



## Notable results

- WSDOT-owned bridge deck area in poor condition has decreased from 4.1 million to 3.9 million square feet since June 2012
- WSDOT's quick response reopened the Skagit River Bridge within four weeks
- In the 2013-2015 biennium, planned bridge preservation funding is \$273.6 million; needs will exceed \$1 billion in the next decade
- The majority (82%) of city- and county-owned bridges are in good condition

## State bridge conditions improve

Ninety-six percent of WSDOT-owned bridges were in fair or better structural condition in fiscal year 2013 (July 2012 to June 2013), up from 95 percent a year ago. When looked at in terms of square footage of bridge deck area, almost 92 percent was in fair or better condition in fiscal year (FY) 2013, a slight improvement from 91 percent in FY2012. See table on [p. 5](#) and definitions of condition ratings on [p. 14](#).

Deck area is a more comprehensive measure of bridge preservation needs because it accounts for bridge size. Counting the number of bridges does not distinguish whether bridges are small or large, which greatly impacts costs for repair and replacement. In FY2013, 4 percent of WSDOT-owned bridges and 8 percent of deck area were in poor condition, indicating some larger bridges were rated poor. These bridges add up to 3.9 million square feet of deck area—the size of 66 football fields. This is an improvement from 4.1 million square feet in poor condition in FY2012.

Bridges rated as poor are still safe for travel. They have some deficiencies and are in need of future repair or replacement. Reporting by deck area aligns with

## Majority of bridge deck area in good condition in 2013

Fiscal year 2013; WSDOT-owned bridge deck area by condition



Data source: WSDOT Bridge and Structures Office.

Note: Percents may not equal 100 percent due to rounding.

requirements in the federal Moving Ahead for Progress in the 21st Century law (see gray box on [p. 13](#)).

WSDOT's bridge preservation funding will decline in the next 10 years. Funding planned for the 2013-2015 biennium totals \$273.6 million, which is about half of the funding available for the next 10 years. Bridge preservation funding is projected to drop to \$87.6 million for the 2015-2017 biennium and significantly in following biennia, down to \$49.1 million in the 2021-2023 biennium. Current projections of State and Federal bridge preservation funding for the next 10 years are expected to meet about 44 percent of the projected needs through the next 10 years, which totals \$1.07 billion.

## WSDOT bridge preservation funding planned for 2013-2015 biennium and projected 10-year needs

FY2013 through FY2023; Dollars in millions

Preservation type	Major bridge repairs /movable bridges	Bridge replacement /rehabilitation	Painting	Concrete overlay	Seismic	Scour	TOTAL
Planned 2013-2015 biennium	20.4	114.7	79.8	8.8	49.2	0.7	\$273.6
Projected 10-year needs	79.6	239.8	486.2	147.2	102.8	14.3	\$1,070

Data source: WSDOT Bridge and Structures Office.

Note: Ten-year needs are projected preservation needs that are not currently funded, meaning funding that is planned for the 2013-2015 biennium is not included in the projected needs.

# Deck area and number of structurally deficient bridges declines

The total deck area of state- and locally-owned structurally deficient bridges in Washington decreased 15 percent, from 8 million in 2011 to 7 million in 2012. Structurally deficient bridges have deteriorated conditions but are safe for travel. The Federal Highway Administration (FHWA) rates bridges for structural deficiency by calendar year, using the same data and condition rating scale that WSDOT uses for good, fair, and poor condition.

A bridge with a rating of four or less on a scale of nine is rated as structurally deficient and also rated as poor by WSDOT (see table on p. 14). Unsafe bridges are closed and are not counted in WSDOT's rating.

Structurally deficient bridges represent 5 percent of the 7,840 total bridges in the state. The 366 deficient bridges in the state in 2012 is a decrease from 391 in 2011. Of the structurally deficient bridges in Washington, 138 were owned by WSDOT in 2012, a drop from 152 in 2011.

The improvement in the deck area and number of deficient bridges in the state can be attributed to continual preservation projects, some of which were funded by Nickel and Transportation Partnership Account gas tax funding (see p. 28). Washington is ranked 22nd highest in the nation in terms of the amount of structurally deficient bridge deck area in 2012 according to FHWA data.

