Chapter 4
Crack Sealing, Crack Filling, and Joint Sealing

From… Maintenance Technical Advisory Guide (MTAG)
Managers’ Overview

From… Maintenance Technical Advisory Guide (MTAG)
Introduction

- Why fill/seal cracks and joints?
- Where to use crack sealing/filling?
- When to use crack sealing?
- How long it will last?

Chapter 4 – Crack Sealing, Crack Filling, and Joint Sealing
Why Treat Cracks?

- Prevent water from entering and weakening the base and subgrade
- Prevent debris (incompressible materials) from entering cracks/joints
- Prepare road surface for overlay or maintenance treatments
- Cost Effective – “fix the roof now so that you don’t have to fix the house later”

Chapter 4 – Crack Sealing, Crack Filling, and Joint Sealing
When to Use?

- Longitudinal Cracking
- Transverse Cracking
- Block Cracking

- Crack width should be 0.12 – 1.00 inch
When NOT to Use?

- Crack sealing/filling is not efficient on:
  - Alligator Cracking (due to poor subgrade support)
  - Fatigue Cracking (due to fatigue failure)
  - Reflective Cracking
  - Edge Cracking
  - Slippage Cracking
When to Use?

- Longitudinal Cracking
- Transverse Cracking
- Block Cracking

- Crack width should be 0.12 – 1.00 inch

Chapter 4 – Crack Sealing, Crack Filling, and Joint Sealing
Performance

- Depending on sealant and method used:
  - Asphalt emulsion placed in flushed configuration, in unrouted cracks: 2 – 4 years
  - Hot-applied rubber and fiber modified asphalt placed in flush or overbanded configuration: 6 – 8 years
Module 4-1

Design, Materials & Specifications

From… Maintenance Technical Advisory Guide (MTAG)
Crack Sealing/ Crack Filling

- Design
- Specification
- Materials

Chapter 4 – Crack Sealing, Crack Filling, and Joint Sealing
## Criteria for Crack Sealing/ Crack Filling

<table>
<thead>
<tr>
<th>Crack Characteristics</th>
<th>Criteria for Crack SEALING</th>
<th>Criteria for Crack FILLING</th>
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<tr>
<td>Width</td>
<td>0.12 – 1.00 inch</td>
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<tr>
<td>Edge Deterioration</td>
<td>Minimal to None (&lt;25% of crack length)</td>
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<td>Annual Horizontal Movement</td>
<td>&gt; 0.12 inch (working cracks)</td>
<td>&lt; 0.12 inch (non-working cracks)</td>
</tr>
<tr>
<td>Type of Crack</td>
<td>Transverse Thermal, Transverse Reflective,</td>
<td>Longitudinal Reflective, Longitudinal Cold Joint, Longitudinal Edge Block, Distantly Spaced</td>
</tr>
<tr>
<td></td>
<td>Longitudinal Reflective, Longitudinal Cold Joint</td>
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Design / Placement Methods

- Flush Fill

- Overband – Simple Band-Aid (100 mm max)

- Overband - Capped

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Placement Methods (Cont’d)

- Reservoir
- Reservoir with Band-Aid
- Sand Fill with Recessed Finish

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Specification

- Caltrans
  - 2006 Standard Specifications
    Section 94
  - Standard Special Provisions 37-400

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Crack Sealant

- Desired properties:
  - Maintain adherence to the walls of the crack
  - Elongate to the maximum opening of the crack and recover to the original dimensions without rupture
  - Expand and contract over the range of service temperatures without rupture or delamination from the crack walls
  - Resist abrasion and damage from traffic

Chapter 4 – Crack Sealing, Crack Filling, and Joint Sealing
Crack Sealant (Cont’d)

- Elastomeric preferred for working cracks – low modulus of elasticity, will stretch easily and to high elongations (~10 times original dimensions) without fracture
- Sealant applied at elevated temperatures (thermoplastic)
- In California most sealants are rubber-modified asphalt

Chapter 4 – Crack Sealing, Crack Filling, and Joint Sealing
Crack Filler

- Desired Properties:
  - Remain attached to the walls of the crack
  - Exhibit some elasticity
  - Resist abrasion and damage from traffic
# Crack Sealer/Filler Specs

<table>
<thead>
<tr>
<th>Material</th>
<th>CT/AASHTO</th>
<th>Application</th>
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<tbody>
<tr>
<td>Asphalt Emulsion</td>
<td>Section 94/ M140, M208</td>
<td>Filling</td>
</tr>
<tr>
<td>Asphalt Cements</td>
<td>Section 94/ M20, M226</td>
<td>Filling</td>
</tr>
<tr>
<td>Fiber Modified Asphalt</td>
<td>No Specification</td>
<td>Filling</td>
</tr>
<tr>
<td>Polymer Modified Emulsion (PME)</td>
<td>Section 94/ M140, M208</td>
<td>Filling/Minor Sealing</td>
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<tr>
<td>Asphalt Rubber (AR)</td>
<td>SSP 37-400</td>
<td>Sealing</td>
</tr>
<tr>
<td>Specialty AR Low Modulus</td>
<td>SSP 37-400</td>
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<tr>
<td>Silicone</td>
<td>SSP 41-200, 51-740</td>
<td>Sealing</td>
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Chapter 4 – Crack Sealing, Crack Filling, and Joint Sealing
Crack / Joint Sealing Process

