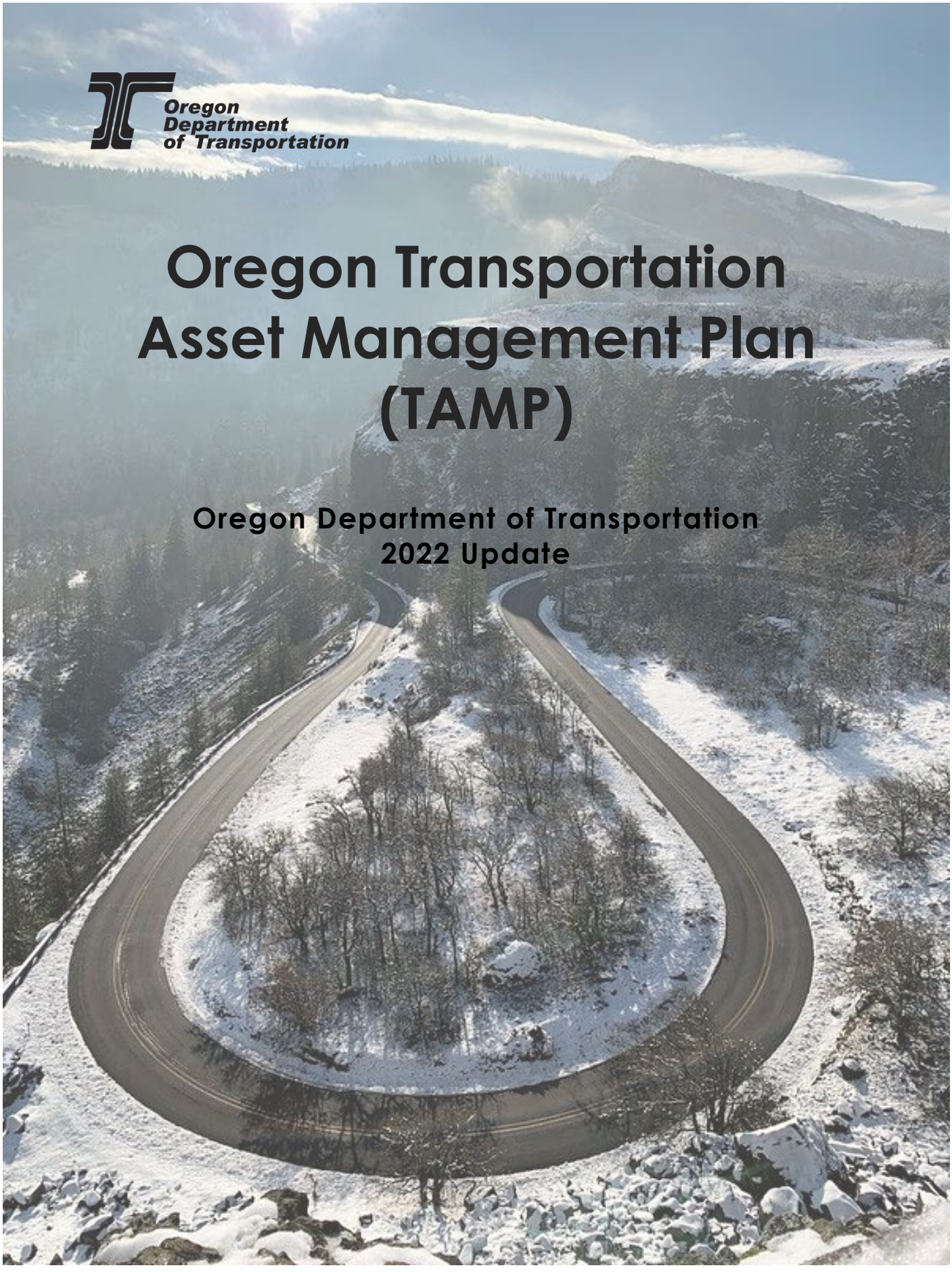


Oregon Transportation Asset Management Plan (TAMP)

Oregon Department of Transportation
2022 Update

This page intentionally left blank.

Oregon
Kate Brown, Governor

Department of Transportation
Office of the Director, MS 11
355 Capitol St NE
Salem, OR 97301-3871

Oregon Transportation Asset Management Plan
Oregon Department of Transportation

Section 119(e)(8) of title 23 United States Code requires each state department of transportation to develop an asset management plan for the National Highway System (NHS) to improve or preserve the condition of NHS infrastructure and performance of the system. Contents of the plan are to be in a form determined by the Secretary of Transportation. A requirement established by the Secretary is that the developed plan is to be approved by the head of the State Department of Transportation.

In accordance with these requirements, I hereby acknowledge that I have reviewed the Oregon Transportation Asset Management Plan and approve its submission to the Federal Highway Administration for formal review and certification.

Kristopher W. Strickler
Director, Oregon Department of Transportation

June 28, 2022
Date

TABLE OF CONTENTS

Executive Summary

Overview and Purpose

Oregon's Transportation Asset Management Plan, or TAMP, documents information about Oregon's National Highway System (NHS) pavement and bridge assets, their condition, use and performance, the processes by which they are managed, and results of alternative management practices and investment decisions.

Provisions of Moving Ahead for Progress in the 21st Century Act (MAP-21) mandate that states develop a risk-based asset management plan which, at a minimum, is in a form that the Secretary determines to be appropriate and includes:

1. A listing and condition of pavement and bridge assets on the National Highway System.
2. Asset management objectives and measures.
3. Identification and analysis of performance gaps between national goals and asset condition.
4. Lifecycle costs and risk-based management analyses.
5. A financial plan with a minimum forecast period of 10 years.
6. Investment strategies.

Pavement and Bridge Ownership and Data

Oregon has 78,991 total public road centerline miles, of which 7,603 are on the State Highway System (SHS) and 4,319 are on the NHS. ODOT owns and maintains 4,048 centerline miles on the NHS. The remaining 271 centerline miles are maintained by local agencies.

Oregon has 6,985 NBI public bridges, of which 2,759 are on the SHS, and 1,848 are on the NHS. ODOT owns and maintains 1,762 bridges on the NHS, totaling an area of 2,659,663 sq. meters. The remaining 86 bridges on the NHS are maintained by local agencies.

Goals, Measures, Targets and Conditions

All 2-year (2020) national performance targets for pavement and bridges on the NHS were exceeded. The Full Performance Period Progress Report will be submitted to FHWA in October 2022.

NHS Pavement National Performance Measure	Baseline	2-Year Condition/ Performance	2-Year Target (2020)	4-Year Target (2022)
Percentage of pavements of **Interstate System in Good condition**	-	**64.4%**	-	35%
Percentage of pavements of **Interstate System in Poor condition**	-	**0.2%**	-	0.5%
Percentage of pavements of **non-Interstate NHS in Good condition**	63.9%	**65.9%**	50%	50%
Percentage of pavements of **non-Interstate NHS in Poor condition**	6.6%	**6.6%**	10%	10%

NHS Bridge National Performance Measure	Baseline	2-Year Condition/ Performance	2-Year Target (2020)	4-Year Target (2022)
Percentage of NHS Bridges Classified as **in Good Condition**	12.4%	**13.2%**	11.4%	10.0%
Percentage of NHS Bridges Classified as **in Poor Condition**	1.9%	**1.9%**	2.4%	3.0%

Both state performance targets for pavement and bridges on the SHS were met.

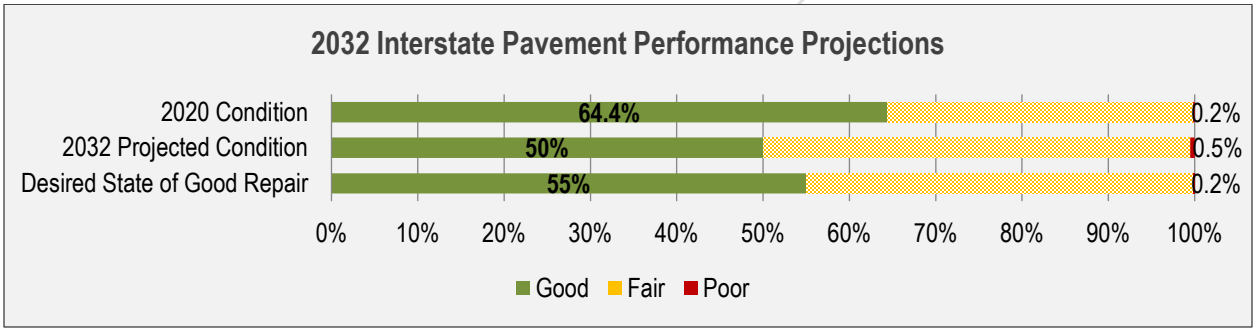
Oregon Legislatively Approved Key Performance Measures	2021 Condition	2021 Target
Pavement Condition - Percent of pavement lane miles rated "**fair" or better** out of total centerline miles in the state highway system	89%	85%
Bridge Condition - Percent of state highway bridges that are **not "distressed"**	78%	78%

Condition & Performance Gap Analysis

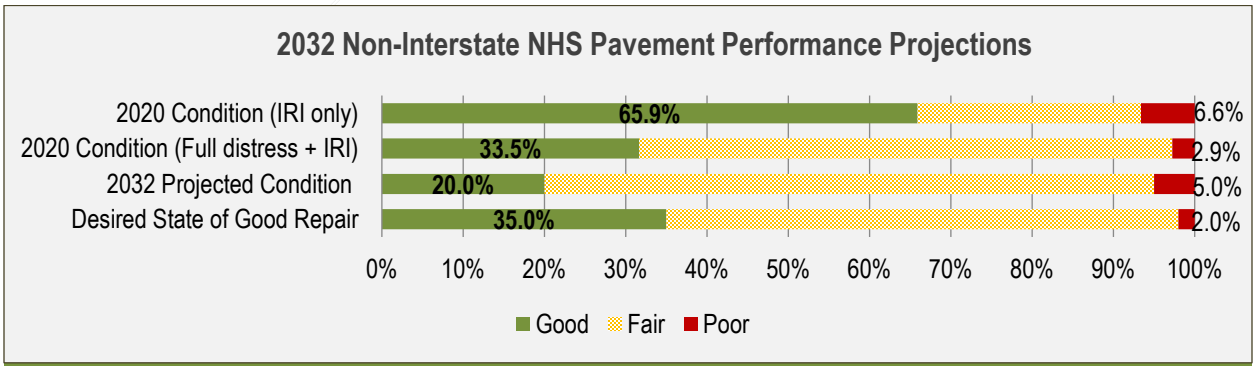
ODOT estimates that the agency needs approximately **$273 million per year to maintain current pavement conditions** and continue to meet the desired state of good repair of 90% "fair" or better, over the long term across the entire system.

Projected annual pavement investment[1]	Annual pavement investment needed to *Maintain Current Conditions*	Annual pavement investment needed to meet *Desired State of Good Repair*[2]
State Highways: **$112M/year** NHS and Interstate only: Approx. **$90M/year**	State Highways: **$273M/year** NHS and Interstate only: Approx. **$241M/year**	State Highways: **$273M/year** NHS and Interstate only: Approx. **$241M/year**

It is projected about 50% (+/-5%) of Oregon's Interstate pavement will be in *good* condition in the year 2032, and that the percent of Interstate pavement in poor condition is projected to be about 0.5%.



Oregon's Non-Interstate NHS pavements are projected to experience significant declines in condition over the next 10 years. The percent of pavement rated good is projected to decline to about 20% (+/-5%) by 2032, similarly the percent of Non-Interstate NHS pavement in poor condition is expected to rise to about 5%.



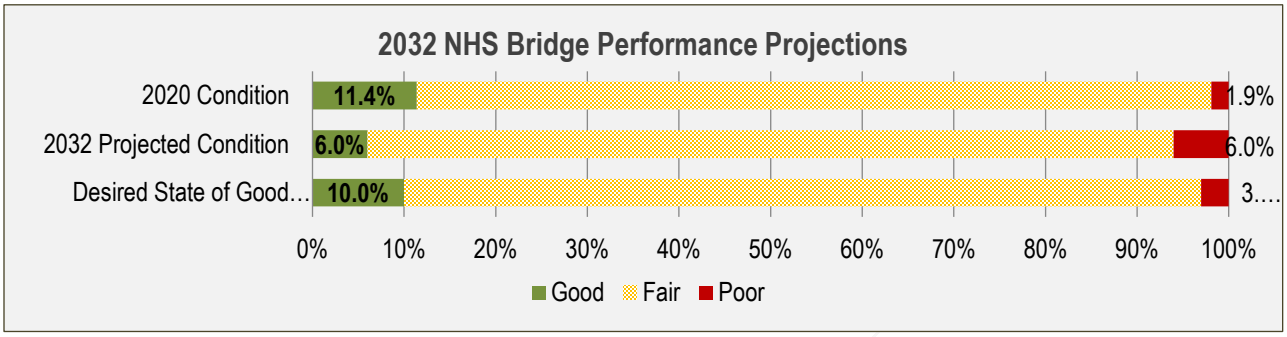
[1] Does not include Interstate Sign funding.

[2] Pavement SOGR is based on 2020 Pavement Condition Report estimate updated to 2022 costs.

An estimated $320 million is needs to maintain current bridge conditions, and $539 million per year is needed to meet the desired state of good repair of 78% of bridges "not distressed" over the long term.

Projected annual bridge investment[3]	**Annual bridge investment needed to *Maintain Current Conditions***	**Annual bridge investment needed to meet *Desired State of Good Repair***
State Highways: **$156M/year** NHS and Interstate only: Approx. **$145M/year**	State Highways: **$320M/year** NHS and Interstate only: Approx. **$273M/year**	State Highways: **$539M/year** NHS and Interstate only: Approx. **$420M/year**

A noticeable decline in bridge conditions on the NHS is projected over the next 10 years. It is projected about 6% of Oregon's NHS bridges will be in *good* condition in the year 2032, and that about 6% will be in poor condition.



Lifecycle Planning

ODOT minimizes life cycle costs through extending the useful life of pavement and bridge assets, to the extent practicable, through establishing life cycle strategies. Reconstruction and maintenance costs rise as pavement and bridges ages. However, if maintenance and/or rehabilitation is carried out too early, the costs are prohibitively high. There is an optimum time at which maintenance can be performed to provide the maximum cost-effectiveness.

Pavements must be resurfaced or rehabilitated at periodic intervals (typical average 15 to 20 years for asphalt and 40 to 50 years for concrete) to keep them out of poor condition

Most bridges today are designed with 75-year design life. With regular attention, the actual service life can be expected to extend to 100 years or more. Based on a service life of 100 years, a conservative approach would be to replace about one percent of all bridges every year.

Risk Management

The goal of the agency's approach to risk management is to make better and more informed decisions regarding existing and potential risks to its transportation assets and programs and better understand the likely outcomes and impacts of alternative actions.

ODOT is engaged in a number of risk management activities and in many cases has already identified and is addressing high-priority risks that may impact achieving the goals of the TAMP. ODOT categorizes risk into the six major risk management categories of:

1. Pavement,
2. Bridge,
3. Other Tier-1 Assets,
4. Environmental,
5. Economic and Financial, and
6. Organization and Leadership

[3] Assumes 50% of bridge seismic funding will benefit SOGR and MCC scenarios, through bridge replacements.

The Pavement Services Unit attempts to address programmatically as many different risks to pavement as possible in the Pavement Management System (PMS). For instance, risks of accelerated pavement deterioration are handled through the scoping process and annual review of interstate pavement conditions and the treatment assumptions and deterioration models in the PMS.

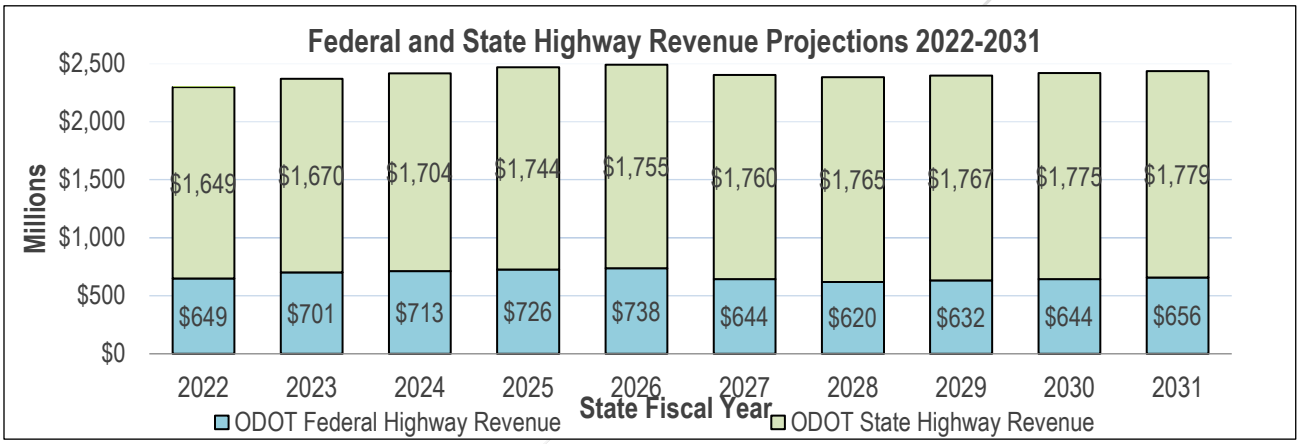
The Bridge Section has focused additional attention on risks related to four key areas:

- decks;
- corrosion on steel bridges and reinforced concrete bridges;
- fatigue cracking on steel bridges; and
- scour

Financial Plan

The TAMP documents and summarizes the requirements, plans, activities and processes emphasizing preservation and improvement of Oregon's pavements and bridges on the State highway system. The TAMP also provides financial planning and investment strategies which inform STIP development and funding allocations.

The following chart represents a snapshot in time and serves as a starting point for identifying optimal investments that maintain, preserve, and enhance Oregon's highway and bridge assets.



The total estimated funding shown below includes all project types and funding sources that contribute to the condition and performance of NHS pavements and bridges, including projects driven by modernization or enhancement efforts.

SCENARIO 1:CURRENT REVENUE FORECAST – NHS PAVEMENT										
TAMP Work Type	***2021- 2024***			***2024-2027***			***2027-2030***			…
	21-22	**22-23**	**23-24**	**24-25**	**25-26**	**26-27**	**27-28**	**28-29**	**29-30**	**30-31**
New Construction	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Reconstruction	$6	$7	$6	$5	$7	$5	$5	$7	$5	$5
Rehabilitation	$41	$42	$41	$39	$40	$39	$37	$38	$37	$37
Preservation	$39	$39	$39	$37	$37	$37	$35	$35	$35	$35
Maintenance	$16	$17	$16	$15	$16	$15	$14	$15	$14	$14
Total	**$102**	**$105**	**$102**	**$96**	**$100**	**$96**	**$91**	**$95**	**$91**	**$91**
	$309m			**$292m**			**$277m**			

SCENARIO 1:CURRENT REVENUE FORECAST – NHS BRIDGE										
TAMP Work Type	*2021- 2024*			*2024-2027*			*2027-2030*			…
	21-22	22-23	23-24	24-25	25-26	26-27	27-28	28-29	29-30	30-31
New Construction	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Reconstruction	$66	$66	$66	$73	$73	$73	$73	$73	$73	$73
Rehabilitation	$93	$93	$93	$81	$81	$81	$81	$81	$81	$81
Preservation	$35	$35	$35	$29	$29	$29	$29	$29	$29	$29
Maintenance	$20	$20	$20	$12	$12	$12	$12	$12	$12	$12
Total	**$214**	**$214**	**$214**	**$195**	**$195**	**$195**	**$195**	**$195**	**$195**	**$195**
	$642			**$585**			**$585**			

Investment Strategy

Underlying the investment strategies is asset management information and analyses presented in other chapters of the TAMP. The performance gap analysis helps identify investment needs to achieve policy goals for condition and performance of NHS pavements and bridges. Lifecycle cost considerations provide information on the costs of maintaining and improving NHS pavement and bridge assets over time. Financial plan estimates of state and federal funding permit the development of likely future conditions and performance of pavements and bridges on priority NHS routes as well as the overall state system. Risk management analysis highlights and prioritizes factors that positively or negatively impact strategies and outcomes.

The agency operates under the direction of the Oregon Transportation Commission (OTC), which sets strategy and policy for the state transportation system. Together, the OTC and ODOT work closely with the governor and state legislature to ensure efforts to maintain and enhance the system are aligned with the broader needs, priorities and resources of the state

Strategies are supportive of ODOT's Mission and Values and founded on policies, plans and objectives adopted by the OTC. They are presented in ODOT's *Oregon Transportation Plan* and associated modal and topic plans including the *Oregon Highway Plan*, *Strategic Business Plan*, *Strategic Action Plan* and the *OTC Investment Strategy*.

The following summarizes ODOT's investment strategies as it seeks to balance investment between Modernization, Preservation, and Maintenance under a constrained revenue scenario:

- Target more dollars for preservation and maintenance over modernization[4]
- Focus preservation and preventative maintenance activities on key routes and corridors5
- Provide funding to enhance the seismic resilience of pavements and bridges[6]

In April 2018, the OTC adopted a strategic business plan for the agency called *One ODOT: Positioned for the Future*. The OTC and ODOT leadership recognized the need to also develop externally facing priorities, and in response developed the *2021-2023 Strategic Action Plan*.

As a result of the Strategic Action Plan, two significant efforts are to more robustly integrate social equity and climate change mitigation and adaptation considerations into ODOT business and asset management investment strategies. What this looks like, is actively being developed.

[4] 1999 OHP (pg. 7)
[5] 2020 OTC Investment Strategy (pg18) and 1999 OHP (pg. 9)
[6] *2020 OTC Investment Strategy (pg. 23-24)*

Unknown Oregon Highway, Photo taken by ODOT on December 1, 2021

Chapter 1 – Purpose, Background and Scope

1.1 Introduction and Purpose

Introduction

Like many other states, Oregon faces challenges in its ability to build and maintain a transportation system that meets its economic and community needs. These challenges include aging infrastructure, a growing population, increased congestion, state and federal revenue that has remained stagnant while faced with inflation, increased material and labor costs, and growing system demand.

The mission of the Oregon Department of Transportation (ODOT) is to "provide a safe and reliable multimodal transportation system that connects people and helps Oregon's communities and economy thrive." The agency's central goals are to improve safety, move people and goods efficiently, preserve and maintain existing transportation infrastructure, and improve Oregon's livability and economic prosperity. Proactive management of Oregon's transportation assets is central to achieving these outcomes.

The major challenge that the agency faces is accomplishing this mission under a constrained revenue forecast. As revenue available for transportation continues to be outpaced by system demand and the costs of maintaining an aging system, ODOT must identify how to use its resources to accomplish its multiple goals in the most efficient and effective ways possible.

Purpose

The primary purpose of Oregon's Transportation Asset Management Plan (TAMP), is to meet the Moving Ahead for Progress in the 21st Century Act (MAP-21) requirements using the certified process and content according to 23 U.S. Code (U.S.C.) 119 and 23 Code of Federal Regulations (CFR) 515.9. An *Index of Federal Regulations*[7] is provided in the Appendices. Further, the TAMP aims to improve internal and external communication around ODOT's evolving asset management practices.

MAP-21 TAMP Requirements

On July 6, 2012, President Obama signed Public Law (P.L.) 112-141, the MAP-21 Act. With the adoption of MAP-21, all state transportation agencies, including ODOT, must demonstrate the use of asset management principles and strategies and develop a TAMP that incorporates lifecycle costs and risk management.

Provisions of MAP-21 mandate that states develop a risk-based asset management plan which, at a minimum, is in a form that the Secretary of Transportation determines to be appropriate and includes:

1. A listing and condition of pavement and bridge assets on the National Highway System (NHS).
2. Asset management objectives and measures.
3. Identification and analysis of performance gaps between national goals and asset conditions.
4. Lifecycle costs and risk-based management analysis.
5. A financial plan with a minimum forecast period of 10 years.
6. Investment strategies.

If a state fails to satisfy minimum conditions for pavements or bridges on the NHS system, fails to develop an asset management plan, or fails to implement the plan per federal expectations and requirements, the state is subject to several financial consequences. They are:

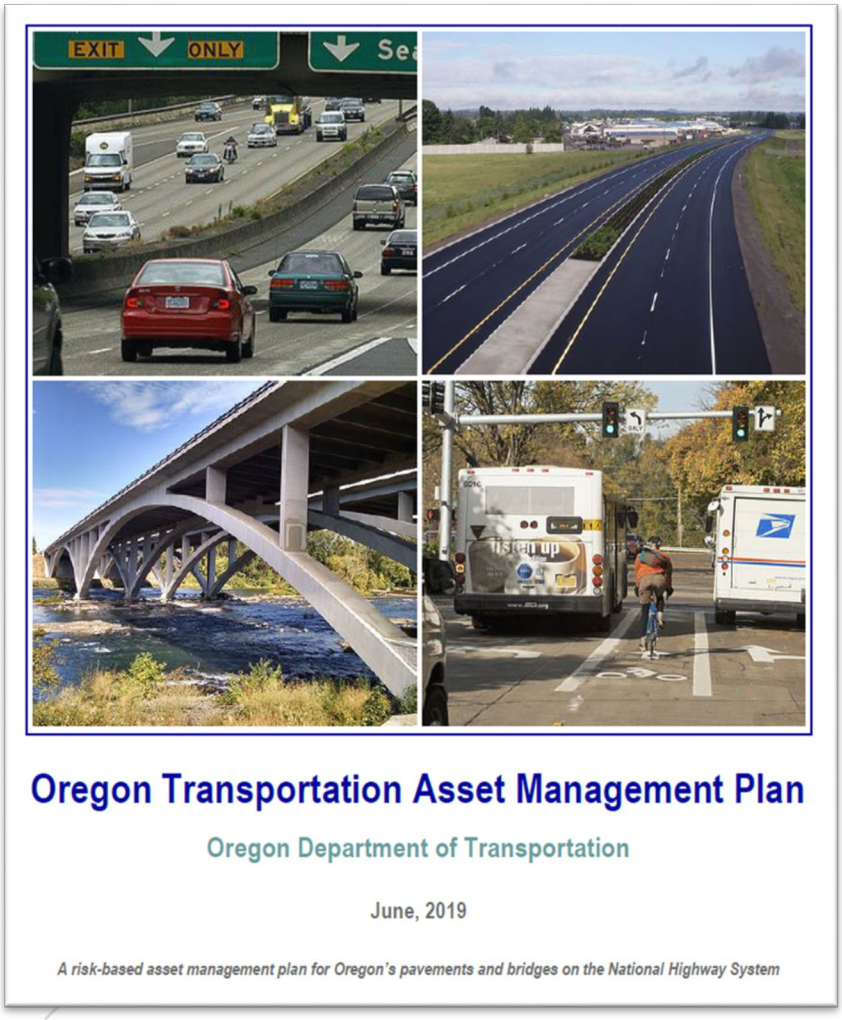
1. The establishment of minimum required annual expenditures in Interstate System pavements and NHS bridges;
2. The loss of the ability to expend annual National Highway Performance Program funds; and
3. A reduction of the federal share provided for transportation projects.

[7] Appendix A – Index of TAMP Content Requirements

1.2 Development Background and Scope

The development of Oregon's first TAMP began during the spring of 2016. The preparation of the TAMP represented a significant step in efforts by ODOT to incorporate the principles of transportation asset management into the agency's business processes and culture.

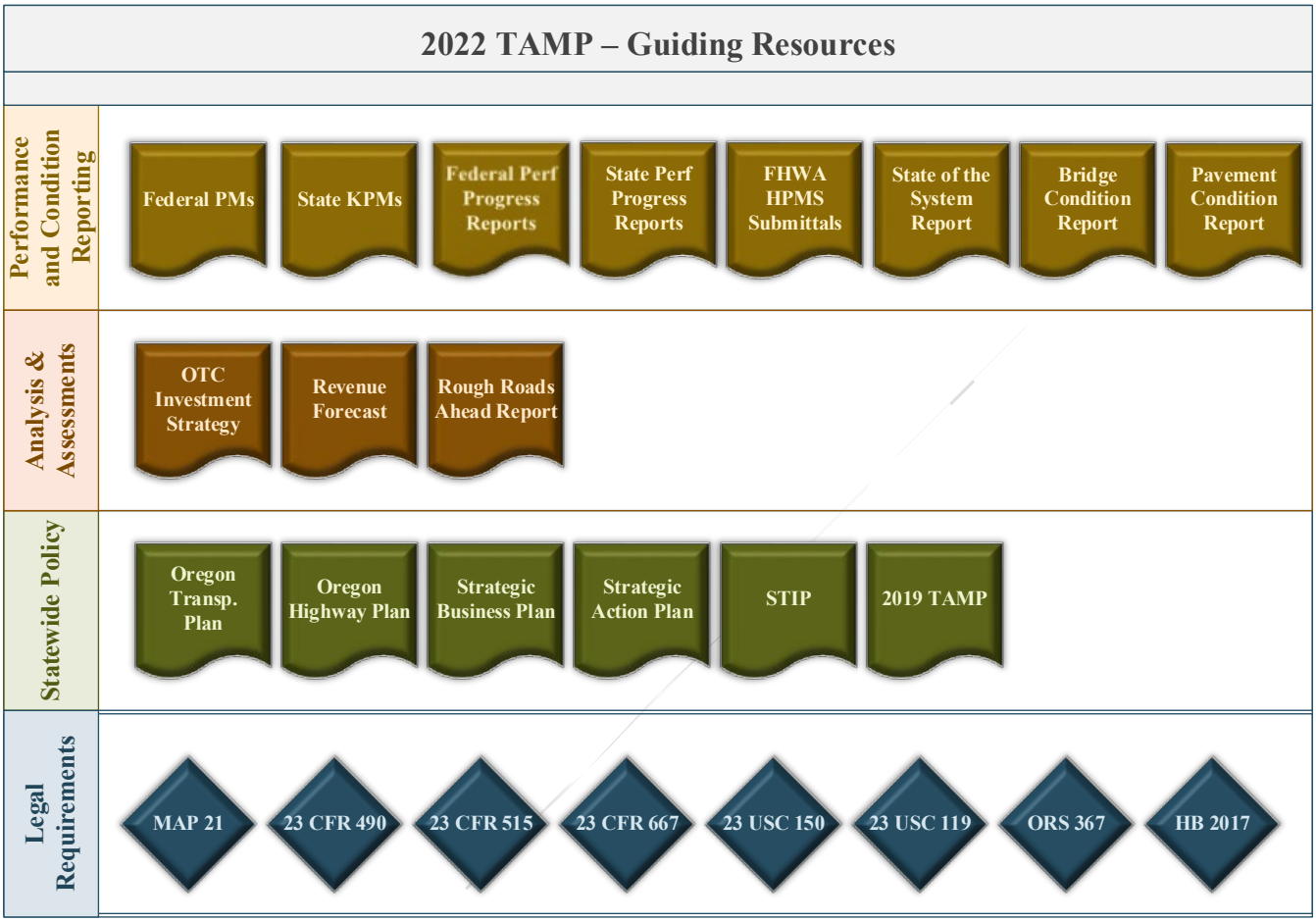
Oregon's TAMP was developed using the required certified processes and required content according to 23 U.S.C. 119 and 23 CFR 515.9. The TAMP was approved by ODOT Director, Matthew Garrett, on June 10, 2019, and the process was certified by the Federal Highway Administration (FHWA) dated June 28th, 2019.



As required by code of federal regulations CFR 23 515.13(b)(2), every year following the certification of the 2019 TAMP, ODOT demonstrated through current and verifiable documentation that ODOT is *"using the investment strategies in its asset management plan to make progress toward achievement of its targets for asset condition and performance of the National Highway System and to support progress toward achievement of national goals identified in 23 U.S.C. 150(b)."*

Guiding Policy, Plans and Documents

Asset management is woven into the fabric of the work that ODOT performs. Development of the TAMP, therefore, draws heavily upon a series of policy plans, project plans, financial plans and condition reports. Below are the major guiding resources for the development of the 2022 TAMP. A complete *Index of TAMP Resources* is provided in Appendix B.



1-1 2022 TAMP Guiding Resources

The Oregon Transportation Plan (OTP A) Strategy 1.1.4 sets the foundation for strategic investment in the state, which is echoed in other statewide mode and topic plans[8]. When planning for transportation investments across the state, policy direction points to first preserving functionality and improving the efficiency of the existing system before adding new capacity (e.g., Oregon Highway Plan Action 1G.1).

2022 TAMP Governance

The **TAMP Council** is the final arbiter for the TAMP governance, strategies and resourcing. The TAMP Council is composed of the agency's Delivery and Operations Division Administrator; Policy, Data and Analysis Division Administrator; Director of Revenue, Finance and Compliance; Statewide Chief Engineer; and the State Maintenance and Operations Engineer. The final responsibility for approval of the Oregon TAMP rests with the ODOT Director.

[8] At the time of developing this TAMP the OTP and OHP are in the process of being updated. ODOT will coordinate with FHWA if the updates to the OTP or OHP result in significant variance from the TAMP.

Under the direction of the TAMP Council, the **2022 TAMP Project Team** and *2022 TAMP Project Charter*[9] were formed. TAMP project team members were selected based on the degree to which the TAMP represents the areas for which they have authority and responsibility or where their portfolio is heavily influenced by or significantly contributes to asset management. The Asset Management Program Manager served as the project manager and architect of the 2022 TAMP.

A **Stakeholder Resources** group was developed by the TAMP Project Team. These individuals serve as members of ODOT's major internal leadership and decision-making groups, ensuring that components of the TAMP are consistent with agency policies and decision making.

TAMP coordination between ODOT, Metropolitan Planning Organizations (**MPOs) and local agencies** has taken place alongside collaborative efforts for meeting bridge and pavement performance measure (PM2) requirements.

Ongoing communications were established between the TAMP Project Manager and the Oregon **FHWA** Branch Office to ensure consistency with FHWA requirements and to keep FHWA informed on key process steps in the development of the TAMP.

2022 TAMP Scope

The 2022 TAMP documents information about Oregon's NHS pavement and bridge assets; their condition, use and performance; the processes by which they are managed; and the results of alternative management practices and investment decisions. While it is focused primarily on Oregon's bridge and pavement assets that are part of the NHS, some components of the TAMP, including investment plans, investment priorities and asset management improvement strategies, look beyond NHS pavements and bridges.

The 2022 TAMP Project Team recommended that the 2022 TAMP be limited to pavement and bridge assets on the NHS, based on the management capacity and maturity level reached in managing these assets[10]. The *2016 Asset Management Gap Analysis*[11] identified that bridge and pavement assets have a high asset management maturity level, with a high level of data reliability and quality which undergoes frequent updates by trained technical staff. This data maturity was found to be sufficient to support lifecycle cost analysis, proactive program management and advanced modeling. While statewide programs are in place to provide project-level decision making for other Tier 1 Assets (tunnels, culverts, traffic signals and ADA ramps), these assets do not yet enjoy the same maturity level as pavement and bridge systems.

ODOT determined that it would be most appropriate to limit the 2022 TAMP to bridge and pavement assets on the NHS, pursuant to 23 CFR 515.9. Further consideration of the TAMP scope could be appropriate in future TAMP updates.

2022 TAMP Scope: Pavement & Bridges on the NHS

[9] Appendix C: 2022 TAMP Project Charter (ODOT, 2021)
[10] Appendix D: 2022 TAMP Scope Recommendation Memo (ODOT, 2021)
[11] Appendix E: 2016 Asset Management GAP Analysis (FHWA,2016)

Portland over the Willamette River. ODOT photo

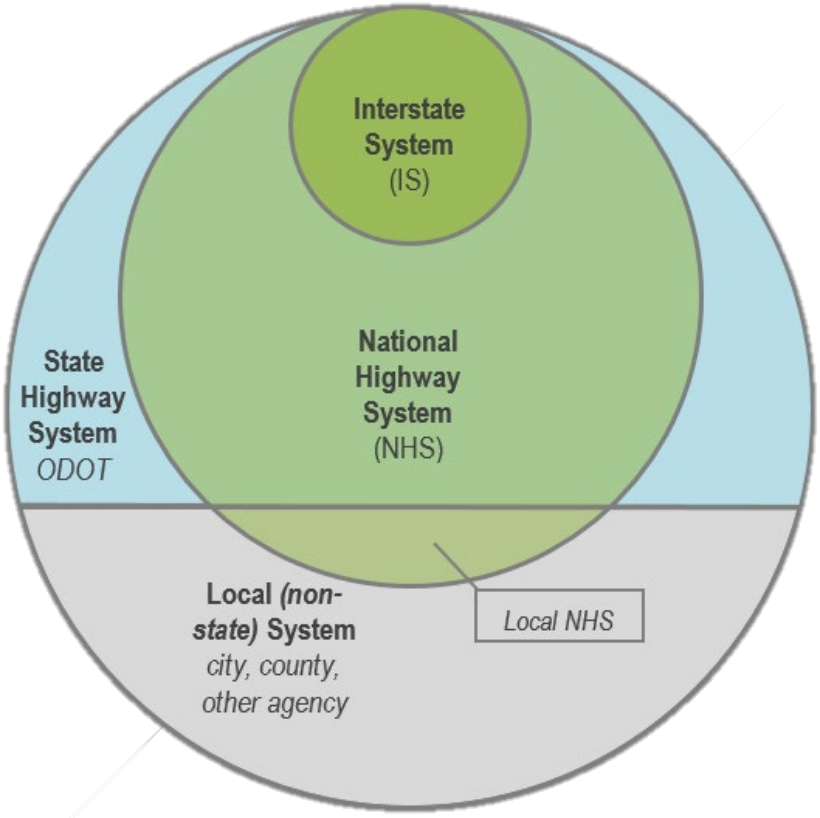
Chapter 2 – Pavement and Bridge Data

2.1 Use of Best Available Data

This 2022 TAMP was developed using the best available data and bridge and pavement management systems that meet the requirements of 23 CFR 515.17. A summary documenting existing procedures for the agency's bridge and pavement data management system is provided in the Appendices[12]. ODOT utilized 2021 pavement and bridge inventory, condition and performance baseline data as this was the most recent complete dataset for Oregon's State Highway System (SHS) and the NHS at the time of writing this plan.

2.2 Ownership of Oregon's NHS

The NHS includes the Interstate Highway System as well as other roads important to the nation's economy, defense and mobility. The NHS was developed by the U.S. Department of Transportation in cooperation with states, local officials and MPOs.



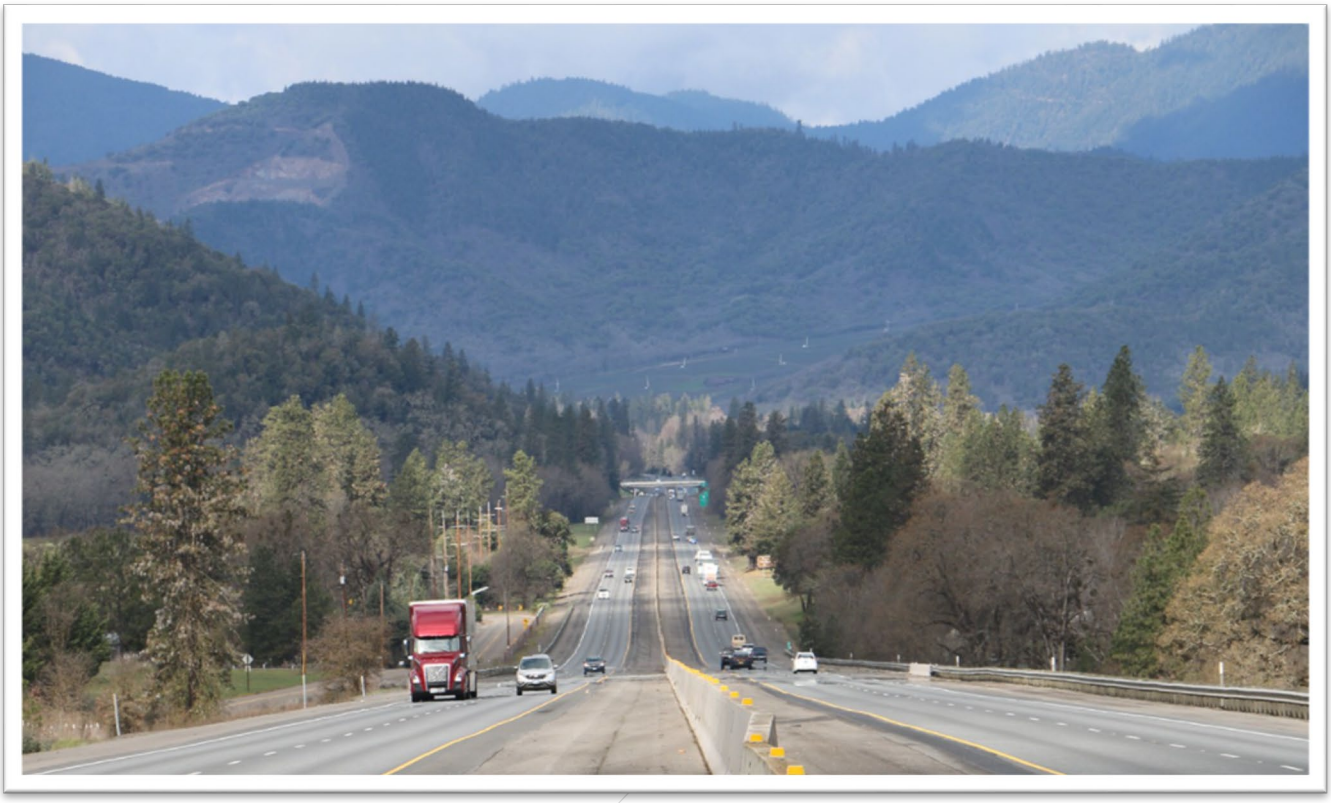
2-1 Highway System Ownership (not to scale)

The subsections below summarize the ownership and jurisdiction of NHS pavement and bridge assets that are included in the TAMP, as well as ODOT non-NHS pavement and bridge assets that are used for Oregon's Key Performance Measures (KPMs).

[12] Appendix F - Bridge and Pavement Program Minimum Standards Compliance with 23 CFR §515.17

Pavement Ownership

Oregon has 78,991 public road centerline miles, of which 7,603 are on the SHS and 4,319 are on the NHS. ODOT owns and maintains 4,048 centerline miles on the NHS. The remaining 271 centerline miles are maintained by local agencies.[13]



2-2 Interstate 5, near Gold Hill, Oregon

Total Oregon Public Roads
78,991 centerline miles

SHS Pavement
7,603 centerline miles

NHS Pavement
4,319 centerline miles

NHS Pavement Maintained by ODOT: 4,048 centerline miles

NHS Pavement Maintained by Local Agencies: 271 centerline miles

[13] Pavement inventory dataset is concurrent with ODOT's 2021 submittal to FHWA

Bridge Ownership

Oregon has 6,985 National Bridge Inventory (NBI) public bridges, of which 2,759 are on the SHS, and 1,848 are on the NHS. **ODOT owns and maintains 1,762 bridges on the NHS**, totaling an area of 2,659,663 square meters. The remaining 86 bridges on the NHS are maintained by local agencies.[14]

2-3 The Dalles Bridge, The Dalles, Oregon

Total Oregon NBI Public Bridges	SHS Bridges	NHS Bridges
6,985; 4,881,374 sq. meters	2759; 3,418,100 sq. meters	1848; 2,829,728 sq. meters

NHS Bridges Maintained by ODOT: 1,762; 2,659,663 sq. meters

NHS Bridges Maintained by Local Agencies: 86; 170,066 sq. meters

[14] Bridge inventory dataset is concurrent with ODOT's 2021 submittal to FHWA

Local Ownership

Local ownership of the NHS in Oregon totals **271 centerline miles of pavement and 80 bridges**.

2-4 Bridge of the Gods, Cascade Lock, Oregon –Port of Cascade Locks owned and maintained

City	Centerline Miles	# Bridges
Ashland	2.00	-
Astoria	0.35	-
Beaverton	1.60	-
Bend	10.54	4
Boardman	1.26	-
Central Point	1.96	-
Coos Bay	4.88	-
Eugene	23.79	8
Grants Pass	1.59	-
Gresham	22.24	-
Keizer	3.23	-
Lake Oswego	6.32	-
McMinnville	2.01	-
Medford	7.68	-
North Bend	0.38	-
Ontario	2.66	-
Phoenix	1.22	-
Portland	67.77	27
Redmond	3.28	-
Roseburg	6.16	1
Salem	28.37	9
Silverton	0.32	-
Springfield	0.93	-
City Total	**200.54**	**49**

County	Centerline Miles	# Bridges
Clackamas	0.21	-
Coos	2.3	1
Douglas	2.54	-
Jackson	3.71	2
Lane	2.87	-
Marion	28.31	4
Multnomah	6.9	10
Washington	19.23	6
County Total	**66.07**	**23**

Other Local Agencies	Centerline Miles	# Bridges
TriMet		4
Port of Hood River	0.53	1
Port of Morrow	1.24	2
Port of Portland	2.52	-
Port of Cascade Locks	0.4	1
Other Total	**4.69**	**8**

2-5 Local Ownership of NHS Pavement and Bridges

2.3 Pavement Data Management

Pavement Data Collection

All NHS pavement asset data (including locally-owned NHS pavement) is collected by a single data collection vendor, under contract with ODOT, to ensure that the data obtained is consistent, accurate and reliable. The vendor is required to collect data in accordance with the *ODOT Pavement Data Collection Manual*, the *HPMS Field Manual*, and applicable American Association of State Highway and Transportation Officials (AASHTO) standards. It is also subjected to quality control/ assurance procedures in accordance with ODOT's *Data Quality Management Plan for Pavement Condition*.

The pavement condition survey for the NHS typically begins in late May and concludes in September. **Interstate conditions are collected annually and the remaining systems are collected every two years.**

The data collection vehicle used for the Oregon project is equipped with an inertial profiler to collect smoothness data, e.g., International Roughness Index (IRI) and a Pave 3D scan laser subsystem to collect both rut depth and pavement cracking information. Pave 3D collects 4,160 data points transversely to measure rut depth, and can identify hairline cracks of widths 0.08 inch and greater.

2-6 Pavement Data Collection Vehicle used for Automated Distress Survey

Both "add" and "non-add" directions are collected on the Interstate system. For highways off the Interstate system, the collection is generally conducted in the "add" mile point direction only. Distress data are collected from a designated lane (generally the outside or rightmost through lane) at 100% sampling, and distress quantities are summarized in 0.1 mile segments.

Data elements relating to the highway ownership and classification are updated by ODOT Policy, Data and Analysis Division staff per standard operating procedures for Oregon's entire NHS, including the local system.

Quality control and assurance activities are integrated throughout the data collection process to ensure the collected data meets acceptance standards. Although these activities have been performed for many years, they are now formally documented in ODOT's *Data Quality Management Plan for Pavement Condition*. The data quality plan defines the acceptable level of data quality and describes how the data collection process will ensure this level of quality in its deliverables and processes. It describes the quality control activities to monitor data quality and resolve errors as they arise, and acceptance criteria to verify data collection deliverables meet defined quality standards.

Pavement Data Storage

Corporate road inventory for Oregon's NHS is stored in ODOT's Transinfo database. This includes National Performance Measures related Highway Performance Monitoring System (HPMS) data. An additional copy of all pavement data is archived and stored in ODOT's Pavement Management database.

Pavement Rating Methods

The **Pavement Management Team** employs two separate and distinct pavement rating procedures to gather condition data – the Automated Distress Survey procedure and the Good-Fair-Poor (GFP) rating procedure. The Automated Distress Survey procedure provides important information that can be used to determine specific pavement problems and deficiencies. However, the data collection required by this procedure is costly and time and labor intensive. To achieve the best balance of cost to value of the data, this procedure is used to rate Oregon's Interstate, NHS highways and selected higher-volume non-NHS highways. The remaining SHS routes are rated using windshield methods per the *GFP Pavement Condition Rating Manual*. From each rating procedure, a condition score is determined ranging from 0 to 100 which relates to pavement condition as shown in figure 2-7. While the Automated Distress Survey data is used for both National and State KPMs, the GFP rating procedure is utilized for the State KPMs only.

National Performance Measures - Pavement Rating Methods

The National Pavement Performance Measures assess pavement conditions on the Interstate and NHS. The scope of roadway jurisdiction differs from the State KPMs for pavement condition because local jurisdiction NHS roads are only included in the national measure and non-NHS state highways are only included in the State KPMs. The National Pavement Performance Measures assess four distinct measures: the **percentage of pavement rated '*Good*' and '*Poor*' condition for both Interstate and non-interstate NHS.** Metrics for determining whether pavements are good, fair or poor utilize a combination of International Roughness Index (IRI), rutting, faulting and cracking percent measurements as shown in figure 2-7 below.

