Oregon Department of Transportation

2024

Bridge Condition Report
& Tunnel Data

Oregon Department of Transportation

Siuslaw River Bridge.

2024 BRIDGE CONDITION REPORT & TUNNEL DATA

Compilation by Michael McDonald

Interstate Era Highway Bridges by Bert Hartman, P.E.

Major Bridge Maintenance Program article by Orren Jennings, P.E.

Bridge Preservation Program article by Fred Gomez, P.E.

Seismic Program article by Albert Nako, P.E.

Load Rating Program article by Jon Rooper, P.E.

Tunnel Data article by Bruce Novakovich, P.E.

Photos courtesy of ODOT Flickr team unless noted by instance

Lead editing by Jill Pearson

Publication design by Carlee Justis

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The 2024 Bridge Condition Report provides a snapshot of the condition of bridges in Oregon that are on state highways. Condition information is measured by Oregon's Bridge Key Performance Measure and by the National Bridge Performance Measure. In addition to condition information, there is information on bridge programs that are in place to manage and preserve state highway bridges. These include Major Bridge Maintenance, Bridge Preservation, the Seismic Program, and Load Rating. Efforts to maintain and preserve existing bridges are critical. With adequate funding, approximately 27 state highway bridges would be replaced annually which is consistent with a 100-year service life.

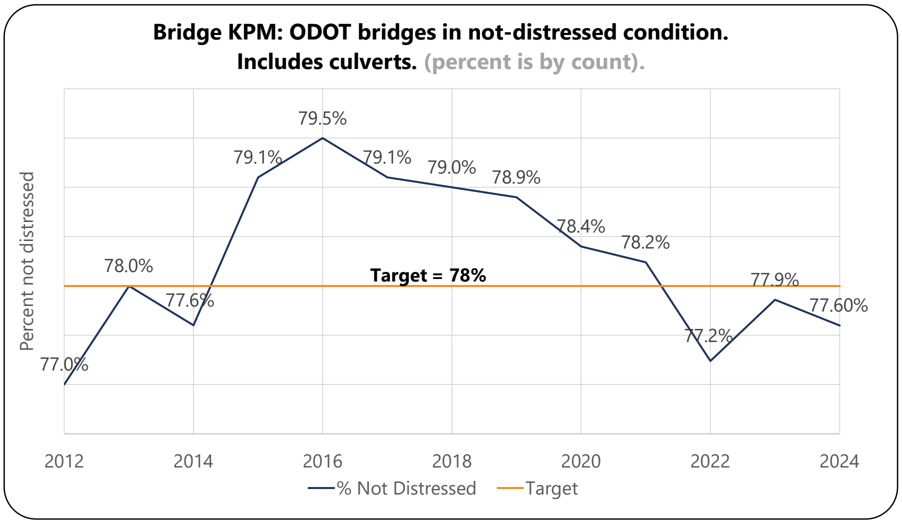
The highlight for this year's report is on Interstate Era Bridges. The Interstate Era began in 1958 and lasted until 1973. During this 16-year span, ODOT built on average 63 bridges a year until 1973. It was funded by the National Interstate and Defense Highways Act of 1956, which established the interstate highway system in the United States and cost $25 billion. These bridges are now between 50 and 65 years old. The normal lifespan of a bridge is between 75-100 years. At some point in the future there will be a 16-year period when approximately 1,000 Interstate Era Bridges will need to be replaced. ODOT is currently funded to replace on average three bridges per year and at this rate only 75 bridges will be replaced between 2025 and 2050, when most of these bridges will reach 90 years old. Current funding levels delay confronting this issue in a way that adds to the already heavy burden of replacing all the Interstate Era Bridges.

This Interstate Era Bridge is one of four bridges at the North Albany Interchange where I-5 crosses over Oregon 99E.

2024 Bridge Condition Report Content

Bridge Conditions: With only an average of three bridges replaced annually, ODOT continues to lose ground in the effort to manage the system. Although a significant portion of these bridges are in fair condition at this time, in the following decades, the agency will be burdened with a huge responsibility to maintain or replace the 40% of the inventory built between 1951-1970, as they continue to deteriorate.

Bridge Key Performance Measure (KPM): The overall trend since 2016 has been down and is consistent with a decrease in the percentage of bridges in good condition that are reported in the National Bridge Performance Measure.



ODOT bridges in not distressed condition. Larger percentages are better.

National Bridge Performance Measure (NBPM): Oregon is meeting the requirements of the National Bridge Performance Measure, especially in the low percentage of deck area for bridges that are in poor condition. At the same time, Oregon has the lowest percentage of deck area for bridges that are in good condition when compared to six other western states.

Major Bridge Maintenance (MBM): The MBM program continued to provide tremendous value to the bridge program in 2024 by repairing six bridges in poor condition and addressing 63 other bridges with high priority maintenance recommendations. The program also funded projects to seal concrete bridge decks to protect against winter chemicals, replace deteriorated asphalt, and perform routine maintenance on many other bridges.

Bridge Preservation: The Preservation program includes the preservation of the historic coastal bridges that were built in the 1930s and economic-focused preservation of high-value bridges statewide. Typical preservation projects include applying corrosion resistant coatings, strengthening bridges and maintaining moveable bridges. The program's objective is to preserve historic bridges while subtly achieving modern-day design standards. Current examples of this work in the 2024-2027 STIP cycle range from applying impressed cathodic protection on the Depoe Bay Bridge to replacing the bridge deck on the Gold Hill Bridge over the Rogue River. Preservation projects for the 2027-2030 STIP cycle are currently under consideration.

Seismic Program: Seismic retrofit construction is underway on the southern portion of U.S. 97, which is designated as a primary north-south lifeline in the aftermath of a major earthquake. Construction is also underway on Oregon 58 and near completion on the Southern Oregon Seismic Bridge Retrofit project. Also, construction activities are in full swing on I-205 Abernethy Bridge and the Van Buren Bridge in Corvallis.

Bridge Load Rating: Our Load Rating program assessed 93 structures during 2024 and placed new or revised restrictions on 16 structures. We were also able to remove the restrictions for five bridges due to construction projects or advanced load rating analysis. Of our total inventory, 15.2% of our structures have at least one weight restriction. Efforts to legalize larger and more robust vehicles – to haul freight and deliver emergency services – pose an ongoing concern. While these larger vehicles allow for greater efficiency by hauling more goods or carrying emergency tools, they pose a significant risk to Oregon's inventory of older bridges. The state constructed much of its bridge inventory prior to 1970. At the time, vehicles were much smaller and lighter weight. New vehicle configurations result in greater, more concentrated stress points on our structures.

When new vehicle configurations are approved at the national level, our program must evaluate our structures individually for the capability to carry these heavier trucks. Load rating structures – assessing, signing, and enforcing – comes at a cost. Conducting engineering reviews on nearly 3,000 structures can cost upwards of $20 million – an expense incurred every time state or national standards change. While it is critical that we assess our structures for their capability to carry people, goods and services across our state, it is important to note that funds spent to load rate bridges come from the same reserve as those used to improve bridge conditions.

ABBREVIATIONS AND DEFINITIONS

Bent – A primary vertical substructure support that serves to hold the bridge erect and still. It can also retain approach embankments and vertical and horizontal loads from the superstructure.

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 applies 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.

National Tunnel Inspection Standards (NTIS) – Federal Highway Administration guidelines for inventorying, inspecting, and load rating tunnels.

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 nine 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.

Types of ODs include:

- **Rail = Bridge rail**
- **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**

Poor Detail Bridge – Bridges identified in the state bridge inventory that have critical design issues related to rail, decks, and reinforcement locations. Bridges with poor details have a higher incidence of shear cracking that may grow rapidly, holes in thin bridge decks developing without warning, low reserve load capacity, and instability during seismic events.

Scour – The removal of sediment such as sand and gravel around the bridge foundations caused by hydraulic forces of fast-moving water.

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.

Service Life – The time duration during which the bridge element, component, subsystem, or system provides the desired level of performance or functionality, with any required level of repair and/or maintenance.

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.

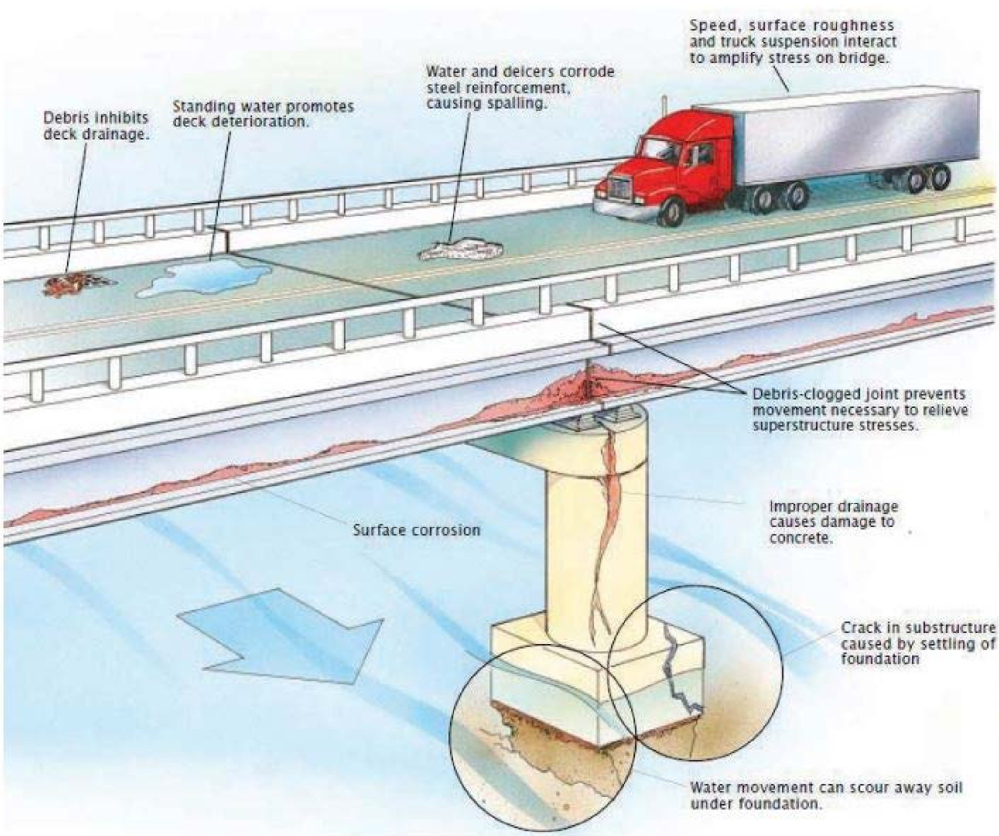
Structurally Deficient (SD) – A bridge condition rating used by the Federal Highway Administration to indicate deteriorated physical conditions of the bridge's structural elements (primarily deck, superstructure, and substructure) and reduced load capacity. Some of these bridges are posted and may require 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 used in the ODOT State Bridge Program for project ranking or selection.

BRIDGES 101

General Deterioration Factors

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

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.

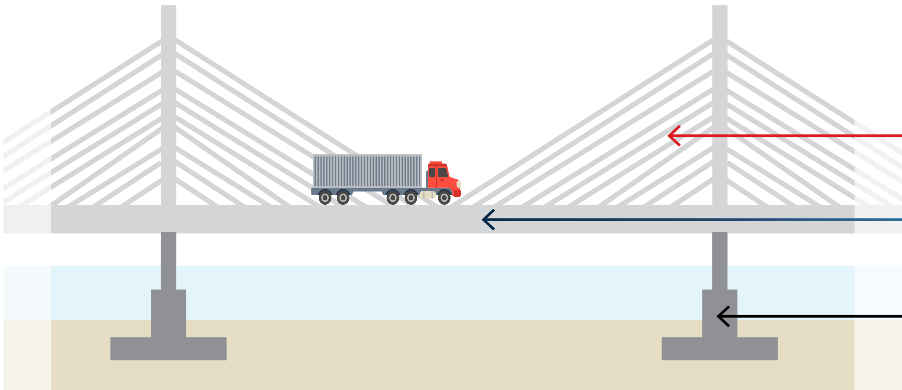


Adapted from "Why America's Bridges are Crumbling," by K.F. Dunker and B. G. Rabbat, 1993, March, Scientific American, 268, no. 3, p. 69. Permission for use courtesy of Jana Brenning, illustrator.

Bridge Condition Ratings

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

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 20 feet and longer 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.



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).

NBI Component	NBI Rating	Condition Rating Description
• Deck • Superstructure • Substructure • Culvert rating (if applicable)	Lowest condition NBI rating of all components (scale =0-9)	8-9: Very good condition 7: Good condition 5-6: Fair condition 4: Poor condition ≤ 3: Very poor condition

Bridge condition rating description.

Beginning in 2018, a bridge is classified as structurally deficient only if any component (deck, superstructure, substructure) has an NBI rating of 4 or less. Previously, load capacity and hydraulic opening below the bridge could result in an SD classification.

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.

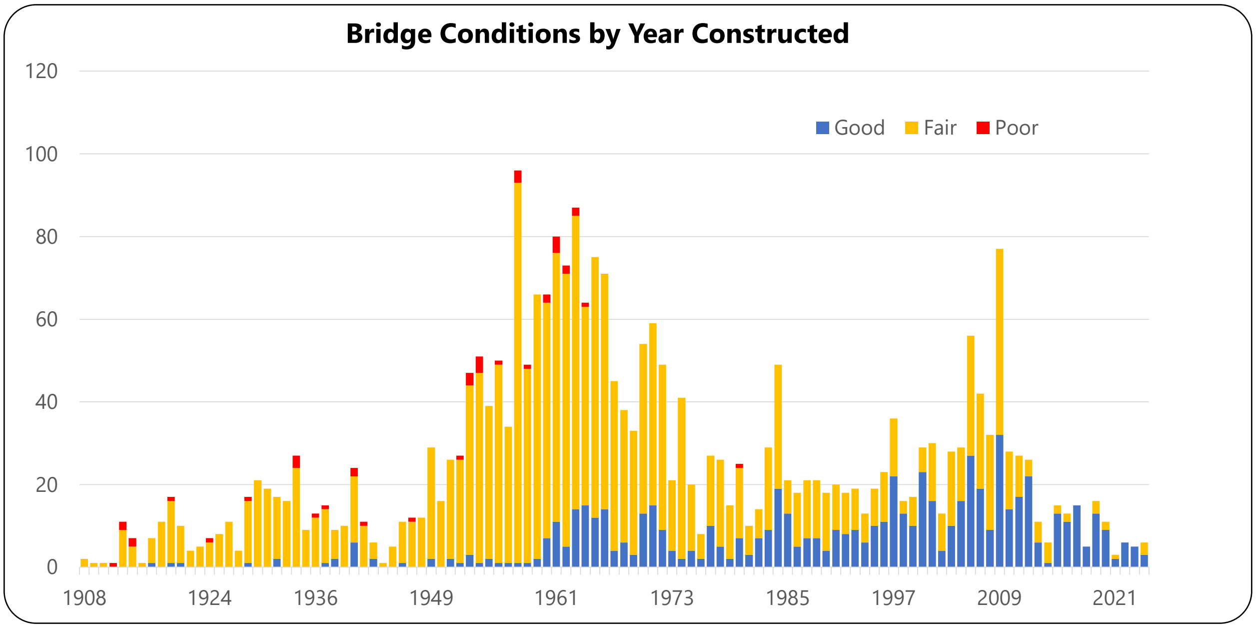
Timing is critical when performing the work since the longer the deterioration occurs, the more extensive/expensive the required treatment.

