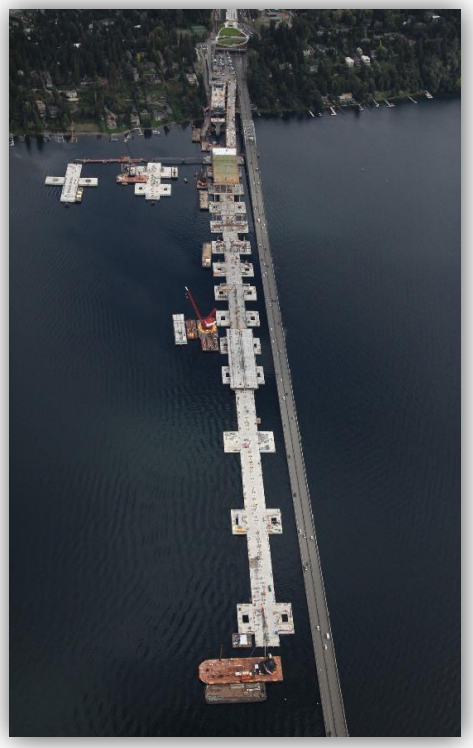
WSDOT Bridge Asset Management Plan

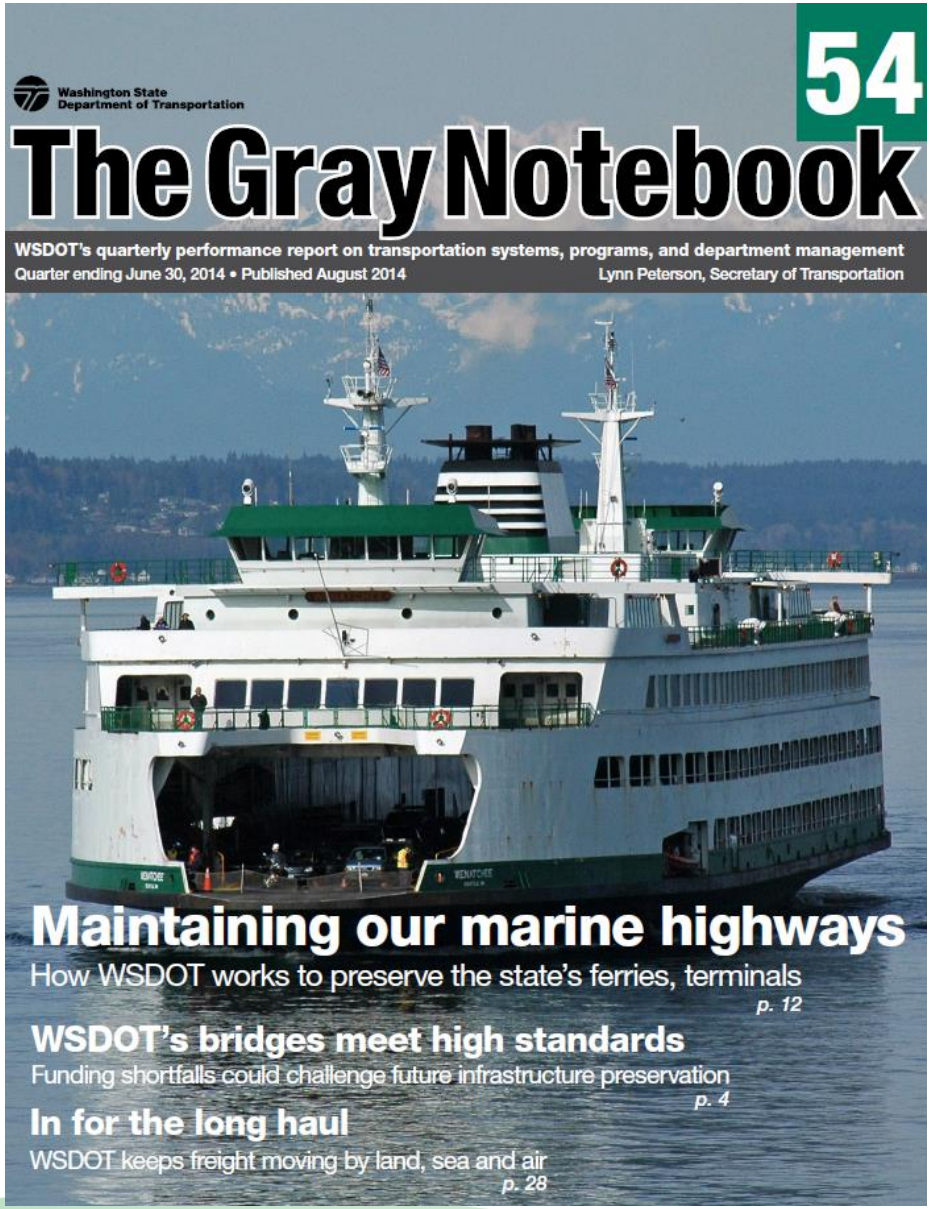
DeWayne Wilson
Bridge Asset Management Engineer

Lynn Peterson
Secretary of Transportation




WBPP
Portland
5/20/15



54 Asset Management: Bridge Annual Report

Notable results

- *Ninety-two percent of state and local bridges measured by deck area are in fair or better condition; 8% are structurally deficient*
- *Of the 3,286 bridges WSDOT manages, 137 have weight restrictions*
- *Measured by deck area, 9.3% of bridges on the National Highway System in Washington are structurally deficient*
- *WSDOT cleaned 44 fracture critical bridges in fiscal year 2014*

Bridge conditions remain steady from previous year

Ninety-two percent of the state-owned bridges by deck area were in fair or better structural condition as of June 2014, the same as in June 2013. In terms of the number of bridges, 96 percent of state-owned bridges were in fair or better condition as of June 2014.

The percentage in fair or better condition is greater in terms of the number of bridges compared to the percentage of deck area because several large bridges — the State Route (SR) 99 Alaskan Way Viaduct and the SR 520 floating bridge — are classified as structurally deficient.

Combined, these two bridges (which are currently being replaced) account for 2 percent of the state-owned bridge deck area in Washington. When construction is completed on these projects in 2017, the percentage of bridge deck area in fair or better condition is expected to improve to 94 percent. In total, there are 24 bridges that account for 1.3 million square feet (2.7 percent of WSDOT-managed bridge deck area) that are in poor condition but are under contract for repair. Once these 24 bridge repairs or replacements have been completed and inspected, they will no longer be considered in poor condition.

Measuring bridge conditions by deck area provides a more comprehensive measure than by number of

WSDOT's percent of bridges by deck area in good condition declines between 2009 and 2014
Number of bridges and percent of bridges by deck area by condition category; Deck area in millions of square feet

STRUCTURAL CONDITION		2009	2014	Trend	Overall Desired Trend
GOOD/VERY GOOD Bridges in good condition range from those with no problems to those having some minor deterioration of structural elements.	Number of bridges	2,828	2,855	↓	↑
	Percent of bridges	89.3%	86.9%		
	Bridge deck area	37.9	37.3	↓	
	Percent of deck area	82.4%	80.1%		
FAIR All 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. By doing this, the agency manages to the lowest life cycle cost.[1]	Number of bridges	261	290	↑	↓
	Percent of bridges	8.2%	8.8%		
	Bridge deck area	5.3	5.5	↑	
	Percent of deck area	11.5%	11.7%		
POOR 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.	Number of bridges	78	141	↑	↓
	Percent of bridges	2.5%	4.3%		
	Bridge deck area	2.8	3.8	↑	
	Percent of deck area	6.1%	8.2%		

Data source: WSDOT Bridge and Structures Office.
Notes: The above condition data only includes state-owned bridges.1 Lowest life cycle cost methodology uses preventative maintenance to preserve the useful life of an asset and minimize maintenance costs over the life of an asset. This method assures that an asset is maintained at an acceptable condition, maximizing safety and useful life.

WSDOT Bridge Web Page

Bridge and Structures

- **Bridge and Structures**
- Bridge Architect
- Bridge Standard Drawings
- Bridge Overlays
- Bridge Preservation
- Design Memorandums
- Accelerated Bridge Construction Resources (ABC)
- Light and Signal Standards
- WSDOT/ACEC Structures Team
- Standard Plans
- Historic Bridges
- Bridge Research
- Highway and Local Programs Bridge Office
- Environmental
- Development Division

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Bridge and Structures

The Bridge and Structures Office provides the full range of structural engineering services required to provide safe, economical and reliable structures for Washington's transportation system, which includes nearly 3,100 existing vehicular bridges and typically 18 new bridges per year.

WSDOT is known for its bridge design and bridge inspection technical expertise. Our professional staff is motivated and trained to design the optimum solutions for the highly complex and challenging projects we deliver and to preserve our large and valuable inventory of existing bridges and structures.

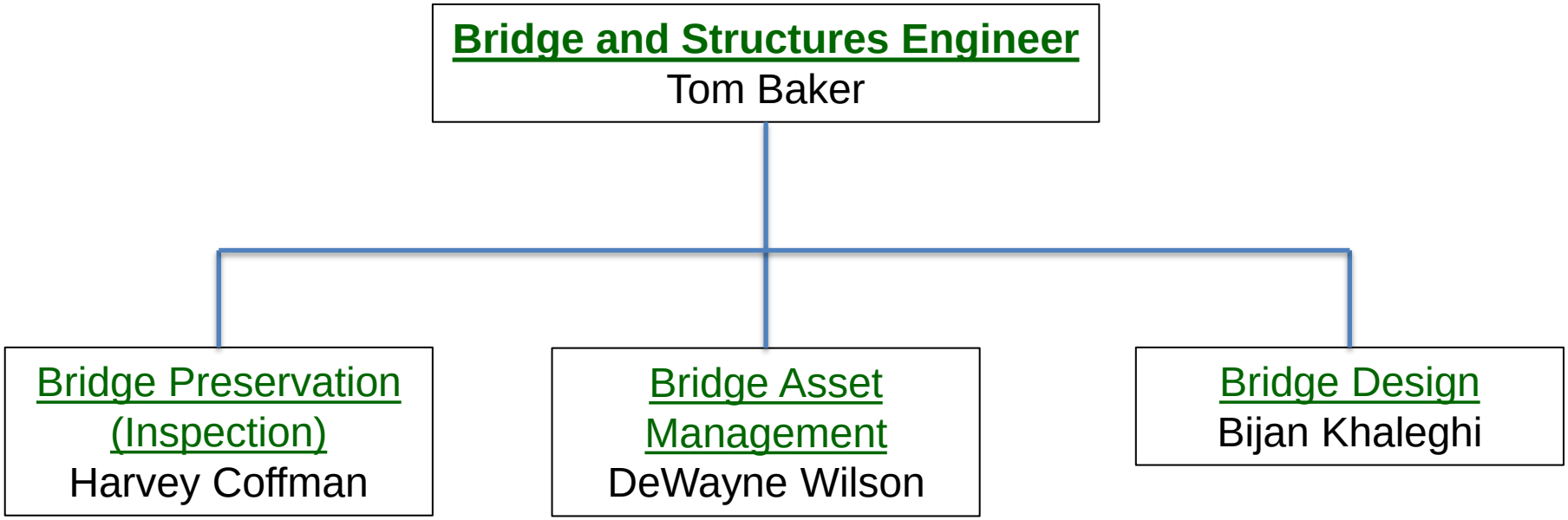
Bridge Asset Management

- Numbers, Ratings, Seismic Retrofit, and Inspection
- Structurally Deficient Bridges
- SD Bridge List (pdf, 225kb)
- SD Bridge Map (pdf, 3.06mb)
- Concrete Bridges in Washington State (pdf, 667kb)
- Bridge Annual Report -Gray Notebook Article 2014
- Past Bridge Gray Notebook Articles - Index
- Bridge Preservation Needs List
- Asphalt Bridge Overlays

Bridge Inspection

- Bridge List
- Bridge Inspection Manual
- Bridge Load Restrictions
- Bridge Vertical Clearance Trip Planner
- Post Earthquake Inspection Video (wmv, 338mb)

WSDOT Bridge and Structures Office



Washington State Department of Transportation

Washington State Bridge Inspection Manual

M 36-64.05

March 2015

Bridge Preservation Office/Local Programs

Washington State Department of Transportation

Bridge Design Manual (LRFD)

M 23-50.13

February 2014

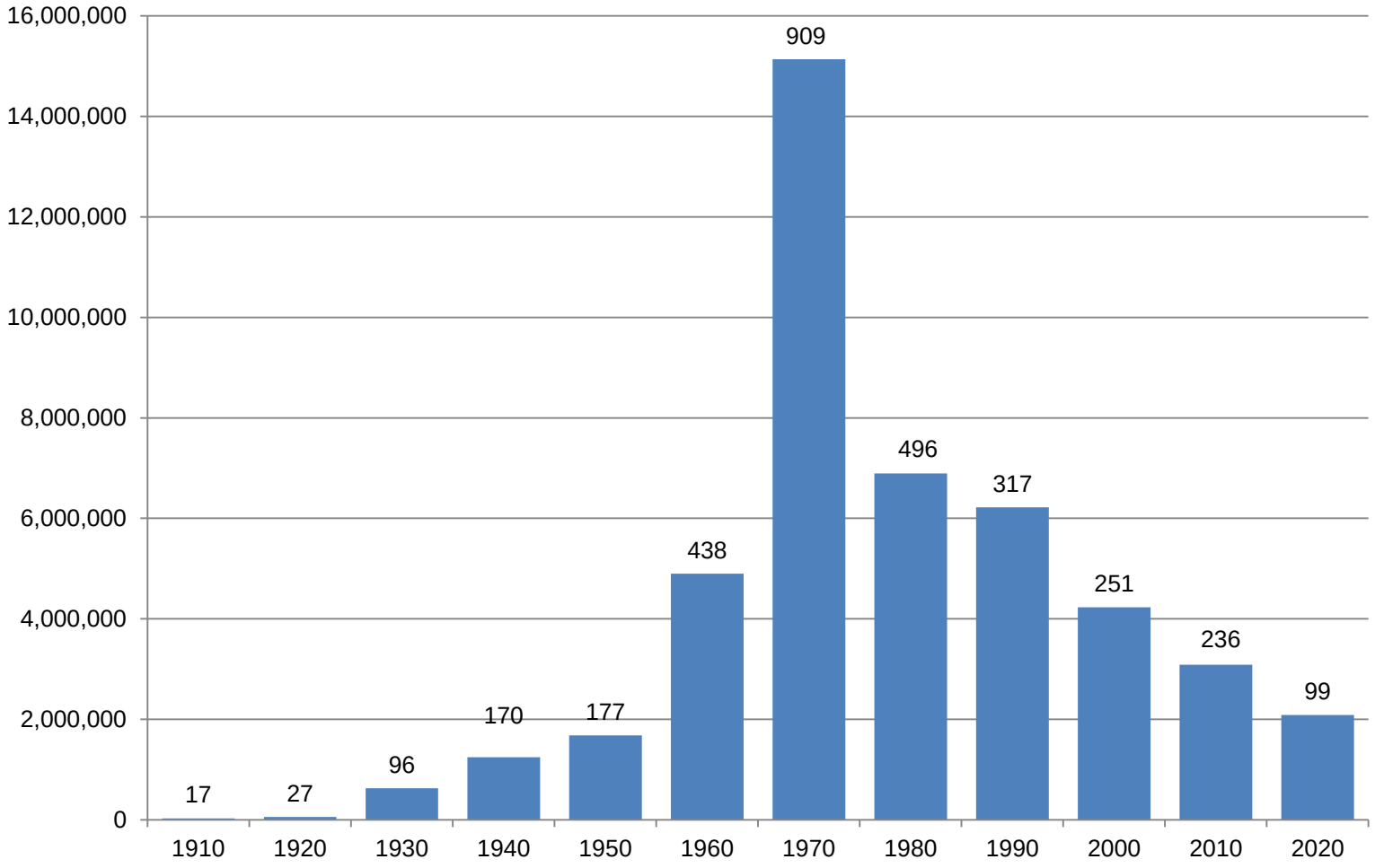
Engineering and Regional Operations
Bridge and Structures Office

WSDOT Bridge Asset Management

WSDOT HQ
Olympia

Maintenance / Preservation

WSDOT Bridges

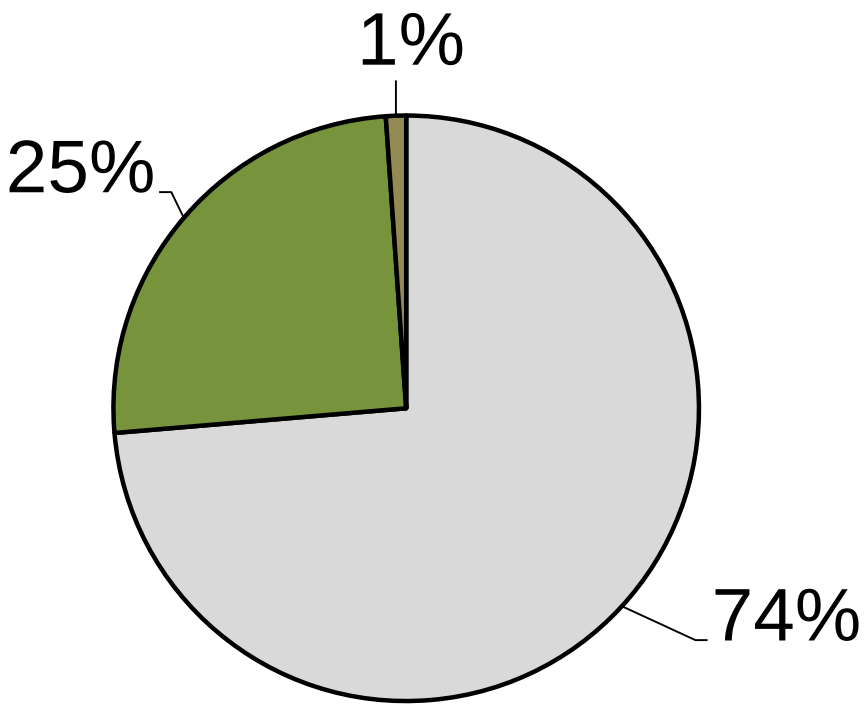


3,127 Vehicular Structures (53M sq. ft.) *(Average Age = 45 yrs)*

75+ yrs old – 310 bridges (1.6 million sq ft)

50+ yrs old - 1,339 bridges (10.7 million sq ft)

WSDOT Bridges – Material Types



Concrete
(2,713 brgs)

Steel
(322 brgs)

Timber
(92 brgs)

% based on bridge deck area

7 out of 10 WSDOT bridges built in the past 10 years are precast prestressed/post-tensioned concrete

Bridge Management Plan

What information is needed?

