

TRANSPORTATION RESEARCH BOARD

# How to preserve your pavement through better crack seal

Monday, February 24, 2020  
2:00-3:30 PM ET

***The Transportation Research Board has met the standards and requirements of the Registered Continuing Education Providers Program. Credit earned on completion of this program will be reported to RCEP. A certificate of completion will be issued to participants that have registered and attended the entire session. As such, it does not include content that may be deemed or construed to be an approval or endorsement by RCEP.***



**REGISTERED CONTINUING EDUCATION PROGRAM**



## Purpose

Explore better crack sealing projects.

## Learning Objectives

At the end of this webinar, you will be able to:

- Identify roadways that can benefit from crack sealing
- List the types of crack seal applications
- Identify the key steps in crack sealing and some alternate approaches



# Building Better Crack Seal Projects

Crack Sealing 101 and Best  
Practices

**Bryan Darling**  
**Regional Manager - Crafcro Inc.**

# Agenda

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- Crack Movement
- Pavement Condition
- Crack Density
- Crack Width
- When is Pavement Too Far Gone for Crack Treatment?
- Seasonal and Environmental Factors
- Application Configuration



# Crack Movement

## § Horizontal Thermal Movement

- Temperature changes
- Pavements contract during lower winter temperatures, opening cracks in the pavements
- Pavements expand during higher summer temperatures, closing cracks in the pavements

Cracks can open up to 100% of original width as the pavement temperature changes from summer to winter extremes <sup>19</sup>

Rate	0 - 0.004 mm/min
Daily	0 - 2 mm
Seasonal	0 - 25 mm

## § Vertical Movement

- Up and down movement
- Caused by traffic loads



# Pavement Condition



Good



Fair

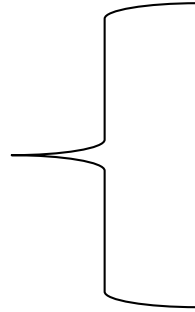


Poor

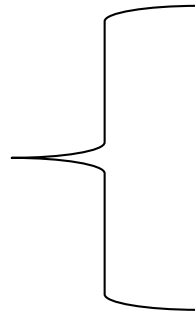
- Good: Crack Sealing increases life expectancy
- Fair: Crack Sealing increases life expectancy
- Poor: Crack Sealing increases life expectancy; however all variables of the pavement should be evaluated to determine the appropriate treatment

# Crack Density

Greater than 20%  
Crack Density



Less than 20%  
Crack Density



\*Crack density can be used as a general guideline to determine whether or not routing is appropriate. Dependent upon other pavement variables, routing may or may not be appropriate outside of these guidelines.\*



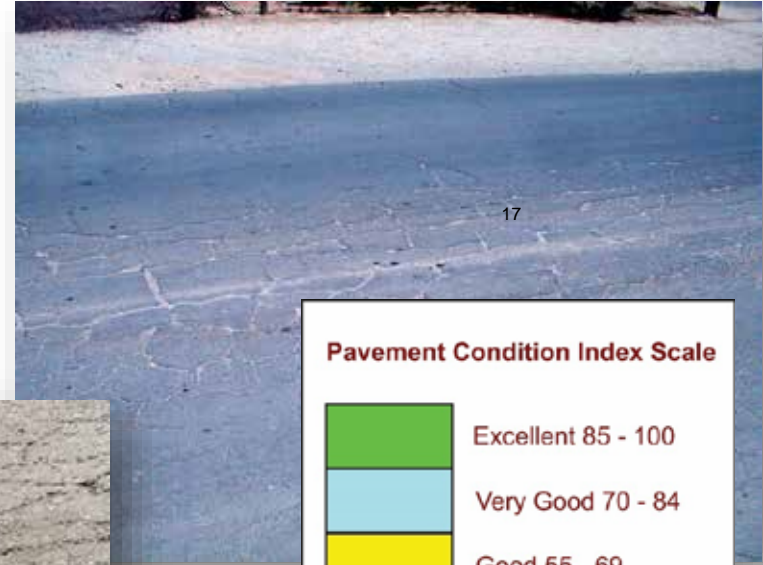
# Pavements Too Far Gone for Crack Treatment








§ **Extensive fatigue cracking**

§ **Structural failure of underlying pavement base**

§ **PCI**

- Very Poor
- Failed



Pavement Condition Index Scale	
	Excellent 85 - 100
	Very Good 70 - 84
	Good 55 - 69
	Fair 40 - 54
	Poor 25 - 39
	Very Poor 10 - 24
	Failed 0 - 9

