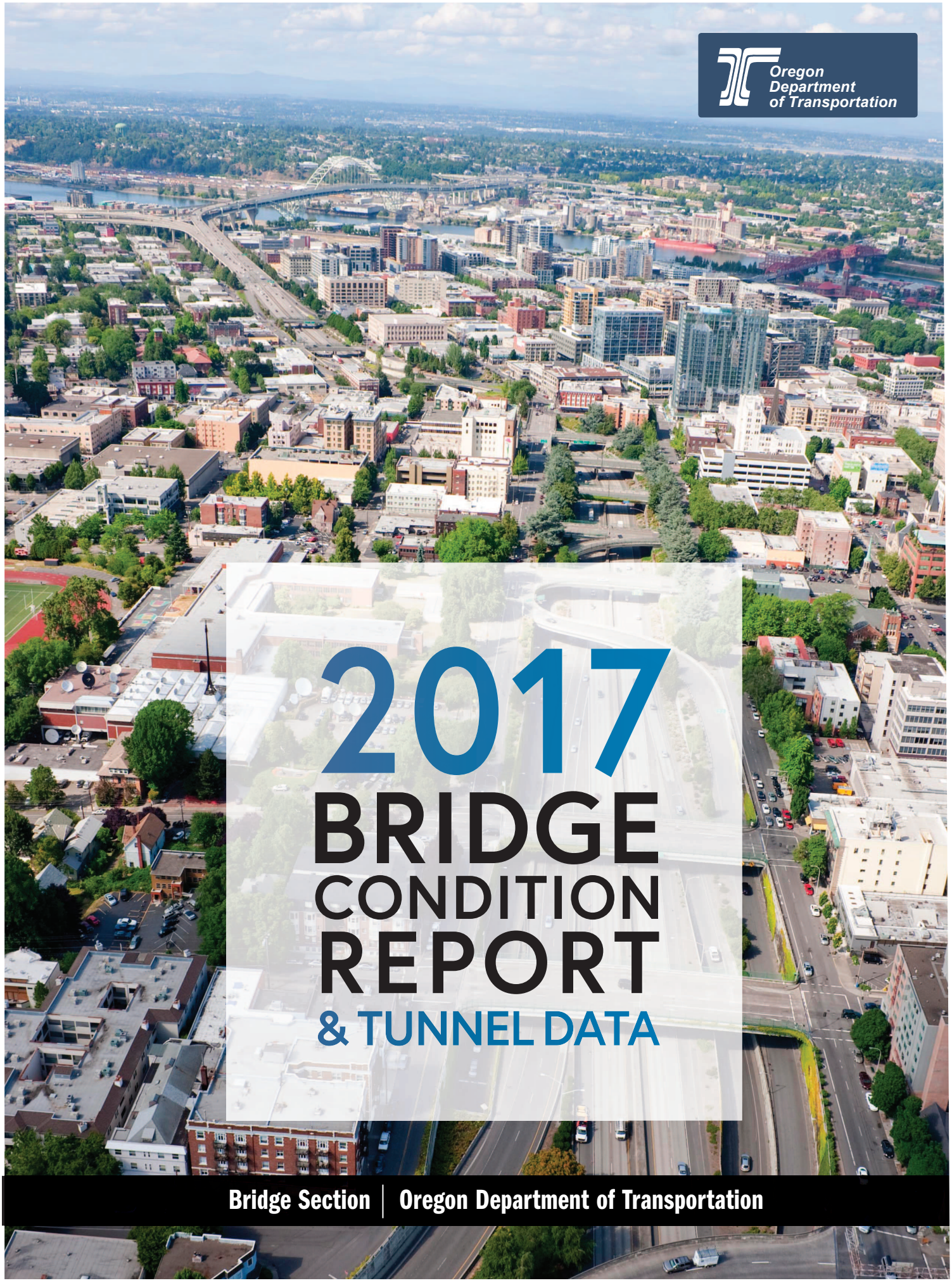
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2017
BRIDGE
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REPORT
& TUNNEL DATA
Bridge Section | Oregon Department of Transportation

Oregon Department of Transportation

2017 BRIDGE CONDITION REPORT & TUNNEL DATA

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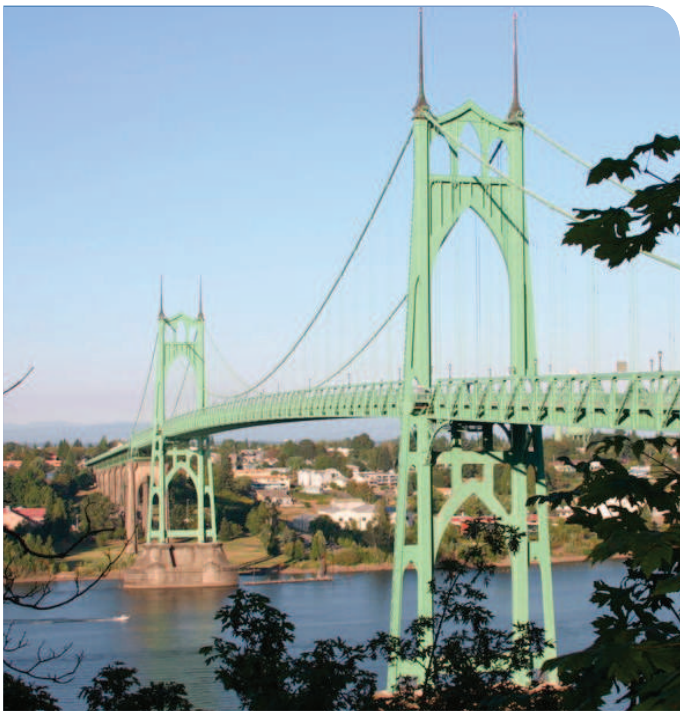


EXECUTIVE SUMMARY

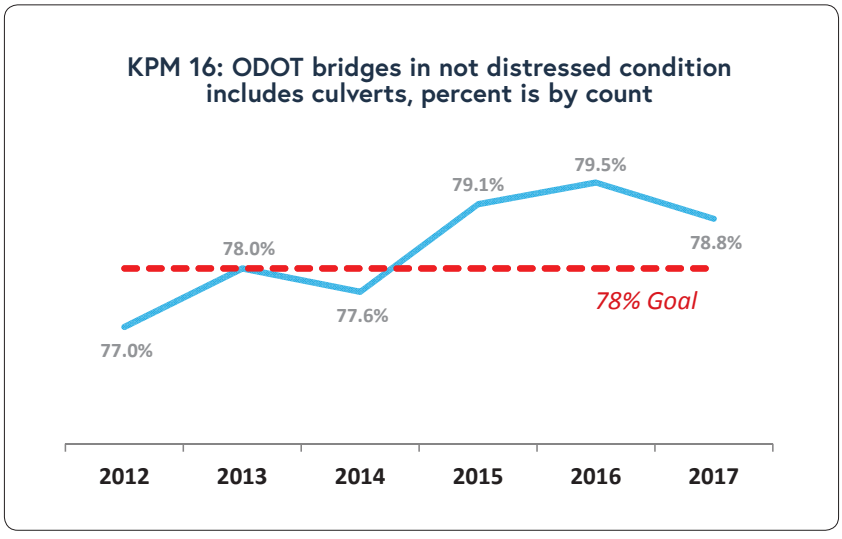
Maintaining bridges in good condition is critical to Oregon's economy and to preserving safe and reliable travel. The increased funding level for ODOT's Fix-It Program from House Bill 2017 will help ensure that deteriorating bridges can be fixed before they impede mobility or force trucks to detour, especially on major state highways.

For the first time, ODOT's Bridge Condition Report includes a section about the bridge program accomplishments and the status of seismic work as a result of HB 2017. The condition data is based on the April 2017 submittal provided annually to the Federal Highway Administration. Project work information includes work added with increased funding from HB 2017.

Current Conditions

ODOT's Key Performance Measure (KPM 16) indicates an increase in the number of distressed bridges. The measure incorporates the percent of structurally deficient bridges and other distressed bridges as defined by ODOT including freight mobility, bridge safety and serviceability. About 80% of bridges on the state highway system are seismically vulnerable.

The increase in distressed bridges is mainly due to the aging bridge population (low service life) and updated load capacity evaluations indicating a potential need for weight restrictions.



ODOT bridges Not Distressed condition. Larger percentages are better.

National Performance Measure

The Moving Ahead for Progress in the 21st Century Act (MAP-21) requires states to establish bridge condition targets and report conditions based on specified performance measures for the National Highway System (NHS) including:

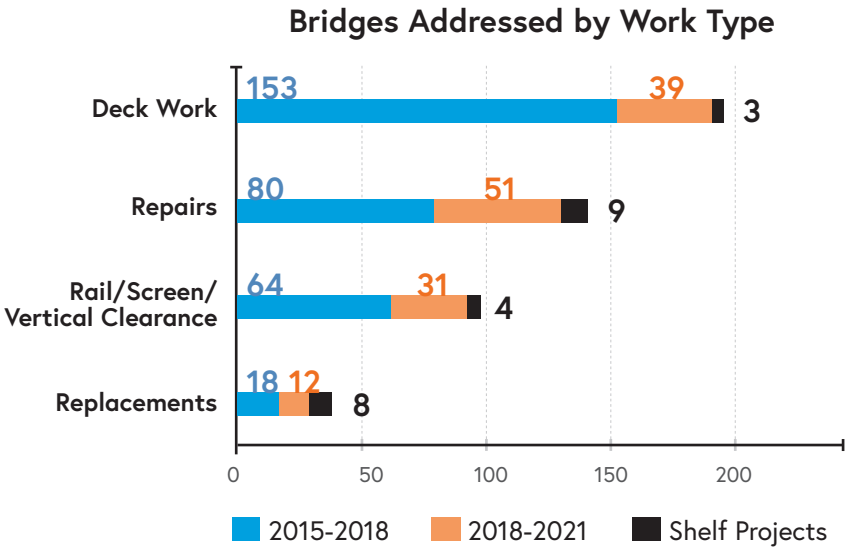
Percent of NHS bridges by deck area classified in Good condition

Percent of NHS bridges by deck area classified in Poor condition.

Currently 13.7% of NHS bridges are in good condition, 2.1% are in poor condition, and 84.2% are in fair condition. With so many bridges in fair condition on the cusp of becoming poor, maintaining bridge conditions in the future will be challenging.

Bridge Program Updates

The ODOT bridge program funds a variety of works types as shown. The majority of ODOT bridge work focuses on preserving bridge decks. With the addition of HB 2017 funding in the 2018-2021 Statewide Transportation Investment Program, a total of 12 bridge replacements are programmed and eight are being developed as shelf projects.



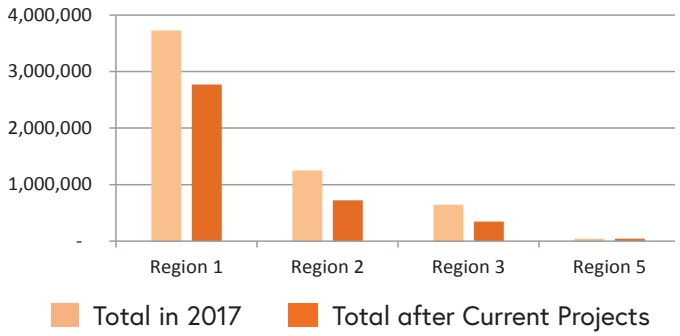
Bridge Preservation: Painting & Cathodic Protection

As subsets of bridge repairs, bridge painting and cathodic protection (CP) are critical tools for preserving Oregon's steel and concrete coastal bridges. Without these tools, many of the historical bridges like the St. Johns Bridge

in Portland or the Siuslaw River Bridge in Florence would be at risk of continued deterioration to the point of needing replacement.

