AASHTO Subcommittee on Maintenance Concurrent Paper Session

Pavement Preservation on High-Volume Roadways: A Review of SHRP2 R26 and Agency Implementation Practices from 2013 to 2015

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applied pavement TECHNOLOGY

providing engineering solutions to improve pavement performance

Topics

- Quick review of SHRP2 R26
- Overview of implementation efforts
- Implementation future

SHRP2 R26

- Define HVR
- Identify preservation practices on HVR
- Develop guidelines based on successful practices

Decision Overview, Part 1

Evaluate Current and Historical Pavement Performance Data
(from field surveys and testing and/or agency PMS database)

- Overall Condition Indicator (PCI, PSR, etc.)
- Individual Distress Types, Severities, and Extents
- Smoothness (IRI, PI, etc.)
- Surface and Subsurface Drainage Characteristics
- Safety Characteristics
  - friction/texture (FN, MPD/MTD, IFI, etc.)
  - crashes
- Pavement–Tire Noise

Review Historical Design, Construction, and Maintenance and Rehabilitation (M&R) Data

- Pavement Type and Cross-Sectional Design
- Materials and As-Built Construction
- M&R Treatments (materials, thicknesses, etc.)

Decision

Develop Preliminary Set of Feasible Preservation Treatments

Decision Overview, Part 2

Develop Preliminary Set of Feasible Preservation Treatments

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Assess Specific Needs and Constraints of Project

Performance Needs

- Treatment Life
  - traffic effects (functional class and/or traffic level)
  - climate/environment effects
- Risk
  - Availability of qualified contractors
  - Availability of quality materials

Construction Constraints

- Funding
- Time (of year) of construction
- Geometrics
- Work duration (facility downtime)
- Traffic accommodation

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Develop Final Set of Feasible Preservation Treatments

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Select the Preferred Preservation Treatment

- Conduct Cost-Effectiveness Analysis
  - Benefit-Cost Analysis
  - Life-Cycle Cost Analysis (LCCA)
- Evaluate Economic and Non-Economic Factors