INTERSTATE ERA HIGHWAY BRIDGES

Constructing the interstate highway system was the biggest public works project in United States' history. It began with the signing of the National Interstate and Defense Highways Act of 1956, which authorized the construction of 41,000 miles of interstate highways, with $25 billion in funding from 1957 through 1969.

Oregon interstate highway bridges began construction in earnest in 1958. From 1958 through 1973, an average of 63 state highway bridges were built each year. The 1,005 bridges built during this 16-year period are over a third of all bridges in ODOT's current inventory.

The newest original construction interstate highway bridge is the Glenn Jackson Bridge over the Columbia River. After the southern portion of I-205 was built in the early 1970s, the northern portion was built in the early 1980s and in 1982, the Glenn Jackson Bridge was completed as the final portion of I-205. The chart below shows the volume of bridges built during the Interstate Era. In the early 2000s, the OTIA III Bridge Program approached the scale of bridge construction in the Interstate Era, but only for a brief period of time.



Like us, bridges have a lifespan. Factors affecting the lifespan of a bridge include the quality of the initial construction, materials used, the level of preventive and reactive maintenance, and the environment. For example, bridges on the Oregon coastline are subjected to a harsh marine environment and bridges in snow zones are subjected to freeze-thaw cycles and also heavy use of winter chemicals to provide safety for travelers. The bridge design code used in the United States uses factors that are based on a 75-year design life. Some bridges in harsh environments or in particularly important corridors are designed for a 100-year design life using a service life design approach.

It's safe to say the lifespan of an individual bridge should be somewhere between 75 and 100 years. At some point in the future there will be a 16-year period when approximately 1,000

Interstate Era Bridges will need to be replaced. By 2050, the earliest of the Interstate Era Bridges will be 90 years old, therefore for illustration purposes, we will use 2050 as the starting year to replace Interstate Era Bridges.

There are currently 670 state highway bridges that were built prior to 1958. These bridges were primarily built in the 1930s (153 bridges) and 1950 through 1957 (286 bridges.) These bridges were built to the design standards that were in place at the time and lack the lane width, shoulder width, load capacity, bridge rail safety features, and seismic resilience of modern bridges. Most of these bridges will need to be added to the number of bridges replaced within a 16-year period. The exception to this is a small number of the most historically significant structures that will be preserved indefinitely.

If ODOT continues to replace bridges at an average rate of three per year, only 75 bridges will be replaced between 2025 and 2050. Assuming all 75 bridges replaced were built prior to 1958, 595 additional bridges of that age remain on the replacement list. Replacing these bridges, and the Interstate Era Bridges within 16 years will require a bridge replacement rate of 100 bridges per year. This is 35 times the current bridge replacement rate and is unrealistic. It will also create another concentrated grouping of bridges for another replacement cycle in the distant future.

If ODOT were to significantly increase the rate of bridge replacements to 15 per year, 375 bridges would be replaced between 2025 and 2050. Assuming all 375 bridges replaced were built prior to 1958, 295 more bridges of that age remain on the replacement list. Replacing these bridges, and the Interstate Era Bridges between 2050 and 2065 will require a bridge replacement rate of 81 bridges per year.

To replace all of the 670 bridges built prior to 1958 before the Interstate Era Bridges begin to be replaced in 2050 requires a replacement rate of 27 bridges per year. Current funding levels delay confronting this issue in a way that adds to the already heavy burden of replacing all the Interstate Era Bridges, which have reached the end of their lifespan.

Regardless of the decisions made on bridge program funding, there are more than 1000 Interstate Era Bridges in the inventory that continue to age and deteriorate. The longer this issue is ignored, the more unrealistic it makes the rate of required bridge replacement to a future generation. The future generation is not an abstract concept, it is our children or grandchildren.

All the information above is part of a planning level analysis with inherent limitations. For example, we don't take historic bridges into account and selecting 2050 as the start of the Interstate Era Bridge replacements may be too early or late. ODOT has already replaced 149 Interstate Era Bridges in the early 2000s through the Oregon Transportation Investment Act (OTIA) program and some individual Interstate Era Bridges have been programmed for replacement in recent capital replacement cycles. While acknowledging these limitations, it's clear we need a significant increase in the rate of bridge replacements in the years before the Interstate Era Bridges reach the end of their design life.

Increasing the bridge replacement rate from three bridges per year to 15 bridges per year, starting in 2025, will help our children deal with replacing the remaining Interstate Era Bridges. An increased bridge replacement rate also has immediate benefits. Not only do we address deteriorated conditions, safety concerns, and seismic resiliency but future maintenance work will be more efficient because we eliminate costly, reactive maintenance issues and work moves toward proactive maintenance that economically extends the life of bridges.

Today, there are over 200 bridges in service that still have some form of timber elements. The Major Bridge Maintenance program spends over $1 million each year to replace deteriorated timber elements. In addition to being high maintenance, these bridges were built to bygone design standards and are often load-posted, narrow, and have rails that may not provide adequate protection to redirect errant vehicles.

Older Bridges with Safety Concerns and Extensive Repairs

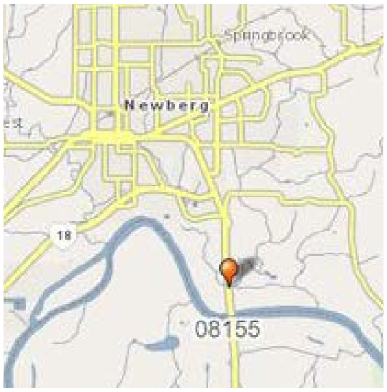
The picture below shows the timber bridge rails on Bear Creek Bridge, Oregon 130. This bridge was built in 1954. While the bridge rails met the safety standards in 1954, they do not meet modern safety standards. There is nothing to cushion the impact if a vehicle hits the end of the bridge rail, and the rail does not have the height nor strength to prevent an out-of-control vehicle from going over the side of the bridge.

Bear Creek Bridge, Oregon 130.

Bear Creek Bridge, Oregon 130.

This is a view of the underside of the same bridge and several issues are visible. The top of the picture shows a strengthening done in 1993 using cables so the bridge could carry heavier loads. A deteriorated timber support in the center of the picture was replaced with steel. Also, the foundation of the bridge is exposed to the current, increasing concerns that the bridge could be undermined and collapse during a flooding event. This is an example of the maintenance required to keep an older bridge in service, and the concerns associated with having older bridges remain in service.

The map and bridge below show the Oregon 219 Bridge over Hess Creek. It was built in 1958 and is located south of Newberg. It carries over 20,000 vehicles per day.



Location of Oregon 219 Bridge over Hess Creek in Newberg, Oregon.

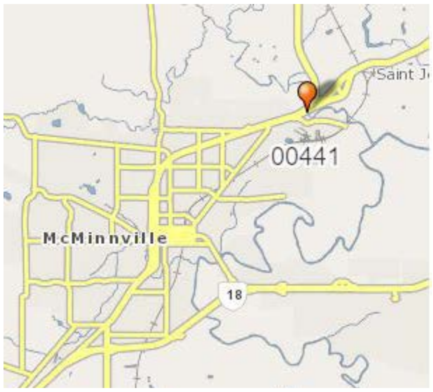
Hess Creek Bridge, Newberg, Oregon.

The photo below shows the timber substructure of the Hess Creek Bridge. It was taken from the ground looking up and shows the extensive use of steel repairs to keep the bridge in service.

Hess Creek Bridge, Newberg, Oregon.

The bridge inspector listed this bridge to be in very poor condition in 2023 due to significant rot in three of the timber columns that support the bridge. These columns are 12 inches in diameter and all but the outer 1 ½ inches of the column is rotted. The bridge was repaired in 2024 by the Major Bridge Maintenance program.

Two Older Bridges Near McMinnville



The Oregon 99W North Yamhill River is a significant crossing that is located northwest of McMinnville.

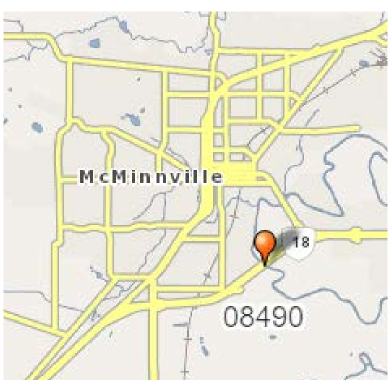
The northbound bridge was built in 1959, well before modern bridge seismic standards were adopted, and is not seismically resilient. The southbound bridge was built in 1921, is in fair condition, and is narrow, with two lanes that are 10 feet wide, however, there are no shoulders. Also, the one sidewalk does not meet federal ADA accessibility requirements and is not useable as the roadways join in the distance. Replacing the southbound bridge with a bridge that is designed to modern standards will address seismic, functional, condition, and accessibility needs at this location.

Oregon 99W southbound Yamhill River Bridge.

A side view of the bridge, showing the significance of the bridge and its height above the North Yamhill River.

In April 2024, a vehicle lost control and impacted the bridge rail. A significant portion of the bridge rail was demolished. Fortunately, the vehicle was able to remain on the bridge.

The Oregon 18 South Yamhill River Bridge southeast of McMinnville was built in 1963 and carries over 15,000 vehicles each day. It's in fair condition due to the deteriorated concrete driving surface.



The Oregon 18 South Yamhill River Bridge is located southeast of McMinnville.

The picture below shows a portion of the concrete driving surface and the many pavement patches that have been placed to ensure the bridge is safe and can remain in service. We recently inspected the driving surface to determine areas that will require new patches. These areas are outlined in white and include portions of existing patches. We concluded that this deck has deteriorated past the point where patches are effective, and the top layer of concrete must be completely replaced.

Oregon 18, South Yamhill River Bridge.

Due to the high traffic volume of this two-lane bridge, we will need to either provide a detour into McMinnville or provide a temporary detour structure. The expense to build a temporary detour structure is appropriate for a bridge replacement project but is too costly for a project that only replaces the top layer of the concrete driving surface. Therefore, to replace the top layer of concrete, we will need to provide a detour route into McMinnville and have a temporary closure that minimizes the impact to motorists and the surrounding communities. This bridge, and others like it, will continue to deteriorate and will consume an increasing amount of maintenance funds until it can be replaced.

Safety Concerns with a Historic Coastal Bridge

The U.S. 101 Necarney Creek Bridge is located on a curve between Tillamook and Seaside. It was built in 1937. The bridge is well above the terrain. The rails that keep out-of-control vehicles from going over the bridge do not meet modern design standards. To increase safety, two rectangular steel tubes were added to the rail in 2008. A vehicle hit this rail in August 2024. As shown below, the original rail and sidewalk failed, with only the steel tubes remaining after the crash. The Major Bridge Maintenance program will repair this portion of the rail at an estimated cost of $650,000.

The Necarney Creek Bridge has a significant curve and Necarney Creek is in a deep valley.

Necarney Creek Bridge on U.S. 101 shows a significant portion of the sidewalk and bridge rail has failed. The two rectangular tubes that were added in 2008 are the only barrier that remained after the vehicle impact.

Repeated Concrete Driving Surface Failures on an I-5 Bridge

The I-5 northbound bridge over Elk Creek is located south of Cottage Grove. It was built in 1953 and carries over 11, 000 vehicles daily. In 2021, a portion of the concrete driving surface failed. An 8.5 foot wide by 90-foot-long full depth repair was completed for the slow lane. In October 2024, another portion of the concrete driving surface in the slow lane failed.

The I-5 northbound bridge over Elk Creek is located south of Cottage Grove.

The photo above shows sunlight through the hole in the concrete driving surface. There are also significant concerns regarding other deteriorated portions that are close to failing and shows significant deterioration in areas that have not failed yet.

Elk Creek Bridge, northbound I-5.

The picture above shows other areas of deterioration that are on the underside of the slow lane. The lower right portion of the picture shows the repair done in 2021.

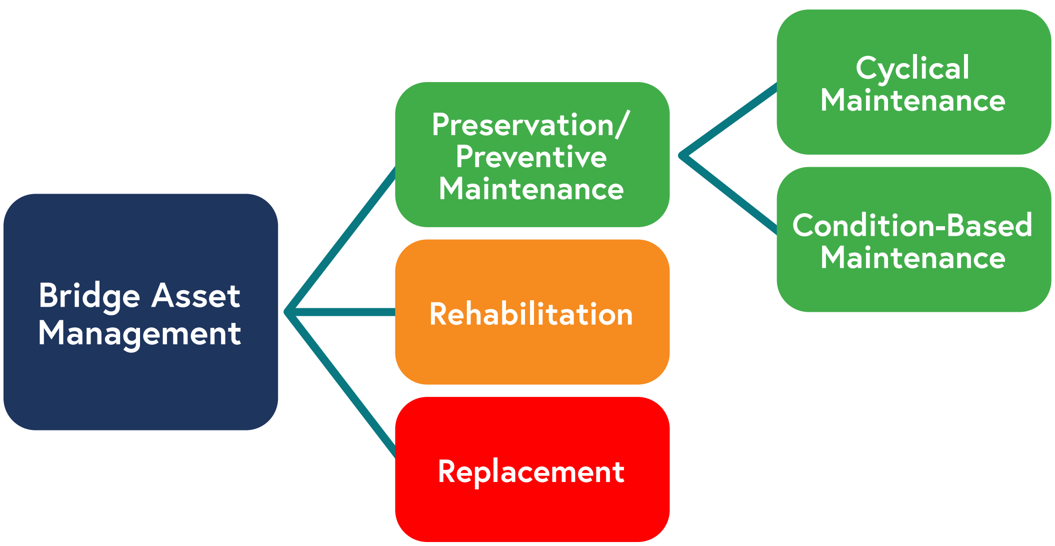
Critical Findings

A bridge inspector will note a critical finding when they discover a major defect that will result in a significant load restriction or need for corrective action to keep the bridge open. Each critical finding is tracked until the bridge is repaired or closed. Sometimes, major defects are discovered during the routine inspection each bridge receives every two years. Other times, major defects are caused by damage to the bridge as a result of an incident such as flooding or a vehicle collision. In 2024, there were three critical findings. Two were discovered during routine inspections of deteriorated timber bridges. The other one was due to the vehicle hit on the Necarney Creek Bridge rail as described earlier. All of these critical findings are either addressed or in the process of being addressed.

The number of critical findings is increasing. From 2015 through 2019, there were just two critical findings. From 2020 through 2024, there were 14 critical findings for state highway bridges.

Preservation and Maintenance Needs

Replacing bridges built before and during the Interstate Era will be challenging for the next 40 years. The longer the bridge replacement rate remains at three bridges per year, the more challenging it will be as time goes by and the bridge population continues to age and deteriorate. However, replacement is just one portion of managing bridges. The graphic below is from the Federal Highway Administration Bridge Preservation Guide.



Preventive maintenance is a planned strategy of cost-effective treatments that preserve the bridge and helps reduce future deterioration. Examples include sealing concrete to prevent winter deicing chemicals from penetrating and damaging the concrete. Painting steel bridges before there is significant corrosion and lubricating mechanical components on moveable bridges are also considered preventive maintenance. Concrete sealing can be effective for several (3-5) years but needs to be reapplied. The effective lifespan of paint is heavily dependent on the location of the bridge. The Fremont Bridge in Portland has been in service for over 50 years and has the original paint, although there are areas where the paint is no longer protecting the steel from corrosion. Bridges located in a coastal environment require painting more frequently, usually every 20-25 years.

Condition based maintenance activities are performed to restore deteriorated bridge elements that are identified during the bridge inspection process. In Oregon, a significant part of the Major Bridge Maintenance program is addressing deteriorated timber elements that support many of our older bridges. The deteriorated timber is often replaced with a combination of steel and concrete. Other condition-based maintenance includes filling ruts and patching the concrete on bridge driving surfaces that have worn away or have separated from the surrounding concrete and is a safety concern.

