



Photo sources: (1) American Concrete Pavement Association; (2) Utah DOT; (3) Applied Pavement Technology, Inc.; (4) National Park Service; (5) Washington State DOT

Pavement Preservation: How Workbook



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This innovation focuses on promoting the practice of applying the right treatment on the right roadway at the right time with quality construction and materials. Pavement Preservation “How” focuses upon quality construction and materials practices of pavement preservation treatments.

Pavements deteriorate as a result of many different forces, but the predominant factors affecting pavement performance are the vehicle loads and environmental elements they are exposed to over their lifetime. Today, most highway agencies accept that an effective pavement preservation program will slow down the rate of pavement deterioration while also providing a safer, smoother ride to the traveling public.

One obstacle to successful pavement preservation is the impact that treatment failures can have on an entire program. Whether it is a failed patch, stone flying off a chip seal, or a microsurfacing that peels off because it did not set, even a single failure and the associated damages can set back an agency's program for many years. However, most early failures can be attributed to a breakdown in some part of the construction process, such as the materials, site preparation, or placement practices, and as such are avoidable.

This EDC effort promotes quality construction and materials practices that apply to both flexible and rigid pavements. For flexible pavements these include asphalt surfacings such as chip seals, scrub seals,

What is Preservation?

Pavement Preservation includes work that is planned and performed to improve or sustain the condition of the transportation facility in a state of good repair. Preservation activities generally do not add capacity or structural value, but do restore the transportation facility's overall condition.

slurry seals, microsurfacing, and ultrathin bonded wearing courses; rigid pavement strategies addressed in this innovation include dowel bar retrofits, partial- and full- depth patching, cross-stitching, and diamond grinding.

By following best practices for materials selection and construction practices, pavement preservation will be less disruptive and safer. Improved construction practices and the associated reduction in construction-related failures allow agencies to continue to use treatments that are proven to be effective, enabling them to realize the benefits of these techniques.

BENEFITS

- **Safety.** The treatments are typically installed in shorter work zones and during off-peak hours, reducing the likelihood of work zone incidents. Improved skid resistance is a key functional benefit of preservation.
- **Performance.** Successful construction practices contribute to improved pavement performance, providing smoother and safer roads and delaying the need for time-consuming and costly rehabilitation.
- **Flexibility.** Retaining a mix of successful treatments in the preservation toolbox provides agencies greater flexibility in placing the right treatment on the right pavement at the right time.
- **Savings.** Improved performance and fewer failures keep a pavement network in a state of good repair at a lower cost.

STATE OF THE PRACTICE

The past 20 years have seen significant advancements in the quality of the materials used in preservation, as well as technological advancements in equipment and construction methods. A focus on improved construction of pavement preservation highlights innovations in treatment materials, construction practices, improved specifications, better equipment, and a greater emphasis on construction quality, all of which lead to longer lasting preservation treatments. FHWA has invested in training to promote implementation of these innovations and thereby enhance the success of pavement preservation treatments.

Properly constructed pavement preservation projects on flexible pavements using chip seals, microsurfacing and slurry seals, and ultrathin bonded wearing courses have allowed agencies to cover more miles of pavements more rapidly and with greater assurance of success. Similarly, successful preservation projects on rigid pavements, using techniques such as dowel bar retrofits, patching, and diamond grinding, have been demonstrated to add years of service life to pavements.

Highway agencies, industry and the Federal Highway Administration (FHWA) have partnered in deploying the materials and methods needed to advance the how aspect of pavement preservation. They have identified effective approaches that are implementation-ready and have been used in all regions of the United States. Some of these include:

- North Carolina Department of Transportation's chip seal specifications and construction practices
- The Kentucky Transportation Cabinet's slurry and microsurfacing specifications and construction practices
- Clinton County, Iowa's portland cement concrete full panel replacement specifications and construction practices

RESOURCES

FHWA EDC-4
https://www.fhwa.dot.gov/innovation/everydaycounts/edc_4/

FHWA EDC-4 Pavement Preservation When and Where
<http://www.fhwa.dot.gov/asset/>

FHWA EDC-4 Pavement Preservation How
<https://www.fhwa.dot.gov/preservation/>

For additional information, please contact:

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U.S. Department of Transportation
Federal Highway Administration



Every Day Counts (EDC), a State-based initiative of FHWA's Center for Accelerating Innovation, works with State, local and private sector partners to encourage the adoption of proven technologies and innovations aimed at shortening and enhancing project delivery.





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Pavement Preservation: How Technical Working Group (TWG) Members

The TWG is providing professional expertise to inform the implementation plan for this innovation. The members of the TWG reflect a diverse group of stakeholders from Federal, State, and local governments, and industry organizations.

1. Jerry Auge, Ramsey County, Minnesota
2. Scott Capps, North Carolina DOT
3. Bryan Cawley, FHWA
4. James Gray, FHWA
5. Todd Kinney, Clinton County, Iowa
6. Laura Lawndy, FHWA
7. Mike McGee, FHWA
8. Jim Moulthrop, FP2, Inc.
9. Tracy Nowaczyk, Kentucky Transportation Cabinet
10. Rusty Price, International Slurry Surfacing Association (ISSA)
11. John Roberts, International Grooving and Grinding Association (IGGA)
12. Michael Sheehan, Olmsted County, Minnesota
13. Leif Wathne, American Concrete Pavement Association (ACPA)



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Purpose of the Workbook

The purpose of this workbook is to share information about this innovation. The remaining pages of the workbook provide the presentations given by FHWA, public sector, and pavement industry presenters during the *Pavement Preservation: How* sessions at the seven regional summits held between October and December 2016 in: Baltimore, MD; Minneapolis, MN; Albany, NY; Portland, OR; Sacramento, CA; Austin, TX; and Orlando, FL; as well as the presentations from the two *Pavement Preservation: How* virtual summits held in September 2016.



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Presenter Biographies

FHWA Representatives

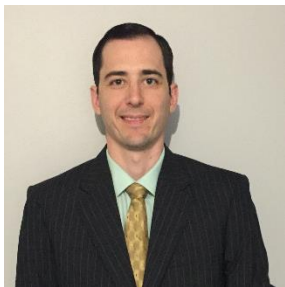


Bryan Cawley, PE, currently serves as the Construction Management Team Leader in the FHWA Office of Infrastructure. Since joining FHWA in 1997, Bryan has held a variety of positions in the Utah Division Office, Nebraska Division Office, Chicago Resource Center, and North Dakota Division Office. Prior to working for FHWA, Bryan worked for Staker Paving and Construction and the Utah Department of Transportation. Bryan holds a Master's in Business Administration from the University of

Nebraska, Master's Degree in Civil Engineering from Iowa State University, and a Bachelor's Degree in Civil Engineering from the University of Utah. Bryan is also a licensed Professional Engineer in the State of North Dakota.

Presented at Regional Summits in: Baltimore, MD and Minneapolis, MN

Presentation on page: 12



James Gray, PE, currently serves as Preservation and Maintenance Engineer on the Construction Management Team in the FHWA Office of Infrastructure. Since joining FHWA in 2006, James has held positions as a Project Engineer and a Construction Operations Engineer with the Eastern Federal Lands Division. Prior to working for FHWA, James worked for the Michigan Department of Transportation, Michigan State University, and the City of Warren, Michigan. James holds a Master's Degree in Business Administration from Pennsylvania State University and a

Bachelor's Degree in Civil Engineering from Michigan State University. James is also a licensed Professional Engineer in the State of Michigan.

Presented at Regional Summits in: Portland, OR; Sacramento, CA; and Austin, TX

Presentation on page: 12



Photo sources: (1) American Concrete Pavement Association; (2) Utah DOT; (3) Applied Pavement Technology, Inc.; (4) National Park Service; (5) Washington State DOT

Laura Lawndy is a Senior Program Analyst in the FHWA Office of Infrastructure. In this role, she serves as the financial manager for the Office of Infrastructures RD&T budgets and is the co-leader for the Pavement Preservation Expert Task Group. Prior to her current role, Laura was a program support contractor in the FHWA Office of Asset Management, supporting the preservation, maintenance, and construction program. Laura holds a Bachelor of Arts Degree in International Business from Grace College.

Presented at Regional Summit in: Albany, NY

Presentation on page: 12

Mike McGee, PE, currently serves as a Pavement and Materials Engineer in the FHWA Missouri Division Office. Since joining FHWA in 2005, Mike has held a variety of positions in the Missouri Division Office. Mike holds a Bachelor's Degree in Civil Engineering from the University of Missouri. Mike is also a licensed Professional Engineer in the State of Missouri.

Presented at Regional Summit in: Orlando, FL

Presentation on page: 12

Public Sector Representatives

Tracy Nowaczyk, PE, is the Branch Manager for the Operations and Pavement Management Branch for the Kentucky Transportation Cabinet (KYTC). The branch is charged with managing programs that collect data to measure condition of KYTC assets, report system performance, and analyze budgetary needs. Tracy has over 12 years of experience in pavement management and has led the effort to grow the pavement preservation program in Kentucky. Prior to working with KYTC, Tracy designed bridges for the Minnesota DOT. She graduated with a Bachelor's Degree in Civil Engineering from the University of Wisconsin-Madison.

