Long Life Asphalt Pavement – LLAP Implementation of Special Provisions

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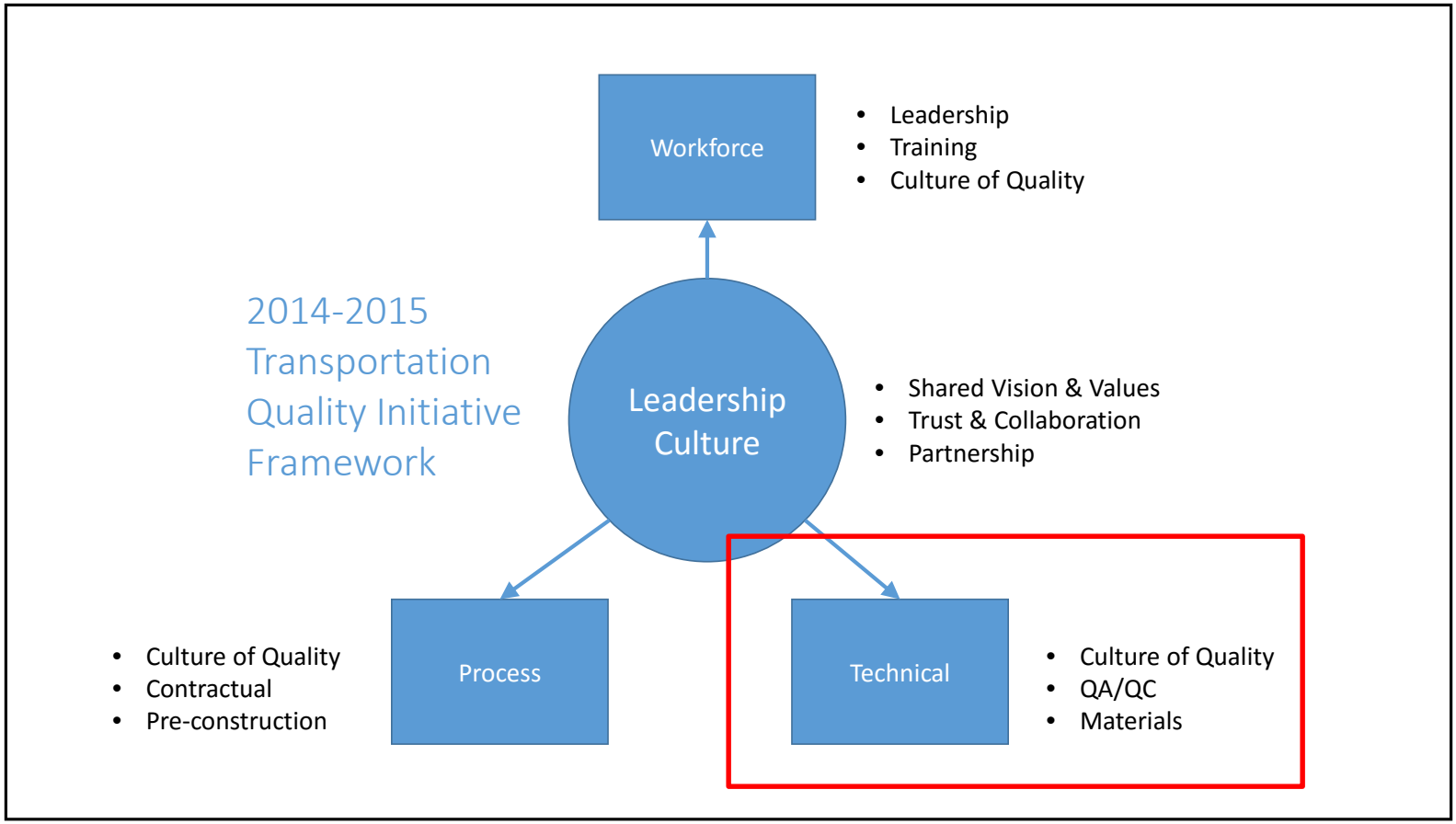
Genesis of LLAP Specification

- **T**ransportation **Q**uality **I**nitiative (TQI) 2014
  - Improve Leadership Culture
  - Workforce Development
  - Process Improvement
  - Technical Improvement