Preservation includes projects on major river crossings such as border bridges and historic coastal bridges. These bridges are high-value, and we cannot afford to allow any of them to deteriorate into a condition where rehabilitation is not an option. ODOT's intention is to maintain these bridges indefinitely and at a higher-than-average structural condition rating. There is a separate section devoted to bridge preservation in the Bridge Program Updates portion of this report.

Rehabilitation involves major work to restore the structural integrity of the bridge, as well as work to correct major safety defects. Examples of rehabilitation include completely replacing the concrete driving surface on bridges that have been subject to many years of winter chemical deicer exposure and are located in areas of the state with hazardous winter driving conditions. Another example of rehabilitation is replacing older bridge rails that do not meet modern safety standards to keep out-of-control vehicles from going over the edge of the bridge. Replacing the top layer of the concrete driving surface of a bridge can last 20 to 30 years, depending on the material used, the winter chemicals the bridge is subjected to, and the extent of studded tire use.

Replacing bridges built prior to and during the Interstate Era, except for major river crossings and historic bridges, will require a significant effort and investment over the next 40 years. Bridge replacement is just one part of managing the bridge inventory. For bridges to remain in service for their intended service lives, we need a series of maintenance, preservation, and rehabilitation projects.

2024 BRIDGE CONDITIONS

ODOT's 2024 Bridge Condition Report summarizes bridge condition ratings on state highways and performance measures based on National Bridge Inventory (NBI) 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 March 2024 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 conditions for decision-making purposes. The most common and those presented here, are the NBI ratings for the 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.

Inventory Changes

ODOT currently owns 2,781 bridges. This year, **two bridges were replaced**: the McMinnville Spur (Oregon 18) Bridge over the South Yamhill River and the Bellevue-Hopewell Highway (Oregon 153) Bridge over Salt Creek. **Eight bridges were added to the inventory**. Four ramps were added as part of the Oregon 217 project. One new bridge was added as the replacement of structures formerly not in the inventory with structures eligible to be included in the inventory. For example, there are many culverts that have openings that are too small to be included in the National Bridge Inventory. When one of these culverts is replaced with a bridge, the bridge is added to the inventory. There was also one bridge that was formerly not in the inventory that was reclassified as being eligible for the inventory. The ownership of one bridge was transferred to ODOT. Finally, the detour structure for the Van Buren Bridge replacement project in Corvallis was added to the inventory to meet federal reporting requirements.

With only two bridges replaced, ODOT continues to lose ground in the effort to manage the system. Current funding levels pay on average for only three bridge replacements a year. At this rate, an Oregon bridge will need to stay in service for over 900 years which is well beyond an expected service life of 75 to 100 years.

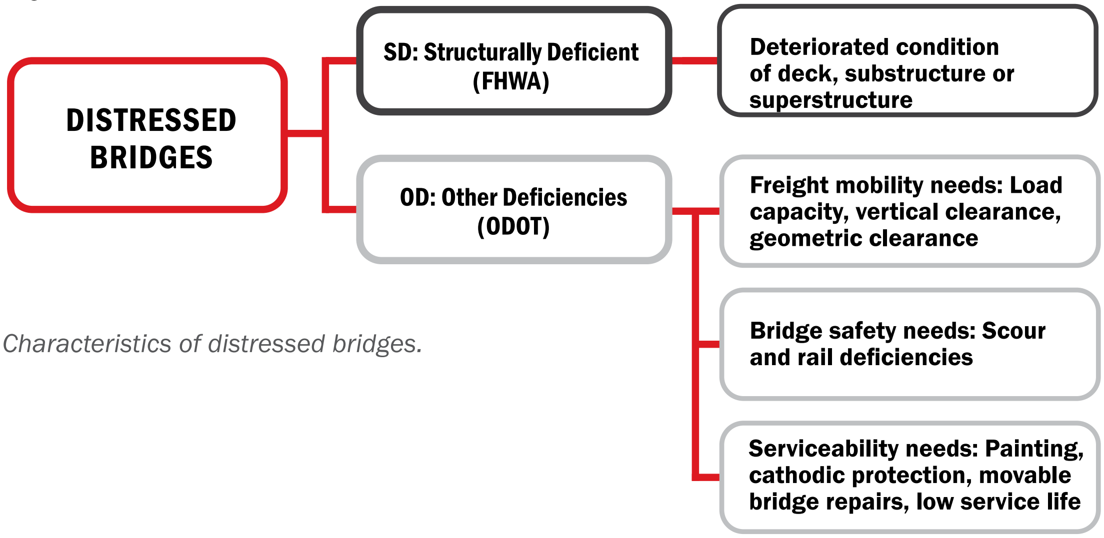
Bridge Key Performance Measure (KPM)

(Percent of Bridges Not Distressed)

ODOT measures bridge conditions based on the bridge key performance measure – percent of bridges not distressed. The KPM includes two categories of bridges:

1. The percent of bridges not structurally deficient (SD) as defined by FHWA.
2. The percent of bridges without other deficiencies (OD) as defined by ODOT. Structurally deficient and other deficiency components capture different characteristics of bridge conditions as shown in the following graphic.

A distressed condition indicates the bridge is rated as structurally deficient or has at least one *other deficiency*. ODOT considers both structural deficiency and *other deficiency* aspects in determining bridge needs and selecting projects for the Statewide Transportation Improvement Program.

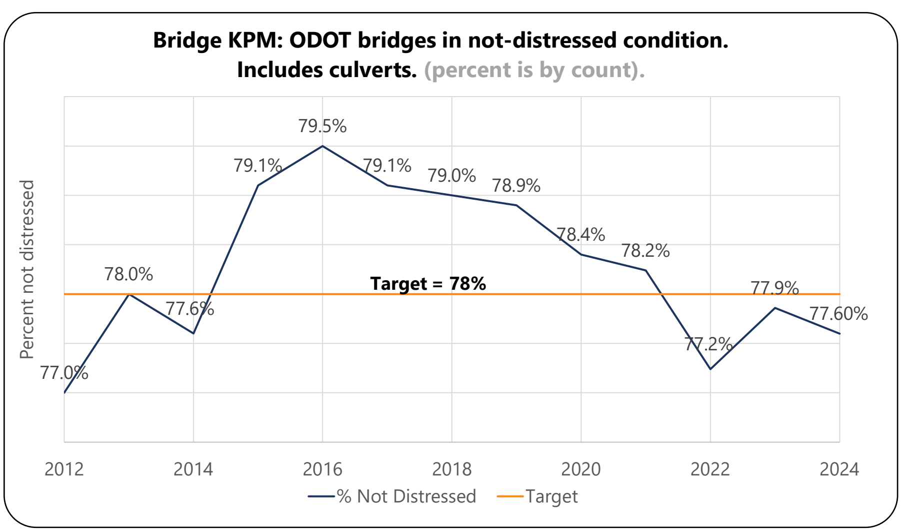


Characteristics of distressed bridges.

The number of bridges with other deficiencies fluctuates with time due to bridges being repaired where a deficiency is removed or deteriorating where a deficiency is added.

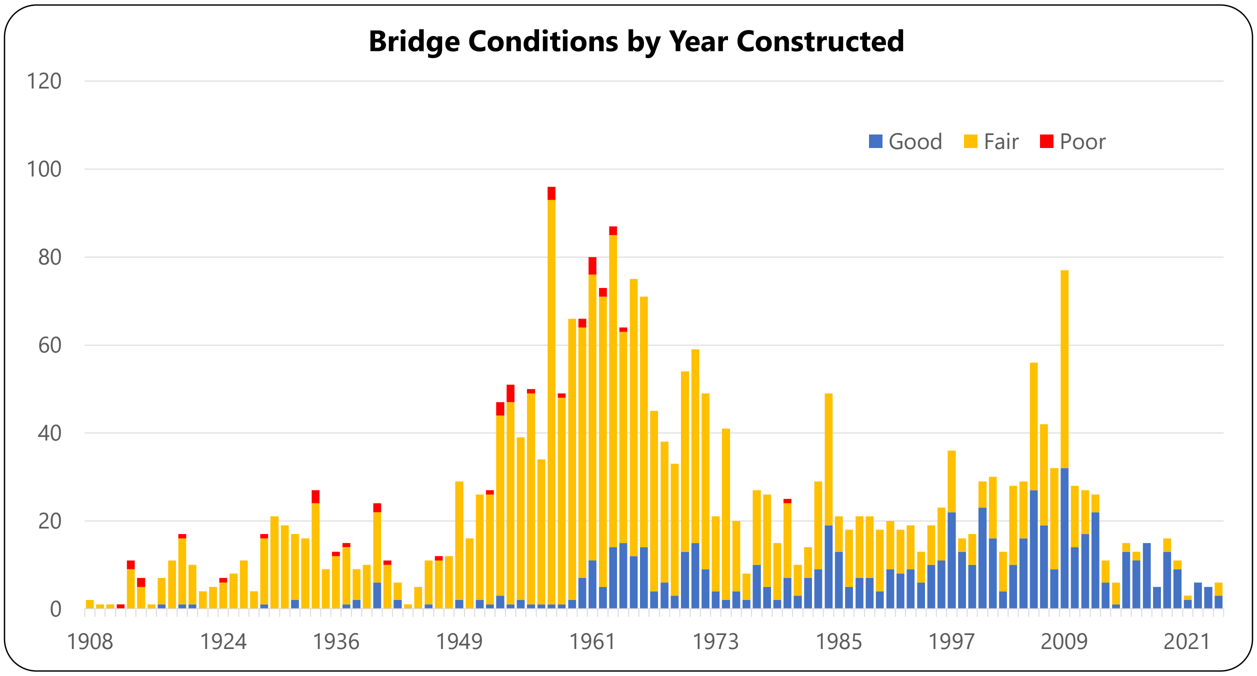
In reviewing the chart below, there is a large spike propelling bridge KPM from a 2014 low of 77.6% to a 2016 high of 79.5%. This spike was due to the Oregon Transportation Investment Act and special federal funding sources enabling a large number of bridges to be built and replaced at higher-than-normal levels for a short period of time.

During the period between 2016 through 2024, the number of ODOT bridges in distressed condition increased gradually, with a corresponding average decline of 0.25% in bridge KPM. While there is a variation in the rate of decline from year to year, the long-term trend is a steady decline in bridge conditions. Since 2022, the bridge KPM has been below the target.



ODOT bridges in not distressed condition. Larger percentages are better.

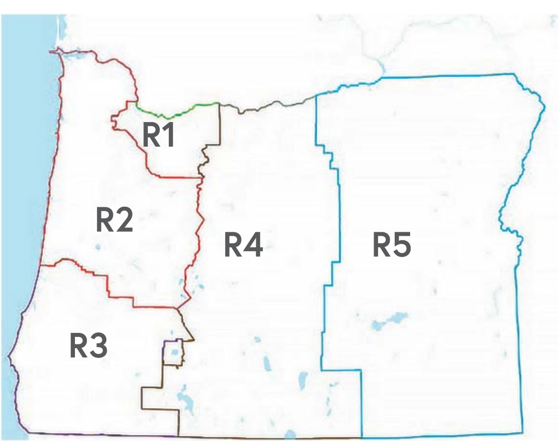
An alternate approach to understand the system needs is to compare bridge conditions by the construction year. The graphic below provides a picture of the looming wave of bridges constructed in the 1960s (now over 55 years old) that are in fair condition and approaching the end of their service lives. While fair bridges are safe, as they continue to age the maintenance and rehabilitation needs increase.



The graph above shows a large number of bridges built in 1950s and 1960s that are now 55 plus years old and most of them have exceeded their design life. Although operating in fair condition, they will eventually move to poor condition if not maintained or replaced.

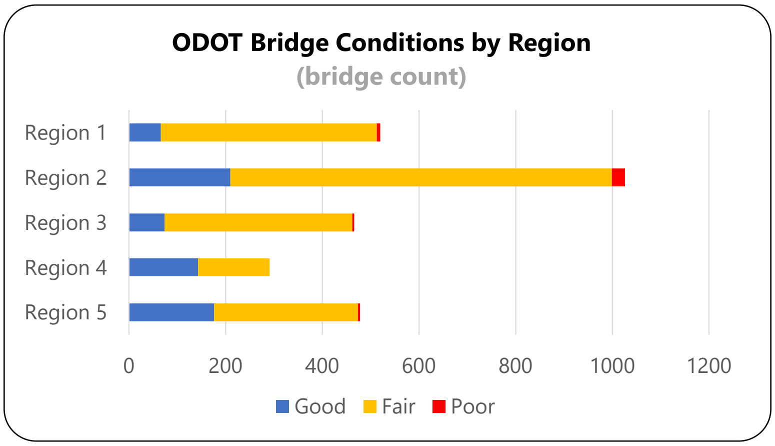
Bridge Conditions by Region

The distribution of bridges by bridge count and deck area are shown in the two graphics following the map for comparison. Region 1, which includes the Interstate Bridge over the Columbia and the Marquam and Fremont bridges over the Willamette in downtown Portland, has more deck area than Regions 3, 4 and 5 combined.

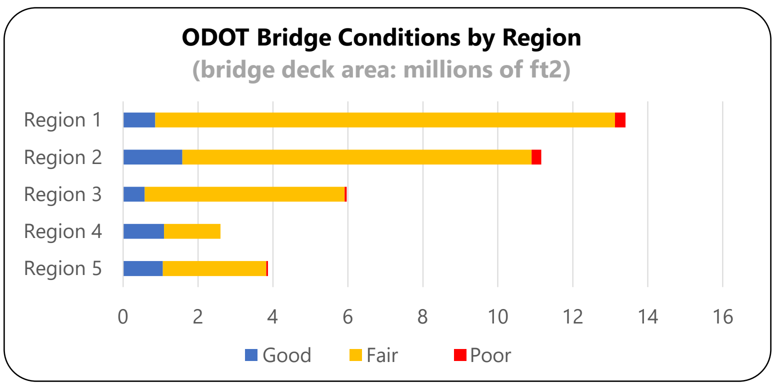


ODOT Region Map.

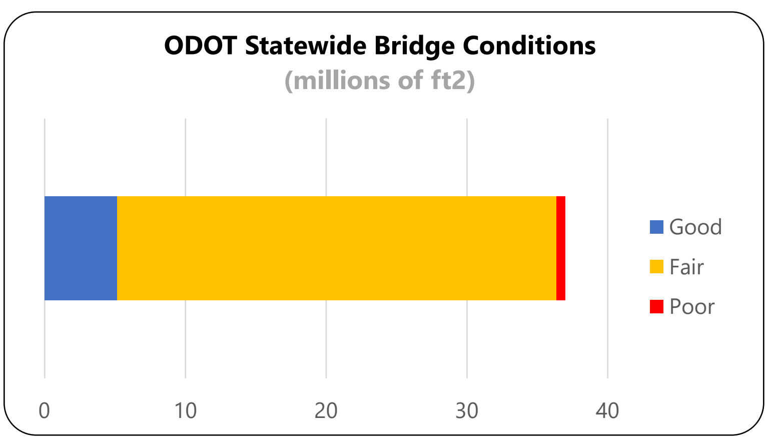
While the bridge system includes only 42 bridges in poor condition (structurally deficient), bridge conditions are slowly declining as noted by the bridge KPM.



ODOT bridge conditions by count. Bridge total count by region is R1 -520 | R2 1,026 | R3 -466 | R4 -291| R5 -478.



ODOT bridge conditions by millions of square feet of deck area. Note that Region 1, which includes the Portland Metro area, includes the greatest quantity by bridge deck area.



