

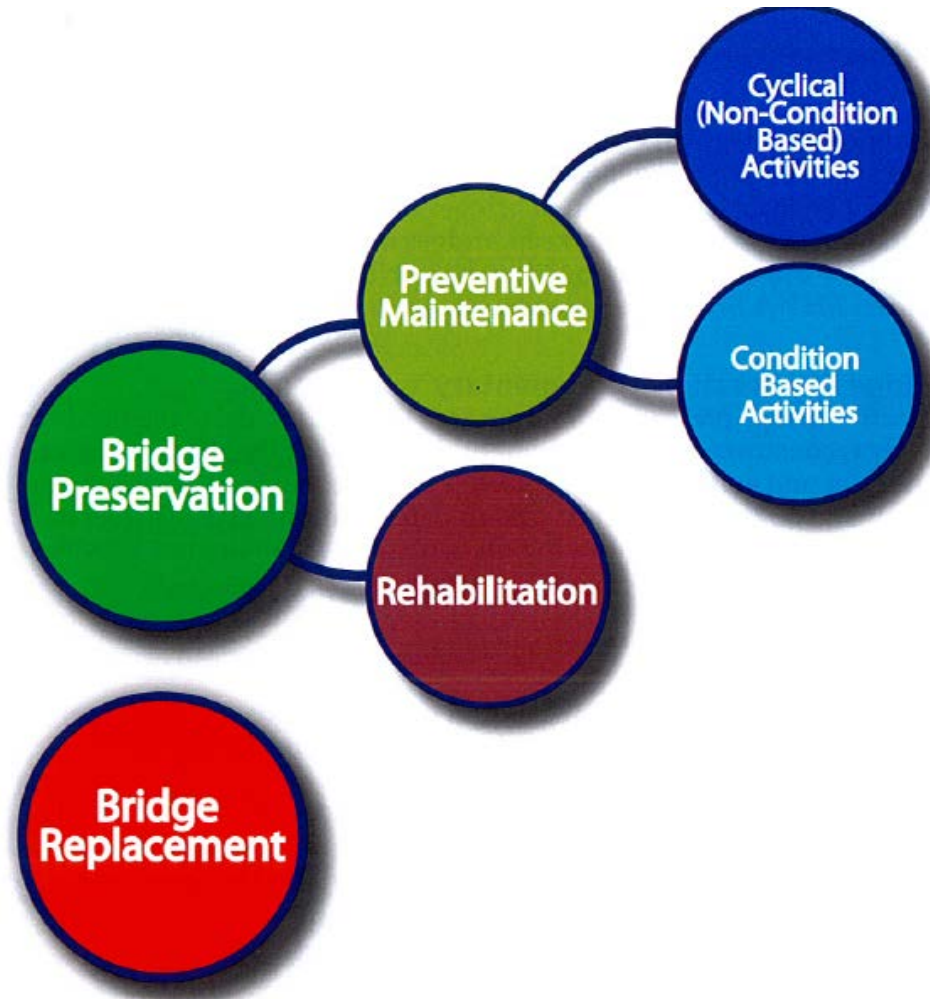
Developing an Effective Bridge Preservation Program

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Western Bridge Engineers' Seminar
Bellevue, WA
September 6, 2013

BRIDGE PRESERVATION



Preserve it or sign it?



Bridge Preservation Requires

- Design for the long term
- Design with inspection, maintenance, and preservation in mind.
- Constructing the bridge as designed
- Cyclic and corrective maintenance treatments completed in a timely fashion.
- Continuous promotion to obtain and maintain the needed funding

Design For the Long Term

- Bridges constructed of easy to maintain materials.
 - Elastomeric bearings
 - Concrete
- Bridges designed with easy to maintain details.
 - Drainage off the bridge
 - No or limited joints
 - Use simple joints that can be maintained
 - Eliminate piers in the water if feasible
 - Urban design to discourage homeless condos
 - Rails that are not valuable when metal prices rise.
 - Details that discourage bird nesting
 - Eliminate large flat surfaces attractive to urban artists, or treat the concrete.
 - Standard components that do not require keeping a large inventory of parts
 - Bridges with sufficient clearance to prevent over height load hits
 - Eliminate or at least minimize skew angles in bridges
 - Design with protective measures where corrosive salts are used for winter maintenance or if in salt water environment.

