PennDOT District 11

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**

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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**

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SR 279 – A83
TRUMBULL
LINDY PAVING

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 sublot of *initial lot*, and *1 additional lot selected at random* (Next paving season)

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SR 279-A83

- Average Pay Factors
  - Asphalt Content – 103%
  - #200 Sieve – 104%
  - Primary Control Sieve – 103%
  - Density – 104%

- Current average IRI = 37.4

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SR 376 – B09
GULISEK
LINDY PAVING

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***

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SR 376-B09

- Average Pay Factors
  - Asphalt Content – 103%
  - #200 Sieve – 102%
  - Primary Control Sieve – 103%
  - Density – 100%

- Average IRI – 30.3

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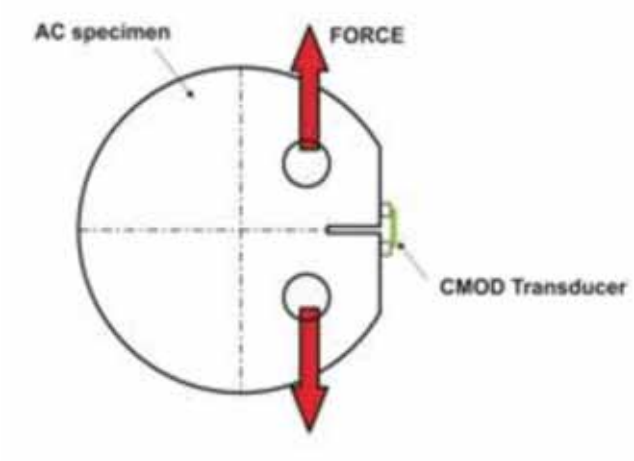
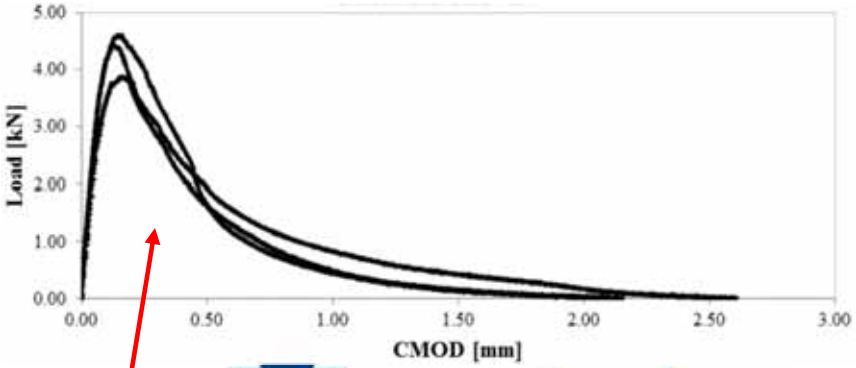
Planned Usage Moving Forward

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?

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Disc Shaped Compact Tension (DCT) Test

- ASTM D7313
- Prepare sample as below
- Measure fracture energy (Min req = 690 J/m^2)

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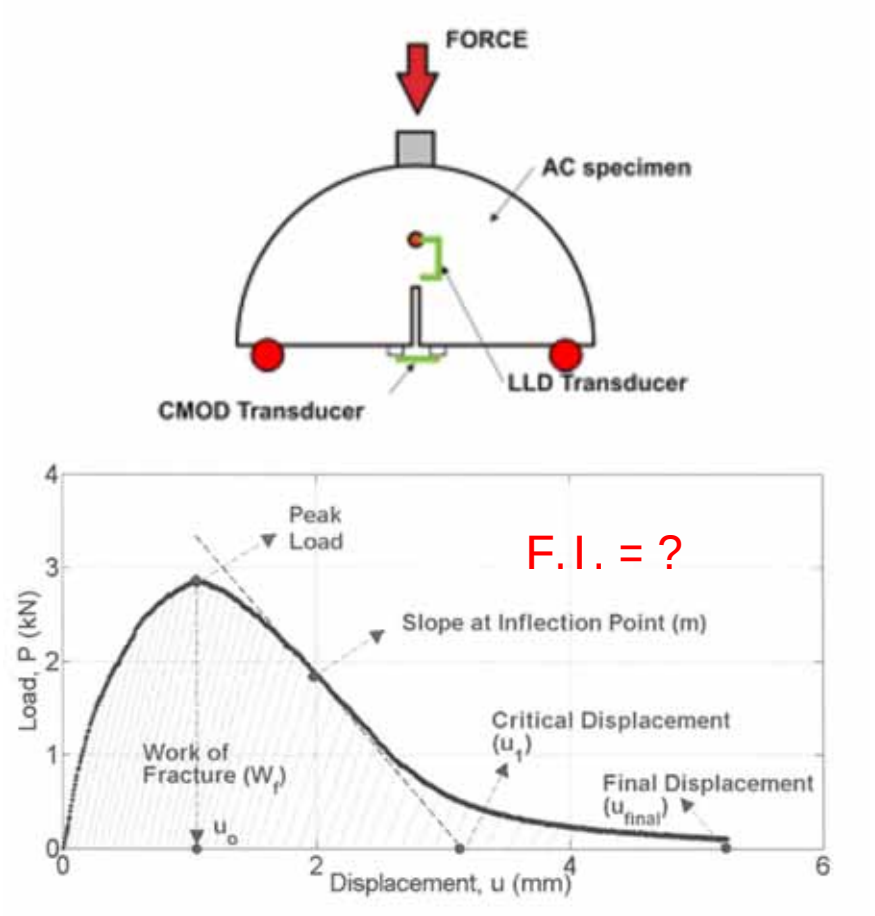
Performance Testing

