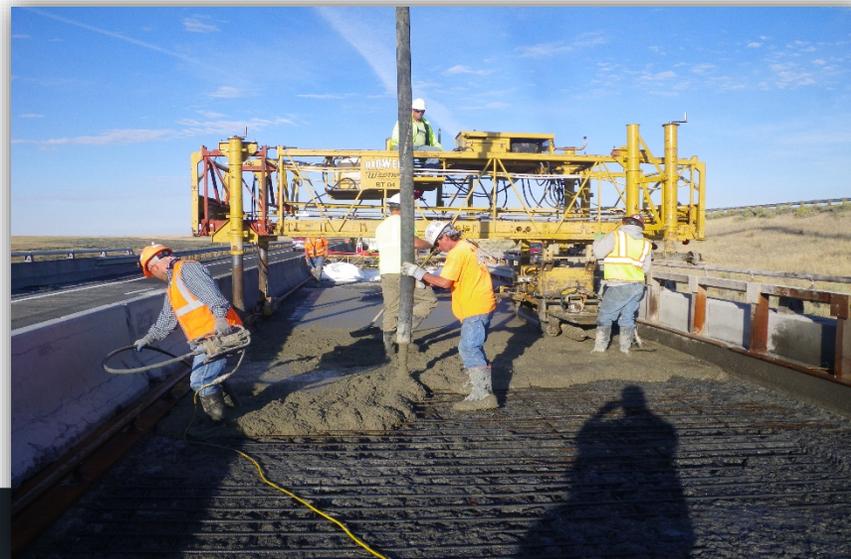


Deck Replacement vs Rehabilitation Experience

2019 WBPP

DeWayne Wilson
Bridge Asset Management Engineer

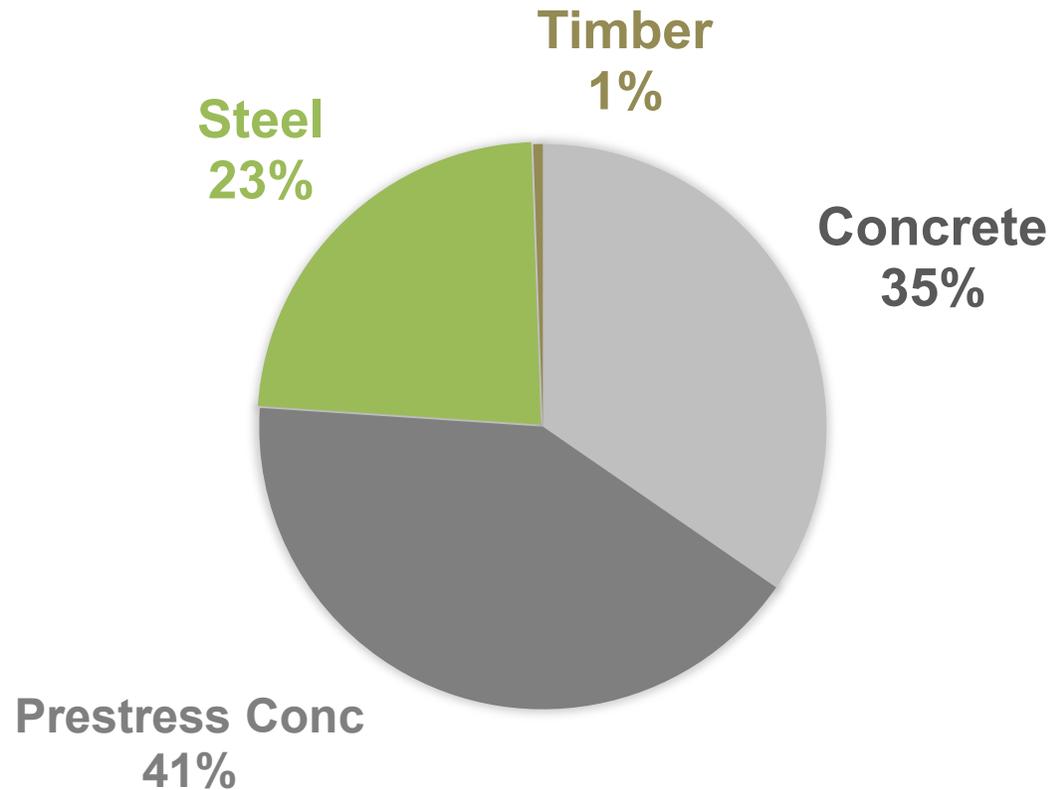


Agenda

- **WSDOT's Bridge Network**
- Bridge Deck Inspection
- Concrete Deck Replacements
- Concrete Deck Rehabilitation
- Develop Criteria (Repl vs Rehab)
- Current Bridge Deck Conditions
- 10 year Bridge Deck Needs
- Questions



WSDOT's Bridge Network



% based on bridge deck area

3,322 bridges (54.4 M SF)
Repl value \$58 Billion

3,039 Bridges with Concrete Decks
45.8 million SF deck area

Border Bridges

11 Border Bridges
5 – ODOT
5 – WSDOT
1 - IDOT

US101 Astoria (ODOT)
Yr Blt – 1966

SR433 Lewis and Clark (WSDOT)
Yr Blt – 1929

US 97 Biggs Rapids (WSDOT)
Yr Blt – 1962

SR-41 RR OC (IDOT)
Yr Blt – 1966

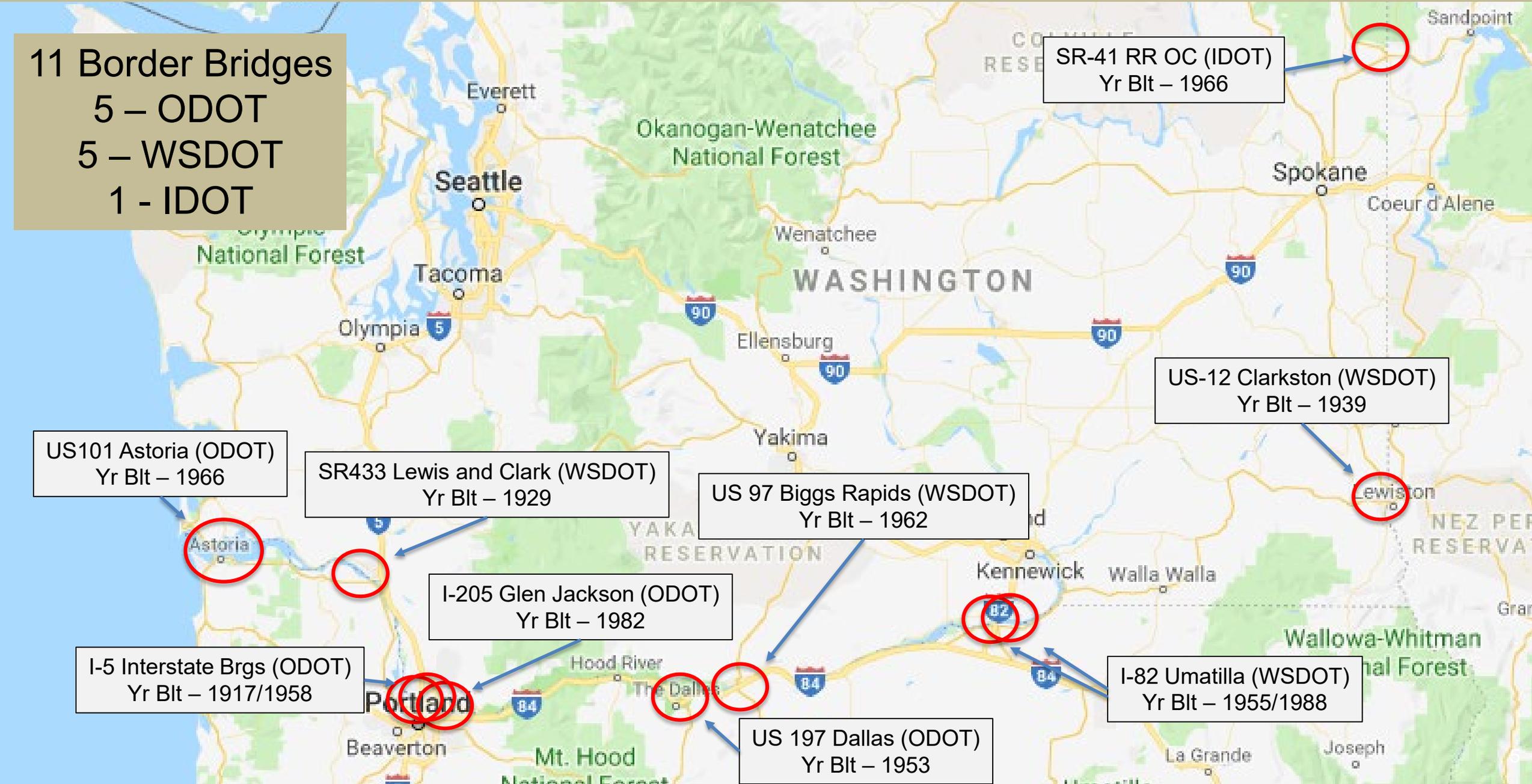
US-12 Clarkston (WSDOT)
Yr Blt – 1939

I-205 Glen Jackson (ODOT)
Yr Blt – 1982

I-5 Interstate Brgs (ODOT)
Yr Blt – 1917/1958

US 197 Dallas (ODOT)
Yr Blt – 1953

I-82 Umatilla (WSDOT)
Yr Blt – 1955/1988



WSDOT's Bridge Network

Ave Age - 49

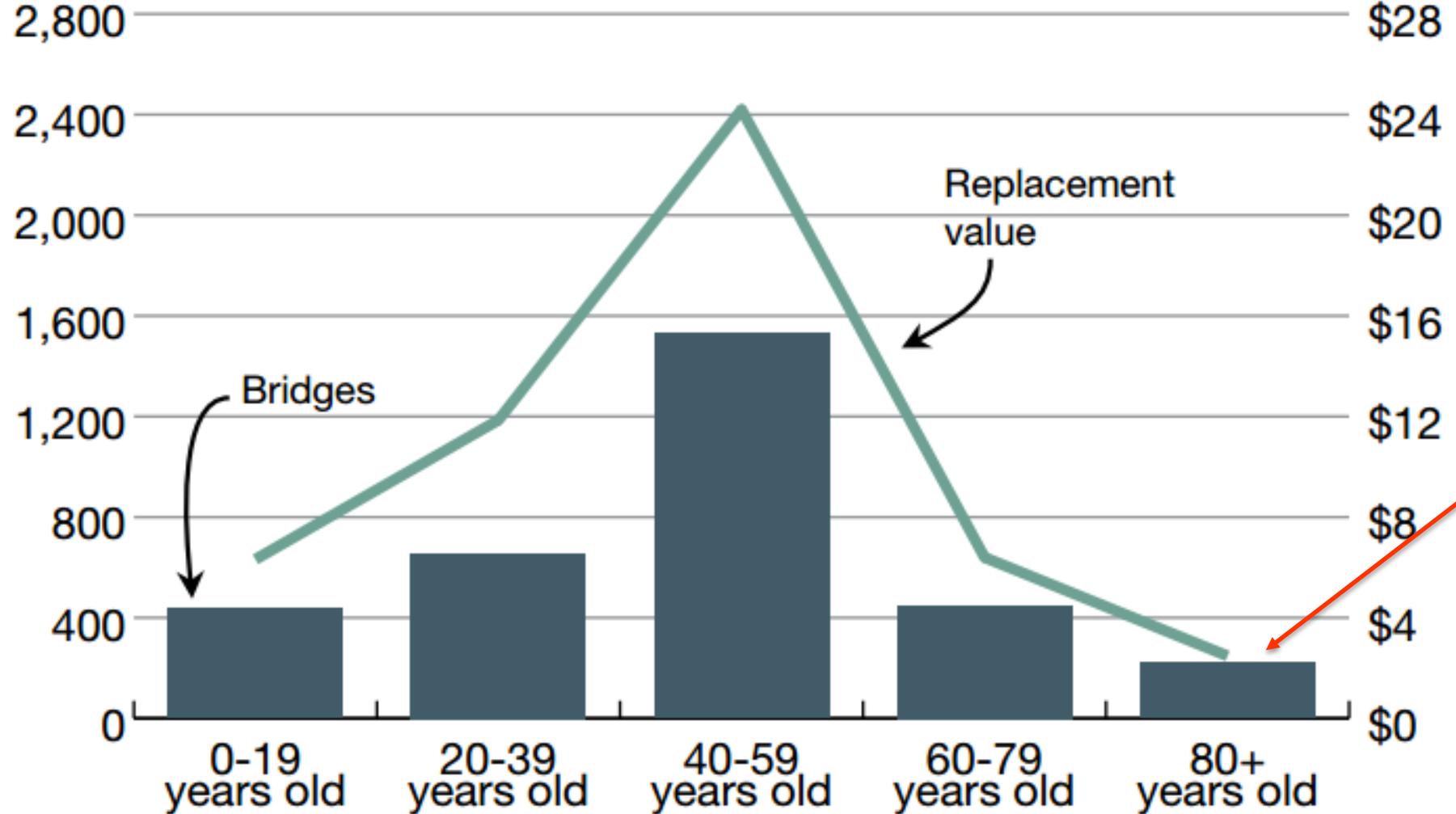
3,322 NBI Structures (54.4 M SF)
Repl value \$58 Billion