## Condition of WSDOT bridges by deck area and number shows most in fair or better condition

Fiscal year 2013; Square feet in millions

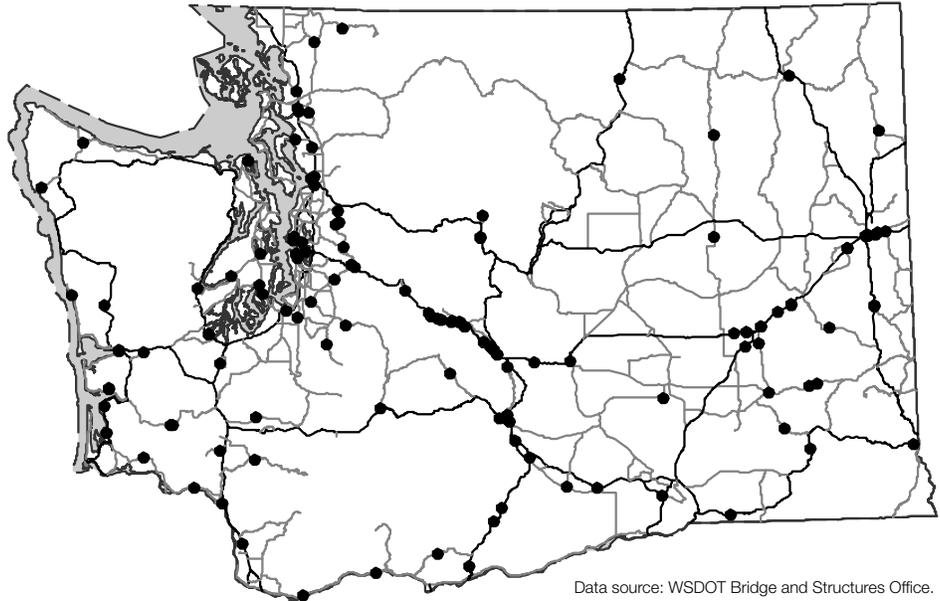
Condition	By deck area		By number of bridges	
	Square feet	Percent	Number	Percent
<b>Fair or better</b>	<b>42.5</b>	<b>92%</b>	<b>3,129</b>	<b>96%</b>
Good	37.2	80%	2,844	87%
Fair	5.3	11%	285	9%
<b>Poor</b>	<b>3.9</b>	<b>8%</b>	<b>138</b>	<b>4%</b>

Data source: WSDOT Bridge and Structures Office.

Notes: Percents may not add to 100 due to rounding for publication. In total, 46.4 of 46.6 million square feet of bridge deck area on 3,267 of 3,794 state-owned bridges were rated for this performance measure in FY2013. See p. 14 for an overview of the bridge condition rating system.

## WSDOT owns 138 structurally deficient bridges

Number of structurally deficient bridges in 2012



Data source: WSDOT Bridge and Structures Office.

To see WSDOT's list of structurally deficient bridges, go to [http://www.wsdot.wa.gov/NR/rdonlyres/6A570363-EC34-4010-986E-591A89CEA6FB/0/SD\\_AUG2010v2.pdf](http://www.wsdot.wa.gov/NR/rdonlyres/6A570363-EC34-4010-986E-591A89CEA6FB/0/SD_AUG2010v2.pdf).



## Safety is WSDOT's first priority

All bridges in Washington are designed, constructed and maintained with one primary goal: safety of the traveling public. Additional considerations include longevity, contributions to the community, and regional economic vitality. Bridges can serve the traveling public for more than 100 years if maintained effectively through their lifespan. Strategic asset management of bridges with maintenance and preservation, such as washing and repainting steel sections and replacing expansion joints, maximizes their useful service life. This work keeps bridges safe and serving the public for the least cost to taxpayers.

This article reports on the current condition of the state's bridge assets and the actions WSDOT is taking to maintain and preserve bridges today and for the future. The majority of WSDOT's bridge assets are in good condition today, and keeping bridges in good shape in the future relies on the continued ability to maintain and preserve bridges to maximize their full service life, keeping them safe for travel.

## WSDOT adds 12 vehicular bridges to inventory

### WSDOT's bridge inventory increases

The WSDOT-owned bridge inventory includes 3,794 structures as of June 30, 2013. These add up to 46.6 million square feet of deck area, about 1.7 square miles. Of these structures, 3,082 carry vehicles and are 20 feet or longer, with a total of 45.5 million square feet of deck area.

WSDOT has added 12 vehicular bridges to its bridge inventory since July 2012, primarily due to new bridges being built. Each new addition to the inventory of bridges introduces new preservation and maintenance needs. At the same time, as older bridges are replaced the preservation and maintenance needs tend to be lower for the replacement bridge.

The average age of WSDOT's vehicular bridges is 43 years. WSDOT has 279 bridges that are 75 years old or older, totaling 1.8 million square feet of deck area. The replacement of the 77-year old timber trestle Bone River Bridge on U.S. 101 was completed in 2013. This project replaced a structurally deficient and functionally obsolete bridge with a concrete structure that was built to withstand flooding and major earthquakes.

### WSDOT inventory shows most bridges carry vehicles

*Inventory of WSDOT bridges as of June 30, 2013*

	Number
<b>Total WSDOT bridge structures</b>	<b>3,794</b>
Vehicular bridges longer than 20 feet <sup>1</sup>	3,082
Structures less than 20 feet long	387
Culverts longer than 20 feet	128
Border bridges maintained by border state <sup>1</sup>	6
Pedestrian structures	75
Tunnels and lids	42
Ferry terminal structures	68
Buildings (I-5 Convention Center) <sup>3</sup>	1
Railroad bridges	5

Data source: WSDOT Bridge and Structures Office.

Notes: 1 The average age of WSDOT vehicular bridges is 43 years; 902 bridges are between 50 and 75 years old, and another 279 bridges are 75 years or older. 2 WSDOT funds 50 percent of the preservation for 11 border bridges. Six of these bridges are maintained by the border state (five with Oregon and one with Idaho). The remaining five border bridges are maintained by WSDOT and included in WSDOT's vehicular bridges category (four with Oregon and one with Idaho). 3. The I-5 Convention Center building is included because it is a structure inventoried by WSDOT.