- **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 25^0 C.
  - Fracture energy requirements vary depending on mix type (SMA) and layer (wearing, binder)



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Semicircular Bend at Intermediate Temp

- Point load applied
- Measure fracture energy
- Includes Illinois Flexibility Index (I-FIT)

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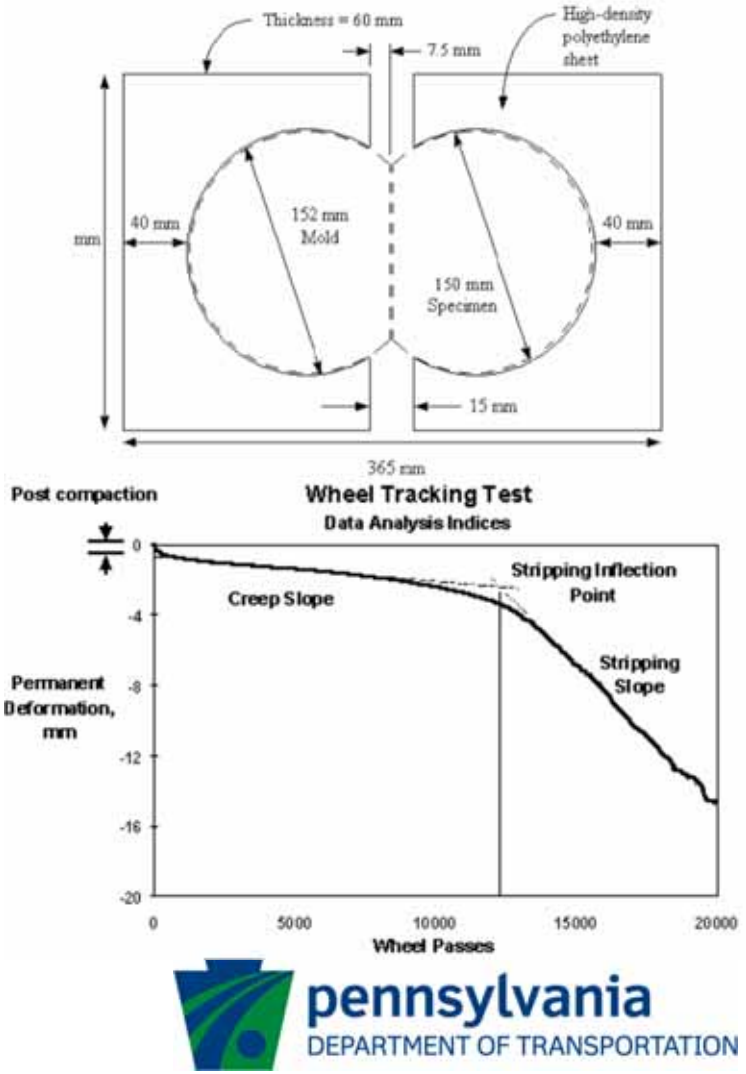
Hamburg Wheel Tracking Test

