Update on VDOT’s Asphalt Research Activities

2014 VDOT Asphalt Seminars
February & March, 2014
General Asphalt Research Topics

- Mixture Research
- Materials Characterization
- Support of VDOT/Industry Initiatives
  - Asphalt Quality Task Force
  - Superpave Mix Evaluation
  - Quiet Pavements
- Technical Assistance
- NCAT Activities
Mixture – RAP, RAP, RAP!

• TPF-5(230) Evaluation of Plant Produced High Percentage RAP Mixtures
  – University of New Hampshire
  – wRAPping up

• In-Service Binder Aging and Performance: RAP Mixtures
  – RAP content → binder grade and mixture performance
  – Sampling/testing early (2007) high RAP sections
  – Include additional trials (new & existing)
Surface Mix RAP Content

Surface Mix Tonnage containing RAP (thousand tons)

- >0%-10%
- >10%-20%
- >20%-30%
- >30%

2009: >20%-30%
2010: >20%-30%
2011: >10%-20%
2012*: >10%-20%
2013: >10%-20%

*2012 Data Loss
Example Field Activities – Elevated RAP Levels

• Fredericksburg
  – SM-12.5 Mixes
  – 20% RAP (PG70-22); 30%, 40% & 45% RAP (PG64-22)

• City of Hampton
  – SM-9.5 Mixes
  – 30% & 40% RAP; PG64-22
## Fredericksburg – Trial Matrix

<table>
<thead>
<tr>
<th>Date</th>
<th>Mixture</th>
<th>Production / Delivery Temperatures, °F</th>
<th>Tonnage Placed</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/12-14, 21, 25</td>
<td>30% RAP (MS)</td>
<td>295-310 / 285-290</td>
<td>4890</td>
</tr>
<tr>
<td>6/17-18</td>
<td>30% RAP (MS &amp; NS)</td>
<td>295-325 / 285-295</td>
<td>3130</td>
</tr>
<tr>
<td>6/19</td>
<td>45% RAP (MS &amp; NS)</td>
<td>295-310 / 285-290</td>
<td>2400</td>
</tr>
<tr>
<td>6/20</td>
<td>40% RAP (MS &amp; NS)</td>
<td>295-310 / 285-290</td>
<td>1600</td>
</tr>
<tr>
<td>6/24-25</td>
<td>20% RAP (MS)</td>
<td>295-310 / 285-290</td>
<td>3870</td>
</tr>
</tbody>
</table>
Dynamic Modulus Basics ($E^*$)

- Higher Frequency / Higher Modulus:
  - Low temperature response
  - Rapid loading response

- Lower Frequency / Lower Modulus:
  - High temperature response
  - Slow loading response

What are the magic values?
No idea...yet...
Mix “Stiffness”

Dynamic Modulus, psi

Reduced Frequency, Hz
Rutting Resistance

- 20% RAP PG 70-22 (MS): 297
- 30% RAP PG 64-22 (MS): 219
- 30% RAP PG 64-22 (MS&NS): 222
- 40% RAP PG 64-22 (MS&NS): 252
- 45% RAP PG 64-22 (MS&NS): 222

Air Void Content
Asphalt Mixture Performance Testing
(Small-Scale Dynamic Modulus)

Objective:
• Characterize field-placed materials
  • Diameter
    – 38 and 50 mm
  • Specimen height
    – 110 and 135 mm
• 16 AC mixtures tested so far
  – 9.5, 12.5, 19, 25mm
Small Scale Dynamic Modulus

Full Size Specimen Dynamic Modulus, MPa

Small Scale Specimen Dynamic Modulus, MPa

50mm diameter, 135mm height
Aggregate Morphology/Grading – “Small-Size” SMA
Support of AQTF Initiatives

• Incentive-Only Smoothness Specifications
  – 2012 and 2013 pilot project review
  – Compiling and analyzing data from “control” projects - Fredericksburg, Richmond, Staunton, Hampton Roads
  – Researchers - Nair, McGhee, Habib, & Shetty

• NDE for Asphalt Construction
  – Continued coordination with national research
  – 2014 Implementation prospects for IR/GPR
  – Researchers - McGhee & B. Diefenderfer
Uniformity – IR Technology
Quiet Pavement – Winter, Finally?

Conventional - SMA

Final Report – June 2015
Technical Assistance

• Alternatives to PG76-22 Binder
  – Evaluation of alternative (non-SBS) binder modifiers to meet PG76-22
  – McGhee & S. Diefenderfer

• Mixtures Containing Shingles
  – Evaluation of mixtures containing RAP and RAS
  – S. Diefenderfer
NCAT Test Sections

• Virginia test sections
  – 3 recycling (FDR & CPR)
  – 2 quiet pavement

• Objectives
  – Accelerated loading/performance
  – Benefit from numerous experiments by other states – RAP concentrations, tack coat methods/materials, reflective cracking, etc.

• Researchers – B. Diefenderfer & McGhee
NCAT 2012 Track Rebuild

- 2012 Virginia PFC
- 2012 Other PFC
- 2009 Other PFC
- 2012 Virginia Recycle

Status Jan 2014: 6 Million ESALs
For more information:
Jose.Gomez@vdot.virginia.gov

http://vtrc.virgiiniadot.org/