Genesis of LLAP Specification



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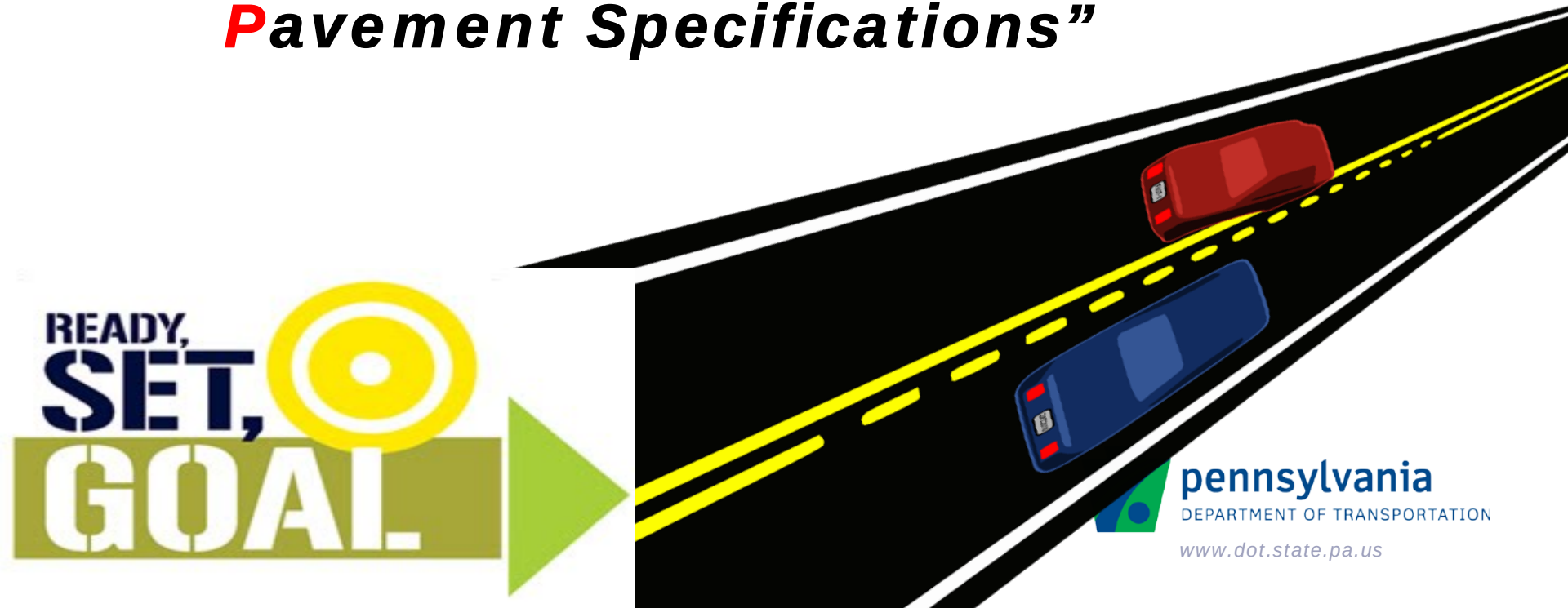
Genesis of LLAP Specification

- **T**echnical **I**mprovement **W**orkgroup
  - Technical Goal #2 of 5 ⇨ ***"Develop Long Life*** *Concrete* ***and Asphalt Pavement Specifications"***



TQI – Technical Work Group

- **LLAP Schedule**

Add LLAP/Perpetual pavement to the Asphalt Pavement Improvement Committee as a work function. Identify 'primary author'	September 2015 COMPLETE
Hold internal meeting with PAPA, Pavement Design, Innovation & 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	October 2015 COMPLETE
Develop initial LLAP specifications for internal (APQIC) member review	December 2016 COMPLETE
Reconcile comments from APQIC	February 2016 COMPLETE
Input from work group on Lab Performance Test Protocols	March 2016 COMPLETE
Complete clearance Transmittal of SSP	July 2016 COMPLETE
Request candidate pilot LLAP projects for implementation from Districts and PTC for construction in 2017.	November 2016 COMPLETE
Develop POA for monitoring pilot projects and their performance through an Asset management approach.	TBD - 2017

