

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: GEORGIA, ALABAMA, AND SOUTH CAROLINA EDC-4 PEER-TO-PEER EXCHANGES

INTRODUCTION

On May 6th, 2019, an FHWA-sponsored EDC-4 “How” Pavement Preservation State Peer-to-Peer Exchange was conducted in Macon, Georgia, with 1 FHWA representative and 20 department of transportation (DOT) representatives from Georgia, 2 from Alabama, 2 from South Carolina, and an observer from Puerto Rico. 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. Georgia was the host state and provided meeting room facilities. Luis Rodriguez of the FHWA 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
Ultrathin bonded wearing course	Dowel bar retrofit
Hot in-place recycling (HIR)	Diamond grinding
Cold in-place recycling (CIR)	—
Micro surfacing	—
Crack seal	—
Chip seal	—
Thin hot-mix asphalt (HMA) overlays	—
Scrub seal	—
Cape seal	—

SUMMARY OF IMPORTANT ISSUES OR SUCCESSES

Asphalt Concrete Pavement Preservation

Ultrathin bonded wearing course: This treatment is not commonly used in these three states, and experience with the treatment has been limited. With limestone aggregates, it was noted that stripping could be an issue, particularly under bridges where the limestone cannot dry out.

Hot in-place recycling (HIR): This treatment is not commonly used in these states, but all three states expressed interest in the treatment. A couple of the states have developed specifications, but the treatment is not yet in the preservation toolbox.

Cold in-place recycling (CIR): This treatment is not commonly used in these three states. Again, the states expressed interest, but nothing regarding this treatment is actively being developed.

Micro surfacing: All three states have used this treatment with varying degrees of success. The importance of equipment calibration was discussed, with one state noting that it conducts a complete calibration at the start of a project with daily calibration of the electronics thereafter. Another state calibrates its equipment using a test strip, evaluates the strip, and then only recalibrates if a problem is found or if there is a mix design change.

One state is significantly increasing its use of this treatment. Equipment issues and calibration issues were the biggest concerns. It was recommended to tack before application of micro surfacing. It was also noted that a good practice is to seal cracks well in advance of treatment (maybe one year). See Table 2.

Crack sealing: All three states use this treatment as part of their preservation programs. Cracks $\frac{1}{8}$ to $\frac{1}{4}$ in. and wider are typically sealed with hot pour in a flush fill configuration.

The states typically just air blow the cracks without routing. Only one state uses routing, with mastic as the filler for very wide cracks. The Georgia Institute of Technology (Georgia Tech) has a five-year crack sealing research project underway that is in its third year. See Table 3.

Chip sealing: All three states use this preservation treatment. CRS-2P is the most common binder, and the use of pilot vehicles and reduced speed limits (25 mph) are the most common traffic management procedures. Both the distributor trucks and chip boxes are calibrated at the start of the project. Two of the states use lightweight aggregate to prevent property damage. Three to four rollers are typically used and vary between pneumatic tire and steel wheel. Rolling patterns are either specified or established through field testing. Only one state fog seals after chip placement. See Table 4.

Table 2. 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
Georgia	See Table 1 (Section 428)	Group II, Class A or B crushed stone or slag, sand equivalent value ≥ 65 (AASHTO T 176) per Section 428	NA	NA	CSS-1h(LRA) or CSS-1P, See Section 824	15–25 lb/yd ²	Yes, 1 year	Yes	Yes	Yes	2	Yes
South Carolina	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Yes
Alabama	See Table 1 (Section 403)	See Section 403.02(a)	NA	NA	CQS-1hp per Section 804 or CSS-1h per Sections 804 and 811	NA	NA	NA	Clean surface, sweeping not specified	Yes, 1,000 ft	NA	Yes

Table 3. 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
Georgia	Yes	NA	NA	NA	Yes	NA	Yes, must be $\geq 35^{\circ}\text{F}$	Yes	No	NA	Contractor for interstate, in-house for all others
South Carolina	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Contract
Alabama	NA	NA	NA	No	Yes	No	NA	No	Yes	Unknown	NA

Table 4. 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
Georgia	See Section 424: Table 1	NA	Vitrified shale	CRS-2H	See Section 424: Table 1	NA	#89: 0.14–0.18 ft ³ /yd ² #7: 0.18–0.26 ft ³ /yd ² #6: 0.30–0.42 ft ³ /yd ²	0.25–0.28 gal/yd ²	3	Next day	Yes	NA	Yes
South Carolina	See Section 406.2	NA	Crushed stone, crushed gravel, or crushed slag	CRS-2P	Nominal $\frac{1}{2}$ in.	0%	No. 789: 15–20 lb/yd ² No. 89M: 12–15 lb/yd ² Lightweight: 6–12 lb/yd ²	0.28–0.35 gal/yd ²	3	Before opening to traffic	No	NA	Yes, 25 mph
Alabama	See Section 401.01(b) Bituminous Surface Treatments	NA	Lightweight	CRS-2P	See Section 401.01(b) Bituminous Surface Treatments	NA	See Section 401.01(b) Bituminous Surface Treatments	See Section 401.01(b) Bituminous Surface Treatments	3–4	Clean surface, sweeping not specified	No	NA	Yes