Feasibility Matrix – Bituminous

Preservation Treatment	Window Of Opportunity		Distress Types and Severity Levels (L=Low Severity, M=Medium Severity, H=High Severity)														Surface Characteristics Issues		
			Surface Distress					Cracking Distress					Deformation Distress						
	PCI/ PCR	Age, yrs	Ravel/ Weather	Bleed/ Flush	Polish	Segre-gation	Water Bleed/ Pump*	Fatigue/ Long WP/ Slippage	Block	Trans Therm	Joint Reflect	Long/ Edge	Wear/ Stable Rutting *	Corrug/ Shove *	Bumps/ Sags	Patches	Ride Quality	Friction	Noise
			L M H	—	—	L M H	—	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	—	—	—
Crack Fill	75-90	3-6 *						× × ×	◉ ○ ×	○ × ×	○ × ×	● ◉ ○							
Crack Seal	80-95	2-5 *						× × ×	◉ ○ ×	● ◉ ○	● ◉ ○	○ × ×							
Slurry Seal (Type III)	70-85	5-8	◉ ● ◉	×	◉	◉ ○ ×	◉	◉ ○ ×	● ◉ ○	◉ ○ ×	◉ ○ ×	◉ ○ ×	○ × ×	× × ×	× × ×	◉ ○ ×	×	◉	◉
Microsurfacing-Single	70-85	5-8	◉ ● ◉	×	◉	● ◉ ○	◉	◉ ○ ×	● ◉ ○	◉ ○ ×	◉ ○ ×	◉ ○ ×	◉ ○ ×	○ × ×	○ × ×	◉ ○ ×	○	●	◉
Microsurfacing-Double	70-85	5-8	◉ ● ◉	×	◉	● ◉ ○	○	◉ ○ ×	● ◉ ○	● ◉ ○	● ◉ ○	● ◉ ○	● ◉ ○	○ ○ ×	○ ○ ×	● ◉ ○	◉	●	◉
Chip Seal-Single Conventional Polymer-modified	70-85 70-85	5-8 5-8	◉ ● ◉ ○ ◉ ◉	○ ×	● ●	● ◉ ○ ◉ ◉ ○	◉ ○	◉ × × ◉ ○ ×	● ◉ ○ ● ◉ ◉	● ◉ ○ ● ◉ ◉	● ◉ ○ ● ◉ ◉	◉ ◉ ○ ◉ ○ ×	◉ ○ × ◉ ○ ×	○ ○ × ○ ○ ×	○ ○ × ○ ○ ×	◉ ◉ ○ ◉ ◉ ○	○ ○	● ●	× ×
Chip Seal-Double Conventional Polymer-modified	70-85 70-85	5-8 5-8	○ ◉ ◉ ○ ○ ◉	× ×	◉ ◉	◉ ◉ ○ ○ ◉ ○	× ×	◉ ○ × ● ◉ ○	● ◉ ◉ ● ● ◉	● ◉ ◉ ● ● ◉	● ◉ ◉ ● ● ◉	● ◉ ◉ ● ◉ ◉	● ◉ ○ ● ◉ ○	◉ ○ × ◉ ○ ×	◉ ○ × ◉ ○ ×	● ◉ ◉ ● ◉ ◉	◉ ◉	◉ ◉	○ ○
Ultra-Thin Bonded Wearing Course	65-85	5-10	◉ ● ◉	×	●	◉ ◉ ○	○	◉ ○ ×	◉ ◉ ○	◉ ◉ ○	◉ ◉ ○	◉ ◉ ○	◉ ○ ×	◉ ○ ×	◉ ○ ×	◉ ◉ ○	◉	●	◉
Ultra-Thin HMAOL	65-85	5-10	◉ ● ◉	×	●	◉ ◉ ○	○	◉ ○ ×	◉ ◉ ○	◉ ◉ ×	◉ ◉ ×	◉ ◉ ×	◉ ○ ×	◉ ○ ×	◉ ○ ×	◉ ◉ ○	◉	●	●
Thin HMAOL	60-80	6-12	◉ ● ◉	○	●	◉ ◉ ○	○	● ◉ ○	● ● ◉	◉ ● ◉	◉ ● ◉	◉ ◉ ●	◉ ● ◉	● ◉ ○	● ◉ ○	● ● ◉	●	●	●
Cold Milling and Thin HMAOL	60-75	7-12	○ ◉ ●	○	○	◉ ● ◉	×	◉ ◉ ○	○ ◉ ◉	◉ ◉ ●	◉ ◉ ●	○ ◉ ●	◉ ● ◉	● ◉ ◉	● ◉ ○	● ● ◉	●	◉	○
Hot In-place Recycling Surf Recycle/HMAOL Remixing/HMAOL Repaving	70-85 60-75 60-75	5-8 7-12 7-12	○ ◉ ● × ○ ○ × ○ ○	○ ○ ○	○ ◉ ◉	◉ ● ◉ × ○ ◉ × ○ ◉	○ × ×	◉ ◉ ○ ◉ ● ◉ ◉ ● ◉	● ◉ ○ ◉ ● ◉ ◉ ● ◉	○ ◉ ● ◉ ● ◉ ◉ ● ◉	○ ◉ ● ◉ ● ◉ ◉ ● ◉	◉ ◉ ○ ◉ ● ◉ ◉ ● ◉	◉ ● ◉ ◉ ● ◉ ◉ ● ◉	◉ ◉ ○ ◉ ● ● ◉ ● ●	◉ ◉ ○ ○ ◉ ● ○ ◉ ●	◉ ◉ ○ ○ ◉ ● ○ ◉ ●	◉ ● ●	◉ ◉ ◉	○ ○ ○
Cold In-place Recycling and HMAOL	60-75	7-12	× × ○	○	○	× ○ ◉	×	◉ ● ◉	◉ ● ◉	◉ ● ◉	◉ ● ◉	◉ ● ◉	◉ ● ●	◉ ● ●	○ ◉ ●	○ ◉ ◉	●	◉	○
Profile Milling	80-90	3-6	○ ◉ ◉	◉	○	× ○ ○	×	× × ×	× × ×	× × ×	× × ×	× × ×	● ◉ ○	○ × ×	◉ ◉ ○*	◉ ◉ ○*	◉	○	×
Ultra-Thin Whitetopping	60-80	6-12	× × ○	○	◉	× ○ ◉	×	○ ◉ ◉	○ ◉ ◉	○ ◉ ◉	○ ◉ ◉	○ ◉ ●	○ ◉ ◉	○ ◉ ◉	× ○ ○	○ ◉ ◉	◉	○	×

● Highly Recommended ◉ Generally Recommended ○ Provisionally Recommended × Not Recommended

*. Porous surface mix problem.