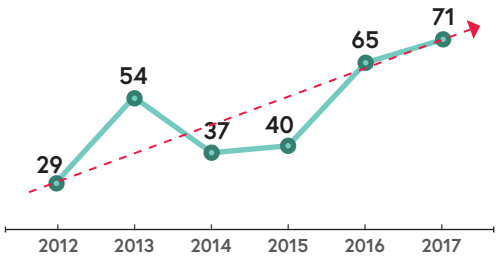
ODOT is responsible for more than 330 painted steel bridges with over 27 million square feet of surface area. Seven bridges are currently under contract for painting and other associated repairs, with a total project cost exceeding $90 million. The current and resulting conditions are shown.

Area of Steel Bridges Classified as Deficient (sf)



Cathodic protection (CP) is a cost effective technique used to extend the life of Oregon's coastal bridges constructed with concrete. In some cases, bridges initially planned for replacement due to corrosion are being considered for CP as an alternative. Although a bridge replacement would provide more than 75 years of service, for less money CP can extend the life of an historic bridge about 30 years, allowing Bridge Program funds to be expended on other needs. ODOT currently has a CP project under construction in Florence and five others in the design phase, with a total cost exceeding $60 million over the next four years.

Total Timber Piles and Caps Replaced in Recent Years



Major Bridge Maintenance (MBM)

The variety and volume of work performed by the Major Bridge Maintenance (MBM) program makes it a key component in maintaining Oregon's infrastructure. Accomplishments for 2016 include addressing 29 urgent bridge maintenance needs, 84 deck treatments and several other projects associated with movable bridge repairs, problematic joints, deteriorated timber elements, etc.

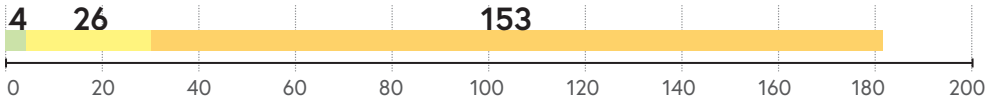
With the number of timber piles and pile cap replacements increasing, timber repairs continue to be the largest component of the MBM program in terms of maintenance and design resources preventing other repairs from being completed.

Seismic

Additional funding to address seismic improvements related to highways and bridges is included with the recently passed transportation package, HB 2017. With the new funds, ODOT plans to work on Phase 1 bridges moving from Eugene, north on I-5 and finishing up on I-84 moving from east to west in 20 to 30 years.

ODOT Phase 1 Seismic Routes - August 2017 Status

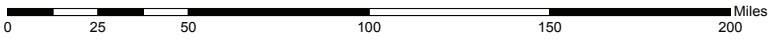
Phase 1 Bridges Remaining:



Estimated Cost $600 M

Completed Funded Remaining

ODOT Phase 1 Seismic Routes - August 2017 Status



Tunnels

Tunnel conditions this year are based on the new National Tunnel Inspection Standards (NTIS). For the eleven ODOT managed tunnels:

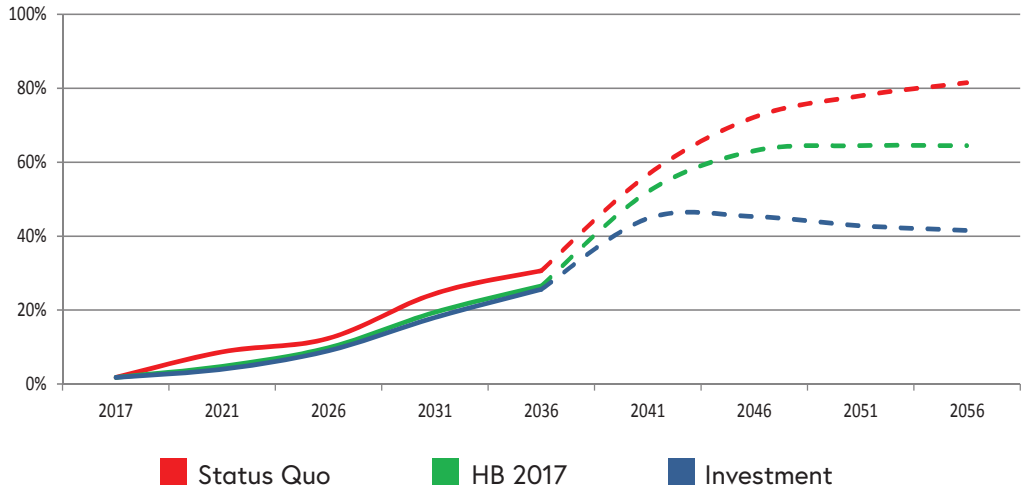
- **8** are in Good Condition
- **2** are in Fair Condition
- **1** is in unknown condition pending an inspection following the Eagle Creek Fire

Where are we headed?

Bridge condition projections were made for various funding levels during the development of HB 2017 ranging from $85M/year for the Status Quo to $185M/year for the Investment Strategy out to 2036. Projections past 2036 are based on analyses and engineering judgement.

HB 2017 provides additional funding for the Fix It program to ensure that deteriorating bridges on Oregon's highest priority routes can be addressed before they impede mobility or force trucks to detour. However, for all scenarios, overall bridge system conditions will continue to deteriorate resulting in an increase in the number of poor bridges. In the short term, the number of poor bridges is expected to be manageable through programs like MBM, painting, cathodic protection and bridge repair projects. However, the large population of aging bridges will result in substantially more needs in the future.

All Route Bridge Condition Projections-Percent Poor



ABBREVIATIONS AND DEFINITIONS

Distressed Bridge – A bridge condition rating used by the Oregon Department of Transportation to indicate that the bridge has been identified as either structurally deficient or as having other deficiencies. A classification of "distressed bridge" does not imply that the bridge is unsafe.

Functionally Obsolete (FO) – A bridge assessment rating used by the Federal Highway Administration to indicate that a bridge does not meet current (primarily geometric) standards. The rating is based on bridge inspection appraisal ratings. Functionally obsolete bridges are those that do not have adequate lane widths, shoulder widths, vertical clearances, or design loads to serve traffic demand. This definition also includes bridges that may be occasionally flooded.

Key Performance Measure (KPM) – A measure used to evaluate the progress of an organization in managing to a particular goal.

Major Bridge Maintenance (MBM) – One of three funding approaches the Bridge Program uses to manage the bridge system. The MBM program typically addresses smaller scale bridge preservation needs and emergency bridge repairs that are outside the scope of work that can be accomplished by an ODOT District.

National Bridge Inventory (NBI) – The aggregation of structure inventory and appraisal data collected to fulfill the requirements of the federal National Bridge Inspection Standards (NBIS).

National Bridge Inspection Standards (NBIS) – 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

National Highway System (NHS) – The National Highway System comprises approximately 225,000 miles of roadway nationwide, including the Interstate Highway System as well as other roads designated as important to the nation's economy, defense, and intermodal mobility. The NHS was developed by the United States Department of Transportation in cooperation with the states, local officials and metropolitan planning organizations. Congress approved the NHS in 1994.

Non-National Highway System (NNHS) – Routes not designated as part of the NHS.

Other Deficiencies (OD) – A bridge condition rating used by the Oregon Department of Transportation to indicate that a bridge has identified needs in one or more of ten factors and

is a candidate for repair or replacement. This condition rating is specifically designed to address specific bridge needs such as freight mobility, deterioration, serviceability, and safety. A classification of "other deficiencies" does not imply that the bridge is unsafe. See also Appendix H online.

Types of ODs include:

Rail = Bridge Rail
CP = Cathodic Protection
LC = Load Capacity
LSL = Low Service Life
MB = Movable Bridge
DG = Other Geometric Clearances (Deck Geometry)
Paint = Paint
Scour= Scour
TS = Timber Structures (Substructure)
VC = Vertical Clearance

Scour Critical Bridge

– A scour critical bridge is one with an abutment or pier foundation rated as unstable due to (1) observed scour at the bridge site or (2) a scour potential as determined by an engineering scour evaluation study.

State Transportation Improvement Program (STIP)

– Oregon's four-year transportation capital improvement program. The STIP document identifies the funding for, and scheduling of, transportation projects and programs.

Structure Condition Abbreviations

–

VG = Very Good
GD = Good
FR = Fair
PR = Poor
VP = Very Poor

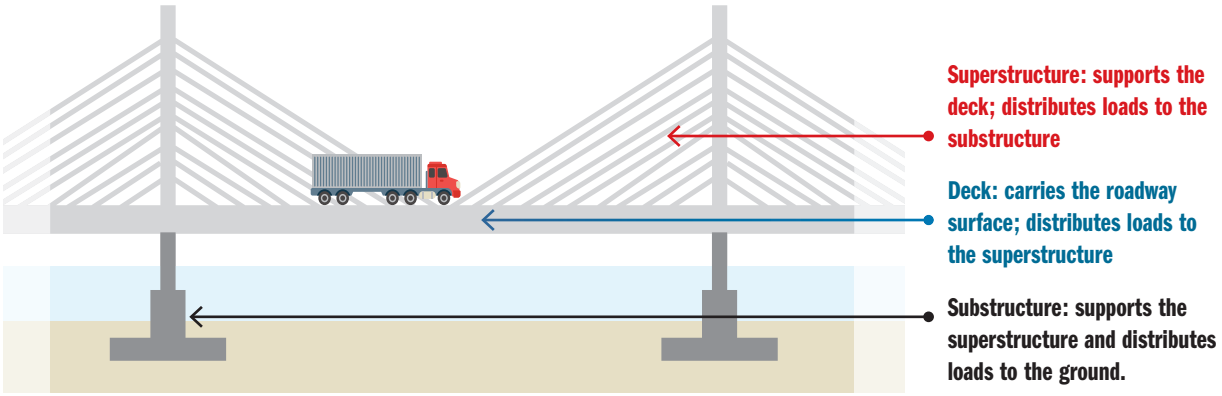
Structurally Deficient (SD)

– A bridge condition rating used by the Federal Highway Administration to indicate deteriorated physical conditions of the bridge's structural elements (primarily deck, superstructure, and substructure) and reduced load capacity. Some of these bridges are posted and may require trucks of a certain weight to detour.

A classification of "structurally deficient" does not imply that bridges are unsafe. When an inspection reveals a safety problem, the bridge is posted for reduced loads, scheduled for repairs, or in unusual situations, closed until repairs can be completed. Structural deficiency is one of the many factors that are used in the ODOT State Bridge Program for project ranking or selection.

BRIDGES 101

Bridge conditions are categorized by evaluating bridge components (deck, superstructure, and substructure) as shown in the graphic.



General Deterioration Factors

Experience has shown that bridge deterioration is dependent on complex interactions of multiple factors as shown.