LLAP Pavement Design

- **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)**

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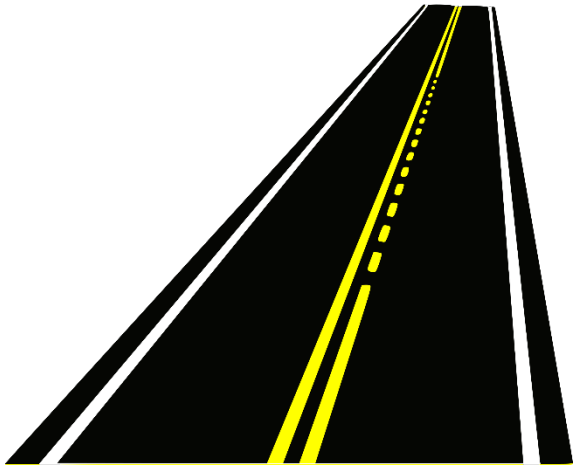
LLAP Asphalt Mix Design

- SMA on Interstates
- Full Deployment of WMA
- Required Use of Anti-Strip Additive
- Asphalt Rich Base
- Optimized – Balanced Mix Design (i.e. Performance Testing)



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LLAP Construction Specifications

- **<u>Many Best practices incorporated</u>**

- **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)**

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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.

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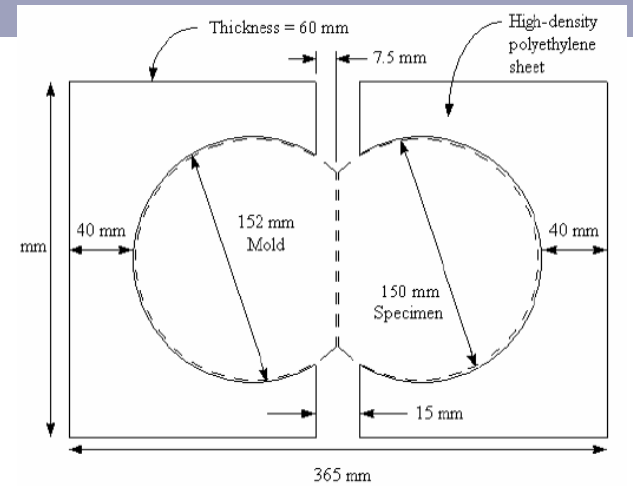
Balanced Approach to Mix Design

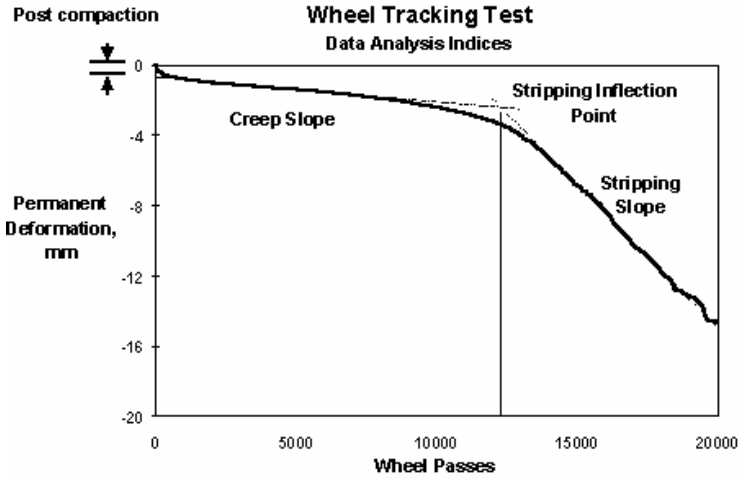
- Looks good & tastes good?

Heavy Duty ID2 placed in 1991 – 25 years

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 122^0 F (50^0 C)
  - Required cycles and rut depth limits vary depending on mix type (SMA) and layer (wearing, binder)





