Tech Brief

U.S. Department of Transportation
Federal Highway Administration

PAVEMENT PRESERVATION HOW

The fourth round of Every Day Counts (EDC-4) innovations promoted quality construction and materials practices that apply to both flexible and rigid pavements. For flexible pavements, these include using improved specifications for thin asphalt surfacings such as chip seals, scrub seals, slurry seals, micro surfacing, and ultrathin bonded wearing courses; following improved construction practices; and using the right equipment to place these treatments. Rigid pavement treatments include the rapid retrofitting of dowel bars to reduce future faulting; the use of new, fast-setting partial- and full-depth patching materials to create a long-lasting surface; advanced pavement removal techniques to accelerate patching construction times; and advancements in diamond grinding that contribute to smoother and quieter pavement surfaces with enhanced friction.

BACKGROUND

Regional peer-to-peer exchanges between states were initiated to exchange knowledge on "How" to effectively implement pavement preservation. Adoption of a comprehensive pavement preservation program will ultimately result in an improved pavement condition and safety rating for the overall network, reduced agency and user delay costs, and decreased environmental impact. In order to achieve these objectives, an understanding of the concepts, capabilities, and applications relevant to constructing pavement preservation treatments with quality materials must be implemented via a technology program aimed at transportation agencies, contractors, consultants, and Federal Highway Administration (FHWA) staff.

PAVEMENT PRESERVATION HOW: LOUISIANA, MISSISSIPPI, AND ARKANSAS

EDC-4 PEER-TO-PEER EXCHANGES

INTRODUCTION

On December 11th, 2018, an FHWA-sponsored EDC-4 "How" Pavement Preservation State Peer-to-Peer Exchange was conducted in Baton Rouge, Louisiana, with 3 FHWA representatives; 17 department of transportation (DOT) representatives from Louisiana, 3 from Mississippi, and 2 from Arkansas; and 1 local agency representative. Larry Galehouse with the National Center for Pavement Preservation and Larry Scofield with the International Grooving & Grinding Association and American Concrete Pavement Association facilitated the day-and-a-half-long meeting. Louisiana was the host state and provided meeting room facilities. Larry Galehouse provided the meeting background and kicked off the meeting.

The meeting format consisted of each of the states identifying their current procedures, issues, and successes for each of the topics discussed. Table 1 indicates the discussion topics.

Table 1. List of pavement preservation treatments discussed

Asphalt pavement preservation treatments	Concrete pavement preservation treatments
Chip seal	Partial-depth repair
Micro surfacing	Dowel bar retrofit
High-friction surface treatments (HFST)	Joint sealing
Open-graded friction course (OGFC)	Full-depth repair
Rejuvenators	Slab stabilization
Crack seal	—
Scrub seal	—
Cape seal	—

SUMMARY OF IMPORTANT ISSUES OR SUCCESSES

Asphalt Concrete Pavement Preservation

Chip sealing: All three states have successful chip seal programs on roadways with average daily traffic (ADT) counts ranging from 900 to 7,000. Both emulsion and hot-applied chip seals are used.

Excessive percentages of material passing the #200 sieve (P200s) have been the biggest issue in this region, with all three states trying to reduce the P200 limit to 1.5%. Better performing chip seals result from lower amounts of P200s because the chips are cleaner and bond better.

Chip seals are placed using both in-house maintenance and contracted workforces. Project selection can be an issue because some projects are too far deteriorated to be preserved with this treatment. Fog seals are beginning to be more regularly used in some states. The number of required rollers ranges between unspecified and three, and both pneumatic and steel-wheeled rollers are used, with different equipment requirements among the three states.

Sweeping typically consists of an initial light brooming before opening to traffic, with a heavy brooming on the following day.

Distributor trucks are commonly calibrated before application. Two of the states use seasonal limitations on when the treatment can be applied. See Table 2.

Micro surfacing: This treatment is not widely used in this area because of previous poor performance due to specification issues, polishing of the surface, and rutting after application as a rut filler. There appears to be renewed interest in micro surfacing, but old failures are still remembered. A district in one state has had positive experience with the treatment, while one state cannot get contractors to bid on micro surfacing projects. See Table 3.

