

Bridge Deck Preservation Program



**Washington State
Department of Transportation**



Washington State's Concrete Bridge Deck Program



Our Mission:

**Preserve WSDOT's reinforced concrete bridge decks,
with cost effective repairs and protective overlays.**





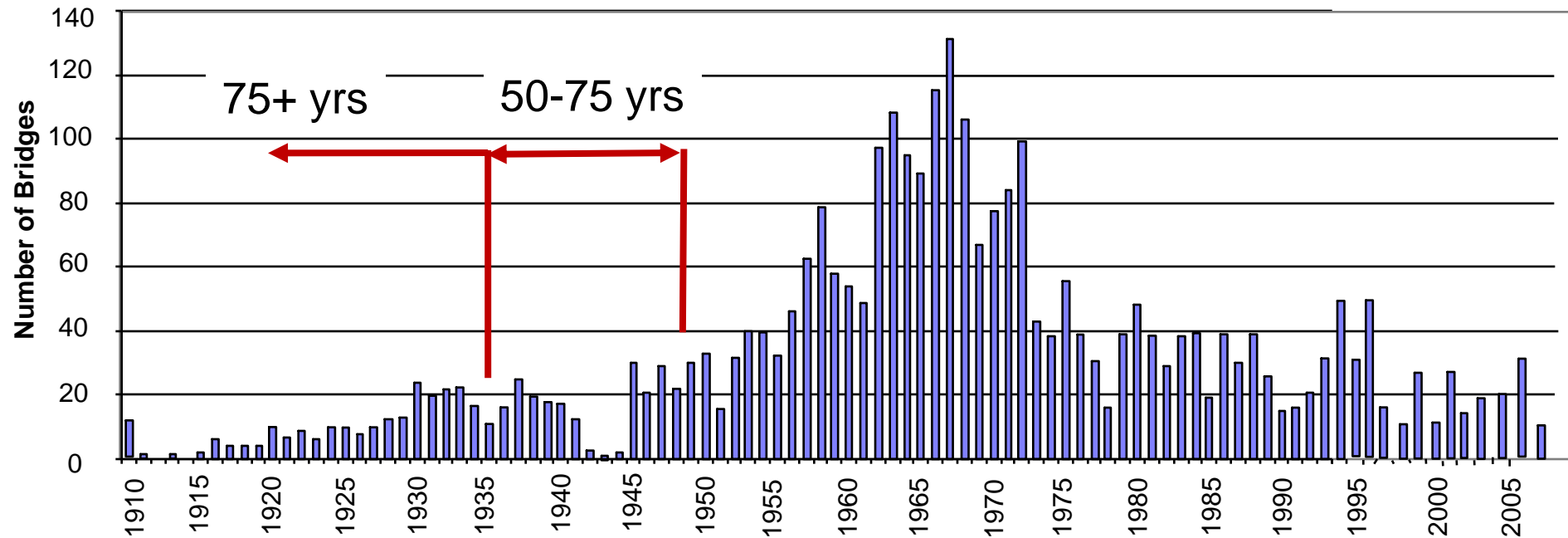
Washington State Department of Transportation



WSDOT Bridges Built-per-Year

3,039 Bridges (45 million sq ft)

Average Age = 43 yrs

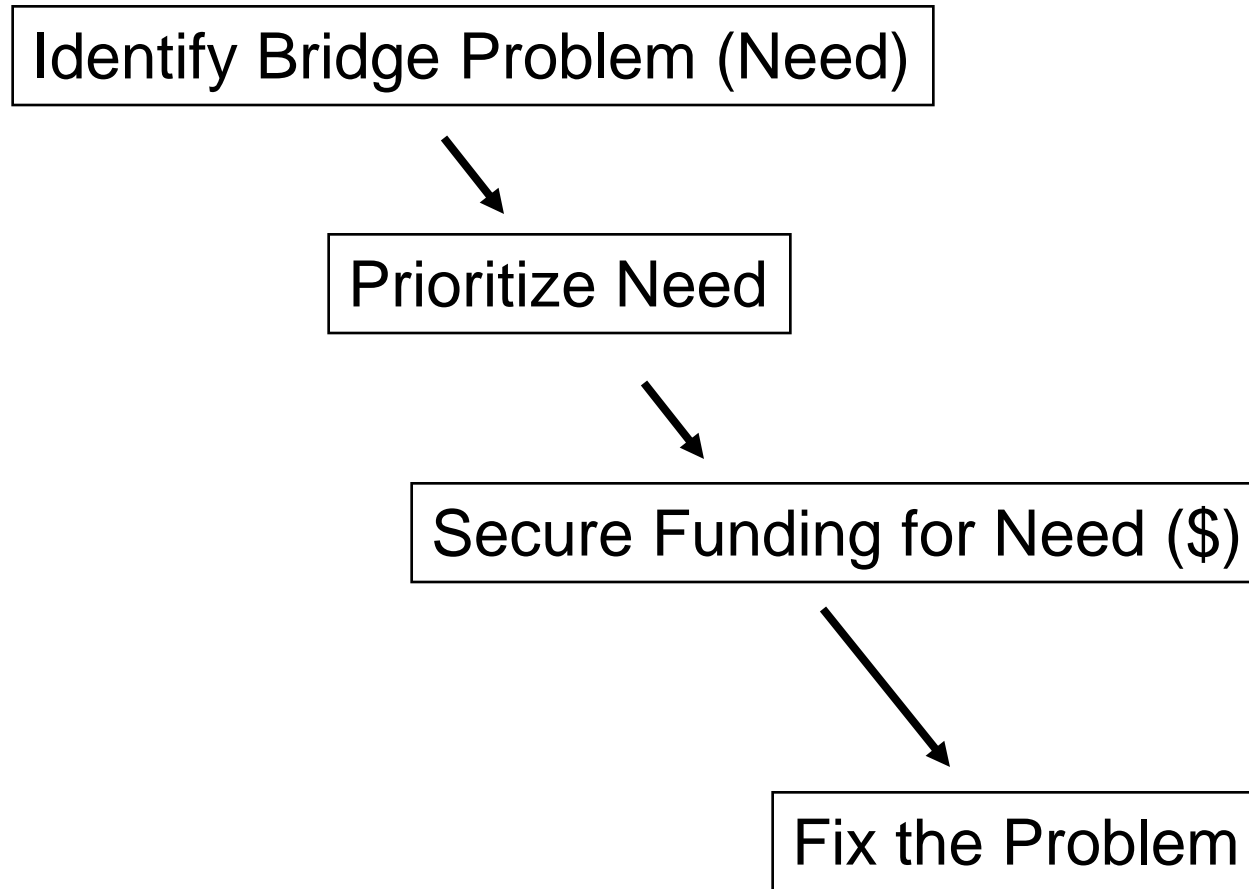


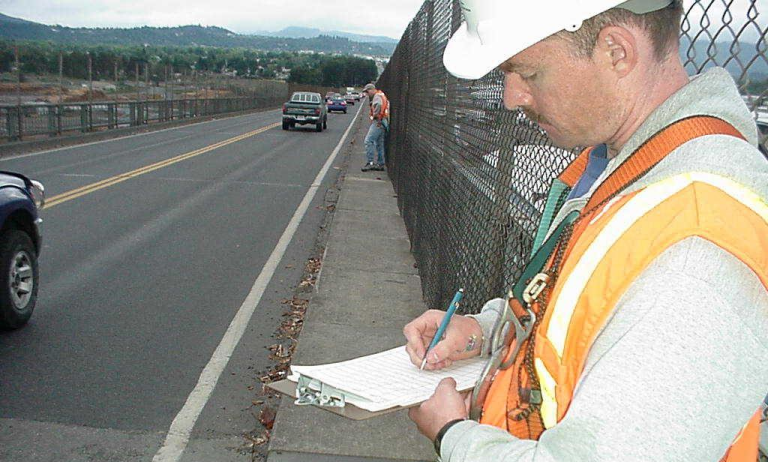
1937 or older – 232 bridges (1.6 million sq ft)