A bridge and a condo



Bridge Troll?



Would you want to break into these to check the abutment and bearings?



All materials cleaned up must be bagged, tagged and stored.



Bridge surfaces in Urban areas
will end up like this.



Treat concrete w/ waterproofing agents



**WASHING BRIDGES TO REDUCE
CHLORIDE**

**State of Oregon Interim Report
SPR 304-031 (Reinforced Concrete
Bridges)**

Chloride levels decreased with a washing cycle of once per day, but no change was observed with washing cycles of once per week or once per month.

Communications and Cooperation

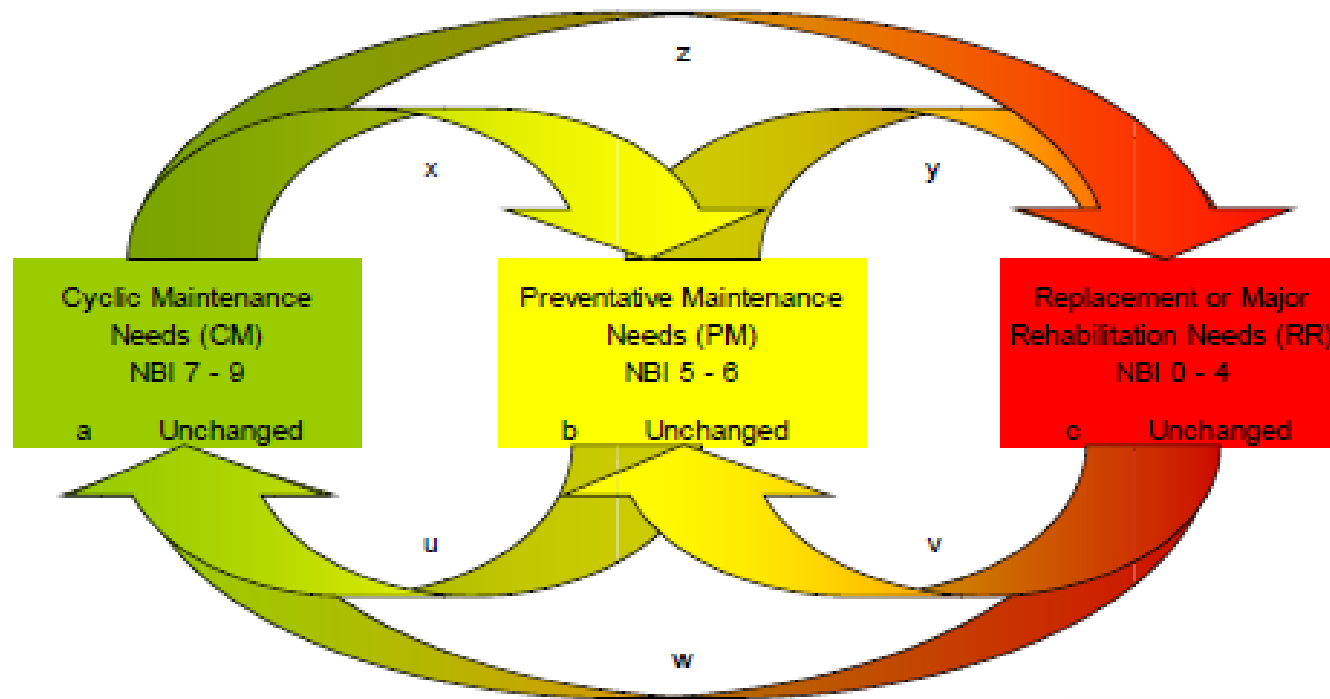
- Bridge Preservation requires close coordination and cooperation between the Bridge Designers, Inspectors, Construction Offices, Program Managers and Maintenance to work effectively.