Oldest - 1910

Number
of Bridges

[3,132 Bridges / 3,039 Conc Decks]

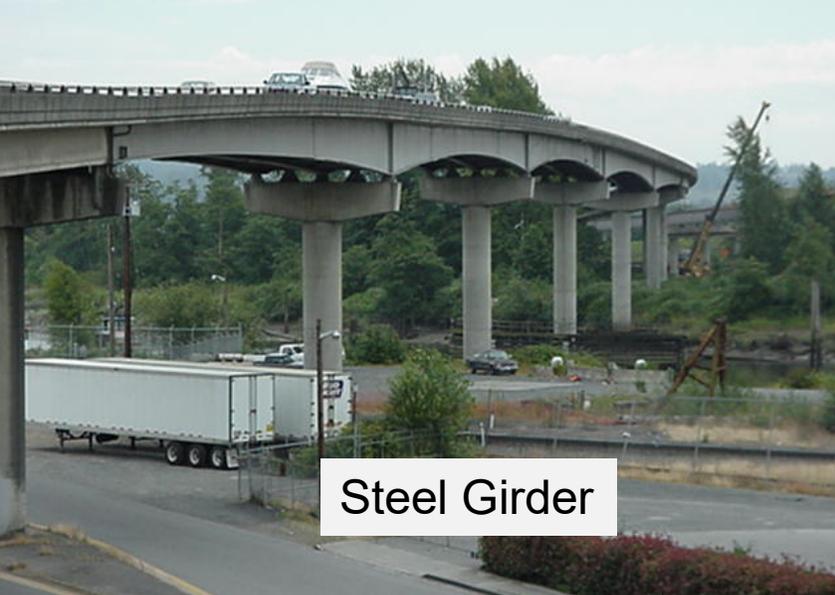
Billions



\$2.7B
266 Brgs
2.0M SF

WSDOT's Bridge Network

Non-Integral Concrete Bridge Decks (Non-Composite)



Steel Girder



Prestress Girder



Steel Truss



Steel Tied Arch



Steel Arch



Concrete Arch

Washington State DOT's Bridge Network

Integral Concrete Bridge Decks (composite)



Precast Prestress Slab



Conc Box



Conc T-Beam



Floating Bridge

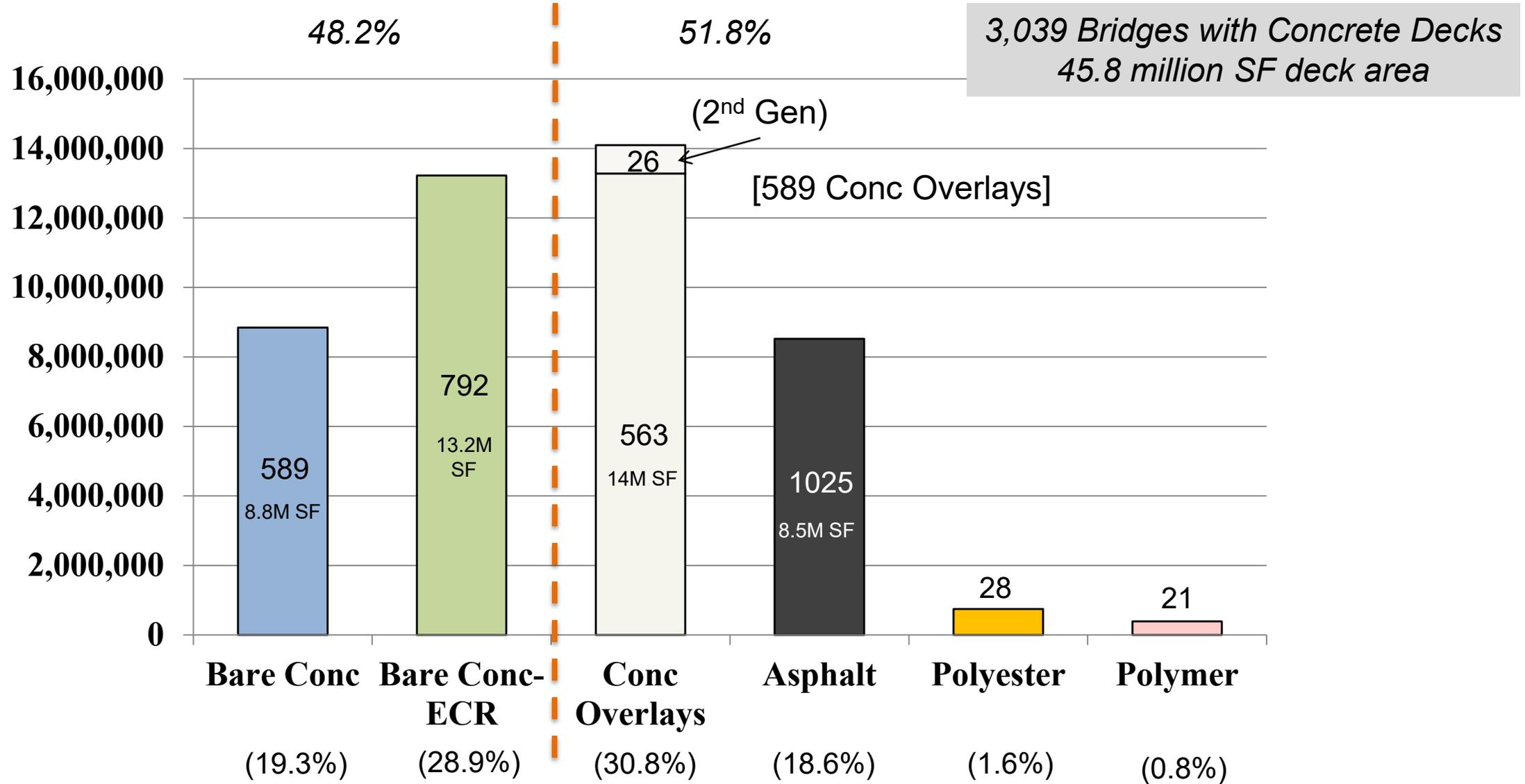


Segmental Post-Tension Box



Prestress Bulb-T

WSDOT's Bridge Network



Agenda

- WSDOT Bridge Network
- **Bridge Deck Inspection**
- Concrete Deck Replacements
- Concrete Deck Rehabilitation
- Develop Criteria (Repl vs Rehab)
- Current Bridge Deck Conditions
- 10 year Bridge Deck Needs
- Questions

Bridge Deck Inspection



Bridge Deck Inspection



Bridge Deck Inspection

Condition State 1

The deck surface has no spalls/delaminations or previous repairs. May have cracking or rutting.

Condition State 2

The deck surface has previous repairs.

Condition State 3

The deck surface has spalling.

Condition State 4

Delamination Test Results.

Year Built – 1972 (40 yrs in 2012)
Deck Thickness – 7"

90/316N Paha Rd OC - milepost 215.24

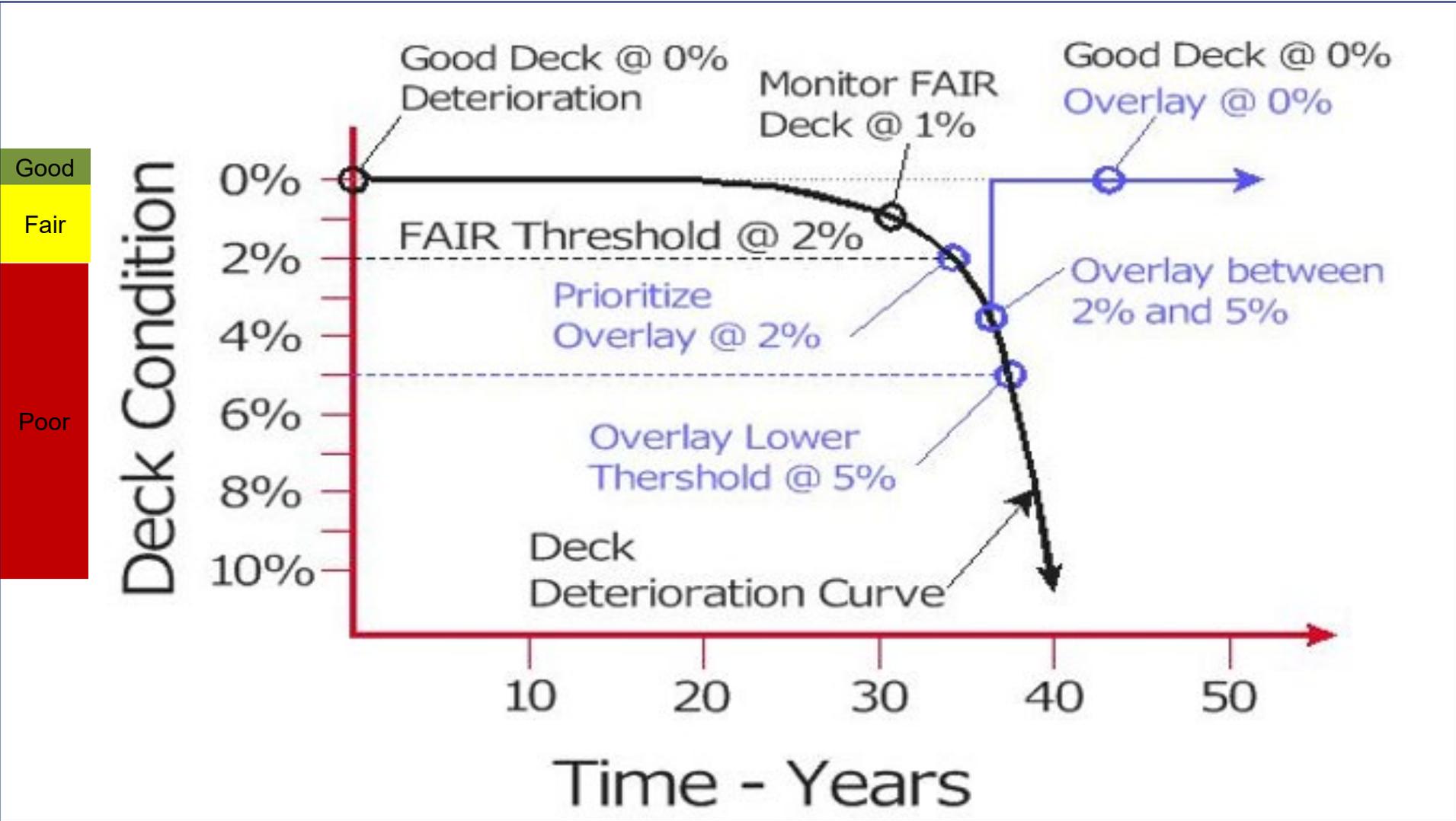
2012

(26%)

Elem	Description	Total	Unit	State1	State2	State3	State4
12	Conc. Deck	3,990	SF	2,774	1,053	0	163
35	Soffit	3,990	SF	3,990	0	0	0
376	Delam Testing	3,990	SF	3,827	0	0	163



