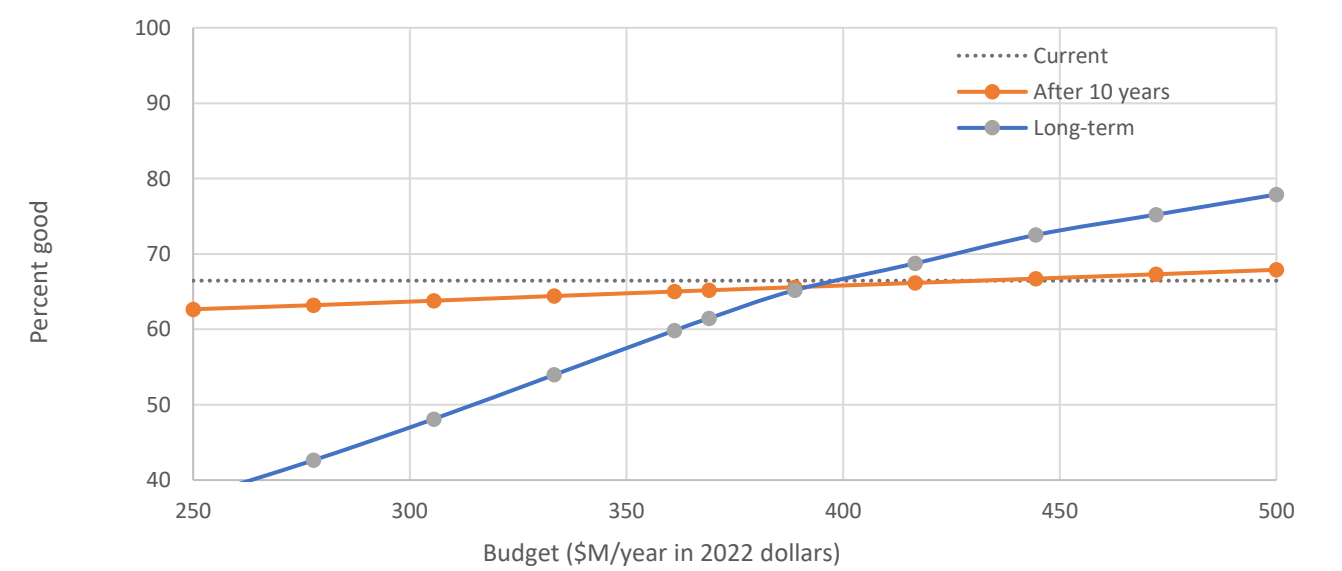


Table 29 - Ohio Bridge NBI NHS All Owners Analysis General Appraisal

Deck:

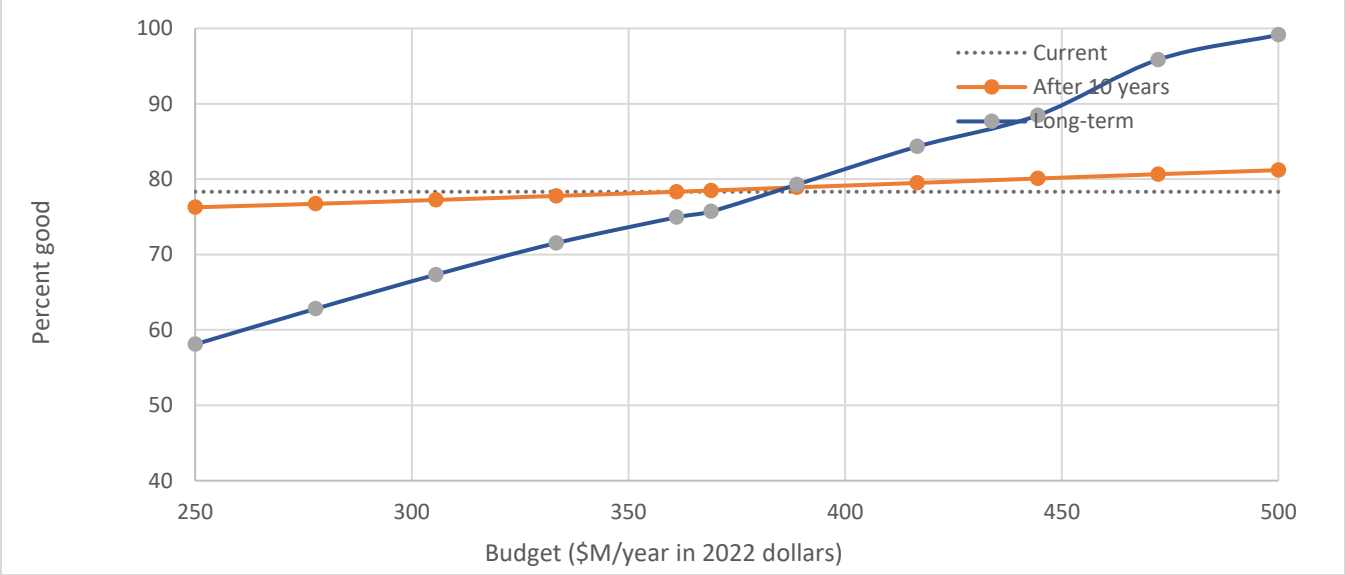


Table 30 - Ohio Bridge NBI NHS All Owners Analysis Deck

Wearing Surface:

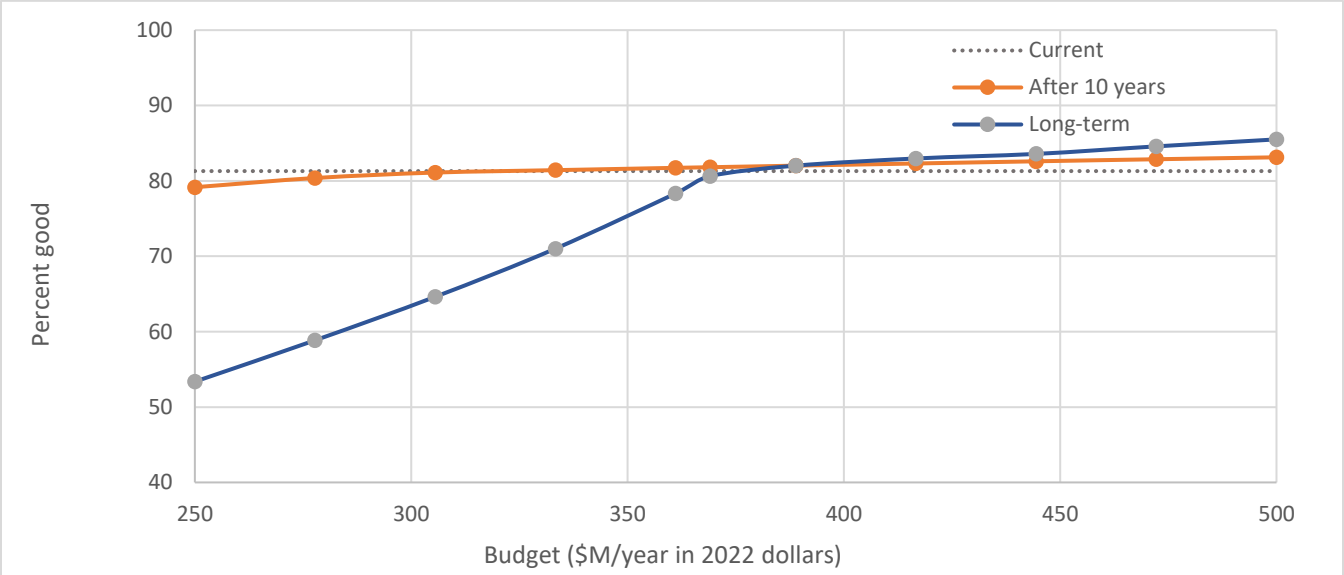


Table 31 - Ohio Bridge NBI NHS All Owners Analysis Wearing Surface

Protective Coating:

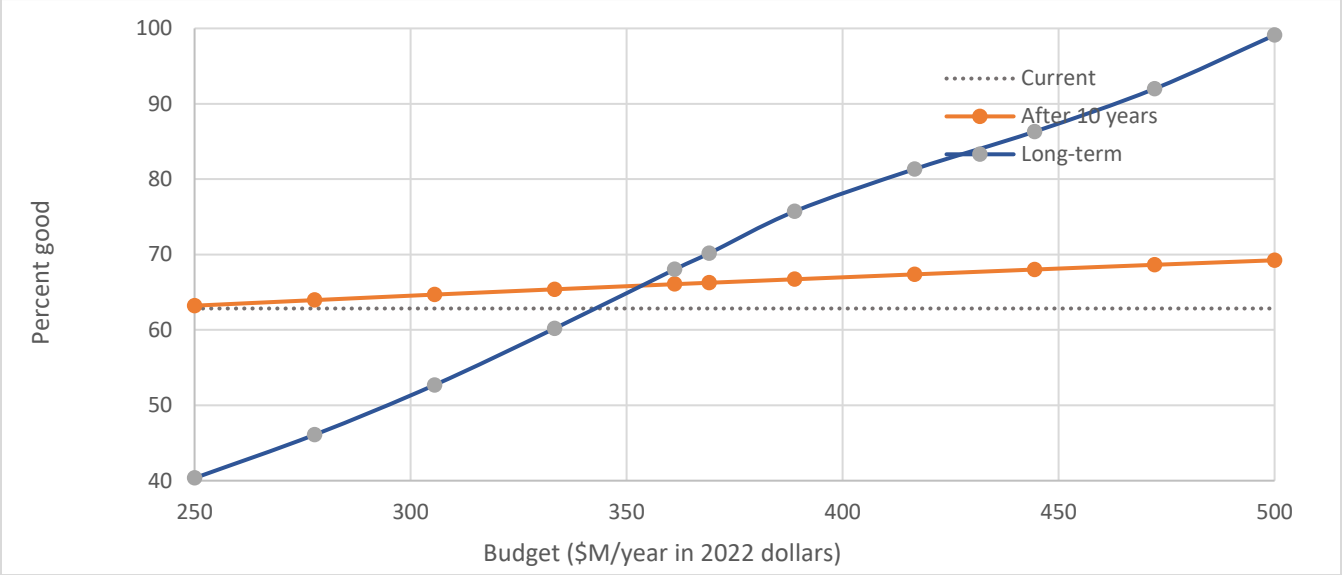


Table 32 - Ohio Bridge NBI NHS All Owners Analysis Protective Coating

Ohio Bridge Non-NBI NHS (ODOT-Owned) Analysis:

General Appraisal:

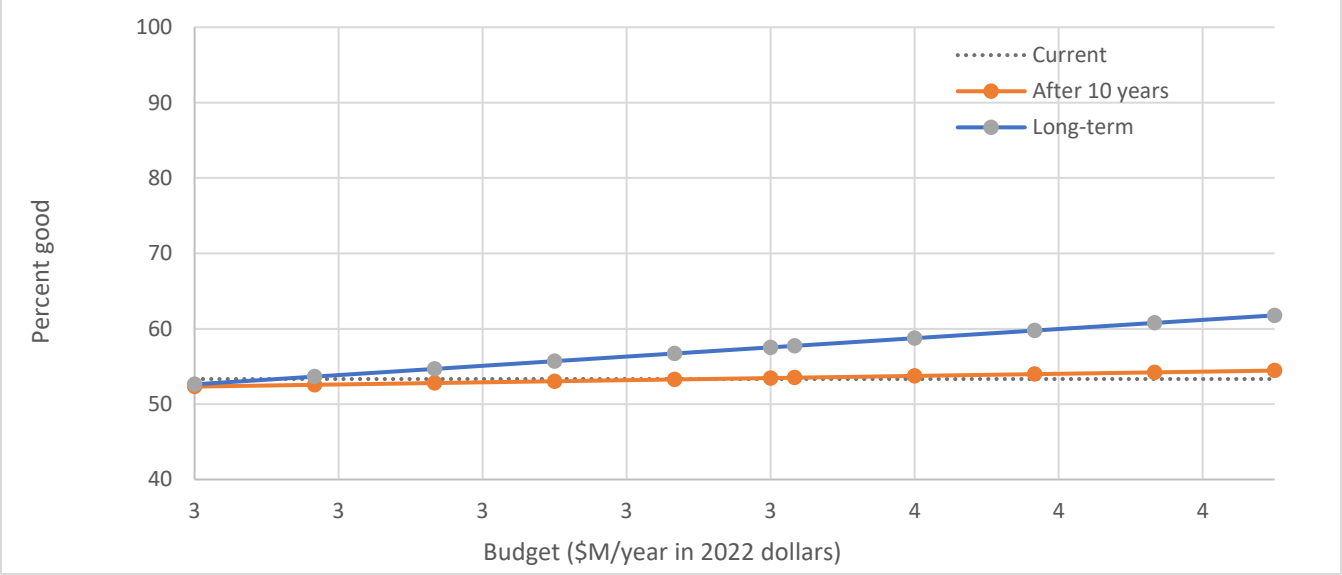


Table 33 - Ohio Bridge Non-NBI NHS ODOT Owned Analysis

Ohio Bridge Non-NHS (ODOT-Owned) Analysis:

General Appraisal:

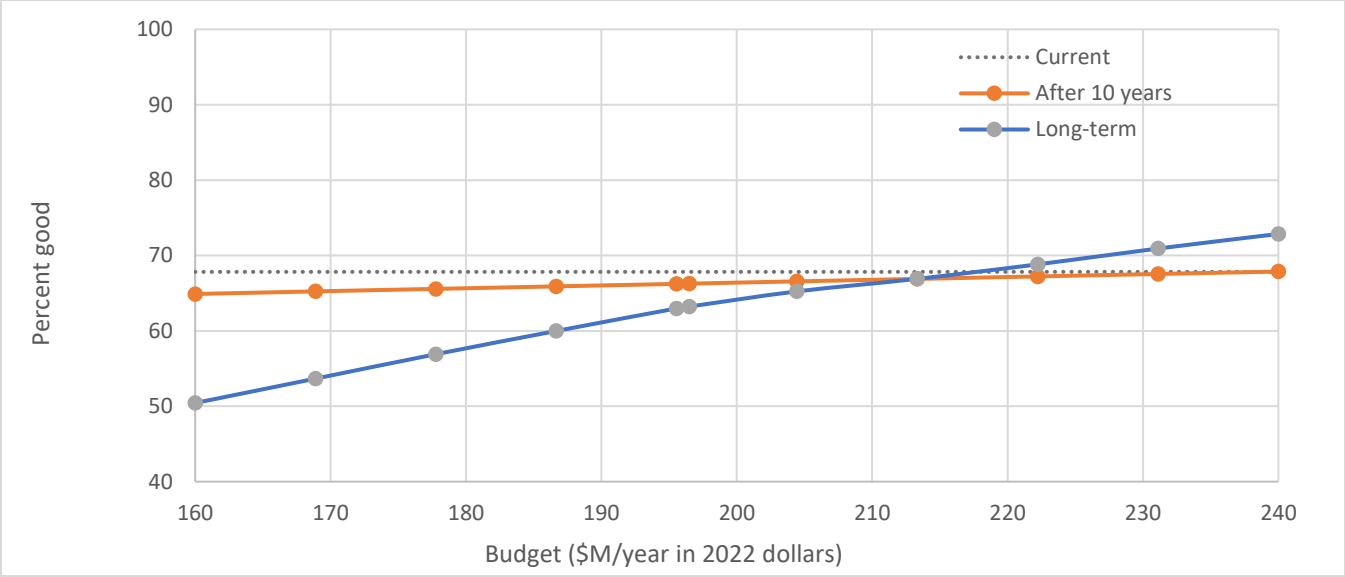


Table 34 - Ohio Bridge Non-NHS ODOT Owned Analysis

Ohio Bridge Turnpike NHS (Turnpike-Owned) Analysis:

General Appraisal:

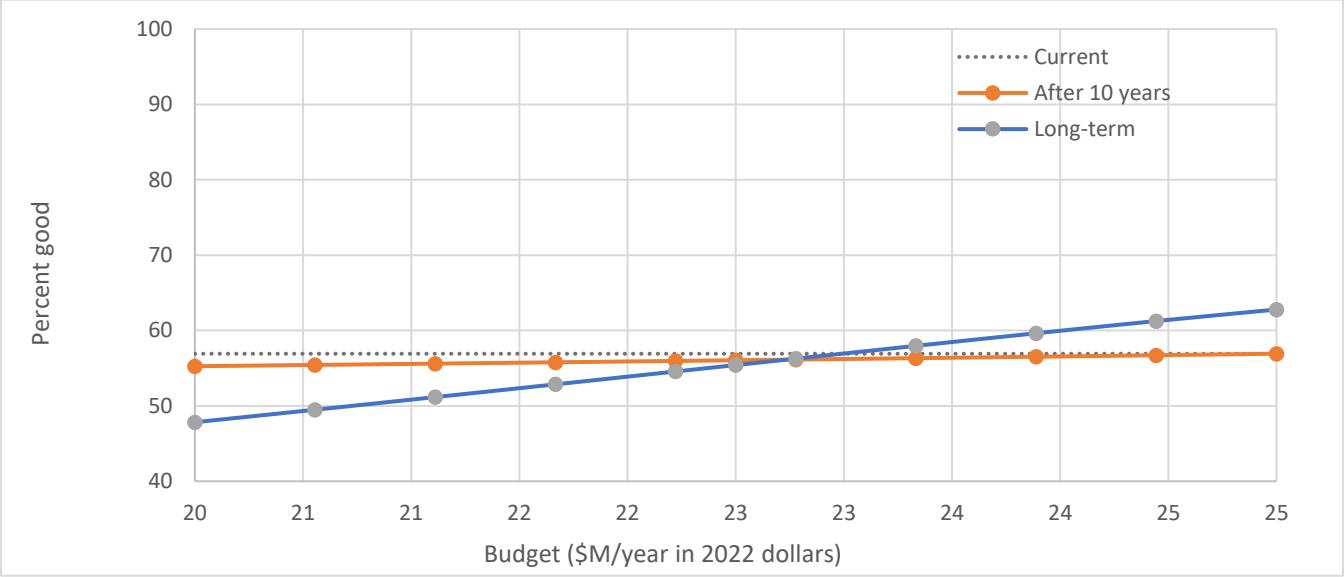


Table 35 - Ohio Bridge Turnpike NHS Turnpike Owned Analysis

4.5.2 Return on Investment

These LCP analysis results were analyzed in their current conditions to assess the return on investment that ODOT achieves from this preservation strategy. The analysis assumed that roughly the same conditions from year to year would be maintained over the long term. The preservation model was calibrated to keep conditions roughly constant. The findings were that ODOT's preservation strategy yields a 47 percent return on investment for the NBI NHS. The non-NHS result showed a 69 percent return on investment.

4.5.3 Bridge Management Application

As noted in Chapter 1, ODOT is planning to implement the AASHTOWare BrM Bridge Management program to enhance the life cycle analysis capabilities. ODOT is committed to implementing the BrM system. Our current Strategic Technology Plan schedule has AASHTOWare BrM being implemented for use in the 2024 work plans.

ODOT has fully implemented AssetWise for the inventory and inspection data collection process for Ohio's Bridges. The AssetWise system houses all structure data for ODOT and local bridges, creating a platform across entities to ensure NBI data is collected in a consistent format.

This application implementation project was scheduled to begin in late 2019, but staffing availability delayed the start of the project, as other bridge-related applications have required the team's attention including the implementation of a new permitting system, and implementation of a new bridge load rating systems for the Special Hauling Vehicles (SHV) and the Emergency Vehicles (EV). The 2020 COVID-19 pandemic further delayed the BrM implementation due to resource IT staffing resource availability.

4.6 Life Cycle Planning for Conduit

4.6.1 Life Cycle Activity Profile

ODOT performed a life cycle cost and deterioration analysis to analyze the potential outcomes of future investment levels.

Ohio Conduit NHS Analysis:

The below scenario recognizes a 19 percent life cycle cost savings from the preservation scenario.

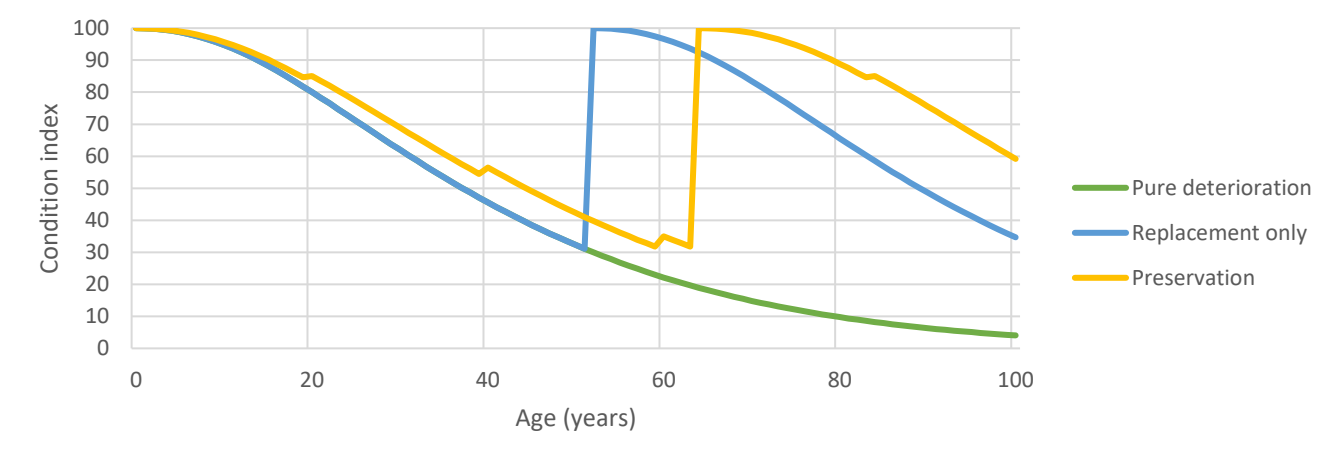


Table 36 - Ohio Conduit NHS Analysis – Life Cycle Cost Savings

Ohio Conduit Non-NHS Analysis:

The below scenario recognizes a 13 percent life cycle cost savings from the preservation scenario.

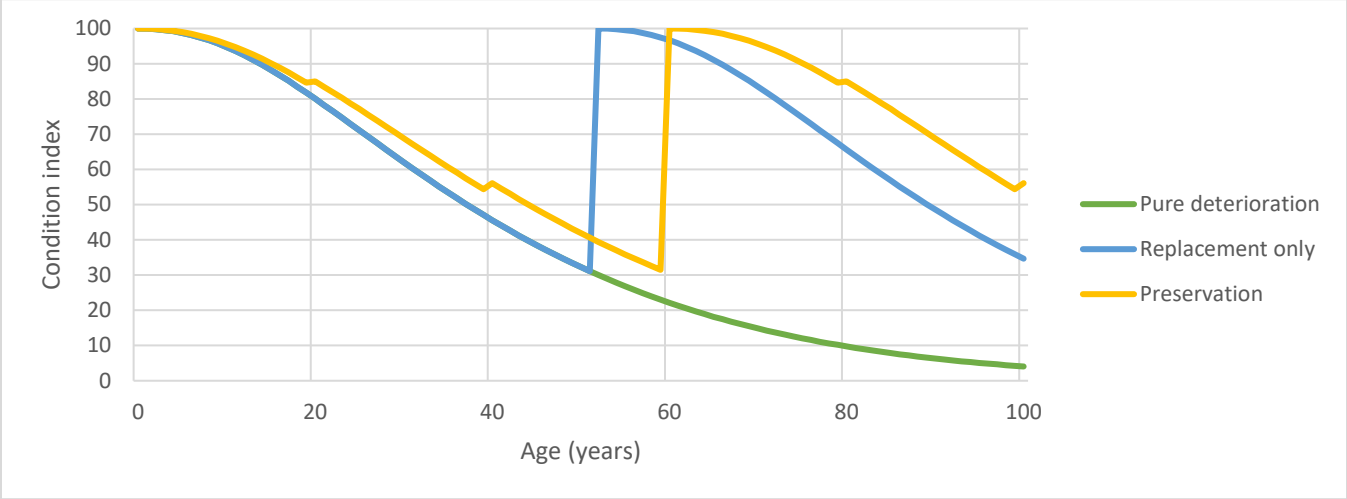


Table 37 - Ohio Conduit Non-NHS Analysis - Life Cycle Cost Savings

4.6.2 The Trade-off of Funding and Condition

The below graphics are the result of a sensitivity analysis of investment level. The result, as expected, is that more money will yield better conditions.

Ohio Conduit NHS Analysis:

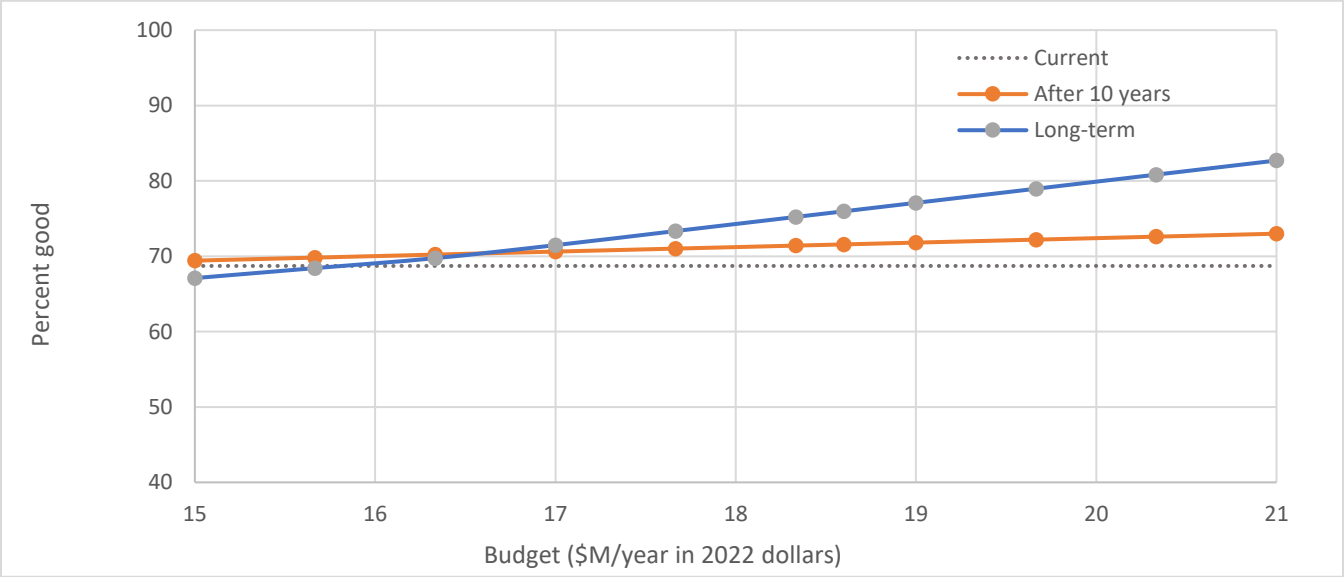


Table 38 - Ohio Conduit NHS Analysis - Budget

Ohio Conduit Non-NHS Analysis:

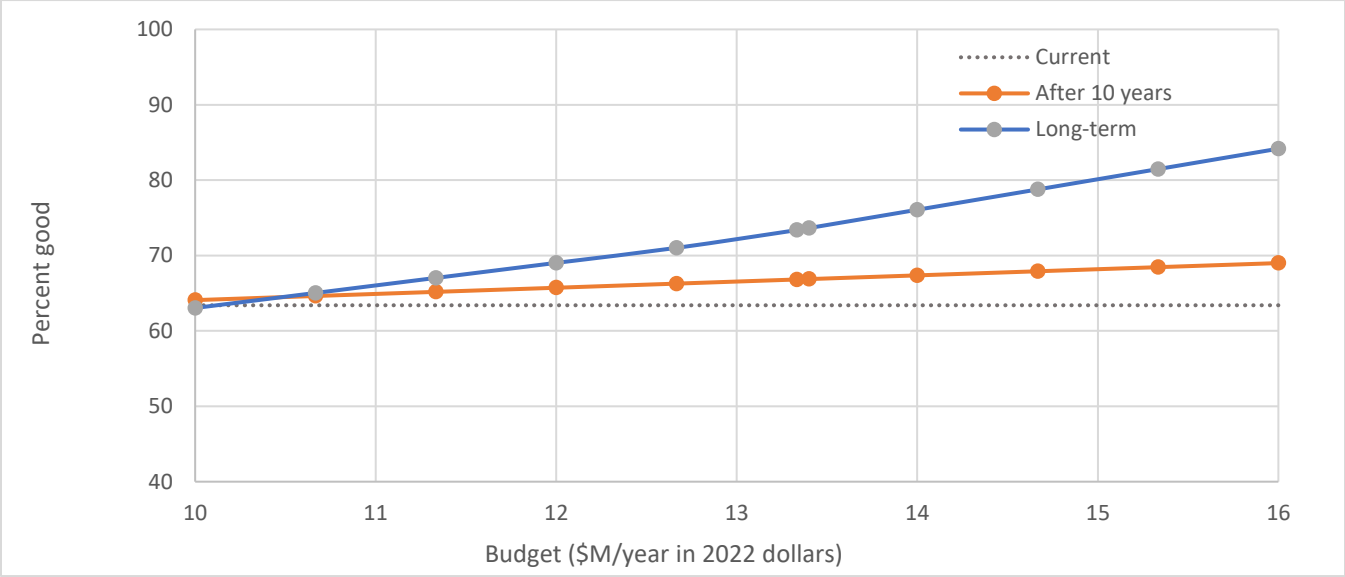


Table 39 - Ohio Conduit Non-NHS Analysis – Budget

4.6.3 Return on Investment

The networks were analyzed in their current conditions to assess the return on investment that ODOT achieves from its preservation strategy. The analysis assumed that roughly the same conditions from year to year would be maintained over the long term. The preservation model was calibrated to keep conditions roughly constant. The findings were that ODOT's preservation strategy yields a 52 percent return on investment for the NHS. The non-NHS result was almost the same at a 49 percent return on investment.

4.7 Life Cycle Costs for Extreme Weather and Resilience

The BIL amendments which took effect on October 1, 2021, instruct State DOTs to consider extreme weather and resilience as part of the life cycle analysis. ODOT's current processes for project selection through the Annual District Work Plan Process and Risk Management strategies provide ODOT planners and engineers the ability to factor in these risks to the agency's strategies.

Conducting a sound life cycle analysis accounting for future extreme weather scenarios requires an understanding of several factors potentially including specific potential impacts, impacts on materials performance, impacts on funding, and impacts on ODOT's project selection processes among others. In Chapter 5, ODOT details a variety of initiatives related to extreme weather and resilience already complete, as well as a proposed project to develop a comprehensive Resiliency Improvement Plan. This plan will enable ODOT to develop a holistic approach for continuing to achieve the SOGR while accounting for these additional risk factors.

Additionally, FHWA indicated in May 2022 that complete ruling making regarding these BIL requirements will not be complete until 2023 at the earliest. Once the rulemaking is available, ODOT can evaluate the TAM program to determine any specific improvements that may be necessary to fully achieve the BIL goals as related to asset life cycle planning.

