Controlling Reflection Cracking in HMA Overlays of PCC Pavement

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ASPHALT INSTITUTE

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• Promotes the use, benefits and quality performance of petroleum asphalt through engineering, research and educational activities.
• HQ office-Lexington, KY
Reflection Cracking

By far, the biggest problem in HMA overlays of PCC pavement is caused by movement at PCC joints and cracks. Load-induced movement is illustrated in the diagram below.

- Reflection Cracks
- Slabs Contract
- Slabs Expand
- Joint Opens
- Joint Closes
Slab Stabilization Procedures

- Crack and seat
- Break and seat
- Rubblize

Alternatives to total reconstruction
Thin HMA Overlays of PCC Pavement

• Often needed to improve functional qualities
  – Smoothness, friction, surface drainage
• Primary problem: Reflection Cracking
• Geometric/practical limitations on overlay thickness
  – Curb and gutter
  – Intersections/driveways
  – Vertical clearance
Jointed PCC Pavements

- Saw and seal has worked effectively to minimize deterioration from reflection cracking
- Examples: New England, New York, Louisiana
Sawcut and Seal

- Controls reflection cracking
- Provides maintainable joints
- Reduces/eliminates spalling at reflective crack
- Good ride quality
- Better appearance
Sawcut and Seal Procedure

- Repair existing PCC, clean and fill joints
- Locate and reference existing joints
- Place, compact HMA
- Sawcut overlay directly above referenced joints the following day
- Clean and dry sawcut
- Apply sealant
Slab Repairs on I-10, Jennings, LA
Reference

Establish Template

Sawcut/Clean

Pour/tool sealant
LaDOTD Sawcut and Seal Details

SECTION A-A

SECTION B-B

RESERVOIR DIMENSIONS

<table>
<thead>
<tr>
<th>SLAB LENGTH</th>
<th>W</th>
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</thead>
<tbody>
<tr>
<td>50' or less</td>
<td>1/8&quot;</td>
</tr>
<tr>
<td>51' or greater</td>
<td>3/8&quot;</td>
</tr>
</tbody>
</table>

INSET

Existing Transverse or Longitudinal Joint

Existing PCCP

Reqd' Sawcut

Reqd' Joint

Reqd' Joint (Shoulder)

Reqd' Joint (Corner)

Existing Joint

Binder and Base Courses

See Inset

Wearing Course

SLAB LENGTH

50' or less

51' or greater

W

1/8" = 1/4"
Sawcut and Sealed Overlay, Baton Rouge
Whoops!
Sawcut and Seal

- Do not open freshly cut pavement to traffic before installing sealant
- Sawcut must be directly above the joints
- ASTM D 6690 (hot-applied rubber-asphalt)
- Do not overfill joint
  - leave sealant material slightly (1/8 to 1/16 inch) recessed
- Typical cost (MnDOT)-$1.25-1.50/linear ft
Concerns about applications

- Worst distress observed on rubblizing projects is where concrete pavement was not fractured
  - These will be the first areas to require maintenance and rehabilitation
- FWD evaluation of load transfer should be performed before selecting sawcut/seal on Interstate projects
- Should considering removing/replacing concrete pavement with an asphalt section under bridges, at approaches to bridges, and ramps/connectors
Interlayers

• Stress absorbing membrane interlayers
  – Chip seals
    • Conventional, asphalt-rubber
• Fabrics/geotextiles
  – Global or strips
• Same limitations as for sawcut/seal
• Installation important!
Geotextile Application

- Best applied onto HMA leveling course
  - Easier to install properly
- Must accurately reference joint/crack locations
- Requires at least 2 in. HMA cover

Glasgrid 8502 installed for transverse joint protection
Location: Interstate 45 Huntsville, Texas
HMA Interlayer

- High binder content, heavily-modified fine-graded mixture
- Produced in HMA plant, placed w/conventional paving equipment
- Dampens movement in PCC, seals
Strata Mixture Qualities

Strata Mix Withstands Many More Loading Cycles, Has Greater Strain Tolerance

- **Strata Interlayer Spec**
  - 100,000 cycles

- **PG 76-28 HMA (PMAC)**
  - 6,000 cycles

- **PG 64-22 HMA**
  - 2,000 cycles

Flexural Beam Fatigue (AASHTO TP-8) Cycles to Failure
Considerations

- Any intact-slab, thin overlay treatment requires good JCP structural condition
- Selection should be driven by economics and practicality
  - Initial cost
  - Ability to construct/install properly
  - Ability to manage traffic during construction
Limitations

• Existing JCP must be intact, i.e., no working cracks, corner breaks, etc.
• Load transfer should be adequate for traffic conditions
  – Less than ¼ in faulting
  – No pumping
  – For highways, load transfer efficiency of at least 80%
• These limitations should also apply for techniques used to delay or prevent reflection cracking
PCC Joint Efficiency

Load transfer efficiency = \( \frac{D2}{D1} \)
## Load Transfer Efficiency

**re: AI MS-17**

<table>
<thead>
<tr>
<th>Deflection Ratio</th>
<th>LTE Category</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;0.75</td>
<td>Adequate</td>
<td>Sawcut/seal, interlayers</td>
</tr>
<tr>
<td>0.60 – 0.75</td>
<td>Fair</td>
<td>Crack relief layer, fractured slab</td>
</tr>
<tr>
<td>&lt;0.60</td>
<td>Poor</td>
<td>Fractured slab</td>
</tr>
</tbody>
</table>
Thanks!

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