Bridge Deck Deterioration



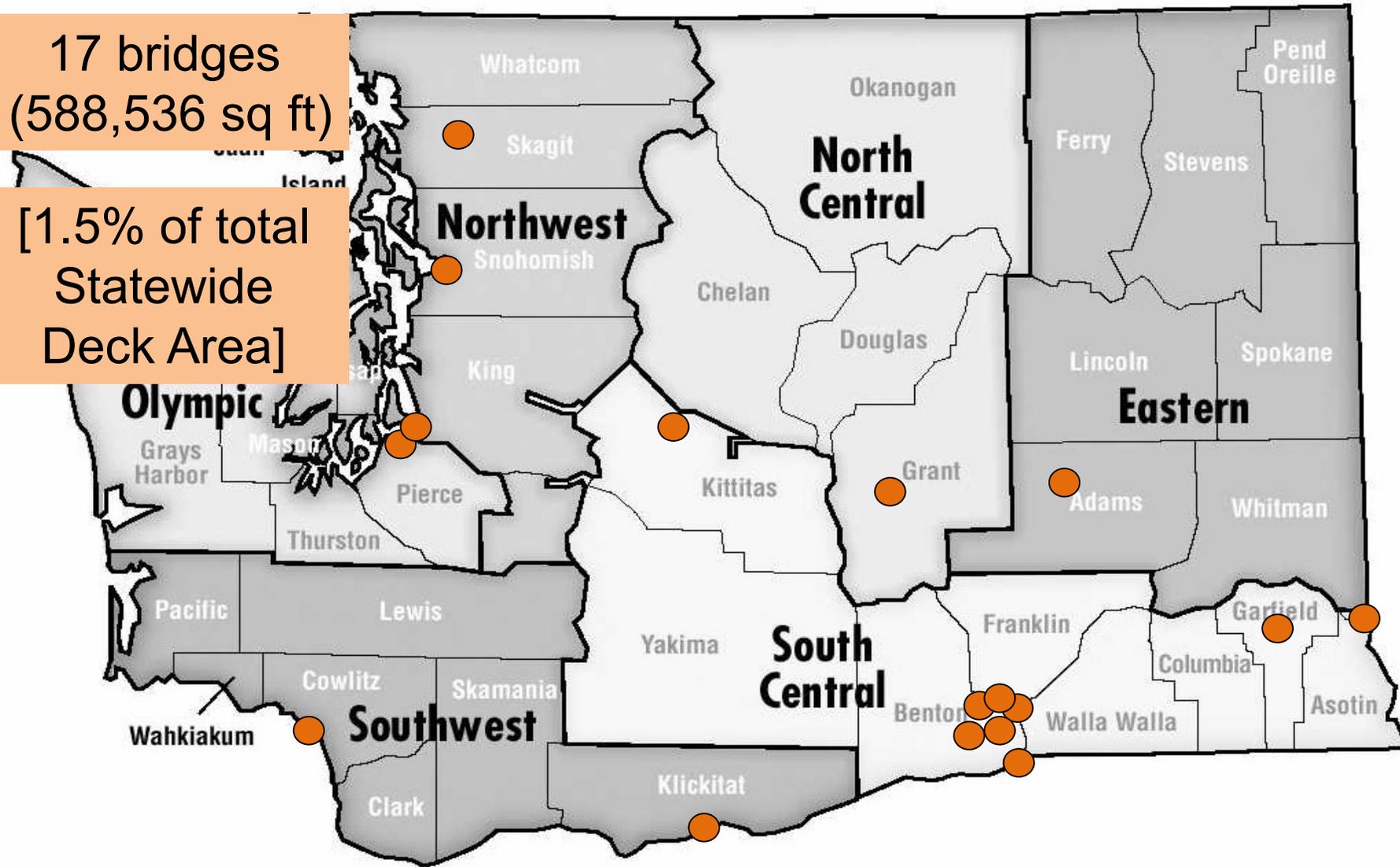
Agenda

- WSDOT Bridge Network
- Bridge Deck Inspection
- **Concrete Deck Replacements**
- Concrete Deck Rehabilitation
- Develop Criteria (Repl vs Rehab)
- Current Bridge Deck Conditions
- 10 year Bridge Deck Needs
- Questions

Concrete Deck Replacements

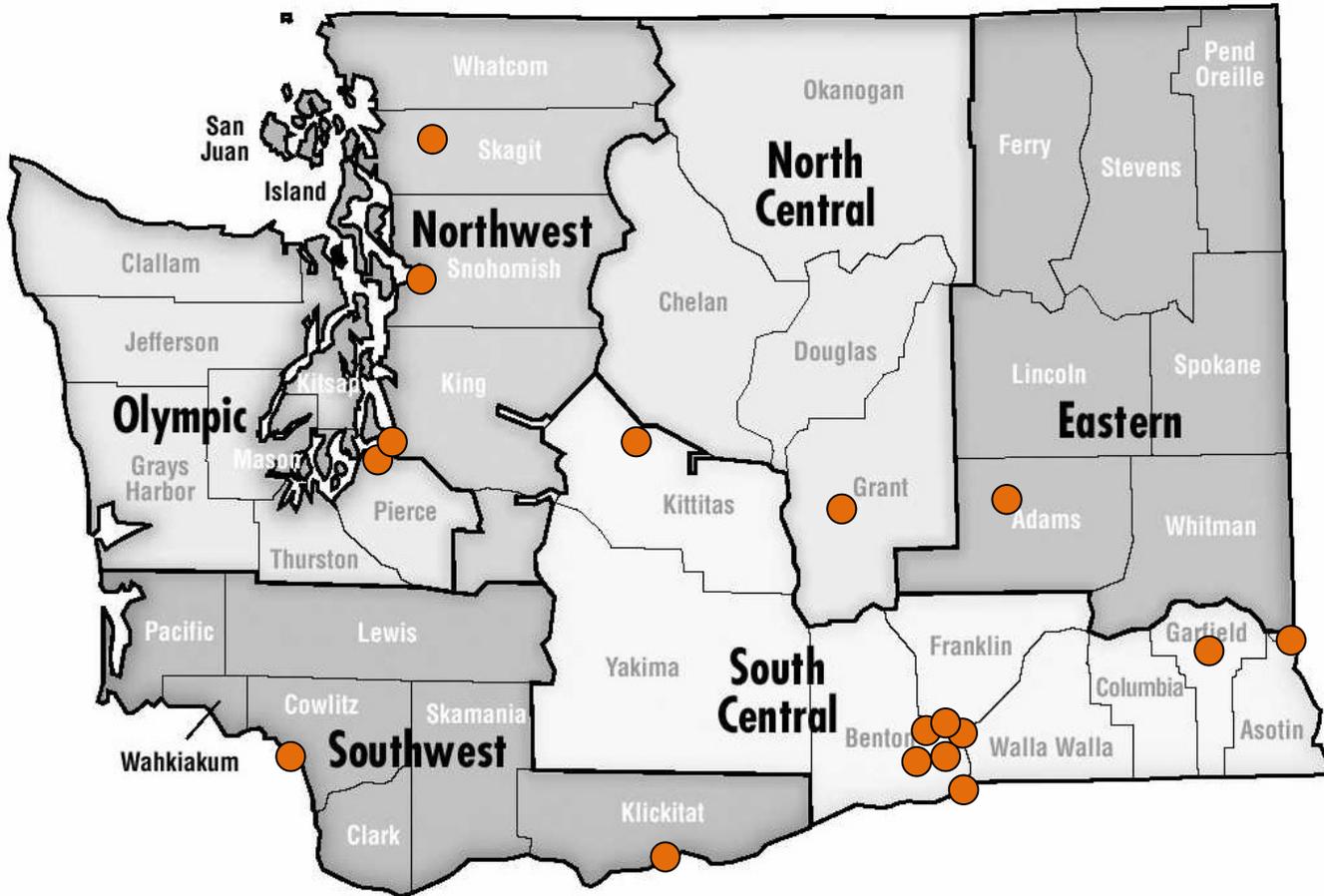
17 bridges
(588,536 sq ft)

[1.5% of total
Statewide
Deck Area]



Br Num	Yr	Length
395/40	1986	2,451
12/512N	1987	1,270
82/280S	1988	1,471
395/16	1988	72
240/32W	1989	244
281/1	1990	196
9/130	1991	344
529/10E	1994	1,544
397/10	1995	261
509/101	1995	562
509/103	1995	264
433/1	2004	5,478
97/1	2009	2,567
10/143	2012	430
5/670W	2014	859
26/119	2018	154
82/280S	2019	1,920

Concrete Deck Replacements

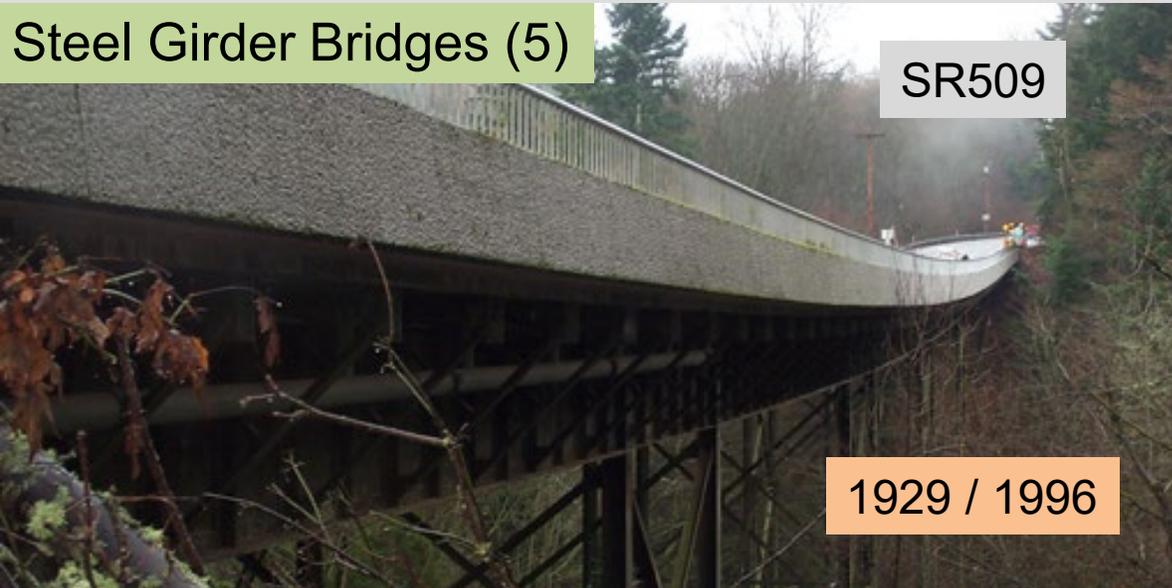


Common Details

- Non-Integral (17)
- Thin decks 5-3/4" (6)
- Lightweight Concrete (3)
- EA Wa (12) / Western Wa (5)
- Average Age 49 years
- Age Range (26 – 81 years)

Concrete Deck Replacements – Non Integral

Steel Girder Bridges (5)



Concrete Deck Replacements – Non Integral

Steel Truss Bridges (6)

I-5



1933 / 2014

02/10/2014 08:41

US395



1954 / 1986



1929 / 2003

SR433

US12



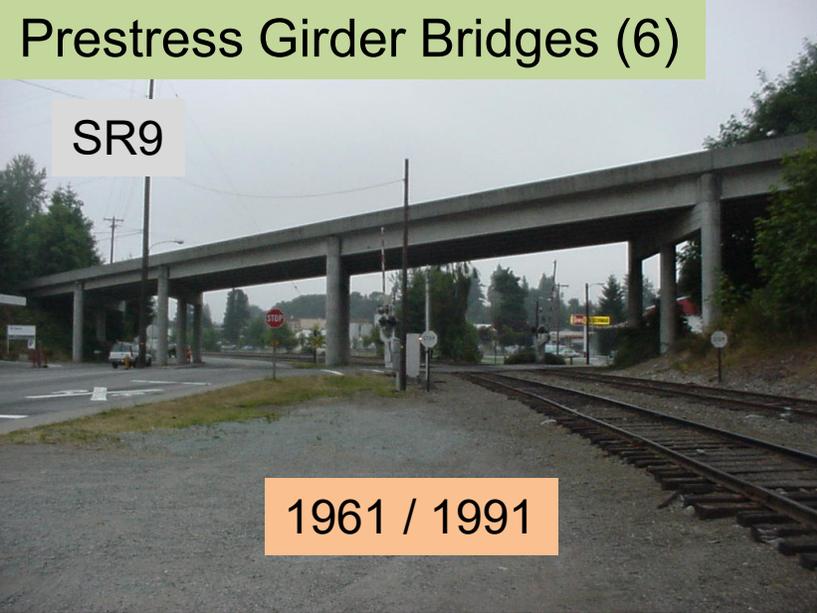
1950 / 1988

Concrete Deck Replacements – Non Integral

Prestress Girder Bridges (6)

