ODOT's Federally-Compliant

TRANSPORTATION ASSET MANAGEMENT PLAN

June 2019

OHIO DEPARTMENT OF TRANSPORTATION
Mike DeWine, *Governor*
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Ohio Department of Transportation (ODOT) has made a strong commitment to Transportation Asset Management. This Transportation Asset Management Plan (TAMP) represents the highest form of "Excellence in Government" and applies to all the Departments, 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 highlighted in *Taking Care of What We Have*.

The TAMP reflects our ongoing programs wherein ODOT uses state-of-art technology to analyze road, bridge and culvert conditions as well as establish our investment priorities. Traffic volumes, expected growth, and user needs are factored into making cost effective decisions when spending taxpayer dollars.

The TAMP includes ODOT's preservation strategy to ensure quality and the optimal service life from our roads, bridges, and culverts. That's why ODOT is cleaning, sweeping, sealing, and painting bridges, replacing culverts, and paving our roadways on a more aggressive schedule.

The success of our Asset Management Plan is due by in large to the partnerships established between ODOT's planning, engineering, and operations divisions, contractors, Ohio's businesses and citizens. By working together, we support over 5.5 million jobs that rely on Ohio's transportation system.

This document is being submitted to the FHWA under the authority of the Director of 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 "Taking Care of What We Have", I invite you to visit our website at: transportation.ohio.gov/AssetManagement

Respectfully,

Jack Marchbanks

Jack Marchbanks, Director

1.0 Introduction

ODOT operates, manages, and maintains one of the country's largest Statewide transportation systems, containing:

- Over 43,000 lane miles of roads, including the 5th largest Interstate highway network in the country.
- More than 14,000 Bridges, which is the 2nd largest inventory in the nation.
- Over 88,000 Conduits (including culverts and storm drains).
- Many other assets (such as guardrails, signs, and retaining walls) that keep traffic moving safely.

The National Highway System (NHS) is a strategic network of highways that serve a vital function in moving people and goods throughout Ohio and beyond. Ohio has 21,776 lane miles on the NHS with the following breakdown:

- 8,357 lane miles of Interstate
- 13,487 lane miles of Non-Interstate

Approximately 96 percent of the NHS lane miles are maintained by Ohio Department of Transportation (ODOT), and as such the performance of the NHS is significantly impacted by the strategic process implemented within the DOT. The remaining lane miles are the responsibility of our Local Partners of whom we work with collaboratively to ensure a level of synergy in terms of investment planning. The Ohio Turnpike Commission is responsible for managing 1,285 lane miles, and ODOT supports the Commission in terms of data collection, collaboration, and planning.

This transportation system enables people and goods to access the markets, services, and production inputs that are essential to the economic vitality of the State of Ohio. In addition to supporting over 5.5 million jobs in Ohio, 68 percent of the State's freight traffic is carried by trucks that travel on ODOT-maintained roads and Bridges, including top exports like crops, vehicles, and plastics. Our State has the 5th highest number of vehicle miles traveled in the

country. By keeping ODOT's highways safe and accessible, the agency also contributes to the quality of life of its citizens and communities.

To effectively manage its transportation system, ODOT relies on the use of Transportation Asset Management (TAM) principles that emphasize sound investment decisions that preserve system performance at a reasonable cost over its useful life. These principles require:

- Clear objectives.
- A forward-looking approach to identify potential challenges and opportunities.
- The use of data, technology, and analysis tools to support decision making.
- Coordination of activities across multiple organizational units (such as Planning, Engineering, Construction, Highway Operations, and Districts).
- Continuous improvement based on lessons learned.

TAM Principles

1. Policy Driven
2. Performance-Based
3. Evaluates Options
4. Data Driven
5. Transparent

Building on Experience

Asset Management principles are evident throughout the ODOT organization. ODOT's Mission Statement acknowledges its commitment to taking care of existing assets and making the system work better, two principles of a TAM approach.

TAM practices have been in place for more than 10 years at the Department. During this time, ODOT has been moving to a more data-focused approach to managing its transportation system. Prior efforts, such as the *Transportation Asset Management Recommendations Report* (2011) the *TAM Maturity Assessment* (2012), and the Department's internal *Transportation Asset Management Plan* (2017) clearly illustrate the agency's ongoing efforts to improve links between data, information, and decisions to guide acceptable transportation asset investments and business process improvements.

The investment strategies employed during ODOT's Asset Management implementation have steadily improved system conditions to the point that the State's Pavements and Bridges are currently at, or exceeding, Statewide performance targets, which ODOT refers to as Critical Success Factors (CSF). In fact, ODOT spends 93 percent of

ODOT spends 93% of its capital dollars preserving infrastructure.

its time and resources taking care of its existing infrastructure.

The Planning Division is charged with leading the implementation of Asset Management for the Department with guidance from an Asset Management Leadership Team. In 2011, ODOT formally adopted a set of recommendations that established the framework for all Asset Management activities. Several of these recommendations have been implemented, including:

- Establishing strong support from ODOT's Executive Leadership.
- Forming an Asset Management Leadership Team[1] to guide and strengthen the use of Asset Management principles throughout the organization.
- Developing a risk-based Transportation Asset Management Plan (TAMP).
- Expanding asset inventories.

This deliberate effort to implement Asset Management has improved ODOT's ability to achieve strategic goals into the future, understand the long-term consequences of investments, evaluate options, and measure performance against risk and cost.

Today, ODOT continues to build on its previous Asset Management efforts to take advantage of the following:

- The opportunity to build workforce capacity and transfer institutional knowledge through a knowledge management program.
- The use of treatment strategies that lower the life cycle cost of system preservation and enable ODOT to meet system performance targets without increasing budget requirements.
- The availability of new tools and technology to better collect and analyze performance data to make investment decisions.

[1]http://www.dot.state.oh.us/AssetManagement/Pages/tam_leadership.aspx

The TAMP is aligned with other important initiatives, such as:

- Access Ohio 2040
- Statewide Transportation Improvement Program
- Ohio Statewide Freight Plan
- Ohio Strategic Highway Safety Plan
- ODOT Business Plan

Support for Other ODOT Initiatives

Asset Management is not a separate program area or an independent function within ODOT. Rather, Asset Management requires coordination between many Divisions such as Planning, Engineering, Construction, Highway Operations, and Districts to ensure that the entire organization is working towards common goals as effectively and efficiently as possible.

To help align the organization, ODOT has outlined plans that will enable the agency to meet its long-term objectives. This TAMP reinforces ODOT's focus on the importance of:

- Taking care of what we have.
- Expanding the use of performance management.
- Making greater use of Asset Management principles and tools for optimized investment decisions.

The implementation of the plans to meet long-term objectives is carried out through the alignment of ODOT's budgeting tools, optimized investment strategies, Critical Success Factors, and Statewide Transportation Improvement Program (STIP). The budgeting tools and Critical Success Factors are used to identify the available level of funding and the strategic objectives to be achieved. ODOT's analysis tools evaluate cost-effective investment strategies to achieve desired conditions, and the STIP reflects the outcomes of these processes in terms of the resulting projects. The TAMP documents the processes used to drive these decisions and summarizes the results that are expected to be achieved in terms of projected conditions and planned investments over a 10-year period. The improved business processes and resulting investment strategies outlined in this document are already leading to more consistency across the transportation system on a Statewide basis and stronger collaboration within the Department to maximize the effectiveness of each effort.

Aligned With National Efforts

The Moving Ahead for Progress in the 21st Century Act (commonly referred to as MAP-21), which was signed into law on July 6, 2012, established a performance-based Federal highway program, funding transportation programs based on national transportation goals and increased accountability and transparency. The Asset Management provisions of MAP-21 were

National Goal Areas

- Safety
- Infrastructure condition
- Congestion reduction
- System reliability
- Freight movement and economic vitality
- Environmental sustainability
- Reduced project delivery delays

perpetuated in the Fixing America's Surface Transportation (FAST) Act of 2015. These acts establish requirements for each State to:

- Develop a risk-based TAMP.
- Report progress in the seven national goal areas for performance-based planning listed on the left.
- Meet minimum condition levels for Interstate Pavement and Bridge conditions on the National Highway System (NHS).
- Meet minimum capabilities for Pavement and Bridge management systems.

ODOT's Asset Management efforts to date are enabling the Department to respond to these requirements.

TAMP Content

On April 30, 2018, ODOT submitted an initial TAMP to the FHWA Division Office to meet Federal requirements. That document, which was certified by the FHWA, documented ODOT's TAM processes and the preliminary analyses that had been conducted in support of ODOT's Asset Management efforts. The initial TAMP exceeded the minimum requirements established in the Federal rules by focusing on Pavements, Bridges, and Conduits on the entire State system and not just Pavements and Bridges on the NHS. These three assets were selected for inclusion in the TAMP since they represent three assets that are critical to system performance and characterize the largest share of ODOT's $115 billion investment in its transportation system.

This version of the TAMP updates the planned 10-year investment strategy using the processes that were certified in ODOT's initial TAMP. The TAMP summarizes asset conditions and describes a life cycle planning approach to manage these assets cost-effectively. In addition to costs, the TAMP considers the potential risks that ODOT faces while managing assets in an unpredictable environment. The risk analysis process described in the TAMP allows ODOT to identify and analyze problem areas before unexpected events occur, rather than wait and react to the resulting impacts. As a result, ODOT can better plan and prioritize future improvements to address high-risk areas. The TAMP also includes an updated 10-year financial plan based on projected revenue and forecasted conditions. The planned

investment strategies presented in the TAMP enable ODOT to continue meeting targets for asset condition in the future. The TAMP concludes with a summary of future enhancements that ODOT is undertaking as the agency continues to refine its Asset Management practices through a commitment to people, processes, and technology.

2.0 Asset Management Objectives

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.

Critical Success Factors (CSF)

To manage the program and monitor progress, ODOT is subject to two different sets of performance targets.

ODOT uses its Critical Success Factors for maintaining system conditions and gauging the quality of the organization. These targets help track and report progress, both internally and to outside stakeholders. In addition, the Critical Success Factors 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.

Additionally, MAP-21 and the FAST Act set performance measures that are used nationally to report the condition of NHS Pavements and Bridges and requires State DOTs to set 2- and 4-year performance targets for the NHS using these measures. Both sets of performance targets are explained further.

ODOT Targets

ODOT's Critical Success Factors (CSF) for Pavements and Bridges were established using existing inventory and condition data while considering anticipated revenue, public expectations, risks, and ODOT's own stewardship responsibilities. Over the last few years, ODOT has made consistent progress at meeting or exceeding its CSF for Pavement and Bridge conditions. In the last year, ODOT

Critical Success Factors (CSF)

- CSF are used to gauge the state of the transportation system and the quality of the organization.
- ODOT uses regular performance reporting to identify areas of needed improvement and areas of excellence.
- CSF are also used to set goals, adjust priorities, establish best practices, develop policy, and celebrate outstanding achievements.

began the process of establishing a Critical Success Factor for Conduits, using inventory and inspection results.

ODOT's existing Critical Success Factors for Pavements and Bridges are shown in the following table, along with a preliminary target for Conduits that is being evaluated. By continuing to implement the business process changes described in the TAMP, ODOT expects to be able to continue to achieve its Pavement, Bridge, and Conduit performance targets over the 10-year period addressed in this TAMP.

Asset Type	Performance Measure	Critical Success Factor
Pavements		
Priority	Weighted average Pavement Condition Rating (PCR) on a 0 to 100 scale	85
General System		80
Urban System		80*
Bridges		
General Appraisal	The Statewide average GA, weighted by deck area.	6.8
Conduits		
General Appraisal	The Statewide average GA	5**

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

** The Critical Success Factor for Conduits has been tentatively set at 5, but it is being evaluated based on the results of the recently completed Conduit inventory.

Since Bridges vary in size and consist of several components, the Office of Structural Engineering has established the internal performance targets shown in the table below to ensure that the Statewide Critical Success Factor for Bridges is met.

Internal Performance Measures for Bridges		
Asset Type	**Performance Measure**	**Performance Target**
General Appraisal	Percent of Bridges in Fair or better condition. For the GA, this means a rating between 5 and 9 (on a 0 to 9 scale). For the other substructures, ratings of 1 or 2 indicate Fair or better condition (on a 0 to 4 scale).	98%
Floor Condition		97%
Wearing Surfaces		97%
Protective Coating		90%

Federal Targets

MAP-21 and the FAST Act require States to set 2- and 4-year performance targets for Pavements and Bridges on the National Highway System[2] (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.

The work ODOT has done to prepare this TAMP allowed the agency to quickly establish acceptable targets prior to the required reporting date. Each of the two minimum condition requirements, and ODOT's 2- and 4-year Federal targets, are described below.

Minimum Pavement Conditions: State DOTs are required to have no more than 5 percent of their Interstate Pavements in *Poor* condition using the Federal performance measures. According to the final performance management rules (23 CFR 490), 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). **ODOT anticipates that less than 5 percent of its Interstate Pavements will be in *Poor* condition during the period covered in the TAMP.**

Minimum Bridge Conditions: State DOTs are also required to have no more than 10 percent of NHS Bridges, by deck area, in *Deficient* condition. As described in the published rules (23 CFR Part 490), performance targets for NHS Bridge conditions will be reported in terms of the National Bridge Inventory (NBI) Rating, which is the same as the General Appraisal rating that ODOT uses. For Federal reporting purposes, a Bridge is in *Good* condition if the deck, superstructure, and substructure are all rated in *Good* condition (NBI Rating of 7 to 9). Federal reporting requirements consider a Bridge to be in *Deficient* condition if

[2] 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.

2- and 4-Year Federal Targets* for NHS Pavements and Bridges

- **Interstate pavements:** No more than 1 percent in *Poor* condition, using the federal performance measures.
- **Non-Interstates NHS pavements:** No more than 3 percent in *Poor* condition, using the federal performance measures
- **NHS bridge deck area:** No more than 5 percent in *Deficient* condition, using the federal performance measures

*All federal targets are based on the federal performance measures.

either the deck, superstructure, or substructure have an NBI rating of 4 or lower. **ODOT anticipates that less than 10 percent of its Bridges will be in *Deficient* condition during the period covered in the TAMP.**

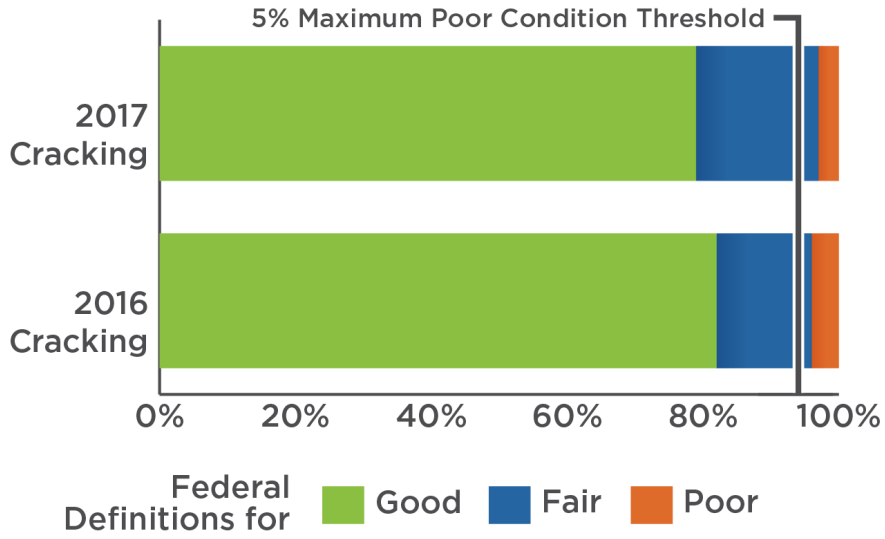
Federal Targets: In addition to the minimum condition requirements, State DOTs are required to establish 2- and 4-year Statewide performance targets for Interstate and non-Interstate NHS Pavements, and all Bridges on the NHS, using performance measures defined in 23 CFR Part 490. State DOT targets are 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:

- Interstate Pavements: No more than 1 percent in Poor condition (including Pavements managed by the Ohio Turnpike).
- Non-Interstate NHS Pavements: No more than 3 percent in Poor condition.
- NHS Bridge deck area: No more than 5 percent in Deficient condition.

ODOT uses its Critical Success Factors internally to monitor the performance of our Pavement, Bridges and Conduits. Because 96 percent of the NHS miles are currently being maintained by ODOT the impact of the CSF on the PM2 performance measures are significant and as such allowed ODOT to establish Federal Performance measure targets that are reflective of our internal measures.

The Federal targets were developed through an analysis of Pavement and Bridge conditions over a 2-year period using the Federal performance measures. The conditions of both State-maintained and locally-maintained NHS Pavements and Bridges were evaluated, using graphics such as the one presented below for one of the State regional planning organizations.

Cracking Example



Although the graphic represents conditions in terms of cracking, similar graphs were developed for the other Federal performance measures to determine the reasonableness of ODOT's proposed targets. For instance, this graphic clearly illustrates that the NHS Pavements managed by local agencies within this region of the State do not exceed the proposed target of no more than 5 percent of the Non-Interstate NHS Pavements in *Poor* condition using the Federal definitions. On the Ohio Turnpike, less than 1 percent of the lane miles are in *Poor* condition using the Federal measures.

In addition to looking at each regional area separately, the information was also analyzed on a statewide basis to determine the reasonableness of ODOT's proposed short-term State targets for NHS Pavements and Bridges. The resulting targets reflect ODOT's review of 8 years of Pavement data and 10 years of Bridge condition data provided to FHWA as part of the Department's Highway Performance Monitoring System (HPMS) submittal. The review confirmed that a high percentage of Ohio's NHS Pavements and Bridges are in Good condition with low percentages in Poor condition. ODOT's Pavement and Bridge management systems predict these patterns to continue. Although Federal performance targets are not required for Conduits, ODOT also established 2- and 4-year targets for this asset.

The resulting 2- and 4-year targets that ODOT submitted to FHWA are presented in the table below. Note that 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.

National Highway System Pavement Condition			
Pavements	**Current**	**2 Yr. Target**	**4 Yr. Target**
Percentage of Interstate Pavements in Good Condition	60.1%	N/A	50%
Percentage of Interstate Pavements in Poor Condition	0.1%	N/A	1%
Percentage of Non-Interstate NHS Pavements in Good Condition	47.1%	35%	35%
Percentage of Non-Interstate NHS Pavements in Poor Condition	1.1%	3%	3%

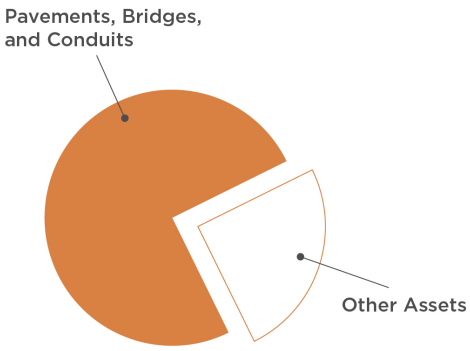
NHS System Bridge Condition			
Bridge	**Current**	**2 Yr. Target**	**4 Yr. Target**
Percentage of NHS Bridges by deck area in Good Condition	64.9%	50%	50%
Percentage of NHS Bridges by deck area in Poor Condition	4.0%	5%	5%

NHS System Conduit Condition			
Conduits	**Current**	**2 Yr. Target**	**4 Yr. Target**
Percentage of NHS Conduits in Good Condition	64.8%	50%	50%
Percentage of NHS Conduits in Poor Condition	2.7%	5%	5%

3.0 Asset Inventory and Conditions

Quality data is foundational to TAMP development. ODOT has maintained an inventory of Pavement and Bridge assets for years, recently completed its Conduit inventory, and is adding other highway assets to the inventory on a regular basis. This TAMP focuses on Pavements, Bridges, and Conduits since these assets are critical to system performance and characterize the largest share of ODOT's $116 billion investment in its transportation system.

Collectively, the value of our Pavements, Bridges, and Conduits dominates the value of all transportation assets maintained by ODOT.



ODOT's Assets

Tier 1

- Pavements
- Bridges
- Conduits
- Barriers/Guardrails
- Overhead Signs
- Post Construction Best Management Practices

Tier 2

- Lighting
- Retaining Walls
- Curb Ramps
- Geotechnical

Tier 3

- Signals
- Ground Mounted Signs
- Pavement Markings
- Noise Walls
- Sidewalks

ODOT has taken a risk-based approach to developing asset inventories, meaning that Department staff prioritized its assets based on their importance to achieving Departmental goals. Tier 1 assets were identified as being the most critical, including Pavements, Bridges and Conduits. Inventories for assets in tiers 2 and 3 will be developed as needed, or as resources allow.

In addition to building asset inventories, ODOT regularly collects inspection and/or condition information on many assets. This has allowed the Department to:

- Identify and prioritize needs.
- Establish performance targets.
- Monitor accomplishments.
- Communicate with outside stakeholders.
- Show that available funding is being used wisely.

ODOT's Transportation Asset Management business processes also rely on the use of asset condition data to quantify needs, support allocations, optimize investments, and support more accountability and transparency in decision making.

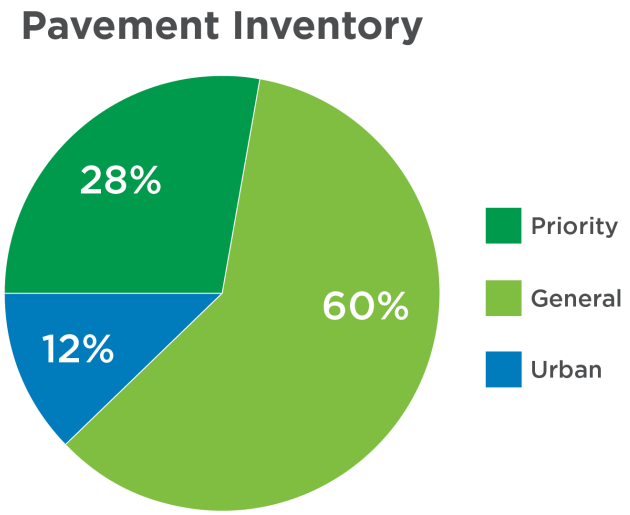
*As a ***home rule*** state, the maintenance of the Urban System is ultimately the responsibility of the Local Government.