Rating	Good	Fair	Poor
IRI *(inches/mile)*	<95	***95-170***	***>170***
PSR* *(0.0-5.0 value)*	≥4.0	2.0-4.0	≤2.0
Cracking Percent *(%)*	<5	***CRCP: 5-10 Jointed: 5-15 Asphalt: 5-20***	***>10 >15 >20***
Rutting *(inches)*	<0.20	0.20-0.40	>0.40
Faulting *(inches)*	***<0.10***	0.10-0.15	>0.15

2-7 Metric Thresholds used for National Pavement Performance Measures

The resulting good, fair and poor condition ratings are based on a summation of these measures by pavement type as shown in figure 2-8 below.

	Pavement Type		
	Asphalt and Jointed Concrete	Continuous Concrete	
Overall Section Condition Rating	3 metric ratings (IRI, cracking and rutting/faulting)	2 metric ratings (IRI and cracking)	Measures
Good	All three metrics rated "Good"	Both metrics rated "Good"	→ percentage of lane-miles in "Good" condition
Poor	≥ 2 metrics rated "Poor"	Both metrics rated "Poor"	→ percentage of lane-miles in "Poor" condition
Fair	All other combinations	All other combinations	

2-8 Determining Pavement Condition from Metrics for National Pavement Performance Measures

State Key Performance Measures - Pavement Rating Methods

ODOT reports pavement conditions on the SHS based on the legislatively-approved KPMs of the **percent of pavement miles rated '*Fair' or better***. The State KPM roadway jurisdiction includes Interstate, NHS and non-NHS state highways. Information from the pavement data collection efforts are used to determine an overall condition score ranging from 0 to 100 which relates to pavement condition as shown in figure 2-9. Calculation procedures for determining the index values are described in the *2020 Pavement Condition Report*. Example images of pavements at various condition levels are shown in figure 2-10.

Condition Score	Pavement Condition
96 – 100	Very Good (VG)
76 – 95	Good (GD)
46 – 75	Fair (FR)
21 – 45	Poor (PR)
0 – 20	Very Poor (VP)

Fair-or-Better (FOB) Line

2-9 Relationship between Pavement Score and Condition Rating

2-10 Examples of Pavement Condition Levels – Good through Very Poor

2.4 Bridge Data Management

Bridge Data Collection

ODOT follows the *National Bridge Inspection Standards (NBIS)*[15] for inspection procedures, frequency of inspections, qualifications of personnel, inspection reports and preparation and maintenance of a State Bridge Inventory.

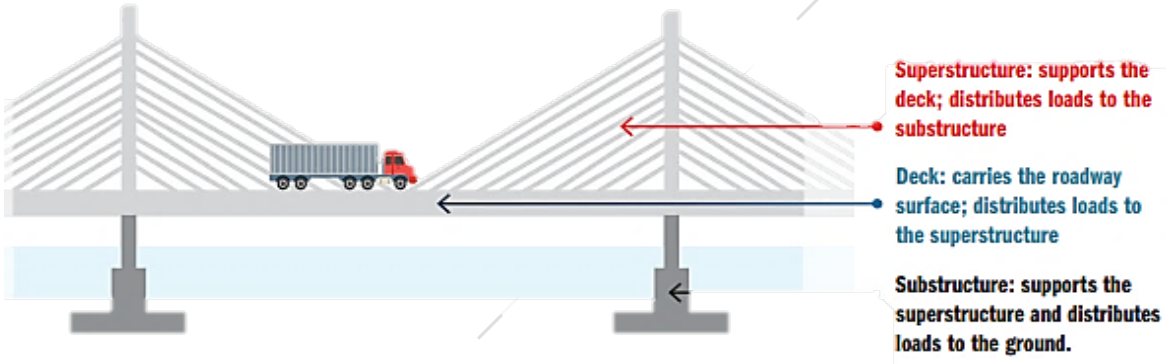
ODOT manages a Statewide Bridge Inspection Program that includes both routine and specialized inspections of all publicly-owned highway bridges (including local NHS) longer than twenty feet located on public roads. **Bridges on the state and local systems are inspected at regular intervals, typically every two years.** Inspection data is collected by certified bridge inspectors employed by ODOT, as well as by consultants. Guidance for bridge inspections and monitoring is provided in ODOT's *Bridge Inspection Coding Guide*, *ODOT Bridge Inspection Program Manual* and FHWA's *Bridge Inspector's Reference Manual*.

Bridge Data Storage

Bridge data is stored in the AASHTOWare Bridge Management software (BrM). A compilation of this data is reported annually to the FHWA.

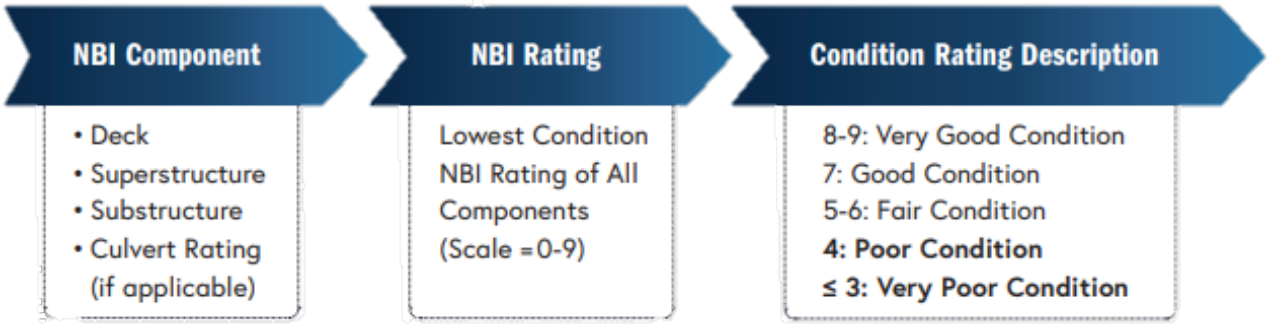
Bridge Rating Methods

Bridge conditions are categorized by evaluating bridge components (deck, superstructure and substructure).



2-11 Bridge Components

The NBI ratings provide simple tools for agencies to describe the overall conditions of their bridge populations and the overall effectiveness of their bridge programs. The critical rating is when a highway bridge is classified as "Structurally Deficient".



2-12 Bridge Condition Rating Descriptions

[15] Code of Federal Regulations 23 CFR Part 650
https://www.govinfo.gov/content/pkg/CFR-2009-title23-vol1/pdf/CFR-2009-title23-vol1-part650.pdf

Beginning in 2018, a bridge is classified as structurally deficient only if any component (deck, superstructure or substructure) has an NBI rating of 4 or less. Prior to 2018 a bridges load capacity and the existence of hydraulic openings below the bridge could influence the structurally deficient classification of a bridge as well.

National Performance Measures – Bridge Rating Methods

National bridge performance measures assesses the **percent of bridges on the NHS in '*Good*' and '*Poor*' condition**. The condition rating for an individual bridge is determined by the lowest rating of deck, superstructure and substructure. If the lowest rating is greater than or equal to 7, the bridge is classified as "Good"; if less than or equal to 4, the classification is "Poor". Bridges that are rated below 7 but above 4 are classified as "Fair".

Example: *Condition classification is based on the lowest-rated feature. If the deck and substructure are both rated Good, but the superstructure is rated Fair, then the overall condition rating would be considered Fair*

NBI Rating:	Deck	Superstructure	Substructure	
≥7	Good	Good	Good	**Overall Condition Rating: Fair**
>4, <7	Fair	Fair	Fair	
≤4	Poor	Poor	Poor	

2-13 Bridge Rating Method Example

State Key Performance Measures – Bridge Rating Methods

ODOT measures bridge conditions based on the Legislatively-Approved Key Performance Measure of the **percent of bridges on the SHS '*Not Distressed*'**. Bridges that are considered *Distressed* under this performance measure fall into one of two categories:

1. Bridges that are *Structurally Deficient* (as defined by FHWA in 2018)[16]
2. Bridges that have *Other Deficiencies* (as defined by ODOT)

The following chart identifies characteristics of bridges considered distressed under these two categories:

ODOT Categories of Distressed Bridges			
Structurally Deficient (FHWA)	**Other Deficiencies (ODOT)**		
Condition Deteriorated condition of deck, substructure or superstructure	**Freight Mobility** Load capacity, vertical clearance	**Bridge Safety** Scour and rail deficiencies	**Serviceability** Painting, cathodic protection, movable bridge repairs, low service life

2-14 ODOT Categories of Distressed Bridges

More information on State KPMs is provided in *Chapter 3 – Goals, Performance, Measures and Targets*.

[16] https://www.fhwa.dot.gov/bridge/britab.cfm

2.5 Obtaining Data from other NHS Owners

In collaboration with MPOs, ODOT developed the *ODOT Coordination Process with MPOs in Setting, Monitoring, and Reporting State Performance Measure Targets.*[17] Section 3 (p.4-7) documents the process for monitoring and reporting on asset condition data as reflected below.

1. ODOT's Performance Measure Coordinator will be responsible for ensuring coordination of the State's submission of all federally-required performance measure reports to FHWA and Federal Transit Administration (FTA). Additionally, MPOs must report their performance to ODOT as required by Federal Rules listed below.

2. Subject to FHWA and FTA defining the specific reporting process, ODOT program Subject Matter Experts (SME) (described in Section I) are responsible for providing the required reporting information to the ODOT Performance Measure Coordinator for the statewide performance measures and targets.

3. Where ODOT has agreed with the MPO (in Section II) to calculate the current performance measure results from the statewide and federal data systems, the ODOT Performance Measure Owners /SMEs will complete the appropriate analysis and provide the results to the MPO and the ODOT Performance Measure Coordinator in a timely manner for compliance with federal reporting requirements.

4. The MPO will be responsible for documenting any other federally required Performance Measure reporting information including relationship to the MPO Performance-Based Planning and Programming process.

5. ODOT will be responsible for ensuring all federally required performance measure reporting elements are completed for the statewide report, including any relationship to the State Performance-Based Planning and Programming process.

6. Based upon the reporting information, any adjustment to a federal performance measure target at either the State or MPO level will follow the appropriate section of this process paper.

MPO reporting requirements are established in 23 CFR 490.107.

[17] July 2020 (Rev.4)

I-5 as it runs through the Willamette Valley

Chapter 3 – Goals, Performance Measures and Targets

3.1 Oregon History on Performance Measures

ODOT's progress on performance measures began in the late 1980s as an agency effort to identify which programs or working groups were efficiently using resources and doing the highest quality work. A key element of the effort involved training staff in the development and use of performance measurements. At the same time, a series of benchmarks aimed at tracking progress toward a set of initiatives for enhancing health, livability and prosperity were developed. Together, these initiatives led to the establishment of KPMs for many transportation assets.

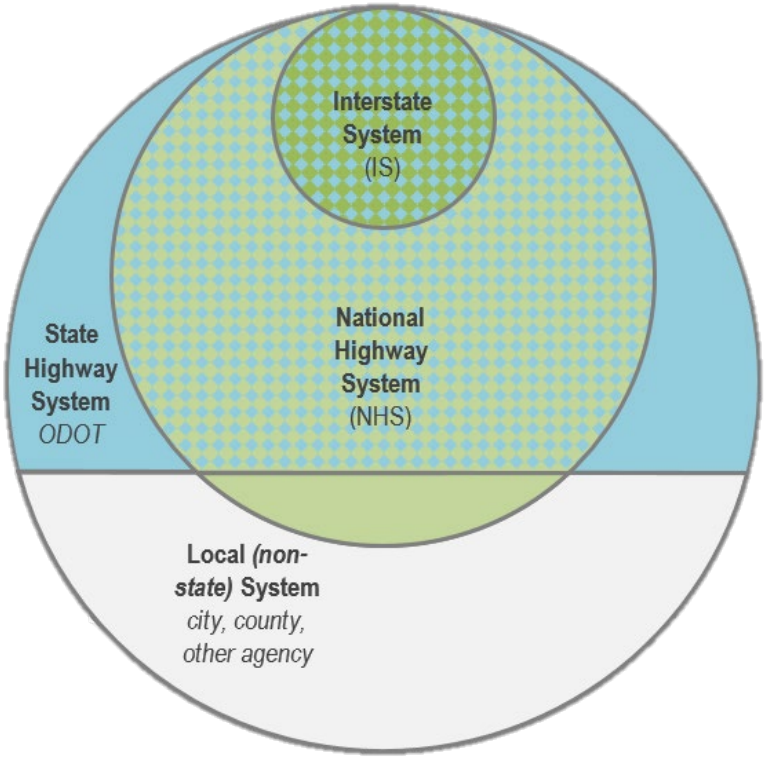
In 1991, the Oregon Progress Board established a series of benchmarks aimed at measuring the state's performance related to the economy, education, civic engagement, social support, public safety, community development and the environment. The board's report to the Oregon State Legislature included benchmarks aimed at tracking transportation performance, including the "…backlog of city, county, and state roads and bridges in need of repair and preservation" and the "…percentage of Oregonians who commute to work during peak hours by means other than a single occupancy vehicle." In 1993, the Oregon State Legislature established an ongoing requirement for state agencies to develop performance measures and to connect these to the benchmarks established by the Oregon Progress Board.

In 2003, the state legislature took the additional step of requiring state agencies to submit agency performance measures as part of the formal budget process for legislative review and approval and to prepare an Annual Performance Report. In 2005, the legislature added the requirement that performance measures be linked to specific agency organizational units and that they include performance targets. The *Annual Performance Progress Report* summarizes the agency's performance for the preceding year.

In 2012, the *"Moving Ahead for Progress in the 21st Century Act" or the "MAP–21"* was enacted. In accordance with provisions of MAP-21, states are required to establish a performance- and outcome-based transportation program. The objective of this effort is for states to invest resources in projects that will make progress toward achieving the *FHWA Performance Management Areas, Measures and Targets for Oregon DOT*. In satisfying the requirements of 23 CFR 515.9(d)(2), states are required to demonstrate progress toward achieving targets for the condition and performance of pavements and bridges, and support progress toward achievement of the seven national transportation goals identified in 23 CFR 150(b).

National and State Goal Alignment

The State Highway System (SHS) contains the entire Interstate System, and nearly the entirety of the National Highway System (NHS). Local agencies own a small portion of the NHS, but do not own any of the SHS.



3-1 Scope of Highway System Performance Measures (not to scale)

To address the challenge of overlapping state and federal performance measures and targets and how they impact agency decision making, ODOT's policy is to continue to emphasize the central role of state performance measures established by the *Oregon Transportation Plan*. ODOT's process for selecting investments is aimed at achieving a more complex set of performance measures to create a balanced program across many competing needs rather than solely meeting the limited scope of the federal performance measures pertaining to asset condition. While state and federal performance measures cannot be directly compared, continued focus on, and prioritization of, state performance measures is anticipated to have the practical effect of meeting the federal performance measures and targets for NHS bridges and pavements due to creating similar trends.

Additionally, state KPMs are distinct from federal Performance Measures (PM2s) in how assets are measured. For example, state KPMs measure pavement by centerline miles, and bridges by bridge count. By contrast, PM2s measure pavement by lane miles, and bridges by deck area.

For a demonstration of how Oregon's goals align with national goals outlined in MAP-21, *see Figure 3-2: State and National Goals and Performance Measures.*

Oregon Transportation Plan Goals	Oregon Key Performance Measures[18]	National Goals — 23 USC 150(b)	National Performance Measures
Goal 1 — Mobility and Accessibility Provide a balanced, efficient and integrated transportation system that ensures interconnected access to all areas of the state, the nation and the world. Promote transportation choices that are reliable, accessible and cost-effective.	Average number of transit rides per each senior and disabled Oregonian annually	**System Reliability** Improve the efficiency of the surface transportation system. **Congestion Reduction** Achieve a significant reduction in congestion on the National Highway System.	Percent of reliable person-miles traveled on the Interstate System
	Number of state-supported rail service passengers		Percent of reliable person-miles traveled on the non-Interstate NHS
	Percent of lane blocking crashes cleared within 90 minutes		Annual hours of peak hour excessive delay per capita
			Percent of non-single occupancy vehicle travel (including travel avoided by telecommuting)
Goal 2 – Management of the System Improve the efficiency of the transportation system by optimizing operations and management. Manage transportation assets to extend their life and reduce maintenance costs.	**Percent of pavement miles rated *fair-or-better* out of total miles on ODOT system**	**Infrastructure Condition** Maintain the highway infrastructure asset system in a state of good repair.	Percent of pavement on the Interstate System in Good condition
	Percent of State highway bridges that are not distressed		Percent of pavement on the Interstate System in Poor condition
	Percent of public transit buses that meet replacement standards		Percent of pavement on the non-Interstate NHS in Good condition
			Percent of pavement on the non-Interstate NHS in Poor condition
			Percent of NHS Bridges classified as in Good condition
			Percent of NHS Bridges classified as in Poor condition
Goal 3 – Economic Vitality Expand and diversify Oregon's economy by transporting people, goods, services and information in safe, energy-efficient and environmentally sound ways. Provide Oregon with a competitive advantage by promoting an integrated freight system.	Percent of ODOT awarded contracts to Oregon Certified Firms (Small Businesses)	**Freight Movement and Economic Vitality** Improve the national freight network, strengthen the ability of rural communities to access national and international trade markets, and support regional economic development.	Percent of Interstate System Mileage providing for Reliable Truck Travel Times
	Percent of state administered projects that have satisfactorily completed all on-site work within 90 days of the baselined last contract completion date		

[18] *The listed state Key Performance Measures are current as of 2021. These measures are subject to possible modifications, additions, and deletions for 2022. However, no changes pertaining to pavement and bridge condition measures are anticipated at this time.*

Oregon Transportation Plan Goals	Oregon Key Performance Measures	National Goals — 23 USC 150(b)	National Performance Measures
Goal 4 – Sustainability Meet present needs without compromising the ability of future generations to meet their needs from the joint perspective of the environment, economy and communities. Encourage conservation and communities that integrate land use and transportation choices.	Percent of urban state highway miles with bike lanes and pedestrian facilities in fair-or-better condition	**Environmental Sustainability** Enhance performance of transportation system while protecting and enhancing the natural environment.	Total emissions reductions for applicable criterial pollutants
Goal 5 – Safety and Security Build, operate and maintain the transportation system so that it is safe and secure. Take into account the needs of all users: operators, passengers, pedestrians and property owners.	Traffic fatalities per 100 million vehicles miles traveled (VMT)	**Safety** Achieve a significant reduction in traffic fatalities and serious injuries on all public roads.	Number of Fatalities
	Serious traffic injuries per 100 million vehicle miles traveled (VMT)		Number of Serious Injuries
	Number of large truck at-fault crashes per million vehicle miles traveled (VMT)		Rate of Fatalities per 100 million VMT
	Number of train derailments caused by human error, track, or equipment		Rate of Serious Injuries per 100 million VMT
			Number of non-motorized fatalities and non-motorized serious injuries
Goal 6 – Funding the Transportation System Create sources of revenue that will support a viable transportation system today and in the future. Expand ways to fund the system that are fair and fiscally responsible.	Percent of projects for which total construction expenditures are within 10 percent of its baselined construction authorization	**Reduced Project Delivery Delays** Reduce project costs, promote jobs and the economy, and expedite the movement of people and goods by accelerating project completion through eliminating delays in the project development and delivery process, including reducing regulatory burdens and improving agencies' work practices.	
Goal 7 – Coordination, Communication and Cooperation Foster coordination, communication and cooperation between transportation users and providers so various means of transportation function as an integrated system. Work to help all parties align interests, remove barriers and offer innovative, equitable solutions.	Percent of customers rating their satisfaction with agency's customer service as "good" or "excellent"		
	Percent of DMV field office customers served within 20 minutes		

3-2 State and National Goals and Performance Measures

3.2 National Performance Measures, Conditions and Targets

The information below is for the condition of pavements and bridges as it relates to national performance measures and targets reported in the *2020 Mid Performance Period Progress Report*. The 2022 Biennial Performance Period Progress Report will be submitted to FHWA in October of 2022. All 2-year (2020) national performance targets for pavement and bridges on the NHS were exceeded.

NHS Pavement – National Measures

64.4% of pavements on the Interstate System were classified in 'Good' condition; 0.2% were classified in 'Poor' condition. 65.9% of pavements on the *non*-Interstate NHS were classified in 'Good' condition; 6.6% were classified in 'Poor' condition exceeding both mid-performance 2-year targets.

NHS Pavement National Performance Measure	Baseline	2-Year Condition/ Performance	2-Year Target (2020)	4-Year Target (2022)
Percentage of pavements of **Interstate System in Good condition**	-	**64.4%**	-	35%
Percentage of pavements of **Interstate System in Poor condition**	-	**0.2%**	-	0.5%
Percentage of pavements of **non-Interstate NHS in Good condition**	63.9%	**65.9%**	50%	50%
Percentage of pavements of **non-Interstate NHS in Poor condition**	6.6%	**6.6%**	10%	10%

3-3 NHS Pavement Performance Measures, Conditions and Targets

NHS Bridges – National Measures

13.2% of bridges on the NHS were classified in 'Good' condition; 1.9% were classified in 'Poor' condition, exceeding both mid-performance 2-year targets.

NHS Bridge National Performance Measure	Baseline	2-Year Condition/ Performance	2-Year Target (2020)	4-Year Target (2022)
Percentage of NHS Bridges Classified as **in Good Condition**	12.4%	**13.2%**	11.4%	10.0%
Percentage of NHS Bridges Classified as **in Poor Condition**	1.9%	**1.9%**	2.4%	3.0%

3-4 NHS Bridge Performance Measures, Conditions and Targets

3.3 State Performance Measures, Conditions and Targets

The TAMP emphasizes the central role of the State's Key Performance Measures (KPMs) in shaping investment decisions for bridge and pavement assets. The TAMP communicates that the ODOT process for selecting investments is aimed at achieving a more complex set of performance measures intended to result in a balanced program across many competing needs rather than solely meeting the limited scope of condition-based performance measures on the NHS system.

The national goals and performance measures established by FHWA are in many ways consistent with Oregon's KPMs. Two of the thirteen KPMs that the Oregon State Legislature established are also for the condition of pavement and bridge, but include assets on the entire SHS.

Both state performance targets for pavement and bridges on the SHS were exceeded or met.

Legislatively Approved KPM	2020 Condition	2021 Condition	2021 - 2023 Target
Pavement Condition - Percent of pavement lane miles rated "fair" or better out of total centerline miles in the State Highway System	89%	89%	85%
Bridge Condition - Percent of state highway bridges that are not "distressed"	78%	78%	78%

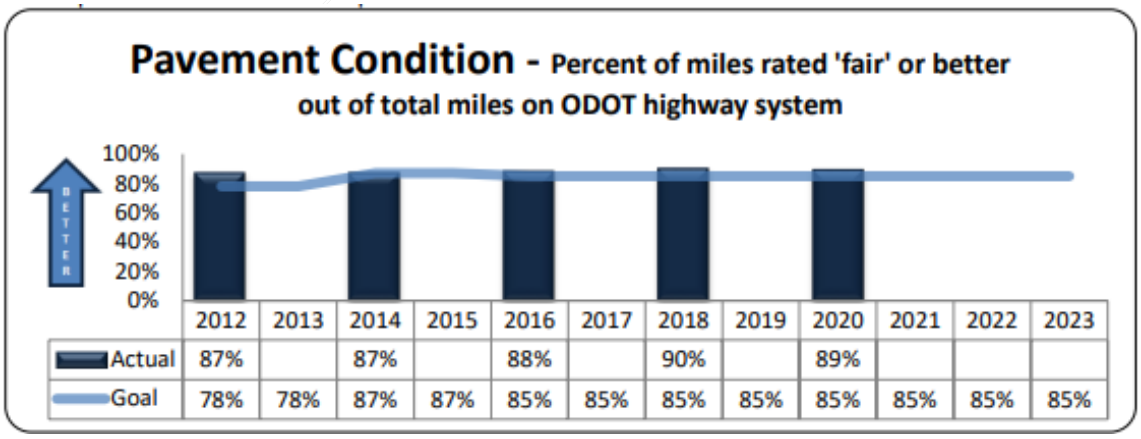
3-5 Oregon Pavement and Bridge Measures, Conditions and Targets

Pavement and bridge condition KPMs reflect the *Oregon Transportation Plan* goal of "Management of the System." Oregon's *Legislatively Approved 2021-2023 Key Performance Measures* is made available to the public at www.oregon.gov/odot/performMang.

Management of the System – "Improve the efficiency of the transportation system by optimizing operations and management. Manage transportation assets to extend their life and reduce maintenance."

Pavement Conditions on SHS – State Measures

89% of pavement on the SHS was in a fair-or-better condition as of 2020, down 1% from 2018, though still exceeding the state goal of 85%.

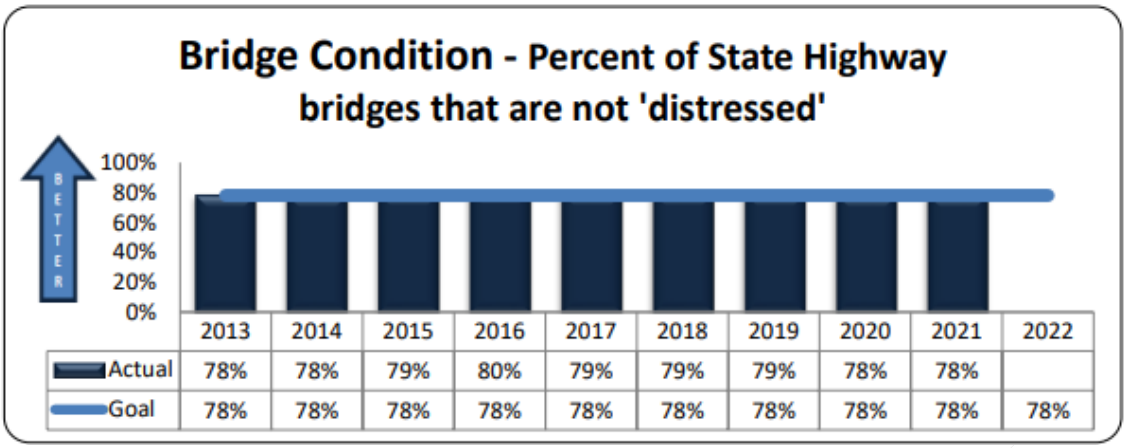


3-6 SHS Pavement Conditions – 'Fair' or Better (Pavement Condition One Pager, 2022)[19]

[19] *Pavement Condition One pager*

Bridge Conditions on SHS – State Measures

78% of bridges on the SHS are not 'distressed' as of 2021, down 1% from 2019, though still meeting the state goal of 78%.



	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Actual	78%	78%	79%	80%	79%	79%	79%	78%	78%	
Goal	78%	78%	78%	78%	78%	78%	78%	78%	78%	78%

3-7 SHS Bridge Conditions – % Not Distressed (Bridge Condition One Pager, 2022)[20]

3.4 Local Performance Measures and Targets

Statewide targets pertaining to the condition and performance of the NHS were developed in collaboration between ODOT and Oregon's MPOs. The process by which ODOT established these statewide targets in coordination with MPOs is outlined in the *Performance Measure Target Setting Process*.

In addition to statewide targets set by ODOT, MAP-21 legislation provides MPOs with the ability to either adopt the statewide performance measure target or establish a specific target for any federally-required performance measure. In developing an MPO performance measure target, the MPO must coordinate with ODOT to ensure consistency to the maximum extent practical.

MPOs set performance targets based on the legislatively-approved KPMs. All MPOs, with the exception of Portland Metro, adopted the statewide targets set by ODOT.

	2020 Pavement Targets		2022 Pavement Targets		2020 Bridge Targets		2022 Bridge Targets	
	Poor	Good	Poor	Good	Poor	Good	Poor	Good
Statewide Targets	**10.0%**	**50.0%**	**10.0%**	**50.0%**	**2.4%**	**11.4%**	**3.0%**	**10.0%**
MPO Targets								
Albany	10.0%	50.0%	10.0%	50.0%	2.4%	11.4%	3.0%	10.0%
Bend	10.0%	50.0%	10.0%	50.0%	2.4%	11.4%	3.0%	10.0%
Central Lane	10.0%	50.0%	10.0%	50.0%	2.4%	11.4%	3.0%	10.0%
Corvallis	10.0%	50.0%	10.0%	50.0%	2.4%	11.4%	3.0%	10.0%
Portland Metro	**25.0%**	**32.0%**	**25.0%**	**32.0%**	**1.0%**	**5.0%**	**1.0%**	**5.0%**
Middle Rogue	10.0%	50.0%	10.0%	50.0%	2.4%	11.4%	3.0%	10.0%
Rogue Valley	10.0%	50.0%	10.0%	50.0%	2.4%	11.4%	3.0%	10.0%
Salem/Keizer	10.0%	50.0%	10.0%	50.0%	2.4%	11.4%	3.0%	10.0%
Longview/Kelso/Rainer	10.0%	50.0%	10.0%	50.0%	2.4%	11.4%	3.0%	10.0%
Walla Walla	10.0%	50.0%	10.0%	50.0%	2.4%	11.4%	3.0%	10.0%

3-8 MPO Performance Targets for NHS Non-Interstate Pavement

[20] Bridge Condition One pager (oregon.gov)

Work on the Newberg-Dundee Bypass

Chapter 4 – Condition and Performance Gap Analysis

4.1 Overview

The Condition and Performance Gap Analysis section provides an overview of the Desired State of Good Repair for Oregon's National Highway System pavements and bridges, and compares the desired state to both current conditions and projected future conditions (10 years) based on the latest funding projections. This section discusses policy guidance derived from the *Oregon Transportation Plan* and *Oregon Highway Plan* that defines a state of good repair as well as strategies for closing gaps in system performance under a constrained funding scenario. Past efforts by ODOT to identify future conditions and the funding needed to close anticipated gaps in performance are outlined. In the final subsection, projections of future conditions of Oregon's NHS pavements and bridges are outlined based on the latest funding projections, and compared to current conditions and a Desired State of Good Repair. Strategies aimed at closing the gaps between projected and desired conditions for pavements and bridges are also summarized.

ODOT Policy Defining a State of Good Repair

ODOT identifies and defines a state of good repair of the transportation system through policy guidance from the *Oregon Transportation Plan*. The *Oregon Transportation Plan* serves as the umbrella document for Oregon's multimodal transportation system. The *Oregon Highway Plan*, which is a modal plan under the *Oregon Transportation Plan*, further defines a state of good repair on Oregon's highway system and identifies policies and priorities for funding the highway system under constrained revenue scenarios.

As a matter of policy, the *Oregon Transportation Plan* needs analysis defines a state of good repair in terms of feasible needs.

> "Feasible need refers to the funding that maintains the system at a slightly more optimal level than current levels, replaces infrastructure and equipment on a reasonable life-cycle, brings facilities up to standard, and adds capacity in a reasonable way."

The *Oregon Highway Plan* lays out a series of policies and priorities for investment in the State Highway System aimed at maintaining a state of good repair. Further, it articulates minimum safety and infrastructure conditions that should be met before investments are made that add new capacity or facilities to the system.

> *"It is the policy of the State of Oregon to place the highest priority for making investments in the State Highway System on safety and managing and preserving the physical infrastructure."*

4.2 Past Efforts to Identify and Address Gaps

Multiple efforts by ODOT have looked at future conditions of Oregon's pavement and bridge system and analyzed the rate of deterioration under various future funding scenarios and the additional revenue required to maintain pavement and bridge assets in a state of good repair into the future.

2006 Oregon Transportation Plan Needs Analysis

As part of Oregon Transportation Plan a needs analysis was conducted that assessed available transportation revenue against the revenue necessary to meet feasible need. The gap between transportation needs and revenues is a barometer for how well Oregon is funding transportation programs. In 2004 dollars the transportation needs analysis found approximately a $1.3 billion per year gap in the funding needed to adequately maintain and expand the publicly funded transportation modes over the plan period. The analysis included the needs of the public and privately-owned components of the state, regional and local transportation systems from 2005 to 2030 for the following:

- Air freight and passenger services,
- Intermodal connectors,
- Local roads and bridges,
- Natural gas and petroleum pipelines,
- Ports and waterways,
- Public transportation,
- Rail freight and passenger services,
- State highways including state bicycle & pedestrian facilities,
- Transportation options program.

The OTP used the needs analysis as a foundation for determining funding priorities and investment scenarios for transportation. The following scenarios established funding priorities for highway-related plans and programs at four general funding levels; the first applies at the 1998 funding level.

Scenario	Action
Scenario 1: With funding that does not increase with inflation and subject to statutory requirements and regional equity, address critical safety issues and manage and preserve existing infrastructure at 77 percent fair-or-better before adding capacity.	- Focus safety expenditures where the greatest number of people are being killed or seriously injured. - Fund modernization only to meet statutory requirements. - Preserve pavement conditions at 77% fair-or-better on all roads except for certain Regional and District Highways. - Do critical bridge rehabilitation and replace bridges only when rehabilitation is not feasible. - Fund operations to maintain existing facilities and services and extend the capacity of the system
Scenario 2: Invest to improve infrastructure conditions and to add new facilities or capacity to address critical safety problems, critical levels of congestion, and/or desirable economic development.	- Address the highest priority modernization projects. - Move toward pavement conditions of an average 78% fair-or-better on all state highways. - Maintain Bridge Value Index (percentage of total replacement value) at 86 percent.
Scenario 3: When critical infrastructure preservation, safety and congestion needs are met, pursue a balanced program of additional high priority modernization projects and preservation of infrastructure.	- Move toward modernization funding to meet 55% of feasible needs. - Bring pavement conditions up to an average 84% fair-or-better level on all state highways. - Maintain bridge conditions at 87% of total replacement value and address the critical 1/3 of seismic retrofit needs.
Scenario 4: With significant funding increases, develop feasible modernization projects, address long-term bridge needs and upgrade pavements to a more cost-effective condition.	- Move toward modernization funding to meet 100% of feasible needs. - Bring pavement conditions up to an average 90% fair-or-better level on all state highways. - Begin to replace 850 aging bridges and increase the Bridge Value Index (percentage of total replacement value) to 91%.

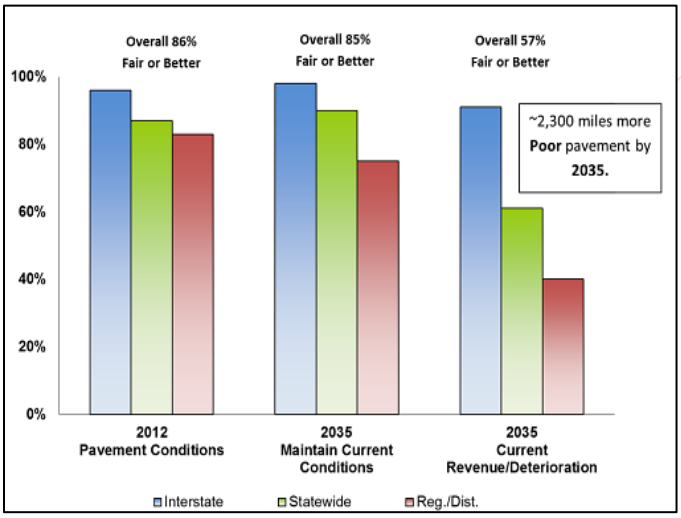
4-1 2006 OTP Funding Scenarios & Priorities

2014 - Estimated Impacts of Deteriorating Highway Conditions to Oregon's Economy

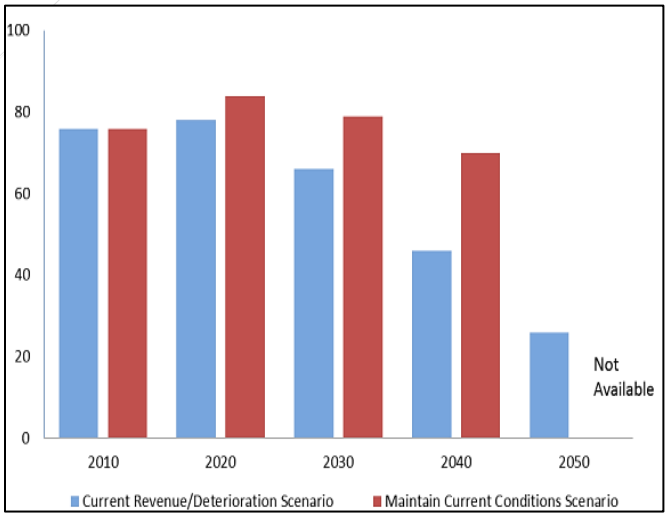
ODOT's 2014 *Estimated Impacts of Deteriorating Highway Conditions to Oregon's Economy* report identified and analyzed two scenarios for state highway funding over the next 20 years. The Current Revenue Scenario analyzed ODOT's budget forecast for state highway spending over the next 20 years. The Maintain Current Conditions Scenario represented a 20-year forecast for highway spending designed to preserve current highway conditions.

Scenario	Action
Current Revenue	- Focus safety expenditures where the greatest number of people are being killed or seriously injured. - Fund modernization only to meet statutory requirements. - Preserve pavement conditions at 77% fair-or-better on all roads except for certain Regional and District Highways. - Do critical bridge rehabilitation and replace bridges only when rehabilitation is not feasible. - Fund operations to maintain existing facilities and services and extend the capacity of the system
Maintain Current Conditions	- Address the highest priority modernization projects. - Move toward pavement conditions of an average 78% fair-or-better on all state highways. - Maintain Bridge Value Index (percentage of total replacement value) at 86 percent.

4-2 Current Revenue/Maintain Current Conditions Scenario (Estimated Impaction of Deteriorating Highway Conditions, ODOT, 2014)



4-3 Pavement Condition by Scenario



4-4 Proportion of Bridges categorized as non-distressed by scenario (Estimated Impacts of Deteriorating Highway Conditions, ODOT, 2014)

2017 - Rough Roads Ahead 2: Economic Implications of Deteriorating Highway

The 2017 *Rough Roads Ahead 2: Economic Implications of Deteriorating Highway Conditions* study considered four different scenarios of investment in Oregon's transportation system, and their impacts on pavement and bridge conditions over the next 20 years, as well as the economic impact of these asset conditions on Oregon's economy.

Scenario 1:	2017 ODOT forecasted budget for the state system.
Scenario 2:	Limited expansion of current (as of February 2017) investment; adds the remainder of Interstate 5 and Interstate 84 to the limited network that can be addressed under the current budget.
Scenario 3:	Hypothetical "What Would It Take" to preserve and repair the entire network of high-priority state highways, known as the Fix-It priority routes.
Scenario 4:	Hypothetical "What Would it Take" to maintain current bridge and pavement conditions for the entire state-owned and operated system, including seismic preparation.

20 Year Program Total $8.7B	Scenario 1: 2017 Forecasted Budget: Inflation Adjusted 2016 dollars by CY				
	2017	2021	2026	2031	2036
Maintenance*	243	246	258	238	221
Pavement	83	74	68	62	58
Bridge	83	74	68	62	58
Enhance	73	38	0	0	0
Seismic	0	0	0	0	0
Other**	49	44	40	37	34
Total	**529**	**477**	**433**	**399**	**371**

**Maintenance cost rises 3% a year, taken from Enhance;*
*** Safety & Operations, Local Government and Special Operations*

20 Year Program Total: $14.7 B	Scenario 2: 35% Increase in Budget (14 cent increase in state fuel tax)				
	2017	2021	2026	2031	2036
Maintenance*	250	271	299	330	345
Pavement	127	127	127	127	127
Bridge	150	150	150	150	150
Enhance	95	75	47	16	0
Seismic	49	49	49	49	49
Other**	64	64	64	64	64
Total	**735**	**735**	**735**	**735**	**735**

**Maintenance cost rises 2% a year, taken from Enhance*
*** Safety & Operations, Local Government and Special Operations*

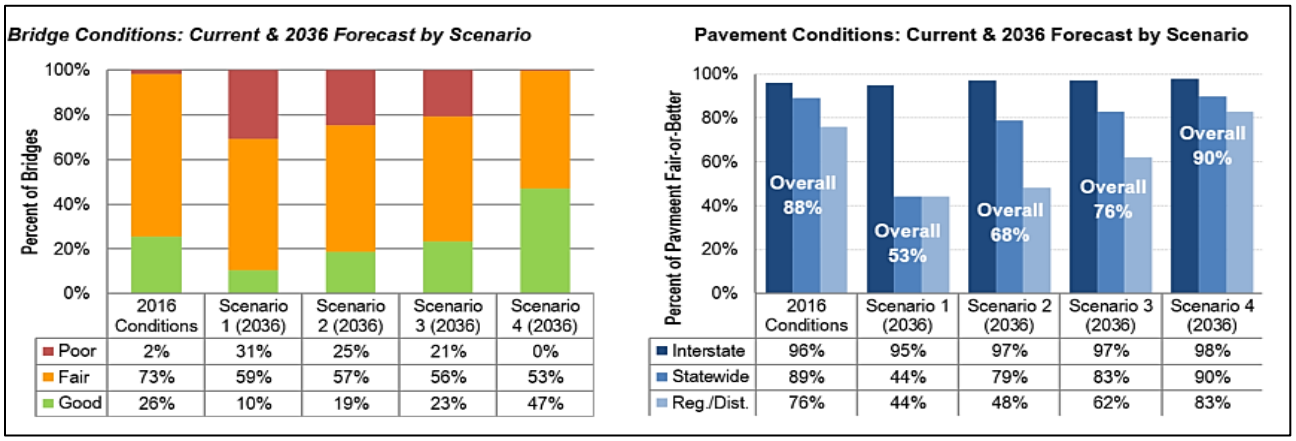
20 Year Program Total: $17.7 B	Scenario 3: 63% Increase in Budget (24 cent increase in Fuel Tax)				
	2017	2021	2026	2031	2036
Maintenance*	250	260	274	287	302
Pavement	154	154	154	154	154
Bridge	220	220	220	220	220
Enhance	116	105	92	78	63
Seismic	70	70	70	70	70
Other**	77	77	77	77	77
Total	**887**	**887**	**887**	**887**	**887**

**Maintenance cost rises 1% a year, taken from Enhance*
*** Safety & Operations, Local Government and Special Operations*

20 Year Program Total: $25.5 B	Scenario 4: 134% Increase in Budget (52 cent increase in Fuel Tax)				
	2017	2021	2026	2031	2036
Maintenance	300	300	300	300	300
Pavement	200	200	200	200	200
Bridge	435	435	435	435	435
Enhance	150	150	150	150	150
Seismic	90	90	90	90	90
Other*	100	100	100	100	100
Total	**1275**	**1275**	**1275**	**1275**	**1275**

**Safety & Operations, Local Government and Special Operations*

4-5 Pavement and Bridge Financial Forecast Scenarios (Rough Roads Ahead 2 Report, ODOT, 2017)



4-6 Pavement and Bridge Condition Forecast (Rough Roads Ahead 2 Report, ODOT, 2017)

2017 - Oregon Transportation Commission Investment Strategy

In October of 2016, the Oregon Transportation Commission (OTC) was approached by the Oregon Legislature's Joint Committee on Transportation Preservation and Modernization and asked to identify state transportation needs and strategies to address these needs. In January 2017, the OTC formally adopted *A Strategic Investment in Transportation*. The document discussed annual investment options for 10 transportation areas. The following chart summarizes three investment strategies identified for highway pavements, bridges, seismic and maintenance needs, and provides a brief discussion of the consequences of different levels of investment.[21]

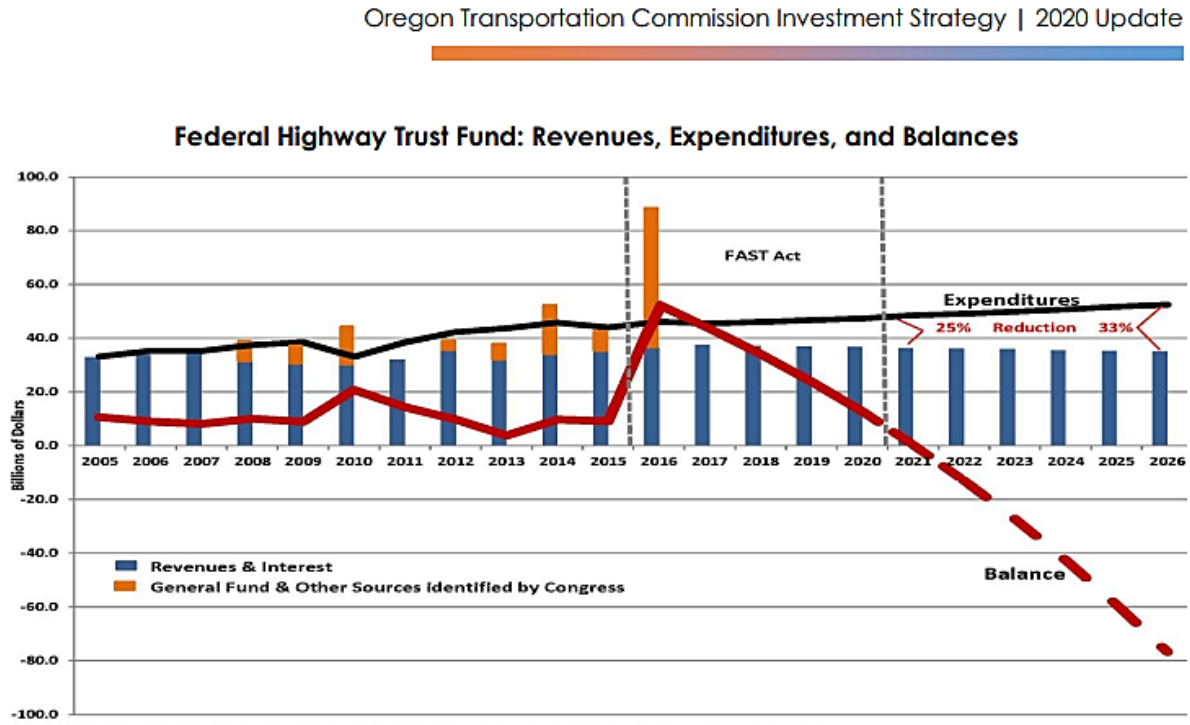
	Status Quo *Annual investment (pre-HB2017)*	**Investment Scenario 1** *Moderate additional annual increase*	**Investment Scenario II** *Additional annual increase to meet total need*
Pavements	**$85 Million**	**$185 million**	**$200 Million**
	13% of highways are in poor or worse condition today, which will rise to 35% by 2035. Deteriorating pavements will increase maintenance costs and vehicle repair costs.	Keep pavement condition on priority (fix-it) corridors from degrading through preservation and rehabilitation. Save millions in pavement maintenance and rehabilitation costs.	Improve pavement condition to meet state performance targets for pavement in fair-or-better condition across all state highways. Save millions in maintenance and rehabilitation costs.
Bridges	**$85 Million**	**$185 Million**	**$435 Million**
	By 2035, 65% of Oregon's state highway bridges will be in distressed condition. At today's investment levels, it will take 900 years for ODOT to replace all its bridges.	Replace and address structurally deficient bridges on key freight routes. Complete Phase I of the bridge component of ODOT's Seismic Plus Plan, replacing and retrofitting bridges to be resilient to a Cascadia Subduction Zone Earthquake.	Address the backlog of deferred work and the Interstate Era bridges due for replacement over the next 25 years.
Seismic	**$35 Million (one time)**	**$20 Million (annual)**	**$250 Million (annual)**
	One-time commitment of funding to retrofit bridges on US 97 and OR 58 as first components of ODOT's Seismic Plus plan.	Address the most critical landslides on priority routes. Address key state highway bridges on local lifeline routes.	Execute all phases of work identified in Seismic Plus Report, completing the backbone system of Lifeline Routes within 20 years.
Maintenance	**$200 Million**	**$250 million**	
	There is a backlog of maintenance needs, particularly outside priority corridors. Lack of staff coverage for major storm events to help keep routes passable.	Offset increasing maintenance costs. Increase winter maintenance staff, materials and equipment. Increase number of incident responders.	Continual investment as the system ages, addressing issues early to prevent more costly fixes to the system, and keep pace with rising maintenance costs.

4-7 Investment Scenarios (OTC Investment Strategy, ODOT, 2017)

[21] Note: While multimodal investments are central to delivering a transportation system that meets the needs of all Oregonians, this OTC Investment Strategy summary lists scenario categories that are most relevant to the TAMP; highway pavements, bridges, seismic, and maintenance needs

2020– Updated Oregon Transportation Commission Investment Strategy

The updated *2020 OTC Investment Strategy* was built on the 2016 iteration by examining the gap between total system-wide needs and current funding-levels (post-HB 2017), given that revenue was projected to decline, costs were rising and needs were growing. This report consisted of an updated overview of how the Department's scarce resources are being invested, the resulting performance/system conditions, and prioritization of expenditures should funding levels remain flat or are further reduced. The anticipated impacts and implications for the transportation system, economy, and traveling public in Oregon were updated and included to inform future decisions regarding Department priorities and strategic investments.



4-8 Federal Hwy Trust Fund Projections (OTC Investment Strategy, ODOT, 2020)

The strategies presented in both the 2017 and *2020 OTC Investment Strategy* reflected the OTP and OHP policy guidance of focusing targeted cost-effective investments on high priority corridors and are aimed at achieving transportation goals for the condition and performance of ODOT's pavements and bridges. The OTC Investment Scenario II serves as a framework for the ODOT-defined Desired State of Good Repair (SORG) in the following subsections.

