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Implementing the AASHTO RAP Guidelines

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Prior to Superpave, RAP was

- ◆ Economical.
- ◆ Reused valuable resource.
- ◆ Avoided disposal problem.
- ◆ It performed.

But what about Superpave?

NCHRP 9-12

- ◆ *Incorporation of Reclaimed Asphalt Pavement in the Superpave System*
- ◆ North Central Superpave Center (Purdue) and the Asphalt Institute
- ◆ Also, regional pooled fund study in the North Central region

Implementation

- ◆ What did those studies tell us?
- ◆ How can we implement the findings?

Issues Addressed

- ◆ Is RAP a "black rock"?
- ◆ Effects of RAP on binder grade.
- ◆ Effects of RAP on mixture properties.
- ◆ Can you use high percentages of RAP?

If RAP is a Black Rock,

- ◆ Blending chart premise is invalid.
- ◆ Mix properties/behavior depend on virgin binder only.
- ◆ How to evaluate?
- ◆ Analyze mixture properties.



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Black Rock Findings

- ◆ RAP is not a black rock – a significant amount of blending occurs.
- ◆ For low RAP contents, there is not enough RAP to change properties.
- ◆ Blending chart premise is valid for higher RAP contents.
- ◆ Lab methods verified by comparison to plant-produced mix.

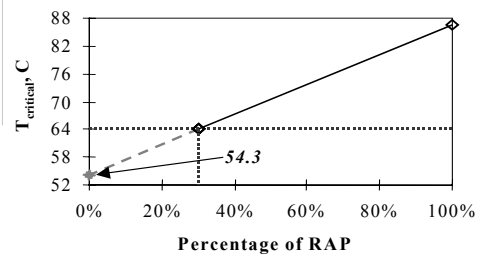
Binder Study Findings

- ◆ Again, at low RAP contents, properties do not change significantly.
- ◆ As RAP content increases, effects become appreciable.
- ◆ Recovered RAP binder should be RTFO-aged to improve linearity. No PAV aging necessary.

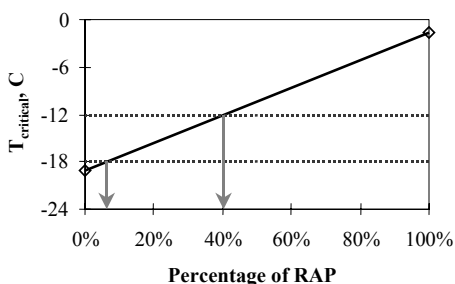
Binder Study Products

- ◆ Recommendations for modified SHRP extraction/recovery method (TP2)
 - Toluene-ethanol or NPB
- ◆ New procedure for developing blending chart using critical temperatures and linear blending (PP28)
- ◆ Suggested revision of tiers

High Temperature Blending Chart, Known RAP Content



Low Temperature Blending Chart, Known Virgin Binder

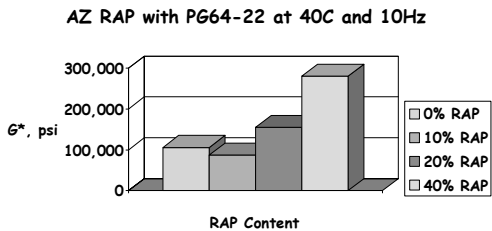


Mix Study Findings

- ◆ As RAP content increases, shear modulus increases.
- ◆ As RAP content increased, maximum deformation decreased.
- ◆ As RAP content increased, plastic strain decreased.
- ◆ Stiffest RAP produced stiffest mix.

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FS Modulus



Other Testing

- ◆ Beam fatigue and indirect tensile testing show similar stiffening effects, overall.
- ◆ At low RAP contents, effects of RAP are not significant.
- ◆ As RAP content increases from 20 to 40%, effects become more pronounced.

Overall NCHRP Results

- ◆ Blending occurs at higher RAP contents. At low RAP contents, effects are not significant.
- ◆ Results from all phases support concept of a tiered system.
- ◆ Mix ETG recommendations were largely confirmed.

Recommended Tiers

- ◆ Up to 15% RAP, no change in binder grade.
- ◆ 16-25% RAP, lower binder grade by one increment on both the high and low temperature grades.
- ◆ More than 25%, create blending charts to determine either virgin binder grade or maximum RAP content.

Regional Pooled Fund Study

- ◆ Confirmed NCHRP findings for RAPs from Indiana, Michigan and Missouri.
- ◆ Increased RAP content to 50%.
 - Gradation became limiting factor for fine RAP.

Mix Design Considerations

- ◆ Treat RAP aggregate like another stockpile for gradation and consensus properties.
- ◆ Estimate RAP aggregate specific gravity.
- ◆ Evaluate RAP binder properties if RAP is very hard or high percentages are used.
- ◆ Adjustment of virgin binder grade may be needed to higher RAP contents.

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RAP Specific Gravity

- ◆ Use RAP agg effective specific gravity, or
- ◆ Backcalculate bulk s.g. from Rice density and absorption.

- ◆ Agency discretion.

QC/QA Considerations

- ◆ Consistency of RAP source
- ◆ Stockpile management
- ◆ Processing of the RAP
- ◆ Moisture content

Practical Considerations

- ◆ Mixtures with 15 to 20% RAP may become more common.
- ◆ At high RAP contents, gradation and properties of RAP aggregate may limit amount of RAP used.
 - Processing or screening RAP?

Practical Considerations

- ◆ RAP variability may need to be controlled to meet production tolerances.
- ◆ Blending charts may limit use of high RAP contents unless there are strong economic incentives.

What else should states do?

- ◆ Test a variety of RAP sources to determine typical RAP binder grades.
- ◆ Implement TP2, MP2 and PP28.

- ◆ Don't forget past experience with RAP.

Why Use RAP with Superpave?

- ◆ Economical.
- ◆ Reuses valuable resource.
- ◆ Avoids disposal problem.

- ◆ *It will perform!*



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More info:

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