Crack	Crack Width	Crack Density Less than 20%	Crack Density Greater than 20%
Hairline to Large			

Use Mastics to seal wide cracks



# Seasonal & Environmental Factors

Crack Sealing can be accomplished in all 4 seasons:

- Summer is typical/customary
- Spring & Fall are optimal
- Winter crack sealing can be done with proper care and if conditions are appropriate



# Preparation Best Practices

- **Structurally sound pavement**
- **Dry Crack**
- **Clean Crack**



# Structurally Sound Pavement

- Intact Bonding Surface
- Tight, strong surface
- No surface raveling
- No Loose aggregate



# Clean Crack

- **Surfaces Need To Be Clean**
- Pavement surface and crack walls free from dirt and debris
- Dirt will prevent proper adhesion



# Dry Crack

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SURFACES NEED TO BE



DRY PAVEMENT  
SURFACE AND CRACK  
INTERIOR



DAMPNESS



DARKENING OR  
DISCOLORATION DUE  
TO MOISTURE



FROST OR DEW



MOISTURE WILL  
PREVENT PROPER  
ADHESION AND  
GUARANTEE SEALANT  
FAILURE

# Winter Crack Sealing

- Clean, dry cracks and proper temperature are the keys to effective crack sealing.
- Having a dry road is even more important than air or pavement temperature.
- When sealing in the winter, choose a softer, more flexible sealant.
- Apply sealants at the upper-end of their recommended application temperature range.
- Ensure that your equipment is ready to work in the cold.
- Keep the sealant narrow and tight to the pavement to minimize exposure and damage from traffic and snow plows.





# Proper Pavement Temperature

- Pavement Temperature 40°F minimum.
- CAUTION should be observed when applying products below the dew point.
- Hot Air Lance can be used to warm the pavement.



# Hot Air Lancing

- Hot Air Lancing
  - Removes debris, burns weeds, removes moisture, and warms pavement
- NEVER to be used to continue work during rain or when pavement surface is saturated
- Conditions where hot air lancing is frequently recommended:
  - Moist climates
  - Nighttime crack treatment projects
  - Temperatures below the dew point





What to Look at  
and for, to  
Achieve Quality

# What are Placement Configurations?

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**4 categories of sealant placement configuration for crack sealing:**

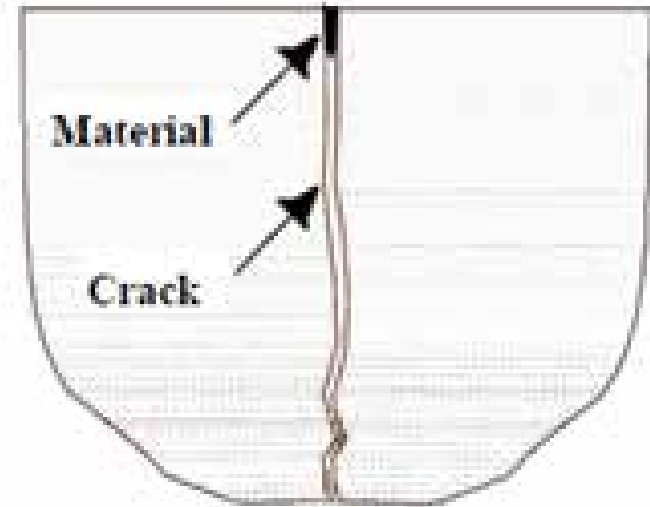
- **Flush Fill**
- **Overband**
- **Reservoir**
- **Combination**