4.3 Pavement and Bridge Performance Gap Analysis

The following projections were developed to provide a snapshot of future gaps in Oregon's pavement and bridge conditions. The pavement and bridge gap analysis' use national and state condition and performance measures as reported in the most recent federal *2020 Mid Performance Period Progress Report (Oct, 2020)* and state *ODOT Annual Performance Progress Report (Sept, 2021)*. Investment needs are calculated using 2022 dollar value and do not account for future inflation.

Future projections include the funding benefits from the Keep Oregon Moving (HB2017) and Infrastructure Investment and Jobs Act (IIJA), and were calculated for the 2032 horizon.

Pavement Performance Gap Analysis

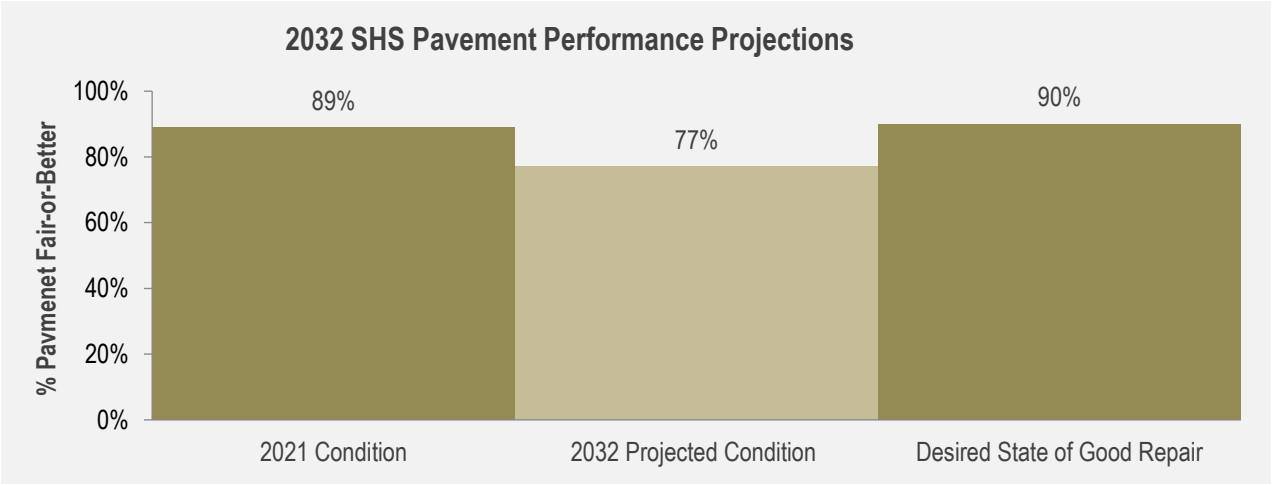
ODOT estimates that the agency needs approximately $273 million per year to maintain current conditions and continue to meet the desired state of good repair of 90% "fair" or better, over the long term across the entire system. The desired state of good repair is similar to the *Oregon Transportation Plan* and represents sustainable conditions, with some sections of pavement spending a duration of time in a poor condition before rehabilitation or reconstruction. This is a higher metric than the state KPM of 85% "fair" or better, which accepts generally lower levels of service and poor pavement in non-critical routes.

Projected annual pavement investment[22]	**Annual pavement investment needed to *Maintain Current Conditions***	**Annual pavement investment needed to meet *Desired State of Good Repair[23]***
State Highways: **$112M/year** NHS and Interstate only: Approx. **$90M/year**	State Highways: **$273M/year** NHS and Interstate only: Approx. **$241M/year**	State Highways: **$273M/year** NHS and Interstate only: Approx. **$241M/year**

4-9 Annual Investment Need Scenario - Pavement

SHS Pavement Performance Projections- State Key Performance Measures

A moderate decline in pavement conditions on the State Highway System (SHS) is projected over the next 10 years, though show significant improvement over earlier projections before HB2017 and IIJA funding. Projections reflect the positive impacts of new infusions of transportation revenue, as well as ODOT asset management strategies aimed at optimizing investments.

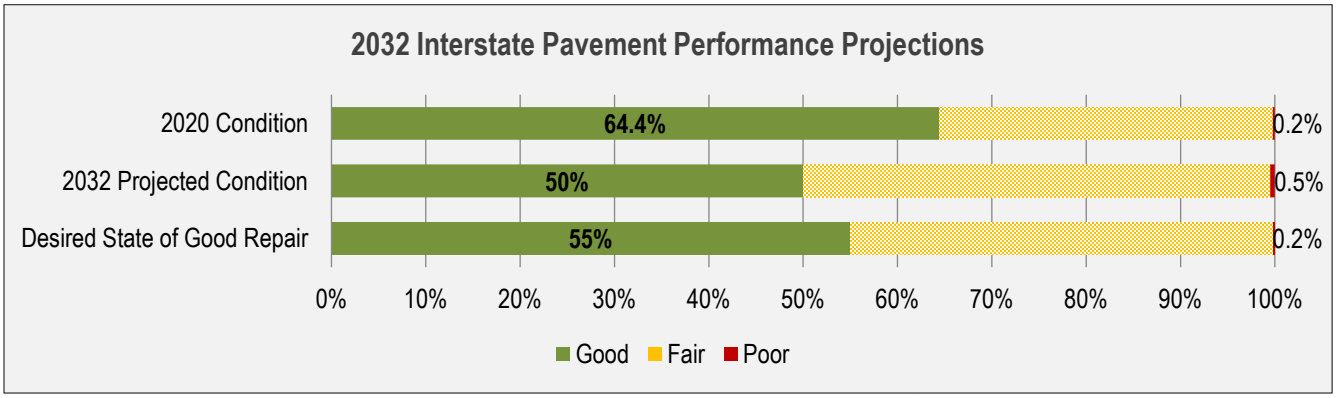


4-10 SHS Pavement Performance Projections comparing desired state of good repair

[22] Does not include Interstate Sign funding.
[23] Pavement SOGR is based on 2020 Pavement Condition Report estimate updated to 2022 costs.

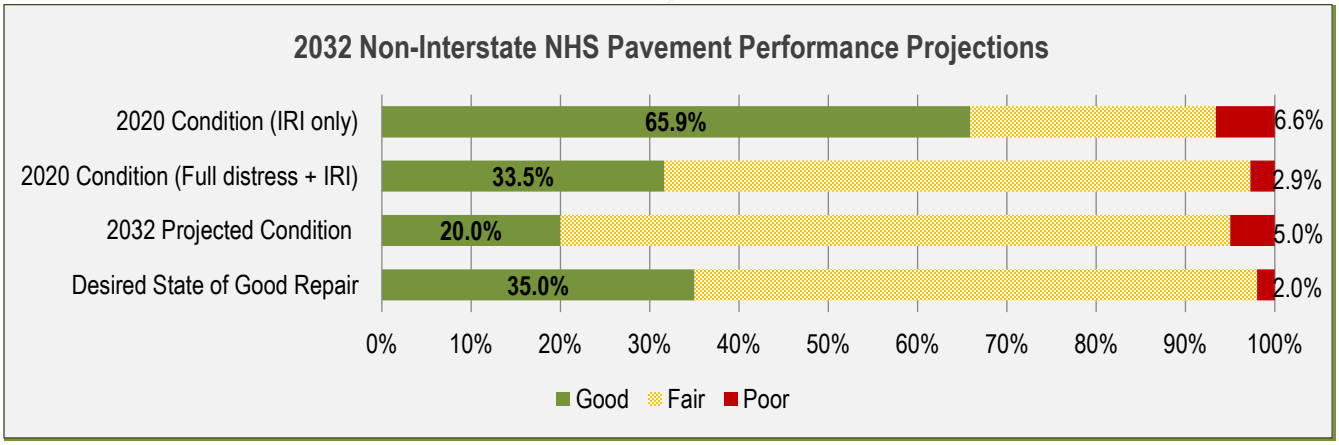
NHS Pavement Performance Projections- National Performance Measure Metrics

Similar to the overall SHS, a moderate decline in pavement conditions on the National Highway System (NHS) Interstate is projected over the next 10 years. It is projected about %50 (+/-5%) of Oregon's Interstate pavement will be in *good* condition in the year 2032, and that the percent of Interstate pavement in poor condition is projected to be about 0.5%. This remains comfortably below the national standard of a maximum of 5% Interstate pavement in poor condition.[24]



4-11 Interstate Pavement Performance Scenarios using National Metric

Oregon's Non-Interstate NHS pavements are projected to experience significant declines in condition over the next 10 years. The percent of pavement rated good is projected to decline to about 20% (+/-5%) by 2032, similarly the percent of Non-Interstate NHS pavement in poor condition is expected to rise to about %5. This shows that by 2032, the percentage of good pavement on the Non-Interstate NHS will be cut nearly in half from current levels while the percentage of poor pavement will nearly double.



4-12 Non-interstate NHS Pavement Performance Scenarios using National Metric

[24] 23CFR 490.315(a) Establishment of minimum level for condition of pavements

Bridge Gap Analysis

ODOT estimates that the agency needs approximately $320 million per year to maintain current conditions of ODOT owned bridges across the entire system. An estimated $539 million per year is needed to meet the desired state of good repair of 78% of bridges "not distressed" over the long term.

Projected annual bridge investment[25]	Annual bridge investment needed to *Maintain Current Conditions*	Annual bridge investment needed to meet *Desired State of Good Repair*
State Highways: **$156M/year** NHS and Interstate only: Approx. **$145M/year**	State Highways: **$320M/year** NHS and Interstate only: Approx. **$273M/year**	State Highways: **$539M/year** NHS and Interstate only: Approx. **$420M/year**

4-13 Annual Investment need Scenario – Bridge

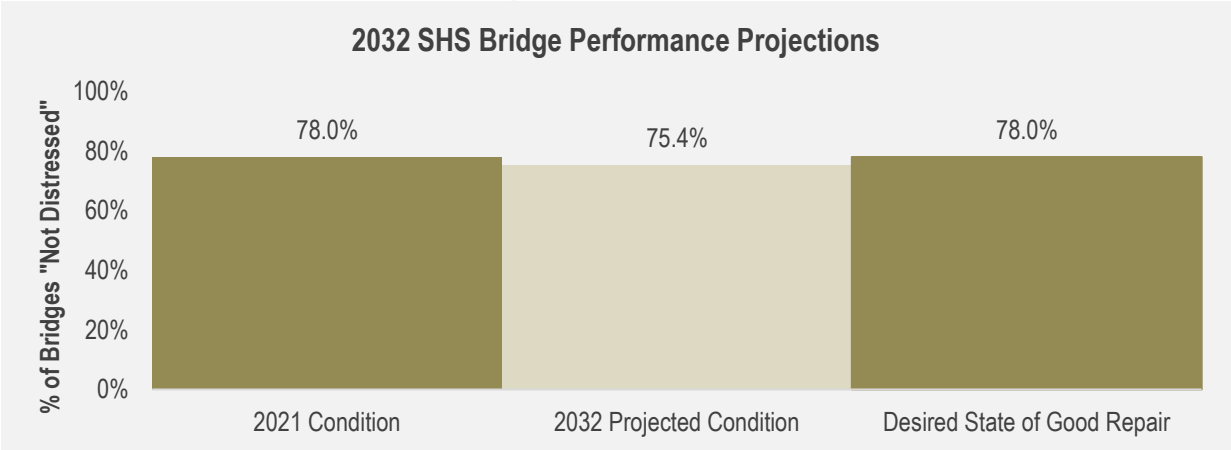
The Bridge Program received about $484M in funding in 21-24 STIP, including $31M directed toward seismic work. The amount left to address bridge conditions is about $453M ($151M annually). However, a portion of the seismic resiliency funding will benefit the overall condition ratings of ODOT's bridge network, through the replacement of seismically vulnerable bridges. For the purposes of the TAMP, 50% of the seismic funds will be credited to improving conditions, which increases the 21-24 investment amount to annual investment amount to $156M.

Replacement decisions using seismic funds are based on the age and condition of the bridge, and the ratio of the retrofit and rehabilitation costs to replacement costs. Funds used for seismic retrofit do not improve conditions, and many bridges that are replaced for seismic reasons are in fair or better condition. More information around how decisions are made between retrofit, rehabilitation and replacement is located in *ODOT's Seismic Implementation: Policies and Design Guidelines (April, 2021)* on pages 10-11.

SHS Bridge Performance Projections- State Key Performance Measures

A moderate decline in bridge conditions on the State Highway System (SHS) is projected over the next 10 years, though HB2017 and IIJA funding is expected to slow the decline.

The projected increase of bridges "in distress" is primarily due to the aging bridge system and a long history of underfunding of bridges that precluded systematic replacement of deteriorated bridges. This is captured in the KPM as "Low Service Life Bridges", as well as bridges projected to become structurally deficient.



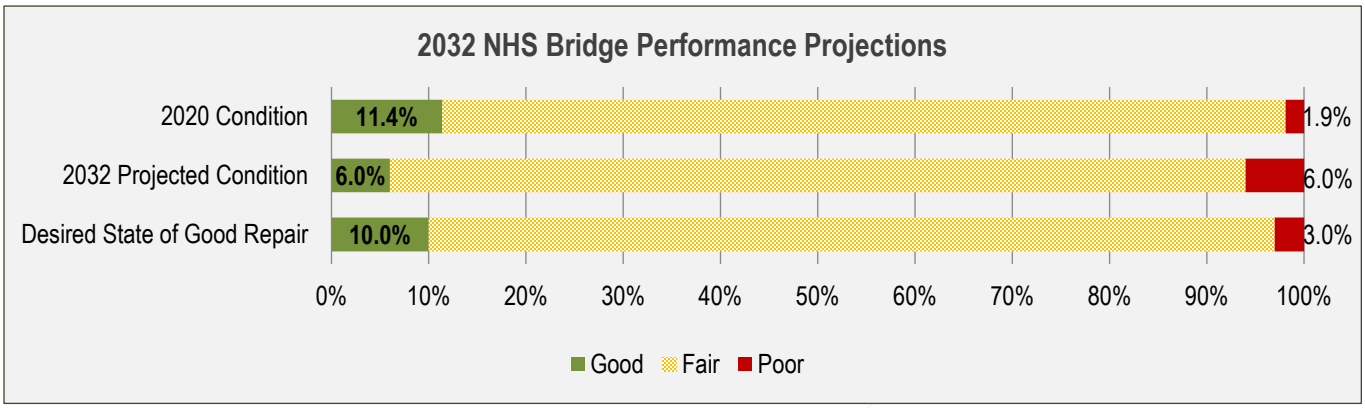
4-14 SHS Bridge Performance Projection comparing desired State of Good Repair

[25] Assumes 50% of bridge seismic funding will benefit SOGR and MCC scenarios, through bridge replacements.

NHS Bridge Performance Projections- National Performance Measure Metrics

A noticeable decline in bridge conditions on the NHS is projected over the next 10 years. It is projected about 6% of Oregon's NHS bridges will be in *good* condition in the year 2032, and that about 6% will be in poor condition. This is below the desired state of good repair of 10% of Oregon's NHS bridges being in good condition, and 3% of Oregon's NHS bridges being in poor condition.

Given the age of Oregon's NHS bridges, the decline is inevitable as bridge replacement is taking place at a much slower rate than the decline in conditions. Bridge preservation or rehabilitation actions generally cannot raise a bridge rating from a fair condition to a good condition. Bridge replacement, by contrast, is the primary action that results in a good rating.



4-15 NHS Bridge Performance Scenarios using National Metric

The Bridge Program received an increase of funding in the 2024-27 STIP totaling about $412 million with close to $130 million directed to seismic work. The amount left to address bridge conditions is about $282 million. However, it is assumed that the increase in seismic resiliency funding will benefit the overall condition ratings of ODOT's bridge network, through the replacement of seismically vulnerable bridges. This should result in a slightly slower decline in the later years of the 10-year projection of the percentage NHS bridges in good condition

The 10-year projection of the percentage of NHS bridges in good condition reflects the policy direction for the bridge program to continue emphasis on maintaining bridges at risk of reaching poor conditions over more expensive bridge replacements. Projections for the percent of bridges by deck area becoming poor shows a steady increase in the next 10 years. However, as the chart indicates, the additional seismic funding is projected to slow this increase.

The increase in poor bridge conditions is expected to be managed with the use of Major Bridge Maintenance (MBM) funding which addresses the immediate repairs needed to keep an at-risk bridge from being classified as poor, as well as the prioritization of bridge work on priority fix-it corridors (s*ee Chapter 8 - Investment Strategies.*)

Impacts of System Enhancements to Overall Performance

Major Enhance projects that have been identified within Oregon's STIP (such as enhancements to I-5 Rose Quarter and I-205 widening) consist of improvements and reconstruction of assets on existing corridors, and have a marginal impact on the total volume of NHS bridge and pavement assets ODOT is responsible for preserving and maintaining long-term.

Enhance projects identified in the STIP are largely driven by the Oregon Transportation Commission, the Oregon State Legislature, and local Area Commissions on Transportation. As a result there is limited capacity to precisely predict the degree to which various funding scenarios increase or decrease the relative dedication of investment to Enhance projects. These limitations and the impact of political decisions in asset management tradeoffs are identified in multiple items within the TAMP Risk Register[26], including Risk #9: Prioritizing Capacity Projects and Risk #44: Changes in Legislative Mandates.

While there are limitations in the ability to address system enhancement and new assets within the TAMP gap analysis, Oregon has made major steps forward in assessing the long-term preservation and maintenance impacts of major investments including the construction of new assets as well as reconstruction or replacement of existing assets. In 2017, the Oregon Legislature adopted HB2017 which provides significant state transportation funding. Among the bill's provisions was the requirement that Enhance projects selected for funding in the STIP "*provide the greatest benefit in relation to project costs."* The bill requires that before any STIP Enhance project that costs $15 million or more is included in the STIP, a rigorous benefit-cost analysis must be prepared and made publicly available. Specifically called out in this legislation are requirements to analyze future costs to the agency to preserve and maintain an undertaken project, and identify increased costs that would result from delays in the performance of routine maintenance scheduled by the agency.

4.4 Reducing the Gap

The *2020 OTC Investment Strategy* addresses ODOT's work in exploring new approaches to fund and finance needed transportation investments. Across the nation, transportation funding has been in a near constant state of crisis for more than a decade. Since 1956, when Congress passed the Interstate Highway program, the federal government has been a strong partner in funding the nation's surface transportation infrastructure. But since 2009, when the SAFETEA-LU authorization legislation expired, the federal contribution has been essentially flat. In fact, from 2011 through 2017 federal-aid highway funding flowing to Oregon actually fell; it wasn't until 2018 that funding reached the same level as 2010—and it was much lower in 2018 in inflation-adjusted terms. The newly adopted IIJA provides a short term increase to funding though is not a replacement for needed long term strategies.

Additional risks identified in meeting the State of Good repair is addressed, in *Chapter 6: Risk Management.*

Alternative Strategies to Reduce the Gap

As discussed in the *2020 OTC Investment Strategy,* in addition to the traditional funding sources of the gas tax, driver and motor vehicle fees, and weight-mile tax, the Department has been exploring new approaches to fund and finance needed transportation investment. Included is, piloting road usage charging programs, implementing increased user-fees on electric and hybrid vehicles and establishing a tolling program to address many of Oregon's congestion challenges.

[26] Appendix G – Risk Register

ODOT's funding priorities and strategies will change according to changes in available revenues. The following scenarios establish funding priorities for highway-related plans and programs at four general funding levels; the first applies at the 1998 funding level. With increases in funding, ODOT will progress toward the fourth funding scenario.

Scenario	Action
With funding that does not increase with inflation and subject to statutory requirements and regional equity, address critical safety issues and manage and preserve existing infrastructure at 77 percent fair-or-better before adding capacity.	- Focus safety expenditures where the greatest number of people are being killed or seriously injured. - Fund modernization only to meet statutory requirements. - Preserve pavement conditions at 77% fair-or-better on all roads except for certain Regional and District Highways. - Do critical bridge rehabilitation and replace bridges only when rehabilitation is not feasible. - Fund operations to maintain existing facilities and services and extend the capacity of the system
Invest to improve infrastructure conditions and to add new facilities or capacity to address critical safety problems, critical levels of congestion, and/or desirable economic development.	- Address the highest priority modernization projects. - Move toward pavement conditions of an average 78% fair-or-better on all state highways. - Maintain Bridge Value Index (percentage of total replacement value) at 86 percent.
When critical infrastructure preservation, safety and congestion needs are met, pursue a balanced program of additional high priority modernization projects and preservation of infrastructure.	- Move toward modernization funding to meet 55% of feasible needs. - Bring pavement conditions up to an average 84% fair-or-better level on all state highways. - Maintain bridge conditions at 87% of total replacement value and address the critical 1/3 of seismic retrofit needs.
With significant funding increases, develop feasible modernization projects, address long-term bridge needs and upgrade pavements to a more cost-effective condition.	- Move toward modernization funding to meet 100% of feasible needs. - Bring pavement conditions up to an average 90% fair-or-better level on all state highways. - Begin to replace 850 aging bridges and increase the Bridge Value Index (percentage of total replacement value) to 91%.

4-16 Alternative Strategies to Reduce the Gap

Interstate 5 Paving from Woodburn to Salem, May 2019

Chapter 5 – Life Cycle Planning

5.1 Life Cycle Overview

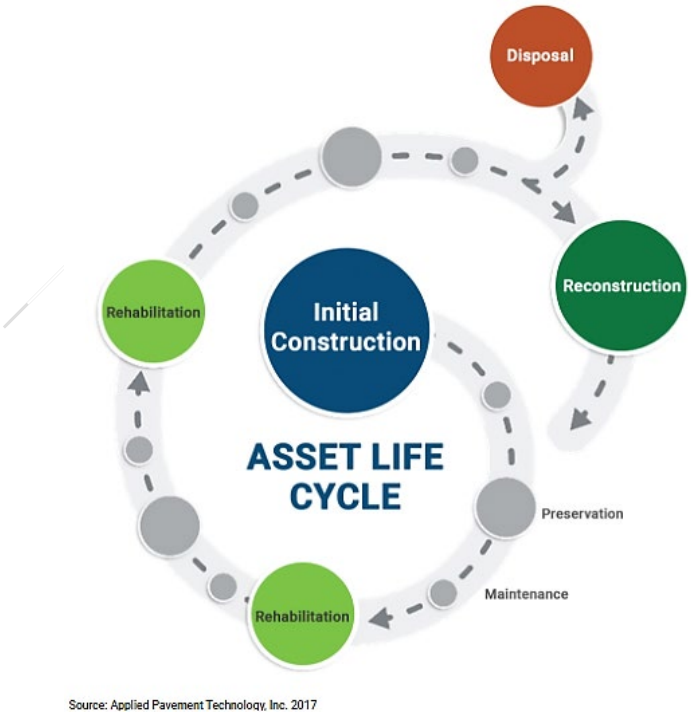
Like all infrastructure, transportation assets owned by ODOT are threatened by physical deterioration over time. In addition to the ordinary wear and tear caused by hundreds of thousands of cars, trucks, buses and other vehicles using the system every day, Oregon's roads and bridges are damaged by inclement weather, natural disasters, roadway crashes and the chemical and physical processes of deterioration.

Maximizing the value from transportation investments is one of ODOT's major goals. Each year, the agency spends more than a billion dollars in federal and state funds constructing, operating, preserving and maintaining the components of its transportation system. Stretching transportation revenue to get the greatest return on investment is not limited to minimizing the costs of constructing and purchasing transportation assets, costs must be minimized at all phases of a transportation asset's life cycle. Timely maintenance and preservation activities extend the asset's useful life and help avoid more expensive repair and replacement costs.

Life Cycle Management Principles

The following information is sourced and summarized from the *Transportation Asset Management (TAM) Guide* which was developed by AASHTO to help agencies advance asset management practices. A more in depth discussion around the principles of life cycle management is provided in the TAM guide.

Life cycle management is an investment approach that considers maintenance, renewal, replacement or repair options through an asset's service life with the intent to maximize the benefit provided by the asset at the minimum practicable cost. It employs data on asset condition, treatment options, costs, deterioration rates, replacement cycles and other factors to evaluate trade-offs between possible investment strategies and treatment timings. Effective life cycle management requires knowledge of the agency's strategic priorities and an understanding of the performance criteria driving investment decisions so the right management strategy can be identified and implemented for each asset class. Aligning asset management measures with agency priorities ensures the investments made to extend asset service life provide the maximum impact to the agency's long-term goals.[27]



5-1 Asset Life Cycle (Source: Applied Pavement Technology, Inc. 2017)

[27] Defining Life Cycle Management | AASHTO TAM Guide

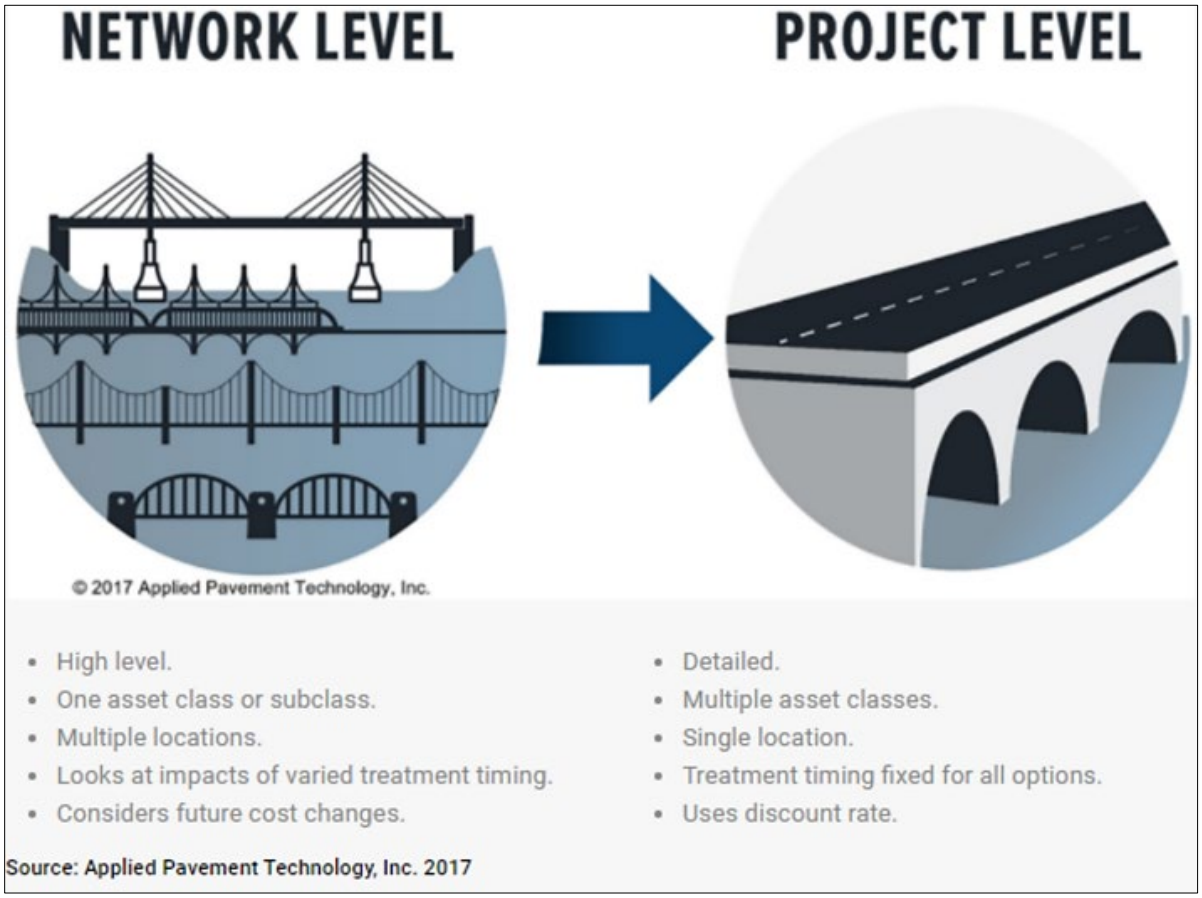
Life cycle cost is defined by FHWA as "the cost of managing an asset class or asset sub-group for its whole life, from initial construction to its replacement."[28]

Life cycle cost analysis is an engineering-economics approach that can be used to quantify the differential costs of alternative design approaches.

Network level life cycle analysis is a more holistic process that manages every stage of an asset's life and may employ life cycle cost analysis or other forms of analysis to inform management decision making. At the network level, life cycle cost analysis can be used to understand how to best manage the network as it ages.

Project level life cycle analysis is used to identify the most effective actions to be taken on the assets within the project scope at the time of project delivery.

Both network level and project level analyses contain many aspects of engineering economic analysis, such as consideration of user benefits, user costs and the time-value of money to identify alternatives that represent the lowest practicable life cycle cost over the analysis period to achieve the desired objectives.



5-2 Attributes of Network Level Life Cycle Management and Project Level Life Cycle Cost Analysis

[28] Asset Management Plan Definitions. 23 CFR § 515.5. October 24, 2016.

Establishing Life Cycle Strategies

A major responsibility of ODOT is to ensure that federal and state funds are managed efficiently and effectively. ODOT minimizes life cycle costs through extending the useful life of pavement and bridge assets, to the extent practicable, through establishing life cycle strategies. Further, life cycle strategies optimize the performance and condition of the transportation system within available resources.

The successful establishment and application of life cycle strategies require relevant, accurate and accessible data and information. Life cycle planning relies on an accumulation of data, information and strategies provided throughout this plan including, but not limited to the following:

- Asset inventory (*Chapter 2 – Pavement and Bridge Ownership*)
  - Pavement - lane miles, centerline miles, ownership
  - Bridges - bridge count, deck area, ownership
- Asset valuation (*Chapter 7 – Financial Plan*)
  - Estimated value of bridge and pavement
  - Estimated cost needed to maintain
- Condition and performance (*Chapter 3 – Goals, Measures, Targets and Condition*; *Chapter 4 – Condition and Performance Gap Analysis*)
  - State and federal performance and condition targets
  - Condition of assets relative to targets
  - Condition and performance gap analysis
- Risk analysis and planning (*Chapter 6 – Risk Management*)
  - Risk processes and practices (bridge, pavement, economic/financial, environmental, organizational)
- Investment strategies (*Chapter 8 – Investment Strategies*)
  - Investment priorities and policy guidance
  - Asset management investment strategies
- Financial Planning (Chapter 7 – Financial Plan)
  - Anticipated revenue
  - Estimated costs to implement investment strategies

ODOT's desired approach to investing in its system is to identify the right treatment at the right time for the right asset to maximize the condition of the asset with minimal cost. ODOT aims to avoid a "worst-first" approach to investing in pavement and bridge assets. The following table summarizes the distinction between approaches.

Asset	Desired Approach	Worst-First Approach
Pavements	Apply periodic seal coats and thin resurface treatments to extend pavement asset life and lengthen the time before major pavement rehabilitation or replacement.	Reconstruct roadway surface after pavement deteriorates to failed condition without routine preservation.
Bridges	Extend functional life of bridges through proactive maintenance and preservation. Focus investments on extending the functional life of priority corridors, rather than just considering individual bridges.	Reconstruct bridge after it deteriorates to poor condition without routine maintenance and preservation.

5-3 Pavement and Bridge Worst-First vs Desired Investment Approach

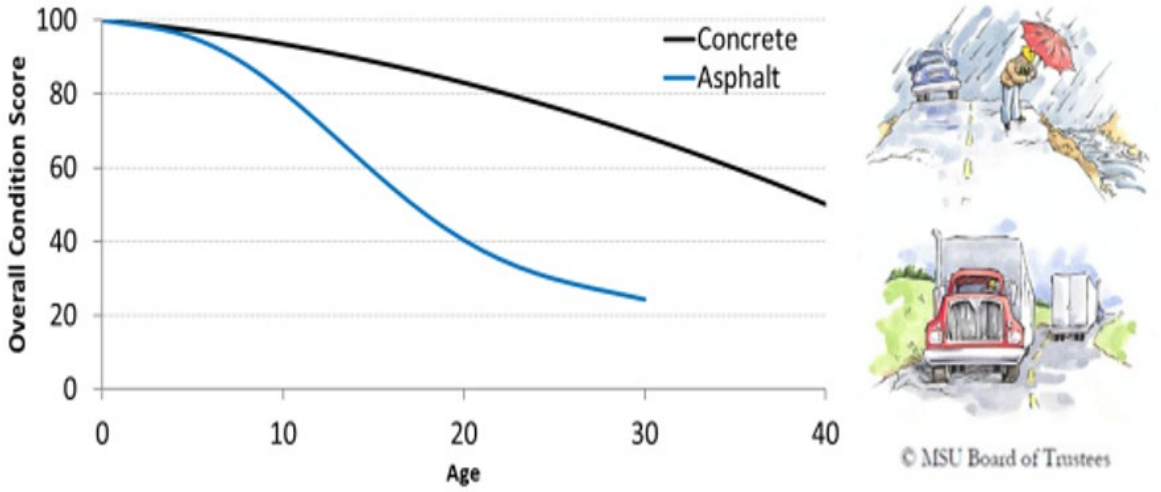
5.2 Pavement Life Cycle Planning

Pavement Deterioration Modeling

Pavements are load-carrying structures that degrade over time due to the cumulative effects of traffic, weather and material aging. To keep them properly maintained and out of poor condition, they must be resurfaced or rehabilitated at periodic intervals (typically every 15 to 20 years for asphalt and 40 to 50 years for concrete). As long as degradation is confined to the surface only, and the pavement's foundation and base layers are protected, a given pavement can be resurfaced over and over again, with occasional strengthening, but without the need for a complete replacement. However, if resurfacing is delayed for too long, the pavement structure and underlying base materials can become excessively damaged and complete replacement (i.e., reconstruction) becomes necessary, at a much higher cost.

Deterioration models using ODOT's Pavement Condition methodology are the primary means for analyzing and managing highway pavement conditions on the State Highway System including the NHS. Forecasts of pavement conditions for each pavement management section are used to determine pavement needs, evaluate funding scenarios, trigger pavement preservation and rehabilitation projects, and determine regional funding allocations. The forecasting takes committed (i.e., programmed) projects that have an impact on pavement conditions into account when evaluating future needs.

Pavement deterioration models use a family curve approach as described in Section 5.4 to 5.6 of the *AASHTO Pavement Management Guide*. The family curves are condition-versus-age models which vary by pavement type (e.g., asphalt, concrete), most recent wearing course, pavement thickness and traffic volume. Examples of family curves for concrete (PCC) and hot mix asphalt pavement (HMAC) are shown below[29].



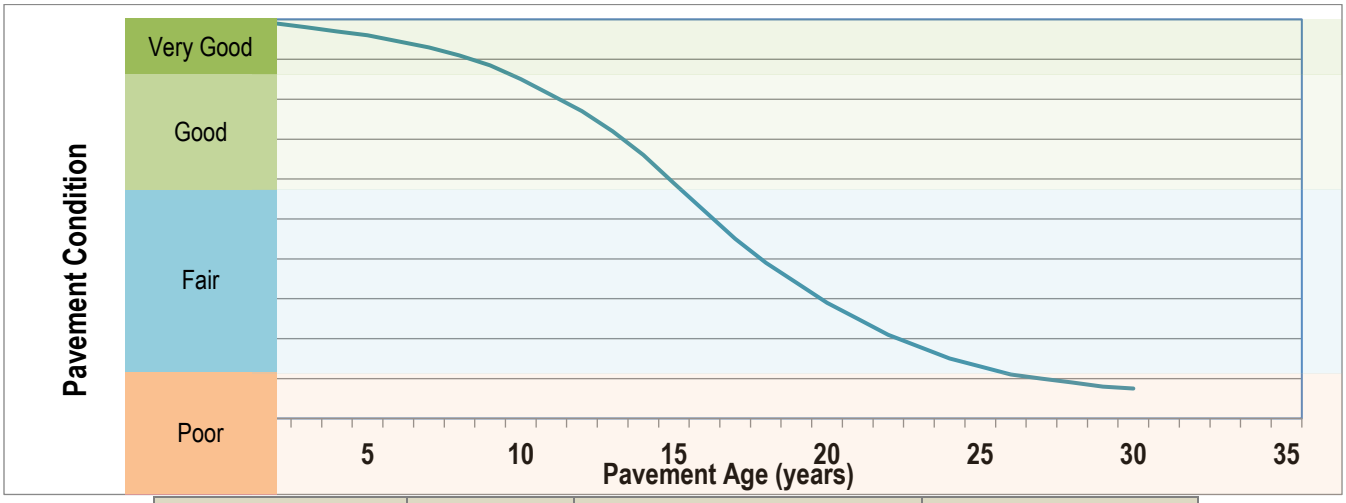
5-4 Typical Asphalt and Concrete Deterioration Rate - 2020 Pavement Condition Report

The family curve is shifted to fit observed conditions to estimate the remaining number of years in fair or better condition for each pavement management section. Age-based models and rutting models are also applied to the pavement management sections. Results are compared and the model with the lowest remaining number of years in fair or better condition is used for forecasting condition. These age-based models are based on the pavement design life or the best estimate of treatment life and primarily govern in the early years after a treatment is applied before there is adequate condition data to determine a reliable deterioration rate. After a few years of deterioration are reflected in conditions, the shifted family curve model is used. On routes which routinely see high wear and winter damage resulting from chain and studded tire wear, the rutting models typically govern.

[29] 2020 Pavement Condition Report

The table below shows a typical pavement deterioration curve with relative costs needed to maintain or return the pavement to a serviceable condition. The graphic illustrates the importance of performing the "right treatment to the right road at the right time." During the first few years, deterioration is slow; but the rate increases quickly as the pavement ages. In the later stages of a pavement's service life, deterioration occurs at an increasing rate, making it critically important not to delay preservation treatment.

Failure to keep roads in a state of good repair has exponentially greater costs than maintaining the system properly over time. The typical cost to restore a severely damaged road is orders of magnitude higher than the cost to preserve pavement through seals and resurfacing treatments. Timely maintenance and preservation are by far the most efficient way to preserve our investment.



Typical treatment	Life	Annual cost per lane mile	Order of Magnitude
Crack Seal	2 years	$1,500	$0.3
Chip Seal	5 years	$5,000	$1
Thin Pave	14 years	$15,000	$3
Thick Overlay	17 years	$30,000	$6
Rebuild	40 years	$75,000	$15

5-5 Typical Pavement Deterioration Rate and Treatment Cost

Concrete Pavement Deterioration Rate

Concrete pavements, including Jointed Concrete Pavement (JCP) and continuously reinforced concrete pavement (CRCP), have a slow rate of deterioration. Actual condition data shows that a typical Oregon State highway **concrete pavement will last 40 to 50 years, and often more, before reaching a condition of "poor".** Some of Oregon's earliest interstate CRCP sections constructed in the late 1960s are still in service today. Of the over 600 miles of CRCP pavement built in Oregon, roughly 60% is still in service, approximately 21% has been overlaid due to rut wear, approximately 16% has been overlaid due to structural deficiencies, and approximately 3% reached a condition requiring reconstruction.

Asphalt Pavement Deterioration Rate

Asphalt-surfaced pavement includes a wide variety of structural pavement categories and wearing course material types. Most asphalt-surfaced pavement constructed in the last 30 years has been resurfacing overlays of older bituminous pavement. Of the over 4,500 miles of asphalt-surfaced interstate and NHS pavement, approximately 83% are a resurfacing of older bituminous pavement, 9% are original non-resurfaced asphalt pavement, and the remaining 8% are a composite of asphalt resurfacing over older concrete pavement. Asphalt-surfaced pavement has a faster rate of deterioration than concrete pavement and also has a much wider variation in service life before reaching a condition of "poor", depending on traffic, environment, climate and materials used.

Condition data from the Pavement Management System (PMS) shows that much of the **asphalt-surfaced pavement will typically average 15 to 20 years before reaching "poor" condition.** This can very however as some routes with relatively high levels of studded tire and chain wear usage may last as little as 8 years. This is in contrast to some of the lower traffic routes east of the Cascades, which will last 30 to 40 years or longer. This is assuming good preventive maintenance practices are followed by doing crack seal and chip seal treatments before excessive deterioration sets in.

Pavement Whole Life Management Strategy

Oregon's State highway mileage inventory is in a nearly constant state of flux. Changes in highway alignments and jurisdictional transfers are examples of these activities. **The goal of the ODOT pavement preservation program is to keep highways in the best condition possible with available funding, by taking a life-cycle-cost approach to preservation and maintenance.**

Typical Costs of Pavement Treatments

ODOT's Fix-It Preservation program and Maintenance program have dedicated funding to maintain pavement assets. Rather than following a "worst-first" philosophy, the Fix-It Preservation program applies a mix of fixes.

A variety of treatment options are available to maintain pavements on the NHS. The treatments range from maintenance activities such as crack sealing and minor patching to full reconstruction. Pavement condition, traffic level, cost, service life, risk and other factors are all considered to determine the most appropriate treatment on a given highway section.

Potential Work Type	Typical Treatment	Typical Life	Typical Cost (per lane mile)
Maintenance	Crack sealing	2 years	$2k to $4k
	Rut filling	2 years	$8k to $12k
	Chip sealing	5 years	$20k to $40k
Preservation	Repaving (single layer)	14 years	$150k to $300k
	Concrete grinding	14 years	$140k to $200k
Rehabilitation	Repaving (multilayer)	17 years	$250k to $400k
Reconstruction	Reconstruction	40 years	$1m to $5m
Initial Construction	New construction	40 years	Variable

5-6 Typical Unit Costs of Pavement Treatments

The state highway network has a mix of different pavement types with different treatments required and different life spans for each. The network can be broken into broad general categories as shown below to determine overall treatment needs. If ODOT could keep up with this treatment cycle, the pavement conditions would be in a sustainable "steady state" where each year the roads coming due for treatment would be programmed and there would be no backlog. **An estimated $220 million per year is needed annually over the long term to make major repairs needed on routes with the worst pavement conditions**, while providing for timely preventive preservation and maintenance on roads in fair to good condition.[30]

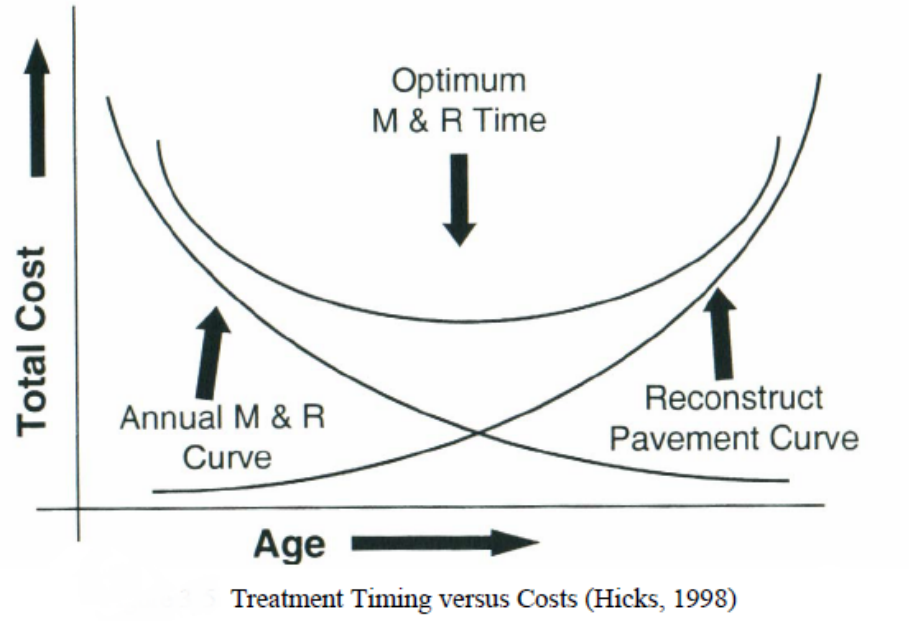
[30] Pavement Condition Report (ODOT, 2020)

Pavement Condition	Activity	Annual Need (lane miles)	Service Life (years)	Lane Mile-Years	Annual Need
Failed	Reconstruction Concrete Asphalt	 20 25	 50 20	 1,000 500	$45 million
Poor	Structural Paving (multi-layers)	250	15 to 25	5,000	$80 million
Fair	Non-Structural (thin paving)	450	12 to 18	6,750	$80 million
Good/Fair	Chip Seals	550	5 to 7	3,300	$15 million
All	Routine & Stop Gap Maintenance	500	2 to 5	1,450	Included in Maint. Budget
Totals **Reconstruct** **Paving** **Chip Seals**		**45** **700** **550**		**18,000**	**$220 million**

5-7 Idealized" Illustration of Sustainable Pavement Program (2020 ODOT Pavement Condition Report

Analyzing Potential Pavement Treatments

The Maintenance program has a long history and well-established philosophy to proactively do crack sealing, chip seals, thin patching and overlays to keep pavements from failing. The most cost-effective strategy is applying preservation treatments to keep highways out of "poor" condition, which extends pavement life at a reduced resurfacing cost. **Deferring preservation can increase whole life cycle costs well beyond what it would have cost to maintain pavement in a "fair" or "good" condition**[31]. The curve below illustrates the typical cost-effectiveness relationship with respect to timing of treatment applications.



5-8 Treatment Timing versus Costs (Hicks, 1998)

Reconstruction and maintenance costs rise as a pavement ages. However, if maintenance and/or rehabilitation is carried out too early, the costs are prohibitively high. There is an optimum time at which maintenance can be performed to provide the maximum cost-effectiveness.

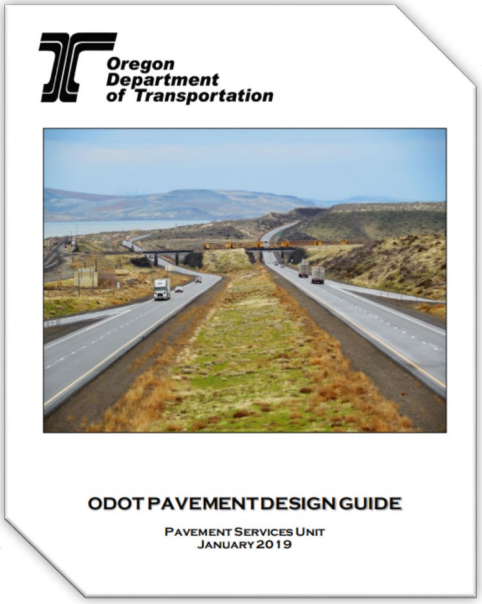
[31] *Legislatively Approved Key Performance Measure*

Most of the pavement investments on Oregon's highway system fall into the preventive maintenance, preservation and rehabilitation work type categories. Although some reconstruction projects are programmed to repair failed pavement, they are not common and are generally confined to the interstate or other routes where a rehabilitation option is not technically feasible.

Pavement Life Cycle Approach

The Pavement Management System tracks pavement conditions as well as treatment history on state highways to evaluate the effect of these treatments on condition and service life. Cost data from pavement preservation and maintenance projects are also gathered so that service life and cost comparisons can be made between different treatment options. Pavement project and work type selection includes a cost-effectiveness component in the selection criteria in the form of dollars per lane mile-year ($/LM-year). This parameter is utilized as a benefit-cost measure and is proportional to a more traditional benefit-cost calculation using area under the performance curve - the lower the $/LM-year parameter, the higher the benefit-cost.

Life cycle cost analysis techniques are considered when making decisions regarding pavement work type selection and determination of appropriate pavement design or pavement rehabilitation strategies. The pavement design alternative with the lowest life cycle cost will typically be the preferred alternative. However, when alternatives have comparable life cycle costs, other factors may be used to base a decision.

