

## Notable results

- In 2016, 91.2% of WSDOT-owned bridges by deck area are in fair or better condition, a slight decrease from 92.1% in 2015
- Of WSDOT's 3,294 vehicular bridges, 126 had weight restrictions in FY2016, an increase from 120 bridges in FY2015
- Washington continues to meet the MAP-21 and Results Washington goals of having less than 10% of bridges in poor condition
- WSDOT conducted 2,040 bridge inspections in FY2016, more than three quarters of which were routine inspections

## Bridge conditions meet 90% performance goal

As of June 2016, 91.2% of WSDOT-owned bridges by deck area were in fair or better structural condition. This is a long-term improvement since 2011, when 90.8% of bridges by deck area were in fair or better condition, but a slight decrease from the 92.1% of bridges in fair or better condition in June 2015. The decrease in bridge deck area in fair or better condition from June 2015 to June 2016 is primarily due to the natural rate of concrete deterioration statewide.

Measuring bridge conditions by deck area incorporates bridge size, giving a more comprehensive picture of

conditions than counting the number of bridges. WSDOT also uses this method because it aligns with the federal Moving Ahead for Progress in the 21st Century Act, which sets a goal of having no more than 10% of bridges measured by deck area in poor condition. Results Washington, the state's performance management system, adopted this same goal. Washington met this goal for 2016 (see [p. 15](#) for performance indicator) All bridges, culverts, or ferry terminals over 20 feet in length and carry vehicular traffic are included in the overall bridge condition ratings.

Translating the 91.2% of deck area into number of bridges, 3,140 of the 3,294 WSDOT-owned bridges in Washington are in fair or better condition in 2016. There are 154 bridges

**WSDOT has 91.2% of its bridges by deck area in fair or better condition, meeting performance goals**  
Number of bridges and percent of bridges by deck area by condition category; Deck area in millions of square feet

### STRUCTURAL CONDITION

		2011	2015	2016	Trend
<b>GOOD/VERY GOOD</b> Bridges in good condition range from those with no problems to those having some minor deterioration of structural elements.	<b>Bridge deck area</b>	16.1	19.2	19.8	↑
	<b>Percent of deck area</b>	31.1%	36.0%	36.9%	↑
	<b>Number of bridges</b>	1,460	1,628	1,678	↑
<b>FAIR</b> Primary structural elements are sound; may have minor section loss, deterioration, cracking, spalling or scour. This is the most cost-effective time to rehabilitate before the underlying structure is damaged.	<b>Bridge deck area</b>	30.9	29.9	29.1	↓
	<b>Percent of deck area</b>	59.7%	56.1%	54.3%	↓
	<b>Number of bridges</b>	1,589	1,522	1,462	↓
<b>GOOD/VERY GOOD &amp; FAIR TOTALS:</b> Goal = 90% or more deck area in fair or better condition	<b>Bridge deck area</b>	47.0	49.1	48.9	↓
	<b>Percent of deck area</b>	90.8%	92.1%	91.2%	↓
	<b>Number of bridges</b>	3,049	3,150	3,140	↓
<b>POOR</b> A bridge in poor condition has advanced deficiencies such as section loss, deterioration, scour, or seriously affected structural components, and may have weight restrictions. A bridge in poor condition is still safe for travel.	<b>Bridge deck area</b>	4.8	4.2	4.7	↑
	<b>Percent of deck area</b>	9.2%	7.9%	8.8%	↑
	<b>Number of bridges</b>	155	138	154	↑

Data source: WSDOT Bridge and Structures Office.

Notes: The above data shows WSDOT-owned bridges, culverts, and ferry terminals over 20 feet in length that carry vehicular traffic.

All numbers shown in the table above are based on the revised "out-to-out" calculation method (which includes curbs and rails on the bridge) instead of the bridge width curb-to-curb. The 2011 data has been updated using this revised calculation method.

# Washington meets federal, state bridge condition goal

in poor condition (structurally deficient) in 2016, with 99 of these located on the National Highway System. From July 2015 through June 2016, 12 WSDOT-owned bridges totaling 91,000 square feet of deck area in poor condition were repaired, transitioning them to good condition. Additionally, 28 WSDOT-owned bridges—with a net total of 505,000 square feet of deck area—deteriorated to a poor condition state. See [Gray Notebook 58, p. 16](#) for information on how bridge conditions are determined.

## Statewide structurally deficient bridges by deck area remain below 10% goal

Structurally deficient bridges represented 8.3% (5.9 million square feet) of the total 71.3 million square feet of bridge deck area in Washington as of June 2016 (includes both WSDOT-owned and locally owned bridges; see table below). By number of bridges, 342 of the 7,335 total bridges were considered structurally deficient. See [Gray Notebook 50, p. 14](#) for an overview of the bridge condition rating system.