### Bridges inspected every two years

WSDOT performs federally-mandated inspections on all state-owned bridge structures on a 24-month cycle to determine bridge condition and preservation needs.

Bridges with specific watch items are inspected annually. Inspections are performed using national standards and WSDOT works with the Federal Highway Administration to ensure the quality of inspections to ensure all bridges open to the public are safe.

WSDOT also performs maintenance inspections to determine additional repairs, inspect bridge contract work, respond to bridge damage, inspect scour critical bridges during floods, and prioritize maintenance work plans.

For fiscal year 2013, WSDOT has scheduled 1,844 bridges for preservation inspections, to determine bridge condition and preservation needs. Some inspections require special needs, such as under-bridge inspection trucks, which are needed for 246 of the scheduled inspections.

Additionally, WSDOT has 67 underwater dive, 40 ferry terminal, 150 sign bridge, and 13 radio tower inspections planned for 2013. WSDOT also plans to perform 64 inspections for local city and county bridges.

### Local inspections follow same national standards

Local agencies follow the same guidance for inspections as the state; bridges are inspected at least once every two years using the same national inspection standards. WSDOT conducts field reviews and provides training and technical assistance to Washington cities and counties for inspecting bridges along city streets and county roads.

WSDOT and local governments closely follow federal guidelines in their bridge inspection and maintenance procedures and report annual state, city and county data concerning the structural condition and adequacy of all bridges statewide.



*Before and after: Replacement of the structurally deficient and functionally obsolete 1936 U.S. 101 Bone River Bridge. The replacement bridge is a concrete structure built to withstand flooding and major earthquakes.*

# Inspections help WSDOT preserve bridge assets

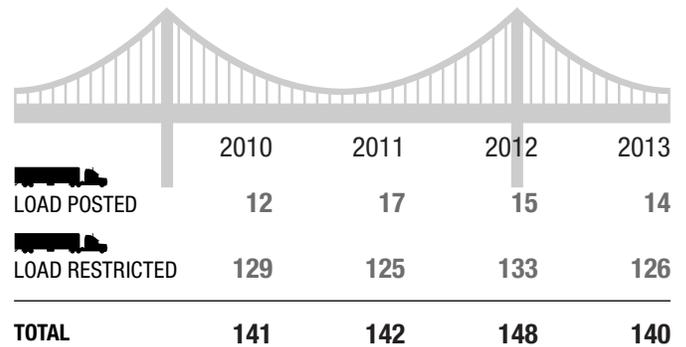
## The art of scheduling bridge inspections

Scheduling the appropriate date for each bridge to be inspected takes coordination. New Federal Highway Administration performance measures require a bridge to be inspected as close as possible to the day that is 24 months after the bridge's previous inspection.

Some bridge inspections require an under bridge inspection truck, those in urban areas or on Interstate routes often must be done during a weekend or between sunrise and 10:00 a.m., sometimes requiring several closures to complete an inspection. Inspections also must be scheduled outside of the nesting periods of migratory birds on about 20 of WSDOT's bridges.

## WSDOT has 140 load posted or restricted bridges

FY2010 to FY2013; Number of bridges with weight restrictions



Data source: WSDOT Bridge and Structures Office.

## Fracture critical bridges

A bridge or structure is classified as fracture critical if it contains any fracture critical support members (a tension member piece of the bridge structure whose failure will probably cause a portion of or the entire bridge to collapse).

In FY2013, 89 percent of WSDOT's 187 fracture critical bridges were in fair or better condition. There are an additional 111 locally-owned fracture critical bridges, of which 77 percent (85 bridges) are in fair or better condition. Fracture critical bridges have an older average age of 56.1 years compared to 43 years for all WSDOT bridges.

Fracture critical bridges are safe bridges, and are generally large steel structures with exposed sections of bridge structure that must be painted on a regular basis as a proactive preservation activity. Fracture critical bridges are given priority for painting to extend their service life.

## Majority of Washington's state and local fracture critical bridges in fair or better condition

Fiscal year 2013

Condition	State		Local	
	# of bridges	Percent of bridges	# of bridges	Percent of bridges
<b>Fair or better</b>	166	89%	85	77%
Good	111	59%	65	59%
Fair	55	29%	20	18%
<b>Poor</b>	21	11%	26	23%

Data source: WSDOT Bridge and Structures Office.

Note: Percents may not equal 100 percent due to rounding.

## Bridge load ratings ensure public safety

A total of 140 WSDOT bridges were load-posted or restricted in FY2013. Bridges are designed to carry the standard truck weight load at the time they are originally built. As a bridge ages and deteriorates, WSDOT performs load rating tests to verify that the bridge can safely carry the weight of trucks currently using the bridge. If results show the structure is not safe to carry certain loads, traffic on a bridge is restricted to vehicles below the allowable weight.

On load-posted bridges, allowable truck weights are restricted to a posted weight limit that is less than typical legal limits. On load-restricted bridges, trucks must comply with reduced axle weights that are lower than typical limits.

About one third of WSDOT's load posted or restricted bridges are on state roadways that carry the most freight - more than four million tons annually.

## Preservation and maintenance keeps bridges safe and in service

WSDOT manages bridges through inspection, maintenance, major rehabilitation, and replacement. These are essential aspects of bridge management to prolong the service life of bridges, keep costs down, and maintain bridge safety.