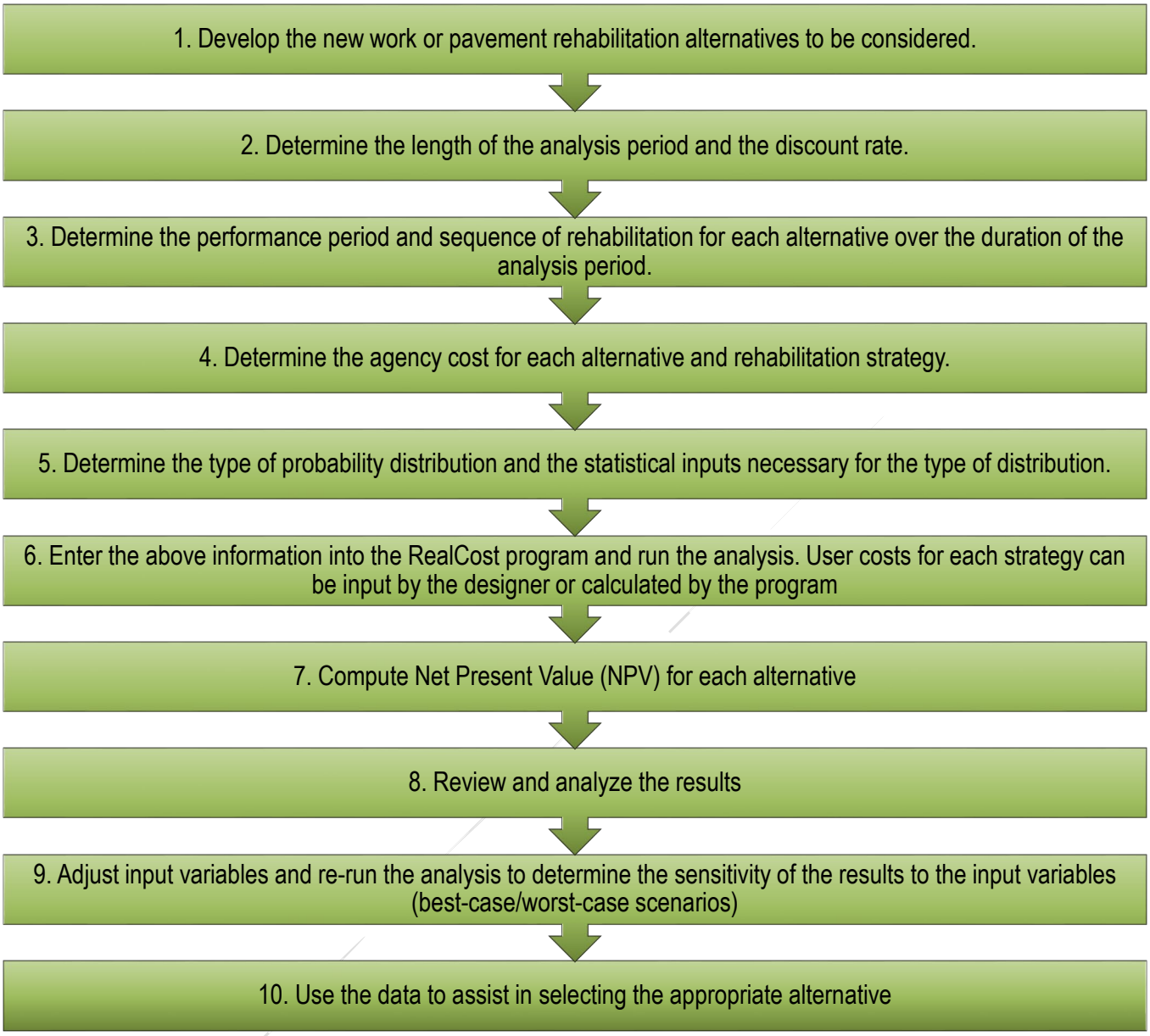


The *ODOT Pavement Design Guide* establishes the agency's guidelines for the use of life cycle cost analysis for pavement design alternatives and provides a discussion of pavement alternative selection. **The *ODOT Pavement Design Guide* requires life cycle cost analysis to be conducted on a project where more than one mile of new roadbed will be constructed**. A discussion of the cost analysis and justification for the selected alternative is to be included in the pavement design memo or report. If less than one mile of new roadbed is to be constructed, a cost analysis that compares the construction costs for each alternative should be conducted.

For rehabilitation of existing pavements, life cycle cost analysis must be conducted where major rehabilitation (such as total reconstruction, rubblization, etc.) is necessary or where options of different life expectancies are being considered. Life cycle cost analysis is also required when pavement design strategies with structural life less than the minimum standard of 15 years are being considered. Preventive maintenance treatments such as chip seals or micro surfacing treatments are not subject to the structural design life standards.

ODOT's pavement design guidelines prescribe that where life cycle cost analysis is applicable, it is to be conducted as early in the project development cycle as possible. The level of detail is to be consistent with the level of investment anticipated.

The expected level of life cycle cost analysis for an ODOT pavement project with a high level of investment is illustrated in the following steps:

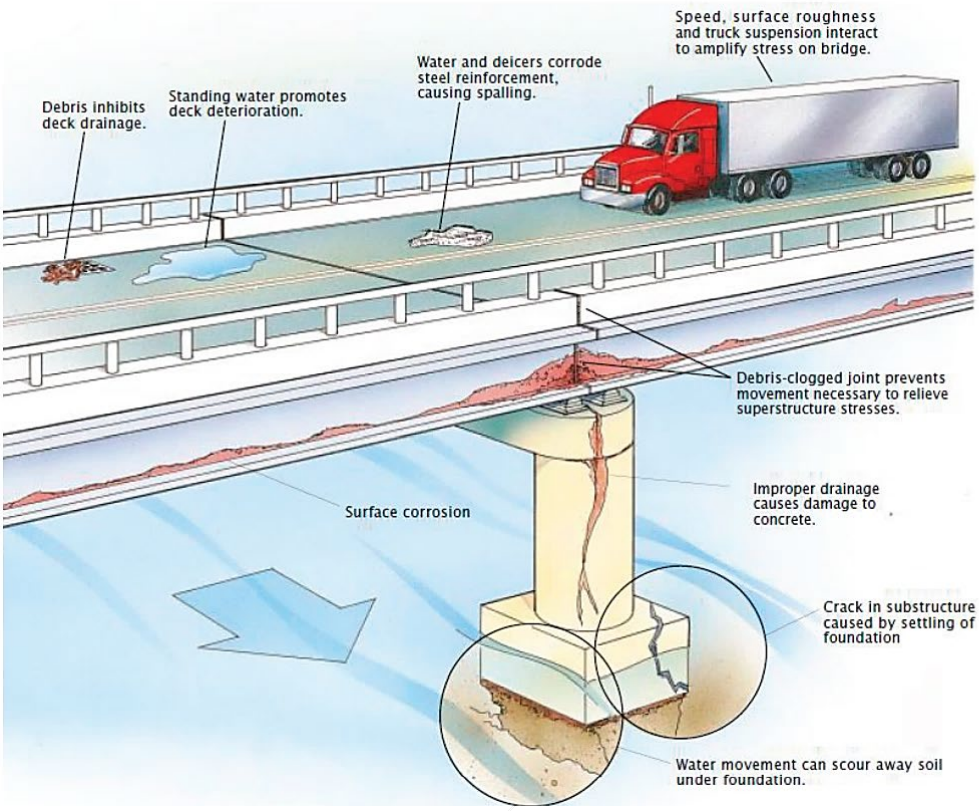


5-9 Pavement Life Cycle Cost Analysis Steps

5.3 Bridge Life Cycle Planning

Bridge Deterioration Modeling

Experience has shown that bridge deterioration is dependent on complex interactions of multiple factors as shown. Extreme events (e.g., earthquakes, flooding, vehicle impacts) are another cause of bridge distress not considered as general deterioration, but which result in the need for quick response and investment to restore mobility.[32]



Adapted from "Why America's Bridges are Crumbling," by K.F. Dunker and B. G. Rabbat, 1993, March, Scientific American, 268, no. 3, p. 69. Permission for use courtesy of Jana Brenning, illustrator.

5-10 Why America's Bridges are Crumbling

ODOT's future conditions projections are put together using deterioration models developed internally based on past trends in bridge condition ratings. For many of the NHS bridges stored in BrM, ODOT is fortunate to have over 20 years' worth of condition data that aids in condition forecasting and bridge management.

Bridge Deterioration Rate

More than half of the bridges in the state's current inventory were built prior to 1970, and 57% reached the end of their design lives by 2020. Each year, about 0.5% of the state's bridges (about 14 structures) deteriorate to the point of becoming structurally deficient. While bridges on the NHS system are newer than those on the total state system, NHS bridges are impacted by higher traffic volumes and heavier truck loads.

Most bridges today are designed with a 75-year design life. With regular attention, the actual service life can be expected to extend to 100 years or more. Based on a service life of 100 years, a conservative approach would be to replace about 1% of all bridges every year. This would amount to roughly 18 bridges per year on the NHS, or 27 bridges per year on the SHS.

[32] 2021 Bridge Condition Report (p.8)

As an example, the Columbia Slough Bridge was built in 1933 and while the main span over the slough has steel girders supported on a concrete foundation, there are 11 other spans that are timber.

Bridge substructure with a mix of older timber and newer steel piles.

5-11 Columbia Slough Bridge

In the picture above you can see that four of the five original timber piles have been replaced with steel, due to deterioration. What you cannot see is that the horizontal timber beam that supports the girders is severely deteriorated. The 6 foot portion between the steel pile on the left and the remaining timber pile has only 2 inches of sound material on the top and bottom. The 10 inches in the middle are rotted and are not capable of carrying load. [33]

Because the number of bridges that need to be replaced can vary greatly in size, a quick assessment of cost can be based on measurement of the system by deck area. This would amount to roughly 300,000 square feet (sf) of deck area (out of 30,000,000 sf) annually on the NHS, or 380,000 sf (out of 38,000,000 sf) on the SHS.

Bridge Whole Life Management Strategy

We all depend on a reliable road network which includes bridges. Unfortunately, Oregon's inventory of aging and deteriorating bridges is trending towards eventually becoming unreliable. While ODOT does a good job of maintaining our older bridges to keep them safe, the service life of a bridge is limited.

What can we expect in the future? An aging bridge inventory will mean an increase in short-term bridge closures to address unexpected repairs, load postings that limit emergency vehicles or semi-trucks, and worst case, permanent bridge closures. While there are no easy solutions, it is important to understand what is coming in order to make decisions now that can help to manage the decline of bridge conditions on the SHS.[32]

The Bridge Program follows ODOT Highway Management Team-established criteria for identifying priority bridges and optimizing bridge program funds. The strategies are listed below:

- Ensure the protection of coastal, historic and major river crossings and border structures.
- Use practical design and fund only basic bridge rehabilitations and rare replacements.
- Focus bridge program funding on bridge work only.
- Give priority to maintaining Fix-It corridor bridges which incorporate the highest priority freight corridors.

[33] 2020 Bridge Condition Report (p.10 & 12)

- Continue to maximize bridge preventative maintenance (PM) treatments to extend the service life of the deck and other structural components using Major Bridge Maintenance (MBM) funding.
- Leverage other programs, e.g., the pavements program, where possible to do additional bridge preservation on the system.
- Continue use of bridge inspection, health monitoring and improved deterioration prediction methods to anticipate future bridge conditions.
- Ready additional bridge shelf projects, projects designed to an interim milestone and then paused till construction funding can be allocated, in anticipation of program savings and/or new funding opportunities.

Typical Costs of Bridge Treatments

A variety of treatment options are available to maintain bridges on the NHS. The treatments range from maintenance activities such as deck and joint sealing to full reconstruction. Bridge condition, traffic level, cost, service life, risk and other factors are all considered to determine the most appropriate treatment.

All typical costs of treatments listed below reflect the estimated installed cost.

Potential Work Type	Typical Treatment	Typical Cost
Maintenance	Deck sealing	$3 per sq. ft. deck area
	Joint sealing	$25-$250 per LF
	Timber pile repairs	$25,000 per EA
Preservation and/or Rehabilitation	Painting/coating	$50 per sq. ft. of surface
	Cathodic protection	$75 per sq. ft. of surface
	Stealth rail	$1500 per LF
	Vertical clearance[34]	Varies
	Deck overlays	$5-$250 per sq. ft. deck area
	Scour mitigation[13]	Varies
Reconstruction	Reconstruction	$850-$2,000 per sq. ft. deck area
Initial Construction	New Construction[13]	Varies

5-12 Typical Unit Costs of Bridge Treatments

Analyzing Potential Bridge Treatments

Keeping a bridge within state condition targets[35] of fair to good condition requires routine inspections, proactive maintenance and preservation treatments. Examples of proactive maintenance are:

1. Sealing or replacing leaking joints to minimize the deterioration of superstructure and substructure elements beneath the joints;
2. Painting, coating or overcoating structural steel to protect against corrosion; and
3. Installing scour countermeasures to protect the substructure from undermining and failure due to scour.

Timing is critical when performing the work since the longer the deterioration occurs, the more extensive/expensive the required treatment will be.

[34] Costs for this type of work are highly variable and cannot be summarized with a single unit cost
[35] *Legislatively Approved Key Performance Measure*

Several PM treatments, including deck sealing and joint sealing, can be performed on a bridge throughout its life cycle to extend its design life and avoid more costly rehabilitation and reconstruction. The following chart describes an optimal cycle of bridge treatment activities. However, under a constrained revenue scenario, many of these activities must be deferred.

5-13 Optimal Cycle of Bridge Treatment Activities

In 1990, the state of Oregon established the Major Bridge Maintenance (MBM) Program, to specifically address major and emergency bridge repairs. These repairs are typically large enough to be outside the scope of work that can be funded at the district level, but are too small or can't wait to be included in future Statewide Transportation Improvement Program (STIP) cycles. Based on current bridge program funding, MBM projects are performed on 7% of ODOT bridges every year. Due to the nature of the work, some bridges (e.g., timber bridges) require MBM funding for major repairs on a regular basis. In addition to repairs, the MBM Program is also used to fund deck seals and waterproofing membranes to extend the life of bridge decks.

Bridge Life Cycle Approach

Because there isn't enough funding to replace bridges, many poor condition bridges are repaired as mentioned above and resuscitated (restored from poor to fair) so they can remain in service. ODOT is very conscientious about maintaining a safe and reliable bridge network. Bridges that have significant defects will be flagged for urgent repairs which often result in improving the bridge condition just enough to move it out of poor condition and back to fair. While these bridges are safe, they will continue to have underlying issues that result in a cycle of needed repairs or resuscitations.[36]

As ODOT's bridges age and approach the end of their service lives, the size and frequency of repairs increases. Many bridges have already had substantial repairs completed and are due for more in the near future. Repair projects on old structures can be costly and have little return on the investment. This means that an economic analysis would determine that a bridge replacement is the smartest long term investment. However, with bridge inventory needs exceeding available financing, few replacements can be funded. There is little choice but to divert maintenance funds to repair the bridge and keep the route open. The number of bridges that are reaching this condition can be visualized as a wave and the number of these bridges far exceeds the available funding.

The most cost-effective approach is to extend the service life of bridge decks and other structural components where possible through routine preventative maintenance. This approach extends the life of bridges, reducing the frequency of and need for costly bridge replacement.

[36] Bridge Condition Report (ODOT, 2022)

Oakland Bridge Piers

Chapter 6 – Risk Management

6.1 Risk Management Overview

Effective risk management requires knowledge and understanding of important risks, an assessment of their relative priority and a comprehensive approach to monitoring and addressing them. The management of risk is a key component of an effective transportation asset management program. Risk management compliments asset management, which seeks to provide transportation assets that are safe, reliable and maintained in a state of good repair for the lowest possible costs.

ODOT's approach to risk management is to focus resources to minimize threats to the condition and operation of the state's multimodal transportation system and maximize opportunities to improve its transportation programs. This approach necessitates balancing risk across multimodal programs and across the diverse geographic areas with a focus on minimizing threats and challenges to the provision of "a safe and reliable multimodal transportation system that connects people and helps Oregon's communities and economy thrive."

The goal of the agency's approach to risk management is to make better and more informed decisions regarding existing and potential risks to its transportation assets and programs and better understand the likely outcomes and impacts of alternative actions.

ODOT is engaged in a number of risk management activities and in many cases has already identified and is addressing high-priority risks that may impact achieving the goals of the TAMP. In order to better manage and communicate the many risks impacting Oregon's pavement and bridge assets, ODOT will continue to document and update the major risks, drawing upon the many plans and studies developed by the agency to manage major risks, including but not limited to:

- *ODOT's Climate Change Adaptation Strategy Report (April 2012)*
- *Seismic Lifelines Evaluation, Vulnerability Synthesis, and Identification (May 2012)*
- *The Oregon Resilience Plan (February, 2013)*
- *Cathodic Protection Evaluation (October 2014)*
- *The Oregon Highways Seismic Plus Report (October 2014)*
- *Climate Change Vulnerability Assessment and Adaptation Options Study (Dec 2014)*
- *Impacts of Potential Seismic Landslides on Lifeline Corridors (February 2015)*
- *A Strategic Investment in Transportation (January 2017)*
- *Rough Roads Ahead 2 (February 2017)*
- *ODOT's Succession Planning Guide (2019)*
- *OTC Investment Strategy (April 2020 Update)*
- *Predicting Seismic- Induced Rockfall Hazard for Targeted Site Mitigation (Dec 2020)*
- *Validation of Tsunami Design Guidelines for Coastal Bridges (January 2021)*
- *ODOT's Seismic Implementation: Policies and Design Guidelines (ODOT, April 2021)*
- *Strategic Action Plan (Updated Nov 2021)*

6.2 Risk Identification, Categories and Responsibilities

ODOT categorizes risk into the six major risk management categories of:

1. Pavement,
2. Bridge,
3. Other Tier-1 Assets,
4. Environmental,
5. Economic and Financial, and
6. Organization and Leadership

Each of the following subsections identifies the key risks and concerns in the specific area and summarizes the existing work to address the risks. Note that there is some overlap across asset groups with respect to risks they are considering. For example, seismic risk is handled by both Bridge Engineering and those working on environmental issues.

Pavement Risk Management

ODOT's Pavement Services Unit is responsible for pavement management; pavement design and materials; and related activities. This unit has worked extensively to develop ODOT's Pavement Management System (PMS). Updates to condition data are performed annually on the interstate system and biannually on the non-interstate system; and this data is used to inform treatment assumptions and deterioration rates in the system. The PMS is used to analyze future conditions and forecast impacts of different funding scenarios. One such analysis is detailed in the ODOT report, *Rough Roads Ahead 2: Economic Implications of Deteriorating Highway Conditions* published in February 2017.

The Pavement Services Unit attempts to address programmatically as many different risks to pavement as possible in the PMS. For instance, risks of accelerated pavement deterioration are handled through the scoping process and annual review of interstate pavement conditions and the treatment assumptions and deterioration models in the PMS.

The Pavement Services Unit also works to manage many non-programmatic risks related to pavement. One such risk is that although the TAMP is intended to address the entire NHS, around 6% of the NHS in Oregon is owned by other agencies besides ODOT. While the non-state-maintained portion of the NHS represents a relatively small portion of system, there is a risk that a lack of asset management on off-system NHS roads will impact the overall pavement condition and the ability of the agency to meet the targets set forth in the TAMP.

Another risk is that, despite the best efforts of ODOT staff, there is significant uncertainty in projections of future pavement conditions. While staff is fairly confident in the projection of conditions up to eight years in the future, there is less confidence in projections beyond eight years. ODOT works to mitigate this risk through biannual updates of its pavement models and modeling assumptions, as described above.

Finally, pavement faces the risk of decreased or inadequate funding and project cost escalation. Uncertainty around the funding received for pavement contributes to this risk. To the degree possible, the Pavement Services Unit mitigates this risk by developing policy statements on how money is allocated and spent within the program. There is also a working group that assesses projects and works to address issues around project costs.

Bridge Risk Management

ODOT's Bridge Section is responsible for managing the Oregon highway system bridge inventory and has performed extensive work to inspect the state's bridges, identify investment needs and develop strategies for mitigating specific types of risks. The *2021 Bridge Condition Report* includes a discussion around risks such as Oregon's aging bridge inventory, declining bridge conditions and the growing backlog of bridge preservation, rehabilitation and replacement.

The report also describes ODOT's process for routine bridge inspection and its programs for bridge preservation, rehabilitation and replacement. Supplementing these activities, the Bridge Section has focused additional attention on risks related to four key areas:

- decks;
- corrosion on steel bridges and reinforced concrete bridges;
- fatigue cracking on steel bridges; and
- scour

In each of these areas, ODOT has identified bridges at increased risk and developed a mitigation plan identifying priorities for treatment. For instance, for addressing fatigue cracking, ODOT has performed supplemental bridge inspections of fatigue-prone areas on its steel bridges, and has prepared a mitigation plan based on the inspections.

To continue to assess and monitor risks in these areas, ODOT is developing a watch list of bridges that are in need of long-term oversight. The goal of this list is to have all the information about the bridges in a central location that is available to anyone who needs it. The integrated list will replace the current set of risk-specific lists maintained by individual engineers.

Another area where ODOT has made progress is in assessing seismic risk to bridges. The agency performed a complete vulnerability assessment of its bridge inventory and determined the funding necessary to address all the resiliency issues in designated lifeline routes. The *2014 Oregon Highways Seismic plus Report* describes the assessment; and it includes a five-phase approach for performing all the necessary retrofitting work. Because the cost of performing all of the seismic retrofit work identified in the plan would be prohibitive, the initial emphasis is on performing seismic retrofits for selected bridges to secure key lifeline routes in the event of a major earthquake.

In 2021, ODOT developed and published *ODOT's Seismic Implementation: Policies and Design Guidelines*, a document that provides guidance to planners, project teams, scoping teams, designers, program managers and ODOT Maintenance and Operations as they implement the Seismic Program. The policy document is intended to facilitate discussions around options to maximize the value of HB 2017 seismic funding. The ODOT Seismic Implementation document designates the ODOT chief engineer as the program owner. A Seismic Program Advisory Group has been assembled to assist the chief engineer with strategic decisions and program direction during program implementation. Members of the advisory group represent key technical disciplines, districts, regions and local agencies.

Other potential risks to ODOT bridges identified by Bridge Section staff include:

- Bridge hits
- Construction defects
- Increased deterioration due to winter maintenance
- Increased deterioration from increases in truck sizes and weights
- Potential for reductions in bridge maintenance and rehabilitation funding to address capacity needs
- Potential that funding will be needed to strengthen bridges for emergency vehicles which will reduce the funding available for rehabilitation and replacements

Other Tier-1 Asset Risk Management

ODOT's other Tier-1 assets include culverts, tunnels, traffic signals and ADA ramps. Tier-1 assets are the top priority assets for ODOT determined through criteria that include: asset value, criticality for highway core operations, accessibility, safety risk and consequence, criticality of stewardship, and attention to status or condition. Although these assets are not included in this TAMP, risks related to these assets are nonetheless relevant to the TAMP to the extent resources otherwise used for pavements and bridges may be required to mitigate Tier-1 asset risks.

Risks identified by staff responsible for these assets can be classified into the following three basic categories:

1. **Asset Failure.** Unexpected asset failures may require diversion of funds from other programs. Failures such as downed signs and rockfalls are routine occurrences and handled through day-to-day maintenance. However, increases in asset failure rates caused by factors such as aging infrastructure may require additional resources to address.
2. **Lack of Quality Asset Data.** It can be a challenge to obtain the funding needed to collect and maintain asset data. This challenge extends to all of ODOT's assets, not just the Tier-1 assets. Data collection and maintenance requires sustained investment in order to prevent data from aging and becoming unusable. The lack of current, quality data can create uncertainty concerning what investments are needed, lead to inefficient decision-making and contribute to a greater incidence of unexpected asset failures.
3. **Changes in Standards and Requirements.** When design standards or other requirements for an asset change, this may result in significant cost implications for ODOT. An example of this is ODOT's recent experience with curb ramps. Many of the curb ramps on state-owned highways fail to meet current design standards. ODOT recently settled a lawsuit over this issue by committing to audit all curb ramps and pedestrian crossing signals along state highways, and then address all issues identified in the audit over the next 15 years.

Environmental Risk Management

A number of different efforts are underway in Oregon and at ODOT to assess and mitigate environmental risks and increase the resiliency of the transportation system to existing and future natural hazards. These risks to the system include those from seismic hazards, extreme weather events and changing environmental conditions due to climate change.

The TAMP addresses risks from natural hazards to the system, including flooding, landslides and coastal erosion from storms as well as ground shaking and tsunamis from seismic events. ODOT's Engineering and Technical Services Branch establishes statewide policies and practices to inform project design and construction, in order to mitigate these natural hazard risks with impacts on transportation. Program disciplines such Bridge Engineering, Geotechnical Engineering, Hydraulic Engineering and Environmental work with internal and external stakeholders alike to guide and design natural hazard mitigation solutions for these risk statewide on transportation projects. ODOT's Climate Office provides leadership, planning, policy analysis and technical support for climate change adaptation and resiliency related issues.

The *Oregon Natural Hazards Mitigation Plan* also assesses risks across the state from the following natural hazards:

- Coastal Hazards
- Droughts
- Dust Storms
- Earthquakes
- Floods
- Landslides
- Tsunamis
- Volcanoes
- Wildfires
- Windstorms
- Winter Storms

Economic and Financial Risk Management

The 2020 update to the *OTC Investment Strategy*, tells the story of the significant long-term funding challenges and risks that face ODOT and Oregon's transportation system. This strategy was updated through request of the Oregon Transportation Commission (OTC) to account for the additional funding in HB2017 and an updated assessment of need across the transportation system. The OTC plays a key role in making investment decisions for the transportation system and the agency, primarily through the Statewide Transportation Improvement Program.

The primary economic and financial risks are related to economic recession, fuel efficiency and electrification, federal funding uncertainty, and the increasing cost of doing business (i.e., inflation and aging infrastructure). Below is a summary of the revenue and funding challenges and risks presented in the *2020 Investment Strategy*.

COVID-19 and the Economy

The onset of the COVID-19 pandemic has reduced traffic volumes significantly, which has also reduced fuels tax revenue. The pandemic's longer-term impact on the economy is unknown. Even if the recession is modest, it will punch a hole in state and federal transportation revenue—and if the recession is worse than projected, the revenue loss could be significant. And COVID-19 could also impact traffic volumes and commuting patterns for years, changing investment needs.

Fuel Efficiency and Electrification

Cars driven today are drastically different than they were even a decade ago. National fuel economy standards were 27.5 miles per gallon (MPG) in 1982, 30.2 MPG in 2011, 37.7 MPG in 2019 and will go up to 49.7 MPG by 2026 for passenger vehicles and light-duty trucks, according to the final rule published by the Environmental Protection Agency and the National Highway Traffic Safety Administration in 2012.

The Legislature attempted to address the revenue issue of higher efficiency vehicles with a surcharge on hybrid and electric vehicle title and registration fees built into HB 2017.

However, even with the tiered registration and title fees, high-efficiency vehicles will pay much less than the average vehicle that gets about 20 MPG. Though the registration surcharges ensure that electric vehicles pay for their use of the roads, the surcharges introduce two inequities:

- An electric vehicle that drives a lot of miles will pay much less than a low-efficiency vehicle.
- An electric vehicle pays the same amount regardless of how many miles it drives, which does not incentivize driving less.

Federal Funding Uncertainty

Oregon receives more than $700 million annually in Federal-Aid Highway Program funds through a variety of formula programs tailored to specific areas of the transportation system. Federal funding for highways, safety, transit and rail is provided through September 2026 under the current surface transportation authorization act, known as the Infrastructure Investment and Jobs Act (IIJA, aka Bipartisan Infrastructure Bill).

The federal fuel taxes provide virtually all of the resources flowing into the Federal Highway Trust Fund. The 18.3 cent per gallon federal gas tax and 24.4 cent per gallon federal diesel tax have not been raised since 1993, resulting in a significant gap between user fee revenue and trust fund expenditures.

Funding estimates developed for the 2024-2027 STIP assume a 10% reduction in federal funds in the year following the expiration of the IIJA and continuing unchanged in the subsequent one or two years, which is consistent with past reductions of federal funding after expiration of authorization acts.

Inflation

Most taxes generally rise along with incomes, prices or property values. However, the gas tax, DMV fees and weight-mile taxes are set at a flat level (rather than a percentage) and their purchasing power is constantly eroded by inflation.

State Highway Fund revenue in total is barely growing, even with HB 2017's tax increases, when accounting for inflation. The gas tax increases under HB 2017 will only get the gas tax back to the same purchasing power of 2011 after the Jobs and Transportation Act gas tax increase. The three 2 cent increases under HB 2017 only keep up with inflation.

Aging Infrastructure

Most of ODOT's transportation assets were built in the post-war Interstate construction era and are reaching the end of their original lifespans. For example, more than half of the state's bridges were built before 1970 and have reached the end of their 50-year design life.

However, funding for maintenance and repair has not kept up with the growing needs of an aging system. As a result, ODOT is managing the decline of the transportation system. Deliberate strategies and expertise by ODOT's public servants and industry partners help stretch the available funding and slow the deterioration.

Increase in Mobility Options

As the smart phone continues to change society, new mobility options enabled by mobile apps continue to roll out. Uber, Lyft and other shared transportation services continue to expand. Electric bicycles and scooters, as well as bike-share systems (sometimes referred to as "micro-mobility" options), are shifting how users get from point A to point B.

These services are often referred to as "mobility on demand" and they will have broad-ranging impacts on transportation, particularly in urban areas. Commuting, public transportation and management of the right of way will all be impacted. Due to COVID-19, teleworking has risen significantly, keeping people plugged in remotely (and out of their cars). Whether this is a short-term blip or part of a longer-term shift is not yet known. As technology continues rapidly advancing, the deployment of autonomous vehicles will undoubtedly alter travel and commuting patterns. All of these trends will modify investment needs across the transportation system, in ways that are not well-understood at this time.

Further information and analysis around investment strategies for pavement and bridge assets on the NHS is provided in *Chapter 8 - Investment Strategies*.

Organizational and Leadership Risk Management

ODOT's Executive Team and Human Resources staff both identified future loss of key staff as a major organizational risk. To address this risk, Human Resources has developed a *Succession Planning Guide for ODOT Managers*[37]. The guidebook helps managers identify critical positions within their team, assess their team's needs and determine both position and employee competencies. Human Resources is also performing a pilot program in competency-based performance related to this issue.

Another organization-related risk to the TAMP is that ODOT has a lean workforce, with limited capacity to meet the increasing need for project delivery and engineering. To mitigate the risk, ODOT is requesting additional project delivery and engineering staff from the legislature. The agency is in the process of expanding the transportation program to address this risk as well.

Staff also identified increased outsourcing as an organization-related risk to the TAMP. There is concern that contractors may not have the depth of knowledge or experience necessary to perform the needed work. In addition, it takes skills within ODOT to oversee contractors. Increased outsourcing also means that key knowledge now resides outside the agency and not with people on staff at ODOT.

37 ODOT's Succession Planning Guide (2019) (internal)

6.3 Risk Assessment, Evaluation and Prioritization

ODOT uses the *ODOT Risk Register*[38] to clearly communicate conditions and challenges faced by the agency. It is used as a tool to build consensus around the likelihood and impact of risks. Each risk identified is written as a risk statement, providing a description of the risk event and a summary of its potential impact as shown below.

Risk Event (if)	*"If ODOT does not plan for extreme weather events,*
Potential Impact (then)	*then bridges, roadways and structures will be damaged."*

Identified risks are compiled and ranked by multiple subject matter experts, according to the *likelihood* (or *frequency*) of the risk event occurring, as well the *impact (*or *significance)* that the risk would have on Oregon's transportation system. The definitions for these risk factors are defined as follows:

Likelihood *(or frequency*	**Impact** *(or significance)*
How likely is it that this event occurs?	If it does occur, what is the impact to the entire system?
1 - Very unlikely to occur *(once every 50+ years)*	**1- Very Low Impact** *(insignificant)*
2 - Unlikely to occur *(less than every 10 years)*	**2 - Low Impact** *(minor)*
3 - Likely to occur *(about every 10 years)*	**3 - Medium Impact** *(Significant)*
4 - Very likely to occur (*more than every 10 years)*	**4 - High Impact** *(major)*
5 - Extremely likely to occur *(more than every few years)*	**5 - Very High Impact** *(catastrophic)*

6-1 Likelihood/Impact Risk Assessment Table

In recognition that an event that is less likely to happen but that would have catastrophic consequences should be prioritized over a risk that is likely to happen but that would have minor or insignificant consequences, an increased weighting was applied to the "Impact" score. Risk Ranking = (Impact multiplied by 1.25) + (Likelihood). The scores for each of these risk factors are combined to determine a risk ranking, and in turn a prioritization of risk. The following matrix identifies the risk ranking based on this formula and scoring criteria:

		IMPACT				
		Insignificant (1)	**Minor (2)**	**Significant (3)**	**Major (4)**	**Catastrophic (5)**
LIKELIHOOD	**Very Unlikely (1)**	Very Low *(2.25)*	Very Low *(3.5)*	Low *(4.75)*	Moderate *(6)*	High *(7.25)*
	Unlikely (2)	Very Low *(3.25)*	Low *(4.5)*	Moderate *(5.75)*	High *(7)*	High *(8.25)*
	Likely (3)	Low *(4.25)*	Moderate *(5.5)*	Moderate *(6.75)*	High *(8)*	Extreme *(9.25)*
	Very Likely (4)	Moderate *(5.25)*	Moderate *(6.5)*	High (7.75)	Extreme *(9)*	Extreme *(10.25)*
	Extremely Likely (5)	Moderate *(6.25)*	High *(7.5)*	High *(8.75)*	Extreme *(10)*	Extreme *(11.25)*
	Scoring Criteria: Very Low: 0-4, Low: 4-5, Moderate: 5-7, High: 7-8, Extreme: 9+					

6-2 Likelihood/Impact Risk Ranking Matrix

[38] Appendix G: ODOT Risk Register

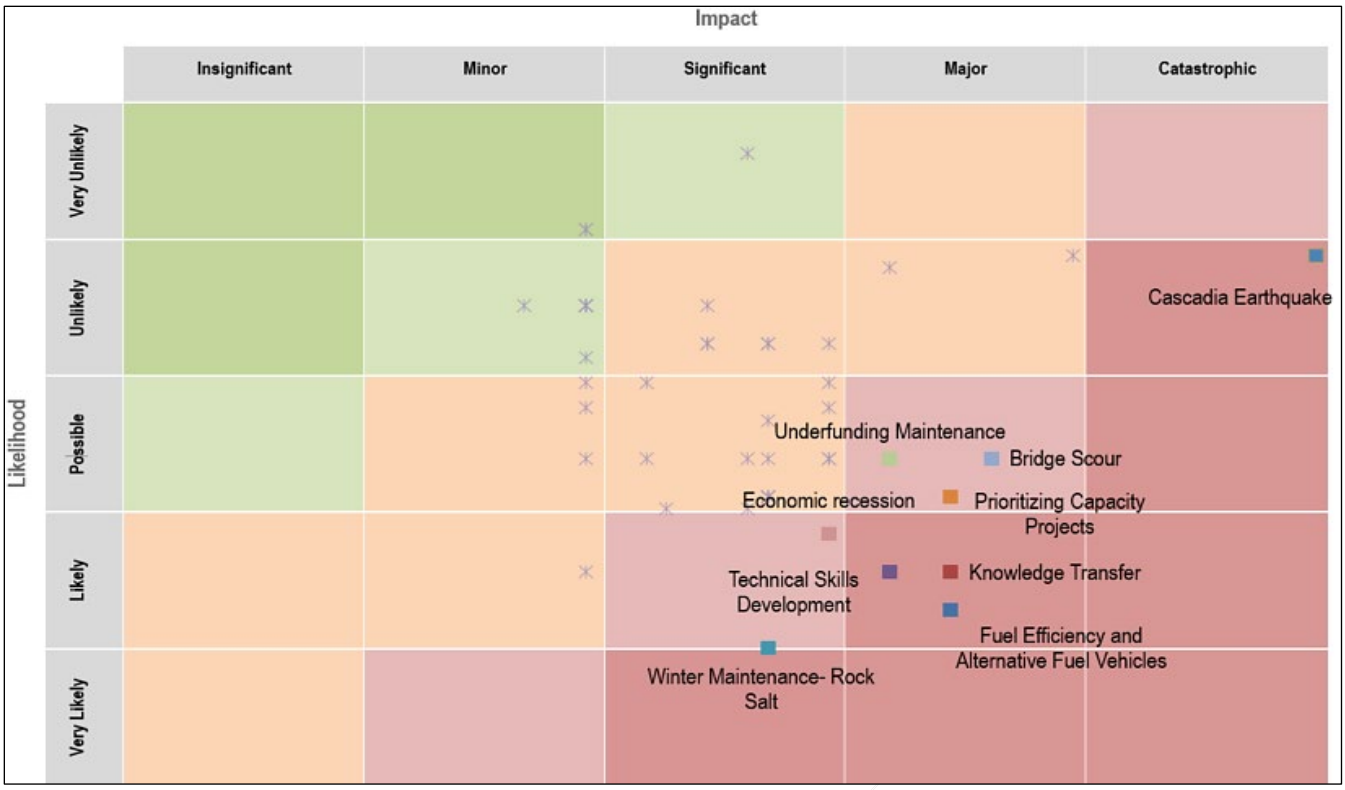
6.4 Risk Mitigation and Monitoring

All risks whose scores were categorized as *high* or *extreme* though the likelihood/impact risk scoring activity were flagged as top priority risks needing a mitigation plan and monitoring approach. Mitigation plans for these "Top Priority Risks" including mitigation potential, strategies and actions are documented in *Appendix H – Mitigation Plans for High Priority Risks* [39]

The following 10 risks were identified as "Top Priority Risks."

1. **Fuel Efficient and Alternative Fuel Vehicles**
   If there are improvements in fuel efficiency and proliferation of alternative fuel vehicles, then future available funds may be reduced.
2. **Knowledge Transfer**
   If we lack appropriate knowledge management and succession planning, then future staff may not have sufficient knowledge to perform needed work.
3. **Cascadia Subduction Zone Earthquake**
   If there is a Cascadia Subduction Zone earthquake, then this would result in large-scale injuries and fatalities, tsunami and landslide risk, major road and bridge damage and adverse impacts to the movement of people and freight.
4. **Technical Skills Development**
   If complex design and engineering work is heavily outsourced to consultants, then the agency may not be able to develop and retain a workforce with necessary technical skills and ability to manage consultant work.
5. **Winter Maintenance - Rock Salts**
   If rock salt is used during the winter, then this may cause increased deterioration of pavement and bridges.
6. **Prioritizing Capacity Projects**
   If capacity projects are prioritized for funding, then money is diverted from maintenance, preservation and rehabilitation work.
7. **Bridge Scour**
   If bridge scour needs are not addressed, then bridges could fail as a result of scour.
8. **Economic Recession**
   If the state experiences an economic recession, then this may result in a reduction in the effective level of funding.
9. **Underfunded Maintenance**
   If maintenance is continually underfunded, then this may cause accelerated asset deterioration.
10. **Increases in Material Costs**
    If there are unexpected cost increases in pavement and bridge materials (aggregate, steel, etc.), then construction and maintenance costs could increase drastically.

[39] Appendix H: Mitigation Plans for High Priority Risks



6-3 Impact/Likelihood for Top Priority Risks

The following table provides a high-level summary of risk-management owners responsible for risk activities, including the monitoring of risks.

Risk Categories	Risk Management Responsibilities
Bridge	Responsibility for bridge-related risk lies with the Bridge Section. Among this section's responsibilities is developing mitigation plans for specific types of distresses.
Pavement	The Pavement Management System and risks related to pavement are managed by the Pavement Services Unit
Other Tier-1 Assets	Responsibility for other Tier-1 asset is shared among the different asset owners.
Environmental	Responsibility for environmental risks is shared among multiple stakeholders, Maintenance and Operations Branch, the Climate Office, and Engineering and Technical Services Branch, which includes ODOTs Asset Management Program Office
Economic and Financial	The Economic Services Unit is responsible for developing both the state and federal revenue forecast. Staff in the Highway Budget Office and Program and Funding Services are responsible for developing the expenditure projections.
Organization and Leadership	Responsibility for managing most organization and leadership-related risks lies with Human Resources and the Executive Team.

6-4 Risk Management Responsibilities

6.5 Facilities Repeatedly Damaged by Emergency Events

23 CFR Part 667 of the Final Rule for the development and implementation of a risk-based asset management plan requires State DOTs to conduct periodic evaluation of transportation infrastructure to determine if there are reasonable alternatives to roads, highways, and bridges that have required repair and reconstruction on two or more occasions due to emergency events. An evaluation is defined as "an analysis that includes identification and consideration of any alternative that will mitigate, or partially or fully resolve, the root cause of the reoccurring damage, the costs of achieving the solution, and the likely duration of the solution." Reasonable alternatives are defined as "options that could partially or fully achieve" the following:

1. Reduce the need for federal funds to be expended on emergency repair and reconstruction activities;
2. Better protect public safety heath and the human and natural environment; and
3. Meet transportation needs as described in relevant and applicable federal, state, local and tribal plans and programs. Relevant and applicable plans and programs include the Long-Range Statewide Transportation Plan, Statewide Transportation Improvement Program (STIP), Metropolitan Transportation Plan(s), and Metropolitan Transportation Improvement Program(s) TIP.

State DOTs are to consider the results of the evaluation of highways and bridges repaired and reconstructed as a result of two or more emergency events when developing projects. State DOTs and MPOs are encouraged to include evaluations during the development of transportation plans and programs. Among the information to be produced as part of the risk management analysis section of a state's asset management plan is "a summary of the evaluation of facilities repeatedly damaged by emergency events."

Oregon Emergency Relief Program Funding

The Oregon Division Office of FHWA provided ODOT with a summary of awarded funding for emergency event repairs beginning with the year 1962. Over the course of the last 58 years, Emergency Relief (ER) funding received by the state totals just over $437 million. As shown in the following table, the emergency funding for the repair and reconstruction of **NHS highways and bridges** over the course of the last 23 years has totaled **$117.6 million**.

Disaster Year	Obligation Amount
2020	$23,327,409
2019	$13,167,000
2018	$0
2017	$22,433,308
2015 -2016	$0
2014	$2,137,727
2013	$0
2012	$990,618
2011	$225,398
2010	$0
2009	$767,177
2007 -2008	$0
2006	$4,615,831
2001 -2005	$0
2000	$6,200,357
1998 -1999	$0
1997	$24,846,410
Total	**$ 117,606,156**

6-5 NHS Oregon Emergency Relief Program Funding 1997-2020

Emergency Events Repeatedly Damaging Transportation Facilities

The nature of Oregon's location, topography and geology subjects the state to an increased likelihood that pavements and bridges in certain locations will be subject to extreme weather and/or seismic damage. The western portion of the state is located over one of the most seismically active regions in the world and demonstrates a history of strong earthquakes. Oregon's coast and Cascade Mountains have always been susceptible to extreme weather events and erosion.

ODOT has long recognized the vulnerability of transportation infrastructure to extreme weather and emergency events and the risks they present to the condition and performance of pavements and bridges. Weather-induced landslides and rock-falls have been ongoing challenges for the agency since its initial founding. In the late 1990s, the agency established an Unstable Slopes Management Program[40], and initiated an effort to inventory and rate all known landslide and rock-fall locations along the state's highways. Currently, the inventory of landslide and rock-fall sites total about 4,200 with an estimated repair cost exceeding $2.7 billion. The majority of very large landslides have been inventoried, however about 45% of the State Highway System landslides remain to be inventoried.

6-6 Repairing Slopes along Oregon 244 to prevent rock fall.

Extreme weather accelerates asset deterioration and requires the use of differing preservation and maintenance measures. Lower-cost solutions which contribute to reduced lifecycle costs include: enhanced monitoring and maintenance of slopes, embankments, and drainage systems; installation of groundwater piping systems; and minor realignment/elevation increase of pavement and bridge infrastructure.

Highways and bridges found to have repeated repairs due to emergency events are evaluated by engineering staff and others to determine if there are reasonable and cost-effective alternatives that would mitigate, or partially or fully resolve the root cause of reoccurring damage.

[40] Oregon Department of Transportation : Unstable Slopes : Geo-Environmental : State of Oregon

The table below, presents instances where portions of NHS routes within specific counties have experienced damage from more than one emergency event during the 24-year period January 1, 1997 through December 31, 2021.

NHS ROUTES EXPERIENCING REPEATED EMERGENCY EVENTS DAMAGING TRANSPORTATION FACILITIES					
ROUTE	COUNTY	START MP	END MP	TYPE OF DAMAGE	# OF EVENTS
I-5	Douglas	154.00	170.00	Debris, Slide, GR, RW Fence, Scour	2
	Jackson	17.00	27.00	Hazard Tree, Erosion, GR, Signs, Fencing	2
I-84	Multnomah	18.00	49.00	Debris, Slides, rockfall, Embankment	4
	Umatilla	182.00	188.00	Scour, RW, Levee, Drift	3
OR126E	Lane	7.59	76.65	Debris, Slide, Haz Tree, Slope, TC, GR, Pvmt, Sign	7
OR126W	Lane	0.00	53.00	Storm debris, Slide, Shoulder, Culvert	7
OR18	Lincoln	2.00	10.40	Debris, Slide, Shoulder, Guardrail, Haz Tree, TC	9
	Polk	14.90	23.24	Debris, Slide, Sink, WashOut, Cul, GR, Haz Tree	4
	Tillamook	10.10	14.00	Debris, Slide, Shoulder, Guardrail, Haz Tree	6
OR22	Marion	12.72	26.18	Storm debris, Landslide, washout	5
		13.00	65.00	Debris, Slide, Scour, Cul/BR, Haz Tree, TC, GR	14
OR38	Douglas	0.00	57.00	Debris, Slide, Shoulder, Culvert, GR	7
OR42	Coos	34.00	44.00	Debris, Slide, roadway collapse, Erosion, Culvert	10
	Douglas	14.70	49.00	Storm debris, rockfall, slide, culvert	5
OR58	Lane	5.73	62.07	Debris, Slide	3
OR99	Jackson	17.02	9.79	Haz Tree, Erosion, GR, Signs, Fencing, TC	5
US101	Clatsop	0.00	37.10	Storm debris, slide	4
	Coos	233.50	248.50	Storm debris, slide, shoulder damage	4
	Curry	292.00	350.40	Storm debris, slide, sink	21
	Douglas	198.56	213.00	Storm debris, slide, slope failure	5
	Lane	172.00	190.84	Storm debris, slide, scour, landslide	6
	Lincoln	111.00	140.00	Debris, slide, shoulder, sink, culvert, Tree, GR	3
	Lincoln	140.00	167.60	Storm debris, slide, sink, landslide	7
	Tillamook	37.00	103.00	Storm debris, slide, washout, guardrail, culvert	7
US20	Lincoln	2.20	20.00	Storm debris, slide, shoulder, sink, culvert	6
	Linn	56.10	65.00	Storm debris, slide, sink, washout, landslide	5
US26	Clackamas	61.00	62.75	Storm debris, slide	2
	Clatsop	0.00	28.00	Storm debris, slide, sink, guardrail	4
	Grant	124.40	154.07	Footing Repair, Scour	2
	Washington	37.00	41.14	Storm debris, slide, sunken grade	3
US30	Columbia	34.00	67.00	Storm debris, rockfall, slide and culvert	5
	Multnomah	6.40	11.60	Debris, Slide, Culvert, Shoulder, Embkmt, Haz Tree	8
US395	Grant	3.50	30.25	Storm washout, unstable slope, wildfire damage	9

6-7 NHS Infrastructure Damaged by More than One Emergency Event (1997-2021)

The table below presents instances where portions of non-NHS routes have experienced damage from more than one emergency event during the 15-year period January 1, 2006 through December 31, 2021.