SR9

1961 / 1991



US12

1964 / 1997



SR240

1960 / 1989



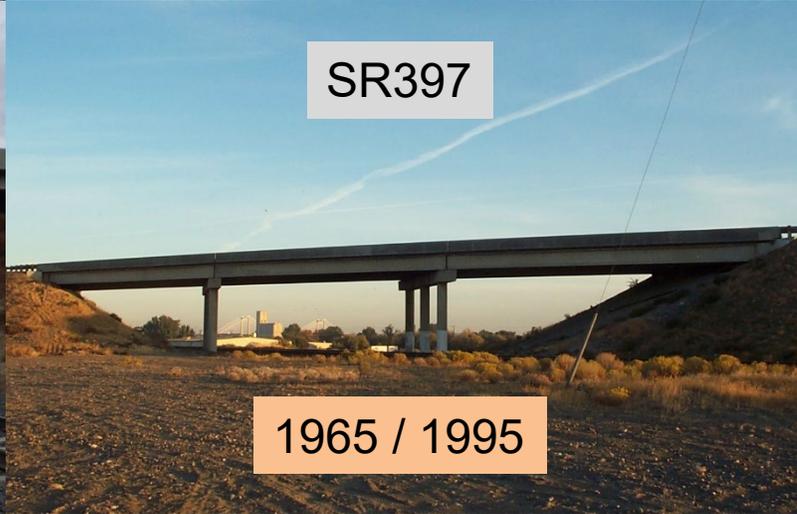
SR26

1959 / 2018



SR397

1965 / 1995



SR281

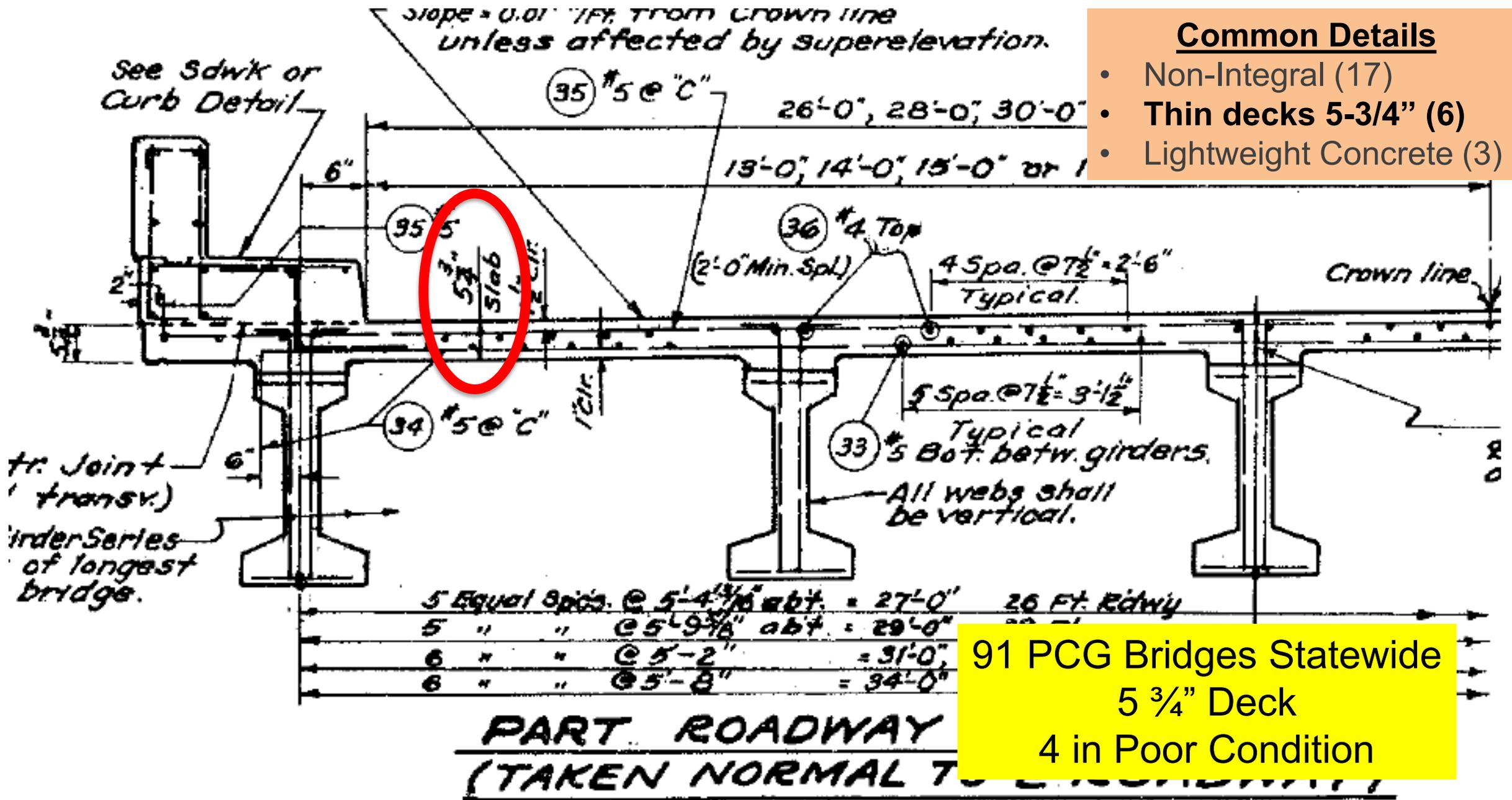
1964 / 1990



Deck Thickness 5 3/4"

Common Details

- Non-Integral (17)
- Thin decks 5-3/4" (6)
- Lightweight Concrete (3)



91 PCG Bridges Statewide
5 3/4" Deck
4 in Poor Condition

Concrete Deck Replacements – Lightweight Conc

7 Bridges Statewide
With Lightweight Conc
2 in Poor Condition

- Common Details**
- Non-Integral (17)
 - Thin decks 5-3/4" (6)
 - **Lightweight Concrete (3)**

SR 433 Lewis and Clark
1929 / 2003 (74ys)

US97 Biggs Rapids
1962 / 2009 (47 yrs)

I-82 Umatilla
1955 / 2019 (64 yrs)

Concrete Deck Replacements – Lightweight Conc

*I-82 Col R Umatilla
Located near Umatilla Or*

*Bridge Built – 1955
Approaches Rebuilt- 1990*

*Bridge Length – 3,403 feet
Truss spans – 1,920 feet*

ADT – 8,947

*Deck on Main Truss
Rehabilitated in 1990
with modified concrete overlay*

**Patches and Spalls
3,884 SF (7.4%)**

BMS Elements						
Element	Element Description	Total	Units	State 1	State 2	State 3
20	Concrete Deck - Lightweight Aggregate	52,800	SF	48,916	3,020	864
26	Concrete Deck w/Coated Bars	40,600	SF	40,600	0	0
35	Concrete Deck Soffit	93,400	SF	92,561	282	557