## WSDOT crews perform day-to-day repairs

WSDOT regional crews perform the day-to-day maintenance of bridges while private sector contractors are hired for major rehabilitation and bridge replacements. Day-to-day maintenance repairs are a key strategy for prolonging bridge service life, similar to routinely changing the oil in a car.

## Repairs and rehabilitation prolong the service life of bridges

In the 2011-2013 biennium, WSDOT crews performed nearly \$11 million of day-to-day maintenance repairs. About 60 percent of prioritized maintenance repairs were completed, leaving a 40 percent backlog from the 2011-2013 biennium. This backlog would have been larger if not for additional Legislative funding in the 2009-2011 biennium, which designated \$1.5 million to make progress towards catching up with some of the bridge maintenance backlog. For the 2013-2015 biennium, funding levels are projected to be similar for day-to-day maintenance, which is expected to also leave a backlog of maintenance work for the biennium.

### How WSDOT prioritizes bridges for rehabilitation or replacement

Bridge preservation work beyond day-to-day maintenance is prioritized for the next 10 years. WSDOT considers a bridge for future replacement or rehabilitation if it has a sufficiency rating of less than 50 and it is classified as structurally deficient.

Often a major preservation repair (also referred to as rehabilitation) is a safe, sufficient and cost effective way to address the reasons the bridge has a low rating or is considered deficient. A bridge is considered for replacement when the problem causing the structural deficiency may reduce the load-carrying capacity of the bridge, and the cost of rehabilitation is more than 50 percent of the replacement cost.

### WSDOT has prioritized 24 bridges for rehabilitation or replacement in the next 10 years

In addition to projects already underway with planned funding this biennium, as of June 30, 2013, 24 WSDOT bridges are prioritized for replacement or rehabilitation in the next 10 years. These bridges are prioritized based on structural condition, truck volumes, and load restrictions. The cost to replace or rehabilitate these 24 bridges in the next 10 years is estimated at \$240 million. This



Replacement of an expansion joint, a common bridge repair, on Interstate 5 in Seattle near Beacon Hill in April 2013.

estimate accounts for funding already allocated. In addition to the 10-year projected preservation needs, several projects are or will be underway this biennium.

### Ten major bridge rehabilitation projects are planned for 2013-2015 biennium

WSDOT has 10 major structural bridge rehabilitation projects either underway or planned for the 2013-2015 biennium. The planned investment in these projects is \$20.4 million for the biennium. This amounts to about one third of the total estimated cost for these projects. As some projects span several years, the rest of the estimated project cost either has been invested in the previous biennium and/or is planned for future biennia.

Bridge rehabilitation projects address specific bridge elements needing repair; the most common types of repairs include floating bridge anchor cable replacement, expansion joint replacement, and concrete column repair.

### WSDOT plans rehabilitation work for 10 bridges in the 2013-2015 biennium

Planned 2013-2015 biennium funding and total estimated project cost for 10 major bridge repairs; Dollars in millions

Bridge repair project	2013-2015 planned funding	Total project cost <sup>1</sup>
SR 16 Tacoma Narrows – Replace maintenance traveler	\$3.5	\$3.8
I-5 near Seattle – Replace expansion joint	\$3.3	\$3.3
SR 104 Hood Canal Bridge – Special repair	\$3.1	\$6.1
I-90 Floating Bridge – Replace anchor cable	\$4.2	\$5.5
Remaining six other projects <sup>2</sup>	\$6.3	\$20.2
<b>Total</b>	<b>\$20.4</b>	<b>\$38.9</b>

Data source: WSDOT Bridge and Structures Office.

Notes: 1 Several of these are multi-year projects, and the total estimated project cost often spans other biennia. 2 Six remaining projects are combined for publication purposes only.

### Seventeen bridge replacement projects will be under contract by December 2013

WSDOT is replacing 16 bridges and one concrete bridge deck on a steel truss bridge in the 2013-2015 biennium with a planned investment of \$114.7 million. Fourteen of these projects are currently under contract; the remaining three will be under contract by December 2013. The planned expenditures this biennium for these projects is 37 percent of the total estimated project costs, the rest of which either has been invested in the previous biennium and/or is planned for future biennia.

## Cleaning and repainting steel bridges extends their service life

Mega projects underway to replace the SR 99 Alaskan Way Viaduct and the SR 520 Evergreen Point Floating Bridge are not included in the bridge replacement projects reported here. Information about the Alaskan Way Viaduct project is available at <http://www.wsdot.wa.gov/Projects/Viaduct/> and information about the SR 520 Evergreen Point Floating Bridge project is available at <http://www.wsdot.wa.gov/projects/sr520bridge/>.

Legislative funding this biennium includes \$220,000 to study the replacement of the functionally obsolete SR 155 Okanogan River Bridge near Omak.

### WSDOT will replace 16 bridges and one bridge deck in the 2013-2015 biennium

*Planned 2013-2015 biennium spending and total estimated project cost to replace 16 bridges and one bridge deck; Dollars in millions*

Bridge replacement project	2013-2015 planned funding <sup>1</sup>	Total project cost <sup>2</sup>
SR 167 Puyallup River	\$27.4	\$30.7
I-5 Stillaguamish River (deck replacement)	\$17.4	\$21.2
SR 9 Pilchuck Creek	\$10.9	\$17.8
SR 162 Puyallup River	\$10.6	\$15.6
Remaining 13 other projects <sup>3</sup>	\$48.4	\$226.3
<b>Total</b>	<b>\$114.7</b>	<b>\$311.6</b>

Data source: WSDOT Bridge and Structures Office.