# Flush Fill Configuration

## Flush Fill

- Sealant placed into crack, flush with the pavement
- Any excess is struck off

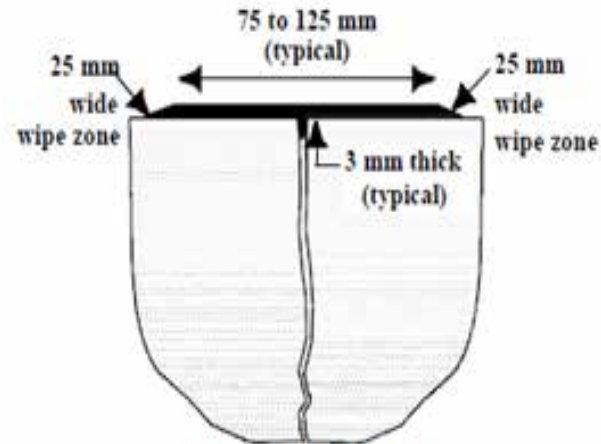


**A. Flush-fill**

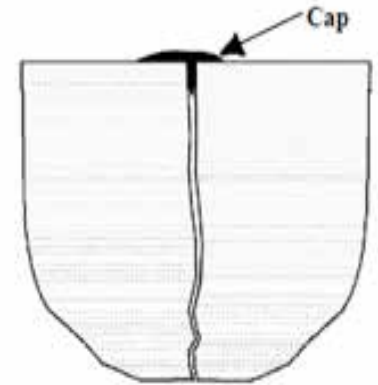
# Overband Configuration

## Overband Configurations

- Squeegeed sealant overband (Figure B)
- Capped overband w/ sealing disc (Figure C)



B. Simple Band-Aid



C. Capped

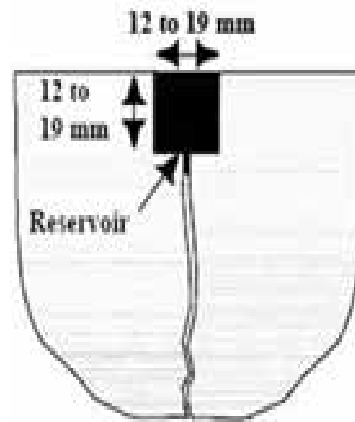
# Reservoir Configurations

## Reservoir Configurations

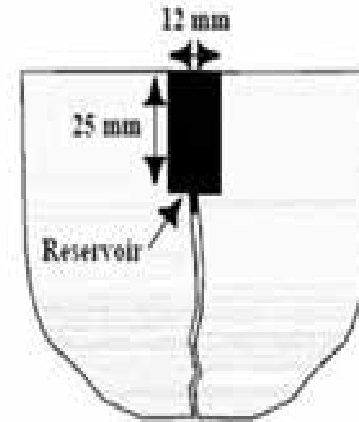
- § Standard Flush
- § Deep Flush
- § Shallow Flush

## Combination Configurations

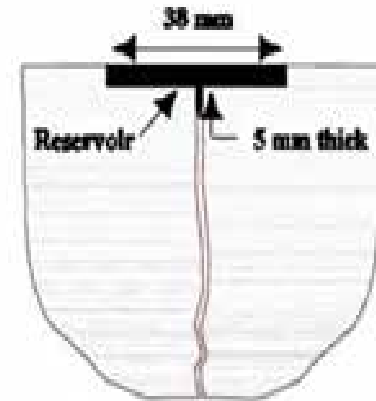
- Designed Reservoir
- Material placed into and over the reservoir
- Material shaped into an overband with squeegee or overband created by use of a sealing disc
- Overband centered over crack reservoir



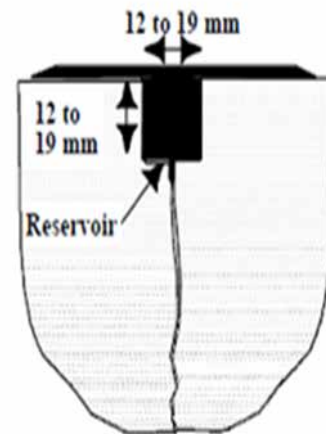
D. Standard Flush



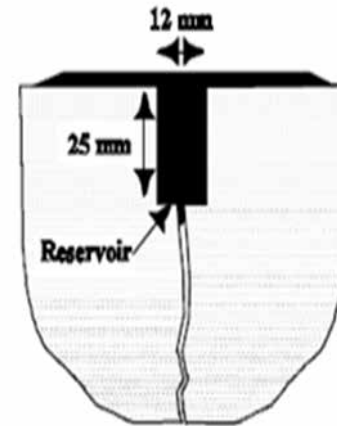
E. Deep Flush



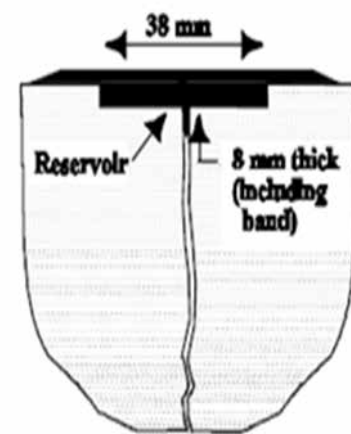
F. Shallow Flush



I. Standard Recessed Band-Aid



J. Deep Recessed Band-Aid



K. Shallow Recessed Band-Aid



# Proper Sealant Temperature

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- Follow the Manufacturer's recommended application temperature range!!  
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- Over-heating or under-heating the sealant will result in limited performance and/or failure.