1936 to 1951 – 672 bridges (7.7 million sq ft)

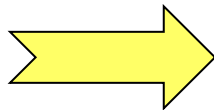
Replacement value – approx \$45 billion

How does WSDOT manage its Bridge Assets?

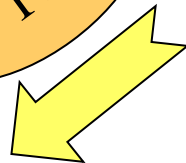




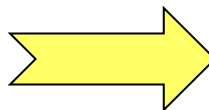
Inspect / Rate
Deck Condition



4 - 10 yrs



Identify/Prioritize Bridges Requiring
Deck Repair (> 2% CS2)

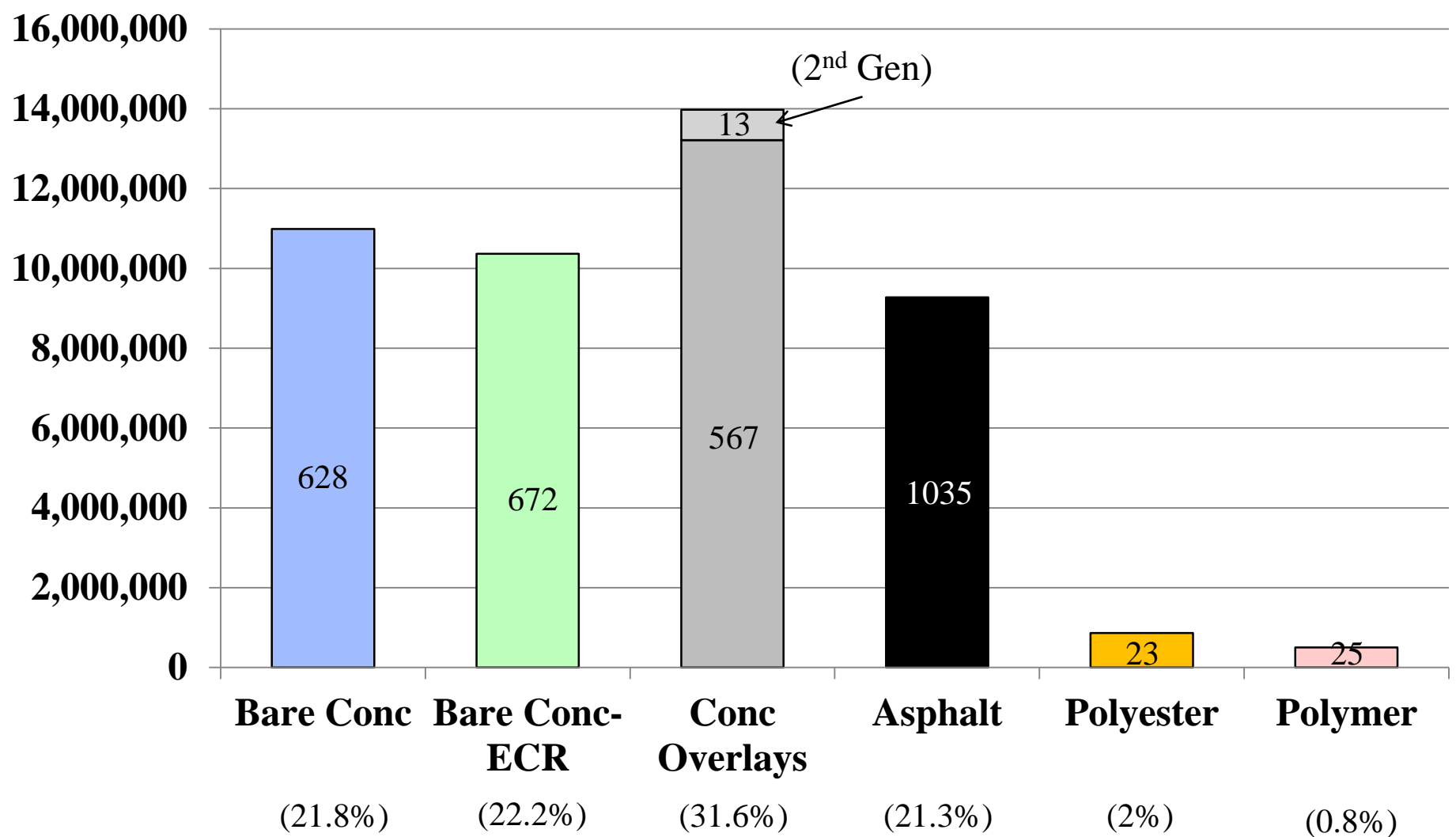


25-30 yrs

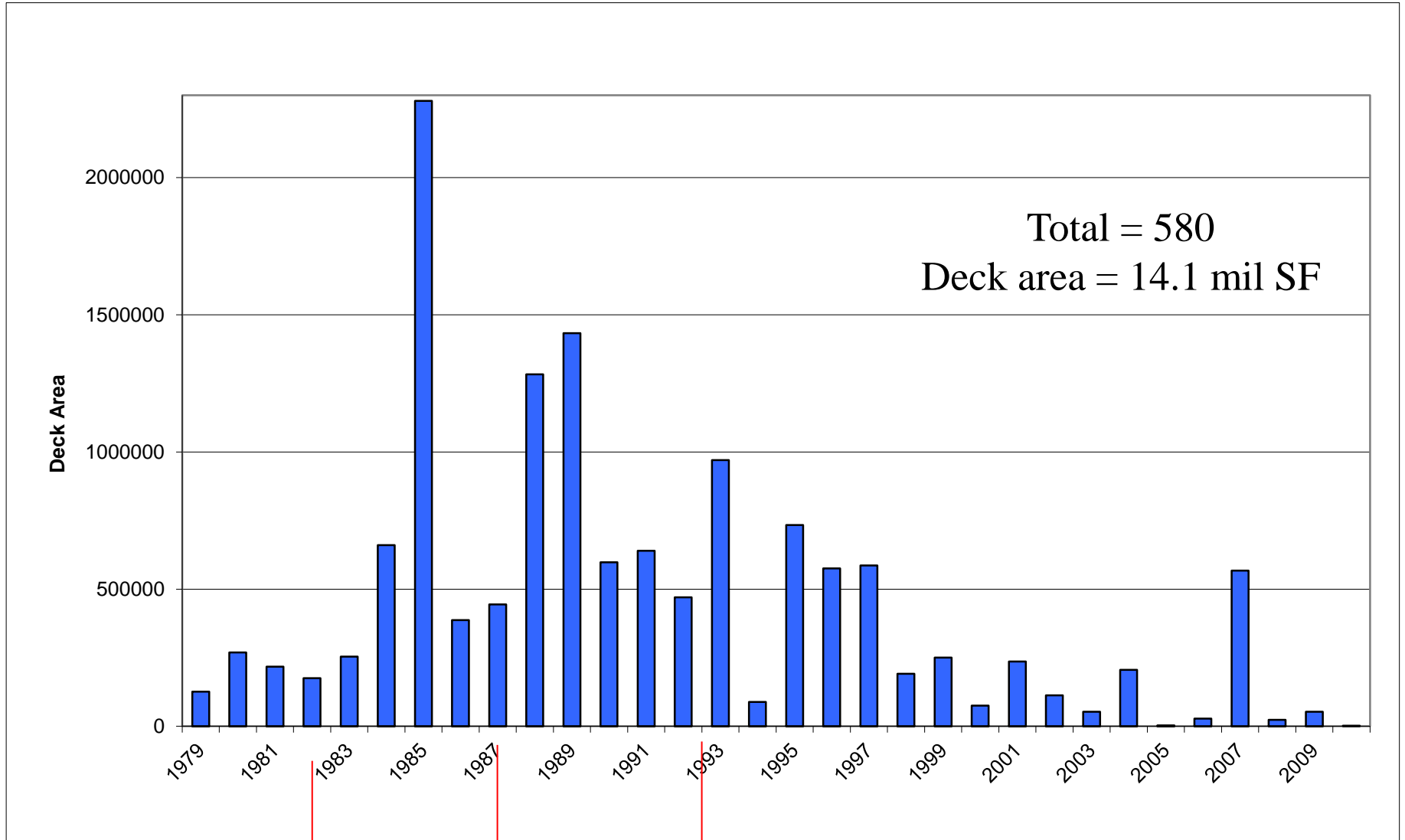


Washington State's Concrete Bridge Deck Program

(2,962 Bridges with Concrete Decks)