Notes: 1 The \$114.7 million planned for bridge replacement projects does not include the Skagit River Bridge, which is funded with an emergency contract and not shown here. 2 All of these are multi-year projects and the estimated total project cost spans into other biennia. 3 Thirteen projects are combined for publication purposes only.

### WSDOT to paint 13 steel bridges

WSDOT plans to repaint 13 steel bridges in the 2013-2015 biennium, with a planned spending of \$79.8 million. The SR 433 Lewis and Clark and the U.S. 101 Astoria border bridges over the Columbia River, and six bridges on Interstate 5 are some of the bridges funded for painting this biennium.

### Steel bridges due or past due for painting

WSDOT owns 289 steel bridges of which 102 are currently due or past due to be repainted. The estimated cost to paint these 102 bridges is \$350 million. This biennium's planned funding to paint 13 of these represents about 23 percent of the total cost. The 10-year repainting needs of the remaining current due or past due bridges combined with the 58 bridges expected to become due in the next 10 years amounts to \$486 million. This

### WSDOT 10-year steel bridge painting needs

*FY2013 through FY2023; Bridges due or past due; Planned projects and spending for 2013-2015 biennium; 10-year needs; Dollars in millions*

Painting needs	Number of bridges	Cost to repaint
Currently due or past due <sup>1</sup>	102	\$350.0
Projects planned for 2013-2015 biennium <sup>2</sup>	13	\$79.8
<b>Remaining backlog</b>	<b>89</b>	<b>\$270.2</b>
Due within the next 10 years <sup>3</sup>	58	\$216.0
<b>10-year total need</b>	<b>147</b>	<b>\$486.2</b>

Data source: WSDOT Bridge and Structures Office.

Notes: 1 There are 28 bridges that are currently past due and 74 that are due for painting. 2 Thirteen projects are already underway or planned to be painted in the 2013-2015 biennium. 3 Bridges expected to be due within 10 years includes 51 painted bridges at a cost of \$192 million, five unpainted weathering steel (\$3 million), and two border bridges shared with Oregon (\$21 million).

includes 51 painted steel bridges expected to become due for repainting in the next 10 years, two border bridges that will be due for repainting (for which WSDOT shares costs with Oregon), and five unpainted steel bridges.

### Paint prevents corrosion, extends service life

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 stretch taxpayer dollars.

Bridges are prioritized for repainting based on the amount of steel corrosion and the route on which they are located. Bridges on primary freight routes are given top priority. Steel truss bridges should be repainted every 20 to 25 years on average and newer steel girder bridges should be painted approximately every 40 years.

Bridge painting is a major repair project with significant costs due to the complexity of safety, environmental regulations, and containment system requirements. Nearly all of the bridges on WSDOT's future paint



*A containment system covering the Southbound Interstate 5 Nisqually River Bridge will keep old paint and paint removal material from entering the environment as the bridge is repainted.*

## Concrete overlay can extend bridge deck service life by 25 years

list will need full paint removal, which requires the construction of a containment system around the bridge to keep old paint and the abrasive paint removal material from entering the environment.

### Cleaning steel truss bridges may extend life

WSDOT region crews clean and spot paint steel bridges and have about \$2 million funded in the 2013-2015 biennium for bridge cleaning.

Cleaning steel bridges entails the removal of dirt and bird manure and properly disposing of it off-site, as required by the National Pollutant Discharge Elimination System waste discharge permit (see [p. 25](#) for more information on programmatic permit use). Once a bridge has had an initial cleaning, it can be flushed with water on an annual cycle, which ideally would occur for all 289 painted steel bridges, however due to funding constraints this is not feasible.

### WSDOT evaluates cost and benefit of routine washing

Regular washing of steel bridges is an important cost saving strategy because it prolongs the service life of the paint and prevents corrosion of the steel. WSDOT is currently conducting research through the University of Washington to quantify the benefits of cleaning steel bridges versus the cost caused by the expected deterioration if a bridge is not cleaned.

To date in 2013, WSDOT's Olympic Region has cleaned 16 steel bridges for a cost of \$93,600, which equates to about 0.91 cents per square foot of deck area. In comparison, the average cost to repaint a steel truss bridge is nearly \$150 per square foot of deck area.

### WSDOT will complete 15 concrete overlay projects currently in progress this biennium

WSDOT has a planned budget of \$8.8 million for the 2013-2015 biennium to rehabilitate and apply concrete overlays. Nearly all of this funding will be used to complete work that is already in progress on 15 bridges. A concrete overlay is a repair to an existing concrete bridge deck that provides corrosion protection for the steel reinforcing.

