Bridge Deck Preservation Program

Washington State Department of Transportation
Our Mission:

Preserve WSDOT’s reinforced concrete bridge decks, with cost effective repairs and protective overlays.
WSDOT Bridges Built-per-Year

3,039 Bridges (45 million sq ft)

Average Age = 43 yrs

Replacement value – approx $45 billion

1937 or older  – 232 bridges (1.6 million sq ft)
1936 to 1951   – 672 bridges (7.7 million sq ft)
How does WSDOT manage its Bridge Assets?

1. Identify Bridge Problem (Need)
2. Prioritize Need
3. Secure Funding for Need ($)
4. Fix the Problem
Inspect / Rate Deck Condition

4 - 10 yrs

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

25-30 yrs

Repaint Bridge
Washington State’s Concrete Bridge Deck Program

(2,962 Bridges with Concrete Decks)

- Bare Conc: 628 (21.8%)
- Bare Conc-ECR: 672 (22.2%)
- Conc Overlays: 567 (31.6%)
- Asphalt: 1035 (21.3%)
- Polyester: 23 (2%)
- Polymer: 25 (0.8%)

(2nd Gen)
WSDOT Bridges with a Modified Concrete Overlay

Total = 580
Deck area = 14.1 mil SF

Deck Area


<table>
<thead>
<tr>
<th>30+ yrs</th>
<th>25–30 yrs</th>
<th>20 – 25 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>25br - $0.6M</td>
<td>140br - $375M</td>
<td>189br - $440M</td>
</tr>
</tbody>
</table>
Bridges with a Modified Concrete Overlay

Total No. = 580
Deck area = 14.1 mil SF

- Latex
- Rapid Set
- Microsilica
- Low Slump
- LMC
- Fly-Ash

Deck Area
Typical Concrete Bridge Deck

Deck issues over Bridge Life

- Rebar Corrosion
- Rebar Cover
- Poor Concrete
- Rutting
Liquid Deicer applications
1.) salt & water penetrates concrete

2.) rebar corrodes & expands

3.) cracks form causing delams

Corrosion of the Reinforcing steel
Bridge Deck Repair by WSDOT Maintenance Forces
Rebar Cover

- 2'-0" Min. Sp. -

4 Sp. @ 7½" = 2'-6"

typical

5 Sp. @ 7½" = 3'-1½"

typical

5½" slab

1½" Cl.

1" Cl.
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.
- $f_c = 1200$ psi
- $f_s = 18,000$ psi
- $n = 10$
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
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

- **State 1**: 26,228,711 sq. ft.
- **State 2**: 52,368 sq. ft. (0.2%)
- **State 3**: 1,703 Bridges with Elem 12 (26,340,721 sq. ft.)
- **State 4**: 50,310 sq. ft.

**Details**:
- **State 2**: 387 brgs, 50 brgs > 2%
- **State 3**: 289 brgs
- **State 4**: 254 brgs

**Total**: 1,703 Bridges with Elem 12
# 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.  

<table>
<thead>
<tr>
<th>Elem</th>
<th>Description</th>
<th>Total</th>
<th>Unit</th>
<th>State1</th>
<th>State2</th>
<th>State3</th>
<th>State4</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>Conc. Deck</td>
<td>3,990</td>
<td>SF</td>
<td>2,774</td>
<td>1,053</td>
<td>0</td>
<td>163</td>
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<tr>
<td>35</td>
<td>Soffit</td>
<td>3,990</td>
<td>SF</td>
<td>3,990</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>376</td>
<td>Delam Testing</td>
<td>3,990</td>
<td>SF</td>
<td>3,827</td>
<td>0</td>
<td>0</td>
<td>163</td>
</tr>
</tbody>
</table>

(26%) (October / 2001)  

(4%)
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

- Bare Conc: $50.5M
- Bare Conc-ECR: $101.1M
- Conc Overlays: $0.9M
- Asphalt: $152.5M

Bar chart showing the preservation needs for different materials:
- Bare Concrete
- Bare Concrete-ECR
- Concrete Overlays
- Asphalt
- Polyester
- Polymer

Numbers on bars:
- Bare Conc: 628
- Bare Conc-ECR: 672
- Conc Overlays: 567
- Asphalt: 1035
- Polyester: 23
- Polymer: 25
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