Simple Performance Test System (SPT)

What is it?

How can I use it?
Outline

• What is the SPT?
• Why Was It Developed?
• Practical Applications
  – Pavement Design
  – Mix Performance
  – RAP
What is the SPT?

- Servo-Hydraulic Machine
- HMA Testing
  - Mix Design
  - Structural Design
  - Evaluation

Most Useful Tool Available for Evaluating HMA!
SPT Capabilities

• Three Performance Related Tests
  – Dynamic Modulus
  – Repeated Load
  – Creep

• Temperature Control
  – 4 to 60 °C

• With and Without Confinement
  – 210 kPa Max

• Fatigue Test Under Development
Key SPT Features

• Rugged
  – Proven Hydraulic System

• Automated Testing Cell
  – Temperature
  – Confining Pressure

• Easy to Install Instrumentation

• Standard Software
  – Testing and Analysis
  – Data Quality

• Technician Friendly
Why Do We Need the SPT?

- Test to Indicate How a Mix Will Perform
  - Rutting
  - Cracking

- Uses
  - Identify Inferior Mixtures
  - Structural Design
  - Evaluations
SHRP Mixture Tests

• Shear Test AASHTO TP7
  – Modulus
  – Permanent Deformation
• Flexural Fatigue AASHTO TP8
  – Fatigue Cracking
• Indirect Tensile Test AASHTO TP9
  – Thermal Cracking
Issues With SHRP Products

• High Costs
  – Equipment
  – Training

• Used With Performance Models
  – Errors
  – Not Calibrated
  – Not User Friendly

• Change The Way We Do Business
  – Engineer Mixtures to Perform
Recommended SPT’s

- Dynamic Modulus
  - Rutting
  - Cracking
- Repeated Load Test
  - Rutting
- Creep Test
  - Rutting
Repeated Load Test

- Rutting
  - Min FN at High Temp
Advantages

• Dynamic Modulus
  – Used in Structural Design
  – Addresses Rutting and Cracking

• Repeated Load
  – Potentially Best Simulation for Rutting

• Creep
  – Simple Test Equipment
  – Minimal Training
SPT Uses

• Dynamic Modulus Master Curve for Structural Design
  – AASHTO MEPDG

• Mixture Design
  – NCHRP Project 9-33 “Mix Design Manual for Hot Mix Asphalt”

• Material Evaluations
  – Homogenity of RAP Mixtures
Pavement Structural Design

- AASHTO Mechanistic-Empirical Pavement Design Guide
  - HMA Characterized by a Dynamic Modulus Master Curve
    - Plant Aged Conditions
  - Modulus Needed
    - Stress-Strain Analysis
    - Rutting Model
    - Fatigue Cracking Model
Evaluate Rutting Resistance
Repeated Load Test

Flow Number = Minimum Permanent Strain Rate
NCHRP 9-33 Tentative Criteria

• Stress Level
  - 600 kPa (87 psi)
  - Database of Mixtures Tested by FHWA

• Temperature
  - 50% Reliability Design Temperature From LTTPPBind 3.1

• Short Testing Time
NCHRP 9-33 Tentative Criteria

Estimated Maximum MESALs

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RAP Mixtures
Mixture Homogenity

- How Well Does the RAP/RAS Binder Mix with the New Binder?
  - Black Rock
  - Complete Mixing

- Process Specific
  - Plant Type
  - Plant Operations
  - RAP/RAS Processing
One Tool

- Dynamic Modulus Data Can Be Used to Evaluate RAP and RAS Mixtures
  - Test Is Highly Sensitive to Binder Stiffness
    - Assess Degree of Mixing of New and Recycled Binders
  - Interpreted to Estimate the Effective Grade of the Combined Binder
  - Relatively Easy to Perform with the Simple Performance Test System
9.5 mm With PG 64-22 + 5% RAS, Batch Plant

![Graph showing the relationship between Binder G* (kPa) and Reduced Frequency (rad/sec). The graph compares data from the mix and recovered binder.]
19.0 mm With PG 64-22 + 45 %
Fractionated RAP, Double Barrel

Graph showing the relationship between Binder G* (kPa) and Reduced Frequency (rad/sec) for PG 64-22 with 45% RAP from mix modulus and recovered binder.
SPT Summary

- Specifically for HMA Testing
- Three Performance Related Tests
  - Dynamic Modulus
  - Repeated Load
  - Creep
- Fourth Test Under Development
- User Friendly, Second Generation Mixture Performance Testing Equipment
- Extensive National Efforts to Develop and Implement
Questions

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