Long Life Asphalt Performance Testing
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LLAP Construction Specifications

- 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)**
- PERFORMANCE TESTING
LLAP Performance Tests

- Disk-Shaped Compact Tension (DCT) Testing
- Semicircular Bend (SCB) Testing
- Semicircular Bend at Intermediate Temperature (SCBIT) Testing
- Texas Overlay Testing
- Rutting Susceptibility Testing
SR 279-A83

- Contract Cost: $87,947,686.73
- Total Tonnage – 185,000 Tons
- PWT-HOLA ~ 74 Lots
  - Binder Course – 2 ½”
  - SMA Wearing Course – 1 ½”
- Performance Testing of Proposed Mix Designs *(For Information Only)*
- Performance Verification Sampling *(For Information Only)*
  - 2 additional cores per subplot of initial lot, and 1 additional lot selected at random (Next paving season)
• Average Pay Factors
  – Asphalt Content – 103%
  – #200 Sieve – 104%
  – Primary Control Sieve – 103%
  – Density – 104%

• Current average IRI = 37.4
• PWT-HOLA - 12 Lots
• Performance Testing for acceptance – SMA Wearing Course – 1 ½" Depth
• Performance Verification Sampling – 2 additional cores per sublot as per spec – 120 additional cores!
• Planned Usage – SR 28-A55 – Planned Let: 11/2/17

SR 376 – B09
• Contract Cost: $18,385,803.42
• Total Tonnage = 39,318 Tons
• PWT-HOLA - 12 Lots
  – SMA Wearing Course - 1 ½” Depth
• Performance Testing Includes:
  – Proposed Mix Designs
  – Testing for acceptance
• Performance Verification Sampling
  – 2 additional cores per sublot as per spec
  – 120 additional cores!
  – Tests performed changed to just DCT, I-FIT, Hamburg
• Average Pay Factors
  – Asphalt Content – 103%
  – #200 Sieve – 102%
  – Primary Control Sieve – 103%
  – Density – 100%

• Average IRI – 30.3
SR 28-A55
Let: 11/2/17
Contract Cost: $34,342,898.65
Total Tons = 150,663 Tons
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 $10^0$ 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?
Disc Shaped Compact Tension (DCT) Test

- ASTM D7313
- Prepare sample as below
- Measure fracture energy (Min req = 690 J/m²)
• **Illinois Flexibility Index Test (IFIT).**
  - 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)
Semicircular Bend at Intermediate Temp

- Point load applied
- Measure fracture energy
- Includes Illinois Flexibility Index (I-FIT)
Hamburg Wheel Tracking Test

- **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°F (55°C)
  - Required cycles and rut depth limits vary depending on mix type (SMA) and layer (wearing, binder)
• Hamburg Wheel-Track Testing
• Test samples at 131°F
• Measure rut depth after 20,000 cycles
DCT Test Results

- Mix Design Phase:

  SMA Mix #1 – 540.4 J/m²

  SMA MIX #2 – 608.8 J/m²

  19mm Mix #1 – 417.6 J/m²
DCT Test Results

• Verification Samples:

**SR 279-A83**
19mm Binder – Brittle Failure
SMA Wearing – 634.7 J/m²

**SR 376-B09**
SMA Wearing (Lots 1 – 3) – 709.2, 796.4, 562.5 J/m²
I-FIT Test Results

- Mix Design Phase:

  SMA Mix #1 – 13.96 J/m²

  SMA MIX #2 – 7.04 J/m²

  19mm Mix #1 – 2.8 J/m²
I-FIT Test Results

• Verification Samples:

**SR 279–A83**
*SMA Wearing – 90.2 J/m²*

**SR 376-B09**
*SMA Wearing (Lots 1 – 3) – 99.1, 109.8, 77.6 J/m²*
Hamburg Test Results

- Mix Design Phase:

  SMA Mix #1 – 4.46 mm

  SMA MIX #2 – 6.26 mm

  19mm Mix #1 – 4.07 mm
Hamburg Test Results

- Verification Samples:

  **SR 279-A83**
  19mm Binder – 5.51 mm
  SMA Wearing – Invalid test – slipped core

  **SR 376-B09**
  SMA Wearing (Lots 1 – 3) – 8.80, 7.57, 5.26 mm
DCT Data

DCT Performance Diagram

DC(T) Fracture Energy (J/m²)

Hamburg Rut Depth (mm)

19mm Design sample 417 / 4.07mm

SMA Design sample 540.4 / 4.46mm

SMA Project samples
IFIT Data

IFIT Performance Diagram

Hamburg Rut Depth (mm) vs. IFIT Fracture Energy (J/m²)

- SMA Design sample 14 / 4.46mm
- 19mm Design sample 2.8 / 4.07mm
- SMA Project samples
IFIT Plots

19mm

SMA

Load Line Displacement, mm

Load, kN

Load Line Displacement, mm
Lessons Learned

• Field Perspective:
  – Performance samples should not be taken at same location as acceptance cores
  – Care must be taken to keep cores organized and logged (Station/offset)
Lessons Learned

• Lab Perspective:
  – Conditioning time for DCT should be minimum needed to make plug
  – 25mm is not applicable to these tests
  – With 10 cores per lot, it is hard to perform all tests called out for in spec due to possible invalid tests requiring
  – Give yourself time during mix design phase to perform tests
Pros

- Potential to provide a more balanced mix design.
- Potential to give producers more flexibility in the mix design process.
• Currently, high number of samples need to be taken
• Potential for error in documentation is high due to number of samples
• Number of testing facilities able to perform necessary tests is currently low – Long lead times
• Insufficient time to perform additional up-front mix design changes and performance testing