Of the 342 state and local structurally deficient bridges in FY2016, 154 are WSDOT-owned bridges, an increase from 138 out of 334 statewide structurally deficient bridges in FY2015. WSDOT's 154 structurally deficient bridges account for 8.8% (4.7 million square feet) of WSDOT-owned deck area.

Total (state and local) structurally deficient bridge deck area on the NHS in Washington increased to 4.6 million square feet in 2016, up from 4.3 million square feet in 2015. The NHS is a strategic highway network used for federal and state performance reporting that includes both state and local highways and roads serving major airports, ports, rail and/or truck terminals, pipeline terminals and other transport

### Washington achieves goal of keeping structurally deficient bridge deck area below 10% statewide

*As of June 2016; Percent of bridge deck area considered structurally deficient (SD); Deck area in millions of square feet*

	National Highway System		Statewide	
	Deck area <sup>1</sup>	Number of bridges	Deck area <sup>1</sup>	Number of bridges
<b>WSDOT owned</b>	44.4	2,259	53.5	3,294
<i>Amount SD (%)</i>	4.1 (9.2%)	99	4.7 (8.8%)	154
<b>Locally owned<sup>2</sup></b>	4.6	189	17.8	4,041
<i>Amount SD (%)</i>	0.5 (10.0%)	19	1.2 (7.0%)	188
<b>Total</b>	49.0	2,448	71.3	7,335
<i>Amount SD (%)</i>	4.6 (9.3%)	118	5.9 (8.3%)	342

Data source: WSDOT Bridge and Structures Office and WSDOT Local Programs Office. Notes: Structurally deficient is equal to the state's poor condition rating. 1 Due to rounding, some percentages are not computable based on numbers in the table. 2 Bridges owned by counties and cities.



## Results Washington Leading Indicator

Based on current funding levels, control the percent of state and local bridges in poor condition from increasing over 10% by 2017.

**Status:** On plan (green)

### Strategies:

#### 1. Replacing deteriorated bridge elements -

WSDOT performs major preservation repairs by addressing specific bridge

elements to improve a bridge with a low condition rating. The most common types of repairs include floating bridge anchor cable replacement, expansion joint replacement and concrete column repair.

**2. Repainting steel bridges** - A protective paint coating on a steel bridge is essential to prevent corrosion, extend the bridge's service life and keep the bridge in fair or better condition. Continuing to keep up with painting can prevent the number of bridges in poor condition from increasing.

**3. Repairing concrete bridge decks** - WSDOT is working to reduce the number of bridges classified as structurally deficient by addressing bridges with the highest benefits and the most cost savings. One strategy is to repair and rehabilitate concrete bridge decks to extend their service life.

Percent of bridges on the NHS that are structurally deficient (by deck area)	
WSDOT owned	9.2%
Locally owned	10.0%
Combined	9.3%

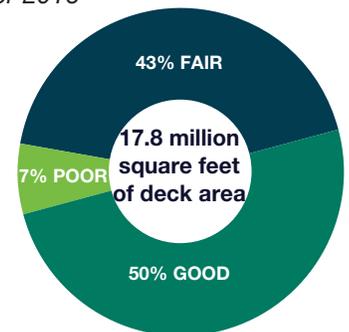
facilities (see [Gray Notebook 54, p. 6](#)). Washington's NHS includes 2,448 bridges; 2,259 (92.3%) are managed by WSDOT and 189 (7.7%) are managed by cities and counties.

## Majority of locally owned bridges remain in fair or better condition

Of the 7,335 bridges across Washington, 4,041 are locally owned and support an average of 10 million crossings per day. Approximately 93% of all Washington's local bridges by deck area were considered to be in fair or better condition during the Federal Highway Administration 2016 reporting period (April 2015 through March 2016), holding steady from the 2015 reporting period.

The next Local Federal Bridge Program call for projects will occur in late fall 2016, and

**Fair or better locally owned bridge deck remains at 93%**  
*Local agency bridge conditions for 2016*



Data source: WSDOT Local Programs Office. Note: This graph shows conditions for all locally owned bridges, both on and off the NHS.

# WSDOT increases its inventory of bridge structures



In 2016, Douglas County used federal and state funding to replace a damaged timber bridge on SR 173 over Foster Creek with a prestressed concrete girder bridge for increased stability.



The old SR 520 bridge was WSDOT's longest structurally deficient bridge, totaling 7,518 feet long (442,810 square feet of deck area). A new floating bridge was opened to traffic in April 2016.

eligible projects selected by the program will be awarded funds in fall 2017. The WSDOT-funded Local Federal Bridge Program aims to preserve and improve the conditions of city and county bridges that are physically deteriorated or structurally deficient through bridge replacements, bridge rehabilitation and preservation methods (such as scour repair, paint for steel structures, seismic retrofit, deck overlays and joint replacement).