Concrete Deck Replacements – Lightweight Conc

*I-82 Col R Umatilla
Located near Umatilla Or*

*Deck Replacement Contract
Awarded to Max J Kuney in
2018 (\$9.5 M)*

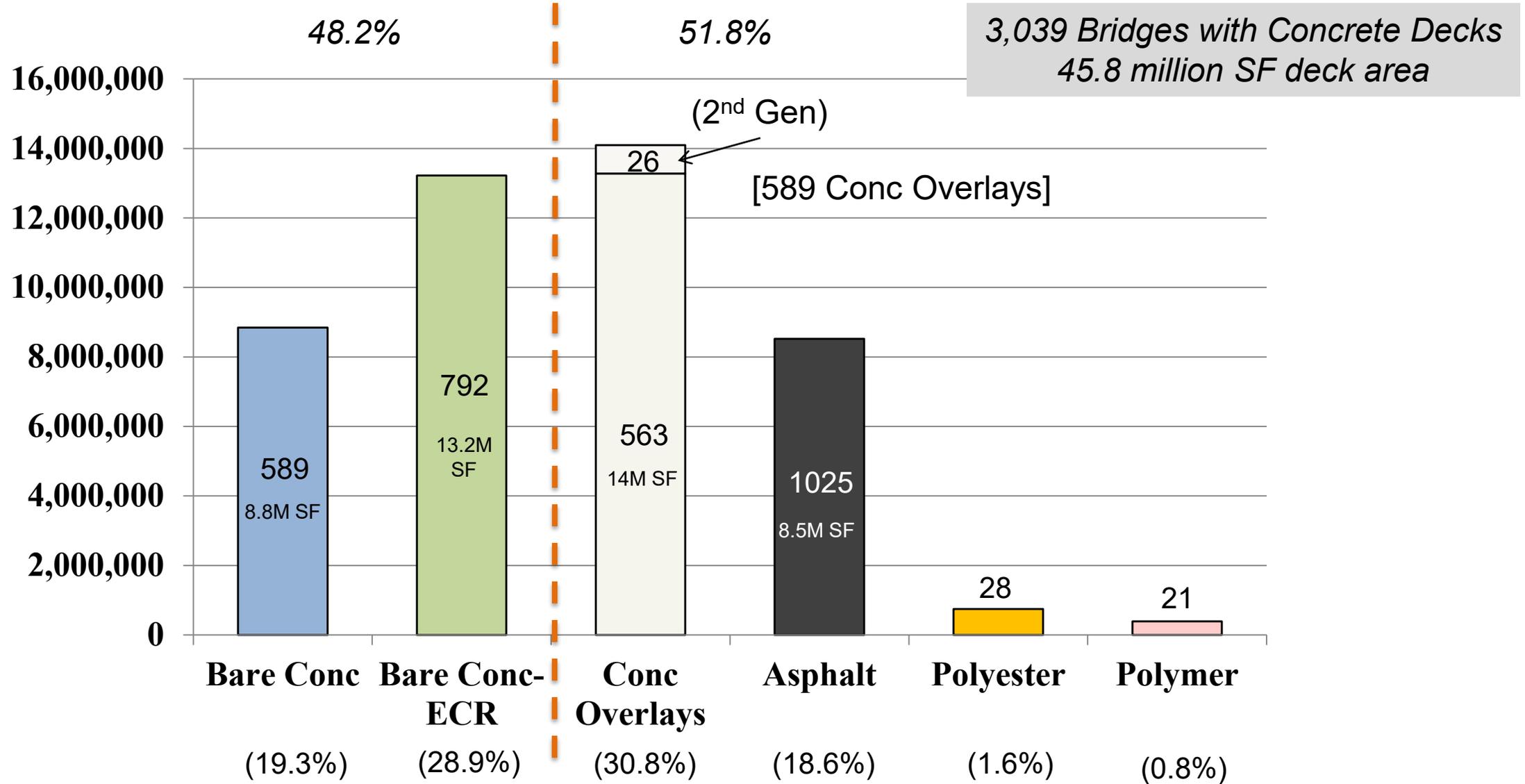
01/09/2015 13:09



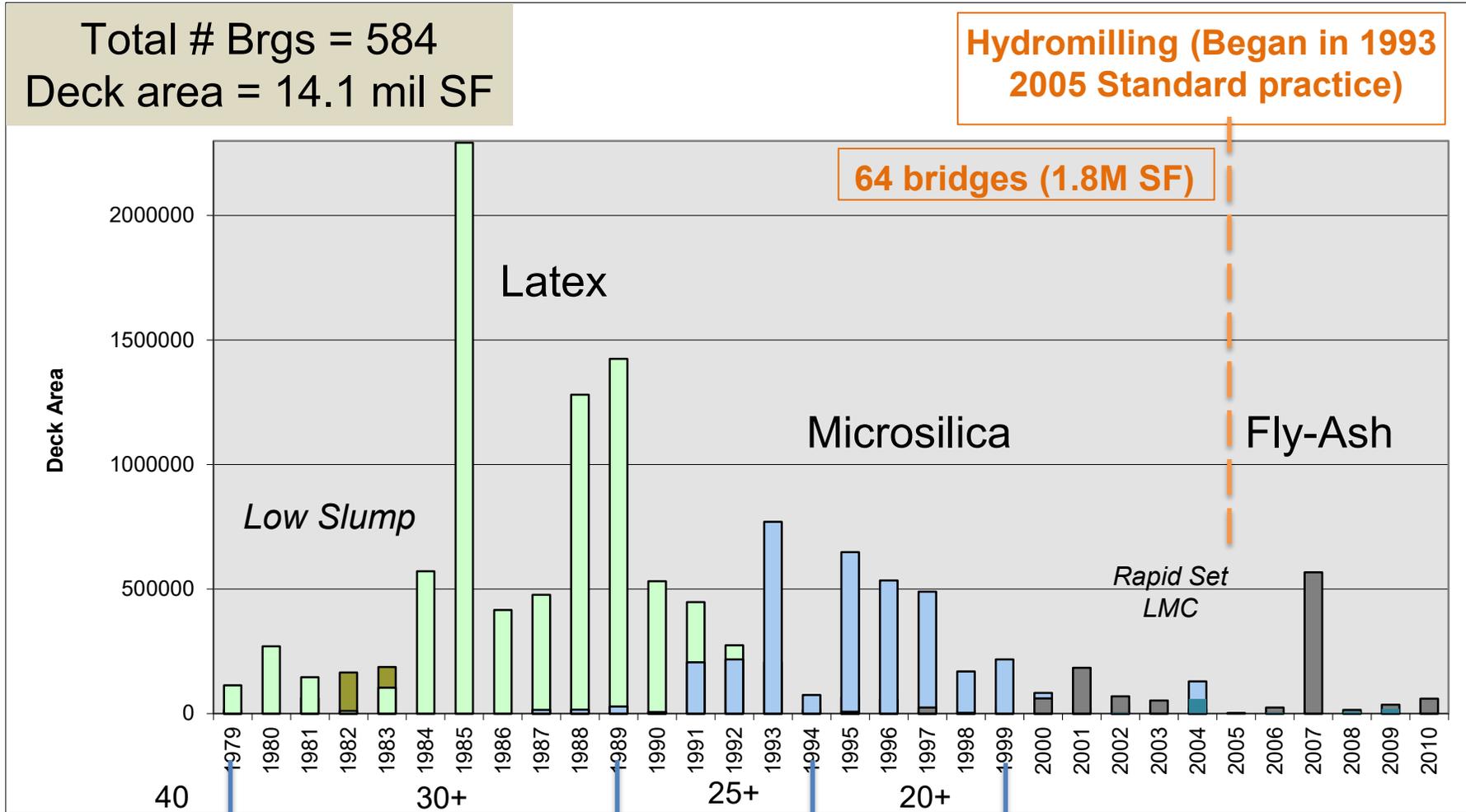
Agenda

- WSDOT Bridge Network
- Bridge Deck Inspection
- Concrete Deck Replacements
- **Concrete Deck Rehabilitation**
- Develop Criteria (Repl vs Rehab)
- Current Bridge Deck Conditions
- 10 year Bridge Deck Needs
- Questions

Concrete Deck Rehabilitation



Concrete Deck Rehabilitation



1st Mod Conc Overlay

Low Slump Discontinued

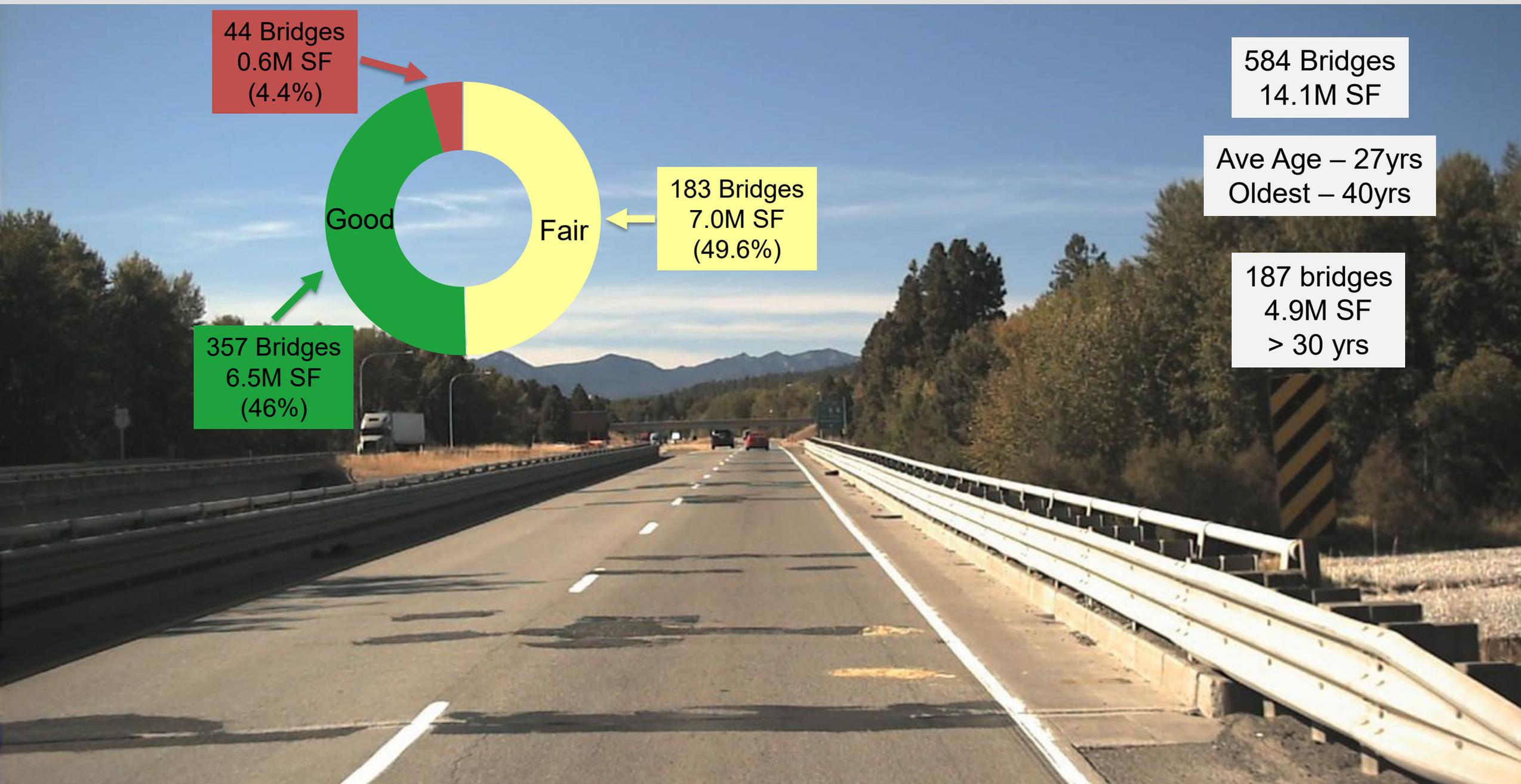
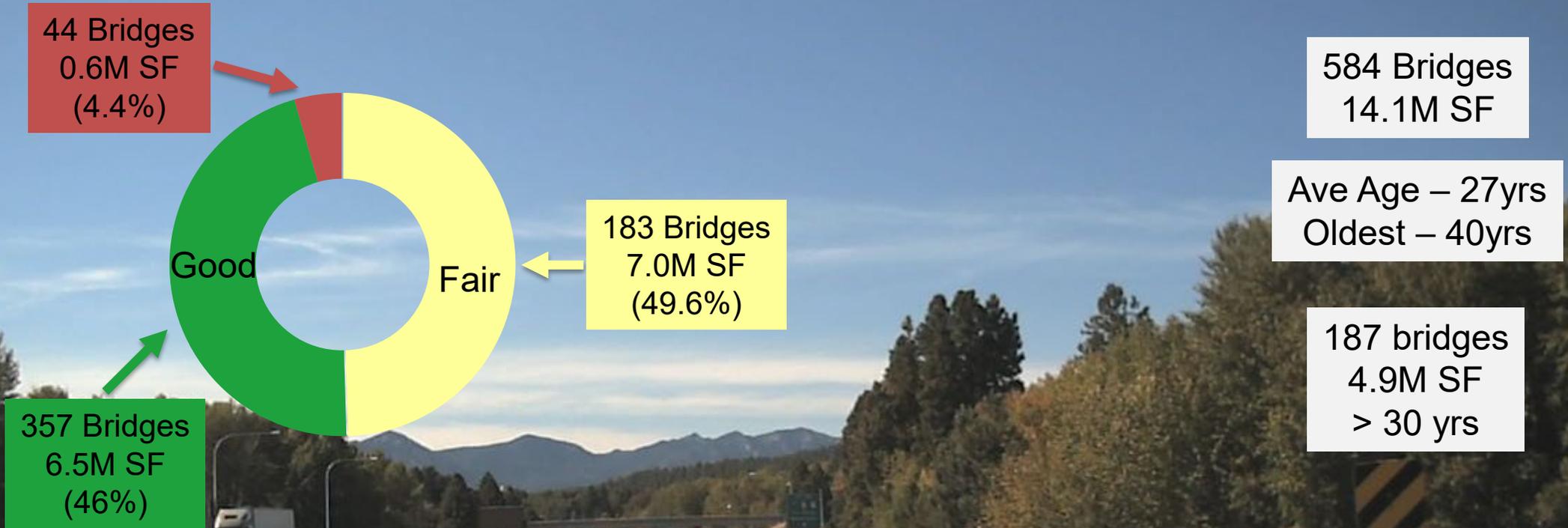
1st Microsilica Conc Overlay