4.8 Work Type Summaries

The life cycle planning strategies presented in this chapter assume that a range of treatments will be considered over the life of an asset, as shown in the following graphic. Each type of treatment serves a different function in keeping an asset operational and the costs vary as the magnitude of the treatment increases. Life cycle strategies that promote the timely application of maintenance and preservation treatments, such as the strategies we have adopted, are cost-effective because they defer the need for more costly rehabilitation and reconstruction activities.

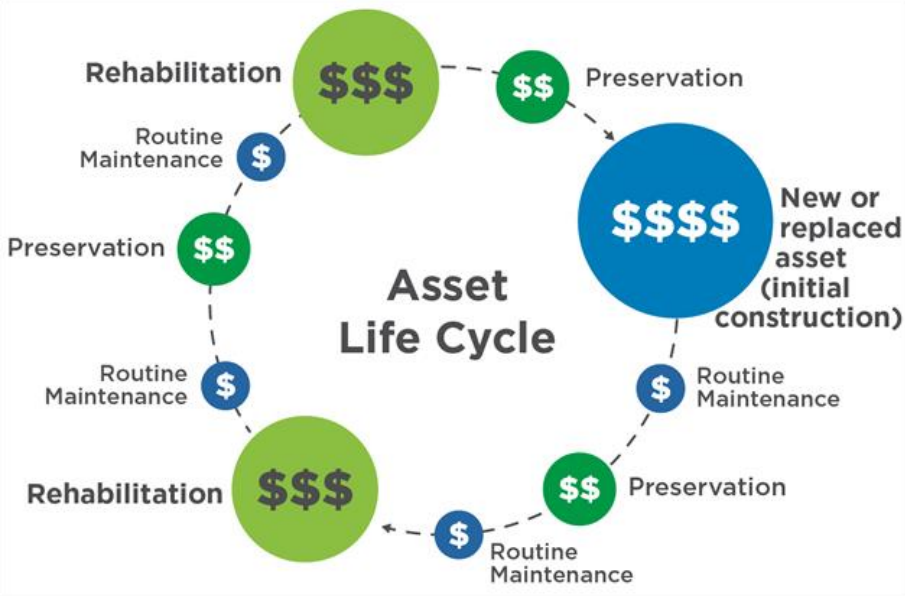


Figure 16 - Asset Life Cycle

The investment strategies presented in Chapter 8 allocate funding to the five different types of work activities required by FHWA: Initial (New) Construction, Maintenance, Preservation, Rehabilitation, and Reconstruction. Within each of these work categories, there are a variety of different types of improvements that we use regularly.

Initial Construction – This category refers to the construction of new assets, including Pavements or Bridges, on new alignments. Adding new Pavement lanes to an existing highway to address congestion is an example of an activity that falls in this category.

Reconstruction – Work activities in this category involve the complete replacement of an existing asset to serve the same alignment once the asset reaches the end of its service life. For a Pavement, it involves replacing both the surface and base layers. For a Bridge or Conduit, it involves the complete replacement of the Bridge or an open-cut replacement of a Conduit.

Rehabilitation – This category involves major work to restore the structural integrity of an asset as well as work that may be necessary to correct major safety defects. For Pavements, rehabilitation may involve a structural overlay of the Pavement surface. For Bridges, repairs to, or replacement of, one or more major Bridge elements, such as deck replacement or substructure rehabilitation may be included. For Conduits, rehabilitation may involve slip lining or spray-on linings.

Preservation – This category includes low-cost treatments applied to assets in relatively good condition to slow the rating of deterioration or address minor repairs. For Pavements, preservation treatments include chip seals, micro-surfacing, and thin overlays. For Bridges, it includes Bridge and

joint sealing, Bridge deck resealing, and painting of steel elements. For Conduits, preservation activities may include joint sealing or internal band sealing.

Routine Maintenance – Maintenance activities may include cyclic activities, such as joint sealing or crack filling, to prevent damage to underlying layers. Routine maintenance may also include repairs to address safety-related issues to keep the asset operational.

The following tables illustrate the types of treatments ODOT may consider in each of the work type categories included in the investment strategies. Additionally, ODOT analyzed over 200,000 capital and maintenance projects or activities which occurred between 2018 – 2022 to determine average low, medium, and high costs for these activities.

Please note:

- This analysis leveraged the best available data from the ELLIS and EIMS databases. The granularity of information per current record-keeping business rules presents limitations in the analysis capabilities.
- Some project costs averages reflected in the following tables may not fully represent all labor, material, or other associated costs for each activity.
- To determine average low, medium, and high costs, all projects within a treatment type were categorized as low, medium, or high based on a statistical 1/3 breaking point of the overall project cost or per mile cost (if applicable). An average low, medium, or high cost was then calculated for each grouping.
- Pavement activities are generally summarized by per mile cost, though some activities may be per project based on available data.
- Bridge and conduit activities are summarized on an average per project cost.
- These tables are not necessarily exhaustive lists of all treatment activities ODOT may leverage.

Pavement Work Type Summary

FHWA Work Category	Treatment Type	Average Low	Average Medium	Average High
Preservation	Durapatching	$458	$886	$1,343
Preservation	Four Lane Resurfacing	$1,010,439	$1,249,106	$2,090,728
Preservation	Microsurfacing	$219,387	$272,978	$969,617
Preservation	Mill And Fill	$460,291	$1,017,985	$1,606,278
Preservation	Pavement Planning	$867	$1,856	$4,098

Pavement Work Type Summary

FHWA Work Category	Treatment Type	Average Low	Average Medium	Average High
Preservation	Resurfacing	$527,042	$593,652	$2,331,651
Preservation	Resurfacing	$281,826	$493,837	$1,643,701
Preservation	Resurfacing, Undivided	$364,367	$275,174	$543,452
Preservation	Spot Paving	$7,173	$12,207	$14,429
Preservation	Strip Seal	$1,552	$2,803	$2,904
Preservation	Two Lane Resurfacing	$352,754	$588,696	$906,835
Reconstruction	Asphalt Pavement Repairs - Full Depth	$3,073	$6,472	$14,141
Reconstruction	Asphalt Pavement Repairs - Partial Depth	$3,265	$10,030	$14,317
Reconstruction	Concrete Pavement Repairs - Full Depth	$1,590	$3,970	$9,115
Reconstruction	Concrete Pavement Repairs - Partial Depth	$1,339	$2,667	$5,540
Reconstruction	Major Reconstruction	$4,528,138	$17,342,485	$184,287,013
Reconstruction	Minor Widening	$1,461,420	$4,663,313	$7,759,523
Rehabilitation	AC Inlay	$149,271	$277,933	$979,520
Rehabilitation	AC Overlay with Repairs	$551,403	$877,147	$3,037,168
Rehabilitation	AC Overlay Without Repairs	$453,131	$685,879	$2,406,556

Pavement Work Type Summary

FHWA Work Category	Treatment Type	Average Low	Average Medium	Average High
Rehabilitation	Concrete Pavement Repair	$459,837	$596,064	$2,958,581
Rehabilitation	Fine Graded Polymer Ac Overlay	$348,377	$538,537	$951,848
Rehabilitation	Intersection Improvement	$3,543,146	$5,826,503	$7,538,903
Rehabilitation	Intersection Improvement (Safety)	$3,327,414	$5,993,581	$8,471,508
Rehabilitation	Minor Rehabilitation	$325,069	$1,178,978	$774,619
Rehabilitation	New Flexible Pavement	$4,200,299	$6,356,192	$20,158,182
Rehabilitation	Reconditioning Shoulders	$403	$1,130	$3,218
Rehabilitation	Roadway Improvement (Safety)	$4,241,191	$5,004,780	$12,295,680
Rehabilitation	Roadway Major Rehab	$1,708,946	$4,038,569	$50,802,456
Rehabilitation	Roadway Minor Rehab	$344,481	$629,613	$1,432,605
Rehabilitation	Widening And Resurface	$404,531	$2,091,445	$4,503,112
Routine Maintenance	2 Lane Resurfacing	$295,034	$490,433	$1,595,803
Routine Maintenance	Chip Seal	$126,284	$235,143	$399,476
Routine Maintenance	Crack Sealing	$43,142	$83,267	$128,473

Pavement Work Type Summary

FHWA Work Category	Treatment Type	Average Low	Average Medium	Average High
Routine Maintenance	Double Application Microsurfacing	$569,349	$478,385	$621,823
Routine Maintenance	Microsurfacing	$158,631	$284,059	$808,493
Routine Maintenance	Pavement Maintenance	$57,903	$140,117	$657,179
Routine Maintenance	Pavement Patching	$101	$264	$1,170
Routine Maintenance	Preventative Maintenance	$204,092	$439,246	$551,856
Routine Maintenance	Thin lay Asphalt	$134,130	$147,922	$522,047

Table 40 - Pavement Work Type Summary

Bridge Work Type Summary

FHWA Work Category	Treatment Type	Average Low	Average Medium	Average High
Preservation	Bridge Preservation	$470,476	$996,527	$6,107,366
Preservation	Patching concrete structures	$722	$8,305	$16,858
Preservation	Slope and channel scour protection	$772	$4,324	$12,725
Preservation	Special - Patching Concrete Bridge Decks	$4,613	$10,659	$19,669
Preservation	Treating concrete	$1,123	$2,152	$3,715
Reconstruction	Add Through Lane(s)	$33,701,824	$49,728,377	$110,433,343
Rehabilitation	Approach slabs	$1,582	$3,328	$5,039
Rehabilitation	Joint Repair	$643	$2,395	$5,110

Bridge Work Type Summary

FHWA Work Category	Treatment Type	Average Low	Average Medium	Average High
Rehabilitation	Railings	$1,138	$1,954	$2,983
Routine Maintenance	Bridge cleaning	$117	$337	$1,388
Routine Maintenance	Bridge Maintenance	$301,541	$671,129	$2,805,538
Routine Maintenance	Bridge Repair per Force Account	$1,212	$2,406	$4,238
Routine Maintenance	Bridge Sweeping	$69	$150	$404

Table 41 - Bridge Work Type Summary

Conduit Work Type Summary

FHWA Work Category	Treatment Type	Average Low	Average Medium	Average High
Preservation	Culvert or Storm Spot Repair	$679	$1,715	$3,904
Preservation	Culvert Preservation	$243,270	$539,858	$1,335,095
Reconstruction	Drainage Structure Replacement	$1,062	$2,756	$12,771
Reconstruction	Storm Sewer/Storm Drain Replacement	$2,347	$5,371	$19,480
Rehabilitation	Culvert Invert Field Paving	$2,902	$4,926	$9,293
Rehabilitation	Culvert Jack and Bore	$4,732	$10,459	$18,799
Rehabilitation	Curbing	$3,029	$8,989	$34,009
Rehabilitation	Linear Grading - Streams	$889	$1,904	$5,345
Rehabilitation	Pipe Culvert Replacement	$2,952	$5,899	$11,188
Rehabilitation	Storm Sewer/Storm Drain Extension	$985	$2,036	$10,593

Conduit Work Type Summary				
FHWA Work Category	Treatment Type	Average Low	Average Medium	Average High
Routine Maintenance	Cleaning Drainage Structures	$329	$935	$2,535
Routine Maintenance	Culvert Repair or Extension	$1,556	$3,241	$6,003
Routine Maintenance	Drainage System Maintenance	$84,926	$262,676	$335,647
Routine Maintenance	Linear Grading - Ditch Cleanout	$596	$3,325	$6,511

Table 42 - Conduit Work Type Summary

5 RISK MANAGEMENT

Risk management is a critical component of successful asset management. This includes day-to-day concerns, such as addressing the risk that assets will deteriorate faster than expected or projects will cost more than budgeted. However, managing risk also involves enterprise-level risks with widespread impacts.

5.1 Federal Requirements

FHWA defines risk and risk management, in the context of transportation asset management, as follows:

- Risk: The positive or negative effects of uncertainty or variability upon agency objectives. (23 CFR 515.5).
  Risk Management: The processes and framework for managing potential risks, including identifying, analyzing, evaluating, and addressing the risks to assets and system performance. (23 CFR 515.5).

Risk Management Analysis (23 CFR 515.7(c)). The TAMP must describe a methodology for:

- Identifying risks that can affect the condition of NHS pavements and bridges, and the performance of the NHS, including the risks listed in 23 CFR 515.7(c)(1).
- Assessing the identified risks in terms of the likelihood of their occurrence and their impact and consequence if they do occur.
- Evaluating and prioritizing the identified risks.
- Developing a mitigation plan for addressing the top priority risks that involve potentially negative consequences.
- Developing an approach for monitoring top priority risks.
- Including in the analysis, and considering, a summary of the results of the 23 CFR Part 667 evaluations of facilities in the State repeatedly damaged by emergency events, including at a minimum the results relating to NHS pavements and bridges.
- The TAMP requirements amended by the BIL (§ 11105) to require that States take into consideration extreme weather and resilience within their risk management analysis.

5.2 Risk Management Approach

ODOT has considered risks in managing its transportation network for years. ODOT's risk management approach is managed through two primary mechanisms: Primary and long-term risk management evaluation.

Sections 5.3 through 5.5 describe various primary risk management protocols leveraged by ODOT staff throughout the asset life cycle.

Sections 5.6 and 5.7 discuss ODOT's approach to identifying long-term or new risks through a periodic risk assessment and review and then incorporating their mitigation actions into the Primary Risk Management strategies.

5.3 Risk Identification

ODOT incorporates risk management strategies into regular decision-making processes to ensure risks are being actively managed. These procedures follow a risk management framework involving the following five steps:

1. Establish the context – identify what risks will be considered and how they will be evaluated.
2. Identify risks – identify the risks that could hinder ODOT's ability to achieve its Asset Management objectives.
3. Analyze risks – use agency-established metrics to evaluate the likelihood and impact of each risk.
4. Evaluate risks – prioritize the results of the analysis.
5. Treat risks – identify a plan for mitigating the top priority risks. The process also includes monitoring risks regularly as risk priorities change, communicating the results of the analysis both internally and externally, and consulting with specialists throughout the process.

Considering risk is important in developing TAM strategies because transportation agencies often must spend significant resources responding to and/or mitigating risks. Reacting to the uncertainty presented by risks can be more expensive than proactive management. Risk management strengthens asset management by explicitly recognizing that any objective faces uncertainty, and by identifying strategies to reduce uncertainty and its effects.

Given the importance of risk management for supporting asset management, agencies should formally identify and manage risks at all organizational levels. The graphic below shows four levels at which risks can be identified within an agency and the typical responsibility of that risk within the organization.

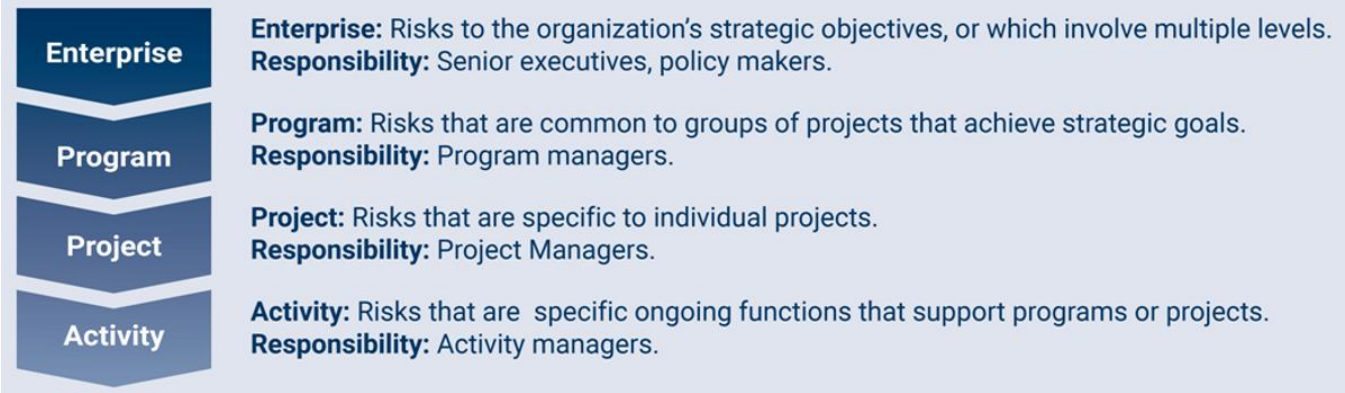


Figure 17 - Agency Level Risks and Responsibility

5.4 Risk Prioritization

Risks are rated based on the likelihood that the uncertainty will occur and the impact, or consequence if it does occur. To facilitate the identification and rating of risks, ODOT developed the following likelihood and impact rating scales. For determining likelihood, ODOT established criteria in terms of both probability and frequency. For impact, ODOT established criteria for a variety of factors, including economic impact, legal compliance, and safety.

ODOT Risk Likelihood Ratings

Risk Ranking	Likelihood	Frequency	Risk Score
Very High or Almost Certain	Near Certainty (90%)	Within 1 Year	5
High or Likely	Highly Likely (70%)	Within 2 Years	4
Moderate	Likely (50%)	Within 3-5 Years	3
Low or Unlikely	Unlikely (20-30%)	Within 6-10 Years	2
Very Low or Rare	Remote (10%)	Within More Than 10 Years	1

Table 43 - Risk Likelihood Ratings

ODOT Risk Impact Ratings

Factor	Impact on System Performance Score				
	Insignificant/ Little	Low/Some	Moderate/ Noticeable	High/ Large	Catastrophic
	1	2	3	4	5
Asset Valuation/ Economic Impact	< $50M	$50M-$100M	$100M-$500M	$500M-$2.2B	> $2.2B
Legal Compliance	In Compliance	Agrees to Compliance Schedule	Adopts Corrective Action	Expects to Comply Within 1 Year	No Viable Plan to Comply
Public Expectations	Minor complaints	Unplanned Disruption < 1 Day	Multiple Unplanned Disruptions 1-4 Days	Large Number of Unplanned Disruptions 5-29 Days	Unplanned Disruption to Essential Services > 30 Days
Safety	None	Minor	Serious	Single Fatality	Multiple Fatalities
Reputation	None	Some Minor Issues	Regional Issues	Larger System Issues	System Highly Impacted
Environmental Damage	Short-Term	Limited	Major	Heavy	Permanent

Table 44 - Risk Impact Ratings

Each risk is rated separately based on the likelihood that it will occur and the impact if it does. The two ratings are combined to determine the overall risk rating using the color-coded heat map shown below.

		Risk Likelihood Ratings and Levels				
		Rare (1)	Unlikely (2)	Moderate (3)	Likely (4)	Almost Certain (5)
Impact Ratings	Catastrophic (5)	Low	Medium	High	Extreme	Extreme
	High (4)	Low	Medium	High	High	Extreme
	Moderate (3)	Low	Low	Medium	High	High
	Low (2)	Very Low	Low	Low	Medium	Medium
	Insignificant (1)	Very Low	Very Low	Low	Low	Low

Table 45 - Risk Likelihood Ratings and Levels

The highest priority risks are addressed using one of the following strategies:

Strategy	Description
Terminating	Eliminating the threat posed by an adverse risk or avoiding the risk by clarifying requirements, obtaining information, improving communications, or acquiring expertise.
Transferring	Shifting the negative impact of a threat, along with the ownership of the response, to a third party (e.g., insurance or transfer responsibility to a private or other public entity). This action does not eliminate the risk.
Treating	Reducing the probability and/or impact of an adverse risk event to an acceptable threshold.
Tolerating	Retaining the risk, which may indicate a decision to accept a risk or an inability to identify any other suitable response strategy.
Take Advantage	Benefitting from an opportunity (e.g., new external funding) that helps attain strategic goals.

Table 46 - Risk Strategies

5.5 Risk Management Implementation

ODOT implements the above risk strategies throughout the asset life cycle, notably through the Annual District Work Plan (see Section 1.11.7) and project selection processes.

ODOT's Annual District Work Plan establishes operations activities and capital investments and maintenance activities for the upcoming four years (new and in-progress). It outlines for each year within the plan the planned investments on pavement, bridges, conduits, and other items (such as guardrails and lighting). The total investment helps ensure that ODOT will continue to take care of our transportation system. As projects are evaluated, the Districts also look at projects planned using other funding sources, such as Safety, TSMO, Major New, and Local Programs. This work plan uses data and tools (i.e., pavement management systems) to develop it and outlines investments that are being made in the region's transportation assets.

Also mentioned in Chapter 1 were the Quarterly Major Project Meetings, where the Central Office and District leadership review the performance and execution of the Annual District Work Plan. These quarterly meetings serve a key risk management function, ensuring ODOT monitors ongoing risk or develops strategies for new risk.

5.6 Risk Identification and Assessment

As part of the 2022 TAMP development process, ODOT's AMLT conducted a risk assessment to identify the most significant risks the Department expects to face over the next several years. This assessment helps ODOT ensure our currently identified risks are still valid and helps identify any new risk the agency should be prepared for.

The risk assessment recognized the following risks as being most significant to ODOT's ability to meet its Asset Management objectives.

5.6.1 Resources and Knowledge

The success of ODOT is directly related to having a strong, capable workforce who is well-equipped to manage the transportation infrastructure. In recent years, the AMLT noted:

- Difficulty in hiring and retaining staff.
- The expectation of significant staff turnover due to retirements in the coming years will result in a loss of institutional knowledge.
- The "Great Resignation," is a widespread trend of a significant number of employees leaving their jobs since 2021.
- A likelihood of a greater fluidity of ODOT's workforce, with fewer people staying with the agency for longer periods of service.

5.6.2 Performance of Assets and Climate Impact

The resiliency and performance of assets are impacted by numerous factors, significantly the usage of the assets and environmental conditions which impact asset material. During the risk assessment, the AMLT noted:

- Many areas within Ohio are expecting to see an increase in the population, which could increase the usage and impact of Ohio's transportation assets. The potential for acceleration in Pavement and Bridge deterioration with increased truck traffic and local economic growth impacts.
- The likelihood that ODOT will need to prepare for, and respond to, extreme weather events as well as extreme temperature changes.

5.6.3 Financial

Sufficient revenue is necessary to effectively sustain the existing asset preservation programs, as well as account for any adaptations to Ohio's transportation system. Items the AMLT noted:

- Cost increases due to unexpected increases in the inflation rate, materials, transportation, and/or fuel costs.
- Reduction in tax revenues as fuel efficiency increases and use of electric vehicles increases.

5.7 Risk Mitigation Plans

In response to the risks identified in Section 5.6, ODOT established the following long-term strategies to cope with these challenges.

5.7.1 Preserving Workforce Capacity

The risk assessment recognized impending workforce changes that will require multiple knowledge management strategies to mitigate the potential loss of workforce capacity. Current projections indicate that 33 percent of ODOT's existing workforce are either currently eligible to retire or will be within the next five years. ODOT's Asset Management approach relies on knowledge management planning, succession planning, coordination between the Districts and Central Office, and training to address this risk.

The NHS pavements, bridges, and conduit programs have implemented knowledge management programs to help ensure process continuity. This includes the development of inventory and inspection manuals, mechanisms to monitor asset CSF and KPI, and identifying opportunities to cross-train staff when possible. By documenting and standardizing asset management practices, new staff can more quickly lead key processes with shorter learning curves.

5.7.2 Managing Performance of Assets and Climate Impact

To manage the potential deterioration with increased truck traffic and local economic growth impacts, ODOT continually monitors traffic levels, traffic loadings (using a weigh-in-motion program that tracks freight loads), pavement conditions, bridge conditions, and deterioration models to update the pavement and bridge management systems' data sets. ODOT maintains appropriate pavement and bridge design. ODOT also tracks economic development projects that could increase traffic.

Additional management on the performance of assets comes from the utilization of an application built to assist with decision making and allows planners to access asset forecasts: TAMDST.

To address potential extreme weather changes, ODOT plans to develop a Statewide Resiliency Strategy which will be based on expected rulemaking from the Infrastructure Investment and Jobs Act (IIJA). There is considerable ongoing research on anticipated future precipitation models and appropriate design standards. ODOT is working on incorporating a Vulnerability Asset Tool for Pavement, Bridges, and Conduits. (For example, the inspection frequency of bridges can be increased if certain vulnerabilities are identified. If temperatures continue to change, other binder grades are available for use.) ODOT is addressing emergency preparedness by sharing resources between counties to address storm response/recovery, tracking damage locations for 23 CFR 667, and dispatching staff as needed to monitor flood-prone areas/assets.

5.7.3 Planning for Cost Increases and Reductions in Tax Revenues

To account for cost increases (inflation rate, materials, transportation, and/or fuel costs), ODOT's Economic Analyst is providing quarterly reports to management on price fluctuations in Ohio and around the world. Additionally, ODOT is monitoring bid prices, and data, and adjusting estimates and programming as needed.

To address the reduction in tax revenues due to changing driving habits and vehicle fuel efficiencies:

- In 2019, the Ohio legislature approved an increase to the state gas tax, increasing the fee per gallon of gasoline by 10.5 cents and 19 cents per gallon of diesel.
- Ohio also implemented an electric vehicle user fee (currently $200 per year).
- ODOT is evaluating a mileage-based user fee (MBUF) at the State level.

ODOT will continue to monitor the performance of these measures to ensure the financial sustainability of its program.

5.7.4 Inflation, Supply Chain Issues, and Labor Shortages

In March 2022, ODOT performed a risk assessment in response to recent changes regarding inflation, ongoing supply chain issues being experienced worldwide, and labor shortages. The risk assessment found additional action necessary to help ensure ODOT's program sustainability given these volatile items. The following practices are being adopted in response to these risk concerns:

- The Office of Estimating and Contract Sales typically updates the historical bid data spreadsheet every two months. This will now be updated every other letting. This will allow the database and its users across all 12 districts and Central Office to have the most accurate current unit prices available to reflect the current market conditions.
- The historical bid data should be considered when developing or updating your project budgets to reflect current pricing more accurately.
- The Office of Estimating and Contract Sales would suggest looking back anywhere from six months to a year to gather relevant data representative of the current pricing we are experiencing.
- The historical bid data spreadsheet can be sorted by district or a cluster of districts which will help with price fluctuations with similar items in a certain region of the state or simply compare more prices.
- The Office of Estimating will inform the districts when projects are being estimated out of their office 10 percent higher than the district budget or over 1 million dollars.
- Project selling within the next two years that are currently estimated at $5 Million or more need to be updated by Friday, April 15th, using the guidance provided above.
- Re-estimate projects are currently estimated at $5M or more every six months in conjunction with the Office of Estimating and Contract Sales updated inflation forecasts.
    - This should not simply be a change in the inflation rate. Current unit pricing should be incorporated.
- If a project involves local participation, they must be notified of an increase as soon as it is known to allow them ample time to accommodate the increased cost.
- If there are questions from your team regarding anything related to pricing, historical bid data, etc. please reach out to the Office of Estimating and Contract Sales.

The risk mitigation strategies indicated above are realized via the Annual District Work Plan development and implementation phases (described at a high level in other sections of the TAMP). ODOT will monitor, adjust, or discontinue these mitigation strategies as deemed appropriate. This

was included as an example of ODOT's risk management strategies being actively utilized in response to changing factors.

5.8 Summary of Transportation Assets Repeatedly Damaged by Emergency Events

A requirement under 23 CFR Part 667, Periodic Evaluation of Facilities Repeatedly Requiring Repair and Reconstruction Due to Emergency Events, involves a periodic Statewide evaluation of the State's existing roads, highways, and Bridges that have required repair or reconstruction on two or more occasions from emergency events declared by the Governor of the State or the President of the United States. State DOTs are required to complete an evaluation of any repair and reconstruction events to Pavements and Bridges that have occurred due to emergency events that occurred after January 1, 1997 and establish a process to continue monitoring these assets into the future.

Monitoring Repair or Reconstruction Activities Due to Emergency Events in the Future

In May 2019, the Office of Technical Services developed an Emergency Relief Application Process that outlines roles and responsibilities associated with the preparation of the FHWA's Standard Emergency Relief (ER) Application for disasters that occur on Federal-Aid Eligible roadways in Ohio. The document outlines business processes associated with the identification, assessment, planning, repair, and request associated with ER events. In general, Federal ER funds are provided to restore a facility to its pre-disaster condition; however, in some circumstances, restoring the facility to its pre-disaster condition would leave it vulnerable to repeat damage, costing the FHWA's ER program more than if the facility had been rebuilt with protective features. Adding protective features is considered economically justified under the FHWA's ER program by comparing the project cost to the ER program from potential recurring damage over the design life for the basis repair to the cost of the betterment.

Roles and responsibilities in support of each state of the business processes are summarized in Appendix A. Per the business process, resiliency planning to add protective features occurs throughout the year, starting with the annual planning process in which the Office of Program Management consults with ODOT District offices for maintenance and improvement projects. During this process, prior ER projects can be considered for improvements or maintenance.

To support the ER business processes required to assess, plan, and request funding, ODOT relies on the following two primary data sources:

- Ellis Project Planning, Management, and Accounting Software – A web-based application designed to be a management system linking ODOT's project delivery, planning, system forecasting, and financial management. Ellis is used to manage the identification and implementation of ODOT's Capital Improvement Program.
- Equipment and Inventory Management Systems (EIMS) – A system used to track ODOT's internal work efforts and costs (including labor, equipment, and materials) associated with maintaining the roadway network and other transportation assets associated with the State highway system.

A summary of the business processes, data sources, and resiliency plans to address assets that have been damaged due to repeat events is provided.