WSDOT Bridges with a Modified Concrete Overlay



30+ yrs

25–30 yrs

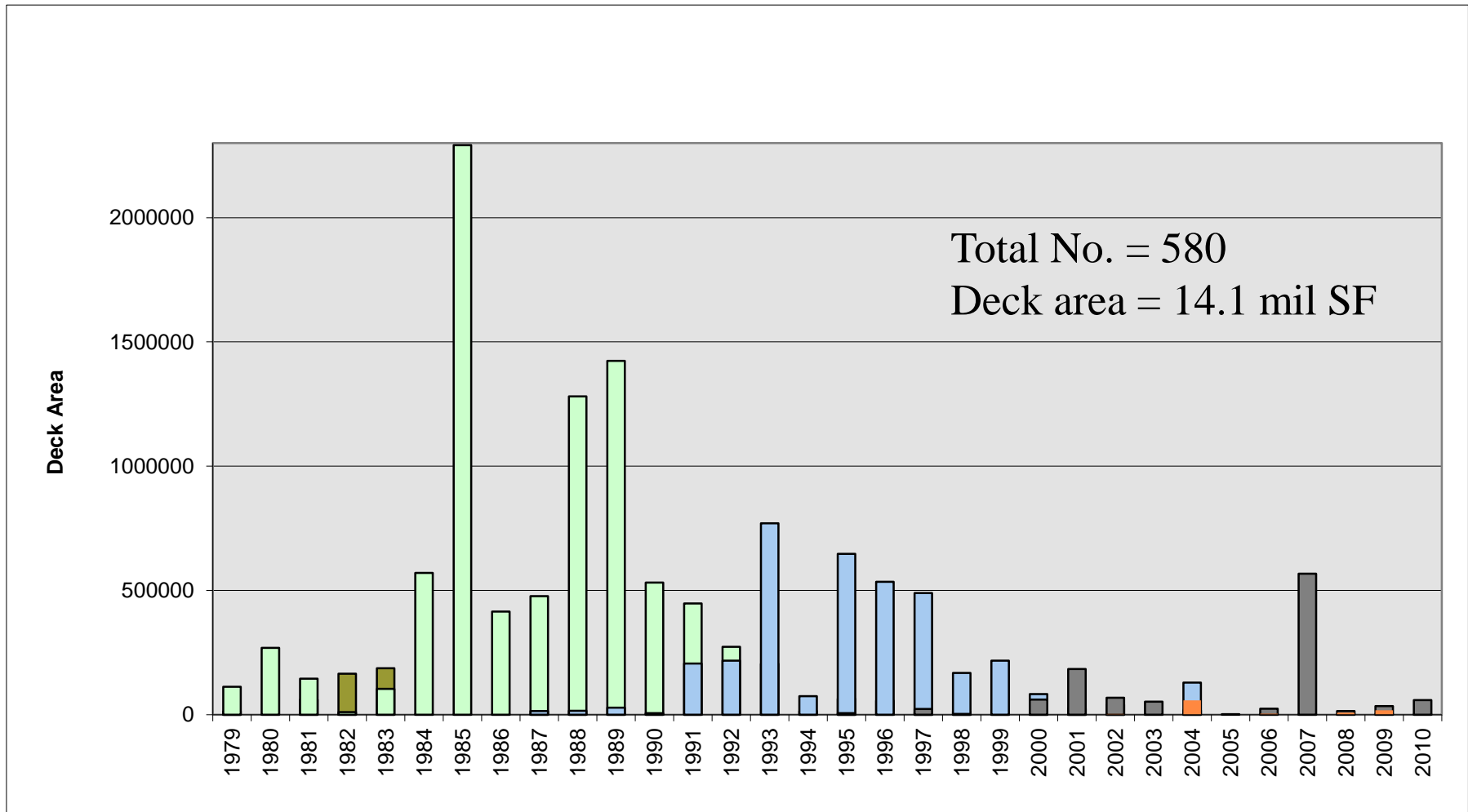
20 – 25 yrs

25br - \$0.6M

140br - \$375M

189br - \$440M

Bridges with a Modified Concrete Overlay



Latex

Low Slump

