BMD – a definition

An asphalt mix design that uses practical performance tests on appropriately conditioned specimens to ensure resistance to common distresses and considers mix aging, traffic, climate and location within the pavement structure.
Why change?

Most asphalt technologists are not satisfied with the current long term performance of our pavements. There is a desire to significantly improve the life of asphalt pavements.
Why change?

• Volumetric properties do not tell us anything about the *quality* of the binder, or about the interactions of different binder components and additives.

• $V_{be}$ is dependent on $G_{sb}$ which is not a reliable property
  • $G_{sb}$ of source materials are subject to change over time, but not often verified.
  • $G_{sb}$ has a low level of precision
  • $G_{sb}$ of RAP aggregate is questionable
With the current volumetric mix design system...

we have no way of knowing if these materials help or hurt
Balanced Mix Design
BMD Optimum Asphalt Content

Cracking

Rutting

Binder Content
BMD Optimum Asphalt Content
BMD Performance Diagram

Performance "Sweet Zone"

6.5% AC

6.0% AC

5.5% AC

IDEAL CT index

HWTT Rut Depth at 20k Passes (mm)
Numerous options to adjust mixes

- Gradation
- Asphalt Content
- Modifiers
- RAP Content
- RAS Content
- Rejuvenator
The BIG questions

1. What performance tests will be used in BMD?
2. How will the performance tests be used? Where will they fit in the mix design process? (The Framework)
3. What criteria should be used in specifications?
4. What aging/conditioning protocols should be used for mixtures in BMD?
5. How will the performance tests be used in Quality Assurance?
6. What should you do to get ready for BMD?
Cracking Group Studies
Cracking Group Experiments

NCAT Test Track
Top-down cracking

MnROAD
Low-temperature cracking
NCAT Test Track

America’s asphalt pavement proving ground
NCAT Cracking Group Sponsors
Selected Top Down Cracking Tests

Energy Ratio  SCB-LA  IFIT  OT-TX  OT-NCAT  IDEAL-CT

All tests have been conducted on:
1. lab prepared mix after short-term aging
2. lab prepared mix after short-term and critical aging
3. plant mix samples that were reheated
4. plan mix samples that were reheated and critically aged

critical aging for Auburn, AL = loose mix oven aging at 135°C for 8 hours
# NCAT CG Field Performance

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Cracking (% of lane area)</th>
<th>Start of this Cycle</th>
<th>10/30/19</th>
<th>Crit. Aged CT Index</th>
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</thead>
<tbody>
<tr>
<td>N1</td>
<td>20% RAP (Control)</td>
<td></td>
<td>10.3</td>
<td>10.6</td>
<td>8.1</td>
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<tr>
<td>N2</td>
<td>Control w/ High Density</td>
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<td>6.9</td>
<td>7.5</td>
<td>5.1</td>
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<tr>
<td>N5</td>
<td>Low AC, Low Density</td>
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<td>3.5</td>
<td>9.3</td>
<td>8.6</td>
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<tr>
<td>N8</td>
<td>20% RAP 5% RAS</td>
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<td>16.6</td>
<td>34.6</td>
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<td>S5</td>
<td>35% RAP PG 58-28</td>
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<td>0</td>
<td>16.3</td>
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<tr>
<td>S6</td>
<td>Control w HiMA</td>
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<td>0</td>
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<tr>
<td>S13</td>
<td>AZ Rubber Mix</td>
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<td>68.4</td>
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MnROAD Cracking Group Test Sections

Test sections constructed August 2016
MnROAD Cracking Group Sponsors
MnROAD Cracking Group

Low temperatures
January 30, 2019
MnROAD Cracking Group
Field Performance through April 2019

<table>
<thead>
<tr>
<th>Cell</th>
<th>Key Mix Factors</th>
<th>Transverse Cracking (ft.)</th>
<th>Load Related Cracking (% of lane area)</th>
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<tbody>
<tr>
<td>16</td>
<td>Moderate RAP + RAS</td>
<td>58</td>
<td>1.5</td>
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<tr>
<td>17</td>
<td>Low RAP + RAS</td>
<td>70</td>
<td>6.3</td>
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<tr>
<td>18</td>
<td>Moderate RAP</td>
<td>35</td>
<td>3.8</td>
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<tr>
<td>19</td>
<td>Moderate RAP, extra AC</td>
<td>61</td>
<td>0.4</td>
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<tr>
<td>20</td>
<td>High RAP, softer binder</td>
<td>0</td>
<td>0.2</td>
</tr>
<tr>
<td>21</td>
<td>Moderate RAP, softer binder</td>
<td>28</td>
<td>1.1</td>
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<tr>
<td>22</td>
<td>Limestone agg. and 9.5 mm NMAS</td>
<td>50</td>
<td>4.4</td>
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<tr>
<td>23</td>
<td>Moderate RAP, Highly mod. binder</td>
<td>43</td>
<td>14.9</td>
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</tbody>
</table>
MnROAD Cracking Group Tests

Intermediate Temperature Tests

IFIT
Cantabro
OT-NCAT
IDEAL-CT

Low Temperature Tests

DCT
IDT Creep Compliance & Strength
Low Temp. SCB

other tests are being performed by other research organizations
BMD Implementation Status

- **California**
  - Bending Beam Fatigue
  - Superpave Shear Test

- **Illinois**
  - Illinois Flexibility Index
  - Hamburg Wheel Tracker

- **New Jersey**
  - Overlay Test
  - Hamburg Wheel Tracker

- **Texas**
  - Overlay Tester
  - Hamburg Wheel Tracker

- **Louisiana**
  - Semi-Circular Bend Test
  - Hamburg Wheel Tracker
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Getting all stakeholders to agree on a common BMD Approach will be like....
Work Ahead

• Selection of Tests
• Ruggedness and ILS studies
• Benchmarking current mixes
• Setting criteria
• Training
• Pilot Projects
Become an AAPT Member!

• Belong to a North American-based organization with significant international membership that focuses specifically on asphalt pavements
• Be a member of an association that operates without organizational biases; policies set by and for individual members by an elected Board.
• Have access to a wealth of information and emerging technologies including free webinars
• Be an integral part of a technical community comprised of individuals from all parts of the asphalt industry (material suppliers, researchers, agency owners, consultants, and equipment manufacturers)
• Enjoy the camaraderie of colleagues in the field during annual meetings at attractive venues
• Be a part of lively debates on important technical issues
• Support the next generation of asphalt technologists through a robust student scholarship program

http://asphalttechnology.org/membership.html
95th AAPT Annual Meeting and Technical Sessions

The 2020 Annual Meeting will be held March 22-25, 2020
Westin San Diego Gaslamp Quarter, San Diego, California USA

2020 Annual Meeting

The Annual Business Meeting and Technical Sessions of the Association of Asphalt Paving Technologists (AAPT) will be March 22-25, 2020 in San Diego, California at Westin San Diego Gaslamp Quarter. The annual meeting includes asphalt-related technical sessions comprised of peer-reviewed papers, and invited presentations on specific topics in the AAPT-ISAP International Forum, and Symposium as well as a Student Poster Session.

Visit http://asphalttechnology.org/annual-meeting.html for more details as they become available.

Important dates
December 2019 – Annual Meeting registration opens
March 22-25, 2020 - Annual Business Meeting and Technical Sessions

For the latest information please check our web site at: http://www.asphalttechnology.org
Questions
Thank You

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