Emergency Relief Business Process

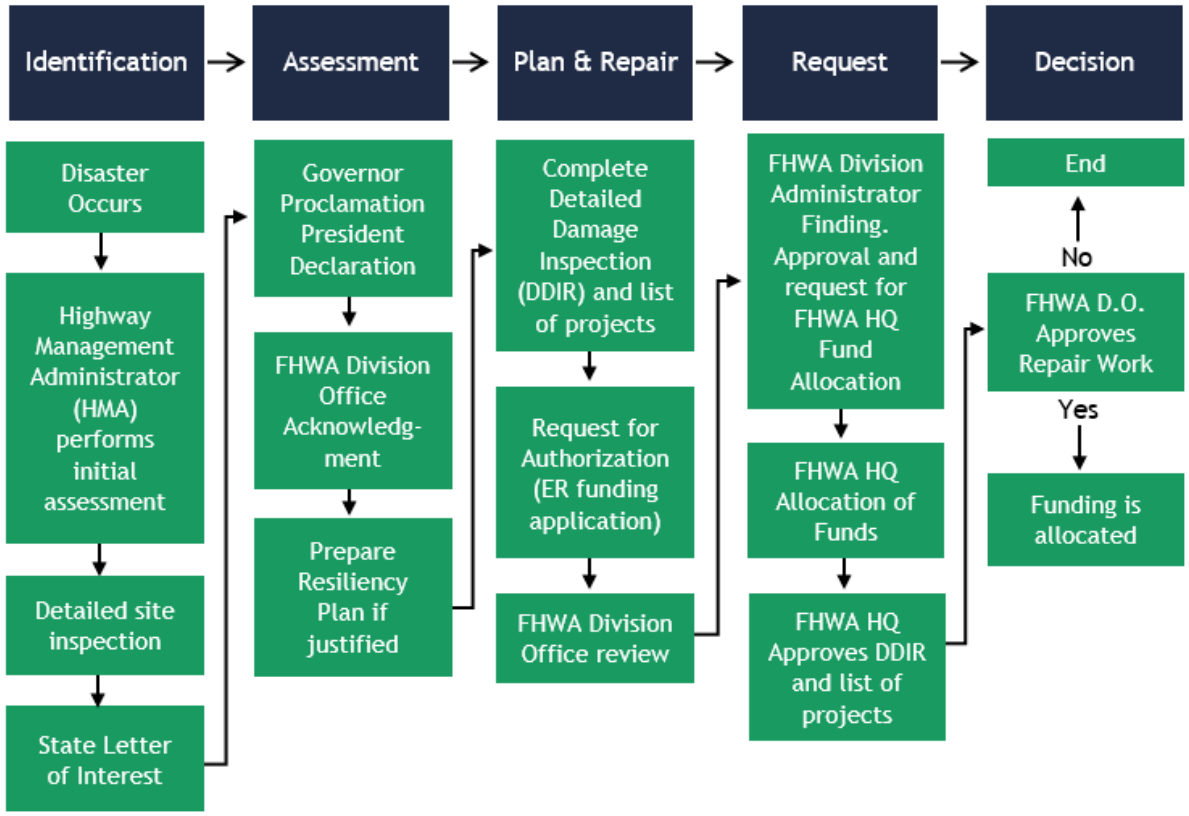


Figure 18 - Emergency Relief Business Process

Emergency Relief Data and Resiliency Flow

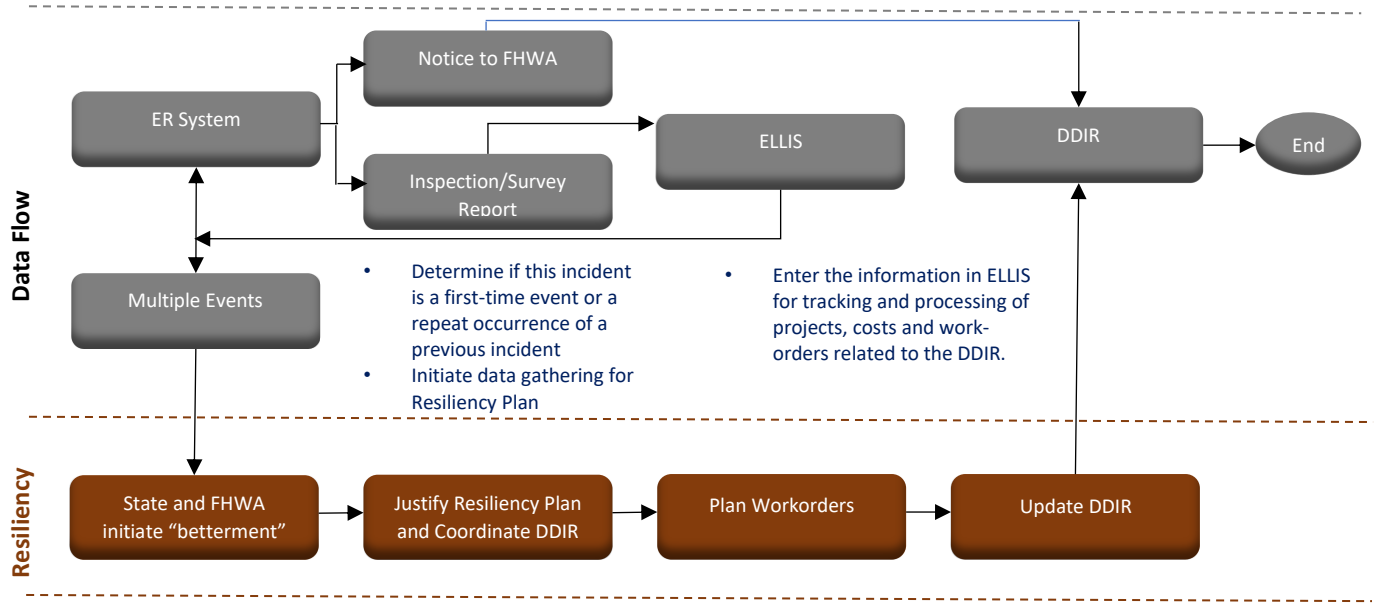


Figure 19 - Emergency Relief Data and Resiliency Process flow

Assessment of Emergency Events

ODOT evaluated the best available data to assess its responses to emergency events declared by either the U.S. President or the Governor of Ohio. Information was extracted from the Ellis and EIMS programs to summarize applicable emergency events that have occurred in the State and to evaluate repairs and costs to Pavement and Bridge assets. Key findings from this analysis include:

- Over 600 locations were identified, and the list was reviewed to determine sites that received repair or reconstruction.
- The results found no locations with two or more incidents to the same assets.
- Additionally, no new ER events have occurred since FY2020.
- The District Offices are proactively monitoring any sites from previous events to evaluate opportunities to reduce the likelihood of future recurring damage.

ODOT created the Emergency Relief Web Mapping Application to aggregate and publish the records of these incidents.

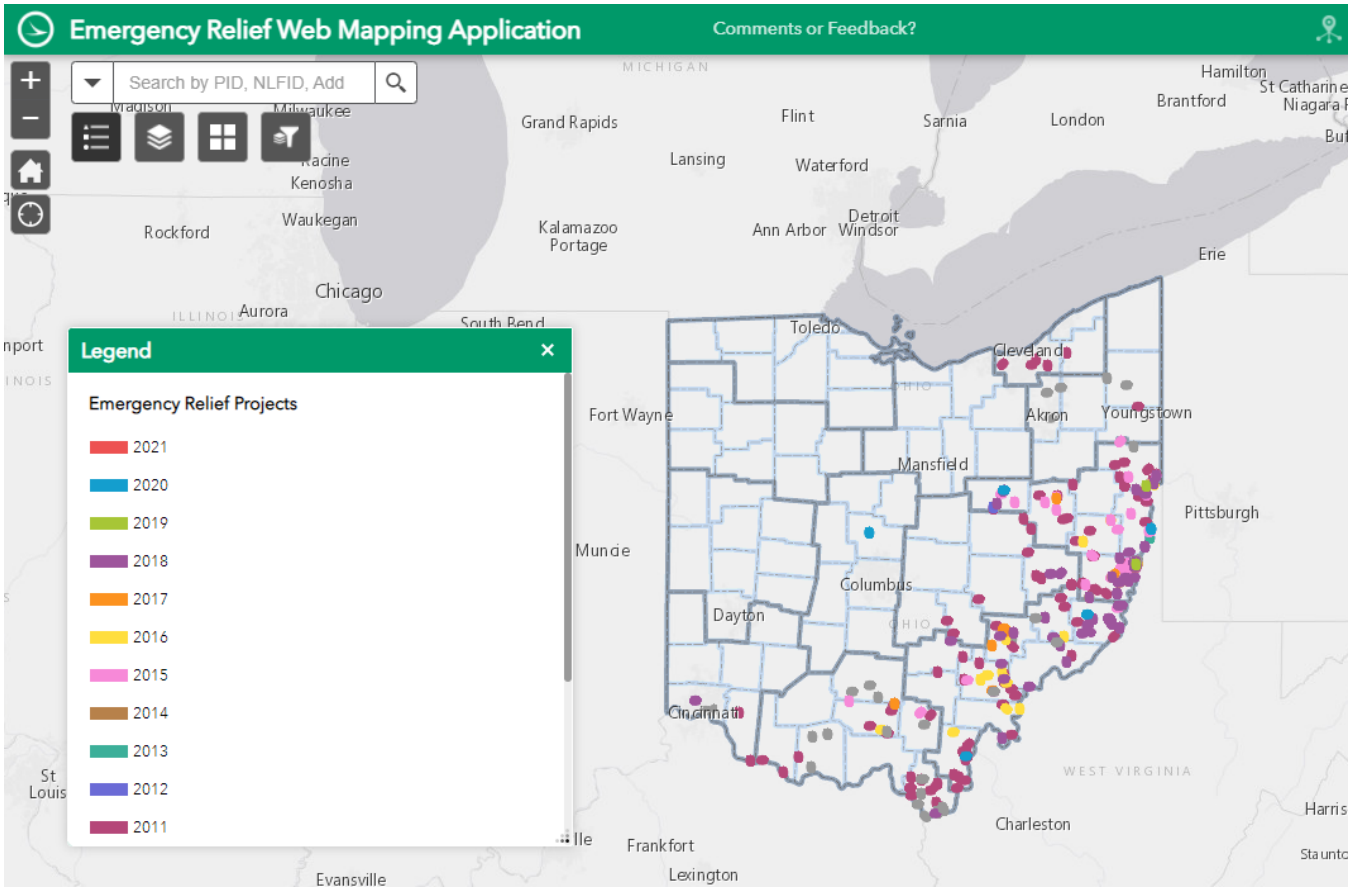


Figure 20 - Emergency Relief Web Mapping Application Example

The following table summarizes the facilities illustrate in the Emergency Relief Web Mapping Application. Please note, this table reflects all assets and ER locations across the state starting in FY2011 and is not limited to NHS pavements and bridges. This information is not summarized by the DSR event.

Statewide ER Event Summary Since FY2011

County	Locations Effected	Funds
Adams	7	$2,566,830
Ashland	2	$343,446
Ashtabula	2	$366,879
Athens	39	$25,911,974
Belmont	119	$31,313,151
Brown	9	$5,756,896
Butler	1	$421,897
Carroll	4	$2,233,772

Statewide ER Event Summary Since FY2011

County	Locations Effected	Funds
Clermont	3	$3,417,550
Clinton	1	$168,702
Columbiana	37	$16,516,538
Coshocton	4	$948,969
Cuyahoga	11	$2,349,041
Delaware	1	$1,294,774
Erie	1	$320,130
Fairfield	1	$401,159
Franklin	1	$2,079,912
Gallia	20	$6,142,643
Geauga	4	$578,906
Guernsey	9	$2,538,789
Hamilton	17	$9,943,450
Harrison	8	$2,324,998
Highland	1	$220,426
Hocking	4	$1,100,267
Holmes	10	$2,153,996
Jackson	10	$3,093,067
Jefferson	41	$96,497,660
Knox	1	$145,417
Lake	3	$1,008,322
Lawrence	37	$22,670,143
Licking	1	$986,490
Mahoning	6	$2,163,805
Meigs	14	$3,620,003
Monroe	30	$24,915,128
Morgan	26	$23,909,603
Muskingum	12	$2,035,785

Statewide ER Event Summary Since FY2011		
County	Locations Effected	Funds
Noble	20	$5,279,458
Ottawa	1	$520,819
Perry	3	$436,834
Pike	19	$9,305,743
Portage	4	$373,761
Ross	6	$4,153,729
Scioto	8	$2,039,305
Stark	4	$908,101
Summit	7	$443,841
Trumbull	7	$1,123,346
Tuscarawas	22	$4,744,440
Vinton	5	$1,422,719
Warren	1	$352,045
Washington	31	$24,813,372

Table 47 - Statewide ER Event Summary Since FY 2011

During the analysis process for this report, ODOT discovered some improvements to how these ER events could be tracked and reported in the ER Web Mapping Application. This application maintenance is being scheduled but may not be fully implemented by the FHWA review of Ohio's 2022 TAMP depending on when the FHWA review is conducted.

5.9 Extreme Weather and Resilience

The BIL (§ 11105) implemented on October 1, 2021 (§ 10003) included updates that direct states to consider extreme weather and resilience as part of their TAMP. ODOT has completed or started the following items to address these requirements.

5.9.1 Infrastructure Resiliency Plan

In 2016, ODOT commissioned an Infrastructure Resiliency Plan to assess the vulnerability of Ohio's transportation infrastructure to climate change effects and extreme weather events. The analysis includes a discussion and analysis of the type of transportation assets vulnerable, the degree of exposure, sensitivity, adaptive capacity, and the potential approaches to adapt to these changes.

The work completed with this study includes:

- Understanding the vulnerability of ODOT's overall transportation system to climate change.
- Determining potential consequences from a broad range of potential climate impacts.
- Identifying facilities at risk of climate change impacts within Ohio by type.
- Identify the range of adaptation and/or sustainability options (activities) that ODOT should consider in detail in future adaptation studies.
- Providing the foundation for ODOT to integrate the results of this vulnerability assessment into future decision-making processes and future adaptation/resiliency studies.

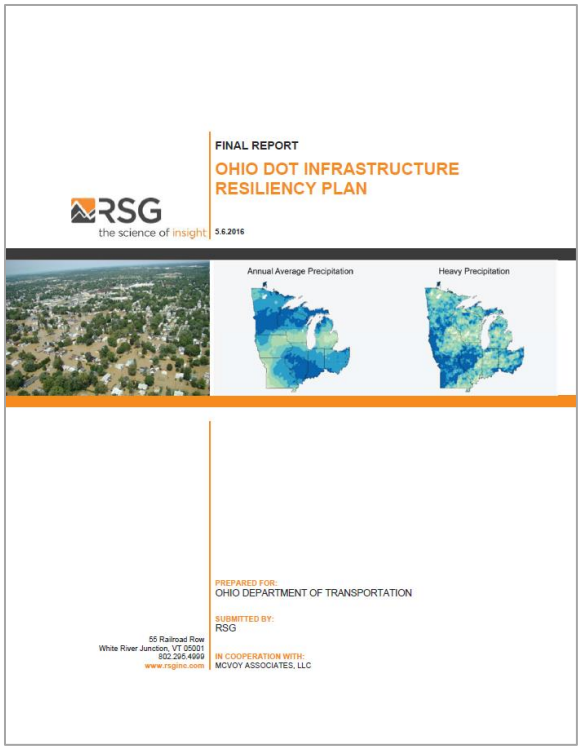


Figure 21 - Infrastructure Resiliency Plan Cover

Climate Change Key Findings

The study examined recently and projected climate change impacts in Ohio (warming trends, precipitation trends, Lake Erie water levels), and how these impacts might be experienced differently throughout Ohio.

The key impacts on transportation assets found by the study include:

1. Increasing average temperatures.
2. Increasing heavy storm events.
3. Increasing frequency and duration of droughts.
4. Declining Lake Erie water levels.

The study projects warmer winters and hotter summers in the Ohio region. Warmer winters offer the potential for:

- Reductions in snow and ice removal costs.
- Reduced environmental impacts from the use of salt and chemicals on roads and bridges.
- Extended construction season.

- Improved mobility and safety of passenger and freight travel through reduced winter hazards.

Hotter summers could mean:

- Limit on construction activities and the hours' road crews can work due to health and safety concerns for highway workers.
- Load restrictions on roads because Pavement damage and buckling will disrupt vehicle movements.
- Extreme heat could disrupt vehicle operations because of overheating and increased risk of tire blowouts in heavily loaded vehicles.

The study also focused on four Special Topic areas.

Impacts of Extreme Heat on Pavements

Pavement modeling generally suggests pavement impacts will be minimal and that there are many ways to adapt pavements to climate change effects, if necessary. ODOT-maintained highways are not typically constructed on expandable clay soils within the pavement structure profile. However, secondary roads maintained by counties or other jurisdictions may be vulnerable to projected drought inundation cycles due to lower design standards.

Impacts on Air Quality

Ohio currently has three Ozone Non-Attainment areas: Cincinnati-Hamilton, Cleveland-Akron-Lorain, and Columbus. There is an anticipated tightening of the Ozone standard to 70 ppm, which will likely increase the degree and extent of non-Attainment.

Lake Erie Water Levels

Studies estimate a potential decrease of Lake Erie's water levels of approximately 1.5 feet by 2040. Water level changes have the potential to impact entrance structures, interior harbor structures, and dredging operations.

Potential Opening of the Northwest Passage

Climate change could make transportation through the northwest passage viable as a means for shipping. This could result in major changes in the freight shipping industry. The study notes several significant infrastructure capacity constraints in the St. Lawrence Seaway and Great Lakes that could result in significant congestion or limit the ability of some larger vessels to navigate through the existing lock system.

Infrastructure Resiliency Plan Key Recommendations

This initial study on infrastructure resiliency included several recommendations for advancing the resiliency plan, including:

1. Identifying the lead office within the ODOT-Office of Planning.
2. Identified potential tasks to incorporate into planning functions.
3. Development and refinement of the Vulnerability Assessment Screening Tool (VAST).
4. Options for interagency coordination, particularly with the TSMO and TAM teams.

5.9.2 Vulnerability Assessment Screening Tool

The 2016 Infrastructure Resiliency Plan developed an initial VAST model to help ODOT identify and mitigate asset risks related to extreme weather. Since the 2016 study, ODOT's Office of Statewide Planning and Research conducted additional projects to further develop the VAST model.

The primary extreme weather risk VAST seeks to address is the impact of anticipated increased precipitation. The forecasts predict more severe and more frequent precipitation events.

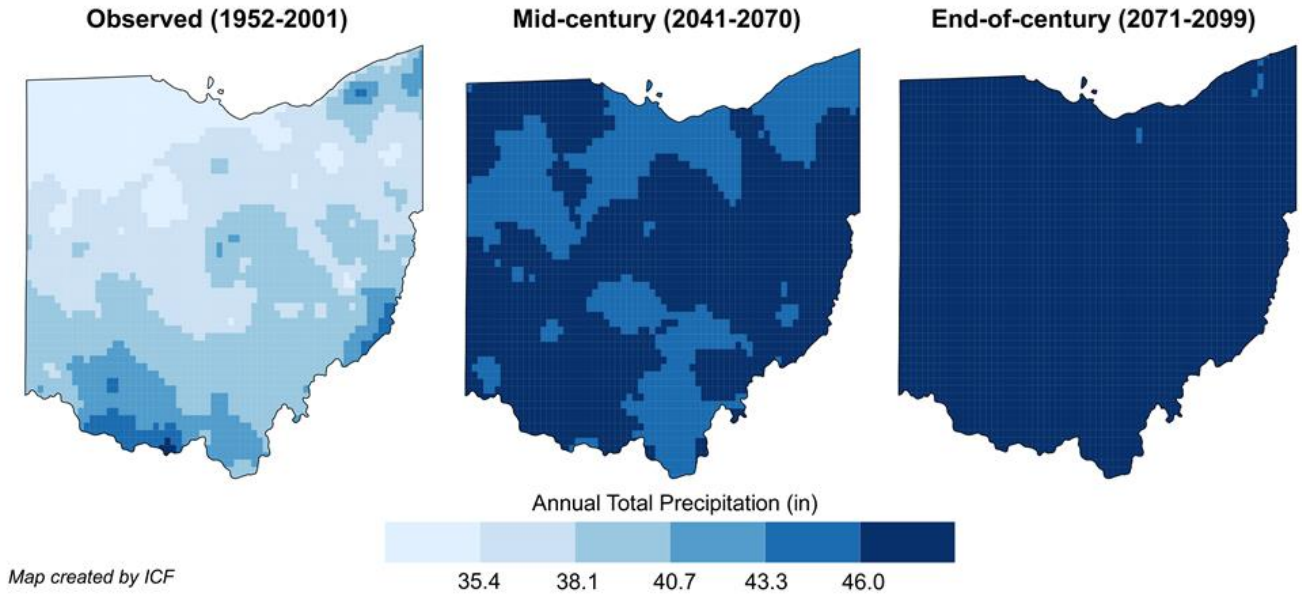


Figure 22 - VAST Precipitation Model

ODOT's VAST model leverages a variety of data sources, including ODOT's pavement, bridges, and conduit inventories, streamflow models, precipitation models, and other datasets, allowing ODOT planners to test for different scenarios by adjusting potential factors. These factors are grouped into categories of Exposure, Sensitivity, and Adaptive Capacity to deliver a Vulnerability Score.

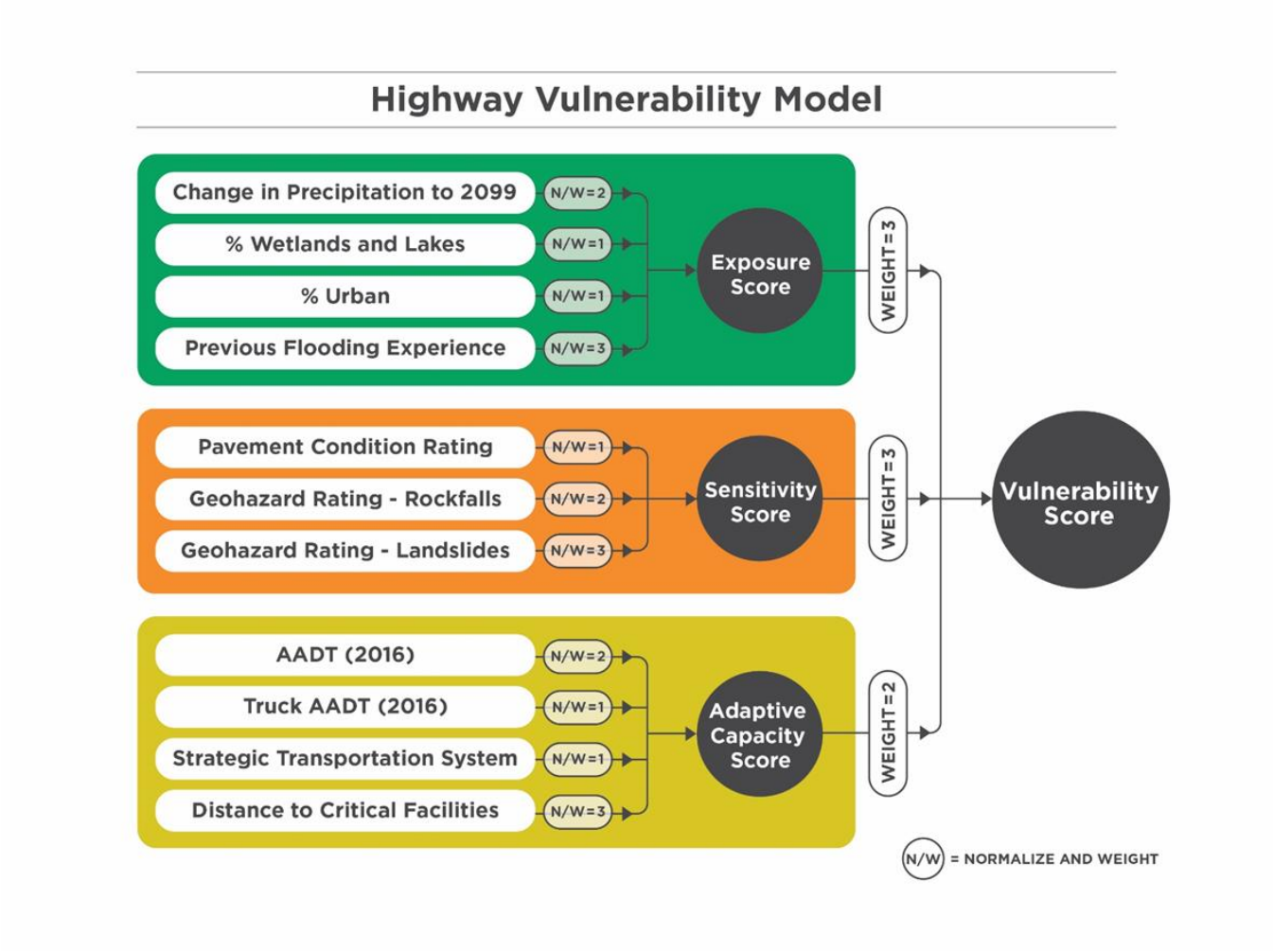


Figure 23 - Highway Vulnerability Model

Planners can adjust the weighting of the different components to model potential scenarios.

ODOT Highway Vulnerability Assessment Scoring Tool

Component	Component Weights			Indicator	Indicator Weights		
	Base Scenario	Scenario 1	Scenario 2		Base Scenario	Scenario 1	Scenario 2
Exposure	3	1	1	Change in Precipitation to 2099	2	1	1
				% Urban	1	1	1
				% Wetlands & Lakes	1	1	1
				Previous Flooding Issues	3	1	1
Sensitivity	3	1	1	Pavement Condition Rating	1	1	1
				Geohazard LandSlide	3	1	1
				Geohazard Rockfall	2	1	1
Adaptive Capacity	2	1	1	AADT	2	1	1
				Truck AADT	1	1	1
				Strategic Transportation System	1	1	1
				Distance to Critical Facilities	3	1	1

Figure 24 - Highway Vulnerability Assessment Scoring Tool

Once a scenario weighting and factors have been decided, the VAST application produces a Top 10 list of assets (pavement, bridges, or conduits) with the highest Vulnerability Score.

Base Case Top 10

Rank	SFN	District	County	Road Name	Vulnerablity Score
1	4801261	2	Lucas County	US 23	2.69
2	**1503367**	**11**	**Columbiana County**	**SR 154**	**2.65**
3	4101650	11	Jefferson County	SR 7	2.57
4	7807082	4	Trumbull County	US 422	2.54
5	5006872	4	Mahoning County	IR 680	2.54
6	1812246	12	Cuyahoga County	US 322	2.52
7	4102169	11	Jefferson County	SR 150	2.52
8	4102533	11	Jefferson County	SR 151	2.51
9	4800699	2	Lucas County	US 20	2.50
10	1813080	12	Cuyahoga County	IR 480	2.50

Figure 25 - Top 10 Assets with the Highest Vulnerability

ODOT planners can then use these results to inform the District Annual Work Plan development process (TAMP Chapter 1) to prioritize project selection activities.

The VAST base scenario has also been integrated into ODOT's TAMDST to help visualize potential at-risk locations.

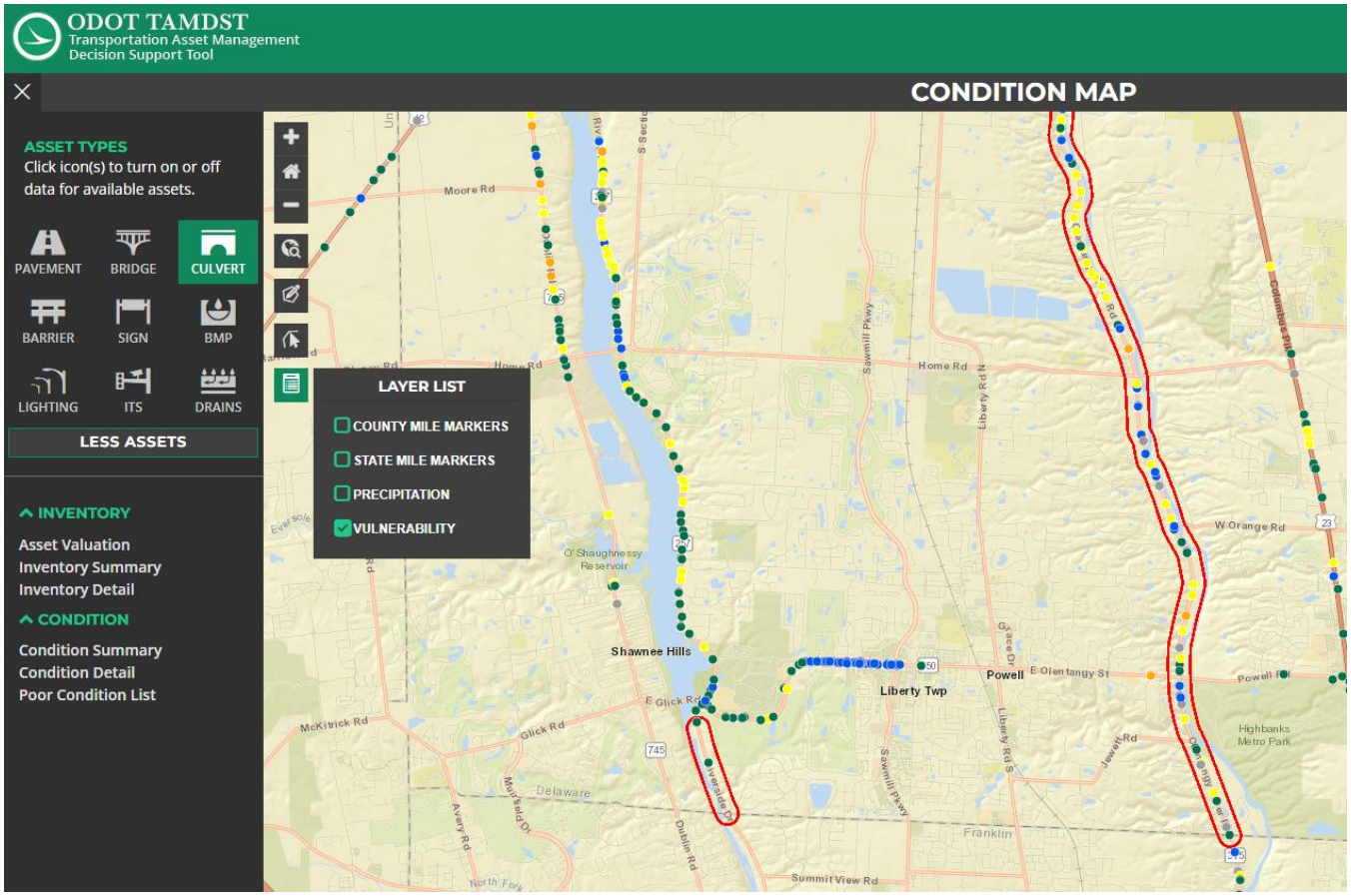


Figure 26 - TAMDST At Risk Condition Map Example

The Vulnerability layer in the image above is represented on the map as the red polygons. Application users can activate asset layers like Pavement, Bridges, or Conduits to view assets located within those at-risk areas.

5.9.3 Transportation Systems Management and Operations Plan

In 2017, ODOT developed a TSMO plan. This plan formalized ODOT's approach to measuring transportation system management and operations performance, policies, procedures, and specific opportunities. The overall goal of the TSMO plan is to implement protocols, tools, or technology to ensure sound and reliable transportation operations. This plan also created recommendations for addressing climate variability.

5.9.4 TSMO Climate Variability Brief

The TSMO Climate Variability Brief builds on the 2016 Infrastructure Resiliency Plan and leverages the VAST model to identify at-risk assets specifically related to TSMO operational infrastructure and plan for asset improvement projects to ensure network continuity. Additionally, the plan created three groups of potential action recommendations:

Group 1: TSMO-Specific Recommendations

These recommendations were sourced from AASHTO's "Top 10" list of suggestions for how TSMO managers can prepare for extreme weather events, including Contingency plans, Evacuation, and

Emergency Routes, Traveler Information, Drill and Test, Pre-Positioned Materials and Equipment, Back up Communications, Risk Reduction Strategies, Early Warning Indicators, Harden the System, and Workforce Preparation.

Group 2: Hazard-Specific Recommendations

The hazard-specific recommendations provided guidance in the following areas: Drought mitigation actions, extreme temperature mitigation actions, flood mitigation actions, landslide mitigation actions, and severe winter weather mitigation actions.

While the specific recommendation varies by hazard, these recommendations include action items to develop plans for quickly resolving incidents, as well as preventative measures like clearing brush and applying soil-stabilizing vegetation to mitigate flooding or leveraging snow fences to reduce blowing and drifting snow.