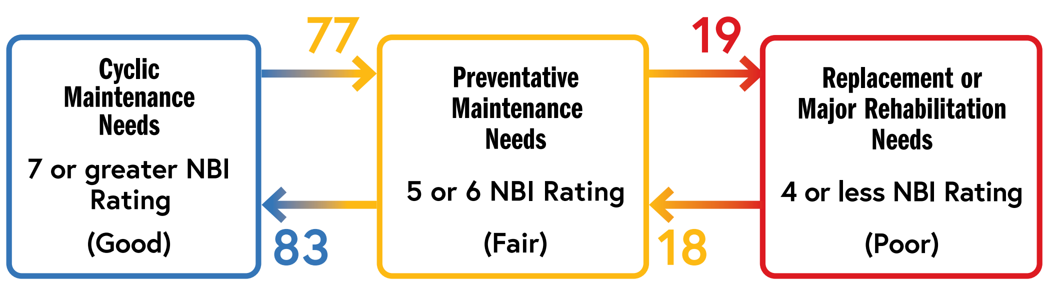
The total statewide bridge deck area is 37 million square feet.
Good = 5.17 mil ft2 Fair = 31.19 mil ft2 Poor = 0.64 mil ft2

2022 – 2024 Changes in Condition Ratings

The following chart shows both the dynamic nature of bridge conditions and the growing backlog of work for those bridges that have changed conditions. The period from 2022 – 2024 reflects bridge conditions over one full inspection cycle (24 months). In a balanced state, the number of bridges moving from blue to yellow and red (deteriorating conditions) would be equal to the number moving from red to yellow and blue (improving conditions.)

In the last two years, 96 bridges had lower (declining) overall condition ratings versus 101 bridges with higher (improved) condition ratings. The changes are primarily due to Oregon implementing updated federal guidance for evaluating and coding specific bridge data. The guidance that was used in the past was from 1995. Since bridges are inspected every two years, and the transition period to the updated federal guidance also has an implementation schedule, the impact of implementing the new guidance will dominate changes in bridge conditions through 2027.

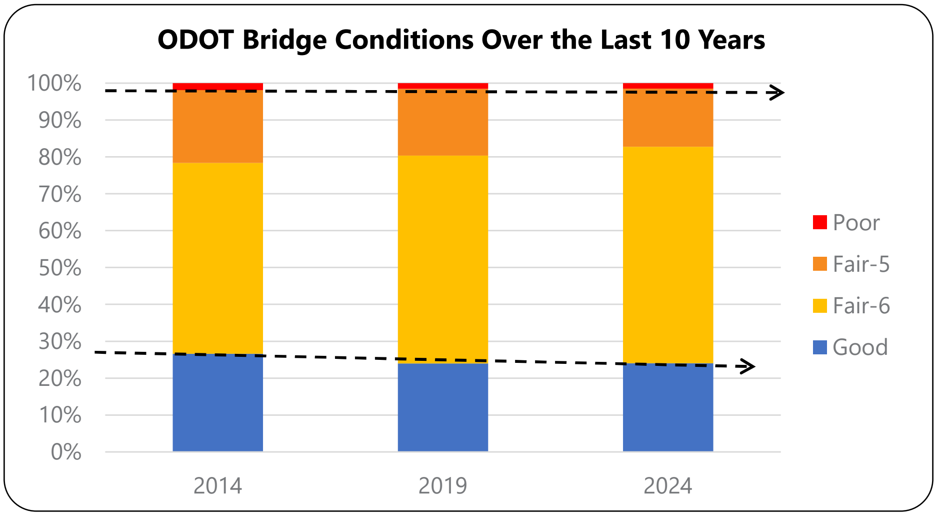
2022 – 2024 Changes in Minimum NBI Ratings



A few more bridges had improving conditions (83+18=101, bottom line) than bridges with deteriorating conditions (77+19=96, top line). However, it should be noted that the number of bridges in poor condition show a net increase.

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 10 years. Bridges are classified as fair if the NBI value is 5 or 6, however, a value of NBI=5 indicates more distress.

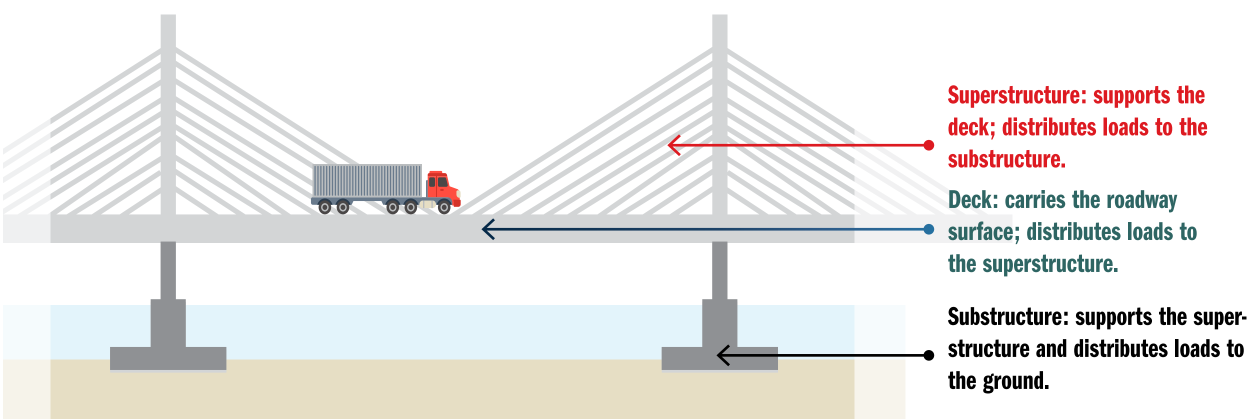


The ten-year chart shows percent of good bridges continuing to move to fair condition due to aging inventory. If more bridges are not maintained or replaced, the poor inventory will continue to increase and put stress on the transportation system.

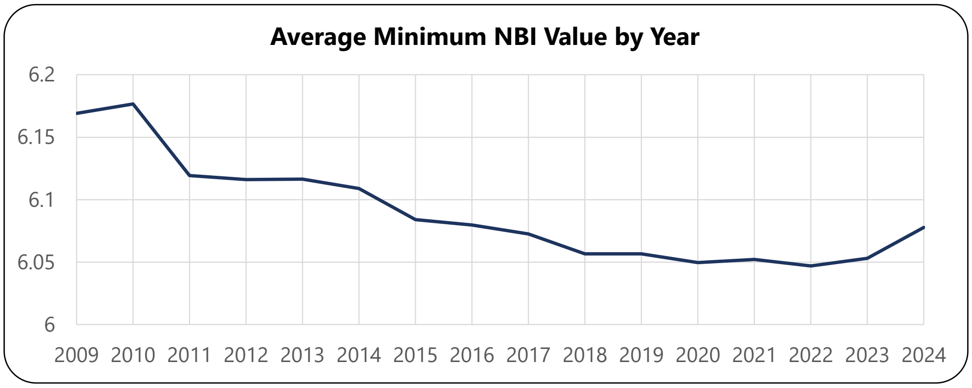
Of concern is the increasing number of bridges moving out of good condition into fair condition. The population of fair bridges continues to age and will require more and more rehabilitation and maintenance over time. Many fair condition bridges have already exceeded their service life but remain in place due to regular maintenance.

Substructure Conditions Deteriorating

The NBI value is a simplified measure of bridge conditions, reflecting only the lowest of the superstructure, deck and substructure conditions. To get a clearer picture of bridge condition changes over time, FHWA submittal data was pulled for 2009 to 2024 to compare the overall deck, superstructure and substructure conditions of ODOT bridges.

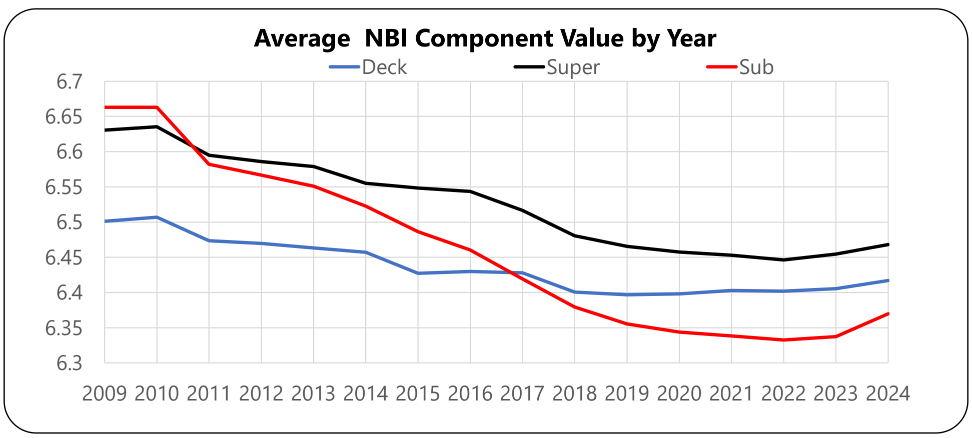


As shown in the graph, the overall NBI conditions (lowest of the superstructure, deck and substructure conditions) have declined since 2010, which would have been close to the end of the Oregon Transportation Investment Act work. Understanding which components of a bridge are deteriorating, is shown in the second graph.



The yearly average NBI value for all bridges has declined since 2010 but has remained relatively steady since 2020.

In this graph, the component NBI values are plotted to indicate changes over time. In 2009, substructure (red) conditions started out in the best condition, relative to the other components, but by 2017, they were in the worst condition. The average substructure NBI value indicates more bridge substructures have moved out of good condition into fair condition.



The graph indicates that averages of all three NBI components that indicate bridge conditions have trended downward from 2010-2022, however, it is important to note that substructure decline is steeper than others. When a bridge has a poor substructure, it is generally more cost-effective to replace than to maintain it. Poor substructure condition leads to bridge postings and potentially closures, if not replaced.

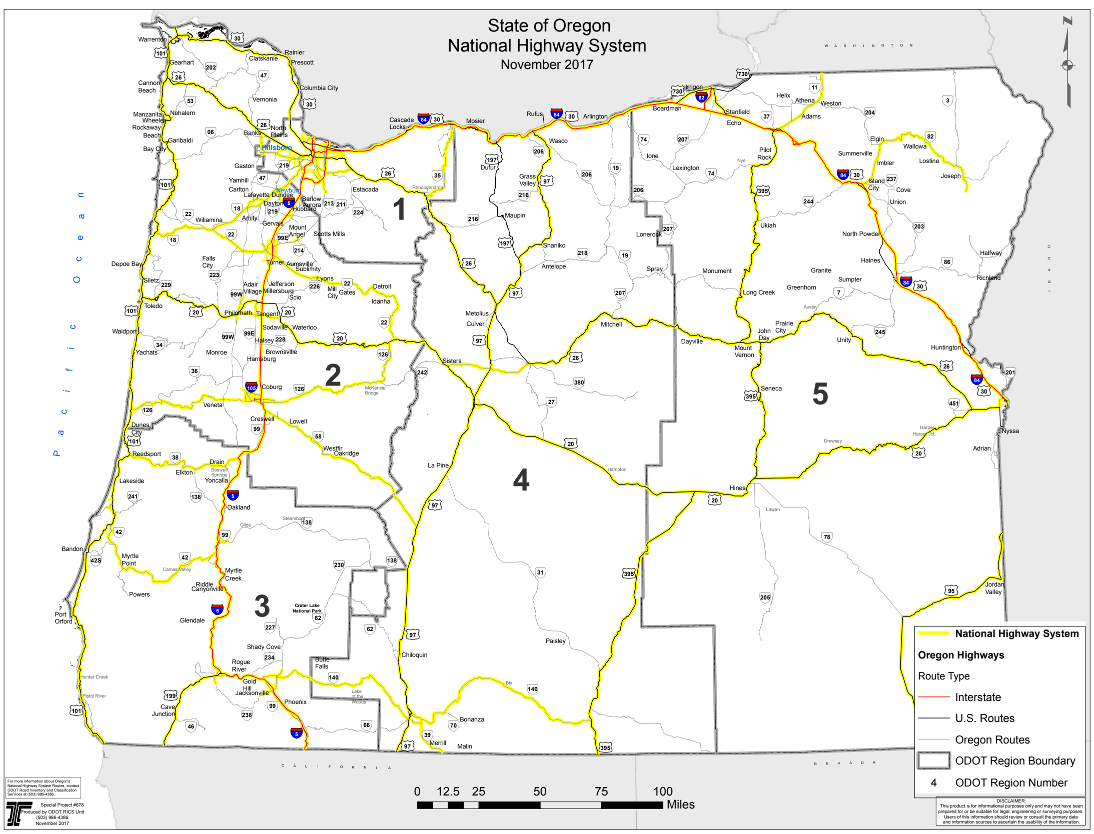
While a substructure deteriorating from good to fair condition is not a major concern at this time, as substructure conditions continue to decline, it will become problematic. Replacing a deck or strengthening the superstructure can be done multiple times, however, if a substructure deteriorates from fair to poor, the most cost effective treatment is generally bridge replacement. As bridge substructures approach poor conditions, expect more bridge postings and potentially closures.

NATIONAL BRIDGE PERFORMANCE MEASURE DETAILS

Condition Based Performance

The Infrastructure Investment and Jobs Act (IIJA) requires the state to establish bridge condition targets and report conditions based on specific performance measures including:

1. **Percent of NHS bridges by deck area classified in good condition.**
2. **Percent of NHS bridges by deck area classified in poor condition.**

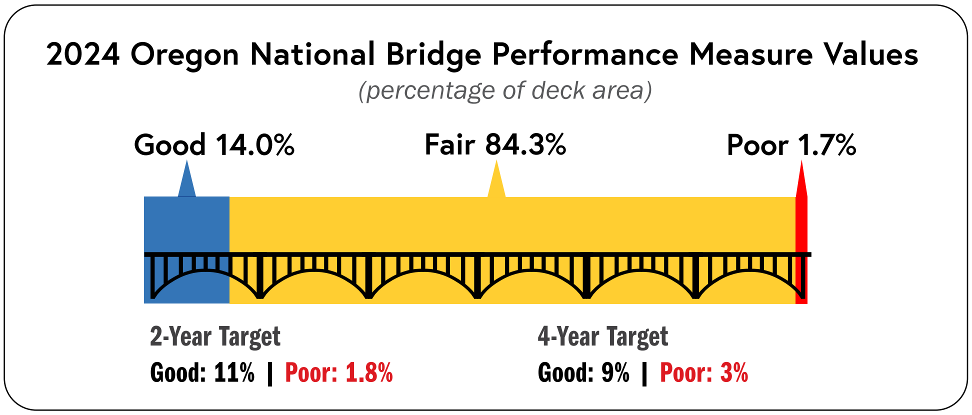


State of Oregon National Highway System.

National Bridge Performance Measure Details

The graph below indicates that Oregon is exceeding the targets set for the National Performance Measure. The percentage of good bridges by deck area increased from 12.9% in 2023 to 14.0% in 2024. This increase is primarily due to the implementation of updated bridge inspection standards.

However, the percentage of poor bridges by deck area also increased from 1.6% in 2023 to 1.7% in 2024. This increase can be attributed to the implementation of updated bridge inspection standards and the normal deterioration of bridges as they age, spending the majority of their service life in fair condition.