ODOT participates with its Local Partners in the investments towards the local system.

Pavement Inventory and Condition Summary

Pavement Inventory

ODOT is responsible for nearly 50,000 lane miles of roads divided between 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 U.S 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 the investments towards the local system. The Ohio Turnpike and Infrastructure Commission (Ohio Turnpike) 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.



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 the Federal Highway Administration (FHWA) for the Pavements on the National Highway System (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.

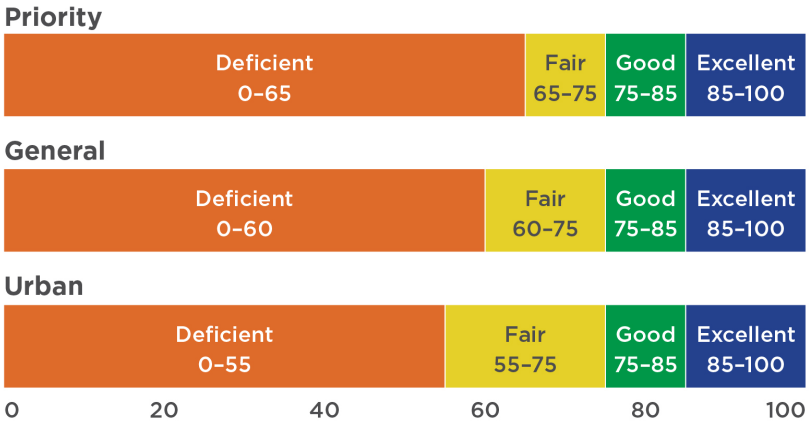
Pavement Inventory	
ODOT Classification	
System	**Mileage (Ln-Mi)**
Priority	13,837
General	29,644
Urban	6,084
Total	**49,565**
NHS Inventory	
Interstate	8,357
Non-Interstate NHS	12,583
Local NHS	103
Municipal NHS	801
Total NHS	**21,844**

Pavement Conditions

Ohio DOT

Pavement conditions are monitored 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 table below demonstrates how the numeric PCR ratings correlate to a typical user's perception of quality.

PCR Condition Levels



ODOT measures the average Pavement conditions for all Priority, General, and Urban routes each year and compares conditions to the Critical Success Factors to gauge Statewide system quality and set investment priorities.

The information is published quarterly and presented in ODOT's Critical Success Factor Dashboard[3]. 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 meeting or exceeding its targets for the Priority and General Systems.

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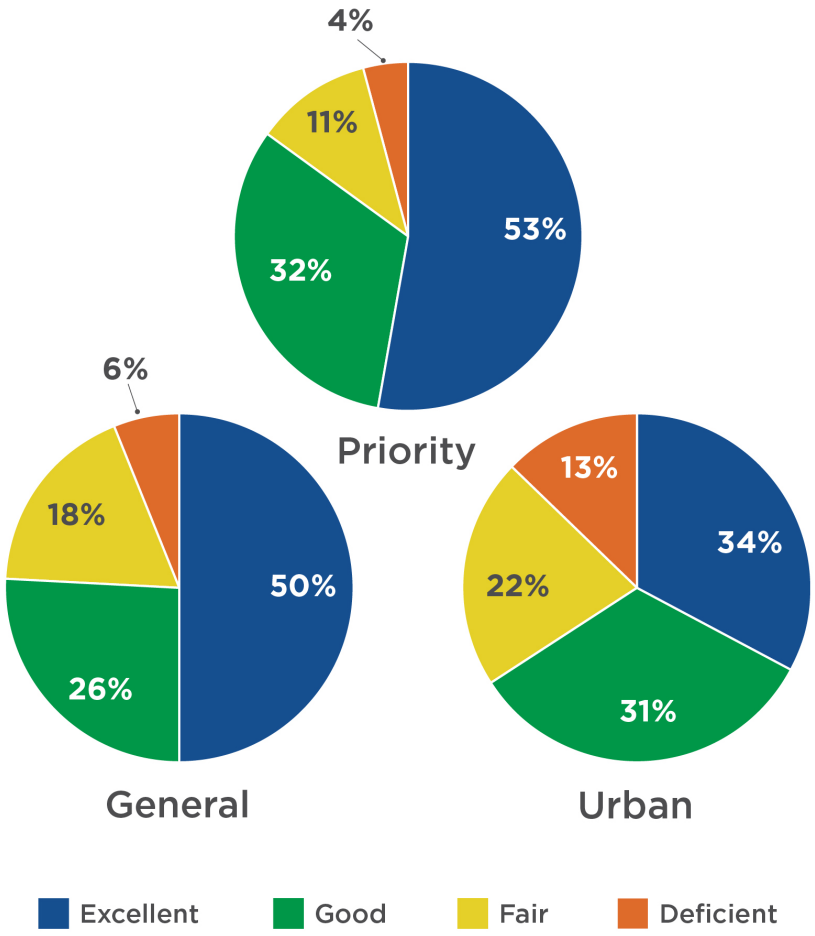
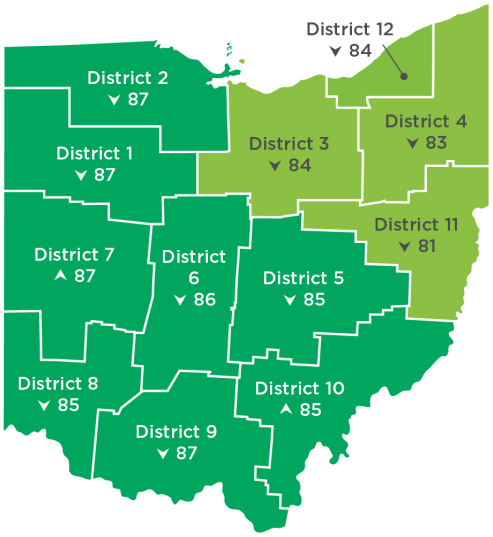
3 http://www.dot.state.oh.us/policy/ODOTStrategicPlan/Documents/FY%2016%20Q1%20CSF%20Dashboard.pdf

Pavement Condition Across Systems



Examples of the average scores by District are provided in the following graphics.



Priority System

State Goal: 85
State Average: 85

Meets Goal

Does Not Meet Goal

1-Year Trend Up
1-Year Trend Down

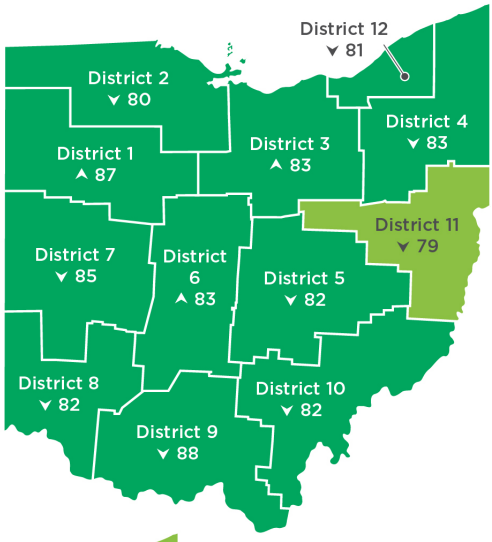
General System

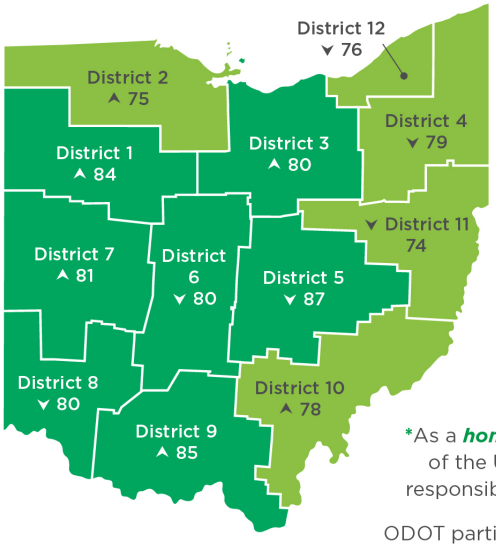
State Goal: 80
State Average: 83

Meets Goal

Does Not Meet Goal

1-Year Trend Up
1-Year Trend Down





Urban System*

State Goal: 80**
State Average: 79

Meets Goal

Does Not Meet Goal

1-Year Trend Up
1-Year Trend Down

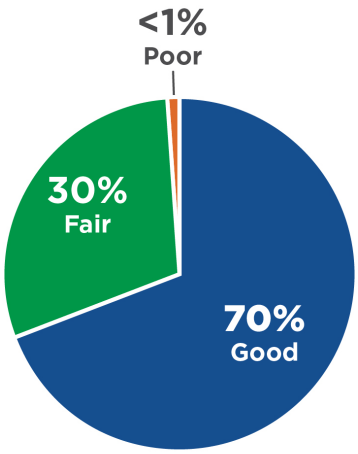
*As a ***home rule*** state, the maintenance of the Urban System is ultimately the responsibility of the Local Government.

ODOT participates with its Local Partners in the investments towards the local system.

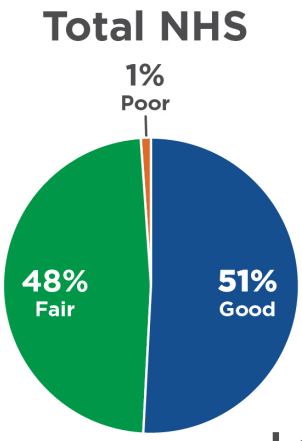
**ODOT no longer sets a Critical Success Factor for the Urban System but monitors conditions to existing state metrics.

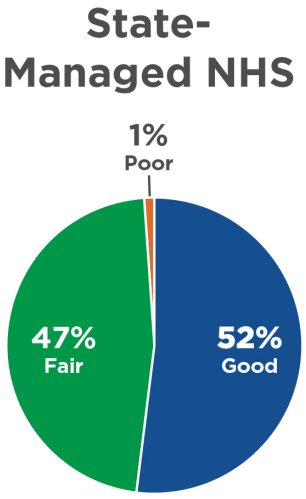
Ohio Turnpike

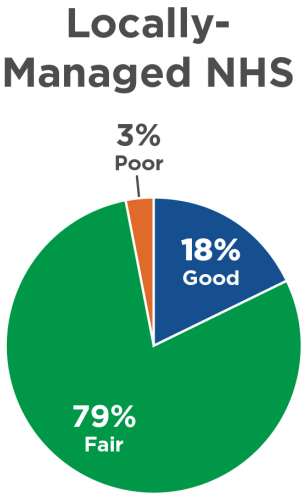
The Ohio Turnpike maintains approximately 1,285 lane miles of Pavement. ODOT uses the PCR to assess the condition of the Pavements. The 2019 survey results indicate that essentially the entire network is in Fair or better condition, as shown below.



National Highway System Conditions



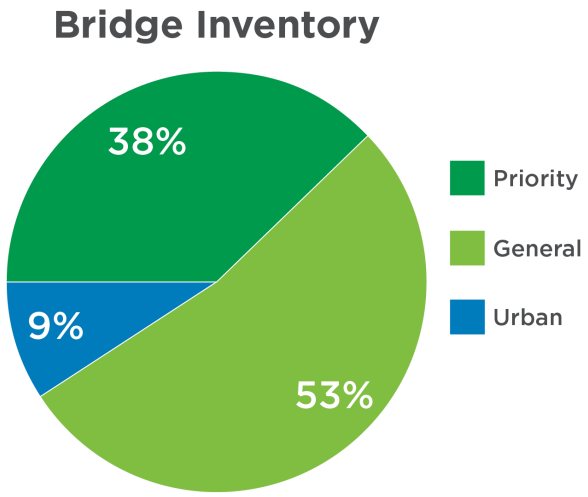




Bridge Inventory and Condition Summary

Bridge Inventory

Ohio has nearly 43,000 Bridges. ODOT is responsible for maintaining over 10,000 of these Bridges on the Priority and General systems. The Ohio Turnpike also maintains 544 additional Bridges. The Bridge inventory includes all Bridges and large culverts with a span greater than or equal to 10 feet.



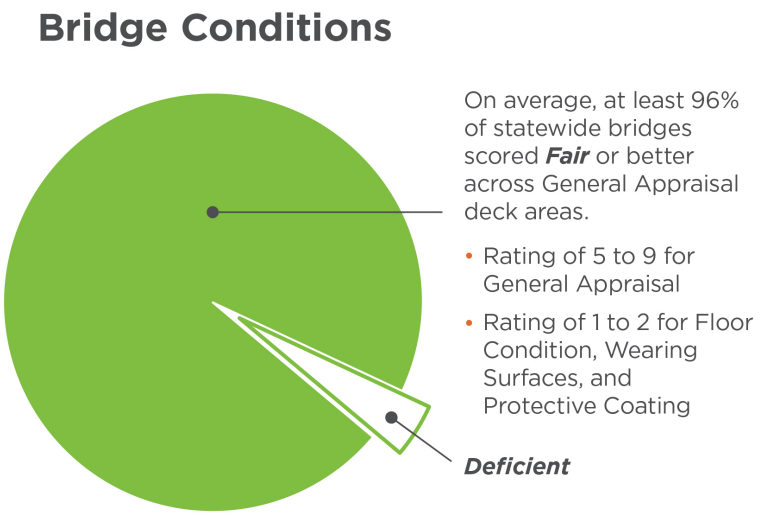
A summary of the Bridge inventory is presented on the following page, differentiating between the number and size of Bridges on the NHS and non-NHS.

System	Classification	Bridge Count	Bridge Area (sq. ft.)
NHS	Interstate	3,293	48,265,851
	Non-Interstate NHS - On System (US Route)	2,134	19,314,394
	Non-Interstate NHS - On System (State Route)	1,652	18,501,670
	Non-Interstate NHS - Off System	201	1,600,097
	Total	**7,280**	**87,682,012**
Non-NHS	Non-NHS - On System	7,721	28,296,896
	Non-NHS - Off System	27,951	45,953,937
	Total	**35,672**	**74,250,833**
Total		**42,952**	**161,932,845**

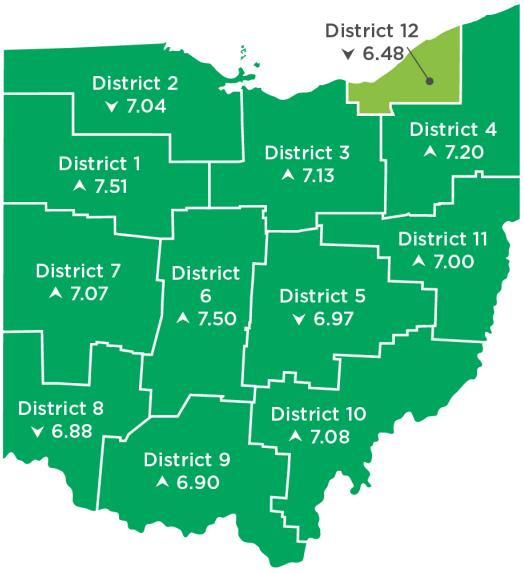
Bridge Conditions

Ohio DOT and Ohio Turnpike

ODOT inspects its Bridges annually. Each inspection provides a rating for the major elements of the Bridge (superstructure, substructure and deck) 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 *Deficient*. To provide an overall assessment of Bridge condition that takes all three elements into account, the lowest rating from these primary elements is reported. The same overall assessment is reported as the General Appraisal (GA) rating, which is a rating ODOT has been using for years. 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 96 percent of the Bridges maintained by ODOT are in *Fair* or better condition (GA of 5 to 9).



The Critical Success Factor used to manage Bridges is a Statewide average GA rating of 6.8 out of 9. ODOT is currently exceeding this target. Weighted Average GA ratings for each District are shown in the map below to demonstrate progress made toward targeted Statewide conditions.



Bridge General Appraisal

State Goal: 6.8
State Average: 7.06

Meets Goal

Does Not Meet Goal

1-Year Trend Up
1-Year Trend Down

Ohio Turnpike

The condition of the Bridges on the Ohio Turnpike are 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.

National Highway System

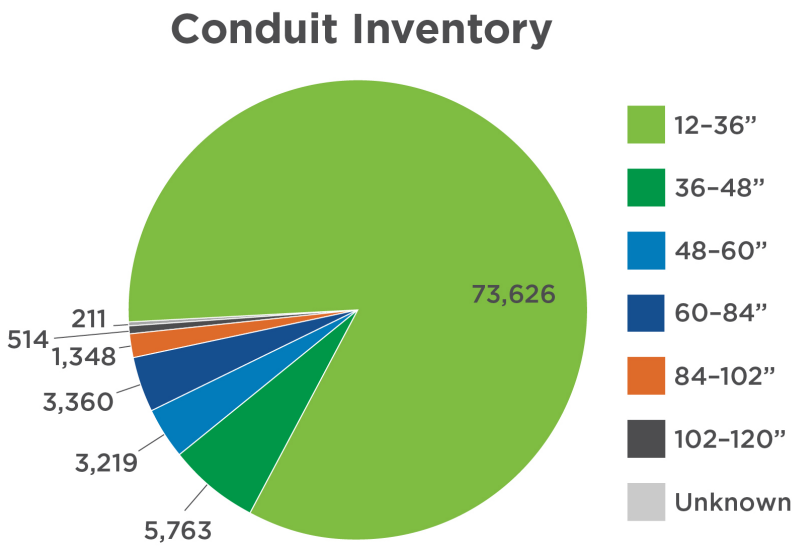
Bridge conditions on the NHS are slightly higher than the Statewide Bridge conditions, as shown below. Because the State maintains the majority of NHS Bridges, the overall average is not significantly impacted by the lower conditions of the NHS Bridges maintained by the local agencies.

NHS Bridge Conditions	% Good	% Fair	% Poor	% Fair or Better
Statewide NHS	62.8%	34.8%	2.3%	97.7%
State-Maintained NHS	63.3%	34.6%	2.1%	97.9%
Locally-Maintained NHS	45.5%	41.6%	10.9%	87.1%

Conduit Inventory and Condition Summary

Conduit Inventory

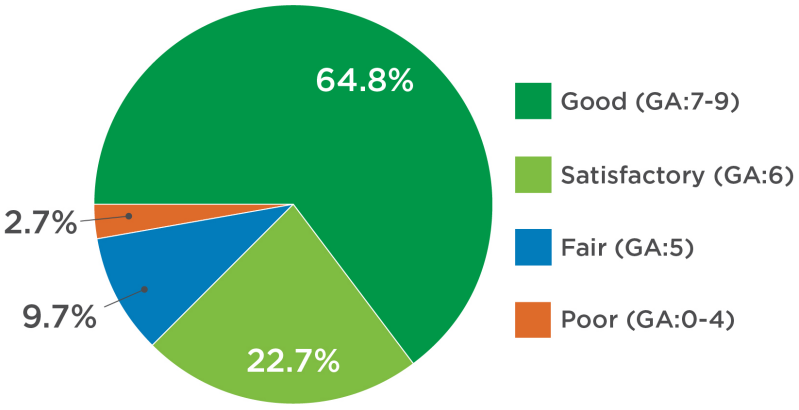
ODOT is responsible for over 88,000 Conduits. These include culverts and storm drains located under Pavements and paved shoulders with a span or diameter of 12 inches or more, but less than 10 feet. ODOT recently completed its Conduit inventory and has been implementing Statewide inspections to enable more effective Conduit management. As part of the inventory development, ODOT is striving to gather information on NHS Conduits managed by local agencies. At the present time, the inventory includes only State-maintained Conduits.



Conduit Conditions

Conduits are rated using a GA rating similar to the one used for Bridges. As with Bridges, a rating of 9 represents *Excellent* condition and a rating of 0 represents total failure. A GA rating of 5 or more is classified in *Fair* or better condition. The inspection frequency ranges from 1 to 10 years based on the size of the Conduit and its condition.

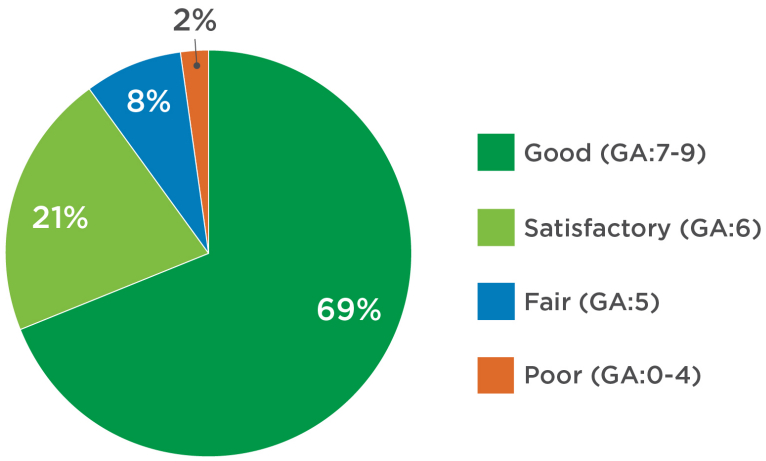
Statewide Conduit Conditions



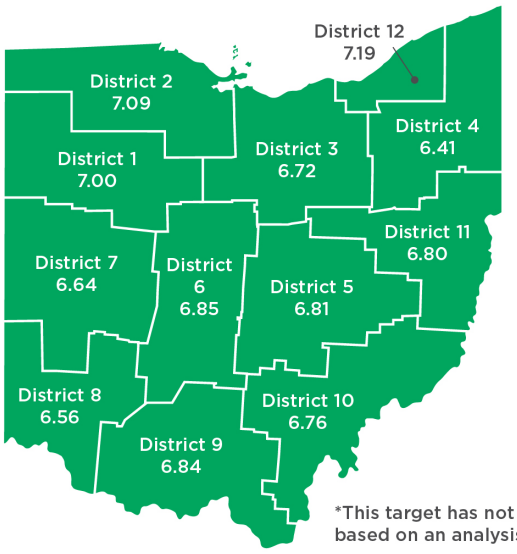
Note: Not all conduits have been inspected due to high water or excessive silt blockage. Partial inspections do not get a GA rating assigned.

The condition of the Conduits on the NHS is presented below.

NHS Conduit Conditions



The Critical Success Factor currently being used to manage Conduits is a Statewide average GA rating of 5 out of 9. ODOT is currently exceeding this target. Weighted Average GA ratings for each District are shown in the following map to demonstrate progress made toward targeted Statewide conditions.