1st Fly-Ash Conc Overlay

Rapid Set Discontinued

1st Perf Mix Design Conc Overlay

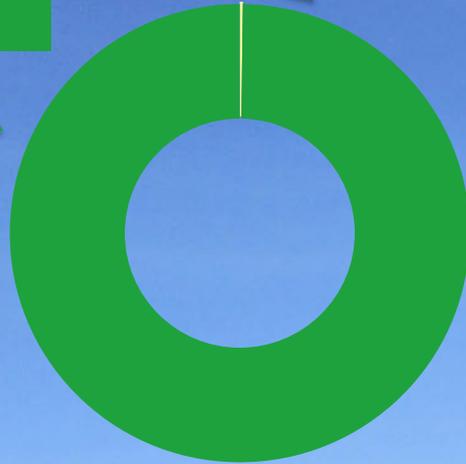
Concrete Deck Rehabilitation



Concrete Deck Rehabilitation

64 Bridges
1.9M SF
"Good"

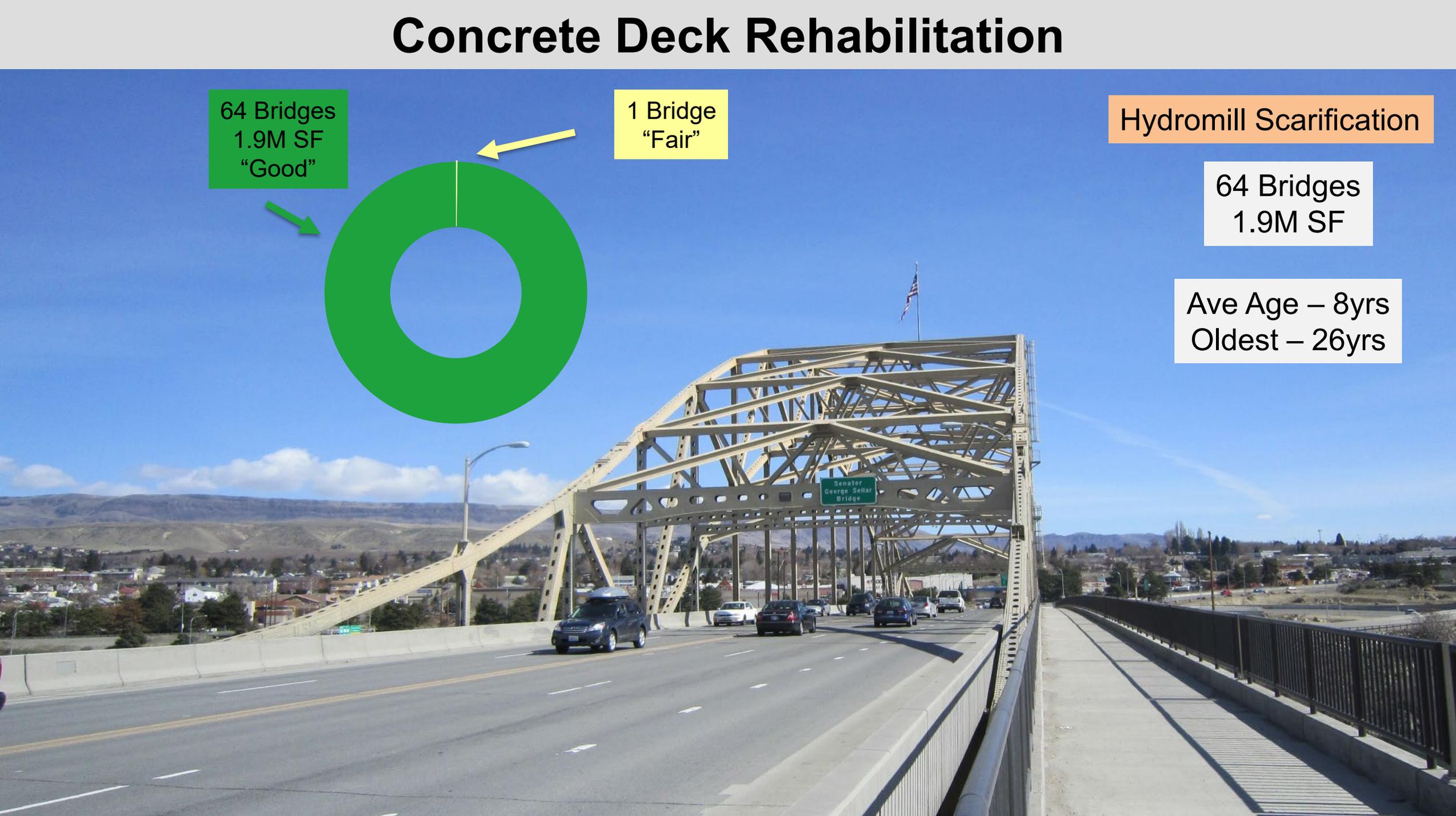
1 Bridge
"Fair"



Hydromill Scarification

64 Bridges
1.9M SF

Ave Age – 8yrs
Oldest – 26yrs



Concrete Deck Rehabilitation

Cantilever Steel Truss
Standard rebar in Deck
Year Built – 1941 (78yrs)
LMC Overlay – 2012 (8yrs)
Deck – 6.5"

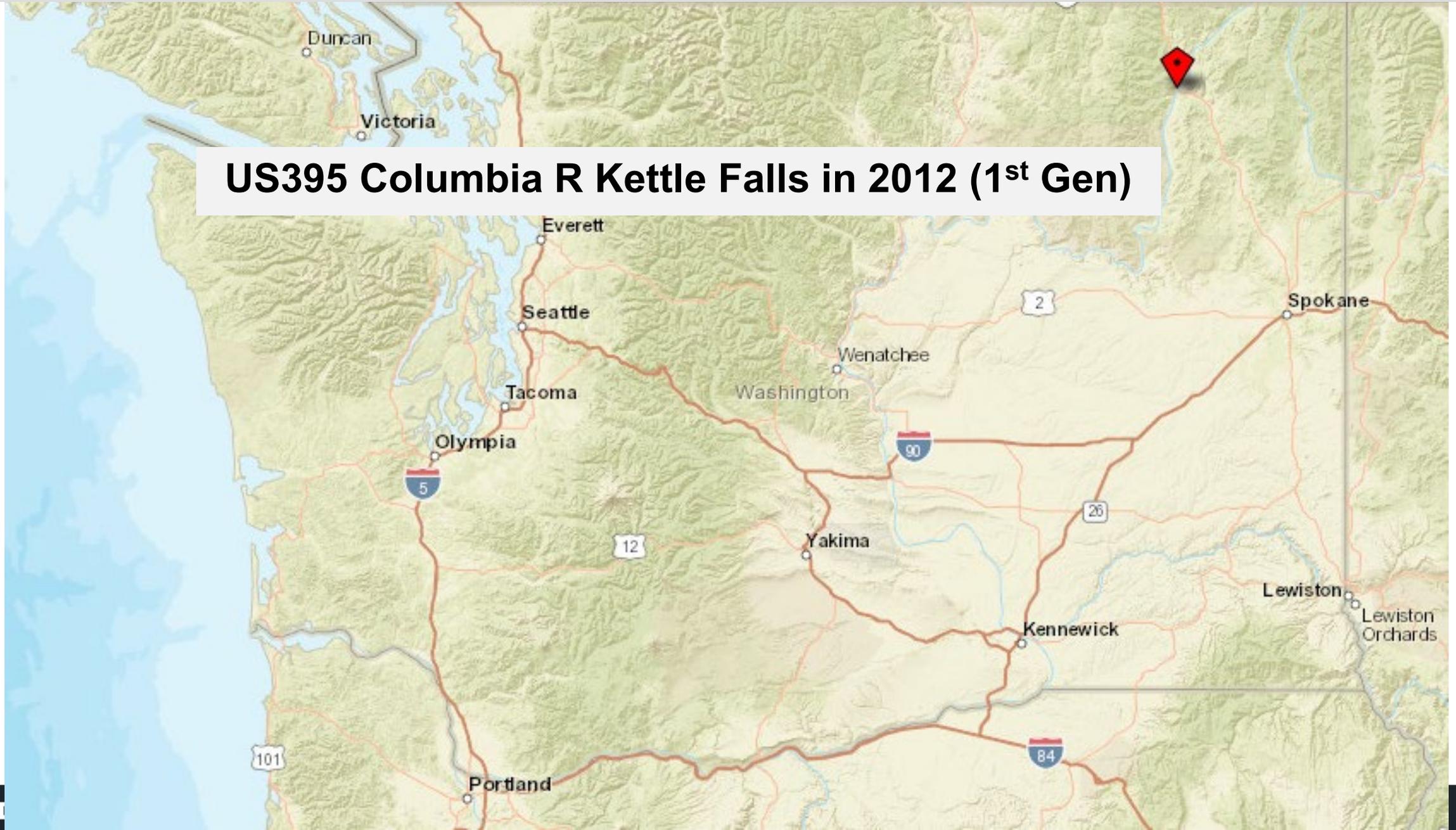
ADT = 4,269 (2012)
Trucks = 683 (16%)

Length – 1,267 feet
Width – 24 feet
Max Span 600 ft
Repl Value - \$40M

US395 Columbia R Kettle Falls in 2012 (1st Gen)

Concrete Deck Rehabilitation

US395 Columbia R Kettle Falls in 2012 (1st Gen)



