Long Life Asphalt Pavement – LLAP
Implementation of Special Provisions

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CMD

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PAPA
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

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>Date</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 <strong>COMPLETE</strong></td>
</tr>
<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 <strong>COMPLETE</strong></td>
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<tr>
<td>Develop initial LLAP specifications for internal (APQIC) member review</td>
<td>December 2016 <strong>COMPLETE</strong></td>
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<tr>
<td>Reconcile comments from APQIC</td>
<td>February 2016 <strong>COMPLETE</strong></td>
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<tr>
<td>Input from work group on Lab Performance Test Protocols</td>
<td>March 2016 <strong>COMPLETE</strong></td>
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<tr>
<td>Complete clearance Transmittal of SSP</td>
<td>July 2016 <strong>COMPLETE</strong></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 <strong>COMPLETE</strong></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>
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</table>
LLAP Pavement Design

• Use Guidelines for Demo Projects

• MEPDG (Comparison)

• Perpetual Pavement Best 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

- Many Best practices incorporated
- MTV Required
- Longitudinal Joint Density Specification
- **RIDE SPECIFICATION OPTIONAL**
- Tack Coat Every Layer (New Section 460)
- % **WITHIN TOLERANCE (PWT) ACCEPTANCE**
- **INCENTIVIZE CRITICAL ELEMENTS (i.e. MAT DENSITY)**
LLAP Pilot Spec. 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.**
Balanced Approach to Mix Design
(Performance Related Testing)

- Looks good, tastes bad.
- Looks bad, tastes good.
Balanced Approach to Mix Design

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

Trying to make this the rule rather than the exception.
Performance Related Testing (Rutting)

- **Hamburg Wheel Tacking Test.** (AASHTO T 324)
  - Required for Mix Design
    - Measures rutting potential
    - Samples fabricated from gyratory samples or cores.
    - Test run at 122°F (50°C)
    - Required cycles and rut depth limits vary depending on mix type (SMA) and layer (wearing, binder)
Performance Related Testing (Cracking)

- **Disk-Shaped Compact Tension (DCT) testing. (ASTM D7313)**
- Required for Mix Design
  - Measures fracture energy \( G_F = \frac{W_f}{\text{Area}_{lig}} \times 10^6 \)
  - 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,
Performance Related Testing (Cracking)

- **Semi-Circular Bending (SCB)** testing. (AASHTO TP 105) For information only during pilots.
  - Measures fracture energy. (Divide the area under the curve by the specimen area.) \( G_F = \frac{W_F}{Area_{lig}} \times 10^6 \)
  - 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,
Performance Related Testing (Cracking)

- **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 (77°F)
  - Fracture energy requirements vary depending on mix type (SMA) and layer (wearing, binder)

\[ FI = \frac{G_f}{m \times A} \]
Fracture Parameters

Fracture work: Area under Load-Displacement curve

Fracture Energy, $G_f$: Energy required to create unit fracture surface

$G_f = \frac{\text{Fracture Work, } S_f}{\text{Fracture Area}}$

Flexibility Index, $FI$: $FI = \frac{G_f}{m}$
Performance Related Testing (Cracking)

- **Overlay Test (OT).** (TEX-248-F) For information only during pilots.
  - Measures fatigue or reflective cracking potential. (number of cycles to failure.)
  - 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.
Testing costs

Disk-Shaped Compact Tension (DCT) – ASTM D7313
- Plant or mix sample preparation  $ 1100.00
- Prepared Specimen (Gyratory)    $ 900.00

Semicircular Bend (SCB) – AASHTO TP 105**
- Plant or mix sample preparation   $ 2000.00
- Prepared Specimen (Gyratory)     $ 1250.00

Semicircular Bend at intermediate Temperature (IFIT) – Average of 3 replicates:
- Plant or mix sample preparation  $ 800.00
- Prepared Specimen (Gyratory)    $ 500.00

Hamburg Wheel (Modified AASHTO T324) – Each wheel
- Plant or mix sample preparation  $ 790.00
- Prepared Specimen (Gyratory)    $ 525.00
# MIX PERFORMANCE TEST COSTS

**Advanced Asphalt Technologies**

## Costs Per Specimen (March 1, 2017)

<table>
<thead>
<tr>
<th>Test</th>
<th>Specimen Preparation</th>
<th>Testing</th>
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</thead>
<tbody>
<tr>
<td>DCT</td>
<td>$90.00</td>
<td>$330.00</td>
</tr>
<tr>
<td>SCB Low</td>
<td>$90.00</td>
<td>$300.00</td>
</tr>
<tr>
<td>SCB Intermediate</td>
<td>$90.00</td>
<td>$240.00</td>
</tr>
<tr>
<td>Overlay</td>
<td>$90.00</td>
<td>$300.00</td>
</tr>
<tr>
<td>Hamburg</td>
<td>$180.00</td>
<td>$500.00</td>
</tr>
</tbody>
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LLAP Current Features

• 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 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.
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.
Current Demonstration Projects

- **District 2-0 – SR 0080 Sect. B34 (ECMS 82105)**
  - Mill and overlay
  - Projected let – 7/2017

- **District 10-0 – SR 0079 Sect. 247 (ECMS 91919)**
  - Structural overlay
  - Projected Letting 11/2017

- **District 11-0 – SR 0279 Sect. A83 (ECMS 87772)**
  - Binder & Wearing Performance Related Testing only.
  - Projected Letting 1/2017

- **District 2-0 – SR 322 Section B06 (ECMS 96820)**
  - LLAP or LLCP alternate bid.
Questions?