

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.

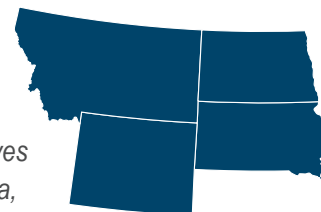
BACKGROUND

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: NORTH DAKOTA, MONTANA, SOUTH DAKOTA, AND WYOMING EDC-4 PEER-TO-PEER EXCHANGES

INTRODUCTION

On December 5th, 2018, an FHWA-sponsored EDC-4 “How” Pavement Preservation State Peer-to-Peer Exchange was conducted in Bismarck, North Dakota, with 13 department of transportation (DOT) representatives from North Dakota, 9 from Montana, 8 from South Dakota, and 2 from Wyoming; 67 attendees from local agencies representing 4 counties and 6 cities; 4 attendees from academia; 6 consultants; and 1 FHWA 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. North Dakota was the host state and provided meeting room facilities at the North Dakota Local Technical Assistance Program (ND LTAP) center. ND LTAP used its remote learning network to broadcast the event to connected agencies, significantly expanding the outreach. Dale Heglund of ND LTAP introduced the attendees, and 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
Crack seal	Partial-depth repair
Micro surfacing	Dowel bar retrofit
Asphalt patching	—
Scrub seal	—

SUMMARY OF IMPORTANT ISSUES OR SUCCESSES

Asphalt Concrete Pavement Preservation

Crack sealing: All four states use this treatment routinely, as do the local agencies. Three of the states route cracks before sealing and one state does not. It was reported that cracks in new asphalt concrete (AC) pavements begin forming between two and five years after construction, and it is important to keep them sealed. One state has a program to seal new pavements three years after construction, while another state has no scheduled program but leaves crack sealing to the districts.

Water penetrating into cracks is a concern because it results in pavement depression/tenting at crack locations. To counter these crack-related distresses, mastic materials and slurry seals are seeing increased use to level the area over the crack. Mastics are also used for cracks wider than $\frac{3}{4}$ in. by one state. Three of the four states sample and test the sealants. One state uses MC-3000 because it believes this material bonds to the sides of the cracks better.

Table 4. Asphalt patching

State	Repair material				Preparation			Installation procedures			
	AC	Mastic	Maintenance recyclers	Spray applied	Cleaned	Air blow	Tack coat	Temperature requirements	Skim patches	Overlay	Contractor or in-house
North Dakota	Yes	NA	Yes	Yes	Dig out and compact	Remove existing broken or unstable surface material	Yes	Temp. <185°F before placing additional material	NA	NA	Maint.
South Dakota	NA	NA	NA	Yes	NA	NA	NA	NA	NA	NA	Maint.
Wyoming	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Montana	Yes	Yes	NA	NA	Yes	Yes	Yes	NA	NA	NA	Maint.

Table 5. 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
North Dakota	NA	NA	NA	NA	NA	NA	NA	NA	NA
South Dakota	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wyoming	NA	NA	NA	NA	NA	NA	NA	NA	NA
Montana	NA	NA	NA	NA	Yes	0.43	Yes	NA	NA

Table 6. 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
North Dakota	NA	Yes	Hot mix	No	NA	No	Hot mix	Yes	NA	NA
South Dakota	NA	Yes	Yes	NA	Yes	Yes	Rapid hardening or MnDOT 3U18	Yes	NA	NA
Wyoming	NA	Yes	Yes	NA	Yes	Yes	DOT horizontal patch material	Yes	NA	NA
Montana	NA	Yes	NA	NA	NA	NA	HP cold patch and easy patch	Yes	NA	NA

Scrub sealing: Two states have used this treatment, but only one uses it regularly. That state indicated that project selection is critical for the success of this application. The state has found the treatment effective for addressing pavement oxidation, alligator cracking, and raveling and targets pavements that exhibit 100 cracks per mile or more. A typical binder application rate is 0.43 gal/yd with an aggregate spread rate of 27 lb/yd². It was recognized that maintaining the proper bow wave in front of the brooms is critical to a successful scrub seal. It was also noted that local agencies use scrub seals more frequently than state agencies. See Table 5.

Concrete Pavement Preservation

Partial-depth repair: Three states conduct partial-depth repairs but are trying to move to full-depth slab replacement when possible due to the better performance of the latter treatment. One state has a limited number of concrete pavements and therefore uses mastic material.

States regularly conducting partial-depth repairs use materials ranging from the Minnesota Department of Transportation's (MnDOT's) 3U18 to HP Concrete Cold Patch. Spall repairs are typically performed by construction contractors, but maintenance crews occasionally perform this repair, and when they do they typically use mastics or Techcrete products. Removal is typically by sawing and jackhammering, with removal by milling only recently being considered. See Table 6.

Dowel bar retrofit: All four states have successfully used this treatment. However, most of the undoweled concrete pavements in these states have already been retrofitted, and there is now limited need for this treatment. One state uses 1¼ in. inch dowels, while another uses 1½ in. dowels. All four states install three dowels per wheel path. The oldest dowel bar retrofit installation for one state was in 1994, and today that pavement is 50 years old. See Table 7.

Table 7. Dowel bar retrofit

State	Design				Construction practices			
	Does state use	Number of dowels	Dowel size	Dowel length	Backfill type	Test strip	Cores retrieved	Cylinders made
North Dakota	Yes	3 per WP	NA	NA	MnDOT 3U18	NA	NA	NA
South Dakota	Yes	3 per WP	1¼ in.	NA	NA	NA	NA	NA
Wyoming	Yes	3 per WP	1½ in.	18 in.	DOT dowel bar retrofit concrete	Contain at least 24 retrofits	Three 6 in. diameter from test section	3 per 300 dowels placed
Montana	Yes	3 per WP	NA	NA	NA	NA	NA	NA

KEY OBSERVATIONS

During this peer-to-peer exchange meeting, agency personnel representing 4 state and 10 local agencies identified and discussed their pavement preservation successes and challenges. The state and local representatives reported the following successes and challenges.