NON-NHS ROUTES EXPERIENCING REPEATED EMERGENCY EVENTS DAMAGING TRANSPORTATION FACILITIES					
ROUTE	COUNTY	START MP	END MP	TYPE OF DAMAGE	# OF EVENTS
200 TERRITORIAL RD	Lane	2.03	42.08	Trees, High water	3
BRAODWAY ST	Coos	0.00	0.91	Culvert damage and sink holes	2
BUTTE FALLS RD	Jackson	1.55	6.00	Trees, Signs, Guardrails	2
HUNTER CREEK RD	Curry	0.27	2.62	Embankment, Flooding	3
OR103	Clatsop	0.00	9.02	Slide, trees, debris	5
OR104	Clatsop	0.00	6.03	Storm	2
OR130	Tillamook	0.00	9.00	Debris, Slide, Erosion	4
OR131	Tillamook	2.00	4.00	Tree, Debris	2
OR138	Douglas	0.00	23.00	Tree, rockfall, slide, guardrail, drift	10
		15.00	39.00	Tree, Signs, Slope Pavement,	24
		39.00	73.00	Trees, Rocks, Slides, Guardrail, Slope,	12
		73.50	83.00	Shoulder, Trees	2
OR153	Yamhill	0.00	6.00	High water	3
OR180	Benton	12.00	19.25	Tree, Slide, Power line, High water, Debris	5
	Lincoln	0.00	11.82		10
OR18B	Polk	0.00	2.00	High water response, traffic management	2
	Yamhill	2.00	8.00	Flooding, Erosion, Slide	8
OR19	Gilliam	7.95	24.00	Debris, Culvert, Debris, Rockfall	2
OR194	Polk	0.00	7.00	Shoulder, ditch, High water	4
OR202	Clatsop	3.57	6.50	Sink, High water, Sunken grade, culvert	7
		7.00	10.50	Slide, trees	2
		10.70	29.20	slide, sunken grade, shoulder, scour, debris, tree	12
		29.00	39.00	Erosion, Slide, Trees, debris, high water	6
	Columbia	39.13	45.20	slide, erosion	4
OR206	Gilliam	43.00	51.67	Washout, Storm Damage	2
OR207	Wheeler	21.00	24.00	Slide, Washout, Shoulder, Debris, Culvert	5
OR211	Clackamas	11.31	33.45	Ditch, Culvert	2
OR213	Clackamas	16.00	24.00	washout, culvert, scour, high water,	3
	Marion	24.00	29.00	Trees, Power lines, High water	2
OR214	Marion	16.00	39.00	High water, Ditch, Debris, Slide, Scour	17
		11.00	15.00	Ditch, Debris	4
		9.80	10.50	Ditch, Debris, Culvert, Crack	2
OR219	Marion	23.46	36.00	Down tree	2
	Washington	10.00	15.61	Tree, High water	3
	Yamhill	14.50	23.50		3
OR22	Tillamook	10.00	10.96	Shoulder, Ditch, Guardrail	2
		0.00	10.00	Debris, Scour, Shoulder	3
	Yamhill	11.00	24.00	Tree, Guardrail, Slide, Sink, erosion	23
OR221	Yamhill	3.50	7.50	High water response, traffic management	2
OR223	Benton	21.57	31.40	Shoulder, Slide, High water	3
	Polk	10.00	21.00	Shoulder, Drift, High water, Landslide, Erosion	9
		4.50	5.20	High water, Washout, Ditch, Shoulder, Debris, Scour	6
		0.00	4.00		4
OR224	Clackamas	26.62	49.97	Scaling, Tree, guardrails, pavement, signs, sink,	11
		24.20	24.50	Slide, debris, guardrail, culvert	3
		10.30	12.30	Slide, Sink, culvert, high water	3
OR226	Linn	4.93	6.31	High water runoff, 200' shoulder damage	2

		13.86	17.50	Shoulder, Culvert, Rockslide, Debris, Drift	3
		18.00	24.00		5
OR228	Linn	2.40	3.50	High water, Shoulder	2
OR229	Lincoln	0.00	24.00	Trees, Slide, sink, high water, culvert, debris,	32
		24.00	31.00		9
OR230	Douglas	6.00	23.00	Shoulder, Slide, Tree, Drift	4
OR234	Jackson	4.30	6.86	Shoulder, Riprap, Approach	2
OR240	Yamhill	1.00	6.00	High water	2
OR241	Coos	0.00	19.15	sink, slide, flooding, shoulder	11
		0.51	3.10	Shoulder, slide, culvert	4
OR244	Union	35.00	47.00	Guardrail, Erosion	6
OR255	Curry	357.00	358.90	Culvert, Slide, Sink, Storm Damage, Collapse	4
		0.00	0.00	Culvert, Slide, Sink, Trees, Drainage	7
		341.49	343.00	Slide, Road fail, scoring, erosion	5
OR31	Lake	54.00	120.00	Ditch, Slope, Guardrail, shoulder	4
OR34	Benton	27.52	52.00	high water, slump, slide, rockfall, trees, debris,	13
		27.00	58.56	high water, debris, culvert, trees, embankment,	15
	Lincoln	1.00	27.00	Trees, Slide, Washout, Embankment, Crack, debris,	25
OR36	Lane	0.00	39.00	Tree, Slide, High water, Crack	24
OR380	Crook	2.00	26.00	Ditching, slide removal, Culverts, Shoulder	2
OR42S	Coos	0.00	17.08	landslide, erosion, drift, dike, trees, slope	11
OR46	Josephine	2.00	17.00	Shoulder , culverts, debris, flooding	2
OR47	Columbia	46.00	53.00	slide, erosion, trees, debris	7
		59.75	64.21	Shoulder, washout, Piling, Drift	3
		1.00	11.00	slide, debris, shoulder, trees,	8
	Washington	70.00	77.00	Slide, Shoulder, Tree, Power lines	3
	Yamhill	26.50	42.00	High water	2
OR501	Benton	0.00	9.49	Slide, Trees, debris	8
OR53	Clatsop	0.00	11.38	Sink, Slide, Shoulder, Scour, High water, Trees	9
	Tillamook	19.00	13.00	Debris, Trees, Sink	4
		11.50	13.00	Sink, Debris	2
OR540	Coos	0.00	14.10	Signs, Trees	3
OR542	Coos	0.00	18.90	Slide, Bridge, Roadway	14
OR6	Tillamook	3.00	32.00	Sink, Slide, Culvert Debris,	30
	Washington	33.00	39.00	Sink	5
OR62	Jackson	44.00	57.00	Slide, Tree, Debris	3
		22.00	44.00	Slide, Shoulder, Culverts, riprap	3
OR66	Jackson	2.00	17.00	Shoulder, Culvert, Debris, Drift	2
OR99E	Marion	24.67	46.49	Tree, High water	2
OR99W	Polk	64.00	72.00	High water, Drift, Debris	5
PEORIA RD	Linn	0.14	1.30	Slope Failure	5
CHETCO RIVER Rd	Curry	5.02	6.11	Ditch, slope	2
SITKUM LANE	Coos	25.50	28.00	Slope, Embankment, collapsed road	2
		14.00	15.20	embankment failure	2
US101B	Clatsop	0.00	7.25	Storm debris cleanup	2
US30	Multnomah	9.00	22.00	Debris, Slide, Culvert, Tree,	5
		2.55	3.95		2
WINCHUCK RIVER RD	Curry	4.83	7.73	Embankment failure	2

6-8 Non-NHS Infrastructure Damaged by More than one Emergency Event (2006-2021)

6.6 Risk Management Improvement Areas

ODOT Climate Office
In recent years, ODOT has placed a heavy emphasis on enhancing the management of environmental risks. In spring of 2020 ODOT created the Climate Office[41]. The ODOT Climate Office mission is to identify and pursue actions that reduce transportation greenhouse gas (GHG) emissions. The office is also charged with helping the agency understand, prepare and respond to the impacts of climate change and extreme weather.

The Climate Office leads ODOT's effort to track and follow the strategies outlined in the *Statewide Transportation Strategy (STS): A 2050 Vision for Greenhouse Gas Reduction*, and fulfill Governor Kate Brown's Executive Order to reduce GHG emissions in Oregon.

Seismic Resiliency Investment Strategy *(2020)*
In the event of an earthquake and tsunami, a resilient transportation network is necessary for reestablishing critical connections for emergency response, medical and shelter facilities, population centers, energy and communications facilities and freight needs for response and economic recovery. The *2020 OTC Investment Strategy* identified an investment strategy for seismic resiliency. Further information is provided in *Chapter 8 – Investment Strategies*.

Predicting Seismic Research *(2020)*
ODOT and FHWA sponsored the research paper *Predicting Seismic- Induced Rockfall Hazard for Targeted Site Mitigation (OSU, Dec 2020)* written by the Oregon State University. The following are summarized objectives of the paper:

1. Evaluate the capabilities and limitations of mobile LIDAR to analyze rock slope.
2. Identify highest-risk seismic rockfall areas along five Oregon lifeline route segments.
3. Provide recommendations of potential mitigation strategies.
4. Identify regions of seismic instability for targeted mitigation to prepare for seismic events.
5. Develop predictive models to be used for seismic predictions at each site.

Tsunami Design Guidelines *(2021)*
ODOT led the Transportation Pooled Fund Study, TPF-5(307) resulting in the *Validation of Tsunami Design Guidelines for Coastal Bridges (January 2021)*. The report focused on bridges for the Western United States. Five major efforts were completed:

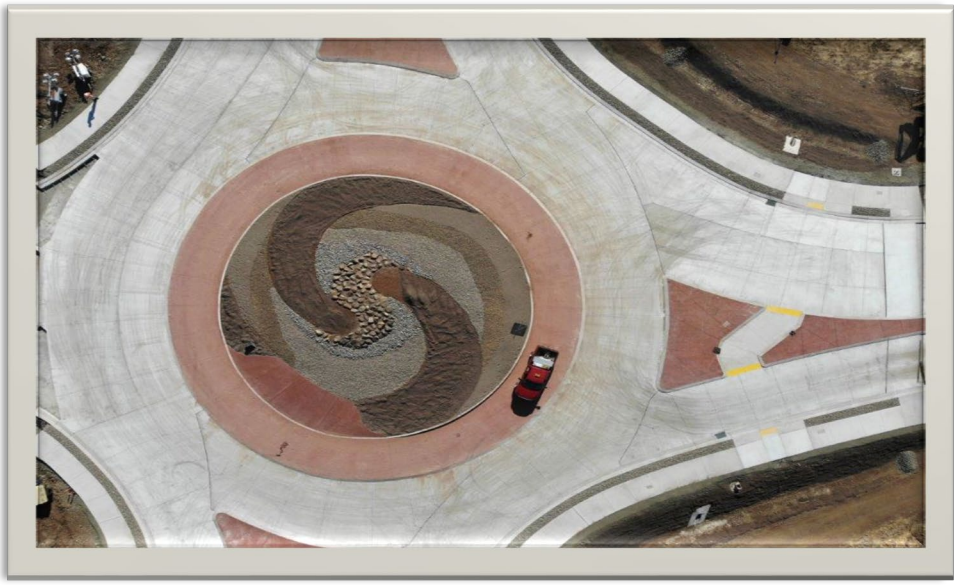
1. Updated probabilistic tsunami hazard mapping to include wave-heights, velocities, and inundation levels at the 1000-year recurrence interval.
2. Uncertainties and bias between models were examined to find areas where they agree and potential areas where the study could identify conservative estimates for optimization.
3. Analysis of site-specific tsunami hazards was developed.
4. Tsunami-induced Hydrodynamic Loading factors are detailed and recommendations for equations presented based on research findings. Three load cases, including conditions showing upward lift were modeled and equated. Bridge skew, slope and super elevation were examined. Debris was considered.
5. Geotechnical considerations were discussed.

[41] Oregon Department of Transportation : Climate Office : Programs : State of Oregon

Seismic Implementation Plan *(2021)*
ODOT's Seismic Implementation: Policies and Design Guidelines (ODOT, April 2021) provides guidance to planners, project teams, scoping teams, designers, program managers and ODOT Maintenance and Operations as they implement the Seismic Program. In addition, the document communicates implementation, provides a consistent decision-making structure for program/project changes and integrates ODOT's work with local agencies

Adaptation Roadmap *(coming soon)*
In 2022 the Climate Office will release an Adaptation Roadmap which includes a statewide climate vulnerability / risk assessment and operational plan. The Roadmap identifies existing and future areas vulnerable to extreme weather hazards and climate impacts, and provides strategies and actions the agency can implement to improve decision-making and system resiliency. Strategies outlined in the Roadmap will enhance the agency's organizational ability to prepare, respond and recover after an event. Example strategies include improving communications and interagency collaboration, collecting more and different data about hazard impacts and costs and updating design guidance for infrastructure to withstand more frequent and intense weather extremes.

Natural Hazard Research and Risk Assessments *(coming soon)*
The Climate Office is also championing research and risk assessments related to natural hazards to improve transportation system resiliency. These projects include: coastal landslide and bluff retreat monitoring; post-wildfire debris flow monitoring / hazard warning systems; coastal erosion hot spot prioritization and design options; nature-based infrastructure protection; and piloting design guidance applying climate information into hydrologic/hydraulic and coastal projects. These efforts are being done in partnership with ODOT Research, Engineering and Technical Services Branch, and Regions.



Oregon 140 Roundabout

Chapter 7 – Financial Plan

7.1 Overview of the TAMP Financial Plan

Financial Plan Requirements

23 CFR 515.7(e) requires a 10-year financial plan that identifies anticipated funding and costs for National Highway System (NHS) pavement and bridge work, broken down by federal work types (i.e., initial construction, maintenance, preservation, rehabilitation and reconstruction) and state fiscal years. Furthermore, 23 CFR 515.13 requires that every year state DOTs provide current and verifiable documentation that it has implemented the Transportation Asset Management Plan (TAMP) and is following the investment strategies in the TAMP.

FHWA considers the best evidence of plan implementation to be: for the 12 months preceding the consistency determination, the State DOT funding allocations are reasonably consistent with the investment strategies in the State DOT's asset management plan. This demonstration takes into account the alignment between the actual and planned levels of investment for various work types.

Considerations and Challenges

In 2018 ODOT developed Oregon's first TAMP financial plan under the new requirements referenced above. There were a number of considerations and challenges involved with developing the financial plan using federal work types and state fiscal year timelines. Consequently, the actual and planned investment levels did not always align to the work type or state fiscal year it was planned in. Below are the main challenges that were discussed and considered during the 2022 update.

- **The required TAMP work types were not clearly defined as they relate to the TAMP.**
  Work type definitions sometimes differ among states and also differ depending on the context of the document. For example, a design manual may consider a retrofit a "Reconstruction" work type for design purposes, but a preservation guide may considered only a total replacement of the bridge or roadway as being "Reconstruction."
- **Oregon STIP work types do not align with TAMP work types.**
  As an example, "Preservation" is the name of pavements STIP Fix-It funding program which encompasses a broad scope of federal work types. But "Preservation" is also the name of one of the five federal work types, which only applies to a portion of the work being completed in the Preservation program. To further complicate matters, it also applies to a portion of work in the Fix-It Bridge funding program.
- **The STIP and TAMP use different timelines.**
  The STIP programs fund for a three-year block of time on the basis of a federal fiscal year, whereas the TAMP plans annually under a state fiscal year. Project life cycles typically extend through multiple state and federal fiscal years, which makes it a challenge to accurately predict which state fiscal year expenditures will impact the budget.
- **Projects may get reprioritized and either modified, delayed or advanced.**
  Planned projects may get reprioritized and either cancelled, delayed or advanced. Advanced projects, do not always have the same work type as the projects that were delayed, which results in a variance between planned and actual spending at the work type level. Also, a project scope may change which could result in the change of the primary work type, creating a variance between when the project was planned and when the project was actually undertaken.

Financial Plan Overview

This chapter presents the Transportation Asset Management Plan (TAMP) financial plan and investment strategies, summarizes federal and state requirements, revenue sources and uses, revenue trends and projections, and highlights investment levels and strategies proposed for State and National Highway System bridges and pavement. The TAMP financial plan is developed and implemented using established asset management procedures. The procedures use information from management systems, input from across the agency, reflect short-term and long-term planning efforts, and are guided by the transportation policies and priorities of the Oregon Transportation Commission (OTC or Commission), the Oregon State Legislature, and the Oregon Transportation Plan (OTP).

ODOT's financial plan and investment strategies are influenced by demographic and revenue trends, federal and state regulations, system physical conditions, technological innovations, environmental conditions, and public input. ODOT seeks to balance investments to preserve and improve the condition and performance of the transportation system with investments in safety, resiliency, multimodal transportation and other projects that enhance Oregon's economic competiveness and quality of life.

Growth in revenues available for the preservation and improvement of Oregon's transportation infrastructure has been drastically outpaced by the growth in the funding needs for an aging system of highways and bridges. As a result, there is an increased importance in identifying investment opportunities that maximize the condition, performance, safety and resiliency of the transportation system for the least cost. Targeted investments in preservation and maintenance treatments increase the service life of transportation assets and reduce lifecycle costs.

7.2 Integration of TAMP and STIP

23 CFR 515.9(h) requires every state DOT to integrate the Transportation Asset Management Plan (TAMP) into financial planning processes that lead to the development of the Statewide Transportation Improvement Program (STIP), supporting its efforts to achieve national and state asset goals and performance measures.

The TAMP documents and summarizes the requirements, plans, activities and processes emphasizing preservation and improvement of Oregon's pavements and bridges on the State highway system. The TAMP also provides financial planning and investment strategies which inform STIP development and funding allocations.

The TAMP informs STIP development and funding allocations for preservation and improvement of pavement and bridges.

The STIP is the Oregon Department of Transportation's four-year capital improvement program. It is not a planning document, but a project scheduling and funding program. Projects in the STIP come from data-based transportation management systems and planning processes involving local and regional governments, Area Commissions on Transportation (ACTs), other state agencies, and the public. In the STIP, ODOT assigns resources to those projects that have been given the highest priority through the STIP update process.

Projects in the STIP are funded primarily through federal and state gas tax revenues, but may also include local government funding, and other state and federal funding sources. The STIP includes projects on the state, city, and county transportation systems, as well as projects in the National Parks, National Forests, and on Tribal Lands. Also included are projects of regional significance, regardless of funding source.

The STIP is a subset of the budget that focuses on capital investments in the transportation system. It is required by the Federal government and shows how ODOT plans to use our federal funds, although it also includes regionally significant state-funded highway projects. The STIP is where the Commission has the most flexibility to make investment decisions by allocating available funding among programs. Investment decisions made are then folded into the agency's biennial budget.[42]

The STIP executes the funding and schedule for capital investments on the transportation system.

There are three steps to developing the STIP:

- **Program allocation:** The Commission will distribute funding among programs such as Enhance Highway, Fix-It, Maintenance and Operations, Safe Routes to School, Americans Disabilities Act (ADA) Accessibility and Public Transportation.
- **Project selection:** The Commission will review the considerations that guide project selection. ODOT will use data in management systems and advisory committees to create preliminary project lists, estimate costs and schedules, then narrow projects to a final recommended list to include in the draft STIP.
- **Public review and approval:** The Commission will put the draft STIP out for a formal public comment period. After taking public comment, the Commission will adopt a revised STIP and forward it for review and approval by the Federal Highway Administration and Federal Transit Administration. [43]

TAMP Work Types

23 CFR 515.7 requires State DOTs to report asset management costs using the Federal work types of **Initial Construction, Reconstruction, Rehabilitation, Preservation and Maintenance**. In preparation for the 2022 TAMP development, ODOT researched various US DOT, FHWA, AASHTO and ODOT publications that defined and/or described work types. While there are many different variations, descriptions were often similar. For purposes of this TAMP, the following descriptions of the work types are assumed.

Maintenance

Maintenance describes work that is performed to maintain the condition of the transportation system or respond to specific conditions or events that restore the highway system to a functional state of operations. Maintenance is a critical component of an agency's asset management plan that includes both routine[44] and preventive maintenance. *Sources: Guidance on Highway Preservation and Maintenance (FHWA, 2016) & Bridge Preservation Guide (FHWA, 2018)*

> **Preventive Maintenance:** AASHTO defines preventive maintenance "as the planned strategy of cost effective treatments to an existing roadway system and its appurtenances that preserves the system, retards future deterioration, and maintains or improves the functional condition of the system without increasing structural capacity." *Source: PDDM Chapter 11 - Pavements (FHWA, 2008)*
>
> **Bridge Maintenance:** The bridge maintenance category includes those projects, of any scale, that are funded exclusively with Major Bridge Maintenance (MBM) funds or other similar sources of state funding. *Source: Bridge Design Manual pg. 21 (ODOT, May 2021)*

[42] 2020 OTC Investment Strategy
[43] https://www.oregon.gov/odot/STIP/Pages/About.aspx
[44] Day to day routine maintenance is not included in the scope of this plan. Refer to Chapter 1 – Purpose, Background and Scope

Preservation

Preservation consists of work that is planned and performed to improve or sustain the condition of the transportation facility in a state of good repair. Preservation activities generally do not add capacity or structural value, but do restore the overall condition of the transportation facility.
Source: Guidance on Highway and Preservation (FHWA, 2016)

Pavement Preservation: Add useful life to the road without increasing the capacity. Source: Highway Design Manual pg.66 (ODOT, March 2022 DRAFT)

Bridge Preservation: Actions or strategies that prevent, delay, or reduce deterioration of bridges or bridge elements; restore the function of existing bridges; keep bridges in good or fair condition; and extend their service life. *Source: Bridge Preservation Guide pg.3 (FHWA, 2018)*

Rehabilitation

Project to perform comprehensive structural repair or capacity, operations, or safety improvements to an existing asset. *Source: TAM Guide (AASHTO, 2020)*

Pavement Rehabilitation: structural enhancements that both extend the service life of an existing pavement and/or improve its load-carrying capability.
Source: PDDM Chapter 11 - Pavements pg.43 (FHWA, 2008)

Bridge Rehabilitation: Rehabilitation involves major work required to restore the structural integrity of a bridge, as well as work necessary to correct major safety defects
Source: Bridge Preservation Guide pg.7 (FHWA, 2018)

Reconstruction

"Rebuilding an existing facility in the same location, possibly with minor grade and/or alignment changes. Includes widening an existing facility one lane width or more. May re-quire some right-of-way acquisition."
Source: 2015-2018 STIP Development Manual

Pavement Reconstruction: Reconstruction projects are projects that utilize an existing roadway alignment (or make only minor changes to an existing alignment), but involve a change in the basic roadway type.
Source: AASHTO Green Book pg.87 (2018)

Bridge Reconstruction: Total replacement of an existing bridge with a new facility constructed in the same general traffic corridor. *Source: Bridge Preservation Guide pg.8 (FHWA, 2018)*

Initial Construction

Initial construction of a transportation asset where no existing like asset is present.

Pavement Initial Construction: New construction projects are those that construct roads on new alignment where no existing roadway is present. *Source: AASHTO Green Book pg.86 (2018)*

Bridge Initial Construction: New construction projects are those that construct bridges on new alignment where no existing bridge is present.

STIP Work Types

ODOT organizes the projects within the 2021-2024 STIP[45] into categories of related state and federal funding programs, and calls these groups "State Programs". This enables ODOT to take care of existing transportation assets while providing a measure of funding to enhance the state and local transportation system.

ODOT's pavement and bridge asset management activities are categorized under four major program areas: Pavement Preservation, Bridge, Seismic and Modernization. The program areas are designed to address certain transportation needs and therefore have eligibility requirements for how the funding may be spent. The STIP funding categories are used, in part, for comparison between actual and planned levels of investments.

STIP work type categories are further established for each program in order to identify allocation of funding for the various work that falls within the program areas.

The following table shows the state programs and program areas that provide funding for pavement and bridge asset management activities on the State Highway System (SHS).

State Program	Program Area	Work Type
Fix-It	Pavement Preservation Program	Interstate Maintenance
		Major Interstate Maintenance
		Regions 1-5
		Chip Seals
		Maintenance Chip Seals
	Bridge Program	Bridge Rail Retrofit
		Major Bridge Maintenance
		Projects
	Seismic Program	Bridge
Enhance	Modernization Program	Enhance HB 2017
		State Highway Leverage
		Regions 1-5

7-1 STIP Funding Work Types Included in TAMP

Fix-It

The Fix-It state program includes all the capital funding categories that maintain or fix ODOT's portion of the highway transportation system. The Fix-It program does not include noncapital maintenance and operations programs. Noncapital maintenance, operations and other agency funding is addressed by the OTC via budget decisions separate from the STIP. Enhancements or other features that are not identified by a Fix-It program to meet Fix-It program goals must be funded by other sources.

Fix-It programs identify needs using asset condition, operations data and management systems to determine where conditions warrant priority investment. The purpose of the individual Fix-It programs is to manage and preserve the condition of the respective program area. Fix-It program areas include: Bridge, Pavements, Culverts, Operations, ADA, Seismic and All Roads Transportation Safety (ARTS).

Directive *DES-01 Use of Fix-It Program Funds* establishes how funding that is allocated to the Fix-It programs may be spent on improvement needs. Within the context of limited funding and the need for collaboration, Fix-It program finds are intended to extend the service life and increase the resilience of program area assets, improve safety of the overall system, and address operation deficiencies.

The following Fix-It program requirements must be satisfied as a condition of using Fix-It funds:

[45] *https://www.oregon.gov/odot/STIP/Documents/2021-2024%20STIP.pdf*

Pavement Preservation Program

Pavement Preservation program funds may only be used for preserving, rehabilitating or reconstructing existing pavements to improve pavement conditions or reduce pavement maintenance requirements. Priority will be given to pavement on priority routes and projects that provide a high pavement service-life return on investment.

Bridge Program

Bridge program funds may only be used to improve the condition of bridges in the overall system, such as bridge rehabilitation, replacement of high-risk bridges, or to increase the resilience of priority lifeline routes. Bridge replacements will be evaluated to ensure the selected design is appropriate for the site and is cost-effective (in terms of construction, inspection and maintenance).

Seismic Program

Bridge Seismic program funds may be used for increased seismic resilience on identified lifeline routes.

Enhance Highway

Enhance Highway programs fund projects that enhance or expand the transportation system. ACTs recommend high-priority investments from state and local transportation plans in many of the Enhance programs.

Oregon regulations require that Enhance projects selected for funding in STIP "provide the greatest benefit in relation to project costs." In 2017, the Oregon Legislature adopted HB2017. A provision of the bill requires that before any STIP Enhance project that costs $15 million or more is included in the STIP, a rigorous benefit-cost analysis must be prepared and made publicly available. Specifically called out in this legislation are requirements to analyze future costs to the agency to preserve and maintain an undertaken project, and identify increased costs that would result from delays in the performance of routine maintenance scheduled by the agency.

Most Enhance Highway funding in the 2021-2024 STIP comes from allocations made by the Oregon Legislature to projects specified in House Bill 2017. In addition, ODOT established the State Highway Leverage Program to distribute funding to ODOT Regions and allow ACTs to provide input on adding enhancement features and elements to Fix-It projects on the State Highway System. Non-highway enhancement projects are not eligible for these funds.

Modernization[46]

The intent of the Modernization Program (per ORS 366.507) is to increase highway safety, accelerate improvements from the backlog of needs on the state highways, and fund Modernization of highways and local roads to support economic development in Oregon. The primary goal is to add capacity. Projects both on and off the State Highway System are eligible. ORS 366.507 requires the Department to spend at least as much money on Modernization projects as the amount of revenue raised by 2¢ of the fuel tax and equivalent heavy vehicle fees. Projects to be implemented by the Modernization Program are selected by the Oregon Transportation Commission. The project selection criteria are established after public hearings that allow citizens an opportunity to review the criteria. The Commission may elect to use up to one-half of available Modernization funds for projects of statewide significance. Projects of statewide significance are projects that require funding that cannot be achieved within standard STIP allocations, but that are viewed by the agency as projects of special statewide importance. Identified funds would be used to either keep existing work on very large projects current, or to support development of very large projects (for example, funding an environmental impact statement (EIS) or updating an existing EIS).

[46] Source: 2015-2018 STIP Development Manual

Alignment between Oregon STIP & TAMP Work Types

As is shown in the figure below, the Oregon STIP and TAMP work types do not always have a clear one-to-one cross comparison. Oregon STIP work types are distinct from TAMP work types in a number of respects. For example, construction and reconstruction projects are primarily categorized under the Enhance/Modernization program that is funded through the Oregon Legislature and projects are specified in House Bill 2017, in the 21-24 STIP. However, when a bridge or pavement needs reconstruction in order to restore or continue services, Fix-it program funds may be used.

STIP Program(s)	Work Type	Does	Does not
Fix-it Pavement Preservation ⇒ Major Interstate Maintenance ⇒ Chip Seals ⇒ Maintenance Chip Seal **Fix-it Bridge** ⇒ Major Bridge Maintenance	Maintenance	Maintain or restore the highway system to a functional state of operations.	Does not add capacity, operations or safety enhancements.
Fix-it Pavement Preservation ⇒ Interstate Maintenance ⇒ Region 1-5 (non-interstate) **Fix-it Bridge** ⇒ Bridge Rail Retrofit[47] ⇒ Projects **Fix-it Seismic** ⇒ Seismic Bridge[39]	Preservation	Improve or sustain the condition of the transportation facility in a state of good repair, and extend the service life.	Generally does not add capacity or structural value. Does not add operation or safety enhancements.
	Rehabilitation	Perform comprehensive structural repair and/or add capacity, operations, or safety enhancements.	Does not completely replace the structure.
	Reconstruction	Rebuild an existing facility in the same location, possibly with minor grade and/or alignment changes.	Construct in a location where no like structure exists (i.e. bridge or roadway).
Enhance-Modernization ⇒ Enhance HB 2017 ⇒ State Highway Leverage	Initial Construction	Perform initial construction of a transportation asset where no existing like asset is present.	Construct of a new element on or for an already existing asset (ex. adding additional lane).

7-2 STIP Funding Programs and TAMP Work Type Cross Walk

As shown above, reconstruction, rehabilitation and preservation projects may be financed through the same STIP funding program. For example, the bridge projects funding program is eligible to be used on all but initial construction and maintenance projects.

Determining the most appropriate TAMP work type for projects can be a subjective process, with the exception of initial construction projects. Many project scopes include elements of more than one work type and encompass both pavement and bridge work. In addition, projects that may have been anticipated as one work type during the financial planning process may evolve to another during the course of the project construction. The projects primary purpose, complexity, cost and unique circumstance are all considered.

[47] Seismic Bridge and Bridge Rail Retrofit are considered either rehabilitation or reconstruction work types.

7.3 Estimated Value of NHS Pavement & Bridges

As part of its asset management improvement process, ODOT is working to better identify the value of its pavement and bridge assets in a manner that is supportive of asset management as a discipline. By having a good estimate of the value of our transportation assets, we are able to also analyze investment options by the degree to which they increase, maintain or reduce the value of our assets. The following subsections provide the NHS pavement and bridge values and explain the methods considered and used to develop those values.

Asset Valuation Methods

Multiple methods were evaluated to determine meaningful ways to present the value of Oregon bridges and pavement. The following valuation methods were seriously considered:

GASB Valuation

Valuation of highway infrastructure traditionally follows the *Government Accountability Standards Board (GASB) Statement No. 34*, which requires transportation agencies to report the combined value of their transportation assets. However, **GASB 34 is based on the historic value of transportation assets** and is therefore effective for accounting purposes but has limited practical application in the field of asset management. For example, a bridge built 50 years ago may have been built for a fraction of the cost of a modern bridge. Even when accounting for inflation, the historic cost of this bridge does not capture the cost of replacing the bridge to meet modern design and safety requirements, or the value of the bridge to the economy at large. Furthermore, maintenance and preservation treatments that add value to the bridge by extending its functionality and usefulness are not captured by a valuation methodology that is limited to historic costs.

Replacement Cost Valuation

The replacement cost is the current cost that would be incurred by replacing an asset. Calculating the replacement cost of major highway and bridge assets has several advantages over historic costs, including the ability to account for: inflation, enhanced modern design requirements, and current material and labor costs. Additionally, using a replacement cost methodology to ascertain the value of major assets can be an effective tool in demonstrating the efficacy of lower-cost investments, such as maintenance and preservation, that prolong an asset's life versus high cost replacements that are accelerated by allowing an asset's condition to degrade.

However, efforts to assign a replacement cost to bridges and pavement is severely limited by several variability factors, including terrain, geology, local climate variation, regional design requirements, and the bundled costs of parallel roadway improvements such as improved drainage, safety elements, sightline improvements, and enhanced bicycle, pedestrian, and ADA features that are included when a roadway is reconstructed.

Replacement costs also tell very little about the value of an existing asset based on age and condition. For example, it may be cheaper to maintain and preserve an aging bridge in poor condition than it is to replace it, but over time, as these assets degrade, efforts to maintain them can bring declining returns on investment. Furthermore, as with historic costs, replacement cost calculations do not adequately capture the value of maintenance and preservation investments.

Elemental Decomposition and Multi-Criteria (EDMC)

Analyses for the elemental decomposition and multi-criteria (EDMC) method were also patterned after the Indiana report: *A Methodology for Highway Asset Valuation in Indiana*. **The EDMC calculates the contribution of each component to the asset value**. *The primary consideration is that assets are elemental in nature, thus each component deteriorates at a different rate and should be considered as a part of a whole in order to yield a more representative asset value*. **Also, the EDMC method incorporates both the condition and the remaining service life of an asset.**

For the EDMC, unique costs are required for each of the asset components which are not readily available in Oregon. The EDMC has merit: however, the data is not available to calculate a "truer" estimate than by other means.

Straight-Line Depreciation (SLD)

Analyses for the straight-line depreciation (SLD) method were patterned after the Indiana report, referenced above. **In straight-line depreciation, it is assumed that the asset loses a fixed value every year.** This annual loss in value, or constant depreciation rate, is simply calculated as the historical cost less salvage value, divided by the asset service life.

Estimated Pavement and Bridge Values

Estimated Pavement Asset Values and Investment Needed to Maintain

While the cost of replacing a mile of roadway varies considerably, ODOT currently relies upon the SLD Method for pavement valuation. **ODOT estimates the total value of ODOT's pavement on the state system at $19.4 billion and the value of pavement on the National Highway System at $12.6 billion, using the SLD valuation method.** This measure applies unit asset values derived from the Indiana report and applies Oregon-specific cost factors.

ESTIMATED PAVEMENT ASSET VALUES			
System/Ownership	**Centerline Miles**	**Lane Miles**	**SLD Total Value** *($ billions)*
ODOT NHS	4,048	11,199	$11.7
ODOT non-NHS	*3,555*	*7,289*	$7.6
Total ODOT	***7,603***	***18,488***	**$19.4**
Local NHS	271	890	$0.9
Total NHS	**4,319**	**12,089**	**$12.6**

7-3 Estimated Pavement Asset Values

Assuming a 30-year life-expectancy for asphalt pavements, a 50-year life-expectancy for concrete pavements, the annual spending needed to maintain the current value of ODOT's NHS pavements would be approximately $379 million. However, this level of annual investment in Oregon's NHS pavement exceeds ODOT's estimated need to maintain a state of good repair, and is likely unnecessary because pavement projects are rarely a full-depth replacement and are generally limited to partial depth replacement and resurfacing.

Estimated Bridge Asset Values and Investment Needed to Maintain Value

ODOT estimates the total value of ODOT's bridges on the state system at $20.1 billion and the value of bridges on the National Highway System at $16.9 billion, using the SLD method. In the interest of practicality, the value of the Local NHS bridges is based on a service life of 80 years and a minimum asset value of 10% of the replacement costs.

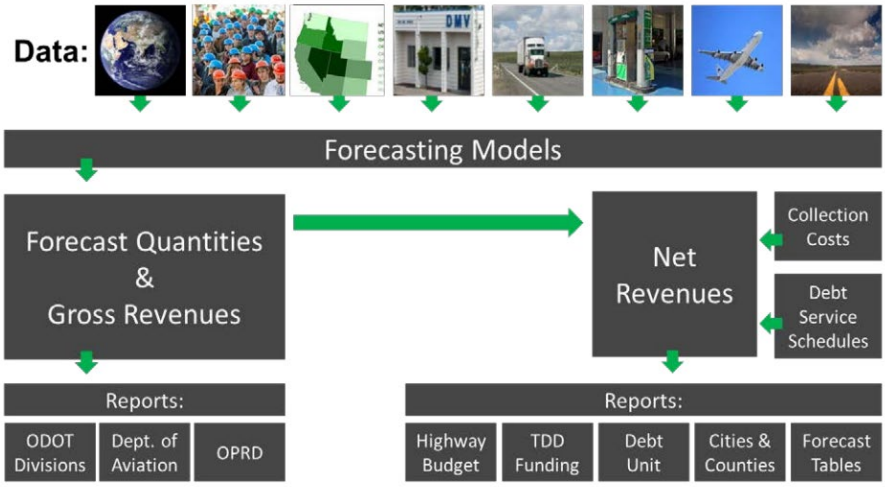
ESTIMATED BRIDGE ASSET VALUES			
System/Ownership	**# of Bridges**	**Bridge Deck Area (sq. meter)**	**SLD Total Value** *($ billions)*
ODOT NHS	1,762	2,659,663	$ 16.2
ODOT non-NHS	1004	753,110	$ 3.9
Total ODOT	**2,766**	**3,412,772**	**$ 20.1**
Local NHS	86	170,066	$ 0.7
Total NHS	**1,848**	**2,829,728**	**$ 16.9**

7-4 Estimated Bridge Asset Values

Assuming an 80-year life expectancy for NHS bridges, the annual spending needed to maintain the current value of ODOT's NHS bridges would be approximately $200 million. However, this level of annual investment is slightly below the amount needed to maintain current conditions. The rough estimate used assumes a straight-line deterioration but in reality, since the bridge inventory has an average age of 47 years, many bridges will deteriorate at an accelerated, non-linear rate in the next 33 years. The resulting expected cost to maintain the current value will exceed the cost to maintain current conditions.

7.4 Anticipated Revenue Sources & Forecast

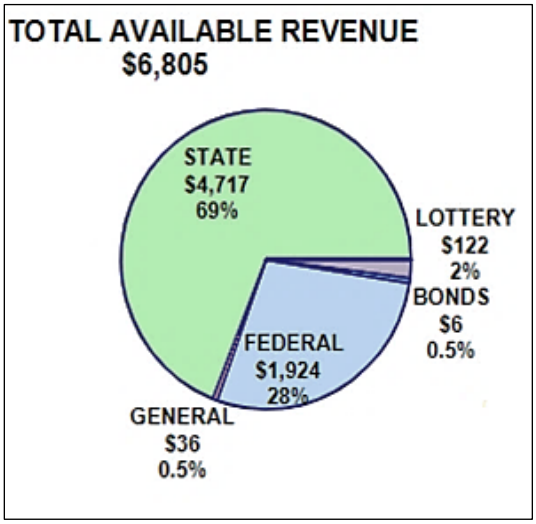
The Oregon Department of Transportation Revenue Forecast presents a selection of forecasts for state transportation revenue. It is published twice a year to assist in financial planning, the formulation of transportation budgets, and to support other decision-making activities.[48] Details for how the forecast is developed is published in the *Transportation Revenue Forecast Model: Methodology Overview*. The ODOT forecast relies on the Department of Administrative Services Oregon Economic & Revenue Forecasts and macroeconomic forecasts from IHS Markit[49] as inputs.



7-5 Transportation Revenue Forecast Model - Schematic for the Revenue Forecast Process

Revenue Sources

ODOT receives revenue from a variety of federal and state sources. The primary sources of both federal and state revenues are taxes and fees associated with the ownership and operation of motor vehicles. ODOT's Legislatively Adopted Budget[50] identifies sources of state and federal transportation funds and how these funds are distributed between ODOT and local agencies. More information on this process is provided at https://www.oregon.gov/odot/About/Pages/Budget-Office.aspx. The figures below provide a high-level overview of revenue sources in the 2021-2023 Governor's Budget[51].



7-6 Consolidated ODOT Sources of Revenue: 2021 -2023 Legislative Adopted Budget ($ millions)

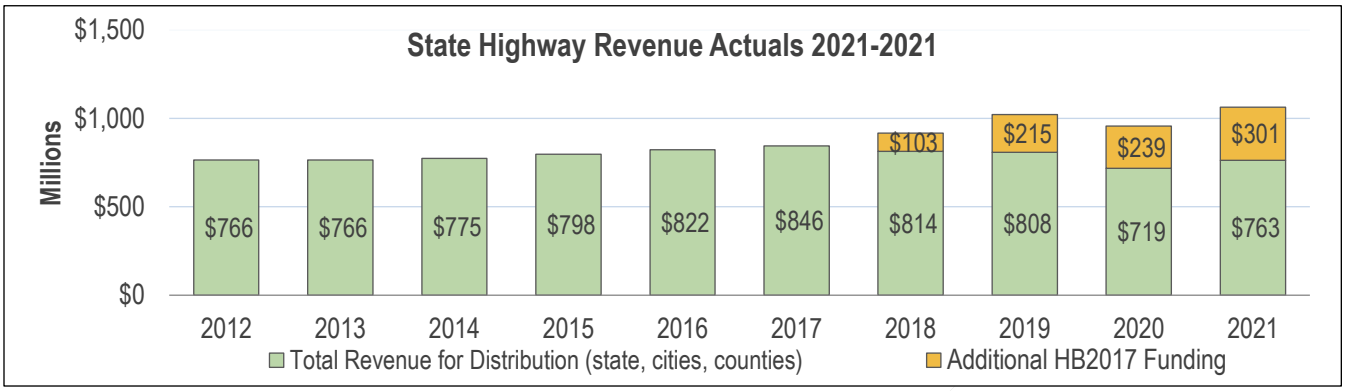
REVENUES	
Beginning Balance	$672
Motor Fuels Tax	$1,415
Federal Funds	$1,924
Weight Mile Tax	$858
Driver & Vehicle Fees	$1020
Transportation License & Fees	$114
Transfers to ODOT	$552
General Fund	$36
Lottery Debt Services	$122
Bond/COP Sales	$6
Sales and Charges for Service	$
All Other Revenue	61
TOTAL REVENUE	**$6,805**

7-7 Itemized ODOT Sources of Revenue 2021 -2023 Legislative Adopted Budget ($ millions)

[48] https://www.oregon.gov/ODOT/Data/Pages/Revenue-Forecasts.aspx
[49] IHS Markit | Leading Source of Critical Information
[50] https://www.oregon.gov/odot/About/Budget/ODOT%202021-23%20Legislatively%20Adopted%20Budget.pdf
[51] ODOT 2021-2023 GRB Sources and Uses.pdf (oregon.gov)

Oregon's fuel taxes, combined with weight-mile taxes for trucks, account for the majority of the state's annual transportation revenue. Fuel taxes, license and vehicle fees and some bond proceeds collected by the state are shared with Oregon cities and counties. In accordance with Section 3a, Article 9 of Oregon's Constitution, revenue from these sources are to *"be used exclusively for the construction, reconstruction, improvement, repair, maintenance, operations and use of public highways, roads, streets, and roadside rest areas in this state."*

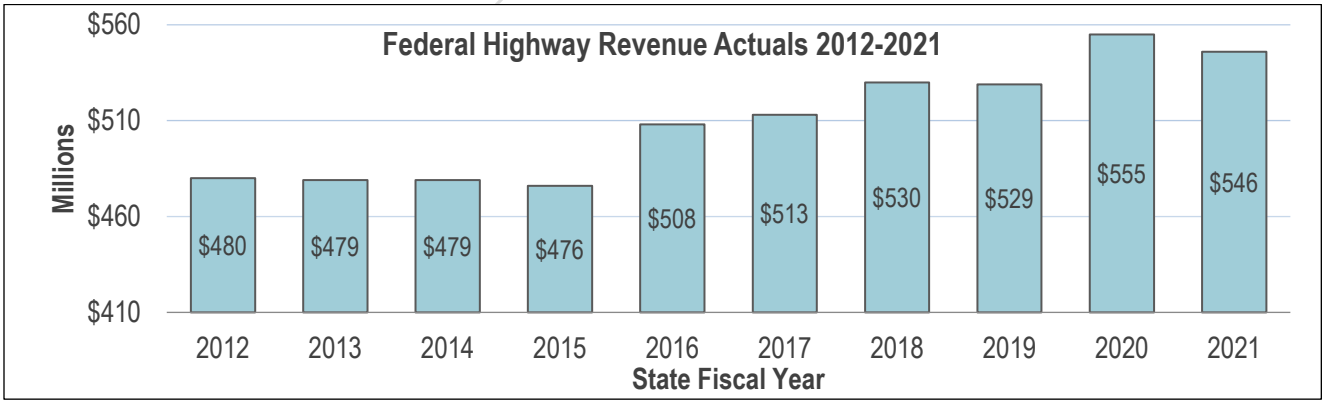
The following figure presents state funding for the past 10 state fiscal years. In 2017, the Oregon Legislature adopted HB2017, providing ODOT and local jurisdictions with a series of staged increases in transportation funding. Along with historic state funding levels, in 2018 additional state highway revenue was added as a result of HB2017.



7-8 State Highway Revenue Actuals 2012-2021

The Federal funds received by the state for preserving and improving the state's transportation system are provided through a number of federal transportation programs**.** The primary source of federal transportation revenues are federal fuel taxes and other truck fees. Federal funds received by the state are shared with Oregon cities, counties, metropolitan planning organizations and other local jurisdictions. Federal funding for highway and bridge projects and activities is provided through the Highway Account of the Highway Trust Fund. As established, expenditures from the account are to be determined by the transportation revenues deposited in the account. However, in the absence of transportation revenue increases to match adopted expenditure levels, Congress has increasingly made General Fund deposits to Highway Trust Fund to ensure solvency of the fund.

The table below presents the federal revenue Oregon has received over the last 10 years. The forecast is shown in terms of obligation limitation, which represents the total federal funding reimbursed to the state in a state fiscal year.

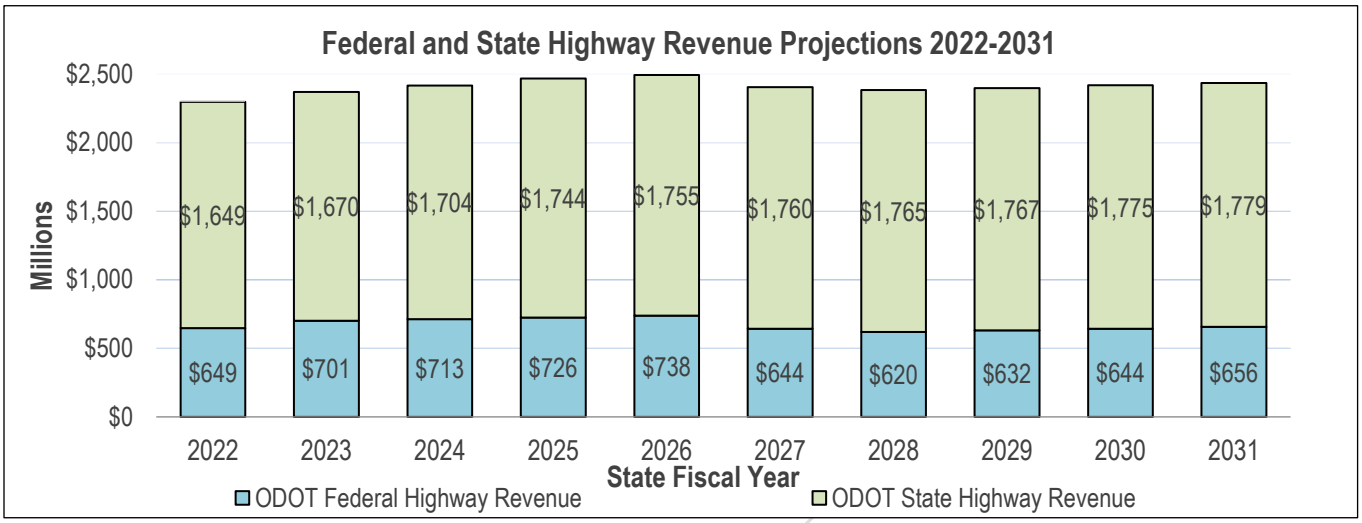


7-9 Federal Highway Revenue Actuals 2012–2021

Revenue Forecast

Forecasts of revenue available to maintain and enhance Oregon's transportation system must account for the myriad of financial risks and assumptions outlined in *Chapter 6: Risk Management*. Revenue projections from state and federal sources are constantly updated by ODOT staff. The projections reflect current and expected economic and demographic trends and consider a multitude of risks and uncertainties.

The following chart represents a snapshot in time and serves as a starting point for identifying optimal investments that maintain, preserve, and enhance Oregon's highway and bridge assets.



7-10 Federal and State Highway Revenue Projections 2022–2031

Federal Revenue Forecast

ODOT's Finance and Budget Division forecasts Federal revenues. These revenue forecasts are then used to determine the agency and divisions' budgets as well as short and long-term plans and programs.

The total federal revenue that states receive in a year is determined largely by formulas written into surface transportation bills. The latest bill was adopted on November 15, 2021 and covers federal fiscal years (Oct 1-Sep 30) 2022-2026. Commonly known as the IIJA (Infrastructure Investment and Jobs Act), it replaces the Fixing America's Surface Transportation Act (FAST Act) of 2015. Future Federal revenue estimates are prepared based on assumptions that a new transportation authorization bill would not be adopted prior to the 2026 expiration of the IIJA. In this scenario, Oregon's funding is expected to decrease by 10% in 2027 and increase at a modest annual rate thereafter (following expiration of SAFETEA-LU). Years following 2026 were increased at the annual rate of growth experienced under the IIJA in accordance with FHWA guidance on future federal revenue projections.[52]

Federal revenue projections shown below represent expected Federal-aid Highway Program formula obligation limitation and August limitation redistributions. It does not include funding expected under allocated or discretionary programs.

