Long Life Asphalt Pavement – LLAP
Implementation of Special Provisions

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CMD

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Genesis of LLAP Specification

- **Transportation Quality Initiative (TQI) 2014**
  - Improve Leadership Culture
  - Workforce Development
  - Process Improvement
  - Technical Improvement
Genesis of LLAP Specification

2014-2015 Transportation Quality Initiative Framework

- Culture of Quality
- Contractual
- Pre-construction

Leadership Culture
- Leadership
- Training
- Culture of Quality

- Shared Vision & Values
- Trust & Collaboration
- Partnership

Workforce

Process
- Culture of Quality
- Contractual
- Pre-construction

Technical
- Culture of Quality
- QA/QC
- Materials
Genesis of **LLAP** Specification

- **Technical Improvement Workgroup**
  - Technical Goal #2 of 5 → “**Develop Long Life Concrete and Asphalt Pavement Specifications**”
### LLAP Schedule

<table>
<thead>
<tr>
<th>Task</th>
<th>Due Date</th>
<th>Status</th>
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</thead>
<tbody>
<tr>
<td>Add LLAP/Perpetual pavement to the Asphalt Pavement Improvement Committee as a work function. Identify ‘primary author’</td>
<td>September 2015</td>
<td>COMPLETE</td>
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<tr>
<td>Hold internal meeting with PAPA, Pavement Design, Innovation &amp; Support Services staff and FHWA to discuss development of a LLAP specification. Identify States with LLAP/Perpetual pavement specifications and those components that the Department should consider</td>
<td>October 2015</td>
<td>COMPLETE</td>
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<tr>
<td>Develop initial LLAP specifications for internal (APQIC) member review</td>
<td>December 2016</td>
<td>COMPLETE</td>
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<tr>
<td>Reconcile comments from APQIC</td>
<td>February 2016</td>
<td>COMPLETE</td>
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<tr>
<td>Input from work group on Lab Performance Test Protocols</td>
<td>March 2016</td>
<td>COMPLETE</td>
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<tr>
<td>Complete clearance Transmittal of SSP</td>
<td>July 2016</td>
<td>COMPLETE</td>
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<tr>
<td>Request candidate pilot LLAP projects for implementation from Districts and PTC for construction in 2017.</td>
<td>November 2016</td>
<td>COMPLETE</td>
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<tr>
<td>Develop POA for monitoring pilot projects and their performance through an Asset management approach.</td>
<td>TBD - 2017</td>
<td></td>
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</table>
LLAP Current Features

• Written as a series of special provisions.
  – Overlay projects
  – Structural overlay projects
  – Full depth reconstruction

• Will only be used on interstate or interstate look-a-like projects initially.

• Performance testing is the most important and different part of this specification.
• Use Guidelines for Demo Projects

• MEPDG (Comparison)

• Perpetual Pavement Best Design
LLAP Asphalt Mix Design

• **Minimum Effective AC Content** ($P_{be}$)
  * Interim Step to Performance Testing

• **SuperPave Design Volumetric Adjustments** (3%, 3.5% voids, gyrations)

• **Binder Modification** (i.e. polymers)
LLAP Asphalt Mix Design

• **SMA on Interstates**

• **Full Deployment of WMA**

• **Required Use of Anti-Strip Additive**

• **Asphalt Rich Base**

• Optimized – Balanced Mix Design (i.e. Performance Testing)
LLAP Construction Specifications

- MTV Required
- Longitudinal Joint Density Specification
- Ride Specification Optional
- Tack Coat Every Layer (New Section 460)
- % Within Tolerance (PWT) Acceptance
- Incetivize Critical Elements (i.e. Mat Density)
• Asphalt Rich Base Course
  – PWT acceptance includes incentive/disincentive.
  – Tack all layers
  – Design at 3% voids
  – Design 1 gyration level lower than other courses.

• Need for low rut and high bottom-up crack resistance.

• High DCT fracture energy requirement (460 J/m²) for crack resistance.

