Outline

• What is the Asphalt Mix Design Task Force
• Goals of the MDTF
• Specifications of interest
• Efforts
• Where are we now?
• Where are we going?
What is the Mix Design Task Force

• Group assembled to evaluate our current asphalt mix designs and explore ways to make them better

• Combination of VDOT and Industry

Ben Bowers, co-chair, VTRC
Sungho Kim, co-chair, VDOT Mats
David Lee, VDOT Salem District
Tanveer Chowdhury, VDOT PM
Angela Beyke, VDOT Mats
Stacey Diefenderfer, VTRC
Tommy Schinkel, VDOT Richmond District

Ed Dalrymple, VTCA
Trenton Clark, VAA
Rick James, Adams Construction Co
Dave Helmick, Superior Paving Corp
Rob Schwear, Allan Myers
Vanna Lewis, FHWA
MDTF Goals

• TASK 1. Benchmark key, current asphalt mixture attributes. This includes VTRC’s 50-gyration study and 2016 MITS/PLAID data.

• TASK 2. Collect national information about ongoing work to improve mix design procedures for performance.
# 2015-2016 Specification Changes

## TABLE II-14
Mix Design Criteria

<table>
<thead>
<tr>
<th>Mix Type</th>
<th>VTM (%)</th>
<th>VFA (%)</th>
<th>VFA (%)</th>
<th>Min. VMA (%)</th>
<th>Fines/Asphalt Ratio</th>
<th>No. of Gyrrations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Production</td>
<td>Design</td>
<td>Production</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SM-9.0A $^{1,2}$</td>
<td>2.0-5.0</td>
<td>75-80</td>
<td>70-85</td>
<td>16</td>
<td>0.6-1.3</td>
<td>65</td>
</tr>
<tr>
<td>SM-9.0D $^{1,2}$</td>
<td>2.0-5.0</td>
<td>75-80</td>
<td>70-85</td>
<td>16</td>
<td>0.6-1.3</td>
<td>65</td>
</tr>
<tr>
<td>SM-9.0E $^{1,2}$</td>
<td>2.0-5.0</td>
<td>75-80</td>
<td>70-85</td>
<td>16</td>
<td>0.6-1.3</td>
<td>65</td>
</tr>
<tr>
<td>SM-9.5A $^{1,2}$</td>
<td>2.0-5.0</td>
<td>75-80</td>
<td>70-85</td>
<td>16</td>
<td>0.7-1.3</td>
<td>50</td>
</tr>
<tr>
<td>SM-9.5D $^{1,2}$</td>
<td>2.0-5.0</td>
<td>75-80</td>
<td>70-85</td>
<td>16</td>
<td>0.7-1.3</td>
<td>50</td>
</tr>
<tr>
<td>SM-9.5E $^{1,2}$</td>
<td>2.0-5.0</td>
<td>75-80</td>
<td>70-85</td>
<td>16</td>
<td>0.7-1.3</td>
<td>50</td>
</tr>
<tr>
<td>SM-12.5A $^{1,2}$</td>
<td>2.0-5.0</td>
<td>73-79</td>
<td>68-84</td>
<td>15</td>
<td>0.7-1.3</td>
<td>50</td>
</tr>
<tr>
<td>SM-12.5D $^{1,2}$</td>
<td>2.0-5.0</td>
<td>73-79</td>
<td>68-84</td>
<td>15</td>
<td>0.7-1.3</td>
<td>50</td>
</tr>
<tr>
<td>SM-12.5E $^{1,2}$</td>
<td>2.0-5.0</td>
<td>73-79</td>
<td>68-84</td>
<td>15</td>
<td>0.7-1.3</td>
<td>50</td>
</tr>
<tr>
<td>IM-19.0A $^{1,2}$</td>
<td>2.0-5.0</td>
<td>69-76</td>
<td>64-81</td>
<td>13</td>
<td>0.6-1.2</td>
<td>65</td>
</tr>
<tr>
<td>IM-19.0D $^{1,2}$</td>
<td>2.0-5.0</td>
<td>69-76</td>
<td>64-81</td>
<td>13</td>
<td>0.6-1.2</td>
<td>65</td>
</tr>
<tr>
<td>IM-19.0E $^{1,2}$</td>
<td>2.0-5.0</td>
<td>69-76</td>
<td>64-81</td>
<td>13</td>
<td>0.6-1.2</td>
<td>65</td>
</tr>
<tr>
<td>BM-25.0A $^{2,3}$</td>
<td>1.0-4.0</td>
<td>67-87</td>
<td>67-92</td>
<td>12</td>
<td>0.6-1.3</td>
<td>65</td>
</tr>
<tr>
<td>BM-25.0D $^{2,3}$</td>
<td>1.0-4.0</td>
<td>67-87</td>
<td>67-92</td>
<td>12</td>
<td>0.6-1.3</td>
<td>65</td>
</tr>
</tbody>
</table>