Thin hot-mix asphalt (HMA) overlays: One state does not use this treatment as part of its stewardship agreement but rather places an open-graded friction course (OGFC) as part of construction projects. Another state uses 4.75 mm Superpave mixes, and the third states uses bituminous surface treatments. Thicknesses range from ½ to 2 in. depending on the state and overlay type. Overlays are placed over chips seals in one state so that the chip seal provides a reflective crack barrier. Tack was discussed as a construction issue by the states and was identified as needing improvement. See Table 5.

Scrub sealing: Two states commonly use this treatment, and one has not used it. It was noted that because surface absorption varies throughout a project, there is a need to monitor application and adjust to changing surface conditions. The state with the largest number of scrub seal applications does not blow out the cracks in advance, nor does it seal the cracks. It was noted that, with this practice, the bigger cracks reflect through while the smaller cracks are sealed by the treatment. That state also uses different shot rates and chip sizes for different distress levels. Each surface absorbs emulsion differently, and it is important to monitor, evaluate, and modify the application rate when necessary.

Cape sealing: Two of the three states use this treatment. It was noted that environmental conditions can affect

treatment success. One state uses larger aggregates for the scrub seal and caps it with an overlay because the state is concerned that if a micro surface is used as a cap, it may drag the larger stones from the scrub seal. That state also does not place scrub seals or chip seals when the humidity is 80% or above. The other state uses cape seals in a limited capacity, and when it does so it places a scrub seal followed by a micro surface. See Table 6.

Concrete Pavement Preservation

Dowel bar retrofit: This treatment is seldom used in these three states. One state has very few concrete pavements, another has only jointed plain concrete pavements, and the third had a bad experience with the treatment on a project many years ago and has never tried it again. Dowel bar retrofit has been used in Puerto Rico since as early as 1984 and is still in use there today.

Diamond grinding: Two of the states rarely use this treatment, and one uses it frequently. Its frequency of use in a given state can be a function of how much concrete pavement the state has and if the state uses dowels. The state that frequently uses this treatment has found that it successfully removes faulting and restores ride quality. See Table 7.

Table 5. Thin hot-mix asphalt overlays

State	Design method	Material type		Construction procedures			
		Aggregate type	Binder type	Crack seal in advance	Spray paver	Tack coat	Thickness
Georgia	NA	NA	NA	NA	No	NA	¾ in.
South Carolina	NA	NA	NA	NA	NA	NA	¾–1¼ in.
Alabama	NA	NA	NA	NA	NA	NA	NA

Table 6. Cape sealing

State	Design method	Material type		Construction procedures						
		Aggregate type	Binder type	Chip seal top size	Chip spread rate	Chip binder rate	Surface type	Delay between layers	Marking problems	Rumble strip issues
Georgia	NA	NA	NA	89 stone	NA	NA	NA	24–48 hours	NA	NA
South Carolina	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Alabama	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 7. Diamond grinding

State	Purpose of grinding				Construction practices			
	Ride quality	Friction	Noise	Buried treasure	Blades per foot	Head width	Smoothness spec	Construction issues
Georgia	Yes	NA	NA	NA	57–60	Minimum 3 ft wide	Looking at percent improvement	NA
South Carolina	NA	NA	NA	NA	NA	NA	NA	NA
Alabama	Yes	NA	NA	NA	NA	NA	ALDOT-448	NA

Miscellaneous

The Georgia Department of Transportation, through Georgia Tech, has developed an app-based inspector training and checklist system. This work is in beta testing and should soon be in the public domain. A short demonstration of this technology was provided at the meeting, and it looks very promising.

KEY OBSERVATIONS

During this peer-to-peer exchange meeting, personnel representing agencies in three states and Puerto Rico identified and discussed their pavement preservation successes and challenges.

Preservation Successes

- Crack sealing is the first line of defense in the preservation program.
- When applying scrub seals, the use of different shot rates and chip sizes for different distress levels is desirable.
- Web-based inspection training tools are being developed.
- Dedicated crack sealing research is underway.