Cities and counties are responsible for managing local bridges and are held to the same standards as WSDOT. Federal, state and local funding sources continue to help local agencies build new or maintain existing bridges.

## Washington's bridge inventory grows by 98 structures

The WSDOT-owned bridge inventory includes 3,865 structures as of June 2016, with 53.5 million square feet of deck area. The inventory includes WSDOT-owned bridges, structures less than 20 feet long and structures not open to vehicular traffic (see table at right). The replacement value of all bridges on the state highway system is estimated to be nearly \$51 billion.

Additionally, there are 5,929 locally owned bridge structures in Washington as of June 2016, an increase of 82 structures from June 2015. Vehicular bridges longer than 20 feet account for 68% of the local bridge inventory, and total 17.8 million square feet of statewide deck area.

The new State Route 520 floating bridge opened to traffic in April 2016 and is the world's longest floating bridge. The previous SR 520 floating bridge that was built in 1963 is no longer in use and is being dismantled. WSDOT's bridge

inventory will not reflect the addition of the new bridge until the SR 520 bridge replacement contract is formally closed.

A contract to replace the SR 99 Alaskan Way Viaduct with a tunnel is also in progress. The existing double decker bridge will be removed from the state's bridge inventory once the new tunnel opens to traffic and the bridge can be removed.

### Washington's bridge inventory increases by 16 WSDOT-owned and 82 locally owned structures

Fiscal years 2015 and 2016; Inventory of WSDOT and local bridges

	WSDOT		Local	
	2015	2016	2015	2016
Vehicular bridges longer than 20 feet	3,108	3,109	4,038	4,041
Structures less than 20 feet long	410	418	1,409	1,465
Culverts longer than 20 feet	124	125	-	-
Pedestrian structures	79	81	252	264
Ferry terminal structures	68	69	9	9
Tunnels and lids	44	47	2	8
Border bridges <sup>1</sup>				
Maintained by border state	6 <sup>2</sup>	6 <sup>2</sup>	1 <sup>3</sup>	1 <sup>3</sup>
Maintained by Washington	5 <sup>4</sup>	5 <sup>4</sup>	-	-
Railroad bridges	5	5	137	142
<b>Total bridge structures<sup>5</sup></b>	<b>3,849</b>	<b>3,865</b>	<b>5,847<sup>6</sup></b>	<b>5,929</b>

Data source: WSDOT Bridge and Structures Office and WSDOT Local Programs Office. Notes: 1 WSDOT funds 50% of preservation for 11 border bridges. 2 Five of these bridges are maintained by Oregon and one by Idaho. 3 The locally owned border bridge count is included in the number of vehicular bridges longer than 20 feet; therefore the one border bridge is not included in the total bridge structures count. 4 Four of these bridges are shared with Oregon and one with Idaho. 5 Inventory totals do not equal the total number of state and local bridges on p. 15 because inventory includes miscellaneous structures that the Federal Highway Administration does not require to be inspected. FHWA requires states to report on conditions for all vehicular bridges, ferry terminals and culverts longer than 20 feet, which are the 3,294 WSDOT-owned and 4,041 locally owned structures. 6 This number differs from the inventory count in [Gray Notebook 58](#) due to a recalculation.

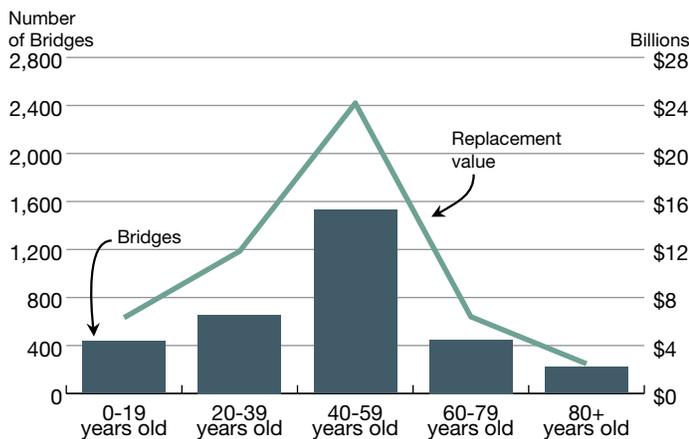
# WSDOT maintains six bridges 100 years or older

Currently, six WSDOT-owned bridges and 117 locally owned bridges are 100 years or older. Five of the WSDOT-owned bridges are concrete earth-filled arches, which use concrete walls to retain the roadway fill—in most cases, earth—in an arch design with an asphalt overlay. These arch bridges, common in the early 1900s, were originally built to last about 50 years, but with continued inspection and maintenance they can remain in service for longer depending on the bridge material condition. Five out of the six WSDOT-owned bridges over 100 years are currently in fair or better condition.