• No Hamburg testing requirement.
**LLAP Current Features**

- **Base Course**
  - Tack all layers
  - PWT acceptance includes incentive/disincentive
  - DCT and Hamburg Wheel track test required as performance testing
  - Anti-Strip Required
  - WMA Technology Required

- **Need for low rut and moderate crack resistance.**

- **Moderate DCT fracture energy requirement (400 J/m²) for crack resistance.**

- **No Hamburg testing requirement.**
LLAP Current Features

- **Binder Course**
  - PWT acceptance includes incentive/disincentive.
  - Tack all layers
  - MTV required
  - DCT and Hamburg wheel track test required as performance testing
    - Anti-strip required
    - WMA technology required

- **Need for moderate rut and high crack resistance.**

- **High DCT fracture energy requirement (460 J/m²) for crack resistance.**

- **High to moderate Hamburg requirement (12.5mm at 20,000 cycles) for rut resistance.**
LLAP Current Features

• Wearing Course
  – SMA only
  – Tack all layers
  – MTV required
  – 2% density incentive possible
  – DCT and Hamburg Wheel track test required as performance testing
  – Anti-Strip Required
  – WMA Technology Required

• Need for very high rut and crack resistance.

• Very high DCT fracture energy requirement (690 J/m²) for crack resistance.

• Very High Hamburg requirement (6.25mm at 20,000 cycles) for rut resistance
LLAP Current Features

- Ride incentive is optional.
- Joint incentive / disincentive is required.
Balanced Approach

- Looks good, tastes bad.

- Looks bad, tastes good.
Balanced Approach

• Looks good & tastes good?
Heavy Duty ID2 placed in 1991 – 25 years

Trying to make this the rule rather than the exception.
Performance Testing

- **Hamburg Wheel Tacking Test.** (AASHTO T 324)
- Required for Mix Design
  - Measures rutting potential
  - Samples fabricated from gyratory samples or cores.
  - Test run at $131^0$ F ($55^0$ C)
  - Required cycles and rut depth limits vary depending on mix type (SMA) and layer (wearing, binder)
Performance Testing

- **Disk-Shaped Compact Tension (DCT) testing.** (ASTM D7313)
- Required for Mix Design
  - Measures fracture energy
  - Samples fabricated from gyratory samples or cores.
  - Test run at 100°C below the low PG mix designation.
  - Fracture energy requirements vary depending on mix type (SMA) and layer (wearing, binder)

How do you determine fracture energy?
Performance Testing

- **Semi-Circular Bending (SCB) testing.** (AASHTO TP 105) For information only during pilots.
  - Measures fracture energy
  - Samples fabricated from gyratory samples or cores.
  - Test run at $10^0$ C below the low PG mix designation.
  - Fracture energy requirements vary depending on mix type (SMA) and layer (wearing, binder)

How do you determine fracture energy?
Performance Testing

- **Illinois Flexibility Index Test (IFIT).** (AASHTO XX-XXX) For information only during pilots.
  - Measures fracture energy.
  - Uses fracture energy and load/displacement slope to compute Flexibility Index.
  - Samples fabricated from gyratory samples or cores.
  - Test run at 25°C.
  - Fracture energy requirements vary depending on mix type (SMA) and layer (wearing, binder)
Performance Testing

- **Overlay Test (OT). (TEX-248-F)** For information only during pilots.
  - Measures fatigue or reflective cracking potential.
  - Samples fabricated from gyratory samples or cores.
  - Test run at 25° C (77°F).
  - Applies load to induce 0.025 inches displacement.
  - Number of cycles to failure is reported along with percent decline in load.
Many Incentives

- SMA wearing
  - Possible 2% incentive for Density.
  - Possible incentive for ride. (if included)
  - Possible incentive for joints.

- Binder
  - Possible 4 % for mix under PWT.

- Base
  - Possible 2 % for mix under PWT.

- Asphalt Rich Base
  - Possible 2 % for mix under PWT.
• District 2-0 – SR 0080 Sect B34 (ECMS 82105)
  – Mill and overlay
  – Projected let – 7/2017

• District 10-0 – SR 0079 Section 247 (ECMS 91919)
  – Structural overlay
  – Projected Letting 11/2017

• Looking for Full-Depth Pavement Pilots (e.g. SR 322 Potters Mills or Central Susquehanna Valley Expressway)
Questions?