Group 3: Recommendations by Phase

The recommendations in Group 3 identify opportunities to improve processes or collaborations across ODOT functional areas of operations, design, and planning, with specific recommendations for improving monitoring and communication of weather events, deployment of smart technologies, or other options for risk avoidance strategies.

5.9.5 2022 Resiliency Improvement Plan

The Infrastructure Resiliency and TSMO Plans have developed a significant foundation for ODOT to understand potential extreme weather risks and begin implementing system resiliency strategies, and ODOT recognizes additional work is necessary to advance these goals. When the BIL (§ 11105) was implemented on October 1, 2021, ODOT's Division of Planning began scoping a project to develop a more comprehensive resiliency plan for the agency. This project is scheduled for ODOT's May 2022 Programmatic Consultant Selection Process to leverage consultant resources to help ODOT craft the plan. The project is expected to be awarded in Fall 2022. The primary goals of this project include:

1. Define resiliency specific to Ohio's transportation system and infrastructure.
2. Re-assess technical components of the VAST solution for improvement opportunities.
3. Perform a needs analysis based on current VAST results.
4. Recommendation investment adaptations to improve infrastructure resiliency (e.g., identify funding opportunities, extreme weather response strategies, preparedness adaptations).
5. Engage with ODOT, local partners (MPOs, RTPOs), and other state agencies to identify collaboration opportunities.

6 FINANCIAL PLAN & INVESTMENT STRATEGIES

A sound risk-based asset management approach needs to clearly understand the revenue and program funding allocation to ensure a state of good repair. ODOT receives funding from a variety of sources and applies these funds across key program areas to ensure performance targets are maintained. This section describes ODOT's financial plan and investment strategies for the next 10 years.

6.1 Federal Requirements

FHWA specifies that state DOTs must provide a financial plan which includes (23 CFR 515.7(d)):

- At least 10 years.
- The estimated cost to implement the investment strategies by State fiscal year and work type.
- The estimated funding levels are expected to be reasonably available, by the fiscal year, to address the costs of implementing the investment strategies, by work type.
- Identified anticipated sources of available funding.
- A summary asset valuation for the State's NHS pavement and bridges including the investment needed on an annual basis to maintain the asset value.

FHWA specifics that state DOTs must provide investment strategies which include (23 CFR 515.7(e) and 515.9(f)):

- Producing investment strategies that collectively make or support progress toward:
    - Achieving and sustaining the 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 the State DOT targets for asset condition and performance of the NHS following 23 U.S.C. 150(d).
    - Achieving the national goals identified in 23 U.S.C. 150(b).
- Identifying and describing how the investment strategies are influenced by:
    - Anticipated available funding to implement strategies and estimated cost of future work types associated with investment strategies being considered, based on the TAMP financial plan.
    - Results of the TAMP risk, management, life cycle planning, and performance gap analysis (this will be discussed in Chapter 7).

6.2 Funding Sources

Federal funding is provided through the Highway Trust Fund, which is financed primarily by the Federal fuel tax. Congress is responsible for authorizing Federal funding, which is apportioned to projects per certain requirements. Although Federal funding fluctuates annually, the average level of funding over the last five years has been relatively constant.

State revenue is generated through several sources, with the largest percentage coming from the State motor fuel tax.

Other sources of State revenue include the fuel use tax and interest income/miscellaneous sources. With the increased gas tax projections, ODOT can maintain a consistent level of State funding over the next 10 years rather than the decreases that had been anticipated earlier.

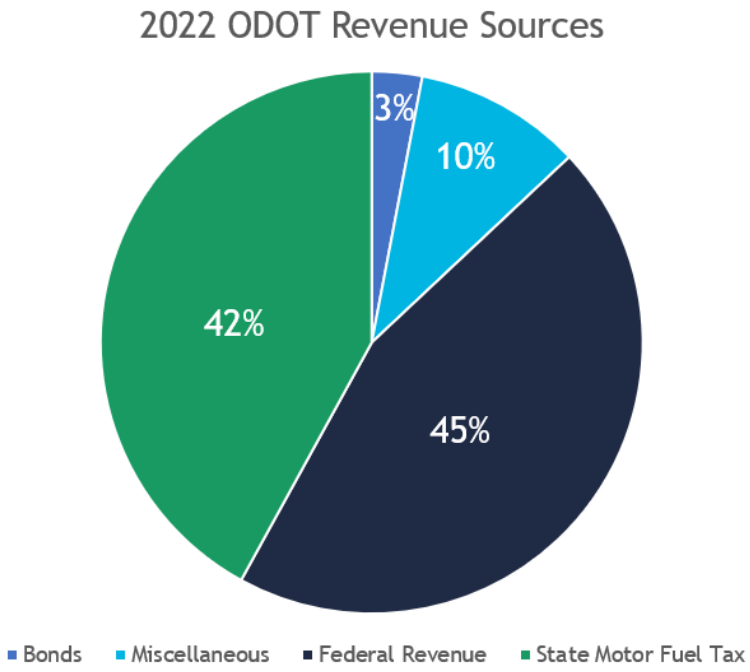


Figure 27 - ODOT 2022 Funding Sources

6.3 Funding Sources Breakdown & Projections

The ODOT's Division of Finance team has provided the following projections for the next 10 years.

6.3.1 Revenue

The ODOT Division of finance Team has made the following assumptions regarding State Motor Fuel Tax, and Federal Revenue.

State Motor Fuel Tax:

- FY2022 estimated 8 percent down adjustment compared to FY2020 Original Estimates, Mid-Year adjustment applied January 2022 due to revenues out pacing estimates.
- FY2023-FY2025 grows consumption by 1.5 percent per year over the FY2022 Estimate.
- FY2026-FY2030 grows consumption by 1 percent per year over the FY2025 Estimate.
- FY2031 keeps consumption flat.

Federal Revenue:

- All Federal Revenues are based on FAST Act levels from Federal FY2020. No growth is assumed.
- IIJA/BIL is not yet incorporated as impacts are unknown at this time.
- FY2022 Other Federal Revenue includes $333 million for CRRSAA funding received.

The following table summarizes the anticipated funding over the next ten years (in millions).

Funding Sources	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	10 - Year Totals
State Motor Fuel Tax	$1,519	$1,515	$1,539	$1,564	$1,557	$1,573	$1,590	$1,606	$1,623	$1,623	$15,709
Other State Revenue	$134	$115	$118	$117	$117	$118	$119	$119	$120	$120	$1,197
Bonding State	$60	$90	$60	$60	$60	$60	$60	$60	$60	$60	$630
Federal Motor Fuel Tax	$1,376	$1461	$1,461	$1,461	$1,461	$1,461	$1,461	$1,461	$1,461	$1,461	$14,521
Other Federal Revenue	$385	$12	$12	$12	$12	$12	$12	$12	$12	$12	$490
Bonding Garvee	$60	$80	$60	$60	$60	$60	$60	$60	$60	$60	$620
Debt Payments State	-$195	-$212	-$222	-$212	-$184	-$188	-$190	-$179	-$161	-$151	-$1894
Debt Payments Federal	-$134	-$142	-$149	-$155	-$130	-$136	-$142	-$147	-$133	-$102	-$1369
Carryforward Revenues	$389	$134	$87	$60	$50	$50	$50	$50	$50	$50	$970
Total	$3,594	$3,052	$2,966	$2,967	$3,002	$3,010	$3,019	$3,041	$3,091	$3,131	$30,874

Table 48 - ODOT 10-year Funding Sources

The chart to the right illustrates the typical revenue distribution across core areas, including Operating costs, Debt Service, Preservation, Local funding, Safety, and TRAC, with the Operating and Preservation distributions accounting for a combined 68.8 percent of ODOT's annual revenue usage.

It is important to note that revenues allocated to the Preservation, Operating, Local, TRAC and Safety distributions typically support NHS assets, with the specific determination made through the project selection processes. Please refer to Section 6.7 for additional detail on these high-level workflows.

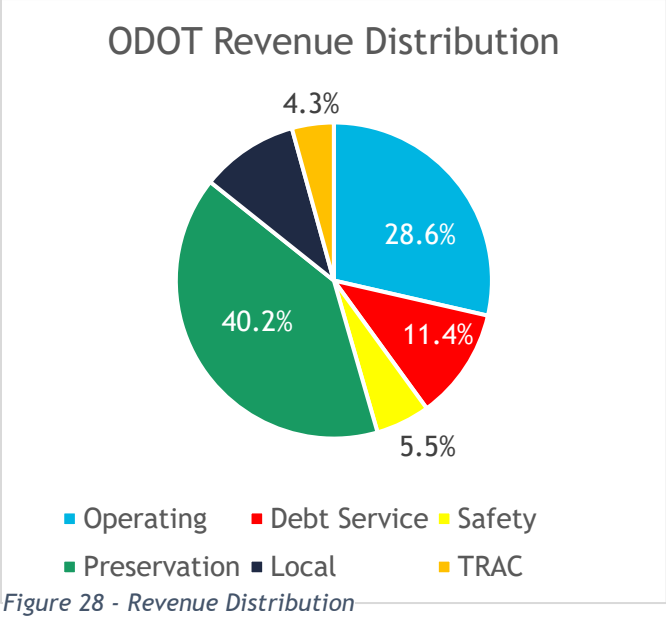


Figure 28 - Revenue Distribution

6.4 Ohio Turnpike Funding Sources

The table below illustrates the Ohio Turnpike expected funding sources for the next 10 years (in millions).

Funding Sources	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	10 - Year Totals
Net Toll Revenue	131.2	136.1	157.2	168.9	187.3	195.4	201.3	208.0	212.4	216.8	1,814.6
Fuel Tax Revenue	3.6	3.6	3.6	3.6	3.7	3.7	3.7	3.7	3.8	3.8	36.8
Bond Proceeds	0	0	0	0	0	0	0	0	0	0	-
Totals	**134.8**	**139.7**	**160.8**	**172.5**	**191.0**	**199.1**	**205.0**	**211.7**	**216.2**	**220.6**	**1851.4**

Table 49 - Ohio Turnpike 10-year Funding Sources Projection

6.5 ODOT 10-Year Funding for Investment Strategies

This section reports ODOT's funding investment according to the FHWA preferred program categories. ODOT matched work categories to FHWA Federal Improvement Codes tracked in the ELLIS system to these FHWA preferred categories to produce these estimates. This was the same methodology ODOT used in the development of the 2018 TAMP. Between 2019 and 2022, ODOT consolidated various work category codes within the ELLIS system, resulting in a need to remap work categories to the FHWA improvement codes. Refer to the table in Appendix B (FHWA code reference matrix). That table illustrates the crosswalk between the federal improvement codes and TAMP categories.

ODOT estimated the funding investment levels by looking at a combination of historical investments and analysis over the last few previous years, along with the most current investment levels currently scheduled in ELLIS. An annual estimated average was determined and applied to the extent of the forecast, as shown in the tables on the following pages.

Please note, while ODOT's Bridge CSF excludes Major Bridges, the investment strategies in the following table do include funding for Major Bridges.

These tables summarize the funding investment by the program over the next 10 years with an annual average described (in millions).

Entire System Investments

Pavement			
	2022	2023 - 2031 Annual Avg.	10-Year Total
Maintenance	$17	$15	$146
Preservation	$553	$533	$5,329
Rehabilitation	$390	$363	$3,630
Reconstruction	$654	$445	$4,453
New Construction	$32	$78	$778
Other	$13	$7	$71
Totals	**$1,660**	**$1,400**	**$14,409**
Bridges			
	2022	2023 - 2031 Annual Avg.	10-Year Total
Maintenance	$110	$33	$329
Preservation/Rehabilitation	$200	$238	$2,378
Reconstruction	$278	$236	$2,359
New Construction	$92	$26	$264
Other	$0.1	$0.6	$6
Totals	**$680**	**$534**	**$5,336**
Conduits			
	2022	2023 - 2031 Annual Avg.	10-Year Total
Totals	**$21**	**$21**	**$213**

Table 50 - Entire System Investments

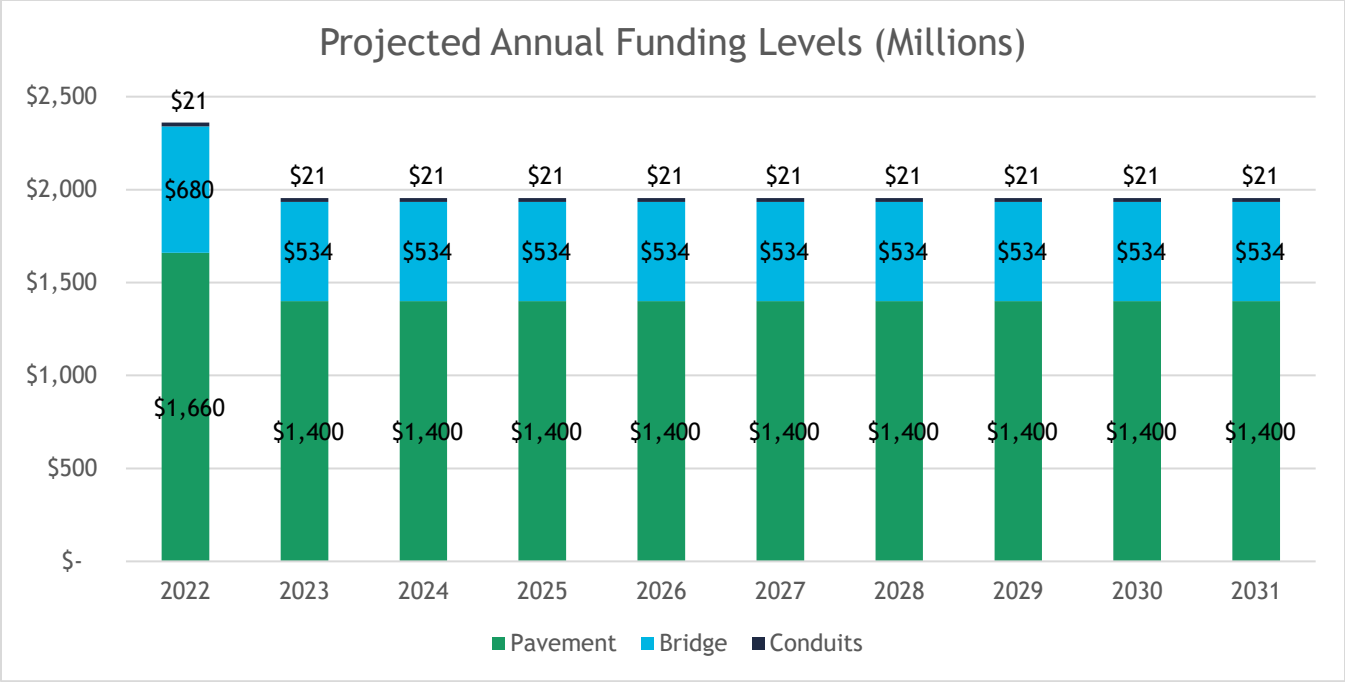


Table 51 - Projected Annual Funding Levels (Millions)

NHS Investments

The following table summarizes the funding investment for the NHS over the next 10 years (in millions)

NHS Pavement			
	2022	2023 - 2031 Annual Avg.	10-Year Total
Maintenance	$16	$10	$104
Preservation	$296	$248	$2,484
Rehabilitation	$171	$163	$1,631
Reconstruction	$499	$341	$3,413
New Construction	$4	$8	$83
Other	$3	$3	$35
Totals	**$990**	**$775**	**$7,751**

NHS Bridges			
	2022	2023 - 2031 Annual Avg.	10-Year Total
Maintenance	$84	$27	$267
Preservation/Rehabilitation	$133	$189	$1,888
Reconstruction	$161	$141	$1,411
New Construction	$91	$28	$283
Other	$0.1	$0.4	$3
Totals	**$469**	**$380**	**$3,806**

NHS Conduits			
	2022	2023 - 2031 Annual Avg.	10-Year Total
Totals	**$10**	**$10**	**$100**

Table 52 - NHS Investments

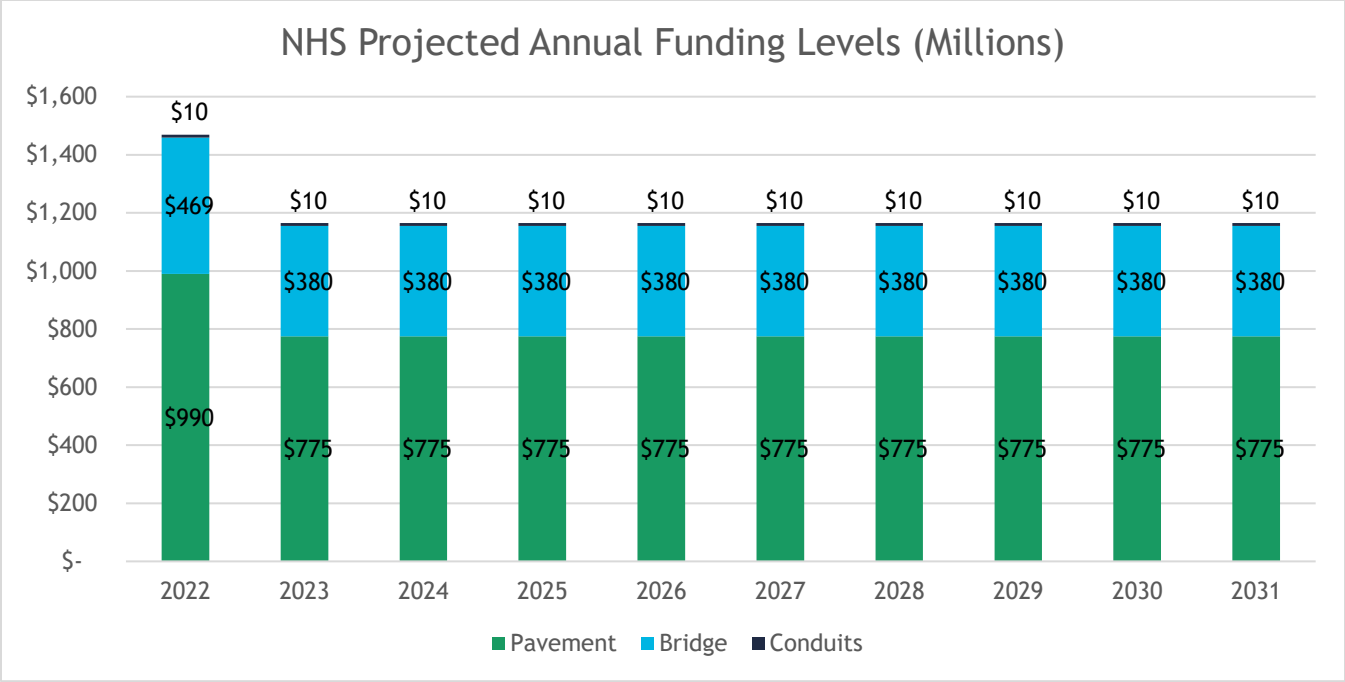


Table 53 - NH Projected Annual Funding Levels (Millions)

6.6 Turnpike 10-Year Funding for Investment Strategies

The Ohio Turnpike provided the following information regarding its funding investment strategies. Since the Turnpike is a separate entity, the work activity mapping to FHWA funding investment categories may vary slightly from ODOT's methodology. Please note that the Turnpike has provided the Bridge and Conduit information combined as prescribed by their Master Trust Agreement which handles these assets similarly.

These tables illustrate the types of work activities the Turnpike includes in each funding investment category.

Pavement Work Activities – Funding Investment Categories	
Category	**Definition/Detail**
Maintenance	Pavement Repairs, RPMs, joint sealing, etc. (Pavement OpEx plus 2x Labor).
Preservation	Pavement Sealing.
Rehabilitation	Resurfacing Projects.
Reconstruction	These are pavement replacement projects.

Table 54 - Pavement Work Activities - Funding Investment Categories

Bridge & Conduit Work Activities - Funding Investment Categories	
Category	**Definition/Detail**
Bridge/Conduit Maintenance	OTC Bridge Maintenance is Operating Expenses spent on Bridges and Maintenance Misc. CIP.
Preservation	OTC Bridge Preservation is Bridge Painting and Weatherproofing.
Bridge/Conduit Rehabilitation	OTC Bridge Rehabilitation is 60 percent of Bridge Deck Replacements, Bridge Deck Overlays, and Misc. Bridge Repairs. The conduit allocation is as follows: 50 percent goes to maintenance and 50 percent goes to Rehabilitation of OpEx and Capex.
Reconstruction	OTC Bridge Reconstruction is 40 percent of Bridge Deck Replacements, Bridge Deck Overlays, and Misc. Bridge Repairs and accounts for replacement structures.

Table 55 - Bridge and Conduit Work Activities - Funding Investment Categories

These tables summarize the funding investment by the program over the next 10 years for the Turnpike portion of Ohio's NHS system, with an annual average described (in millions).

Turnpike Pavement			
	2022	**2023 - 2031 Annual Avg.**	**10-Year Total**
Maintenance	$4	$4.6	$41
Preservation	$0.5	$0.5	$4.5
Rehabilitation	$34.5	$31	$280.5
Reconstruction	$58	$48	$436.3
New Construction	$-	$-	$-
Totals	$97	$84.1	$762.3

Turnpike Bridges & Conduits			
	2022	**2023 - 2031 Annual Avg.**	**10-Year Total**
Maintenance	$0.3	$0.3	$ 2.9
Preservation	$-	$6.1	$ 55.1
Rehabilitation	$15	$38	$ 360
Reconstruction	$10	$25	$ 239

Turnpike Pavement			
New Construction	$-	$-	$-
Totals	**$25.3**	**$69.4**	**$657**

Table 56 - Turnpike Funding Investment

6.7 How Investment Strategies Ensure NHS State of Good Repair

Considering the information presented in Chapter 5, collectively the anticipated revenues and program investment strategies are expected by ODOT to ensure the NHS SOGR as defined by the TPM targets. The process for linking revenue, investment programs, and outcomes involves several functions carried out by different business units across ODOT, some of which are already described in the TAMP like the Life Cycle Planning for Pavement in Chapter 4. A similar cycle is leveraged throughout ODOT's programs and processes.

Creating a linear representation of these project processes is somewhat challenging, as each has its internal cycles, timelines, and decision logic factors. However, the following diagram generalizes how these programs function within ODOT's overall asset management strategy.

ODOT revenues are calculated and estimated budgets and proforma are presented in the biennium transportation bill which is approved by the Ohio General Assembly. Budget estimates consider many items but are largely influenced by estimated revenue, travel patterns, inflation, and observed historical patterns. Once the biennium budget bill is approved, ODOT allocates funding to the different programs, like TRAC, the Highway Safety Improvement Program, and others. Each of these programs focuses on improving portions of Ohio's broader transportation system, of which the NHS is included. Each program has different internal mechanisms for evaluating project fitness and need, potentially based on asset condition, community impact, economic development interests, safety goals, local partnership funding programs, as well as risk and resiliency factors.

Programs begin by scheduling projects in the ELLIS system. Depending on the project, projects may exist in ELLIS as partially funded for some time or in various states of progress for different reasons. Federal improvement categories are assigned to projects based on different treatment types or work activities.

Please note, that the graphic to the right does not fully illustrate all programs or federally required plans, like the Safety Plan, Freight Plan, STIP, etc., and seeks to illustrate the flow and relationship across these items of the process.

Allocating revenues to different funding programs has proven to be an effective method for ensuring holistic improvements to overall transportation system performance.

The Division of Finance monitors actual revenue received every month while the Division of Planning monitors project development being programmed in ELLIS. If revenues are less than estimated budgets, the Division of Planning evaluates various scenarios to adjust program funding levels. The Office of Estimating monitors factors like inflation, material costs, labor costs, and other trends to help anticipate future costs for projects.

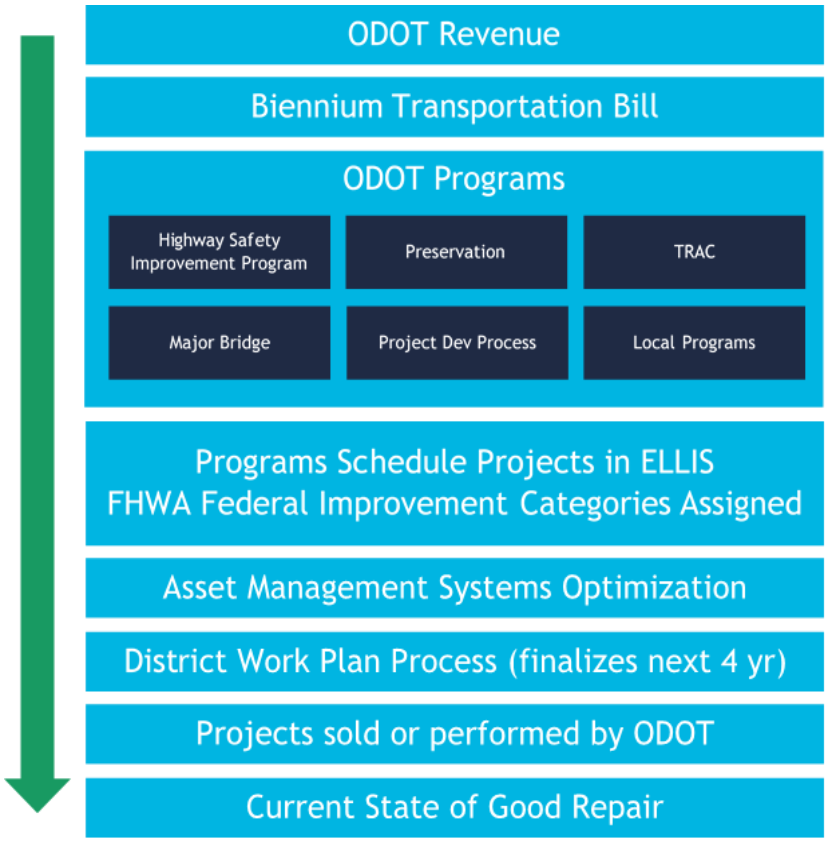


Figure 29 - How Investment Strategies Ensure NHS State of Good Repair

During the District Work Plan process, the asset management systems run optimizations based on the existing asset condition levels, asset life cycle planning strategies, currently scheduled projects or projects that are in progress, and newly developed projects by the different program areas. The asset management systems create additional project recommendations based on this holistic understanding of known activities, based on the life-cycle strategies defined within each asset (pavement, bridges, conduit) strategy.

These recommended projects are reviewed and selected by Districts for incorporation into the new Annual District Work Plan. Districts are required to adhere to a certain percentage of recommended projects but have discretion for the remaining to account for risk, including extreme weather and resiliency needs.

Projects are then sold or performed by ODOT forces as appropriate. Once the projects are realized, the asset inventories and conditions are updated during the next inspection, and the Current State of Good Repair is sustained.

ODOT also maintains a reservoir of projects ready in the event excess budget becomes available.

ODOT formalized this process workflow as part of the 2018 TAMP development. Using this strategy, ODOT achieved the TPM goals during the 2018 – 2022 performance period and will continue to leverage this process in the 2022 – 2026 performance period.

6.8 Asset Valuation Summary

As part of the TAMP Financial Plan Development requirement (23 CFR 515.7(d)), states must include a summary asset valuation for the State's NHS pavement and bridges.

6.8.1 PAVEMENT VALUATION

ODOT uses an average replacement cost approach to pavement valuation. This approach ultimately determined the rate of $1,250,000/lane mile.

PAVEMENT VALUATION (LANE MILES)		
NHS	Lane Miles	Valuation
Interstate	7,080	$8,850,000,000
U.S. Route	6,717	$8,396,250,000
State Route	5,758	$7,197,500,000
Turnpike	1,285	$1,606,250,000
Local	918	$1,147,500,000
No PCR data	120	$150,000,000
TOTAL	**21,881**	**$27,347,500,000**
Non-NHS		
U.S. Route	4,318	$5,397,500,000
State Route	25,569	$31,961,250,000
Local	26,866	$33,582,500,000
No PCR data	177,660	
TOTAL	**234,414**	**$70,941,250,000**
GRAND TOTAL	**256,295**	**$98,288,750,000**

Table 57 - Pavement Valuation - Lane Miles

6.8.2 BRIDGE VALUATION

ODOT uses an average bridge valuation calculation based on the Deck area (sq. ft.) multiplied by $213.76.

BRIDGE VALUATION

NHS	Count	Valuation
Interstate	2,157	$7,481,497,395
U.S. Route	1,895	$3,567,194,602
State Route	1,468	$3,457,674,666
Turnpike	380	$1,106,855,265
Local	185	$363,404,612
TOTAL	**6,085**	**$15,976,626,540**
Non-NHS		
U.S. Route	978	$1,003,098,513
State Route	6,457	$4,539,429,377
Turnpike*	151	$233,971,863
Local	29,826	$11,744,569,722
TOTAL	37,412	$17,521,069,475
GRAND TOTAL	**43,497**	**$33,497,696,015**

Table 58 - Bridge Valuation

* NON-NHS Turnpike Bridges are Overhead Local Township, County, pedestrian, bridges that fall under the Turnpike Team.

6.8.3 CONDUIT VALUATION

ODOT derives Conduit Valuation by considering multiple factors which include the size of the Conduit and the location of the conduit (e.g., if it is on IR, US, or SR routes).

The following formula is used to calculate the conduit valuation:

Valuation = Length * Unit Cost per Width * Max Height of Cover Multiplier * Length Multiplier * Route Type Multiplier * MOT * Dewater

CONDUIT VALUATION		
NHS	**Count**	**Valuation**
Interstate	10,937	$749,185,602
U.S. Route	10,100	$473,246,292
State Route	6,803	$281,723,504
Turnpike	470	[7]
TOTAL	28,310	$1,504,155,398
Non-NHS		
U.S. Route	6,279	$187,774,665
State Route	51,549	$893,471,706
Other	3,469	-
TOTAL	61,297	$1,081,246,371
GRAND TOTAL	**89,607**	**$2,585,401,769**

Table 59 - Conduit Valuation

[7] Detailed information to calculate is not available currently. The turnpike team does not currently valuate conduits.

7 PERFORMANCE SCENARIOS AND GAPS

This chapter evaluates the results of the Life Cycle Planning and Financial Plan chapters to determine whether performance gaps exist in achieving the desired SOGR.

7.1 Federal and State Requirements

Performance Gap Analysis (23 CFR 515.7(a)) should consider the physical condition of assets:

- Identifying gaps affecting the State DOT targets for the condition of NHS pavements and bridges as established according to 23 U.S.C. 150(d).
- Identifying deficiencies hindering progress toward achieving and sustaining the desired state of good repair (as defined by the State DOT).
- Developing alternative strategies that will close or address the identified gaps.

Additionally, the TAMP must describe a methodology for analyzing gaps in the performance of the NHS that affect NHS bridges and pavements regardless of their physical condition, that will:

- Identify gaps in the effectiveness of the NHS in providing safe and efficient movement of people and goods. (23 CFR 515.7(a)(2)).
- Identify strategies to close or address the identified gaps affecting the physical assets. (23 CFR 515.7(a)(3)).