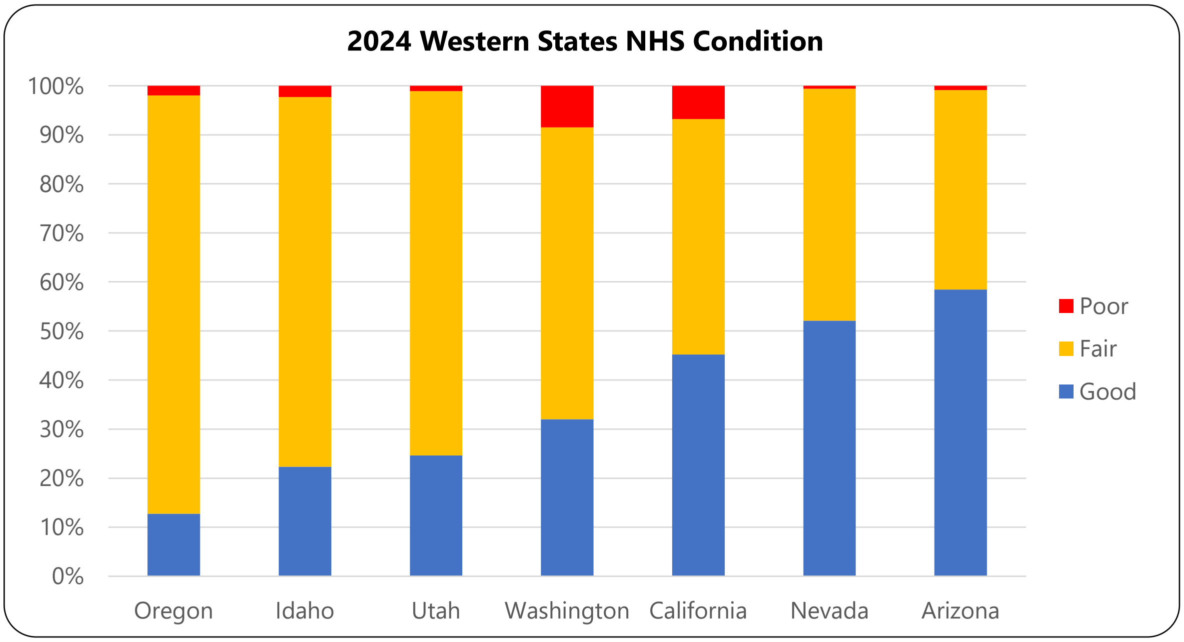


ODOT has a large inventory of aging bridges, as a result, more bridge are likely to transition to poor condition in the future.

Oregon's NHS bridge conditions and two- and four-year targets are shown above. Oregon expects NHS bridge conditions to decline but be under the 10% threshold for poor bridges in the near future. However, with so many bridges in fair condition on the cusp of becoming poor, maintaining bridge conditions in the future will be challenging.

Performance Relative to Neighboring States

Compared to neighboring states, Oregon has the least quantity of NHS bridges in good condition. The graph below shows western states' bridge conditions using 2024 data submitted to FHWA. While Oregon ranks among the best for the least percentage of poor bridge conditions, it includes the smallest percentage of bridges in good condition as a result of few bridge replacements. Due to a large number of aging bridges in Oregon's inventory, some of the fair condition bridges continue to slide into poor condition due to limited funding resources required for bridge replacement and maintenance.



Oregon has the lowest percent of good bridges and highest percent of fair bridges compared to its neighbors. If not replaced, fair bridges will attain poor status over a period of time.

The National Performance Measure does not include penalties around the percent of good condition bridges; it does recognize the importance of having a range of bridge conditions in the statewide inventory providing a balanced approach to managing the bridge system.

BRIDGE PROGRAM UPDATES

		FOCUS
1	Major Bridge Maintenance	► Funding ► Accomplishments ► Repair of Older Bridges ► Repair of Bridges for Scour
2	Bridge Preservation	► Preserving Oregon's Big Bridges-Cathodic Protection ► Temporary Work Access and Containment ► Strengthening and Modifications
3	Seismic Program Status	► Oregon 58: Coast Fork Willamette River to Lower Salt Creek Bridges ► I-205 Abernethy Bridge and Van Buren Bridge ► Southern Oregon Retrofit Project
4	Bridge Load Rating	► History ► Basics ► SHVs and EVs

1 Major Bridge Maintenance

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.

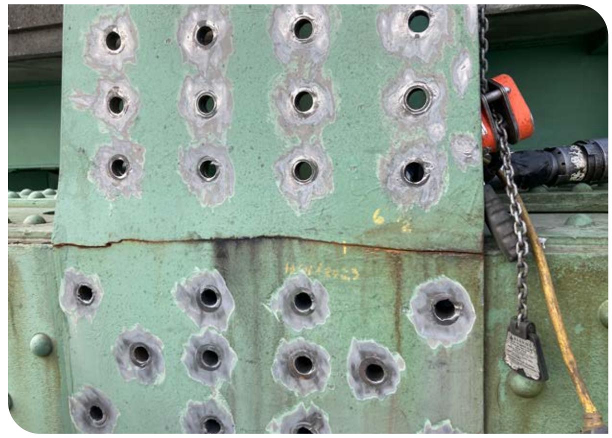
MBM highlights include:

- Approximately 200 projects are selected annually.
- Starting in 2018, funding increased to $10,000,000/year.
- Starting in 2021, funding increased to $12,000,000/year.

One of the primary objectives of the MBM program is to address urgent maintenance recommendations. Urgent maintenance recommendations are defects identified during the routine bridge inspection that need to be corrected as soon as possible or pose a traffic safety concern. In 2023, the MBM program funded 14 projects to address urgent maintenance recommendations at a total cost of $1,415,500. Examples of these projects include repairing steel fatigue cracks, replacing deteriorated timber members, deck repairs, and scour.

Typical Distresses Addressed by MBM

Failed Deck



Steel Fatigue Crack

Distressed Timber

Foundation Scour

Maintaining the asphaltic concrete pavement (ACP) on bridge decks and approaches has become a growing challenge for ODOT. Deferred maintenance on secondary highways has resulted in more bridge only paving projects. These smaller volume paving projects tend to attract high bids. In 2023, the MBM program funded paving work on 35 bridges at a total cost of $1,942,400. Maintaining ACP represents a significant expenditure for the MBM program and will be a continued challenge for the agency into the future.

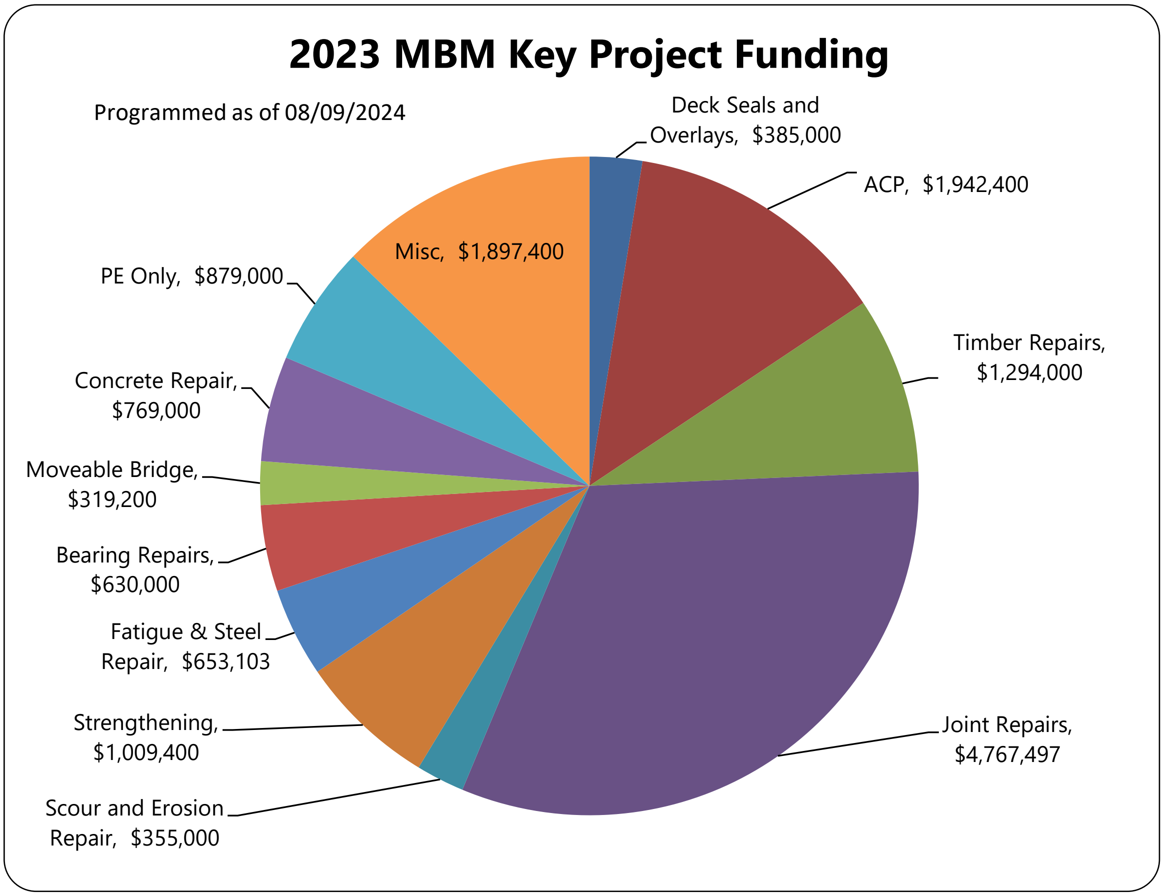
In addition to addressing urgent defects and performing preventative deck maintenance, the MBM program addresses deck joint repairs, timber repairs, approach repairs, bearing replacements, and maintenance on the moveable bridges. The variety and volume of work performed by the MBM program is what makes it a key component in maintaining Oregon's infrastructure.

2023 MBM Project Accomplishments

In 2023, ODOT repaired six bridges in poor condition through the MBM program. In addition, we repaired 63 bridges with urgent or high priority needs. These are bridges with defects identified during routine bridge inspections that need to be corrected as soon as possible since they may pose a traffic safety issue.

There is a detailed list of MBM expenditures in the graphic below, which includes six bridges that were not strong enough to support modern truck weights and were therefore strengthened.

ODOT is updating the load carrying capacity calculations of all existing bridges in the state. By doing so, MBM will add more strengthening projects to avoid load postings and closures. You can find more details on ODOT's load rating efforts in this report.



2023 annual funding distribution by project type, with $4,767,497 for joint repairs, $1,942,400 for ACP, $1,294,000 for timber repairs and $1,897,400 for miscellaneous repairs.

Focus on Older Bridges

Each year the Major Bridge Maintenance program funds approximately 200 bridge repair projects typically in response to a localized defect on the bridge. Localized MBM repairs can raise the bridge condition rating from poor to fair, however, the rise is only temporary as the bridge will continue to deteriorate. These focused repairs aren't intended to rehabilitate the entire structure but rather focus on a single defect. Many of the bridges that require the repairs should be replaced, however, the upfront replacement costs simply aren't available as funding is allocated to higher priority bridges and spread around to keep more bridges in service.

As resources continue to shift toward maintaining deteriorating bridges that should be replaced, fewer resources are available for cost effective preservation and maintenance treatments. Eventually bridges on lower priority routes will not be serviceable leading to load restrictions or even closures, posing a significant risk to Oregon's mobility in the coming decades.

Preventive Maintenance

In 2023, preventive maintenance projects accounted for 40% of the annual MBM budget. Preventative maintenance activities are widely considered a cost-effective way to extend the service life of bridges. Strategic preventive maintenance projects can delay the need for larger, expensive rehabilitation projects.

The deck is the highest value item on a bridge, and 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 and reach the reinforcing steel. Once the reinforcing steel begins to corrode, costly deck rehab or replacement projects are required. However, if the deck can be sealed quickly, the deck service life can be significantly extended. Other maintenance activities include bridge washing, spot painting and joint repairs.

Highlighted Projects

Timber substructure rehabilitation at Willamette River Overflow, Oregon 219

Willamette River Overflow, Oregon 219.

This timber trestle bridge was constructed in 1958, is 225 feet long and consists of 17 spans. The bridge was originally supported by 126 timber piles. Over time, 53 timber piles have been replaced with steel. During a routine inspection in 2023, ODOT found an additional 10 piles and one cap in need of replacement. Some of the timber had extensive decay and required us to install temporary shoring for the bridge to remain open. ODOT setup temporary shoring and later completed the permanent repairs.

Timber deck rehabilitation at Maltby Creek, Oregon 34

Maltby Creek, Oregon 34.

The Maltby Creek Bridge was constructed in 1956. The timber deck decayed and needed replacement and due to the extensive nature of the repair, necessitated a full road closure. Multiple ODOT bridge crews performed the timber repairs. The bridge railing was also upgraded as part of the project.

Little Nestucca Bridge, Oregon 130 - Steel truss repair.

Little Nestucca River, Oregon 130.

A vehicle struck a truss during a winter storm. One of the members, a main component of the bridge, was partially severed and required the bridge to be closed until repairs could be completed. The MBM program utilizes 100% state funds which allows the program to deliver work with ODOT bridge maintenance crews or contract the work. This flexibility allows MBM to deliver projects in an effective and timely manner with lower overhead costs.

As resources continue to shift toward maintaining deteriorating bridges that should be replaced, fewer resources are available for cost effective preservation and maintenance treatments. Eventually bridges on lower priority routes will not be serviceable, leading to load restrictions or even closures. This will pose a significant risk to Oregon's mobility in the coming decades.

As Oregon's older bridges continue to age, we expect the frequency and urgency of repairs on timber structures will continue to escalate.

2 Bridge Preservation

One of the Bridge Preservations Unit's primary goals is to maintain and preserve historic bridges. Preserving these cultural assets for Oregonians to appreciate is important to our state's culture and many are protected under federal law. In addition, preservation work is often more cost effective compared to a full bridge replacement. Many of Oregon's 300+ historic bridges identified in Oregon's Historic Bridge Field Guide were built in the early part of the 20th century. In the past 100 years traffic volumes, vehicle dimensions, and vehicle weights have steadily increased. The challenge arises from balancing preserving the character-defining historic features, modifying the structure to achieve modern day design standards, and determining feasible construction methods.

Temporary Work Access and Containment

The most common bridge preservation projects found in Oregon are steel bridge coating and impressed current cathodic protection on concrete bridges. Both types of projects require extensive temporary work access and containment to carry out coating and structural repair work. Temporary work access and containment are typically achieved with scaffolding, hanging platforms, and rigid and soft containment walls.

Many historic bridges have marginal capacity to support typical vehicular service loads. ODOT must carefully consider how to best accommodate these additional construction loads. To find the right solution, ODOT must balance numerous project constraints and goals with public safety and, most importantly, minimize mobility impacts. Through structural analysis, the outcome is often a combination of strengthening the bridge, posting vehicular load limits, and providing specifications to the contractor to regulate construction loads.

Temporary work access and containment on the Yaquina Bay Bridge (Newport, OR) – Cathodic Protection Work (2023).

Strengthening

When ODOT designs preservation projects, we complete a thorough structural analysis to determine if structural strengthening work is required to support temporary or permanent loads. Years ago, many of these bridges were designed for 20-ton trucks. The truck used for design purposes was increased to three axles and 36 tons in 1944. It increased again in 1980 and again in 1993. To accommodate the greater modern day loads most bridges need to be strengthened.

Strengthening is the process of providing additional structural capacity beyond the capacity of the original construction of the bridge. This can be accomplished in a number of different ways. For steel bridges, structural members receive increased section strengthening using welded or bolted plates with steel strength greater than that of original construction. For concrete bridges, internal strengthening is achieved by sawcutting or drilling into existing structural members and providing new reinforcing bars that are secured with high strength epoxy. There are other means of strengthening, but the methods described here are the most discrete methods, which is always preferred from a historic preservation standpoint.