Conduit General Appraisal

State Goal: 5.0*
State Average: 6.8

Meets Goal

Does Not Meet Goal

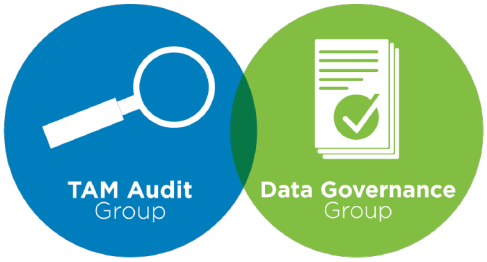
*This target has not been finalized and will be verified based on an analysis of the culvert inventory

Maintaining Data Quality

A performance-based approach to managing assets is dependent on the availability of reliable asset data. Because of the importance to its business processes, ODOT has taken steps to manage its asset data to ensure that the data is complete, current, and is collected consistently across the State.

Processes to Ensure Data Quality

ODOT relies on its TAM Audit Group and its TAM Governance Group, both of which were established under the Asset Management Leadership Team, to help ensure data quality.



Comprised of Central Office and District personnel

Oversees all asset data collection requirements

Ensures data governance and collection standards are in place for any asset data collected by the Department

Comprised of Central Office and District personnel

Sets agency data standards

Develops data governance and data collection standards for all asset data collected by the Department

The Data Governance Group was established to ensure that agency data collection standards are in place for any data that is collected on a Statewide basis. In addition, the Group develops data governance standards that assign ownership of the data, identify data users (including systems), establish data collection frequency, and define data formats.

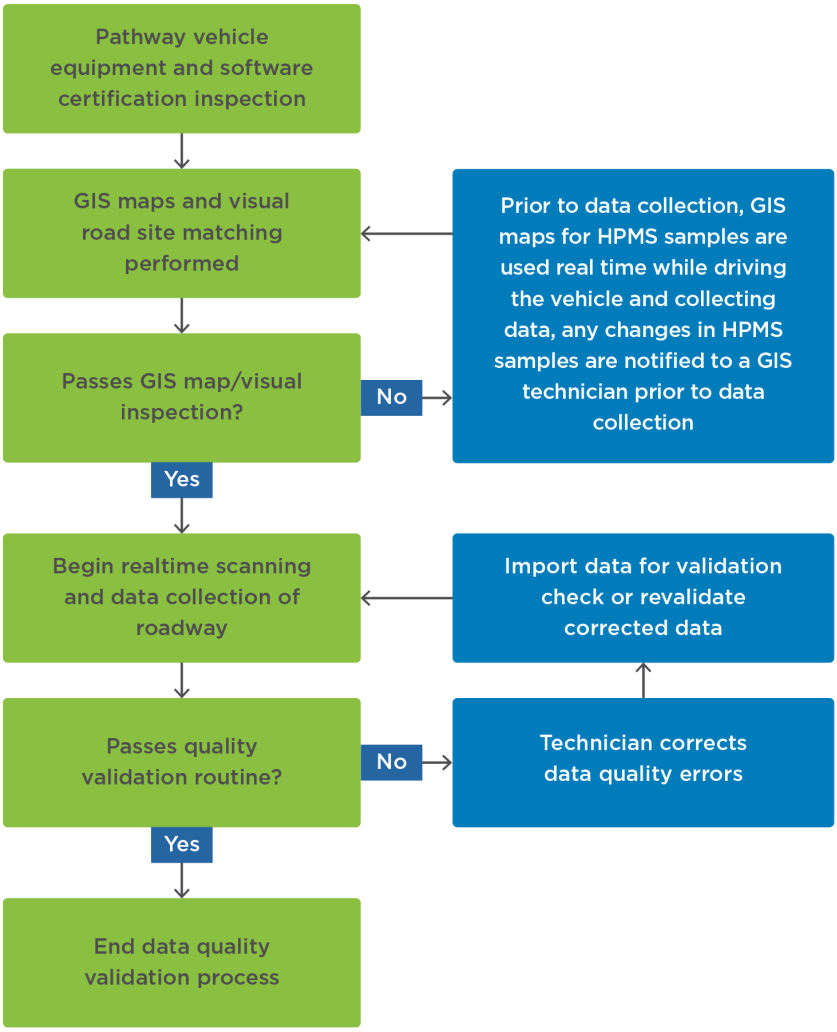
The TAM Audit Group is responsible for ensuring that the asset data collection standards are followed as part of ODOT's quality assurance processes. The Group helps ensure that data is collected from a holistic, agency-wide perspective and that all locational data matches the current Linear Referencing System.

For Pavement condition data collected on the NHS, more specific information about the Quality Management Process is being documented as required under current legislation.

Data Quality Management and Monitoring

ODOT's Infrastructure Transportation Management staff use Data Quality Management processes that rely on a combination of scheduled testing and maintenance procedures for the highway monitoring vehicles and systems to establish high quality data gathering. Additional data quality processes include a synchronization of Geographic Information System (GIS) maps with Pavement condition information provided by the automated Pathway equipment to detect any data inconsistencies. A summary of the data quality validation processes is presented in a graphical form below.

Data Quality Validation Process



Processes in place to manage data quality are listed below.

- Vehicle maintenance and vendor visits are performed regularly to inspect all equipment and software.
- All Infrastructure Management Field Technicians are required to have Commercial Driver's Licenses and have been trained extensively on vehicle operations and data quality assessments.
- The vehicles are taken to a profiler certification course, where software is verified through comparative analyses with maps and Pathway data.
- Weekly "bounce" tests are performed to certify all equipment and software are collecting accurate data.
- All vehicle equipment and software certification results are documented and tracked in Excel for historical trending and reporting.

- Prior to data collection with the vehicle - GIS maps (collector mobile app) for local Highway Performance Monitoring System (HPMS) samples are used in real-time while driving the vehicle and collecting data. The GIS technician is notified of any changes in HPMS samples prior to data collection.
- GIS maps and visual road site matching are performed in real time. If any discrepancies are identified prior to data collection, the GIS team will be notified to assist in resolving the item.
- After the vehicle data is collected and processed, the quality check begins with a comparison of miles actually collected versus miles forecasted. Spatial reconciliation with the Linear Referencing System (LRS) is also conducted.
- Business rules and data profiling are automated to detect data quality for International Roughness Index (IRI). These rules can detect data correctness, accuracy for segment lengths, missing data, and overlapping data.
- Reports for IRI are produced to monitor the data quality, such as frequency distributions, test distance, and historical reports.
- Business requirements were developed to enhance the Highway Information Management (HIM) system in the areas of IRI, faulting, cracking, rutting, skid tests, and HPMS submittals in the following data categories:
    - Pre-data collection
    - Conversion of historical data
    - Data importing
    - Data computing
    - Data quality
- New reports were developed in the HIM system to focus on standardizing data quality reports for data profiling. The new reports target missing data, duplicate data, boundary matching, and expected values, plus more robust HPMS reporting.

Processes to Acquire Data for NHS Routes Not Maintained by ODOT

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 way this data is reported, ODOT includes all locally-maintained Pavements and Bridges on the NHS in its on-going 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, Metropolitan Planning Organizations (MPOs), 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 its local partners and submitted to the Office of Technical Services located in the Division of Planning at ODOT. As noted in the Enhancements included in Chapter 9, ODOT is developing processes to improve the collection of data on locally-maintained NHS Conduits to assist in future reporting.

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, consume, and distribute data. ODOT also utilizes its Local Transportation Assistance Program (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. In 2017 alone, LTAP trained over 15,000 local transportation professionals on a variety of topics related to managing Ohio's infrastructure.

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

Asset Value

The transportation network represents a significant investment that is critical to the State's economic vitality. In today's dollars, it would cost nearly $116 billion to replace the Pavements, Bridges, and Conduits that ODOT maintains, as shown in the following table. The NHS Pavements and Bridges alone would cost approximately $54 billion to replace.

Estimated Asset Replacement Value (in billions)

Asset Type	Estimated Replacement Value
Pavements	$65
Bridges	$22
Conduits	$3
Other Assets	$26
Total	**$116**

By investing regularly in certain low-cost preservation treatments, the value of these assets is preserved and the cost of maintaining system conditions is reduced, because costly repairs and replacements are needed less frequently. Preserving the condition of the highway system so fewer assets must be replaced is an important objective for the investments included in this TAMP.

4.0 Life Cycle Planning

Using an analysis of all costs over the life of its Pavements and Bridges, the Asset Management Leadership Team has made a business case for long-term financial investments that will reduce the life cycle cost of maintaining ODOT's assets while maintaining system performance.

To evaluate the investment strategies documented in this TAMP, ODOT performed life cycle planning for Pavements and Bridges. Using asset condition data and predictive models, ODOT analyzed the impacts of increasing the use of properly-timed preservation treatments to extend asset service life. For Pavements, the analysis was based on treatment strategies and performance data from ODOT's Pavement management system. For Bridges, the analysis used data from its Bridge inspection database and projected deterioration rates based on expert opinion.

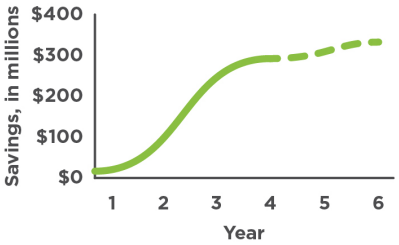
For both Pavements and Bridges, the life cycle planning showed that the life extension provided by a long-term commitment to timely preservation delays costly replacements and reduces life-cycle costs. The results showed that if just 5 percent of the NHS Bridges were to receive an appropriate preservation treatment annually, up to $50 million could be reallocated across the system to maximize service life. For Pavements, the analysis showed that if half of the low-volume roads eligible for preservation were addressed with a chip seal rather than an overlay, at least $75 million could be reallocated to other parts of the highway system each year. In the four years that the life cycle planning strategies have been followed, ODOT has realized a financial efficiency of over $300 million while addressing more than 1,700 additional lane miles of Pavement and 150 Bridges.

To help ensure that the planned investments are implemented, ODOT used its life cycle planning results to drive business process changes that led to a more collaborated and coordinated process for developing District work plans to help ensure the timely application of preservation treatments. The business process changes that were made are further discussed in Chapter 8, *Asset Management Approach*. In addition, guidance is provided to the Districts to assist them in developing their work plans. An example of the guidance is provided in Appendix B.

Reducing the overall life cycle cost of maintaining pavements, bridges, and conduits requires:

- Increased preservation activities
- A unified approach to maintenance and capital planning

In four years, Ohio realized a financial efficiency of over $300 million in life cycle costs



These efficiencies are expected to continue

Pavement Preservation Treatments

- Crack sealing
- Chip seals
- Microsurfacing
- Thin Overlays
- Underdrain cleaning

Bridge Preservation Treatments

- Sealing of bridge decks
- Cleaning bridges
- Sweeping

Conduit Preservation Treatments

- Debris removal
- Erosion protection

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 is Critical Success Factors.

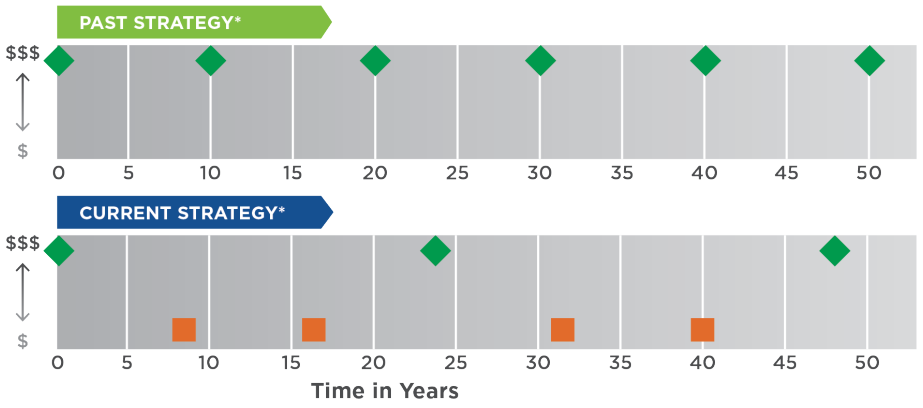
Preservation Strategies

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.

Small, planned investments in maintenance save money in the long run.

Similar to maintaining vehicles with properly timed oil changes and tune-ups, a long-term strategy based on routine, low-cost preservation treatments is 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.

Pavement Preservation Strategies



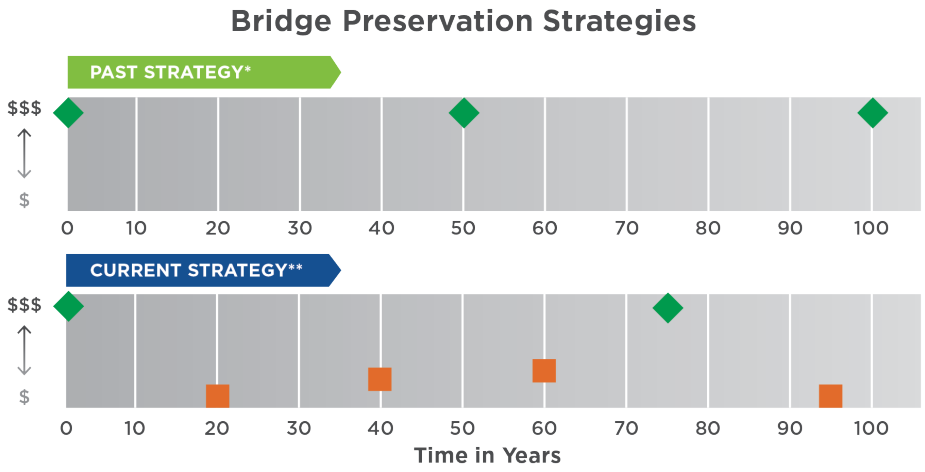
Chip Seal/Microsurfacing/Thin Overlay | $40–80k per lane-mile

Mill/Overlay with pre-overlay repairs | $250–$350k per lane-mile

*In both strategies, crack sealing is performed on a 2–3 year cycle.

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. The following figures illustrate how the current preservation strategies differ from the typical strategies used in the past. Over the analysis period, both the Bridge and the Pavement preservation strategies are significantly less expensive than

the traditional strategies, even though each asset receives more frequent treatments. When considered over an entire network, these savings quickly become significant.



Preservation treatments: 20 years = $29k per bridge
40 years = $110k per bridge | 60 years = $149k per bridge

New or replaced bridge | $1.9 million

*Past strategies do not include preservation; only routine maintenance amounting to $2.5k per bridge per year.

**Current strategies include treatments like bridge deck sealing and bridge washing.

Life Cycle Planning Process

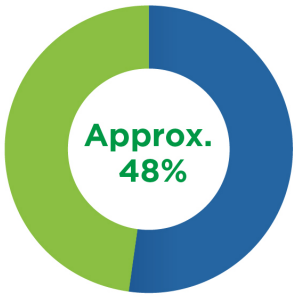
ODOT has adopted a long-term view of the costs required to keep its Pavements, Bridges, and Conduits in service. Decisions made today can have a significant impact on costs many years into the future. Two different approaches were used during the life cycle planning process to develop the recommended strategies introduced previously.

Pavement Life Cycle Planning

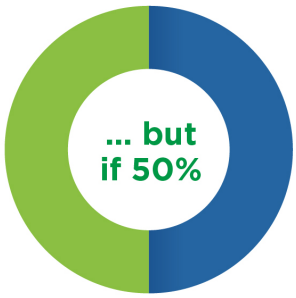
ODOT has implemented a state-of-the-art Pavement management system to model the deterioration of its Pavement network and to evaluate the long-term impacts of different maintenance and rehabilitation strategies based on factors such as the overall condition of the Pavement, the type and severity of distress observed on the Pavement surface, and traffic levels.

Approximately 97 percent of ODOT's roadway network is comprised of asphalt-surfaced Pavements. For that reason, the Pavement life cycle planning considered only one class for the Pavement network include crack sealing, chip sealing (on low-volume roadways), and asphalt mill and overlays.

The LCP analysis found that:



of the general system is eligible for chip seals* ...



of overlay projects were chip sealed instead ...

Life cycle costs would

decrease by over $300 million in four years

even though an additional 1,700 lane miles are being in improved without increased funding.

*The analysis was conducted using chip seal rules that specified average daily truck traffic <250 and average daily traffic <2,500. In 2018, the rules were modified, retaining the truck traffic criteria, but expanding the average daily traffic criteria to <4,000.

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

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 determine the most appropriate treatments for the available funding, based on their knowledge of local conditions. Historically, asphalt mill and overlays were the most commonly used treatment strategy for maintaining the system.

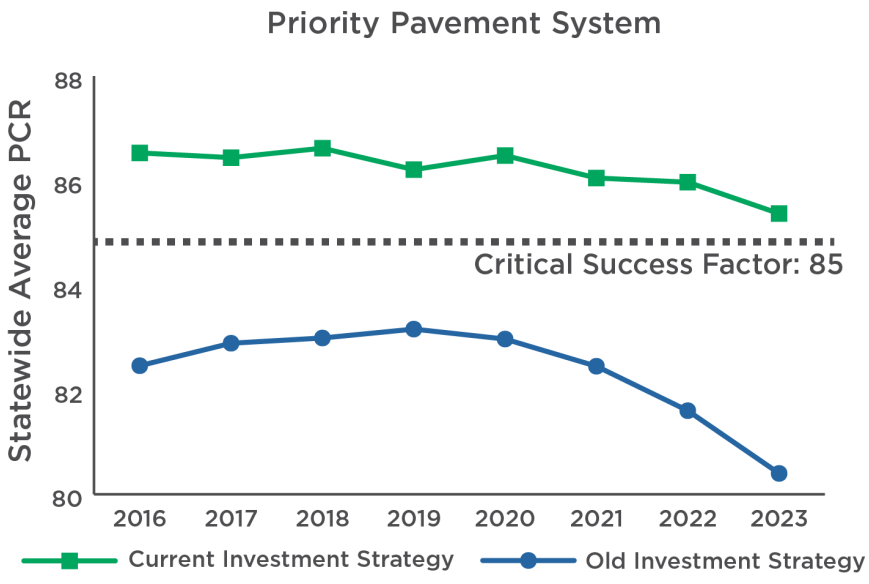
However, the life cycle planning (LCP) analysis showed that over a 10-year period, it would be difficult for ODOT to continue to achieve its Critical Success Factor for Pavements with anticipated funding levels if the traditional overlay strategy was continued. Therefore, an alternate strategy was implemented that focused on increasing the use of chip seals on eligible Pavements on the General System. The analysis found that approximately 48 percent of the Pavements on the General System were eligible for chip seals (based on PCR values, truck traffic levels, and average daily traffic levels). If 50 percent of the Pavements in this category, which the Districts traditionally overlaid, were chip sealed instead, the analysis showed that the annual cost of preserving the network could be reduced by approximately $75M. These results were sufficient to incentivize ODOT to develop and implement new business processes that help to ensure the timely and appropriate use of chip seals on eligible Pavements to support the life cycle strategy presented in this TAMP, which includes the use of chip seals and other preventive maintenance treatments on the Pavement network. Since the LCP analysis was completed, ODOT has revised its chip seal criteria based on input from

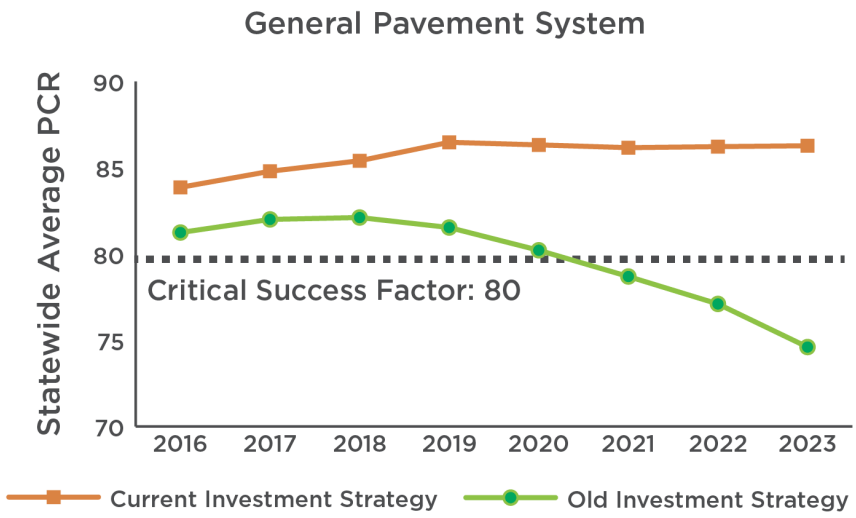
District Engineers. The LCP strategy has been used for the past 4 years and has resulted in improved efficiency of over $300 million even though an additional 1,700 lane miles of Pavement have been improved during that time. Additional efficiencies are expected over the next several years.

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

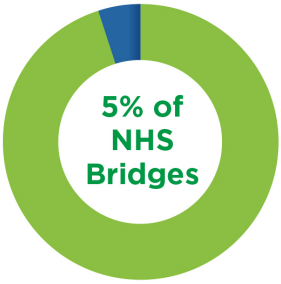
- General System – Low volume Pavements are typically treated with several chip seals applied on a 6- or 7-year interval, followed by a mill and fill around year 20. Additional repairs are applied as needed and crack sealing is applied every 5 years.
- Priority Routes (including the Interstate System)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

An illustration of the impact that the current preservation strategy is expected to have on the Statewide average PCR is illustrated in the following graph, which was generated using information in the Pavement management system. Even over the short period of time illustrated in this graph, average conditions between the prior investment strategy and the current investment strategy are dramatic. Similar results were generated for the General System, as shown in a separate graphic.





