



Florida Department of
TRANSPORTATION

RAP/RAS Team Update

Jim Musselman
Florida DOT

Gerry Huber
Heritage Research Group

TEAM MEMBERS

- John D'Angelo
- Gerry Huber
- Ron Sines
- Randy West
- Richard Willis
- Tim Ramirez
- Audrey Copeland
- Danny Gierhart
- Hassan Tabatabaee
- Lee Gallivan
- Tim Aschenbrener
- Jim Musselman
- Tanya Nash

Background

- 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:

Recommended Virgin Asphalt Binder Grade	RAS or RAS + RAP Binder Percentage
No change	<15
One grade softer	15 to 25
Use blending charts	>25

Alternative Approach

- 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.

BBR DATA

For stiffness (S):

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

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 (ΔT_c)

ΔT_c = Stiffness critical temp (S) – the Relaxation critical temp (m-value)

Previous work by Mike Anderson and Tom Bennert indicates that when ΔT_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 $\sim 0.50\%$
 - Could have a mix with better quality binder but not enough of it
- Some potential issues with virgin binders meeting the -5°C criteria

Proposal

- 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 0.19
 - Corresponds to roughly 5% RAS with $\Delta T_c = -5^\circ\text{C}$
- States that want to exceed this amount would need to evaluate ΔT_c

Summary

- ΔT_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 ΔT_c
 - Possibly 5% RAS with RBR of 0.19
- RAP complicates things...
- Need feedback and data to refine the idea further.