10-YEAR FEDERAL HIGHWAY REVENUE PROJECTIONS											
FEDERAL REVENUE SOURCE	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2022-2031**
National Highway Performance Program	$299	$316	$322	$329	$335	$312	$308	$314	$320	$327	$3,180
Surface Transportation Block Grant Program	$139	$145	$148	$151	$154	$143	$142	$144	$147	$150	$1,464
Other Federal Programs	$180	$210	$213	$216	$219	$159	$141	$144	$147	$150	$1,778
Redistribution	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30	$300
GRAND TOTAL	**$649**	**$701**	**$713**	**$726**	**$738**	**$644**	**$620**	**$632**	**$644**	**$656**	**$6,723**

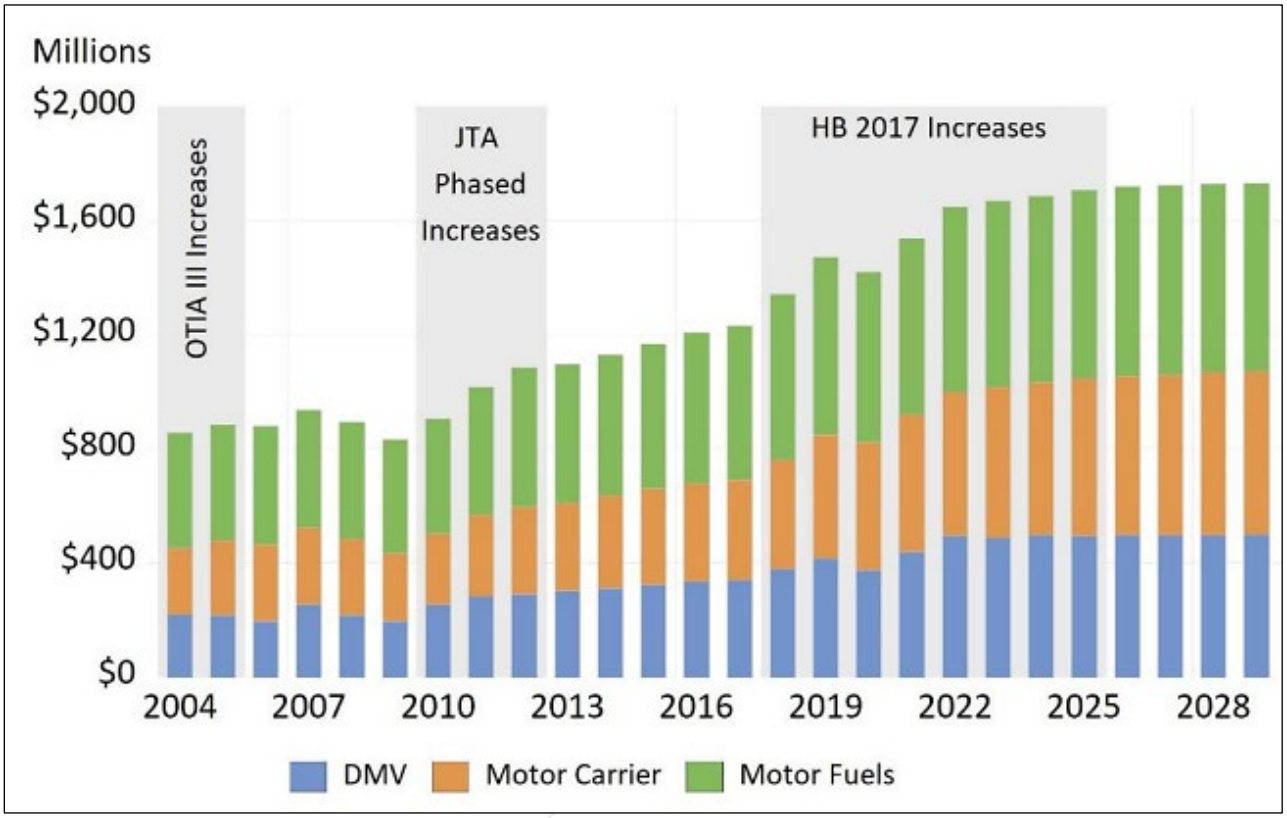
7-11 10-year Federal Highway Revenue Projection ($ Millions)

[52] https://www.fhwa.dot.gov/planning/clarify_fiscal_constraint_guidance.cfm

State Revenue Forecast

ODOT's Finance and Budget Division also produce the State revenue forecast. These revenue forecasts are then used to determine the agency and divisions' budgets as well as short and long-term plans and programs.

ODOT's State Highway Revenue Forecast presents a selection of forecasts for state transportation revenue. It is published twice a year to assist in financial planning, the formulation of transportation budgets, and to support other decision-making activities. The following chart summarizes the state revenue forecast as presented in the *ODOT State Highway Fund Transportation Revenue Forecast* developed in April 2022.



7-12 Total Gross State Highway Revenues by Fiscal Year

As stated in the Revenue Forecast Overview "First, there is a noticeable drop in FY 2020 revenues, despite the tax and fee increases implemented in January 2020. This drop is due to the COVID-19 impact. Revenues rebounded in 2021 and are expected to continue growing into 2022 as the economy recovers. A weight-mile tax increase is scheduled for January 2024, which will help boost overall revenues through 2025. An additional two-cent fuels tax increase will be implemented in January 2024, if the conditions are met for triggering this final increase. This would further boost revenues through 2025. Beyond 2025, revenue growth stagnates overall as the economic and demographic growth slow down and fuel demand declines due to increases in on-road vehicle fuel efficiency."

The State revenue identified in the table below represents ODOT's expected share of transportation funding deposited in the State Highway Fund. For a discussion of assumptions used in the preparation of state revenue estimates, see the April 2022 edition of the *ODOT's Revenue Forecast*.

10-YEAR STATE HIGHWAY REVENUE PROJECTIONS											
STATE REVENUE SOURCE	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2022-2031**
State Weight-mile Tax Collection (MCTD)	$506	$528	$535	$551	$557	$563	$569	$575	$582	$589	$5,556
State Gas Tax Collection (FSB)	$650	$654	$671	$697	$700	$700	$697	$693	$692	$694	$6,849
State License & Registration Fees Collection (DMV)	$494	$487	$498	$496	$497	$497	$498	$499	$501	$496	$4,962
TOTAL GROSS HWY FUND	**$1,649**	**$1,670**	**$1,704**	**$1,744**	**$1,755**	**$1,760**	**$1,765**	**$1,767**	**$1,775**	**$1,779**	$17,368
Collection, Programs and Transfers	($1,026)	($1,069)	($1,106)	($1,146)	($1,164)	($1,172)	($1,189)	($1,195)	($1,211)	($1,219)	($11,497)
NET REVENUE TO HWY FUND	**$623**	**$601**	**$598**	**$597**	**$590**	**$588**	**$576**	**$572**	**$564**	**$561**	**$5,871**
Net OTIA I & II Revenue for Distribution	$16	$17	$17	$17	$17	$15	$12	$11	$12	$12	$148
Net OTIA III Revenue for Distribution - Local	$36	$32	$33	$33	$33	$35	$38	$46	$55	$55	$395
Net OTIA III Revenue for Distribution - State	($20)	($20)	($20)	($19)	($17)	($28)	($43)	($60)	($71)	($71)	($370)
Net JTA Revenue for Distribution - Local	$144	$140	$141	$141	$142	$142	$143	$142	$143	$143	$1,421
Net JTA Revenue for Distribution Above D/S-State	$8	$7	$7	$6	$5	$15	$32	$43	$42	$42	$207
Net HB 2017 Revenue for Distribution - Local	$176	$189	$204	$222	$224	$226	$228	$229	$230	$232	$2,161
Net HB 2017 Revenue for Distribution -State	$167	$181	$187	$198	$200	$202	$204	$205	$206	$208	$1,957
TOTAL NET REVENUE FOR DISTRIBUTION	**$1,149**	**$1,147**	**$1,168**	**$1,195**	**$1,196**	**$1,196**	**$1,189**	**$1,188**	**$1,183**	**$1,180**	**$11,790**

7-13 State Highway Fund Revenues by SFY 2022-2031 ($ Millions)

7.5 Estimated Funding and Costs to Implement Investment Strategies

Estimated Funding to Address Future Work

23 CFR 515.7(d)(2) requires State DOT's to produce "*estimated funding levels that are expected to be reasonably available, by fiscal year, to address the costs of future work types.*" It goes on to say "*State DOTs may estimate the amount of available future funding using historical values where the future funding amount is uncertain*." The following estimates of annual funding levels work types were developed using the best financial and project information reasonably available.

Because the STIP provides funding on a three year cycle, the annual estimated funding level was split into thirds equally within each STIP cycle. Funding levels beyond the 2024-2027 STIP cycle is not available at the time of developing this plan, therefore 2027-2031 funding values are assumed using historical values and trends.

The breakdown of funding between TAMP work types was produced through analyzing 2019 – 2021 Fix-It funded project work type trends alongside available 2021-2024 STIP project details for all projects that have an impact on pavement and bridge condition or performance. Further explanation of how funding by work type is projected beyond 2024 is provided with each of the tables presented below.

As is the nature of projects, it is expected that some projects will experience scope changes, schedule adjustments or reprioritizations resulting in advancements or delays, or project work type changes. Also, because projects often cross over multiple state fiscal years within federal fiscal years of the STIP, estimates of annual project payouts are completed using the hypothetical scenario that project pay outs will balance out evenly over the three years within the STIP. It is expected that there will be some fluctuation with payouts between state fiscal years within the federal fiscal years of STIP cycles, as ebbs and flows of monthly invoice amounts is common within projects.

Estimated NHS Pavement Funding by STIP Category

The following tables are subsets of the total estimated funding for NHS pavement, separated between Fix-It funded projects and all other projects funded by different means.

Fix-It NHS Pavement Preservation Funding by Work Type

Because the 24-27 STIP Fix-it Pavement Preservation project list was not finalized at the time of developing this plan, **the percentages of work types for the 21-24 STIP projects were flat lined through 2031**. 2024-2031 estimated work type funding amounts will be updated after the 24-27 STIP Fix-It project list is approved and adopted.

ESTIMATED FIX-IT PAVEMENT PRESERVATION FUNDING BY WORK TYPE												
STIP Work Type	*TAMP Work Type*[53]		*2021-2024*			2024-2027			2027-2030			2031
			21-22	22-23	23-24	24-25	25-26	26-27	27-28	28-29	29-30	30-31
Fix-It Pavement Preservation	New Construction	0%	$0	$0	$0	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*
	Reconstruction	5%	$5	$5	$5	*$4*	*$5*	*$4*	*$4*	*$5*	*$4*	*$4*
	Rehabilitation	39%	$37	$37	$37	*$35*	*$35*	*$35*	*$33*	*$33*	*$33*	*$33*
	Preservation	39%	$37	$37	$37	*$35*	*$35*	*$35*	*$33*	*$33*	*$33*	*$33*
	Maintenance	17%	$16	$17	$16	*$15*	*$16*	*$15*	*$14*	*$15*	*$14*	*$14*
ODOT NHS Pavement Preservation		**NHS**	**$95**	**$96**	**$95**	***$89***	***$91***	***$89***	***$84***	***$86***	***$84***	***$84***
Fix-it Total		**85%**	**$286**			***$269***			***$254***			
SHS Pavement Preservation Fix-it Total			$337			$316			$299			

7-8 Estimated Fix-It Pavement Preservation Funding by TAMP Work Type ($million)

[53] TAMP work type percentages for years 2024-2031 mirror 2021-2024 because the project portfolios have not yet been finalized.

Non Fix-It NHS Pavement Preservation Funding by Work Type

The estimated non Fix-It funding for NHS pavement provided below reflects only the portion of the projects that contribute to the condition or performance of pavement. Many of these projects are driven by enhancement and modernization efforts, as described in *Section 7.2* of this chapter. Beyond the 21-24 STIP period, it is unknown at this time how much projects outside of the Fix-It program will impact the NHS pavement condition. Therefore, **dollar amounts and work types are flat-lined through 2031**. The 2024-2031 estimated funding amounts and work type splits will change after the 24-27 STIP non Fix-It project list is approved and adopted.

ESTIMATED NON FIX-IT PAVEMENT PRESERVATION FUNDING BY WORK TYPE											
STIP Work Type	*TAMP Work Type*	2021-2024			2024-2027			2027-2030			2031
		21-22	22-23	23-24	24-25	25-26	26-27	27-28	28-29	29-30	30-31
Non Fix-It Pavement Preservation	New Construction	$0	$0	$0	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*
	Reconstruction	$1	$2	$1	*$1*	*$2*	*$1*	*$1*	*$2*	*$1*	*$1*
	Rehabilitation	$4	$5	$4	*$4*	*$5*	*$4*	*$4*	*$5*	*$4*	*$4*
	Preservation	$2	$2	$2	*$2*	*$2*	*$2*	*$2*	*$2*	*$2*	*$2*
	Maintenance	$0	$0	$0	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*
ODOT NHS Non Fix-it Total[54]		**$7**	**$9**	**$7**	***$7***	***$9***	***$7***	***$7***	***$9***	***$7***	***$7***
		$23m			***$23m***			***$23m***			

7-15 Estimated Non Fix-It Pavement Preservation Funding by TAMP Work Type ($million)

Estimated NHS Bridge Funding by STIP Category

The following tables are subsets of the total estimated funding for NHS bridges, separated between Fix-It bridge funded projects, HB 2017 Seismic Bridge funding, and all other projects funded by different means.

Fix-It NHS Bridge Funding by Work Type

Because the 24-27 STIP Fix-it Bridge project list was not finalized at the time of developing this plan, **the percentages of work types for the 21-24 STIP projects were flat lined through 2031.** 2024-2031 estimated funding splits between work type's amounts will change after the 24-27 STIP Fix-It project list is finalized.

ESTIMATED FIX-IT BRIDGE FUNDING BY TAMP WORK TYPE												
STIP Work Type	*TAMP Work Type*[55]		*2021-2024*			*2024-2027*			*2027-2030*			2031
			21-22	22-23	23-24	24-25	25-26	26-27	27-28	28-29	29-30	30-31
Fix-It Bridge	New Construction	0%	$0	$0	$0	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*
	Reconstruction	25%	$33	$33	$33	*$20*	*$20*	*$20*	*$20*	*$20*	*$20*	*$20*
	Rehabilitation	35%	$46	$46	$46	*$29*	*$29*	*$29*	*$29*	*$29*	*$29*	*$29*
	Preservation	25%	$33	$33	$33	*$20*	*$20*	*$20*	*$20*	*$20*	*$20*	*$20*
	Maintenance	15%	$20	$20	$20	*$12*	*$12*	*$12*	*$12*	*$12*	*$12*	*$12*
ODOT NHS Bridge Fix-it Total		**NHS 87%**	**$131**	**$131**	**$131**	***$82***	***$82***	***$82***	***$82***	***$82***	***$82***	***$82***
			$394			***$246***			***$246***			
ODOT SHS Bridge Fix-it Total			$453			$282			$282			

7-9 Estimated Fix-It Bridge Funding by TAMP Work Type ($million)

[54] TAMP work type % and funding for 2024-2031 mirror 2021-2024 because the project portfolios have not been finalized yet.

[55] TAMP work type percentages for years 2024-2031 mirror 2021-2024 because the project portfolios have not yet been finalized.

NHS Seismic Bridge Funding by Work Type

Because the 24-27 STIP Seismic Bridge project list was not finalized at the time of developing this plan, **the percentages of work types for the 21-24 STIP projects were flat lined through 2031.** 2024-2031 estimated funding splits between work type's amounts will change after the 24-27 STIP Seismic Bridge project list is finalized.

ESTIMATED HB2017 SEISMIC BRIDGE FUNDING BY TAMP WORK TYPE												
STIP Work Type	*TAMP Work Type*[51]		*2021-2024*			*2024-2027*			*2027-2030*			2031
			21-22	22-23	23-24	24-25	25-26	26-27	27-28	28-29	29-30	30-31
Fix-It Pavement Preservation	New Construction	0%	$0	$0	$0	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*
	Reconstruction	65%	$6	$6	$6	*$26*	*$26*	*$26*	*$26*	*$26*	*$26*	*$26*
	Rehabilitation	15%	$1	$1	$1	*$6*	*$6*	*$6*	*$6*	*$6*	*$6*	*$6*
	Preservation	20%	$2	$2	$2	*$8*	*$8*	*$8*	*$8*	*$8*	*$8*	*$8*
	Maintenance	0%	$0	$0	$0	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*
ODOT NHS Seismic Bridge Total		**NHS 93%**	**$10**	**$10**	**$10**	***$40***	***$40***	***$40***	***$40***	***$40***	***$40***	***$40***
			$29			***$120***			***$120***			
ODOT SHS Seismic Bridge Total			$31			$130			$130			

7-17 Estimated HB2017 Seismic Bridge Funding by TAMP Work Type ($million)

Non Fix-It NHS Bridge Funding by Work Type

The estimated non Fix-It funding for NHS Bridge provided below reflects only the portion of the projects that contribute to the condition or performance of bridges. Many of these projects are driven by enhancement and modernization efforts, as described in *Section 7.2* of this chapter. Beyond the 21-24 STIP period, it is unknown at this time how much projects outside of the Fix-It program will impact the NHS bridge condition. Therefore, **dollar amounts and work types are flat-lined through 2031**. 2024-2031 estimated funding amounts and work type splits will change after the 24-27 STIP non Fix-It project list is finalized.

ESTIMATED NON FIX-IT BRIDGE FUNDING BY WORK TYPE											
STIP Work Type	*TAMP Work Type*	*2021-2024*			*2024-2027*			*2027-2030*			2031
		21-22	22-23	23-24	24-25	25-26	26-27	27-28	28-29	29-30	30-31
Non Fix-It Bridge	New Construction	$0	$0	$0	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*
	Reconstruction	$27	$27	$27	*$27*	*$27*	*$27*	*$27*	*$27*	*$27*	*$27*
	Rehabilitation	$46	$46	$46	*$46*	*$46*	*$46*	*$46*	*$46*	*$46*	*$46*
	Preservation	$1	$1	$1	*$1*	*$1*	*$1*	*$1*	*$1*	*$1*	*$1*
	Maintenance	$0	$0	$0	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*
ODOT NHS Non Fix-it Bridge Total[56]		**$73**	**$73**	**$73**	**$73**	**$73**	**$73**	**$73**	**$73**	**$73**	**$73**
		$219m			**$219m**			***$219m***			

7-18 Estimated Non Fix-It Bridge Funding by TAMP Work Type ($million)

[56] TAMP work type % and funding for 2024-2031 mirror 2021-2024 because the project portfolios have not been finalized yet

Estimated Costs to Implement Investment Scenarios

23 CFR 515.7(d)(1) requires State DOT's to produce "the estimated cost of expected future work to implement investment strategies contained in the asset management plan, by State fiscal year and work type.

The following sub-section presents the estimated cost of expected future work to implement investment strategies contained in the asset management plan, by State fiscal year and TAMP work type. Three investment scenarios considered are:

- Scenario 1 – Current Revenue Forecast Optimized investment in ODOT NHS Pavements and Bridges based on current revenue forecasts.
- Scenario 2 - State of Good Repair (SOGR) The estimated cost to achieve and maintain a state of good repair for condition and performance of ODOT NHS pavements and bridges.
- Scenario 3 - Maintain Current Condition (MCC) The estimated cost to maintain the current condition of ODOT NHS pavement and bridges, and maintain State targets.

The scenarios considered reflect approaches by ODOT in making progress toward achieving national and state targets for asset condition and performance, and ones required by federal regulations aimed at achieving national goals identified in *section 150 (d) of title 23*. Not included in the following scenarios are the major portion of maintenance funding devoted to activities which are considered normal and routine state responsibilities.

The impact of the 3 investment scenarios on pavement and bridge conditions over the next ten years is analyzed in further detail in *Chapter 4 - Condition and Performance Gap Analysis*. Discussion around how the investment strategies were developed is in *Chapter 8: Investment Strategies*.

Scenario 1 – Optimize Current Revenue Forecasts

Scenario 1 optimizes the current revenue forecasts for ODOT NHS pavement and bridge, in order to support progress towards the achievement of national transportation targets and goals. The estimated costs by TAMP work type is based on currently available revenue forecasts and project information and is a culmination of all funding sources which affect the condition and performance of NHS pavement and bridges.

The total estimated funding shown below includes all project types and funding sources that contribute to the condition and performance of NHS pavements, including projects driven by modernization or enhancement efforts.

SCENARIO 1:CURRENT REVENUE FORECAST – NHS PAVEMENT										
TAMP Work Type	***2021- 2024***			***2024-2027***			***2027-2030***			*…*
	21-22	**22-23**	**23-24**	**24-25**	**25-26**	**26-27**	**27-28**	**28-29**	**29-30**	**30-31**
New Construction	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Reconstruction	$6	$7	$6	$5	$7	$5	$5	$7	$5	$5
Rehabilitation	$41	$42	$41	$39	$40	$39	$37	$38	$37	$37
Preservation	$39	$39	$39	$37	$37	$37	$35	$35	$35	$35
Maintenance	$16	$17	$16	$15	$16	$15	$14	$15	$14	$14
Total	**$102**	**$105**	**$102**	**$96**	**$100**	**$96**	**$91**	**$95**	**$91**	**$91**
	$309			**$292**			**$277**			

7-19 Total Estimated NHS Pavement Funding by TAMP Work Type ($million)

The total estimated funding shown below includes all project types and funding sources that contribute to the condition and performance of NHS bridges, including projects driven by seismic[57], modernization or enhancement efforts.

SCENARIO 1:CURRENT REVENUE FORECAST – NHS BRIDGE										
TAMP Work Type	***2021- 2024***			***2024-2027***			***2027-2030***			*…*
	21-22	**22-23**	**23-24**	**24-25**	**25-26**	**26-27**	**27-28**	**28-29**	**29-30**	**30-31**
New Construction	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Reconstruction	$66	$66	$66	$73	$73	$73	$73	$73	$73	$73
Rehabilitation	$93	$93	$93	$81	$81	$81	$81	$81	$81	$81
Preservation	$35	$35	$35	$29	$29	$29	$29	$29	$29	$29
Maintenance	$20	$20	$20	$12	$12	$12	$12	$12	$12	$12
Total	**$214**	**$214**	**$214**	**$195**	**$195**	**$195**	**$195**	**$195**	**$195**	**$195**
	$642			**$585**			**$585**			

7-20 Total Estimated NHS Bridge Funding by TAMP Work Type ($million)

As is the nature of projects, it is expected that some projects will experience scope changes, schedule adjustments or reprioritizations resulting in cancellations, advancements or delays, or project work type changes. Also, because projects often cross over multiple state fiscal years within the STIP, estimates of annual project payouts are completed using the hypothetical scenario that project pay outs will balance out evenly over the three years within the STIP. It is expected that there will be some fluctuation with payouts between state fiscal years within the STIP cycle, as ebbs and flows of monthly invoice amounts is common within projects.

[57] 50%

Scenario 2 –Meet and Maintain State of Good Repair (SOGR)

Scenario 2 estimates costs over the next 10 years that would ensure that state highway bridge and pavement condition and performance meets a "State of Good Repair" as defined by the OTC and described in *Chapter 4 – Performance and Condition Gap Analysis*. This more ambitious investment scenario would ensure that both NHS and non-NHS pavements and bridges see significantly improved asset conditions above the current revenue forecast, while also addressing mobility and accessibility needs such as satisfying Americans with Disabilities Act (ADA) and improving the seismic resiliency of lifeline routes. The *2020 OTC Investment Strategy* provides a discussion around the investment needed to achieve and maintain a state of good repair for bridges and pavement on the State Highway System. Shown below are estimated costs by work type, to meet and maintain a state of good repair on NHS pavement and bridges over the next 10 years.

ODOT estimates that the agency needs approximately **$273 million a year**, plus inflation, to achieve and hold pavement at a state of good repair across the entire system.

SCENARIO 2:STATE OF GOOD REPAIR – PAVEMENT										
TAMP Work Type	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**
New Construction	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Reconstruction	$49	$52	54	55	57	59	61	63	65	$67
Rehabilitation	$88	$92	$95	$98	$101	$105	$108	$111	$115	$118
Preservation	$88	$92	$95	$98	$101	$105	$108	$111	$115	$118
Maintenance	$16	$17	$18	$18	$19	$20	$20	$21	$22	$22
ODOT NHS Pavements Total	**$241**	**$254**	**$262**	**$270**	**$279**	**$287**	**$296**	**$306**	**$315**	**$326**
ODOT SHS Pavements Total	$273	$287	$296	$306	$315	$325	$335	$346	$356	$368

7-21 Scenario 2: Pavement State of Good Repair Investment Needs ($ millions)

With the growing population of bridges in fair condition deteriorating into poor condition, a significant and prolonged investment in new bridge construction will be required to return the system to a state of good repair. Funding to maintain a state of good repair is substantial at about **$539 million a year**, plus inflation, which far exceeds the level of funding that bridges have received for several decades.

This investment scenario would see a greater portion of total bridge revenue dedicated to non-NHS bridges assets due to addressing a backlog of lower-priority state highway bridges that are not a part of the NHS system.

SCENARIO 2:STATE OF GOOD REPAIR – BRIDGE										
TAMP Work Type	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**
New Construction	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Reconstruction	$112	$118	$121	$125	$129	$133	$137	$141	$146	$151
Rehabilitation	$207	$218	$225	$232	$239	$247	$254	$262	$271	$279
Preservation	$60	$63	$65	$67	$69	$71	$73	$75	$78	$80
Maintenance	$42	$44	$46	$47	$49	$50	$52	$53	$55	$57
ODOT NHS Bridges Total	**$420**	**$443**	**$457**	**$471**	**$486**	**$500**	**$516**	**$532**	**$549**	**$567**
ODOT SHS Bridges Total	$539	$568	$586	$604	$623	$642	$662	$683	$705	$728

7-22 Scenario 2: Bridges State of Good Repair Investment Needs ($ millions)

Scenario 3 –Maintain Current Conditions (MCC)

The establishment of national targets for the condition and performance of NHS assets is consistent with Oregon's performance-driven approach to investment in its highway system[58]. Achieving and maintaining State targets for the condition and performance of Oregon highways and bridges has been a departmental objective for more than 20 years. This scenario considers the investment levels needed to maintain the bridge and pavement conditions, as well as continue to meet national and state condition and performance targets over a 10-year horizon.

The tables below, presents the annual expected work type expenditures needed to maintain current conditions and achieve performance measure targets established for ODOT's NHS highways and bridges.

The current conditions of NHS pavements already meet the desired state of good repair, therefore the total investment levels as well as work type splits under this scenario are the same as Scenario 2.

SCENARIO 3:MAINTAIN CURRENT CONDITIONS - PAVEMENT										
TAMP Work Type	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**
New Construction	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Reconstruction	$49	$52	54	55	57	59	61	63	65	$67
Rehabilitation	$88	$92	$95	$98	$101	$105	$108	$111	$115	$118
Preservation	$88	$92	$95	$98	$101	$105	$108	$111	$115	$118
Maintenance	$16	$17	$18	$18	$19	$20	$20	$21	$22	$22
ODOT NHS Pavements Total	**$241**	**$254**	**$262**	**$270**	**$279**	**$287**	**$296**	**$306**	**$315**	**$326**
ODOT SHS Pavements Total	$273	$287	$296	$306	$315	$325	$335	$346	$356	$368

7-23 Scenario 3: Pavement Maintain Current Condition Investment Needs ($ millions)

In contrast to pavements, current conditions of NHS bridges are slightly below a desired state of good repair, and therefore need less funding to maintain the current conditions rather than to achieve and maintain a state of good repair. Currently, the bridge conditions on the state system can be maintained with roughly **$320 million a year**, plus inflation.

SCENARIO 3:MAINTAIN CURRENT CONDITIONS - BRIDGES										
TAMP Work Type	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**
New Construction	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Reconstruction	$55	$57	$59	$61	$63	$65	$67	$69	$71	$73
Rehabilitation	$136	$144	$148	$153	$158	$162	$167	$172	$178	$183
Preservation	$55	$57	$59	$61	$63	$65	$67	$69	$71	$73
Maintenance	$27	$29	$30	$31	$32	$32	$33	$34	$36	$37
ODOT NHS Bridges Total	**$273**	**$287**	**$296**	**$306**	**$315**	**$325**	**$334**	**$344**	**$355**	**$367**
ODOT SHS Bridges Total	$320	$337	$348	$358	$370	$381	$393	$405	$418	$432

7-24 Scenario 3: Bridges Maintain Current Condition Investment Needs ($ millions)

[58] Chapter 3: Goals, Measures, Targets and Conditions

Comparison of Scenarios

The above investment scenarios are designed to implement investment strategies and to various degrees maintain or improve the condition of NHS pavements and bridges and make progress towards the achievement of national performance targets and goals. A summary of the three investment scenarios pertaining to the NHS system are summarized in the following tables.

COMPARISON OF INVESTMENT SCENARIOS - ODOT NHS PAVEMENT											
SCENARIO	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**AVG**
Scenario 1 Optimize Current Revenue	$102	$105	$102	$96	$98	$98	$91	$93	$93	$91	$102
Scenario 2 Maintain a State of Good Repair	$241	$254	$262	$270	$279	$287	$296	$306	$315	$326	$241
Scenario 3 Maintain Current Condition	$241	$254	$262	$270	$279	$287	$296	$306	$315	$326	$241

7-25 Comparison of NHS Pavement Scenarios ($ millions)

COMPARISON OF INVESTMENT SCENARIOS - ODOT NHS BRIDGES											
SCENARIO	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**AVG**
Scenario 1 Optimize Current Revenue	$214	$214	$214	$195	$195	$195	$195	$195	$195	$195	$214
Scenario 2 Maintain a State of Good Repair	$420	$443	$457	$471	$486	$500	$516	$532	$549	$567	$420
Scenario 3 Maintain Current Condition	$273	$287	$296	$306	$315	$325	$334	$344	$355	$367	$273

7-26 Comparison of NHS Bridge Scenarios ($ millions)

U.S. 199, Applegate River Bridge, SW of Grants Pass

Chapter 8 – Investment Strategies

8.1 Producing Investment Strategies

TAMP Investment Strategy Requirements

Federal statutes requires every State DOT to develop both a financial plan and investment strategies as part of the TAMP that encompasses at least 10 years and identifies the revenues and costs associated with preserving and improving the condition and performance of the transportation assets included in its asset management plan. Investment strategies are to demonstrate how adopted actions improve or preserve the condition and performance of NHS infrastructure and make progress in achieving national policy goals. The investment strategies process is required to provide a description of how investment decisions are influenced by (at a minimum):

- Performance gap analysis;
- Lifecycle planning;
- Risk management analysis; and
- Anticipated available funding and estimated costs of future work.

Investment Strategy Overview

One of the major challenges facing Oregon's transportation system is that increases in revenue dedicated to transportation have not kept pace with the funding needed to maintain, preserve, and enhance an aging transportation system. While transportation funding for pavements and bridges has stagnated or increased incrementally with new state and federal investments (with the exception of the Infrastructure Investment and Jobs Act (IIJA) which has a five-year increase in bridge funding), inflation and rising construction costs have substantially reduced the buying power of available financial resources needed to preserve and improve aging facilities.

ODOT's investment strategies under this constrained revenue scenario are founded on policies and objectives adopted by the Oregon Transportation Commission (OTC or Commission)[59] and presented in ODOT's *Oregon Transportation Plan (OTP)* and associated modal and topic plans. The investment strategies link organizational financial and management system priorities with asset management processes that consider asset conditions, performance targets, lifecycle planning, and risk analysis. The investment strategies developed by ODOT support progress towards the achievement of national and state performance targets and policy goals, and reflect optimal investments in a constrained funding environment.

Underlying the investment strategies is asset management information and analyses presented in other chapters of the TAMP. The performance gap analysis helps identify investment needs to achieve targets and policy goals for condition and performance of NHS pavements and bridges. Lifecycle cost considerations provide information on the costs of maintaining and improving NHS pavement and bridge assets over time. Financial plan estimates of state and federal funding permit the development of likely future conditions and performance of pavements and bridges on priority NHS routes as well as the overall State Highway System. Risk management analysis highlights and prioritizes factors that positively or negatively impact strategies and outcomes.

Investment Priorities and Policy Guidance

ODOT began in 1913 when the Oregon Legislature created the Oregon Highway Commission to *"get Oregon out of the mud."* Today, we develop and operate a diverse portfolio of programs related to Oregon's system of:

- Highways, roads, and bridges (including bikeways and walkways),
- Railways,
- Public transportation services,
- Transportation safety programs,
- Driver licensing and vehicle titling/registration, and
- Motor carrier/trucking regulation.

[59] https://www.oregon.gov/odot/Get-Involved/Pages/OTC_Main.aspx

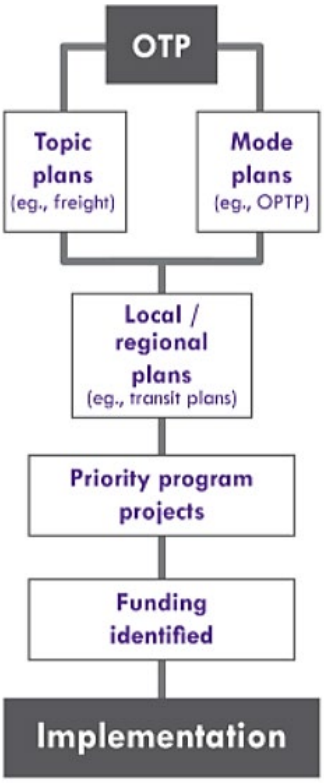
The agency operates under the direction of the OTC, which sets strategies and policies for the state transportation system. Together, the OTC and ODOT work closely with the governor and state legislature to ensure efforts to maintain and enhance the system are aligned with the broader needs, priorities and resources of the state.

Strategies are supportive of ODOT's Mission and Values and founded on policies, plans and objectives adopted by the OTC. They are presented in ODOT's *Oregon Transportation Plan* and associated modal and topic plans including the *Oregon Highway Plan*, *Strategic Business Plan*, *Strategic Action Plan* and the *OTC Investment Strategy*.

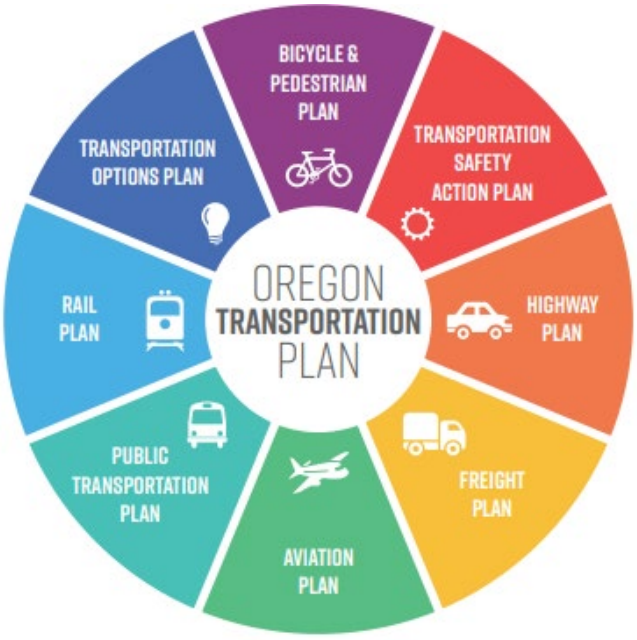
ODOT Planning Documents

Oregon Transportation Plan

The OTC, working through ODOT, sets a comprehensive 20-year vision and policy for Oregon's transportation system: the *Oregon Transportation Plan*. The *Oregon Transportation Plan* is supported by specific transportation mode and topic plans that provide policy and goals to guide the evolution of transportation across the state. These plans are developed in partnership with transportation stakeholders and adopted by the OTC. All of these documents work together to provide a comprehensive strategy for preserving, maintaining and enhancing transportation throughout Oregon, setting the foundation for ODOT's mission.



8-1 OTP Guidance Flow through Implementation



8-2 Transportation Policy Plans (Strategic Business Plan, pg. 3)

As part of its overall plan, the *Oregon Transportation Plan* identifies investment scenarios that provide a framework for decision-making based on the amount of funding available for the transportation system. Under a scenario where available revenue remains flat and is insufficient to meet system needs, the plan identifies a policy for "Triage in the Event of Insufficient Revenue." It specifies that under this constrained funding scenario, investments should "support Oregonians' most critical transportation needs, broadly considering return on investment and asset management." Efforts should be focused on preservation and operational improvements to maximize system capacity and safety at the least cost possible.

Updates to the *Oregon Transportation Plan* are underway! Current info and events are provide on the project webpage[60]

[60] https://www.oregon.gov/odot/Planning/Pages/Oregon-Transportation-Plan-Update.aspx

1999 Oregon Highway Plan

The *Oregon Highway Plan* functions as a strategic element under the guiding aspect of the *Oregon Transport*ation Plan and establishes long-range policies and investment strategies for the State Highway System. The commission adopted the *Oregon Highway Plan* on March 18, 1999, and it has been updated multiple times with technical and policy amendments, since then. The most recent update was completed in 2015.

To help meet Oregon's transportation system needs, the *Oregon Highway Plan* establishes policies and scenarios used in planning and prioritizing programs at a range of potential funding levels. Both the *Oregon Transportation Plan* and *Oregon Highway Plan* focus on preserving the system and making it safer before adding capacity.

Oregon Highway Plan policy 1G.1outlines the following investment hierarchy:

1. Protect the existing system.
2. Improve the efficiency of facilities that already exist, by implementing intelligent transportation systems and other solutions.
3. Add capacity to the existing system.
4. Only after we've done everything else do we add new facilities.

This hierarchy and fix-it policy lean is reflected in the Statewide Transportation Improvement Program (STIP).

One of the ways we deal with limited funding is by **focusing on the most critical corridors**– the ones that connect most of our communities and serve most freight. By focusing our investments we can stretch scarce bridge and pavement funding further.

Under the constrained revenue that Oregon currently faces, the *Oregon Highway Plan* emphasizes **doing as much as possible to operate the highway system safely and efficiently to preserve what is already in place.** Specifically, the Oregon Highway Plan lays out the following strategy under a constrained revenue scenario:

With funding that does not increase with inflation and subject to statutory requirements and regional equity, address critical safety issues and manage and preserve existing infrastructure at 77% fair-or-better before adding capacity, as explained below:

- *Focus safety expenditures where the greatest number of people are being killed or seriously injured*
- *Fund modernization only to meet statutory requirements*
- *Preserve pavement conditions at 77% fair-or-better on all roads except for certain Regional and District Highways*
- *Do critical bridge rehabilitation and replace bridges only when rehabilitation is not feasible*
- *Fund operations to maintain existing facilities and services and extend the capacity of the system*

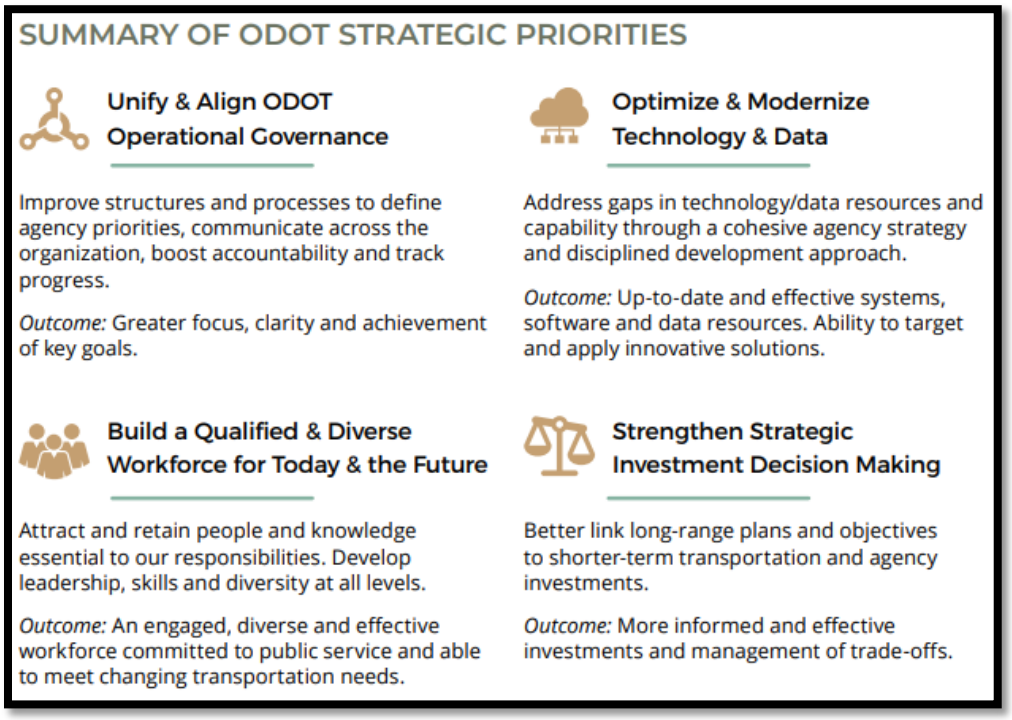
The Oregon Highway Plan update will begin following the adoption of the new Oregon Transportation Plan anticipated in early 2023.

The updated Oregon Highway Plan will:

- Provide a long-range vision for the State Highway System that aligns with the updated Oregon Transportation Plan
- Understand the system's multiple users and their needs, and articulate the multi-modal nature of the State Highway System
- Provide a framework for prioritizing investments statewide and regionally on the State Highway System.
- Inform tactical-level planning and management objectives for the State Highway System
- Establish an approach for implementing the vision, goals, policies, and strategies developed in the plan.

2018-22 Strategic Business Plan

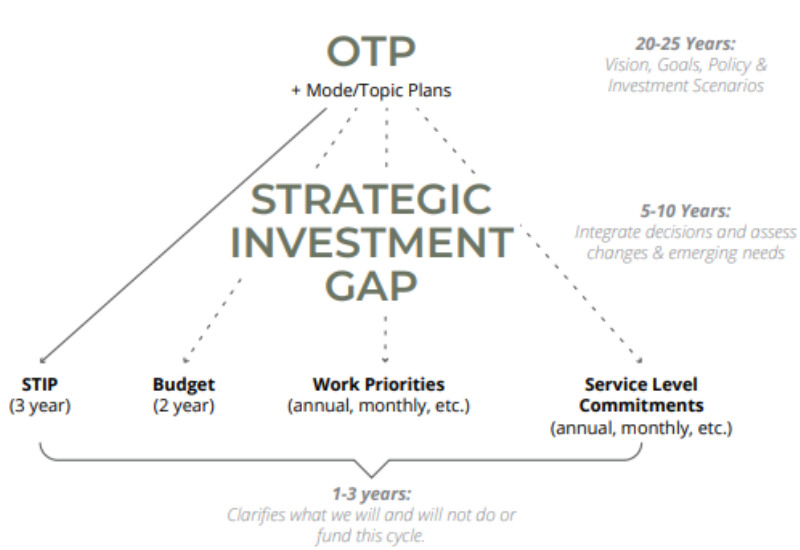
The *2018-22 Strategic Business Plan* focuses on priorities and actions that make ODOT a more capable, efficient organization for delivering on our mission and strengthening our unity of purpose as One ODOT. The following four agency strategic priorities are identified.



8-3 Summary of ODOT Strategic Priorities (Strategic Business Plan, pg.7)

Of our four strategic priorities, the effort to build a more robust and informed investment decision process will have the most direct impact on priorities and direction for the state transportation system.

The priority to *strengthen strategic investment decision making (pg.22-25)* aims to better link long-range plans and objectives to shorter-term transportation agency investments. The anticipated outcome of this effort is designed to lead to more informed and efficient investments and management of trade-offs, support investment decisions that are clearly linked to plans, goals and policies, and improve the agency's ability to explain the rationale for investment choices and trade-offs.



8-4 Strategic Investment Gap Illustration (Strategic Business Plan, pg.22)

2020 OTC Investment Strategy

The *2017 OTC Investment Strategy*[61], adopted by the Oregon Transportation Commission (Commission) in January 2017, laid out the agency's investment strategies in various program areas, compared total need to available funding, discussed the implications of long-term system performance at current funding-levels, and outlined options for additional investment. It was developed for legislative consideration during the 2017 legislative session, during development of the transportation funding package.

In 2019, the Commission requested the opportunity to update its 2017 Investment Strategy to account for the additional funding in HB 2017 and an updated assessment of need across the transportation system. The Commission plays a key role in making investment decisions for the transportation system and the agency, primarily through the STIP. The Commission also provides direction on the specific funding programs in which projects are selected

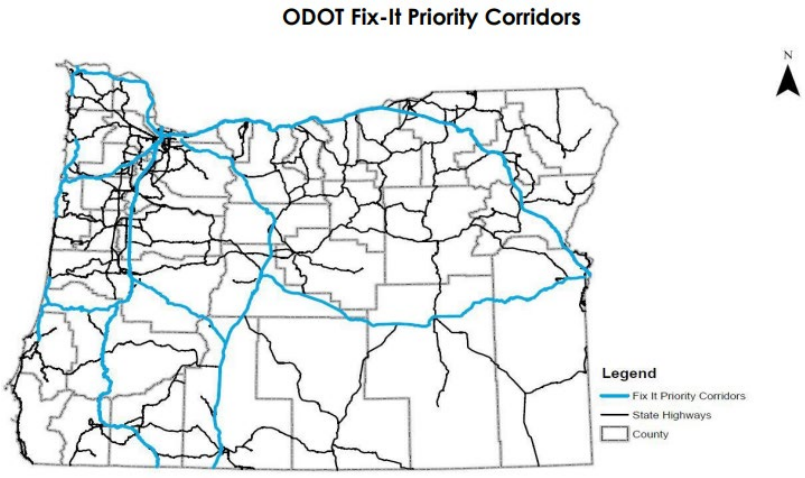
The *2020 OTC Investment Strategy* update builds on the 2017 iteration by examining the gap between total system-wide needs and 2020 funding-levels (post-HB 2017). The updated strategy includes an overview of how resources are being invested, the resulting performance/system conditions, revenue generation efforts and prioritization of expenditures.

The figure below summarizes the investment areas and supporting programs discussed in the *2020 OTC Investment Strategy*.

PRESERVATION	SAFETY	MULTIMODAL TRANSPORTATION OPTIONS	SYSTEM OPERATIONS	STRATEGIC CAPACITY EXPANSION
Bridge Pavement Culverts Seismic Highway Maintenance	All Roads Transportation Safety (ARTS) Rail Crossings	Active Multimodal Freight Public Transit Passenger Rail	Optimization/ Enhancements Operations Incident Response	Modernization

8-5 2020 OTC Investment Areas & Supporting Programs

The Preservation investment strategies reflect the *Oregon Transportation Plan* and *Oregon Highway Plan* policy guidance of focusing targeted cost-effective investments on high priority corridors and are aimed at achieving transportation targets and policy goals for the condition and performance of ODOT's pavements and bridges. The most critical corridors are those that connect most of our communities and serve most freight. By focusing our investments on corridors most important for the movement of people and goods, we can stretch bridge and pavement funding further.

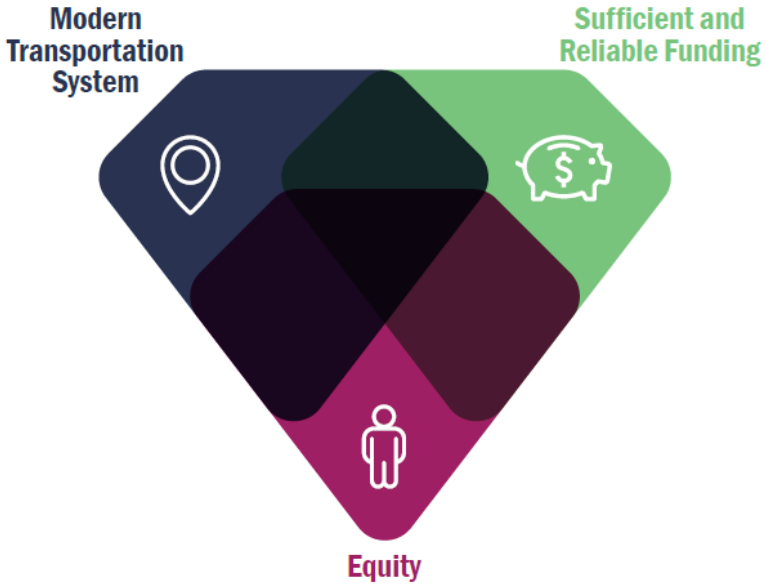


8-6 ODOT Fix-It Priority Corridors

[61] A Strategic Investment in Transportation (ODOT, January 2017)

2021-23 Strategic Action Plan

Three strategic priorities set the overall direction for the 2021-23 Strategic Action Plan.[62] These priorities inform our work, guide our decision-making, and are objectives against which we hold ourselves accountable. These priorities are interrelated, overlapping, and intended to identify specific actions that lead to concrete, tangible outcomes. Achieving these priorities will enable us to better serve all Oregonians.



8-7 Strategic Action Plan Priorities (Strategic Action Plan, pg.1)

Each priority has specific goals and outcomes attached. Click on the goal to learn more.

Equity– Prioritize diversity, equity and inclusion by identifying and addressing systemic barriers to ensure all Oregonians benefit from transportation services and investments.

Modern Transportation System – Build, maintain and operate a modern, multimodal transportation system to serve all Oregonians, address climate change, and help Oregon communities and economies thrive.

Sufficient and Reliable Funding – Seek sufficient and reliable funding to support a modern transportation system and a fiscally sound ODOT.

Nested beneath each priority are goals that further focus our work. While each individual goal is important, it is the interrelationship among the goals that make the whole more valuable than the sum of its parts.

At the heart of this Strategic Action Plan are *near-term strategic outcomes* designed to advance not an isolated objective, but multiple goals concurrently. The goals provide a framework to deliver on our priorities simultaneously.

[62] https://www.oregon.gov/odot/Pages/SAP.aspx

8.2 TAMP Investment Strategies

This chapter identifies actions and strategies that the agency is undertaking to improve how the agency employs asset management strategies to stretch limited resources, as well as strategies to reduce the gaps between transportation needs and funding available for transportation assets.