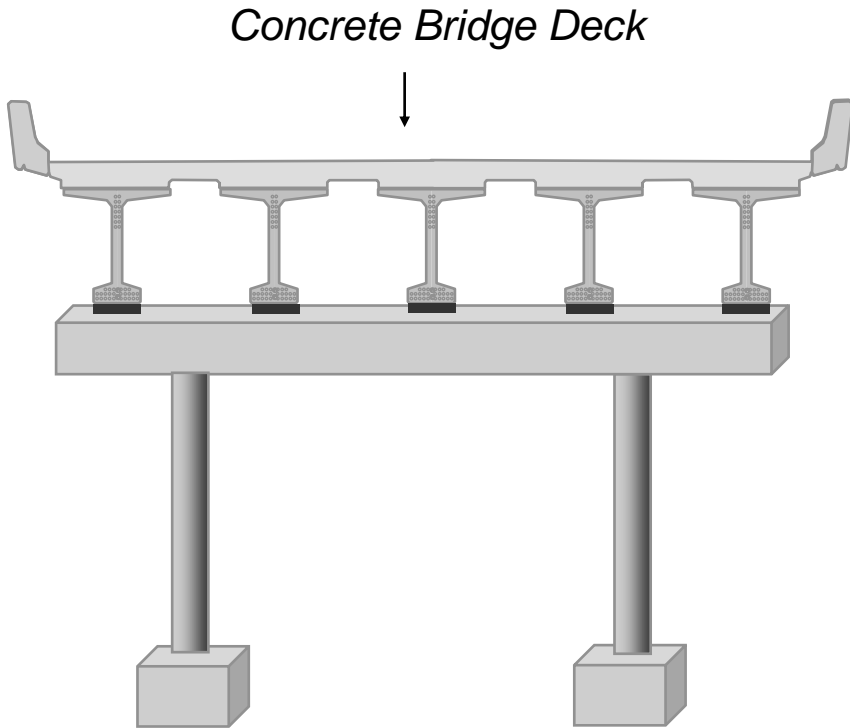


Rapid Set
LMC

Microsilica

Fly-Ash

Typical Concrete Bridge Deck



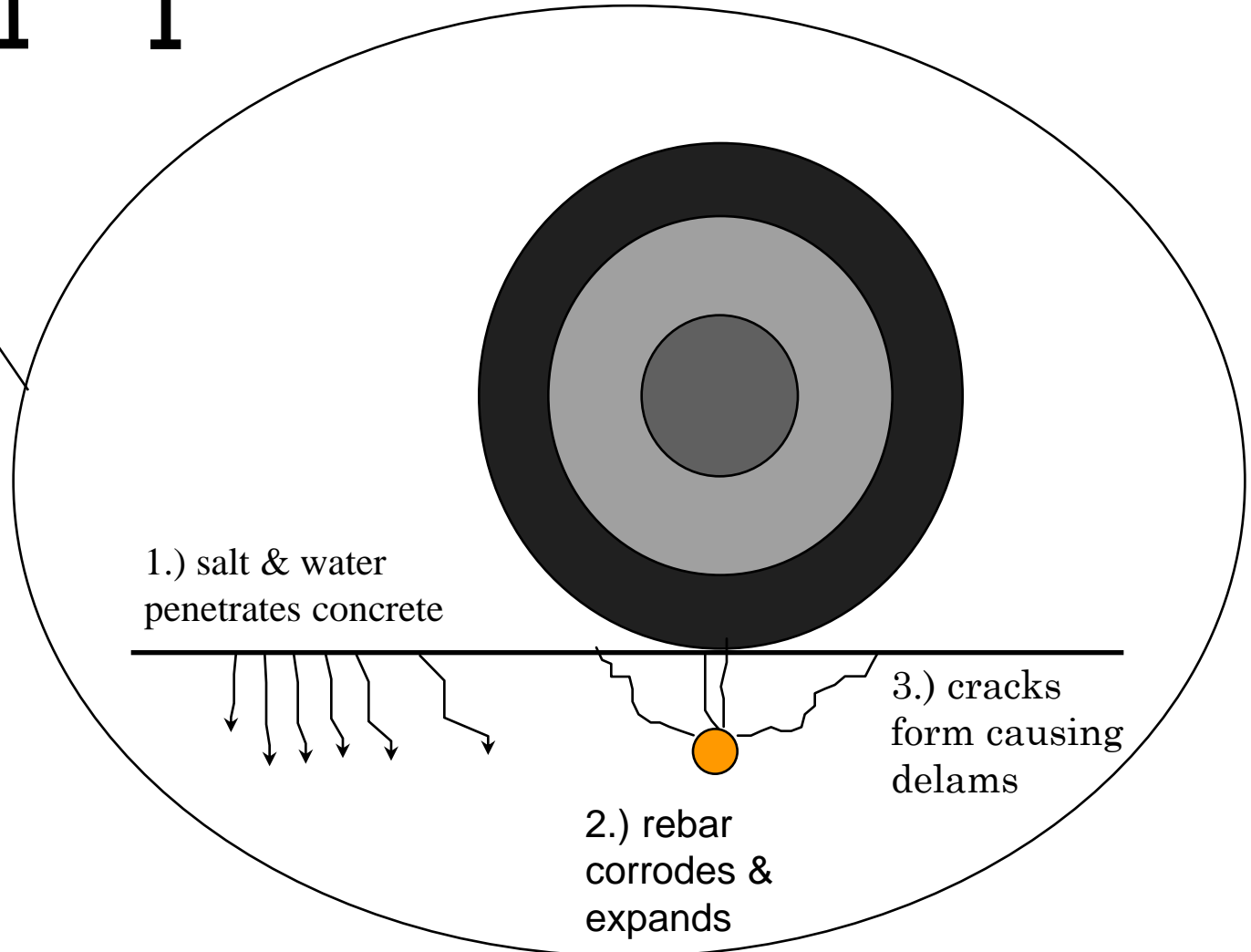
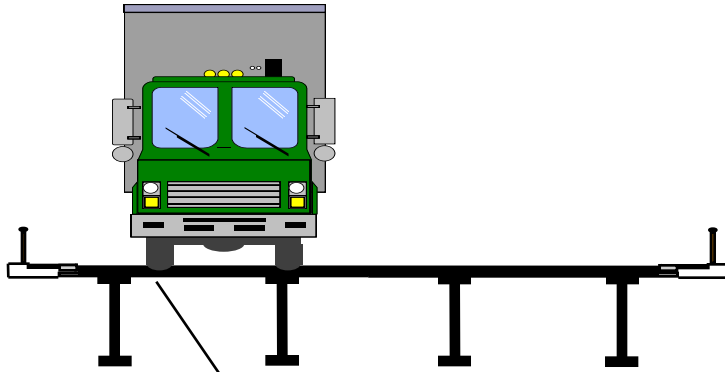
Deck issues over Bridge Life