ODOT's regular schedule of bridge preservation activities target



each year for capital preservation, such as:

- Bridge cleaning
- Deck sealing
- Deck sweeping

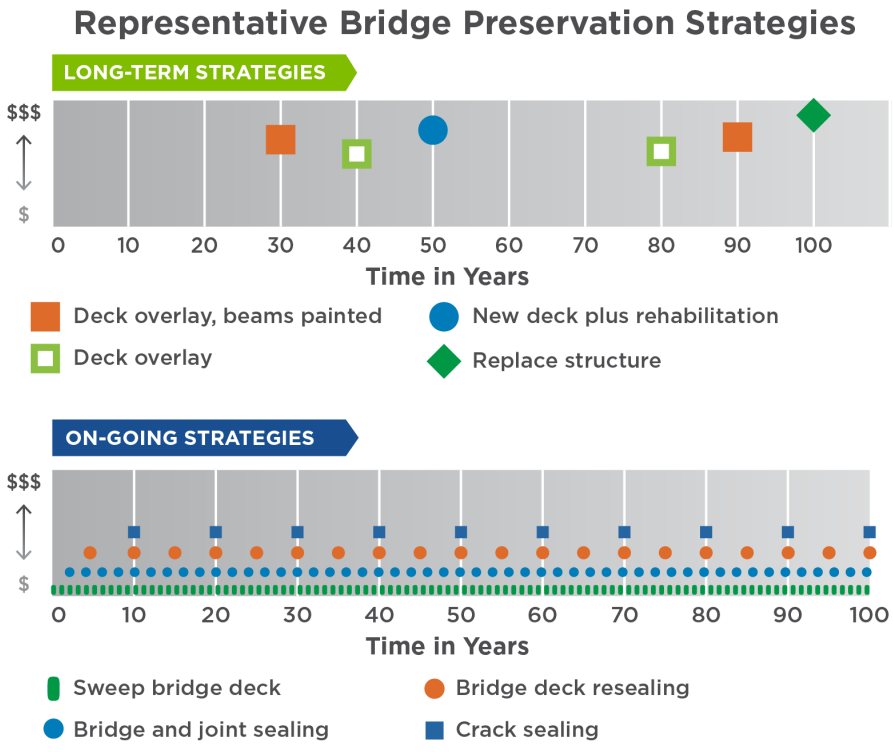
This program has contributed to a **financial efficiency of over $300 million** over 4 years and an additional 150 bridges receiving treatment without increasing the budget.

Bridge Life Cycle Planning

A life cycle planning analysis was also conducted for Bridges using a spreadsheet analysis tool that was developed specifically for this purpose. The spreadsheet tool enabled ODOT to conduct a life cycle analysis for its Bridge network as the agency began the implementation of new Bridge management software. The spreadsheet tool used representative rates of deterioration for Bridge conditions developed with input from ODOT's Office of Structural Engineering. In addition, various treatment cycles were considered to enable the comparison of both ODOT's traditional rehabilitation approach (which predominantly included deck replacement and Bridge replacement) with a strategy that increased the amount of preservation work (such as Bridge cleaning, deck sealing, and deck sweeping).

The life cycle planning for Bridges also considered only one Bridge class, although future analysis conducted with the Bridge management system may address additional sub-classes based on Bridge type.

A typical preservation strategy for Bridges is illustrated below. The graphic illustrates that in addition to long-term strategies, such as deck overlays, ongoing preservation activities (such as sweeping, cleaning, and deck sealing) are performed on a regular basis.



The results of the analysis indicated that by increasing the use of preservation activities by just 5 percent on NHS Bridges, ODOT could reduce its annual Bridge preservation costs by $50M once a steady-state condition was achieved. Based on this analysis, ODOT adopted a strategic preservation program for its Bridges and is implementing state-of-the-art management tools to identify candidate projects. To ensure that Bridge preservation activities are conducted each year, guidance is provided to the Districts to assist in developing their work plans (as shown in Appendix B). In addition, the Office of Structural Engineering provides each district with a list of the Bridges to be cleaned, swept, and sealed. In the 4 years since the Bridge preservation program has been implemented, ODOT has realized a financial efficiency of over $300 million and has been able to address 150 more Bridges without increasing the budget.

Conduit Life Cycle Planning

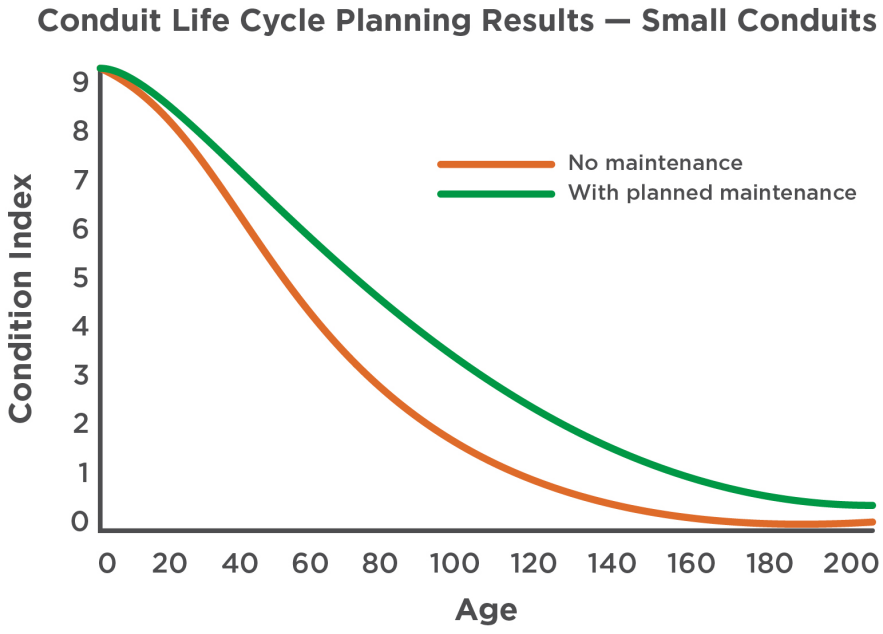
The Conduit life cycle planning analysis was similar to the Bridge analysis, which used a spreadsheet tool to analyze the benefits associated with different treatment strategies for a representative Conduit. The spreadsheet tool used the result of Conduit inspections to determine current conditions and a

probabilistic analysis was conducted to forecast future conditions. Different levels of investment were considered, representing different types of treatments to address forecasted deterioration.

The following types of routine maintenance and corrective actions were considered in the analysis:

- Routine maintenance (cyclic) – cleaning.
- Routine maintenance (reactive) – repairs.
- Corrective actions – joint sealing/internal band sealing, paved invert, spray-on lining, sliplining, pipe bursting, pipe jacking.
- Replacement – open-cut replacement.

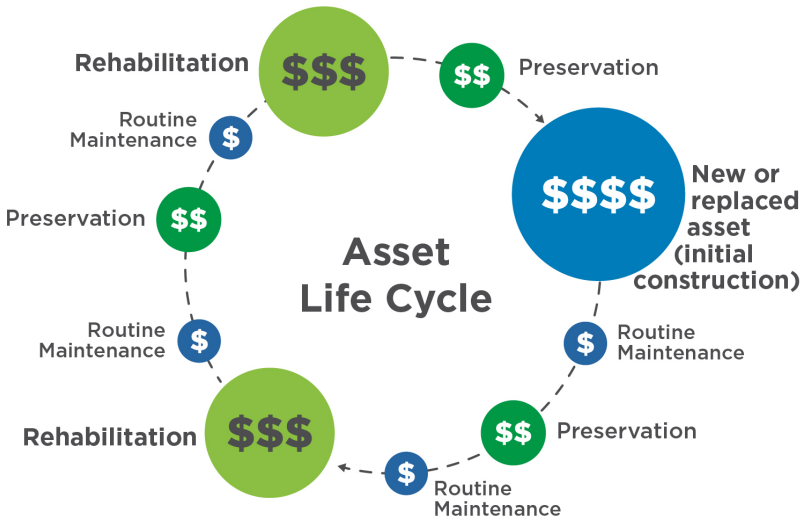
As shown in the following graph for small (12-36 inch) Conduits, the preservation strategy improves Conduit conditions over an alternate strategy that uses only rehabilitation and reconstruction strategies. In this example, the use of planned preservation treatments while the Conduit is still in relatively good condition added approximately 25 years to the life of a Conduit. Similar results were generated for other Conduit sizes, illustrating the long-term benefits associated with Conduit preservation investments.



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 haves adopted, are cost-effective because they defer the need for more costly rehabilitation and reconstruction activities.

The investment strategies presented in Chapter 6 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 categories of work there are a variety of different types of improvements that we use regularly.



- Initial Construction – This category refers to the construction of brand new assets, including Pavements or Bridges, on new alignments. Adding new Pavement lanes to an existing highway address congestion is an example of an activity that falls in this category. As stated earlier in the TAMP, 93 percent of our capital dollars are spent on preserving existing assets rather than adding to the network.

- **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, microsurfacing, and thin overlays. For Bridges, it includes Bridge and joint sealing, Bridge deck resealing, and painting 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 table illustrates the types of treatments ODOT may consider in each of the work type categories included in our investment strategies.

FHWA Work Type Category	Pavement Treatment Types	Bridge Treatment Types	Conduit Treatment Types
Routine Maintenance	• Crack filling • Joint sealing	• Bridge cleaning • Deck sweeping	• Conduit cleaning • Minor repairs
Preservation	• Crack seal • Chip seal • Microsurfacing • Thinlays • Thin overlay •	• Joint sealing • Bridge deck resealing • Crack sealing • Painting steel elements	• Joint sealing • Internal band sealing
Rehabilitation	• Structural overlay • Mill and overlay • Shoulder repair	• Partial or complete replacement of a Bridge deck or wearing surface • Retrofit of fatigue-prone steel details or fracture critical members • Partial or complete replacement of the superstructure	• Paved invert • Spray-on lining • Sliplining • Pipe bursting • Pipe jacking
Reconstruction	• Pavement replacement	• Bridge replacement	• Open-cut replacement
Initial Construction	• New road • New lane	• New Bridge	• New Conduit

5.0 Risk Management

Modern management practices require leaders to prepare for uncertainties and unplanned events. Risk management - the practice of recognizing, documenting, and managing uncertainty – is an integral component of Asset Management.

ODOT's Asset Management Leadership Team conducted a risk assessment to identify the most significant risks the Department expects to face over the next several years. The risk assessment recognized the following risks as being most significant to ODOT's ability to meet its Asset Management objectives:

- The potential impact of projected revenue changes on network conditions over the next several years;
- Inflation rates that diminish buying power and impact the amount of work that can be constructed each year;
- The likely acceleration in Pavement and Bridge deterioration with increased truck traffic;
- The expectation of significant staff turnover due to retirements in the coming years and the resulting loss in institutional knowledge; and
- The likelihood that ODOT will need to prepare for, and respond to, extraordinary weather events.

The process used to identify and evaluate these risks, the potential impacts of each of these risks, and ODOT's approach to mitigating these risks, are discussed in the remainder of this chapter.

Key Risks:

Marginal revenue growth

Changing workforce

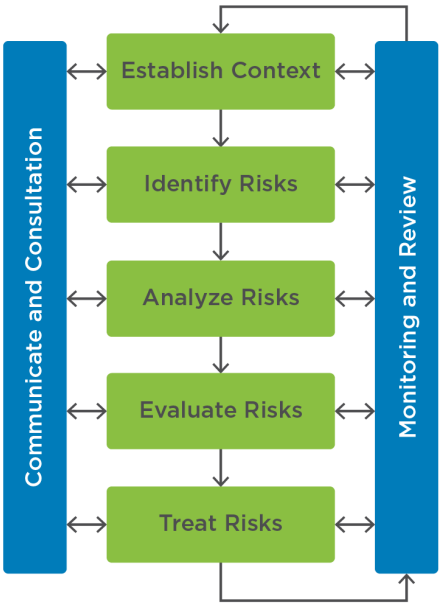
Extraordinary weather events

Price volatility

The Risk Management Process

ODOT has considered risks in managing its transportation network for years, following the risk management framework originally developed by the Institute of Organizational Standards (ISO). This framework involves the following five steps:

- Establish the context – identify what risks will be considered and how they will be evaluated.
- Identify risks – identify the risks that could hinder ODOT's ability to achieve its Asset Management objectives.
- Analyze risks – use agency-established metrics to evaluate the likelihood and impact of each risk.



- Evaluate risks – prioritize the results of the analysis.
- 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. The Division of Planning has been assigned responsibility for managing the risk management process in the future.

Risk Identification

The risk analysis conducted for the TAMP considered a variety of different types of risks related to the following:

- Flat funding and inflation, impacting ODOT's ability to continue meeting Critical Success Factors while costs climb and the Department's buy power decreases.
- The availability of data, models, and tools (e.g., management systems) to predict and evaluate asset conditions over time so dollars are invested wisely.
- Asset vulnerability due to extraordinary weather events such as catastrophic flooding, high winds, and hot/cold extremes.
- Increases in truck freight that adds to congestion in areas not designed to handle the traffic volume and causes more rapid wear and tear on Pavements and Bridges.
- Asset-related risks that hinder ODOT's ability to manage its assets effectively, such as the uncertainty that Conduit inspections will be completed on a timely basis.
- Potential workforce changes through retirements that could impact ODOT's ability to implement its investment strategies unless institutional knowledge is preserved.
- Leadership and organizational changes that could impact existing goals and priorities.

Risk Ratings and 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'S 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

ODOT's 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

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.

		Likelihood Ratings and Risk 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

The highest priority risks, including those discussed earlier in the chapter, are addressed using one of the following strategies:

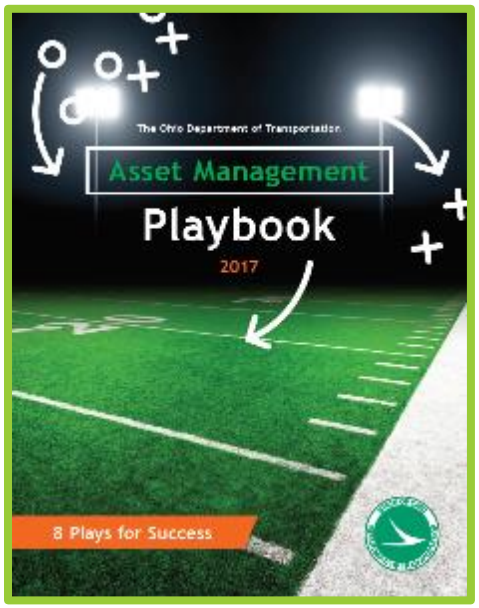
- Terminating – eliminating the threat posed by an adverse risk or avoiding the risk by clarifying requirements, obtaining information, improving communications, or acquiring expertise.
- Transferring – shifting the negative impact of a threat, along with the ownership of the response, to a third party (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 Of – benefitting from an opportunity (e.g., new external funding) that helps attain strategic goals.

Applying the Risk Management Framework

In 2012 ODOT first used its risk management framework to prioritize the order in which asset data would be collected. The risk exercise involved individuals representing each asset class, as well as representatives from Planning, Operations, Information Technology, and the Districts. The risk assessment categorized each asset into one of three tiers. Several tier one assets (i.e., Pavements, Bridges, and Conduits) are included in this TAMP.

During the development of the TAMP, the Asset Management Leadership Team conducted another risk evaluation, focused primarily on the risks associated with achieving the Asset Management objectives outlined in this TAMP. The results of that analysis were described earlier in the chapter and the strategies that have been adopted are discussed in the next section of this chapter.

Because of the importance of addressing risks, the Asset Management Leadership Team monitors these risks at its monthly meetings. Although the Asset Management Leadership Team has responsibility for monitoring risks, the Team collaborates with any impacted Data Business Owner to identify suitable mitigation strategies. Risks associated with extraordinary weather events are assigned to the Office of Environmental Services, which works with the Division of Planning to incorporate mitigation strategies into future investment strategies.



Managing Risks

To address the most significant risks that ODOT faces, an Asset Management Playbook was developed in 2017 to describe each of the key risks and outline the strategies ODOT is using to monitor ongoing performance so the agency can respond accordingly. This section summarizes the key strategies that ODOT has put in place to manage the most significant risks. The Playbook is scheduled to be updated in the fall of 2019 to reflect the changes that have occurred in the past 2 years. The Division of Planning is leading the development of the new Asset Management Playbook.

Managing Revenue, Inflation, and Traffic Impacts

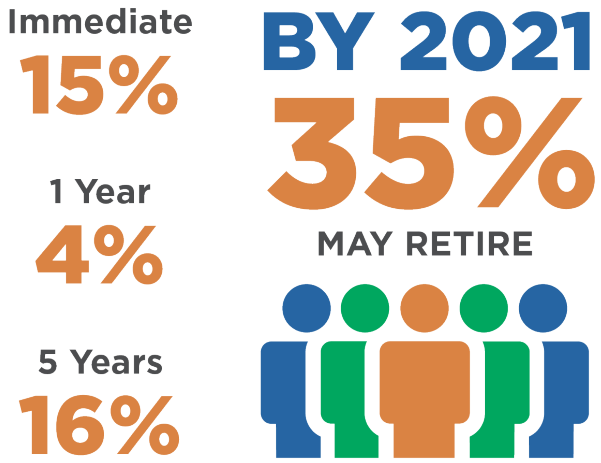
In the initial TAMP, ODOT's financial forecasts indicated that there would be only slight increases in available revenue levels over the next several years. Since repair costs were expected to continue to increase at an average annual rate of 3.5 percent[4], funding was not expected to keep pace. As a result, the initial TAMP anticipated that fewer assets (roads, Bridges, etc.) would be fixed each year. In addition to the funding issues, truck traffic volumes were expected to increase by 67 percent by the year 2040. Increasing truck traffic accelerates the rate at which Pavements and Bridges deteriorate, necessitating more frequent and substantial repairs. In response, ODOT acted quickly to adopt new, cost-effective strategies that slow system deterioration and allow ODOT to maintain system conditions at current levels with anticipated revenue (as discussed in the previous chapter). In addition, ODOT implemented strategies to obtain better data and encourage more teamwork to generate more Statewide consistency in maintenance activities so best practices can be repeated and practices that aren't working can be eliminated. In the 4 years since the new strategies were implemented, ODOT has realized a financial efficiency of over $300 million that could be used to address Statewide transportation priorities.

In addition, a 10.5-cents-per-gallon increase on motor fuel and 19 cents-per-gallon increase on diesel that goes into effect beginning July 1, 2019. The additional funding is incorporated into the financial plan and investment strategies presented in Chapter 6. It will enable ODOT to counter the risks associated with increasing construction costs and the increased traffic volumes that are causing the State's Pavements and Bridges to deteriorate more quickly than expected. Perhaps more importantly, the additional funding is expected to restore funding for approximately $150 million in essential preservation work that had been deferred in the current biennium budget and funds a new major project program to address critical congestion issues.

[4] Based on trends provided by the Estimating Department.

Preserving Workforce Capacity Through Knowledge Management

The risk assessment also recognized impending workforce changes that will require multiple knowledge management strategies to mitigate the potential loss of workforce capacity. Current projections indicate that 35 percent of ODOT's existing workforce will be eligible to retire by 2021. ODOT's Asset Management approach relies on knowledge management planning, succession planning, and training to address this risk.



Because of the anticipated workforce changes, ODOT has taken steps to develop a Knowledge Management Plan that guides the workforce-development and knowledge-transfer efforts necessary to ensure the continued implementation of the new business process improvements. The Asset Management Leadership Team is directing this effort to ensure that the future workforce has the requisite skills and expert knowledge to continue meeting the needs of the traveling public. The plan involves clarifying the roles of staff in the District and Central Office, conducting training, and preserving institutional knowledge using information technology. For training, ODOT is taking advantage of the Ohio Administrative Knowledge System (OAKS) to extend and enhance ODOT's current operational capabilities in people management, financial systems, purchasing power, and other common platforms and consistent business processes.

Addressing Asset Vulnerability Due to Extraordinary Weather Events

Over the past several years, ODOT has experienced increases in average annual rainfall that has resulted in widespread flooding in the southeastern and eastern portions of the State.

Recognizing that these and other extraordinary weather events (such as high winds and hot/cold temperature extremes) are taking place, ODOT initiated the development of an *Infrastructure Resiliency Plan*[5] in 2016 to identify the vulnerability of ODOT's transportation system to climate change effects and extreme weather events. The study was led by ODOT's Office of Environmental Services, but involved representatives from ODOT's Office of Technical Services, Office of Systems Planning, Office of Statewide Planning, and maintenance staff in each of ODOT's 12 Districts. Representatives from ODOT's design teams and two MPOs were also involved in the process.

The study identified the ten most vulnerable Bridges and highway sections, as well as the 20 most vulnerable Conduits, based on an analysis of asset conditions, exposure potential, and adaptive capacity. The Office of Planning has been charged with responsibility for incorporating the results into future improvements and coordinating those improvements with Asset Management, Operations, and other interagency partners. The results outlined proactive steps that ODOT can take to help mitigate consequences, such as scheduling more frequent cleaning of storm drains or widening Conduits to help relieve flooding.

In addition, ODOT studies risks and rewards to guide transportation investments that will help protect the system, even when the unexpected happens.

Managing the Network as a Comprehensive System

The steps ODOT has taken to improve the availability and accessibility of data has also enabled the agency to improve

[5]http://www.dot.state.oh.us/Divisions/Planning/Environment/Documents/Ohio%20DOT%20Infrastructure%20Resiliency%20Plan.pdf

the way transportation assets are managed. These activities have involved:

- Coordinating Transportation Asset Management with Transportation Systems Management and Operations (TSMO) to better leverage data to make Ohio's transportation system work better and to stretch limited resources to manage risks effectively.
- Using Transportation Information Mapping Systems (TIMS) and Traffic Monitoring management Systems (TMMS) data to advise Districts on geohazard risks, to plan emergency response, to incorporate activities that reduce risks in annual work plans.
- Implementing a dashboard to track risks, enabling ODOT to better mitigate unplanned events that could disrupt system operations.
- Establishing Asset Management Coordinator job descriptions to ensure Asset Management priorities are implemented.

Accounting for Risks in Future Investments

The business processes outlined in this TAMP have enabled ODOT to better manage and mitigate risks that could impact its ability to achieve its Asset Management objectives. ODOT can't stop these events from occurring, but by building awareness of these risks, ODOT can identify investment strategies that will reduce the impact if they do occur. The TAMP includes strategies that will enable ODOT to proactively reduce the likelihood that the transportation system will be severely impacted if, and when, these types of events occur.

Managing Assets With Repeated Damage Due To 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 have 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 C. In accordance with 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.