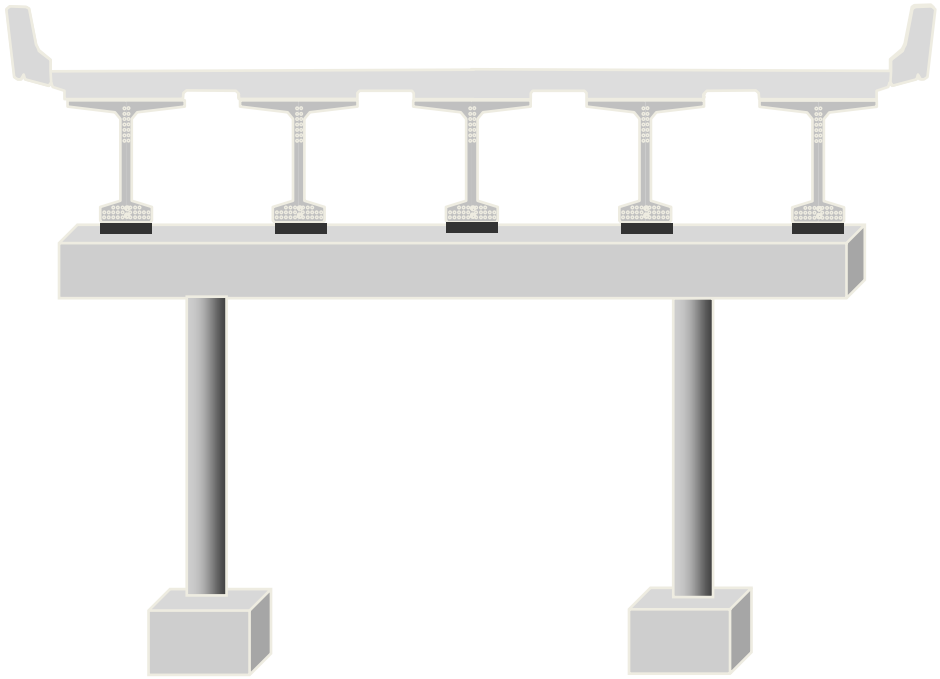
- Basic Inventory Data (NBI)
- Inspection Data
  - NBI
  - Element Level
- Element History
- Element Service Life
  - Deterioration Rate
- Risks
  - Seismic
  - Scour
  - Overheight / Overloads

Bridge Condition Rating – MAP 21

Deck

Superstructure

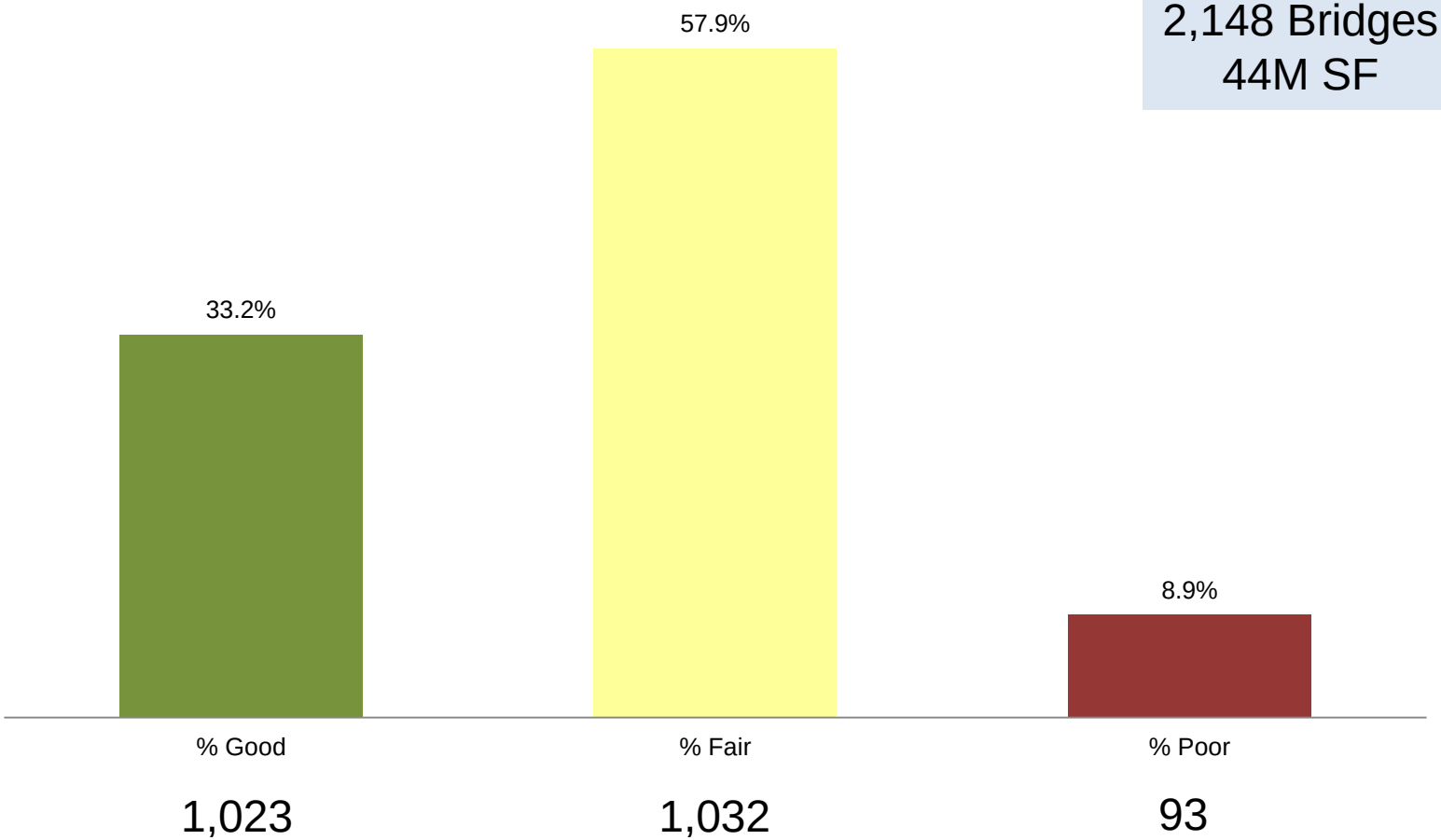
Substructure



8	Good
7	
6	Fair
5	
4	
3	Poor

WSDOT Bridges - NHS

2,148 Bridges
44M SF



137 All

WSDOT Structurally Deficient Bridges

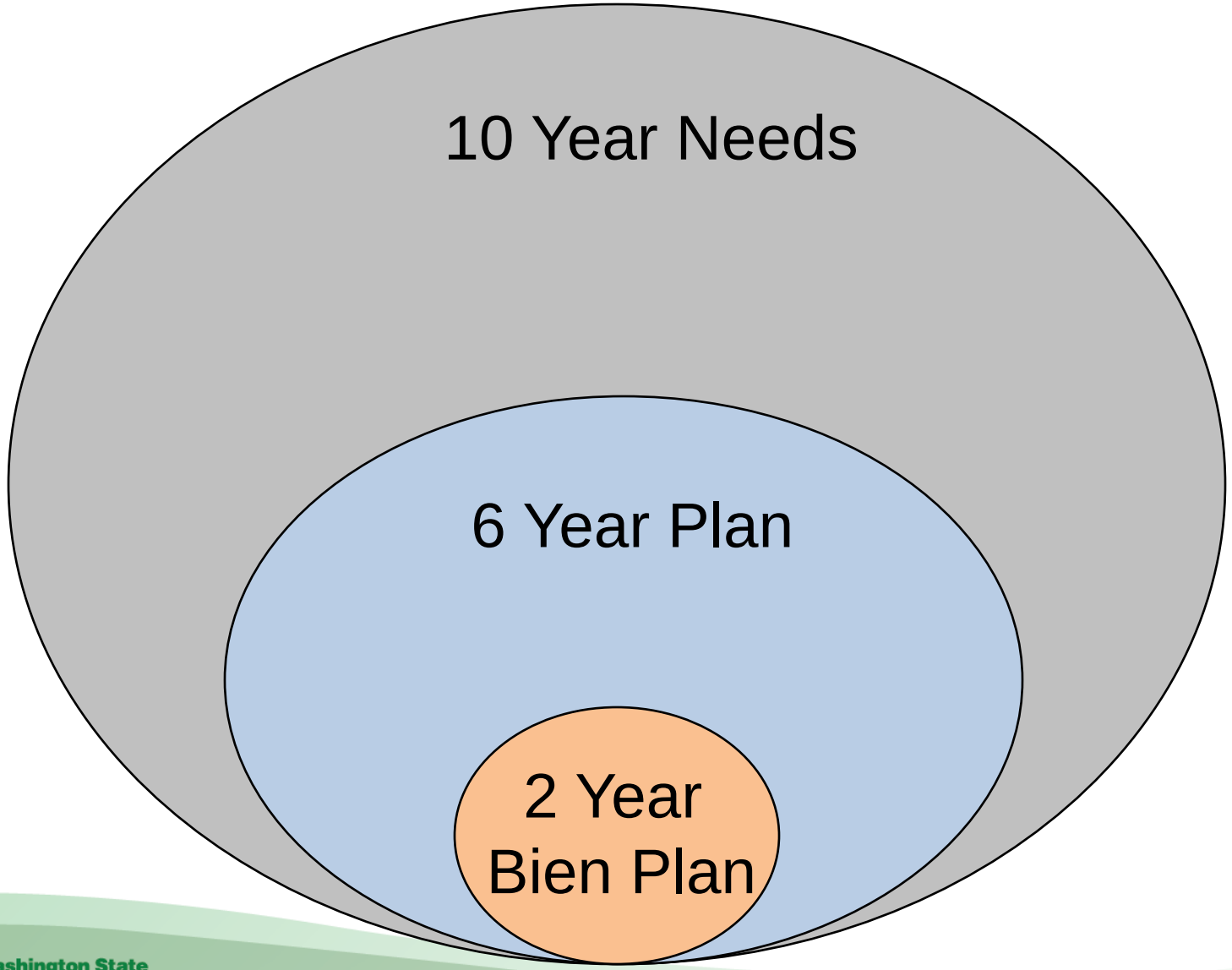
Washington State Department of Transportation

JANUARY 2015

WSDOT Bridge Asset Management

- Border Bridges
- Scour Repairs
- Bridge Repairs (incl. Movable Brgs)
- Bridge Painting
- Bridge Deck Rehab and Overlay
- Bridge Replacement / Rehab
- Seismic Retrofits

State Highway Funding Plan



WSDOT Bridge Preservation Program

10 year Needs vs 6 year Plan

	Category	# Brgs	10yr Needs $	6yr (# brgs)	6yr Plan $	Gap $
	Border Bridges	5	$71M	5	$71M	$0
Risk	Scour Repair	13	$16M	7	$11M	$5
	Bridge Repairs	134	$118M	22	$49M	$69
	Movable Bridges	12	$26M	8	$17M	$9
	Steel Painting	144	$694M	31	$143M	$551
	Deck Rehab	70	$125M	13	$21M	$104
	Repl / Rehab	26	$182M	9	$65M	$117
Risk	Seismic Retrofit	??*	??*	0	$0	??
	Totals	404	$1,232M	95	$377M	$855

**10 year Seismic Needs excluded"*

WSDOT Bridge Asset Management

- Border Bridges
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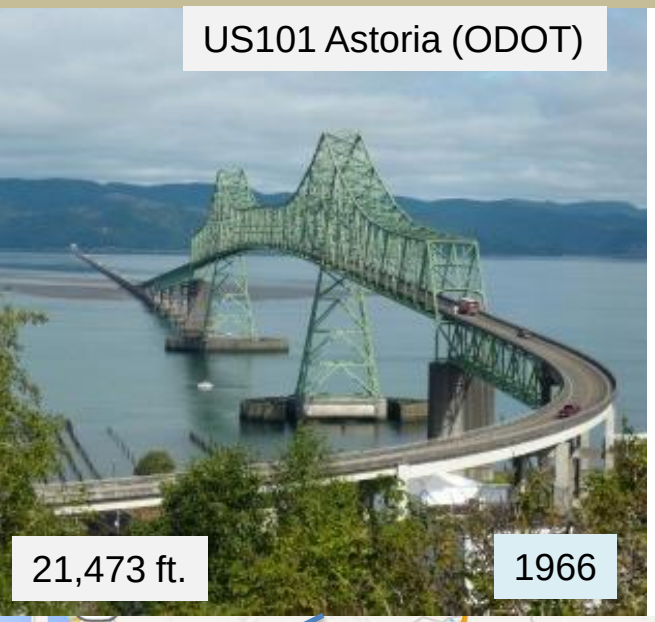
Border Bridges

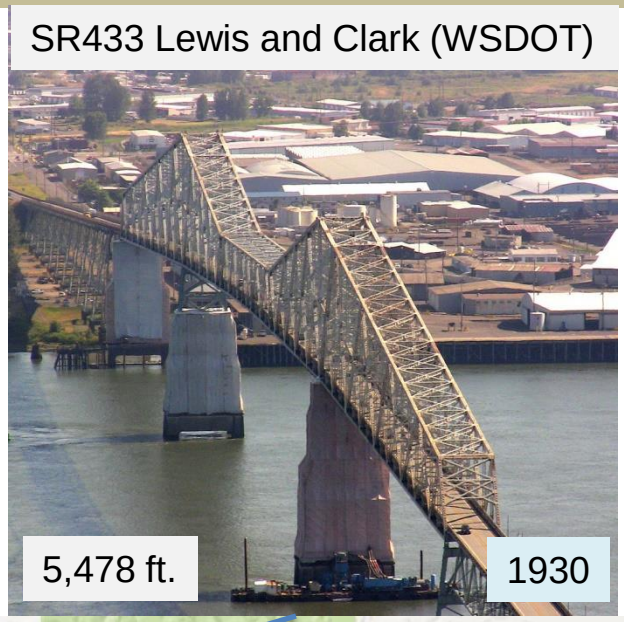
US101 Astoria (ODOT)



21,473 ft.

