Crack Sealing Innovations

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Rocky Mountain West Pavement Preservation Partnership Meeting
Oct 9, 2014
Innovation -- Definitions

• An improvement to something already existing

• A new idea, device, method, or process

• Application of a better solution to meet needs

• Translating an idea into good service that creates value
Areas of Innovation in Crack Sealing

- Benefits of Crack Sealing
- Crack Seal and Crack Fill
- Design Process
- Meltable Packaging
- Mastics
- Equipment
Benefits of Crack Sealing

• Slows pavement deterioration rate
• Slows roughness increases
• Reduce pothole and depression formation
• Slows crack spalling
• Extends pavement life
• Cost effective
• Effective pretreatment for other preservation processes
Longer Pavement Life

Performance Curves: control vs Treated -- Highway 11 (Ontario)
Crack Seal and Crack Fill

• From FWHA RD-99-147 report, SHRP H-106
• Different techniques should be used for high movement and low movement cracks
• Crack Seal - high movement > 1/8 in/yr
  – Thermal transverse, > 15-20 ft spacing
  – Extensible sealants in designed reservoirs
• Crack Fill - low /non-moving <1/8 in/yr
  – Longitudinal, close transverse < 15-20 ft
  – Installation in cleaned cracks or reservoirs
NCHRP Report 784    Best Practices for Crack Treatments

• 62% of survey respondents made no distinction between crack seal and crack fill

• Generally Crack Sealing used in cold climates and transverse cracks and Crack Filling in warmer climates and longitudinal cracks

• Many agencies do not differentiate between processes which likely precipitates some performance issues

• Some agencies have developed different processes

• Determining Crack Seal or Crack Fill is considered the Best Practice for evaluation of cracking
Crack Treatment Design Process

1. Pavement Evaluation
2. Temperature Ranges
3. Installation Geometry
4. Sealant Selection
5. Installation
Step 1 - Pavement Evaluation

- Examine pavement for applicability and determination of crack treatment process

- Intact defined cracks
- Max width 1.5 in
- Minimal base damage
- PCI Range 40-90
- Condition can be too bad for crack sealing & filling
- Crack spacing & density
- Determine Seal or Fill
Crack Movements

Figure 12c Crack movement, crack No. 1. pos. 1 B
Step 2 – Temperature Ranges

**FHWA LTPPBIND** can be used for indicating pavement temperatures at a site

- Indicates maximum and minimum pavement surface temperatures, statistically based
- High temperatures  40 to 76°C  (98%)
- Low temperatures  -10°C to -52°C (98%)
LTPPBIND 98% High
LTPPBIND 98% Low
# LTPPBIND 98% Temperatures

<table>
<thead>
<tr>
<th>State</th>
<th>Temperatures: 76 70 64 58 52 46 40</th>
<th>-10 -16 -22 -28 -34 -40 -46 -52</th>
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<tr>
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<td>Wyoming</td>
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RMW Pavement Temperatures

- Most states in the Rocky Mountain and West regions have much wider range of climates than most other areas of the US.
- Most states in the region need multiple crack treatment materials for different temperature range regions.
- Example: California has 5 different sealant specs designed for different LTPPBIND determined temperature range regions.
Step 3 Installation Geometry

• Crack Seal Project
  - Widened reservoir designed to accommodate expected annual crack movements

• Crack Fill Project
  - Fill and/or overband the existing crack or install in a reservoir for improved life
Step 3 - Installation Geometry

Crack Movement

Crack Fill

Crack Seal
Reservoir Configurations

Configuration A
Standard Reservoir-and-Flush

Configuration B
Standard Recessed Band-Aid

Configuration C
Shallow Recessed Band-Aid
Step 3-Installation Geometry Selection

Based on LTPPBIND 98% Temperature Range (difference from high to low) Asphalt Grade.

Minimum Reservoir Recommended

<table>
<thead>
<tr>
<th>Range</th>
<th>Width</th>
<th>Depth</th>
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<tr>
<td>80 °C or less</td>
<td>½”</td>
<td>¾”</td>
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<tr>
<td>86°C</td>
<td>¾”</td>
<td>¾”</td>
</tr>
<tr>
<td>92°C</td>
<td>1 1/8”</td>
<td>½”</td>
</tr>
<tr>
<td>98°C or greater</td>
<td>1 ½”</td>
<td>3/8”</td>
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</table>

Note: These recommendations are applicable for thermal crack spacing up to approximately 50 to 75 feet. For greater spacing, the next wider width can be used for improved results. Reservoir width should not exceed 1 ½”. 
Step 4  Sealant Selection

• Sealing and Filling materials need to resist:
  – High and low temperature extremes
  – Traffic loadings and abrasion
  – Horizontal and vertical movements
  – Aging and water exposure

• Sealant and filler performance is controlled by low temperature, high temperature, adhesive, elastic, and aging properties over the entire range of temperatures and strains experienced.
Crack sealants and fillers need to remain functional over the range of anticipated pavement temperatures.