Preservation Challenges

- Tacking prior to asphalt concrete (AC) overlays was noted as a construction concern.
- Some treatments are more sensitive than others to the existing condition of the surface, and it is necessary to monitor the changing surface conditions and adjust the application as needed.
- It is recommended that scrub seals or chips seals not be placed when the humidity is 80% or above.

SUMMARY

Nine asphalt and two concrete pavement preservation treatments were discussed in depth (see Figures 1–11). All three states use crack sealing, chip seals, and micro surfacing as asphalt preservation treatments. None of the three states use ultrathin bonded wearing course, HIR, or CIR treatments. Two of the three states seldom use either of the concrete preservation treatments discussed, and the third primarily uses diamond grinding with very good success. Training was recognized as an important issue and the reason why Georgia developed their web-based training app. It should also be noted that a five-year crack sealing research project is ongoing at Georgia Tech.



All States Materials Group

Figure 1. Ultrathin bonded wearing course



Pavement Recycling Systems

Figure 3. Cold in-place recycling



National Center for Pavement Preservation

Figure 2. Hot in-place recycling

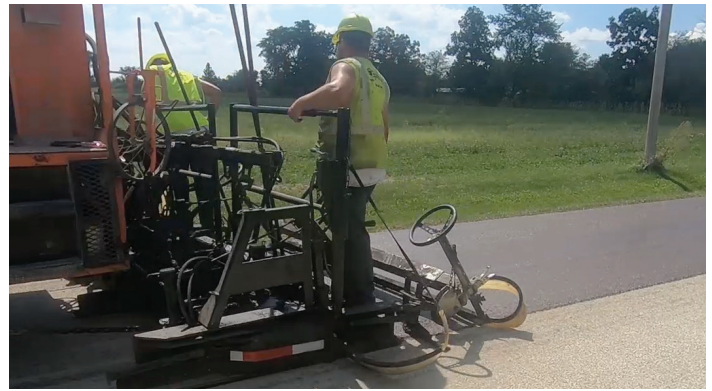


National Center for Pavement Preservation

Figure 4. Micro surfacing



National Center for Pavement Preservation
Figure 5. Crack sealing



Strawser Construction Inc.
Figure 9. Cape sealing



Slurry Pavers, Inc.
Figure 6. Chip sealing



ACPA
Figure 10. Dowel bar retrofit



National Center for Pavement Preservation
Figure 7. Thin hot-mix asphalt overlay



International Grooving and Grinding Association
Figure 11. Diamond grinding



Saskatchewan Ministry of Highways and Infrastructure
Figure 8. Scrub sealing

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This tech brief can be found at <https://www.fhwa.dot.gov/pavement/preservation/>.

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AGENCY SPECIFICATIONS

The relevant agency specifications are available at the following websites:

Georgia: <http://www.dot.ga.gov/PartnerSmart/Business/Source>

Alabama: <https://www.dot.state.al.us/conweb/specifications.html>

South Carolina: <https://www.scdot.org/business/standard-specifications.aspx>

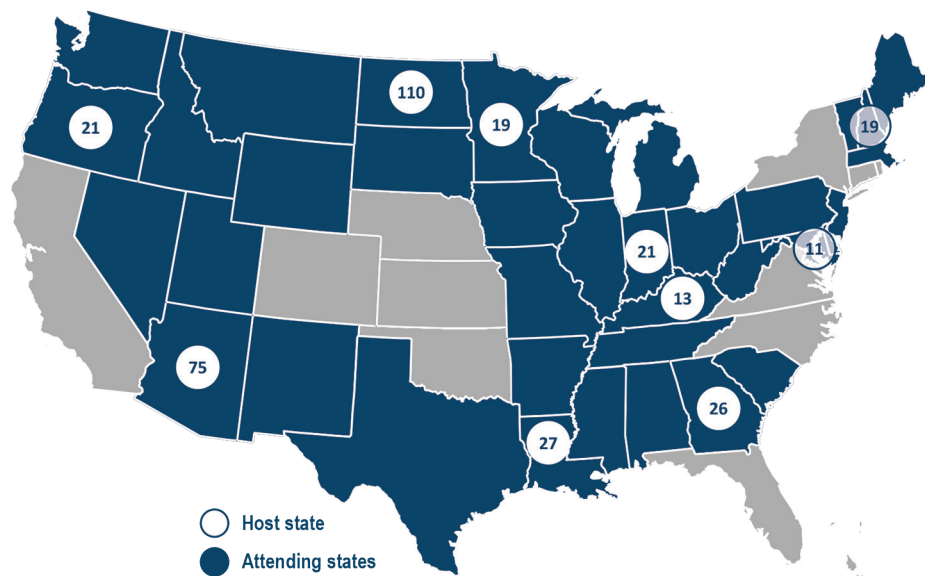
ONLINE RESOURCES

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