Of WSDOT's bridges, 223 are 80 years or older. Replacement of these bridges as they near 100 years of age would have a total project cost of nearly \$2.5 billion over the next 20 years, or approximately \$125 million per year (in 2016 dollars). Many of these bridges will still be in use during the next 10 years, and WSDOT will continue to focus on their preservation.

## Replacing WSDOT's 223 bridges that are 80 years or older would cost \$2.5 billion over the next 20 years

*As of June 2016; Number of bridges by age; Replacement value in billions of dollars*



Data source: WSDOT Bridge and Structures Office.  
Notes: The graph shows WSDOT-owned bridges only. Replacement value describes the cost to replace all bridges in each age range.

## Majority of bridge inspections required by FHWA are routine

WSDOT performed 2,040 bridge inspections in FY2016, more than three-quarters (1,584) of which were routine inspections. While the majority of WSDOT's bridges are inspected on a two-year cycle as mandated by the FHWA, there are 25 bridges and six ferry terminals with specific watch items that require them to be inspected annually.

A total of 521 concrete bridges that are in good condition and meet defined FHWA criteria are inspected on a four-year cycle. WSDOT performs federally required

## WSDOT performs 1,584 routine bridge inspections

*Fiscal year 2016; Number of inspections by type*

Type of inspection	Number
WSDOT routine bridge inspections	1,584
WSDOT Under Bridge Inspection Truck bridge inspections	204
Special bridge inspections <sup>1</sup>	46
WSDOT local agency inspections	60
Underwater bridge inspections	65
Mechanical and electrical inspections	48
WSDOT routine ferry terminal inspections	21
Fracture critical ferry terminal inspections	12
<b>Total WSDOT bridge inspections</b>	<b>2,040</b>

Data source: WSDOT Bridge and Structures Office.  
Notes: These inspections are for WSDOT-owned bridges only. FHWA requires inspections on vehicular bridges longer than 20 feet. WSDOT performs inspections on all structures included in the inventory on p. 16, but only reports on the inspections required by FHWA. 1 These are discretionary and based on known or suspected deficiencies.

inspections on all WSDOT-owned bridges as outlined in the National Bridge Inspection Standards to determine bridge conditions, maintain bridge safety, and identify preservation and maintenance needs.

Local agencies performed 2,356 bridge inspections in FY2016, 96% (2,264) of which were routine. In addition, they conducted 55 inspections on fracture critical structures (bridges that contain support pieces or members that are under tension, where failure would likely cause a portion of or the entire bridge to collapse) and 29 underwater inspections. Local agencies follow the same federal guidance for inspections as the state. Even though most local governments inspect their own bridges, WSDOT conducts field reviews and provides training and technical assistance to Washington cities and counties for inspecting bridges on local roads.

## Under Bridge Inspection Trucks are vital for inspections and maintenance

WSDOT owns six Under Bridge Inspection Trucks with four used to conduct bridge inspections and one used for bridge maintenance activities such as annual steel bridge cleaning. WSDOT is currently refurbishing the sixth UBIT that will be used by the Eastern Region for bridge maintenance. A cost comparison analysis conducted by WSDOT found that refurbishing a UBIT in its fleet is a better value than purchasing a new vehicle.

UBIT operation requires one truck driver and two bridge inspectors or maintenance personnel stationed in the truck's bucket. One employee operates the movement

# Number of load restricted and posted bridges increase



A WSDOT crew uses an Under Bridge Inspection Truck to conduct an inspection on the State Route 99 Alaskan Way Viaduct.

of the bucket while the second employee performs the inspection or maintenance work. Operation of the UBIT must be done in daylight hours to ensure employee safety.

## WSDOT has load restrictions, postings on 126 bridges in fiscal year 2016

A total of 126 WSDOT-owned bridges were load restricted or posted in FY2016, up from 120 in FY2015. Nearly half (60 out of 126) of WSDOT's load posted or restricted bridges are on the National Highway System, and slightly more than one-fifth (28 out of 126) were considered structurally deficient in FY2016. Additionally, there were 186 locally owned bridges that were load restricted in FY2016 (12 of which were on the NHS, and 69 of which were structurally deficient), an increase from 167 in FY2015.

As part of the bridge inspection program, WSDOT performs load rating evaluations to verify whether bridges can safely carry the weight of trucks using them. Some bridges are weight restricted because they were designed and built at a time when the standard truck weight was lower. If load rating evaluation results show the structure cannot safely carry certain loads because of when it

## WSDOT has 126 load restricted or load posted bridges Fiscal years 2013 through 2016; Number of bridges with weight restrictions



Data source: WSDOT Bridge and Structures Office.