1966

SR433 Lewis and Clark (WSDOT)



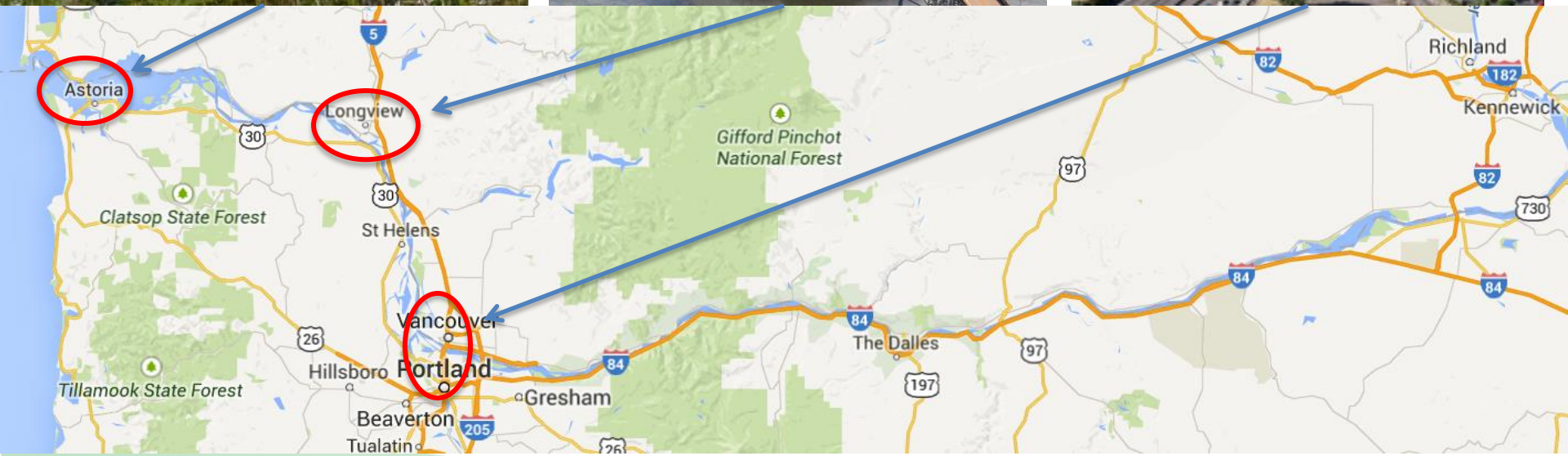
5,478 ft.

1930

Interstate 5 (ODOT)

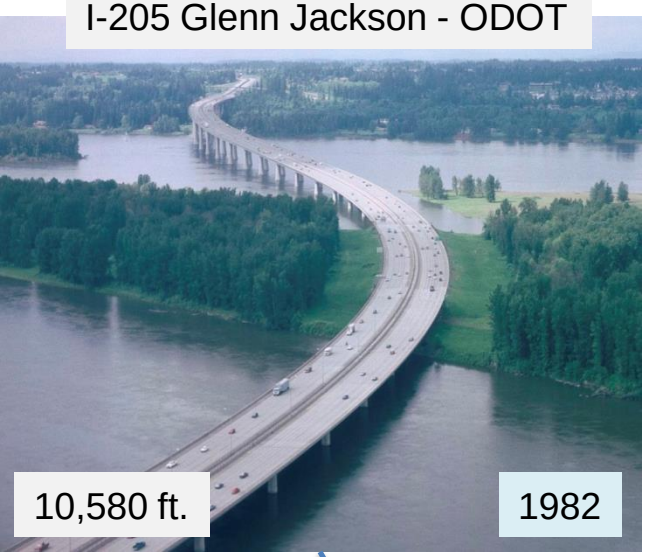
NB - 1917
SB - 1958

3,538 ft.

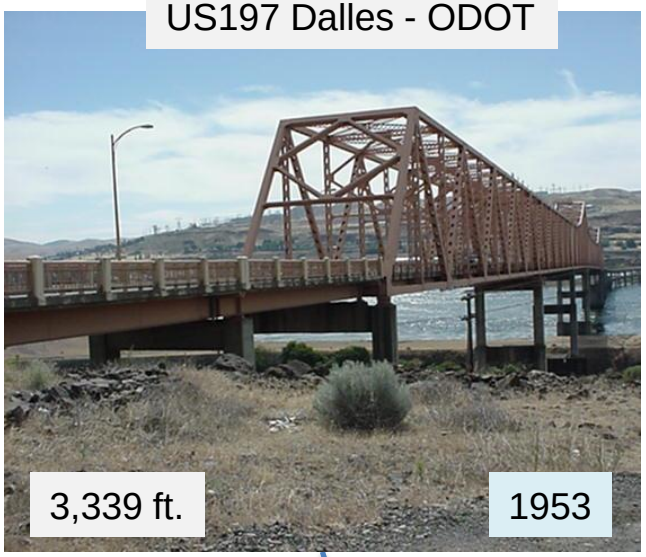


Border Bridges

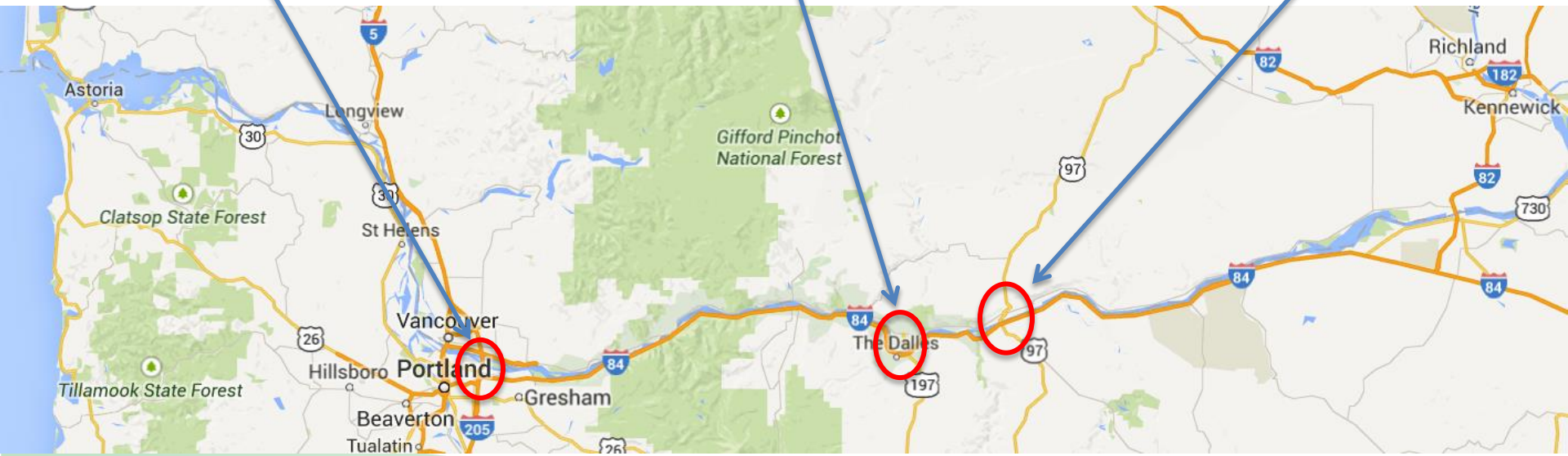
I-205 Glenn Jackson - ODOT



US197 Dalles - ODOT



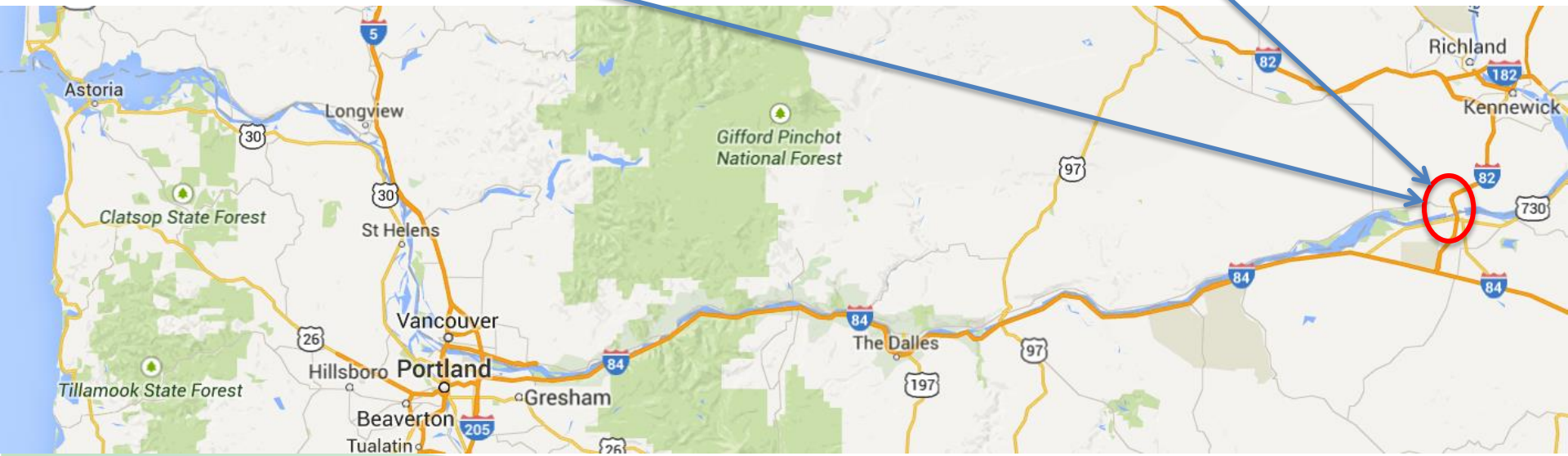
US97 Biggs Rapids - WSDOT



Border Bridges

Interstate 82 Umatilla - SB

Interstate 82 Umatilla - NB



WSDOT Bridge Asset Management

- Border Bridges
- Scour Repairs
- Bridge Repairs (incl. Movable Brgs)
- Bridge Painting
- Bridge Deck Rehab and Overlay
- Bridge Replacement / Rehab
- Seismic Retrofits

Bridge Scour Repair

Since 1923 – WSDOT Owned Bridges:

- 70 Documented Bridge Failures
- 43 due to Floods/Scour

SR542 Nooksack River Bridge - Nov 10, 1989

SR542 Nooksack River Bridge - Nov 10, 1989

Bridge Scour Repair

- WSDOT has 1,583 bridges over water
- 262 bridges categorized as being “scour critical”.
- Dec. 1979 - US101 Russel Barker bridge failure - (Bogachiel River)
- Dec. 1999 - last WSDOT Bridge scour failure (Scour of a bridge pier).
- Over the past 10 years $12M has been invested to address 17 bridges.
- Seven bridges to be addressed over the next 6 years for $11M.

Bridge Scour Folio

WSDOT Bridge Asset Management

- Border Bridges
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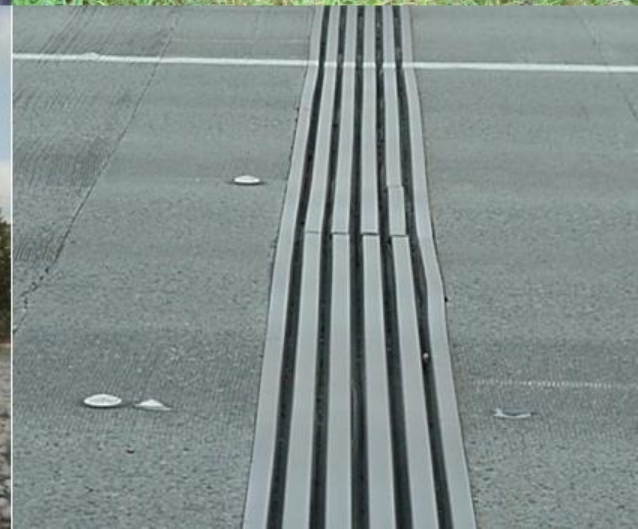
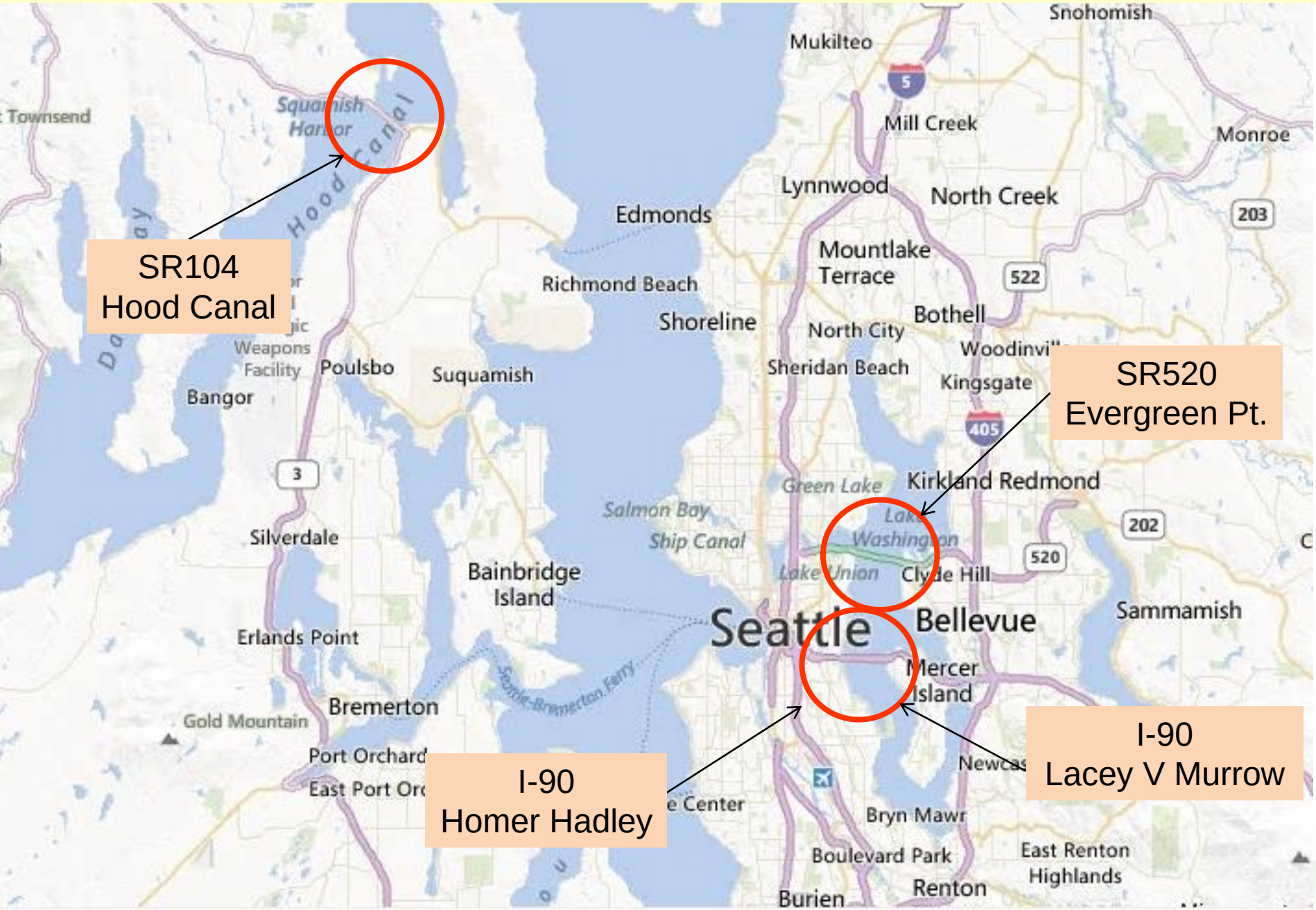
- Seismic Retrofits