There will be no new concrete overlay projects this biennium. Projects in progress address four bridges that are due and 11 that are past due for deck overlay. This fixes 15 out of 81 due or past due bridges. The estimated cost for all 81 due and past due overlay projects is \$92 million, leaving a backlog of about \$83 million after

### WSDOT 10-year concrete bridge deck overlay needs

*FY2013 through FY2023; Bridges due or past due; Planned projects and spending for 2013-2015 biennium; 10-year needs; Dollars in millions*

Concrete deck overlay needs	Number of bridges	Total cost
Currently due or past due <sup>1</sup>	81	\$92.0
Projects underway for 2013-2015 biennium <sup>2</sup>	15	\$8.8
<b>Remaining backlog</b>	<b>66</b>	<b>\$83.2</b>
Due for overlay within the next 10 years	10	\$64.0
<b>10-year total need</b>	<b>76</b>	<b>\$147.2</b>

Data source: WSDOT Bridge and Structures Office.

Notes: 1 Past due bridges for concrete overlay (43 bridges) have had significant maintenance patching work while bridges that are due (38 bridges) have had smaller amounts. 2 Fifteen projects are underway for the 2013-2015 biennium.

this biennium's work is complete. Another 10 bridges are expected to become due in the next 10 years.

### Addressing deck deterioration cost effectively

WSDOT has been working since the early 1980s on a systematic program to cost effectively address deterioration on concrete bridge decks, which is generally caused by a variety of factors, including winter salt applications. WSDOT crews routinely provide temporary repairs in the form of quick-cure patching materials to keep the bridge in service. These repairs normally have a service life of a few years. A full bridge deck rehabilitation and concrete overlay provides a longer service life of at least 25 years and is more cost effective for bridge decks that have repeated deterioration, yet is less expensive than replacing the entire deck or bridge.

The average cost to repair and apply a traditional modified concrete overlay is nearly \$80 per square foot. This is about 25 percent of the cost to completely replace a bridge deck or 10 percent of the cost to replace an entire bridge.

### Criteria for prioritizing repairs and concrete overlays

A bare concrete deck is due for repair and overlay when 2 percent or more of the area is deteriorated or has previous maintenance repairs. This is also the trigger that will classify a bridge as structurally deficient.

Bridges programmed for overlay are prioritized based on the total square footage of deterioration and the type of freight route on which the bridge is located. The top 10 priority bridges are determined by the amount of existing maintenance patching and deterioration. Bridges on the T-1 and T-2 freight routes (most

## Puget Sound region emergency routes prioritized for seismic retrofit

important routes for moving goods) are prioritized first, followed by the remaining state-owned bridges.

WSDOT's maintenance deck repair budget was about \$2.5 million in the 2011-2013 biennium. With no new overlays planned, maintenance deck repair needs will likely increase during the 2013-2015 biennium to address the expected increase of deck deterioration. For example, WSDOT performed emergent large volume full depth deck repairs on the U.S. 12 Wildcat Creek and U.S. 82 Umatilla bridges in 2013.

### Seismic retrofit reduces risk of earthquake damage to bridges

WSDOT plans to have seismic retrofit projects underway for 24 Interstate 5 (I-5) bridges between Tacoma and the I-405 interchange at Southcenter during the 2013-2015 biennium, with a planned budget of about \$50 million.

An analysis of the I-5 Ship Canal Bridge to determine project scope and cost estimates of the retrofits, needed to meet the standards for a 1,000 year earthquake, is also funded this biennium.

Seismic retrofit of selected bridges and scour repair of in-water bridge piers are proactive approaches to minimizing the risk of bridge damage due to earthquakes and flooding. WSDOT has prioritized bridges in the Puget Sound region that require a seismic retrofit to minimize the risk of significant damage or collapse during a major earthquake (defined as an earthquake occurring once every 1,000 years).



During the 2013-2015 biennium, WSDOT will conduct an analysis of the I-5 Ship Canal Bridge to assess the cost of retrofits needed to withstand a major earthquake.

### Emergency access routes are prioritized for retrofit

The seismic retrofitting of bridges on I-5 between Tacoma and I-405 at Southcenter is the first phase of a 10-year bridge retrofit plan for the Seattle-Bellevue area. WSDOT developed this plan in coordination with emergency management groups in order to best use limited funds. Bridges on southbound I-405 are planned to be retrofitted next, which will give access for emergency response vehicles and critical emergency freight movement throughout the Puget Sound region in the event of a major earthquake. The cost to complete the 10-year prioritized emergency access route for the region is estimated to be at least \$100 million.

### Steel jackets are most common seismic retrofit

The most common type of seismic retrofit is the addition of steel jackets around the bridge columns and adding more concrete and steel reinforcements to the pier caps (this is also known as a "bolster").

The total cost for seismic retrofit of all bridges that require it on highways across the state is estimated to be about \$1.4 billion, (see [Gray Notebook 46, p. 13](#), for more information on WSDOT's long-range seismic retrofit needs for all state highway bridges).

### Some 18 percent of WSDOT bridges over water at risk of river bed erosion

WSDOT has 270 bridges and culverts longer than 20 feet that are classified as "scour critical." This represents 18 percent of WSDOT's more than 1,500 total such bridges and culverts that are located over water.

Scour is the term used to describe the erosion of stream bed material from under bridge foundations. Scour generally happens during floods, when a river is experiencing high water flows, and is historically the most common reason for bridge collapses in both Washington and the nation. In Washington, 43 bridges have failed due to scour during flood events; the most recent occurred in 1999 on the U.S. 101 Nolan Creek Bridge, which was replaced in 2004.