Presented at Regional Summits in: Minneapolis, MN and Orlando, FL

Presentation on page: 16

Gerald "Jerry" Auge, Jr., PE, currently serves as the Construction and Maintenance Engineer for the Ramsey County, Minnesota Public Works Department. Since joining Ramsey County in 2006, Jerry has held positions as a Project Manager and as the Construction Engineer in the Engineering Division of Public Works Department. Prior to working at Ramsey County, Jerry worked for the City of Shoreview, MN, Qwest (now



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Century Link), a communications company, the City of Farmington and MSA Consulting/H.R. Green Company. For the past two years, Jerry has been working with the Minnesota DOT as a member of a Technical Working Group for Concrete Specifications and Collaboration. Jerry holds a Master's of Science in Infrastructure Systems Engineering from the University of Minnesota and a Bachelor's Degree in Civil Engineering from the University of Minnesota. Jerry is also a licensed Professional Engineer in the State of Minnesota.

Presented at Regional Summits in: Albany, NY and Austin, TX

Presentation on page: 21

Scott Capps, PE, CEM, is the State Maintenance and Equipment Engineer for the North Carolina DOT. Scott has over 25 years of experience in the maintenance and repair of asphalt and concrete pavements and has been actively involved in the agency's pavement preservation activities. He is currently the Vice Chair of the Pavement Technical Working Group of the AASHTO Subcommittee on Maintenance. Scott graduated from North Carolina State University in 1990 with a Bachelor of Science degree in Civil Engineering Construction. He is a registered Professional Engineer in North Carolina and is also a Certified Equipment Manager.

Presented at Regional Summits in: Portland, OR and Sacramento, CA

Presentation on page: 27

Industry Representatives



David Peshkin, PE, is the Chief Engineer of Applied Pavement Technology, Inc., where he has worked since 1996. He has over 30 years experience as a pavement engineer, working on a wide variety of projects in pavement evaluation, performance, design, and maintenance. For the past 25 years, his work has been focused on pavement maintenance and preservation through research, training, and application. David holds Bachelor's and Master's degrees in Civil Engineering from the University of Illinois and a Bachelor of Arts in History from Swarthmore College. He is a licensed Professional Engineer in Illinois and 13 other States.

Presented at Regional Summits in: Baltimore, MD; Albany, NY; Sacramento, CA; Austin, TX; and Orlando, FL



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Presentation on page: 33



Gregory Duncan, PE, is a Senior Engineer at Applied Pavement Technologies, Inc. (APTech) with 21 years of pavement materials, construction, and roadway maintenance engineering experience. His work at APTech has focused on highway maintenance, pavement preservation, and evaluation for both highways and airfields. Prior to joining APTech, Mr. Duncan was the Assistant Chief Engineer of Operations for the Tennessee DOT, where he was responsible for coordination of construction projects and maintenance and operations of the highway system. Since

beginning his career with the Department in 1994, he served as State Bituminous Engineer, Assistant Director of Construction, Regional Director for Western Tennessee Region 4, and Director of the Maintenance Division. Mr. Duncan was an active member of the AASHTO Subcommittee on Maintenance, Subcommittee on Transportation Systems Management and Operations, and the Special Committee on Transportation Security and Emergency Management. In October 2014, he was appointed the chairman of the AASHTO Winter Maintenance Technical Services Program. Mr. Duncan is a licensed professional engineer, and earned a Bachelor's Degree in Civil Engineering from Tennessee Technological University and a Master's Degree in Civil Engineering from Auburn University.

Presented at Regional Summits in: Minneapolis, MN and Portland, OR

Presentation on page: 33

Chuck Ingram is the Sales Manager at Slurry Pavers, where he has worked for 40 years. He began his career as a laborer, and has also worked as a foreman, and superintendent. He has been a part of the firm's evolution into a multi-faceted company with many disciplines of Pavement Preservation, including slurry seal, micro surfacing, chip sealing, crack sealing, pavement milling, full depth reclamation, and asphalt emulsion manufacturing. For the past 25 years, Chuck has been in charge of Business Development for the company in the Mid-Atlantic region. He has also been involved with the International Slurry Surfacing Association (ISSA) for over 20 years, serving on the Industry Relations Committee and the Quality/Education and Training Committee. In addition, he serves as SME on ISSA's web-based training modules for Slurry Seal and Micro Surfacing and is currently co-chair of ISSA's Slurry Systems Workshop. Chuck also serves as an instructor for the Slurry Systems Certification



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programs for VDOT and SCDOT, and has provided training for the Asphalt Institute, World of Asphalt, and the National Center for Pavement Preservation.

Presented at Regional Summit in: Baltimore, MD

Presentation on page: 36



Dan Patenaude, PE, is a licensed professional engineer with a Bachelor's degree in Civil Engineering from the University of Vermont and a Master's degree in Business Administration from Curry College. After spending the first 11 years of his career in construction management and commercial real estate development, Dan joined the public sector and became the Public Works Director for the Town of Walkkill in New York, where he gained his passion for pavement management. In 10 years of service with the Town, Dan and his team were able to raise the community's network pavement condition index (PCI) from 76 to 83, a very noticeable improvement for local road users.

Dan rejoined the private sector in 2002, and since that time has enjoyed working with multiple road owner agencies along the east coast, helping them optimize their limited roadway funding. Dan is currently the Sales & Marketing Manager for Sealcoating, Inc. based in Braintree, MA. He and his team promote innovative pavement preservation solutions throughout New England and downstate New York.

Presented at Regional Summit in: Albany, NY

Presentation on page: 41

Robert Seghetti is the President of ACME Concrete Paving, Inc. He has been involved at ACME since receiving his BS in Civil Engineering in 1985 from Gonzaga University. Since that time he has constructed many new concrete pavements for streets, highways and airports along with many Concrete Pavement Restoration (CPR) Projects throughout the Western US. During his time at ACME, the company has evolved from being a strictly concrete paving contractor to a full service concrete pavement rehabilitation contractor completing panel replacements, dowel bar retrofit, and concrete grinding and grooving. He is currently on the board of the CP Tech Center and is a member of ACPA and IGGA.

Presented at Regional Summits in: Portland, OR and Sacramento, CA

Presentation on page: 49



Photo sources: (1) American Concrete Pavement Association; (2) Utah DOT; (3) Applied Pavement Technology, Inc.; (4) National Park Service; (5) Washington State DOT

Billy Miller is a graduate of Northeastern University with extensive experience in civil construction. Since 2015, Miller has served as Vice President of Highway/Contract Services and Risk Management at Penhall Company, a construction company specializing in concrete cutting, breaking, excavation, and grinding services.

Presented at Regional Summit in: Orlando, FL

Presentation on page: 49

Rusty Price started working in the industry for Intermountain Slurry Seal in 1984. Since that time, he has held the following positions with the company: foreman, superintendent, estimator, project manager, operations manager and general manager. Intermountain performs various pavement preservation techniques for Federal, State, and local municipalities in 17 States from Texas to the west coast. He is a member of the International Slurry Surfacing Association (ISSA), a nonprofit association dedicated to the interests, education, and success of slurry surfacing professionals and corporations around the world. He has been on their Board of Directors since 2006 and currently serves as the ISSA President. He also served as the Slurry and Micro surfacing committee chairman from 2009 to 2014. In 2010, he was a topic panel member of an NCHRP Synthesis Project 411, Micro surfacing Highway Practice. From 2013 to the present, he has served as a member of the FHWA Emulsion Task Force and he is also a member of the FHWA Pavement Preservation Expert Task Group.

Presented at Regional Summit in: Austin, TX


Presentation on page: 55



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Federal Highway Administration Presentation

Pavement Preservation: How

every day counts  **Pavement Preservation:
How**
An Innovation Partnership with States





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EDC 

every day counts  **Pavement Preservation:
How**
An Innovation Partnership with States







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Pavement Preservation - Quality Construction and Materials

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<p>Laura Lawndy Program Analyst Office of Infrastructure, FHWA laura.lawndy@dot.gov 202-366-0102</p>	<p>Mike McGee Pavement and Materials Engineer Missouri Division, FHWA mike.mcgee@dot.gov 573-638-2608</p>

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Objectives

-  **What is Pavement Preservation: How?**
-  **Where did EDC-4 Pavement Preservation: How come from?**
-  **What can we expect to accelerate national deployment of Pavement Preservation: How?**
-  **Tools under development**
-  **For additional information**

EDC 

Pavement Preservation: "How"

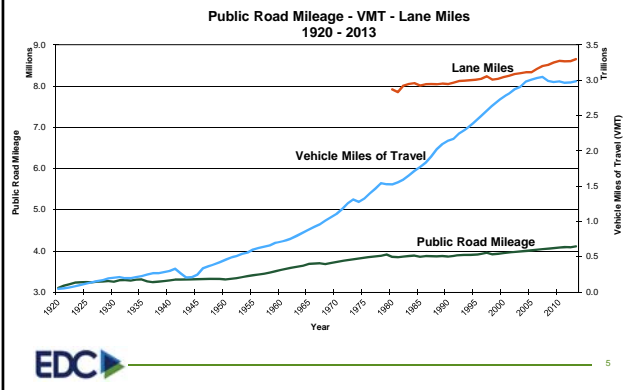
Applying the right treatment on the right roadway at the right time with quality construction and materials. Pavement Preservation "How" focuses upon quality construction and materials practices of pavement preservation treatments.



Source: Applied Pavement Technologies, 2016 Source: FHWA, 2013 Source: American Concrete Pavement Association, 2016

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Where did Pavement Preservation: *How* come from?