7.2 Performance Gap Analysis Process – Physical Assets

ODOT's methodology for identifying potential performance gaps affecting physical assets leverages the information presented in the TAMP. This process includes the following steps:

1. Model scenarios in the Life Cycle Planning Analysis (Chapter 4) to determine whether the life cycle treatment strategies are effective in achieving performance goals across different funding scenarios.

2. Establish a Financial Plan (Chapter 6) which includes estimated funding levels for pavements, bridges, and conduits based on historical funding trends and any current known variables.

3. Compare and align the Life Cycle Planning Analysis and Financial Plan results to determine whether a performance gap is expected, and any specific deficiencies to the State of Good Repair.

4. Implement asset investment strategies through the Annual District Work Plan process.

5. Act and develop alternative strategies for resolving gaps if a performance gap is expected or occurs during the delivery of the Annual District Work Plan process.

    a. Leverage strategies outlined in the Risk Management to determine short-term resolutions as applicable.
    b. Review LCP to determine any necessary adjustments to the long-term strategies.

7.2.1 Pavement Gap Analysis

The pavement life cycle planning analysis considered three funding scenarios for the Priority and General Systems, where the total annual investment across those two systems were $410 million, $510 million, and $610 million. The middle scenario of $510 million proved successful in achieving the General System CSF statewide average PCR greater than 80, as well as the Priority System CSF statewide average PCR greater than 85.

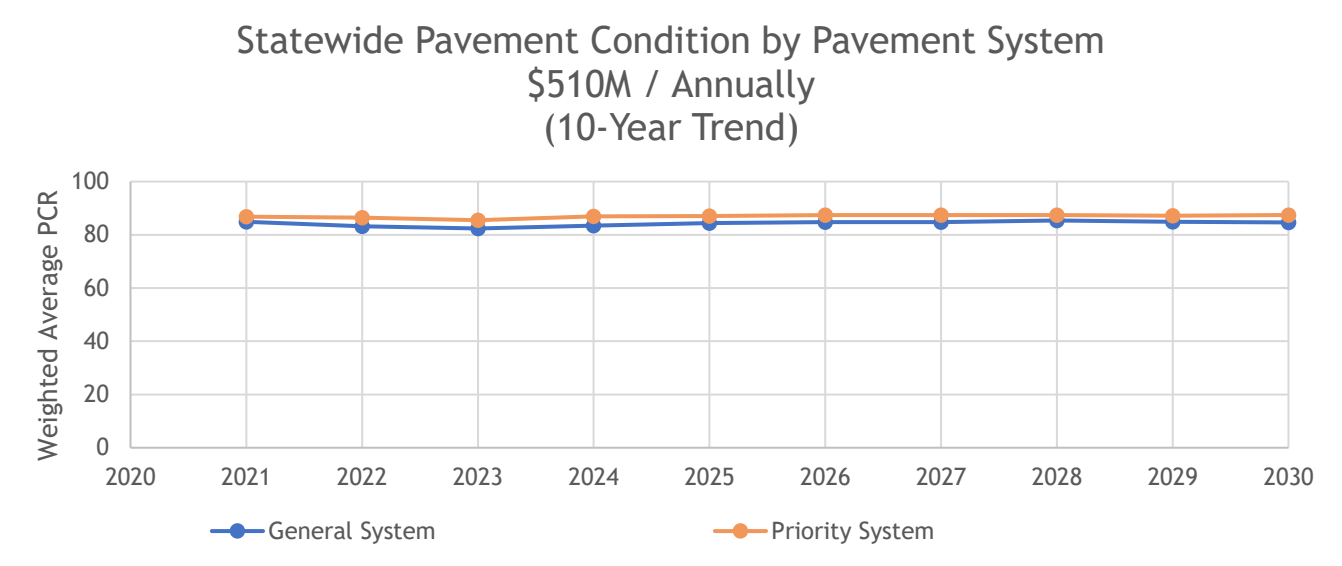


Table 60 - Statewide Pavement Condition by Pavement System $510M Annually

ODOT's pavement planning processes does not optimize specifically for the NHS system, and an individual CSF for NHS pavement performance is not defined by ODOT. However, when extracting the NHS from the General and Priority system pavement optimizations, the middle $510 million scenario illustrates the NHS sustains a weighted average PCR above 80 for the next 10 years, which is above the minimum General system CSF of 80.

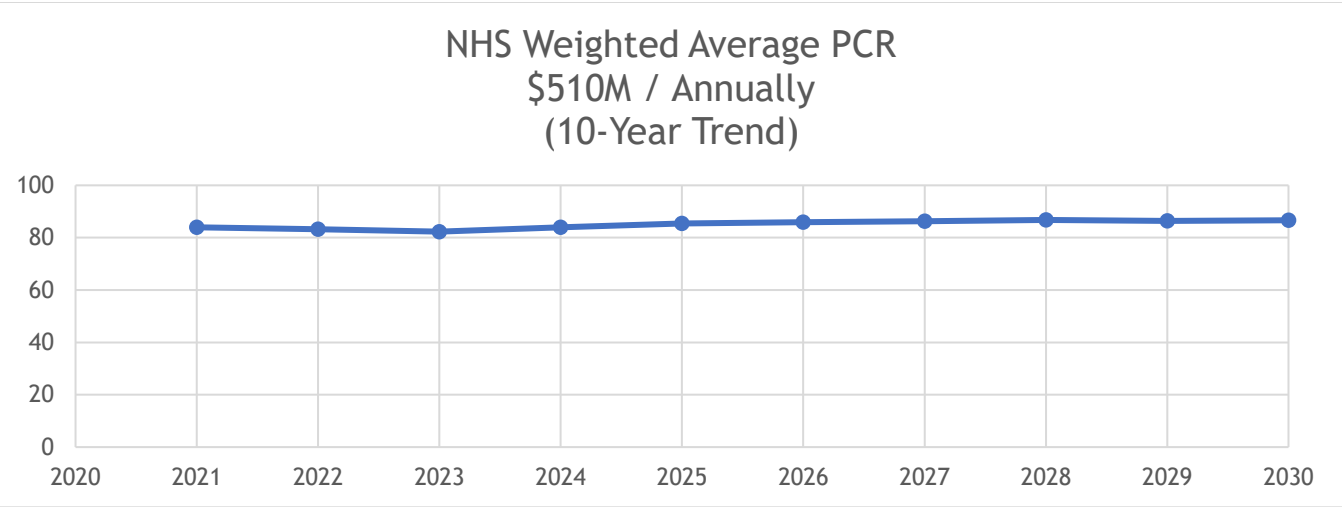


Table 61 - NHS Weighted Average PCR $510M Annually

Additionally, the Interstate system performance in this scenario illustrates a consistent trend of PCR values between 85 and 90. This is expected since ODOT's Priority system is largely comprised of interstate routes.

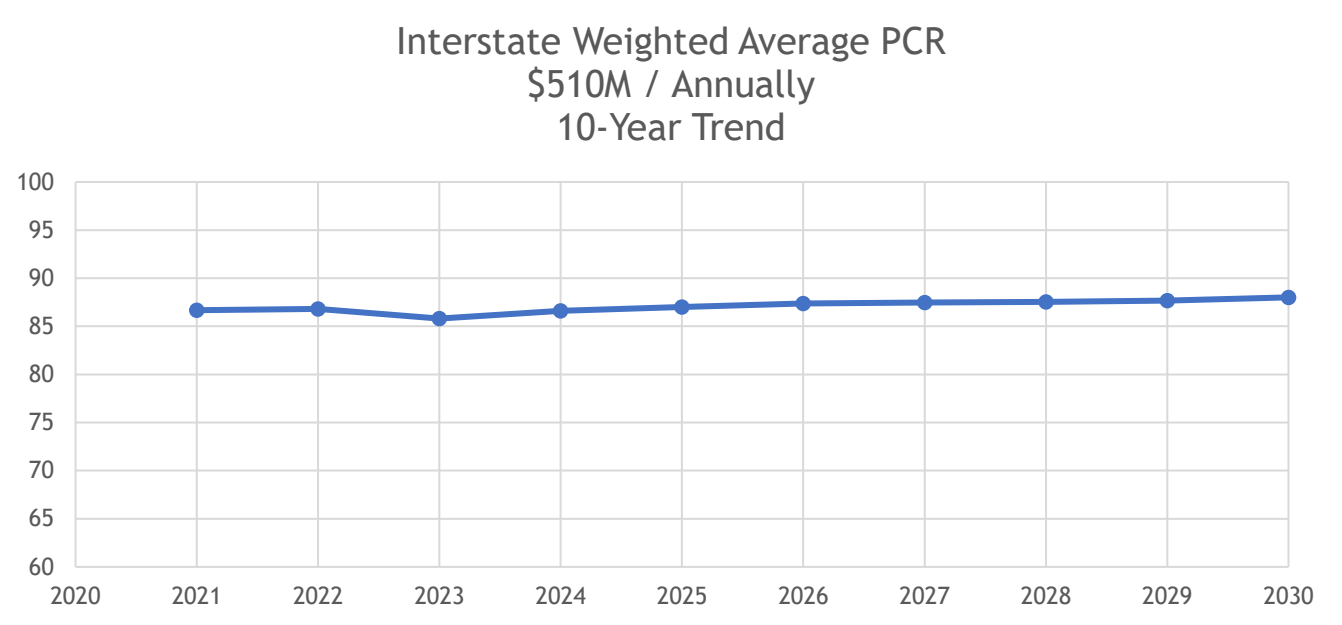


Table 62 - Interstate Weighted Average PCR $510M Annually

These results show at a funding level of $510 million annually across the General and Priority Systems, ODOT should be capable of sustaining the agency CSF. This is likely to correspond to the successful achievement of the TPM targets. Additionally, the Financial Plan anticipates the annual average pavement investment to be $1,400 million and $775 million for the NHS. Based on these results and funding estimates, no performance gap for pavements is expected during this performance period.

It is important to highlight the investment strategy in Chapter 6 identifies funding and investment levels for NHS pavements higher than what is reflected in the life-cycle planning and gap analysis sections. This difference is due to some of the NHS spending being attributed to projects not solely focusing on condition improvement or preservation. The investment strategy also accounts for improvements such as safety or capacity improvements. The lifecycle and gap analysis focuses on condition preservation. Neither ODOT's investment strategy or lifecycle analysis includes the turnpike, which is managed by the Ohio Turnpike Commission.

7.2.2 Bridges Gap Analysis

The bridge life cycle analysis illustrated a high return on investment leveraging a preservation-focused strategy compared to a "worst-first" strategy while considering three different funding scenarios of $250 million, $369 million, and $500 million of annual investment over 10 years. The analysis results indicate the preservation strategy performs well, indicating the types and strategies of treatments to be successful, should sufficient funding be available.

The planned investments outlined in the Financial Plan chapter are based on historical and known investments to determine an average annual investment of $380 million. The following chart illustrates expected performance based on the financial plan.

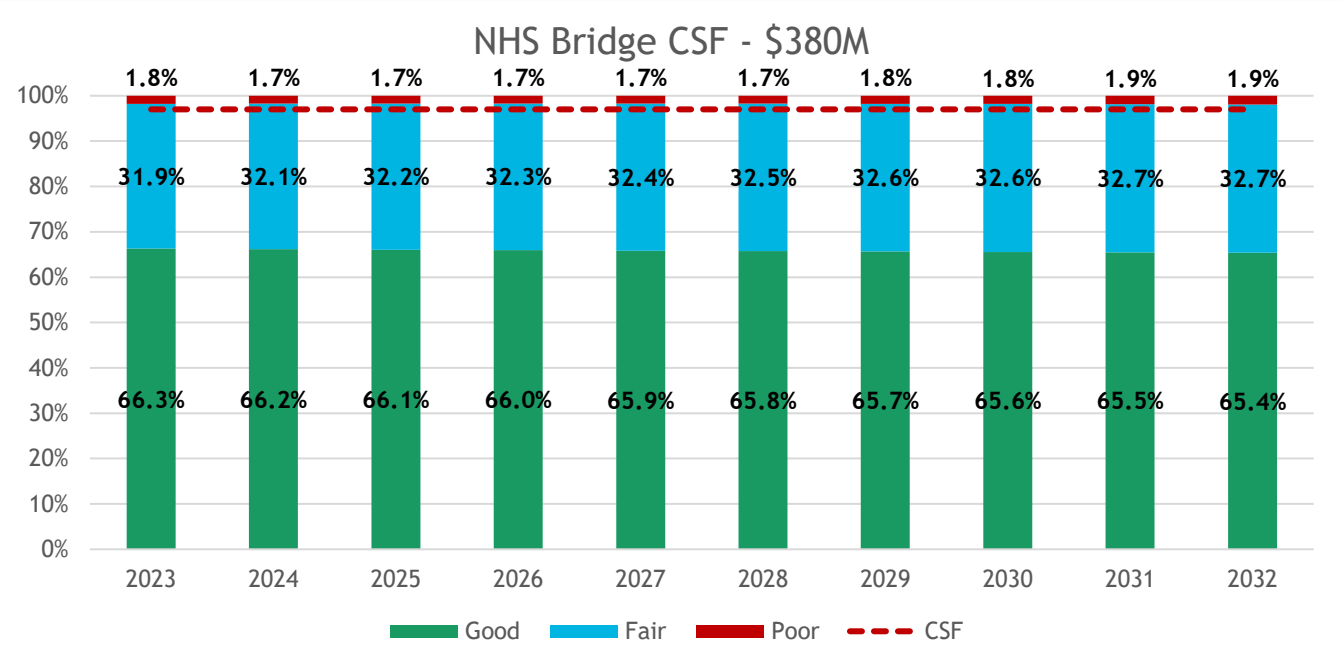


Table 63 - NHS Bridge CSF $380M

In the above chart, a Good rating is a GA of 7–9, a Fair rating is a GA of 5–6, and a Poor rating is a GA of 1-4. The percent projected to be in a Poor rating is less than 2 percent during the entire period, which achieves ODOT's CSF of less than 3 percent.

Additionally, the Bridge TPM goals of ensuring 55 percent or more maintain a Good rating and less than 3 percent are noted as Poor is also achieved.

Based on these results, the $380 million average annual investment identified in the Financial Plan is expected to achieve both the TPM and CSF goals. Also considering the additional ability of ODOT to manage risk through the Annual District Work Plan process, ODOT does not find a performance gap in achieving the state of good repair for bridges.

7.2.3 Conduit Gap Analysis

The conduit life cycle analysis was performed using a similar methodology as the bridges, though tailored to the data availability of ODOT's conduit inventory. It is important to note this inventory is not as mature, with less historical data available. Additionally, for the current year, ODOT's Office of Hydraulics reports about 6 percent of conduits do not have an inspection available for various reasons. For the life cycle analysis, this 6 percent figure remained constant throughout the 10-year assessment.

The Financial Plan estimates $10 million invested annually for the NHS Conduit system. ODOT's Conduit CSF target to have less than 5 percent receiving a poor GA is expected to be achieved.

The results show the TPM goals of greater than 55 percent of all conduits maintaining a Good rating and ensuring less than 5 percent having a Poor rating are both sustained over the 10-year projection period.

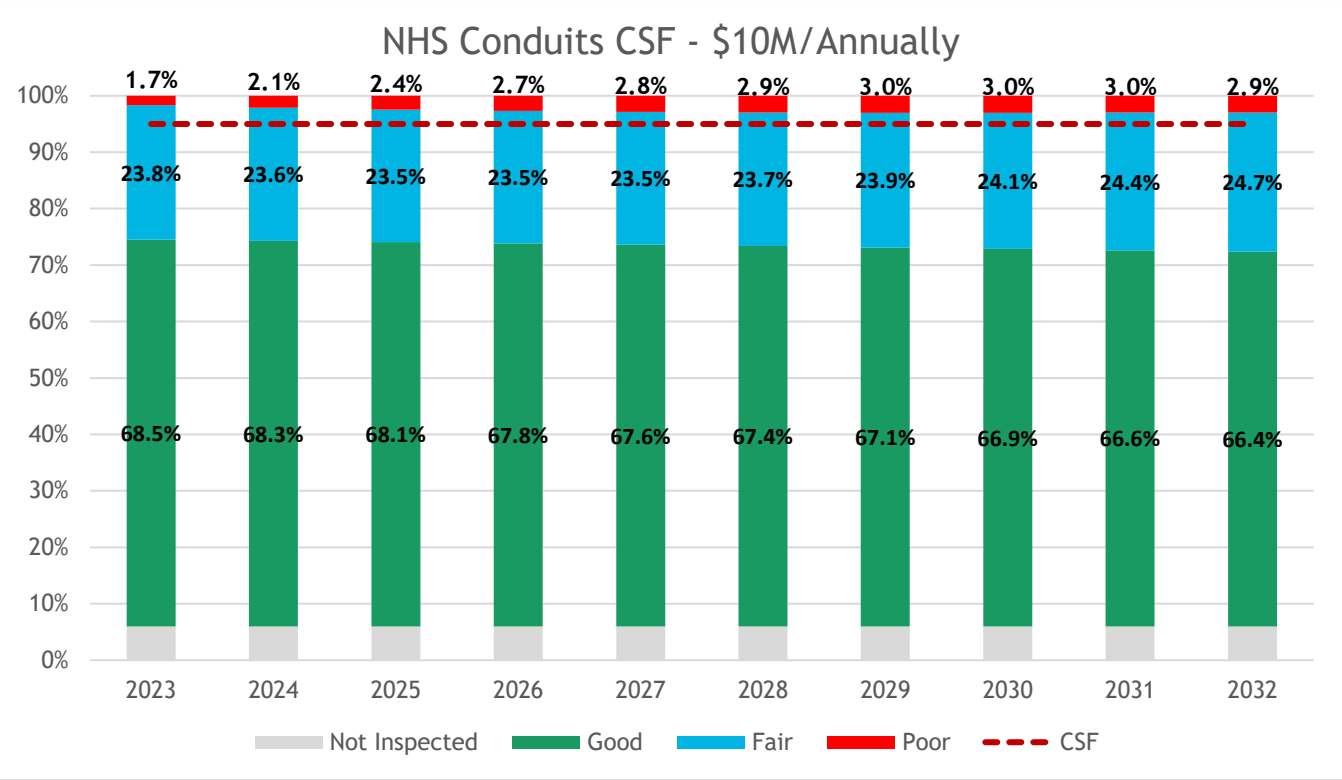


Table 64 - NHS Conduits $10M Annually

Based on these results that both the TPM and CSF goals are projected to be achieved for the NHS Conduits, ODOT finds no performance gap for the conduit system.

7.3 NHS Physical Gaps – Alternative Methods

Based on the current performance gap analysis, no gaps are anticipated during this performance period of 2022 – 2026, or over the 10-year analysis range. Therefore, no alternative methods are necessary to be identified in the TAMP at this time.

If alternative methods were required to be identified, ODOT would:

- Re-evaluate the individual asset life cycle planning strategies to determine whether changes to treatment strategies are necessary to ensure a long-term SOGR.
- Evaluate the Financial Plan to determine whether different funding allocation scenarios would provide a different long-term SOGR.
- Leverage the Risk Management strategies to work with leadership stakeholders across the agency to determine the impact, likelihood, and severity of the specific issue, as well as look more closely at mitigation scenarios concerns.

7.4 NHS Effectiveness Providing Safe and Efficient Movement

ODOT has established agency-wide Critical Success Factors to monitor Ohio's transportation system effectiveness for providing the safe and efficient movement of people and goods. This CSF is monitored by ODOT Leadership throughout the year and with the most current reports published on

ODOT's website. Programs and activities are distributed throughout the agency for continuous improvement processes related to each CSF to ensure ODOT is taking action to remain successful or discover opportunities to improve.

Here are excerpts of the most current reports (at the time of the TAMP report writing) relevant to this requirement:

7.4.1 Fatalities CSF

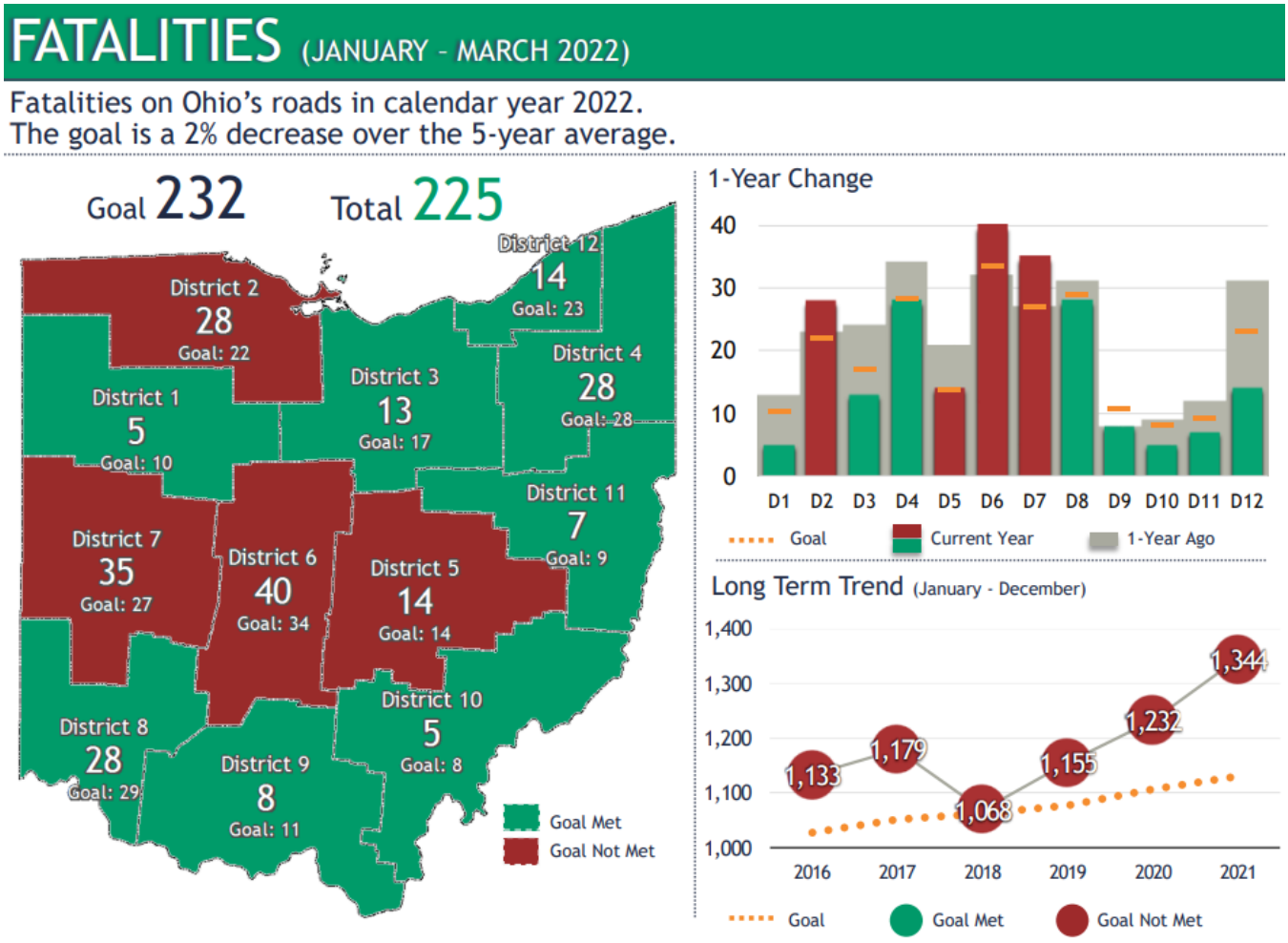


Figure 30 - Fatalities CSF

The Highway Safety Improvement Program can be contacted for more information about this CSF.

7.4.2 Serious Injuries CSF

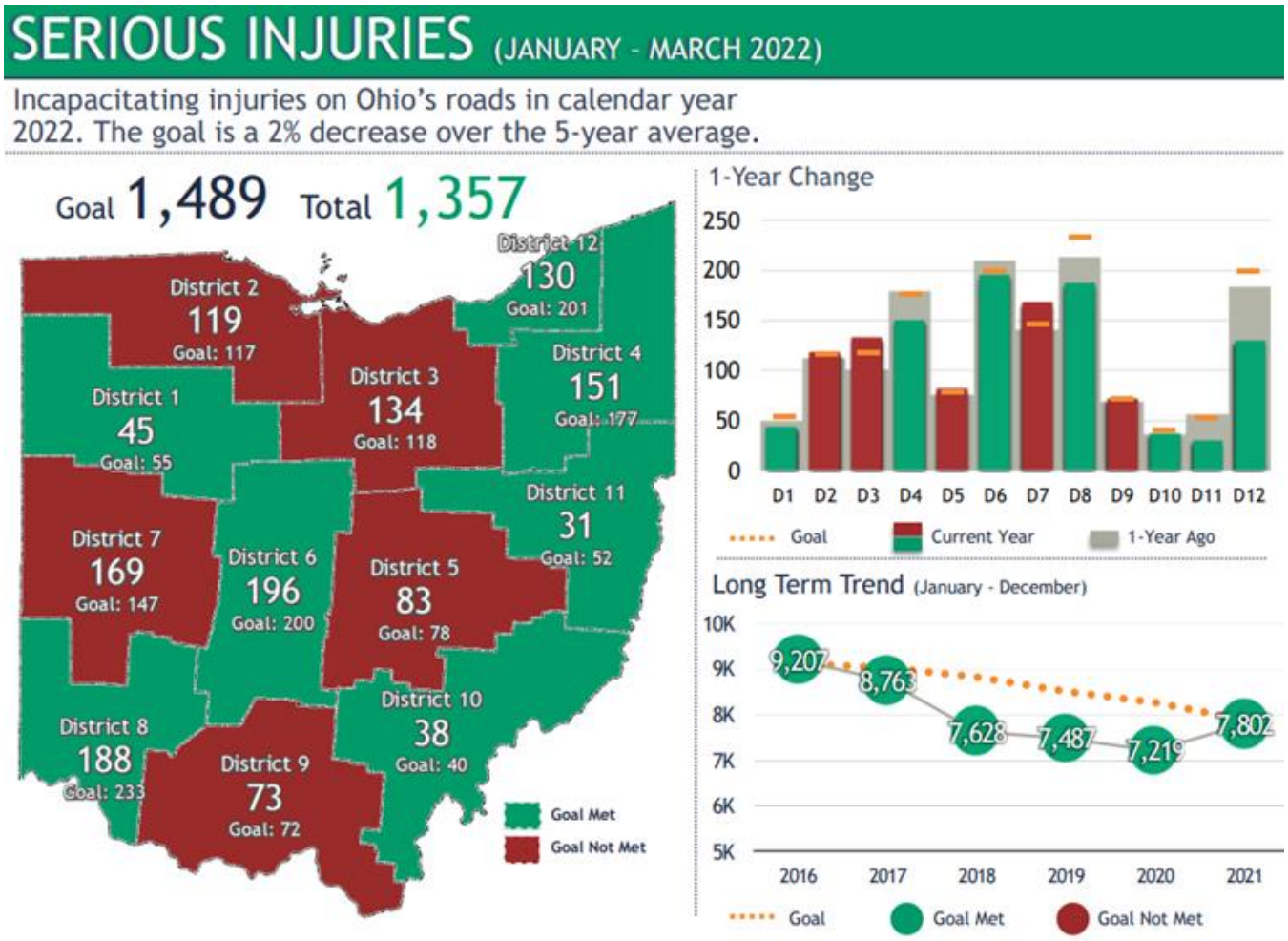


Figure 31 - Serious Injuries CSF

The Highway Safety Improvement Program can be contacted for more information about this CSF.

7.4.3 Bike-Pedestrian Fatalities CSF

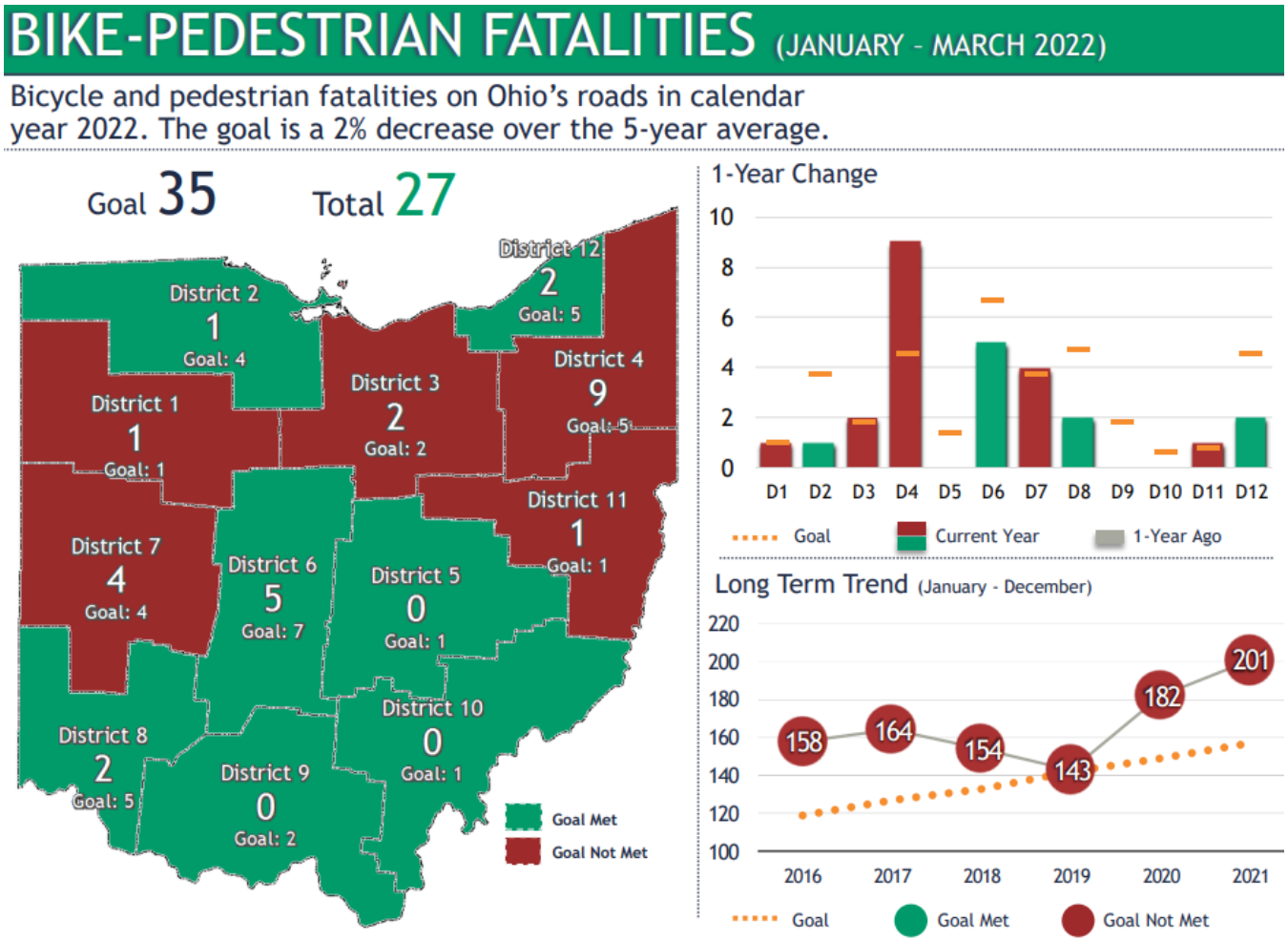


Figure 32 - Bike - Pedestrian Fatalities CSF

The Highway Safety Improvement Program can be contacted for more information about this CSF.