Preservation Successes

- Crack sealing in this region should occur sooner than in other regions, and somewhat aggressive crack sealing programs are maintained.
- Mastics are being used more commonly on wider cracks and as rut filling over cracks.
- Micro surfacing has successfully been used for rut filling, and one state has developed a smoothness specification involving micro surfacing to improve ride quality.
- Mastic and pavement recyclers have successfully been used to patch AC pavements in remote areas that lack access to hot plants. Thin lifts of mastic material have been placed on aggregate bases for AC patch repairs. Commercial pavement recycling equipment allows for wintertime AC patching.
- It was noted that maintaining the proper bow wave in front of the broom is critical to a successful scrub seal.
- The oldest dowel bar retrofit project in this region is 26 years old (for a pavement that is 50 years old) and is still performing satisfactorily.

Preservation Challenges

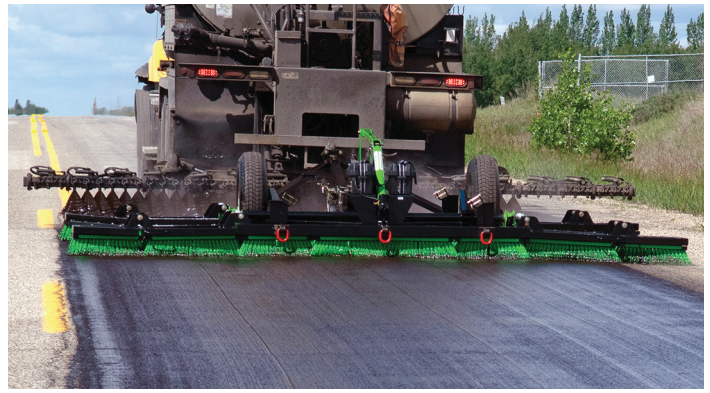
- Tenting and cupping of cracked pavements is a serious concern and contributes to accelerated pavement deterioration and rougher ride quality.
- Cracks reflect through a micro surface rather quickly.
- It is very important to verify that the distributor truck has been calibrated, but this verification is often not done.

SUMMARY

Four asphalt and two concrete pavement preservation treatments were discussed in depth (see Figures 1–6). Crack sealing is the predominate preservation treatment used in this region. Micro surfacing for rut filling applications is the next most commonly used, followed by scrub seals, which are beginning to see consideration and/or use in three of the states in this region. Concrete preservation applications such as dowel bar retrofits or partial-depth repairs are minimally used due to the limited amount of concrete pavement that exists in these states and the fact that most undoweled pavements have already received dowel bar retrofits.



National Center for Pavement Preservation
Figure 1. Crack sealing



Saskatchewan Ministry of Highways and Infrastructure
Figure 4. Scrub sealing



National Center for Pavement Preservation
Figure 2. Micro surfacing



ACPA
Figure 5. Partial-depth repair



City of El Paso
Figure 3. Asphalt patching



ACPA
Figure 6. Dowel bar retrofit

This tech brief was developed under Federal Highway Administration (FHWA) contract DTFH61-13-D-00009.

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DISTRIBUTION AND AVAILABILITY

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

KEY WORDS

pavement, preservation, peer-to-peer

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AGENCY SPECIFICATIONS

The relevant agency specifications are available at the following websites:

North Dakota: <http://www.dot.nd.gov/dotnet/supplspecs/standardspecs.aspx>

Montana: https://www.mdt.mt.gov/business/contracting/standard_specs.shtml

Wyoming: http://www.dot.state.wy.us/home/engineering_technical_programs/manuals_publications/2010_Standard_Specifications.html

South Dakota: <http://www.sddot.com/business/contractors/Specs/default.aspx>

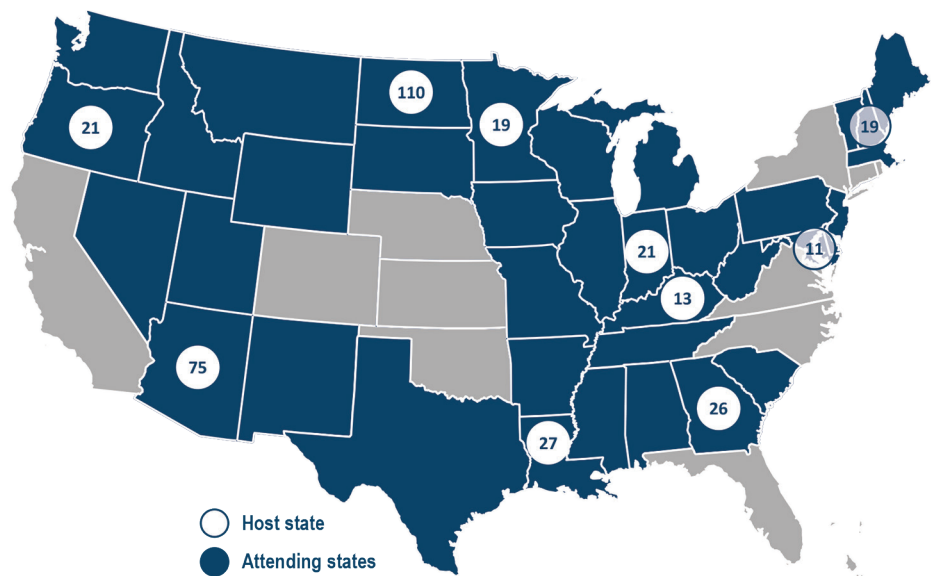
ONLINE RESOURCES

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