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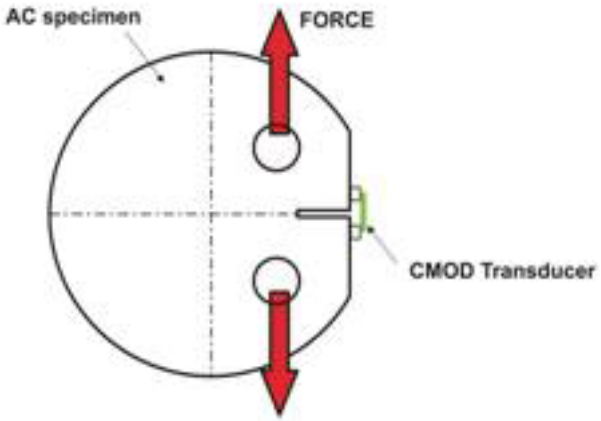
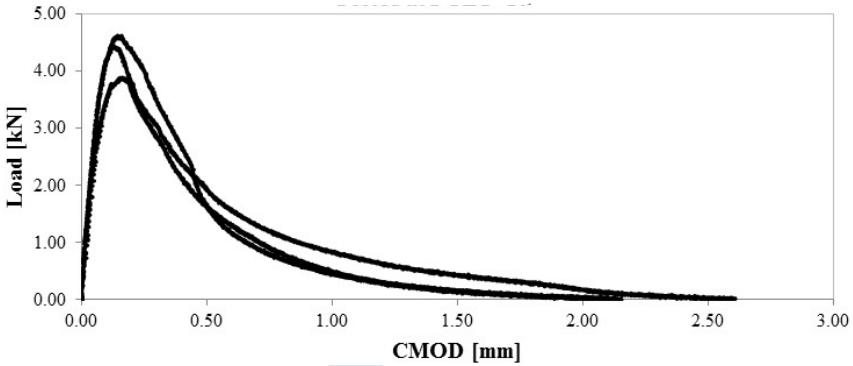
Performance Related Testing (Cracking)

- **Disk-Shaped Compact Tension** (DCT) testing. (ASTM D7313)
- Required for Mix Design
  - Measures fracture energy (Divide the area under the curve by the specimen area.) $G_F = W_f / Area_{lig} \times 10^6$
  - 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,





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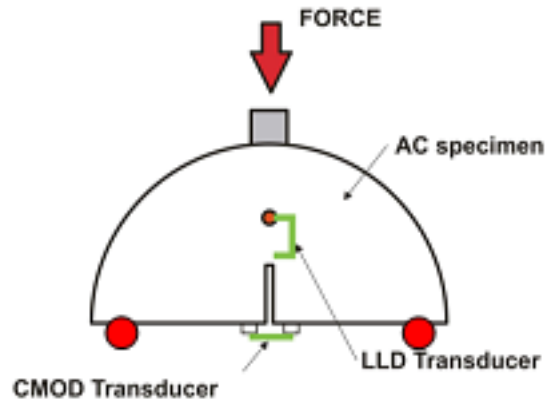
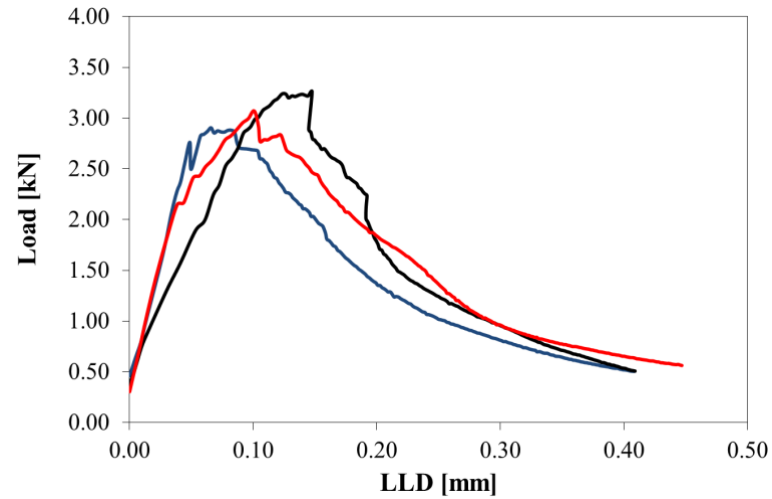
Performance Related Testing (Cracking)

- **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.) $G_F = W_f / Area_{lig} \times 10^6$
  - 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,