Construction

Original Design
Materials Used
Craftsmanship

Environment

Traffic Loading
Climate
Corrosion

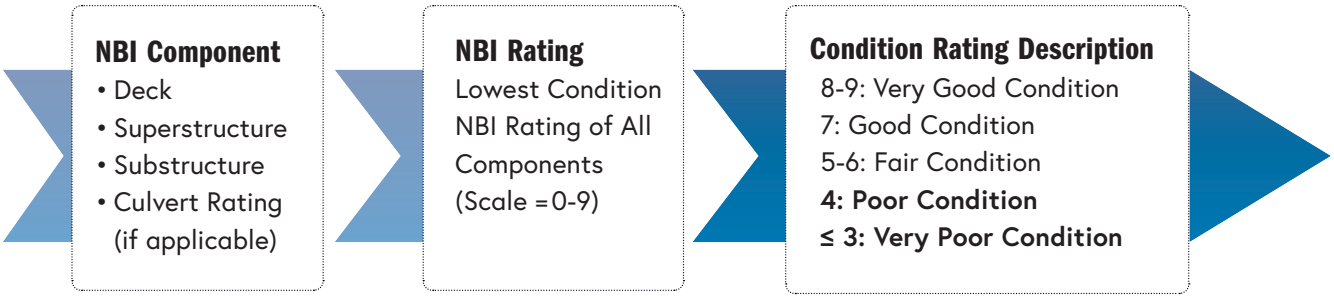
Maintenance

Type
Timing
Treatment Effectiveness

Extreme events (earthquakes, flooding, vehicle impacts) are another cause of bridge distress not considered as general deterioration, but result in the need for quick response and investment to restore mobility.

Bridge Condition Ratings

National bridge inspection standards (NBIS) were established in 1968 to monitor existing bridge performance to ensure the safety of the traveling public. The NBIS regulations apply to all publicly owned highway bridges longer than twenty feet located on public roads. To comply with the NBIS and assess bridge conditions, ODOT manages a statewide bridge inspection program that includes both routine and specialized inspections. Bridge condition ratings are described on the next page.



Bridge condition rating description.

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 (SD)** which occurs for many reasons.

SD based on Condition	SD based on Load Capacity	SD based on Opening
If the deck, superstructure, or substructure, is rated in "poor" condition or worse (coded 4 or lower on the NBI rating scale)	If the load-carrying capacity is significantly below current design standards	If the hydraulic opening below the bridge is inadequate

Structurally deficient bridge description.

Beginning in 2018, a bridge will be classified as structurally deficient only if any component (deck, superstructure, substructure) has an NBI rating of 4 or less.

Maintenance Needs and Cost Impacts

Keeping a bridge in fair to good condition requires routine inspections, proactive maintenance and preservation treatments. Examples of proactive maintenance are:

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

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

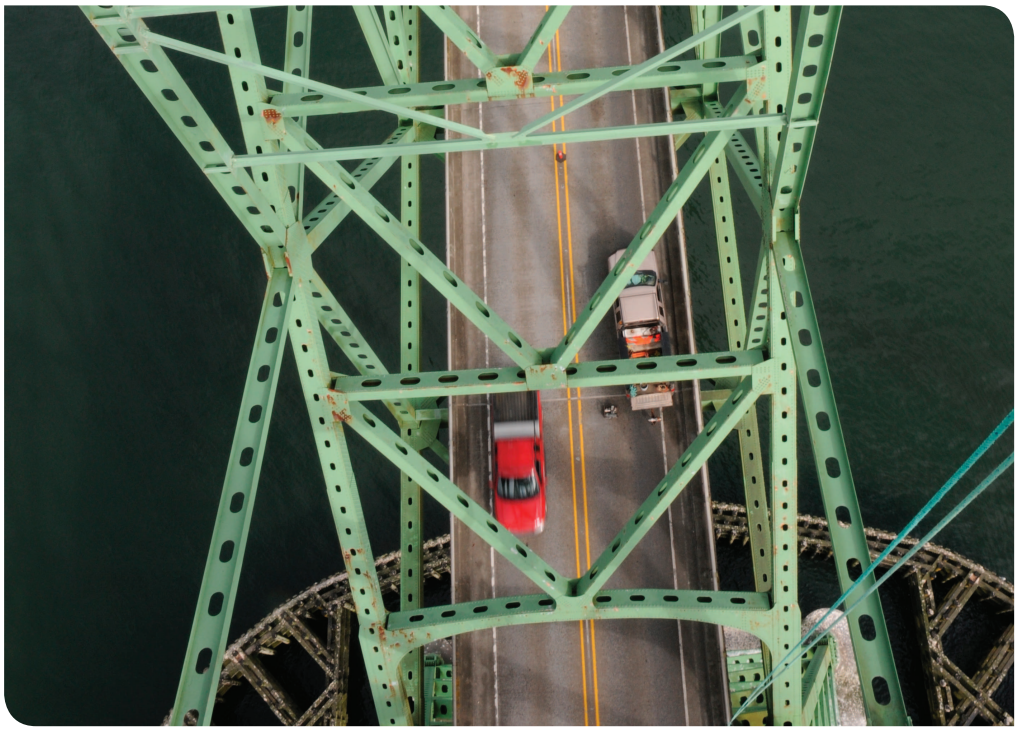
2017 BRIDGE CONDITIONS

ODOT's 2017 Bridge Condition Report summarizes bridge condition ratings on state highways and performance measures based on National Bridge Inventory and ODOT data. As a consistent reference point for evaluation, ODOT uses the bridge conditions snapshot provided annually to the Federal Highway Administration. Data from the April 2017 submittal is the basis of this report.

Bridge conditions are reported in a number of different measures, none of which stands alone in the communication of bridge condition for decision making purposes. The most common and those presented here, are the NBI ratings for the three major structural components of the bridge (deck, superstructure, and substructure, or the culvert rating), deficient bridge classification, and structural condition rating.

The structural condition rating ranging from 'Very Good' to 'Very Poor' is based on the lowest of the deck, superstructure, substructure, or culvert ratings.

> **"THE MAJORITY OF THE 2,742 BRIDGES THAT ODOT MANAGES ARE IN FAIR CONDITION."**



Inventory Changes

ODOT currently manages 2,742 bridges. This year, five new bridges were added to the inventory including:

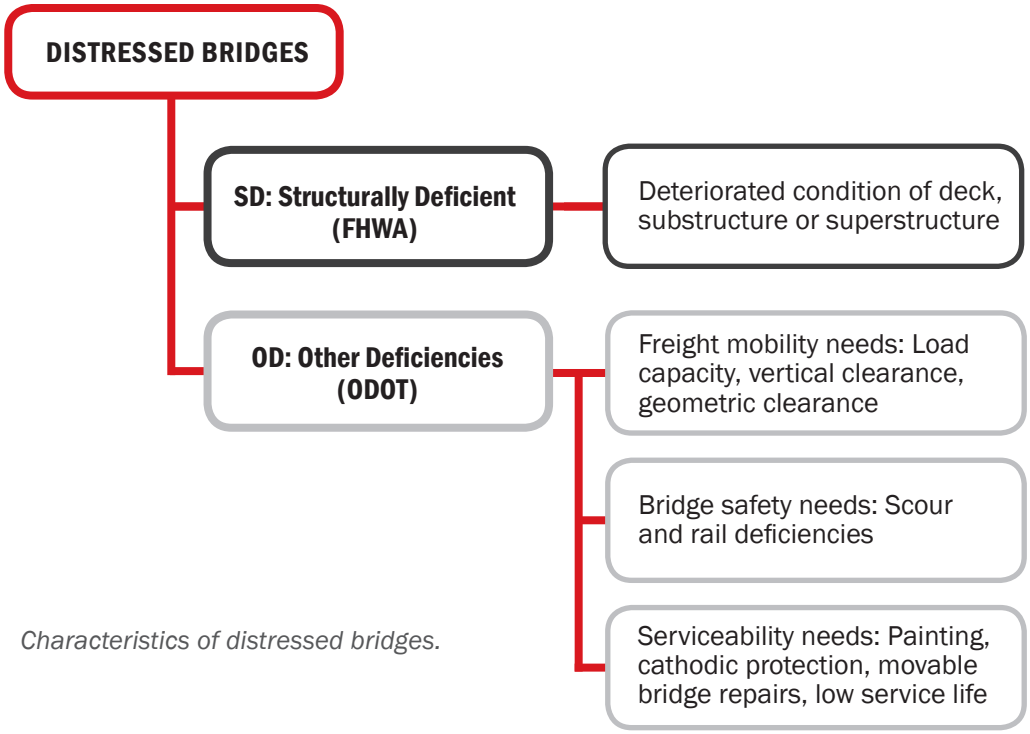
- 2 New bridges on a new alignment as part of the US 20 Pioneer Mountain Eddyville Project
- 2 New bridges that replace culverts for stream restoration
- 1 New bridge replacement of a 62-year old bridge to address load capacity issues

Key Performance Measure 16 (Percent of Bridges Not Distressed)

ODOT measures bridge conditions based on Key Performance Measure (KPM) 16 – Percent of Bridges Not Distressed (%ND). KPM 16 includes two categories of bridges: 1) the percent of bridges not SD as defined by FHWA and 2) the percent of bridges without other deficiencies (OD) as defined by ODOT. SD and OD components capture different characteristics of bridge conditions as shown.

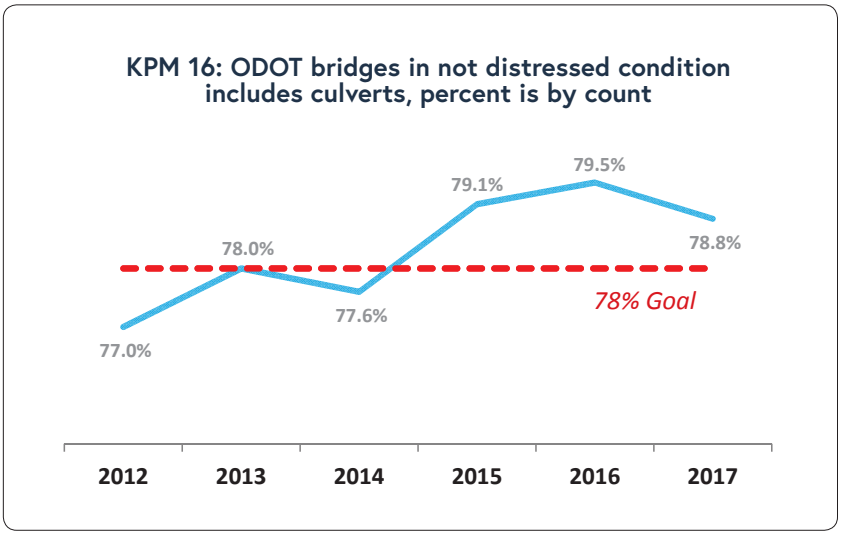
A condition of distressed indicates that the bridge is rated as SD or has at least one OD. ODOT considers both SD and OD aspects in determining bridge needs and selecting projects for the Statewide Transportation Improvement Program (STIP).

> **"ODOT ADDED FIVE NEW BRIDGES TO THE INVENTORY IN 2017 - ONLY ONE AS A RESULT OF DETERIORATING CONDITION."**



Characteristics of distressed bridges.