Underlying the investment strategies is asset management information and data-driven analyses presented in other chapters of the TAMP. The performance gap analysis helps identify investment needs to achieve targets and policy goals for condition and performance of National Highway System (NHS) pavements and bridges. Lifecycle cost considerations provide information on the costs of maintaining and improving NHS pavement and bridge assets over time. Financial plan estimates of state and federal funding permit the development of likely future conditions and performance of pavements and bridges on priority NHS routes as well as the overall state system. Risk management analysis highlights and prioritizes factors that positively or negatively impact strategies and outcomes.[63]

Work Type Investment Strategies

The three major categories of investment that ODOT employs to preserve and enhance the NHS pavement and bridge system are: Modernization, Preservation, and Maintenance. Modernization activities include initial construction and reconstruction of existing assets; preservation includes both preservation activities and well as rehabilitation activities; and Maintenance includes both proactive and reactive maintenance efforts.

The following summarizes ODOT's investment strategies as it seeks to balance investment between Modernization, Preservation, and Maintenance under a constrained revenue scenario:

Target more dollars for preservation and maintenance over modernization[64]

This strategy continues to focus on preservation measures to add useful life to pavement and bridges before the structures and their underlying bases are damaged and require major rehabilitation or reconstruction. Further, this strategy also places emphasis on preventative maintenance activities that can delay the need for more costly repairs.

Current funding allocations for pavement and bridge preservation and maintenance limit the decline in condition on the state and National Highway System over the next 10 years. Additional funding provided by 2017 Keep Oregon Moving Act (HB2017) and the Infrastructure Investment and Jobs Act (IIJA) will help delay the deterioration in conditions, but will not stop this decline from taking place. Even with prioritization of preservation and maintenance over modernization, additional revenue for pavement and bridges is necessary to meet and maintain a desired state of good repair. See *Chapter 4 - Condition and Performance Gap Analysis* for more information.

Focus preservation and preventative maintenance activities on key routes and corridors[65]

To preserve movement of freight and economic activity under a constrained funding environment, ODOT employs a "corridor approach" that prioritizes resources to keep key freight corridors open to truck traffic and maintain critical connections across the state. ODOT has designated the main routes of the State Highway System connecting most of the state's communities and carrying most freight and automobile traffic as "Fix-It priority corridors" and focuses scarce resources on maintaining bridge and pavement conditions on these routes.

Fix-It priority corridors include all the routes in the Oregon Transportation Investment Act (OTIA) Stages 1-3, Seismic Phase 1 and 2 Lifeline Routes, and Priority Routes identified by the ODOT Executive Management Team. The identification of key routes or corridors to receive priority consideration coincides with the establishment of the National Highway System under the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991. A key priority

[63] The OTP and OHP are being updated in the near future, likely resulting in an update to strategies.
[64] 1999 OHP (pg. 7)
[65] 2020 OTC Investment Strategy (pg18) and 1999 OHP (pg. 9)

of the *1999 Oregon Highway Plan* is to "give priority to Interstate pavement and bridge conditions and pavement and bridge conditions on other priority routes."

Provide funding to enhance the seismic resilience of pavements and bridges[66]

One of the foremost environmental risks facing Oregon and its transportation system is a Cascadia Subduction Zone Earthquake. The *1999 Oregon Highway Pla*n, established as a priority to provide "a secure lifeline network of streets, highways, and bridges to facilitate emergency services response and to support rapid economic recovery after a disaster." Over the years, the agency has made incremental progress in developing approaches to mitigate seismic vulnerabilities of the state's highways and bridges. The 2015 *Oregon Highways Seismic PLUS Report* outlined a statewide program to address seismic vulnerability and mitigate structural deficiencies. In 2021 the *ODOT Seismic Implementations: Policies and Design Guidelines* was published. This document provides guidance to planners, project teams, scoping teams, designers, program managers and ODOT maintenance and operations as they implement the Seismic Program. In addition, the document communicates implementation, provides a consistent decision-making structure for program/project changes and integrates ODOT's work with local agency plans.

In March 2016, the OTC allocated $35 million for the first phase of enhancing the seismic resiliency of lifeline routes. Subsequently, additional revenue from HB2017 and IIJA was dedicated for funding seismic improvements on highways and bridges. As reflected in *Chapter 7- Financial Plan*, $31 million was provided in the 21-24 STIP cycle for bridge seismic work and an additional $129.6 million is estimated to be provided in the 24-27 STIP cycle.

Given limited resources, ODOT's seismic investment strategy has a number of components:

- **Focus mitigation on Phase 1.** ODOT is retrofitting and replacing bridges to achieve a long-term full mitigation for the most important corridors in Phase 1.
- **Triage for Phases 2-4**. ODOT will identify lower cost alternative routes on the local system that could serve segments of the corridor.
- **Recovery planning for bridges in Phase 5**. Phase 5 bridges include the major coastal bridges that are cost-prohibitive to replace at current funding levels.
- **Enhance maintenance facilities**. ODOT is enhancing maintenance stations and pre-staging critical supplies in the most affected areas. This approach aims to leverage existing funding and co-location with local partnerships. The three first priority locations that have been identified are Coos Bay, the central coast, and Astoria.

Increase funding for pavement and bridge maintenance activities[67]

Existing resources no longer keep pace with the maintenance and operations needs of an aging system, responding to more extreme weather events, and dealing with increasing traffic volumes. In addition, maintenance requirements for the upkeep of traffic signs, retaining walls, tunnels, variable message signs, and other infrastructure are growing. An additional investment would help address maintenance needs in freeway corridors and across key highway assets, preserving our multibillion dollar highway system and keeping our highways more reliable and safe during the winter months.

Pavement funding in the Maintenance program outside the STIP plays a critical role in the overall preservation of the pavement system. Approximately 46 percent of state highway mileage are not eligible for STIP Pavement Preservation funding program and only receive maintenance treatments through the Low Volume Roads (LVR) program. Although these roads are not as high in priority as other routes, they are vital links between local communities and the rest of the state. LVR funding was increased from $13.5 million per year to $15.5 million per year during the 21-23 biennium. This amount is subject to cuts during heavy winter weather years when maintenance funds are diverted to more immediate needs and also subject to cuts in future biennia. The Major Bridge Maintenance program funding was increased from $10M per year to $12M per year, starting in FY22.

ODOT continues to look for efficiencies in the maintenance program to help offset increasing costs.

[66] *2020 OTC Investment Strategy (pg. 23-24)*
[67] *2020 OTC Investment Strategy (pg. 28, 33-35)*

Pavement Asset Management Investment Strategy

ODOT has developed and implemented a pavement strategy that makes the best use of available funds incorporating Pavement Management System data and analyses into the process. The pavement strategy uses a tiered approach to prioritize highway routes and also includes dedicated funding programs for the most cost-effective maintenance treatments, preservation resurfacing and rehabilitation, and reactive pavement patching.

State highway pavement preservation investments prioritize pavement conditions by state highway classification, *set by the Oregon Highway Plan*, into four levels:

1) Interstate highways (highest priority, highest condition targets, and highest level of investment)
2) Fix-It priority Routes (e.g., US-97, OR-58, or US-26)
3) Remaining State level NHS routes (e.g., US-101)
4) Region and district level routes (e.g., OR-99E or OR-214)

ODOT's pavement investment strategy is overseen by a longstanding interdisciplinary Pavement Committee steering team that includes the State Pavement Engineer, Pavement Management Engineer, State Traffic/Roadway Engineer, State Construction Engineer, Maintenance and Operations Manager, and Region, Area and District Managers. This steering team meets regularly and sets the overall strategy and policy direction for the pavement programs. The team manages the financial plans for the Interstate preservation program, the HB2017 funded preservation program, and the chip seal program, and also determines funding allocations to the interstate and regional paving and chip seal programs. Financial details for the different pavement programs is provided in *Chapter 7 - Financial Plan.*

Funding for ODOT's pavement program comes from two sources, the STIP Fix-It Pavement Preservation program and the Maintenance program. By policy, the state highway network is broken up by traffic volume and truck traffic loading so that the Interstate and most of the NHS pavement projects are delivered with STIP funds through the Fix-It Pavement Preservation Program while projects on low volume state highways are delivered with Maintenance Program funds. Both programs rely on pavement management system data and analysis to set funding levels and identify priority projects. *Chapter 7 – Financial Plan* is used to help inform ODOT's investment strategies.

Fix-It Pavement Preservation Program

The Fix-It Pavement Preservation program invests primarily in pavement maintenance, preservation, rehabilitation and reconstruction projects on the Interstate and state highways with relatively higher traffic volumes. As part of the program, roadside safety feature and accessibility deficiencies on walkways abutting repaving projects are corrected where required. Overall funding levels are established for each STIP update cycle (typically every 3 years) at ODOT's executive level and are informed by the Pavement Management System which forecasts the impacts of different investment levels on pavement conditions. Approximately one-third to one-half of total program funds are allocated to Interstate preservation projects depending on overall funding level and pavement needs.

Maintenance Low Volume Roads and Pave Patch Programs

There are two dedicated pavement funding line items within the Maintenance budget – Low Volume Roads and Pave Patch. Funding levels and district allocations for both of these programs are established each biennium (2 year cycle) within Maintenance as part of the normal budgeting process and are informed by the Pavement Management System Database.

The Low Volume Roads Program maintains state highways with an average daily traffic of less than 5,000 vehicles and less than 3 million equivalent single axel truck loads projected over 20 years. Funded under the maintenance limitation, these highways do not receive Statewide Transportation Improvement Program Preservation Program funds unless approved by an exception from the Statewide Pavement Committee.

The program started with the 1999 Oregon Highway Plan. It covered Region and District level highways with an average daily traffic of less than 1,000 vehicles. The program's intent is to maintain these highways at their 1999 conditions with thin "maintenance only" treatments such as chip seals or thin overlays. As a result of timely and efficient treatment, pavement conditions on low volume highways increased beyond expectations. The average

daily traffic threshold was increased to 2,500 for the 2005-2007 biennium. It was raised again for the 2009-2011 biennium to 5,000 vehicles per day. This was to keep pavement conditions balanced across traffic levels. Faced with declining conditions and reduced funding levels, another change was implemented for the 2009-2011 biennium; state-wide level highways were added to the program. An additional filter of less than 3 million equivalent single axel truck loads projected over 20 years was included. This ensured that routes with heavy truck volumes remained in the STIP Pavement Preservation Program to receive thicker treatments where appropriate. Although some of the state NHS highway system is part of the Low Volume Highway network, the majority of these routes are non-NHS.[68]

The Pave Patch Program funding applies corrective maintenance on deferred highways and occasionally does maintenance preservation projects to extend pavement service life. The overall budget for Pave Patch program is informed by the Pavement Management System by monitoring historic and forecast pavement conditions, and adjusting as needed. The Pave Patch district splits are based on a formula incorporating lane miles, pavement condition, and traffic level.

Bridge Asset Management Investment Strategy

The standard ODOT strategy for bridge preservation is to keep bridges in the best condition possible, at the lowest cost, by taking a preventative approach to preserve and maintain bridges. As outlined in *Chapter 5 – Life Cycle Planning*, the most cost-effective approach is to extend the service life of bridge decks and other structural components where possible through routine preventative maintenance. This approach extends the life of bridges, reducing the frequency and need of costly bridge replacement.

In 2011, ODOT's Highway Leadership Team developed a System Preservation Strategy Work Plan for bridges on the state system. This work plan identified a bundle of strategies aimed at reducing the number of high value bridges falling into a condition where bridge rehabilitation is not an option. The strategies identified in this work plan are as follows:

1. Protection of high value coastal, historic, major river crossings, and border structures by acting before cost becomes prohibitive.
2. Use of Practical Design and funding of basic bridge rehabilitation projects and rare replacements with bridge program funding.
3. Give priority to maintaining the highest priority freight corridors (OTIA III, Stages1-3).
4. Develop bridge preventative maintenance (PM) program that will extend the service life of bridge decks and other structural components.
5. Continue to raise awareness of the lack of seismic preparation.
6. Bring Structurally Deficient (SD) bridges to a Fair condition using a partial rehabilitation scope of work.
7. Leverage other programs where possible to do additional bridge preservation on the system.
8. Continue use of bridge inspection, health monitoring and improved deterioration prediction.

ODOT's bridge investment strategy is overseen by a newly formed Bridge Program Advisory Group that includes the State Bridge Engineer, State Bridge Program & Standards Engineer, representation from the Maintenance & Operations Branch, representation from the Commerce & Compliance Division, and Region, Area and District Managers. This steering team meets regularly and is tasked with providing input on implementation of program strategy and fostering effective communication between the Bridge Engineering Section and its partners.

[68] lvr_2011_2013_rev.pdf (oregon.gov)

8.3 STIP Asset Management Strategies

Dedication of STIP Funding toward Fix-it Projects

The investment strategies outlined in the sections above are largely implemented through Oregon's STIP. In 2012, the OTC and ODOT changed how the STIP is structured. The STIP is no longer developed as a collection of projects for specific pools of funding dedicated to specific transportation modes or specialty programs. Instead the STIP primarily divides funding into two broad categories: *Fix-It and Enhance.*

Enhance: Activities that enhance, expand, or improve the transportation system.

Fix-it: Activities that maintain and preserve the transportation system.

The process of organizing the STIP around Enhance and Fix-it categories was a significant change and reflects ODOT's goal of becoming a more multimodal agency and making investment decisions based on the system as a whole, not for each mode or project type separately. The agency has requested assistance from local partners in developing the STIP and identifying those projects that assist in moving people and goods through the transportation system safely and efficiently.

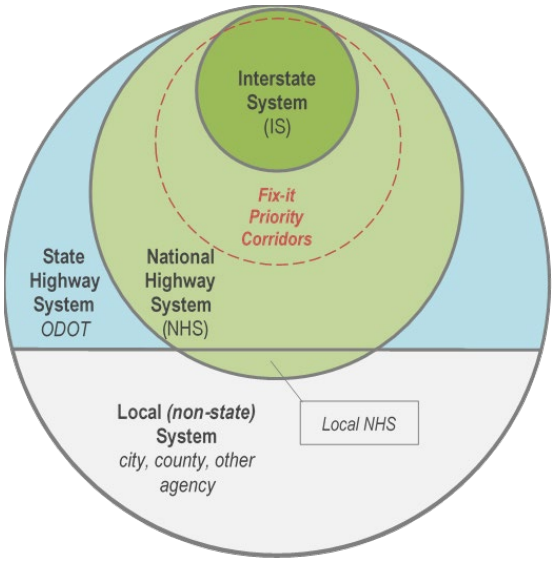
The process for selecting Fix-It projects within the STIPs relies heavily on data-driven project identification and selection driven through ODOT management systems that help identify needs based on technical information and condition data for assets including pavement and bridges.

Prioritization of Fix-it Corridors in the STIP

To preserve movement of freight and economic activity under a constrained funding environment, ODOT employs a "corridor approach" that prioritizes resources to keep key freight corridors open to truck traffic and maintain critical connections across the state. ODOT has designated the main routes of the State Highway System connecting most of the state's communities and carrying most freight and automobile traffic as "Fix-It priority corridors" and focuses scarce resources on maintaining bridge and pavement conditions on these routes.

Fix-It priority corridors include all the routes in the OTIA Stages 1-3, Seismic Phase 1 and 2 Lifeline Routes, and Priority Routes identified by the ODOT Highway Management Team. As demonstrated in *Figure 8-8*, the Fix-it priority corridors are all part of the State Highway System and the National Highway System.

The designation of Fix-it Priority Corridors ensures that the constrained revenue needed to repair and maintain Oregon's transportation system is focused on critical corridors in the system. Furthermore, because these corridors are all part of the ODOT-owned NHS. Dollars invested in these corridors are directly aimed at maintaining and improving the condition and performance of corridor pavements and bridges and achieving national and state performance measures, targets and policy goals.



8-8 Fix-It Priority Corridors and Highway System Networks

STIP Fix-it Project Identification and Selection Process Coordination

DES -01: Use of Fix-It Program Funds establishes how funding that is allocated to Fix-It programs may be spent on improvement needs.

The process to identify and select STIP Fix-it projects within the program requirements involves coordination and collaboration between Fix-It and other programs. Project selection decision-making needs to be integrated and

coordinated in a way that is efficient, effective and strategic for leveraging opportunities across programs, while still achieving individual Fix-It program goals and objectives. It is expected that this integration and coordination will make the most efficient use of the limited funding available, seeking opportunities to leverage when possible and appropriate.

Fix-It program managers will provide 125% -150% lists to regions and other participants. Regions, in coordination with Area Commissions, will identify leverage opportunities to make improvements to the state system. Regions and Fix-It program managers will give additional consideration to the project locations from the 125%-150% lists that have also been selected for leveraging. Regions and Fix-It program managers will collaborate to determine 100% lists for each program.[69]

Integrating ODOT Strategic Priorities into Asset Management Strategies

In April 2018, the OTC adopted a strategic business plan for the agency called *One ODOT: Positioned for the Future*. The Strategic Business Plan focus is internal, describing how ODOT will deliver on our Mission and included four ODOT Strategic Priorities:

- *Unify & Align ODOT Operational Governance*
- *Optimize & Modernize Technology & Data*
- *Build a Qualified & Diverse Workforce for Today & the Future*
- *Strengthen Strategic Investment Decision Making*

The agency priority to *strengthen strategic investment decision making* aims to "better link long-range plans and objectives to shorter-term transportation agency investments." The anticipated outcome of this effort is designed to lead to more informed and efficient investments and management of trade-offs, support investment decisions that are clearly linked to plans, goals and policies, and improve the agency's ability to explain the rationale for investment choices and trade-offs.

The OTC and ODOT leadership recognized the need to also develop externally facing priorities, and in response developed the *2021-2023 Strategic Action Plan*. The Strategic Action Plan describes what tangible and measurable actions ODOT will take to deliver on our mission. The following three priorities through 2023 were officially approved through the OTC:

Equity: Prioritize diversity, equity, and inclusion by identifying and addressing systemic barriers to ensure all Oregonians benefit from transportation services and investments.

Modern Transportation System: Build, maintain, and operate a modern, multimodal transportation system to serve all Oregonians, address climate change, and help Oregon communities and economies thrive.

Sufficient and Reliable Funding: Seek sufficient and reliable funding to support a modern transportation system and a fiscally sound ODOT.

As a result of the Strategic Action Plan, two significant efforts are to more robustly integrate social equity and climate change mitigation and adaptation considerations into ODOT business and asset management investment strategies. What this looks like, is actively being developed.

Irrespective of how these efforts are integrated into asset management practices, ODOT's Transportation Asset Management Plan will help to ensure short and long-term resource allocation decisions are based on data and analysis, including consideration of engineering management systems, life cycle costs, and risk analysis. Investment strategies implemented will make sure that available current and future funding will best be allocated to maintaining the condition and performance of transportation assets and achieving national and state asset targets and policy goals.

[69] DES-01.pdf (pg.4)

8.4 Strategies for Reducing Gaps in Available Funding

Past efforts to dedicate additional revenue to Oregon's state and local transportation systems have been successful in helping preserve and maintain the condition and performance of Oregon NHS Bridge and Pavement assets. These investment efforts have included, but are not limited to, the Oregon Transportation Investment Acts (OTIA I, II, II), the 2009 Jobs and Transportation Act (JTA) and HB2017. These state investment packages have supported the funding of essential asset management activities on critical transportation corridors across the state and have helped mitigate many of the costly consequences and risks associated with deferred maintenance and preservation of Oregon's pavements and bridges.

Despite these critical investments, along with the additional investment provided by the IIJA, ODOT continues to face on ongoing funding gap between revenue available to maintain and preserve bridge and pavement assets, and the revenue needed to maintain asset conditions and meet a desired state of good repair over a ten-year time horizon. These funding gaps are summarized in *Chapter 4: Condition and Performance Gap Analysis* with further detail provided in *Chapter 6: Risk Management* and *Chapter 7: Financial Plan.*

The 2020 OTC Investment Strategy[70] summarize some of ODOTs biggest transportation revenue and funding challenges and risks which include:

- Constitutional and legal framework;
- COVID-19 and the economy;
- Fuel efficiency and electrification;
- Federal funding uncertainty;
- Increased cost of doing business: Inflation and aging infrastructure, and
- The shifting landscape of mobility

In addition to the traditional funding sources of the gas tax, driver and motor vehicle fees, and weight-mile tax, ODOT has been exploring new approaches to fund and finance needed transportation investment, such as piloting road usage charging programs, implementing increased user-fees on electric and hybrid vehicles and establishing a tolling program to address many of Oregon's congestion challenges. These approaches are discussed in more detail in the *2020 OTC Investment Strategy, pages 72-85*.

[70] 2020 OTC Investment Strategy.pdf (pg. 11-16)

Appendices

Appendix A – Index of TAMP Content Requirements

REQUIREMENT	DESCRIPTION	2022 TAMP PRIMARY LOCATION	SUPPLEMENTAL REFERENCES & MATERIALS
23 CFR 515.5	Work type means initial construction, maintenance, preservation, rehabilitation, and reconstruction. Chapter 7 – Financial Plan		
23 CFR 515.7	**Process for establishing an asset management plan.** A State shall develop a risk-based asset management plan that describes how the NHS will be managed to achieve system performance effectiveness and State DOT targets for asset condition, while managing the risks, in a financially responsible manner, at a minimum practicable cost over the life cycle of its assets. The State DOT shall develop and use, at a minimum the following processes to prepare its asset management plan:		
515.7(a)	A State DOT shall establish a process for conducting **performance gap analysis** to identify deficiencies hindering progress toward improving or preserving the NHS and achieving and sustaining the desired state of good repair. At a minimum, the State DOT's process shall address the following in the gap analysis:	Chapter 4 - Condition & Performance Gap Analysis	Chapter 3 - Goals, Performance Measures and Targets
515.7(a)(1)	The **State DOT targets for asset condition** of NHS pavements and bridges as established by the State DOT under 23 U.S.C. 150(d) once promulgated.	Section 4.3 Pavement and Bridge Performance Gap Analysis	Chapter 3 - Goals, Performance Measures and Targets Section 3.2 – National Performance & Targets Section 3.3 - State Performance & Targets Legislatively Approved 2021-2023 Key Performance Measures (LFO, May 2021) FHWA Performance Management Areas, Measures and Targets (FHWA & ODOT, Aug 2018) Performance Measure Target Setting (ODOT & MPO, 2020)
515.7(a)(2)	The **gaps, if any, in the performance** of the NHS that affect NHS pavements and bridges regardless of their physical condition; and	Section 4.3 AM Plan Performance Gap Analysis	Annual Performance Progress Report (ODOT, Sept 2021) Federal Biennial Mid Performance Period Progress Report (ODOT, 2020) State Performance Dashboards & Reports (FHWA)
515.7(a)(3)	Alternative strategies to close or address the identified gaps	Section 4.4 Reducing the Gap	2020 OTC Investment Strategy (ODOT, 2020)

REQUIREMENT	DESCRIPTION	2022 TAMP PRIMARY LOCATION	SUPPLEMENTAL REFERENCES & MATERIALS
515.7(b)	A State DOT shall establish a process for conducting **life-cycle planning** for an asset class or asset sub-group at the network level (network to be defined by the State DOT). As a State DOT develops its life-cycle planning process, the State DOT should include future changes in demand, information on current and future environmental conditions including extreme weather events, climate change, and seismic activity and other factors that could impact whole of life costs of assets	Chapter 5 - Life Cycle Planning	2021 Bridge Condition Report & Tunnel Data (ODOT, 2021) 2020 Pavement Condition Report (ODOT, January 2020) ODOT Pavement Design Guide (ODOT, 2019)
515.7(b)(1)	A life-cycle planning process shall, at a minimum, include the following: The State DOT targets for asset condition for each asset class or asset sub-group;	Section 5.2 Pavement Whole Life Management Strategy Section 5.3 Bridge Whole Life Management Strategy	Legislatively Approved 2021-2023 Key Performance Measures (LFO, May 2021) Chapter 3 - Goals, Performance Measures and Targets
515.7(b)(2)	Identification of deterioration models for each asset class or asset subgroup, provided that identification of deterioration models for assets other than NHS pavements and bridges is optional;	Section 5.2 Pavement Deterioration Modeling Section 5.3 Bridge Deterioration Modeling	2021 Bridge Condition Report & Tunnel Data (ODOT, 2021) 2020 Pavement Condition Report (ODOT, January 2020)
515.7(b)(3)	Potential work types across the whole life of each asset class or asset subgroup with their relative unit cost; and	Table 5.6 Typical Unit Costs of Pavement Treatments Table 5.12 Typical Unit Costs of Bridge Treatments	
515.7(b)(4)	A strategy for managing each asset class or asset sub-group by minimizing its life-cycle costs, while achieving the State DOT targets for asset condition for NHS pavements and bridges under 23 U.S.C. 150(d).	Section 5.2 Pavement Whole Life Management Strategy Section 5.3 Bridge Whole Life Management Strategy	Oregon Highway Plan (ODOT, November 1999, Revised May 2015)
515.7(c)	A State DOT shall establish a process for developing a **risk management** plan. This process shall, at a minimum, produce the following information:	Chapter 6 – Risk Management	
515.7(c)(1)	**Identification of risks** that can affect condition of NHS pavements and bridges and the performance of the NHS, including risks associated with current and future environmental conditions, such as extreme weather events, climate change, seismic activity, and risks related to recurring damage and costs as identified through the evaluation of facilities repeated damaged by emergency events carried out under part 667 of this title. Examples of other risk categories include financial risks such as	Section 6.2 Risk Identification, Categories and Responsibilities	Appendix H – Risk register

REQUIREMENT	DESCRIPTION	2022 TAMP PRIMARY LOCATION	SUPPLEMENTAL REFERENCES & MATERIALS
	budget uncertainty; operational risks such as asset failure; and strategic risks such as environmental compliance.		
515.7(c)(2)	An **assessment** of the identified risks in terms of the **likelihood** of their occurrence and their **impact** and consequence if they do occur;	Section 6.3 Risk Assessment, Evaluation and Prioritization	Appendix H – Risk register
515.7(c)(3)	An **evaluation and prioritization** of the identified risks	Section 6.3 Risk Assessment, Evaluation and Prioritization	Appendix H – Risk register
515.7(c)(4)	A mitigation plan for addressing the top priority risks;	Section 6.4 Risk Mitigation and Monitoring	Appendix I – Mitigation plan for top priority risks 2021 Bridge Condition Report & Tunnel Data (ODOT, 2021) Oregon Highways Seismic Plus Report (ODOT, 2014) 2020 Pavement Condition Report (ODOT, January 2020)
515.7(c)(5)	An approach for monitoring top priority risks; and	Section 6.4 Risk Mitigation and Monitoring	
515.7(c)(6)	A summary of the evaluations of facilities repeatedly damaged by emergency events carried out under part 667 of this title that discusses, at a minimum, the results relating to the State's NHS pavements and bridges	Section 6.7 Facilities Repeatedly Damaged by ER Events	
515.7(d)	A State DOT shall establish a process for the development of a **financial plan** that identifies annual costs over a minimum period of 10 years. The financial plan process shall, at a minimum, produce:	Chapter 7 – Financial Plan	
515.7(d)(1)	The estimated cost of expected future work to implement investment strategies contained in the asset management plan, by State fiscal year and work type;	Section 7.5 Estimated Costs to Implement Investment Strategies	
515.7(d)(2)	The estimated funding levels that are expected to be reasonably available, by fiscal year, to address the costs of future work types. State DOTs may estimate the amount of available future funding using historical values where the future funding amount is uncertain;	Section 7.6 Estimated Funding to Address Future Work	
515.7(d)(3)	Identification of anticipated funding sources; and	Section 7.4 Anticipated Revenue Sources and Forecast	
515.7(d)(4)	An estimate of the value of the agency's NHS pavement and bridge assets and the needed investment on an annual basis to maintain the value of these assets.	Section 7.3 Estimate of Value of NHS Pavement and Bridges	
515.7(e)	A State DOT shall establish a process for developing **investment strategies** meeting the requirements in § 515.9(f). This process must	Chapter 8 – Investment Strategies	

REQUIREMENT	DESCRIPTION	2022 TAMP PRIMARY LOCATION	SUPPLEMENTAL REFERENCES & MATERIALS
	result in a description of how the investment strategies are influenced, at a minimum, by the following:		
515.7(e)(1)	Performance gap analysis required under paragraph (a) of this section;	Section 8.2 Pavement & Bridge Investment Strategies	Chapter 4 – Condition & Performance Gap Analysis
515.7(e)(2)	Life-cycle planning for asset classes or asset sub-groups resulting from the process required under paragraph (b) of this section;	Section 8.2 – Pavement & Bridge Investment Strategies	Chapter 5 - Life Cycle Planning
515.7(e)(3)	Risk management analysis resulting from the process required under paragraph (c) of this section; and	Section 8.2 – Pavement & Bridge Investment Strategies	Chapter 6 – Risk Management
515.7(e)(4)	Anticipated available funding and estimated cost of expected future work types associated with various candidate strategies based on the financial plan required by paragraph (d) of this section.	Section 8.2 – Pavement & Bridge Investment Strategies	Chapter 7 – Financial Plan
515.7(f)	The processes established by State DOTs shall include a provision for the State DOT to **obtain necessary data from other NHS owners** in a collaborative and coordinated effort.	Chapter 2 – Pavement & Bridge Ownership and Data	
515.(g)	States DOTs shall use the **best available data** to develop their asset management plans. Pursuant to 23 U.S.C. 150(c)(3)(A)(i), each State DOT shall use bridge and pavement management systems meeting the requirements of § 515.17 to analyze the condition of NHS pavements and bridges for the purpose of developing and implementing the asset management plan required under this part. The use of these or other management systems for other assets that the State DOT elects to include in the asset management plan is optional (e.g., Sign Management Systems, etc.).	Chapter 2 – Pavement & Bridge Ownership and Data	
23 CFR 515.9	**Asset Management Plan Requirements**		
515.9(a)	A State DOT shall develop and implement an asset management plan to improve or preserve the condition of the assets and improve the performance of the NHS in accordance with the requirements of this part. Asset management plans must describe how the State DOT will carry out asset management as defined in § 515.5	2022 Oregon DOT TAMP	
515.9(b)	An asset management plan shall include, at a minimum, a summary listing of NHS pavement and bridge assets, regardless of ownership	Chapter 2 – Pavement & Bridge Ownership and Data	
515.9(c)	In addition to the assets specified in paragraph (b) of this section, State DOTs are encouraged, but not required, to include all other NHS infrastructure assets within the right-of-way corridor and assets on other public roads. Examples of other NHS infrastructure assets include tunnels, ancillary structures, and signs. Examples of other public roads include non NHS Federal-aid highways. If a State DOT decides to include other NHS assets in its asset management plan, or to include assets on other public roads, the State DOT, at a minimum, shall evaluate and manage those assets consistent with paragraph (l) of this section	Chapter 1 – Purpose, Background & Scope	Appendix D – TAMP Scope Recommendation Memo

REQUIREMENT	DESCRIPTION	2022 TAMP PRIMARY LOCATION	SUPPLEMENTAL REFERENCES & MATERIALS
515.9(d)	The minimum content for an asset management plan under this part includes a discussion of each element in this paragraph (d).	Chapter 3 - Goals, Measures, Targets and Conditions	
515.9(d)(1)	Asset management objectives. The objectives should align with the State DOT's mission. The objectives must be consistent with the purpose of asset management, which is to achieve and sustain the desired state of good repair over the life cycle of the assets at a minimum practicable cost.	Chapter 3 - Goals, Measures, Targets and Conditions	Oregon Transportation Plan
515.9(d)(2)	Asset management measures and State DOT targets for asset condition, including those established pursuant to 23 U.S.C. 150, for NHS pavements and bridges. The plan must include measures and associated targets the State DOT can use in assessing the condition of the assets and performance of the highway system as it relates to those assets. The measures and targets must be consistent with the State DOT's asset management objectives. The State DOT must include the measures established under 23 U.S.C. 150(c)(3)(A)(ii)(I)-(III), once promulgated in 23 CFR part 490, for the condition of NHS pavements and bridges. The State DOT also must include the targets the State DOT has established for the measures required by 23 U.S.C. 150(c)(3)(A)(ii)(I)-(III), once promulgated, and report on such targets in accordance with 23 CFR part 490. The State DOT may include measures and targets for NHS pavements and bridges that the State DOT established through pre-existing management efforts or develops through new efforts if the State DOT wishes to use such additional measures and targets to supplement information derived from the pavement and bridge measures and targets required under 23 U.S.C. 150.	Chapter 3 - Goals, Measures, Targets and Conditions	FHWA Performance Management Areas, Measures and Targets for Oregon DOT 2020 Mid Performance Period Progress Report.
515.9(d)(3)	A summary description of the condition of NHS pavements and bridges, regardless of ownership. The summary must include a description of the condition of those assets based on the performance measures established under 23 U.S.C. 150(c)(3)(A)(ii) for condition, once promulgated. The description of condition should be informed by evaluations required under part 667 of this title of facilities repeated damaged by emergency events.	Chapter 3 - Goals, Measures, Targets and Conditions	Annual Performance Progress Report 2020 Mid Performance Period Progress Report.
515.9(d)(4)	Performance gap identification	Chapter 4 - Condition & Performance Gap Analysis	
515.9(d)(5)	Life-cycle Planning	Chapter 5 -Life Cycle Planning	
515.9(d)(6)	Risk management analysis, including the results for NHS pavements and bridges, of the periodic evaluations under part 667 of this title of facilities repeated damaged by emergency event.	Chapter 6 – Risk Management	Appendix H – Risk Register
515.9(d)(7)	Financial Plan	Chapter 7 – Financial Plan	
515.9(d)(8)	Investment Strategies	Chapter 8 – Investment Strategies	

REQUIREMENT	DESCRIPTION	2022 TAMP PRIMARY LOCATION	SUPPLEMENTAL REFERENCES & MATERIALS
515.9(e)	An asset management plan shall cover, at a minimum, a 10-year period.	Chapter 7 – Financial Plan - Section 7.1 – Overview of TAMP Financial Plan	
515.9(f)	An asset management plan shall discuss how the plan's investment strategies collectively would make or support progress toward:	Chapter 8 – Investment Strategies	
515.9(f)(1)	Achieving and sustaining a desired state of good repair over the life cycle of the assets	Chapter 8 – Investment Strategies	Chapter 6 -Life Cycle Planning 2020 OTC Investment Strategies
515.9(f)(2)	Improving or preserving the condition of the assets and the performance of the NHS relating to physical assets,	Chapter 8 – Investment Strategies	Chapter 6 -Life Cycle Planning
515.9(f)(3)	Achieving the State DOT targets for asset condition and performance of the NHS in accordance with 23 U.S.C. 150(d), and	Chapter 8 – Investment Strategies	Chapter 3 - Goals, Performance Measures and Targets
515.9(f)(4)	Achieving the national goals identified in 23 U.S.C. 150(b).	Chapter 8 – Investment Strategies	Chapter 3 - Goals, Performance Measures and Targets
515.9(g)	A State DOT must include in its plan a description of how the analyses required by State processes developed in accordance with § 515.7 (such as analyses pertaining to life cycle planning, risk management, and performance gaps) support the State DOT's asset management plan investment strategies.	Chapter 8 – Investment Strategies	Chapter 4 - Condition & Performance Gap Analysis Chapter 6 -Life Cycle Planning
515.9(h)	A State DOT shall integrate its asset management plan into its transportation planning processes that lead to the STIP, to support its efforts to achieve the goals in paragraphs (f)(1) through (4) of this section.	Chapter 7 – Financial Plan	Section 7.2 Integration of TAMP into Financial Planning Process Chapters 3-8
515.9(i)	A State DOT is required to make its asset management plan available to the public, and is encouraged to do so in a format that is easily accessible.	Chapter 1 – Purpose, Background & Scope	https://www.oregon.gov/odot/STIP/Documents/2019-Oregon-TAMP-Full.pdf
515.9(j)	Inclusion of performance measures and State DOT targets for NHS pavements and bridges established pursuant to 23 U.S.C. 150 in the asset management plan does not relieve the State DOT of any performance management requirements, including 23 U.S.C. 150(e) reporting, established in other parts of this title.	n/a	
515.9(k)	The head of the State DOT shall approve the asset management plan.	Cover letter	
515.9(l)	If the State DOT elects to include other NHS infrastructure assets or other public roads assets in its asset management plan, the State at a minimum shall address the following, using a level of effort consistent with the State DOT's needs and resources:	Chapter 1 – Purpose, Background & Scope	Appendix D – TAMP Scope Recommendation Memo
515.9(l)(1)	Summary listing of assets, including a description of asset condition;	Chapter 3 - Goals, Measures, Targets and Conditions	
515.9(l)(2)	Asset management measures and State DOT targets for asset condition;	Chapter 3 - Goals, Measures, Targets and Conditions	

REQUIREMENT	DESCRIPTION	2022 TAMP PRIMARY LOCATION	SUPPLEMENTAL REFERENCES & MATERIALS
515.9(l)(3)	Performance gap analysis;	Chapter 4 - Condition & Performance Gap Analysis	
515.9(l)(4)	Life-cycle planning;		
515.9(l)(5)	Risk analysis, including summaries of evaluations carried out under part 667 of this title for the assets, if available, and consideration of those evaluations;	Chapter 5 -Life Cycle Planning Chapter 6 – Risk Management	
515.9(l)(6)	Financial plan;	Chapter 7 – Financial Plan	
515.9(l)(7)	Investment strategies.	Chapter 8 – Investment Strategies	
515.9(m)	The asset management plan of a State may include consideration of critical infrastructure from among those facilities in the State that are eligible under 23 U.S.C. 119(c)	Chapter 1 – Purpose, Background & Scope	Appendix D – TAMP Scope Recommendation Memo
23CFR515.13	Process certification and recertification, and annual plan consistency review		
515.13(a)	Process certification and recertification under 23 U.S.C. 119(e)(6)	Chapter 1 – Purpose, Background & Scope	
515.13(b)	Annual determination of consistency under 23 U.S.C. 119(e)(5)	Chapter 1 – Purpose, Background & Scope	
515.13(c)	Updates and other amendments to plans and development processes	Chapter 1 – Purpose, Background & Scope	
23 CFR 667	Periodic Evaluation of Facilities Repeatedly Requiring Repair and Reconstruction due to Emergency Events	Chapter 6 – Risk Management	
23 USC 119 (e)(4)	Plan contents.-A State asset management plan shall, at a minimum, be in a form that the Secretary determines to be appropriate and include-		
119(e)(4)(A)	a summary listing of the pavement and bridge assets on the National Highway System in the state, including a description of the condition of those assets;	Chapter 2 – Pavement & Bridge Ownership and Data	
119(e)(4)(B)	asset management objectives and measures;	Chapter 3 - Goals, Measures, Targets and Conditions	
119(e)(4)(C)	performance gap identification;	Chapter 4 - Condition & Performance Gap Analysis	
119(e)(4)(D)	lifecycle cost and risk management analyses, both of which shall take into consideration extreme weather and resilience;	Chapter 5 – Life Cycle Planning Chapter 6 – Risk Management	
119(e)(4)(E)	a financial plan; and	Chapter 7 – Financial Plan	
119(e)(4) (F)	Investment strategies.	Chapter 8 – Investment Strategies	
23 USC 135(d)(2)(c)	Integration of other performance-based plans.—A State shall integrate into the statewide transportation planning process, directly or by reference, the goals, objectives, performance measures, and targets described in this paragraph, in other State transportation plans and transportation processes, as well as any plans developed pursuant to chapter 53 of title 49 by providers of public transportation in areas not	Chapter 3 - Goals, Performance Measures and Targets	

REQUIREMENT	DESCRIPTION	2022 TAMP PRIMARY LOCATION	SUPPLEMENTAL REFERENCES & MATERIALS
	represented by a metropolitan planning organization required as part of a performance-based program.		
23 CFR 450.206(c)(4)	A State shall integrate into the statewide transportation planning process, directly or by reference, the goals, objectives, performance measures, and targets described in this section, in other State transportation plans and transportation processes, as well as any plans developed pursuant to chapter 53 of title 49 by providers of public transportation in areas not represented by an MPO required as part of a performance-based program. Examples of such plans and processes include the HSIP, SHSP, the State Asset Management Plan for the National Highway System (NHS), the State Freight Plan (if the State has one), the Transit Asset Management Plan, and the Public Transportation Agency Safety Plan.	Chapter 3 - Goals, Measures, Targets and Conditions	Performance Measure Target Setting (ODOT & MPO, 2020)
23 CFR 450.314.(h)(1)	The MPO(s), State(s), and the providers of public transportation shall jointly agree upon and develop specific written provisions for cooperatively developing and sharing information related to transportation performance data, the selection of performance targets, the reporting of performance targets, the reporting of performance to be used in tracking progress toward attainment of critical outcomes for the region of the MPO (see § 450.306(d)), and the collection of data for the State asset management plan for the NHS for each of the following circumstances:	Chapter 3 - Goals, Performance Measures and Targets	Performance Measure Target Setting (ODOT & MPO, 2020)

Appendix B – Index of TAMP Resources

Analysis & Assessment

Document	Referenced Section
A Strategic Investment in Transportation (ODOT & OTC, Jan 2017)	Chapter 6 - Risk Management Chapter 8 - Investment Strategies
Climate Change Adaptation Strategy Report (ODOT, April 2012)	Chapter 6 - Risk Management
Climate Change Vulnerability Assessment and Adaptation Options (ODOT, 2014)	Chapter 6 - Risk Management
Estimated Impacts of Deteriorating Highway Conditions to Oregon's Economy (ODOT, November 2014)	Chapter 4 - Condition & Performance Gap Analysis
OTC Investment Strategy - 2020 Update (ODOT & OTC, April 2020)	Chapter 4 - Condition & Performance Gap Analysis Chapter 6 - Risk Management Chapter 8 - Investment Strategies
Rough Roads Ahead 2: Economic Implications of Deteriorating Highway Conditions (ODOT, February 2017)	Chapter 4 - Condition & Performance Gap Analysis Chapter 5 - Lifecycle Planning Chapter 6 - Risk Management
State Highway Revenue Forecast(ODOT, Oct 2021)	Chapter 7 - Financial Plan
The Oregon Highway Seismic Plus Report (ODOT, 2014)	Chapter 6 - Risk Management Chapter 8 - Investment Strategies
The Oregon Resilience Plan (OEM, 2013)	Chapter 6 - Risk Management

Guiding Laws & Requirements

Document	Referenced Section
23 CFR 490 National performance management measures	Appendix A Index of TAMP Content Requirements
23 CFR 515 Asset Management Plans	Appendix A Index of TAMP Content Requirements
23 CFR 667 Periodic evaluation of facilities repeatedly requiring repair and reconstruction due to emergency events	Appendix A Index of TAMP Content Requirements Chapter 6 - Risk Management
23 USC 119 National highway performance program	Appendix A Index of TAMP Content Requirements
23 USC 150 National goals and performance management measures	Appendix A Index of TAMP Content Requirements
Government Accountability Standards Board (GASB) Statement No. 34	Chapter 7 - Financial Plan
Infrastructure Investment and Jobs Act (IIJA)	Chapter 4 - Condition & Performance Gap Analysis Chapter 7 - Financial Plan Chapter 8 - Investment Strategies
Keep Oregon Moving (HB 2017)	Chapter 4 - Condition & Performance Gap Analysis Chapter 7 - Financial Plan
Legislatively adopted budget for ODOT (21-23)	Chapter 7 - Financial Plan
MAP-21 Moving Ahead for Progress in the 21st Century Act	Chapter 3 - Goals, Measures, Targets and Conditions
ORS 366.507 Modernization program; funding; conditions and criteria	Chapter 8 - Investment Strategies
Section 3a, Article 9 of Oregon's Constitution	Chapter 7 - Financial Plan

Performance/Condition Reports

Document	Referenced Section
Annual Performance Progress Report (ODOT, Sept 2021)	Chapter 3 - Goals, Measures, Targets and Conditions
Bridge Condition Report & Tunnel Data (ODOT, 2022)	Chapter 2 - Pavement & Bridge Ownership
Federal Biennial Mid Performance Period Progress Report (ODOT, 2020)	Chapter 3 - Goals, Measures, Targets and Conditions
Pavement Condition Report (ODOT, January 2020)	Chapter 2 - Pavement & Bridge Ownership
Performance Measure Target Setting (ODOT & MPO, 2020)	Chapter 2 - Pavement & Bridge Ownership Chapter 3 - Goals, Measures, Targets and Conditions

Resource - Federal

Document	Referenced Section
AASHTO Pavement Guide (AASHTO)	Chapter 5 - Lifecycle Planning
Bridge Preservation Guide (FHWA, 2018)	Chapter 7 - Financial Plan
Guidance on Highway & Preservation (FHWA, Feb 2016)	Chapter 7 - Financial Plan
Highway Performance Monitoring System Field Manual (FHWA, December 2016 and Errata February 2018)	Chapter 2 - Pavement & Bridge Ownership
Highway Performance Monitoring System (FHWA.dot.gov)	Chapter 2 - Pavement & Bridge Ownership
MAP-21 resource index	Chapter 1 - Scope Chapter 3 - Goals, Measures, Targets and Conditions
Methodology for Highway Asset Valuation in Indiana (JTRP)	Chapter 7 - Financial Plan
Project Development and Design Manual (US DOT, Nov 2017)	Chapter 7 - Financial Plan
TAM Guide (AASHTO, Jan 2020)	Chapter 5 - Lifecycle Planning
Testimony on Addressing the Long-Term Solvency of the Highway Trust Fund (CBO, April 2021)	Chapter 7 - Financial Plan

Resource - State

Document	Referenced Section
Bridge Design Manual (ODOT, May 2021)	Chapter 7 - Financial Plan
Bridge Inspection Coding Guide (ODOT, March 2015)	Chapter 2 - Pavement & Bridge Ownership
Bridge Inspection Program Manual (ODOT, January 2013)	Chapter 2 - Pavement & Bridge Ownership
Cathodic Protection Evaluation (October 2014)	Chapter 6 - Risk Management
Data Quality Mgmt. Plan for Pavement Condition (ODOT, Oct 2018)	Chapter 2 - Pavement & Bridge Ownership
GFP Pavement Condition Rating Manual (ODOT, July 2010)	Chapter 2 - Pavement & Bridge Ownership
Impacts of Potential Seismic Landslides on Lifeline (Feb 2015)	Chapter 6 - Risk Management
ODOT Climate Change Adaptation Strategy Report	Chapter 6 - Risk Management
ODOT Climate Office Internet Page	Chapter 6 - Risk Management
ODOT Pavement Design Guide (ODOT, 2019)	Chapter 7 - Financial Plan
State Hwy Fund Trans Revenue Forecast (ODOT, April 2022)	Chapter 7 - Financial Plan
Oregon National Hazards Mitigation Plan	Chapter 6 - Risk Management
Pavement Data Collection Manual (ODOT, April 2019)	Chapter 2 - Pavement & Bridge Ownership
Predicting Seismic- Induced Rockfall Hazard for Targeted Site Mitigation (ODOT & FHWA, Dec 2020)	Chapter 6 - Risk Management
Seismic Lifelines Evaluation (May 2012)	Chapter 6 - Risk Management
Statewide Transportation Strategy: A 2050 Vision for Greenhouse Gas	Chapter 6 - Risk Management
Validation of Tsunami Design Guidelines for Coastal Bridges (Jan 2021)	Chapter 6 - Risk Management

Statewide Policy

Document	Referenced Section
DES-01: Use of Fix-it Program Funds (ODOT, 2018)	Chapter 7 - Financial Plan
Exec Order 20-24 Reduce and Regulate Greenhouse Gas Emissions	Chapter 6 - Risk Management
FHWA Performance Management Areas, Measures and Targets (FHWA & ODOT, Aug 2018)	Chapter 3 - Goals, Measures, Targets and Conditions
2021-2023 Key Performance Measures (LFO, May 2021)	Chapter 3 - Goals, Measures, Targets and Conditions
ODOT's Seismic Implementation: Policies and Design Guidelines (ODOT, April 2021)	Chapter 6 - Risk Management Chapter 8 - Investment Strategies
Oregon Highway Plan (ODOT, November 1999, Revised May 2015)	Chapter 4 – Cond & Performance Gap Analysis Chapter 8 - Investment Strategies
Oregon Transportation Plan (ODOT, September 2006)	Chapter 1 - Scope Chapter 3 - Goals, Measures, Targets and Conditions Chapter 4 - Cond & Performance Gap Analysis Chapter 8 - Investment Strategies
Statewide Transportation Improvement Program (STIP)	Chapter 8 - Investment Strategies
STIP Development Manual (2015-2017)	Chapter 7 - Financial Plan
STIP Final (2021- 2024) (ODOT, Sept 2019)	Chapter 7 - Financial Plan
Strategic Action Plan (ODOT, Nov 2021)	Chapter 6 - Risk Management Chapter 8 - Investment Strategies
Strategic Business Plan One ODOT: Positioned for the Future *(ODOT & OTC, April 2018)*	Chapter 8 - Investment Strategies
Succession Planning Guide for Managers (ODOT, 2019)	Chapter 6 - Risk Management

Appendix C – 2022 TAMP Project Charter

2022 TAMP Project Charter

2022 Transportation Asset Management Plan (TAMP)

Background

Section 119(e)(8) of title 23 United States Code requires each state department of transportation to develop an asset management plan for the National Highway System (NHS) to improve or preserve the condition of NHS infrastructure and performance of the system. Map-21 Requirements mandate that states develop a risk-based asset management plan which, at a minimum, in in the form the Secretary determines to be appropriate and includes:

1. A listing and condition of pavement and bridge assets on the National Highway System.
2. Asset management objectives and measures.
3. Identification and analysis of performance gaps between national goals and asset condition.
4. Lifecycle costs and risk-based management analyses.
5. A financial plan with a minimum forecast period of 10 years.
6. Investment strategies

Oregon's Transportation Asset Management Plan (TAMP) is due June 29, 2022.