Construction Inspection

- Build the Bridge as Designed.
- Refer back to the Designer of Record before instituting a change.
- Make sure the contractor cleans up the site. No formwork left in place, Joint gaps are thoroughly cleaned out to allow for expansion-contraction. Deck overlays – make sure the overlay material did not flow through the expansion joint on to the beam ends etc.

Preservation Cycle

Bridge Condition Diagram

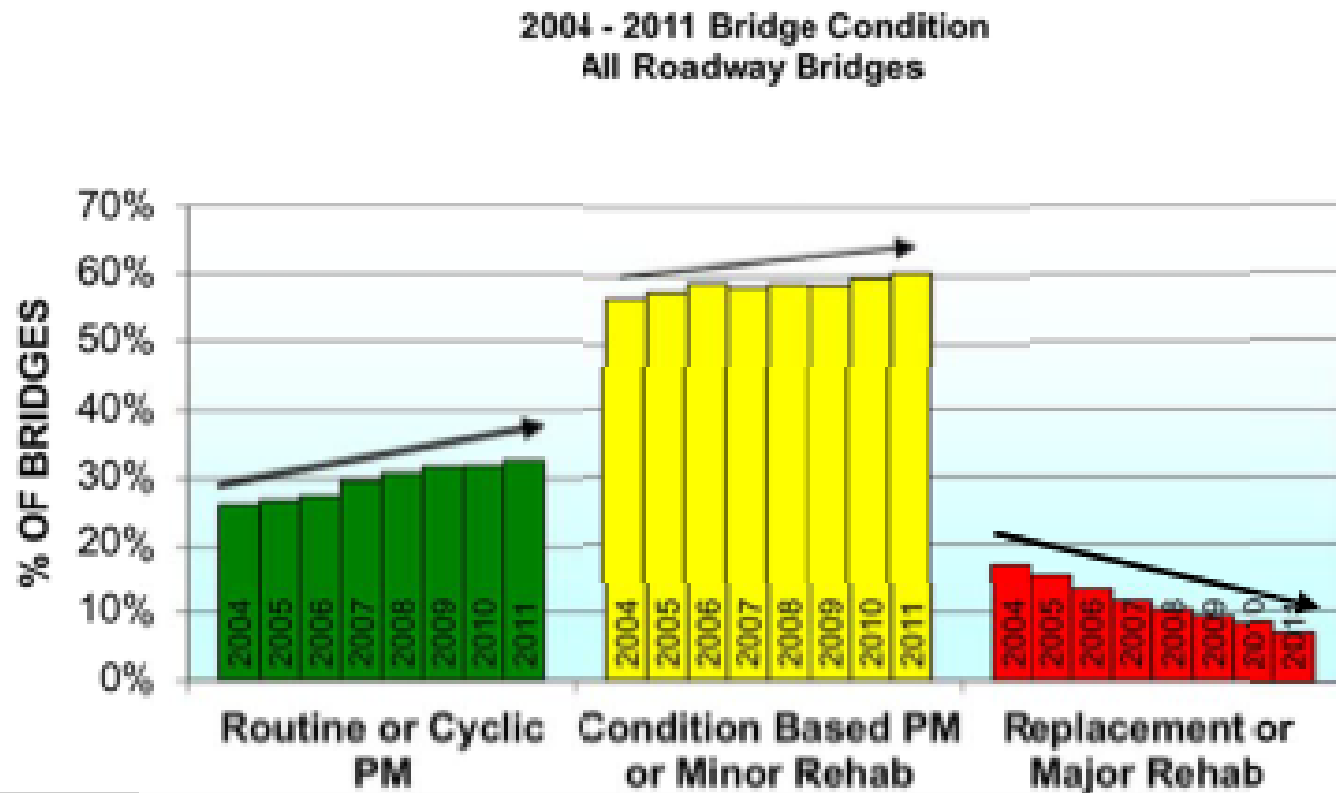


General Targets:

$$v \geq y \quad u \geq x$$

$$u+v+w \geq x+y+z$$

Ideal Trend



Preventive Maintenance Development Process

- Select preventive maintenance treatments
- Develop and test treatments
- Select treatments that provide the best return for the cost considering climate, winter maintenance ADT, etc.
- Prioritize
- Deliver the Preventive Maintenance program
- Review Results
- Make changes to improve the program

