Slurry Seals and Micro-surfacing Mix Design

FHWA Pooled Fund Study
(Adapted from a MPPP presentation)

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Slurry Seals and Micro-surfacing

• “Catch-all” Preservation Techniques
  – Minor rutting (Micro-surfacing)
  – Surface cracking
  – Aggregate polishing
  – Raveling

• Aesthetical Improvement
• Typically Quick Return to Traffic

Significant History

– Surface Seals
  • First used in early 1900s
  • Empirical or trial-and-error driven
  • Late 1960s – Norman McLeod Method introduced

– International Slurry Surfacing Association (ISSA) established in 1963
  • 122 members
  • 36 countries

**FHWA Pooled Fund Study**

- FHWA
- States
  - CA, DE, GA, IL, KS, ME, MI, MN, MO, NH, NY, ND, TX, and VT
- ISSA
- Consultants
  - Fugro Consultants
  - MACTEC Engineering and Consulting
  - Consolidated Engineering Labs
  - Applied Pavement Technology

**Three Phases**
- Phase I (Completed 2004)
  - Literature Review
  - Industry and Agency Survey
  - Finalize Phases II & III
- Phase II (In Progress)
  - Develop Mix Design
- Phase III (In Progress)
  - Field Trials
  - Specifications and Guidelines
  - Training Manuals

**Literature Review**

- Review Worldwide Usage
- Current Mix Designs
  - ISSA
  - TTI
  - ASTM
- Field Performance of Existing Installations
  - USA
  - Canada

**Project Goals**

“The overall goal of this research is to improve the performance of slurry seal and micro-surfacing systems through the development of a rational mix design procedure, guidelines, and specifications.”
- Phase I Final Report, March 2004
Literature Review

- Guidelines and Specifications
  - ISSA
  - TTI
  - Caltrans
  - Austroads
  - CSIR (South Africa)

Surveys

- Respondents
  - 21 Agencies
  - 21 Industry
  - 4 Advisory Panel

Surveys

- Current Mix Designs
- Current Use of Technologies
- Current Benefits
- Current Problems
- Current Life Expectancies
- Current Tests and Performance
- Current Quality Assurance

Survey Findings

- Mix designs all derived from ISSA Guidelines A105 (Slurry) and A143 (Micro)
- Project success dependent on experience
- Laboratory test repeatability questionable
- Performance data limited
- Failures typically attributed to project selection
  - Surface condition
  - Rutting
Phase II – Currently Active

- Developing framework for Mix Design
- Evaluating test methods
  - Existing
  - Proposed
- Finalize Mix Design
- Offer recommendations for field trials

Laboratory Testing

- Highly Repeatable
- Relate to Field Performance
- Consistent with Field Conditions
  - Temperature
  - Humidity
- Ease of Implementation
- Reasonable Cost

Mix Properties

- Mixable – proper and homogenous coating
- Workable – allows for a quick return to traffic
- Performance – mixture provides good long-term characteristics

Differences

- No Distinction

Slurry Surfacing Systems (S3)
(Slurry = Micro-surfacing)
### Major Changes – Proposed

<table>
<thead>
<tr>
<th>Current Testing</th>
<th>Proposed Testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISSA TB 113 – Trial Mix Procedure for Slurry Seal Design</td>
<td>Automated Mixing Test (AMT)</td>
</tr>
<tr>
<td>ISSA TB 100 – Test Method for Wet Track Abrasion of Slurry Surfaces (WTAT)</td>
<td>Cohesion-Abrasion Test (CAT)</td>
</tr>
<tr>
<td>ISSA TB 139 – The Modified Cohesion Tester</td>
<td>Automated Cohesion Test (ACT)</td>
</tr>
<tr>
<td>Tests run at standard laboratory temperature and humidity</td>
<td>Tests run over a range of temperature and humidity conditions</td>
</tr>
</tbody>
</table>

### Automated Mixing Test

- Spread Time
- Mixing Time
- Mixing Torque

### Automated Mixing Test

- Spreads and times test materials with a controlled spread.
- Measures mixing and torque conditions.

### Cohesion-Abrasion Test (CAT)

- Evaluates the cohesion and abrasion properties of slurry seal materials.
- Utilizes a modified cohesion tester for standardized testing conditions.
Evaluation of CAT

- 300 Tests
- 5 Slurry Systems
- 3 Temperatures
- 2 Humidity Levels
- Compacted and Uncompacted
- Conditioned and Unconditioned (conditioning = soaking & oven curing)

CAT Results

- Results were not dependent on compaction
- Non-soaked
  - Temperature
  - Humidity
  - Curing Time
  \(\text{Affected Abrasion Resistance}\)
- Models can predict affects

Automated Cohesion Tester (ACT)

Field Tests

- Objectives
  - Correlate to long-term performance
  - Evaluate adherence to mix design
  - Evaluate traffic readiness
- Methodology
  - Current test options
  - Recommendations
**Field Test Candidates**

- Field Cohesion Test (traffic time)
- Field Abrasion Test (performance)
- GeoGauge (traffic time)
- Infrared Camera (traffic time and uniformity)
- In-Situ Shear Tester (performance)

**Progress on Phase II**

- Mix Design – Beta Version 3 available
- Test Method Evaluations  
  - AMT and CAT – completed  
  - ACT – in progress  
- Ruggedness Testing – in progress  
- Recommended QA Tests – in progress

**Pilot Project – Phase III**

- 5 States have expressed interest
- Developing site selection guidelines
- Developing test section layout
- Developing construction guidelines  
  - Pre-construction  
  - Construction  
  - Post-construction

**Training – Phase III**

- 1.5-Day Course  
  - Reference Manual  
  - Visual Aids  
  - Instructor’s Guide  
  - Workshops  
- Project Training Module  
  - Pocket Guide  
  - Tailgate Session
Deliverables – Phase III

- As of October 2007
- Training – 95%
- Guidelines – 90%
- Field Project(s) – Fall 2008

Questions?

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