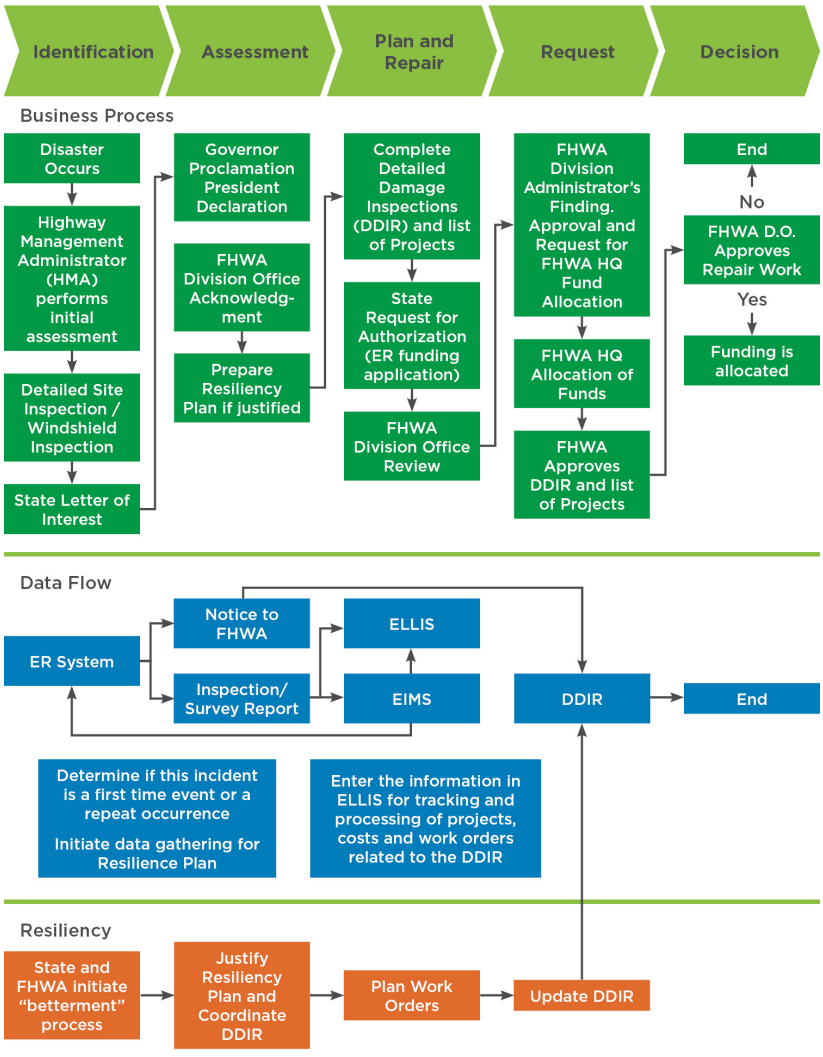
To support the ER business processes required to assess, plan, and request funding, ODOT relies on the following two primary data sources:

- 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.



Assessment of Prior Emergency Events

ODOT conducted an evaluation of 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 EAMS programs to summarize applicable emergency events that have occurred in the State and to evaluate repairs and costs to Pavement and Bridge assets. Over 700 locations were identified initially, and the list was reviewed to determine sites that received repair or reconstruction. The results found no locations with 2 or more incidents to the same assets but identified 38 locations in 18 counties with a single incident that required emergency repairs. All but one of the incidents involved Pavement damage caused primarily by landslides and embankment failures. The Bridge repairs in Franklin County related to fire damage caused by a truck crash. The District Offices are proactively monitoring these sites, listed in the following table, to evaluate opportunities to reduce the likelihood of future recurring damage.

Locations With One ER Repair to Pavements or Bridges		
County	Total ER Funds Expended	Number of Locations
Adams	$758,110	1
Athens	$4,313,262	5
Belmont	$2,861,357	2
Brown	$1,638,051	1
Columbiana	$2,712,029	2
Franklin	$1,426,629	1
Gallia	$776,629	1
Hamilton	$1,277,556	1
Harrison	$743,544	1
Jackson	$1,521,606	1
Jefferson	$78,431,522	6
Lawrence	$4,922,288	2
Meigs	$10,000,332	2
Monroe	$4,263,649	4
Morgan	$748,721	1
Pike	$3,549,466	3
Tuscarawas	$908,575	1
Washington	$15,170,914	3
Totals	**$136,024,239**	**38**

6.0 ODOT's Performance-Based Investment Plan

With the continued implementation of the relatively new business processes that are outlined in Chapter 8, and the revenue provided by the gas tax increase to offset construction costs increases and restore funding that had been diverted in previous years to balance the State budget. Our projections indicated that anticipated funding levels over the next several years will enable ODOT to continue achieving the desired levels of performance represented by the Critical Success Factors. The changes that have been implemented over the past four years, particularly regarding the increased use of preservation treatments reflected in this TAMP, will allow ODOT to reduce the rate of asset deterioration and make more cost-effective use of available funding. Additionally, the changes that were made to coordinate the District Work Plans are fostering a more consistent Statewide approach to meet targeted conditions.

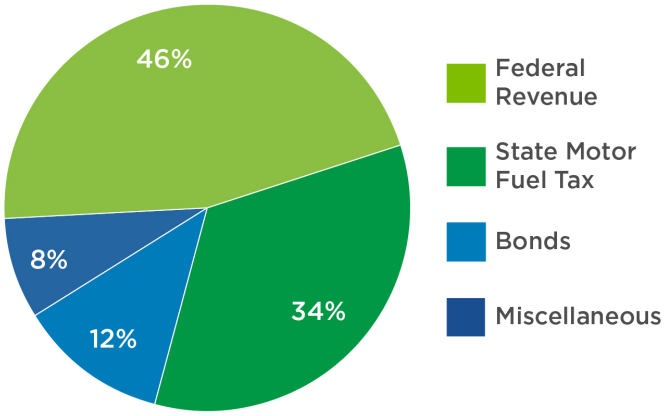
Revenue Forecasts

ODOT Revenue Forecasts

ODOT receives funding from a variety of sources, including both Federal and State revenue funds. In FY 2019, total ODOT revenue was just under $3 billion. Capital Pavement, Bridge, and Conduit needs are funded at approximately $2 billion annually. In addition to the capital funds, operating funds are also used to support Pavement, Bridge, and Conduit needs. The remainder goes to support local transportation needs, safety and other Statewide programs, debt service, and other major projects. In total, approximately 98 percent of the $3 billion in revenue is used to address transportation needs.

For the 2016-2017 Biennium Fiscal Year, 82 percent of ODOT's revenue came from Federal Revenue and State Motor Fuel Tax, as shown in the figure on the next page.

2019 ODOT Revenue 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 in accordance with certain requirements. Although Federal funding fluctuates annually, the average level of funding over the last 5 years has been relatively constant. Current projections for Federal funding show modest increases of approximately 2 percent over the next several years.

State revenue is generated through several sources, with the largest percentage coming from the State motor fuel tax (approximately 90 percent). On July 1, 2019 a 10.5-cents-per-gallon increase on motor fuel and 19 cents-per-gallon increase on diesel fuel goes into effect. This increase is reflected in ODOT's revenue projections. The additional revenue generated by the fuel tax increase will offset construction price increases and will restore transportation funding that had been diverted in previous years. Other sources of State revenue include the fuel use tax and interest income/miscellaneous sources. With the increased gas tax projections, ODOT is able to maintain a consistent level of State funding over the next 10 years rather than the decreases that had been anticipated earlier. The resulting revenue projections for the next 10 years are presented in the following table.

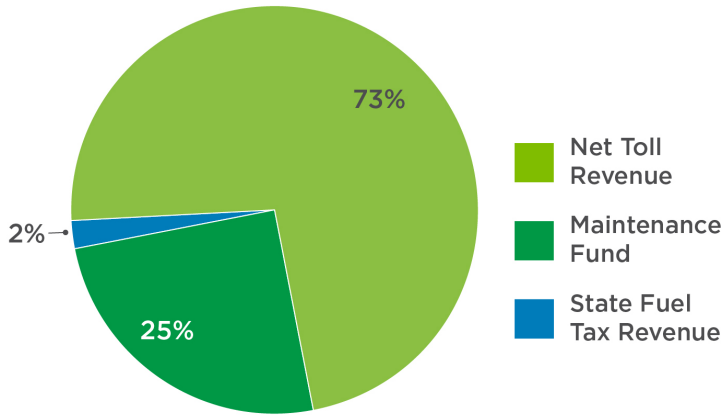
10-Year Revenue Projections (in millions)

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	10-Year Totals
Funding Sources											
State Motor Fuel Tax	$1,170	$1,643	$1,660	$1,660	$1,659	$1,659	$1,650	$1,634	$1,634	$1,634	$16,005
Other State Revenue	$107	$108	$106	$107	$105	$105	$104	$104	$104	$104	$1,052
Bonding State	$208	$103	$60	$60	$60	$60	$60	$60	$60	$60	$791
Federal Motor Fuel Tax	$1,461	$1,471	$1,471	$1,426	$1,426	$1,426	$1,426	$1,426	$1,426	$1,426	$14,382
Other Federal Revenue	$116	$12	$12	$12	$12	$12	$12	$12	$12	$12	$222
Bonding Garvee	$187	$17	$60	$60	$60	$60	$60	$60	$60	$60	$684
Debt Payments State	-$182	-$205	-$216	-$216	-$220	-$222	-$209	-$181	-$184	-$186	-$2,021
Debt Payments Federal	-$167	-$183	-$167	-$139	-$147	-$151	-$157	-$131	-$137	-$143	-$1,521
Carryforward Revenues	$155	$92	$53	$90	$92	$40	$40	$40	$40	$40	$681
Total	**$3,056**	**$3,057**	**$3,039**	**$3,058**	**$3,047**	**$2,988**	**$2,985**	**$3,023**	**$3,014**	**$3,006**	**$30,275**

Ohio Turnpike Revenue Forecasts

The largest source of operating revenue for the Ohio Turnpike comes from tolls, but additional sources include revenue generated by special toll permits and concessions. The Ohio Turnpike also receives nonoperating revenue from the State fuel tax allocation and investment earnings. The amount of funding available is also heavily influenced by the availability of bond proceeds. In 2019, toll revenue is estimated to represent 69 percent of the total revenue, less expected bond proceeds. As shown in the following graphic, the maintenance fund for operating expense and the State fuel tax make up the remainder of the Ohio Turnpike's revenue.

2019 Ohio Turnpike Revenue Sources (Excluding Bond Revenue)



A summary of the expected revenue for the next 10 years is provided in the following table.

Ohio Turnpike's 10-Year Revenue Projections (in millions)

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Funding Sources										
Net Toll Revenue	$98.4	$117.5	$117.3	$123.4	$116.1	$127.8	$138.8	$154.4	$161.0	$166.7
Fuel Tax Revenue	$3.5	$3.5	$3.6	$3.6	$3.6	$3.7	$3.7	$3.7	$3.7	$3.7
2020 Bond Proceeds	–	$140.0	–	–	–	–	–	–	–	–
Maintenance Expenses	$41.5	$42.7	$43.8	$45.0	$46.2	$47.0	$48.6	$49.9	$51.4	$52.7
Total	**$143.4**	**$303.8**	**$164.7**	**$172.0**	**$166.0**	**$178.9**	**$191.1**	**$208.0**	**$216.1**	**$223.2**

Investment Needs

ODOT has invested in state-of-the-art tools and technology to support the development of its improvement programs.

Pavement Needs

Pavement needs are identified using ODOT's dTIMS Pavement management system. The system features an open architecture, which allows ODOT to use data stored in agency databases for road inventory, traffic, and so on. The system

uses Markov performance models that were generated inhouse to predict distresses that are then rolled up to calculate a PCR on a scale of 0 to 100. The system also uses decision trees that were developed by the Office of Pavement Engineering. The decision trees use Pavement condition, traffic, Pavement type, and other road inventory attributes to recommend an appropriate work type and to predict future conditions. The Pavement management system then optimizes based on available funding, treatment life cycles, and traffic over a defined planning horizon. The results of the Pavement management analysis are used to determine the funding needed to achieve ODOT's Critical Success Factors and at least 75 percent of the projects included in a District's Work Plan are required to match the recommendations generated by the Pavement management system.

Bridge Needs

Funding needs for Bridges are developed based on agency-developed spreadsheet tools that forecast changes in Bridge conditions with time. ODOT is actively pursuing the implementation of new Bridge management software that will improve the Department's ability to forecast future Bridge needs. As part of the implementation of the new Bridge management software, ODOT will develop Bridge deterioration models and treatment strategies. Funding levels allocated to Bridges are based on estimates of the amount of work needed to maintain Bridge Critical Success Factors on a Statewide basis. Districts are assigned Critical Success Factor goals and their Bridge programs are developed to address existing deficiencies. The Bridge programs are based, in part, on a list provided to the Districts each year by the Office of Structural Engineering that identifies Bridges that should be cleaned, swept, and sealed as part of the Department's Bridge preservation program. Other Bridge improvements are based on an analysis of the GA appraisals conducted by the Office of Structural Engineering.

Conduit Needs

ODOT recently completed its Conduit inventory and set a Critical Success Factor for Conduits. Currently, $20 million is allocated to the Districts to address Conduit needs based on the size of the inventory and inspection results. The money covers the costs of construction, design, right-of-way, construction inspection, and Conduit condition inspection. In

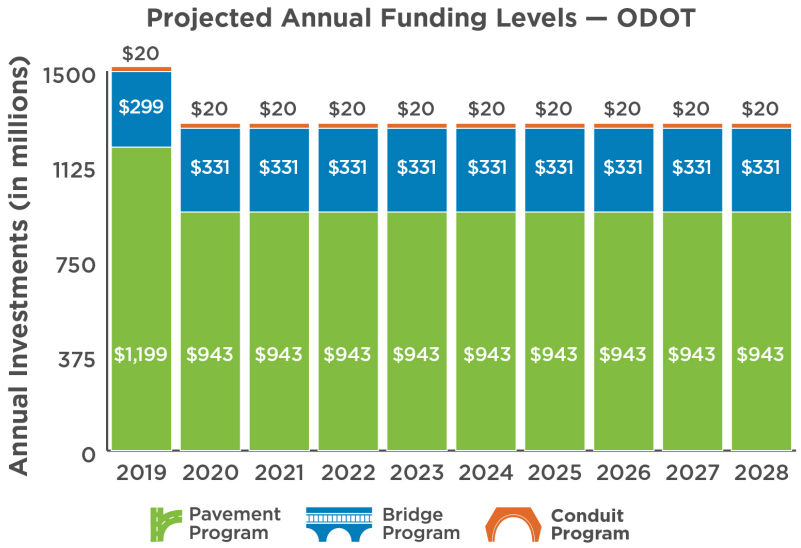
the future, ODOT expects to establish a Conduit preservation program similar to the one established for Bridges to help ensure that low-cost treatments are used to reduce the overall life cycle costs of maintaining this asset. In addition, ODOT is in the process of identifying a Critical Success Factor for Conduits based on the current inventory and inspection results.

Planned Investment Levels

Ohio DOT Investments

To assist in allocating available funding to ODOT's operating and capital programs, ODOT established a Funding Council in 2017. The mission of this Council is to guide the overall use of ODOT's financial resources by recommending funding allocations for operating and capital programs to the Director, Chief of Staff, and Assistant Directors (the ODOT Governance Board). The Council's goal is to develop a balanced budget using the agency's Funding Proforma to recommend a fiscally responsible budget approach to make funding allocations. The Funding Council will ensure that the optimum level of funding is provided to each program to achieve ODOT's mission, vision, values, goals, and Critical Success Factors. The Funding Council will base its recommendations on a data-driven decision process that focuses on creating steady-state conditions for the Department's assets.

The figure below shows the planned investment levels in Pavements, Bridges and Conduits that will allow ODOT to achieve its Critical Success Factors for these assets. These numbers assume that costs increase at a rate of 3 percent annually. Since costs are increasing at a rate that is higher than projected revenue increases, it is especially important that ODOT uses available funds wisely. By implementing the Asset Management processes documented in this TAMP at the planned investment levels, ODOT expects to maintain its system condition targets over the next 10 years.

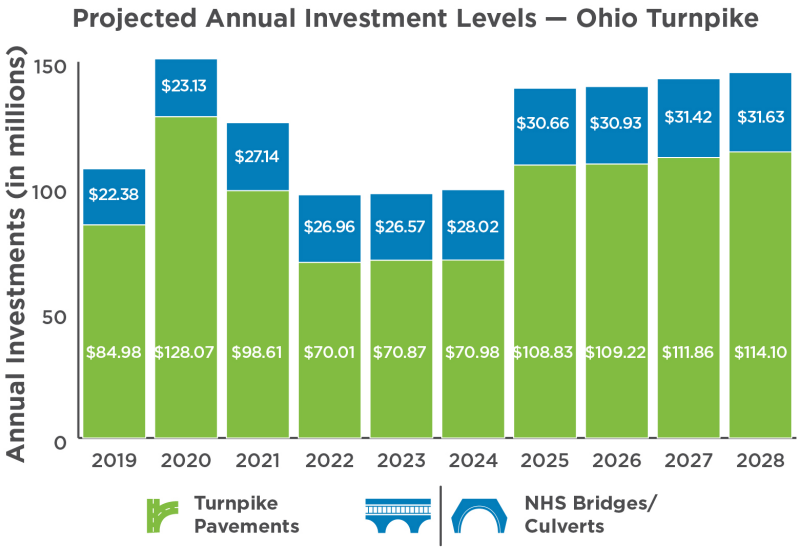


Over a 10-year period, ODOT expects to invest a total of $9.693 billion to preserve, improve, and replace Pavements, and $3.272 billion to preserve, improve, and replace State-maintained Bridges. A total of $200 million is expected to be invested in Conduit preservation during this period.

As a result of this level of investment, ODOT's Critical Success Factors for Pavements and Bridges are achieved, indicating that there is no financial funding gap projected in this TAMP.

Ohio Turnpike Planned Investments

The Ohio Turnpike also anticipates achieving its goals for Pavement and Bridge condition with the following planned investments.



Over the 10-year period covered in this TAMP, the Ohio Turnpike plans to spend a total of $957.53 million on Pavements, $412.44 million on Bridges and large culverts. This planned level of investment addresses the Ohio Turnpike's needs; therefore, there is no financial funding gap between planned and needed funding levels.

Planned Investment Strategy

Ohio DOT Investment Strategies

Since 2015, ODOT's project selection process has been largely driven by the information provided by its Asset Management systems, enabling the Department to optimize its preservation investments.

ODOT began phasing in new requirements for the development of District Work Plans that combine Capital and Maintenance projects in fiscal year 2016. At that time, Districts' Work Plans were required to match 25 percent of the lower cost treatments (such as chip seals and microsurfacing) recommended by the Pavement management system. Since 2017, District Work Plans have been required to match 75 percent of the Pavement management system recommendations for these treatments.

This same investment strategy will be followed over the next 10 years, resulting in the planned level of investment on the NHS and non-NHS in each of the following work type categories:

- Initial (new) construction.
- Maintenance.
- Preservation.
- Rehabilitation.
- Reconstruction.

Since ODOT does not currently track projects in accordance with these five work types, an analysis was conducted using construction projects completed over the past 4 years to estimate the portion of each program related to the five work types. Separate analyses were conducted for Pavement and Bridge projects and the results were used to allocate available funding to each work activity. Since the allocation of funding is based on a 4-year average, which coincided with ODOT's transition from its old investment strategies to the new strategy that places more of an emphasis on the use

of preservation treatments, ODOT anticipates that some of the funding currently allocated for rehabilitation will shift to the preservation category as more contractors are available to support ODOT's new business processes. The resulting 10-year investments for Pavements, Bridges, and Conduits are presented in the following table.

ODOT's 10-Year Investment Strategy (in millions)

Pavements			
	2019	2020–2028 Annual Avg.	10-Year Total
Maintenance	$17	$25	$242
Preservation	$153	$114	$1,182
Rehabilitation	$832	$545	$5,739
Reconstruction	$142	$194	$1,885
New Construction	$34	$25	$260
Other	$21	$40	$385
Totals	**$1,199**	**$943**	**$9,693**
Bridges			
	2019	2020–2028 Annual Avg.	10-Year Total
Maintenance	$8	$9	$88
Preservation	$12	$13	$133
Rehabilitation	$115	$128	$1,263
Reconstruction	$140	$155	$1,530
New Construction	$24	$26	$258
Totals	**$299**	**$331**	**$3,272**
Conduits			
	2019	2020–2028 Annual Avg.	10-Year Totals
Totals	**$20**	**$20**	**$200**

A portion of this investment will be made on the NHS. Currently, ODOT's financial system does not track

investments based on NHS and non-NHS designations. Therefore, estimates of NHS expenditures were prepared based on averages using the construction records from the past 4 years. First, the percent of the total Pavement and Bridge expenditures over the past 4 years that were on NHS Pavements and Bridges were determined. Then, for each project, costs were allocated to one of the five work types. The resulting 4-year averages were then used to determine the NHS Pavement and Bridge expenditures expected over the next 10 years. The results are presented in the following table.

ODOT's 10-Year NHS Investment Strategy (in millions)

Pavements			
	2019	2020–2028 Annual Avg.	10-Year Total
Maintenance	$10.5	$15.5	$150.0
Preservation	$94.9	$70.7	$732.8
Rehabilitation	$515.8	$337.9	$3,558.2
Reconstruction	$88.0	$120.3	$1,168.7
New Construction	$21.1	$15.5	$161.2
Other	$13.0	$24.8	$238.7
Totals	**$743**	**$585**	**$6,010**
Bridges			
	2019	2020–2028 Annual Avg.	10-Year Total
Maintenance	$5.0	$5.6	$54.6
Preservation	$7.4	$8.1	$82.5
Rehabilitation	$71.3	$79.4	$783.1
Reconstruction	$86.8	$96.1	$948.6
New Construction	$14.9	$16.1	$160.0
Totals	**$185**	**$205**	**$2,029**

Ohio Turnpike Investment Strategies

The 10-year planned investments for the Ohio Turnpike, all of which are on the NHS, are provided in the following table.