What is Measured Gets Funded (WSDOT)

- Percent of Bridges in Good and Fair Condition
- Number and Deck area of S/D and F/O Bridges
- Percent of Priority 1 Repairs completed within a year
- Deck Condition
- Bridge Cleanliness

Funding Increased for Maintenance

- Due to Low Structural Repair Scores funding in 2009 -2011 biennium was increased \$1.5 Million for structural bridge repairs. This was to increase scores from an F to a C.
- For the 2011 to 2013 biennium funding was increased for Deck repairs by \$530,000 to increase the deck score.
- For 2013-2014 \$2 million set aside for bridge cleaning. (108 bridges)

DATA

- Maintenance Work Operation Codes are needed to collect enough information to determine:
 - What was done
 - When it was done
 - What was the cost
 - Which Bridge and what element was repaired.

BRIDGE ASSET MANAGEMENT BACKLOG

Preservation Asset activity	Preservation Biennial Funding	Preservation Backlog	Maintenance Biennial Funding	Backlog Units	Maintenance Backlog
Structural Repair			\$ 9,498,998	47	\$ 568,700
Expansion Joints	\$ 15,000,000	\$ 75,000,000	\$ 1,200,000	36,438	\$ 10,202,640
Scour	\$ 4,000,000	\$ 20,000,000	\$ -		
Painting	\$ 55,000,000	\$ 346,000,000	\$ 845,878		\$ 500,000
Bridge Cleaning			\$ 1,127,122	135	\$ 2,550,000
Decks	\$ 15,000,000	\$ 75,000,000	\$ 2,124,011	22,384	\$ 6,330,282
Misc struct incl Sign Bridges	\$ 3,000,000	\$ 15,000,000	\$ -	1202	\$ 2,163,600
Movable Bridges			\$ 7,440,335		
Bird Exclusion			\$ 50,000	100	500,000.00
Urban Tunnels			\$ 3,657,088		
Bridge Inspection	\$ 19,000,000			2306	\$ 350,000.
	\$ 111,000,000	\$ 531,000,000	\$ 27,403,982		\$ 23,163,622

Maintenance Pilot Projects

- Bridge washing
- Bridge maintenance inspections
- Bridge deck repair and joint sealing
- Spot and area painting with one coat paint and an SP3 preparation
- Stopping fatigue cracks with cold expansion
- Use of borate rods and paste on timber members at first sign of decay.

Bridge Washing

- 2010 – 7 bridges, cost: \$98,289 = \$14,041/bridge
- 2011 – 8.5 bridges, cost \$91,219 = \$10,731/bridge
- 2012 – 12 bridges, cost: \$87,350 = \$7279/bridge
- 2013 – 16 bridges, cost \$93,600.=\$5850
- 51% reduction in cost per bridge

Skagit River Bridge



Floor beam 6 after cleaning



Span 6 L4 Typical rust exposed after cleaning





Bridge Washing Pilot

- The science has shown that there is little change in water quality if you flush a bridge annually.
- The Department of Ecology has Permitted annual flushing of bridges over fresh water without first hand cleaning.

Maintenance Inspections Olympic Region

- 2010 -Inspected 435 bridge, Cost of \$400/bridge, (bridges not insp by BP)
- 2011 – Inspected 753 bridges, cost \$139/bridge (insp all bridges)
- 2012 – Inspected 375 bridges, cost of \$100/bridge (bridges not insp by BP)
- * In 2011 & 2012 they did a maintenance inspection, 2010 they did an inventory inspection.



New Bridge Maintenance Activities Added

- Bridge spot and area painting program
 - Testing out a single coat paint (Calcium Sulfonate) for use with an SP3 preparation
- Use of borate rods to halt decay in timber members.
- A better way to stop fatigue cracks
 - How the airlines prevent cracks on their airplanes.