*. Rutting primarily confined to HMA surface layer and largely continuous in extent.

*. Corrugation/shoving primarily HMA surface layer mix problem and frequent in extent.

*. For composite AC/PCC pavements, a more probable window of opportunity is 2-4 years for crack filling and 1-3 years for crack sealing.

*. Localised application in the case of bumps.

Feasibility Matrix – PCC

Preservation Treatment	Window Of Opportunity		Distress Types and Severity Levels (L=Low Severity, M=Medium Severity, H=High Severity)													Surface Characteristics Issues		
			Surface Distress					Joint Distress		Cracking Distress		Deformation Distress						
			Polish	Map Crack/Scale (non-ASR)	D-Crack	Popouts	Water Bleed/Pump	Joint Seal Damage	Joint Spall	Corner	Long/ Trans	Faulting	Patches	Ride Quality	Friction	Noise
	PCI/ PCR	Age, yrs	—	—	L/M/H	—	—	L/M/H	L/M/H	L/M/H	L/M/H	L/M/H	L/M/H	—	—	—
Concrete Joint Resealing	75-90	5-10						○◉●	○××							
Concrete Crack Sealing	70-90	5-12								●◉○	●◉○					
Diamond Grinding	70-90	5-12	●	◉	×××	×	×	×××	×××	×××	××○[a]	◉●◉	◉●◉	●	◉	●
Diamond Grooving	70-90	5-12	○	×	×××	×	×	×××	×××	×××	×××	×××	×××	×	◉	●
Partial-depth Concrete Patching	65-85	6-15	×	○	×××	◉	×	×××	◉●●	×××	×○◉	×××	○◉○	×	×	×
Full-depth Concrete Patching	65-85	6-15	×	○	○◉●[b]	×	◉	×××	×○◉	◉●●	××○	×○◉[c]	○◉●	◉	×	×
Dowel Bar Retrofitting	65-85	6-15	×	×	×××	×	◉	×××	×××	×○○	×××	○◉●[d]	×××	×	×	×
Ultra-Thin Bonded Wearing Course	70-90	5-12	◉	●	◉○×	○	×	×××	×××	○××	○◉○	◉○×	◉●◉	●	●	◉
Thin HMA Overlay	70-90	5-12	◉	●	◉○×	○	×	×××	×××	○××	○◉○	◉○×	◉●◉	●	●	●

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[a] May be appropriate in conjunction with partial- and/or full-depth repairs to ensure smooth profile.
[b] Isolated incidences of D-cracking only.
[c] Isolated incidences of faulting only.
[d] Likely needed in conjunction with diamond grinding.