Where did Pavement Preservation: *How* come from?

- Flexible-surfaced preservation initiatives:
 - ✓ Chip seal
 - ✓ Microsurfacing
 - ✓ Slurry seal/scrub seal
 - ✓ Ultrathin bonded wearing course

Where did Pavement Preservation: *How* come from?

- Rigid-surfaced preservation initiatives:
 - ✓ Partial-depth repair
 - ✓ Full-depth repair
 - ✓ Dowel bar retrofit/cross stitching
 - ✓ Diamond grinding

What can we expect from FHWA EDC-4 Pavement Preservation How?

- 1 of 11 EDC-4 technologies
- 4-months
 - 7 EDC Summits
 - Explanation of technology
 - Owner Subject Matter Expert presenting how and why they adopted best quality practices
 - Contractor Subject Matter Expert presenting how and why they adopted best quality practices
 - Development of Implementation Plan
- 2017 and 2018
 - Delivery of Implementation Plan activities

Tools under development to accelerate deployment

- Best Practice Guide
 - Flexible-surfaced: Nevada DOT
 - Rigid-surfaced: Missouri DOT
- Web based training for constructing rigid-surfaced pavement preservation
 - Under contract
- Web based training for constructing flexible-surfaced pavement preservation.
 - Complete
 - o <http://slurry.org/education/industry-training-courses/web-based-courses/>
- Researching the use of RAP in Pavement Preservation Treatments



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Implementation Team

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For Additional Information

<https://www.fhwa.dot.gov/preservation/>
https://www.fhwa.dot.gov/innovation/everydaycounts/edc_4/



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Public Sector Representative Presentations

Kentucky Transportation Cabinet Microsurface Best Practices

Tracy Nowaczyk, P.E.
Operations and Pavement Management

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**Pavement Preservation:
How**



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Kentucky's System Mileage



- + 800 Interstate
- + 520 Parkway
- + 11,674 Primary and Secondary routes
- + 12,742 Rural Secondary
- + 1,749 Supplemental routes
- 27,465 centerline miles**

8th largest state system

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Preservation Need

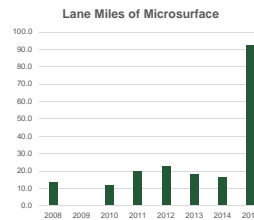
- 95% of system asphalt
- Requires annual investment of over \$250 million to sustain conditions
- Traditional resurfacing cost \$146,000 per centerline mile
- Microsurface \$58,000 per centerline mile



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Microsurface Growth

- 2008-2011: demo projects
- 2012: began letting as alternate bid
- 2015: let first geographic package



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Microsurface Introduction



- Mixture of polymer-modified asphalt emulsion and mineral aggregate
- Chemical reaction causes set
- Cures quickly
- Can be used to treat rutting and skid
- Addresses minor surface distresses



Microsurface Applications

- Type III used for rut fill
- Type II for leveling and surface

TYPES OF SLURRY SEAL

Type 1: #200 x 1/8" (3.175mm)	Type 2: #200 x 1/4" (6.35mm)	Type 3: #200 x 3/8" (9.525mm)



Microsurface Applications

Leveling/Scratch Course

Rut Fill



Weather

- Pavement temp 50 degrees and rising
- Air temp 45 degrees and rising
- May be applied at night
- No imminent rain
- No imminent freezing



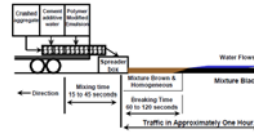
Materials

- Approved quality materials
- Screened aggregate
 - Polish resistant
 - No porous
- Portland cement
- Emulsion
 - CSS-1H polymer modified



Microsurface Equipment

- Approved
- Calibrated
- Continuous, self-propelled or truck-mounted paver
- Spreader box
- Screening equipment
 - Aggregate is screened directly into trucks to prevent oversized materials



Preparation



- Patching
- Crack sealing
- Remove thermoplastic markings
- Cover raised pavement markers, utility inlets, and manholes
- Removal of loose materials
- Notify residents



Test Strip

- Required in the specification
- Approves
 - Cure time
 - Application rates
 - Time to traffic
- 1000-ft long, one lane-width
- Same day under similar conditions



Hand Work



- Coverage in areas that can't be reached by the paver
- Lightly dampened pavement
- Uniform texture and thickness



Joints

- Clean and straight
- Non-overlapping transverse
- No excessive longitudinal overlap
- Feathered edge lines
- Done on roofing felt



Curing Time

- Premature opening to traffic creates loss of material
- Sanding can be used for intersections
- Extend curing time if possible



Keys to Success

- Proper site selection
- Current specifications
- Site preparation
- Equipment calibration
- Quality materials
- Knowledgeable contractors
- Knowledgeable inspectors
- Partnerships



Contact for More Information

Tracy Nowaczyk, P.E.
Kentucky Transportation Cabinet
Operations and Pavement Management
tracy.nowaczyk@ky.gov
502-782-5595



Concrete Preservation in a Urban Setting Ramsey County MN

Jerry Auge, PE
Maintenance and Construction Engineer

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**Pavement Preservation:
How**



EDC

Sponsored by American Concrete Pavement Association, by Utah DOT, by Applied Pavement Technology, Inc., by National Park Service, by Washington State DOT

Ramsey County Demographics

Capitol is St. Paul

Population ~540,000

- Suburbs of St. Paul (County Staff)
- St. Paul (City Maintains 55 Miles, County 15 Miles)
- 109 5/8 Public Works Employees

AADT 150-25,000 per day

Most urbanized County in the State

Smallest County in the State (by area)

131 different languages spoken in St. Paul Schools

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2

Ramsey County 291-Mile Roadway System

Bituminous Pavements – 234 Miles

Concrete Pavements – 30 Miles

- Concrete Pavement – Higher AADT

Bituminous over Concrete – 27 Miles

- Mostly State turnback routes
- County system in St. Paul

No Gravel Roads

Funding Sources- Bond Funds, County Board Allocation, Wheelage Tax, CSAH, Fed STP

EDC

3

Past Approaches to Concrete Pavement Preservation

St. Paul –

- No Concrete Preservation
- Overlay with Bituminous
- Utility Holes
 - Bituminous Patches
 - Concrete Patches

EDC

4

Stakeholders' Needs on Roadways

City Utilities

- Watermain
- Sanitary Sewer
- Signal Systems
- Storm Sewer

Private Utilities

- Gas
- Commun.
- Electric

Watershed



5

Preservation Project Field Work

Mobile Temporary Traffic Control

Measure the Distresses

- Sample areas
- Entire project limits

Core Joints – Deterioration limits

Partial Depth Repairs

Mid Panel Cracks (tight/wide)

Panel Faulting

Deterioration of Structures/Rings



6

Cost Benefit

Determine Preservation Project Costs

New Concrete Pavement Costs

- Cost benefit

Bituminous Overlay or Ultra Thin

- Rapid concrete deterioration
- Have a future plan

Do Nothing



7

Keep in Mind There is more Hidden to New Construction Costs

Water Treatment Requirements

- Treat water – watershed requirements
- Very costly in an urbanized community
- Don't touch the base or the dirt!!!

Storm Sewer Design Requirements

- Add more storm sewer inlets
- Limited capacity in mainline storm

Right of Way Impacts are costly

- Permanent
- Temporary
- Damages and loss of business claims



8

Standard Plan Sheets/Details

PAVEMENT REPLACEMENT (TYPE C1)
DESCRIPTION: REMOVE CONCRETE, EXPOSE AND CORRECT SUBGRADE, RECONSTRUCT BASE, FORM AND PLACE CONCRETE ON NEW SUBGRADE.

FULL DEPTH REPAIR (TYPE CD-LV)
DESCRIPTION: REMOVE CONCRETE, PLACE REPAIRMENT MASS AND FINISH, SMOOTH AND CURE.

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Standard Plan Sheets/Details

PARTIAL DEPTH REPAIR SPECIAL (TYPE BE)
DESCRIPTION: REMOVE CONCRETE, EXPOSE AND CORRECT SUBGRADE, RECONSTRUCT BASE, FORM AND PLACE CONCRETE ON NEW SUBGRADE.

VARIABLE WIDTH JOINT CRACK REPAIR / JOINT REPAIR (TYPE AJ)
DESCRIPTION: IN NEWLY CONSTRUCTED REPAIRS OR IN PLACE JOINTS OR CRACKS, SAW, CLEAN, SEAL TRANSVERSE AND / OR LONGITUDINAL PAVEMENT JOINTS OR CRACKS.

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Anticipated Concrete Preservation Cycle

15-20 Years (Minor Repairs)

- Partial-depth repairs
- Full-depth cracked panel repairs

30-50 Years (Major Repairs)

- Partial-depth repairs
- More full-depth repairs
 - Joints/dowels
 - Full Panels
- Diamond grinding
- Storm structures
- Signal system

After this Cycle??