United States
Department of
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Forest
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Laboratory

General
Technical
Report
FPL-GTR-205



In cooperation
with the
United States
Department of
Transportation

Federal
Highway
Administration



Guide for In-Place Treatment of Wood in Historic Covered and Modern Bridges

Stan Lobow
Grant Kirker
Robert White
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H. Michael Barnes
Michael Sanders
Jeff Morrell



Cold Expansion to Stop Fatigue Cracks & Spot Painting Programs



Bridge Preventive Maintenance Program Results

- Priority 1 Repairs dropped from about 85 per year to just 27 for the Olympic Region.
- Enabled crews to do preventive maintenance work that will reduce future repairs.
- Allowed crew to do repairs that removed weight limits from 3 bridges and raised the vertical clearance on another.



Funding Challenges

- Funding will be even more constrained in the future.
- MAP 21 allows more leeway for use of Federal Funds and there will be increased competition for those funds.
- Preservation funding has been hit very hard and they will need Maintenance help to preserve our bridges in a “State of Good Repair”

Cyclic Preservation Activities Challenges

- Proving need and effectiveness
- Finding the funding
- Determining what needs to be done and how often, to maximize the life of the asset at the lowest cost.
- Preservation is the last to be funded and the first to be cut when funds are tight.





15 Bridges – 740,000 square feet

ADDITIONS: Port of Tacoma to King County Line.				
	Units	unit cost	freq	bien cost
One lane in each direction for 3.78 miles or 7.56 lane miles				
1A1 - pavement repair				
6A2 - Raised recessed pavement markers				
6A2 - Pavement Markings				
6A1 - Striping	7.56 mi	\$601/mi	1.2	\$ 5,452.00
1A4 - Sweeping, median barrier increases need to 4 x/ yr from 1	7.56 mi	\$300/mi	8	\$ 18,144.00
5B1 - Snow and Ice	7.56 mi	\$2434/mi	1	\$ 18,401.00
Drainage				
2A2 - Culverts Existing hooked up to grate inlets and catch basins.	7	\$50.00	4	\$ 1,400.00
2A4 - 4 acres of flood mitigation site.	1	\$11,050	0.4	\$ 4,420.00
2A3 - Grate inlets & Catch basins	188	\$75.00	2	\$ 28,200.00
2A4 - Media filter strips, 11470 feet added	11.4	\$1,422	1	\$ 16,210.80
Landscape				
3A5 - landscaped 5 acres, 465 trees, 1169 wet mix plants, 7200 upland plants, 2 irrigation systems.	7	\$1,500.00	2	\$ 21,000.00
3.78 miles of 48 ft wide median removed				
3A3 mowing	-20	\$594.00	1	\$ (11,880.00)
3A2 Noxious weed control	-20	\$154.00	1	\$ (3,080.00)
Bridges 23,000 sq ft added.				
4A1 Bridge Decks	23,000	0.05	1	\$ 1,150.00
4A2 Structural Bridge	23,000	0.31	1	\$ 7,130.00
4A3 Bridge Cleaning	23,000	0.1	1	\$ 2,300.00
Sign bridges: 5 sign bridges, 3 cantilever, 7 bridge mounted (4 removed)	11	600	0.5	\$ 3,300.00
Walls	730	0.5	1	\$ 365.00
Guardrail				
6A7 - Concrete barrier, 17,055 added, 2571 removed	14,484	4.37	0.25	\$ 15,823.77
6A7 - Beam Guardrail, 8932 added, 5650 removed	3,282	0.49	1	\$ 1,608.18
6A7 Cable Barrier, 11,510 removed	-11,510	1.28	0.5	\$ (7,366.40)
- Impact Attenuators	3	1200	1	\$ 3,600.00
6B3 Intelligent Transportation System Operations				
Cameras	3	3930	1	\$ 11,790.00
Variable Message Signs, (1 bridge mount removed, 3 added)	2	2387	1	\$ 4,774.00
Data stations	8	1615	1	\$ 12,920.00
Highway Advisory radio system	1	1615	1	\$ 1,615.00
Ramp Meters	4	1614	1	\$ 6,456.00
9B1 3rd party Damage				
Unknown or unrecoverable damage	8	896	1	\$ 6,773.76
Increase in biennium cost				\$ 170,507.11



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QUESTIONS?