High-friction surface treatments (HFST): All three states have used HFSTs. When this surface treatment experiences failures, it is usually a result of debonding or delamination of the HFST or the underlying asphalt concrete (AC). This appears to be a result of moisture. However, HFSTs placed over chip seals have also debonded as a result of the chip seal softening and itself debonding from the underlying asphalt surface. One state shot blasts before HFST installation and is considering NovaChip and thin bonded overlays as alternative treatments. Another state waits 30 days before installing an HSFT on new ACs. See Table 4.

Table 2. Chip sealing

State	Design		Material type				Construction procedures						
	Design procedure	Maximum ADT	Aggregate	Binder	Top size	P200	Aggregate rate	Binder rate	Rollers	Sweeping	Fog seal	Stripe pretreatment	Pilot vehicle
Louisiana	No, standard specs	7,000	See Section 1003.07 and Table 1003-15	Emulsion and hot applied	1 in.	Size 1 and 1A: 0%–1%; Sizes 2 and 3: 0%	Tables 507-1 and 507-2	Tables 507-1 and 507-2	Minimum of three pneumatic	Before opening to traffic	Not an option in all districts	NA	Contractor option
Arkansas	No, standard specs	NA	Refer to Table 403	Asphalt binder furnished shall conform to the requirements of AASHTO M 320 Table 1, except the direct tension requirement is deleted.	Refer to Table 403	1.5%	See chart in Section 402.06c	By engineer	One pneumatic and one steel	First day, and then again at 24 hours	Just started doing	NA	Contractor option
Mississippi	No, standard specs	1,000	Limestone	CRS-2P	No. 7	1.5%	Size 7 slag, stone, gravel, or expanded clay: 0.30 ± 0.02 ft^3/yd2; Size 8 expanded clay: 0.25 ± 0.02 ft^3/yd^2; Size 89 slag, stone, or gravel: 0.25 ± 0.02 ft^3/yd^2	Size No. 7 aggregate, AC material: 0.28 gal/yd^2; Size No. 8 or 89, AC material: 0.23 gal/yd^2; Size No. 7, emulsified asphalt: 0.38 gal/yd^2; Size No. 8 or 89, emulsified asphalt: 0.35 gal/yd^2	Not specified	First day, and then again at 24 hours	Up to the districts, not typically done	NA	Contractor option

Table 3. Micro surfacing

State	Design method	Material type				Construction procedures						
		Aggregate	Binder	Type	Cement	Application rate	Crack seal in advance	Tack in advance	Sweeping in advance	Test section	Number of courses	Calibration verification
Louisiana	NA	NA	NA	NA	NA	NA	NA	No	Yes	NA	1 & 2	NA
Arkansas	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mississippi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 4. High-friction surface treatments

State	Design		Material type			Construction procedures	
	Design procedure	Maximum ADT	Aggregate	Binder	Top size	Aggregate rate	Epoxy rate
Louisiana	NA	NA	NA	NA	NA	NA	NA
Arkansas	NA	NA	NA	NA	NA	NA	NA
Mississippi	NA	NA	NA	NA	NA	NA	NA

Open-graded friction course (OGFC): Two of the states require this treatment as the wearing course on Interstates. This treatment is placed with conventional pavers, and spray pavers are not required. One state fog seals the OGFC periodically as a maintenance activity, while another state does not. Fog seals are conducted to improve the durability of the OGFC, but some states are concerned that fog sealing will eventually clog up the OGFC, preventing it from performing as intended. OGFCs are placed at a thickness of 3/4 to 1 in. See Table 5.

Rejuvenators: All three states have limited to no experience with this technology. One state just recently placed a test section with a proprietary product.

Crack sealing: Two of the states do not crack seal because they believe doing so traps water in the pavement, accelerating stripping of the asphalt, which is an issue in this region, and causing raveling at the cracks. One state prefers scrub seals because its pavements exhibit too much distress to use crack sealing techniques. In short, this treatment is not widely used in the region. The use of contractor or maintenance forces for crack sealing application varies among the states. See Table 6.

Scrub sealing: Two of the states use this technology and one does not. Of the two that use it, one state is still developing a selection criterion as to when to place it and currently avoids areas with fatigue cracking. The third state has been using scrub seals as its major preservation treatment in the last several years due to extensive cracking in the state's pavements. The work is contracted out. Both states that use scrub seals have seen very good performance with this treatment. Some districts patch before placement, and they do not blow out the cracks in advance. See Table 7.