# Proper Sealant Heating

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- Load and heat sealant prior to planned start of installation.
- Always apply product within manufacturer's minimum and maximum temperature range.
- Inspect your temperature regularly.
- Overheating may damage product properties.
- Under-heating may cause adhesion issues.



# Maintaining Temperature

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- Agitation should be continuous; except when melter lid is opened to add sealant
- Agitation increases heating and maintains sealant temperature uniformity
- Add sealant blocks equal to installation rate to best maintain sealant temperature – avoid adding many blocks all at one time



# Maintaining Temperature

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- Heating for too long at high temperatures can damage sealant.
- Thickening or gelling (getting “stringy”) are signs of overheating.
- In this case, sealant must immediately be drained from melter and disposed.
- Using damaged sealant may result in adhesion, tracking/bleeding issues.
- Always follow manufacturer’s instructions for heating temperatures.



# Re-Heating

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- Some manufacturers recommend to attempt to use all sealant on the day of installation. Check manufacturer recommendations to ensure you are following their instructions for re-heating.
- Some sealants can be reheated; check manufacturer's instructions



# Finishing

Good applications are achieved by:

1. Meeting the project design configuration: (Flush, Overbands, Reservoirs, Combination)
2. Performing good, clean applications free from drips, puddles, and excess sealant



# Opening to Traffic

- Crack treatment areas should not be opened to traffic or pedestrians until:
  - the sealant has cooled to the pavement surface temperature
  - cured sufficiently to not be affected by traffic
- Application configurations should be taken into consideration
- De-tacking products may be used to open treatments to traffic more quickly



De-tack  
Application

Keep traffic off treatment until  
sufficiently cooled or cured



# Re-Sealing Procedures

1. Remove old sealant
  - § If old sealant is not removed; use a hot air lance on old sealant to help new sealant adhere
2. Remove debris and moisture; air compressor.
3. Hot air lance to remove moisture and heat old sealant to create a better bond between old and new sealant.
4. Fill the crack with sealant from bottom to top to ensure a complete seal.
5. Overband using a sealing disc or squeegee. Overbands should extend approximately 1" beyond each side of the crack.



# Improper Application





# Common Finishing Issues

## 1. Sagging

- Apply a second coat to achieve desired level



## 2. Puddling

- Turn and go back over crack to make a smooth, even application



## 3. Drips and excessive application

- Use a drip stopper
- Avoid poor workmanship



Questions?



Thank You!

# **Building Better Crack Seal Projects**

## **Introduction to Crack Sealing and Filling**

**Larry Galehouse, P.E., P.S.  
National Center for Pavement Preservation**

# Introduction to Crack Sealing and Filling

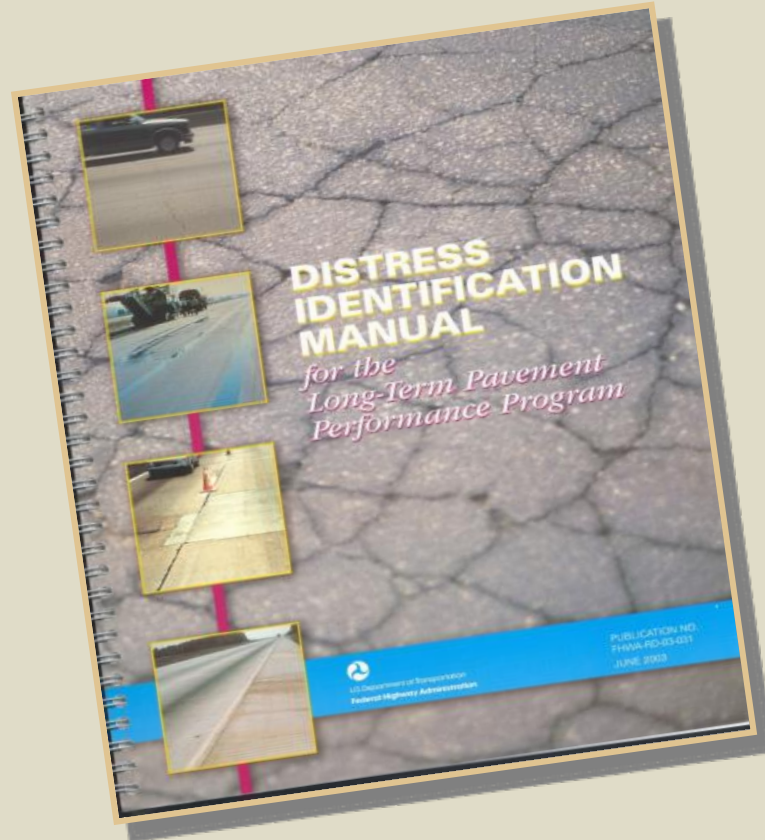
## Learning Objectives:

- Distinguish the difference between working and non-working cracks.
- Understand the reasons for crack sealing and crack filling.
- Recognize the advantages of crack treatments.

- Asphalt is most flexible and resistant to cracking at construction.
- Cracks occur when the asphalt is no longer flexible enough to resist movement due to:



# Distress Identification Manual



# Working Cracks

- Cracks that open and close horizontally with temperature and moisture changes or undergo vertical movements as the result of load applications.
- Annual ( ).
- Most working cracks are **transverse cracks**.

# Transverse Cracks





# Transverse Cracks

- Cracks form perpendicular to the pavement lane.  
Thermal  
Reflective
- Typically caused by environmental factors and by reflection of underlying joints.
- Often experience concentrated and extreme movement.
- Crack Sealing is recommended to accommodate the expected crack movement.

# Non-Working Cracks

- Generally non-active cracks and created by aging of the asphalt binder.
- Most non-working cracks are longitudinal and diagonal cracks.

# Longitudinal Cracks

- Cracks run parallel to pavement lane
  - Construction Joint
  - Thermal/Reflective
  - Wheel path
- Typically caused by construction of pavement joint, thermal conditions, and traffic loading.
- Crack Sealing is recommended to prevent intrusion of moisture and debris.



# Block Cracks

- Block cracks typically form in older pavement.
  - Hardening of asphalt
  - Thermal effects/shrinkage of asphalt during cold weather
  - Form in traffic and non-traffic areas
- Effectively treated by crack sealing.



# Fatigue Cracks

- Fatigue cracks are also known as **alligator** cracks.
- Indication of structural failure.
- Typically occurs later in a pavement's life due to high traffic loads.
- Crack seal or fill cracks larger **cracks** -treatment to other surface treatments.



# Crack Sealing & Crack Filling

- The methods in which cracks are directly treated.
- Crack sealing and crack filling are cost-effective pavement preservation methods that:
  - Extend pavement life
  - Protect an agency's investments
  - Maintains pavement structure
  - Limits future deterioration, prevents potholes

# Crack Sealing & Crack Filling

**Crack Sealing** is the placement of

above or into cracks using unique configurations to prevent the intrusion of water and incompressible materials into the pavement structure.

**Crack Filling** is the placement of \_\_\_\_\_ into low-moving cracks to reduce infiltration of water and to reinforce the adjacent pavement.



<b>Crack Sealing</b>	<b>Crack Filling</b>
Seals the crack to prevent the intrusion of water and incompressible materials	Fills some of the void in the crack to reduce intrusion of water and incompressible materials
Specialized treatment materials	Ordinary treatment materials
Highly-elastic and flexible material	Rigid material or semi rigid
Endures vertical & horizontal movement	Can not endure vertical & horizontal movement
Crack preparation to assure long service life of sealant	Cursory crack preparation
Sealant placement configuration	Fill crack void, then dust with sand



<b>Crack Sealing</b>	<b>Crack Filling</b>
Considered semi-permanent	Considered temporary
Seals routed/working crack (Life average of 5 years. Up to 10 years on new pavements)	Filling not recommended for moving cracks, unable to accommodate movement
Seals overbanded/non-working crack (Life approximately 2 to 5 years)	Fills non-working crack (Life approximately a few months up to 1 year)
Modification to perform in a wide variety of climatic temperatures	More susceptible to environmental conditions