$^{1}$Asphalt content should be selected at 4.0% air voids for A & D mixes, 3.5% air voids for E mix.
$^{2}$Fines-asphalt ratio is based on effective asphalt content.
$^{3}$Base mix shall be designed at 2.5% air voids. BM-25A shall have a minimum asphalt content of 4.4% unless otherwise approved by the Engineer. BM-25D shall have a minimum asphalt content of
2015-2016 Specification Changes

TABLE II-13
Asphalt Concrete Mixtures: Design Range

<table>
<thead>
<tr>
<th>Mix Type</th>
<th>2 in</th>
<th>1 1/2 in</th>
<th>1 in</th>
<th>3/4 in</th>
<th>1/2 in</th>
<th>3/8 in</th>
<th>No. 4</th>
<th>No. 8</th>
<th>No. 30</th>
<th>No. 50</th>
<th>No. 200</th>
</tr>
</thead>
<tbody>
<tr>
<td>SM-9.0 A,D,E</td>
<td>100^</td>
<td>90-100</td>
<td>90 max.</td>
<td>47-67</td>
<td>2-10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SM-9.5 A,D,E</td>
<td>100^</td>
<td>90-100</td>
<td>58-80</td>
<td>38-67</td>
<td>23 max</td>
<td>2-10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SM-12.5 A,D,E</td>
<td>100</td>
<td>95-100</td>
<td>90 max.</td>
<td>58-80</td>
<td>34-50</td>
<td>23 max</td>
<td>2-10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IM-19.0 A,D,E</td>
<td>100</td>
<td>90-100</td>
<td>90 max.</td>
<td>--</td>
<td>--</td>
<td>28-49</td>
<td>2-8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BM-25.0 A,D</td>
<td>100</td>
<td>90-100</td>
<td>90 max.</td>
<td>--</td>
<td>--</td>
<td>19-38</td>
<td>1-7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C (Curb Mix)</td>
<td>100</td>
<td>92-100</td>
<td>70-75</td>
<td>50-60</td>
<td>28-36</td>
<td>15-20</td>
<td>7-9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

^A production tolerance of 1% will be applied to this sieve regardless of the number of tests in the lot.
What should these changes help?

• 50-gyrations and VMA increase
  – In some cases, increase the asphalt content
  – Assist in achieving increased density in the field
  – Make mixes somewhat fine
  – Decrease permeability

• Addition of maximum on #30 sieve
  – Prevent overuse of fine material to achieve VMA

• Changes only look at typical surface mixes
  – Base mix, intermediate mix, and SM-9.0 unchanged
So what have we been up to?

• First meeting:
  – Introduce goals
  – TASK 2 conversation started:
    • Balanced Mix Design – Tim Aschenbrener, FHWA
    • NCAT Cracking Group Study – Randy West, NCAT
    • Superpave 5 – Rebecca McDaniel, NCSC/Purdue University
    • Michigan Regression Method – Pete Capon, Reith-Riley

• Second Meeting
  – Recap meeting one / discussion
  – Establish TASK 1 metrics
Metrics Defined for TASK 1

• **VDOT Materials**
  – Compare AC contents
  – In-place density this year vs. last year
  – Permeability for 2016 50-gyration mixes

• **VTRC**
  – Compare AC contents between 50 and 65 gyration mixes
  – In-place density comparison
  – Permeability
  – Semi-Circular Bend test for cracking

• **VDOT Materials / VTRC**
  – Film thickness *and* effective asphalt content
  – Evaluate changes in ride quality
So what have we been up to?

• Third meeting
  – Web meeting
  – Provided preliminary data from
    • VTRC 50-gyration study from Summer 2015 pilot projects
    • VDOT Materials MITS/PLAID data mining from 2016
    • VTRC In-Place Density Trials (Kevin McGhee)

• Fourth Meeting
  – Schedule TBA, Winter months
  – Provide completed data sets
2015: VTRC 50-gyration Study

• VTRC led study examining 50-gyration mixes versus 65-gyration mixes
• 11 projects from around the state
  – Each had a 65 and 50 gyration pair
  – Pairs were the same mix type
  – All mixes were SM-9.5 A/D or SM-12.5 A/D

• Data:
  – Volumetrics / Permeability
  – Performance Tests
% Asphalt Content

- Average of 5.76% for 50-gyration mixes
- Average of 5.58% for 65-gyration mixes
- Average increase of 0.18% for 50-gyration mixes
- Average of 17.5 for 50-gyration mixes
- Average of 16.8 for 65-gyration mixes
- Average increase of 0.70 for 50-gyration mixes
Average decrease of 1.54 for 50-gyration mixes
Decrease controlled by three 65-gyration sample mixes
Percent Effective Binder

- Increase of 0.18% for 50-gyration mixes
Where are we now?

• The data collected *to date* indicates changes to the mix design have been beneficial
  – Slight increase in total asphalt content
  – Slight increase in effective asphalt content
  – Density seems to be more easily achieved

• Still collecting data through the 2016 season!
Where are we going?

• The group will convene a few more times and ultimately make recommendations

• Recommendations will be considered by the State Materials Engineer
  – These will be appropriately vetted by VDOT/Industry
Questions?

Benjamin F. Bowers, PhD
Research Scientist
Ben.Bowers@vdot.virginia.gov