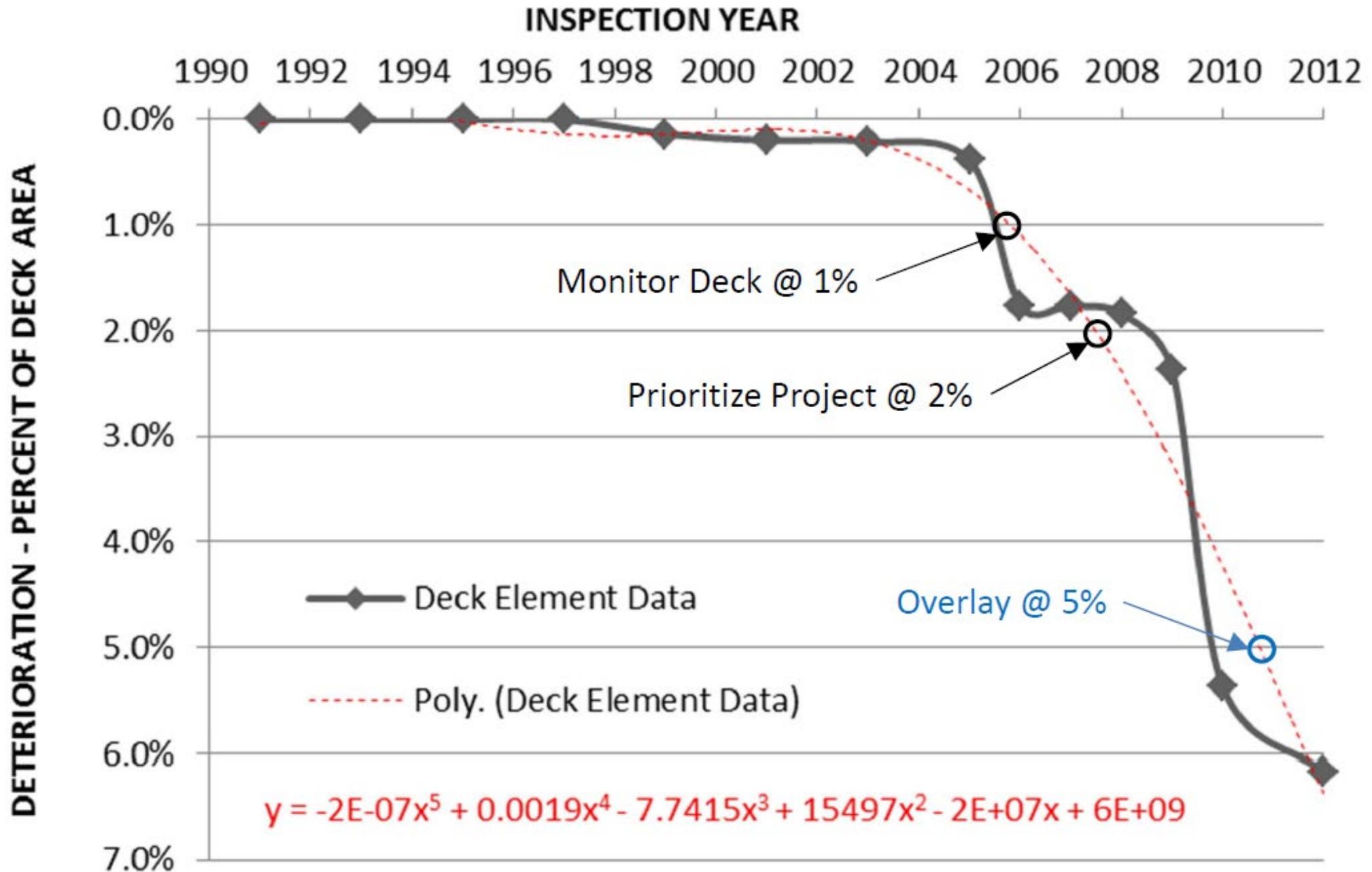
Concrete Deck Rehabilitation



24ft Roadway

6.5" Deck

Concrete Deck Rehabilitation



Concrete Deck Rehabilitation

2002

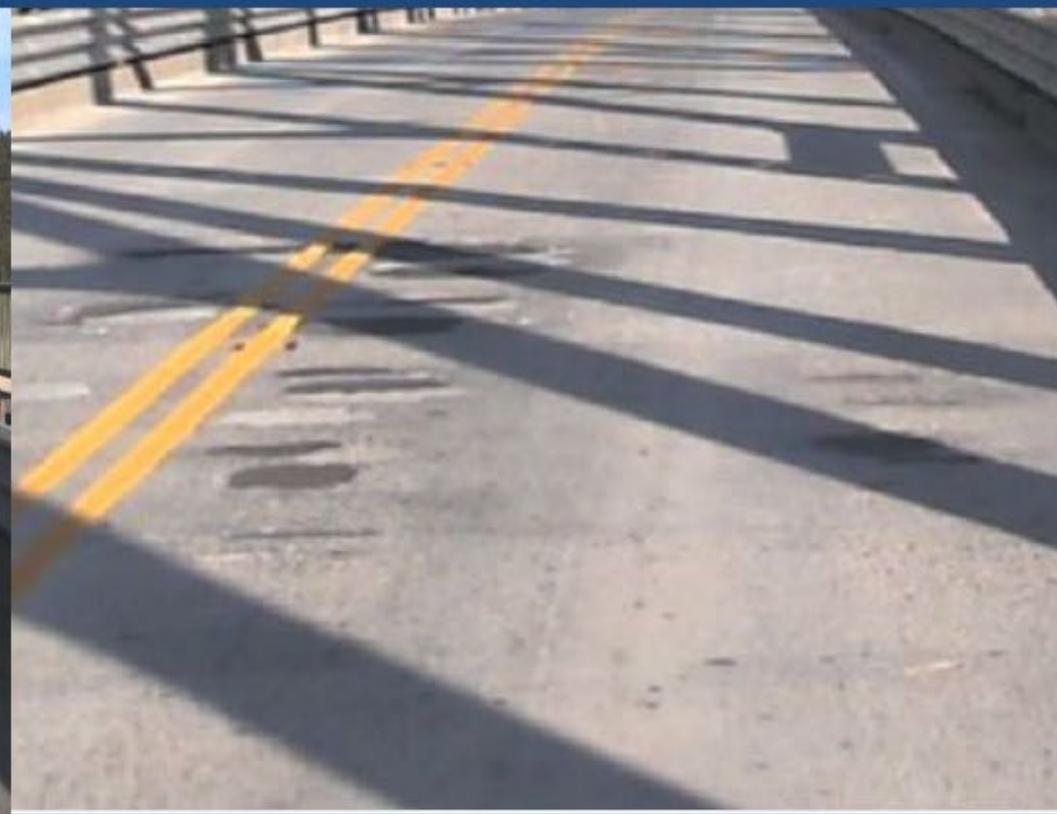
- Two truss panels: 60 SF patching = 0.194%
- Not on the Radar
- Built 1941 Length = 1267 ft. Area = 30,408 SF



Concrete Deck Rehabilitation

2007

- Same two truss panels: (2002 @ 60 SF)
- 2007: Five Panels & other patching, 536 SF = 1.8%
- On the Radar – Prioritized in 2008



Concrete Deck Rehabilitation

2010

- 2010 Chain Drag Results = 5.4% Deterioration
 - Patch = 1159 SF, Spall = 156 SF, Delam = 324 SF
- New deteriorated truss panels
- Raised the priority in 2010



Concrete Deck Rehabilitation

- Deck Replacement or Overlay?

\$8M

\$1.8M



Concrete Deck Rehabilitation

2012



10/22/2012 10:06AM

Concrete Deck Rehabilitation

2012



Concrete Deck Rehabilitation

2018

Bridge Deck in Good Condition
(\$1.8M investment deferred \$8M deck replacement)



Agenda

- WSDOT Bridge Network
- Bridge Deck Inspection
- Concrete Deck Replacements
- Concrete Deck Rehabilitation
- **Develop Criteria (Repl vs Rehab)**
- Current Bridge Deck Conditions
- 10 year Bridge Deck Needs
- Questions

Develop Criteria (Deck Repl vs Rehab)



Rehab

- ✓ Thin Deck < 5% Patching / 1st Gen / Good Soffit
- ✓ Normal Deck / Good Soffit
- ✓ Integral Deck



Replace

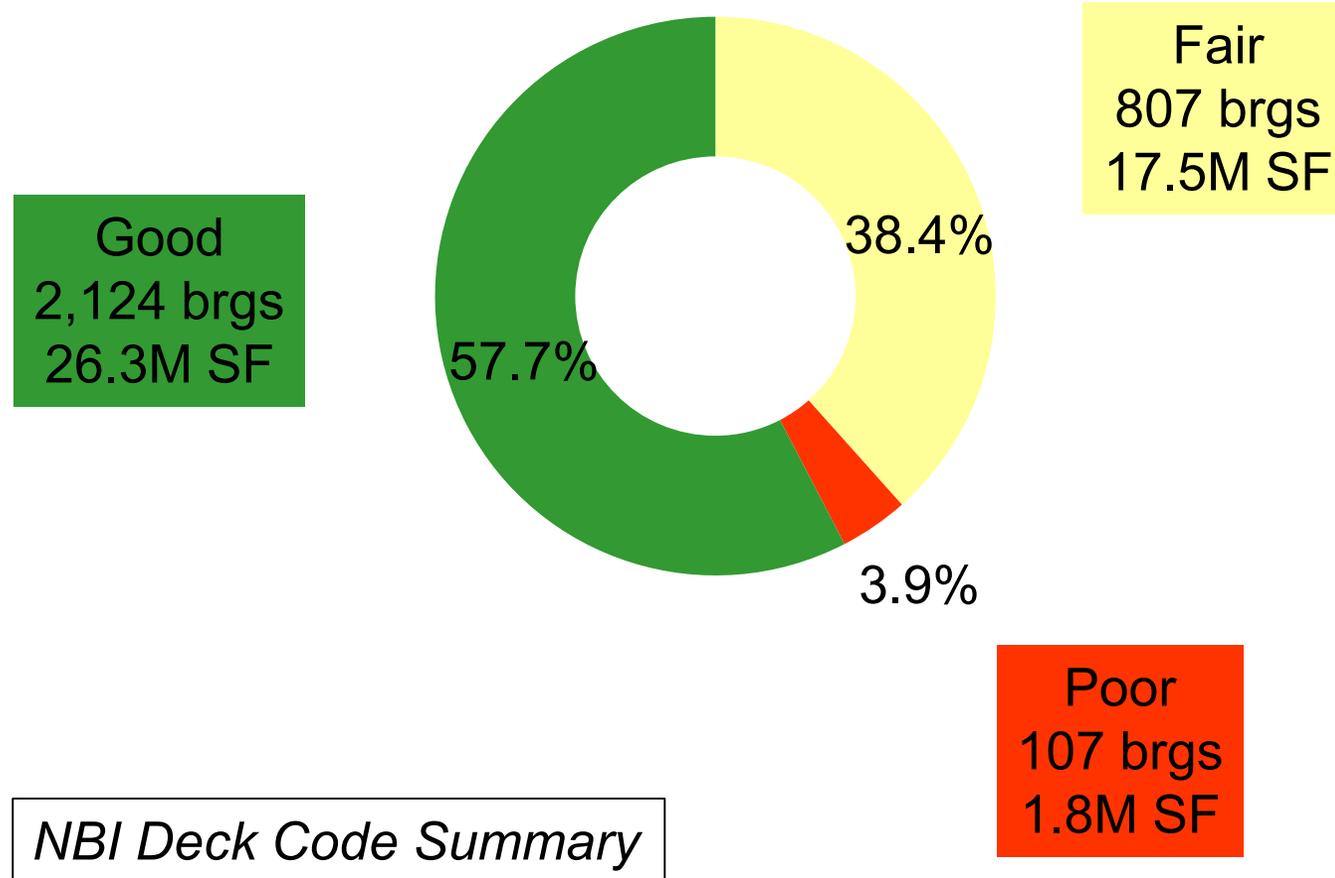
- ✓ Thin Deck > 5% Patching / 1st Gen
- ✓ Thin Deck > 2% Patching / 2nd Gen
- ✓ Normal Deck > 5% Patching / Bad Soffit
- ✓ Lightweight Deck > 2% Patching

Agenda

- WSDOT Bridge Network
- Bridge Deck Inspection
- Concrete Deck Replacements
- Concrete Deck Rehabilitation
- Develop Criteria (Repl vs Rehab)
- **Current Bridge Deck Conditions**
- 10 year Bridge Deck Needs
- Questions