# Crack Sealing & Crack Filling



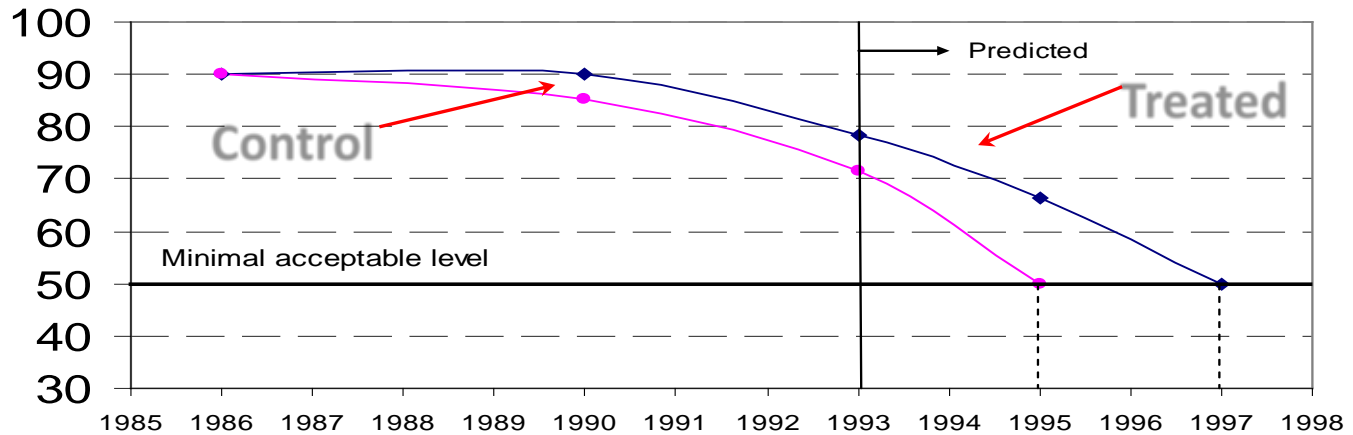
# Advantages and Benefits

- Reduces water penetration into the pavement structure, thus maintaining base strength near the crack.
- Reduces incompressibles, thus reducing crack growth and raveling.

# Advantages and Benefits

- Slows pavement deterioration
- Prevents future roughness increase
- Reduces potholes
- Slows crack spalling
- Extends pavement life from 1 to 4 years

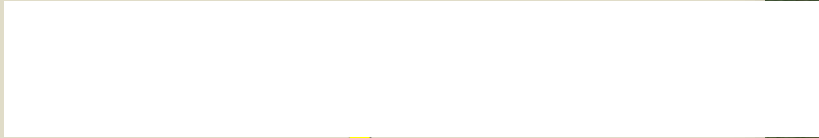
# Advantages and Benefits



# Commonly Missed Opportunities



# Commonly Missed Opportunities



# Best Practice





# Commonly Missed Opportunities



# Commonly Missed Opportunities



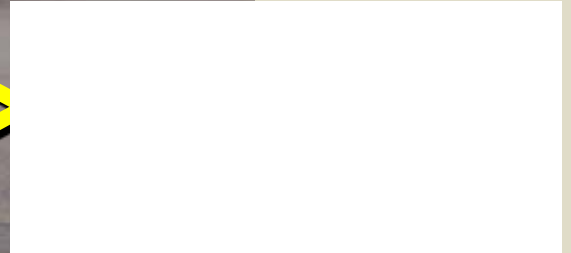
# Commonly Missed Opportunities



# Best Practice



# Best Practice



Thank You!

A row of seven colorful circles in red, orange, yellow, green, blue, purple, and dark purple, positioned below the text.

# Building Better Crack Seal Projects

Moderated by: Judith Corley-Lay  
Chairman of AHD18

# Agenda for this webinar

- u Larry Galehouse will provide an introduction to crack treatments and project selection.
- u Bryan Darling will provide specifics. What we should look for to have successful projects.
- u Andy Bennett will discuss the Michigan DOT program and how crack sealing helps them reach their performance goals.
- u Questions from the chat box.



# Sponsors

- u AHD18 (soon to be AKT20), the committee on Pavement Preservation, developed this webinar.
- u AHD20 (soon to be AKT30), the committee on Pavement Maintenance, is co-sponsoring. AHD25, the committee on Sealants and Fillers for Joints and Cracks is also co-sponsoring.