For 2017, KPM 16 equals 78.8%, slightly exceeding the target of 78%. However, compared to last year, the number of distressed bridges has increased mainly due to the aging bridge population (low service life) and updated load capacity evaluations indicating the potential need for weight restrictions. Overall, 2.2% of state owned bridges are SD and 19.0% are OD for a total of 21.2% distressed bridges by count.



ODOT bridges Not Distressed condition. Larger percentages are better.

> **CURRENT EVALUATIONS INDICATE A DECLINE IN THE PERCENT NOT DISTRESSED BRIDGES.**

Bridge Conditions By Region

The distribution of bridge conditions by ODOT Region is presented in Charts A and B. Region 2 which includes a large portion of the Willamette Valley, major coastal and high elevation bridges has the greatest number of distressed structures in Oregon. Of the 298 distressed bridges in Region 2, 56 are timber bridges requiring frequent maintenance.

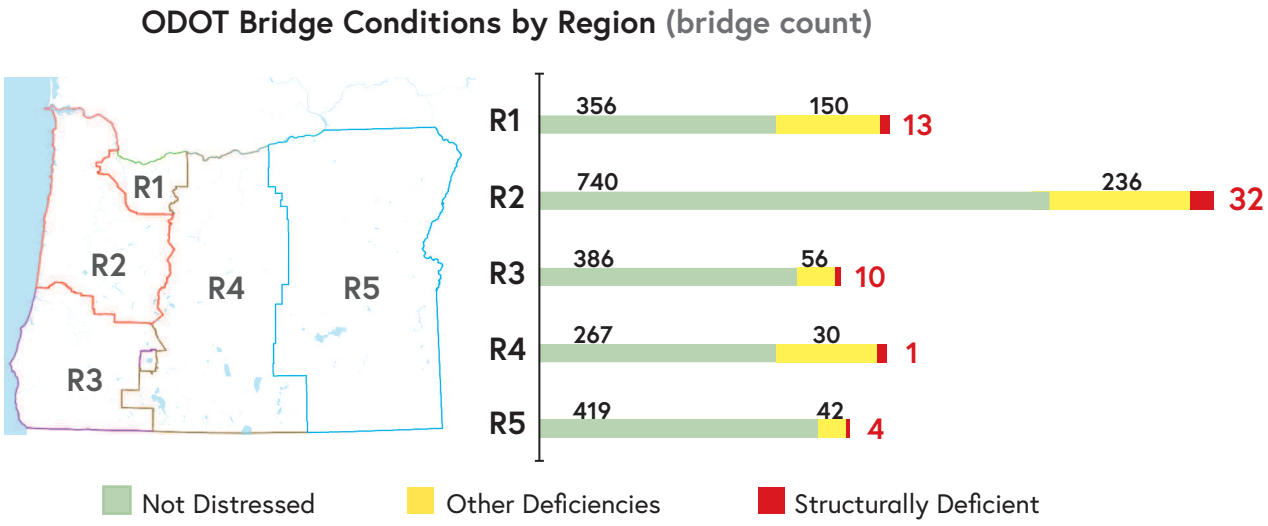


Chart A: *ODOT bridge conditions by count.*

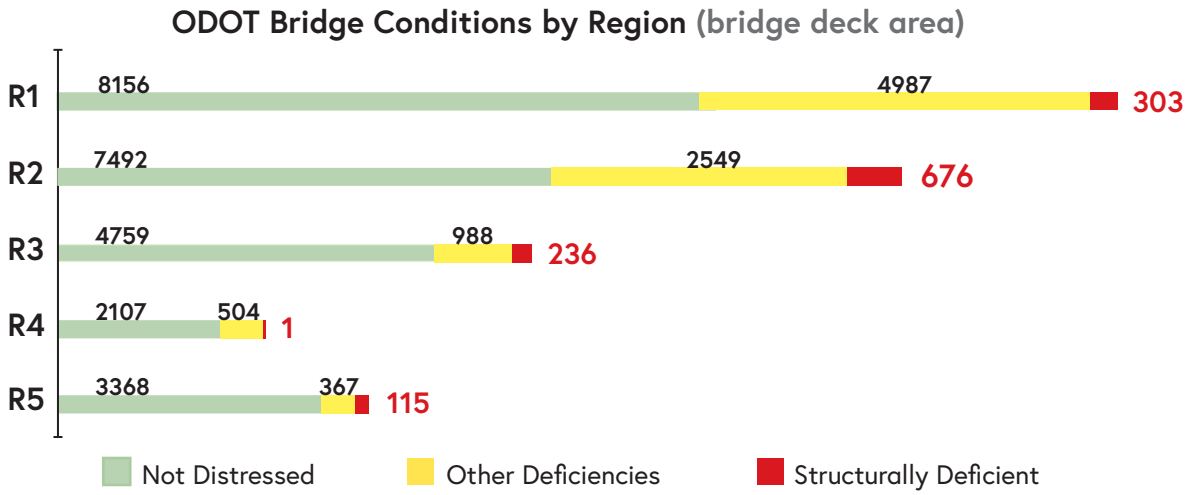
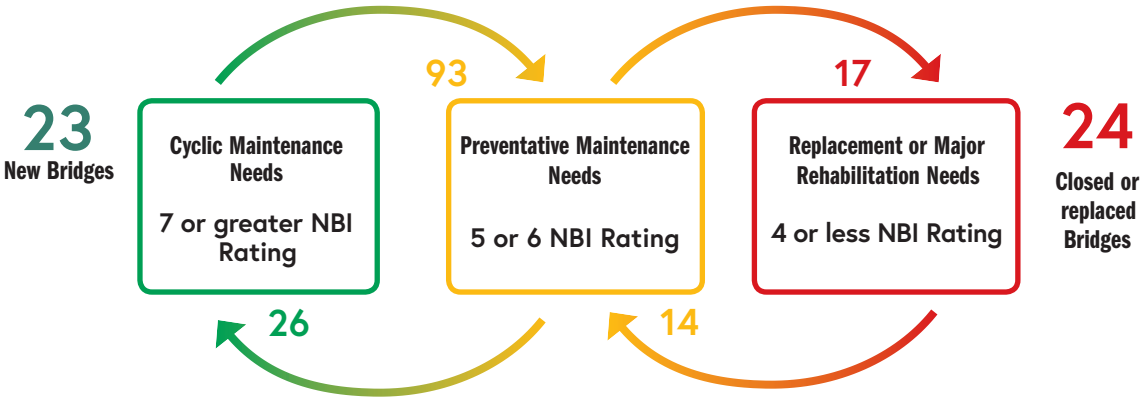


Chart B: *ODOT bridge conditions by 1,000 square feet of deck. Note that Region 1, which includes the Portland Metro area, includes the greatest quantity by bridge deck area.*

2015-2017 Changes In Condition Ratings

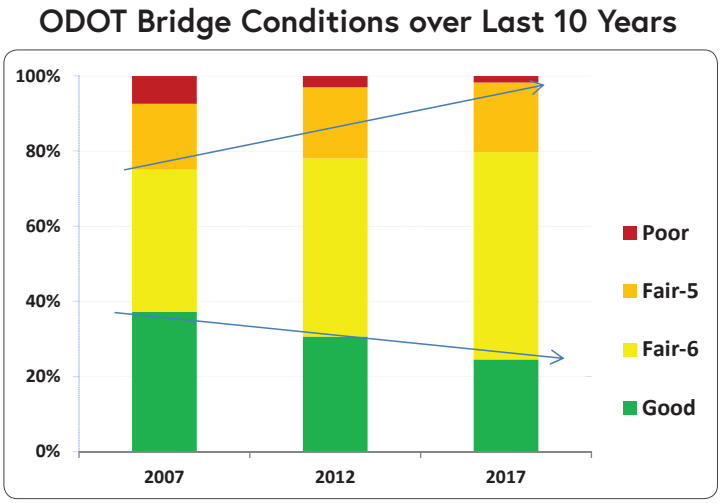
The chart below shows both the dynamic nature of bridge conditions and the growing backlog of work, for those bridges that have changed conditions. The period from 2015 to 2017 reflects bridge conditions over one full inspection cycle (24 months). In a balanced state, the number of bridges moving from green to yellow and red (deteriorating conditions) would be equal to the number moving from red to yellow and green (improving conditions). The chart shows that we are managing the Poor (Red) bridges reasonably well, but the transition of bridges from Good (Green) to Fair (Yellow), indicates that bridge preventative maintenance actions are not occurring at a rate necessary to maintain current conditions. Totals reflect two-year counts based on comparison of 2015 and 2017 snapshots.



2015-2017 Changes in Minimum Ratings of Superstructure, Substructure, or Deck Condition Ratings.

Condition Changes Over The Last 10 Years

An overall assessment of bridge condition changes can be determined by comparing previous to current NBI ratings. The chart below provides the percentage of bridges in good, fair and poor condition in the last ten years. Bridges are classified as fair if the NBI value is 5 or 6, however, a value of NBI=5 indicates more distress, as noted in the descriptions below. Of concern is the increasing number of bridges moving out of good condition into fair condition and the slightly increasing number of bridges in fair (NBI=5) condition which are the bridges most at risk of becoming structurally deficient.



Bridge conditions over last 10 years.