EDC

Why? Benefits to Concrete Preservation

Older Concrete Pavements have Quality Aggregates

- Durability
- Size of rock (1")

Ability to Repair Utilities Internally

- Water main
- Sanitary sewer
- Storm sewer

Less Impact to Motoring Public
Improve Structural Integrity and Ride

EDC

Preservation Costs Vs. New Construction

B Repairs – \$21-32/LF

CX Repairs – \$73.85-\$91/SY

CD-LV Repairs – \$50.50 – \$60.50/LF

Concrete Paving Costs

\$5.42-\$8.47/SY/In



13

Opening Times

B Repairs 24 Hours

CX Repairs 24-36 hours

CX-LV Repairs Timeline 36 hours

Break beams for full depth repairs

- Rock Angularity
- Rock Size ¾" and 1"



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Photos Prior to Preservation Project



15

Photos Prior to Preservation Project



16

Deteriorated Joint Repair



17

Removal of Panels



18

Drilling and Dowel Bar Grouting



19

Pouring and Curing Concrete



20

Saw and Seal Repairs



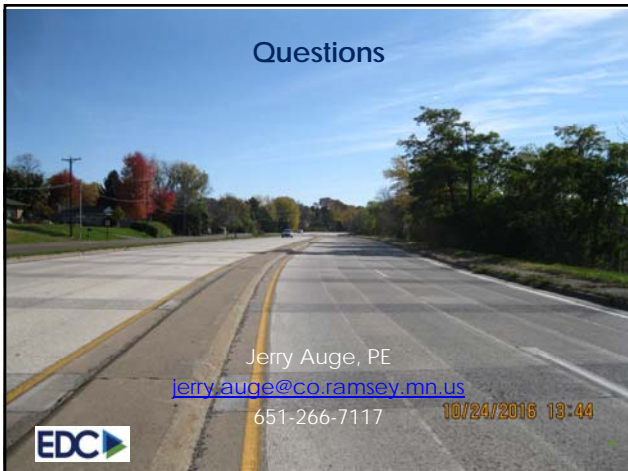
21

Completed Project



22

Questions



Jerry Auge, PE

jerry.auge@co.ramsey.mn.us

651-266-7117

10/24/2016 13:44



23

North Carolina Department of Transportation: Chip Sealing Best Practices

Scott Capps, P.E.
North Carolina Department of Transportation

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An Innovation Partnership with States

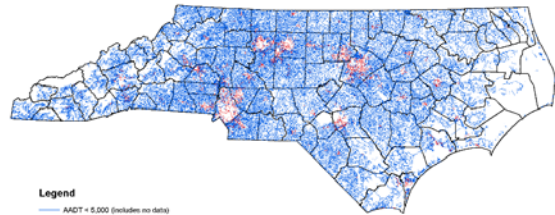
**Pavement Preservation:
How**



EDC

Why is Preservation Important in NC?

North Carolina Secondary Roads



Legend
— AADT < 5,000 (includes no data)
— AADT > 5,000

EDC

msau

What Does North Carolina's System Look Like?

- Approximately 60,000 miles on Secondary Paved System
- 54% have Plant Mix (32,000 miles)
- 44% have Chip Seal Treatment (26,300)
- 2% "other" – composites, slurry



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Why are Chip Seals Important to North Carolina?

- System size second only to Texas
- 50,000 miles with an ADT less than 2000
- Chip Seal costs approximately \$25,000/mile
- Plant Mix costs approximately \$100,000/mile



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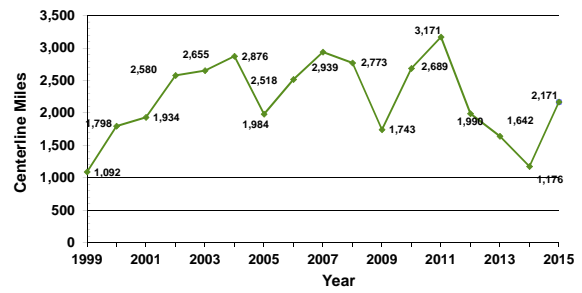
Best Practices to Ensure A Great Chip Seal

- Dedicated Funding
- Equipment
- Materials
- Operator/Supervisor Training
- Research
 - Began research initiative in 2003
 - 9 projects with NC State



Annual Chip Seal Use

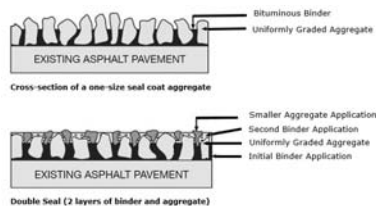
NC Chip Seals: Centerline miles by year



Introduction to Chip Seals Keep Good Roads Good

Also known as:

- Road Oil
- Tar and Gravel
- Bituminous Surface Treatment (BST)
- Asphalt Surface Treatment (AST)
- Chip Seal
- Chip Seal – Layer of Emulsion, followed by a Layer of Aggregate



Equipment

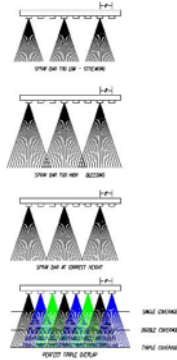
- Aggregate spreaders
- Distributors
- Rubber tire or combo rollers
- Broom/vacuum



Primary Key to Success: Calibration

Distributor

- Height of spray bar for single, double, and triple coverage
- Cut off one or two nozzles so that the tips touch
- Uniform spray
- New/clean nozzles



Primary Key to Success: Calibration

Spreader

- Application rate (lbs/sy)
- Uniform coverage
- Operating speed



Calibrating the stone spreader



What Materials Are We Using?

Clean Washed Stone:

- 78 M – Granite Material (mostly 3/8")
- 5/16 LW – Lightweight Expanded Slate

Emulsions:

- CRS 2P
- CRS 2L



Materials – Aggregate

Lightweight
5/16" Slate



78 M 3/8" Granite



Aggregates – Know Your Rock

- Coordination with Materials and Test
- Coordination with Quarries
- Compatible – anionic
- Shape – cubical
 - Flat tends to bleed
- Hardness – granite or slate
 - Doesn't fracture from rolling
- Cleanliness – minimum fines
 - Dust tends to bleed and ravel
- Uniform size – single or gap graded
- Surface properties – crushed face

Reminders:

- Keep stockpiles clean and dry
- Keep aggregate separated
- Keep base material out of aggregate pile



Materials – Emulsion

- Emulsions are mixture of liquid asphalt, emulsifying agent, and water, with additives for stability
- Durable, long lasting, rapid setting, good aggregate retention
- Specifications require cationic rapid set emulsion
- CRS-2L or CRS-2P – proven reduction in loose aggregate
- Emulsion will have a slightly positive charge
- Do not mix emulsion grades
- Application temperature 160-170°F



New Table 660-1: Design

Type of Coat	Layer	Aggregate Type	Aggregate Target Rate (Lbs / SY)	Emulsion Target Rate (Gal / SY)
SINGLE SEAL	TOP	#78M(3/8")	18	0.35
DOUBLE SEAL	TOP	5/16" LW	9	0.25
DOUBLE SEAL	BOTTOM	#78M(3/8")	18	0.30
TRIPLE SEAL	TOP	#14(1/4")	7	0.20
TRIPLE SEAL	MIDDLE	#5/16 LW	9	0.25
TRIPLE SEAL	BOTTOM	#67(5/8")	30	0.32



Chip Seal Weather Considerations

Moisture and Temperature

- Goldilocks and the Three Bears

Moisture

- Too much water has the tendency to bleed
- Too little water has the tendency to ravel
- A little water on surface aggregate – just right

Temperature

- Extremely high temperatures have the tendency to bleed
- Extremely low temperatures have the tendency to ravel
- Between 70°F and 80°F degrees – just right

Wind



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Additional Weather Consideration

Do not place AST from
Oct. 15th to April 1st



17

12-month Chip Seal Warranty

- Performance and Payment Bond
- Loss of aggregate
- Emulsion bleeding
- Small distresses over a Lot (200-ft length)



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Questions?





Photo sources: (1) American Concrete Pavement Association; (2) Utah DOT; (3) Applied Pavement Technology, Inc.; (4) National Park Service; (5) Washington State DOT

Industry Representative Presentations

Pavement Preservation: How Implementation

every day counts  Pavement Preservation: How
An Innovation Partnership with States



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every day counts  Pavement Preservation: How
An Innovation Partnership with States



Photo sources: (1) American Concrete Pavement Association, (2) Utah DOT, (3) Applied Pavement Technology, Inc., (4) National Park Service, (5) Washington State DOT

- Purpose
- Approach
- Today's Objective

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2

Today's Objective

- Highlight the innovations
- Discuss the Draft Implementation Plan
- **Solicit feedback on implementation**
- **Identify implementation needs**

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3

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Draft Implementation Plan: Your Input

Photo sources: (1) American Concrete Pavement Association, (2) Utah DOT, (3) Applied Pavement Technology, Inc., (4) National Park Service, (5) Washington State DOT

4

The State of (Your) Practice: Written Responses

Do you construct quality pavement preservation treatments?

- Which treatments?
- What practices contribute to quality?
- Will you share your practices?



5

Challenges: Written Responses

- What are your challenges in incorporating quality practices in pavement preservation construction?
- Is it difficult to obtain quality materials?
- Are quality contractors bidding on your projects?



6

Measuring and Tracking Progress: Written Responses

- What are good deployment targets?
- What are appropriate measures of deployment success?
- How will you track progress?



7

Adopting Improved Construction Practices

- What information would support adoption of these innovations?
- What implementation help do you need?
- What do you need to address your challenges?



8

Awareness and Dissemination

- How can we get needed resources into practitioners' hands?
- Which methods or channels of communication are particularly effective for reaching you?