Ohio Turnpike's 10-Year Investment Strategy (in millions)

Turnpike Pavements						
	Maintenance	Preservation	Rehabilitation	Reconstruction	New Construction	Totals
2019	$3.80	$0.00	$30.29	$33.37	$17.52	$84.98
2020	$3.80	$0.00	$20.59	$85.69	$17.99	$128.07
2021	$3.80	$0.00	$24.41	$70.40	$0.00	$98.61
2022	$3.80	$0.00	$30.06	$36.15	$0.00	$70.01
2023	$3.80	$0.00	$29.97	$37.13	$0.00	$70.90
2024	$3.80	$0.00	$29.05	$38.13	$0.00	$70.98
2025	$3.80	$0.00	$26.71	$78.32	$0.00	$108.83
2026	$3.80	$0.00	$24.99	$80.43	$0.00	$109.22
2027	$3.80	$0.00	$25.46	$82.60	$0.00	$111.86
2028	$3.80	$0.00	$25.46	$84.84	$0.00	$114.10
10-Year Totals	**$38.00**	**$0.00**	**$256.96**	**$627.06**	**$35.51**	**$957.53**

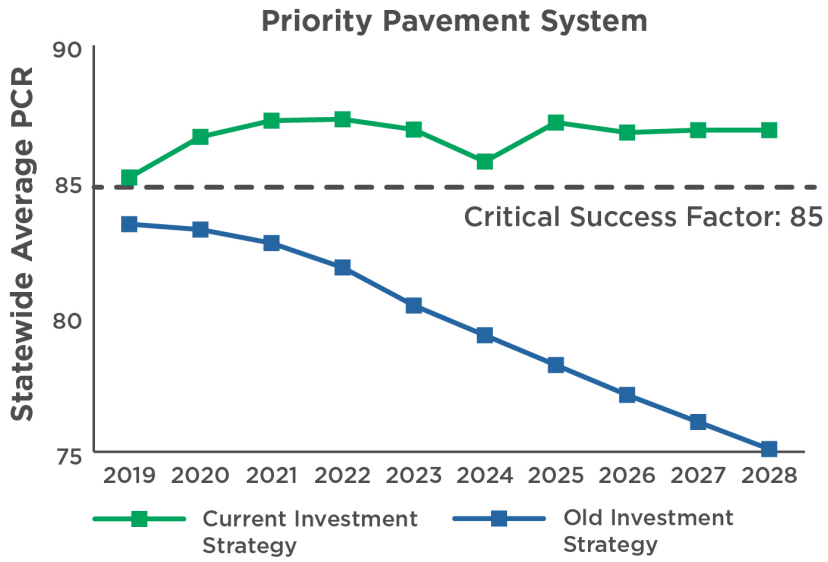
NHS Bridges/Culverts					
	Maintenance	Preservation	Rehabilitation	Reconstruction	Totals
2019	$0.70	$0.30	$10.87	$10.51	$22.38
2020	$0.70	$0.20	$11.60	$10.63	$23.13
2021	$0.70	$0.25	$13.93	$12.26	$27.14
2022	$0.70	$0.35	$14.76	$11.15	$26.96
2023	$0.70	$0.35	$15.31	$10.21	$26.57
2024	$0.70	$0.35	$15.09	$11.88	$28.02
2025	$0.70	$0.30	$15.50	$14.16	$30.66
2026	$0.70	$0.30	$16.59	$13.34	$30.93
2027	$0.70	$0.30	$16.86	$13.56	$31.42
2028	$0.70	$0.30	$16.86	$13.77	$31.63
10-Year Totals	$7.00	**$3.00**	**$147.37**	**$225.07**	**$278.84**

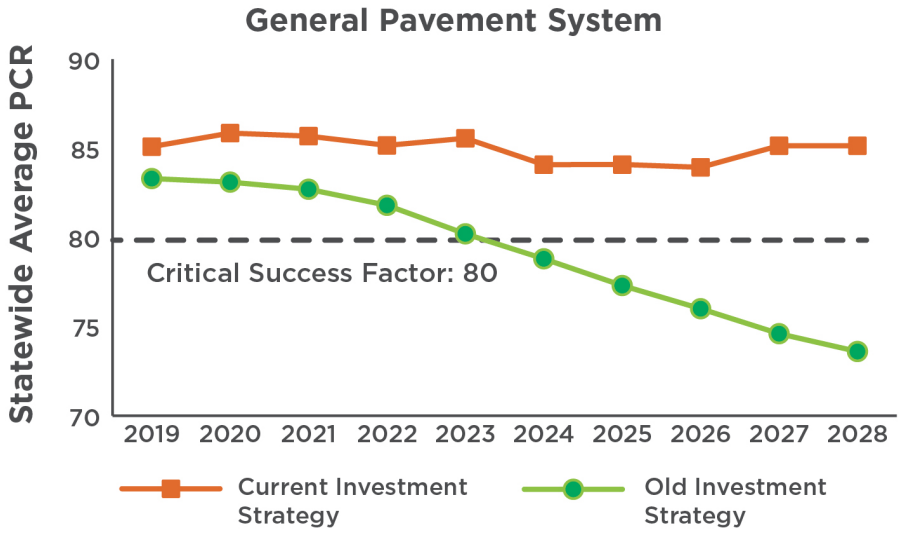
7.0 Performance Gap Analysis

With the implementation of the changes to its business processes several years ago, ODOT expects to be able to preserve system conditions with the anticipated funding levels over the next several years. As a result, ODOT does not anticipate any performance gaps over the 10-year period covered by this TAMP, meaning that funding is adequate to achieve the desired Critical Success Factors for both Pavements and Bridges.

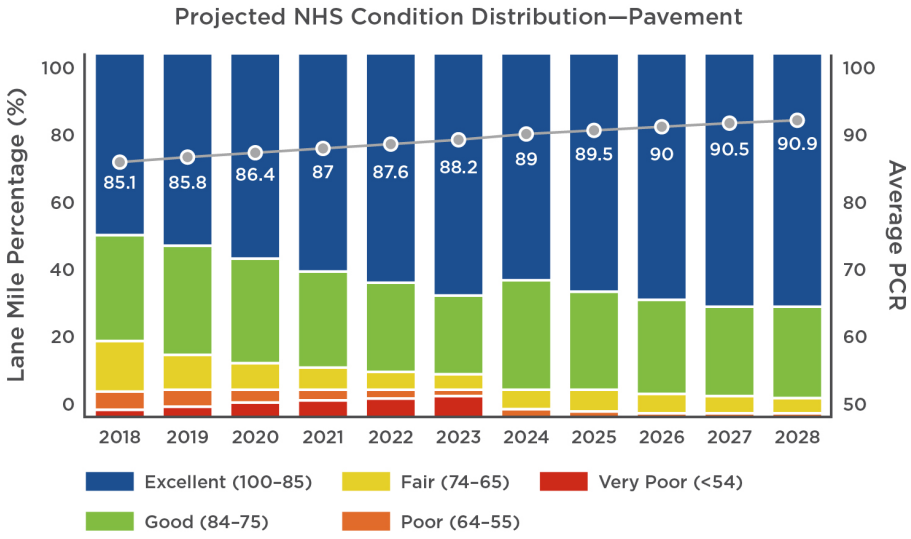
Pavements

As shown in the graphs below, implementing the planned investment strategy outlined in this TAMP will allow ODOT to achieve its targeted Critical Success Factors for Pavements over the 10-year period addressed in this TAMP. Based on projections from the Pavement management system, ODOT expects to achieve an average Statewide PCR of 86 on the Priority System and 85 on the General System by 2028 using the current Asset Management process.





On the NHS, the average PCR (o to 100 scale) is expected to increase from approximately 85 in 2019 to nearly 91 by the end of the 10-year period, as shown in the figure below. ODOT anticipates a significant increase in the percent of lane miles that will be in *Excellent* and *Good* condition over that period due to the preservation strategies presented in the previous chapter.

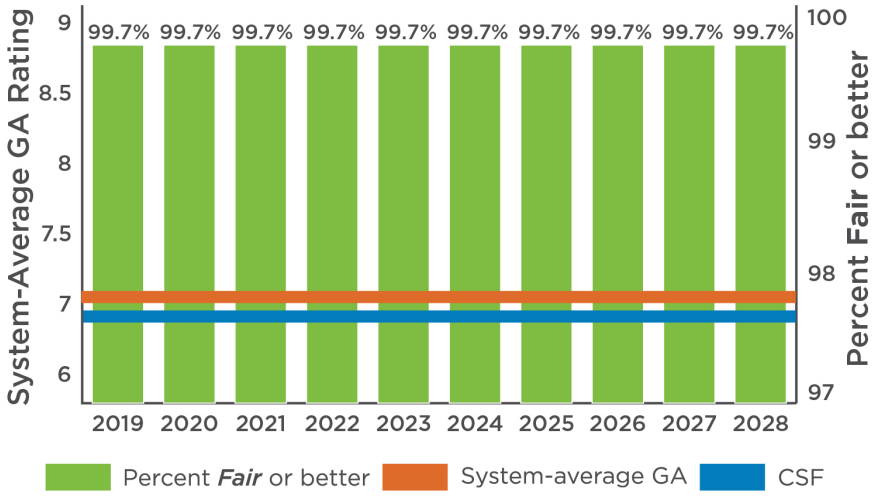


Bridges

Using data from its Bridge inspection database and projected deterioration rates, ODOT analyzed the impact of various investment strategies and budget levels on future conditions. The results demonstrated that the combination of planned investment levels and increased use of preservation

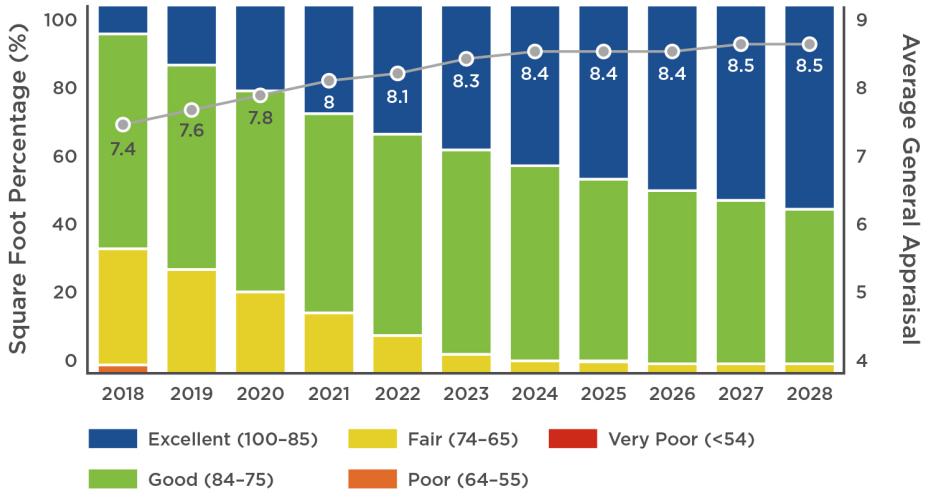
treatments on Bridges is expected to improve conditions. Based on this analysis, ODOT will continue to surpass its Statewide average GA goal of 6.98 over the next several years. The improved conditions will lead to nearly all State-maintained Bridges in *Fair* or better condition during this time period.

Projected Bridge Conditions by Deck Area



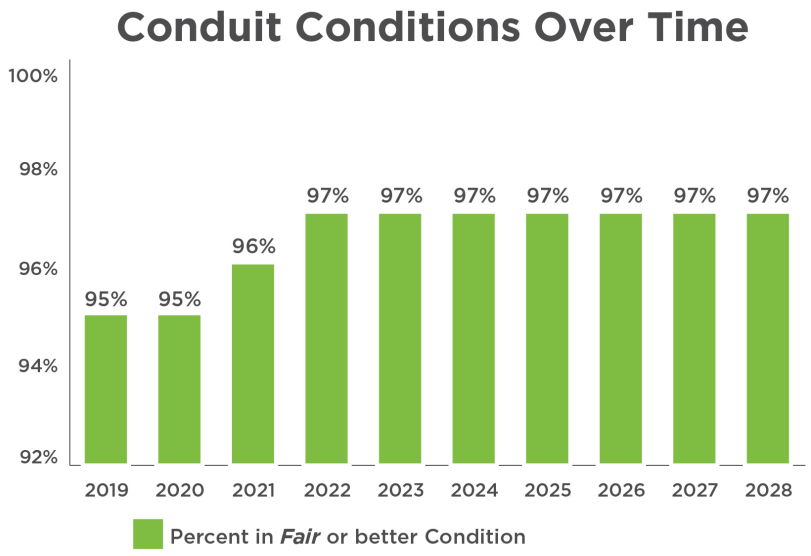
The NHS Bridge conditions reflect a significant improvement in condition over the 10-year analysis period, as shown in the following graphic. The average GA rating for the NHS Bridges is expected to increase to 8.5 and all of the Bridges are expected to be in *Fair* or better condition.

Projected NHS Condition Distribution—Bridges



Conduits

ODOT recently completed its Conduit inventory and is using the results to set a Critical Success Factor based on the GA rating. Projections generated during the development of the TAMP indicate that approximately 97 percent of the small Conduits will be in *Fair* or better condition by 2028, in terms of the GA rating. ODOT is in the process of improving its ability to monitor and predict Conduit conditions, which will be useful in the future for establishing investment needs for Conduits.



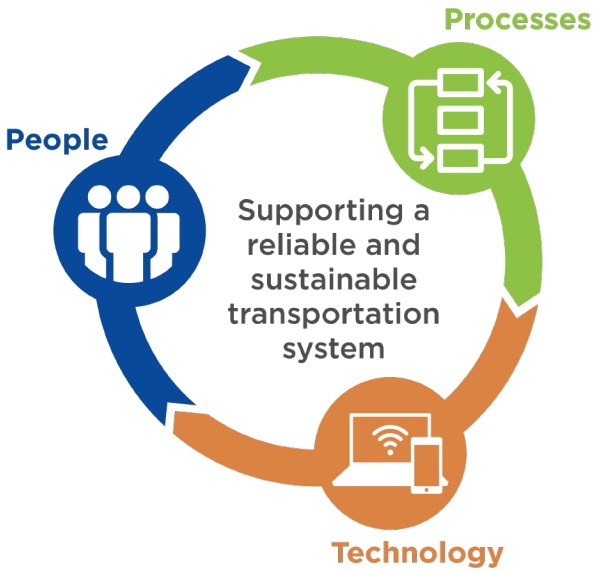
Other System Performance Needs

Although ODOT does not anticipate a gap in meeting performance expectations, it is important to recognize that the agency has to achieve a balance between system performance goals related to preserving asset conditions with other objectives related to improving safety, addressing capacity needs, and fostering economic development. In addition to restoring funding for asset preservation activities, the expected revenue from the increased motor fuel tax will allow ODOT to restore funding to its major new project program to address critical congestion and safety issues on major highways. The restoration of this important revenue source will reduce the likelihood that maintenance funds will be diverted in the future, ensuing that we continue to allocate at least 93 percent of our available capital funds for asset preservation.

8.0 Asset Management Approach

Asset Management is critical to achieve ODOT's performance objectives. ODOT considers Asset Management to be more than just big data and computer programs. It also includes strategies for integrating ODOT's **people**, **processes**, and **technology** into a performance-based investment plan with an end goal of a reliable and sustainable transportation system. This section outlines the changes that have been implemented over the past several years to:

- 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.



These changes allow ODOT's people, processes, and technology to work together to address system needs, overcome risks, improve efficiency and accountability, and meet the agency's strategic objectives. Planned enhancements in each of these areas are summarized in Chapter 9, *Summary of Planned Activities and Enhancements*.

People

Every ODOT employee has a role in the agency's success at implementing Asset Management. For this reason, ODOT's Asset Management approach focuses on building the skills necessary to navigate the business process and technology changes that are underway and transferring institutional knowledge from one generation to another. To guide its efforts in this area, ODOT has developed a Knowledge Management Plan to meet the agency's changing needs and a Communication Plan that explains why the changes are being made.

To illustrate the importance of ODOT's personnel in navigating the changes outlined in the TAMP, the significant roles of the Asset Management Leadership Team and District personnel are highlighted below. A summary of other roles and responsibilities in support of Asset Management, including the re-establishment of a Communications Team to support these and other implementation and outreach efforts, is presented in Chapter 9, *Summary of Planned Activities and Enhancements*.

Role of the Asset Management Leadership Team

The Asset Management Leadership Team was created to guide the implementation of Asset Management throughout ODOT and to monitor progress at each step in the process. The Team is charged with developing and updating the TAMP, and overseeing the implementation of the organizational changes needed to achieve ODOT's strategic objectives.

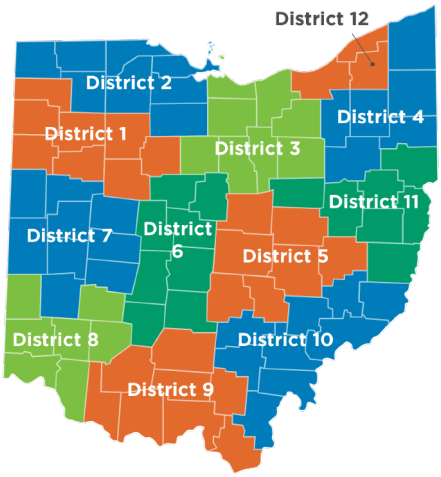
The Asset Management Leadership Team is made up of representatives from all of the major business units in both the Central and District Offices and is connected to the policy level of the organization through its Executive-level members. Its objectives are to:

- Maintain and implement plans and business processes to support TAM activities.
- Communicate TAM activities to the Executive levels to foster implementation or awareness.
- Establish data governance and data collection standards.
- Facilitate knowledge transfer and collaboration among the business units represented on the team.

- Engage in the solicitation and promotion of best practices.
- Promote TAM benefits and uses throughout ODOT and with external partners.
- Promote training opportunities to support ODOT's TAM activities.

The work of the Asset Management Leadership Team is supported through the activities of various subgroups. In addition to the Communications, Infrastructure, and TAM Audit Groups, a Data Governance Group was added to provide additional support to the Asset Management Leadership Team.

ODOT District Map



Role of the ODOT Districts

The Districts have a crucial role in the implementation of the business processes outlined in the TAMP. District personnel have direct, regular interactions with the public and a 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. 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 can 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 ensure surfaces are ready to pave with replaced Conduits and other necessary pre-surfacing repairs.
- **Adjusting to new practices.** District personnel recognize 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

program delivery that is cost effective, solidifies the TAM culture in the Districts, and guides the implementation of technology and policy from the Central Office.

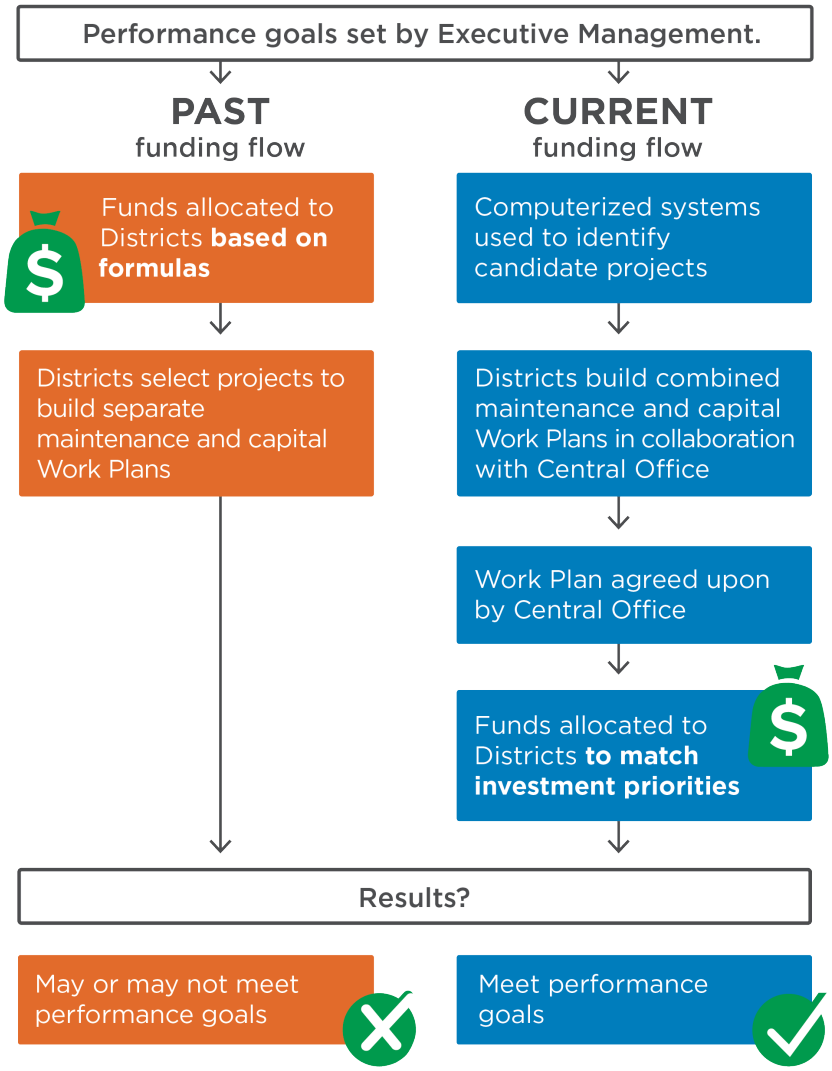
Processes

ODOT's past investment strategies and Asset Management practices have been very effective at improving the condition of the State-maintained Pavements and Bridges. Over the years, ODOT has been continuously improving its business processes and analytical capabilities to better manage its transportation system. However, in light of the identified risks, ODOT recognized that significant change was needed to continue its success in a changing world. The investment strategies and improved business processes outlined in the TAMP continue ODOT's efforts to use performance data effectively to allocate resources, achieve strategic objectives, and manage risk.

The Asset Management Leadership Team is responsible for reviewing and improving planning and programming practices to ensure that resources are being used as efficiently and effectively as possible. The Team's work in this area showed that transformational changes could be made by modernizing ODOT's Work Plan development process to consider life cycle costs, emphasize the use of cost-effective preservation treatments, and implement more collaborative and consistent procedures.