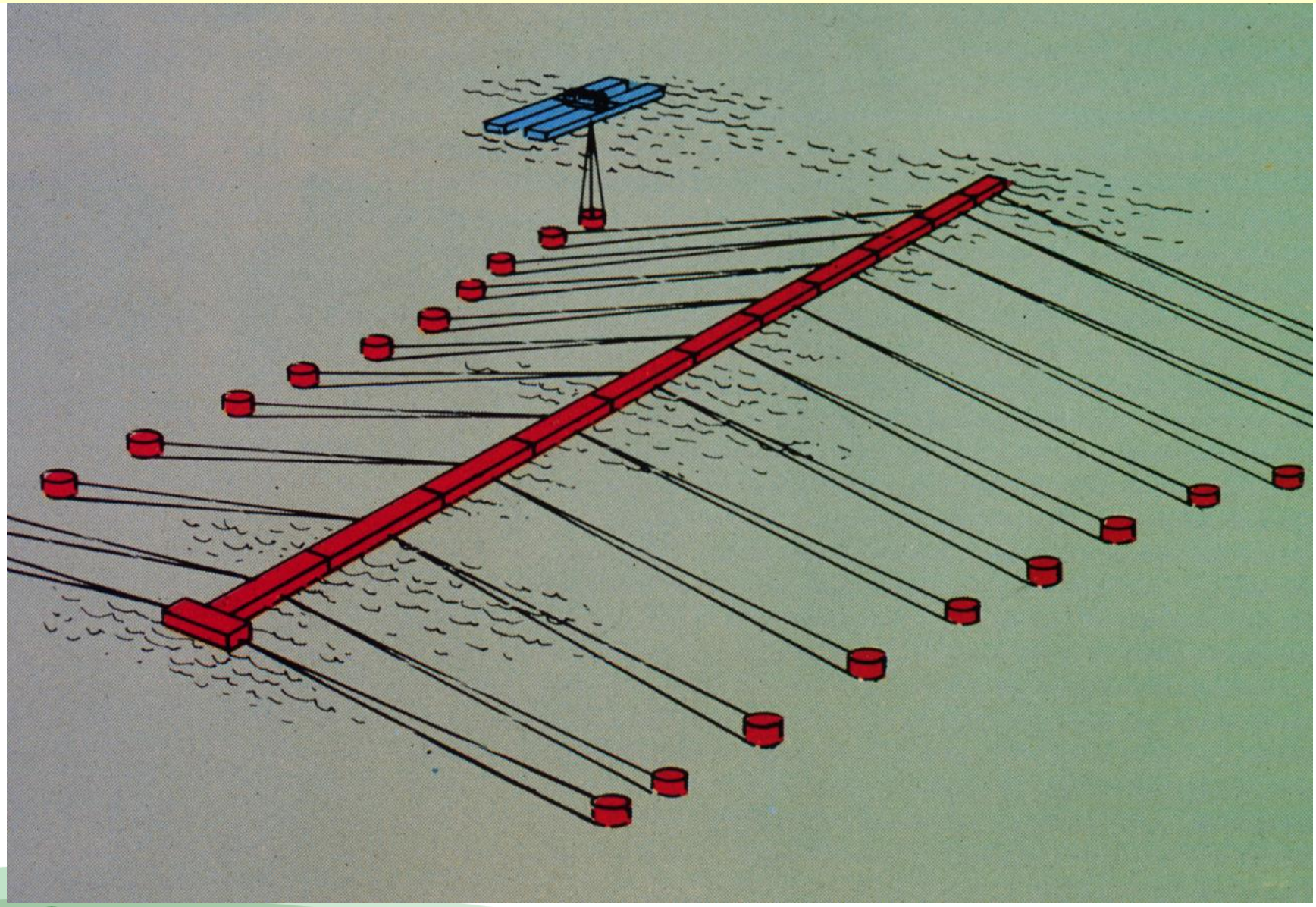
Bridge Repairs



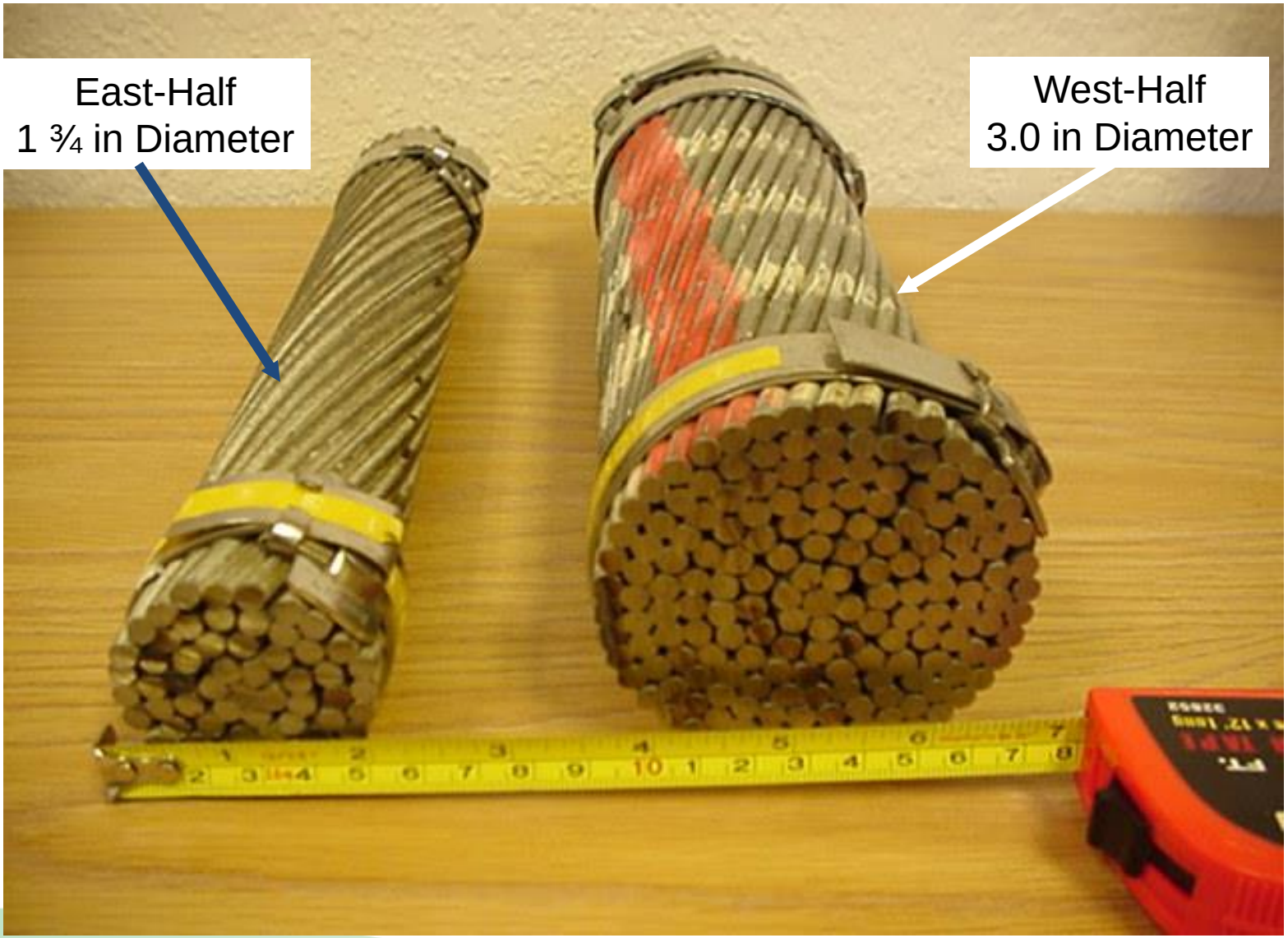
Bridge Repairs – Floating Bridges



Bridge Repairs – Floating Bridges

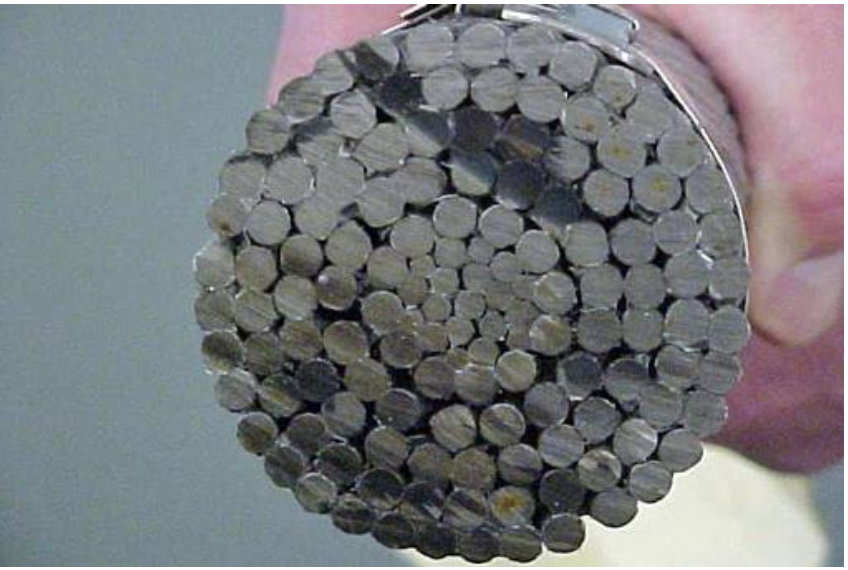


Bridge Repairs – Floating Bridges



Sample anchor cables (similar to those used on Hood Canal Bridge)

Bridge Repairs – Floating Bridges



Cond State 1:

Like New – No Defects

Anchor Cable Service Life 25-30 years

Cond State 2:

Surface Corrosion / Galvanizing starting to deteriorate.

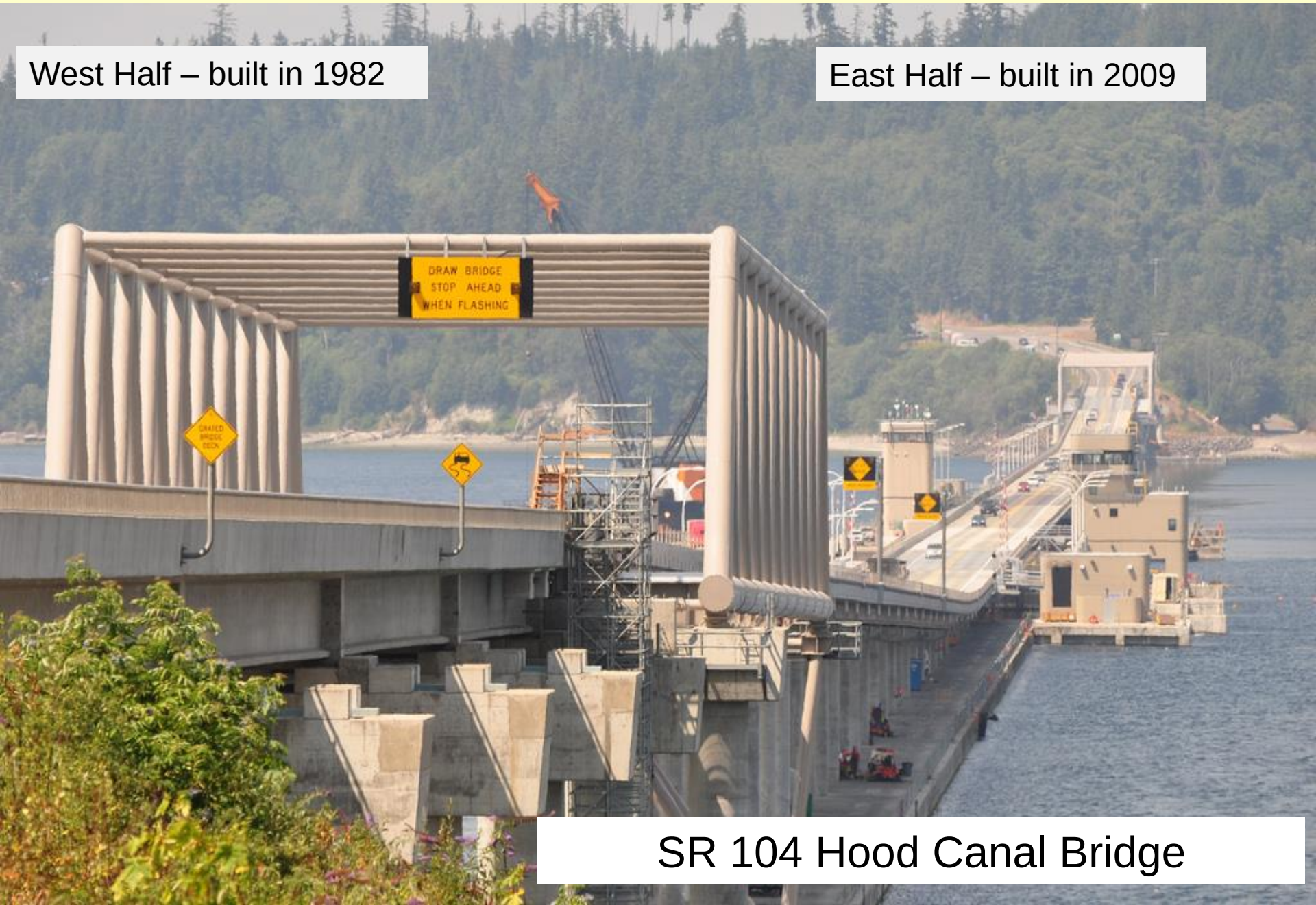
Cond State 3:

Corrosion with section loss / Single wire breaks

Cond State 4:

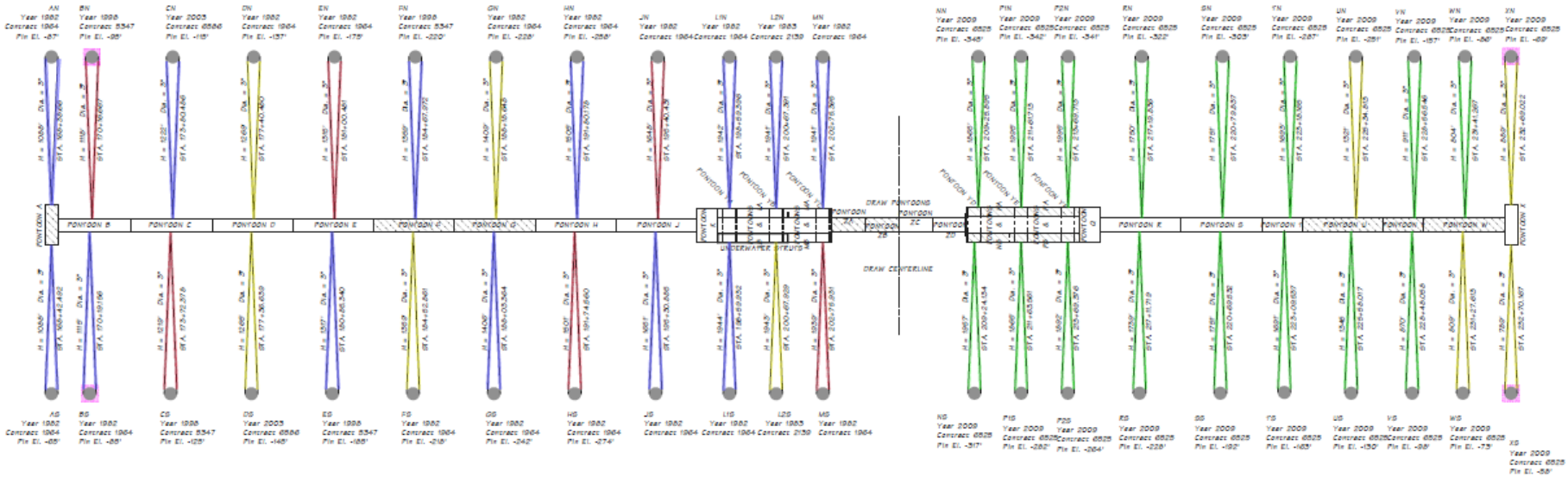
Multiple wire breaks / affects capacity

Bridge Repairs – Floating Bridges



Bridge Repairs – Floating Bridges

SR104 Hood Canal Bridge - Anchor Cable Conditions



West Half – 24 cables (1982)