Ideas could include: Newsletters, e-mail blasts, websites, webinars, peer exchanges, visitor presentations, a clearinghouse... are there others?



9

Accelerating Change

- Where should efforts be focused nationally?
- What would help your organization?



10

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Thank you for sharing your ideas!

Photo sources: (1) American Concrete Pavement Association; (2) Utah DOT; (3) Applied Pavement Technology, Inc.; (4) National Park Service; (5) Washington State DOT

11

“That’s the way we’ve always done it”

WHAT ???

Chuck Ingram
Slurry Pavers, Inc./
SSA

FHWA EDC 4 Summit
Baltimore, Md.
October 18, 2016

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Pavement Preservation:
How



EDC

Sponsored by American Concrete Pavement Association, by State DOTs, by Asphalt Pavement Technology, Inc., by National Park Service, by Transportation Trust Funds

We Have Built a Lot of Stuff...
letting it crumble is not an option...



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2

Some Effective “Top of the Curve” Treatments

- **Slurry Seal** (change gradations, polymer modified, etc.)
- **Micro Surfacing** (double apps., change gradation of aggregate, rut fill, fiberized, etc.)
- **Chip Seal** (single seal, split seal, latex modified binder, etc.)
- **Crack Treatment** (least expensive first line of defense)
- **Combination Treatments** (cape seal, fog seal, etc.)

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3

Crack Sealing



EDC

4

Chip Sealing



5

HIP Surface Recycling



6

Slurry Seal/Cape Seal Curb & Gutter



7

Cape Seal Primary Route



8

Micro Surfacing



9

Double Application Micro Surfacing



10

Combinations



11

Actual County Budget ~\$25M


Budget vs. Miles Comparison

Treatment	Budget Dollars (% of Total)	Completed Miles (% of Total)
Reconstruction	16	6
Resurfacing	59	30
Surface Treatments & Patching	18	58
Masonry	7	6
Total	100	100



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PERFORMANCE GUIDELINES



www.slurry.org

EDC 13

Communication / Education / Training

- ISSA Slurry Systems Workshop
- Web-Based Training (WBT)
 - How to Construct High Quality Slurry Seal and Micro Surfacing Treatments — Part 1 and Part 2
 - How to Construct High Quality Chip Seal Treatments
 - Best Construction Practices for Operating a Spreader Box used with Slurry/Micro Surfacing Materials
 - Best Construction Practices for Crack Sealing and Joint Filling of Asphalt and Concrete Pavements
- NCPP Training Courses
 - For Training Course Details: www.pavementpreservation.org

EDC 14

Accreditation and Certification

- AASHTO Material Reference Laboratory (AMRL) ... Pavement Preservation Laboratory Accreditation Program
 - ISSA recognized need to qualify labs doing mix designs
 - Certified 10 of 21 labs requesting certification this year
- Agency/Contractor Certification

EDC 15

There's No "How" Without a "Who"

- Agencies need a **CHAMPION** (sometimes, a "Renegade")
- Be able to answer the challenges
- Get away from another "W"**Worst First**
- Dedicate portion of budget to PP (10 – 15%)
- Not a one time shot
- Better community outreach

EDC 16

Some Final thoughts... New to Some

- Multi-Year Contracts
 - Don't forget the Asphalt Index
- Purchase Order Contracts
 - NCDOT...\$2.5 M Division Administered Contracts
- Piggyback Contracting
 - Peer-to-peer communication
 - Take advantage of small budget/minimize mobilization



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Pavement Preservation:
How



Photo sources: (1) American Concrete Pavement Association; (2) Utah DOT; (3) Applied Pavement Technology, Inc.; (4) National Park Service; (5) Washington State DOT

Thank You!
Questions ?

Chuck Ingram
Slurry Pavers, Inc.
c Ingram@slurrypavers.com



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Pavement Preservation Industry Innovations to Raise the Bar

Dan Patenaude, P.E.
Sealcoating, Inc. / ISSA
International Slurry Surfacing Association

FHWA EDC 4 Summit
Albany, NY
November 1, 2016


every day counts  **Pavement Preservation:
How**
An Innovation Partnership with States



EDC logo SOURCE: American Concrete Pavement Association; by State DOTs; Applied Pavement Technology, Inc.; National Park Service; by State DOTs

Presentation Overview

- **WHY** Pavement Preservation is important
- **HOW** Pavement Preservation is currently being done in this region
- **HOW** Pavement Preservation will be done **BETTER** going forward

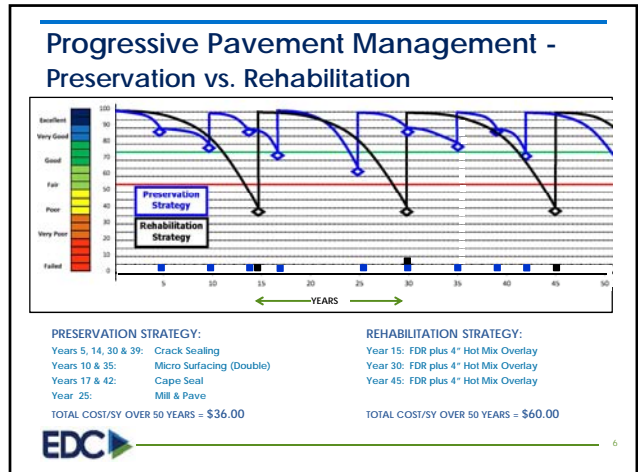
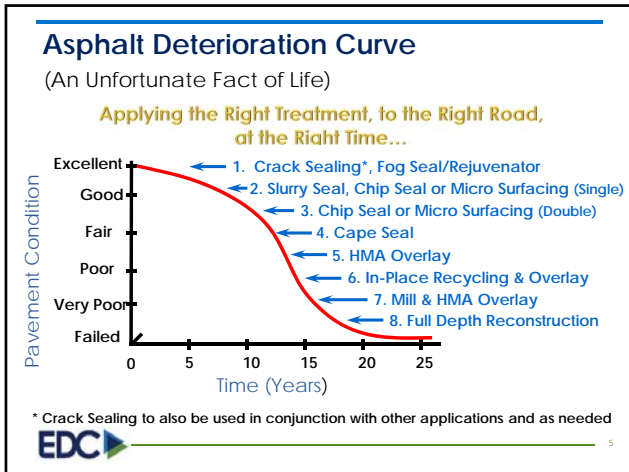
EDC 



We've built a lot of stuff in this country...
letting it crumble is not an option!



EDC  SOURCE: Proof.nationalgeographic.com



NHDOT – Pavement Management Section

2011 / 2012 Equivalent Annual Costs (EAC's)

Treatment Alternative	2011/2012 Approx. Costs (\$/lane-mile)	2011/2012 Approx. Costs (\$/SY)	Estimated Service Life (years)	Equivalent Annual Cost (\$/SY/year)
Micro or 4.75 HMA	\$ 22,810	\$ 3.24	6	0.54
Double Chip Seal	\$ 28,301	\$ 4.02	7	0.57
½" Paver Shim	\$ 25,281	\$ 3.59	6	0.60
1" HBP Overlay	\$ 33,708	\$ 4.79	8	0.60
Chip Seal	\$ 21,120	\$ 3.00	5	0.60
15% AR Chip Seal	\$ 35,482	\$ 5.04	8	0.63
Nova Chip (PPST)	\$ 44,352	\$ 6.30	10	0.63
1-1/2" HBP Overlay	\$ 50,561	\$ 7.18	10	0.72
1-1/2" ARGG Overlay	\$ 70,786	\$ 10.05	13	0.77
1-1/2" HBP Inlay	\$ 67,457	\$ 9.58	10	0.96
FDR with 4" HBP	\$ 147,502	\$ 20.95	15	1.40
2" TW Inlay with 1-1/2" FW Overlay	\$ 134,872	\$ 19.16	13	1.47
4" CIP with 3" HBP Overlay	\$ 156,035	\$ 22.16	15	\$ 1.48

SOURCE: NHDOT

Notes:

1. Costs per lane mile based on 12-foot lane width.
2. Costs shown here include a 20% multiplier to account for fixed costs.

EDC

- ### Pavement Preservation HOW---
- #### Some Options
- Crack Sealing
 - Fog Sealing
 - Slurry Seals and Micro Surfacing
 - Chip Seals and Cape Seals
 - Thin Hot Mix Asphalt (HMA) Overlays (<1")
- EDC

Pavement Preservation HOW--- Crack Sealing



Photo Courtesy of Sealcoating, Inc.

- Stop water intrusion
- Keep out incompressibles
- Excellent cost-benefit ratio



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Pavement Preservation HOW--- Fog Sealing



Photo Courtesy of MassDOT

- Slow the rate of oxidation
- Reduce raveling
- Some add rejuvenation
- Very low cost "sunscreen" for pavements



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Pavement Preservation HOW--- Fog Sealing

- Rejuvenating sealer applied Sept. 2006
- Macrotexture testing 3 years after application indicated greatly reduced raveling of the treated section



Photo Courtesy of Asphalt Systems, Inc.

Interstate 88 near Oneonta, NY



11

Pavement Preservation HOW--- Micro Surfacing

- Crack seal first
- Match aggregate to traffic
- Very high friction
- Consider performance additives
- Cost-effective life extension



Photo Courtesy of Sealcoating, Inc.