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



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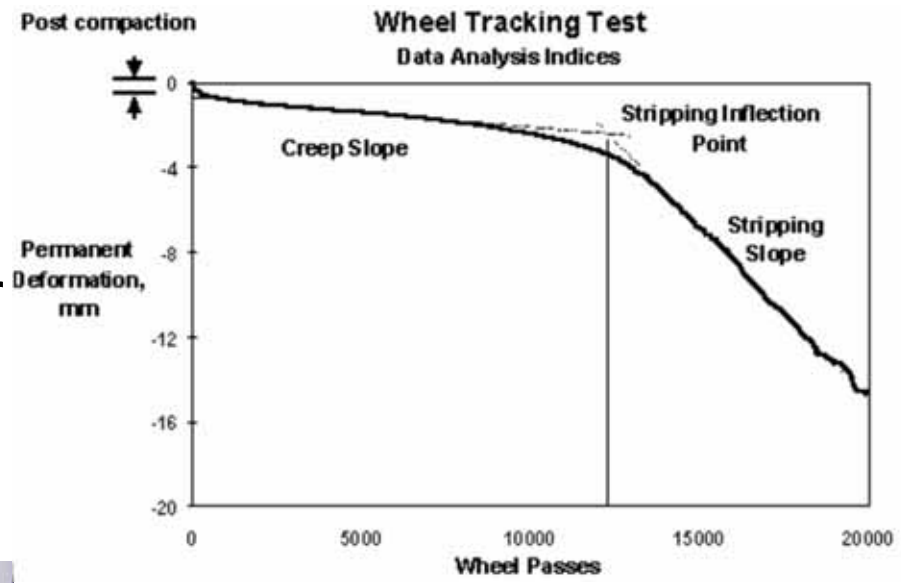
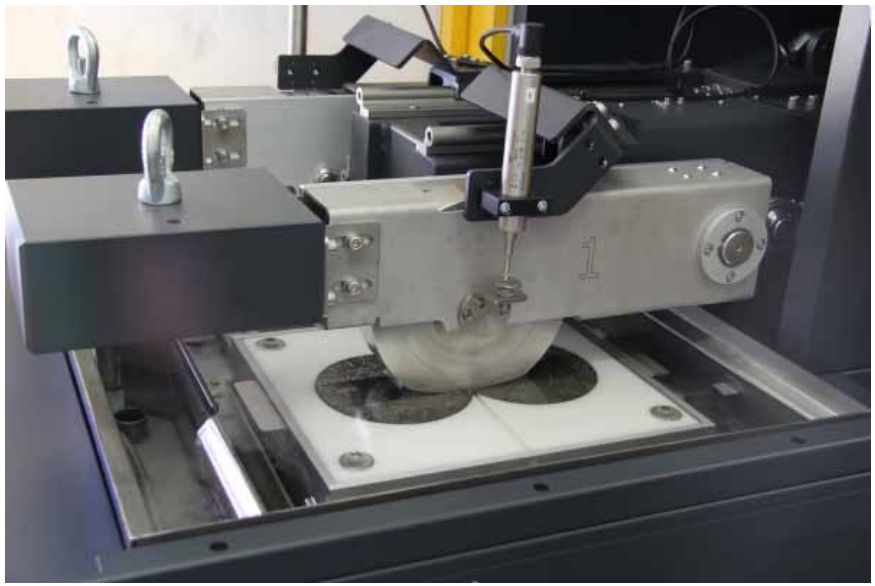
Rutting Susceptibility Test (ASTM T 324)

- Hamburg Wheel-Track Testing
- Test samples at 131°F
- Measure rut depth after 20,000 cycles





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DCT Test Results

- Mix Design Phase:

SMA Mix #1 – 540.4 J/m^2

SMA MIX #2 – 608.8 J/m^2

19mm Mix #1 – 417.6 J/m^2

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DCT Test Results

- Verification Samples:

<u>SR 279–A83</u>

19mm Binder – Brittle Failure

SMA Wearing – 634.7 J/m^2

<u>SR 376-B09</u>

SMA Wearing (Lots 1 – 3) – 709.2, 796.4, 562.5 J/m^2

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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

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I-FIT Test Results

- Verification Samples:

<u>SR 279–A83</u>

SMA Wearing – 90.2 J/m^2

<u>SR 376-B09</u>

SMA Wearing (Lots 1 – 3) – 99.1, 109.8, 77.6 J/m^2

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Hamburg Test Results

- Mix Design Phase:

SMA Mix #1 – 4.46 mm

SMA MIX #2 – 6.26 mm

19mm Mix #1 – 4.07 mm

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Hamburg Test Results

- Verification Samples:

<u>SR 279–A83</u>

19mm Binder – 5.51 mm

SMA Wearing – Invalid test – slipped core

<u>SR 376-B09</u>

SMA Wearing (Lots 1 – 3) – 8.80, 7.57, 5.26 mm

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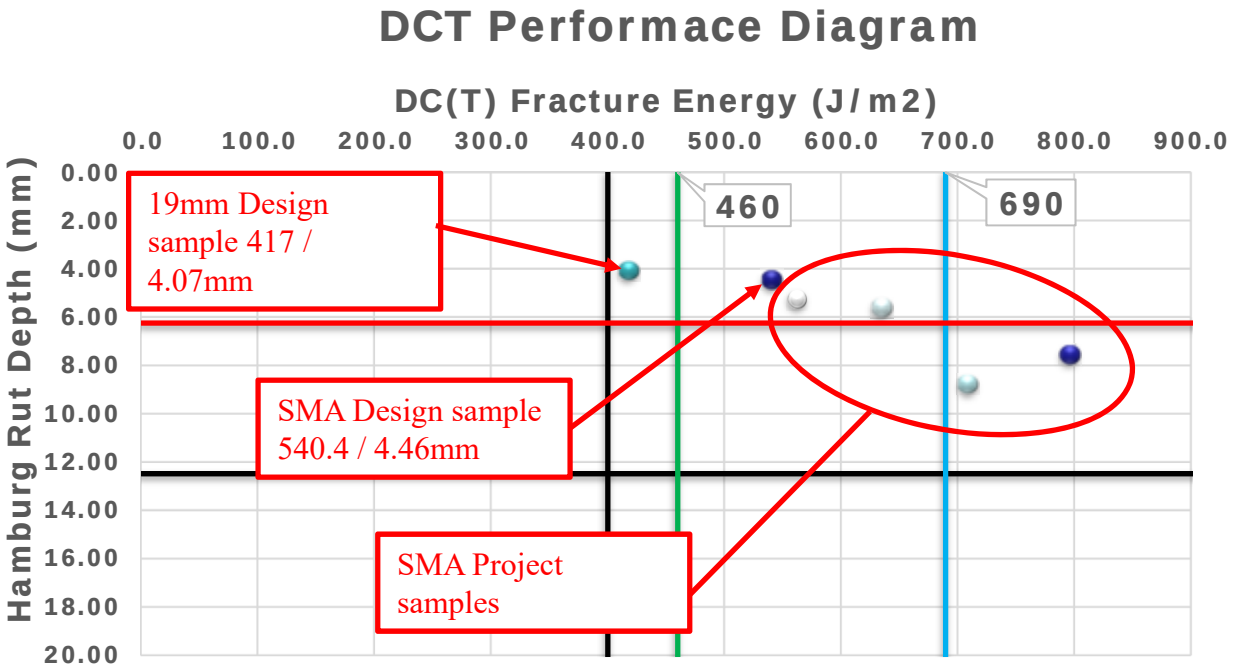
DCT Data