Bridge rail is often a distinct feature of a historic bridge; however, the main purpose of bridge rail is to contain and redirect errant vehicles. Railing must provide crashworthiness and safety. These objectives can be achieved by strengthening existing historic rail or replacing historic rail with replica rail. The Bridge Standards Unit is in the process of standardizing a crash tested, ornamental, open-window bridge rail. The new standard rail will be used on several historic bridge projects during the 2024-2027 STIP cycle.

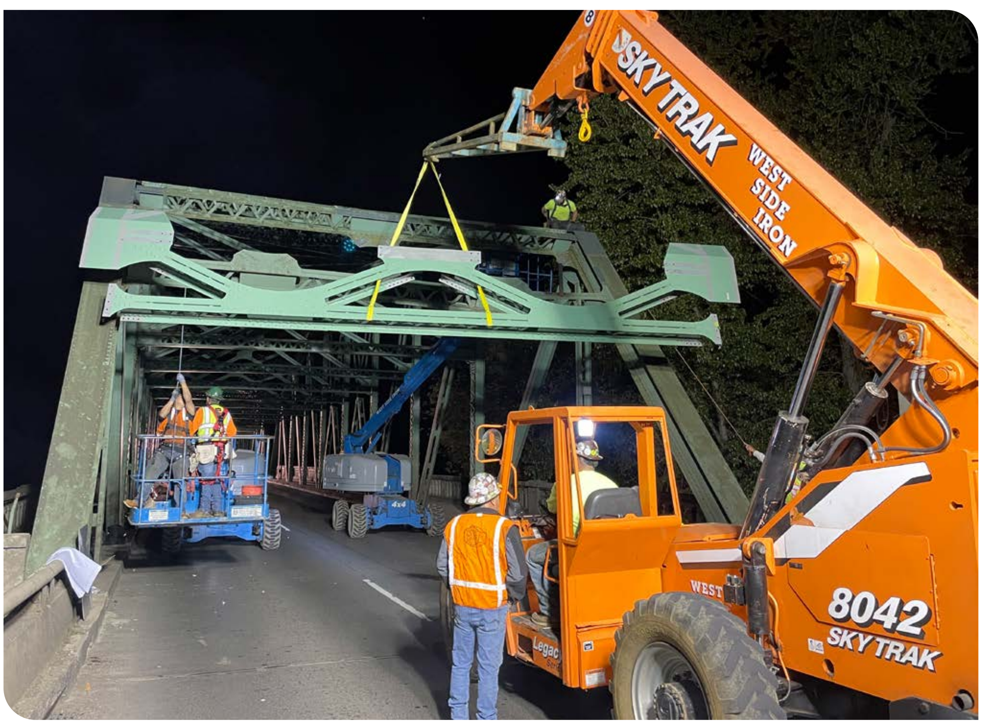
Winchester Bridge over the North Umpqua River (Roseburg, OR) – Bridge Rail and Widening work (2008).

Geometric Modifications

Oregon has many historic, through-truss bridges and through-arch bridges. With these types of bridges, there are trusses overhead giving motorists the feeling they are driving through a bridge, rather than on a bridge. These types of bridges, however, have some shortcomings. Similar to strengthening needs for modern day loads, height and width dimensions have increased and historic bridges are not typically constructed to accommodate these loads. It is not uncommon for through-truss bridges, despite being signed with height restrictions, to get hit by over-height loads.

We can take steps to reduce damage to our historic bridges from vehicular collisions by modifying and replacing the existing bracing system. The transverse bracing system, also known as cross bracing or X bracing, is a structural system that uses diagonal supports to keep a structure stable under lateral forces like wind or seismic activity. Modified bracing systems provide increased vertical clearance. They must be designed carefully to meet structural loading requirements and consider construction sequencing and erection tolerances.

Sometimes historic bridges can be modified to accommodate additional lanes, shoulder width, and lane width for both vehicles and pedestrians. When a historic bridge needs this type and variety of work, it's difficult to avoid major visual impacts to the bridge. There are times when it's possible to widen a bridge deck on the existing superstructure and substructure. Other times the increased loads and width require us to construct new superstructure and substructure elements, designed and detailed to look similar to the original bridge architecture.



Ellsworth Bridge over the Willamette River – Portal bracing replacement (2024).

Making the Right Decision and Stretching Funds

The Bridge Preservation Unit works closely with ODOT architectural historians to ensure that our historic resources are preserved to the greatest extent possible. This process consists of exhaustive alternative analysis and ODOT engineers consider avoidance, minimization, and mitigation measures. We always pursue strengthening and bridge modification measures with historic integrity in mind.

There is no single solution for bridge preservation projects, and we consider the context of the bridge, it's history and location. In one situation the right choice might be to discretely strengthen a bridge since it is on a major freight route. In another case where a historic bridge is on a route with low traffic volumes, and a short detour route is present, it might be best to avoid strengthening work and simply load post the bridge. The Bridge Preservation Unit will continue to pursue, design and construct projects that preserve historic integrity but also increase functional purpose.

3 Seismic Program

The Seismic Program has become an important part of the State Bridge Program, which manages the state highway bridge inventory. Maintaining a good balance between improving seismic resilience while preserving the state's highway assets has been a real challenge for the Bridge Program. Although bridges with severe structural deficiencies are generally seismically vulnerable, not all seismically vulnerable bridges have other structural deficiencies. Also, prioritization of the routes included in the Seismic Program adds another level of complexity to the selection process for bridge projects.

ODOT's Seismic Implementation: Policies and Design Guidelines provides useful tools for planning an efficient strategy toward resilience. A good understanding of the flexibilities for investment prioritization while not losing focus on the main goal and objective becomes more important under a budget constraint situation. Evaluating lower-tier seismic corridors, where both structural deficiencies and seismic vulnerabilities can be addressed at the same time, could provide the most economical option, especially when these lower-tier corridors can be used to detour traffic from higher-tier corridors after a seismic event.

Many bridges on Highway 99W are older and in need for major repairs or replacement, while bridges on Interstate 5 are in relatively good condition apart from their seismic performance. Highway 99W offers an alternative route for traffic movement between Eugene and Portland. Replacing deficient bridges on 99W will allow ODOT to meet seismic resiliency goals and other bridge needs at the same time.

While ODOT evaluates future investment options for the Seismic Program, several projects are either under design, construction, or have just recently been completed. Once all completed, these projects will offer seismically resilient highway corridors that can save lives and help the Oregon economy to recover after a major seismic event.

Construction is at its peak on U.S. 97: Oregon 58 California Border Bridge Retrofits project, consisting of six bridge retrofits and one complete bridge replacement. This project will improve the seismic resiliency of U.S. 97 which is designated as a primary north-south lifeline route in the aftermath of a major earthquake.

Construction is now complete for replacement of Pelican City Bridge (U.S. 97 over Lakeport Boulevard & Union Pacific Railroad) and the new bridge, which is much wider than the old one, is now open to traffic. Work is also complete on four out of six bridges planned to be seismically retrofitted: U.S. 97 over Nevada Avenue, U.S. 97 over United States Bureau of Reclamation Canal, Green Springs Interchange (U.S. 97 over Oregon 140), and U.S. 97 over Klamath River.

The last two bridges of this project (U.S. 97 over UPRR (Lobert) and U.S. 97 over Link River) are at the final phase of construction and work is expected to be complete by summer 2025. Completion of this project will mark the first complete resilient highway for our state, which will ease the state's post-disaster response and speed up our economic recovery after a major seismic event.

Pelican City Bridge– Placing precast concrete girders.

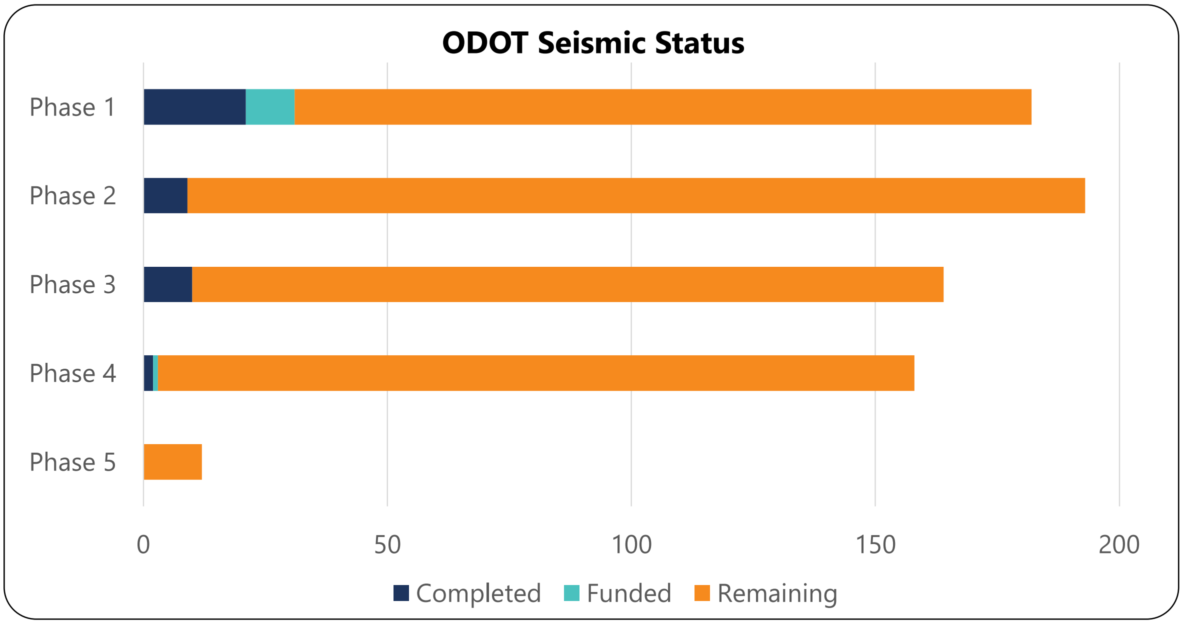
We have made significant progress on another seismic retrofit project; Oregon 58: Coast Fork Willamette River to Lower Salt Creek Bridges. This project will provide another seismically resilient corridor that will allow traffic flow from U.S. 97 to the Willamette Valley immediately after a major seismic event. This project will strengthen four bridges.

Work is complete or nearly complete on all four bridges in this project. Salmon Creek Bridge at milepost 36 and Lower Salt Creek Bridge at milepost 38.2 are complete. Remaining work on the other two bridges includes strengthening the steel truss and one of the bridge supports for Coast Fork Willamette River Bridge at milepost 2.4, and strengthening the last two bridge supports and resurfacing the bridge deck on the Willamette River (Barnard) Bridge at milepost 33.2.

This project was met with a few challenges. The design for the strengthening was based on the existing plans for the bridge. However, the design needed to be changed when it became apparent that the existing plans did not entirely match what was built. The project caused minimal traffic impact (single lane nighttime closure) as most of the work was performed below the bridge deck.

Design is complete for the Salt Creek Bridge Replacement on Oregon 58 and construction is expected to start in early 2025. Besides being seismically vulnerable, the existing bridge has other deficiencies including a severely deteriorated concrete deck. The new bridge is being designed according to modern seismic requirements and will have a wider deck.

ODOT Seismic Program Status



Several bridges have been removed from the program after the field scoping, or the preliminary design confirmed no need for seismic improvements.

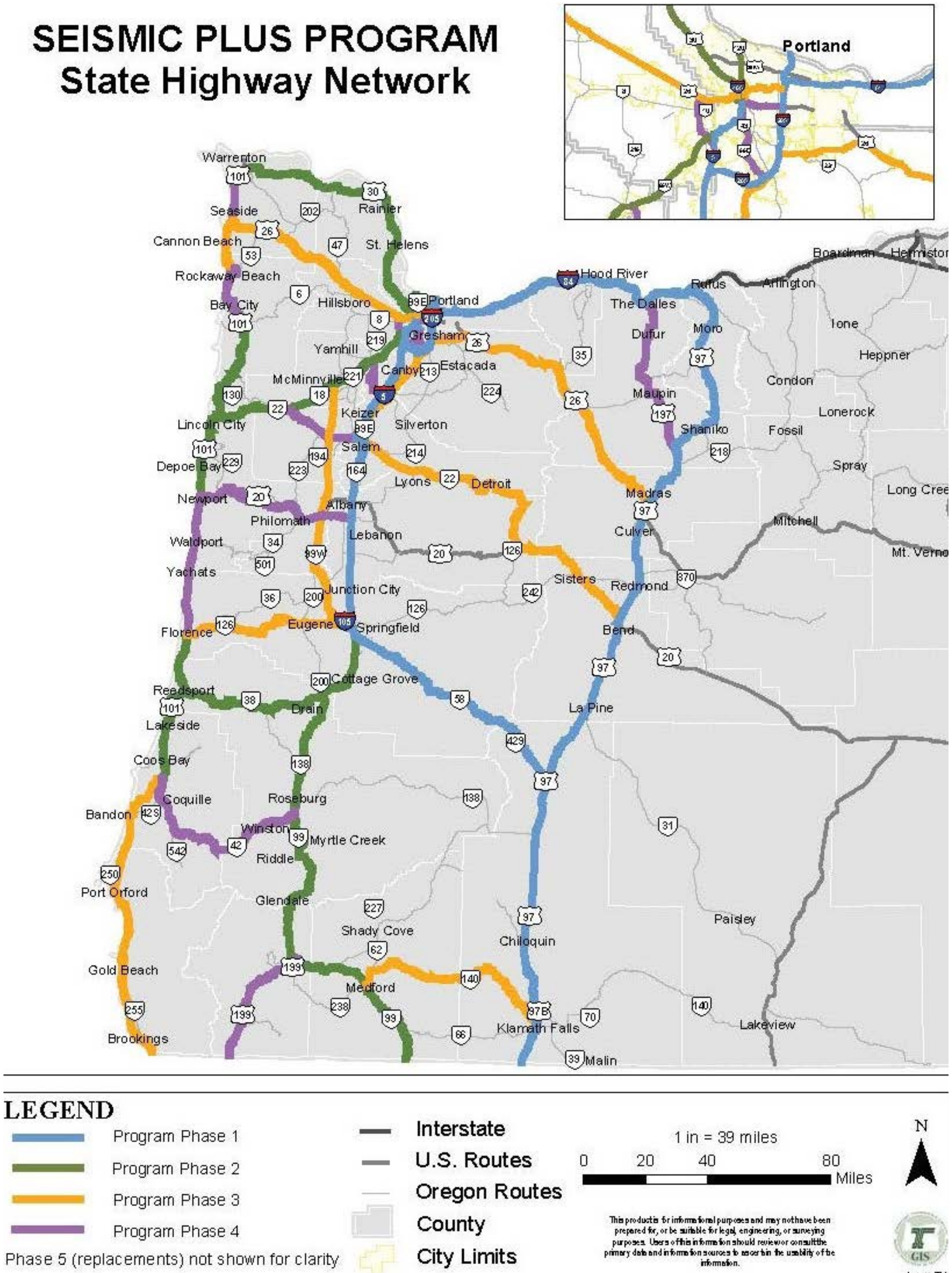
Phase 1: Provides a connection to the Redmond Airport; east-west freight movement and a north-south corridor on U.S. 97, the cornerstone of the program.

Phase 2: Connect the Willamette Valley with the coastal communities and Southern Oregon (Rogue Valley.)

Phase 3: Adds redundancy and capacity to the transportation network already strengthened in Phases 1 and 2.

Phase 4: Will finalize strengthening of all proposed seismic lifeline corridors.

Phase 5: Includes 12 bridge replacements like the Medford Viaduct, the Ross Island Bridge, several historic coastal bridges and other large bridges.