Scope of TAMP

A Transportation Asset Management Plan (TAMP) meeting all requirements of 23 Code of Federal Regulations (CFR) Part 515 for bridge and pavement assets on the NHS, that aligns with agency objectives, plans and strategies.

Responsibilities

TAMP Project Team Responsibilities

- Identify and support resources for the development and implementation of the Transportation Asset Management Plan (TAMP).
    - Assign responsibilities and authority to relevant roles.
    - Provide guidance and oversite to resources to ensure tasks are completed timely and accurately.
- Understand the needs and expectations of TAMP stakeholders.
    - Understand the stakeholders that are relevant to the asset management system;
    - the requirements and expectations of these stakeholders with respect to asset management;
    - the criteria for asset management decision making;
    - requirements for recording and reporting information relevant to asset management
- Provide review, input and feedback to the TAMP.

    - Review TAMP drafts and provide feedback and input.
    - Ensure identified stakeholders have opportunity for review and input.
- Demonstrate leadership and commitment to the TAMP.
    - Understand and share the purpose, requirements and scope of the TAMP.
    - Promote increased connection and collaboration across business lines.
    - Direct and/or support persons to contribute to the effectiveness of the TAMP.
    - Respond timely to questions, issues and tasks.
- Ensure TAMP meets all federal requirements
- Ensure TAMP is aligned with state objectives, plans, strategies and parallel initiatives.
    - Share relevant information and updates on parallel initiatives, such as the Oregon Transportation Plan and Oregon Highway Plan.

Asset Management Council Responsibilities

The Asset Management Council has the following responsibilities associated with the 2022 TAMP.

- Develop the scope of the TAMP, in compliance with federal requirements.
- Develop a TAMP leadership structure to guide development of the plan.
    - Establish the TAMP project team based on the degree to which the TAMP represent areas for which they have authority and responsibility or where their portfolio is heavily influenced by or significantly contributes to the agency's vision for transportation asset management.
    - Assign responsibilities and authority to project team member roles.
    - Establish and approve the TAMP Project Charter.
- Provide council, oversite and governance to the TAMP project team.
    - Act as final arbiter for TAMP governance, strategies and resourcing.
    - Establish criteria and processes for determining what, when, and how decisions need to be elevated.
- Demonstrate leadership and commitment to the TAMP.
    - Understand and share the purpose, requirements and scope of the TAMP
    - Promote increased connection and collaboration across business lines;
    - Direct and/or support persons to contribute to the effectiveness of the TAMP;
    - Respond timely to questions, issues and tasks.
- Ensure the TAMP meets all federal requirements
- Ensure the TAMP is aligned with state objectives, plans, strategies and parallel initiatives.
    - Share information and updates on parallel initiatives, such as the Oregon Transportation Plan and Oregon Highway Plan.
- Review TAMP drafts and provide feedback and input.
    - Approve final draft before routed for final approval and signature from director, Kris Strickler.

Desired Outcome

A 2022 TAMP which meets all federal requirements and is aligned with state objectives, plans and strategies.

Authority

The Asset Management Council is the final arbiter for the TAMP governance, strategies and resourcing. The TAMP project team will work with the Asset Management Council to establish criteria and processes for determining what, when, and how decisions need to be elevated.

Membership

TAMP project team members are selected based on the degree to which the TAMP represent areas for which they have authority and responsibility or where their portfolio is heavily influenced by or significantly contributes to the agency's vision for transportation asset management.

Other resources, including staff and subject matter experts, will provide support on an as-needed basis.

Meeting Schedule and Materials

During the development of the TAMP project team meetings will be scheduled monthly. Smaller sub-group meetings related to specific tasks within the TAMP will be scheduled as needed.

Meetings may be cancelled, if it is decided that decisions and information can be shared through email. Ad-hoc meetings may be scheduled depending on the urgency and importance of the topic.

Agendas and meeting materials will be posted no later than five business days before each meeting. Members are expected to review materials prior to the meeting and come fully prepared for discussion and participation.

Agendas and meeting materials will be available on the Asset Management intranet site.

Meetings and decisions will be documented in a meeting summary which will be available no later than two weeks following each meeting.

Appendix

1. TAMP Project Team List
2. TAMP Project RACI
3. 2019 Oregon Transportation Asset Management Plan (TAMP)
4. 23 Code of Federal Regulations (CFR) Part 515
5. 23 U.S.C. 119 (e)

Appendix D – 2022 TAMP Scope Recommendation Memo

Date: November 1, 2021

To: Mac Lynde, Delivery and Operations Division Administrator

From: Lisa Letney, 2022 TAMP Project Manager

CC: Steve Cooley, Statewide Chief Engineer, Erik Havig, Planning Section Manager; Phil Kase, Agency Performance Program Manager; Jeff Flowers, Statewide Programs Manager; Justin Moderie, Statewide Pavement Engineer; Bert Hartman, Statewide Bridge Program Manager; Galen McGill, Operations and ITS Manager

Subject:Recommendation on 2022 TAMP Scope

Summary

This memo lays out the issues considered by the ODOT leadership in determining the scope of the 2022 Transportation Asset Management Plan. It recommends that ODOT create a TAMP that is limited in scope (NHS Bridge and Pavement). The recommended actions outlined in this memo are based on input received from members of the 2022 TAMP Project Team[71] representing the disciplines or planning, performance management, engineering, operations, finance and asset management.

Background:

In October 2016, the Final Rules for the Transportation Asset Management Plan (TAMP) were released by FHWA. Among other things, these Final Rules set minimum requirements for DOTs in developing their state TAMPs. At a minimum, states are required to include in the scope of their TAMPs, pavement and bridge assets that are on the National Highway System. With this minimum requirement set, states were also encouraged to go beyond this minimum scope, both in terms of assets considered (including assets in addition to pavement and bridge), as well as in terms of roadway jurisdiction (including roadways that are not part of the National Highway System).

The ODOT Asset Management Executive Committee[72] determined in spring 2017 that an initial TAMP limited to the National Highway System would be most appropriate for the plan due in 2019, and that further consideration of the TAMP scope could be appropriate in future TAMP updates.

Oregon's TAMP was developed using the required certified processes and required content pursuant to 23 USC 119 and 23 CFR 515. The TAMP was approved by the Director of the State Department of Transportation (DOT), Matthew Garret, on 6/10/19, and the process certified by the Federal Highway Administration (FHWA) dated 8/26/19.

Recommendation:

It is recommended that ODOT conduct a 2022 TAMP which meets the minimum requirements as required by 23 CFR 515.9(b) At the same time, the TAMP should strive to create congruency between this narrow scope and ODOT's more expansive investment strategy and state performance measures. This approach can be summarized as follows:

1. The assets scope of the **2022 TAMP should be limited to pavement and bridge assets**, the two assets required by the TAMP Final Rules. Additional assets may be appropriate for inclusion in future asset management plans conducted by the agency.
2. The roadway classification scope of the **TAMP should be limited to the state and local NHS system**, the minimum scope required by the TAMP Final Rules. At the same time, non-NHS State Highways should also be considered and discussed in the context of state performance measures and the agency's investment strategies aimed at meeting performance targets for the entire State Highway System.
3. To keep additional asset data cost burdens in check, the agency should limit new PM2 asset data collection, analysis, and reporting for bridges and pavement to the NHS system. The agency will also continue to collect and analyze data on the entire State Highway System that satisfies Oregon's Key Performance Measures (KPMs) for pavement and bridge. **Both of these asset data sets should be reported in the TAMP** with clear explanations of how they differ in terms of the roadway systems analyzed and condition measurements.

4. To address the challenge of overlapping state and federal performance measures and targets and how they impact agency decision-making, **the TAMP should emphasize the central role of state performance measures (KPMs) in shaping bridge and pavement investment decisions and project selection.** The TAMP should communicate that the ODOT process for selecting investments is aimed at achieving a more complex set of performance measures that are intended to result in a balanced program across many competing needs rather than solely meeting the limited scope of the Federal measures. This process is expected to have the practical effect of meeting the narrow scope of the Federal performance targets for NHS bridges and pavements.

Appendix E – 2016 Asset Management Gap Analysis

ODOT manages a wide range of assets to meet public, agency, and legislative expectations. Physical transportation infrastructure is one type of asset. Others include agency's human resources, financial capacity, equipment and vehicle fleets, materials stocks, real estate, and corporate data and information. The overall AM framework needs to be flexible enough to be adapted and refined for use with each type of asset above. However, this Gap Analysis focuses on the particular set of assets that constitutes ODOT's physical transportation infrastructure. Other assets can be viewed in this context as resources that are allocated and utilized in managing the physical transportation infrastructure. ODOT expects to expand its AM practices to other types of assets over time.

The full contents of this report is available on ODOT's Website.

Appendix F – Bridge and Pavement Program Minimum Standards Compliance with 23 CFR §515.17

Section 515.17 of the Final Rule for developing a Transportation Asset Management Plan (TAMP) identifies the documentation requirements for pavement and bridge management system used for developing and implementing asset management plans.

Bridge and pavement management systems shall include, at a minimum, documented procedures for:

1. ***Collecting, processing, storing, and updating inventory and condition data for all NHS pavement and bridge assets.***
2. ***Forecasting deterioration for all NHS pavement and bridge assets;***
3. ***Determining the benefit-cost over the life cycle of assets to evaluate alternative actions (including no action decisions), for managing the condition of NHS pavement and bridge assets;***
4. ***Identify short- and long-term budget needs for managing the condition of all NHS pavement and bridge assets;***
5. ***Determining the strategies for identifying potential NHS pavement and bridge projects that maximize overall program benefits within the financial constraints; and***
6. ***Recommending programs and implementing schedules to manage the condition of NHS pavement and bridge assets within policy and budget constraints.***

The following summaries were provided by the ODOT Bridge and Pavement Units to document existing procedures for the agency's bridge and pavement management systems, in compliance with 23 CFR 515.17.

ODOT BRIDGE PROGRAM MANAGEMENT SYSTEM SUMMARY
1. Collecting, processing, storing, and updating inventory and condition data for all NHS bridge assets Monitoring bridge conditions and associated inspection activities falls under the responsibility of the Bridge Section, specifically the Bridge Operations and Bridge Program & Standards units. Bridge inspection guidance is provided in ODOT's Bridge Inspection Coding Guide, Bridge Inspection Program Manual and FHWA's Bridge Inspector's Reference Manual. Bridge inspections are conducted at regular intervals, usually every two years. Inspection data is collected by certified bridge inspectors employed by ODOT and by consultants and is stored in the AASHTOWare Bridge Management software (BrM). A compilation of data is reported annually to the Federal Highway Administration. ODOT follows the National Bridge Inspection Standards (NBIS),which are federal regulations establishing requirements for inspection procedures, frequency of inspections, qualifications of personnel, inspection reports, and preparation and maintenance of a State Bridge Inventory. The NBIS apply to all structures defined as bridges located on all public roads. By meeting the requirements of the NBIS satisfies the requirement to collect, process, store, and update the inventory and condition data for all NHS bridge assets.
2. Forecasting deterioration for all NHS bridge assets ODOT is fortunate to have over 20 years of condition data for many of the NHS bridges stored in BrM to aid in condition forecasting and bridge management. Currently, condition projections are made using deterioration models developed internally based on trends of the condition ratings over the period of the records.

3. Determining the benefit-cost over the life cycle of assets to evaluate alternative actions (including no action decisions), for managing the condition of NHS bridge assets

Not currently being done as part of asset management. Alternative actions are evaluated by first cost and estimated increase in service life during the preliminary design stage.

4. Identifying short- and long-term budget needs for managing the condition of all NHS bridge asset

ODOT has prepared program level models that predict the condition of bridges as represented in ODOT and national performance measures that consider various levels of funding to help inform the budget setting process.

5. Determining the strategies for identifying potential NHS bridge projects that maximize overall program benefits within the financial constraints

The Bridge Program follows ODOT Highway Management Team established criteria in the Bridge Priority Selection Policy for identifying priority bridges and optimizing bridge program funds. The strategies are listed below:

- Ensure the protection of high value coastal, historic and major river crossings and border structures.
- Use Practical Design and fund only basic bridge rehabilitations and rare replacements.
- Focus bridge program funding on bridge work only.
- Give priority to maintaining Fix It corridor bridges which incorporate the highest priority freight corridors (OTIA III, Stages 1 3).
- Continue to maximize bridge preventive maintenance (PM) treatments to extend the service life of the deck and other structural components using Major Bridge Maintenance (MBM) funding.
- Leverage other programs where possible to do additional bridge preservation on the system, E.g. pavements program
- Continue use of bridge inspection, health monitoring and improved deterioration prediction methods to anticipate future bridge conditions.
- Ready additional bridge shelf projects in anticipation of program savings and/or new funding opportunities.

6. Recommending programs and implementation schedules to manage the condition of NHS bridge assets within policy and budget constraints

Future analyses will be done using the updated version of BrM (6.5) which ODOT is currently in the process of implementing. The new software includes enhanced deterioration modeling and project/program analyses to assist in program optimization including life cycle planning and short and long term budget needs for alternative programs. ODOT will be developing processes and documentation around bridge planning as the new software is implemented.

ODOT Pavement Program Management System Summary

1. *Collecting, processing, storing, and updating inventory and condition data for all NHS pavement assets*

Inventory data for the entire NHS, both state and local, is managed and maintained by the Roadway Inventory and Classification Services (RICS) Unit in ODOT's Policy, Data and Analysis Division. The corporate "Transinfo" data base including elements such as highway name and numbering, Linear Reference System (LRS) identification, jurisdiction, NHS status, functional classification, mileage, number of lanes, and structure type. These data elements are collected and updated regularly by Policy, Data & Analysis staff in accordance with standard operating procedures for all of the NHS including the local system. Pavement specific data such as surface type and condition data for pavement asset management and Highway Performance Monitoring System (HPMS) reporting is the responsibility of the Pavement Services Unit within the ODOT's Delivery & Operations Division. The Pavement Services Unit maintains this data in the Pavement Management Database.

Pavement condition data for all Interstate and NHS routes on both state and local jurisdiction are collected by a single data collection vendor, under contract with ODOT, to ensure the data obtained is consistent and accurate. Interstate conditions are collected annually and the remaining systems are collected every two years. Data collection is performed in accordance with the ODOT Pavement Data Collection Manual, the HPMS Field Manual, and applicable AASHTO standards and is subjected to quality control / quality assurance procedures in accordance with ODOT's Pavement Data Quality Management Plan. A final copy of all 0.10 mile pavement data is archived and stored in the Pavement Management database and is used to create the HPMS pavement dataset which is processed and formatted in accordance with HPMS requirements.

2. *Forecasting deterioration for all NHS pavement assets*

Oregon has collected pavement distress and roughness data on state jurisdiction Interstate and NHS highways for over 20 years. ODOT's Pavement Management System (PMS) uses a 0 to 100 scale Overall Condition Index based on quantity and severity of distress to categorize and report pavement condition and to manage the system. More information is available in ODOT's 2020 Pavement Condition Report. Deterioration is included when determining pavement needs, evaluating funding scenarios, identifying pavement preservation and rehabilitation projects, and determining regional funding allocations. Pavement condition forecasting takes committed (e.g. programmed) projects that have an impact on pavement conditions into account.

Pavement deterioration models use a family curve approach as described in Section 5.4 to 5.6 of the AASHTO Pavement Management Guide. The family curves are based on pavement type (e.g. asphalt, concrete), most recent wearing course and thickness, and traffic volume. The family curve is shifted to fit the most recent observed conditions to estimate the remaining number of years in fair or better condition for each pavement management section. Age based models and rutting models are also applied to the pavement management sections and the results are compared and the model with the lowest remaining number of years in fair or better condition is used for forecasting condition. The age-based models are based on the pavement design life or the best estimate of treatment life and primarily govern in the early years after a treatment is applied before there is adequate condition data to determine a reliable deterioration rate. After a few years of deterioration are reflected in conditions,

the shifted family curve model is used. On routes which routinely see high wear and winter damage resulting from chain and studded tire wear, the rutting models typically govern.

3. *Determining the benefit-cost over the life cycle of assets to evaluate alternative actions (including no action decisions), for managing the condition of NHS pavement assets*

The goal of the ODOT pavement preservation program is to keep highways in the best condition possible with available funding, by taking a life-cycle cost approach to preservation and maintenance. A variety of treatment options are available in the 'toolbox' to maintain pavements on the NHS. The treatments range from maintenance activities such as crack sealing and minor patching to full reconstruction. Pavement condition, traffic level, cost, service life, risk, and other factors are all considered to determine the most appropriate treatment on a given highway section.

The Pavement Management System tracks pavement conditions as well as treatment history on state highways to evaluate the effect of these treatments on condition and service life. Cost data from pavement preservation projects are also tracked so that service life versus cost comparisons can be made between different treatment options. Pavement project and work type selection includes a cost effectiveness component in the selection criteria in the form of dollars per lane mile-year ($/LM-year). This parameter is utilized as a benefit-cost measure and is proportional to a more traditional benefit-cost calculation using area under the performance curve; the lower the $/LM-year parameter, the higher the benefit-cost. Project selection also considers route classification, traffic level, and speed. Each of these factors impacts the benefit side of the equation when pavement projects are selected. Projects on higher classification routes and where traffic volumes and speeds are relatively higher impact more users and provide more benefit than less critical locations. This is accounted for in preservation program funding allocations and project selection through the use of appropriate weighting factors.

Alternative treatment strategies can be compared using Life Cycle Cost Analysis (LCCA). Chapter 7 of the ODOT Pavement Design Guide provides LCCA guidance. The treatment strategies, timing, and cost should be as realistic as possible based on actual pavement management data. Both alternatives should provide similar levels of service (e.g. remain in "fair" or better condition) throughout the analysis period so that both alternatives have similar benefits. The analysis period should be of sufficient length to capture resurfacing/rehabilitation for both alternatives (a minimum of 30 years is suggested) and both alternatives should include salvage value at the end of the analysis period. Comparisons should be based on equivalent uniform annual cost (EUAC). A sensitivity analysis to the LCCA inputs should be conducted to evaluate inputs used.

4. *Identifying short- and long-term budget needs for managing the condition of all NHS pavement assets*

There are no specific definitions of short-term and long-term included in § 515.17. The Performance Measure rule which complements the TAMP rule use a 4-year time horizon for performance targets and measures. This timeline is consistent with the approved STIP but is shorter than the STIP development planning horizon which has a lag of about 6 to 8 years between data collection and project delivery. The TAMP financial plan requires a minimum time horizon of 10 years. This matches ODOT's standard PMS practice which uses an analysis period that goes one STIP cycle beyond the

ODOT Pavement Program Management System Summary

programming period to better capture long-term trends and needs. For example, the 2021-2024 programming cycle which began in 2017 used data collected in 2016 to estimate pavement conditions and budget needs out to 2026. Although project selection and programming only go out to 2024, the budget needs in the outer years helps identify longer range issues that may require adjustments to future programs. ODOT's Chip Seal subprogram in the Fix-It Preservation program and the Maintenance pavement programs use a timeline of about 2 to 3 years between data and delivery. Once again, for these subprograms, standard ODOT PMS practice is to use the shorter time horizon for project selection and go one cycle beyond for planning and long-term budgeting purposes.

Budget needs estimates are determined at the network level by evaluating the treatment needs and costs for each pavement management section and summing up the results for the entire NHS network. Within the PMS, highway jurisdiction, route classification, traffic level, geography and climate, urban/rural, construction history, age, forecasted pavement condition, treatment cost and service life are the primary decision factors in determining the treatment required for each PMS section. At the network level, treatments are typically assigned using treatment categories rather than specific treatments and planning level cost estimates are determined from unit cost data for pavement projects typically on the basis of dollars per lane mile. More refined project level treatment and cost estimates are developed during scoping for priority sections (e.g. 125% list). Lane-mile weighted average unit cost factors appropriate for treatment type, route (interstate/non-interstate), urban/rural, and region are inflated to the year the treatment is to be applied.

Most of the NHS mileage is state highway jurisdiction and only approximately 6 percent is on the local NHS system. Since the local NHS system is such a small part of the overall system and pavement management decisions on the local NHS highway system are not under ODOT's control, total NHS needs are estimated by analyzing NHS state highways and adding an appropriate increase factor for the local NHS system. Since much of the local NHS is in urban locations where resurfacing costs are higher, even though the local NHS is only 6% of the mileage, in terms of resurfacing cost, it represents about 8% of the total overall NHS funding need.

A check on long-term needs can be made using the FHWA's quick checkup tool on their pavement preservation website. For the Interstate and NHS highway system, approximately 12,100 lane mile-years of life is lost due to deterioration annually. For long-term pavement health, an equivalent number of 12,100 lane mile-years of pavement repair work must be put back into the system to offset this deterioration. This is best accomplished by programming an appropriate mix of preventive pavement maintenance, preservation and rehabilitation projects.

Annual rehabilitation and resurfacing mileage needs for the NHS highway network can be approximated by dividing the number of lane miles by the typical life span of resurfacing and rehabilitation treatments and factoring in maintenance treatments to extend life where appropriate. The NHS highway network has a mix of different pavement types with different pavement condition levels, treatments required, and different life spans. Based on Pavement Management data, treatment cycles and appropriate treatments unit costs to maintain a sustainable "steady state" program can be determined to estimate annual needs.

About 92% of the NHS highway network is asphalt surfaced. Resurfacing or rehabilitation treatments on asphalt surfaced pavements last about 10 to 20 years before another one is required, depending on traffic, environmental conditions, resurfacing thickness, and maintenance practices. Seal coat treatments such as chip seals can extend the resurface interval to 25 years or more on some low and

moderate traffic asphalt surfaced roads by providing a barrier against the harmful effects of moisture, aging, and traffic. Some asphalt surfaced pavements are too damaged to cost effectively rehabilitate and must be reconstructed. The remaining 8% of the NHS highway network is concrete pavement which typically needs resurfacing or replacement after 30 to 50 years of service.

5. ***Determining the strategies for identifying potential NHS pavement projects that maximize overall program benefits within the financial constraints***

For state highways, the pavement strategy uses a tiered approach to prioritize highway routes and also includes dedicated funding programs for the most cost-effective maintenance treatments, preservation resurfacing and rehabilitation, and reactive pavement patching.

State highway pavement conditions are prioritized by state highway classification into four levels, 1) Interstate highways are the highest priority, have the highest condition targets, and the highest level of investment, 2) Fix-It priority routes like US-97, OR-58, or US-26 are the next highest priority, followed by 3) remaining State level NHS routes like US-101, followed by 4) Region and district level routes like OR-99E or OR-214.

Since it is more cost effective over the long run to do low cost thin resurfacing and seal treatments on pavements with only minor deterioration than to employ a "worst first" approach, dedicated funding subprograms are provided to preventive maintenance and seal coat projects in both the STIP and Maintenance budgets based on needs as determined by PMS analysis.

Pavement Management data are used to determine candidate project lists for all pavement seal coat, resurfacing and rehabilitation projects. By policy, the state highway network is broken up by traffic volume and truck traffic loading so that the Interstate and most of the NHS pavement projects are delivered with STIP funds through the Fix-It Preservation Program while projects on lower traffic volumes state highways are delivered with Maintenance funds. Decision factors explained in the Budget Needs section above are used to estimate treatment needs and costs. Because there are differing design standards and delivery options for the STIP and Maintenance programs, there are separate decision factors for each subnetwork.

Age and forecasted pavement conditions are the primary factors to determine chip seal and micro-surfacing needs within the appropriate analysis period. The decision tree is used to initially time the treatment and then packaging and bundling opportunities are explored when developing project lists. A revolving 4-6 year planning horizon is used where project selections are made about 2 to 3 years ahead of treatment and program funds are budgeted for the next cycle based on likely candidates from the PMS. Funding levels for chip seal are set to ensure that best chip seal candidate projects identified from the PMS can be programmed.

STIP Fix-It resurfacing projects are prioritized by a cost effectiveness weighting factor in terms of $/LM-year. Total vehicle and truck traffic volumes, risk of treatment delay to maintenance and repair cost, pavement program manager priority, and regional priority are also accounted for in project prioritization through the use of weighting factors. The prioritization process is used to hone down the candidate list to a list which is approximately 125% of the available budget (e.g. 125% list).

The following guiding principles are considered when making decisions about allocating pavement dollars and selecting projects.

- Prioritize pavement condition by route classification, from a state level perspective.

ODOT PAVEMENT PROGRAM MANAGEMENT SYSTEM SUMMARY

- Provide consistent, stable, and adequately funded allocations to preventive maintenance and seal coat treatments.
- Prioritize treatments and projects which provide higher pavement service life for funds expended (e.g. $/lane mile-year).
- Prioritize projects where poor pavement surface condition poses an increased safety risk.
- Favor projects with higher speeds and higher traffic volumes where user costs are more negatively impacted by rough road conditions.
- Favor projects requiring significant maintenance expense to save on maintenance costs.
- Distribute projects across all parts of the state to balance pavement conditions geographically.
- If substantial increases in pavement funds become available, allocate a portion to rehabilitate urban and lower volume highways that are in poor to very poor condition to help reduce deferred backlog.

6. Recommending programs and implementation schedules to manage the condition of NHS pavement assets within policy and budget constraints

Pavement Management System data and analyses are integrated into ODOT's pavement strategy, which is overseen by an interdisciplinary Pavement Committee steering team that includes state pavement representation, traffic/roadway, construction, region and area managers, and maintenance. This steering team meets regularly and sets the overall strategy and policy direction for the pavement programs based on Pavement Management analysis. The team manages the financial plans for the Interstate preservation program, the HB2017 funded preservation program, and the chip seal program, and also determines funding allocations to the interstate and regional paving and chip seal programs.

Overall funding levels for ODOT's Fix-It Preservation program are established each STIP update cycle, typically every 2 to 3 years, at ODOT's executive level and are informed by the PMS which forecasts the impacts of different investment levels on pavement conditions. Program funds are then allocated to the Interstate, regional NHS and non-NHS state highway resurfacing, and chip seal subprograms using PMS data and analysis.

Interstate –Interstate highways are the highest priority in ODOT's pavement investment strategy and the funding allocation is set before any other subprogram by running a 10 year analysis (typically one STIP cycle beyond the one being planned) of interstate treatment needs and conditions and setting funding levels to maintain pavement long-term conditions above 95% "fair" or better using ODOT's condition measure which also assures compliance with the national performance measure of no more than 5% poor Generally, one-third to one-half of total program funds are allocated to Interstate preservation projects. Stand-alone interstate sign replacement projects funded at $2 million per year to do sign replacement projects on a corridor approach so that replacement occurs on a recurring cyclical basis. Another $3 million per year goes to the Major Interstate Maintenance (MIM) subprogram for local pavement repair projects on the Interstate. The intent of MIM is to do maintenance work beyond what normal crew patching budget can cover that will prolong the life of the pavement and maximize the time interval before a larger scale interstate preservation project becomes necessary. The ideal project would be one where there are relatively small sections of poor pavement within a section of relatively good pavement where fixing the small section of poor would extend the life of the entire section. MIM projects are selected from a District solicitation / Headquarters field review / Pavement Committee approval process.

ODOT Pavement Program Management System Summary

NHS State Highways –Most NHS state highways are funded from the Fix-It Preservation Program although projects on some lower volume NHS state highways are funded from the Maintenance program. For both programs, PMS data is used to determine chip seal and micro-surfacing project needs for the appropriate analysis period. Funding levels for the Fix-It Chip Seal subprogram have historically been roughly $5 million per year while the Maintenance Low Volume program historically adds another $2 to $3 million annually on lower volume NHS state highways. Remaining program funds are allocated to the state highway system for pavement resurfacing projects using an allocation formula that forecasts pavement conditions in each region one STIP cycle ahead (typically 8 to 10 years from data collection) and compares them to target levels by state highway classification. From this, funding needs to reach target levels in each region are determined and the resulting percentages are pro-rated to funds available.

Pavement Management data and analysis are also incorporated into the Maintenance program budgeting process every biennium. Within the Maintenance budget there are two dedicated pavement funding line items –Low Volume and Pave Patch. Funding levels and district allocations for both of these programs are established each biennium (2 year cycle) within Maintenance as part of their normal budgeting process and are informed by PMS data. The Low Volume Program is budgeted to hold pavement conditions on low volume state highways with mostly chip seals and patching. Budget levels are periodically adjusted based on pavement condition trends. Funds are allocated to the districts in proportion to lane-miles. Starting with the 19-21 biennium, the budget was increased by about 15% to apply resurfacing overlays to priority locations with extensive deterioration and/or high risk of failure. The Maintenance Leadership Team selects the locations for resurfacing based on recommendations from Pavement Management. The overall budget for Pave Patch is informed by the PMS by monitoring historic and forecast pavement conditions, and adjusting as needed. The Pave Patch district splits are based on a formula incorporating lane miles, pavement condition, and traffic level.

Local NHS –Although local NHS inventory and conditions are included in ODOT's PMS and budget needs for local NHS projects can be reasonably estimated, ODOT does not identify potential projects on the local NHS. Pavement management and project selection on the local NHS falls under the responsibility of each local agency with NHS routes under their jurisdiction. The HB2017 transportation bill now requires all local agencies to report pavement conditions on all federal aid highways under their jurisdiction to receive state funding. This reporting requirement was first implemented in 2019. Over time, this information should allow strengthened ties to local system PMS management strategies on the NHS.

Appendix G – Risk Register

ID	Category	Description	Risk Statement	Potential Impacts Relevant to TAMP (bridge and pavement assets)					Current Controls	Owner	Risk Matrix Score		
				TAMP targets may not be met	Funding **could** decrease	Acceleration deterioration	Damage to assets requiring diversion of funds	Suboptimal or inefficient use of revenue			**Likelihood** (or Frequency)	**Impact** (or Consequence)	Score and Ranking
1	Asset Performance	Bridge Scour	If bridge scour needs are not addressed, then bridges could fail as a result of scour.	X					Bridge Engineering identifies, analyzes, evaluates, and mitigates this ongoing risk.	Bridge Engineering	3.0	3.7	HIGH
2	Asset Performance	Corrosion	If corrosion on steel bridges and reinforced concrete bridges is not addressed, then bridges could fail as a result of corrosion.	X					Bridge Engineering identifies, analyzes, evaluates, and mitigates this ongoing risk.	Bridge Engineering	2.7	3.0	MODERATE
3	Asset Performance	Fatigue Cracking	If fatigue cracking on steel bridges is not addressed, then bridges could fail as a result of fatigue cracking.	X					Bridge Engineering identifies, analyzes, evaluates, and mitigates this ongoing risk.	Bridge Engineering	3.0	3.0	MODERATE
4	Asset Performance	Winter Maintenance- Rock Salt	If rock salt is used during the winter, then this may cause increased deterioration of pavement and bridges.	X					Performed a study to determine the impact of rock salt use on roads. Planning seal and overlay work in anticipation of rock salt use in winter	Bridge Engineering/ Pavement Services Unit	4.3	2.8	HIGH
5	Asset Performance	Truck Volume/Weights	If truck traffic and/or weights increase at a greater rate than anticipated, this may cause accelerated pavement and bridge deterioration.	X						Bridge Engineering/ Pavement Services Unit	2.3	3.0	MODERATE
6	Asset Performance	Non-State NHS Pavement and Bridges	If non-state NHS pavement and bridge assets are not maintained with asset management principles, then the agency may not meet condition targets.	X				X		Bridge Engineering/ Pavement Services Unit	2.0	1.8	LOW
7	Asset Performance	Non-State NHS Pavement and Bridges	If non-state NHS pavement and bridge assets are in poor condition, funds to fix local NHS assets may need to be diverted from higher-priority state highway NHS roads.	X				X			1.5	2.0	LOW
8	Asset Performance	Other Tier 1 Assets	If other Tier 1 assets (aside from pavement and bridge) fail, then increased funds may be needed for these assets.		X					Tier 1 Asset Owners	3.0	2.8	MODERATE
9	Asset Performance	Prioritizing Capacity Projects	If capacity projects are prioritized for funding, then money is diverted from maintenance, preservation and rehabilitation work.			X					3.3	3.5	HIGH
10	Asset Performance	Worst-First Asset Investments	If poor condition assets are prioritized for funding, then money is diverted from preservation projects that keep good condition assets from falling into fair condition and fair condition assets from falling into poor condition.	X		X			Asset management investment decisions seek to strike the right balance between preservation and rehabilitation to meet long-term condition targets	Bridge Engineering/ Pavement Services Unit	2.5	3.0	MODERATE
11	Asset Performance	PM2 Minimum Conditions	If minimum condition requirements pertaining to interstate pavement and bridges in poor condition (PM2s) are not met, funds may need to be diverted from preservation and preventative maintenance.					X			1.8	3.3	MODERATE
12	Highway Safety	Construction Defects	If there are construction defects on bridges, then additional safety investments may be required.		X					Bridge Engineering/Construction Section	2.0	2.0	LOW
13	Highway Safety	Design Standards	If assets do not meet current design standards for traffic and safety features, then additional investments may be required.		X					Other Tier 1 Asset Owners	3.3	2.8	MODERATE
14	Highway Safety	Bridge Railing	If deficient bridge railing is not addressed, then this may cause injuries and fatalities.		X					Bridge Engineering	2.7	2.0	MODERATE

ID	Category	Description	Risk Statement	Potential Impacts Relevant to TAMP (bridge and pavement assets)					Current Controls	Owner	Risk Matrix Score		
				TAMP targets may not be met	Funding **could** decrease	Acceleration deterioration	Damage to assets requiring diversion of funds	Suboptimal or inefficient use of revenue			**Likelihood** (or Frequency)	**Impact** (or Consequence)	Score and Ranking
15	Highway Safety	Automated and Connected Vehicles	If the deployment of automated and connected vehicles impact highway safety feature needs and priorities, this may result in suboptimal near-term decisions around safety investments that have long-term impact.					X		Bridge Engineering/ ODOT Research	1.5	2.0	LOW
16	External Threats	Litigation	If there are lawsuits regarding assets, then this may require diversion of funds.		X						3.3	2.8	MODERATE
17	External Threats	Earthquakes *(non-Cascadia subduction)*	If there is a (non-Cascadia subduction) earthquake, then this may result in injuries and fatalities, road and bridge damage, and adverse impacts to the movement of people and freight.				X		Performed a vulnerability assessment. Conducting triage studies to increase mobility.	Geo-Environmental Section/ Bridge Engineering	2.3	2.0	LOW
18	External Threats	Cascadia Subduction Zone Earthquake	If there is a Cascadia Subduction Earthquake, this would result in large-scale injuries and fatalities, tsunami and landslide risk, major road and bridge damage, and adverse impacts to the movement of people and freight.								2.3	5.0	HIGH
18	External Threats	Flooding	If there is severe flooding, then this may result in injuries and fatalities, damaged roadways, and adversely impact the movement of people and freight.				X		Developing flood and sea level rise risk mapping.	Geo-Environmental Section/ Bridge Engineering; Transportation Development Division	3.0	2.7	MODERATE
19	External Threats	Fires	If there are severe fires, then this may result in injuries and fatalities, damaged roadways, and adverse impacts to the movement of people and freight.				X			Geo-Environmental Section/ Bridge Engineering	3.0	2.0	MODERATE
20	External Threats	Tsunami	If there is a tsunami, then this may result in injuries and fatalities, damaged roadways, and adverse impacts to the movement of people and freight.				X			Geo-Environmental Section/ Bridge Engineering	1.7	4.0	MODERATE
21	External Threats	Landslides	Is there is a landslide, then this may result in injuries and fatalities, damaged roadways, and adverse impacts to the movement of people and freight.				X		Developing landslide risk mapping; costal landslide and bluff monitoring research.	Geo-Environmental Section	3.3	2.3	MODERATE
22	External Threats	Storm Damage	If there is an increasing number of storms due to climate change, then this may result in injuries and fatalities, damaged roadways, and adverse impacts to the movement of people and freight.			X	X		Maintenance resource optimization; hazard tree removal program; performing coastal resilience pilot studies; assess vulnerabilities and risks from storms.	Maintenance and Ops; Geo-Environmental Section; Transportation Development Division	3.3	2.7	MODERATE
23	External Threats	Crash Damage	If there is vehicle crash damage (bridge hits, spills, etc.), then the damage will need to be repaired.			X	X			Bridge Engineering/ Pavement Services Unit	3.8	2.0	MODERATE
24	External Threats	Terrorism or Sabotage	If there is terrorism or sabotage, this may result in injuries and fatalities, damaged roadways, and adverse impacts to the movement of people and freight.				X				1.0	2.7	LOW
25	Finances	Funding Uncertainty	If there is uncertainty of future funds, then the agency may face challenges in making optimized tradeoff decisions.					X	Federal revenue projections take a conservative approach, assume a 10% reduction.	Program and Funding Services/ Economic & Financial Analysis	3.0	2.3	MODERATE
26	Finances	Demographic Changes *(impacting revenue)*	If there is uncertainty in funding caused by demographic changes (i.e. aging population, urbanization, vehicle automation), then the agency may face challenges in making optimized tradeoff decisions.					X		Program and Funding Services	2.0	2.0	LOW
27	Finances	Underfunding Maintenance	If maintenance is continually underfunded, then this may cause accelerated asset deterioration.			X				Highway Budget Office	3.0	3.3	HIGH

ID	Category	Description	Risk Statement	Potential Impacts Relevant to TAMP (bridge and pavement assets)					Current Controls	Owner	Risk Matrix Score		
				TAMP targets may not be met	Funding **could** decrease	Acceleration deterioration	Damage to assets requiring diversion of funds	Suboptimal or inefficient use of revenue			**Likelihood** (or Frequency)	**Impact** (or Consequence)	Score and Ranking
28	Finances	Inaccurate Revenue Projections	If state or federal revenue projections are inaccurate, then this may result in suboptimal decisions concerning what work to perform.					X	Federal revenue projections take a conservative approach, assume a 10% reduction. State projections updated every 6 months.	Program and Funding Services/Economic & Financial Analysis	2.3	2.5	MODERATE
29	Finances	Inflation	If inflation increases at a greater rate than predicted, then this may result in reduction in the effective level of funding.			X			Financial and revenue projections are updated every 6 months, and OTP provides guidance on investment under constrained revenue scenario.	Program and Funding Services/Economic & Financial Analysis	3.0	3.0	MODERATE
30	Finances	Economic recession	If the state experiences an economic recession, this may result in a reduction in the effective level of funding.			X			Financial and revenue projections are updated every 6 months, and OTP provides guidance on investment under constrained revenue scenario.	Program and Funding Services/Economic & Financial Analysis	3.5	3.0	HIGH
31	Finances	Fuel Efficiency and Alternative Fuel Vehicles	If there are improvements in fuel efficiency and proliferation of alternative fuel vehicles, then future available funds may be reduced.			X			Financial and revenue projections are updated every 6 months, and OTP provides guidance on investment under constrained revenue scenario.	Program and Funding Services/Economic & Financial Analysis	4.0	3.5	HIGH
32	Finances	Funding for Data Collection and Maintenance	If there is not sufficient funding for data collection and data maintenance, then asset inventories will be incomplete and unreliable.					X		Program and Funding Services/ Asset Management Integration	2.3	2.5	MODERATE
33	Finances	Dedicated Funding for Other Tier 1 Assets	If the Tier 1 assets (excluding pavement and bridge) lack dedicated funding, then this may reduce available funding for pavement and bridge work.		X					Program and Funding Services	2.5	2.3	MODERATE
34	Finances	Dedicated Funding for NHS	If there is a lack of dedicated funding for NHS assets, then it may be difficult to estimate the total spending on the NHS.	X						Program and Funding Services	2.0	2.0	LOW
35	Finances	Impacts Of Debt Servicing	If the debt servicing costs increase, then funding for asset management may be reduced.			X			Debt service requirements are monitored on an ongoing basis.	Program and Funding Services	2.8	2.8	MODERATE
36	Information & Decisions	Performance and Analysis Models	If we do not have reliable asset performance and analysis models, then we may not correctly predict future conditions.			X		X		Bridge Engineering/ Pavement Services Unit/ Other Asset Owners	2.3	2.8	MODERATE
37	Information & Decisions	Quality Of Asset Inventory and Condition Data	If we have incomplete or poor quality data on asset inventory and/or condition, then we may not correctly predict future conditions and needed work.			X		X	Working on updating asset inventory for culverts, curb ramps, traffic signals, and rockfall/landslide mitigation features.	Bridge Engineering/ Pavement Services Unit/ Other Asset Owners	2.3	2.8	MODERATE
38	Information & Decisions	Data Management Software Upgrades	If new data management software is needed or required, this may divert revenue and staff and/or cause current asset inventory systems to fail.					X	Strategic Data Business Plan developing recommendations on how to better upgrade and manage data systems.		2.5	2.0	MODERATE
39	Information & Decisions	Demographic Changes *(impacting system demand)*	If there is uncertainty in system demand caused by demographic and technology changes (i.e. aging population, urbanization, vehicle automation), then this may result in suboptimal decisions concerning system investment.			X		X		Planning	2.0	2.0	LOW
40	Business Operations	Knowledge Transfer	If we lack appropriate knowledge management and succession planning, then future staff may not have sufficient knowledge to perform needed work.					X	Succession Planning Workbook. Competency-based performance system.	Human Resources	3.8	3.5	HIGH
41	Business Operations	Technical Skills Development	If complex design and engineering work is heavily outsourced to consultants, then the agency may not be able to develop and retain a workforce with necessary technical skills and ability to manage consultant work.					X			3.8	3.3	HIGH

ID	Category	Description	Risk Statement	Potential Impacts Relevant to TAMP (bridge and pavement assets)					Current Controls	Owner	Risk Matrix Score		
				TAMP targets may not be met	Funding **could** decrease	Acceleration deterioration	Damage to assets requiring diversion of funds	Suboptimal or inefficient use of revenue			**Likelihood** (or Frequency)	**Impact** (or Consequence)	Score and Ranking
42	Business Operations	Lack of Project Delivery and Engineering Staff	If we lack experienced project delivery and engineering staff, then we may not be able to perform needed work.					x		Human Resources	3.3	2.8	MODERATE
43	Business Operations	Contractor Capacity	If contractors lack the capacity to perform the needed volume of certain types of work, then we may not be able to perform the needed work.					x		Human Resources	2.0	2.5	MODERATE
44	Business Operations	Changes In Regulations/ Legislative Mandates	If there are future changes to regulations or legislative mandates, then this may result in diversion of funds.		x					Office of the Director	3.3	2.8	MODERATE
Additional Risks- identified after agency-wide risk scoring process:													
45	*Finances*	*Increases in Material Costs*	*If there are unexpected cost increases in pavement and bridge materials (aggregate, steel, etc.), construction and maintenance cost could increase drastically.*		*x*					*Program and Funding Services/Economic & Financial Analysis*	***n/a***		***HIGH***
46	*Asset Performance*	*Investment in strengthening bridges for emergency vehicles*	*If the agency invests substantially in ensuring bridges are strengthened to accommodate heavy emergency vehicles, limited revenue could be diverted away from preserving, rehabilitating and replacing bridges at the appropriate time in their service life*			*x*		*x*		Bridge Engineering;	***n/a***		*n/a*

Appendix H – Mitigation Plans for Top Priority Risks

ID	Category	Description	Likelihood	Impact	Score	Mitigation Potential	Mitigation Strategy	Mitigation Actions
18	External Threats	Cascadia Subduction Earthquake	**2.3**	**5.0**	**8.38**	Major impacts from a Cascadia Subduction Earthquake cannot be prevented, but investments in bridge and landslide resiliency along critical corridors can drastically reduce casualties, support emergency response and expedite recovery efforts.	Develop and implement resiliency plans and programs including the Seismic Plus Program. https://www.oregon.gov/ODOT/Bridge/Docs_Seismic/Seismic-Plus-Report_2014.pdf Adopt project design changes that increase asset resiliency. http://www.oregon.gov/ODOT/Bridge/Pages/Seismic.aspx	Implement Seismic Plus Program on priority transportation life-line corridors. Stockpile supplies and equipment in key locations that can support road and bridge repair and recovery efforts.
31	Finances	Fuel Efficiency and Alternative Fuel Vehicles	**4.0**	**3.5**	**8.13**	Financial risks can be mitigated through monitoring trends and adjustments to tax rates and revenue sources that are tied to fuel consumption.	Complete cost responsibility studies and implement findings. Maintain ongoing communication on financial risks with state legislators and other policymakers.	Propose adjustments to gas tax rates. Propose adjustments to alternative fuel vehicle registration and other fees. Implement Mileage-based user charges.
40	Business Operations	Knowledge Transfer	**3.8**	**3.5**	**7.92**	Loss of experience and institutional knowledge can be reduced through expanded mentorship and cross-training programs.	Develop and implement knowledge transfer programs and transition plans.	Develop a Succession Planning Workbook. Establish a competency-based performance system.
41	Business Operations	Technical Skills Development	**3.8**	**3.3**	**7.81**	Impacts of diminished technical competency of agency staff can be mitigated through the provision of ongoing opportunities and requirements for maintaining and improving technical skill.	Ensure proper balance of outsourced versus in-house work to ensure adequate staff technical skills development.	Implement workforce development strategies to ensure prevalence of technical competency among agency staff, and provide ongoing opportunities to improve non-technical skills.
4	Asset Performance	Winter Maintenance-Rock Salts	**4.3**	**2.8**	**7.69**	Impacts of rock salts on pavement and bridge condition can be mitigated through limiting its use to areas where the need is critical, and impacts on asset condition is lower.	ODOT's Rock Salt Pilot Program will help the agency determine how to use solid salt, in combination with the snow fighting tools already in use, to improve highway safety and mobility while attempting to minimize impact to the environment. http://www.oregon.gov/ODOT/Maintenance/Pages/Salt-Pilot.aspx	ODOT is concerned about the impact of salt on the environment, infrastructure and vehicles. ODOT will continue to implement best practices for storing and using salt, and will pursue appropriate research to inform effective decision making.
9	Asset Performance	Prioritizing Capacity Projects	**3.3**	**3.5**	**7.63**	Impacts can be mitigated through ensuring that maintenance and preservation of assets continues to be prioritized above projects that increase capacity.	Maintain ongoing communication with policymakers and other decision-makers on the need to prioritize maintenance and preservation funding over projects that increase capacity.	Limit undertaking capacity projects to only those that complete the legislatively required benefit-cost analysis and are found to be most consistent with ODOT goals and objectives.
1	Asset Condition and Performance	Bridge Scour	**3.0**	**3.7**	**7.58**	Bridge scour can be mitigated on new bridges through adequate design. Impacts to existing bridges can be managed through routine inspections.	Manage risk through adequate design of new bridges and routine inspection of existing bridges.	Manage risk through adequate design of new bridges and routine inspection of existing bridges.
30	Finances	Economic Recession	**3.5**	**3.0**	**7.25**	Risk of economic recession cannot be prevented but it can be somewhat constrained through management of agency expenditures and a shift toward more stable funding sources.	Identify stable funding sources that are adequate to meet asset maintenance and preservation needs during periods of economic recession.	Monitor federal and state economic conditions and expectations. If needed adjust agency expenditures to minimize adverse impacts on the condition and performance of bridge and pavement assets.
27	Finances	Underfunding Maintenance	**3.0**	**3.3**	**7.06**	Underfunded maintenance can be mitigated through adequate dedication of financial resources.	Ensure that new revenue allocations such as HB2017 adequately fund maintenance needs.	Monitor programmed and planned agency maintenance expenditures, adjust actual expenditures to meet agency maintenance goals and objectives.
45	Finances	Increases in Material Costs	***n/a***		**High**	ODOT has little control over the fluctuation of materials costs on the regional or national marketplace. However, the agency can take proactive steps to safeguard itself from the impact of these major market fluctuations.	Monitor and track market trends and fluctuations in material costs. Identify cost savings strategies.	Employ cost-effective construction materials and practices. Ensure the agency maintains affordable access to essential construction materials including aggregates.