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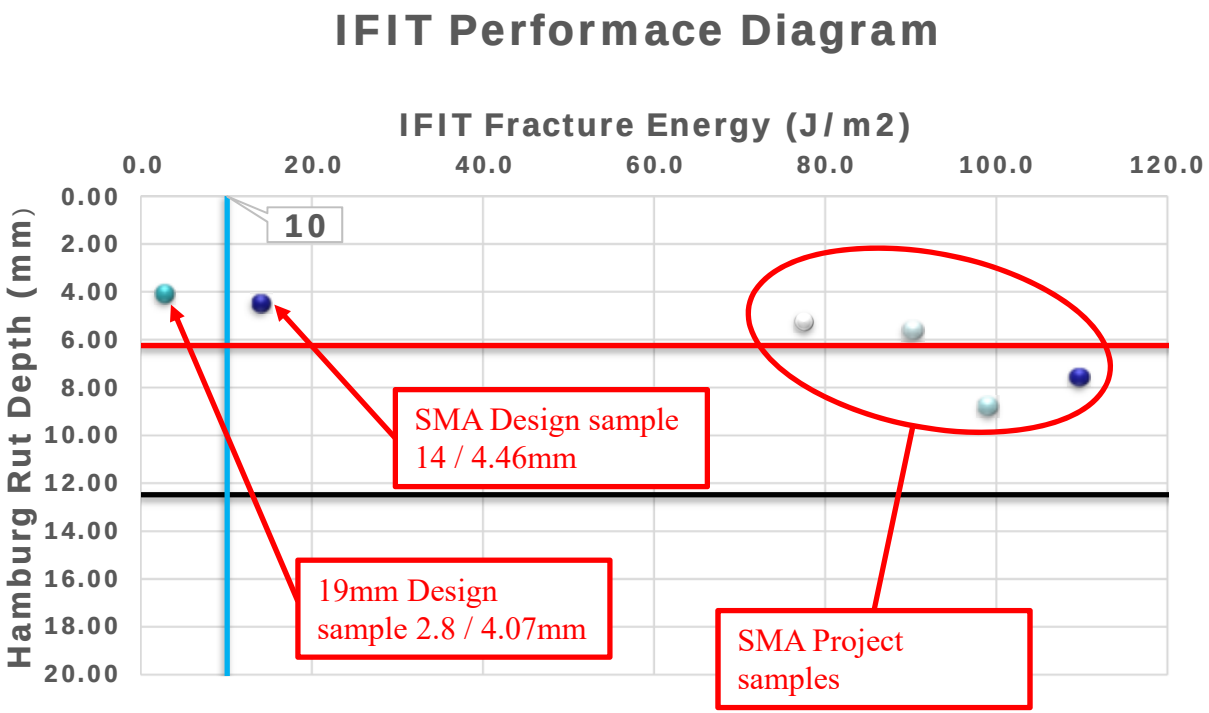
IFIT Data



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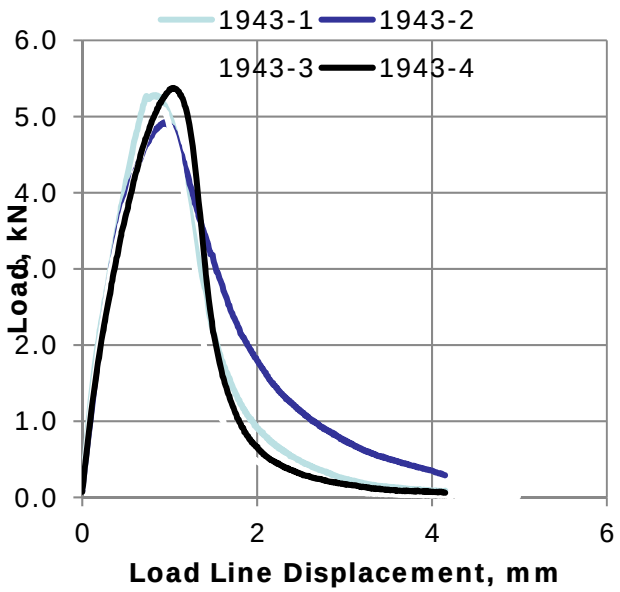
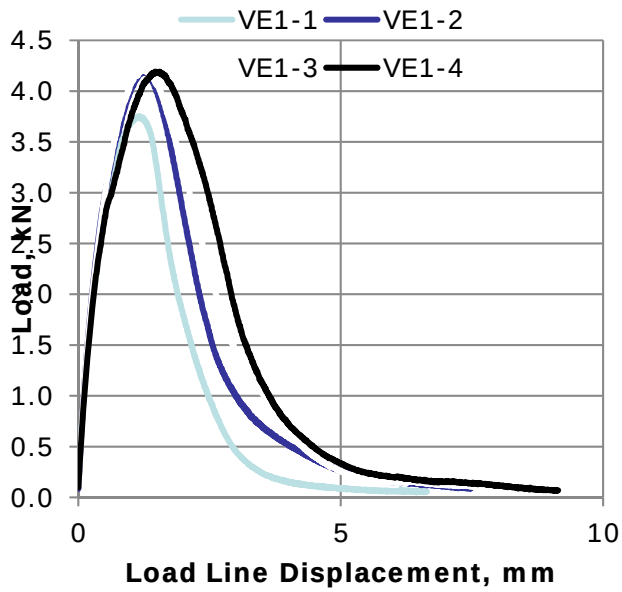
IFIT Plots

19mm



SMA



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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

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Pros

- Potential to provide a more balanced mix design.
- Potential to give producers more flexibility in the mix design process

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Cons

- 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

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QUESTIONS

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