12

Pavement Preservation HOW--- Micro Surfacing

- NYS Thruway near the Westmoreland exit
- 2014 Micro Milling and Micro Surfacing to remove ruts and restore friction



Photo Courtesy of Suit-Kote Corporation



Photo Courtesy of Suit-Kote Corporation



13

Pavement Preservation HOW--- Micro Surfacing

- I-393 near Concord, NH and NHDOT Main Office
- Micro Surfaced in 2009 (night work); photos taken July 14, 2016
- Unit bid price = \$2.83/SY (current EAC at 7 years = \$0.40/SY/Year)



Photos Courtesy of Sealcoating, Inc.



14

Pavement Preservation HOW--- Chip Seals



Photo Courtesy of New York Bituminous Products Corp.

- Widespread global utilization
- Multiple binder and stone options
- Excellent friction
- Low life-cycle costs
- Consider a Cape Seal in urban/suburban locales



15

Pavement Preservation HOW--- Chip Seals

- Conventional (HFRS-2P) Chip Seal
- NYSDOT Route #26 – Cincinnatus, NY



Photo Courtesy of Suit-Kote Corporation

2008 (installed)



Photo Courtesy of Suit-Kote Corporation

2014 (at 6 years old)



16

Pavement Preservation HOW--- Chip Seals

- Asphalt-Rubber Chip Seal
- VTrans Route #100 – Dover VT



Photo Courtesy of All States Materials Group

June 2013 (installed)



Photo Courtesy of All States Materials Group

October 2016 (current)



17

Pavement Preservation HOW--- Cape Seals

- Restorative benefits of a Chip Seal
- Surface texture and aesthetics similar to HMA
- Life extension equivalent to thin overlays



Photo Courtesy of Sealcoating, Inc.



Photo Courtesy of Sealcoating, Inc.



18

Pavement Preservation HOW--- Thin HMA Overlays

- Bonded Wearing Course (BWC - previously known as "NovaChip")
- NHDOT Route #3 – Nashua, NH



Photo Courtesy of All States Materials Group

July 2014 (installed)



Photo Courtesy of All States Materials Group

October 2016 (current)



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Pavement Preservation HOW--- Thin HMA Overlays

- MassDOT Route #3 near Burlington MA
- Multiple BWC mixes applied in 2015 for comparative evaluation over time



Photo Courtesy of MassDOT



20

Why not more Pavement Preservation happening here in the Northeast?

- Agency resistance to change?
- Incumbent treatment providers defending against the new competition?
- Lack of knowledge and training about the options?
- Less than perfect past performance?



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Pavement Preservation – HOW can we do it BETTER?

- New AASHTO standards
(American Association of State Highway and Transportation Officials)
- Recommended performance guidelines
- AMRL accreditations for Pavement Preservation
(AASHTO Materials Reference Laboratory)
- Expanded education and training
- Agency / Contractor certifications



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Pavement Preservation – HOW can we do it BETTER?

New AASHTO Pavement Preservation Standards:

Micro Surfacing

- MP028 -16 - UL Standard Specification for Materials for Micro Surfacing
- PP083 -16 -UL Provisional Standard Practice for Micro Surfacing Design

Chip Seal

- MP027-16 - UL Standard Specification for Materials for Emulsified Asphalt Chip Seals
- PP082 -16 - UL Provisional Standard Practice for Emulsified Asphalt Chip Seals

Emulsion Specification Amendments

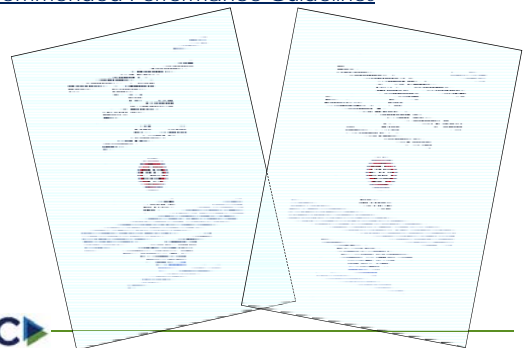
- M140 Emulsified Asphalt
- M208 Cationic Emulsified Asphalt
- M316 Polymer-Modified Cationic Emulsified Asphalt



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Pavement Preservation – HOW can we do it BETTER?

Recommended Performance Guidelines



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Pavement Preservation – HOW can we do it BETTER?

“High Performance” Micro Surfacing Guidelines in development (A153)

Some items being considered:

- Field tests to confirm mix
- Additional aggregate tests
- Higher binder contents
- Different binder grades
- Performance additives

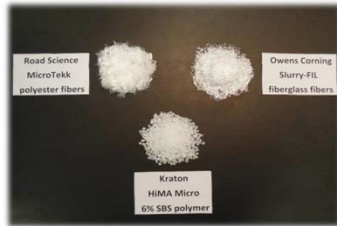


Photo Courtesy of Sealcoating, Inc



25

Pavement Preservation – HOW can we do it BETTER?

AASHTO Materials Reference Laboratory (AMRL)
Pavement Preservation lab accreditation program

- ISSA recognized the need to qualify labs doing mix designs
- Completed 10 of 21 labs requesting certification this year



Photo Courtesy of Ingevity



26

Pavement Preservation – HOW can we do it BETTER? Education & Training

ISSA Slurry Systems Workshop - January 23-26, 2017 - Las Vegas, NV
www.slurry.org/event/2017-slurry-systems-workshop/

Web-Based Training

www.slurry.org/education/industry-training-courses/web-based-courses/

How to:

- Construct High Quality Slurry Seal and Micro Surfacing Treatments - Parts 1 & 2
- Construct High Quality Chip Seal Treatments

Best Construction Practices:

- Operating a Spreader Box with Slurry or Micro Surfacing Materials
- Crack Sealing and Joint Filling of Asphalt and Concrete Pavements

NCCPP Training Courses - <https://www.pavementpreservation.org/classes/>



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Pavement Preservation – HOW can we do it BETTER? Contractor & Agency Certification






- Goal = Consistently high-quality treatment installations
- Nevada DOT became the 1st to require in 2016
- National Center for Pavement Preservation (NCCPP) will administer the **Certification exam** at:
ISSA Slurry Systems Workshop, Las Vegas, NV, Jan. 2017
Register at: <https://www.tsp2.org/register>



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Thank You!

Questions?

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Photo sources: (1) American Concrete Pavement Association, (2) Utah DOT, (3) Applied Pavement Technology, Inc., (4) National Park Service, (5) Washington State DOT

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Concrete Pavement Preservation Quality Construction and Materials

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**Pavement Preservation:
How**



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Source: (1) American Concrete Pavement Association; (2) Utah DOT; (3) Applied Pavement Technology, Inc.; (4) National Park Service; (5) Washington State DOT

CPP Beginnings

Concrete Pavement Preservation with diamond grinding was first used as part of an engineered system to preserve PCC Pavement in the early 1960's



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Concrete Pavement Preservation Techniques

- Subsurface rehabilitation
- Cross-stitching longitudinal cracks/joints
- Dowel bar retrofit
- Partial-depth repair
- Full-depth repair
- Diamond grinding
- Joint & crack resealing

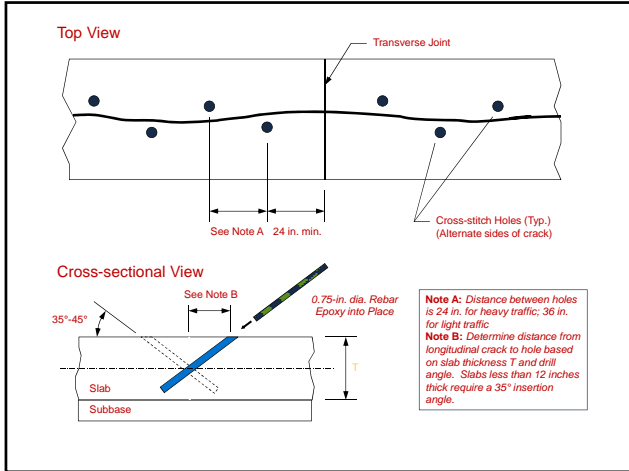
EDC

Cross Stitching

- Used for longitudinal cracks that are in good condition
- Used to maintain aggregate interlock and provide added reinforcement to crack
 - Strengthen longitudinal cracks
 - Prevent slab migration
 - Maintain aggregate interlock
 - Prevent lane separation
 - Prevent longitudinal joint faulting



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Partial Depth Repair - PDR

- Partial-depth repairs are used on surface defects and joint spalls that are limited to the upper one-third of the PCC slab
- Restores ride quality and pavement functionality with minimal traffic interruption
- Costs less than a full depth repair

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MNDOT PDR Method

- Concrete removal by modified cold-milling
- Must be faster and less expensive than sawing and jack-hammering
- Since PDR is a bonding operation, irregular shapes are permitted.
- Provides long term performance (20 years plus)

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Cementitious vs Non-Cementitious

- New cementitious fast setting materials minimize traffic disruption and increase durability
- Non cement based materials do not require reformation of the joint or crack due to greater flexibility
 - Polymer Resins
 - Elastomeric Materials
- More expensive than cement based mixes



Dowel Bar Retrofit - DBR

- Placement of load transfer devices across joints or cracks of existing pavements
- Reestablishes load-transfer across joints or cracks in PCCP
- Used in undoweled pavements to limit future faulting