Cape sealing: This technology has seen only limited use in these states. One state does not use it, another just placed its first cape seal test section, and the third state used it several years ago but not recently, though the treatment appears to be performing well.

Concrete Pavement Preservation

Partial-depth repair: There is very little use of this treatment among these states, but when it is employed, elastomeric products are typically used. There is very little concrete in these states to warrant the need for this treatment. See Table 8.

Table 5. Open-graded friction course

State	Design method	Material type		Construction procedures				
		Aggregate type	Binder type	Crack seal in advance	Spray paver	Tack coat	Thickness	Used as interlayer
Louisiana	Submit JMF	See Table 502-3 for aggregate friction	PG 76-22m	NA	No	Polymer emulsion tack (PET) or SS-1L per Section 503.	¾–1 in.	NA
Arkansas	NA	NA	NA	NA	NA	NA	NA	NA
Mississippi	Submit job mix formula, see Section 402.02.3.2	See Sections 703 and 403.02.1.2.2. No natural sand.	PG 76-22	NA	No	Yes	1 in.	NA

Table 6. Crack sealing

State	Sealant type			Crack preparation			Installation procedures				
	Hot pour	Mastic	Other	Route cracks	Air-blow cracks	Vacuum cracks	Temperature requirements	Overband	Flush fill	Detackifier	Workforce
Louisiana	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arkansas	NA	NA	NA	NA	Yes	NA	Apply at 50°F–100°F	NA	Yes	NA	Maint.
Mississippi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 7. Scrub sealing

State	Material type			Construction procedures					
	Emulsion spec	Aggregate type	Binder type	Crack seal in advance	Blow out cracks in advance	Binder rate	Fog seal	Commerical broom	Contract work
Louisiana	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arkansas	NA	NA	NA	NA	Yes	NA	NA	NA	Only one project as demo
Mississippi	NA	NA	CRS-2P	Yes	No	NA	NA	NA	Contract work

Table 8. Partial-depth repair

State	Distress type		Design		Construction practices					
	Materials-related distress	Spall repair	Repair material specs	Coring in advance	Defining patch limits	Use of milling equipment	Repair materials	Bonding agent	Grouting edges	Warranty
Louisiana	Settlement	No	Yes	NA	Yes	No	Elastomeric	No	No	No
Arkansas	ASR	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mississippi	No	Yes	NA	NA	NA	No	Elastomeric	No	No	No

Table 9. Slab stabilization

State	Design		Construction practices			
	Void filling	Slab jacking	Polyurethane	Bituminous	Bridge repair	Pavement repair
Louisiana	NA	Yes	Yes	Cement	Yes	NA
Arkansas	Yes	Yes	NA	NA	NA	Yes
Mississippi	NA	NA	NA	NA	Yes	Yes

Dowel bar retrofit: There is very little use of this technique due to the limited amount of concrete pavement in these states. It was used a long time ago, but with mixed success.

Joint sealing: There is little use of this technique due to the limited amount of concrete pavement in these states. One state noted that vegetation begins to grow up through the joints within six months on new concrete pavements. Joint resealing is not considered.

Full-depth repair: Most concrete repair is full-depth slab repair, but it is not commonly done due to the limited amount of concrete pavement in these states.

Slab stabilization: One state has used this technique very successfully on both bridge approaches and pavements. One state is not allowed to use it because of an FHWA ban on the treatment resulting from quantity overruns. The third state has successfully used it on bridge approaches. Some negative historical experiences were related, including a case of joint lock up that subsequently caused blow ups and attempts to fix faulting using slab jacking instead of dowel bar retrofit. See Table 9.

KEY OBSERVATIONS

During this peer-to-peer exchange meeting, agency personnel representing three state agencies and one local agency identified and discussed their pavement preservation successes and challenges.

Preservation Successes

- Reducing the amount of P200s in the chip seal gradation results in better performing chip seals because the aggregate is cleaner and bonds better.
- HFSTs have been successfully used for accident reduction.
- OGFCs have successfully been used on Interstates in this region.