Notes: 1 A "load restricted" bridge cannot be legally used by an overloaded truck. 2 A "load posted" bridge limits the allowable weight of trucks to below typical legal weights.



### Strategic Plan Goal 1: STRATEGIC INVESTMENTS

Strategic Investments Strategy – Create a process to identify strategic preservation and maintenance investments and strategic operational and multimodal capacity improvement investments in corridors to achieve performance levels.

Asset Management Strategy – Define a strategic, agency-wide asset management policy.

In support of these strategies, WSDOT is currently reviewing a draft instructional letter detailing a policy for strategically managing bridge structures. The instructional letter will then become a part of an agency-wide asset management and preservation plan.

was built or bridge deterioration or damage, WSDOT implements weight restrictions to reduce the risk of further damage and ensure bridges are safe to the traveling public.

A bridge may first be "load restricted," making it illegal for any overloaded truck to use the bridge. If the condition worsens and the bridge's capacity to carry heavy loads decreases, then the bridge will be "load posted." This limits the allowable weight of trucks to below typical legal weights. Preservation activities are required to correct load restricted or posted bridges.

## WSDOT identifies potential risks affecting bridge service life

The federal MAP-21 legislation requires states to develop a risk-based asset management plan for the National Highway System within their boundaries. The plan outlines risk management techniques to improve or preserve the condition of assets and performance of the NHS (see box above).

Risk management is the systematic process used to identify risks, analyze consequences and develop treatment strategies. WSDOT encounters several types of risks related to preserving the bridge inventory such as deterioration, scour of foundations, earthquakes and over-height trucks. Each of these risks must be evaluated and preservation strategies must be determined for inclusion in the asset management plan.

Deterioration—the primary risk—is a natural occurrence that is determined by the material, design type, and the amount of maintenance and preservation received over the service life of the bridge. Most bridges are preserved until the preservation cost exceeds replacement cost, at which point replacement becomes the better value.

# Deterioration presents highest risk for bridges statewide

## Concrete bridge deck preservation will be WSDOT's largest bridge need in the next 10 years 2016 through 2026; Dollars in millions

Category	Current needs	Predicted additional needs	Total 10-year needs
Border bridge preservation <sup>1</sup>	\$81.2	N/A <sup>2</sup>	\$81.2
Bridge element repairs	\$26.5	\$85.9	\$112.4
Expansion joint preservation <sup>3</sup>	\$250.5	\$155.2	\$405.7
Movable bridge preservation <sup>3</sup>	\$39.6	N/A <sup>2</sup>	\$39.6
Concrete deck preservation	\$115.6	\$726.5	\$842.1
Steel painting	\$414.5	\$292.1	\$706.6
Bridge rehab or replacement	\$255.7	\$227.8	\$483.5
Bridge scour	\$9.5	\$20.0	\$29.5
<b>Total</b>	<b>\$1,193.1</b>	<b>\$1,507.5</b>	<b>\$2,700.6</b>

Data source: WSDOT Bridges and Structures Office.

Notes: 1 Border bridge preservation is the highest funding priority and includes work from other preservation categories in the table. 2 N/A = Not applicable; the predicted additional preservation need has not been defined. 3 Categories are separate to highlight specific bridge element repairs.

WSDOT currently builds bridges using two primary material types: concrete and steel. Some older bridges were built with timber. Bridge design methods include beams or girders, arches, and boxes and trusses. Each of these materials and design types have different rates of deterioration that can affect the overall service life of a bridge. WSDOT addresses bridge deterioration through several preservation activities such as bridge repairs, painting steel bridges, concrete bridge deck rehabilitation, and bridge rehab or replacement.

### Risk: Bridge element deterioration

WSDOT hires contractors to address specific bridge element deterioration beyond what regional bridge crews can accomplish. Examples of this work include replacing steel anchor cables on floating bridges, repairing deteriorated concrete columns, replacing large steel expansion joints, and movable bridge mechanical and electrical rehabilitation.

Total funding in the 2015-2017 biennium (July 2015 through June 2017) for bridge repair is \$48.2 million. This includes a \$10.0 million reserve to be used for prioritized bridge

### 1,730 bridge element repairs needed in next 10 years As of June 2016; Dollars in millions

Bridge element needs	Number of bridges	Cost to repair
Bridge element repairs	92	\$112.4
Expansion joints	1614	\$405.7
Movable bridges	12	\$39.6
Border bridge elements	12	\$12.9
<b>Total 10-year needs</b>	<b>1,730</b>	<b>\$570.6</b>

Data source: WSDOT Bridge and Structures Office.