7.4.4 Bike-Pedestrian Serious Injuries

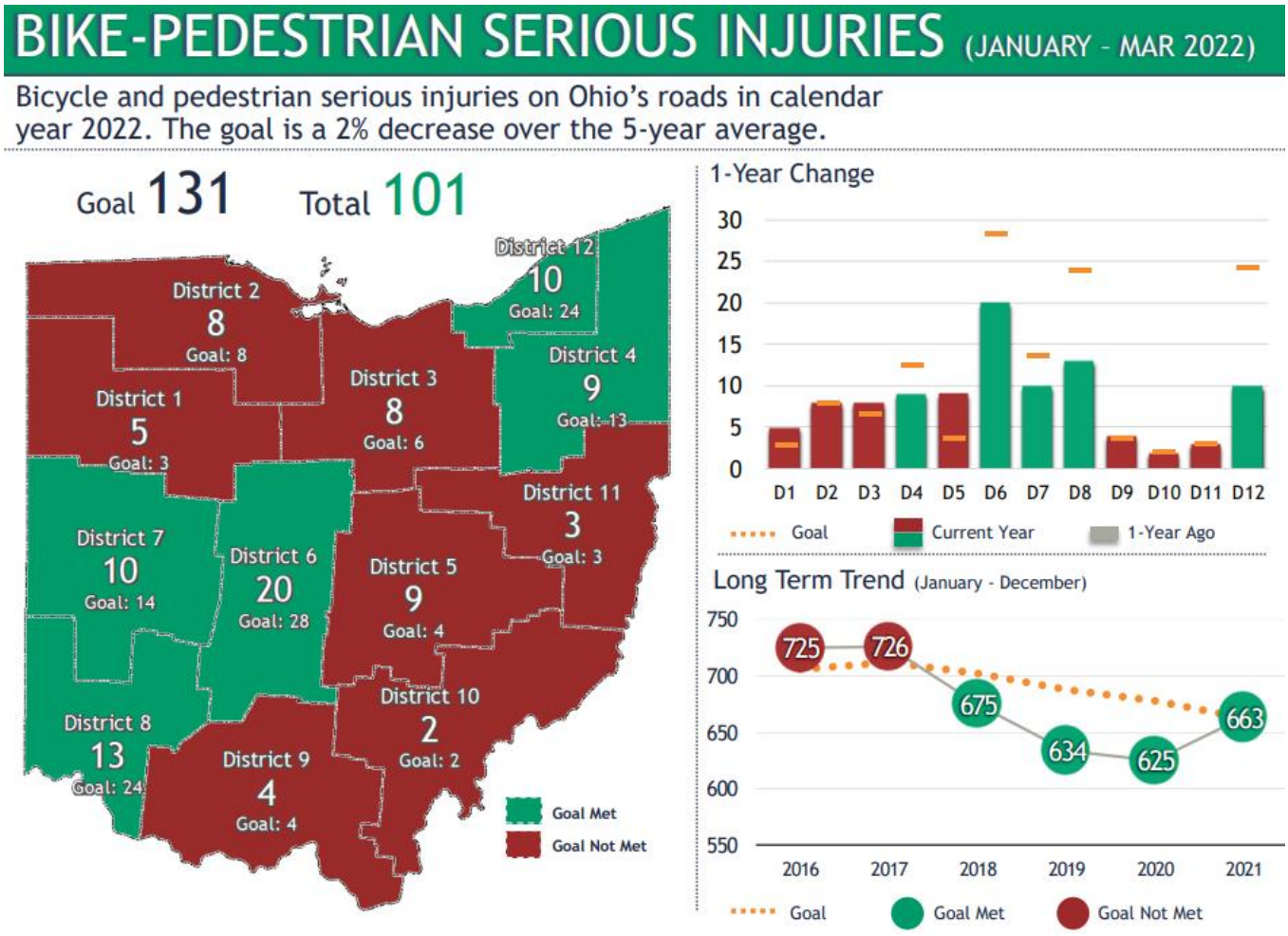


Figure 33 - Bike -Pedestrian Serious Injuries

The Highway Safety Improvement Program can be contacted for more information about this CSF.

7.4.5 Travel Time Reliability CSF

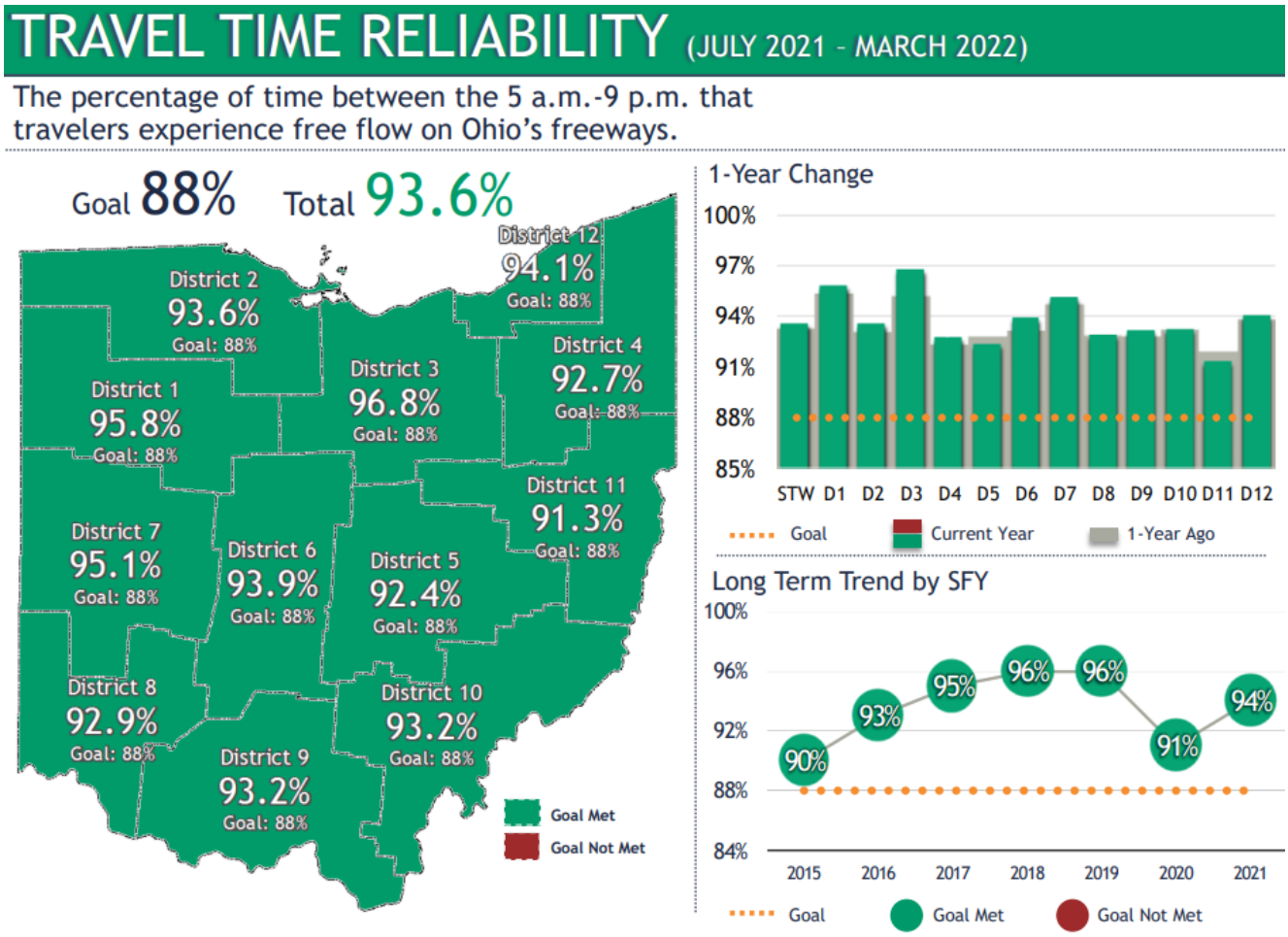


Figure 34 - Travel Time Reliability CSF

The Office of Traffic Management can be contacted for more information about this CSF.

7.4.6 Snow and Ice CSF

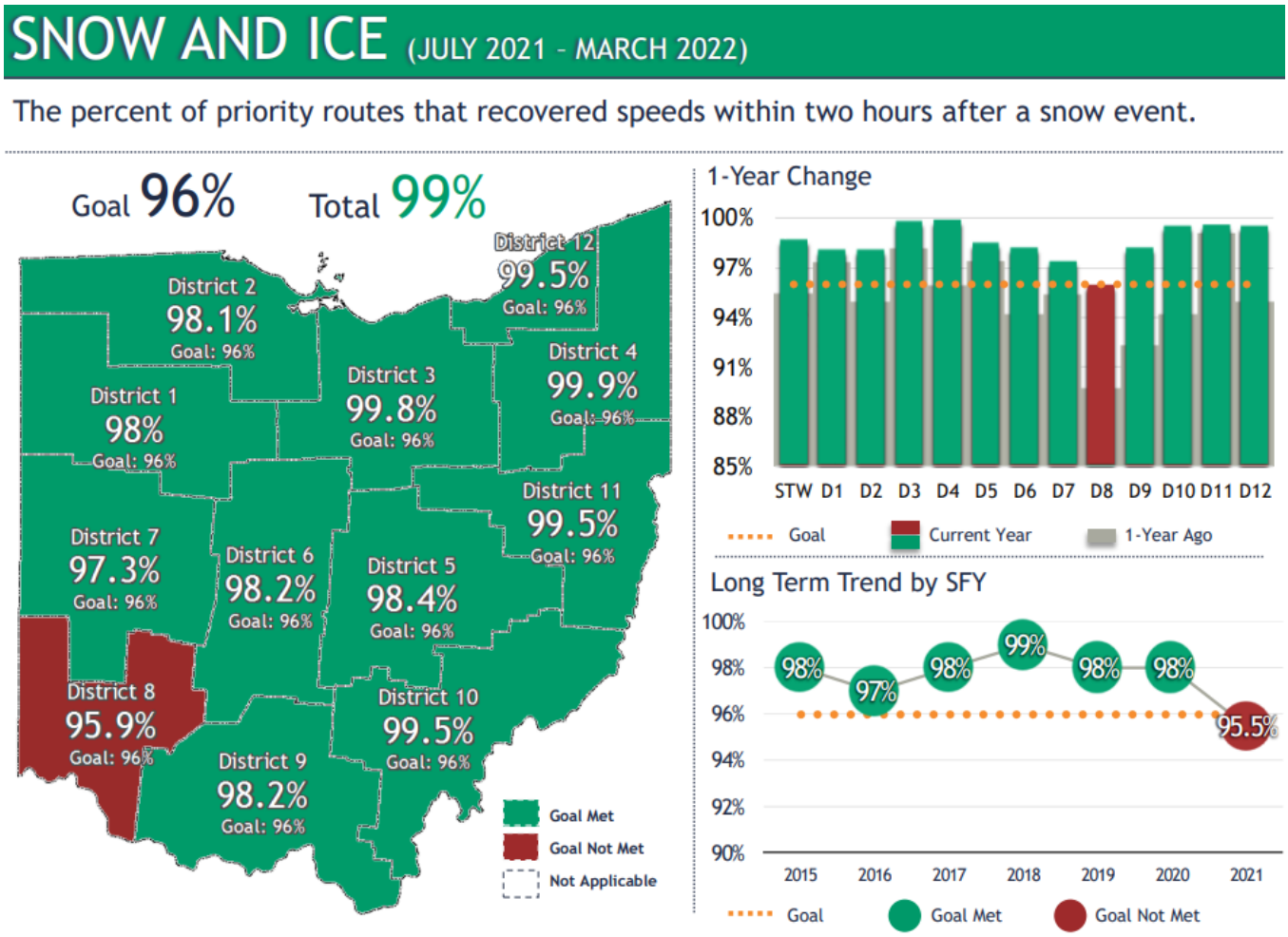


Figure 35 - Snow and Ice CSF

The Office of Traffic Management can be contacted for more information about this CSF.

8 TAM PROCESS IMPROVEMENTS

Transportation Asset Management is an evolving initiative as new requirements, objectives, advancements, or other factors arise. ODOT remains committed to adapting to these changes to ensure the NHS maintains the Desired State of Good Repair, as well as Ohio's broader transportation system, remains safe and reliable. The following section details key TAM process improvements ODOT has currently identified.

8.1 AASHTOWare BrM Application

The Life Cycle Planning Chapter (Chapter 4) noted that ODOT has successfully been utilizing a life cycle planning tool for structures, with a goal of implementing the AASHTOWare BrM application but has experienced resource challenges delaying the implementation. ODOT remains committed to implementing BrM with a current target implementation date of July 2023. The below table illustrates the current milestone accomplishments of the project.

AASHTOWare BrM Implementation Schedule

Date	Milestone
08/01/18	Acquire AASHTOWare BrM License.
09/05/18	Install BrM and Sample Database (Begin Testing).
09/18/18	2018 BrM User group Meetings.
03/28/19	Join MWBPP Deterioration Modeling Research Group.
09/17/19	2019 BrM user groups Meetings.
05/12/20	AssetWise Update Complete.
09/01/20	2020 BrM user group Meetings.
02/02/21	Attend FHWA Asset Management Workshop.
09/14/21	2021 BrM User Groups Meetings.
10/27/21	Create BrM Database with Ohio NBI & NBE Data from FHWA Website.
02/14/22	Deadline for Element Level Inspection Data for All Ohio Bridges.
02/15/22	Successfully Run 1st Optimization with FHWA Bridges.
04/01/22	Review 2022 District Workplans.
09/13/22	2022 BrM user group Meetings.
11/14/22	Create BrM Database with All Ohio NBI & NBE Data.
12/01/22	Successfully Run 1st Optimization with all Bridges.
12/31/22	Obtain MWBPP Deterioration Models.
01/30/23	Compare Optimization Results with Select District Workplans.
04/03/23	Review 2023 District Workplans.

07/03/23	Implement BrM as an Engineering Tool and Assist all Districts.

Table 65 - AASHTOWare BrM Implementation Schedule

8.2 2022 Resiliency Improvement Plan

In Chapter 5, the 2022 Resiliency Improvement Plan project was described. This project is currently in the procurement process and is expected to be awarded in fall 2022. This project, along with anticipated FHWA rulemaking related to BIL in 2023 or later, will guide ODOT in continuing to address Extreme Weather and Resilience.

8.3 Conduit Service Life Methodologies

In 2016, ODOT commissioned an "Assessment of ODOT's Conduit Service Life Prediction Methodology." The objectives of this project were:

- Determine the effectiveness of ODOT's current methodology for estimating the service life of conduits and storm sewer conduits.
- Determine alternative metrics, as necessary, to ensure accurate and reliable service life predictions for newer materials.
- Develop service life estimates using degradation models developed through research on various materials and protective coatings currently used by ODOT.
- Recommend changes to Volume 2 of the Location and Design Manual.

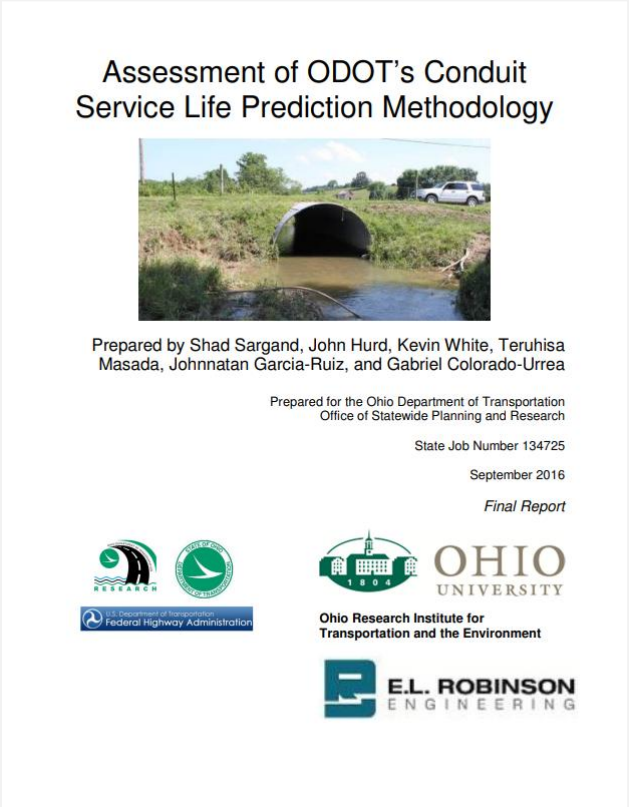


Figure 36 - Assessment of ODOT's Conduit Service Life Prediction Methodology Cover

ODOT has already leveraged many of the study's findings but notes the current Conduit inventory lacks enough historical condition information to fully analyze the service life. The life cycle planning analysis used in Chapter 4 leveraged the best available information at this time. Over time, as the Conduit inventory matures, ODOT will be able to further refine the life cycle planning processes to optimize the treatment and investment strategies enabling the SOGR.

This is a continual process improvement goal that will span beyond the 2022 – 2026 TAMP performance period.

8.4 Maintenance Operations

ODOT utilizes the Agile Assets solution for recording maintenance activities (this application is branded as "EIMS" at ODOT). Initial analysis of EIMS data in the TAMDST application provides some insights but improvements to the implementation of EIMS must be made to fully capture and analyze maintenance activities. For instance, the current EIMS implementation lacks full integration with ODOT's LRS resulting in limited locational information about where maintenance activities occur.

This hinders ODOT's ability to fully understand all maintenance impacts to maintain asset performance.

A 2018 gap analysis of the system provided recommendations that ODOT began to advance in 2019, however, these efforts were halted due to the COVID-19 Pandemic. In 2021, ODOT revisited the concerns, and a project is now being scheduled with the following goals:

- Move EIMS from an ODOT-managed solution to a vendor, cloud-managed solution.
- Upgrade EIMS to the currently supported application version.
- Achieve LRS integration.

Once this multi-year project is complete, ODOT can reassess the information available to support asset management planning and analysis.

8.5 Digital Project Delivery & BIM

Transportation technology advancements present opportunities for how ODOT collects and leverages information across the organization and asset life cycle. ODOT business units have embraced many of these technology advancements individually, and ODOT is now positioned to further these existing investments to deliver a more efficient program. This can be achieved by implementing technology, data management practices, and processes aimed to increase collaboration across ODOT's Divisions.

In December 2021, ODOT's Office of CADD & Mapping and Office of Data Governance began developing strategic recommendations for delivery to ODOT leadership in July 2022. This evaluation process included numerous surveys, conversations, and workshops with internal and external stakeholders, as well as a review of industry best practices related to advanced 3D models, digital project delivery, and/or Building Information Modeling (BIM) concepts. Significant support for advancing these practices at ODOT were found.

Some of the anticipated strategic recommendations include developing Smart Plans, implementing Advanced 3D models, implementing BIM infrastructure, and working towards the delivery of As-Built information.

Some of the benefits identified for implementing these improvements include the ability to catch inefficiencies in design and construction early in a project, reduction of change orders, improvement to estimating and bidding processes, and improving the handoff across planning, design, construction, and maintenance cycles.

Implementing such changes may have profound impacts on existing processes, and the strategic recommendations note risk must be managed through sound organizational change management processes.

These recommendations are pending ODOT leadership evaluation and adoption currently. Should ODOT pursue these recommendations, it is expected to benefit the TAM and TAMP initiatives by enabling greater information related to assets, improving ODOT's ability to make both long-term and day-to-day operational data-driven decisions.

8.6 Data Collection & Automation

Chapter 1 provided an overview of the broader TAM program at ODOT, beyond the core pavement, bridge, and conduit programs. ODOT is currently exploring new methods for gathering asset information to supplement existing inventory information or create new inventories. The goal would

be to augment current data collection methods with automated technologies, such as machine learning, to reduce manual data editing time by staff, and develop models to perform change detection to identify asset condition concerns or other similar business cases. ODOT is currently scoping business cases, evaluating appropriate data sources (i.e., mobile LiDAR, vehicle-mounted cameras), and different machine learning or artificial intelligence platforms or services. This business case analysis will rely on an overall return on investment to determine the extent these technologies can benefit ODOT's TAM program.

9 ODOT ACRONYMS AND TERMS GLOSSARY

This glossary includes a list of acronyms used in the ODOT TAMP and the Ohio Department of Transportation's (ODOT) Office of Data Governance (DGO) glossary of enterprise business terms used by two or more business units in ODOT.

A

Acronym	Term	Definition
AADT	Annual Average Daily Traffic	The total volume of vehicle traffic on a highway or road for a year divided by 365 days.
	Accuracy	The extent to which the data provide an unbiased representation of the true value is also known as "correctness."
AASHTO	American Association of State Highway and Transportation Officials	AASHTO is a nonprofit, nonpartisan association representing highway and transportation departments in the 50 states, the District of Columbia, and Puerto Rico with a primary goal of fostering the development, operation, and maintenance of an integrated national transportation system.
ADA	Americans with Disabilities Act	The Americans with Disabilities Act (ADA) prohibits discrimination against people with disabilities in several areas, including employment, transportation, public accommodations, communications, and access to state and local government programs and services.
AMLT	Asset Management Leadership Team	AMLT is comprised of Policy level, Executive level, and working professionals in the major business units with the duty to provide governance and awareness of ODOT Transportation Asset Management Activities.
ARNOLD	All Road Network of Linear Referenced Data	FHWA standardized, nationwide, and authoritative LRS-based road network.
	Assimilate	A step in the ODOT Data Life Cycle where disparate sets of data are combined, or integrated, for reporting purposes.
AV	Automated Vehicles	Vehicles whose operation occurs without direct driver input for steering, acceleration, or breaking.

B

Acronym	Term	Definition
	Barriers	Barriers refer to the ODOT program for assets (Barriers). Barrier types include Guardrail, Cable, and Concrete.
BI	Business Intelligence	Business intelligence (BI) comprises the strategies and technologies used by enterprises for the data analysis of business information. BI technologies provide historical, current, and predictive views of business operations. Common functions of business intelligence technologies include reporting, online analytical processing, analytics, data mining, process mining, complex event processing, business performance management, benchmarking, text mining, predictive analytics, and prescriptive analytics. Or

Acronym	Term	Definition
		A technology-driven process for analyzing data and presenting actionable information to help executives, managers, and other corporate end-users make informed business decisions.
BIL	Bipartisan Infrastructure Law	Law enacted on October 1, 2021, supporting infrastructure activities within the United States. See IIJA
BMP	Best Management Practices	Refers to a storm water structural element designed to reduce pollution caused by precipitation runoff.
	Bridge	An asset that spans over a body of water, valley, or another roadway. Bridges and 10' conduits are both managed by the Structures group.
BMS	Bridge Maintenance System	An IT application used to record bridge maintenance activities.
BrM	AASHTOWare Bridge Management System	An IT application used for performing lifecycle analysis for structures.
BTRS	Base Transportation Reference System	A BTRS provides a standard for identifying transportation locations around the state. The system links GIS and/or LRS (Linear Reference Systems) to different databases for referencing locations consistently.
	Business Glossary	An ODOT glossary of internal terminologies used within ODOT to maximize understanding of core business concepts and terminologies used within the organization or used to minimize misuse of data due to inaccurate understanding of business concepts or terms.
	Business Plan	ODOT Divisions and Offices prepare operational plans allowing each business unit in the agency to plan for future activities, monitor current initiatives, and manage risk and funding. All business plans are reviewed for performance at various levels of the organization and communicated to the agencies' staff, facilitating a unified focus. High-quality data enables advanced planning capabilities to optimize operational efficiencies.

C

Acronym	Term	Definition
CDE	Critical Data Element	Data elements that are sourced or created in primary business systems or collections but used through the organization to make important decisions or references vital to ODOT business functions.
CDO	Chief Data Officer	Chair of the Data Governance Committee who oversees the ongoing implementation and management of the Data Governance Policy and Standards. The CDO is the director of the Office of Data Governance.
CEAO	County Engineers Associations	An organization within Ohio whose mission is to support the County Engineers in achieving safe and efficient movement of people, goods, and services.
CMM	Capability Maturity Model	A model containing the essential elements of effective processes for one or more areas of interest and describes an evolutionary improvement from ad-hoc, immature processes to disciplined, mature processes with improved quality and effectiveness.

Acronym	Term	Definition
	Collector	The collector program is an ESRI GIS software application, as well as an ODOT asset management program used to inventory and manage specific asset classes like pavements, conduits, barriers, traffic signage, et al.
	Completeness	The expectation is that certain attributes are expected to be assigned values in a data set. It also refers to the absence of gaps in data.
	Conduit	An open-ended drainage pipe that is buried underneath or alongside a roadway to divert rainwater from the road surface. Conduits 10' and smaller are managed by the Conduits group. Conduits over 10' are managed by the Structures group.
	Conduit Service Life Prediction Methodology	The use of decision tree-based predictive models for improving the conduit inspection process.
	Create	A step in the ODOT Data Life Cycle where data is retrieved from external sources, internally collected, or generated from a primary source.
CSF	Critical Success Factor	Critical Success Factors provide ODOT with quantitative measures of mission success. Understandable, repeatable, and periodic reporting on the CSF metrics (People, System Conditions, Safety, Capital Programs) enables the ability to identify areas of improvement and excellence. High-quality data is paramount to support these key metrics.
CV	Connected and Automated Vehicles	Vehicles that use several communication technologies to communicate with the driver, other cars on the road (vehicle-to-vehicle, or V2V), roadside infrastructure (vehicle-to-infrastructure, or V2I), and the Cloud, (vehicle-to-cloud, or V2C). The technology is used to improve vehicle safety, efficiency, and commuter times, amongst other things.
CRSSAA	Coronavirus Response and Relief Supplemental Appropriations Act	On December 27, 2020, the Coronavirus Response and Relief Supplemental Appropriations Act of 2021 (CRRSAA), which includes $900 billion in supplemental appropriations for COVID-19 relief, $14 billion of which will be allocated to support the transit industry during the COVID-19 public health emergency, was signed into law

D

Acronym	Term	Definition
	Dashboard	A visual display of all of your data. Its primary intention is to provide information at-a-glance, such as KPIs.
DAMA	Data Management Association	A global association dedicated to advancing the concepts and practices of information and data management. DAMA's primary purpose is to promote the understanding, development, and practice of managing data and information as key enterprise assets to support the organization.
DAS	Department of Administrative Services	The Ohio Department of Administrative Services (DAS) provides centralized services, specialized support, and innovative solutions to state agencies, boards and commissions, local governments, and state universities. DAS issues policies or directives which impact data management and usage. ODOT's DG Framework must adhere to these policies.
	Data Catalog	A data catalog is a metadata management tool designed to help organizations find and manage large amounts of data – including tables, files, and databases.

Acronym	Term	Definition
	Data Dictionary	A data dictionary, or metadata repository, as defined in the IBM Dictionary of Computing, is a "centralized repository of information about data such as meaning, relationships to other data, origin, usage, and format". Oracle defines it as a collection of tables with metadata.
	Data Elements	A data field that is tracked in a tabular database.
	Data Format	Controls how data is displayed (Date displayed as MMDDYYYY or MMDDYY).
DBO	Data Business Owner	A Data Business Owner (DBO), sometimes referred to as a database owner, is a business unit that has primary responsibility and/or ownership of a business system and its corresponding data and database technologies. The DBO also utilizes and maintains the system in question as part of its daily operations.
DBP	Data Business Plan	Data Business Plans are used to outline critical information for each business system used within ODOT that includes basic qualifying information for the collection, management, and use of specific datasets. The DBP should address all phases of the Data Life Cycle.
DDD	District Deputy Director	Each of ODOT's 12 districts has one person in charge of, and responsible for, the entire district, which is known as the DDD.
DDIR	Detailed Damage Inspection	An inspection report was completed as part of the Part 667 Emergency Relief application process.
DG	Data Governance	Overarching policy and procedures to maximize the availability, integration, usability, quality, and security of data. It is a business competency that engages ODOT's workforce at executive, strategic, tactical, and operational levels to create, implement and maintain data standards for making better decisions. Or FHWA: It is the discipline that establishes the criteria and requirements for data; their quality, management, policies, business process; and risk management for the handling of data within FHWA. In short, it is a corporate approach to collecting and managing data. Or Wikipedia: Data governance is a data management concept concerning the capability that enables an organization to ensure that high data quality exists throughout the complete life cycle of the data. The key focus areas of data governance include availability, usability, consistency, data integrity, and data security. It establishes processes to ensure effective data management throughout the enterprise such as accountability for the adverse effects of poor data quality and ensuring that the data which an enterprise has can be used by the entire organization.
DGPMT	Data Governance Project Management Team	The collective team of Data Governance project managers for ODOT and data governance project vendors.
DGC	Data Governance Committee	A chartered committee that provides executive and organizational oversight and enforces data governance standards. The DGC is headed by the Chief Data Officer along with one central and one district assistant director.

Acronym	Term	Definition
DGF	Data Governance Framework	The framework that encompasses everything from the people and process behind data governance to the technologies used to manage and analyze the data.
DGP	Data Governance Policy	A formal enforcement strategy that states how data governance policy will be managed and upheld to ensure ODOT gets the most value from its data.
DGS	Data Governance Standards	Data governance standards (DGS) are rules and standards used for integrating, sharing, and reporting data between two or more databases. Standards outline requirements related to quality, quantity, level, grade, controls, security, format, etc. for specific data fields found in one or more databases. DGS also applies to the workflow requirements to implement, manage, and enforce your DGP and DGS.
DLC	Data Life Cycle	A policy-based approach to managing the flow of an information system's data throughout its life cycle. The ODOT data life cycle includes seven pillars or major steps in the data life cycle. The life cycle includes Plan, Create, Maintain, Assimilate, Use, Distribute, and Archival/Removal of data.
DQMP	Data Quality Management Plan	FHWA requires States to develop Data Quality Management Programs (DQMPs) appropriate for their agency, per 23 CFR 490.319. The DQMP requirement is intended to help States improve the accuracy of the pavement condition metrics. A DQMP is a document that defines the acceptable level of data quality and describes how the data collection process will ensure this level of quality in its deliverables and processes.
	Data Silos	Data systems with inhibited collaboration or connectivity with other data systems within an enterprise environment.
	Data Type	The attribute of data that tells the compiler or interpreter how the programmer intends to use the data. (Date, decimal number, currency, etc.)
	DBE Participation Plan	Plan overviewing the project participants of the state-required Disadvantaged Business Enterprise to ensure the state-required minimum 5 percent project participation.
PSC	DG Project Steering Committee	Committee to ensure project delivery is on track and meeting requirements. A project-level steering committee providing tactical guidance and technical input as well as ensuring project delivery is on schedule. Or A project-level steering committee providing tactical guidance and technical input as well as ensuring project delivery is on schedule.
	Directive	A directive may establish policy, assign responsibilities, define objectives, and delegate authority to those working in and with the authoritative figure.
DBE	Disadvantaged Business Enterprise	State program and vendor designation to encourage women and minority-owned businesses participation in DOT-funded projects.
DGO	Data Governance Office	The Office of Data Governance oversees the creation, standardization, and implementation of ODOT's Data Governance program. The DGO is directed by the Chief Data Officer.
	Distribute	A step in the ODOT Data Life Cycle where data is presented to internal and external consumers of the data in the form of dashboards, graphics, reports, or decision support tools. The distribution also includes disseminating data and information through public media.