Work Plan Development

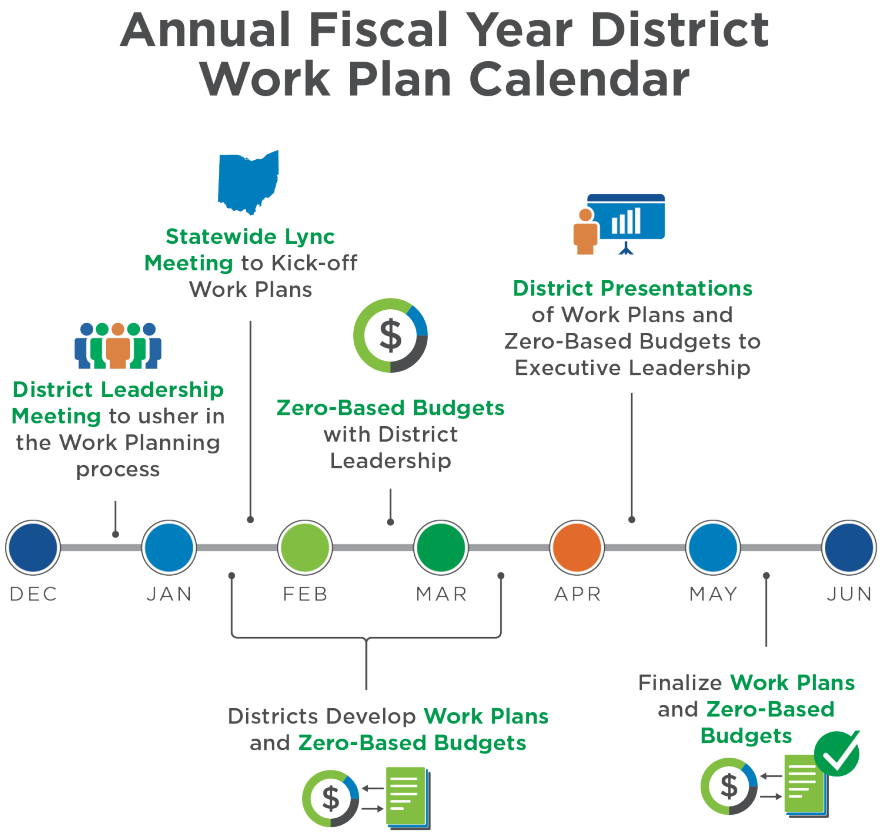
The investment strategies outlined in this document are based on ODOT's implementation of coordinated business processes that strengthen the emphasis on Asset Management principles and tools. The current business processes reflect an increased use of preservation treatments to slow the rate of asset deterioration, and the implementation of updated processes that are more optimized, streamlined, and collaborative. The next figure illustrates the significant differences between ODOT's current business processes and the way planning and programming were historically performed.



Overall, changes to existing planning and programming activities include:

- Using performance data to guide funding allocations.
- Fostering more consistency across Districts.
- Coordinating District work activities to ensure Statewide performance goals are met.
- Increasing the use of low-cost maintenance treatments.
- Removing artificial distinctions between capital projects and maintenance activities.
- Selecting preservation activities through collaborative efforts with Planning and Highway Operations.

An example work-plan-development calendar is provided below.



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

portion of ODOT's long-term plan for maintaining its transportation assets. Each District's Operations Work Plan lists the routine and reactive maintenance, preservation, ready-to-pave, and gap projects that are planned during the respective fiscal years.

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.

ODOT recently merged the District's Capital and Operations Work Plans in an effort to build more coordinated and collaborative processes involving both the Planning (Capital) and Operations groups in both the Districts and in the Central Office. The combined Work Plans are fiscally constrained and meet the performance goals established by Executive Management. ODOT recently 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.

Technology

Historically, ODOT has used performance measures to establish funding levels needed to achieve Critical Success Factors for desired Pavement and Bridge conditions and to track accomplishments. Going forward, an important part of ODOT's Asset Management practices will be the additional use of performance data and computerized management systems to analyze treatment strategies and optimize the use of available funding on a Statewide basis.

Both life cycle and comprehensive work planning require integrated management systems supported by high-quality data. ODOT has applied considerable resources to this issue and has already produced tools like its Transportation Information Mapping System[6] (TIMS), which helps Planners,

6 http://www.dot.state.oh.us/Divisions/Planning/TechServ/Pages/tims.aspx

TIMS TRANSPORTATION INFORMATION MAPPING SYSTEM
Better Data. Better Decisions.

Engineers, and Executives access and manage key asset, safety, and operational data in an integrated map-based format. The data integration efforts that have enabled TIMS will underpin all future management system implementations.

ODOT has also implemented computerized management systems to store asset data and evaluate investment options. ODOT uses a state-of-the-art Pavement management system called dTIMS for its Pavement network and plans on implementing a new Bridge management software program over the next several years. ODOT is also implementing comprehensive maintenance management processes that are currently being linked to the agency's Asset Management program.

New technology is also impacting the way data is collected and treatments are applied. Improvements in material specifications and construction material properties are just two examples of technology advancements resulting in better-performing preservation treatments. In the era of "Big Data," ODOT is rich in data and is in the process of implementing a Business Intelligence (BI) tool called Transportation Asset Management Decision Support Tool (TAMDST). This application will allow the agency to access data and generate detailed reports about asset inventories, condition, performance, capital and maintenance expenditures, and operations (in terms of labor, equipment, and materials).

TAMP Implementation

To address the risks outlined in this TAMP, ODOT is building on its Asset Management efforts and improving the way it does business: leveraging department-wide collaboration to improve results and ensure a reliable, sustainable transportation system. Specifically, ODOT is employing the use of TAM principles to guide investment decisions. These principles rely on the use of performance data to optimize investments and implement more accountable and transparent decision-making to reduce risks.

As outlined earlier in this chapter, ODOT has developed an Asset Management approach that employs improved and refined business processes to drive ODOT's 6-year plan for managing investments in its roads, bridges, and Conduits. By

changing the way ODOT conducts business, an estimated $300 million has been redirected to other priorities over a 4-year period by increasing the use of Pavement, Bridge, and Conduit preservation activities.

These changes have helped preserve ODOT's $115 billion investment in its highway assets and ensure that its strategic objectives for a more reliable, sustainable transportation system are met.

ODOT's TAMP will be executed through a five-step business process, represented in the figure on the following page. This process leverages ODOT's technology advancements and life cycle planning results to provide ODOT staff with a consistent, data-driven approach to make decisions on capital and maintenance investments.

Step 1: Maintain Critical Asset Inventories and Condition

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 on a regular basis. 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

ODOT's Assets

Tier 1

- Pavements
- Bridges
- Conduits
- Barriers/Guardrails
- Overhead Signs
- Post Construction Best Management Practices

Tier 2

- Lighting
- Retaining Walls
- Curb Ramps
- Geotechnical

Tier 3

- Signals
- Ground Mounted Signs
- Pavement Markings
- Noise Walls
- Sidewalks

Pavements, Bridges, and Conduits. Inventories for assets in tiers 2 and 3 will be developed as needed, or as resources allow.

In addition to building asset inventories, 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.

All data collection activities are conducted in accordance with data collection and governance standards established and monitored by the Data Governance Group and the TAM Audit Group under the guidance of the Asset Management Leadership Team.

Step 2: Establish Performance Targets and Funding Needs

Need-Based Allocations

The improved Asset Management business process has led to changes in the way funding allocations to the Districts are made.

In the past, the Central Office used funding allocation formulas to determine the budget that would be available to each District. This included funding for capital projects, such as Pavement resurfacing and the rehabilitation or replacement of Conduits and Bridges, along with a maintenance allocation to cover routine maintenance activities such as crack sealing, drainage repair, and guardrail repair.

Once the funding allocations were made, Districts had the flexibility to determine how much of the budget to use for Pavements and Bridges, and how best to use the funding to accommodate program needs and fluctuations in a given year. Districts developed an Annual Work Plan to coordinate the capital and maintenance work they expected to complete with the funding provided. Performance targets were used to hold Districts accountable for the decisions that were made.

Under the improved business process, funds are allocated to the Districts to match Statewide performance targets and investment priorities based on candidate projects suggested

by ODOT's computerized management systems. Districts are also held accountable for utilizing the funding as recommended by Asset Management systems. For instance, 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. The improved process makes better use of data and technology to support ODOT's performance-based decision making than in the past.

Step 3: Develop Work Plans

ODOT has made significant changes to the way that Annual Work Plans are being developed by the Districts.

In the past, once funding allocations were made, the Districts developed separate Work Plans for the capital and maintenance work they expected to complete. Under the current approach, key changes were made to the development of the Work Plans.

- Districts now work collaboratively with Central Office Planning and Operations personnel to develop an Annual Work Plan that ensures that Statewide performance targets will be met.
- Work Plans better reflect the coordination of maintenance and capital activities. The removal of artificial distinctions between capital and maintenance allows the Districts more flexibility in addressing asset needs over the entire service life.
- Guidance is provided to the Districts to ensure that preservation funds are used as planned. An example of the guidance provided to the Districts is included in Appendix C.

As a result of these changes, District expenditures better match Statewide priorities, Statewide goals are more likely be achieved, and ODOT has a more coordinated and collaborative process in place for optimizing investment strategies. This, in turn, allows the Department to reduce the annual costs associated with system preservation and improve consistency in practices across Districts.

The Knowledge Management Plan is designed to ensure that:

- Employees are prepared to identify when actions are needed
- Share what they've learned with others.

Step 4: Monitor Progress for Continuous Improvement

Asset Management is not a static process. Implementation requires continual monitoring, analysis, and improvement. The success of the TAMP relies on continued efforts in the four areas described below. A summary of the actions that will be taken is provided in Chapter 9, *Summary of Planned Activities and Enhancements*.

Personnel Development and Capacity Building

ODOT employees have a vital role in implementing the changes outlined in 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.

ODOT has already initiated several activities to build agency capacity to ensure the success of this TAMP. In 2015, ODOT sponsored a peer exchange with speakers from leading DOTs in Pavement and Bridge preservation brought in to share best practices with District personnel. Since then, ODOT continues to enhance the skills of District personnel so they can assume responsibility for improving the performance of preservation treatments. For example, training has also been provided to contractors and construction staff to promote consistency in the use of best practices across the State. In 2019, ODOT sponsored a workshop to bring together TAM and TSMO (Transportation Systems Management and Operations) Coordinators to determine how to better leverage data to make Ohio's transportation system work better and stretch limited resource.

Business Process Changes

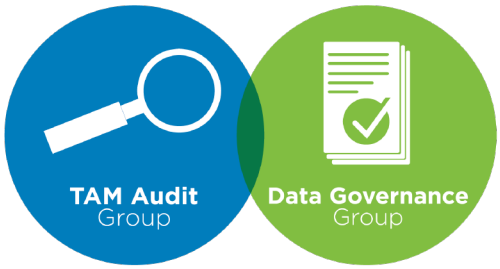
Efforts to reduce the overall life cycle cost of maintaining Pavements, Bridges, and Conduits require the increased use of preservation activities and a more unified approach to maintenance and capital planning. This has led to the business process changes described in the TAMP. The

implementation of the business process changes included activities to:

- Combine capital and maintenance improvements that adhere to life cycle strategies in the District Work Plans.
- Develop and implement a Communication Plan that informs internal and external stakeholders of the planned changes.
- Establish an ODOT Transportation Asset Management Policy that communicates the importance of the activities outlined in the TAMP throughout the agency.
- Continue 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 to its business processes, ODOT has taken steps to manage its asset data to ensure that that data is complete, current, and is collected consistently across the State. ODOT's TAM Audit Group, a subset of the Asset Management Leadership Team, is responsible for ensuring the availability of data collection and governance standards for all asset data collected by the Department.



Comprised of Central Office and District personnel

Oversees all asset data collection requirements

Ensures data governance and collection standards are in place for any asset data collected by the Department

Comprised of Central Office and District personnel

Sets agency data standards

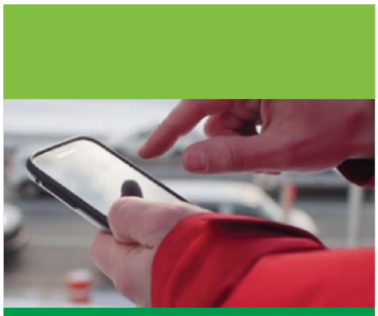
Develops data governance and data collection standards for all asset data collected by the Department

ODOT has established a Data Governance Group under the Asset Management Leadership Team that is in the process of establishing a data governance framework with standards for each piece of data.

Having access to data is also important and ODOT is proud of its Transportation Information Mapping System (TIMS) that serves as an integrated data portal for entering or accessing asset data using a map interface. Through this easy-to-use portal, ODOT employees have easy access to the information they need to make better decisions.

A strong partnership is also needed between the Asset Management Leadership Team and the Data Business Owners to ensure that the data collected for Asset Management purposes meets Federal and State requirements while serving the needs of the Department.

Technology and Management Systems



State-of-the-Art Technology

In addition to the need for quality data, 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 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.

Within the next few years, a new Bridge management system will be implemented for improving the analysis of Bridge and major Conduit investment options. The Bridge management system will also be linked to the Asset Management program,

leading to fully integrated Asset Management analysis capabilities. In addition, now that the Statewide Conduit inventory has been completed, the analysis of smaller Conduit investment needs will be incorporated into the maintenance management process.

ODOT is also implementing a TAM Decision Support Tool (TAMDST), which is a business intelligence data analytic tool. This tool will further leverage the data available to support Asset Management by generating reports and other outputs that facilitate effective investment decisions.

Technology is expected to play an important role in future data collection efforts, especially as ODOT expands its Asset Management program to include other assets. Methods of automatically tracking asset inventory and performance information will be explored so that data collection can be done quickly and with greater reliability. Technological enhancements that improve the efficiency of operations, such as e-construction efforts, are also being explored.

ODOT is also incorporating improvements in technology into its design and construction practices to ensure that planned preservation treatments perform as expected. This includes activities such as developing improved asphalt-binder specifications for emulsions that will lead to better performing Pavement treatments. Another practice consists of investigating improved material properties to expand the use of preservation treatments in order to address a broader range of Pavement and Bridge conditions.

Step 5: Communicate Strategic Direction and Progress Made

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, it is essential that ODOT 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 Communication Plan was launched in 2015 and includes two videos describing ODOT's asset preservation strategy, a web page for downloading information, a PowerPoint presentation that

can be used to share the message with stakeholders, and a Fact Card that summarizes key points.

The Communication Plan focuses on the three-pronged approach outlined in this TAMP:

- Using state-of-the art technology for better decision-making, including the use of computerized management systems that objectively predict asset needs.
- Aggressively applying asset preservation treatments to get out in front of problems before they occur.
- Improving collaboration in the way ODOT manage its assets that result in better, timelier decisions and more consistency across Districts.

Over the past 2 years the plan has been refined based on feedback from key Department staff to build an understanding of ODOT's Asset Management efforts and help ensure ODOT's continued success. It is currently being updated to address the needs of the new ODOT administration.

9.0 Summary of Planned Activities and Enhancements

Achieving the goals outlined in the TAMP requires that ODOT continue taking steps to effectively use performance data to allocate resources in a way that achieves strategic objectives and manages risks. As discussed earlier in the TAMP, ODOT's planned activities and enhancements are organized into the four following areas:

- Personnel Development and Capacity Building.
- Business Process Changes.
- Data Integration and Governance.
- Technology and Management Systems.

The table below summarizes the activities and enhancements that are planned and identifies the responsible party and the targeted completion date. The Asset Management Leadership Team will guide these initiatives and ensure that the Department stays on task and meets its objectives.

Activity	Responsible Party	Target Date	Status
Personnel Development and Capacity Building			
Develop and implement a Knowledge Management Plan	Asset Management Leadership Team	2020	Pilot completed, implementation is ongoing
Apply skills and knowledge to continually improve the performance of preservation treatments	All Districts, with Training and Guidance by Central Office		Ongoing
Conduct Cradle-to-Grave training to a) support change management efforts, and b) ensure staff know how to use tools to manage assets from cradle to grave	Central Office, Districts, and Local Agencies		Workshop completed, additional training is ongoing

Activity	Responsible Party	Target Date	Status
Business Process Changes			
Merge capital and maintenance activities into a single District Work Plan	Planning Division		Completed
Establish a Communications Team to lead the development of a Communications Plan	Asset Management Leadership Team	March 2020	Re-establish due to new Administration
Develop and implement a Communications Plan 1. Develop and launch a communications toolkit with external stakeholders 2. Initiate implementation activities outlined in the Communication Plan 3. Monitor accomplishments and lessons learned and make adjustments as necessary	Communications Group		1. Completed 2. Ongoing 3. Ongoing
Establish needed ODOT Transportation Asset Management Policies	Executive Leadership		Ongoing
Develop and implement guidance to improve the construction quality of preservation treatments	Pavement Engineering Structural Engineering Highway Operations Construction		Ongoing
Review preservation treatment specifications at least annually to identify changes to extend treatment performance and promote good practices	Pavement Engineering Structural Engineering Highway Operations		Ongoing

Activity	Responsible Party	Target Date	Status
Data Integration and Governance			
Continue efforts to evaluate data collection priorities and ensure that data collection standards are in place	TAM Audit Group		Ongoing
Develop and implement a data governance plan/framework	Data Governance Group	Summer 2020	Project began January 2019
Strengthen the partnership between the Asset Management Leadership Team and the Division of Opportunity, Diversity, and Inclusion to support American Disability Act (ADA) requirements.	Asset Management Leadership Team		Using Collector App for Data Collection. Other activities ongoing
Integrate local data collection into ODOT's data repository	Asset Management Leadership Team/GIS Team	June 2020	Visited all MPOs in the State and will follow up with the Counties
Technology and Management Systems			
Implement new maintenance management software that is integrated into the Department's existing Asset Management processes	Highway Operations Technical Services Planning Operations	Oct 2020	Formed a sponsoring committee. The Department will move forward with gathering requirements
Establish a history database containing reliable data	Structural Engineering	Oct 2020	Not started
Create prediction models for Bridges	Structural Engineering	May 2019	Participating in a Midwestern State Pool Fund to develop models

Activity	Responsible Party	Target Date	Status
Implement new Bridge management software that is integrated into the existing Asset Management processes	Structural Engineering	Sept 2020	Starting the implementation of the Bentley Product SMS/Asset wise inspection system
Develop a Civil Integrated Technology strategy	Utilize TAM Research Task Order	June 2020	Not started
Continue to add enterprise-level asset inventories	Asset Management Leadership Team		Tier 1 are complete. Start Tier 2 review based on risk assessment
Implement an Asset Management decision-support tool for cross-asset planning	Asset Management Leadership Team	Oct 2019	
Conduct a TAM and TSMO workshop and develop a strategic plan for implementation of recommendations	Asset Management Leadership Team	May 2019 and Oct 2019	Completed first ever TAM & TSMO workshop. Will meet with the Governance Board with recommendations
Explore opportunities for using technology to improve data collection activities and improve organizational efficiency	TAM Audit Group & GIS Team	Sept 2019	Reviewing RFI to identify potential option
Identify and implement opportunities to incorporate new means, methods, treatments, specifications and technology into the construction of preservation treatment strategies	Pavement Engineering Structural Engineering Hydraulic Engineering Highway Operations Construction		Ongoing

Activity	Responsible Party	Target Date	Status
Develop Phase 2 of the TAM Decision Support Tool for implementation and training		June 2020	After a very successful phase 1, we will add new assets and reporting tools in Phase 2

Appendix A: TAMP 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 June 30, 2019. The checklist identifies each of the specific requirements in the legislation and/or the final rule, and the relevant content in the ODOT TAMP.

Required Elements	Indicators Element Meets the Requirements	Reference
Plan Development and Content		
TAMP approved by head of State DOT (23 CFR 515.9(k))	The TAMP bears the signature of the head of the State DOT.	Cover letter provided
State DOT has developed its TAMP using certified processes (23 CFR 515.13(b))	The TAMP describes processes used, the process descriptions align with the FHWA-certified processes for the State DOT, the TAMP analyses appear consistent with use of the certified processes, and the TAMP includes the information the processes are required to produce.	The processes certified in the April 30, 2018 TAMP have been followed in conducting the required analyses.
TAMP includes the required content pursuant to 23 USC 119 and 23 CFR Part 515 (23 CFR 515.13(b))	The content of the TAMP is consistent with 23 CFR 515.9. The TAMP must include the following: • Description of how the State DOT will carry out Asset Management as it is defined in 23 CFR 515.5 • A summary listing of NHS Pavement and Bridge assets, regardless of ownership. • Discussion of each element in 23 CFR 515.9(d) based on the results of the required TAMP analysis processes, and showing compliance with the requirements established for each element in paragraph (d): o State DOT Asset Management objectives. o Measures and State DOT targets for asset condition, including those established pursuant to 23 USC 150, for NHS Pavements and Bridges. o A summary description of the condition of NHS Pavements and Bridges, regardless of ownership. o Performance gaps that were identified in accordance with the State Dot's performance gap analysis process. o Life-cycle planning results that were developed in accordance with the State's life-cycle planning process.	All required sections of the TAMP are included, for NHS Pavements and Bridges as well as Pavements and Bridges on the entire State system. Conduits, which consist of culverts and storm drains are also included in the TAMP. ODOT does not current have information on the locally managed conduits on the NHS, but is in the process of obtaining this information, as noted in Chapter 9 on planned enhancements. Several enhancements have been added to this TAMP to better address the requirements:

Required Elements	Indicators Element Meets the Requirements	Reference
	○ Risks that were identified, assessed, evaluated, and prioritized in accordance with the State's certified risk analysis process. This includes the results of periodic evaluations under 23 CFR Part 667 relating to NHS facilities and discussion of the mitigation plan for addressing the top priority risks that may have adverse effects. ○ A 10-year Financial Plan developed in accordance with the State DOT's financial plan analysis process. ○ Investment strategies in accordance with the State's certified investment strategy development process and the requirements in 23 CFR 515.9(f), including discussion of how the requirement TAMP analyses support the selected investment strategies. • Discussion of how the TAMP'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 related to physical assets. ○ Achieving the State DOT targets for asset condition and performance of the NHS in accordance with 23 USC 150(d). ○ Achieving the national goals identified in 23 USC 150(b). • If the State DOT elects to include other NHS infrastructure assets or other public road assets in its TAM, the following must be included in the TAMP for those assets (23 CFR 515.9(l)): ○ Summary listing of assets, including a description of asset condition. ○ Asset Management measures and State DOT targets for asset condition. ○ Performance gap analysis. ○ Life-cycle planning. ○ Risk analysis, including summaries of evaluations carried out under part 667 of this title for the assets, if available, and consideration of those evaluations. ○ Financial plan. ○ Investment strategies.	• Additional information on NHS conditions has been added to Chapter 3 on asset inventories and conditions. • A summary of common treatments included in each of the FHWA work type categories has been added to Chapter 4 on life-cycle planning. • New information on how ODOT addressed the requirements under 23 CFR Part 667 have been added to Chapter 5 on risks. • The investment strategies in Chapter 6 have been updated to reflect ODOT's new revenue expectations. • A section on addressing system investment needs has been added to Chapter 7 on performance gaps. In

Required Elements	Indicators Element Meets the Requirements	Reference
		addition, forecasted NHS conditions have been added.
TAMP Implementation		
Integration of TAMP into transportation planning processes that lead to the Statewide Transportation Improvement Program (STIP) (23 CFR 515.9(h)).	• State DOT planning documents or records of planning activities show that the TAMP was considered during the planning process, including development of the STIP. • The State DOT STIP reflects adoption of TAMP investment strategies.	As described in Chapter 8, the processes used to develop the STIP have become an integrated part of ODOT's planning and programming processes for the past 4 years.
TAMP available to the public (23 CFR 515.9(i)).	• State DOT posts its TAMP on its web site. • State DOT makes copies of its TAMP available at planning meetings. • State DOT provides a copy of its TAMP to MPOs and other interested parties.	Once the TAMP is recertified by the FHWA, it will be made available on ODOT's Asset Management website. In addition, copies of the TAMP will be provided to our regional and local partners through our outreach and communication efforts. ODOT is also developing an updated communication strategy that will highlight information from the TAMP for the public and other interested parties.
State DOT demonstrates through current and verifiable documentation that it has implemented a TAMP meeting requirements of 23 USC 119 and 23 CFR Part 515 and that the State DOT is following the investment strategies in the TAMP. CFR 515.13(b)(2)).	• For the 12 months preceding the constancy determination, there is alignment between the actual and planned levels of investment (in the TAMP) for various work types as defined in 23 CFR 515.5 (i.e., initial construction, maintenance, preservation, rehabilitation and reconstruction) (23 CFR 515.13(b)(2)(i)); or the State DOT otherwise convincingly demonstrates implementation by means of other documented evidence. • The State DOT has deviated from the TAMP investment strategies, but the State DOT gives reasons for the deviation(s) that are documented and verifiable, and those	Documentation showing ODOT's asset investments over the past 12 months has been provided separately.

