IDOT Technical Update

Illinois Asphalt Pavement Association
82nd Annual Meeting

Brian Pfeifer
Engineer of Materials
Pavement Improvement Selection

Four Categories:

- Reconstruction
- Rehabilitation
- Preservation
- Contract Maintenance
<table>
<thead>
<tr>
<th>Category</th>
<th>Subcategory</th>
<th>Treatments</th>
<th>Service Life</th>
<th>CRS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reconstruction</td>
<td></td>
<td>Replacement of entire cross-section, Unbonded Concrete Overlay, HMA Overlay of Rubblized PCC</td>
<td>30-40</td>
<td>&lt; 4.0</td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>Major</td>
<td>Structural HMA Overlay, Structural PCC Overlay (Requires a Design Exception) (4)</td>
<td>10 - 15</td>
<td>4.0 - 4.5</td>
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<tr>
<td></td>
<td>Minor</td>
<td>Standard HMA Overlay, Bonded PCC Overlay on Asphalt, Structural Cold In-Place Recycling (Requires a Design Exception) (4)</td>
<td>10 - 15</td>
<td>4.6 - 5.4</td>
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<tr>
<td>Preservation</td>
<td>High</td>
<td>SMART Overlay, Longitudinal Joint Partial-Depth Repair, Ultra-Thin Bonded Wearing Course, Load Transfer Restoration (Transverse Cracking) (4), Cross-Stitching (Longitudinal Cracking) (4)</td>
<td>7 - 12</td>
<td>5.5 - 6.5</td>
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<tr>
<td></td>
<td>Low</td>
<td>Micro-Surfacing</td>
<td>3 - 7</td>
<td>6.6 - 7.5</td>
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<tr>
<td></td>
<td>Proactive Maintenance</td>
<td>Crack and Joint Filling / Sealing, Fog Seal (4), Cold/Micro-Milling, Diamond Grinding / Grooving</td>
<td>2 - 5</td>
<td>&gt; 6.0</td>
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<tr>
<td>Contract</td>
<td>Reactive Measures</td>
<td>Low Preservation as a Stop-Gap (2)</td>
<td>Varies</td>
<td>&lt; 5.5 (3)</td>
</tr>
</tbody>
</table>

Notes:

(1) Interstates with ADT < 15,000 will receive a Major Rehabilitation Treatment in lieu of Reconstruction.

(2) High Preservation activities of Full-depth Repairs and Longitudinal Joint Partial-Depth Repair are allowed as Reactive Measures. HMA Surface Mill and Replacement will be approved on a case by case basis.

(3) For localized failures, any CRS value may be considered (patching, centerline failures, intermittent locations of surface repairs).

(4) Treatment will require an experimental feature according to Construction Memo 02-2.
Standard HMA Overlay

- Two Lifts
  - Single lift may be approved as an exception

- Thickness Ranges
  - Interstate: 3.00 – 4.25 inches (previously 3.75)
  - Non-Interstate: 2.00 – 2.75 inches (previously 2.25)
## Mixture Options

<table>
<thead>
<tr>
<th>Mixture</th>
<th>Lift Thickness (in.)</th>
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<tbody>
<tr>
<td>IL-19.0 (Interstate binder only)</td>
<td>2.25</td>
</tr>
<tr>
<td>IL-9.5</td>
<td>1.50</td>
</tr>
<tr>
<td>IL-9.5FG</td>
<td>1.25</td>
</tr>
<tr>
<td>IL-4.75* (binder only)</td>
<td>0.75 – 1.00</td>
</tr>
<tr>
<td>SMA 12.5</td>
<td>2.00</td>
</tr>
<tr>
<td>SMA 9.5**</td>
<td>1.75</td>
</tr>
</tbody>
</table>

*Increase to 1 inch when used over bare PCC.

**District 1 is using this mix successfully and need to add to the specifications as an option.

The milling depth should remove the entire existing surface lift, unless it is rated fair or better.

If there are constraints such as curb and gutter or other profile limits, core to better define milling depth and required HMA lift thickness.

Avoid milling within 0.50 inches of a lift line whenever possible to eliminate scabbing.
Illinois Flexibility Index Test Updates
I-FIT Long Term Aging (LTA) Protocol

- Developed through ICT Research Project
- Surface Mixes
- Specimens Aged for 3 Days at 95 C
- Simulates $\approx 8 \pm$ Years of Field Performance
- Screening Tool for Asphalt Modifiers
- Added to Manual of Test Procedures (R 30)
2019 I-FIT Shadowing Exercise

- Each District Selected One Project
  - Daily Samples for Surface Mix
    - As Produced I-FIT
    - Long Term Aging I-FIT
  - Sample In-Line Asphalt Binder Daily for CBM
    - Asphalt binder performance testing
2019 I-FIT Shadowing Exercise

- Districts Gain Experience w/ LTA Prior to 2020
- Provide Feedback on Procedure
- Quantify Variation in Production FI
- Determine whether:
  - LTA FI of 4.0 can be met
  - LTA FI is driven by plant conditions or asphalt binder source
Perpetual Mix Designs