The Bridge program has closely followed the guidelines and recommendations for allocating seismic program funds provided in [ODOT's Seismic Implementation: Policies and Design Guidelines](). Addressing seismic vulnerabilities of bridges on Phase 1 routes remains the program's priority, however, several bridges with lower seismic priority phases have either been replaced due to poor condition or retrofitted/replaced as part of projects funded directly from the House Bill 2017 (e.g., Southern Oregon Seismic Bridge Retrofit.)

Other Funded Seismic Projects

Construction continues on I-205 Abernethy Bridge Project. In addition to providing a wider structure and accommodating additional travel lanes for both northbound and southbound traffic, this project will improve the seismic performance of the existing bridge, making it the only reliable point for interstate traffic to cross the Willamette River after a major seismic event affecting the Portland Metro area.

This project consists of numerous seismic retrofit measures that can be categorized into three primary types of work: replacing existing bridge supports, strengthening supports, and replacing bridge bearings.

The existing support replacement work is primarily associated with supports in the water or near the water's edge. These support replacements have reinforced concrete drilled shafts as large as 12 feet in diameter and work is now complete on 24 out of 28. We have now shifted our focus to constructing the new bridge columns for support replacement or support widening. We also started constructing crossbeams for the supports and afterwards will begin procedures to increase displacement between northbound and southbound structures. All ramps will be closed during these activities, and lanes will be closed intermittently. All new drilled shafts and bridge columns are expected to be completed in 2025.

Abernethy Bridge: Enlarging existing bridge columns.

Construction is underway to replace the Van Buren Bridge in Corvallis. Once we shifted traffic from the old bridge on to the diversion structure in November 2023, we started removing the old bridge, including its' foundation within the Willamette River. After a significant part of the old bridge was removed, we shifted focus to completing the work bridge. The work bridge is a temporary structure exclusively for crew access and equipment during construction.

Constructing drilled shafts, which will serve as the foundation for the bridge, started late summer 2024, and we expect it to be completed in the fall. This will be followed by constructing the new bridge columns and the crossbeams at the support locations of the new bridge. Erecting bridge girders and pouring the concrete bridge deck is expected to take place early summer 2025, which will allow for opening one lane of traffic on the new bridge and removing the diversion structure in late summer of 2025.

Van Buren Bridge – Removing the old bridge while traffic was shifted onto the diversion structure.

The Southern Oregon Seismic Bridge Retrofit is an additional seismic project funded by House Bill 2017. This project is divided into four separate projects. The first coincided with a pilot project to evaluate the cost-benefit of using the buckling restraint bracing (BRB) system for seismic bridge retrofits. The BRB system proved to be a cost-effective retrofit method for bridges with multi-column bridge supports, especially for grade separation structures. It allowed ODOT to address the seismic vulnerabilities of the first two bridges of this project (I-5 northbound and southbound over Leland Road) at a relatively low cost. ODOT will continue exploring opportunities to use this retrofit strategy in future seismic retrofit projects.

The second project addressed seismic vulnerabilities of five bridges supporting Interstate 5: Hwy 1 over Hillcrest Drive, Hwy 1 over Hwy 25 northbound, Hwy 1 over Scoville Road, and both Hwy 1 northbound and southbound over Glendale Interchange. This project is now complete.

Construction is also complete on the third project, consisting of five bridges. Four bridges have been seismically retrofitted on Oregon 140: Little Butte Creek, Schoolhouse Creek, Lick Creek, and North Fork Little Butte Creek. The fifth bridge, Sutherlin Creek, located on Del Rio Road, will provide a detour option for part of Interstate 5.

Bridge support strengthening on Southern Oregon Seismic Bridge Retrofit Project.

The fourth project includes replacing three bridges on Oregon 99, another detour route for I-5. The construction to replace Millers Gulch Bridge and Birdseye Creek Bridge is now complete. The first structure was open to traffic late summer 2024 while the second bridge was open late 2024. Piles for the foundation of Foots Creek Bridge replacement are already installed, and we expect construction to reconvene in the spring of 2025, with traffic shifted onto the new bridge early summer of 2025. The pile installation for this bridge was met with some challenges due to obstructions deep in the ground. Also, several utilities carried by this bridge will need to be relocated before demolition begins.

Right of way funding is available for coastal maintenance stations at Seal Rock and Coos Bay. We are considering an additional facility in Astoria, but it is not currently funded. Each station will be supplied with seismic response kits. The purpose of the kits is to stockpile key materials and supplies that can assist local communities in the early days following a seismic event. The kits will include culvert pipes of various sizes, construction materials, solar powered 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.

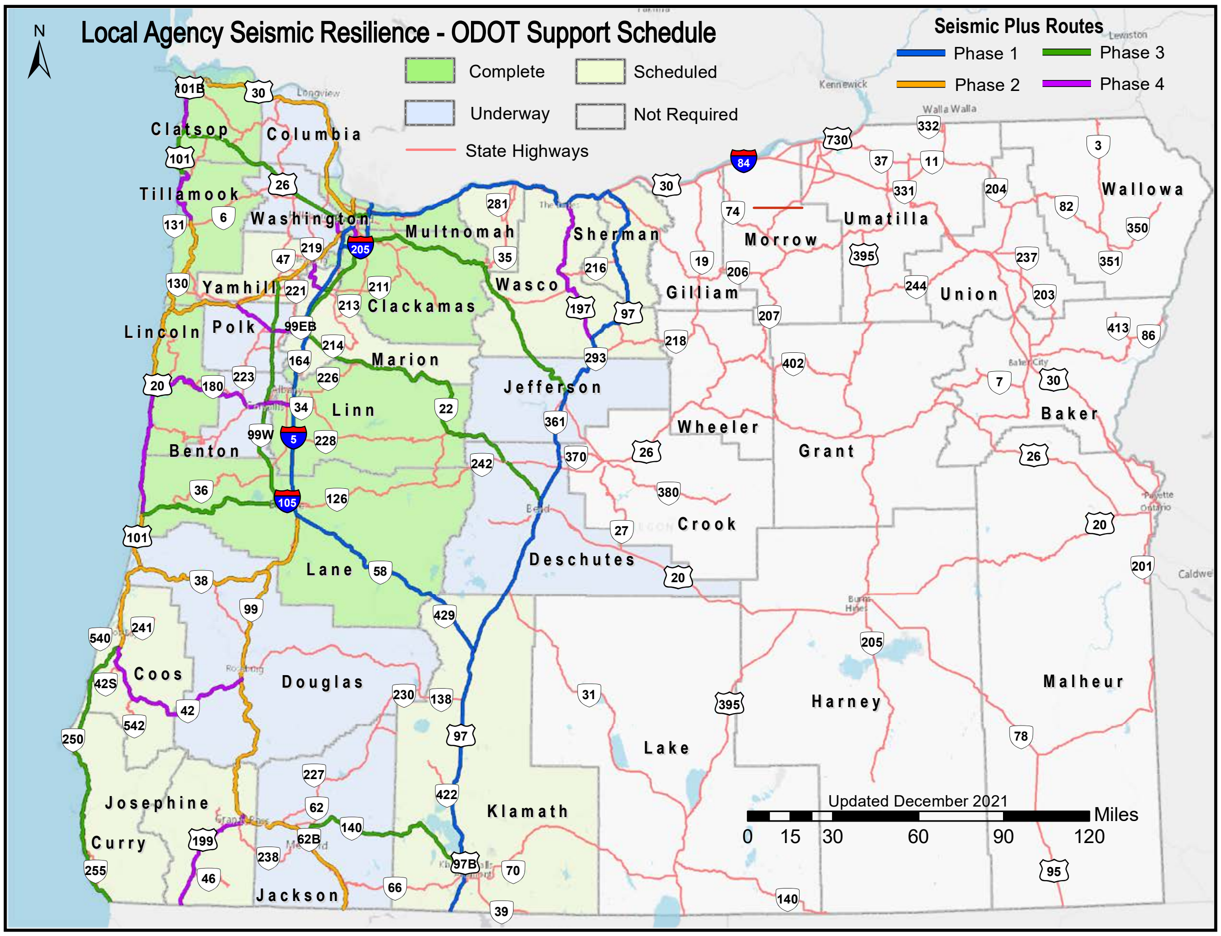
Local Agency Seismic Resilience Support

The Bridge seismic standards engineer and other leaders at ODOT are working collaboratively with Oregon counties to develop planning reports documenting county routes and priorities for seismic resiliency. ODOT provides bridge data and technical support, and the counties provide information about their network.

While the information is useful for county planning, we can also compare it to the state seismic bridge priorities to determine possible state highway detour routes that may be more cost effective to seismically retrofit or replace. Eventually the planning reports may provide an opportunity for seismic resiliency funding from either state or federal funds.

The status of the local agency work is provided below.

Complete	Underway	Scheduled
Clackamas Clatsop Lane Lincoln Linn Multnomah Tillamook	Benton Columbia Deschutes Douglas Jackson Jefferson Polk Washington	Coos Curry Hood River Josephine Klamath Marion Sherman Wasco Yamhill



Local Agency Seismic Resilience - ODOT Support Schedule.

4 Bridge Load Rating

Trucks continue to evolve to improve the efficiency of freight movement and emergency response. The result is modern trucks travelling over older bridges designed for much smaller loads. To ensure bridges can safely support the trucks, ODOT evaluates each bridge to determine the safe load capacity based on a load rating.

ODOT is currently including the specialized hauling vehicles (SHVs), and emergency vehicles (EVs) in all new load ratings. Due to the concentrated loading, we expect there will be a need in the near future to strengthen or place load restrictions on many state and local agency bridges.

Load Rating History

In an effort to keep up with transportation demand, national design loads for bridges were increased in 1944, 1980, and 1993. Over half of the bridge population was designed before 1970 using existing design loads; yet the economy demands more efficient delivery services, so trucks continue to get bigger and heavier.

An early delivery truck with two axles.

An early freight truck with just three axles.

Bridge Load Rating Basics

The load rating analysis determines the capability of a bridge to carry loads. The analysis calculates rating factors (RF) at many points to determine the bridge's weakest member. A rating factor is simply the ration of the load the bridge can carry to the load produced by the vehicle considered.

The load capacity of a bridge considers the following factors:

- The weight of the bridge since the bridge must hold itself up.
- The bridge configuration like length of the bridge spans.
- The strength of the concrete, steel, or timber that was used to construct the bridge.
- The bridge condition – are steel members corroded or damaged? Is the concrete cracked? Are portions of the timber decayed?

Using the bridge related factors identified above, we evaluated different truck loading configurations. The analysis is based on the national bridge formula established in 1975 to limit the weight-to-length ratio of a vehicle. There are four categories of loads evaluated that cover different truck configurations.

Legal Loads

(includes SHVs)

Common semi-trucks, construction and waste management trucks with short wheel bases.

≤80,000 lbs GVW

Continuous Trip Permits

Log trucks, milk tank trucks, chip trucks, gasoline tanker trucks, and other semi-trucks that are heavier than legal loads.

≤105,500 lbs GVW

Single Trip Permit Loads

Non-divisible loads like vehicles hauling windmill components; self-propelled cranes.

Variable weights

Emergency Vehicle Loads

Fire trucks and other vehicles equipped to mitigate hazardous situations.

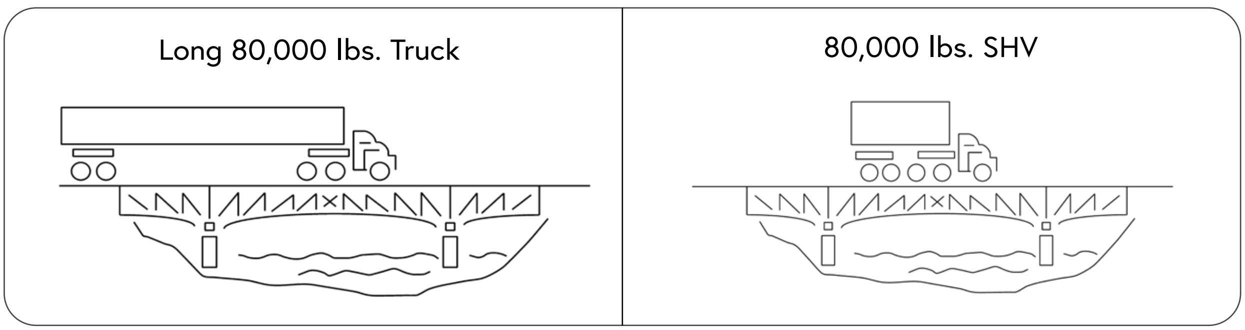
Up to 86,000 lbs GVW with short wheelbases that create highly concentrated loads.

Concentrated Loading from SHVs and EVs

As trucks grew heavier in the 1950s and 1960s, ODOT had to do something to protect bridges. The solution was to link allowable weights to the number and spacing of axles and using the bridge formula to establish limitations. Limiting the weight-to-length ration of a vehicle crossing a bridge is accomplished by either spreading the weight over additional axles or by increasing the distance between axles. One unintended consequence of the bridge formula is a new class of trucks that are called specialized hauling vehicles (SHVs.) These trucks are a single unit with many axles spaced closely together to comply with the requirements of the bridge formula.

Specialized hauling vehicle (SHV).

As shown in the FHWA publication on the bridge formula (excerpt shown below), the loading on bridges can be considerably more for an 80,000-pound specialized hauling vehicle than for an 80,000-pound semi-truck.



This illustration shows how a short vehicle with closely spaced axles can produce higher load effects on bridges compared to a longer vehicle of the same weight that has the axles farther apart.

Because of the national concern with SHVs there is a requirement to update all load ratings to include these vehicles. Specialized hauling vehicles emerged at the same time as new, heavier emergency vehicles were beginning to use roadways.

The current federal highway bill, Fixing America's Surface Transportation (FAST) Act, made it legal for emergency vehicles that have heavier than legal axle weights to travel on the interstate system to respond to wildland fires and other natural disasters. As a result, FHWA has mandated all states to load rate, and if necessary, load post bridges on interstate routes, or within reasonable access (one road mile) of an interstate, for FAST-Act emergency vehicles.

The FHWA mandate requires that lower risk bridges on an interstate or within one road mile, referred to as group 1 bridges, be rated for emergency vehicles when a normal re-rating is warranted. All other bridges that are on an interstate or within one road mile are identified as group 2 bridges and were required to be rated for emergency vehicles by Dec. 31, 2021, which we completed.

Firetruck. (Emergency vehicle.)

The truck shown on this page is an example of the EVs legalized by the FAST Act. These EVs can have a tandem axle weighing nearly double that of the traditional legal tandem. The weight on the two rear axles of this firetruck is equal to the weight that a five-axle dump truck can carry, while the dump truck spreads the load out over its 22-foot wheelbase. Not only is this load much more concentrated than the SHVs, but it is also almost twice the concentrated load that was used to design the Interstate Era bridges built in the 1950s and 1960s.

Oregon is planning to expand these same criteria to all public roadways instead of just on or near an interstate. The FHWA mandate requires that if a state law allows or exempts emergency vehicles to operate as legal loads without restriction off the interstate system, then bridges must be load rated and posted, if necessary, for these vehicles.

It will take several years to get all of the bridges within Oregon load rated for the FAST Act emergency vehicles. ODOT decided to load post all state-owned bridges that have been load rated for emergency vehicles and do not have the capacity to support them safely. As a result, there are 417 state-owned bridges that are load posted.

It Gets More Complicated

The majority of Oregon bridges need updated load ratings using the current method for analysis and to account for the new types of heavier vehicles.

The engineering aspect of an analysis can be complicated. In some cases, the plans for older bridges are not available. Instead of being archived, they may have been placed in an unknown location or inadvertently discarded as office locations and personnel changed. The challenge is that bridge details like the location of reinforcing steel is not known so a load rating is assigned based on the condition and length of the bridge spans.