East Half – 20 cables

Anchor Cable Service Life 33 years

Condition State

CS1

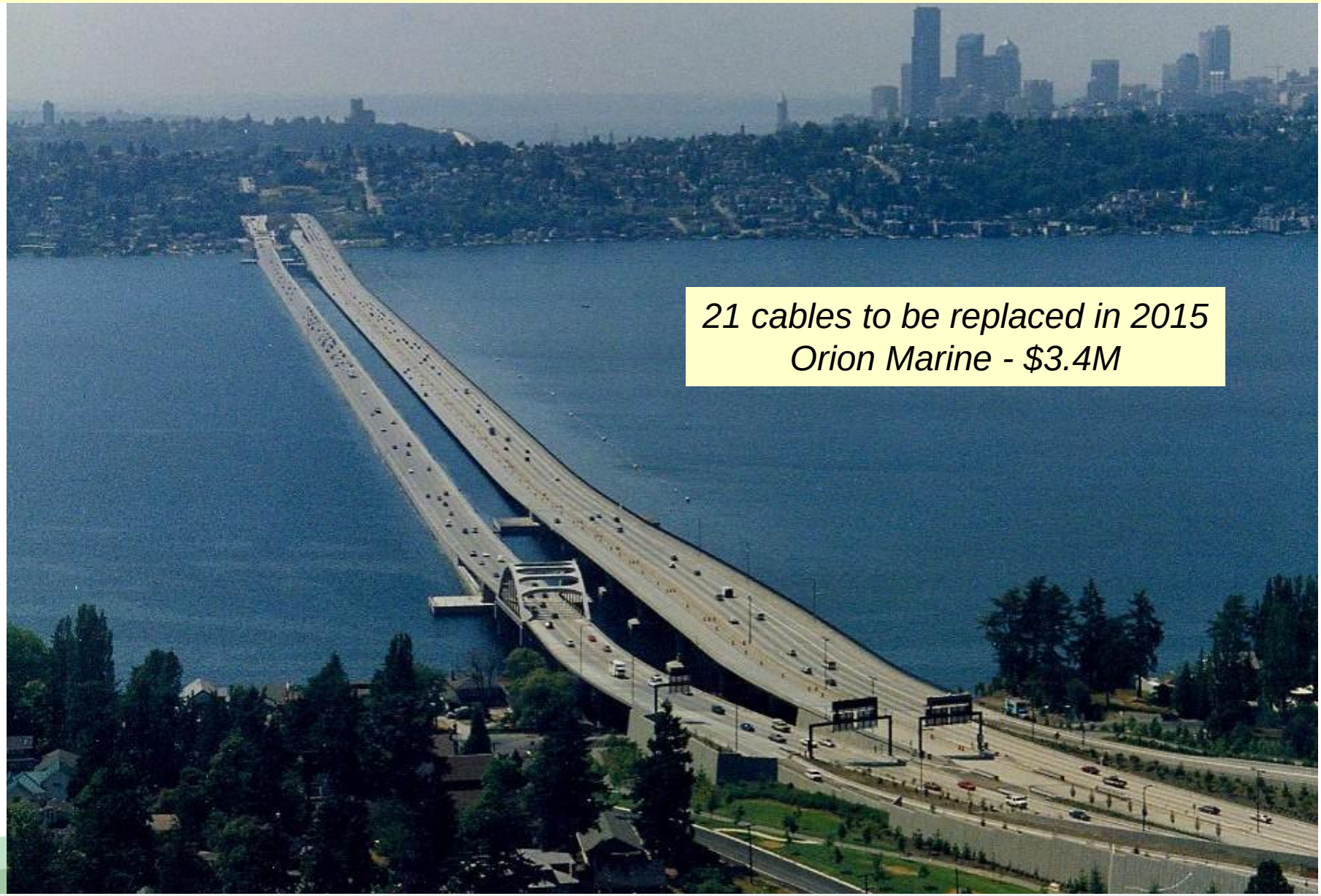
CS2

CS3

CS4

21 cables to be replaced in 2015
Manson Construction - $7.3M

Bridge Repairs – Floating Bridges

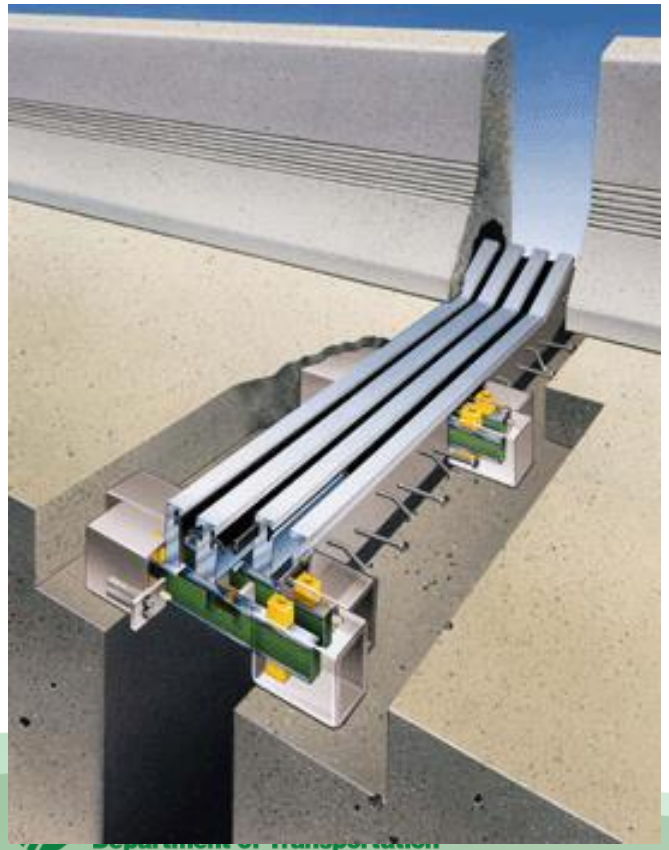


I-90 Floating Bridges – Homer Hadley and Lacey V Murrow


BMS Expansion Joints

Bridge Repairs – Modular Expansion Joints

60 WSDOT bridges
4,977 Lineal Feet



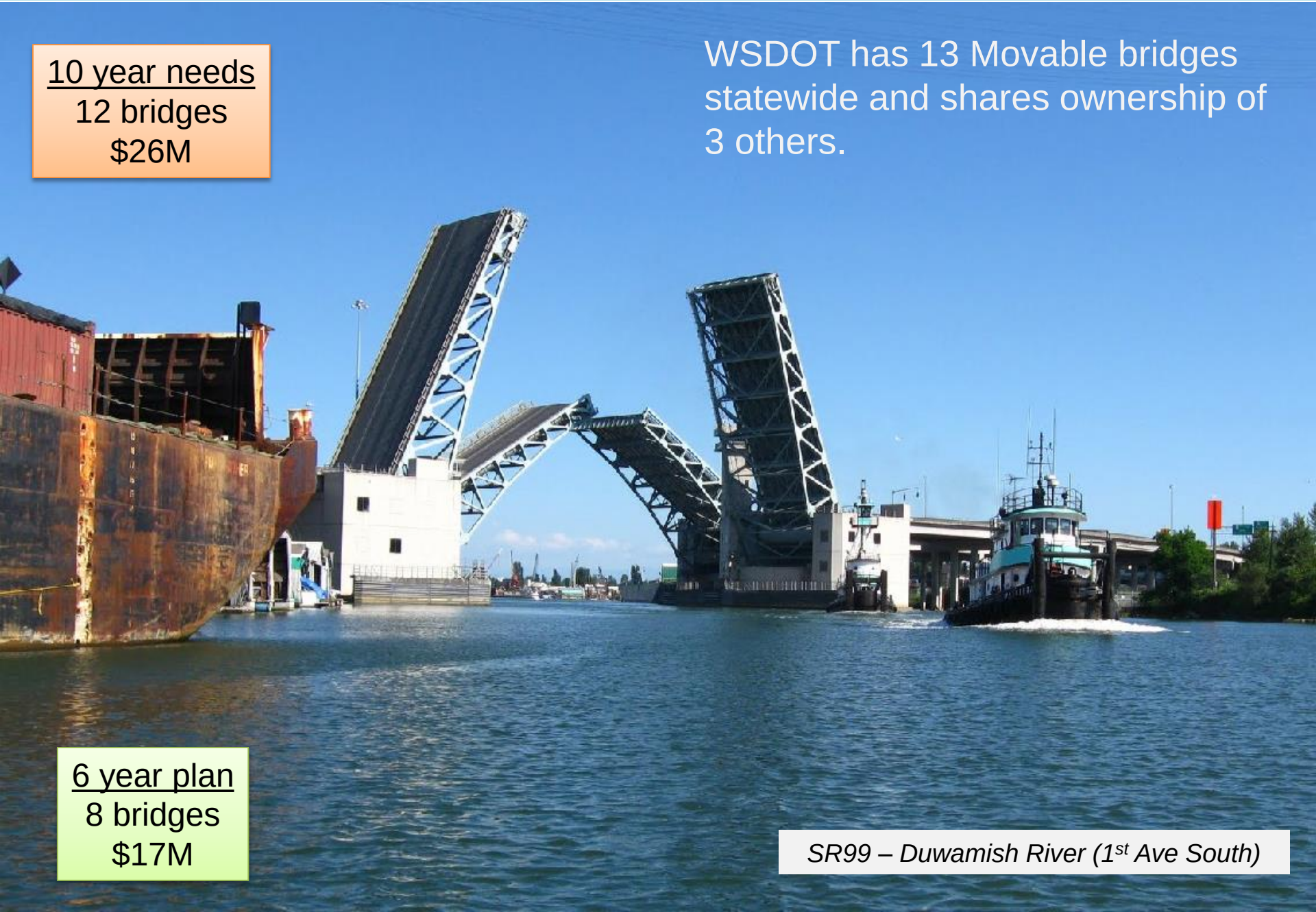
Bridge Repairs – Modular Expansion Joints

Bridge Repairs – Modular Expansion Joints


04/28/2012

Bridge Repairs – Modular Expansion Joints

Movable Bridges



10 year needs
12 bridges
$26M

WSDOT has 13 Movable bridges statewide and shares ownership of 3 others.

6 year plan
8 bridges
$17M

SR99 – Duwamish River (1st Ave South)

WSDOT Bridge Asset Management

- Border Bridges
- Scour Repairs
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- Bridge Painting
- Bridge Deck Rehab and Overlay
- Bridge Replacement / Rehab
- Seismic Retrofits

Steel Bridge Painting

Steel Structures Painting Council

"All coating systems will fail eventually."

The question is "When?"

US 101 Hoquiam River (Simpson Ave)

Steel Bridge Painting

WSDOT Steel Bridge Paint Access Database

- Inventory Data
- Last Painted Years
- Paint type
- Paint Condition
- Rating (OK/Due/Past Due)
- Contract Info
- Future Planning
- Future Condition Prediction

Steel Bridge Paint Form

Bridge Number:	Bridge Name:	Milepost:	Region:
141 / 5	WHITE SALMON RIVER	8.70	Southwest

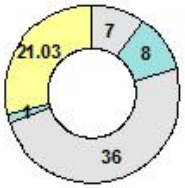
Year Built	Bridge Type:	Steel Span Length:	Width (curb-curb):	Steel Tonnage:
1940	ST CTB	120 ft.	27 ft.	96

Paint Age:	Paint Color: 34097	Steel Surf. Area:	BMS Cond State 2:	BMS Cond State 3:
1	Evergreen	21,717 sqft	0 sqft	0 sqft

Next Paint Year:	Priority Rank:	OK/Due/Past Due	CPMS Ad date:	Paint Pin Number:	Future $/SF	Future Paint Cost:
2039		OK			$30	$651,500

Years	Cycle
2014	36
1978	8
1970	7
1963	12
1951	

Painting Cycle

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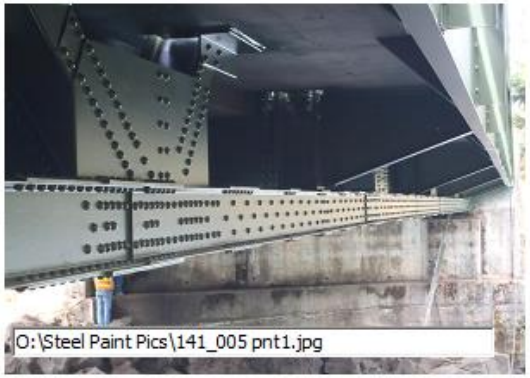

O:\Steel Paint Pics\141_005 pnt1.jpg


O:\Steel Paint Pics\141_005 pnt2.jpg

The bridge was repainted in 2014. All the previous paints were removed and the steel was prepared per SSPC SP-10 specifications. A new Zinc and Moisture cured urethane paint system was applied.

Washington State Department of Transportation

Steel Bridge Painting

Paint Cond State 1:	Paint Cond State 2:	Paint Cond State 3:
The paint system is sound and functioning as intended.	The paint system may be chalking, peeling, curling, or showing distress with no exposure of metal.	The paint system is no longer effective. The metal substrate is exposed.

Steel Bridge Painting

Steel Bridge Painting

Steel Bridge Paint Form

Bridge Number:	Bridge Name:	Milepost:	Region:
12 / 328N	NACHES R NELSON	198.66	South Central

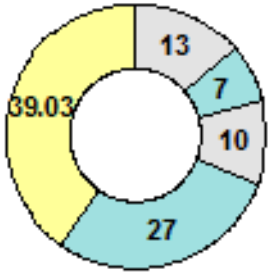
Year Built	Bridge Type:	Steel Span Length:	Width (curb-curb):	Steel Tonnage:
1958	ST	304 ft.	28 ft.	316

Paint Age:	Paint Color: 30277	Steel Surf. Area:	BMS Cond State 2:	BMS Cond State 3:
27	Light Brown	47,400 sqft	3,934 sqft	2,654 sqft

Next Paint Year:	Priority Rank:	OK/Due/Past Due	CPMS Ad date:	Paint Pin Number:	Future $/SF	Future Paint Cost:
2018	10	Past Due			$50	$2,370,000

Years	Cycle
1988	10
1978	7
1971	13
1958	

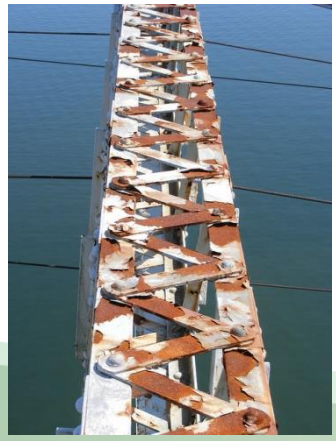
Painting Cycle



5.6%

Steel Bridge Painting

Paint Condition "OK"	Paint Condition "Due"	Paint Condition "Past Due"
Repainting not planned < 2% Paint CS3	Repainting Needed 2% - 5% Paint CS3	Repainting Needed Repairs may be required > 5% Paint CS3



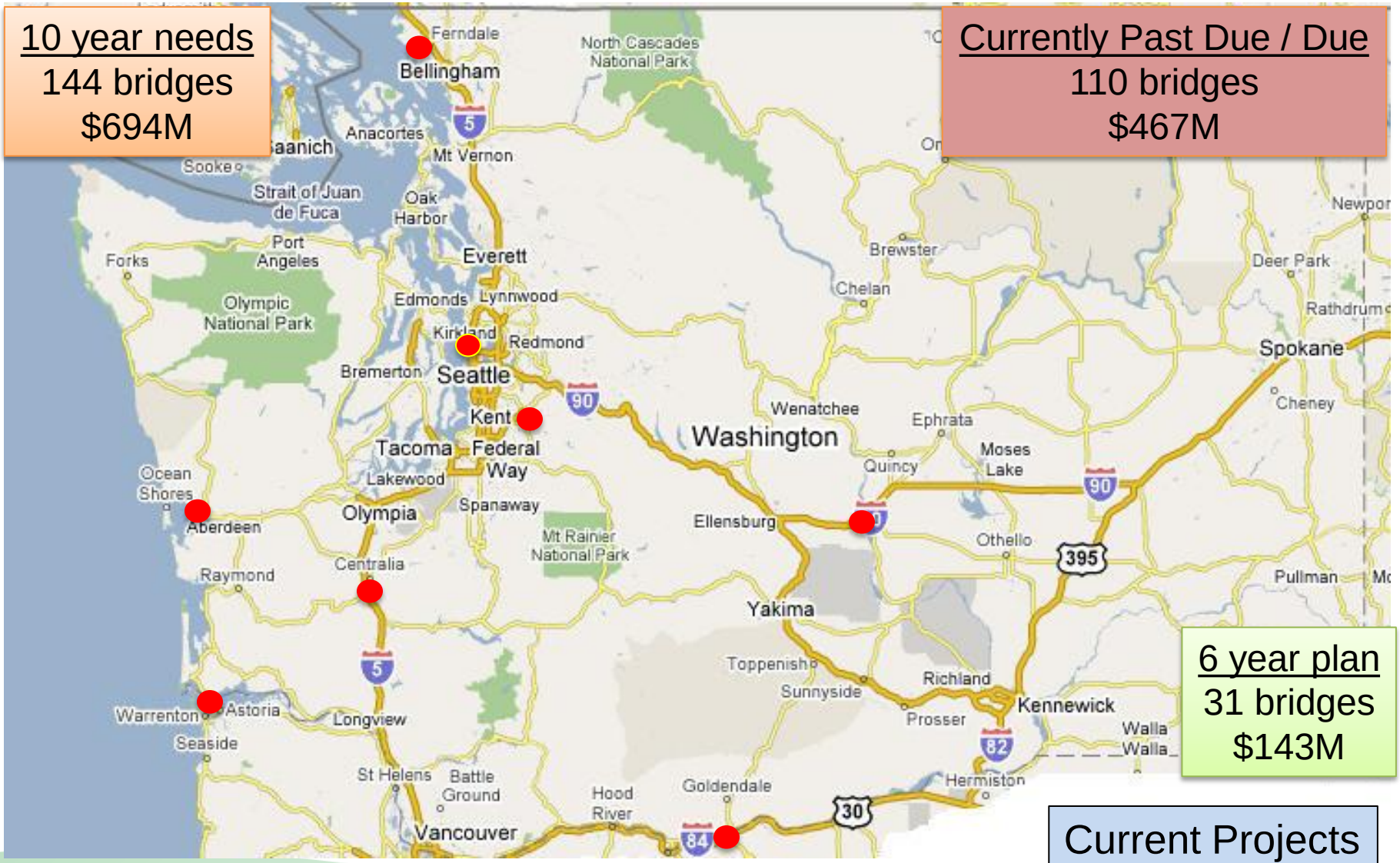
Steel Bridge Painting

WSDOT needs $694 million for 10-year steel bridge painting plan

Fiscal years (FY) 2013 through 2023; Planned projects and spending for 2013-2015 biennium; Dollars in millions