- Rebar Corrosion
- Rebar Cover
- Poor Concrete
- Rutting



Liquid Deicer applications

Corrosion of the Reinforcing steel



1.) salt & water penetrates concrete

2.) rebar corrodes & expands

3.) cracks form causing delams

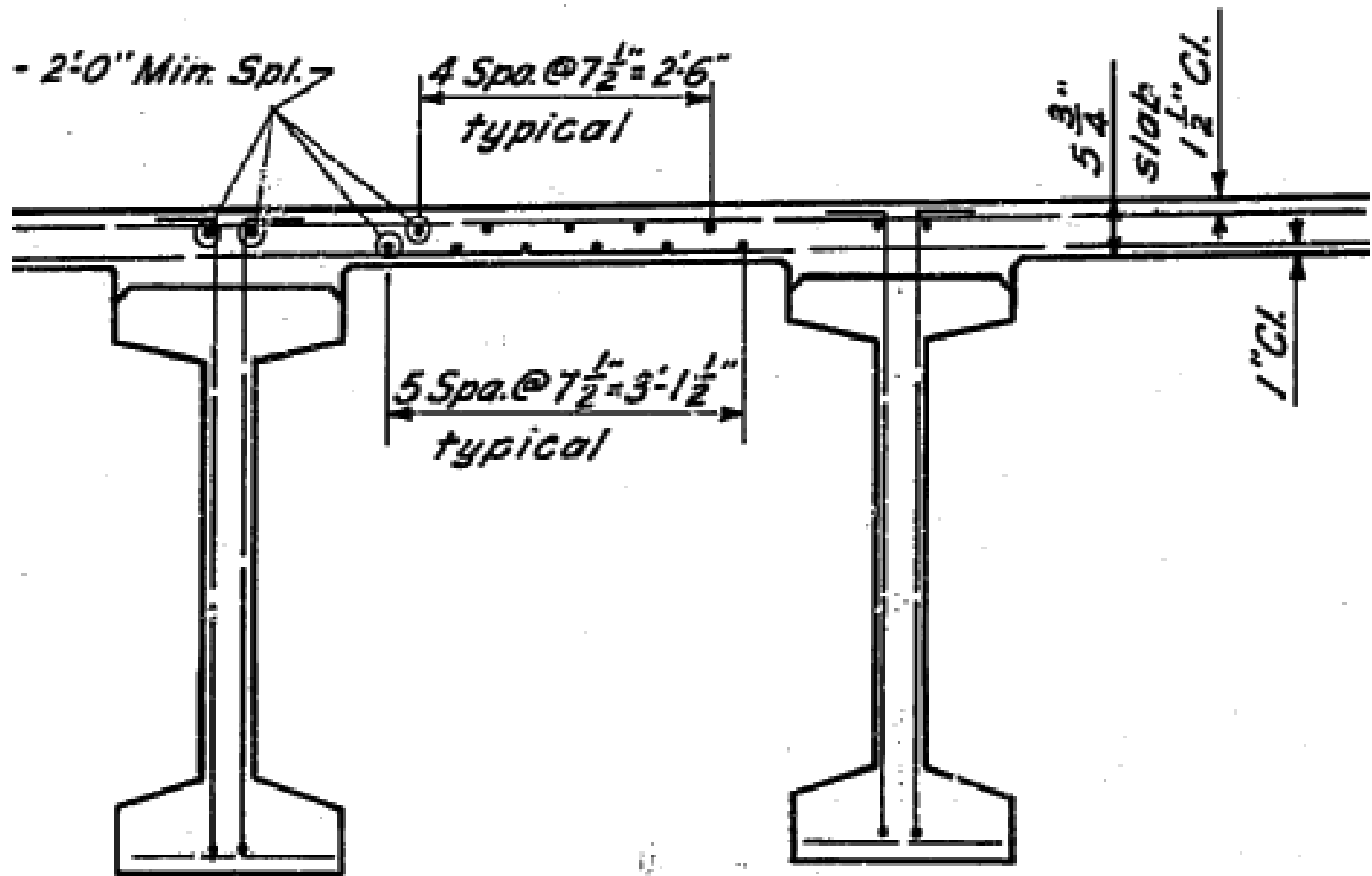


Bridge Deck Repair by WSDOT Maintenance Forces



Bridge Deck Repair by WSDOT Maintenance Forces

Rebar Cover



Rebar Cover



05/27/10
SR# 432-INC
SRMP 9.87
DIR ≅ N

Rebar Cover





Poor Concrete

SR10 Bristol Fill

Near Cle Elum / Ellensburg

Built in 1937 (75 yrs old)

DESIGN ASSUMPTIONS.

CONCRETE IN ROADWAY SLAB:

Class "A" mix - Vibrated.

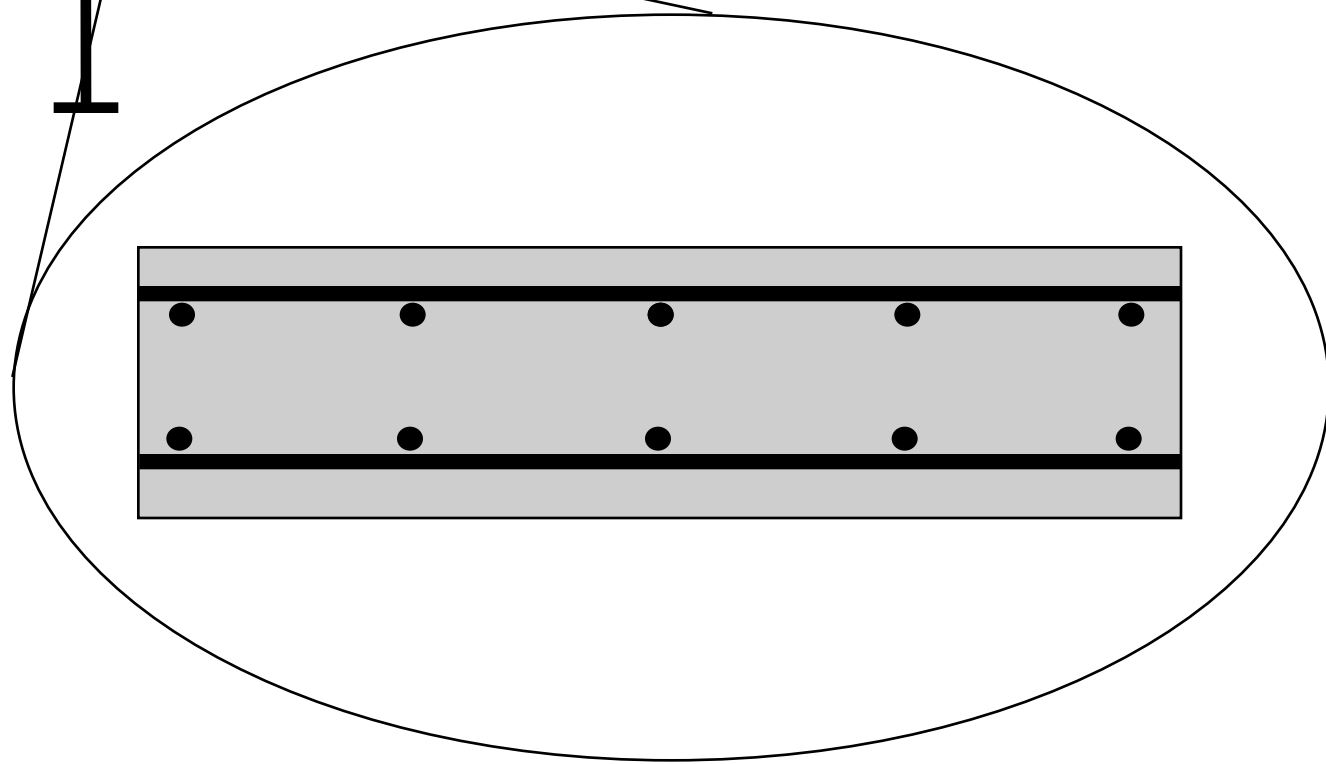
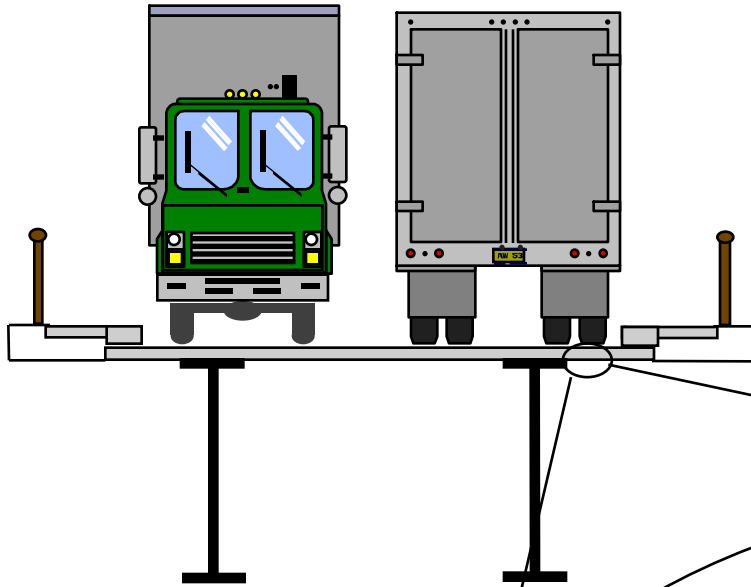
$f_c = 1200$ #per sq. inch.