The term "scour critical" is used by the Federal Highway Administration to classify bridges that have the potential for scour depth to be lower than the existing foundation.

## Ninety percent of local bridge deck area in fair or better condition

WSDOT has developed an action plan for responding to scour critical bridges during flood events. When a river or creek under one of these bridges rises to flood level or above, WSDOT will inspect the bridge at least every 24 hours to ensure the bridge is safe for public use. Of the 270 scour critical bridges, 28 will require scour repair in the next 10 years, at total estimated cost of \$15 million.

WSDOT’s scour repair budget for the 2013-2015 biennium is \$705,000, which will be used for a scour repair on the SR 108 Wild Cat Creek Bridge. Once funding has been authorized for a scour repair, it generally takes two to four years to design the repair and obtain the environmental permits to complete the work.

### Most local bridges remain in good condition

For bridges owned by cities and counties, 95 percent of bridges and 90 percent of deck area were in fair or better condition as of June 30, 2013, the same rating as one year ago. The lower rating when considered by deck area means some larger bridges are in poor condition.

Within the state of Washington, there are more than 3,900 locally-owned and maintained bridges that support a cumulative average of 10 million crossings each day. The number of bridges fluctuates from year to year as new bridges are added to the system and some older bridges are permanently removed without being replaced. Local agencies face challenges in managing bridges, such as keeping up with traffic demand and prioritizing limited funds, see the [Gray Notebook 46, p. 14](#), for details.

#### City, county bridges remain in good condition

*As of June 30, 2013; Local agency structural condition bridge ratings*

Condition	County bridges		City bridges		Total	
	% of bridges	% of deck area	% of bridges	% of deck area	% of bridges	% of deck area
<b>Fair or better</b>	<b>96%</b>	<b>93%</b>	<b>93%</b>	<b>87%</b>	<b>95%</b>	<b>90%</b>
Good	84%	83%	76%	74%	82%	78%
Fair	12%	10%	17%	13%	13%	12%
<b>Poor</b>	<b>4%</b>	<b>7%</b>	<b>7%</b>	<b>13%</b>	<b>5%</b>	<b>10%</b>

Data source: WSDOT Highways and Local Programs Office.

Note: The percent of deck area of bridges in each rating category is calculated out of total deck area of all county or city owned bridges.



U.S. 97 Biggs Rapids Bridge across the Columbia River. WSDOT leads the maintenance of this border bridge shared with Oregon.

### States share border bridges

WSDOT shares with the Oregon Department of Transportation 50 percent of the funding for maintenance and operation of nine border bridges crossing the Columbia River. Both states treat the maintenance and preservation of these border bridges as a high priority. WSDOT leads the maintenance and operations for four of the bridges shared with Oregon:

- SR 433 Lewis and Clark Bridge (1930 steel bridge that was recently repainted)
- U.S. 97 Biggs Rapids Bridge (1962 steel bridge with a deck replacement in 2008, due for repainting by 2015)
- Two I-82 Umatilla bridges (a 1955 steel bridge due for repainting and deck replacement, and a 1988 concrete bridge)

Oregon leads maintenance of the other five shared bridges:

- Two I-5 bridges crossing the Columbia River (one bridge for each direction of traffic), which were built in 1917 and 1958. Oregon rates both bridges in fair structural condition with deficiencies such as vertical clearance and a low amount of remaining service life.
- U.S. 101 Astoria Megler Bridge (built in 1966, primarily a steel structure that is in the process of being repainted)
- I-205 Glenn Jackson Bridge between Vancouver, Wash., and Portland (built in 1982, expansion joints replaced in 2009)
- U.S. 197 Dalles Bridge (1954 built steel bridge, due for deck replacement and repainting by 2016)

WSDOT also shares two bridges with Idaho. WSDOT maintains a bridge crossing the Snake River on U.S. 12 between Lewiston, Idaho and Clarkston, Wash. Idaho maintains a bridge on SR 41 that crosses a rail line in Newport, Wash.

# Skagit River Bridge replacement on schedule to open by October

## Skagit River Bridge hit draws attention to state bridge conditions

The hit and collapse of the Interstate 5 (I-5) bridge over the Skagit River near Mount Vernon on May 23, 2013 focused attention on the conditions of the nation's bridges. After a southbound truck carrying an oversize (both over-height and over-width) load collided with the steel framework of the bridge, the northern steel truss span of the bridge collapsed, closing I-5 in both directions. Though there fortunately were no fatalities, the collapse of the Skagit River Bridge shut down I-5 near Mount Vernon for 26 days. This section of I-5 is a major transport corridor, and the Skagit River Bridge carries an average of 71,000 vehicles per day. Detour routes and a temporary additional Amtrak trip between Seattle and Bellingham kept goods and people moving through the area.

The bridge reopened on June 19 with a temporary bridge span, achieving the Governor's mid-June goal. The National Transportation Safety Board is investigating the collapse. A \$6.9 million permanent replacement span is scheduled to be installed by October 1, 2013. After completing the permanent replacement, a \$4.5 million WSDOT project will raise and reinforce the bridge's overhead structural support system, raising the bridge's vertical clearance to 18 feet, which is four feet higher than the legal height limit.



