HMA Mix Type Selection

Design & Bridge Conference 2007
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TxDOT HMA Classifications, 2004 Standard Specifications

- Item 340 Dense Graded Hot Mix Asphalt (Method)
- Item 341 Dense Graded Hot Mix Asphalt (QC/QA)
- Item 342 Permeable Friction Course (PFC)
- Item 344 Performance Design Mixtures
- Item 346 Stone Matrix Asphalt (SMA)
Mixture Usage Summary

- Total tons of hot mix let by TxDOT in 2005: 13,505,431
- Dense Graded ≈ 75.8% ≈ 10,231,094 tons
- PFC ≈ 6.5% ≈ 873,569 tons
- CMHB ≈ 5.3% ≈ 721,985 tons
- Superpave ≈ 6.5% ≈ 873,823 tons
- SMA ≈ 6.0% ≈ 804,960 tons
Item 340

Dense Graded Hot Mix Asphalt (Method)
Item 341

Dense Graded Hot Mix Asphalt (QC/ QA)
Item 341 - Dense Grade HMA

- Typical Use
  - Item 341 can be used for new construction and overlays
  - Dense graded mixtures can be applied to high volume and low volume roads
  - Used as base, intermediate or surface layers.

- Advantages
  - Low initial cost
  - Previous experience (wide range of uses)
Item 341 - Dense Graded HMA

- Disadvantages
  - Cannot accommodate high AC contents
  - No stone on stone contact
  - Low texture of dense graded surface mixtures (Type C, D, and F)
  - can either highly rut resistant or highly crack resistant but not both
Dense-Graded Hot Mix Asphalt Type A vs. Type D
# Min & Max Lift Thickness for Item 341

<table>
<thead>
<tr>
<th>Type</th>
<th>Minimum Lift Thickness</th>
<th>Maximum Lift Thickness</th>
<th>Typical location of pavement layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type A</td>
<td>3”</td>
<td>6”</td>
<td>Base</td>
</tr>
<tr>
<td>Type B</td>
<td>2.5”</td>
<td>5”</td>
<td>Base/Intermediate</td>
</tr>
<tr>
<td>Type C</td>
<td>2.0”</td>
<td>4”</td>
<td>Intermediate / Surface</td>
</tr>
<tr>
<td>Type D</td>
<td>1.5”</td>
<td>3”</td>
<td>Surface</td>
</tr>
<tr>
<td>Type F</td>
<td>1.25”</td>
<td>2.5”</td>
<td>Surface</td>
</tr>
</tbody>
</table>
Item 342

Permeable Friction Course
Item 342
Permeable Friction Course

- Typical Use
  - Surface course on high-speed roadways
  - PFC is recommended in areas susceptible to head-on collisions (undivided highways w/curves)

- Advantages
  - Reduce water spray,
  - Improve wet weather visibility
  - Visibility of pavement markings,
  - Reduce tire noise, and
  - Restore ride quality
Texas Asphalt Pavement Texas Asphalt Pavement

Click on image below to show video

US 183 – Williamson Co.
South Bound near San Gabriel River
Item 342
Permeable Friction Course

- Disadvantages
  - higher initial cost (>6% PG76 & additives)
  - Additives require modifications to typical HMA production processes. (fibers, lime, or A-R)
  - PFC mixtures must be placed on a pavement that is structurally sound and relatively impermeable
  - PFC mixtures (18% air voids) tend to freeze faster and thaw slower. Lower resistance to high shearing forces.
Dense-Graded Type D vs. Permeable Friction Course
## Min & Max Lift Thickness for Item 342

<table>
<thead>
<tr>
<th></th>
<th>Min Lift Thickness</th>
<th>Max Lift Thickness</th>
<th>Typical location of pavement layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>PFC PG 76-22</td>
<td>3/4”</td>
<td>2”</td>
<td>Surface</td>
</tr>
<tr>
<td>PFC AR</td>
<td>3/4”</td>
<td>2”</td>
<td>Surface</td>
</tr>
</tbody>
</table>
Item 344

Performance Design Mixtures
Item 344
Performance Design Mixtures

- Typical Use
  - for applications ranging from high volume roadways to low volume
  - Used as base, intermediate or surface layers.