WSDOT DBR Research

- Since 1992, WSDOT has retrofitted over 300 Lane-mi or 650,000 bars
- Average age of pavement prior to DBR was 32 yrs
- Many 30 and 40 year PCCPs successfully retrofitted adding over 20 years additional pavement life at a fraction of the cost of reconstruction



Full-Depth Repair

- Removal and replacement of concrete through entire depth
- Restores ride quality
- Fast setting materials minimize traffic disruption
- Pin/lift-out removal speeds process
 - Full depth saw cuts done days prior to the lift out.
 - Minimizes traffic disruption.
 - Preserves base and minimizes base repair labor and materials



Diamond Grinding

- Removal of thin surface layer of hardened PCC using closely spaced diamond saw blades
- Results in smooth, level pavement surface
- Provides a longitudinal texture with desirable friction and low noise characteristics
- Frequently performed in conjunction with other CPP techniques, such as full-depth repair, dowel bar retrofit, and joint resealing



Advantages of Diamond Grinding

- Can be used on both concrete and asphalt pavements
- Costs substantially less than overlays
- Enhances surface friction and safety
- Can be accomplished during off-peak hours with short lane closures and without encroaching into adjacent lanes
- Grinding of one lane does not require grinding of the adjacent lane
- Does not affect overhead clearances underneath bridges
- Blends patching and other surface irregularities into a consistent, identical surface
- Environmentally friendly



Pavement Problems Addressed

- Faulting at joints and cracks
- Built-in or construction roughness
- Polished surface
- Wheel-path rutting
- Permanent upward slab warping
- Inadequate transverse slope
- Unacceptable noise level



Safety, Surface Texture and Friction

- MoDOT Increased macro-texture of asphalt surface by diamond grinding to improve profile and drainage of water at tire-pavement interface
- In Wisconsin Marquette University found that, overall accident rates for ground surfaces were 40% less than for un-ground surfaces over a 6-year period, 57% in wet weather conditions

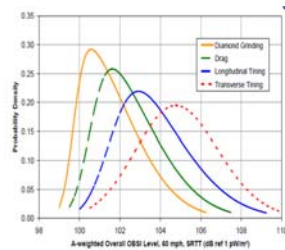


Commonly Used on Asphalt Pavement!

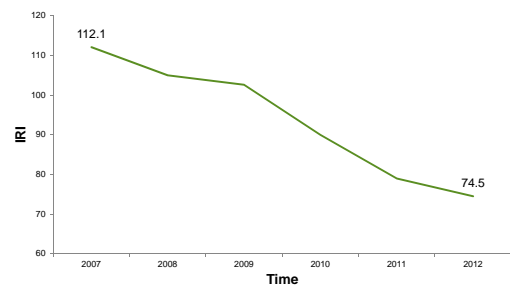


Blade Spacing Can Be Optimized

- Noise, Friction, or Smoothness can be optimized by blade spacing
- Research conducted by the National Concrete Pavement Technology Center shows diamond grinding as the most quiet PCCP surface texture commonly used



IRI of Kentucky Interstate PCCP



Impact of CPP Strategy in KY

- IRI Improved from 112.1 to 74.5 in 5 years
- Lowest recorded average IRI ever covering 536 lane miles
- \$188,000 per lane mile
- Diamond grinding had an avg. cost of \$2.75 per sq. yd. in KY over a 5-year period
- Reconstruction cost would have been \$1.5 - \$2.5 million/lane mile
- Preservation saved over \$1 Billion



Summary

- This is a challenging time for the transportation industry
- Innovative, cost-effective solutions are needed to meet these challenges
- Many CPP techniques provide sustainable benefits such as increased friction (safety), reduced noise, improved smoothness and long life
- Concrete Pavement Preservation can extend pavement life significantly at a competitive cost
- When building roadways we must begin with the end in mind – consider sacrificial thickness for future grinding
- IGGA/ACPA is ready to assist



For Additional Information

<https://www.fhwa.dot.gov/pavement/pres.cfm>
https://www.fhwa.dot.gov/innovation/everydaycounts/edc_4/
<http://igga.net>
<http://acpa.org>



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MICRO SURFACING

Association and Industry Acumen
Best Practices – HOW

Rusty Price
International Slurry Surfacing Association President
Intermountain Slurry Seal Vice President and
Operations Manager

every day counts  **Pavement Preservation:
How**
An Innovation Partnership with States



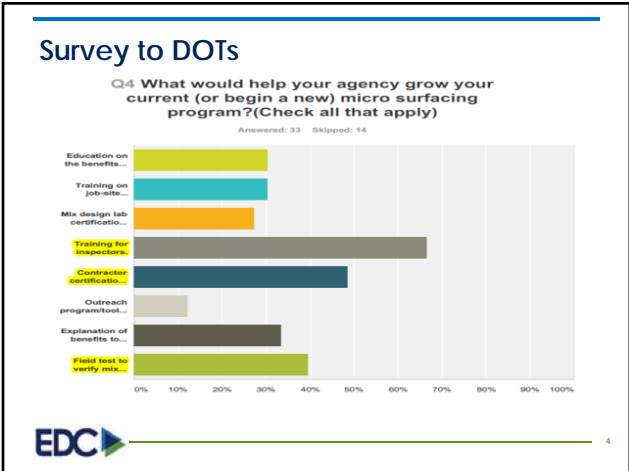
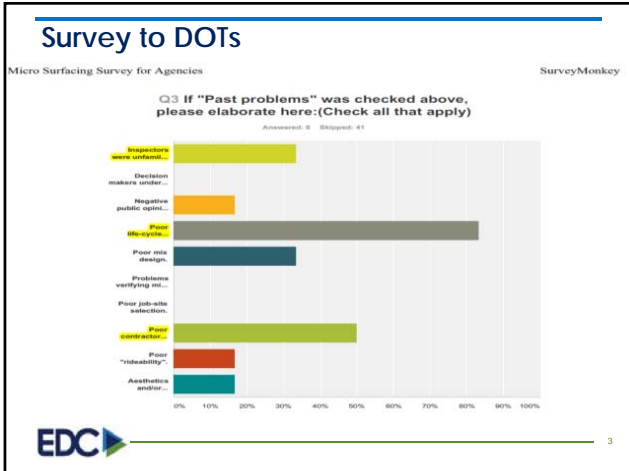
Source: (1) American Concrete Pavement Association; (2) Utah DOT; (3) Applied Pavement Technology, Inc.; (4) National Park Service; (5) Intergrain, Inc. DOT

EDC 

Best Practices

- Inspection
- Training
- Specifications
- Equipment and Calibration
- Mix Design
- Laboratory Accreditation
- Certification
- QC/QA Process and TQM
- Innovative Contracting Methods

EDC 



Inspection

"You don't get what you Spec, you get what you Inspect!"

- Micro surfacing is a cold, thin surface treatment that requires specialized personnel, equipment and experience...
- What it is not... "Black Magic"
- Knowledge and experience are critical at all levels of the process / contractor and agency



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Training

- ISSA Slurry Systems Workshop
- (WBT) Web-Base Training
 1. How to construct high-quality micro surfacing treatments
 2. Best construction practices for operating a spreader box for micro surfacing
- NCPP Training Courses
ncpp@egr.msu.edu
- ISSA Inspectors Manual



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Slurry Systems Workshop Live Demonstrations



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Specifications

AASHTO... New Specifications for Micro surfacing

- [MP028-16-UL](#) Standard Specification for materials for micro surfacing.
- [PP083-16-UL](#) Provisional Standard Practice for micro surfacing design.
- [M316](#) Polymer Modified Cationic Emulsified Asphalt
- Local Department of Transportation Standard Specifications or Special Provisions



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Equipment – Continuous Paver



EQUIPMENT – EMCAD System



Variable-Width Spreader Box



Calibration

- Why do we calibrate?
- We calibrate the machine so we can adjust it to obtain the ratio of the mix as set forth in the mix design
- Job Mix Formula (JMF) mix design information
- Test strip prior to construction
- Verify JMF proportions

Mix Design ISSA A 143 Specifications

ISSA TEST NO.	DESCRIPTION	SPECIFICATION
ISSA TB-139	Wet Cohesion @ 30 Minutes Minimum (Set) @60 Minutes Minimum (Traffic)	12 kg-cm Minimum 20 kg-cm Minimum or Near Spin
ISSA TB-109	Excess Asphalt by LWT Sand Abrasion	50 g/ft ² Maximum (538 g/m ² Maximum)
ISSA TB-114	Wet Stripping	Pass (90% Minimum)
*ISSA TB-100	Wet-Track Abrasion Loss One-hour Soak Six-day Soak	50 g/ft ² (538 g/m ²) Maximum 75 g/ft ² (807 g/m ²) Maximum
ISSA TB-147	Lateral Displacement	5% Maximum
ISSA TB -144	Classification Compatibility	11 Grade Points Minimum (AAA, BAA)
ISSA TB-113	Mix Time @ 77° F (25 °C)	Controllable to 120 Seconds Minimum



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Laboratory Accreditation for Micro surfacing Mix Designs

AMRL and ISSA have been working together for 2 years.