- With HW and I-FIT, No Need to Verify Every 3 Yrs
- New Mix Designs Verified by District Labs
- Mix Design $G_{sb}$ Values Updated Annually
- No Expiration Unless Significant Changes
  - Clarification to be sent soon
- MTP Updated
I-FIT Implementation

- **2019:** I-FIT on all Interstates (10 projects)
  - Also 18 off-Interstate projects
  - 5% higher ABR with I-FIT

- **2020:** I-FIT on all HMA projects
  - Higher FI threshold for SMA
  - Long Term Aging for surface mixes
  - Begin allowing modifiers in asphalt binders
Explore FI Moving Average Concept

- Add Production Testing Frequency?
- Moving Average $\geq 8.0$
- Establish Control Limits for Individual
- Prevent Shutdown on Individual $< 8.0$
- Wait until 2021 to Determine District Testing Capability
AASHTO
Proficiency Sample Program (PSP)
AASHTO re:source Proficiency Sample Program (PSP)

- **Intent:**
  - Compare individual labs with large pool of results
  - Verify testing apparatus and operator
  - Opportunity to identify and correct problems
  - Allow Illinois to align w/ the rest of the Country

- **AASHTO provides results rating sheet**
  - Good Rating = 3, 4, or 5
  - Low Rating = 2 or less
Disputing Individual Test Results

- PFP Method 2 Dispute Resolution
  - Contractor Lab maintain PSP Rating ≥ 3
  - Individual parameters may be disputed
- All District Labs Participate in PSP
- Central Materials Lab for 22+ Years
PSP Observations

- All private & IDOT labs received good scores on Gyratory Bulk Gravities ($G_{mb}$)
- A few labs on both sides had issues w/ Max Gravities ($G_{mm}$) that warranted investigation, corrective action & retesting
- Illinois as a whole was light on the Gyratory Bulk Gravities ($G_{mb}$)
Update on ICT Research: Evaluation of Data Trends and Variability in the QCP and PFP Programs
QCP and PFP Evaluation

- Statistical Analysis of QCP and PFP Data from 2015-2017
- Differences Between Results for $G_{mm}$, $G_{mb}$, VMA, and Voids
- Shadowing in Each District: Jobsite, Plant, and Both Labs
- Final Report Expected in December 2019
Paver Segregation Process Review
Paver Segregation – I-72
Paver Segregation – I-55
Paver Segregation Process Review

- **Districts Provided Locations, Looking for Others**
- **Core Locations in Each District**
  - asphalt content
  - gradation
  - lab permeability
  - I-FIT
- **Collect Anti-Segregation Component Literature from Paver Manufacturers**
<table>
<thead>
<tr>
<th>Type of HMA Pavement</th>
<th>Layer</th>
<th>Illinois $N_{design}$ Number</th>
<th>Design ESALs (million)</th>
<th>PG Binder Grade $^{(2)(3)}$</th>
<th>Traffic Loading Rate</th>
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<tbody>
<tr>
<td>IL-4.75</td>
<td>Surface and Binder</td>
<td>50</td>
<td>$\leq 10$</td>
<td>SBS PG 70-22</td>
<td>SBS PG 70-22</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>$&gt; 10$</td>
<td>SBS PG 76-22</td>
<td>SBS PG 76-22</td>
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<tr>
<td>SMA Overlay of PCC or Composite Pavement</td>
<td>Surface and Binder</td>
<td>50</td>
<td>$\leq 10$</td>
<td>SBS PG 76-22</td>
<td>SBS PG 76-22</td>
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<tr>
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<td></td>
<td></td>
<td>$&gt; 10$</td>
<td>SBS PG 76-22</td>
<td>SBS PG 76-22</td>
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<tr>
<td>SMA for Full-Depth Pavement and Overlays of Full-Depth Pavement</td>
<td>Surface and Binder</td>
<td>50</td>
<td>$\leq 10$</td>
<td>SBS PG 76-28</td>
<td>SBS PG 76-28</td>
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<tr>
<td></td>
<td></td>
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<td>$&gt; 10$</td>
<td>SBS PG 76-28</td>
<td>SBS PG 76-28</td>
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<tr>
<td>Overlay of PCC or Composite Pavement</td>
<td>Surface or Binder</td>
<td>30</td>
<td>$\leq 0.3$</td>
<td>PG 58-22</td>
<td>PG 64-22</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>$&gt; 0.3$ to 3</td>
<td>PG 64-22</td>
<td>SBS PG 76-22</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$&gt; 3$ to 10</td>
<td>PG 64-22</td>
<td>SBS PG 76-22</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$&gt; 10$</td>
<td>SBS PG 76-22</td>
<td>SBS PG 76-22</td>
</tr>
<tr>
<td>Districts 1-6</td>
<td>Surface and Top Binder</td>
<td>All</td>
<td>All Levels</td>
<td>SBS PG 64-28 $^{(8)}$</td>
<td>SBS PG 70-28</td>
</tr>
<tr>
<td></td>
<td>Lower Binder</td>
<td>All</td>
<td>All Levels</td>
<td>PG 64-22</td>
<td>PG 64-22</td>
</tr>
<tr>
<td>Districts 7-9</td>
<td>Surface and Top Binder</td>
<td>All</td>
<td>All Levels</td>
<td>PG 64-22 $^{(9)}$</td>
<td>SBS PG 76-22</td>
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<tr>
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<td>Lower Binder</td>
<td>All</td>
<td>All Levels</td>
<td>PG 64-22</td>
<td>PG 64-22</td>
</tr>
</tbody>
</table>
PG Binder Usage
2011 to 2018 Grade Usage

