Southeastern Asphalt User/Producer Group (SEAUPG) 2016 Annual Meeting and Exhibits
November 15-17, 2016
Corpus Christi, TX

Presenter
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• Braden Smith, Rabeea Bazuhair, Drew Moore, Anna Baglan, Carl Pittman, Brad Hansen, Abby Sparks, Westin Graves

Construction Materials Research Center (CMRC) Overview
• Housed within Civil and Environmental Engineering (CEE) department. http://www.cee.msstate.edu/cmrc/
• 31 entities have contributed to CMRC’s endowment.
• Two meetings per year. A variety of issues associated with construction materials are discussed at general meetings, PDH presentations are given at some meetings, and anyone is welcome to attend.
• Emails are sent around periodically, and anyone who is interested in getting on this email distribution list can send an email to ilhoward@cee.msstate.edu indicating you want to be added to the list.

Summary of Methods Presented at AAPT Leading Edge Workshop
• 6 categories of methods, 8 test methods
  1. Semi-Circular Bend (SCB)
     a. LTRC (Intermediate Temperature)
     b. Illinois Flexibility Index Test (I-FIT)
     c. Minnesota (Low Temperature)
  2. Disc-Shaped Compact Tension (DCT)
  3. Bending Beam Fatigue (BBF)
  4. Texas Overlay Test (TXOT)
  5. SuperPave Indirect Tensile Test (SIDT)
  6. Simplified Viscoelastic Continuum Damage (S-VECD)

This Boils Our Mix Testing Challenge Down Pretty Well
We Do Three Types of Jobs Here... GOOD, FAST AND CHEAP
You May Choose Any Two!
If It Is Good and Cheap It Will Not Be Fast.
If It Is Good and Fast It Will Not Be Cheap.
If It Is Fast and Cheap It Will Not Be Good.

Acknowledgements
AAPT Leading Edge Workshop – March 2016
• Presiding Officer: Gaylon Baumgardner
• Moderator: Professor Carl Monismith
• Panel Members: Imad Al-Qadi, Bill Buttlar, Rita Lehay, Richard Kim, Jon Epps, Louay Mohammad, Rey Roque, Fujie Zhou [All contributed content used in the presentation, and slides 6 to 14 are a very abbreviated version of that presentation]
• Several AAPT Past Presidents, Established Members, and Newer Members Also Contributed to the Workshop Program

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Schematics of Methods

Note: transducer locations can vary from one set-up to the next in some cases.

Photos of Methods

Photos of Methods Presented
Cantabro Test Method on DGA
(Very Fast, Pretty Cheap, Perhaps not as Good)

Cantabro Test

- Historically used for OGFC or PFC, BUT that does not mean that all the Cantabro test is useful for
- Cantabro test has been successfully used for projects (see SEAUPG 2014 presentation)
- A key attribute of the Cantabro test is the most likely undesirable issues to be encountered during production all make mass loss increase
  (some other tests can have increased or decreased outputs depending on the situation)

Cantabro Test and Present Day Paving
1. We are producing “dry” mixes
2. We know (and have for decades) general principles that lead to more durable mixes, but during production, we don’t always fully incorporate these items
   - Fine Graded Mixes
   - Enough VMA
   - Softer binders (just hard enough not to rut)
   - Dust Control
   - Low Air Voids
   - Use of Polymers….(others)

3. Presenter’s Opinion: Cantabro test is a brittleness index that considers (good, fast, and cheap) at least comparable to any other alternative in the industry when talking about mixture production

100% RAP and Virgin Binder

Overall Summary of AAPT LEW Relative to These Methods
- All methods related to cracking
- The majority of these methods have some data on their relationship to field performance
  - Data sets and prediction quality vary in some cases, but the bottom line is these methods have been vetted
  - These methods lean toward the good, not as much toward fast, and sometimes not toward cheap.
1. Binder Grade and Polymers
   • Lots of different types of mixes and different amounts of replication

<table>
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<tr>
<th>High PG Grade</th>
<th>Avg ML (%)</th>
<th>Specimens</th>
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<tr>
<td>64</td>
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<td>6</td>
</tr>
<tr>
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<td>11.5</td>
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<td>16.0</td>
<td>18</td>
</tr>
<tr>
<td>76</td>
<td>9.2</td>
<td>119</td>
</tr>
</tbody>
</table>

2. New Cantabro Data
   [Full-Scale & Non-Trafficked Section]

   Newly Constructed Test Section (November 2011)
   • 12 Test Strips, 1 Gradation, 3 Binders (HMA, Foamed, Evotherm), 4 Haul Times (1 hr to 10.5 hr)

   5 Years and around 2,900 Cores Later (November 2016)

3. “Dry” Mixes and Cantabro Test
   - MLR = Mass loss ratio = mass loss divided by reference mass loss
   - ABR = Asphalt binder Ratio = binder content /design binder content

4. References
   (Most of the Data Presented to Date Was Collected for Other Studies and is Already Published)

**Test Section Moisture Damage Resistance**

- Hamburg testing shows no stripping
- No inflection point and rut depths of 6 mm or less

**Cantabro (ML) vs 25°C IDT \( (S_t) \)**

- IDT and Cantabro both increased over time
- IDT changed less than Cantabro over time
- IDT and Cantabro were expected to correlate reasonably well when no moisture damage is present, and that generally appears to have happened

**Test Section Cantabro vs Binder Penetration**

\[
y = 815x^{1.118} \\
R^2 = 0.70
\]

**Test Section Cantabro vs Air Voids**

\[
y = 4.7x - 22.8 \\
R^2 = 0.57 \\
n = 179
\]

**Test Section Cantabro vs Fracture Energy**

\[
y = 53x^{-1.061} \\
R^2 = 0.57
\]

Note that for GTR Modified Specimens that Were Gyratory Compacted, Relationship was Different

\[
ML(\%) = -2.45 (FE_{20°C}) + 13.9 \\
R^2 = 0.79
\]
Another Aging Experiment
(Airfield Mixes – Gyratory Compacted)

--Fine graded mixes
--Lots of additional data is collected and forthcoming, not shown for brevity

Summary (Presenter’s Opinion)

1. We need to evaluate mix tests relative to whether or not they can help us produce better mixes now.
2. We need to stop hoping for the perfect good, fast, and cheap test, and use what we have, even if it is only a little better than what we have now.
3. We can improve on mix testing over time, but trying some of this during production should help provide more understanding of what to do w/ time.
4. The more data we collect on the Cantabro test for dense graded asphalt, the more promising it looks.

Questions?