WSDOT replaced an old maintenance traveler (a movable platform providing under-bridge access) with a new one (pictured above) on the SR 16 Tacoma Narrows Bridge in 2016, allowing WSDOT crews to complete work on the bridge more safely and efficiently.

repair needs during the biennium; repairs are prioritized based on engineers' judgements on the severity of the issue, route importance and the risk of doing nothing. Also included in the \$48.2 million budget are \$1.0 million and \$4.6 million reserves for as-needed preservation activities on the new SR 520 floating bridge and the new SR 16 Tacoma Narrows Bridge, respectively.

WSDOT completed a project to replace 41 expansion joints on six bridges along Interstate 5 near Marysville in August 2016. This project adds nearly 20 years of service life to the bridges. Three bridge element deterioration projects are scheduled for the SR 104 Hood Canal floating bridge to replace anchor cables, repair deteriorated prestressed concrete (a compression method to strengthen concrete) girders and replace gear boxes on the movable span.

### Risk: Concrete bridge deck deterioration

The majority of WSDOT-owned bridges have reinforced concrete decks. The primary goal of WSDOT's comprehensive bridge deck program is economically repairing and overlaying concrete bridge deck to prolong their lifespan and avoid expensive deck replacements.

When funding becomes available, WSDOT hires contractors to perform deck repairs and add a protective

### Thirty-eight bridge decks are past due for repair As of June 2016; Dollars in millions

Bridge deck needs	Number of bridges	Cost to repair
Past due for repair <sup>1</sup>	38	\$38.4
Due for repair <sup>2</sup>	47	\$77.2
Due within the next 10 years	223	\$726.5
Border bridge deck repairs	2	\$22.3
<b>Total 10-year needs</b>	<b>310</b>	<b>\$864.4</b>

Data source: WSDOT Bridge and Structures Office.

Notes: 1 Bridges with more than 5% of deck area patched or spalled are classified as "past due." 2 Bridges with 2% to 5% of deck area patched or spalled are classified as "due."

# WSDOT manages 16 bridges that need replacing

overlay, normally a 1.5-inch thick layer of modified concrete. A full bridge deck rehabilitation and concrete overlay extends the bridge's service life by at least 25 to 30 years and is more cost-effective than replacing the entire deck or bridge for bridge decks that have repeat deterioration.

Using the modified concrete overlay method, WSDOT has extended the service life of 343 bridge decks (8.2 million square feet) by at least 25 years. As a result of WSDOT utilizing this overlay method as a bridge deck preservation strategy, only 14 total deck replacements have been necessary to date. WSDOT has identified another 198 overlays (6.5 million square feet) that are predicted to need replacing during the next 10 years.

Once the reinforcing steel in concrete bridge decks starts to corrode (for example, due to winter weather or the use of deicing salt), the concrete starts to "spall" (pothole) and deteriorate. WSDOT crews repair spalled areas annually, but these repairs are considered to be temporary and typically last one to three years. Once the total area of repairs and/or patching exceed 2% of the total deck area, the bridge is added to the list of future needs and classified as structurally deficient. Bridge deck overlay projects are prioritized based on the total square footage of deterioration and the type of freight route (see [p. 40](#)) on which the bridge is located. Bridges on the most vital freight routes and those leading to islands get higher priority.

WSDOT has one concrete overlay project under contract out of the 16 statewide projects planned to be completed or under contract in the 2015-2017 biennium. WSDOT plans to spend \$4.1 million for concrete bridge deck overlays during the biennium. Additionally, a six-year preservation funding plan includes \$84.1 million for concrete bridge deck rehabilitation and overlay.

## Risk: Steel bridge deterioration

WSDOT preserves steel bridges on state highways by painting them as needed to protect the steel elements against premature corrosion. WSDOT currently maintains 311 steel bridges and eight steel border bridges that require painting on a regular basis. Though WSDOT does not directly manage all eight of the steel border bridges, painting costs are shared equally between the bordering states. WSDOT has completed six painting projects on steel bridges in the 2015-2017 biennium, with three additional projects under contract. The total planned biennial funding for steel bridge painting is \$45.3 million.

## WSDOT determines a need of \$742 million to fully fund its 10-year steel bridge painting plan

As of June 2016; Dollars in millions

Painting needs	Number of bridges	Cost to paint
Past due for painting <sup>1</sup>	39	\$163.2
Due for painting <sup>2</sup>	70	\$251.3
Due within the next 10 years	70	\$292.1
Border bridge painting	3	\$36.0
<b>10-year total need</b>	<b>182</b>	<b>\$742.6</b>

Data source: WSDOT Bridge and Structures Office.

Notes: 1 Steel bridges with more than 5% of steel exposed are classified as "past due for painting." 2 Steel bridges with 2% to 5% of steel exposed are classified as "due for painting."