Usage Percent

PG 64-22 | 70-22 Mod | 58-28 | 76-22 Mod | 70-28 Mod | Other

Bituminous Price Index

$524.51/ton (10/1/18)
$484.55/ton (3/1/19)

http://www.idot.illinois.gov/doing-business/procurements/construction-services/construction-bulletins/transportation-bulletin/price-indices
Percent Polymer Used vs. Time

Year of Use

Percent Polymer Used

Year of Use

- 2004
- 2005
- 2009
- 2010
- 2011
- 2012
- 2013
- 2014
- 2015
- 2016
- 2017
- 2018

Percent Polymer Used

- 0
- 5
- 10
- 15
- 20
- 25
- 30
- 35
- 40
- 45
Asphalt Binder Performance Testing
Illinois Center for Transportation

Rheology/Chemical Based Procedure to Evaluate Additives/Modifiers used in Asphalt Binders for Performance Enhancements (Phase 2)
Develop advanced screening protocol w/ long-term aging & rheological/chemical characterization methods for modified binders.

- Effect of modifiers on binder chemistry & performance
- Validate & fine-tune preliminary thresholds
Identify and Collect Modifiers

• Up to 10 Available in Illinois

• Asphalt Binders to be Collected & Tested
  • 64-22’s (Base Binders), 58-28, 52-34, 46-34

• Formulas, Mix Ratios & Blending Requirements
  Provided by Suppliers
Field Core Selection

- Typical Surface Mixtures, 5-10+ Yrs. Old
- Working w/ Districts & Tollway to Identify Core Locations
- Test Extracted Binder
- Set Baseline for Developing LTA Protocol
Experimental Features
Full Lane Sealant (FLS)

- Pavement Durability Improvements
  - Decreased Permeability
  - Increased Bond, Density, Flexibility
  - Minimize Typical Pavement Distresses
  - Reduced Wait-Time to Pave (≤ 5 minutes)
<table>
<thead>
<tr>
<th>Section</th>
<th>Length</th>
<th>Applied Material</th>
<th>Residual Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Section 1</td>
<td>¼ mile</td>
<td>SS-1h</td>
<td>0.05 lb/sq ft</td>
</tr>
<tr>
<td>Test Section 1</td>
<td>¼ mile</td>
<td>FLS Tack</td>
<td>0.13 lb/sq ft</td>
</tr>
<tr>
<td>Control Section 2</td>
<td>¼ mile</td>
<td>SS-1h</td>
<td>0.05 lb/sq ft</td>
</tr>
<tr>
<td>Test Section 2</td>
<td>¼ mile</td>
<td>FLS Tack</td>
<td>0.17 lb/sq ft</td>
</tr>
<tr>
<td>Control Section 3</td>
<td>¼ mile</td>
<td>SS-1h</td>
<td>0.05 lb/sq ft</td>
</tr>
<tr>
<td>Test Section 3</td>
<td>¼ mile</td>
<td>FLS Interlayer</td>
<td>0.20 lb/sq ft</td>
</tr>
<tr>
<td>Control Section 4</td>
<td>¼ mile</td>
<td>SS-1h</td>
<td>0.05 lb/sq ft</td>
</tr>
<tr>
<td>Test Section 4</td>
<td>¼ mile</td>
<td>FLS Interlayer</td>
<td>0.25 lb/sq ft</td>
</tr>
<tr>
<td>Control Section 5</td>
<td>¼ mile</td>
<td>SS-1h</td>
<td>0.05 lb/sq ft</td>
</tr>
<tr>
<td>Test Section 5</td>
<td>¼ mile</td>
<td>FLS Interlayer</td>
<td>0.30 lb/sq ft</td>
</tr>
</tbody>
</table>
Experimental Feature, Dist. 5
Plan of Study – 5 Years

- Pavement Distress Survey
- Collect 3 X 6” Full Depth Cores per Section
- Permeability, Bond Strength, I-FIT, Migration
FLS Waterproofing for Bridge Decks

- Experimental Feature Alternative to 581 Spec
  - 0.05 lb/ft² emulsion
  - 0.25 lb/ft² FLS
  - 0.75 inch IL-4.75 HMA
  - 0.15 lb/ft² FLS
  - 1.5 inch 9.5 SMA (or Fine Graded 9.5)