Painting needs	Number of bridges	Cost to repaint
Currently due or past due[1]	110	$467.0
11 projects planned for 2013-2015 biennium[2]	8.5[3]	$54.8
Remaining backlog	**101.5**	**$412.2**
Due within the next 10 years	43	$282.0
10-year total need	**144.5**	**$694.2[3]**

Steel Bridge Painting



Current Projects

9 Bridges - $68 million

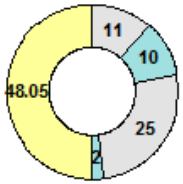
Washington State Department of Transportation

Steel Bridge Painting

2013 Paint Contract

Total Cost = $6.9M

Years	Cycle
2013	25
1988	10
1978	11
1967	

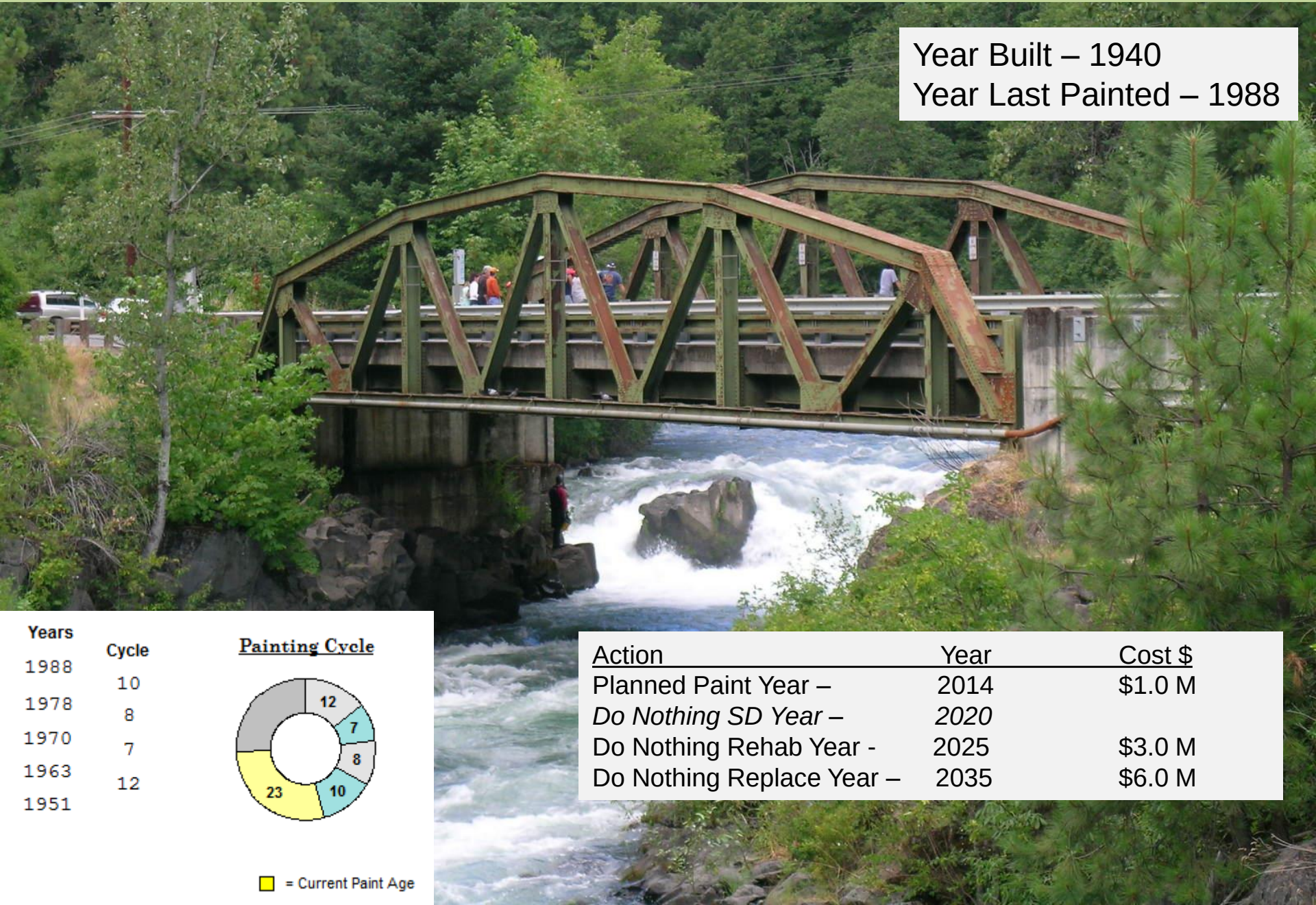


I-5 Nisqually River Bridges

Previously painted - 1988

Paint Service life – 25yrs

Steel Bridge Painting



Year Built – 1940
Year Last Painted – 1988

Years	Cycle
1988	
	10
1978	
	8
1970	
	7
1963	
	12
1951	

Painting Cycle

= Current Paint Age

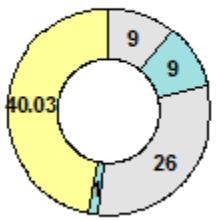
Action	Year	Cost $
Planned Paint Year –	2014	$1.0 M
Do Nothing SD Year –	*2020*	
Do Nothing Rehab Year -	2025	$3.0 M
Do Nothing Replace Year –	2035	$6.0 M

Steel Bridge Painting

2014 Paint Contract
Total Cost - $1.0M

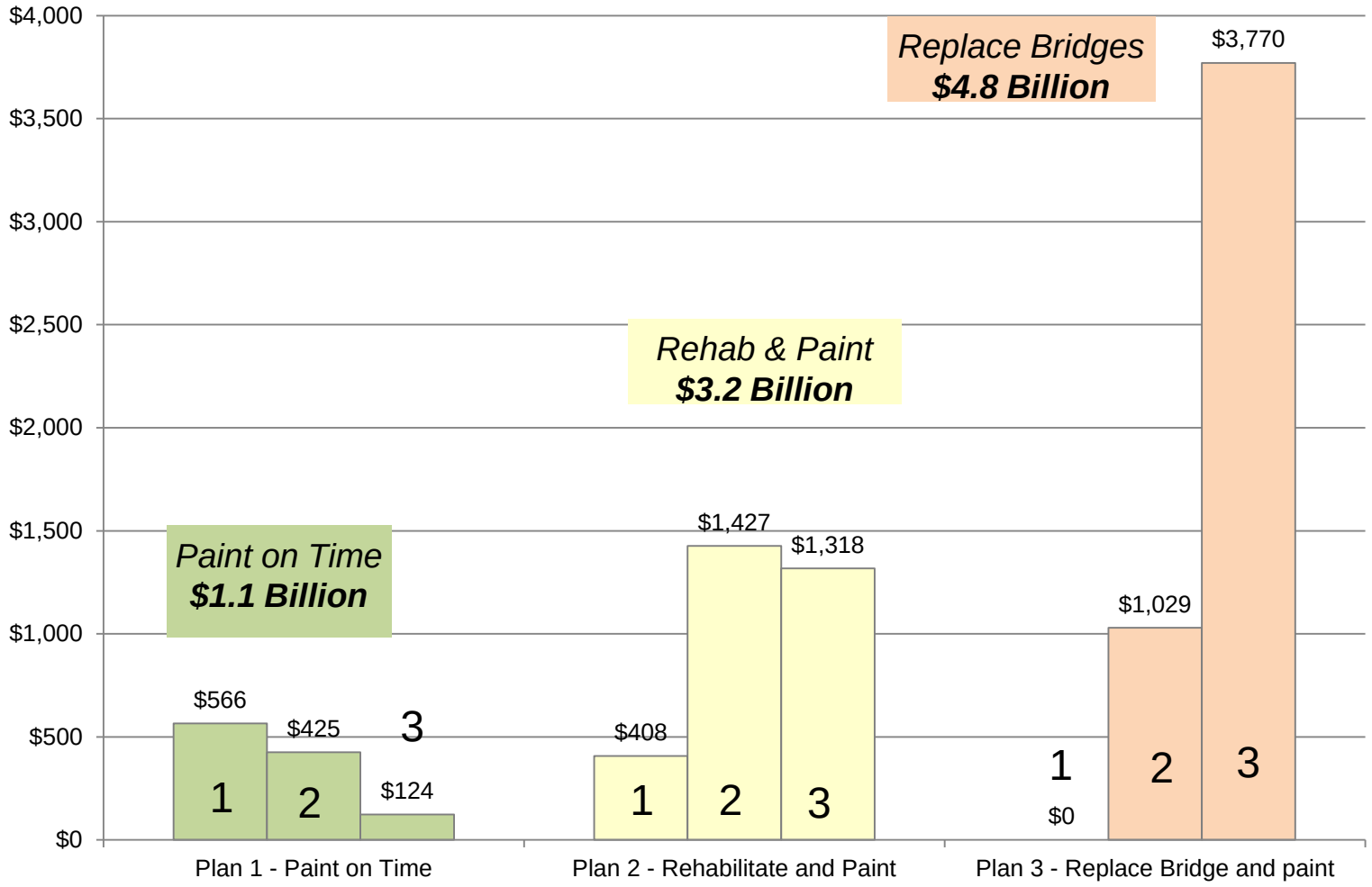
Year Built – 1940
Year Last Painted – 2014

Years	Cycle
2014	26
1988	9
1979	9
1970	7
1963	



Action	Year	Cost $
Planned Paint Year –	2014	$1.0 M
Do Nothing SD Year –	*2050*	
Do Nothing Rehab Year -	2055	$3.0 M
Do Nothing Replace Year –	2065	$6.0 M

WSDOT Steel Bridge Preservation Options

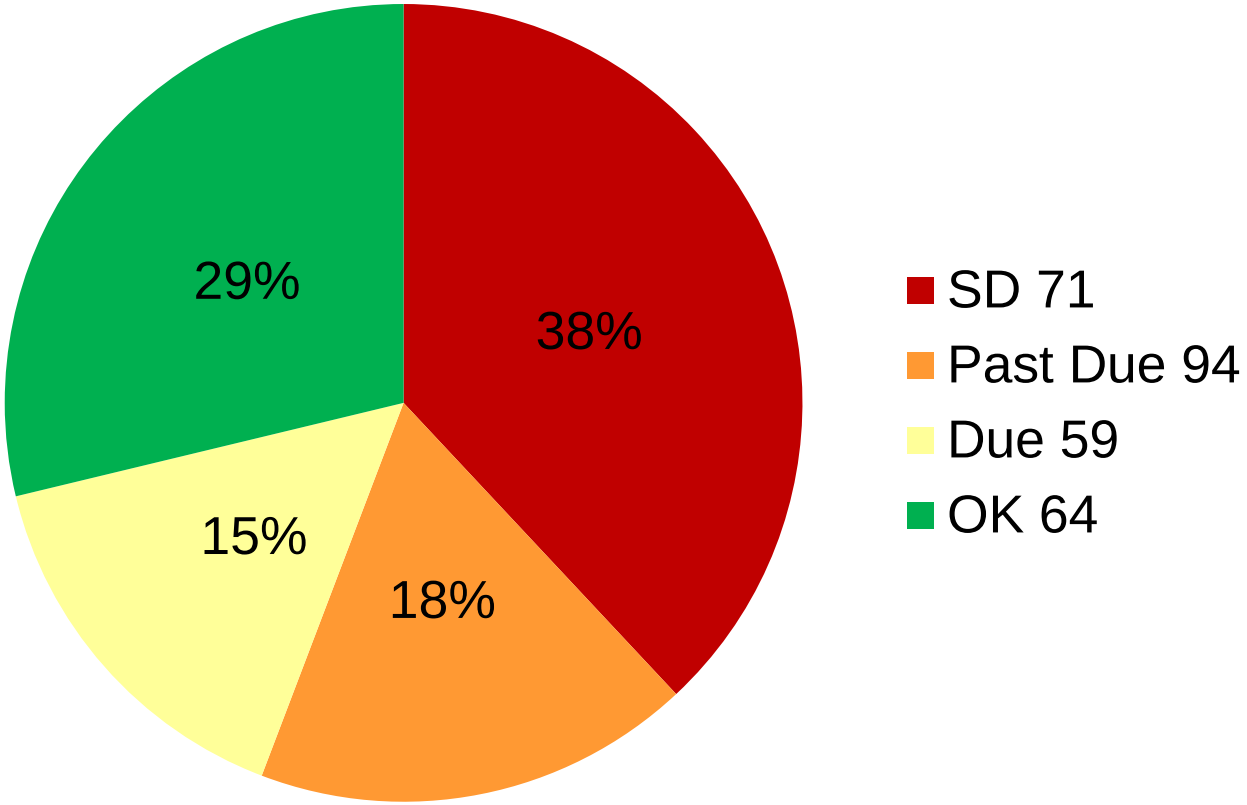


Period 1 - 2015-24
Period 2 – 2025-34
Period 3 – 2035-44

30 years

WSDOT Steel Bridge Preservation Options

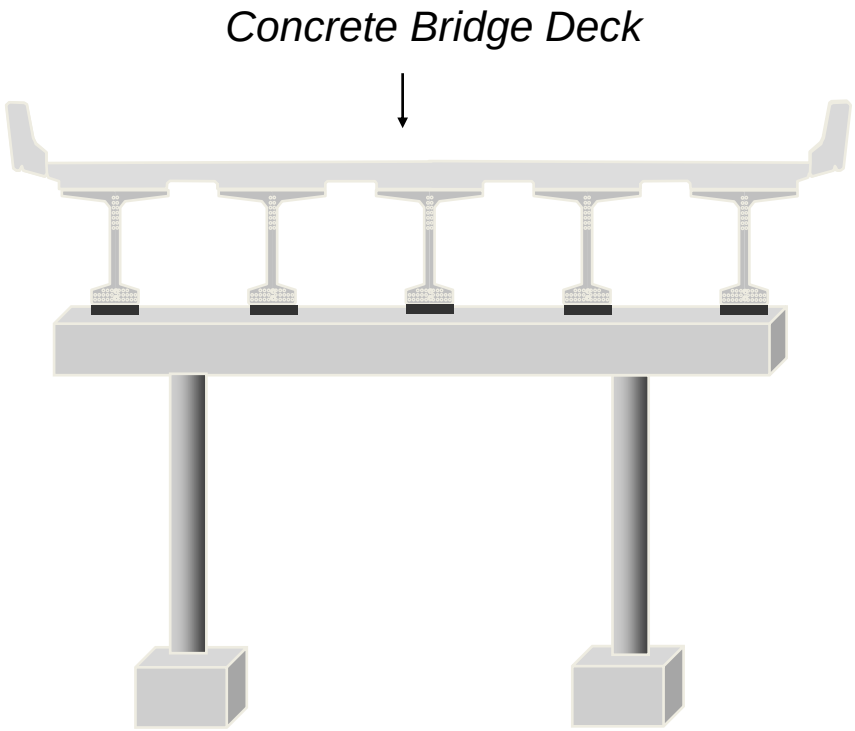
2023 – Projected Steel Bridge Inventory Condition
(with $141M funding for painting)



WSDOT Bridge Asset Management

- Border Bridges
- Scour Repairs
- Bridge Repairs (incl. Movable Brgs)
- Bridge Painting
- Bridge Deck Rehab and Overlay
- Bridge Replacement / Rehab
- Seismic Retrofits