$f_s = 18,000$ #per " "

$n = 10$



Rutting



Rutting



08/18/09
SR# 090-DEC
SRMP 47.98
DIR ≅ W

I-90 Denny Creek Rd OC Westbound

WSDOT's Deck Evaluation Process

Inspect / Rate Deck Condition



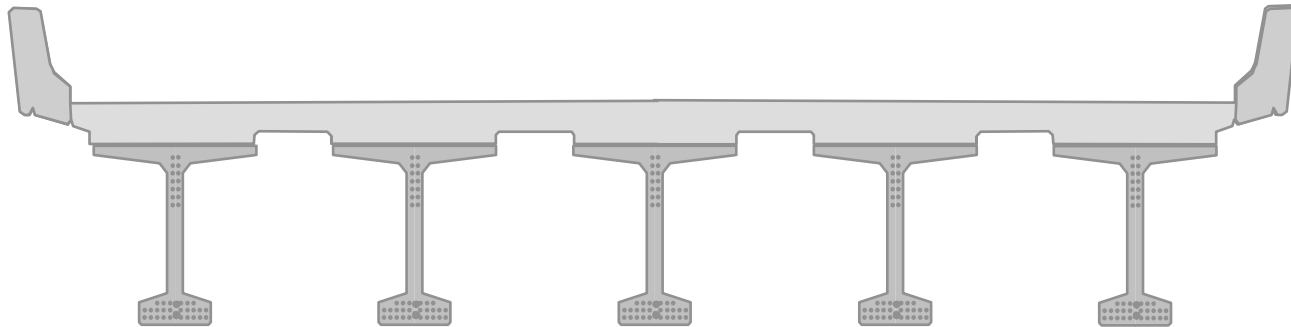
Typical Concrete Bridge Deck

WSDOT BMS Deck Elements

Element # 12 – Concrete Deck

Element # 20 – Concrete Deck with lightweight aggregate

Element # 26 – Concrete Deck with coated bars



Element # 35 – Deck Soffit

Element # 36 – Deck Rebar Cover Flag

Element # 376 – Concrete Deck Delamination

Typical Concrete Bridge Deck (with Overlay)

WSDOT BMS Overlay Elements

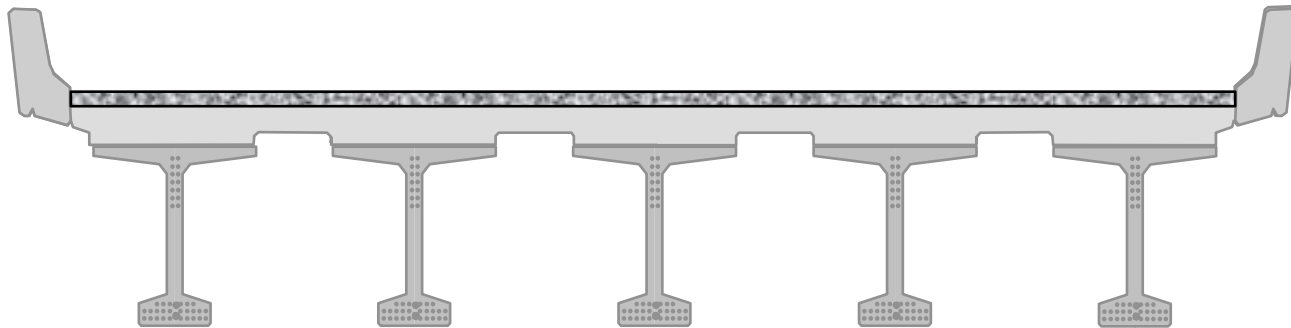
Element # 800 – Asphalt Overlay

Element # 801 – Asphalt with membrane overlay

Element # 802 – Thin Polymer Overlay

Element # 803 – Concrete Overlay

Element # 804 – Polyester Concrete Overlay



Bridge Deck Inspection

Element#12 – Concrete Deck

Element #803 – Modified Concrete Overlay

Condition State 1

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

Condition State 2

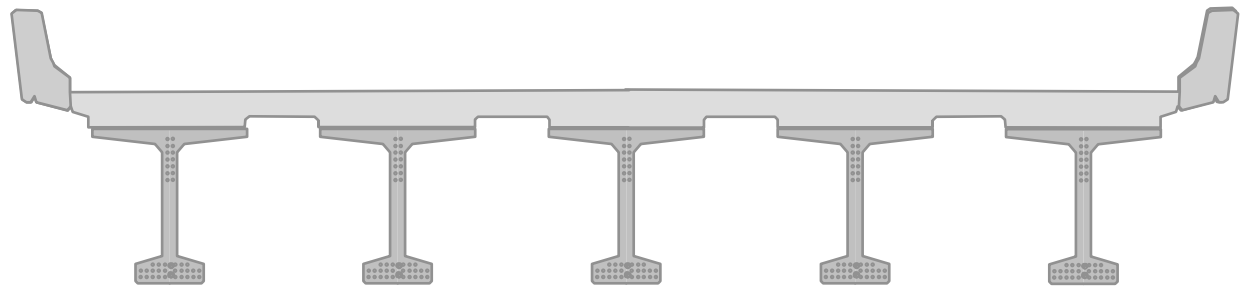
The deck surface has previous repairs.