Determine temperature ranges with LTPPBInd

www.tfhrc.gov/pavement/ltpp/reports/03080/
www.tfhrc.gov/pavement/ltpp/ppt/bind.ppt
www.fhwa.dot.gov/pavement/ltpp/bind/dwnload

Methods for sealant selection
Low and High Temperature Properties

• Low Temperature
  – Crack Seal- Pass bond – extension test at the determined low temperature 50- 200% extension
  – Crack Fill -- pass mandrel bend at the determined low temperature - approx 10% extension

• High Temperature
  – Crack Seal--Meet D6690 softening point of 80C minimum
  – Crack Fill—minimum 25C above max determined pavement temperature
## General Crack Seal Specification

### Applicability

#### Low Temperature

- **34, -40, -46 areas**
- **-22, -28 areas**
- **-16 areas**
- **-10 areas**

#### Specification Type

- **D6690 Type IV & Modified**
- **D6690 Type II or III**
- **D6690 Type I,II, or III**
- **State and Local Specs**
## Caltrans SSP 37-400

<table>
<thead>
<tr>
<th>Property</th>
<th>Type 1</th>
<th>Type 2</th>
<th>Type 3</th>
<th>Type 4</th>
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<tr>
<td>Softening Point</td>
<td>102C</td>
<td>96C</td>
<td>90C</td>
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<td>Flexibility</td>
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<td>Typical Climate Use</td>
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Proposed SG Specification

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<tr>
<th>Crack Sealant Performance Grade</th>
<th>SG 46</th>
<th>SG 52</th>
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<td>Apparent Viscosity, SC-2</td>
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<td>Maximum Viscosity (Pa.s)</td>
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<td>Minimum Avg. Creep Rate</td>
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<td>Minimum Extendibility (%)</td>
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*Note: Crack sealant surface energy is provided by manufacturer.*
Step 5  Installation

• Weather Conditions – Dry, 40F +
• Sealant Preparation - Proper heating
• Reservoir Cutting - Centered, correct dimensions
• Crack Cleaning - intact, dry, clean
• Finishing Method
Step 5 – Installation- Finishing

**Finishing**--The final sealant configuration at the pavement surface:

1. **Recess** - approx ¼ in low- *Before Overlay*
2. **Flush Fill** – to surface level - *Squeegee Excess*
3. **Overband Cap** – approx 1/16 in by 2-4 in wide band - *Sealant on top of pavement*
Recommend Overband Appearance
(Non-Rout/Clean & Fill)
Meltable Boxless Packaging

• Several versions available
• Must melt quickly and not affect sealant properties
• Less handling - reduces jobsite labor
• No cardboard box to ship, open, handle dispose of
Hot Applied Mastic Repair Materials for Large Cracks

- Flexible
- Water Proof
- Highly Adhesive
- Aggregate Filled
- No Compaction
- Ready for Traffic Quickly
- Good Skid Resistance
Large Crack Repair
Deteriorated Transverse Crack
Deteriorated Longitudinal Joint
Milling Preparation
Installed Mastic
Depressed Thermal Crack Repair
Passing lane not treated

Driving lane 3 years after application
Pretreatment - Surface Seals
Equipment Innovations

• To make crack sealing easier, faster, more productive, cleaner, more effective
• Crack Cleaning
• Reservoir Cutting
• Heating
• Installation
Melter with Compressor
Vacuum

• Reduces dust
• No post job clean up
• Healthier work environment
• Safer work environment
• PM 10 air regulation compliant
Standard Carbide Cutter
Proper Equipment - Routing
PAVEMENT CUTTER
Proper equipment - Routing

Worn Cutters will not provide a good reservoir.

- New Cutter
- Worn Cutter
Dust Collection Router
Center Heating System
Swivel Applicator Disk Tip
Melter- Applicator Features

• Loading Conveyors
• Heated Hoses and Wands
• Designed Applicator Tips
• Pump on Demand
• Internal Pumps
• Dual Application System
• Self Propel
Several Innovations are available now that can be used to improve the crack sealing process including

1. Evaluate projects for Seal- Fill
2. Design Installation Geometry
3. Design Sealant Selection
4. Mastics for Large Cracks
5. Equipment Features
THANK YOU!!