RAP/RAS Team Update

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• Previous Asphalt Mixture ETG Task Team reviewed PP 53 and MP 15; made a number of revisions
  – PP 53 “Design Considerations When Using Reclaimed Asphalt Shingles (RAS) in Asphalt Mixtures”
  – MP 15 “Reclaimed Asphalt Shingles for Use in Asphalt Mixtures”
• Provisional standards were modified and subsequently sunset by AASHTO;
  – Reissued as PP 78 and MP 23
• Main issues to be addressed by the Task Team:
  – RAS asphalt binder availability
  – Binder grade adjustment guidelines
Issues

• How to address the stiffness/brittleness of the RAS binder?
  – Quality of binder

• How much of the RAS binder becomes effective asphalt binder?
  – Quantity of binder
Existing Approach

• Current approach:
  – Use a RAS Binder Availability Factor of 0.70 – 0.85
  – Use Binder Grade Adjustment Guidelines:

<table>
<thead>
<tr>
<th>Recommended Virgin Asphalt Binder Grade</th>
<th>RAS or RAS + RAP Binder Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>No change</td>
<td>&lt;15</td>
</tr>
<tr>
<td>One grade softer</td>
<td>15 to 25</td>
</tr>
<tr>
<td>Use blending charts</td>
<td>&gt;25</td>
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</tbody>
</table>
• Focus on the brittleness of the blended binder:
  – Estimate brittleness of the blended binder with the Bending Beam Rheometer (BBR)
    • Stiffness (S) and Relaxation (m-value)
  – BBR testing is done at two temperatures bracketing the specification requirements from which the temperature where the criteria are met can be interpolated.
For stiffness (S):

\[ T_c = T_1 + \left[ \frac{\log(300) - \log(S_1)}{\log(S_1) - \log(S_2)} \times (T_1 - T_2) \right] - 10 \]

For Relaxation (m-value):

\[ T_c = T_1 + \left[ \frac{0.300 - m_1}{m_1 - m_2} \times (T_1 - T_2) \right] - 10 \]
CRITICAL TEMPERATURE DIFFERENCE ($\Delta T_c$)

$\Delta T_c = \text{Stiffness critical temp (S) – the Relaxation critical temp (m-value)}$

Previous work by Mike Anderson and Tom Bennert indicates that when $\Delta T_c$ “exceeds” -5°C there is a significant loss of cracking resistance.
Assumptions

- Assumes “worse case” scenario (from a binder perspective)
  - If blending is less than complete, the impact of the aged binder on stiffening and relaxation is less than the laboratory would predict
  - If blending is completely homogeneous, the impact on stiffening and relaxation would be accounted for.
Pro’s

- Relatively simple approach
- Easy for states to make an informed decision on setting RAS limits based on available virgin binders and existing RAS materials
Con’s

- Doesn’t address mixture issues (VMA) if the RAS binder does not become fully blended
  - Binder volume would be less than calculated
  - Binder availability of 0.70 would result in a VMA reduction of ~ 0.50%
  - Could have a mix with better quality binder but not enough of it

- Some potential issues with virgin binders meeting the -5°C criteria
To simplify the process further, the Task Team is looking at setting maximum Recycle Binder Ratio (RBR) for mixtures with RAS:

- Possibly a RBR of ~0.10
- Corresponds to roughly 3% RAS with $\Delta T_c = -5^\circ C$

States that want to exceed this amount would need to evaluate $\Delta T_c$

Possible Tiered approach
Summary

- $\Delta T_c$ is a relatively simple way of addressing impact of RAS on binder quality
- -5°C is a possible recommended starting point
- Task Team looking at setting maximum Recycle Binder Ratio (RBR) for mixtures with RAS
  - Based on $\Delta T_c$
  - Possibly 3% RAS with RBR of 0.10
- RAP complicates things...
- Need feedback and data to refine the idea further.
Action Items/Timeline

• Task Team to revise PP 78 and MP 15 to reflect the $\Delta T_c$ criteria
  – Include Tiers? Y/N?
  – Target date March 2016

• Task Team to continue to address:
  – Volume of effective binder issue
  – Recommended performance test (maybe)
First, do no harm
25% RAP W/PG 76-22

Crack Map (Recent Cracks in Solid Red, Potential Reflective Cracks in Blue, Patches Outlined in Green, and Trucking Percent Complete via Height of Gray Map Date Box)
20% RAP, 5% RAS W/PG 76-22

Crack Map (Recent Cracks in Solid Red, Potential Reflective Cracks in Blue, Patches Outlined in Green, and Trucking Percent Complete via Height of Gray Map Date Box)

Approx. Cracked Areas:  
- Lane: 72%  
- LWP: 81%  
- RWP: 100%