Condition State 3

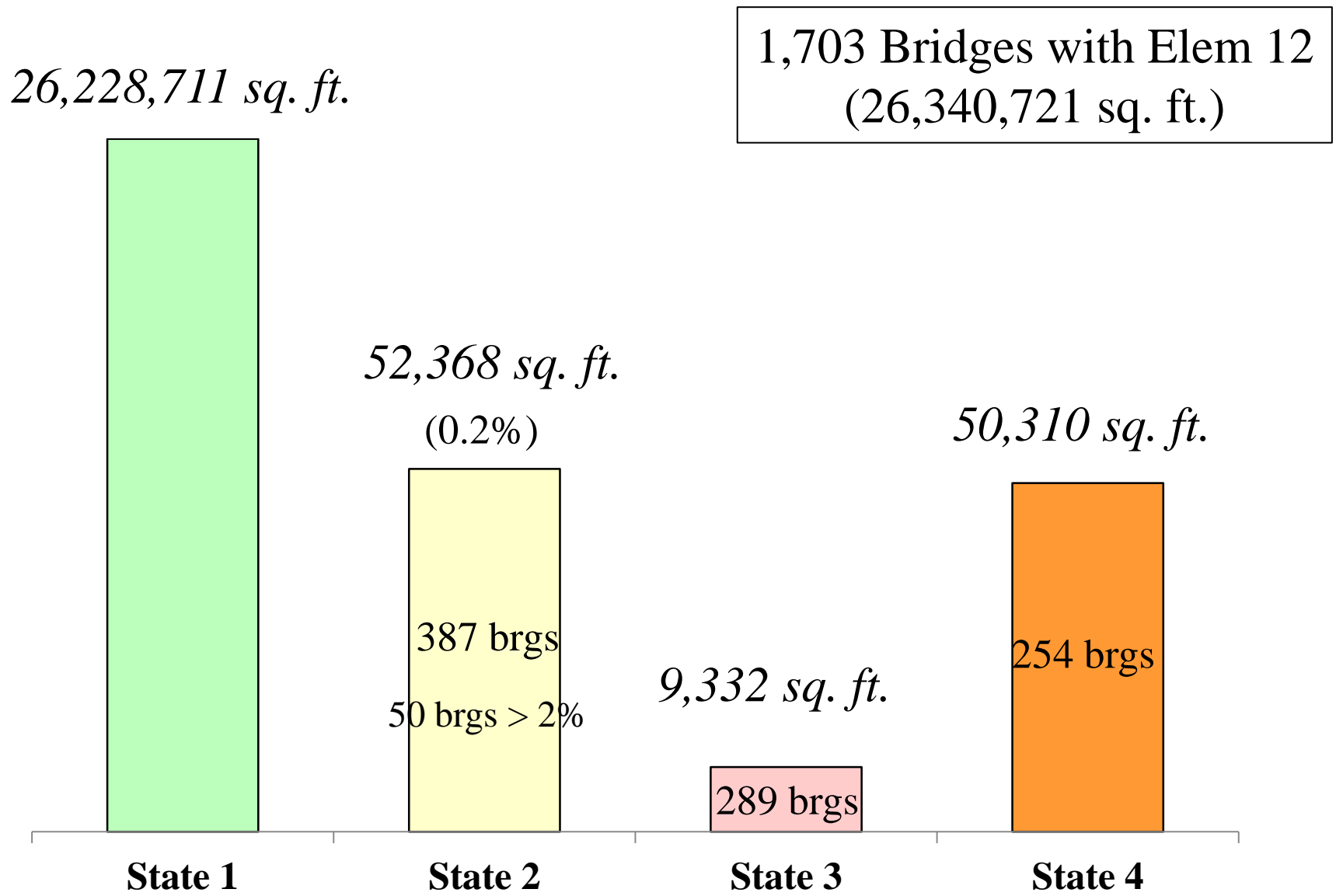
The deck surface has spalling.

Condition State 4

Delamination Test Results.



WSDOT BMS Data – Elem 12 Concrete Deck



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

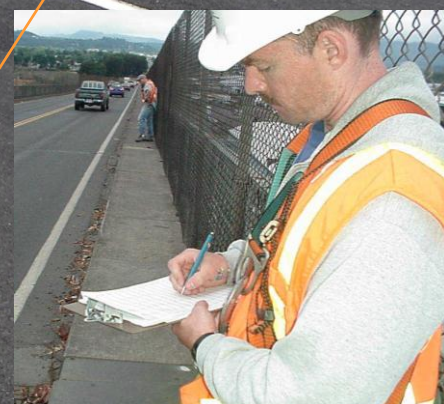
Delamination Test Results. (October / 2001)



(26%)

(4%)

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 Preservation Options

Maintain only?

Deck Rehab and Concrete Overlay?

Deck Replacement?



What should we do and when should we do it?

Bridge Deck Preservation Options



Maintain Only?

Bridge Deck Preservation Criteria

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

Interstate 90

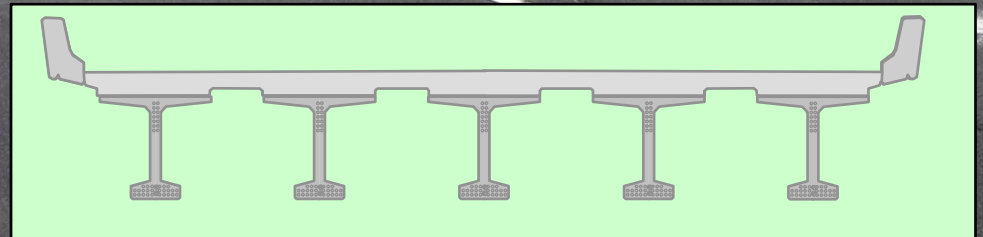
Length: 105ft

Width: 38ft

Year Built: 1972

Deck Thickness: 7”

Top Conc. Cover: 2”