Preservation Challenges

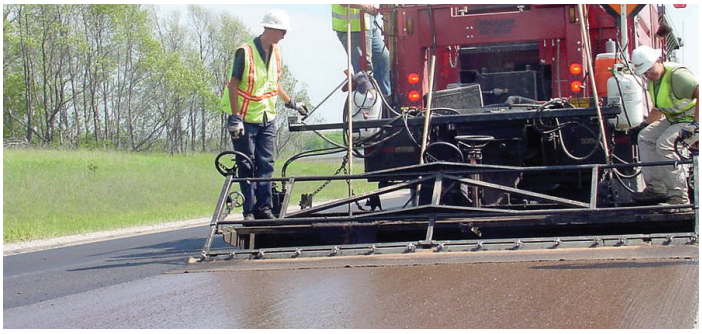
- Chip seals are typically designed according to standard specifications.
- Finding local contractors willing to bid on some treatment alternatives such as micro surfacing can be difficult.
- When HFSTs do not perform as expected, it is typically a result of debonding or delamination of the HFST or the underlying AC.
- Selecting and constructing the appropriate treatment before excessive deterioration occurs can be an issue.
- It was clear that only a limited number of preservation treatments were successfully being used for either AC or concrete pavements.

SUMMARY

Eight asphalt and five concrete pavement preservation treatments were discussed in depth (see Figures 1–13). Chip sealing is the primary AC preservation treatment used by all three states, and all three states also use HFST for accident reduction where needed. Most other AC and concrete preservation treatments only see limited use.

Slurry Pavers, Inc.

Figure 1. Chip sealing



National Center for Pavement Preservation

Figure 2. Micro surfacing

Kwik Bond Polymers

Figure 3. High-friction surface treatment

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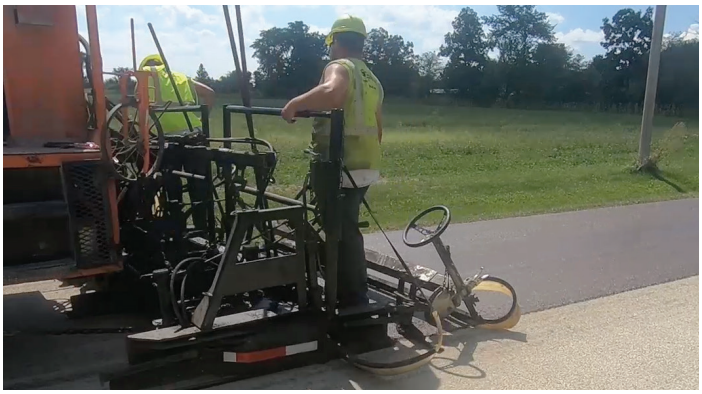
Tom Kuennen

Figure 4. Open-graded friction course



Strawser Construction Inc.