Acronym	Term	Definition
DTAMC	District Transportation Asset Management Coordinators	District level coordinators are responsible for carrying out the roles and responsibilities of the Transportation Asset Management Plan (TAMP) as defined by the Asset Management Leadership Team (AMLT).
DoIT	Division of Information Technology within Ohio DOT	The Division of Information Technology builds, coordinates, and maintains all IT-related business needs following the ODOT business plan and initiatives.
	DoIT Strategic Plan	A DoIT Strategic Plan for data governance has been developed and is maintained by DoIT and the Office of Data Governance.
	Drive Ohio	Ohio is home to dozens of public and private entities all involved in the design, development, testing, use, and regulation of autonomous and connected technologies. DriveOhio, the state's new center for smart mobility, brings all of these organizations together under one umbrella, serving as the hub for all things autonomous and connected in Ohio. Supported by the Ohio Department of Transportation, DriveOhio also works to ensure Ohio's regulatory environment and public policies are conducive to the development of the infrastructure and technologies needed for smart mobility.
dTIMS	Pavement management system	ODOT's Pavement Management System for performing budget and condition capital improvement analysis and planning.

E

Acronym	Term	Definition
Ellis	Transportation Project Management System	Project accounting system and database critical to ODOT operations.
EA	Enterprise Architecture (EA)	Enterprise architecture is a well-defined practice for conducting enterprise analysis, design, planning, and implementation, always using a comprehensive approach, for the successful development and execution of strategy.
EASP	Enterprise Architecture Strategic Plan	Enterprise architecture is a well-defined practice for conducting enterprise analysis, design, planning, and implementation, always using a comprehensive approach, for the successful development and execution of strategy.
EDE	Enterprise Data Element	Data elements that are used by all (or nearly all) datasets in the organization and are standardized for all through the ODOT Data Governance Program and the Office of Data Governance.
EIMS	Equipment Inventory Management System	Maintenance management solution for Roadway, PEC, and Fleet to document work and cost data. The system integrates Agile Assets with a variety of other resource systems in ODOT including KRONOS, HRIS, Ellis, MANCON, and others.
ETL	Extract – Transform - Load	ETL is short for extract, transform, and load. They are three database functions that are combined into one tool to pull data out of one database, format or standardize it, and place it into another database.

Acronym	Term	Definition
EPA	Environmental Protection Agency	US Federal agency providing oversight and guidance related to environmental matters
ER	Emergency Relief	Related to the Part 667 Emergency Relief process.
	ESRI Collector	Provides ODOT the Ability to collect and Maintain Data Inventories using Mobile devices and Web Applications.
EV		Emergency Vehicles.

F

Acronym	Term	Definition
FAST	Fixing America's Surface Transportation Act of 2015	Infrastructure legislation passed by Congress in 2015. Is now superseded by the BIL.
FWHA	Federal Highway Administration	The Federal Highway Administration is an agency within the U.S. Department of Transportation that supports state and local governments in the design, construction, and maintenance of the nation's highway system (Federal-Aid Highway Program) and various federally and tribal-owned lands (Federal Lands Highway Program).
	Functional Data Element	Data elements that are sourced or created in primary business systems or collections and only used in those systems as part of the application functionality.

G

Acronym	Term	Definition
GA	General Appraisal	A term for the condition rating of structures and conduits.
GIS	Geographic Information System	A system designed to capture, store, manipulate, analyze, manage, and present spatial, locational, or geographic data.
GQL	Graphic Query Language	A data warehouse and reporting solution used in ODOT to report on roadway, Projects/Engineering/Construction (PEC), and Fleet maintenance using a Graphic Query Language driven report generator.
	Granularity	The extent to which data is provided at the right level of detail to meet ODOT's needs.

H

Acronym	Term	Definition
HDNA	Highway Network Data Application	An IT application used to process rutting, cracking, faulting data.
HIM	Highway Infrastructure Management	A section with the Office of Technical Services responsible for pavement data collection.

Acronym	Term	Definition
HMA	Highway Management Administrator	A role within ODOT who oversees District maintenance activities.
HPMS	Highway Performance Monitoring System	The HPMS is a national-level highway information system that includes data on the extent, condition, performance, use, and operating characteristics of the nation's highways. The HPMS contains administrative and extent of system information on all public roads, while information on other characteristics is represented in HPMS as a mix of universe and sample data for arterial and collector functional systems. Limited information on travel and paved miles is included in summary form for the lowest functional systems.

I

Acronym	Term	Definition
IAM	Institute of Asset Management	The Institute of Asset Management (IAM) is a UK-based not-for-profit professional body for those involved in the acquisition, operation, and care of physical assets, especially critical infrastructure. It was instrumental in the development of the international standard ISO 55000 for asset management and is recognized worldwide as a leading authority in Asset Management.
IIJA	Infrastructure Investment and Jobs Act	A law passed by the US Congress related to infrastructure. See BIL
IRI	International Roughness Index	A condition rating system for pavement.
ISO	International Organization for Standardization	An organization that establishes international standards.
ITS	Intelligent Transportation Systems	Systems or technology deployed with transportation infrastructure to improve the operational performance.

J

Acronym	Term	Definition

K

Acronym	Term	Definition
KPI	Key Performance Indicators	A measurable indicator of progress towards an intended result.
	KRONOS	Payroll system and database.

L

Acronym	Term	Definition
LCP	Life Cycle Planning	Strategies for managing assets over their entire life by capitalizing on timely and appropriate treatments to extend life at the lowest reasonable cost.
	Lineage	Documentation identifying the originating source of any new and updated data element used in a system.
LRS	Linear Referencing System	A method of spatial referencing, in which the locations of features or assets are described in terms of measurements along with a linear element, from a defined starting point, for example, a milestone along a road. The Roadway Inventory Management System (RIMS) is ODOT's primary LRS.
LTAP	Local Technical Assistance Program	An ODOT program offering funding, services, and other opportunities to local agencies.

M

Acronym	Term	Definition
	Maintain	A step in the ODOT Data Life Cycle where data is synthesized, cleansed, reconciled, and maintained per data governance standards.
	MANCON	Material inventory and ordering system and database.
MAP-21	Moving Ahead for Progress in the 21st Century Act	Legislation passed by the US Congress. Superseded by FAST and now BIL.
	Metadata	Metadata is data that provides information about other data fields. Many distinct types of metadata exist, among this descriptive metadata, structural metadata, administrative metadata, reference metadata, and statistical metadata. • Descriptive metadata describes a resource for purposes such as discovery and identification. It can include elements such as title, abstract, author, and keywords. • Structural metadata is metadata about containers of data and indicates how compound objects are put together, for example, how pages are ordered to form chapters. It describes the types, versions, relationships, and other characteristics of digital materials. • Administrative metadata provides information to help manage a resource, such as when and how it was created, file type and other technical information, and who can access it. • Reference metadata describes the contents and quality of statistical data. • Statistical metadata may also describe processes that collect, process, or produce statistical data; such metadata is also called process data.

Acronym	Term	Definition
MDM	Master Data Management	Technology-enabled discipline in which business and IT work together to ensure the uniformity, accuracy, stewardship, semantic consistency, and accountability of the enterprise's official shared master data assets.
MIRE	Model Inventory of Roadway Elements	A Federal Highway Administration recommended a list of roadway inventory and traffic elements critical to safety management.
MPO	Metropolitan Planning Organizations	A policy board of an organization created and designated to carry out the metropolitan transportation planning process.
MS2	Traffic Monitoring System	An IT application used to manage AADT traffic data.

N

Acronym	Term	Definition
NBI	National Bridge Inventory	NBI is an FHWA collection of regulations, policies, and guidelines for the inventory and standardized reporting on the inspection condition of our nation's bridge structures. NBI includes National Bridge Inspection Standards ODOT must gather and submit to the federal government periodically.
NCHRP	National Cooperative Highway Research Program	Research and report findings on issues integral to the state Departments of Transportation (DOTs) and transportation professionals at all levels of government and the private sector.
NHS	National Highway System	A network of strategic highways which include interstates and other roads important to the nation's economy, defense, and mobility.

O

Acronym	Term	Definition
OARC	Ohio Association of Regional Councils	Ohio-based organization facilitating collaboration across government agencies.
OCMCF	Organizational Change Management and Communication Framework	Framework for the approach and schedule to develop and communicate an organizational change management plan.
OCMP	Organizational Change Management Plan	Plan for managing and communicating the effect of new business processes, changes in organizational structure, or cultural changes within an enterprise.
OIT	Office of Information Technologies	Ohio state government's Office of Information Technologies that all state departments, including ODOT, must adhere to. ODOT's counterpart is DoIT.

Acronym	Term	Definition
		OIT delivers statewide information technology and telecommunication services to state government agencies, boards, and commissions. OIT administers many policies and standards development, life cycle investment planning, and data privacy and security management. ODOT will monitor this agency for compliance with governance principles and standards when developing and managing data policies, plus any enterprise-shared technology solutions.
	Office of Technical Services	The Office of Technical Services provides a world-class data repository, disseminating information to support decision-making in the areas of planning, design, construction, and preservation of Ohio's transportation system.
	Ohio Rail	A counterpart to ODOT, Ohio Rail Development Commission, referred to as Ohio Rail, oversees Ohio's rail infrastructure and rail transportation system safety in a similar manner ODOT does for the roadway and bridge networks.
	Organizational Integration	Organizational integration allows ODOT to discover new efficiencies by aligning processes and systems to eliminate redundancy or discover new opportunities. Formal data governance structures are necessary to successfully integrate across business verticals.
OSE	Office of Structural Engineering	The ODOT Office that is responsible for structures.
OTC	Ohio Turnpike Commission	The Ohio Turnpike commission manages 241 miles of toll roads in the northern corridor of Ohio.

P

Acronym	Term	Definition
PCR	Pavement Condition Rating	Pavement condition ratings permit ODOT to establish a standard critical threshold level below which the pavement is considered unacceptable and in need of major maintenance or rehabilitation.
	Precision	The measure of the exactness of a data element's value.
	Policy	A policy, on the other hand, is more of a guideline or a principle, or a rule. It is mainly used to regulate organizational affairs.
	Project Change Control Plan	Plan for managing any changes to the project scope.
	Project Communication Plan	Explanation of how the Project Management team will communicate. Not to be confused with the "DG" Communication Plan that is a component of the Organizational Change Management and Communications Plan.
	Project Management Group	Project Management Group is made up of ODOT and DoIT staff, that work with the other DoIT offices and ODOT districts and divisions to successfully deliver ODOT information technology projects within stated estimates and expectations. The team uses an agile methodology to optimize delivery outcomes and customer satisfaction while supporting the vision of ODOT’s business plan and strategic initiatives.
PMO	Project Management Office	ODOT'S Project Management Office (PMO) works with the other DoIT offices and ODOT districts and divisions to successfully deliver ODOT information technology projects within stated estimates and

Acronym	Term	Definition
		expectations. The team uses an agile methodology to optimize delivery outcomes and customer satisfaction while supporting the vision of ODOT's business plan and strategic initiatives.
	Project Risk Management Plan	Tracks all project risks and mitigation efforts.

Q

Acronym	Term	Definition
QA	Quality Assurance	The maintenance of a desired level of quality in a service or product, especially utilizing attention to every stage of the process of delivery or production.

R

Acronym	Term	Definition
RCF	Rutting, Cracking, and Faulting	Specific pavement distresses that are monitored for pavement management activities and reporting purposes.
	Regulatory	ODOT must adhere to existing and changing legal and regulatory frameworks. Many of these regulatory requirements impact funding, system specifications, and condition reporting. High-quality data enables adherence to these requirements. Examples include portions of the Ohio Revised Codes (ORC), Federal Highway Administration (FHWA) information guidelines for Transportation Asset Management, National Bridge Inventory (NBI), Americans with Disabilities Act (ADA) compliance, and Highway Performance Monitoring System (HPMS).
	Reliability	Extent data is trusted or highly regarded in terms of its source or content. Data should reflect stable and consistent data collection processes and analysis methods over time such that users deem the data dependable and consistent.
	Remove	A step in the ODOT Data Life Cycle where data that has outlived its useful purpose is archived, purged, or retired from the enterprise database.
ROI	Return on Investment	Return on Investment is traditionally defined as a profitability measure of the financial gain or loss generated on financial investment, relative to the amount of money invested. This is often represented by the following formula: ROI = (Net Profit / Cost of Investment) X 100 In terms of government investment, ROI is often used to evaluate the efficiency of financial investment. While monetary value is the traditional measure of ROI, there are several alternate ways efficiency gains can be quantified: 1. Time savings. 2. Better data for decision-making and reporting.

Acronym	Term	Definition
		3. Migrating from reactive to proactive work, resource, and asset management. 4. Increased level of service. 5. Timely regulatory compliance. 6. Monetary savings realized through decision support tools . 7. Improved safety.
RIMS	Roadway Inventory Management Systems	RIMS, also known as the Roadway Inventory, is ODOT's official Linear Referencing System and pavement inventory.
	Risk Management	The processes and framework for managing potential risks, including identifying, analyzing, evaluating, and addressing the risks to assets and system performance. (23 CFR 515.5).
	Risk	The positive or negative effects of uncertainty or variability upon agency objectives. (23 CFR 515.5).
RTPO	Regional Transportation Planning Organization	Organizations that operate in non-metropolitan areas conduct outreach to the public and local officials and provide transportation planning support under contract to the state departments of transportation.

S

Acronym	Term	Definition
SHV	Special Hauling Vehicles	Vehicles of certain weight classes which require specialized permits to travel on roadways or bridges.
SOGR	State of Good Repair	A term defined by TAMP legislation referring to the condition a capital asset must achieve to operate at full performance.
	String	A sequence of characters, either as a literal constant or as a variable. The latter may allow its elements to be mutated and the length changed, or it may be fixed.
	Structures	The Structures group is responsible for bridges and any conduits over 10' in length.
SME	Subject Matter Expert	A person with expertise in a particular area or topic.
	System of Record	The system (i.e., RIMS, Ellis, Collector, etc.) is the foundation for the Enterprise Data Element (EDE) standard.
STIP		Statewide Transportation Improvement Program.

T

Acronym	Term	Definition
TSP	Technical Strategic Plan	A technical strategic plan is an organization's process of defining its approach, or direction, and making decisions on allocating its resources to pursue this strategy. It may also extend to control mechanisms for guiding the implementation of the strategy.

Acronym	Term	Definition
	Technology Council	The purpose of the Technology Council at ODOT is to recommend policies, procedures, and processes to the Director, Chief of Staff, and Assistant Directors (the ODOT Governance Board) to guide technology investments. It evaluates and recommends technology investments that generate business value, evaluates technology investments in consideration of enterprise architecture deployment and agency risk mitigation, and manages the performance of ODOT's technology program and technology investments.
TAM	Transportation Asset Management	The activities a transportation agency undertakes to develop and maintain the system of facilities and equipment—physical assets such as pavements, bridges, signs, signals, and the like—for which it is responsible. The purpose of TAM as a business process is to provide a vital contribution to the economic health of the state of Ohio by leveraging its critical assets for the safe and efficient movement of people and goods. The TAM process will support the Department's decision-making in providing a safe, affordable, and high-performing transportation system through optimal resource allocation.
	Transportation Asset Management (TAM) Action Plan	Proposed strategy outlining steps for reaching a level 5 maturity and compliance in Transportation Asset Management.
TAMAG	Transportation Asset Management Audit Group (aka TAM Audit Group)	The TAM Audit Group is responsible for facilitating the implementation of the TAM Plan. TAMAG responsibilities include: - Asset oversight. - Enterprise database standards. - Liaison between Business, Tech Council, and Districts. - Asset collection equipment oversight. - Gathering business and stakeholder requirements. - Producing in-house web apps. - Commercial off the Shelf (COTS) product research. - Participating in Vendor Selection Committees.
TAMDST	Transportation Asset Management Decision Support Tool	A web-based application for accessing and reporting on "ODOT" assets. It integrates information from multiple systems to provide long-term planning support across districts.
TAMP	Transportation Asset Management Plan	The FHWA required document detailing a DOT's risk-based plan for managing transportation assets.
TIMS	Transportation Information Mapping System	Web-based, mapping portal containing information about Ohio's transportation system.

Acronym	Term	Definition
	Timeliness	The extent to which the data is up to date and still valid for its intended business use. This may be a function of how old the data is or the frequency of updating concerning reporting and other requirements.
TPM	Transportation Performance Management	FHWA defines Transportation Performance Management as a strategic approach that uses system information to make investment and policy decisions to achieve national performance goals. https://www.fhwa.dot.gov/tpm/
TRB	Transportation Research Board	TRB is one of seven program units of the National Academies of Sciences, Engineering, and Medicine, which provides independent, objective analysis and advice to the nation and conducts other activities to solve complex problems and inform public policy decisions.
TSMO	Transportation Systems Management & Operations	ODOT program "TO" actively manages the multimodal transportation network. TSMO activities focus on incident management, traffic signal timing, ramp metering, road weather management, and other strategies.

U

Acronym	Term	Definition
	Use	A step in the ODOT Data Life Cycle where data is used to forecast and model ODOT infrastructure and resource needs, or report on ODOT operations.

V

Acronym	Term	Definition
	Validity	The degree to which data adequately represents what is intended to be documented.
VAST	Vulnerability Assessment Screening Tool	An IT tool and process ODOT created to screen assets for potential extreme weather impacts.

W

Acronym	Term	Definition
WPR	Weekly Progress Report	The weekly report is used in the Project Team meetings between the ODOT and DTS (Data Transfer Solutions) project teams.
	Work Order	Work Order vs. Project vs. Task Order vs. Work Request. Used interchangeably within ODOT. Work Order is primarily used in EIMS by Operations.

X

Acronym	Term	Definition

Y

Acronym	Term	Definition

Z

Acronym	Term	Definition

APPENDIX A: EMERGENCY RELIEF APPLICATION PROCESS

The following ER application processes were developed in May 2019.

Responsible	Task
	Identification
ODOT District ER Coordinator/HMA	**Disaster Assessment** – Depending on the disaster, the initial damage assessment may be based on windshield surveys of a sample of sites or detailed damage inspections at many or all sites. The ODOT District ER Coordinator notifies the ODOT Central Office ER Coordinator of the potential emergency disaster assessment.
ODOT ER Coordinator and Chief Legal	**Notification** - The State of Ohio sends a "letter of intent" to the FHWA Division to give notice that it plans to request ER funds. This is usually completed as soon as there is eligible damage, either during or shortly after the disaster. The letter of intent will be signed by the ODOT Director of Transportation.
	Assessment
ER Coordinator ER Coordinator and Chief Legal Governor of Ohio or President	**Declaration** - To be considered for ER funding a disaster declaration/proclamation is required. If any of the following fulfills this requirement, ER Coordinator compiles the list of affected counties, Prepares Disaster Proclamation, and sends it to Governor's Office. The Governor of the State of Ohio issues an emergency or disaster proclamation and FHWA concurs on the proclamation, or The President makes a major disaster declaration under the Stafford Act.
FHWA	**Acknowledgment** - The FHWA Division Administrator acknowledges in writing the States letter of intent. This acknowledgment letter will allow temporary operations, emergency repairs, and preliminary engineering to start before FHWA authorization.
ODOT District ER Coordinator	Prepare Resiliency Plan (if justified) – Adding protective features is considered economically justified under the FHWA emergency relief program if:

FHWA District Personnel ODOT Office of Program Management	*Cost of protective feature < probability of damage within facility lifetime * cost of damage that would be incurred by the FHWA emergency relief program.* Annual Planning Process: • Resiliency planning occurs throughout the year starting with the annual planning process, where the Office of Program Management consults with ODOT District offices for maintenance and improvement projects. • During this process, prior ER projects can be considered for improvements or maintenance. • The State District offices will request support from the County transportation agencies to periodically inspect prior ER events on a scheduled basis. This will maintain a running condition inventory of the previously damaged site and can supply justification for the annual planning process. ER Event Resiliency Process: When an ER event occurs, the State District offices work in concert with the FWHA District personnel at the site of the disaster, to: • Determine if the site had a reoccurrence of a previous disaster by examining the ER database of historical ER events. • Survey the site and create the initial DDIR. • Collaborate to determine the proper method to repair the damage and consider a potential "betterment" to the segment to save additional expenses for future disasters. • Coordinate the proper work plans to secure the damage and construct the necessary improvements. Finalize/augment DDIR (Detailed Damage Inspection Report).
Plan and Repair	
ODOT District ER Coordinator/HMA	Detailed Damage Inspections – These inspections are completed later, usually after the Division Administrator has made a finding of ER eligibility. The Detailed Damage Inspections Reports (DDIRs) are used to prepare a comprehensive list of projects. ODOT records projects and work orders within Ellis and EIMS as appropriate.
ODOT District ER Coordinator/HMA	State Request for Authorization – State transportation agencies must submit applications for ER funding to the FHWA Division within two calendar years of the date of the disaster. The application must include a comprehensive list of all eligible project sites and repair costs. Please note: Project work can proceed before submitting the ER application.
ODOT District ER Coordinator Completes DDIR	FHWA Division Review – State submits approved DDIR and resiliency plan (if applicable) to FHWA division administrator.

Request	
FHWA	Division Administrator's Finding - The FHWA Division Administrator notifies the State of Ohio that ER funding for the disaster is approved. This notification serves as the finding that a natural disaster or a catastrophic failure has occurred causing substantial damage to Federal-aid highways and that the disaster is eligible for ER funding.
FHWA	Request for ER Funding Allocation – At the same time, the FHWA Division requests an allocation of ER funds, either by memorandum or email, from the FHWA Office of Program Administration.
FHWA	FHWA Approves DDIR and list of Projects – The DDIR is approved, and reconstruction can begin.

FHWA's roles and responsibilities during the ER process are to:

1. Administer the ER program through coordination and implementation of disaster relief policies and procedures.
2. Assist State, Federal, or other highway agencies in applying for funds and determining eligibility.
3. Support the State, Federal, or other highway agencies in the technical review, design, repair, and reconstruction of damaged highway facilities.

APPENDIX B: FEDERAL IMPROVEMENT REFERENCE TABLE

Federal Improvement Code	Federal Improvement Definition	TAMP Category
Bridge - New Construction	Construction of a new bridge that does not replace or relocate an existing bridge.	New Construction
New Construction	Construction of a new roadway that will not replace an existing roadway. A new roadway will provide: (1) a roadway where none existed, or (2) an additional and alternate roadway to an existing roadway that will remain open and continue to serve through traffic.	New Construction
Bridge Replacement - Added Capacity	Total replacement of a structurally inadequate or functionally obsolete bridge with a new structure constructed with additional lanes in the same general traffic corridor to current geometric construction standards. Incidental roadway approach work is included. The use of this code requires the reporting of the National Bridge Inventory (NBI) structure number in the data field identified Bridge Numbers.	Reconstruction
Bridge Replacement - No Added Capacity	Total replacement of a structurally inadequate or functionally obsolete bridge with a new structure constructed without additional lanes in the same general traffic to current geometric construction standards. A bridge removed and not replaced or replaced with a lesser facility is considered a bridge replacement. Incidental roadway approach work is included. Widening the lanes and/or shoulders of an existing structure without adding through lanes. The use of this code requires the reporting of the National Bridge Inventory (NBI) structure number in the data field identified Bridge Numbers.	Reconstruction
Reconstruction - Added Capacity	Construction on the approximate alignment of an existing route where the old pavement structure is substantially removed and replaced. Such reconstruction includes widening to provide continuous additional through lane(s), adding, or revising interchanges, and replacing other highway elements such as a grade separation to replace an existing grade intersection. Also, incidental improvements such as drainage and shoulder improvements.	Reconstruction
Reconstruction - No Added Capacity	Widening the lanes and/or shoulders of an existing roadway without adding through lanes. May include reconstructing the existing pavement and other incidental improvements such as shoulder and drainage improvements.	Reconstruction
4R Maintenance - Relocation	Construction of a roadway at a new location that replaces an existing roadway. The new roadway carries all the through	Rehabilitation

Federal Improvement Code	Federal Improvement Definition	TAMP Category
	traffic with the previous facility closed or retained as a land-service road only.	
4R Maintenance - Restoration & Rehabilitation	Work required to return existing pavement (including shoulders) to a condition of adequate structural support or a condition adequate for placement of an additional stage of construction. There may be some upgrading of unsafe features or other incidental work in conjunction with restoration and rehabilitation. Typical improvements would include replacing spalled or malfunctioning joints; substantial pavement stabilization before resurfacing; grinding/grooving of rigid pavements; replacing deteriorated materials; reworking or strengthening bases or sub-bases and adding under-drains.	Rehabilitation
4R Maintenance - Resurfacing	Placement of additional surface material over the existing roadway to improve serviceability or to provide additional strength. There may be some upgrading of unsafe features and other incidental work in conjunction with resurfacing. Where surfacing is constructed by a separate project as a final stage of construction, the type of improvement should be the same as that of the preceding stage B new route, relocations, reconstruction, minor widening, etc.	Preservation
Bridge Rehabilitation - Added capacity	The major work required to restore the structural integrity of a bridge as well as work necessary to correct major safety defects. Bridge deck replacement (both partial and complete) and widening of bridges including the addition of through lanes to specified standards are included. Construction of a dual structure to alleviate a capacity deficiency is also included. Work required to correct minor structure and safety defects or deficiencies, such as deck patching, resurfacing, protective systems, upgrading railings, curbs and gutters, and other minor bridgework. If HBRRP funds are involved, the use of this code requires the reporting of the National Bridge Inventory (NBI) structure number in the data fields identified as Bridge Numbers.	Rehabilitation
Bridge Rehabilitation - No Added Capacity	The major work required to restore the structural integrity of a bridge as well as work necessary to correct major safety defects. Bridge deck replacement (both partial and complete) and widening of bridges without adding through lanes to specified standards are included. Work required to correct minor structure and safety defects or deficiencies, such as deck patching, resurfacing, protective systems, upgrading railings, curbs and gutters, and other minor bridge work. If HBRRP funds are involved, the use of this code requires the reporting of the National Bridge Inventory (NBI) structure number in the data fields identified as Bridge Numbers.	Rehabilitation

Federal Improvement Code	Federal Improvement Definition	TAMP Category
Rail/Highway Crossing	Improvements to crossing warning Protective Devises such as signs, markings, and crossbucks; flashing light additions/improvements, and improvements to track circuitry.	Rehabilitation
Safety	A project or a significant portion of a project which provides features or devises to enhance safety. For example, expenditures on projects designed to improve the safety of at-grade railroad crossings or for the construction of facilities dedicated to the enforcement of vehicle weight regulations.	Rehabilitation
Bridge Preventive Maintenance		Maintenance
State Preventative Maintenance		Maintenance

APPENDIX C: LIFE CYCLE PLANNING GRAPHS

Reference: Section 4.5 Bridge (All Graphics)

Ohio Bridge NBI NHS (All Owners) Analysis:

General Appraisal:

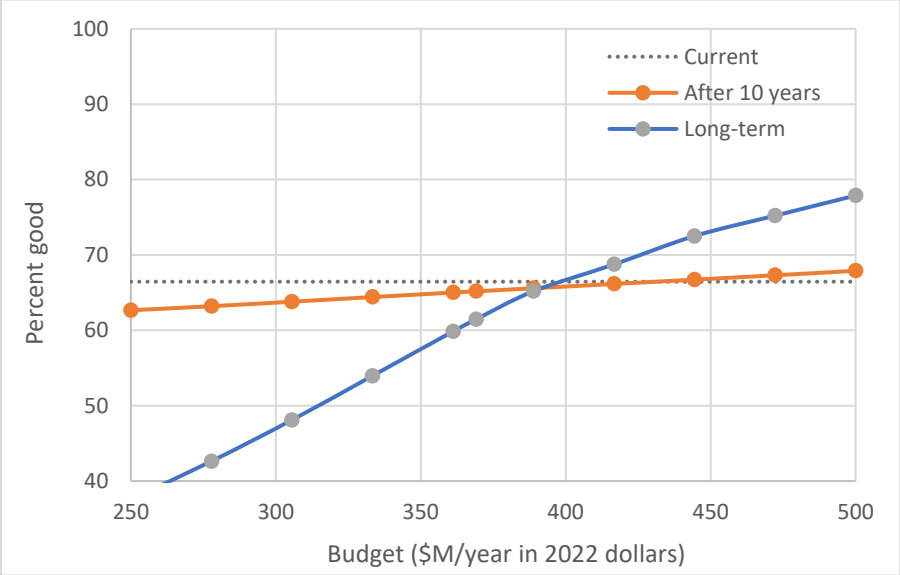


Table 66 - Ohio Bridge NBI NHS All Owners Analysis General Appraisal

Deck:

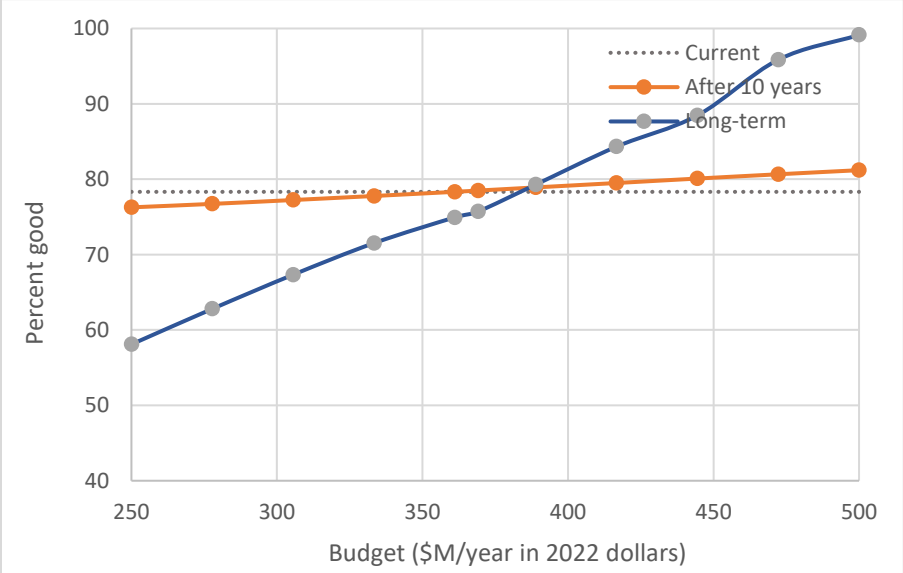


Table 67 - Ohio Bridge NBI NHS All Owners Analysis Deck

Wearing Surface:

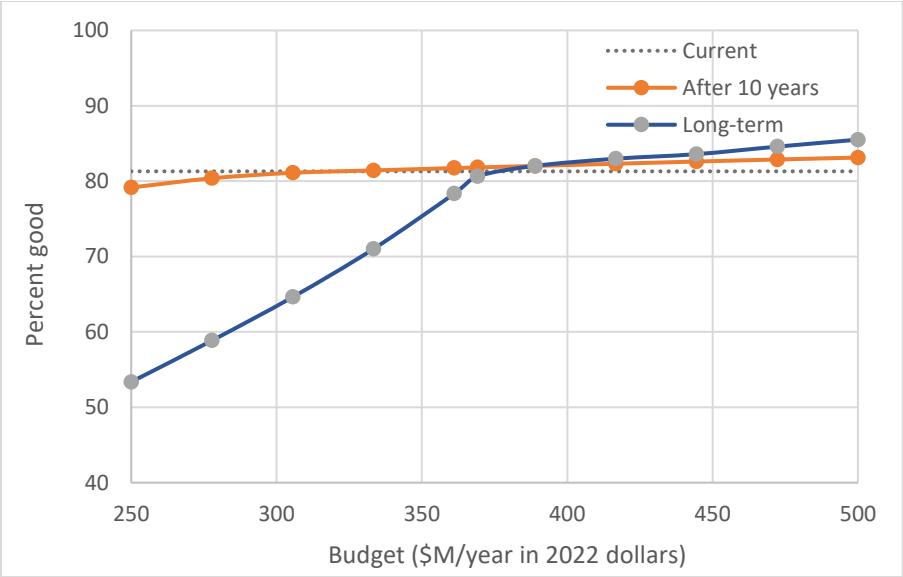


Table 68 - Ohio Bridge NBI NHS All Owners Analysis Wearing Surface

Protective Coating:

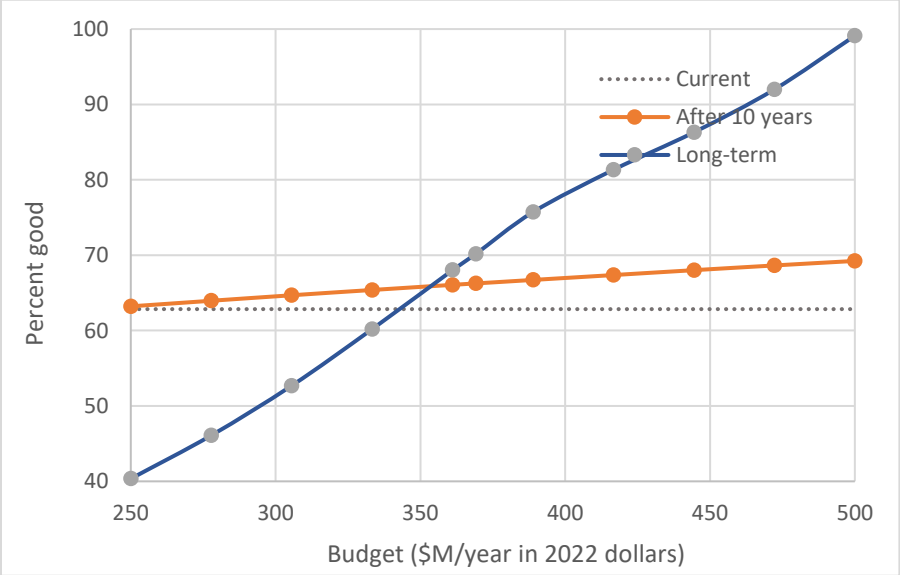


Table 69 - Ohio Bridge NBI NHS All Owners Analysis Protective Coating

Ohio Bridge Non-NBI NHS (ODOT-Owned) Analysis:

General Appraisal:

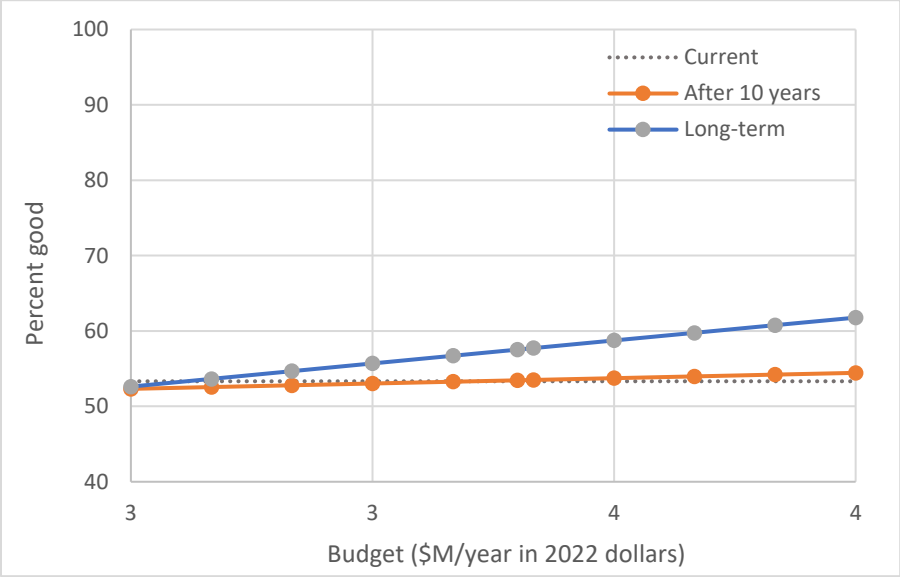


Table 70 - Ohio Bridge Non-NBI NHS ODOT Owned Analysis General Appraisal

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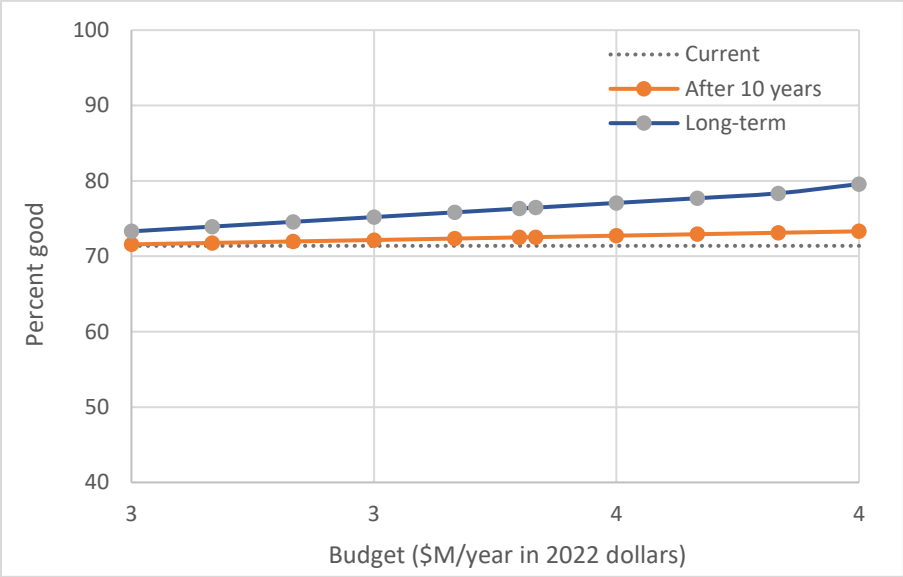

Table 71 - Ohio Bridge Non-NBI NHS ODOT Owned Analysis Deck

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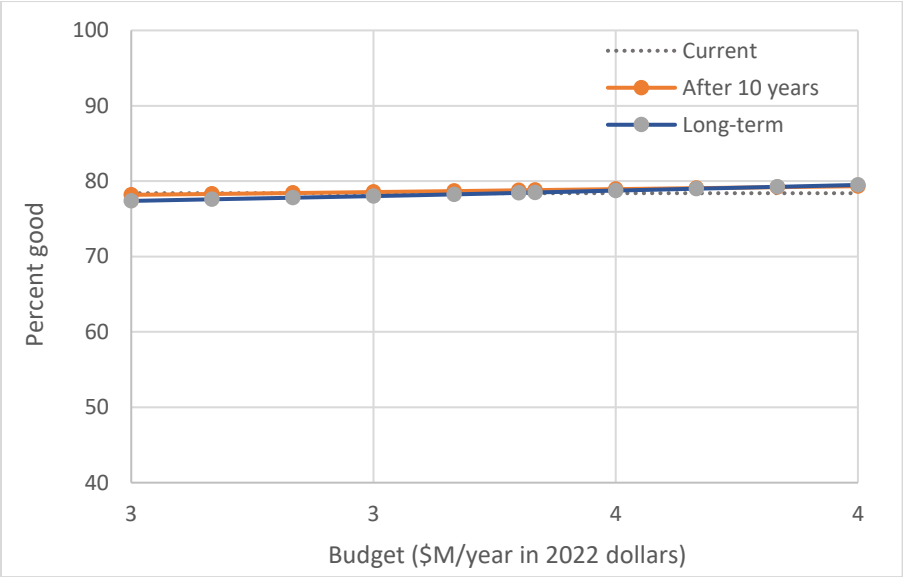

Table 72 - Ohio Bridge Non-NBI NHS ODOT Owned Analysis Wearing Surface

Protective Coating:

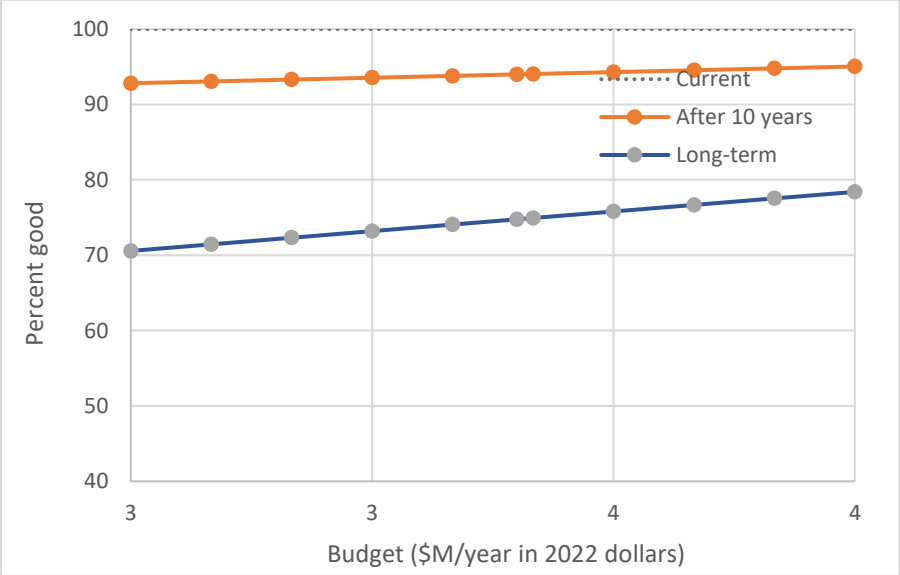

Table 73 - Ohio Bridge Non-NBI NHS ODOT Owned Analysis Protective Coating

Ohio Bridge Non-NHS (ODOT-Owned) Analysis:

General Appraisal:

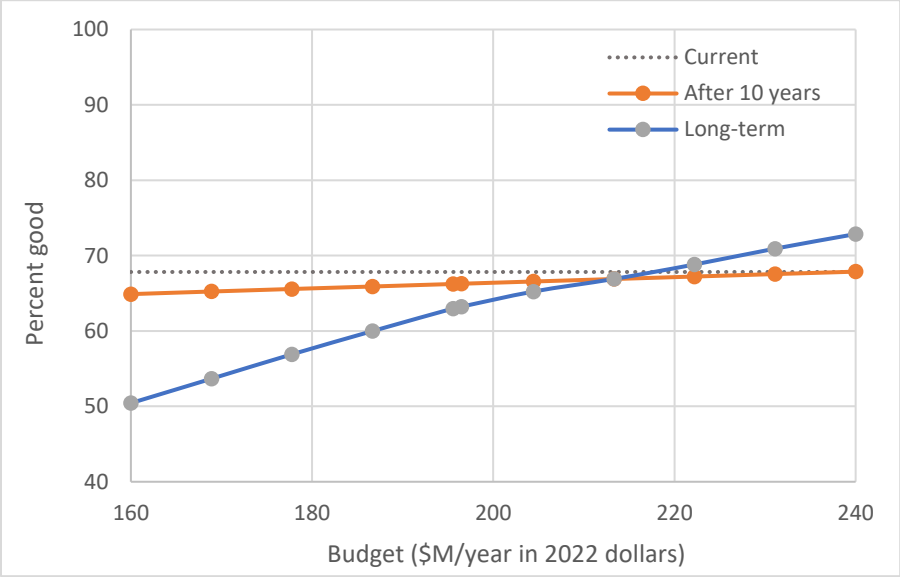

Table 74 - Ohio Bridge Non-NHS ODOT Owned Analysis General Appraisal

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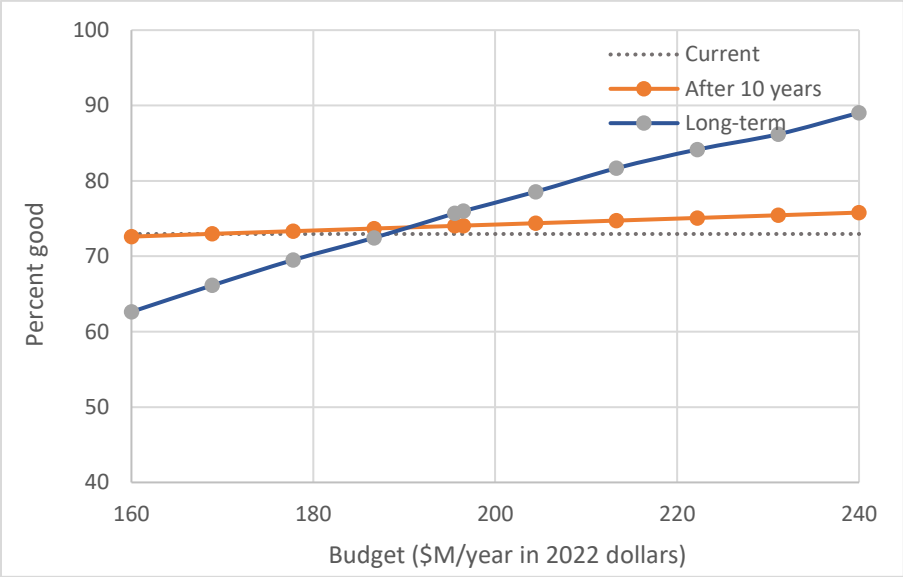

Table 75 - Ohio Bridge Non-NHS ODOT Owned Analysis Deck

Wearing Surface:

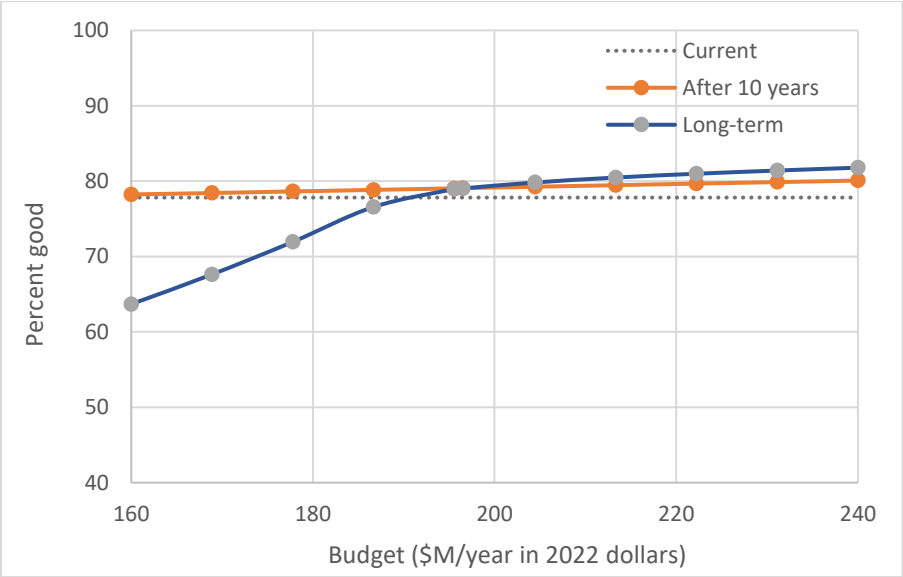

Table 76 - Ohio Bridge Non-NHS ODOT Owned Analysis Wearing Surface

Protective Coating:

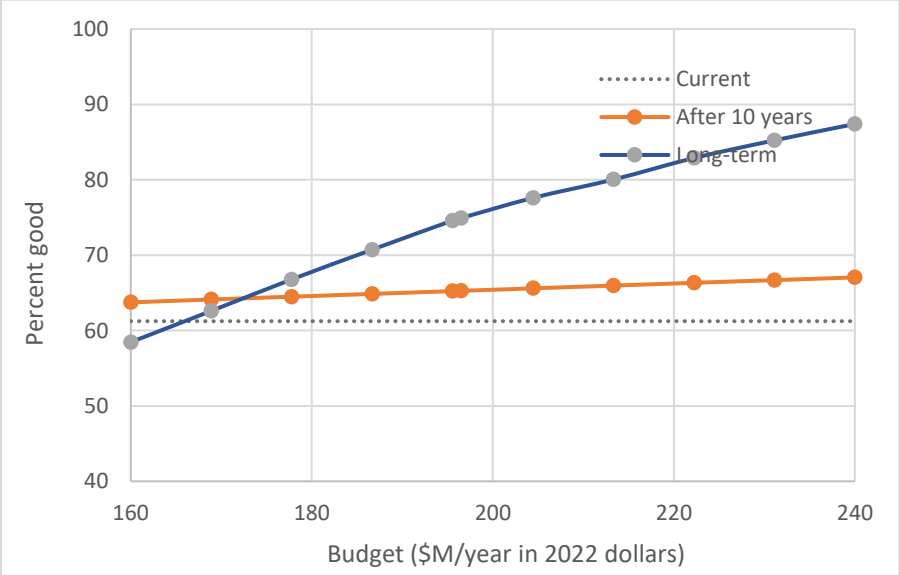

Table 77 - Ohio Bridge Non-NHS ODOT Owned Analysis Protective Coating

Ohio Bridge Turnpike NHS (Turnpike-Owned) Analysis:

General:

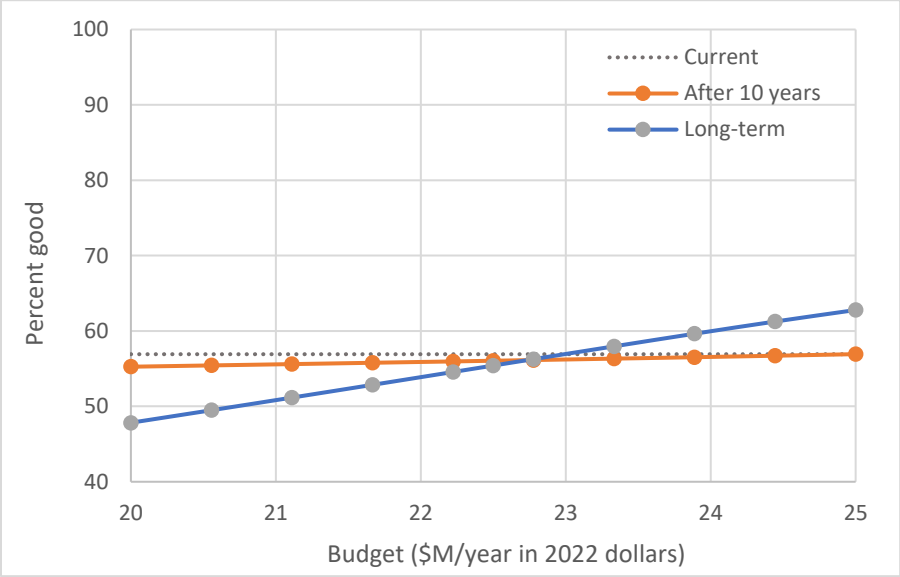

Table 78 - Ohio Bridge Turnpike NHS Turnpike Owned Analysis General

Deck:

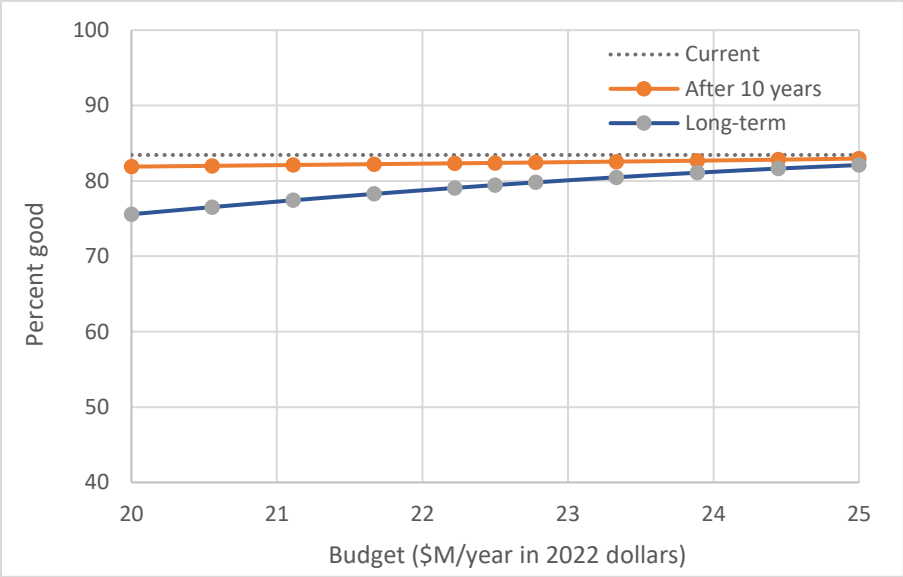

Table 79 - Ohio Bridge Turnpike NHS Turnpike Owned Analysis Deck

Wearing Surface:

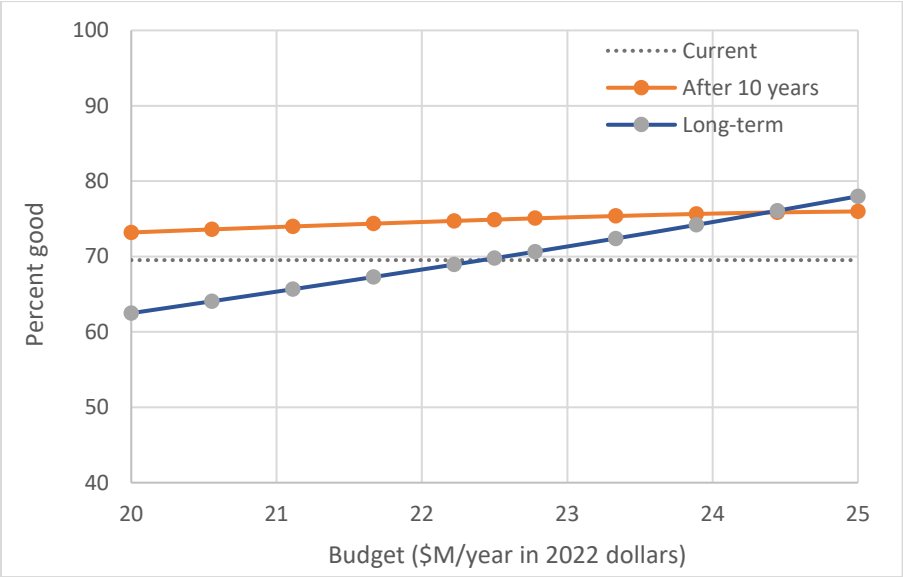

Table 80 - Ohio Bridge Turnpike NHS Turnpike Owned Analysis Wearing Surface

Protective Coating:

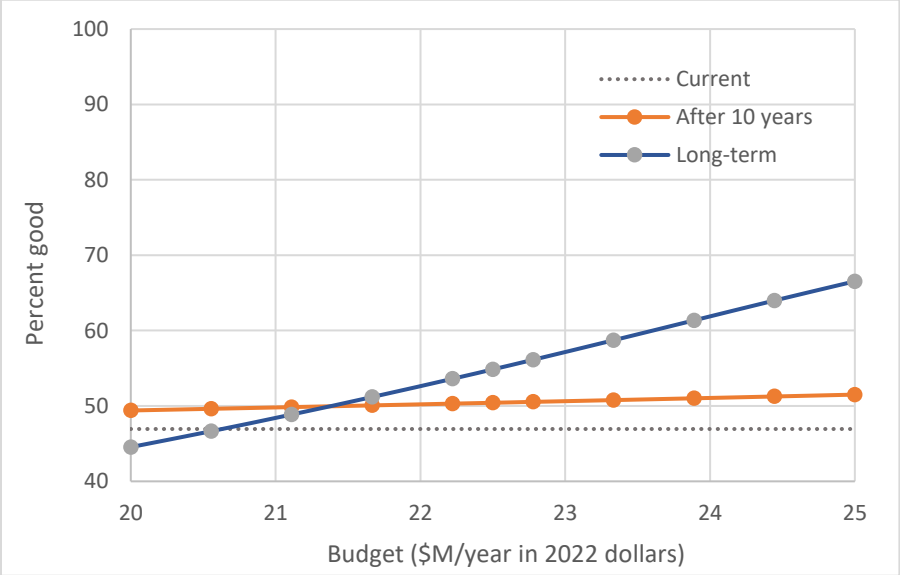

Table 81 - Ohio Bridge Turnpike NHS Turnpike Owned Analysis Protective Coating

APPENDIX D: TAMP REQUIREMENTS CHECKLIST

The following checklist is provided to document the specific requirements that must be addressed in the risk based TAMP submitted to the FHWA for review no later than July 30, 2022. The checklist identifies each of the specific requirements in the legislation and/or the final rule and the relevant content location in the ODOT TAMP.

FHWA Certification Required Elements	Section
Performance Gap Analysis (23 CFR 515.7(a))	**Section**
Physical Condition of Assets: The TAMP must describe a methodology, concerning the physical condition of the assets: • Identifying gaps affecting the State DOT targets for the condition of NHS pavements and bridges as established according to 23 U.S.C. 150(d). • Identifying deficiencies hindering progress toward achieving and sustaining the desired state of good repair (as defined by the State DOT). • Developing alternative strategies that will close or address the identified gaps.	7.2.1, 7.2.2, 7.2.3, 7.3, 8.3
NHS Effectiveness Performance: The TAMP must describe a methodology for analyzing gaps in the performance of the NHS that affect NHS bridges and pavements regardless of their physical condition, that will: • Identify gaps in the effectiveness of the NHS in providing safe and efficient movement of people and goods. (23 CFR 515.7(a)(2)). • Identify strategies to close or address the identified gaps affecting the physical assets. (23 CFR 515.7(a)(3)).	7.2.1, 7.2.2, 7.2.3, 7.4
Life Cycle Planning Analysis (23 CFR 515.7(b))	**Section**
• Incorporating the State DOT targets for asset conditions for each asset class or asset sub-group into the analysis.	3; 4.2, 4.4.1
• Modeling deterioration for NHS bridges and pavements for each asset class or asset sub-group.	4.2, 4.4-4.6, 5.6.2, 5.7.2
• Analyzing potential work types across the whole life of each asset class or asset sub-group with the general unit costs identified.	4.8
• Identifying management strategies for each asset class or asset subgroup to minimize the life cycle costs while achieving the 23 U.S.C. 150(d) performance targets for asset conditions.	4.2-4.6
• Identifying any subgroups that have been excluded, with justification for their exclusion.	4.4

Risk Management Analysis (23 CFR 515.7(c))	Section
The TAMP must describe a methodology for: • Identifying risks that can affect the condition of NHS pavements and bridges, and the performance of the NHS, including the risks listed in 23 CFR 515.7(c)(1). • Assessing the identified risks in terms of the likelihood of their occurrence and their impact and consequence if they do occur. • Evaluating and prioritizing the identified risks. • Developing a mitigation plan for addressing the top priority risks that involve potentially negative consequences. • Developing an approach for monitoring top priority risks. • Including in the analysis, and considering, a summary of the results of the 23 CFR Part 667 evaluations of facilities in the State repeatedly damaged by emergency events, including at a minimum the results relating to NHS pavements and bridges.	5.3, 5.4, 5.5, 5.6, 5.7, 5.8

Financial Plan Development (23 CFR 515.7(d))	Section
The TAMP must describe a methodology for producing a financial plan that: • Covers at least 10 years. • Includes the estimated cost to implement the investment strategies by State fiscal year and work type. • Includes the estimated funding levels that are expected to be reasonably available, by the fiscal year, to address the costs of implementing the investment strategies, by work type. • Identifies anticipated sources of available funding. • Includes a summary asset valuation for the State's NHS pavement and bridges including the investment needed on an annual basis to maintain the asset value.	6.2, 6.3.1, 6.4, 6.5, 6.6, 6.7, 6.8

Investment Strategies (23 CFR 515.7(e) and 515.9(f))	Section
23 CFR 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 the following: • Performance gap analysis. • Lifecycle planning for asset classes or asset sub-groups. • Risk management analysis. • Anticipated available funding and estimated cost of expected future work types associated with various candidate strategies based on the financial plan.	7.2.1, 7.2.2, 4.6.2, 4.8, 5.5. 6.5
23 CFR 515.9(f): An asset management plan shall discuss how the plan's investment strategies collectively would make or support progress toward: • Achieving and sustaining a 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 the 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).	6.5, 6.6, 6.7

Obtaining Data from Other NHS Owners (23 CFR 515.7(f))	Section
The TAMP must describe a methodology for obtaining necessary data from other NHS owners in a collaborative and coordinated effort.	2.6

Use of best available data and bridge and pavement management systems to develop TAMP (23 CFR 515.7(g))	Section
States DOTs shall use the best available data to develop their asset management plans. Pursuant to 23 U.S.C. 150(c)(3)(A)(i), each State DOT shall use bridge and pavement management systems meeting the requirements of § 515.17 to analyze the condition of NHS pavements and bridges for the purpose of developing and implementing the asset management plan required.	4.4, 4.5

Use of best available data and bridge and pavement management systems to develop TAMP (23 CFR 515.7(g))	Section
The TAMP must describe a methodology for: • Ensuring that the State DOT uses the best available data for the development of the TAMP. • Ensuring that the TAMP is developed using bridge and pavement management systems that meet the requirements of 23 CFR 515.17. If at the time of the first certification, the State DOT does not have bridge and pavement management systems that fully comply with 23 CFR 515.17 standards, the State DOT process identifies additional means it will use to provide analyses or other information needed to meet all of the requirements in 23 CFR 515.17. • Ensuring the process for using information from the State DOT's Statewide Transportation Improvement Program (STIP) in the development of the State DOT's TAMP is consistent with TAMP process and data requirements. This means that the STIP may be used to provide background information but cannot be used as a substitute for carrying out the required analyses or be used to override the results of the required independent analyses of relevant data when developing investment strategies.	2.4, 2.5, 4.4, 4.5, 4.8, 5.8

BIL Amendments to 23 U.S.C 119(e) as of 10/1/2021	Section
The TAMP must: • Consider extreme weather and resiliency in the life cycle cost and risk management analysis of their TAMPs 23 U.S.C. 119(e)(4)(d).	4.7, 5.9