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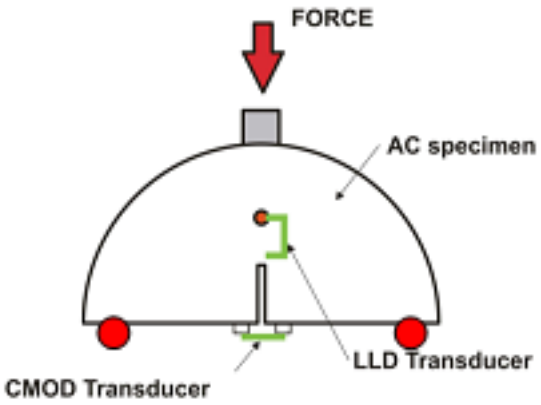
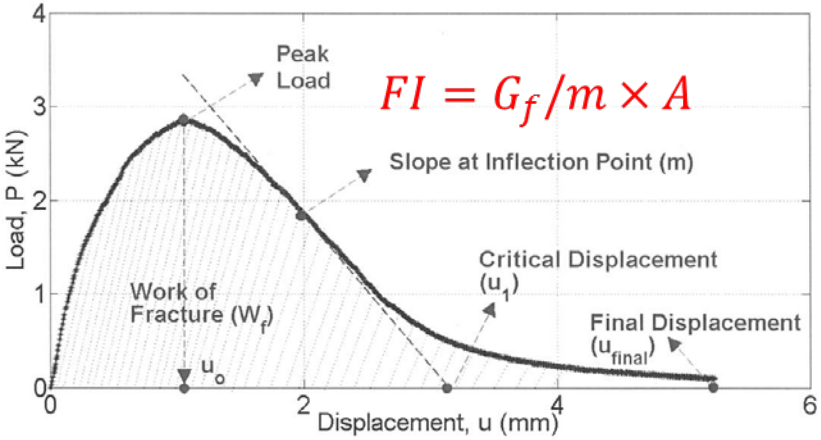
Performance Related Testing (Cracking)

- **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 25^0 C. (77°F)
  - Fracture energy requirements vary depending on mix type (SMA) and layer (wearing, binder)





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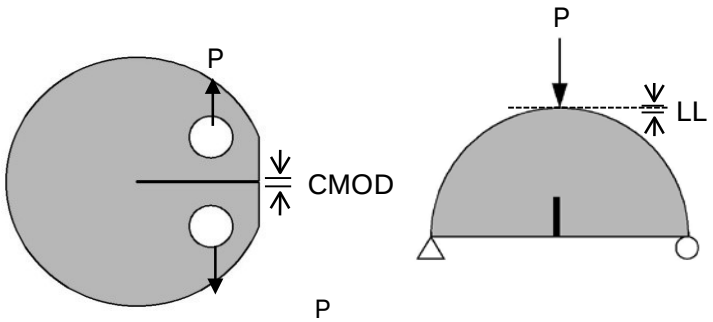
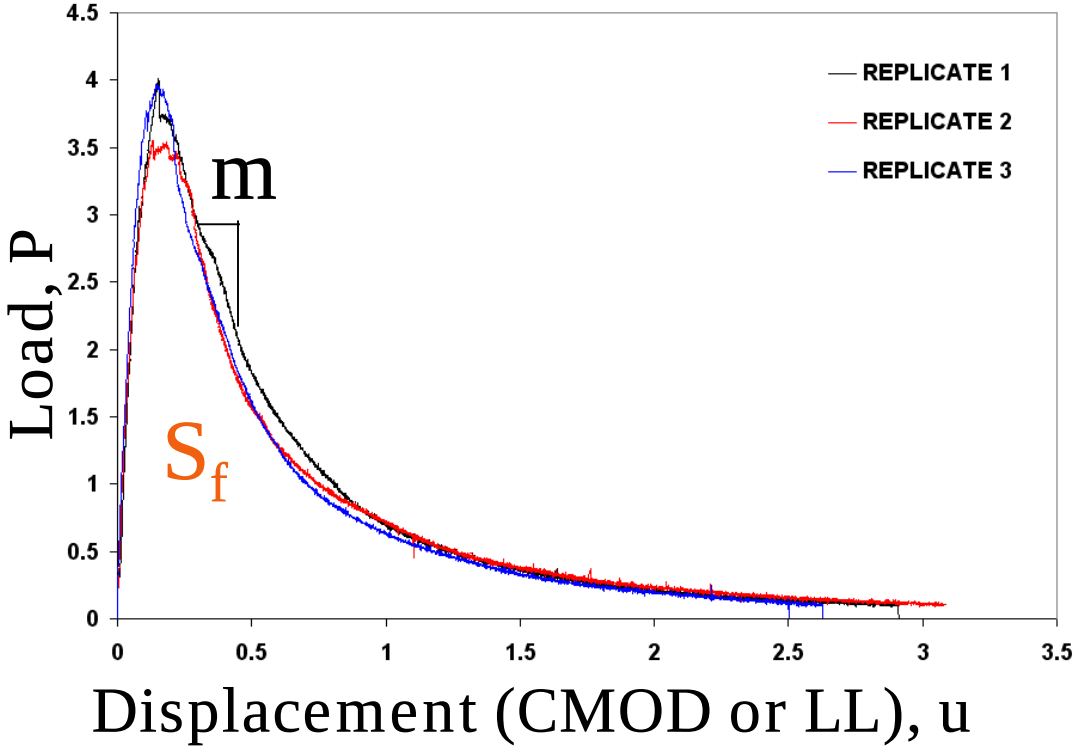
Fracture Parameters