*You are invited to attend these committees at the January annual TRB meeting.*

# Michigan Crack Sealing

How Crack Sealing Fits in MDOT's  
Preventive Maintenance Program

Andy Bennett  
CPM Scoping Specialist

# MDOT Capital Preventive Maintenance (CPM)

- ▶ MDOT CPM program was established in the early 1990's
- ▶ MDOT classifies two categories of CPM program treatments, Pavement Seals and Functional Enhancements
- ▶ Functional Enhancements include non-structural HMA overlays, concrete pavement restoration, and under-drain repair
- ▶ Pavement Seals category includes HMA crack treatment, chip seal, micro surfacing, and ultra-thin HMA overlay

# HMA Crack Treatment

- ▶ Stand alone projects that include both crack sealing for working transverse cracks and crack filling for non-working and secondary cracks
- ▶ HMA crack treatment stand-alone projects typically include a two-year material and workmanship warranty
- ▶ Overband Crack fill as a pre-treatment for chip seal, micro surfacing, and ultra-thin HMA overlays
- ▶ Warranty for pre-treatment is on the surface seal

# Materials

- ▶ ASTM 6690 Type IV is specified for crack sealing and ASTM 6690 Type I/II material is specified for crack filling
- ▶ 2010 pavement test section was constructed with industry partners (MRPA) to evaluate 16 different Type I/II crack fill materials
- ▶ Qualified Product List (QPL) for crack fill materials was developed that combined the field performance and laboratory test results
- ▶ Crack seal material (6690 Type IV modified) are also accepted by QPL
- ▶ Mastic materials for wide cracks are specified by Special Provision and are currently being evaluated for performance

# 2010 Crack Fill Test Section



# Project Scoping

- ▶ MDOT call for CPM projects occurs 2 years in advance of contracts
- ▶ 22 Transportation Service Centers coordinate with 7 Region offices for review of projects with MDOT Central office
- ▶ Pavement data including distress index, ride quality, rutting, and remaining service life are assessed at annual review for each fix type
- ▶ HMA crack treatment timing guidelines for full depth HMA pavement is 2-4 years old and on composite pavement 1-2 years old
- ▶ Region offices need to anticipate projects for stand-alone crack treatment due to the 2-year call process

# CRACK SEALING



Pre-treatment



Stand Alone



??



# CRACK SEALING

- ▶ Best Practices → Location Selection in Spring
- ▶ Review Sites Before Work
- ▶ Crack Density
  - ▶ When to crack seal vs surface seal
  - ▶ Contact Rob Green, CPM Engineer



# CPM Crack Treatment Contracts

- ▶ Rout and seal all working cracks ( $1/8''$  movement) less than  $1\ 1/4''$  wide creating a reservoir approximately  $3/4'' \times 3/4''$  filled flush to the surface
- ▶ Fill all visible non-working cracks less than  $1\ 1/4''$  wide in an overband configuration  $4''$  wide for stand alone crack treatment
- ▶ Requirement for pre-treatment crack filling are specific to the type of overlay treatment
- ▶ Pay items for HMA Crack Treatment (stand alone) and Overband Crack Fill (pre-treatment) are paid for by Lane Mile

# Contracts Continued

- ▶ MDOT requires the contractor to have a quality control (QC) plan that outlines a list of minimum project requirements
- ▶ A two-year warranty begins for most stand-alone crack treatment projects after initial acceptance of the project
- ▶ Many MDOT offices have bundled multiple Region-wide locations with single contracts for economy of scale
- ▶ Fixed-price, variable scope is an innovative contracting approach that MDOT has utilized for crack treatment projects

# Cost Effectiveness of MDOT's CPM Program

- ▶ 2013 study conducted by Applied Pavement Technology, Inc. ( Peshkin, Ram) in association with MTU looked at several years of pavement data (IRI, Rut, Distress Index) to determine the costs and benefits of various preventive maintenance treatments
- ▶ Outcome of the study showed the preservation strategy resulted in a cost savings of 25 percent per lane mile over a rehabilitation strategy
- ▶ For full depth flexible pavements HMA crack treatments have the highest benefit-cost ratio when all data was considered
- ▶ Stand alone HMA crack treatment showed a life extension of up to 3 years, 1109 crack seal projects were evaluated in the study