Deck Repair/Overlay in 2013

\$335,000

Prioritize Bridge Deck Preservation Needs



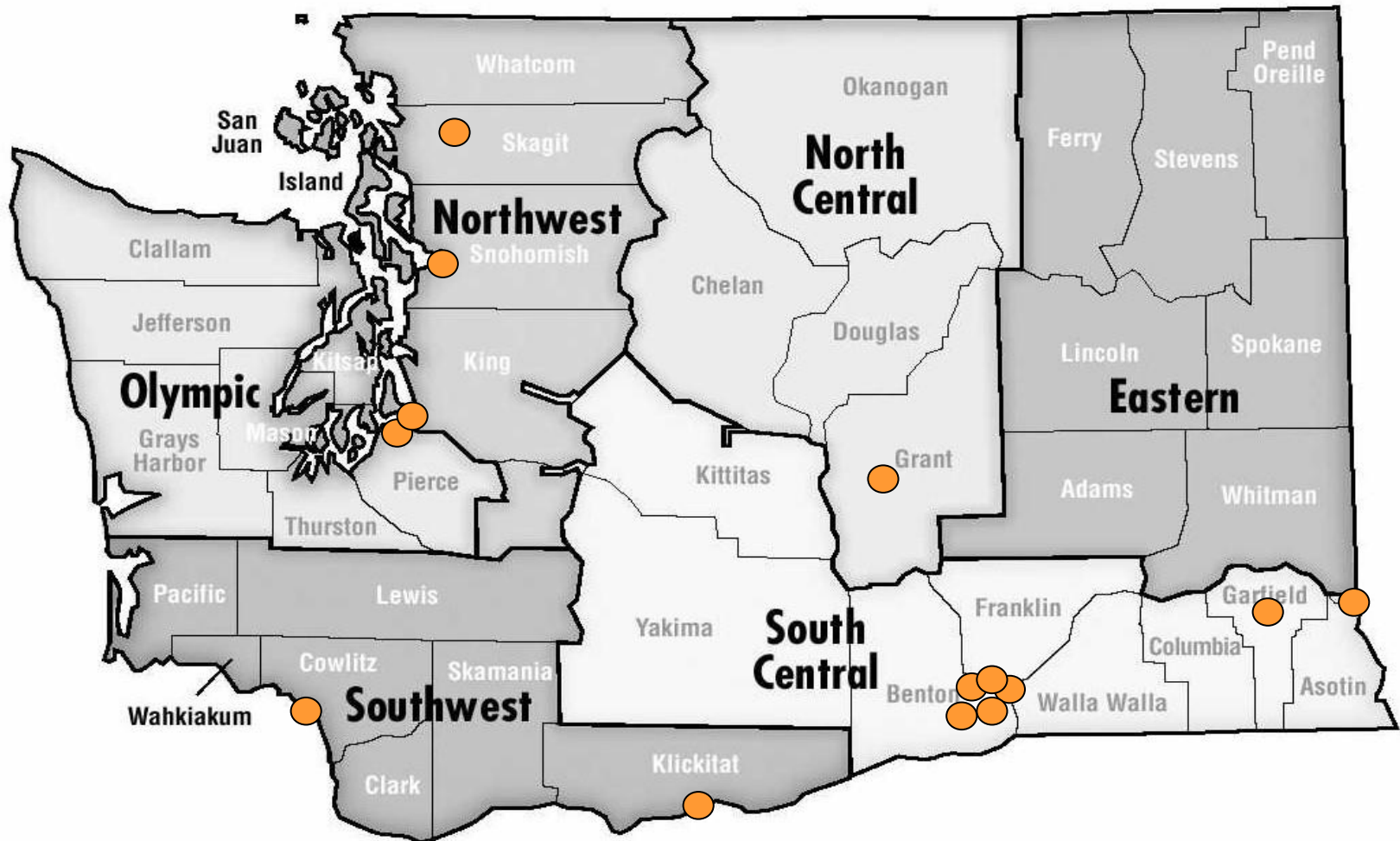
- 1) Top 10 by Patching quantity (sq Ft)
- 2) T1 Routes – Ranked by Patching Quantity
- 3) T2 Routes – Ranked by Patching Quantity
- 4) Other Routes – Ranked by Patching Quantity

Past Bridge Deck Replacements

14 bridges (588,536 sq. ft.)

1986 thru 2009

1.3% of total Statewide Deck Area



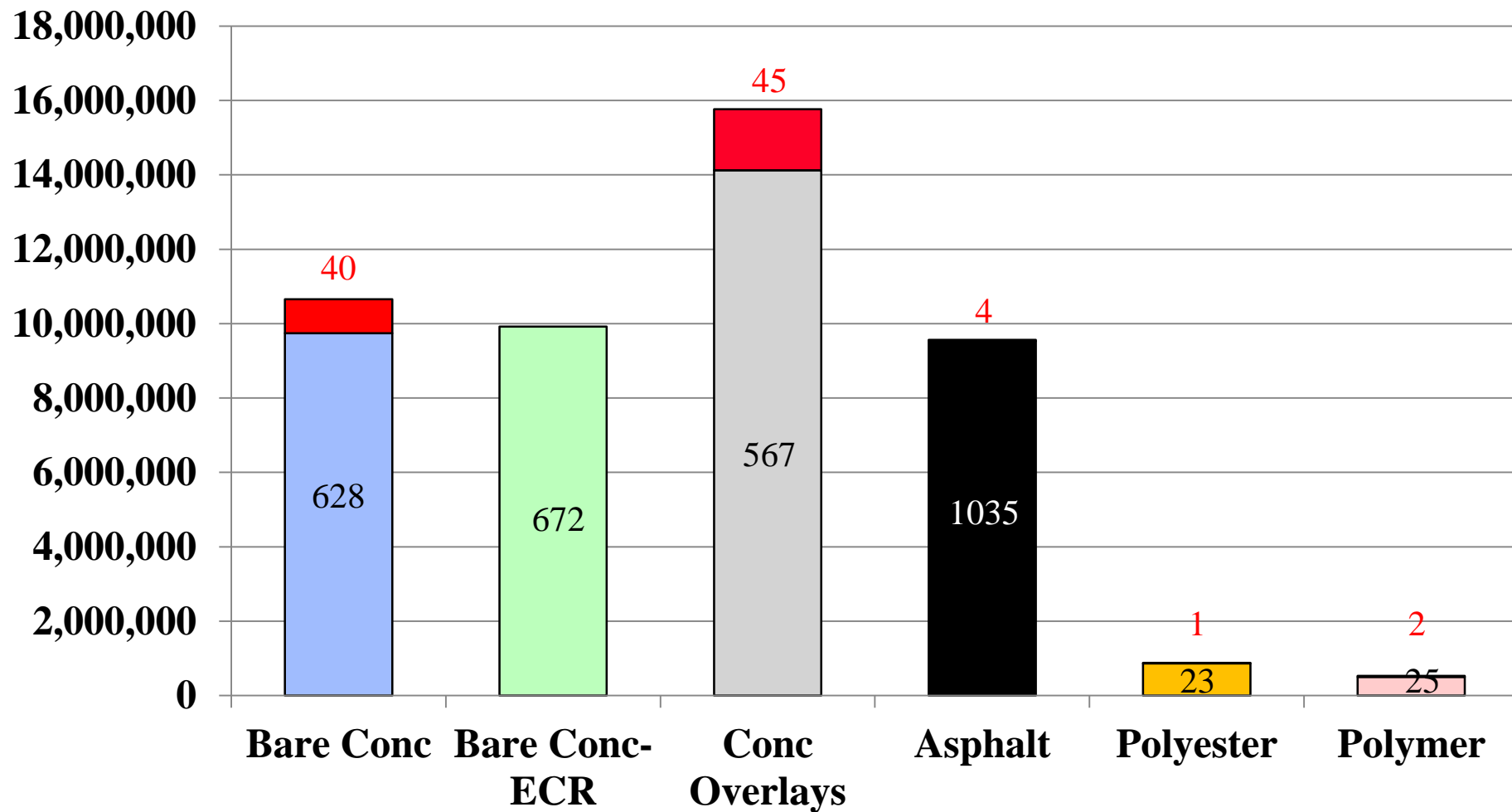
Washington State's Bridge Deck Preservation Needs

\$50.5M

\$101.1M

\$0.9M

\$152.5M



P2 - Bridge Deck Program Funded for the 2011-13 Biennium

US395 – Kettle Falls



US395 Columbia River @ Kettle Falls



Year Built – 1941

Length = 1,267ft

Width = 24ft

US395 Columbia River @ Kettle Falls

Year Built – 1941

Deck Area Patched – 1,159 (4%)



US395 Columbia River @ Kettle Falls

Year Built – 1941

Deck Area Patched – 1,159 (4%)



US395 Columbia River @ Kettle Falls

Ad-Date – May 2013



Maintenance Deck Repair –	\$100,000
Deck Repair and Overlay -	\$2.6 million (\$86/SF)
Deck Replacement -	\$8.0 million (\$250/SF)

Thank You