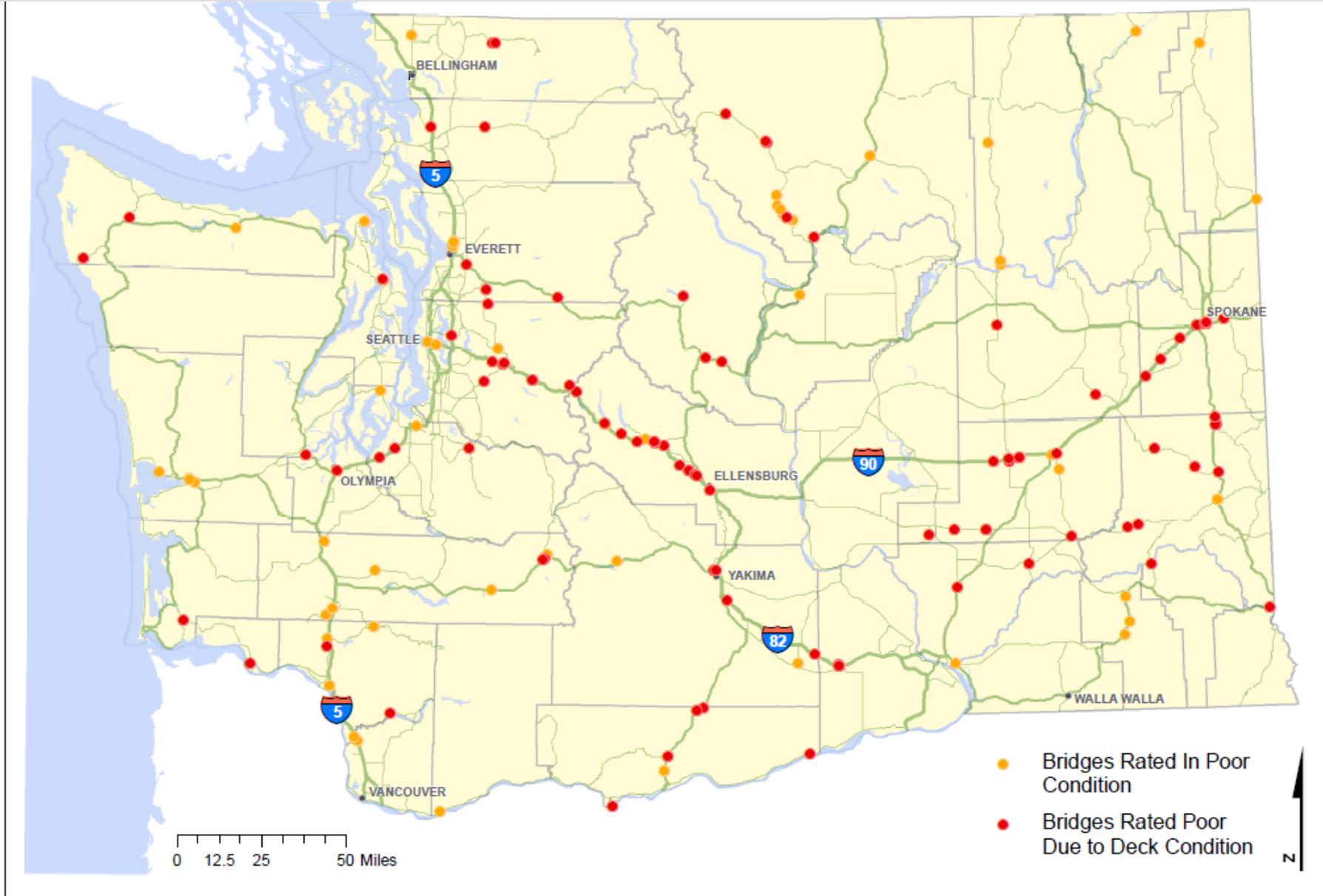
Current Bridge Deck Conditions

3,038 WSDOT Bridges with Conc Deck



Current Bridge Deck Conditions

Poor
107 brgs
1.8M SF

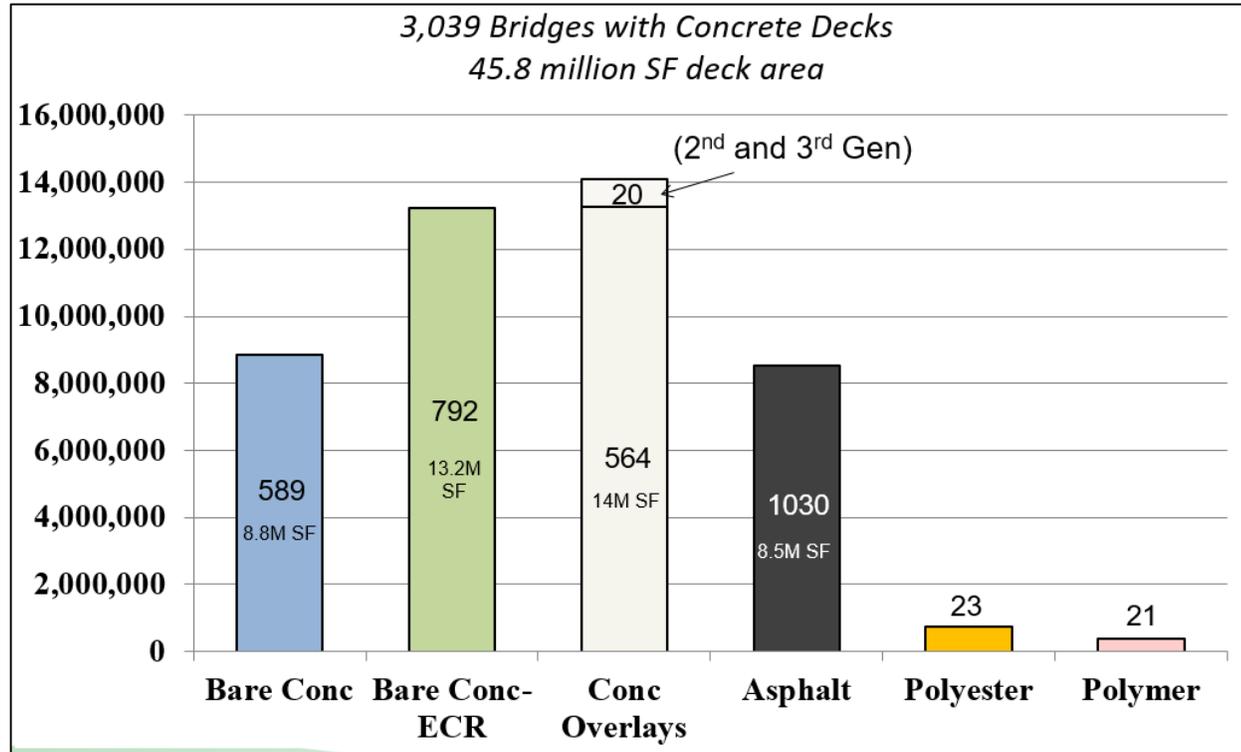


- Bridges Rated In Poor Condition
- Bridges Rated Poor Due to Deck Condition

Agenda

- WSDOT Bridge Network
- Bridge Deck Inspection
- Concrete Deck Replacements
- Concrete Deck Rehabilitation
- Develop Criteria (Repl vs Rehab)
- Current Bridge Deck Conditions
- **10 year Bridge Deck Needs**
- Questions

10 year Bridge Deck Needs



ECR -	\$1/SF
ACP w/membr -	\$20/SF
Rehab/Conc Overlay -	\$80/SF
Replace Deck -	\$300/SF
Replace Bridge -	\$800/SF

10 year Bridge Deck Needs

In next decade, 616 WSDOT bridges will need repairs to concrete decks

As of June 2018; Dollars in millions

Bridge deck status	Number of bridges	Square footage ¹	Cost to repair
Contract work in progress	18	323,500	\$31.6
Past due for repair ²	20	141,800	\$13.1
Due for repair ³	50	1,565,100	\$99.4
To be due in next 10 years	528	11,974,000	\$902.4
Total 10-year needs	616	14,004,400	\$1,046.5

Data source: WSDOT Bridge and Structures Office.

Notes: **1** Square footage is rounded to the nearest hundred. **2** Bridges with more than 5% of deck area patched or spalled are classified as "past due." **3** Bridges with 2% to 5% of deck area patched or spalled are classified as "due."

Needed funding – \$100M per year

10 year budget – \$15M per year

Gap – \$85M per year

10 year Bridge Deck Needs

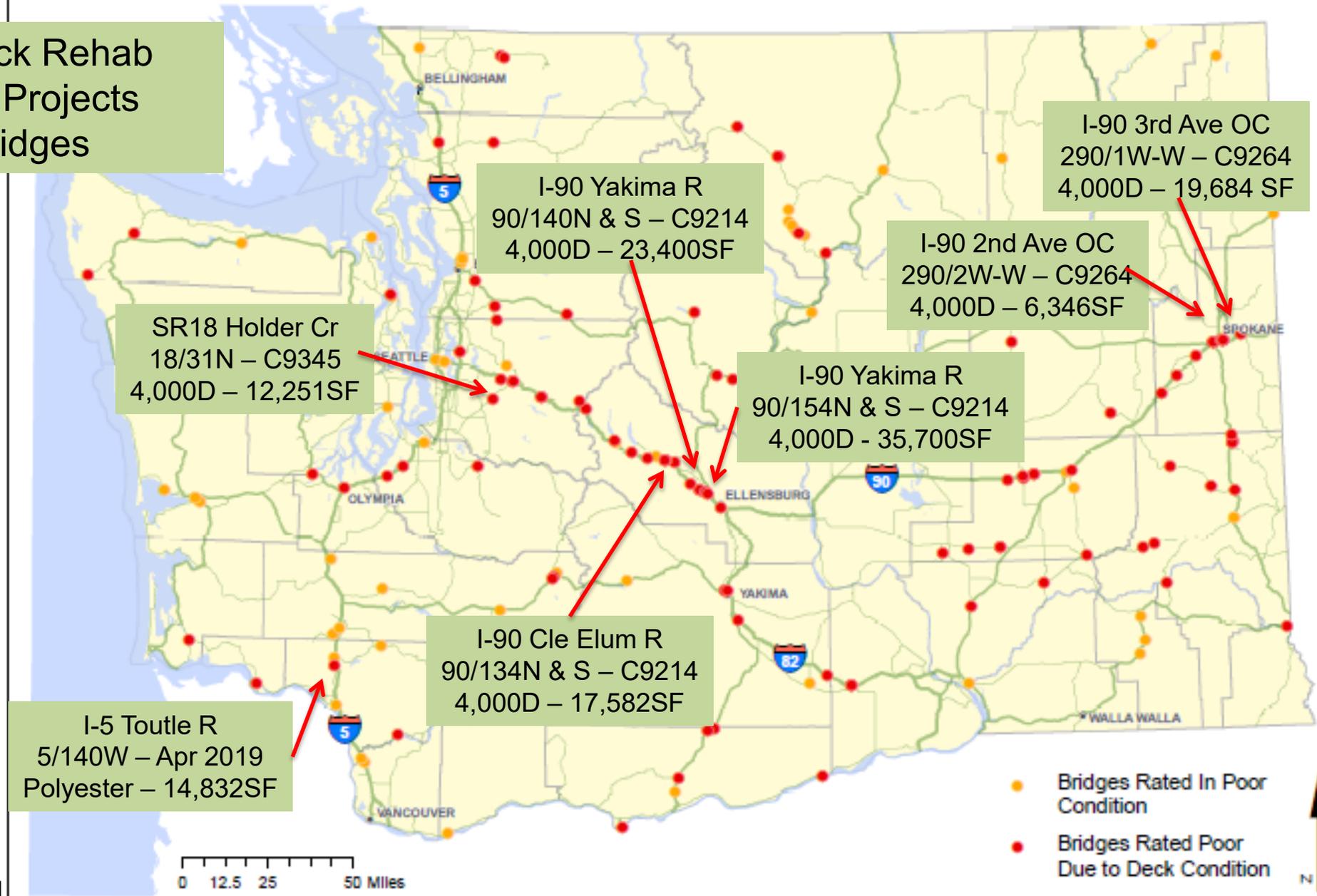
Reinforced Conc Box Girder Bridges

421 CBOX Brgs Statewide
10.2 million SF

140 on the 10 year needs list
\$340M Deck Rehab

WSDOT Concrete Deck Rehab – 2019

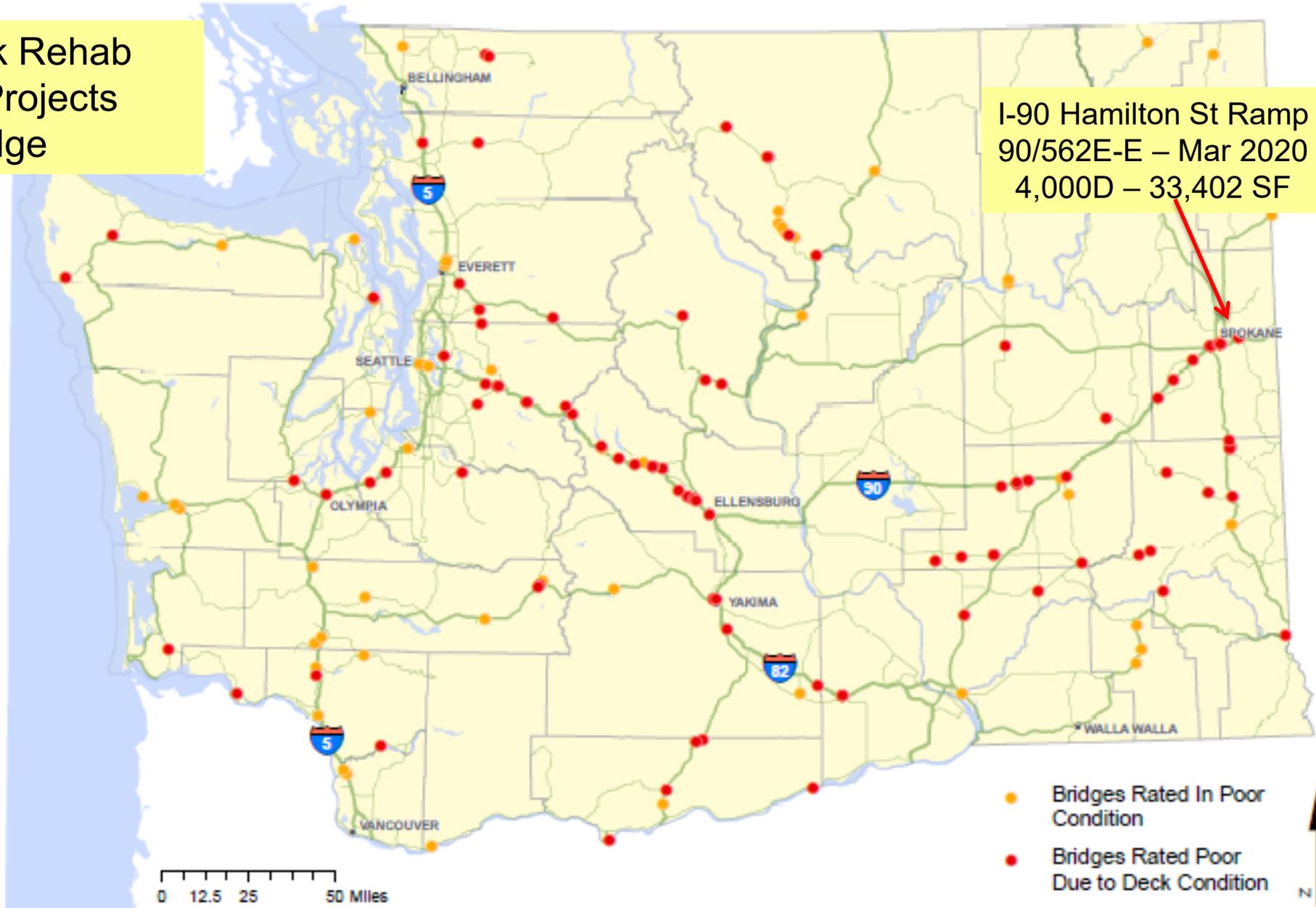
2019 Deck Rehab
Funded Projects
10 bridges



WSDOT Concrete Deck Rehab – 2020

2020 Deck Rehab
Funded Projects
1 bridge

I-90 Hamilton St Ramp
90/562E-E – Mar 2020
4,000D – 33,402 SF





Questions?