NATIONAL BRIDGE PERFORMANCE MEASURE

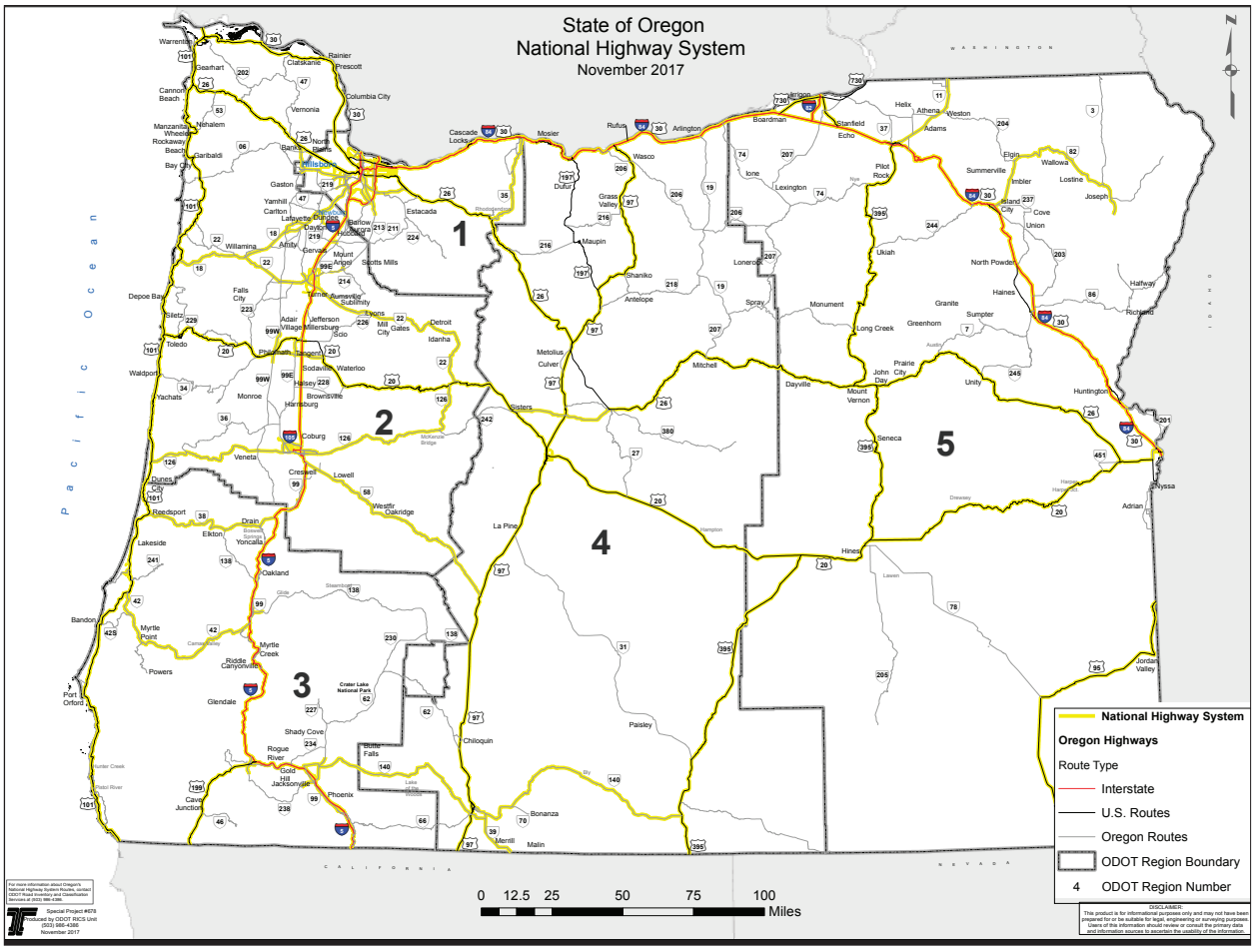
Condition Based Performance

Effective Date: May 22, 2017

The Moving Ahead for Progress in the 21st Century Act (MAP-21) requires states to establish bridge condition targets and report conditions based on specified performance measures including:

1. Percent of NHS bridges by deck area classified as in Good condition

2. Percent of NHS bridges by deck area classified as in Poor condition



National Highway System

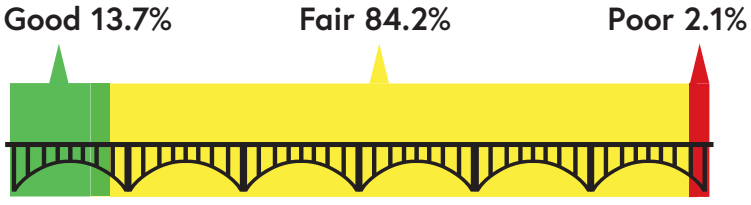
National Bridge Performance Measure Details

Oregon is required to develop condition targets determined from asset management analyses and procedures **that reflect investment strategies that work toward achieving a state of good repair** over the life cycle of assets at minimum practicable cost.

If for **3 consecutive years more than 10.0% of a State DOT's NHS bridges'** (see map) total deck area is classified as Structurally Deficient (poor condition), the State DOT must obligate and set aside National Highway Performance Program (NHPP) funds for eligible projects on bridges on the NHS.

2017 Oregon National Bridge Performance Measure Values

Oregon expects to be able to maintain bridge conditions and not exceed the 10% threshold of bridges in poor condition for now. However, with so many bridges in fair condition on the cusp of becoming poor, maintaining bridge conditions in the future will be challenging.



2018 PLAN

Jan 1 — 1st 4-year performance period begins.

May 24 — Initial 2-and 4-year targets established.

Oct 1 — Baseline Performance Period Report for the 1st Performance Period due. State DOTs report 2-year and 4-year targets; etc.

BRIDGE PROGRAM UPDATES

	1 Major Bridge Maintenance	2 Seismic Bridge Program	3 Bridge Preservation	4 Bridge Rehabilitation/ Replacement
Focus	Smaller scale bridge work and emergency repairs	Phase 1 Seismic Plus bridges	Work on steel, coastal, and/or historic bridges	Significant work needed to address bridge function and/ or deterioration
Work Types	Deck seals, timber pile repairs, joint work	Retrofits, Replacements	Painting, Cathodic Protection, Stealth Rail	Vertical clearance, deck overlays or replacements, scour mitigation, strengthening
Funding	$10M/year	$20M-$30M/year	$20M-$30M/year	$70M-90M/year

Projected Funding based on HB 2017.

Damaged bridge bearing ledge.

Bridge crew on Ross Island Bridge.

Painting project on Thomas Creek Bridge.

A summary of work that has been recently accomplished in each category follows. The data is up to date as of September 2017 following the addition of projects to the 2018-2021 STIP as a result of HB 2017.

1 Major Bridge Maintenance

Damaged bridge joint

Beaver Creek timber bridge

Failed deck

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 the STIP. MBM highlights include:

- Approximately 200 projects are selected annually.
- Total estimated value of $8,000,000.
- Starting in 2018, funding will increase to $10,000,000/year.

Significant effort goes into deck treatments as the deck is typically the highest value item on a bridge. It is also at the highest risk due to its exposure to weather, de-icing chemicals, and wear from traffic. When concrete decks are cracked, the risk to the deck is elevated because there are now pathways for water and de-icing chemicals to get deep into the concrete to the level of the reinforcing steel. Once the reinforcing steel begins to corrode costly deck rehab or replacement will be required.

> **"THE VARIETY AND VOLUME OF WORK PERFORMED BY THE MBM PROGRAM IS WHAT MAKES IT A KEY COMPONENT IN MAINTAINING OREGON'S INFRASTRUCTURE."**

MBM Accomplishments

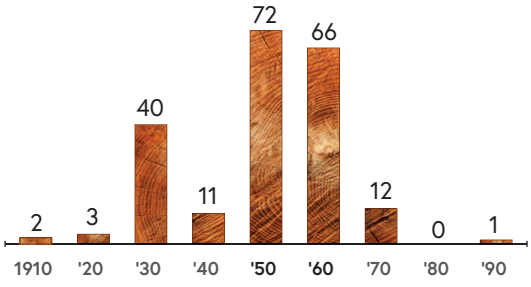
Activity Type	Objective	Action(s)	Number	Total Cost
Urgent maintenance	Address defects identified during routine bridge inspections that need to be corrected as-soon-as-possible or pose a traffic safety concern	Repair damaged joints, replace deteriorated timber members, and fix fatigue cracks in steel beams	29	$1,360,000
Deck Treatments	Preventive maintenance: Seal cracks on decks in good condition to reduce exposure to weather and de-icing chemicals	Deck seals	30	$989,000 (505,000 sf)
	Rehab and seal decks that include rutting, exposed rebar, or a polished wearing surface to extend the service life 10 to 15 years	Deck overlays	43	$1,700,000
	Preserve/seal the decks of bridges with asphalt concrete wearing surfaces	Waterproofing membranes	11	$1,700,000
Miscellaneous	Address issues associated with scour, joints, timber, approaches, bearing replacements, and maintenance on the movable bridges		Many	~$2,000,000

Repaired timber pile at Flat Creek Bridge.

Timber Substructure Conditions—High Demand on MBM

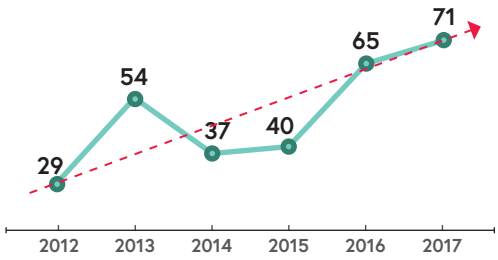
Oregon has 207 bridges with timber substructures that are State owned and part of the National Bridge Inventory (NBI). **93% of these bridges have exceeded the original design life of 50 years.** To keep these bridges in service requires continued maintenance to repair/replace members that have rotted to the point of no longer being able to safely support service loads.

Timber Substructures Constructed by Decade



Repairs to timber substructures continue to be a substantial percentage of the overall MBM program. There are 75 timber substructures which have at least moderate levels of degradation. As this population of bridges ages, it is expected that the frequency and urgency of timber substructures repairs will continue to escalate. In 2016, the MBM program funded 30 timber repair projects to address 45 piles and 20 caps that were deteriorated. In 2017, the MBM program has funded 37 repair projects to address 54 piles and 17 caps at a total anticipated cost of $1.5M.

Total Timber Piles and Caps Replaced in Recent Years



The South Yamhill Bridge on OR 18 is a good example of how larger timber substructures can dominate maintenance resources. This bridge was constructed in 1951 on 34 timber bents and measures 990 ft in length. To date, 85 of the original 204 timber piles have been repaired (some more than once) and 13 of the original 34 timber pile caps have been repaired with steel. The local ODOT bridge crew responds on an almost yearly basis to perform high or urgent priority repairs.

Repaired timber pile at South Yamhill River Bridge.

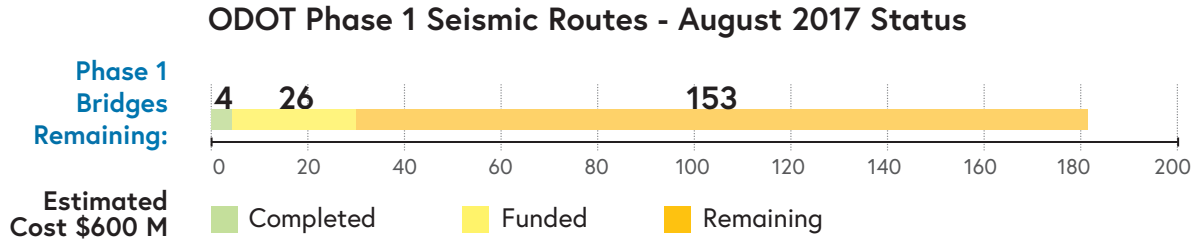
Although the dollar value of these repairs isn't tremendous, they do monopolize the available maintenance and design resources preventing other repairs from being completed. As the population of timber substructures continues to age the percentage of maintenance resources dedicated to repairs is expected to substantially increase.

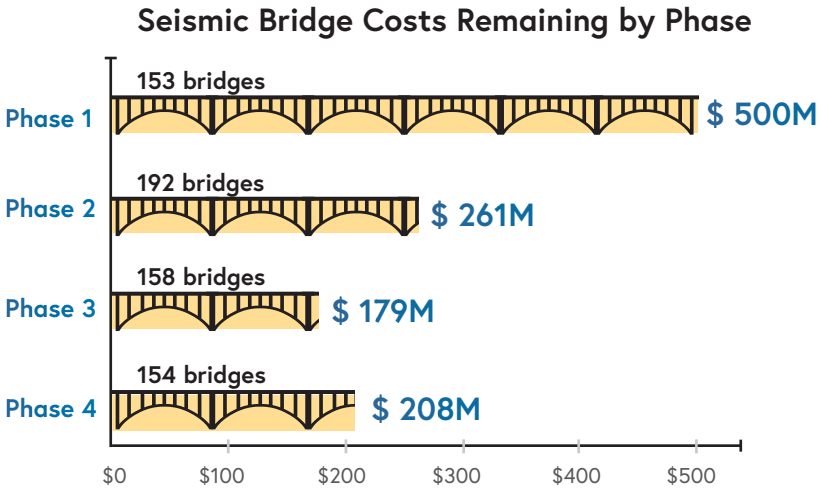
2 Seismic Program Status

The 2014 Seismic Plus report identified five phases of bridge seismic work to "provide the maximum degree of mobility with reasonable investments spread over several decades." The goal of the phasing is to "retrofit all seismically vulnerable bridges and address unstable slopes on key lifeline routes in a strategic and systematic program to allow for rescue and recovery following a major earthquake.

