Meeting the challenges of LIMITED RESOURCES

36th Annual Rocky Mountain Conference & Equipment Show
February 18-20, 2009

♦ Using Reflective Crack Interlayer-
  - John Cheever, SemMaterials
  - Nicola Upright, Colorado Department of Transportation
Reflective Crack Interlayer System
Topics

- **What? (John)**
  - The Problem
  - The Solution: Reflective Crack Relief System
  - Specifications
- **Why? (John)**
  - Advantages
  - Project results
- **Where? (John)**
  - Site Selection Criteria
- **How? (Nicki)**
  - Colorado Construction of RCI
What?

The Problem
What? The Problem

Before Conventional HMA overlay 6 months later
Superpave didn’t address reflective cracking
Many miles of PCC in poor condition
Conventional HMA overlays not addressing need
NCHRP recent Request for Proposal for reflective cracking addition to AASHTO Design Guide (1-41)
What?

The Solution
The Solution
Reflective Crack Interlayer System

- Significantly delays reflective cracking
- Protects pavement from moisture damage (impermeable)
- Lengthens service life
- Recyclable
The Solution
Reflective Crack Relief System

Before

Control HMA overlay
Interlayer section

After

The crack stops here!
The Solution
Reflective Crack Interlayer System

Interlayer
- Thin (1”) fine aggregate HMA
- Highly elastic PMAC
- Asphalt-rich, impermeable

Overlay
Recommendation
- SBS modified SHRP+ spec, 98% reliability
- Minimum thickness to protect interlayer

Overlay
Interlayer
Existing PCC
# Interlayer Specifications

## Materials

**Liquid AC Binder**
- Minimum PG
- Elastic recovery
- Separation

**Fine aggregate**
- Sand equivalency $\geq 45$
- Crushed & natural sands
- Gradation:

<table>
<thead>
<tr>
<th>Sieve</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8 inch (9.5 mm)</td>
<td>100</td>
</tr>
<tr>
<td>No. 4 (4.75 mm)</td>
<td>85 – 100</td>
</tr>
<tr>
<td>No. 8 (2.36 mm)</td>
<td>75 – 99</td>
</tr>
<tr>
<td>No. 16 (1.18 mm)</td>
<td>53 – 87</td>
</tr>
<tr>
<td>No. 30 (600 $\mu$m)</td>
<td>32 – 59</td>
</tr>
<tr>
<td>No. 50 (300 $\mu$m)</td>
<td>9 – 26</td>
</tr>
<tr>
<td>No. 100 (150 $\mu$m)</td>
<td>1 – 12</td>
</tr>
<tr>
<td>No. 200 (75 $\mu$m)</td>
<td>1 – 6</td>
</tr>
</tbody>
</table>
## Design Specifications

### Volumetrics

<table>
<thead>
<tr>
<th>Mix Design Comparison</th>
<th>Typical interlayer mix specs</th>
<th>Superpave mix specs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SGC design</strong></td>
<td><strong>SGC design</strong></td>
<td></td>
</tr>
<tr>
<td>(Superpave Gyratory Compactor)</td>
<td>(Superpave Gyratory Compactor)</td>
<td></td>
</tr>
<tr>
<td>50 gyrations</td>
<td>*100 gyrations</td>
<td></td>
</tr>
<tr>
<td>3.0 – 5.0% air voids</td>
<td>4% air voids</td>
<td></td>
</tr>
<tr>
<td>18% min VMA</td>
<td>*15% min VMA</td>
<td></td>
</tr>
</tbody>
</table>

*Criteria for 9.5mm mixture, medium traffic.*
Design Performance
Based Specs: Reflective Crack Resistance

- Flexural Beam Fatigue Device, AASHTO T-321
- Tests mix’s ability to withstand repeated bending
- Data = number of loading cycles to failure (loss of strength)
- Run at 10x typical strain (deformation) to simulate reflective cracking caused by PCC joint movement
Design Performance Based Specs: Hveem Stability

- Resistance to rutting during construction
- 18.0 minimum Hveem stability
  - US 85 design = 26.0

AASHTO T 246
The Problem

TYPICAL PROGRESSION OF CRACKS
The Problem & The Solution

TYPICAL PROGRESSION OF CRACKS

NO DAMAGE TO STRATA INTERLAYER
Why Isn’t the Reflection Crack Over the Joint?

Stress distributed over larger area

Crack forms at weakest point in overlay

Interlayer System

Stress concentrated at crack / joint

Typical Overlay
What Does That Mean for Performance?

Interlayer

Overlay

Interlayer

PCC

CRACK OFFSET

Ride is better, structure is intact

Simple Overlay

Overlay

CRACKED THROUGH TO BASE

Ride is worse, structure is compromised
The Solution
Impermeable Interlayer Protects Pavement

New Jersey Route 10, Constructed 1997
Field Performance Analysis

- **Crack counting**
  \[
  \text{% reflective cracking} = \frac{\text{length of cracks measured}}{\text{length of cracks before overlay}}
  \]

- **Core analysis**
  Cores from interlayer and control sections
Data represents 15 projects built with control sections, up to 5 years old.
Average 69% improvement in reflective cracking on reflective crack relief system projects (avg. 6% reflection cracking/year) over control sections (avg. 20% reflection cracking/year)

Interlayer improves overlay performance

Data represents 15 projects built with control sections, up to 5 years old
Other Advantages

- Can be recycled
  - Mills easily
- Standard HMA production & construction methods
  - Uses locally available materials
- Decreased construction time
  - vs fabric, grid
  - Lower lane closures, user delay costs
Where?

Site Selection Guidelines
PCC, ACC & composite pavements slated for overlays

- Cracked
- Needing moisture protection
- **If not doweled, PCC slab must be stable**
  
  Failed joints & unstable asphalt patches will cause early cracking

- User-delay concern
Where?
Low & Moderate Severity Distresses

- Spalling of joints
- Transverse cracking
- Corner cracking

*From SHRP P-338 Distress Manual*
Where?

- Moderate to severe distresses repaired full depth or replaced prior to construction

From SHRP P-338 Distress Manual
Site Evaluation

- Core to verify condition
- Verify that stripping is not a concern in underlying asphalt
- Program severe distresses for repair
- Ground Penetrating Radar - Potential moisture issues
Summary
Reflective Crack Relief System Advantages

- Significantly delays reflective cracking
- Impermeable
- Lengthens service life
- Recyclable
Reflective Crack Relief System Projects - Colorado

Here’s Nicki!!!!
Thank you.

Questions?