Bridge Deck Rehab and Overlay



Deck issues over Bridge Life

- Rebar Corrosion
- Rebar Cover
- Poor Concrete
- Rutting

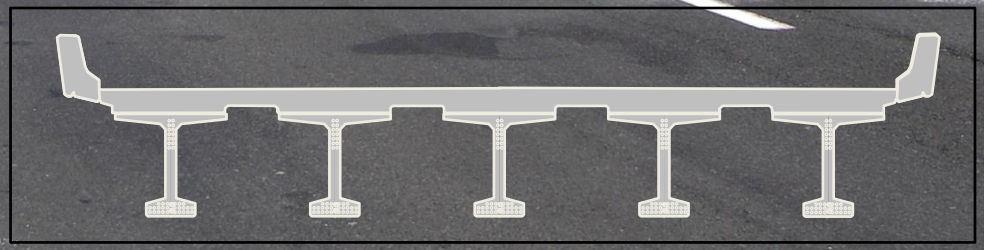
Bridge Deck Rehab and Overlay

Bridge Deck Rehab and Overlay

Maintain – Patching and spalls < 2% of total deck area

Preserve - (Deck Rehab and Overlay) > 2% of total Deck area

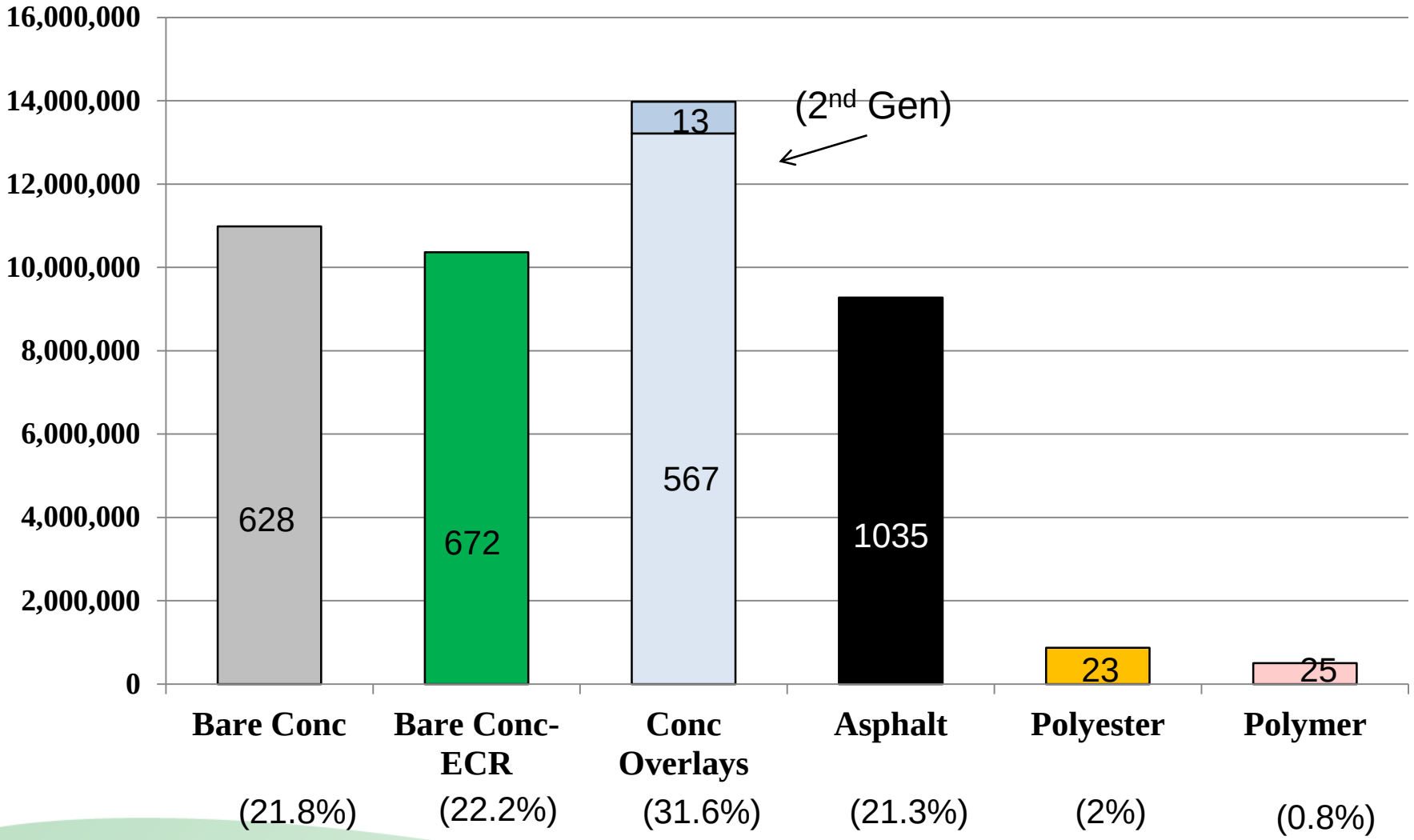
Replace Deck - Patching and spalls > 10-15% of total deck area



Deck Repair/Overlay in 2013

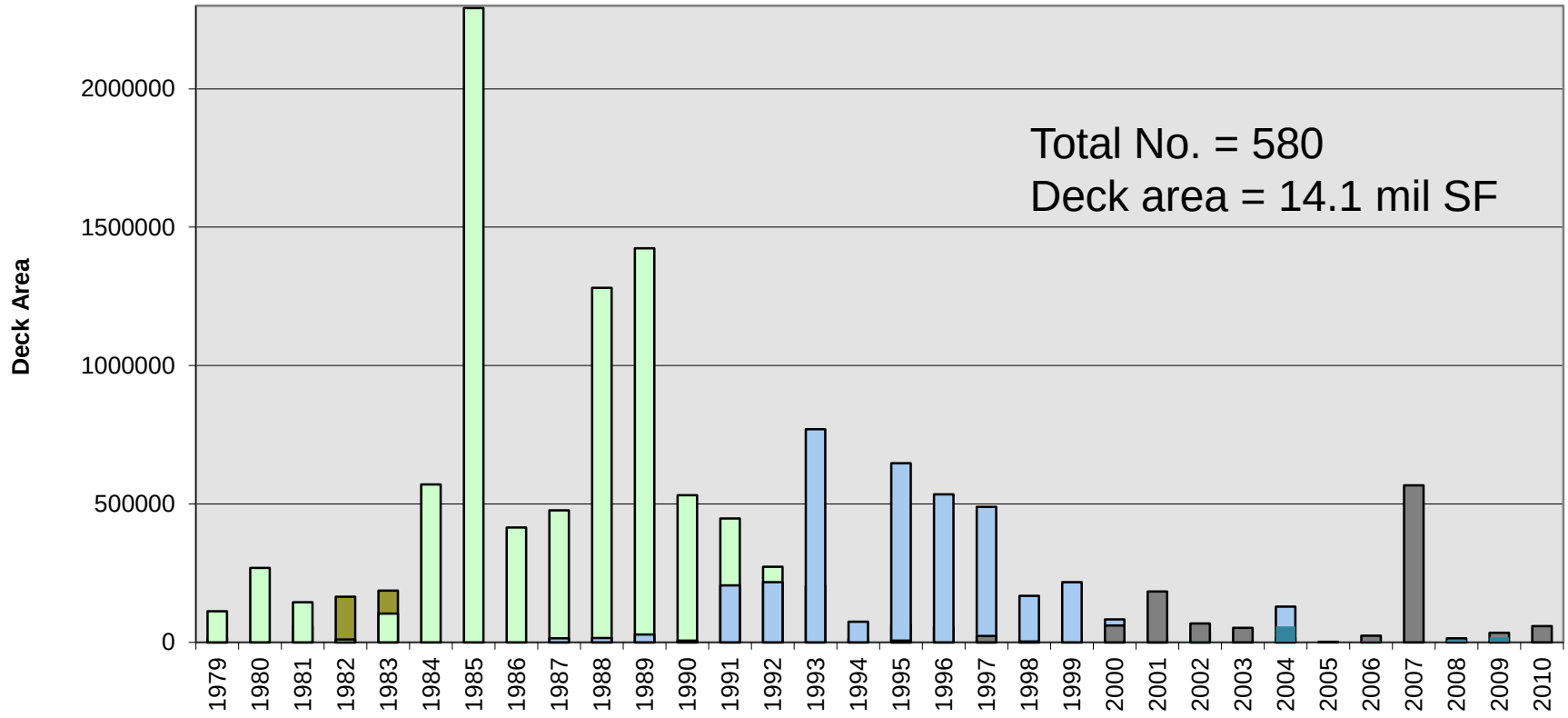
WSDOT Concrete Bridge Decks

(2,962 Bridges with Concrete Decks)



Modified Concrete Overlays

Bridges with a Modified Concrete Overlay



30+ yrs
144br - $185M

25–30 yrs
165br - $182M

20 – 25 yrs
142br - $139M

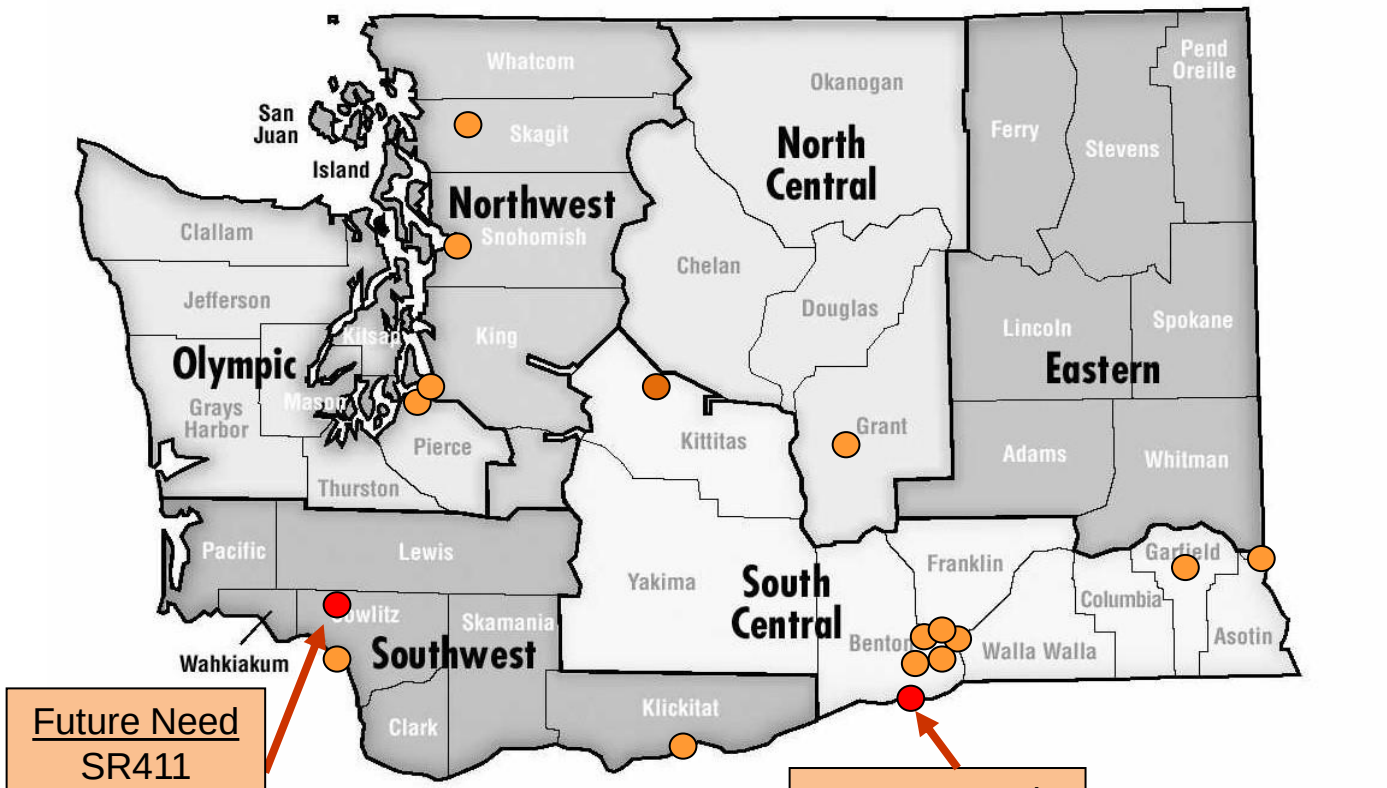
Latex
Microsilica
Low Slump
Fly-Ash

Washington State Department of Transportation

451br - $506M

10 year needs – 70 brgs ($125M)

Bridge Deck Replacements



14 bridges (588,536 sq ft)

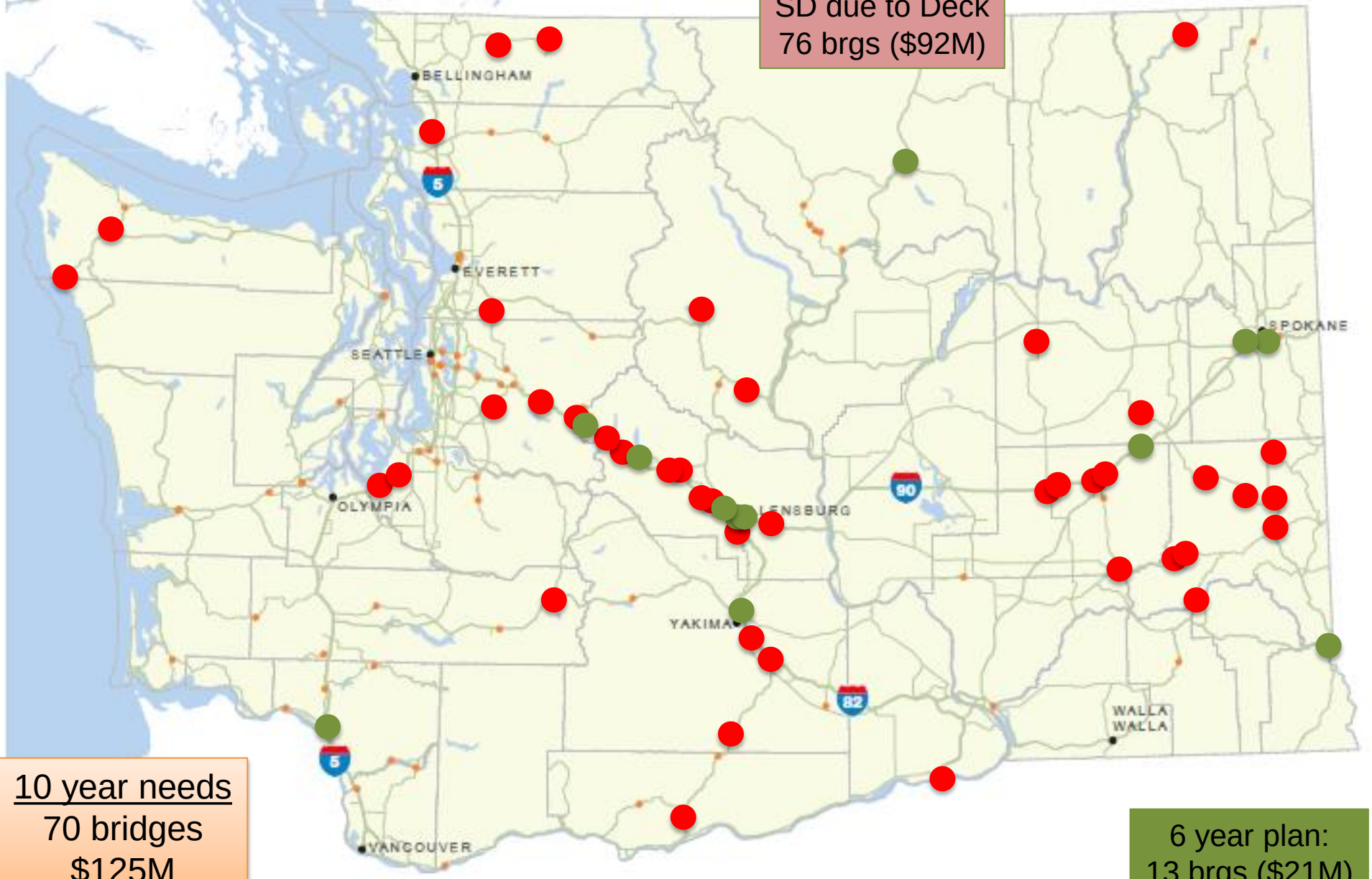
[1.3% of total Statewide Deck Area]