Secondary Selection – Bituminous

Preservation Treatment	Treatment Durability								Work Zone Duration Restrictions			Expected Performance on High Volume Facility, yrs	Relative Cost
	Rural Roads				Urban Roads				Overnight or Single-Shift	Weekend	Longer		
	High Traffic ADT > 5,000 vpd	Climatic Zone			High Traffic ADT > 10,000 vpd	Climatic Zone							
		Deep-Freeze	Moderate-Freeze	Non-Freeze		Deep-Freeze	Moderate-Freeze	Non-Freeze					
Crack Fill	●	●	●	●	●	●	●	●	●			2-3	$
Crack Seal	●	●	●	●	●	●	●	●	●			2-6	$
Slurry Seal (Type III)	○	×	◉	◉	○	×	◉	◉	●			3-5	$$
Microsurfacing-Single	◉	◉	●	◉	◉	◉	●	◉	●			3-5	$$
Microsurfacing-Double	◉	◉	●	◉	◉	◉	●	◉	●			4-6	$$ $$$
Chip Seal-Single Conventional Polymer-modified	◉	●	◉	◉	◉	◉	◉	◉	●			4-6	$$ $$$
Chip Seal-Double Conventional Polymer-modified	◉	●	◉	◉	◉	◉	◉	◉	●			6-8	$$ $$$ $$$
Ultra-Thin Bonded Wearing Course	◉	◉	●	◉	◉	◉	●	◉	●			5-8	$$$
Ultra-Thin HMAOL	○	○	◉	×	◉	◉	●	○	●			4-7	$$
Thin HMAOL	●	●	●	◉	●	●	●	◉	●			5-10	$$$
Cold Milling and Thin HMAOL	●	●	●	◉	●	●	●	●	●			6-11	$$$
Hot In-place Recycling Surf Recycle and HMAOL Remixing and HMAOL Repaving	○	○	○	×	○	○	◉	○	●			5-8 6-12 6-12	$$$ $$$ $$$
Cold In-place Recycling and HMAOL	◉	◉	◉	○	◉	◉	◉	◉	●			5-11	$$$
Profile Milling	◉	○	◉	◉	◉	○	●	◉	●			2-4	$
Ultra-Thin Whitetopping	○	○	○	○	○	○	◉	○	×	○	◉	NA	$$$$

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$ (lowest relative cost) ↔ $$$$ (highest relative cost)

Secondary Selection – PCC

Preservation Treatment	Treatment Durability								Work Zone Duration Restriction:			Expected Performance on High Volume Facility, yrs	Relative Cost
	Rural Roads				Urban Roads				Overnight or Single-Shift	Weekend	Longer		
	High Traffic ADT > 5,000 vpd	Climatic Zone			High Traffic ADT > 10,000 vpd	Climatic Zone							
		Deep-Freeze	Moderate-Freeze	Non-Freeze		Deep-Freeze	Moderate-Freeze	Non-Freeze					
Concrete Joint Resealing	●	◉	●	●	●	●	●	●	●			4-7	$
Concrete Crack Sealing	●	◉	●	●	●	◉	●	●	●			4-6	$
Diamond Grinding	●	◉	●	●	●	◉	●	●	●			6-12	$$
Diamond Grooving	◉	×	◉	×	●	×	◉	◉	●			6-12	$$
Partial-depth Patching	●	●	●	●	◉	◉	●	●	●[1]	●[1]	●	5-15	$$ $$$
Full-depth Patching	●	●	●	●	●	●	●	●	●[1]	●[1]	●	10-15	$$ $$$
Dowel Bar Retrofitting	◉	●	●	●	◉	◉	◉	●	●[1]	●[1]	●	10-15	$$$
Ultra-Thin Bonded Wearing Course	○	◉	◉	×	◉	×	◉	◉	●			5-7	$$$
Thin HMA Overlay	○	×	●	×	◉	×	◉	◉	●			5-8	$$$

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$ (lowest relative cost) ↔ $$$$ (highest relative cost)

[1] Use of high early strength or fast-track proprietary materials make these treatments suitable options for overnight, single-shift, and weekend closures. Use of conventional PCC repair materials generally require "longer" closures.

Implementation Overview

- Funded by FHWA and supported by FHWA and AASHTO
- Selected agencies
- Other implementation activities

Funded Agencies

- Pennsylvania
- Arizona
- Tennessee
- Kentucky
- Maine
- Wisconsin
- Washington
- Delaware
- Georgia
- Rhode Island
- Missouri
- Minnesota
- Massachusetts
- D.C.

Other Implementation Activities (1)

- Quarterly User Group calls
- Outreach
  - Workshops (AL, AZ, DE)
  - Showcases (MA… on Thursday)
  - Peer Exchanges (RI)

Other Implementation Activities (2)

- Tools
  - Data collection guide
  - Field guide
  - Others

Implementation Future

- Additional funding available in Round 7
- IPW in August to discuss possible uses of funding
- Case studies

All implementation efforts aimed at the ultimate goal…

Thank You!

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