- Advantages
  - Medium to high volume roadways
  - Adjust the binder content (by adjusting the N-des level)
  - Stone on stone contact
  - The coarse surface texture can be beneficial in terms of wet weather traction.
Disadvantages
– More difficult to compact?
– Intermediate temperature tenderness?
– Gradation is not as “gap graded” as an SMA mixture
– More susceptible to cracking and water infiltration than SMA mixtures
Dense-Graded HMA Type A vs. Superpave A
# Min & Max Lift Thickness Item 344

<table>
<thead>
<tr>
<th>Type</th>
<th>Minimum Lift Thickness</th>
<th>Maximum Lift Thickness</th>
<th>Typical location of pavement layer</th>
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</thead>
<tbody>
<tr>
<td>Type SP-A</td>
<td>3”</td>
<td>5”</td>
<td>Base</td>
</tr>
<tr>
<td>Type SP-B</td>
<td>2.25”</td>
<td>4”</td>
<td>Base/Intermediate</td>
</tr>
<tr>
<td>Type SP-C</td>
<td>1.5”</td>
<td>3”</td>
<td>Intermediate/Surface</td>
</tr>
<tr>
<td>Type SP-D</td>
<td>1.25”</td>
<td>2”</td>
<td>Surface</td>
</tr>
<tr>
<td>CMHB-C</td>
<td>2”0</td>
<td>4”</td>
<td>Int./Surface</td>
</tr>
<tr>
<td>CMHB-F</td>
<td>1.5”</td>
<td>3”</td>
<td>Surface</td>
</tr>
</tbody>
</table>
Item 346

Stone Matrix Asphalt
Item 346
Stone Matrix Asphalt Mixtures

- **Typical Use**
  - surface mix or intermediate layer in the pavement structure on high volume roadways

- **Advantages**
  - Excellent rut resistance and crack resistance (reflective cracking delayed by approx. 4 times)
  - Stone on stone contact
  - Impermeable compared to performance design mixtures
  - High degree of surface texture beneficial in terms of wet weather traction.
Item 346
Stone Matrix Asphalt Mixtures

- Disadvantages
  - Higher initial cost compared to other mixtures (>6% PG76, fibers and filler)
  - Additives require modifications to typical HMA production processes
  - Higher quality aggregates
  - SMA mixtures can be particularly difficult to place in cool weather
Dense-Graded Type D vs. SMA-D
## Min & Max Lift Thickness for Item 346

<table>
<thead>
<tr>
<th></th>
<th>Min Lift Thickness</th>
<th>Max Lift Thickness</th>
<th>Typical location of pavement layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMA-C</td>
<td>2.25”</td>
<td>4.0”</td>
<td>Int./Surface</td>
</tr>
<tr>
<td>SMA-D</td>
<td>1.5”</td>
<td>3.0”</td>
<td>Int./Surface</td>
</tr>
<tr>
<td>SMA-F</td>
<td>1.25”</td>
<td>2.5”</td>
<td>Surface</td>
</tr>
<tr>
<td>SMAR-C</td>
<td>2.0”</td>
<td>4.0”</td>
<td>Int./Surface</td>
</tr>
<tr>
<td>SMAR-F</td>
<td>1.5”</td>
<td>3.0”</td>
<td>Surface</td>
</tr>
</tbody>
</table>
Summary & Conclusions

- Match the HMA type to the application
  - Comfort, Safety, Durability, Cost Effectiveness
  - Consider life cycle costs –Vs- initial cost

- Performance is a function of mix type, aggregate quality, asphalt quality and quantity and existing structure

- Finer mixes = thinner lifts = less cost/SY
- Finer mixes = more asphalt = less cracking = more cost/ton

- HMA mixture selection guideline is available online