Fracture work: Area under Load-Displacement curve

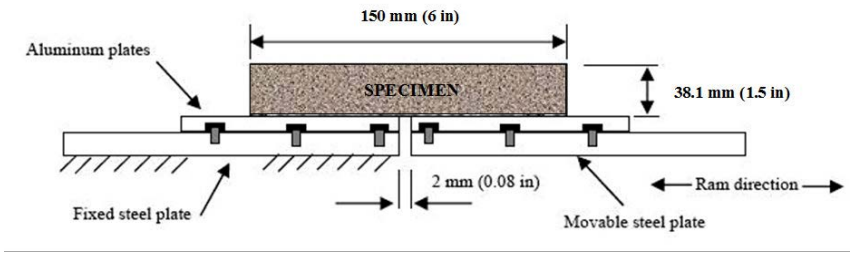
Fracture Energy, G_f: Energy required to create unit fracture surface

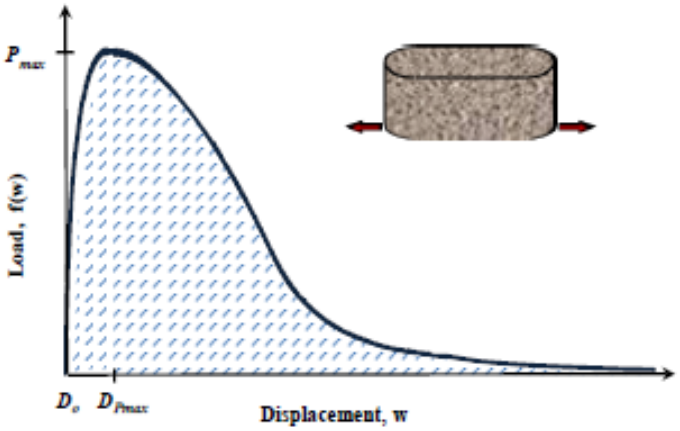
$$G_f = \frac{\text{Fracture Work, } S_f}{\text{Fracture Area}}$$

Flexibility Index, FI: FI = 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 25^0 C (77°F).
  - Applies load to induce 0.025 inches displacement.
  - Number of cycles to failure is reported along with percent decline in load.





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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)		
Test	Specimen Preparation	Testing
DCT	$90.00	$330.00
SCB Low	$90.00	$300.00
SCB Intermeidate	$90.00	$240.00
Overlay	$90.00	$300.00
Hamburg	$180.00	$500.00

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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/m^2) for crack resistance.**
- **No Hamburg testing requirement.**

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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/m^2) for crack resistance.**
- **No Hamburg testing requirement.**

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LLAP Current Features

- Binder Course
  - PWT acceptance includes incentive /disincentive.
  - Tack all layers
  - MTVrequired
  - DCT and Hamburg Wheel track test required as perform-ance testing
  - Anti-strip required
  - WMA technology required

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

- **High DCT fracture energy requirement (460 J/m^2) for crack resistance.**

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

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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/m^2) for crack resistance.**
- **Very High Hamburg requirement (6.25mm at 20,000 cycles) for rut resistance**

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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?