# Crack Filling as a Pre-treatment

Chip Seal without crack filling



Chip seal with crack filling



# MDOT Challenges with Crack Seal Projects

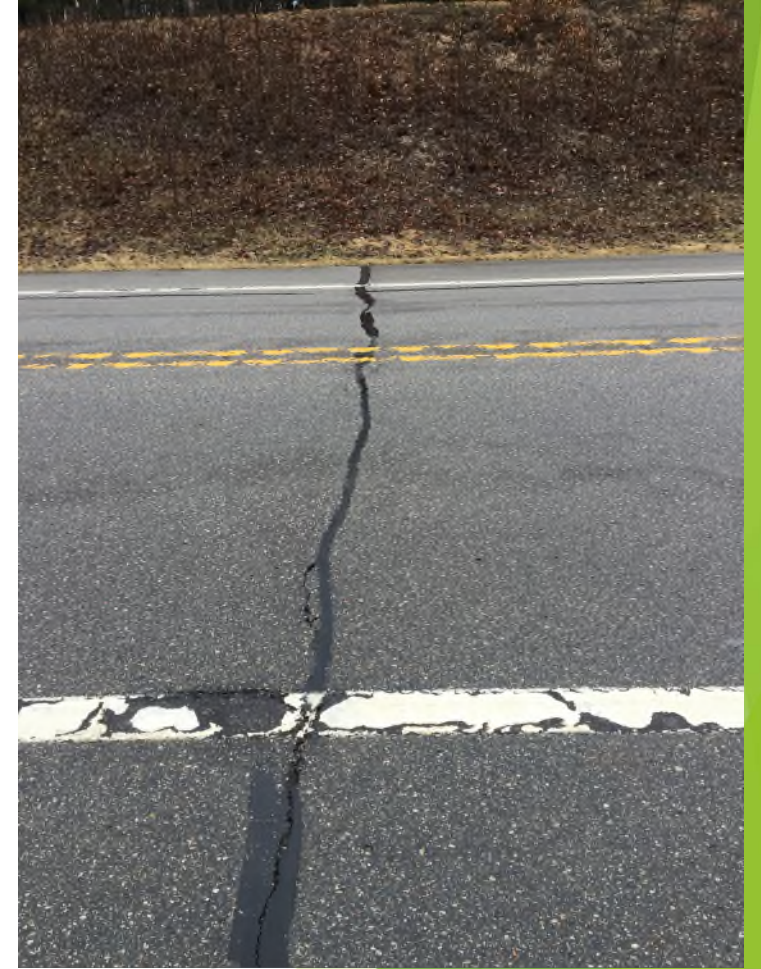
- ▶ Selecting and locating transverse working cracks before or during installation of the sealant
- ▶ Secondary cracks and multiple reflective cracks in composite pavement sections (mainly determined by repairs in concrete prior to overlay)
- ▶ Setting better guidelines for crack density to determine when pre-treatment with a thin surface overlay is more appropriate than stand alone
- ▶ Training



Should have been routed



Multiple cracks in composite



Secondary cracking

# Future for HMA Crack Treatment

- ▶ MDOT will continue crack sealing and filling as a preventive maintenance treatment to postpone major rehabilitation and extend the service life of the original pavement
- ▶ Continue to review crack treatment project performance and update guidelines to MDOT's CPM manual
- ▶ Evaluate mastic materials for wider cracks (over 1 ¼") as an additional tool for crack treatment projects



# QUESTIONS

THE END



# Today's Speakers

- Judith Corley-Lay, [jcorleylay314@gmail.com](mailto:jcorleylay314@gmail.com)
- Larry Galehouse, [galehou3@egr.msu.edu](mailto:galehou3@egr.msu.edu)
- Bryan Darling, [bryan.darling@crafco.com](mailto:bryan.darling@crafco.com)
- Andy Bennett, [Bennetta@michigan.gov](mailto:Bennetta@michigan.gov)



# Get Involved with TRB

- Getting involved is free!
- Join a Standing Committee (<http://bit.ly/2jYRrF6>)
- Become a Friend of a Committee (<http://bit.ly/TRBcommittees>)
  - Networking opportunities
  - May provide a path to become a Standing Committee member
- ***Sponsoring Committee: AHD18***
- For more information: [www.mytrb.org](http://www.mytrb.org)
  - Create your account
  - Update your profile



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Board

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- Highlight 100 years of accomplishments.

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