Required Elements	Indicators Element Meets the Requirements	Reference
	reasons support a FHWA finding that the deviation from the TAMP investment strategies was necessary due to extenuating circumstances beyond the State DOT's reasonable control (23 CFR 515.13(b)(2)(ii)).	

Appendix B: District Multi-Year Work Plan Guidance

The following information was provided to the Districts to guide the development of their FY2018-2023 Multi-Year Work Plans. The guidance is provided to help ensure safe, reliable, efficient, and accessible travel conditions throughout the State, while maintaining Bridge and Pavement assets at agreed upon performance levels. It includes information on the funding allocated to each asset class and information on the maintenance and preservation activities that should be accomplished.

District Multi-Year Work Plan

FY2018 – FY2023

The District Multi-Year Work Plan represents the ODOT's long term plan for maintaining its transportation assets. A compilation of the district **capital** and **operations** work plans, the District Multi-Year Work Plan lists the rehabilitation and maintenance projects that will take place during the FY2018 – FY2023 timeframe.

The goal of the work plan is to identify a cost effective and fiscally constrained work program that assures safe, reliable, efficient, and accessible travel conditions, while maintaining bridge and pavement assets at agreed upon performance levels.

Developed in unison with the District Zero Based Budget Process, the development, implementation and maintenance of the District Multi-Year Work Plan requires a collaborative effort between the District Planning & Engineering, Highway Management, and Business & Human Resources administrations.

The District Multi-Year Plan is due March 20, 2017:

- Capital Work Plan – In Ellis and in the spreadsheet provided at : O:\Planning\Multi Year Work Plan Guidelines\OPERATIONS WORK PLANS\Work Plan Data Entry Forms
- Operations Work Plan – In the spreadsheet provided at : O:\Planning\Multi Year Work Plan Guidelines\OPERATIONS WORK PLANS\Work Plan Data Entry Forms

The districts will present their Multi-Year Work Plan presentations on April 10, April 13, April 18, and April 19. The district presentations should involve less experienced future leaders as well as current leadership.

Schedule:

Don Scott Conf. Room 100

April 10 – 8:30 A.M. – District 6

10:00 A.M. – District 12

1:00 P.M. – District 4

2:30 P.M. – District 8

April 13 - 8:30 A.M. – District 5

10:00 A.M. – District 2

1:00 P.M. – District 1

2:30 P.M. – District 7

April 18 – 1:00 P.M. – District 11

2:30 P.M. – District 3

April 19 – 8:30 A.M. – District 9

10:00 A.M. – District 10

District Capital Work Plan Guidelines

FY2018 - FY2023

The District Capital Work Plans represent the contracted portion of ODOT's long term plan for maintaining its transportation assets. Each district capital work plan lists the rehabilitation and maintenance projects that will be awarded during the FY2018 - FY2023 timeframe.

The completed FY2018 – FY2023 District Capital Work Plan should be entered in Ellis by March 20, 2017.

The Division of Planning, Office of Program Management, acts as the administrator of the District Capital Work Plan. In this role, they provide guidance and resources to assist the districts in the development of their work plans.

The District Capital Work Plans consists of the following interrelated components:

- **Priority System and General System Pavements**
- **Urban System Pavements**
- **Other Assets (***concrete and cable barrier, guardrail, ramps, interchanges, crack sealing, signing, signals, etc.***)**
- **Bridges**
- **Culverts**
- **Pavement Marking and RPM**

Priority and General System Pavements

FY2018 priority and general system paving projects were identified by the district in the December 2016 lock-down. FY2018 projects should closely match the strategies committed to in the previous years approved work plan.

During the month of December, the Office of Program Management will run the department's pavement management system to identify the optimal pavement treatment strategy for FY2019 - FY2023. The district P&EA, Pavement Engineer, and Work Plan Coordinator will receive a copy of the results.

Urban System Pavements

Thirty five million dollars is allocated annually for the paving of state and U.S. routes within cities not included in the priority system. Funds are distributed to the districts based on their pro-rata share of urban mileage.

Eligible pavement treatments include:

- Surface Treatments - Application of asphalt and/or aggregate to a roadway surface, generally less than or equal to 1 ½ inches thick, which improves or protects the surface characteristics of the roadway with little or no direct structural improvement; and the application of other preventive maintenance practices.
- Non-Structural Overlay – Application of a uniform layer of asphalt, less than 3 inches thick, applied to a roadway surface.

Non-Eligible Activities

- Curbs, curb ramps, gutters, manhole reconstruction, catch basin reconstruction, utility relocations and other non-surface items.

Other Assets

This allocation funds "stand-alone" projects for roadway maintenance activities not addressed by the pavement management system.

This allocation is distributed to the districts based on each districts pro-rata share of:

- priority and general system mileage,
- *poor condition lane miles of pavement* (priority and general systems),
- ramp mileage,
- guardrail, cable barrier,
- concrete barrier,
- CE, PE, RW.

Types of activities funded include:

- crack sealing – In December, the Office of Pavement Engineering will provide the districts with a list of candidates for crack sealing. The district work plan should address twenty percent of the crack seal candidates on an annual basis,
- gap projects, ready to pave projects, spot paving, joint repairs,
- sign replacement, signals, lighting, etc.
- underdrains,
- ramps (stand-alone project or as part of a mainline paving project),
- guardrail and cable barrier projects,
- concrete barrier maintenance,
- CE, PE, RW.

(*Poor Condition Lane Miles of Pavements – The pavement management system does not allow for a minimum PCR threshold. As a result, the optimized solution allows pavements to reach unacceptably poor conditions. The districts are allocated funds to hold these pavements together until a project is recommended by the pavement management system.)*

Bridge

- Critical Success Factor Goal – Weighted Average General Appraisal – 6.8
- Deficiencies Targets –
    - General Appraisal – 2% deficient
    - Floor Condition – 3% deficient
    - Paint Condition – 10% deficient
    - Wearing Surface – 3% deficient
- Maintenance Goals –
    - Cleaning – 100% every two years – Expansion joints, scuppers and drainage troughs, and bridge under expansion joints – Bridges with ODOT routine maintenance responsibility
    - Sweep Bridge Decks – 100% annually – Bridges that do not have over the side drainage
    - Sealing Bridge Decks – 100% every 5 to 10 years depending on condition - All major bridges and mainline priority system bridges

By the first week of January, the Office of Structural Engineering will post a list of bridges that should be cleaned, swept, and sealed on the departments network drive O. (O:\Planning\Multi Year Work Plan Guidelines\2017 MYWP QUERIES AND DOCUMENTS\Bridge Sweeping_Cleaning_Sealing)

Culverts

Twenty million dollars per year allocated to the districts based on conditions and inventory. This allocation funds the cost of construction, design, right-of-way, construction inspection and culvert conditions inspection.

Pavement Marking and RPM

This allocation is distributed to the districts based each districts inventory of edge lines, lane lines and centerlines (4" or 6").

Completing the District Capital Work Plan

During the months of January through March the districts work plan teams will:

- analyze systems conditions,
- prioritize needs,
- evaluate the optimized priority and general systems pavement treatments strategies recommended by the pavement management system:
    - compare optimized results to the current program maintained in Ellis
    - combine/split optimized pavement strategies into logical project segments,
    - the pavement treatments and locations selected by the districts should match the locations and treatments recommended by the pavement management system seventy-five percent of the time over the FY2018 – FY2023 timeframe. The Office of Program Management will provide the districts with progress reports upon request.
- perform field reviews to:
    - validate existing Ellis projects in terms of location and treatment,
    - validate projects recommended by the pavement management system,
    - identify additional needs,

  Include pavement engineers and county managers in field reviews
- adjust existing Ellis project work limits, treatments, schedules, and project costs,
- identify new projects,
- identify the need for "ready to pave" tasks such as culvert replacements and pavement repairs,
- identify the need for Gap projects,
- coordinate the timing of projects (paving, bridge, culverts, striping, etc.),
- identify which tasks will be completed by capital contract vs. operations forces,
- determine if capital funds need to be transferred to operations to cover the cost of maintenance activities included in the operations work plan,
- identify PE, RW, CE needs (including culvert inspection),
- reaffirm prior urban system local funding commitments,
- compile fiscally a constrained six year program (four years for the urban system).

Resources

Ellis GQL Queries are located on ODOT's shared internet drive at: O:\Planning\Multi Year Work Plan Guidelines\2017 MYWP QUERIES AND DOCUMENTS\Capital Program Queries

Use these resources to develop and record your District Capital Work Plan.

Operations Work Plan Guidelines

FY 2018 - FY 2019

The Operations Work Plan represents the maintenance portion of ODOT's long term plan for maintaining its transportation assets. Each district's Operations Work Plan lists the Routine Maintenance, Reactive Maintenance, Preservation, Ready to Pave, and Gap projects that are planned during the FY 2018 – FY 2019 timeframe.

The Operations Work Plan serves two purposes. First, it identifies the work planned for the upcoming fiscal years, and second, it establishes a rental equipment and materials budget to perform the planned work for the upcoming year.

The Division of Operations, Office of Maintenance Operations, acts as the administrator of the District Operations Work Plan. In this role, they provide guidance and resources to assist the districts in the development of their work plans.

The District Operations Work Plan is due March 20, 2017.

General

Districts will use and maintain the work plans located at:

O:\Planning\Multi Year Work Plan Guidelines\OPERATIONS WORK PLANS

Each district is to prepare a FY 2018 and FY 2019 Operations Work Plan for work taking place in their counties. It is understood the FY 2018 work plan will have more specificity than the FY 2019 work plan.

Each county should prepare a work plan submitted through the Highway Management Administrator. However, if Highway Management within the district consists of departments or teams separate from the counties (e.g., traffic, special projects, bridge, paving team) their work needs to be submitted on a separate plan or included in the county work plan where the work will be performed. The intent is that all Highway Management work for the upcoming two fiscal years be included in the Operations Work Plan.

For purposes of the work plan, the following maintenance work category definitions are offered:

- Routine Maintenance – Activities that need to be performed on a regular basis either during a season of the year or throughout the year. Generally speaking, these activities can be scheduled in advance or if a situation occurs, can be scheduled for the next available opportunity. Examples include:
    - Reconditioning shoulders
    - Pruning existing trees
    - Litter
    - Sweeping
    - Linear Grading – Ditch cleanout
    - Mowing
    - Asphalt Pavement Repairs – Partial Depth
    - Guardrail
- Reactive Maintenance – Activities that are known to occur and need immediate attention when they occur but the date and time is unknown at the time a plan is developed. The activity may occur during a season of the year or throughout the year. When the situation occurs, the situation needs to be addressed within a short period of time, not scheduled for the next available opportunity. Examples include:
    - Snow and Ice
    - Pavement Patching

    - Litter – Dead Deer
    - Debris removal
- Preservation – The three Pavement (crack sealing, underdrain outlet cleaning, chip sealing) and three Bridge (cleaning bridges, sweeping bridge decks, sealing bridge decks) preservation strategies.
- Gap Projects – Those projects that are done to "hold" a roadway or bridge over until the Planned Capital Project is done. These projects can be funded by both Capital and Maintenance funding. Typically a Gap project would not have a PID associated with it.
- Ready to Pave Projects - Those projects that are done in anticipation or ahead of a Capital Project (i.e. pavement repairs, tree cutbacks, ditching, crack sealing). A Ready to Pave project must have an associated PID.

The District Operations Work Plans consists of the following interrelated components:

- **Personnel**
- **Work Days**
- **Job Entry Screen**
- **Operations Work Plans**
- **Operation Work Plan Summary**

Use of the Operations Work Plan Spreadsheets

As stated, the workbook consists of several spreadsheets. The following provides general information regarding the workbook and spreadsheets. Further guidance and support will be provided on the use of the workbook.

The PERSONNEL spreadsheet provides a tool for the manager to assess the number of employees available to the county taking into account full time staff, HT's to construction, summer students, leave, etc. The available staff can be distributed by the month in which the staff will be available, or not available, to better assess when staff is able to perform the work.

For purposes of this work plan, available staff to be planned are all HT's and managers as depicted on the latest table of organization maintained by the district HR staff. All planned staff additions (seasonal, summer students, interns) minus staff deductions (HT's to construction) are to be included as available staff.

The PERSONNEL spreadsheet is a useful tool but data entry is not required.

The WORK DAYS spreadsheet is a tool that identifies the available work days per month and works interactively with the PERSONNEL and OPERATIONS WORK PLANS spreadsheet. As jobs and projects are populated on the OPERATIONS WORK PLANS spreadsheet, the WORK DAYS spreadsheet is updated to reflect whether staff can take on additional work during the particular month (Below Target Person Days/Hours) or whether staff is overcommitted (Above Max Person Days/Hours).

The WORK DAYS spreadsheet is a useful tool for the manager. No data entry is needed. However, for the WORK DAYS spreadsheet to provide meaningful information, the PERSONNEL spreadsheet needs to be completed.

The JOB ENTRY SCREEN is a tool where the manager identifies the jobs or projects to be completed in FY 2018 and FY 2019.

The JOB ENTRY SCREEN provides a series of drop down cells to simplify data entry. Use of this tool populates the OPERATIONS WORK PLANS spreadsheet.

The location, project, equipment, materials and labor information are all identified by the manager.

For projects in which a location is known in advance, the route, log point and Structural File Number (SFN) or Culvert File Number (CFN), if applicable, should be identified. For work on multiple or various routes such as mowing, snow and ice, traffic signal inspection, the route can be "multiple".

Some activities have both known locations and unknown locations. For example, guardrail upgrade projects should include a route and logpoint since the location is likely known in advance. However, guardrail repair locations due to accidents would not be known but time (using the Labor Information portion of this spreadsheet) should be dedicated in the work plan for this activity as well. Each type of guardrail job would be entered separately.

The Project and Work Description portion of the JOB ENTRY SCREEN also uses drop down cells to simplify data entry. For example, if the EIMS Project Category of Vegetation is selected, only those EIMS Activity Codes for Vegetation are displayed.

If the Ready to Pave category is used, a PID for the associated capital project is required. Typically a Gap project would not have a PID associated with it.

Rental Equipment and Materials Required as well as purchase order costs are needed to properly budget for the required items. These costs will form the basis for the county/districts zero-based operating budget.

The manager is able to schedule the month in which the work is planned. By doing so, the manager will be able to assess whether sufficient staff are available that month by periodically referring to the WORK DAYS spreadsheet as Projects/Jobs are entered. Provisions for 8 and 10 hour day staff are made.

The OPERATIONS WORK PLANS spreadsheet is automatically populated as the JOB ENTRY SCREEN tool is completed. If the JOB ENTRY SCREEN tool is not used, the required columns must be completed in the required format. This may be burdensome to the manager especially when looking up and correctly formatting NLF_ID numbers, properly recording the EIMS Activity Codes, and individually accounting for materials and labor hours/days for each entry.

The OPERATION WORK PLAN CTY SUMMARY spreadsheet summarizes the information from the OPERATIONS WORK PLANS. No data should be entered on this spreadsheet.

However, this spreadsheet does summarize the information input to the OPERATIONS WORK PLANS spreadsheet and may be helpful to review during or at the conclusion of the work plan process. The spreadsheet will be used to assess a county and district's planned work.

Completing the District Capital Work Plan

During the months of January through March the districts work plan teams will:
During the months of January through March the districts work plan teams will:

- analyze systems conditions,
- identify routine, reactive, and preservation project,
- identify the need for "ready to pave" tasks such as culvert replacements and pavement repairs,
- identify the need for Gap projects,
- identify which tasks will be completed by capital contract vs. operations forces,
- determine if capital funds need to be transferred to operations to cover the cost of maintenance activities included in the operations work plan,
- develop a zero-based budget for FY 2018.

Resources

The district and county work plans are located on ODOT's shared internet drive at: O:\Planning\Multi Year Work Plan Guidelines\OPERATIONS WORK PLANS\Work Plan Data Entry Forms

- District folder
- County plans
- Other highway management unit work plans

The EIMS and EIMS PVT spreadsheets are included as reference material in the Operations Work Plan workbook to assist in identifying proper EIMS activities. The EIMS spreadsheet lists all the EIMS Activity Codes and the EIMS PVT is a pivot table spreadsheet useful for analyzing information.

The Office of Maintenance Operations can conduct a Skype Meeting to demonstrate the use and functionality of the Operations Work Plan workbook. Further support is available depending on need.

Analysis

Two primary analyses will be performed. The first analysis will examine the breadth of work Highway Management performs through Routine and Reactive Maintenance, Pavement and Bridge Preservation, and its capacity for supporting the capital work plan through Ready to Pave and Gap projects.

The second analysis will be a "before and after" analysis examining work planned versus work performed.

A before analysis for FY 2018 will be made grouping work by county/district/statewide into existing EIMS Project Categories (e.g., Overhead, General, Earthwork, Vegetation).

A before analysis for FY 2018 will be made grouping work by county/district/statewide into Categories (e.g., Gap, Ready to Pave, Reactive Maintenance, Routine Maintenance, and Preservation).

A before analysis for FY 2018 will be made grouping work by county/district/statewide into EIMS Roadway Module Activity Codes (e.g., M201-001 Clearing and Grubbing, M250-001 Pavement Patching, M606-002 Guardrail End Treatment, M611-003 Cleaning drainage structures).

An analysis will be made grouping work by pavement and bridge preservation strategies.

- Pavement
  - M423-001 – Crack sealing, hot applied
  - M605-001 - Underdrains
  - M422-001 – Chip seal
- Bridge
  - M518-001 – Bridge cleaning
  - M512-001 – Treating concrete
  - M518-002 – Bride sweeping

Results

A post work plan analysis (circa July, 2018) will be made of the FY 2018 plan in the following areas:

- Ready to Pave (by planned location)
- Gap (by planned location)
- Pavement (by planned location)
  - M423-001 – Crack sealing, hot applied
  - M605-001 - Underdrains
  - M422-001 – Chip seal
- Bridge (by planned location)
  - M518-001 – Bridge cleaning
  - M512-001 – Treating concrete
  - M518-002 – Bridge sweeping

The goal is to complete 100% of the FY 2018 Ready to Pave and Preservation (Pavement and Bridge) projects.

All activity codes will be analyzed, planned verses performed.

Gap projects will be analyzed by the location and number of person days required for the project. This will aid decision makers in better understanding the locations and effort involved in "holding a road together" until a capital project is scheduled.

An after analysis will be made grouping work by county/district/statewide into existing EIMS Project Categories (e.g., Overhead, General, Earthwork, Vegetation).

An after analysis will be made grouping work by county/district/statewide into Categories (e.g., Gap, Ready to Pave, Reactive Maintenance, Routine Maintenance, and Preservation).

An after analysis will be made grouping work by county/district/statewide into EIMS Roadway Module Activity Codes (e.g., M201-001 Clearing and Grubbing, M250-001 Pavement Patching, M606-002 Guardrail End Treatment, M611-003 Cleaning drainage structures).

Appendix C: 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 & 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 & Chief Legal Governor of Ohio or President	Declaration - To be considered for ER funding a disaster declaration/proclamation is required. Any of the following fulfill this requirement, ER Coordinator compiles list effected county/counties Prepares Disaster Proclamation and sends 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 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 works 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 data base 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. (see Betterments on pg. 4) • 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 at a later date, usually after the Division Administrator has made a finding of ER eligibility. The Detailed Damage Inspections Reports (DDIRs) are used to prepare the comprehensive list of projects. ODOT records projects and workorders 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 disaster. The application must include a comprehensive list of all eligible project sites and repair costs. *Please note:* Project work can proceed prior to 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 e-mail, 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. Provide assistance to State, Federal or other highway agencies in applying for funds and determining eligibility; and,

3. Support the State, Federal or other highway agencies in the technical review, design, repair, and reconstruction of damaged highway facilities.