Another complication can be that a basic analysis may show the need for load posting or strengthening when the bridge shows no signs of distress. For these situations, ODOT performs a load rating using a more advanced analysis to determine the strength of the bridge. If the load rating for a bridge in good condition still shows the need for load posting or strengthening, ODOT may test the materials or perform an on-site load test to determine the strength of the bridge.

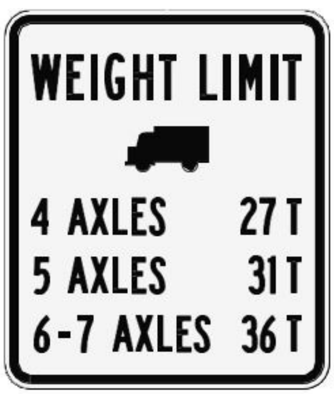
What Happens When a Bridge Can't Carry the Truck Load?

Oregon's economy depends on moving goods efficiently and communities depend on emergency vehicles having ready access to all bridges. Therefore, we make every effort to ensure bridges are safe and reliable. If a load rating indicates that one or more loads exceed the bridge capacity, ODOT uses the under-capacity resolution process to address the load rating.

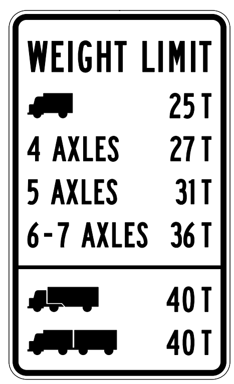
Actions include:

- Coordinating with local agencies, the freight industry and interested parties, including FHWA.
- Monitoring by the region bridge inspector (if not already begun.)
- Reviewing impacts of a load restriction and alternate routes.
- Assembling a response team by ODOT Maintenance to generate an action plan.
- Mobilizing a bridge crew to complete repairs if a bridge cannot be restricted or preparing a contract to either repair or replace the bridge, depending on timing and overall needs.

According to FHWA, if there isn't readily available means to address the load rating, the bridge owner must post load restrictions as soon as possible but no later than 30 days after a load rating identifies the need for posting.



An example of a load posting sign for when only SHVs need to be restricted.



An example of a load posting sign for when all legal vehicles, including SHVs, need to be restricted.

When load postings for a bridge get down to 15 tons or less, we will use a sign that has a single weight posting for all vehicles, showing the maximum tons allowed on the bridge.

Why a Recent Increase in the Number of Load Posted/Restricted Bridges?

Per FHWA memorandum HIBT-10, every U.S. state and other jurisdiction had until Dec. 31, 2022, to have every NBI bridge re-load rated to include the specialized hauling vehicles. ODOT met this federal deadline by working with our consultant engineering firms to complete the load ratings. As a result of completing so many load ratings in a relatively short time, there has been a slight increase in the number of bridges that have rated out low for legal or permit vehicles and thus required either a load posting for legal vehicles or a restriction for permit loads.

Some of the bridges that needed to be re-load rated ended up with much lower rating factors. This was due to differences in current load rating methods versus previous practices. The main difference is that previous load rating methods only analyzed the maximum force locations of each member, or bridge component, that were required to be load rated within a bridge. Current load rating procedures not only analyze these same maximum force locations but also look at every change in structural details (changes in reinforcing, material properties, and member geometries) that will have an effect on the member capacity through the entire bridge. Since our current load rating procedures are now looking at every detail that can change a member's capacity throughout the entire bridge, we often find locations on a bridge that now control the load rating that were never looked at or considered in the older load rating methods since they are not at maximum force locations. This is the reason why some bridges that had previously passed a load rating analysis are now rating out low and requiring a load posting/restriction. Having a relatively large number of bridges re-load rated in a short time has resulted in an increase in load posting/restrictions when compared to previous years.

2024 TUNNEL DATA

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.

ODOT manages nine state-owned vehicular tunnels and is responsible for all inspections, maintenance, and major rehabilitation of the structures. ODOT also inspects the Capitol Mall Tunnel owned by the Oregon Department of Administrative Services, two state-owned pedestrian tunnels that were formerly vehicular tunnels and five vehicular tunnels owned by other road agencies.

ODOT has performed inspections on tunnels for more than 20 years. Until 2017 there were no FHWA requirements to inspect or report tunnels. The inspections were done under the authority of the State of Oregon, and the inspection program/procedures were devised by the State of Oregon, although they were based on the National Bridge Inspection Standards (NBIS.) Under the ODOT program, tunnels were inspected on a regular two-year cycle, with in-depth inspections on a 10-year cycle. ODOT district maintenance crews perform tunnel and drainage inspections yearly.

National Tunnel Inspection Standards (NTIS) Implementation

In 2017, FHWA instituted a requirement that tunnels be inspected. Now, the National Tunnel Inspection Standards (NTIS) for tunnel inventory, inspection and load rating is available to the public. States are now required to report the results of these inspections yearly to FHWA, similar to the way they are required to report inspection information for the National Bridge Inventory (NBI.)

While there are parallels between the data reported for the NBI and NTI, there is one striking difference. The NTI condition data is only element data (the condition of the individual parts of a tunnel, such as the liner, portal, electrical system, etc.) The NBI condition data includes element data as well as ratings of the major components of a bridge, such as the deck, superstructure, substructure and culvert. The NTI has no equivalent to major components, only elements.

The major component rating allowed FHWA to create a bridge condition rating for the entire structure in the NBI. However, there is not major component rating for tunnels and no similar rating for an entire tunnel.

Oregon wanted to be able to determine the overall tunnel conditions (good, fair or poor) using element conditions. Putting the element condition information together to determine the overall tunnel condition provided a challenge as there is no established national standard.

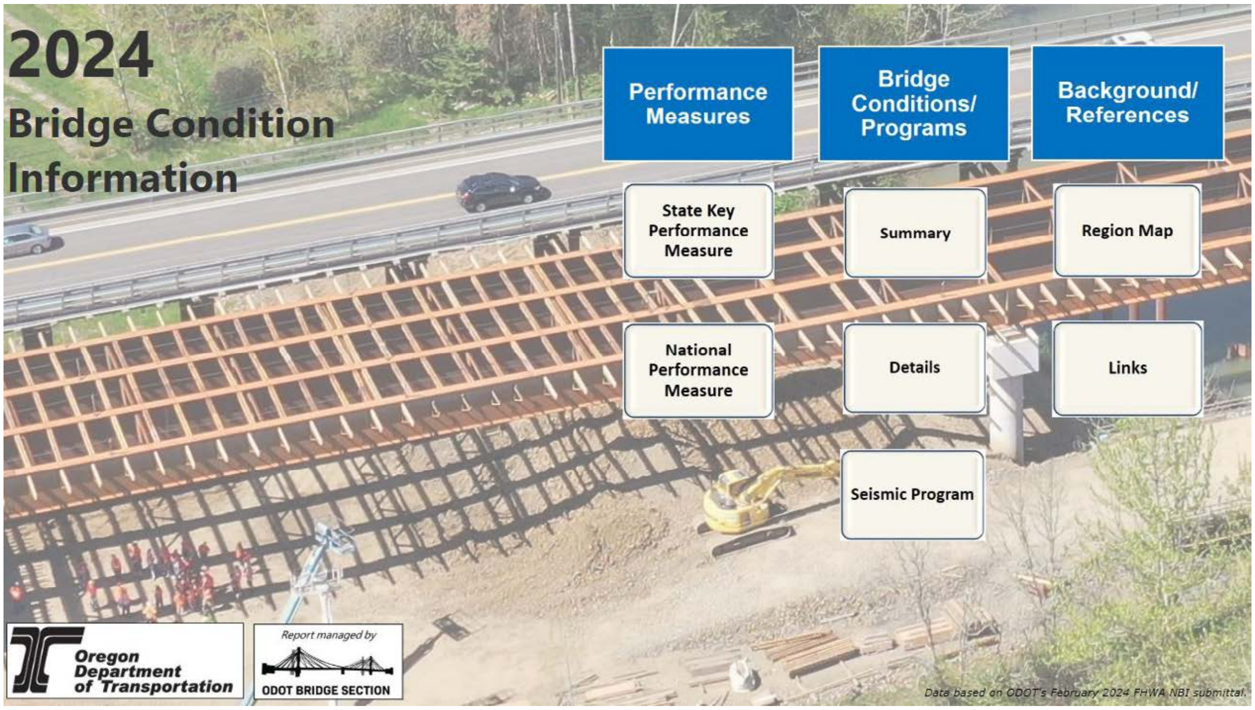
To classify the tunnel condition with the updated NTI Oregon Data, ODOT borrowed a bridge condition parameter termed Health Index (HI) with values ranging from 0 to 100. The HI, in general, incorporates the condition of each element with a weighted average based on the importance of the element to the tunnel and the unit of measurement. The 2024 tunnel condition information reported is based on the updated HI method calibrated with a general assessment of the tunnel conditions and engineering judgement.

Tunnel Conditions 2024

The data provided in the following table was constructed using this ODOT tunnel rating system based on the Oregon NTI element data.

Tunnel Conditions as of February 2024 (based on 2024 FHWA submittal of NTI data)

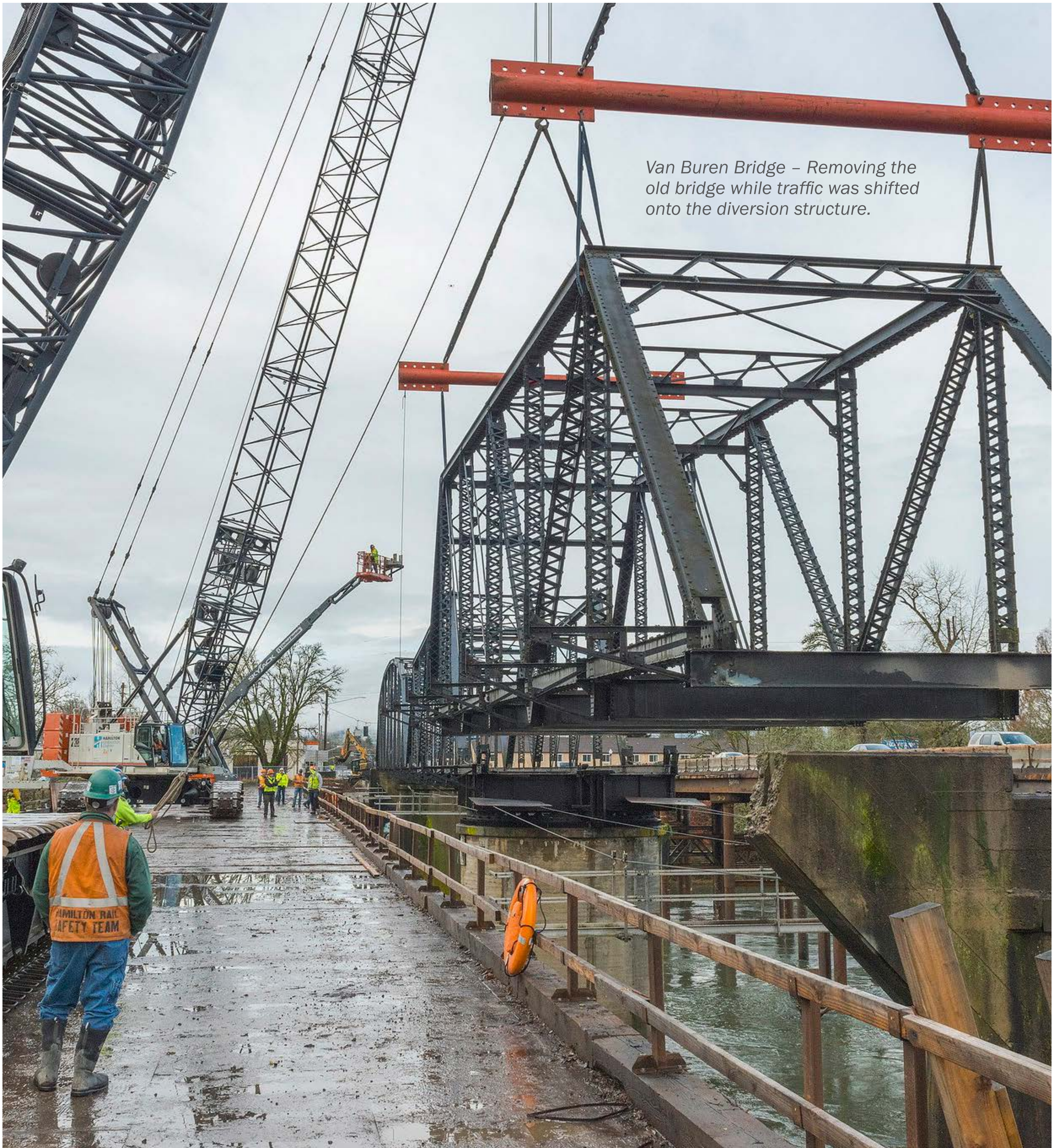
Region	District	Tunnel Name	Year	Length, ft	Materials	Condition	Owner/Notes
Reg. 1	2B	Vista Ridge Tunnel, Hwy 47 EB	1969	1002	Reinforced Concrete	Good	ODOT
Reg. 1	2B	Vista Ridge Tunnel, Hwy 47 WB	1970	1048	Reinforced Concrete	Good	ODOT
Reg. 1	2C	Oneonta Tunnel (Bike/ Ped), Hwy 100	2008	115	Shotcrete Concrete	Good	ODOT (Ped Only)
Reg. 1	2C	Tooth Rock Tunnel, Hwy 2 EB	1936	827	Reinforced Concrete	Fair	ODOT
Reg. 2	01	Arch Cape Tunnel, Hwy 9	1937	1228	Shotcrete Concrete	Fair	ODOT
Reg. 2	01	Sunset Tunnel, Hwy 47 (Dennis L Edwards Tunnel)	1940	772	Shotcrete Concrete	Good	ODOT
Reg. 2	05	Knowles Creek Tunnel, Hwy 62	1958	1430	Reinforced Concrete	Good	ODOT
Reg. 2	05	Salt Creek Tunnel, Hwy 18	1939	905	Reinforced Concrete	Fair	ODOT
Reg. 2	05	Cape Creek Tunnel, Hwy 9	1931	714	Shotcrete Concrete	Fair	ODOT
Reg. 3	07	Elk Creek Tunnel, Hwy 45	1932	1090	Shotcrete	Good	ODOT
Reg. 4	09	Mosier Tunnels	1920	1096	Shotcrete	Fair	ODOT (Ped Only)
Other Agency Tunnels							
Reg. 1	2B	Rocky Butte Tunnel	1939	400	Reinforced Concrete	Good	Portland
Reg. 1	2B	W Burnside Tunnel	1940	230	Reinforced Concrete	Fair	Portland
Reg. 1	2B	Cornell Tunnel #2, (West), NW Cornell Rd	1941	247	Reinforced Concrete	Good	Portland
Reg. 1	2B	Cornell Tunnel #1, NW Cornell Rd	1940	497	Reinforced Concrete	Good	Portland
Reg. 2	03	Capitol Mall Tunnel Chemeketa St	1990	363	Reinforced Concrete	Good	DAS
Reg. 5	14	Owyhee Tunnel, Owyhee Lake Rd	1929	200	Unlined Rock	Fair	Malheur County



More information is available online through the 2024 Interactive Bridge Condition Report.

https://www.oregon.gov/odot/Bridge/Pages/BCR.aspx

The report includes detailed bridge condition information by region, county, district and route with tables and an interactive map.



Van Buren Bridge – Removing the old bridge while traffic was shifted onto the diversion structure.

Oregon Department of Transportation