WSDOT Structurally Deficient Bridges

Washington State Department of Transportation

SD based on Br Deck Conditions

SD due to Deck
76 brgs ($92M)



10 year needs
70 bridges
$125M

6 year plan:
13 brgs ($21M)

WSDOT Bridge Asset Management

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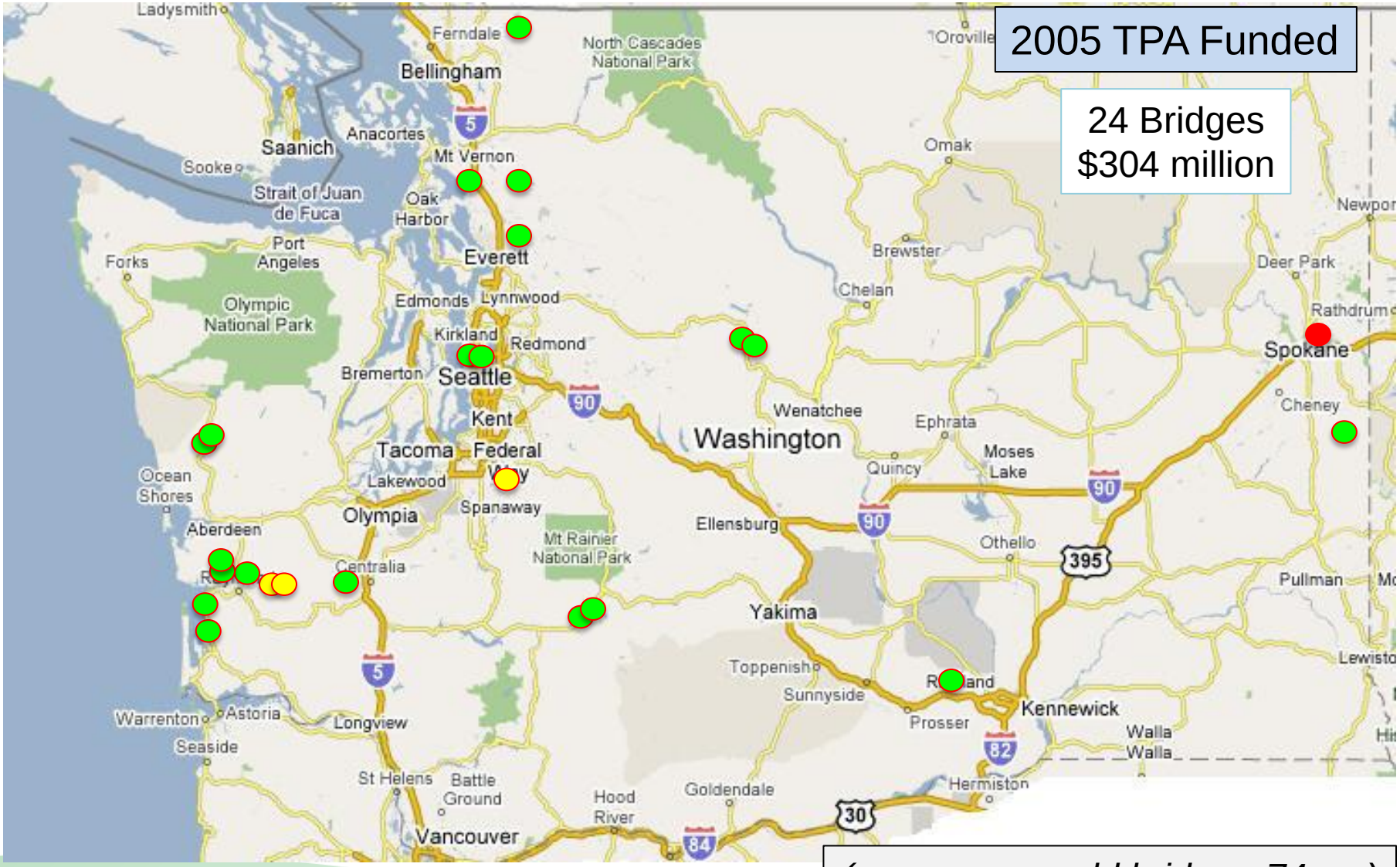
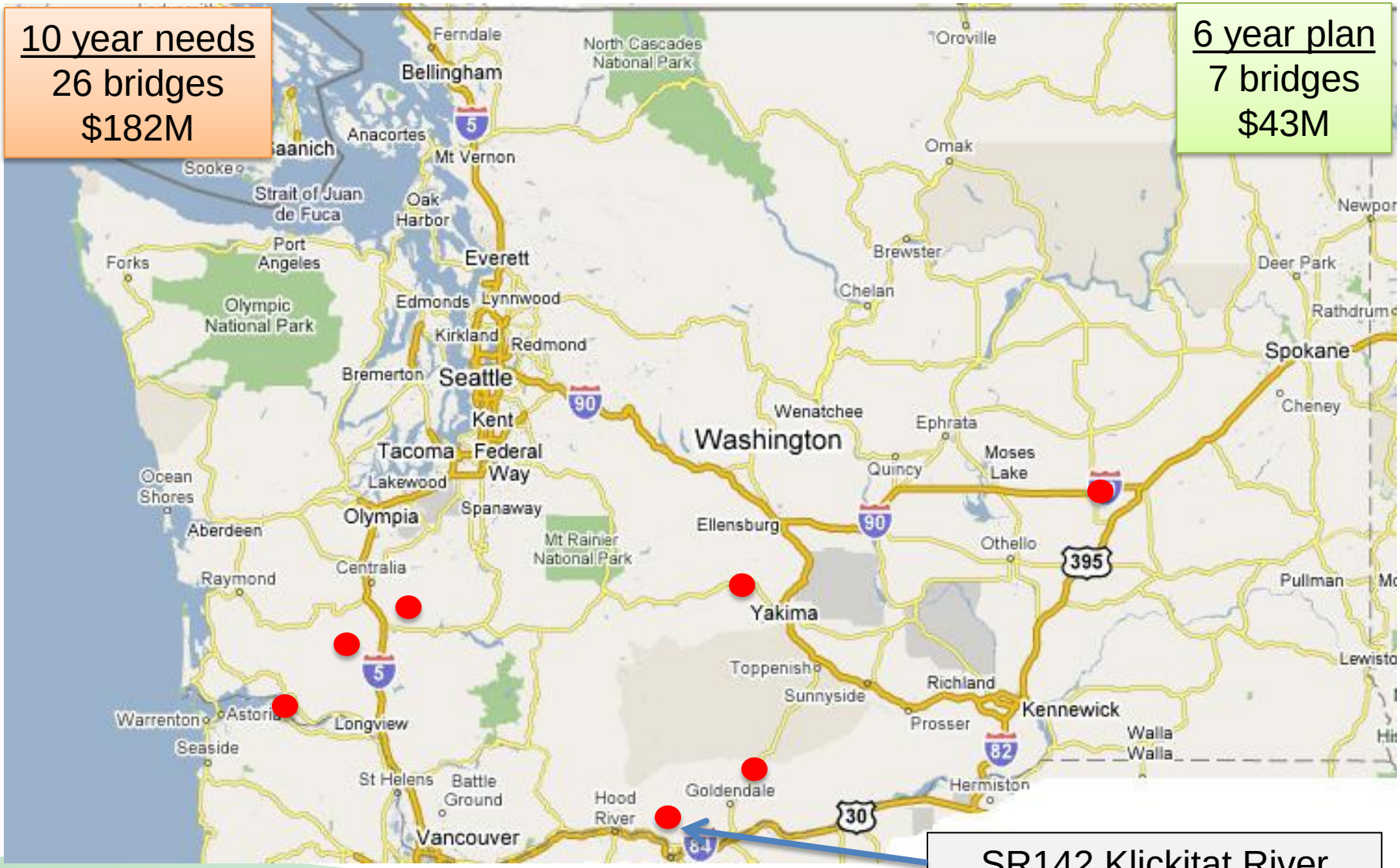
- Bridge Replacement / Rehab
- Seismic Retrofits

Bridge Rehabilitation / Replacement



Bridge Rehabilitation / Replacement



Washington State Department of Transportation

Bridge Rehabilitation / Replacement

Year Built – 1954

2011

SR142 Klickitat River

Bridge Rehabilitation / Replacement

SR142 Klickitat River

Bottom side of Deck

SR142 Klickitat River

Bottom side of Deck

Bridge Rehabilitation / Replacement

Bridge Rehabilitation / Replacement

New Bridges - Performance Deck Concrete

Performance Deck Concrete

SR105 Smith Creek Bridge
2014

I-90 Gold Creek Bridge
2012

WSDOT Bridge Asset Management

- Border Bridges
- Scour Repairs
- Bridge Repairs (incl. Movable Brgs)
- Bridge Painting
- Bridge Deck Rehab and Overlay
- Bridge Replacement / Rehab
- Seismic Retrofits

WSDOT Seismic Retrofit Program

Objectives:

- Minimize risk of bridge collapse
- Keep Interstate / essential bridges open
- Accept moderate damage

Program Status:

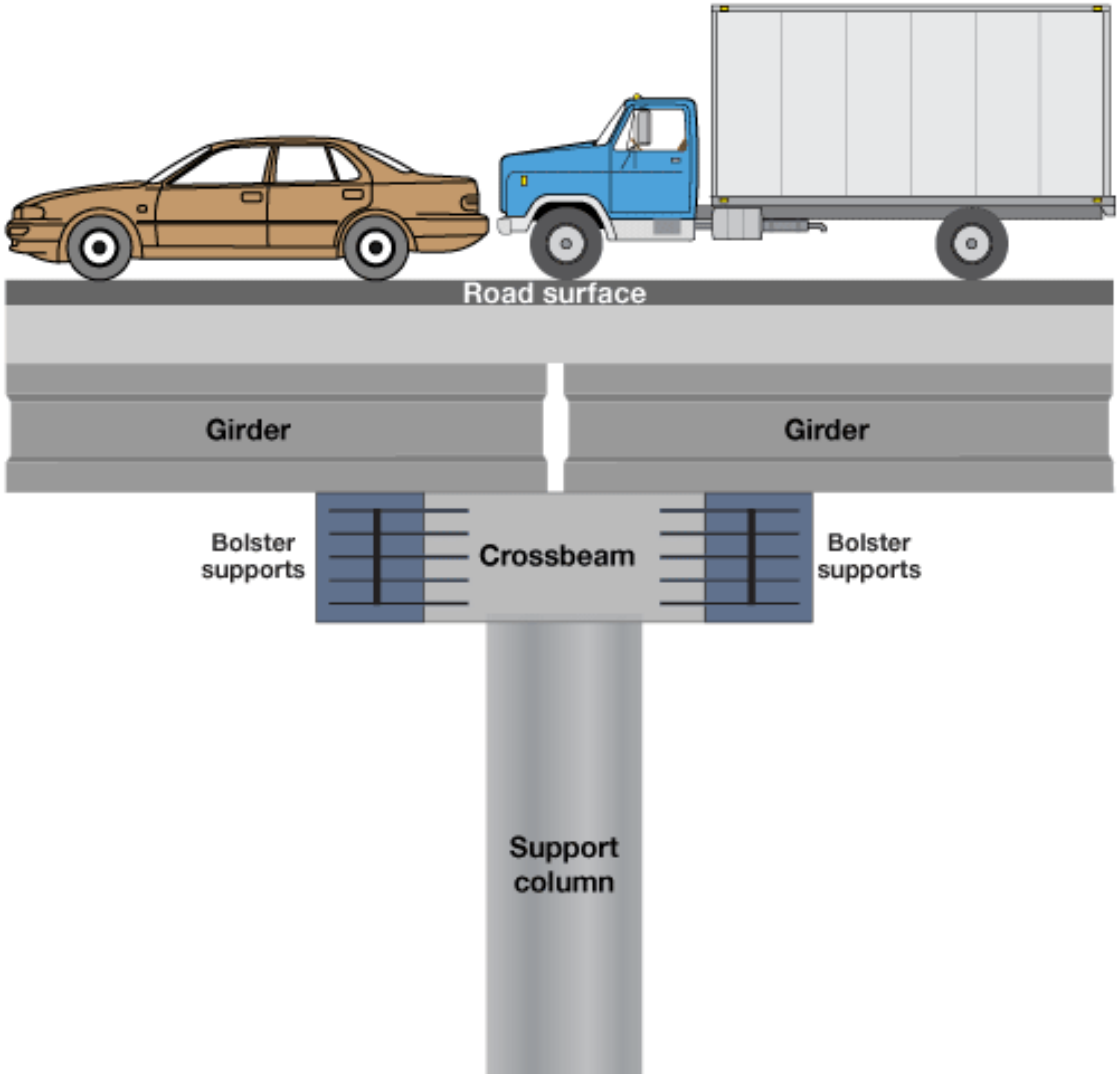
Category	Number of Bridges
Retrofit Complete	301
Partially Retrofitted	120
In-Progress	17
Retrofit Needed	462
Totals	900

WSDOT Seismic Retrofit Program

Comparison of selected Earthquakes

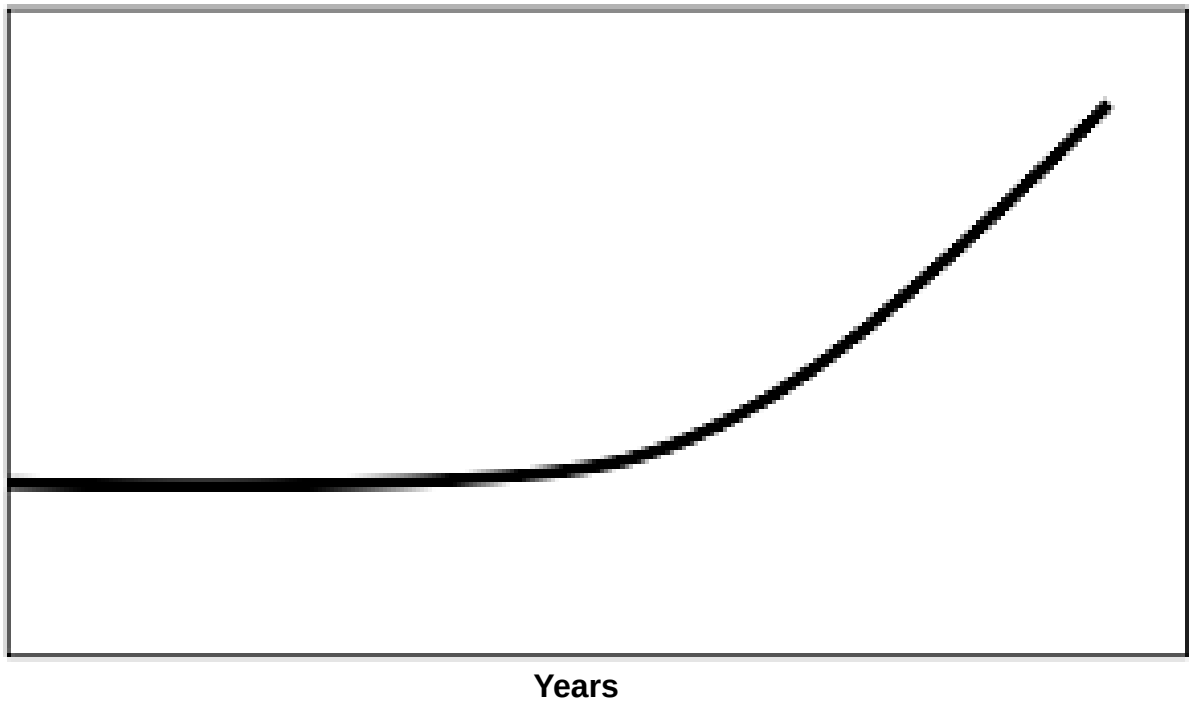
	NISQUALLY	KOBE	NORTHRIDGE	LOMA PRIETA
Year	2001	1995	1994	1989
Magnitude	6.8	6.9	6.7	7.1
Peak Acceleration (a)	0.25	0.80	1.00	0.60
Depth of Rupture (km)	52.0	14.3	18.0	19.0
Duration (sec.)	10	11	9	8
Bridge Damage ($ x Millions)	$5	$6,700	$300	$1,500

Multiple Column Retrofit



WSDOT Bridge Asset Management

“Pay me now, or pay me more - lots more - later”




Questions?