- Proficiency sampling
- Assessment
- Accreditation



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Certification: The Why, Who, What, and How

- NCPP – National Center for Pavement Preservation
- ISSA – International Slurry Surfacing Association
- AASHTO – American Association of State Highway Transportation Officials
- TSP² – AASHTO Transportation System Preservation Program (the AASHTO voice for preservation)
- PPP – Pavement preservation partnerships (regional groups of TSP² Members)



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Certification: Why

- Over the past 5+ years the Regional PPP have looked for ways to increase use of preservation among member states
- Have identified 3 major points that, if adopted, would increase the use of preservation
 - Mix Design lab accreditation
 - Updated specifications
 - Contractor certification



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Quality Assurance

Micro surfacing Quality Assurance Research

- Quality Assurance (QA) is NOT Quality Control (QC)
- The **difference** is that **QA** is process oriented and **QC** is product oriented
 - Testing is product oriented and is in QC domain
 - Testing for **quality** doesn't assure **quality**; it controls it
- **QA** makes sure you are doing the right things in the right way



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Total Quality Management

- Quality – degree of satisfaction of the customer
- Quality Control (QC) – assess and adjust the level of quality produced for the end product
- Quality Assurance (QA) – confidence that a product or service will perform satisfactorily and the continued evaluation of all project activities
- Independent Assurance – third party assessment of product and reliability of the testing
- Verification – determining the accuracy of test results, sampling, and testing part of the QC/QA process

TOTAL QUALITY MANAGEMENT – the ultimate in managing the design and construction of the above



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Innovative Contracting Methods

- Method of Measurement and Payment
- Incentive / Disincentive Pay Factors
- P + T / Lane Rental / IDIQ
- Performance Measures or Specifications
- Certification
- Laboratory Mix Design Accreditation



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Do's



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Don'ts



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SUCCESS

- Specifications / Innovative Contracting
- Experience / Training
- Equipment
- High-Quality Materials
- Testing and Verification
- Inspection
- PLEASE BE SAFE!

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Photo sources: (1) American Concrete Pavement Association; (2) Utah DOT; (3) Applied Pavement Technology, Inc.; (4) National Park Service; (5) Washington State DOT

Virtual Summit Presenter Biographies and Presentations



Photo sources: (1) American Concrete Pavement Association; (2) Utah DOT; (3) Applied Pavement Technology, Inc.; (4) National Park Service; (5) Washington State DOT

Virtual Summit Presenter Biographies

Todd Kinney is a 1993 graduate of Iowa State University with BS in Civil Engineering. He has 8 years of experience as a consulting engineer and 15 years of experience serving as the Clinton County Engineer. He is an active member of the National Association of County Engineers, serving as chair of the NACE Pavement Preservation committee the last three years. In 2015 he was selected as the NACE Rural County Engineer of the Year.

Presented at Virtual Summit on: September 28, 2016

Presentation on page: 63



Bob Jerman has been with Ingevity for almost 30 years. He began his career with Ingevity in 1986 in their Research Division. In 1995, he joined the Pavement Technologies team. He was promoted to Technical Service Manager in 2000. He is currently the Director of Technical Services, responsible for global technical support for the Pavement Preservation and Evotherm Technologies businesses provided from the Ingevity laboratories in Lille, France; Shanghai, China; Bangalore, India; and Charleston, South Carolina. In addition to his Ingevity responsibilities, Bob has served on ISSA's Board of Directors as Technical Director for the last nine years.

Presented at Virtual Summit on: September 28, 2016

Presentation on page: 68

Concrete Pavement Repair Best Practices Clinton County, Iowa

Todd Kinney, P.E.
County Engineer

every day counts
An Innovation Partnership with States

**Pavement Preservation:
How**



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Best Practices – Full Depth Repair

- Selection of repair sites
- Work staging
- Materials
- Standards
- Work zones

EDC

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Clinton County, Iowa

- 220 miles of paved roads
- Approximately 50,000 population
- 780 miles of aggregate roads
- 39 Road Department employees
- 10th largest county in Iowa by area
- Our eastern county line is the Mississippi River
- \$50,000- \$75,000 per year on PCC repair

EDC

How sites are selected

- Faulted or cracked areas that cause rideability issues
- Summer time blowups
- Over drainage structures that experience heave differentials and settlement issues
- Over Drainage structures recently replaced in preparation for resurfacing project
- Restore rideability and structural integrity

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Freeze/Thaw heave differential



Freeze/Thaw issue



Culvert replacement



Work Staging

- Sawcut patching area 1-2 days in advance
- Traffic disruption 7:30AM-3:30PM
- One lane patching completed at a time
- Through traffic maintained via traffic control
- Scope of repair work sized for one day lane closures only



Saw cut replacement area



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Materials

- High early strength ready mix concrete
- 5 hour cure time
- 6% air entrainment target
- 3" slump
- No flyash
- Calcium chloride additive
- Epoxy coated rebar

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Epoxy coated rebar



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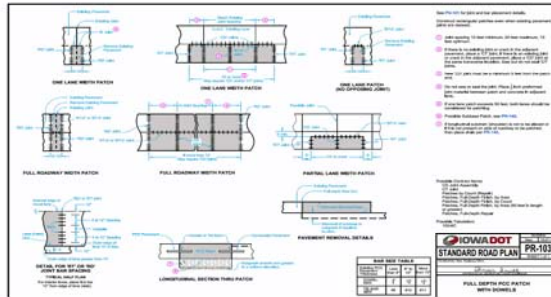
Standards

- Foreman have copies of Iowa DOT standard details
- Basic/uniform method for repairs
- Employees have familiarity with process and requirements
- Reduces errors and re-work
- Adequate load transfer at transverse joints

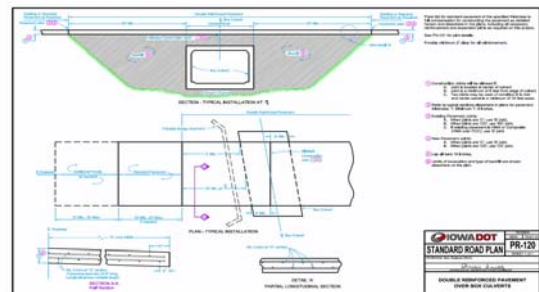
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Iowa DOT standard



Iowa DOT standard



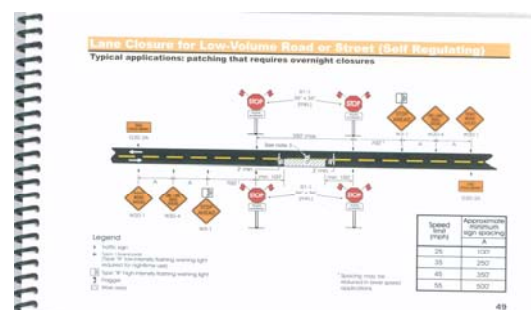
Work Zones

- Each Foreman has Work Zone Handbook
- Designated traffic control trailer (standard signs and equipment)
- Temporary work zone speed limits
- Patch usually placed by 10-11AM (opened by end of the day)
- Work zone signage discussed at safety meetings (annual flagger training)



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Typical Work Zone Signage



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Traffic Control Trailer



Other Best Practices

- Patching trailer with tools, re-usable steel forms, vibrator, power screed, saw, etc... stocked and ready to go
- Transverse tine finish
- Self propelled compaction unit (uniform subgrade support)
- Usually high speed locations 55 mph and up (get in and get out)



Questions?

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Clinton County Engineer
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Innovations in Slurry Systems – Association/Industry Insight

Domestic and International Perspectives from the International Slurry Surfacing Association (ISSA) and Industry

Bob Jerman

ISSA Technical Director / Ingenuity Pavement Technologies Technical Service Director

every day counts
An Innovation Partnership with States

**Pavement Preservation:
How**



ISSA Pavement Preservation Treatments

- Slurry Seal
- Micro Surfacing
- Chip Seal
- Crack Treatment



2

PERFORMANCE GUIDELINES



3

EXPRESSWAY MICRO SURFACING



4

MICRO SURFACING, CRACK TREATMENT AND SLURRY SEAL



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5

MICRO SURFACING



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6

Next ???

2017 ???

- Recommended Performance Guideline for Polymer-Modified Emulsified Asphalt Slurry Seal – A110 ???
- Recommended Performance Guideline for High Performance Micro Surfacing – A153 ???

EDC

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AASHTO ... New Standards Impacting Pavement Preservation

- **Micro Surfacing**
 - MP028-16-UL Standard Specification for Materials for Micro Surfacing
 - PP083-16-UL Provisional Standard Practice for Micro Surfacing Design
- **Chip Seal**
 - MP027-16-UL Standard Specification for Materials for Emulsified Asphalt Chip Seals
 - PP082-16-UL Provisional Standard Practice for Emulsified Asphalt Chip Seals
- **Emulsion Specification Amendments**
 - M140 Emulsified Asphalt
 - M208 Cationic Emulsified Asphalt
 - M316 Polymer-Modified Cationic Emulsified Asphalt

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Communication / Education / Training

- ISSA Slurry Systems Workshop
- Web-Based Training (WBT)
 - How to Construct High Quality Slurry Seal and Micro Surfacing Treatments — Part 1 and Part 2
 - How to Construct High Quality Chip Seal Treatments
 - Best Construction Practices for Operating a Spreader Box used with Slurry/Micro Surfacing Materials
 - Best Construction Practices for Crack Sealing and Joint Filling of Asphalt and Concrete Pavements
- NCPP Training Courses
 - For Training Course Details, Contact ncpp@egr.msu.edu



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Accreditation and Certification

- AMRL ... Pavement Preservation Laboratory Accreditation Program
- Agency/Contractor Certification



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Thank You For Questions/Comments:

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