- Project Selection
- Construction
- Quality Control
- Troubleshooting
- Field Considerations

Chapter 4 – Crack Sealing, Crack Filling, and Joint Sealing
Project Selection

- Use as maintenance treatment or to prepare a cracked pavement for surface sealing
- Criteria:
  - Structurally sound pavement structure
  - Crack width is between 0.1 – 1.0 inch
- Should not use on pavements with: alligator, fatigue, reflective, edge and slippage cracking
- Recommended for: longitudinal, transverse, block cracking

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Cracking in Flexible Pavements

Chapter 4 – Crack Sealing, Crack Filling, and Joint Sealing
“Working Cracks”

- The width of a crack may change because of temperature and moisture changes; the crack may “open” or “close”
- The sides of a crack may undergo vertical movements under traffic loading
- Criteria for “working” cracks: total horizontal movement of a crack over a period of 1 year
- According to Caltrans, a crack that undergoes > ¼ inch horizontal movement is a “working” crack
Seal or Fill?

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Chapter 4 – Crack Sealing, Crack Filling, and Joint Sealing
Planning

- Apply during relatively cool weather, when “working” cracks are at midpoint to widest – spring, fall or winter
- “Non-working” cracks can be sealed any time
Placement Methods

- Flush Fill
- Overband – Simple Band-Aid
- Overband - Capped

Chapter 4 – Crack Sealing, Crack Filling, and Joint Sealing
Placement Methods (Cont’d)

- Reservoir

- Reservoir with Band-Aid

- Sand Fill with Recessed Finish

Chapter 4 – Crack Sealing, Crack Filling, and Joint Sealing
Placement Method Selection

Consider:

- Type and extent of the sealing or filling operation
- Traffic conditions
- Crack characteristics
- Material requirements
- Desired performance (expectations)
- Aesthetics
- Cost
Safety and Traffic Control

- Traffic control should be in force during the application of the treatment, long enough to allow for adequate curing of the product and prevent tracking.
- Sanding is typically used to prevent tracking of cold-applied systems.

Chapter 4 – Crack Sealing, Crack Filling, and Joint Sealing
Construction Activities

● Routing and Sawing
● Crack Cleaning and Drying
● Application of Sealer or Filler
● Finishing
● Trafficking and Subsequent Treatments
Routing or Sawing

- Not appropriate on pavements with extensive cracking
- Especially important in climates where crack movement is very high
- Allows for more filler to be used and better control of the crack channel shape
- Use vertical spindle routers, rotary impact routers and random crack saws
- Generally not used in California
Cleaning and Drying

- Purpose: eliminate debris/contamination
- Methods:
  - Air blasting
  - Hot air blasting
  - Sand blasting
  - Wire brushing
Application

- Hot Pressure Fed
- Pour Pot

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Chapter 4 – Crack Sealing, Crack Filling, and Joint Sealing
Finishing (Cont’d)

- **Over-banding** in California was found to contribute to poor ride, increased noise and poor surface appearance – not recommended unless flush with pavement surface.
- **Sanding** may be used to minimize the potential for “pull-outs”
Quality Control

- **Typical Failures:**
  - Adhesion loss
  - Cohesion loss (fail in tension)
  - Potholes
  - Spalling
  - Pull-on

- **Typical Causes:**
  - Poor choice of sealing and filling methods
  - Poor workmanship

Chapter 4 – Crack Sealing, Crack Filling, and Joint Sealing
Examples

POOR WORKMANSHIP

EXCESSIVE SEALANT

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Troubleshooting

- See Tables 4.4 and 4.5 in MTAG, Volume I, 2nd Edition
- Problems addressed:
  - Crack wet
  - Sealant not cured
  - Crack dirty
  - Insufficient sanding
  - Poor finish, wrong tools
  - Application too high
  - Application too low
  - Sealant degraded due to overheating
  - Rain during application
  - Cold weather
  - Hot weather
  - Tracking
  - Pick-out of sealer
  - Bumps

Chapter 4 – Crack Sealing, Crack Filling, and Joint Sealing
Field Considerations

- See Tables at the end of Chapter 4, MTAG, Volume I, 2nd Edition

- Project Responsibilities
  - Project Review
  - Document Review
  - Determining Application Type
  - Materials Checks

- Pre-Seal Inspection Responsibilities
  - Surface Preparation
  - Weather Requirements
  - Traffic Control
Field Considerations (Cont’d)

- Equipment Inspection
  - Sawing/Routing Unit
  - Sealing Unit

- Application Considerations
  - Application
  - Clean up
Thank You

Questions?