Additional funding to address seismic improvements related to highways and bridges is included with the recently passed transportation package, HB 2017. With the new funds, ODOT plans to work on Phase 1 bridges moving from Eugene, north on I-5 and finishing up on I-84 moving from east to west in 20 to 30 years. Phase 1 Seismic Routes are shown on the next page.

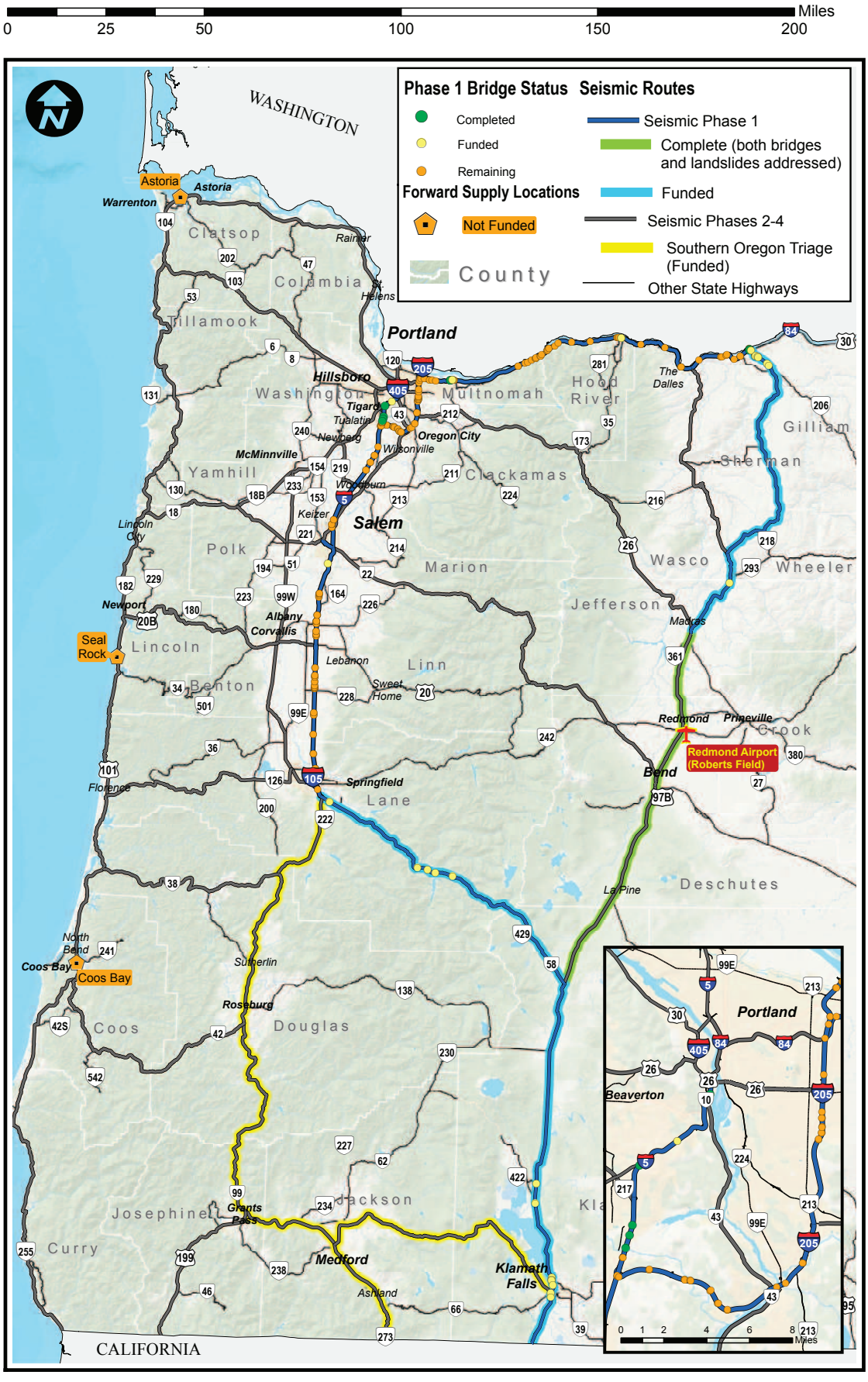
Phase 1 **Provides a connection to the Redmond Airport; east-west freight movement and a north-south corridor on US97 -- the cornerstone of the program.**





Phase 5 includes 12 bridge replacements like the Medford Viaduct, the Ross Island Bridge, several historic coastal bridges and other large bridges. **The estimated replacement costs total $1.5 billion.**

ODOT Phase 1 Seismic Routes - August 2017 Status



Other Funded Seismic Projects

HB 2017 provided funding for an additional seismic project entitled the Southern Oregon Triage strategy. The strategy focuses on mitigating seismic impacts along Interstate 5 south of Eugene, and OR 140 which are key lifeline routes to and from the Rogue Valley. Most of the seismic impacts on the routes are expected to be addressed through quick repairs or temporary detours. The funding will be used to address those bridges and potentially unstable slopes that are more problematic or where a feasible detour does not exist.

Seismic Response Kits to be located at maintenance station facilities on the coast at Astoria, Seal Rock and Coos Bay are being considered but are currently not funded. The purpose of the Seismic Response Kits is to stockpile key materials and supplies that can be used to assist local communities in the early days following a seismic event. The kits will include culvert pipes of various sizes; construction materials; solar power generators and trailer mounted solar light panels; diesel and unleaded fuel storage tanks; survival supplies (water, field rations, first aid supplies); power tools; batteries; portable boats; flat railroad cars; and satellite phones and Ham radios.

Bridge damage caused by historic earthquakes. Photos courtesy of USGS.

3 Bridge Preservation: Painting & Cathodic Protection

Bridge painting and cathodic protection (CP) are critical tools for preserving Oregon's steel and concrete coastal bridges. Without these tools, many of the historical bridges like the St. Johns Bridge in Portland or the Siuslaw River Bridge in Florence would be at risk of continued deterioration to the point of needing replacement.

Coastal and steel bridge conditions are monitored by the ODOT Bridge Preservation Unit to identify painting and CP needs, develop designs, and ensure timely treatment to maintain the integrity of the bridges. The treatments are labor intensive and expensive but still economical in terms of extending the life of a bridge versus replacement.

Corrosion damage on Old Youngs Bay Bridge

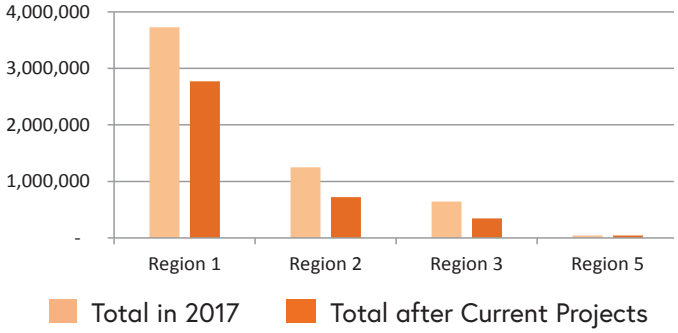
Painting project on Ross Island Bridge

Steel Bridge Paint Conditions

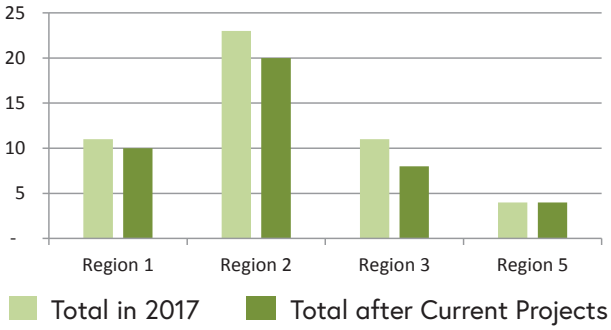
ODOT is responsible for more than 330 painted steel bridges with over 27 million square feet of surface area. Bridge paint conditions are collected during regular bridge inspections. Painting steel bridges (applying a protective coating) is vital to preserving and extending the service life of the state's bridge system. Timely applications of protective coatings prevent steel corrosion and any subsequent structural capacity loss.

Bridges with 15% or greater painted surface area in poor (Condition State 3) or severe (Condition State 4) are considered distressed and the painting distress is documented as an other deficiency (OD). The quantity of painted surface in poor and severe condition is significant with Region 1 having the largest quantity by area and Region 2 having the largest quantity by count, as shown.

Area of Steel Bridges Classified as Deficient (sf)



Number of Steel Bridges Classified as Deficient



Steel bridge painting needs exceed the available resources available. With limited funding, bridges are prioritized based on condition state, environment, freight routes, and historical significance. Bridges, like the fourteen Conde McCullough designed bridges along US Route 101, are the highest priority as they are considered irreplaceable due to their historical significance and high replacement cost.

Seven bridges are currently under contract for painting and other associated repairs, with a total project cost exceeding $90 million. The table below lists the bridges and their locations. Additional projects are in the design phase that will address some of the backlog, however,bridge painting needs are recurring.

RECENT PAINTING PROJECTS

Region	Key Number	Bridge Name	Hwy	MP	Total Project Cost
1	17523	Willamette River (Ross Island)	US 26	0.8	$28,873,603
2	18078	Old Youngs Bay Bridge	US 101	6.9	$21,196,924
		Lewis & Clark River	US 101	4.8	
2	17528	Columbia River (Astoria) Bridge	US 101	2.4	$17,559,902
3	18600	Reinhart Creek	US 101	311.4	$13,912,832
		Thomas Creek	US 101	347.8	
3	19207	Isthmus Sl (Eastside) Bridge	OR 241	0.4	$9,703,497

Bridge Preservation with Cathodic Protection

Cathodic protection (CP) is a cost effective technique used to extend the life of Oregon's coastal bridges constructed with concrete. In some cases, bridges initially planned for replacement due to corrosion are being considered for CP as an alternative. Although a bridge replacement would provide more than 75 years of service, for less money CP can extend the life about 30 years, allowing Bridge Program funds to be expended on other needs.