Bridges are prioritized for repainting based on the amount of corrosion and the route on which they are located. Bridges on primary freight routes and those leading to islands are given top priority. Steel truss bridges require repainting every 20 to 25 years on average and steel girder bridges require painting every 30 to 40 years on average. WSDOT will need to repaint 182 of its 311 steel bridges within the next 10 years (see table above).

Painting steel bridges is the best economic decision based on the lowest lifecycle cost. A full paint removal and repainting project is approximately 20-25% of the cost to replace a bridge and provides an additional 20 to 25 years of service life.

## Risk: Deterioration requiring bridge rehabilitation or replacement

WSDOT currently manages 16 bridges that are structurally deficient and require replacement (excluding the SR 99 Alaskan Way Viaduct bridge as it has an active replacement contract). An additional 16 structurally deficient bridges have been identified as needing rehabilitation (a major preservation repair) with three of those requiring bridge deck replacement, a more intensive project than bridge deck repair or concrete overlay (see [p. 19](#)).

## WSDOT currently needs to replace 16 bridges

As of June 2016; Dollars in millions

Bridge needs	Number of bridges	Cost to replace
Current replacement need	16	\$148.1
Current rehabilitation need	16	\$107.6
Replacement/rehabilitation need within the next 10 years	60	\$227.8
Border bridge replacement/rehabilitation need	1	\$10.0
<b>10-year total need</b>	<b>93</b>	<b>\$493.5</b>

Data source: WSDOT Bridge and Structures Office.

# Three bridges to be repaired after impact damages

Bridges that have reached the end of their service life require rehabilitation or replacement. Bridge rehabilitation is considered before replacement. Generally, if rehabilitation is 60% or more of the replacement cost then bridge replacement is chosen.

## **Risk: Scour of bridge foundations**

Bridges experience “scour” when high volumes of water cause soil erosion around their foundation. Foundation scour is the leading cause of bridge failures in Washington and nationwide. There are 1,583 WSDOT-managed vehicular bridges and culverts longer than 20 feet that cross over water. WSDOT has evaluated these bridges using national inspection standards and determined 262 (16.6%) to be “scour critical,” meaning they are at risk for future scour. All of these bridges are monitored and inspected every two years as part of the routine bridge inspections.

WSDOT reviewed the conditions and original bridge plans for all of the scour critical bridges in spring 2016 and determined the top priorities that will need scour repair. The three highest scour priorities—US 101 Chehalis River bridge, SR 529 Union Slough bridge and the US 2 South Fork Skykomish River bridge—are in the design phase with construction planned to begin in 2018. The 2015-2017 biennium scour program funding is \$700,000.

In November 2015, a prestressed concrete bridge on US 2 at milepost 54 near Skykomish was partially closed and required an emergency foundation repair due to erosion caused by heavy rainfall. In May 2016, a bridge on US 12 at milepost 135 near Packwood also required an emergency foundation repair. Both bridges are currently open to traffic.

## **Risk: Over-height truck impacts**

Steel truss bridges and other bridges that cross over state highways are frequently damaged by over-height truck impacts. The damage can result in bridge collapse (the I-5 Skagit River bridge collapse in 2012), bridge closure (the I-5 Koontz Road bridge closure in December 2015), or lane restrictions. Funding in the 2015-2017 biennium to address bridges damaged by truck impacts is nearly \$7.7 million.

WSDOT has recently completed contracts to replace truck-damaged prestressed concrete girders on three bridges: the I-5 northbound bridge over 41st Division Drive near Joint Base Lewis-McChord, the I-5/Birch Bay Road undercrossing in Custer and the I-90 eastbound bridge over Front Street in Issaquah.



*The Koontz Road bridge over I-5 was severely damaged by an over-height truck impact in December 2015, requiring closure of the bridge until two of the four prestressed concrete girders can be replaced.*

Three bridges are currently under design to be repaired:

- SR 121/93rd Ave. bridge – A northbound truck impacted the bridge in 2015. Bridge engineers determined the damaged girder needs replacement. Work is scheduled to be completed in 2017.
- I-5/Koontz Road bridge – A southbound truck impacted the bridge in 2015. Bridge engineers determined the bridge needed to be closed and two damaged girders replaced. Work is scheduled to be completed in 2017.
- Southbound I-5 Cowlitz River bridge – A southbound truck impacted a vertical member of the north steel truss span in 2015. Bridge engineers determined the vertical member needs replacement. Work is scheduled to be completed in 2017.

