Simple Performance Test for Superpave Mix Design

What Is It?

Test That Indicates How Mix Will Perform
- Rutting
- Cracking

1. Identify Inferior Mixes
2. QC/QA Operations
3. Structural Design

Two Projects

NCHRP Project 9-19
- Recommend Test(s)
- Develop Protocol(s)
- Develop Criteria
- Validate Criteria
- Validate Criteria

NCHRP Project 9-29
- Equipment Specs
- Procure First Articles
- Evaluate First Articles
- Revise Specs

Project 9-19 Candidate Tests

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

Project 9-19 Correlation Study

- MnRoad
- WesTrack
- FHWA-ALF
Advanced Asphalt Technologies, LLC
"Engineering Services for the Asphalt Industry"
Southeastern Asphalt User/Producer Group

**ALF: Rut Depth vs. E\(^{\text{max}}/\sin \phi \) @ 130 °F (54.4 °C)**

Unconfined – Linear Range

- Unconfined - Linear Range
- Se/Sy = 0.35
- R\(^2\) = 0.90

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ø5 - AC-10</td>
<td></td>
</tr>
<tr>
<td>ø7 - Styrelf</td>
<td></td>
</tr>
<tr>
<td>ø8 - Novophalt</td>
<td></td>
</tr>
<tr>
<td>ø9 - AC-5</td>
<td></td>
</tr>
<tr>
<td>ø10 - AC-20</td>
<td></td>
</tr>
<tr>
<td>ø11 - Base AC-5</td>
<td></td>
</tr>
<tr>
<td>ø12 - Base AC-20</td>
<td></td>
</tr>
</tbody>
</table>

**Dynamic Modulus Test**

\[ E' = \frac{\sigma}{\epsilon} \]

- Rutting  – Min |E'| at High Temp
- Fatigue Cracking  – Max |E'| at Intermediate Temp

**Creep Flow Time Test**

- Rutting  – Min FT at High Temp

**Repeated Load Permanent Deformation Test**

- Rutting  – Min FN at High Temp

**Advantages**

- Dynamic Modulus  – Used For Structural Design in 2002 Design Guide
  - Addresses Rutting and Cracking
- Creep  – Simple Test Equipment
  - Minimal Training
- Repeated Load  – Potentially Best Simulation of Actual Loading

**Disadvantage**

Specimen Size
  - 100 mm Diameter by 150 mm High
  - Smooth Parallel Ends (Sawed)

Needed to Ensure Fundamental Properties

Sawed and Cored From Over-Height Gyratory Specimens
  - Some SGC Can Not Produce Tall Specimens
Project 9-19 Criteria Development
- Use Models Proposed in Project 1-37A for the 2002 AASHTO Design Guide
- Account for:
  - Climate
  - Traffic Level
  - Structure
- Test at Effective Pavement Temperature
  - Minimum or Maximum Values
    - Traffic Level
    - Pavement Structure
- To be Completed by end of 2002

Project 9-19 Validation
- Criteria Will Be Validated
  - Not the tests
- 50 + Sections
  - LTPP and Other Test Sections
- Completed in Spring of 2002

Project 9-29 Equipment Specifications
- Simple Performance Test System
  - Creep / Flow Time Test
  - Repeated Load / Flow Number Test
  - Dynamic Modulus
- Automated Specimen Fabrication Equipment
- Encourage Innovation by Manufacturers
  - User Friendliness
  - Reliability
  - Cost

Project 9-29 Specification Development
- Research Test Protocols
  - Draft Equipment Specs
  - Cost Estimate
  - Manufacturer’s Review
- User’s Workshop Ideas
  - First Article Equipment Specs
  - Revised Estimate

Project 9-29 First Article Simple Performance Test Procurement
- EnduraTec
- Instron
- Interlaken
- Shedworks
- Specifications
- Advantages
- Cost
- Past Performance

Project 9-29 First Article Simple Performance Test Systems
- Tests
  - Flow Time
  - Flow Number
  - Dynamic Modulus
- Temperature Range
  - 20 to 60 °C
- Confining Pressure Range
  - 0 to 210 kPa
Project 9-29 First Article Specimen Fabrication System

- Pine
- Shedworks

- Specifications
- Automated
- Cost

Summary - Simple Performance Test Work Completed

- Three Candidate Tests
  - Dynamic Modulus
  - Flow Number
  - Flow Time
- Detailed Draft Protocols
- Detailed Equipment Specifications
- First Article Devices
  - Simple Performance Test System ($25k to $45k)
  - Automated Specimen Fabrication System ($12k)
Summary - Simple Performance
Test Work in Progress

• Criteria Development
  – End of 2002
• Criteria Validation
  – Spring of 2003
• First Article Evaluation
  – Spring of 2003