The Skagit River Bridge was built in 1955 and was classified as "functionally obsolete" when it was hit. More information is available at <http://www.wsdot.wa.gov/Projects/I5/SkagitRiverBridgeReplacement/default.htm>.

## Aerial view after May 23



*Aerial view of the I-5 Skagit River Bridge near Mount Vernon, which collapsed on May 23, 2013 after a truck collided with the steel framework.*

## Temporary replacement



*The bridge with the temporary span, which reopened on June 19, 2013.*

## Permanent replacement



*Conceptual design of the finished replacement span before it is installed. Image is used with permission from Max J. Kuney Construction and Parsons Brinckerhoff.*

### New federal law impacts bridge management

The federal Moving Ahead for Progress in the 21st Century (MAP-21) law will require every state to direct infrastructure investments toward the achievement of performance targets. MAP-21 includes funding penalties if a state's targets are not met in a given period of time. See [p. viii](#) for requirements.

#### Federal threshold and penalty is set in law

MAP-21 requires that the deck area of structurally deficient bridges not exceed 10 percent of the total deck area of bridges on a state's National Highway System. If a state does not meet this requirement for three consecutive years, the state must devote National Highway Performance Program funds in an amount equal to 50 percent of the it's federal fiscal year 2009 Highway Bridge Program apportionment. This is \$76.5 million for WSDOT to improve bridge conditions during the following fiscal year.

WSDOT currently collects and reports bridge condition data to the Federal Highway Administration annually for bridges on the National Highway System, and will have no issues in collecting or reporting the required data for MAP-21. Reporting on this performance measure will begin in 2016.

# Overview of Federal and Washington State bridge rating systems

## Federal bridge rating system

WSDOT is required to report data annually on the condition, functional adequacy and essentiality for the public for all bridges statewide to the Federal Highway Administration. The bridge data determines sufficiency ratings and if a bridge is structurally deficient and/or functionally obsolete. The same bridges that are rated for WSDOT's condition rating are also rated in the federal system, in addition to local agency owned bridges across the state.

- **Structurally deficient:** A bridge is deteriorated structurally, as indicated by a superstructure, deck, and/or substructure rating of four or less on a scale of zero to nine. WSDOT's poor condition category uses the same data, criteria, and rating scale (see table on previous page). A bridge is also classified as structurally deficient if its load-carrying capacity or potential for flooding indicates a priority of replacement; WSDOT's rating does not include these because they are not indicators of the bridge's structural condition.
- **Functionally obsolete:** A bridge does not meet intended traffic needs and is below accepted design standards. This rating is applied if a bridge's approach roadway alignment,

deck geometry, under clearance, load-carrying capacity, or flood potential is rated three or less (substandard) on a scale of zero to nine. In 2012, 836 WSDOT bridges were considered functionally obsolete.

- **Sufficiency rating:** Measures the bridge's ability to serve its intended purpose on a scale of zero to 100; lower values indicate higher need of repair or replacement.

## WSDOT bridge structural condition rating

WSDOT's bridge condition performance measure classifies a bridge's structural condition as:

- **Good:** Ranges from no problems to some minor deterioration of structural elements.
- **Fair:** All primary structural elements are sound; may have minor section loss, deterioration, cracking, spalling or scour.
- **Poor:** Advanced deficiencies such as section loss, deterioration, scour, or seriously affected structural components; may have weight restrictions. A poor condition bridge is safe for travel. An unsafe bridge will be closed and is not counted in the poor condition rating.

*Contributors include Rico Baroga, DeWayne Wilson, Sarah Lowry and Alison Wallingford*

## An overview of bridge condition rating systems

*How the Federal Highway Administration (FHWA) and WSDOT rate bridge conditions*

	FHWA		State and Federal description	WSDOT	
	Rating scale	Condition category		Rating scale	Condition category
	9	Excellent	No description given	NA	Not applicable
	8	Very good	No problems noted	8	Good condition = 6-8 *WSDOT rates all excellent bridges with the very good category
	7	Good	Some minor problems	7	
	6	Satisfactory	Structural elements show some minor deterioration	6	
	5	Fair	All primary structural elements are sound but may have minor section loss, cracking, spalling, or scour	5	Fair condition = 5
FHWA structurally deficient rating = 4 and below	4	Poor	Advanced section loss, deterioration, spalling, or scour	4	Poor condition = 3-4
	3	Serious	Loss of section, deterioration, spalling, or scour have seriously affected primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present	3	
	2	Critical	Advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored, it may be necessary to close the bridge until corrective action is taken	2	
	1	Imminent Failure	Major deterioration or section loss present in critical structural components, or obvious vertical or horizontal movement affecting structural stability. Bridge is closed to traffic, but corrective action may put it back in service	1	Closed bridges = A bridge with a rating of 2 or below would be closed, and not included in WSDOT's condition rating
0	Failed	Bridge is out of service and is beyond corrective action	0		

Data source: WSDOT Bridge and Structures Office and Federal Highway Administration.

Note: In FY2013, 3,267 of WSDOT's 3,794 bridge structures were rated for the structural condition measure, including all vehicular bridges and culverts longer than 20 feet and 56 ferry terminal structures that carry vehicles. While WSDOT's bridge conditions are reported by fiscal year, the Federal Highway Administration releases structurally deficient bridge data by calendar year.