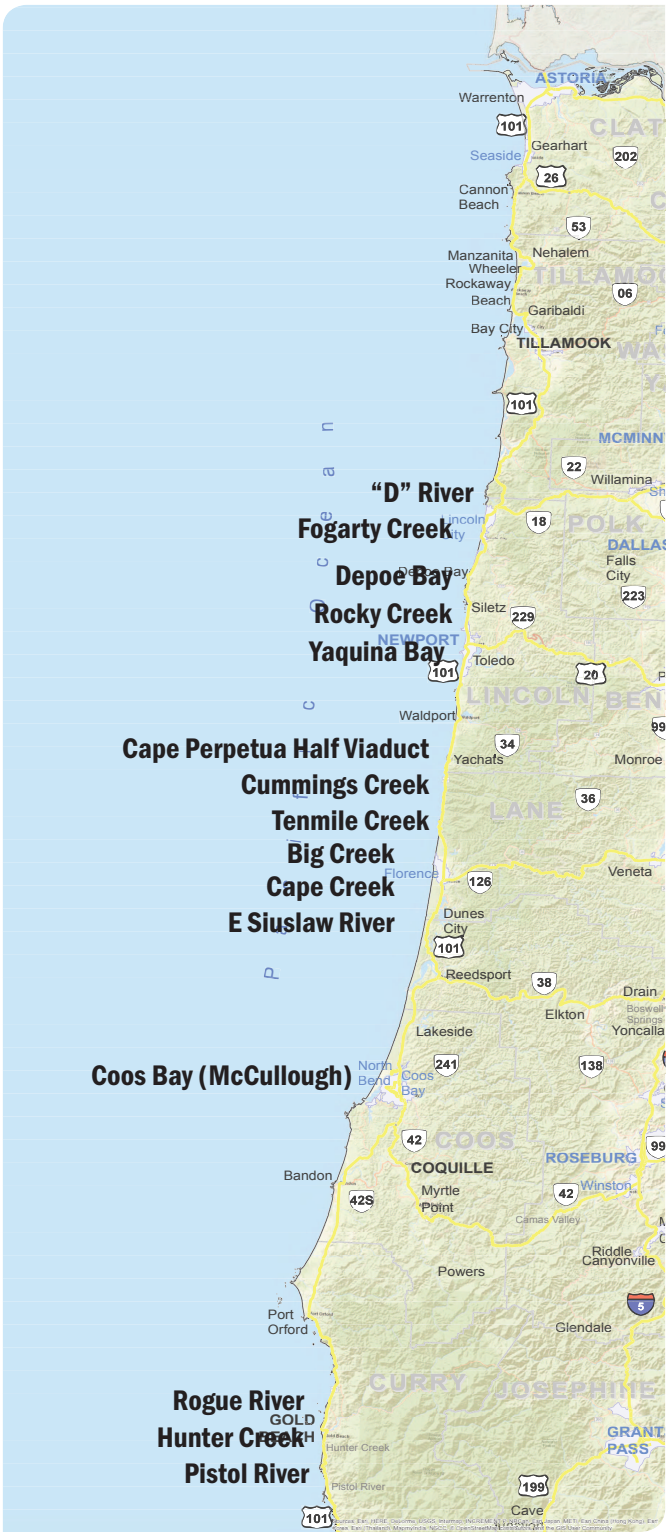
To understand cathodic protection (CP), it's important to first understand what happens without it. Bridges along the coast face extreme conditions in comparison to the valley or high desert of Oregon. When a concrete bridge is exposed to high levels of salt water, the salt can migrate through the concrete coming in contact with the reinforcing steel creating a chemical reaction that is corrosion. The rust formed as a result of corrosion takes up more space than the steel forcing the concrete to crack and eventually break away or spall.

Corroded reinforcing steel prepared for cathodic protection.

Cathodic protection application (zinc).

PROGRAMMED AND UPCOMING CATHODIC PROTECTION PROJECTS

Region	Key Number	Bridge Name	Hwy	MP	Total Cost	Notes
2	18599	Devils Lake Outlet ("D" River)	US 101	114.88	$3,500,000	Going to bid in 2018.
2	20110	Depoe Bay	US 101	127.61	$300,000	Funded for PE only.
2	20109	Yaquina Bay, South end	US 101	141.68	$20,623,600	Going to bid in 2020; HB 2017 funding.
2	19457	Yaquina Bay	US 101	141.68	$23,400,000	Going to bid in 2018.
		Cape Perpetua Half Viaduct	US 101	166.46		
		Cape Creek	US 101	178.35		
2	17526	Siuslaw River	US 101	190.98	$19,412,880	Currently under contract.
3	18870	Garrison Slough	US 101	300.00	$2,238,000	Going to bid in 2019.



Approximate CP Bridges locations.

Cathodic protection most often includes an electrical current that allows the reinforcing steel to resist the salt; and an anode (like zinc) applied to the bridge that keeps it away from the reinforcing steel. The zinc may be sprayed on as a coating or pucks may be embedded in the bridge concrete. Putting it all together -- electrical current facilitates the salt movement, the zinc attracts the salt and the reinforcing steel is left intact.

Oregon's first cathodic protection (CP) system was installed in 1985 at the Yaquina Bay Bridge; to date ODOT has applied CP to over a million square feet of concrete on Oregon's Coastal bridges.

ODOT currently has a CP project under construction in Florence and five others in the design phase, as noted in the table on the previous page, with a total cost exceeding $60 million over the next four years.

The map on the left shows the location of previous (and future) bridges preserved with CP.

4 Bridge Repair and Replacements

BRIDGE WORK DESCRIPTIONS

Deck Work

Construct Overlays, seals, membranes, new AC paving

Bridge Repairs

Repair concrete, steel bridge components, paint, install cathodic protection, repair joints

Rail/Screen/ Vertical Clearance

Upgrade non-standard rail to meet safety standards; install screening on interstate overpasses; increase vertical clearance on critical freight routes

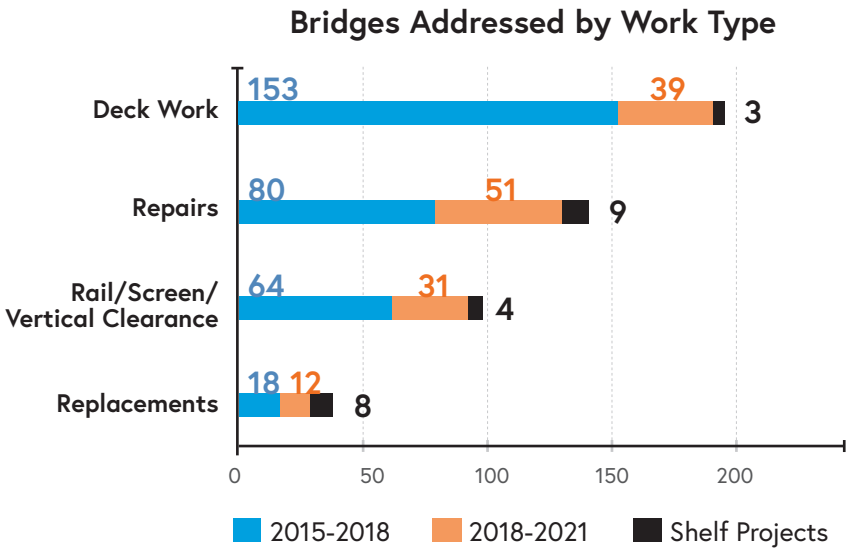
Bridge Replacement

Replace bridges due to deterioration and/or function

The breakout of work types by time frame on the next page provides a general overview of the extent of the variety of work done to manage the State's bridge network. The data is up to date as of October 2017 so reflects projects added as part of the new transportation package, HB 2017. Note that the number of bridges that received work is not the same as the number of projects as there may be multiple bridges in a project. Also, the work types may overlap in the counts as a bridge may have had deck and repair work or repair and rail work, etc.

The majority of ODOT bridge work focuses on preserving bridge decks. Whenever possible, bridge deck preservation work is incorporated into pavement preservation projects for efficiency.

Eighteen shelf projects are underway including eight for bridge replacements. Shelf projects are funded for design and are available for construction funding when funds are available either through savings from other projects or unanticipated funding. Shelf projects not funded in the current STIP cycle will be the highest priority for the next STIP cycle.



> **THE MAJORITY OF ODOT BRIDGE WORK FOCUSES ON PRESERVING BRIDGE DECKS.**

The breakout of work types by time frame indicates that more bridge work was done in 2015-2018, particularly deck work, than is currently programmed in 2018-2021. Because project programming is dynamic, work done in the 2015-2018 timeframe may have funding originally programmed in 2012-2015. In addition, the bridge work planned as part of other projects in 2018-2021 has not yet been captured in the data or in some cases will be developed during project design.

2017 TUNNEL DATA

Oneonta Tunnel following the 2017 Eagle Creek Fire

Tooth Rock Tunnel being inspected following the 2017 Eagle Creek Fire

Introduction

Keeping ODOT tunnels functioning with regular monitoring and timely maintenance is critical to ensure safe passage for all users. In addition, minimizing tunnel closures is critical to prevent hardship for the travelling public in the area served by the tunnel.

ODOT manages nine state-owned vehicular tunnels and is responsible for all inspection, maintenance, and major rehabilitation of the structures. ODOT also provides inspection of two pedestrian tunnels that were formerly vehicular tunnels and starting in 2017, six vehicular tunnels owned by other road agencies.

Inspections have been performed on ODOT tunnels for more than 20 years based on the National Bridge Inspection Standards (NBIS), modified by Oregon DOT Tunnel Inspection Procedures. Under the ODOT program, tunnels were on a two-year regular inspection cycle, with in depth inspections on a 10-year cycle and drainage inspections each year by the ODOT district maintenance crews.

New National Tunnel Inspection Standards (NTIS) Implementation

Federal Highway Administration (FHWA) guidelines now require State DOTs to follow the new National Tunnel Inspection Standards (NTIS) for the inventory, inspection and load rating of tunnels. In March 2018 and annually, thereafter, ODOT is required to provide a snapshot of Oregon tunnel conditions to the FHWA.

The data provided in the table on the next page is based on the new NTIS standards with the exception of the Arch Cape Tunnel inspection which is based on the old ODOT procedure. Updating to the new standards has resulted in a revised assessment of the structural condition for many of the tunnels.

TUNNEL CONDITIONS AS OF AUGUST 2017

Region	District	MP	Tunnel	Tunnel Name	Year	Length, ft	Materials	Condition	Owner/Notes
1	22	73.5	09103	Vista Ridge Tunnel, Hwy 47 EB	1969	1002	Reinforced Concrete	Good	ODOT
1	22	73.6	9103B	Vista Ridge Tunnel, Hwy 47 WB	1970	1048	Reinforced Concrete	Good	ODOT
1	23	41.2	04555	Tooth Rock Tunnel, Hwy 2 EB	1936	827	Reinforced Concrete	Fair	ODOT
1	23	20.2	20318	Oneonta Tunnel (Bike/Ped), Hwy 100 at MP 20.15	2008	115	Shotcrete	UKN[1]	ODOT (Pedestrian traffic only)
2	01	35.7	02247	Arch Cape Tunnel, Hwy 9	1937	1228	Shotcrete/ Concrete	Good[2]	ODOT
2	01	40.9	02552	Sunset Tunnel, Hwy 47 (Dennis L Edwards Tunnel)	1940	772	Shotcrete/ Concrete	Good	ODOT
2	05	56.1	02539	Salt Creek Tunnel, Hwy 18	1939	905	Reinforced Concrete	Fair	ODOT
2	05	178.5	03961	Cape Creek Tunnel, Hwy 9	1931	714	Shotcrete/ Concrete	Good	ODOT
2	05	19.7	07139	Knowles Creek Tunnel, Hwy 62 at MP 19.68	1958	1430	Reinforced Concrete	Good	ODOT
3	07	39.8	03437	Elk Creek Tunnel, Hwy 45	1932	1090	Shotcrete	Good	ODOT
4	09	56.0	00653	Mosier Tunnels	1920	369	Shotcrete	Good	ODOT (Pedestrian traffic only)
Other Agency Tunnels			51C26	W Burnside Tunnel	1940	230	Reinforced	TBD	PDX
			51C32	Rocky Butte Tunnel	1939	400	Reinforced Concrete	TBD	PDX
			25B125	Cornell Tunnel #1, NW Cornell Rd	1940	497	Reinforced Concrete	TBD	PDX
			25B127	Cornell Tunnel #2, (W), NW Cornell Rd	1941	247	Reinforced Concrete	TBD	PDX
			22473	Copperfield Tunnel, Homestead Rd	1910	370	Unknown	TBD	Idaho Power
			22476	Owyhee Tunnel, Owyhee Lake Rd	1929	200	Rock	TBD	Malheur County

[1] *Structural condition unknown following the 2017 Eagle Creek Fire.*

[2] *Structural condition based on old ODOT Tunnel Inspection Procedures.*

The condition update does not necessarily reflect an actual change in condition but a change in how the condition is assigned. The primary feature that drives the overall tunnel condition is the liner. Previously, the ODOT procedure accounted for liner defects by linear feet versus the NTIS method which accounts for defects by square feet. For example, a horizontal crack could extend the entire length of the tunnel. Under the old ODOT system the crack would affect the condition of the entire tunnel liner; however, under the NTIS system, the crack only represents a small percentage of the total tunnel liner. As ODOT collects more data under the new NTIS standards, all tunnel data collected will be reviewed and analyzed to ensure the overall tunnel condition is accurately assigned.