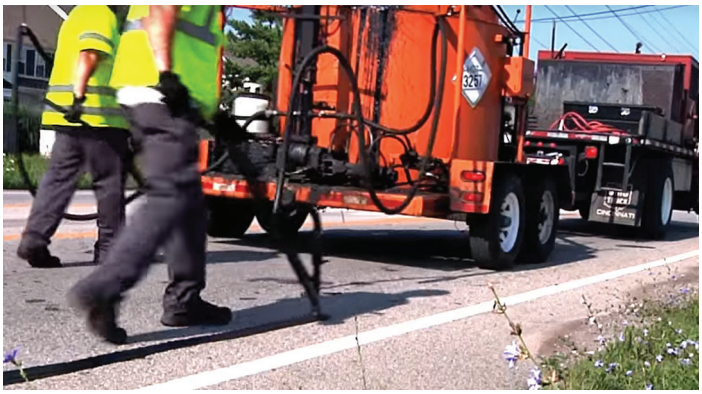
Figure 8. Cape sealing

Pavetech Incorporated

Figure 5. Rejuvenators

ACPA

Figure 9. Partial-depth repair

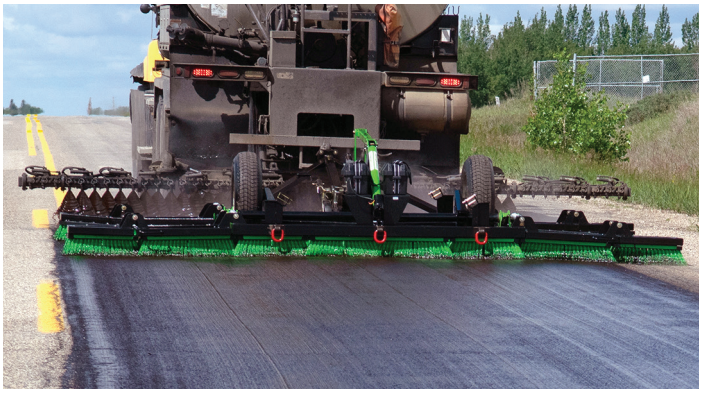


National Center for Pavement Preservation

Figure 6. Crack sealing

ACPA

Figure 10. Dowel bar retrofit



Saskatchewan Ministry of Highways and Infrastructure

Figure 7. Scrub sealing

Dow Corning

Figure 11. Joint sealing

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DISTRIBUTION AND AVAILABILITY
This tech brief can be found at https://www.fhwa.dot.gov/pavement/preservation/.

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ACPA, used with permission

Figure 12. Full-depth repair

International Grooving and Grinding Association, used with permission

Figure 13. Slab stabilization

AGENCY SPECIFICATIONS

The relevant agency specifications are available at the following websites:

Louisiana: http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/Standard_Specifications/Pages/Standard%20Specifications.aspx

Mississippi: http://sp.mdot.ms.gov/Construction/Pages/Standard%20Specifications.aspx

Arkansas: https://www.arkansashighways.com/standard_specifications.aspx

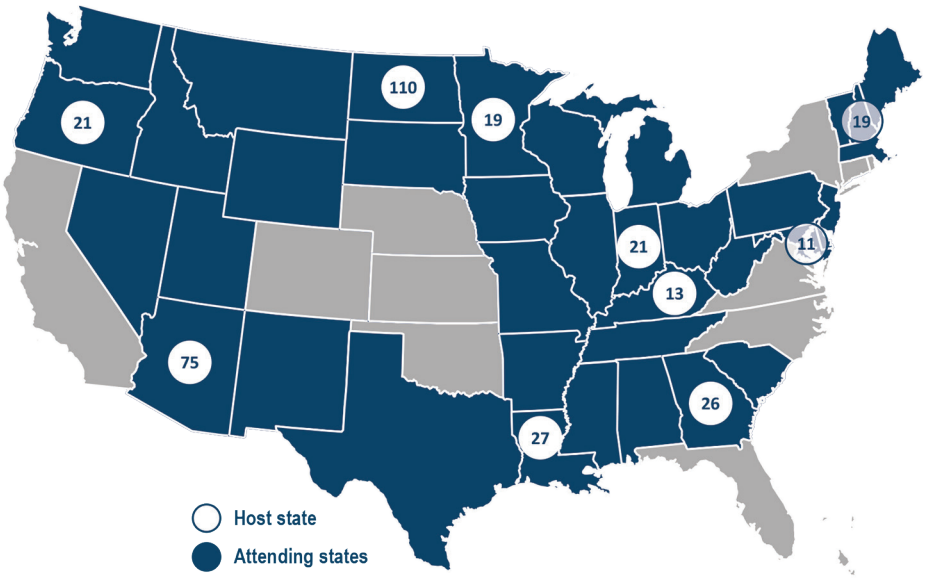
ONLINE RESOURCES

National Center for Pavement Preservation (https://www.pavementpreservation.org/)

National Concrete Pavement Technology Center (https://cptechcenter.org/)

Federal Highway Administration (https://www.fhwa.dot.gov/pavement/preservation/)

Pavement Preservation & Recycling Alliance (https://roadresource.org/)



Host state	AZ	DE	GA	IN	KY	LA	MN	NH	ND	OR
Attending states	NM	MD	AL	IL	TN	AR	IA	ME	MT	ID
	TX	NJ	SC	OH	WV	MS	MO	MA	SD	NV
	UT	PA	—	MI	—	—	WI	VT	WY	WA
Number of attendees	75	11	26	21	13	27	19	19	110	21

Regional state peer-to-peer exchanges were held in 10 states with 342 total attendees from 37 states