Fractionation and the Effect on HMA Production

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Reclaimed Asphalt Pavement (RAP)

- Greatest single upfront cost saving measure available to MTO and Municipal agencies is increasing the usage RAP

- Different RAP processing techniques have the potential to change the marketplace and the quality of our material
### RAP in OPSS.PROV 1151

<table>
<thead>
<tr>
<th>Traffic Category</th>
<th>Binder Course</th>
<th>Surface Course</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>150 mm or More Below Pavement Surface</td>
<td>Within 150 mm of Pavement Surface</td>
</tr>
<tr>
<td>A, B</td>
<td>40%</td>
<td>40%</td>
</tr>
<tr>
<td>C, D</td>
<td>40%</td>
<td>20%</td>
</tr>
<tr>
<td>E</td>
<td>40%</td>
<td>20%</td>
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</tbody>
</table>

• For FC1 and FC2 surface course the lithology of the fine aggregate fraction is specified
<table>
<thead>
<tr>
<th>Traffic Category</th>
<th>Binder Course Mixes</th>
<th>Surface Course Excluding 12.5 FC 1, 12.5 FC 2 and SMA</th>
<th>12.5 FC 1, 12.5 FC 2 and SMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, B, C and D</td>
<td>30% or 40%</td>
<td>15% or 20%</td>
<td>0%</td>
</tr>
<tr>
<td>E</td>
<td>30%</td>
<td>15%</td>
<td>0%</td>
</tr>
</tbody>
</table>

- for OPSS 1150 – 0% in HL 1, DFC and HDBC, 15% for surface and 30% for binder; in App D – 0% for HL 1, DFC and HDFC, 20% for surface and 40% for binder and 30% for MDBC
**Reasons for using RAP**

- HMA is the Best and Highest Use
- Production and Stockpiling
- NCHRP Rpt 452 for RAP in Superpave mixes
- AC selection for RAP use

**Use of a RAP Gator to control lumps**

- Air scavenger system to collect moisture and dust
- The Economic Case
- Available online under the Publications tab
NCAT Study on RAP

Is RAP variable? Is it truly a GOK pile?

- NO – surveyed 70 RAP stockpiles and 60 crushed stone stockpiles in 6 states
- Found that the processed RAP pile was more consistent than the aggregate stockpiles (lower standard deviation on the median and finest sieve)
- Why – all the material comes from road pavements so it has already been processed
- “Mix as you feed” procedure during the processing of raw RAP into the active stockpile results in further uniformity
NCAT Study on RAP

- Is fractionation necessary for quality?
  - Not necessarily – fractionation provides many more options for the HMA process but does not necessarily improve variability
  - It involves extra costs and therefore it may not suitable in areas where RAP utilization is low
  - Most suppliers crush to one size and use it appropriately in their mixes
    - Over crushing can produces fines that are detrimental
NCAT Study on RAP

How do we access the quality of RAP?

- Over 75% of the HMA producers surveyed sample their stockpile while it is being built at a frequency of 1 test every 1,000 tonnes
- 43% take one test every 500 tonnes
- Ignition oven used for AC content and gradation about 70% of the time
How is RAP changed by fractionation

- Fractionation changes the asphalt cement content of RAP
  - Finer fractions have proportionately more of the AC
- Fractionation allows for greater control on the final gradation
  - More bins give more control, just like any aggregate
  - Become more important as RAP content increases
- Prevents over processing to get to a finer size
  - Reduces the generation of fines
What might be coming

- NCHRP Report 752 – *Mixes with High RAP*
- Randy West (NCAT) was PI
  - Incorporated a lot of the NCAT study
  - Control of working stockpile is critical
  - Choosing how to process the bulk pile for uniformity
  - Testing requirements as outlined
- RAP stockpile maintenance
  - Conical to shed water or cover
  - On sloped (6%) paved surface to promote drainage and prevent contamination
AASHTO Requirements

- AASHTO specs are referenced in MTO specs but not directly implemented
- Typically, the implications of new AASHTO specs are discussed with the various MTO-OHMPA task groups for implementation
- In the end, as it deals with contracts, all discussions regarding implementation of new specs resides with ORBA
  - OHMPA is asked for technical advice about asphalt related specifications
**AASHTO M 323-13 (Spec)**
**AASHTO R 35-12 (Method)**

- Change in calculation of AC from RAP
  - Use % RAP by mass in the past
- New calculation method allowed
  - Binder Replacement (Binder Ratio)
  - Proportion of binder from RAP
- Affects when the AC Grade transition is done
  - Currently 20% RAP by mass
  - Will be 20% Binder Ratio
Blending Charts are required above a limit
- Procedure for blending charts given in appendices
- Requires continuous grading of the RAP binder
- Equipment limitations

Asphalt Institute recommends that Blending Charts are the best approach, particularly if the details of the RAP are not known
- Typically not the case in Ontario
Black Rock Debate  
(APSHALTopics Fall 2013)

- Does AC from RAP blend with virgin AC?
- Hotly debated for about 20 years – what’s the answer?
- Research by Pavel Kriz (Imperial Oil) that shows that RAP and virgin binder in HMA will blend by diffusion before compaction is complete
- **BUT** – film thickness must be 0.5 mm, and AC locked in voids will never blend
- No true for WMA
A few comments on RAS

- RAS has a substantially higher asphalt cement content
- AC in RAS is not paving grade asphalt (much stiffer)
- In Ontario, we allow for that by equating 1% RAS with 10% RAP
- Blending charts are required
- MP 23-14 reduced RAS from 12.5 mm max to 9.5 mm max size (non-extracted)
Questions & Discussions

Plant has 4 RAP Bins (one for processed shingles)