WHERE ARE BRIDGE CONDITIONS HEADED?

Yaquina Bay Bridge inspection

Salt Creek Bridge

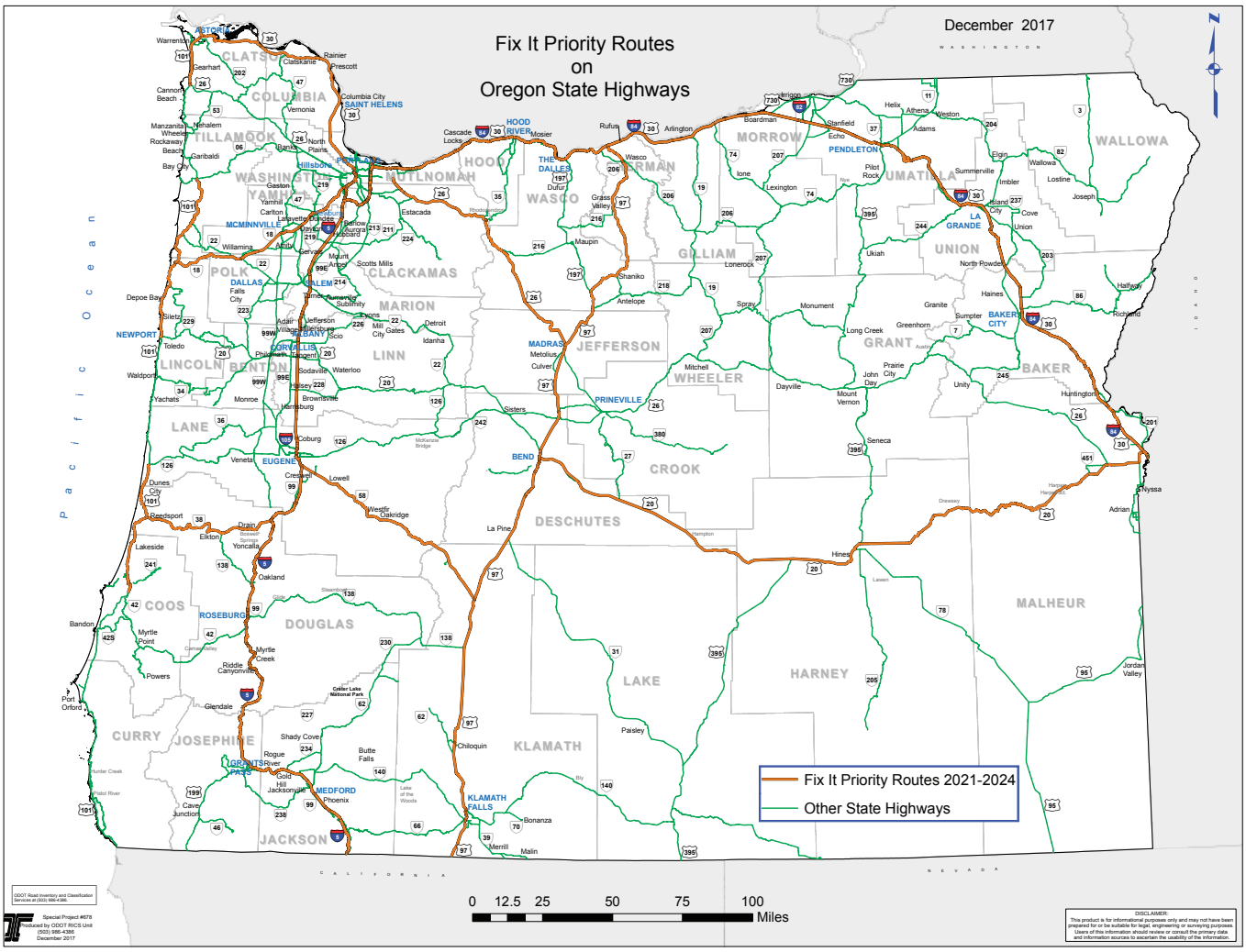
Old Youngs Bay Bridge

Bridge Condition Projections following passage of HB 2017

Recent passage of HB 2017 provides increased funding for the Bridge Program. Projected conditions based on the increase will essentially maintain current bridge conditions. Long term projections are less optimistic.

Funding will continue to be focused on highest priority Fix It Routes that carry the highest volumes of vehicles, particularly trucks. The Fix It Routes are shown on the map on the next page.

Lower priority Off Fix It Route bridges will be repaired or replaced as possible with STIP funding, however, a majority of the repairs will be addressed through the MBM program. The MBM program budget was recently increased from $8,000,000 to $10,000,000 per year in order to keep up. In the future, the need is expected to exceed the funding capacity along with the staffing (maintenance crews, contract administrators) needed for project delivery.

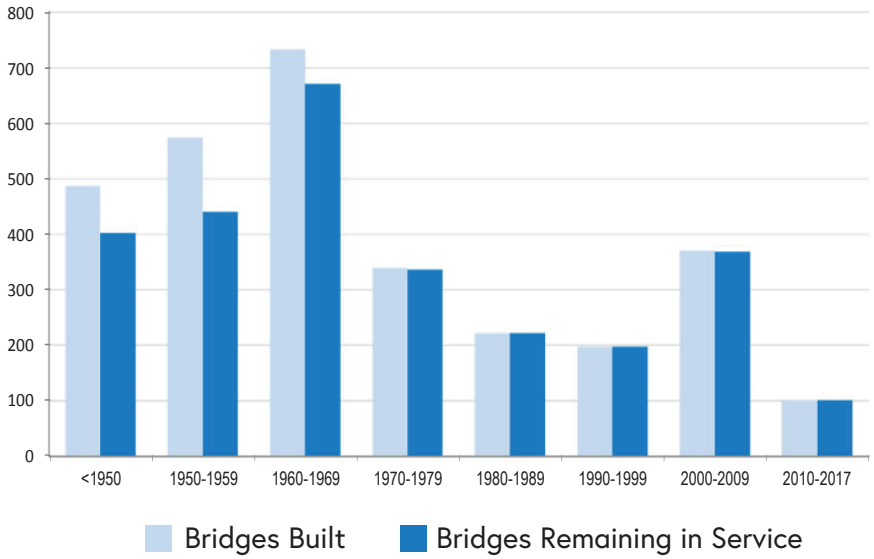


ODOT Fix It Priority Routes

McCord Creek Bridge inspection

Predicting bridge conditions over time is challenging as the outcome depends significantly on the assumptions used and unknown risks like storms and fires. While the number of bridges that will be distressed over time is an estimate, the overall trend is that more bridges will reach poor condition due to the aging system and the large number of bridges built during the Interstate-era, as shown.

ODOT Bridge Built and Remaining by Decade

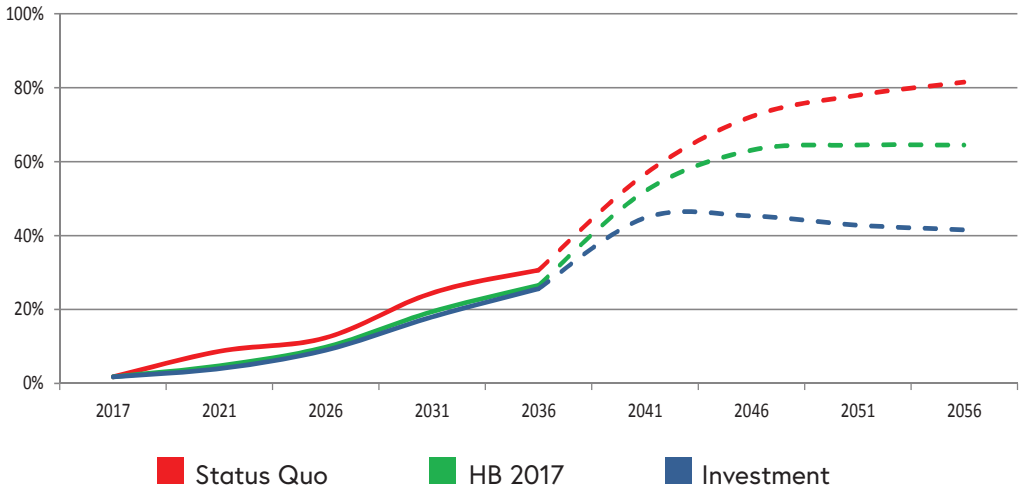


> **NEARLY 50% OF ODOT'S BRIDGES ARE OVER 50 YEARS OLD.**

Bridge condition projections were made for various funding levels during the development of HB 2017. Three scenarios were compared including:

1. Status Quo funding at $85M/year (pre-HB 2017)
2. HB 2017 funding based on all bridge work currently programmed, in the DRAFT STIP, and the additional bridges identified for the $100M associated with the new funding to 2021. From 2022 to 2036, the projection is based on $140M/year. Note however, that the exact funding levels have not yet been set.
3. Investment (Strategic Funding) from now until 2036 is based on $185M/year.

All Route Bridge Condition Projections-Percent Poor



Projections past 2036 are based on analyses and engineering judgement. What is known is that in 2036 the Interstate Era bridges will be at the end of their design lives with many approaching the end of their service lives.

HB 2017 provides additional funding for the Fix It program to ensure that deteriorating bridges on Oregon's highest priority routes can be addressed before they impede mobility or force trucks to detour. However, for all scenarios, overall bridge system conditions will continue to deteriorate resulting in an increase in the number of poor bridges. In the short term, the number of poor bridges is expected to be manageable through programs like MBM, painting, cathodic protection and bridge repair projects. However, the large population of aging bridges will result in substantially more needs in the future.

The increase in funding associated with HB 2017 will not change the bridge strategy except that a small amount of funding will increase the seismic resiliency on Phase 1 seismic routes. The focus will remain on bridge rehabilitation versus bridge replacement.

Rail Repair: Applegate Pioneer Bridge

2017 BRIDGE CONDITION REPORT & TUNNEL DATA

http://www.oregon.gov/odot/bridge/pages/index.aspx

Oregon Department of Transportation