At the time of publication, the WSDOT-owned Chamber Way bridge over I-5 in Chehalis had been struck by an over-height truck on July 22, 2016, causing significant structural damage; the bridge was immediately closed to traffic. The next day, structural engineers performed a thorough inspection, determining that damages to the support girders over the southbound lanes of I-5 were irreparable. Emergency contractor crews completed demolition of the bridge during a nighttime closure of I-5 on July 26, 2016. A temporary span was constructed, reopening the bridge on August 4, 2016, to two-way vehicular traffic. On August 8, 2016, another over-height truck struck the bridge over the northbound I-5 lanes; damages were minor and did not affect the bridge structure. A long-term solution for the much-used overpass is still in development.

## **Risk: Earthquakes**

Washington state bridges are at risk of earthquake damage, and risk is highest for those bridges west of the Cascade Mountains. WSDOT participated with federal agencies, California and Oregon during the “Cascadia Rising” earthquake drill in June 2016 which assumed a 9.0 magnitude earthquake along the Cascadia Subduction

# Connecting Washington aids in bridge preservation

Zone along with a potential tsunami. Lessons learned from this drill will help agencies better understand how they will be able to respond to a major seismic event.

New bridges are designed based on current seismic design standards. Bridges may sustain some damage in large earthquakes, but should not collapse, and would need to be repaired following an extreme event like the Cascadia Rising earthquake simulation. WSDOT has coordinated with the state Department of Emergency Management and others to identify key routes (such as I-5 from JBLM to the I-405/SR 518 interchange, I-405 and I-90) determined to be critical to have open following a seismic event to help move emergency vehicles, goods and supplies for the response.

## Connecting Washington addresses bridge preservation needs

As part of the \$16 billion Connecting Washington transportation revenue package, \$1.2 billion is allocated to state highway preservation, which includes maintaining pavement, bridges and traffic operations. WSDOT is working to identify bridge preservation projects as part of this investment. Three specific bridge projects identified by the Legislature will be addressed in the next six years:

- SR 241 Yakima River bridge near Mabton – \$12 million
- US 12 Wildcat Creek bridge near White Pass – \$12 million
- SR 107 Chehalis River bridge near Montesano – \$12.5 million

In addition to the \$1.2 billion, another \$57.5 million from Connecting Washington is allocated to bridge preservation and repair projects over the next 16 years. No specific projects have been identified as part of this investment.

Connecting Washington funding will not clear WSDOT's list of structurally deficient bridges. Structurally deficient does not mean that the bridge is unsafe or needs to be replaced; it generally indicates that one or more of the bridge components requires either repair or preservation. In delivering preservation strategies using a lowest lifecycle cost approach, there will continue to be bridge components that need to be addressed.

Connecting Washington will help address the most critical needs for bridges. In particular, it will help eliminate most of the weight restrictions on many of the deficient bridges and help prevent new weight restrictions from being imposed.

WSDOT has addressed bridge seismic retrofit needs for the past two decades, including identifying and retrofitting all or part of more than 400 bridges. WSDOT has invested nearly \$195 million since 1991 to strengthen bridges to better withstand earthquakes in Washington.

WSDOT has a current need of \$1.5 billion for seismic retrofitting. One bridge on SR 167 near Auburn is currently under contract to be retrofitted by adding steel jackets to the concrete columns. Funding in the 2015-2017 biennium for the seismic retrofit of state bridges is nearly \$6.7 million.

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### A closer look at MAP-21, Results Washington and GASB bridge condition requirements

The federal Moving Ahead for Progress in the 21st Century legislation (see [p. 7](#)) requires that states have no more than 10% of bridge deck area classified as structurally deficient (poor condition) on the National Highway System. States failing to meet this target for three consecutive years must devote a portion of National Highway Performance Program funds to improve bridge conditions. The Results Washington goal mirrors this federal requirement (see [p. 9](#) for more on Results Washington; see [p. 15](#) for the progress toward this goal).

WSDOT also follows infrastructure asset reporting policies adopted by the state from the Governmental Accounting Standards Board, which establishes reporting standards for state and local governments that follow Generally Accepted Accounting Principles. For GASB reporting, WSDOT has set a condition goal of 90% of WSDOT-owned bridge deck area in fair or better condition. WSDOT is required to maintain an inventory of assets, document asset conditions, and estimate the annual preservation costs needed to maintain assets at the 90% bridge condition goal.

#### Bridge condition reporting requirements Condition targets by performance reporting system

Reporting system	Target	Included bridges
Moving Ahead for Progress in the 21st Century	≤10% of deck area on structurally deficient (poor condition) bridges	All NHS bridges (WSDOT- and locally owned)
Results Washington	≤10% of deck area on structurally deficient (poor condition) bridges	All NHS bridges (WSDOT- and locally owned)
Governmental Accounting Standards Board	≥90% of bridge deck area in fair or better condition	All WSDOT-owned bridges (NHS and non-NHS)

Data source: WSDOT Office of Strategic Assessment and Performance Analysis.  
Note: NHS = National Highway System.