



## Higher RAP Percentages in HMA A Florida DOT Perspective

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(The King of Asphalt and a Prince of a Man)

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## Overview

- Background on use of RAP in Florida.
- Benefits of using RAP.
- Current Florida Specifications.
- Eliminate artificial restrictions on use of RAP.
- What are the real restrictions on use of RAP.
- Trade-offs and Risk of increasing RAP.

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## FL Recycling Background

- Joint effort  
Industry and Agency.
- Full implementation in 1980.
- Separated milling and HMA decisions.
- Contractor ownership of RAP.
- Expectation **equal performance** of HMA w RAP.



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## FL Spec Concepts

- Permit use of RAP, not require.
  - Let contractor determine economics.
- Bid Ton mix to include binder (& RAP value).
- Characterize milled material and RAP stockpiles.
  - Gradation, binder content, binder stiffness.
  - Think of RAP as a commercial material with value.
- HMA specifications must assure quality.
  - At mix design and during production.

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## Benefits of using RAP

- Environmental: reuse of resources.
- Energy conservation.
- **Economic \$\$\$.**
  - Agency: stretch our transportation dollar.
  - Contractor: edge in bidding.
    - \$400/ton binder, \$25/ton aggregate.
    - Material value RAP reduced by transportation, storage, additional processing (fractionation), waste, profit.
    - Not all RAP has equal value: Let competitive bidding rule.



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## Current FL Specs

- RAP is permitted a component material.
  - Mix Design Manual covers obtaining Gsb for RAP.
  - Characterization for gradation, Pb, stiffness.
- RAP limitation (originally requested by Industry)
  - 50% max base and low traffic.
  - 30% max hi traffic >10M ESALs.
    - Reflects typical FL high dust content RAP.



### Current FL Specs

- Additional RAP limitation.
  - 15% max modified PG76-22: polymer effectiveness.
  - No RAP in Friction course: aggregate specific specs.
- Binder Selection.
  - PG67-22 (3600 max vis) <20% RAP.
  - PG64-22 (2400 max vis) 20-29% RAP.
  - Recycle Agent (viscosity graded) >29% RAP.

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### Current FL Specs

- Mix Design Criteria.
  - RAP or virgin, ALL mix design criteria must be met.
  - Recovered vis 4,000-12,000 poises.
- Mix Production.
  - No changes in acceptance criteria for HMA w RAP.
  - Recovered vis 4,000-12,000 poises.
- Why recovered Vis not PG?
  - RAP recovered = PG82-22 (not modified)
  - Need PG parameter identify ambient crack potential

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### Remove Artificial Restrictions

- Minimum criteria for RAP.
  - Assure that it's aggregate and asphalt.
- Allow or permit the use of RAP.
  - In all mixes.
  - Contractor decision.
- Let mix characteristics govern amount of RAP.
  - Use same mix design criteria and acceptance.
  - Assure binder characteristics by recovery testing.

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### Removing Restrictions in FL

- Minimum criteria for RAP.
  - Minimal since all aggregate commercial sources.
- Allow or permit the use of RAP.
  - No RAP in Friction Course: aggregate specific.
    - Practical decision: would consider for known aggregate.
- Let mix characteristics govern amount of RAP.
  - 15% max RAP in modified PG76-22
    - No performance test to assure modification of RAP binder.
  - Willing to eliminate other "max limits" on RAP

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### Real Restrictions of RAP

- Aggregate Properties
- Binder Characteristics
- Workability of the Mix
- Gradation of the RAP



### Real Restrictions of RAP

- Aggregate Properties
  - Geologic type
  - Hardness (LA Abrasion)
  - Soundness
  - Particle Shape (Flat and Elongated)
  - Deleterious Materials
- Most RAP aggregate from acceptable sources
  - Not necessary to check all RAP.

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## Real Restrictions of RAP

- Binder Characteristics.
  - Binder interaction / compatibility
    - Black rock vs complete blending of binder.
  - Stiffness of RAP binder.
  - Availability of proper Recycling Agent
- Assume complete blending.
  - Works with low stiffness RAP & compatible RA's
- Problem in North getting proper recovered PG
  - Need PG parameter identify ambient crack potential

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## Real Restrictions of RAP

- Mix Workability
  - Stiffness
    - Binder compatibility characteristics
- Fact of Life
  - Warm Mix technology is possibility for future



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## Real Restrictions of RAP

- RAP Gradation
  - Maximum size
  - Distribution
  - Dust
- Usually it's the **Dust** that limits use of RAP
  - Maximum size can be handled by processing
  - Distribution is a given, handled by other components
  - Fractionation discussed by others (AC is in Dust)

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**So...if you have removed all  
Artificial Restrictions,  
and addressed the real ones,  
How can you use more RAP?**

**And what is the Impact?**

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## Increase RAP in Florida

- Get rid of "old FDOT fossils"  
Set in their ways.
- Usually it's the **Dust** that limits use of RAP
  - Maximum size can be handled by processing.
  - Distribution is handled by other components.
  - Rarely a binder issue.
- Reduce VMA or Va requirements.
  - Or decrease Ndes for given Traffic Level (NCHRP)



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## Impact of Reduced VMA

- Reduce VMA 1% - Increase RAP 6-10%
- Increase RAP 10% - Reduce Cost \$6/ton
  - **And you are a Hero.**
- ME Design Guide (performance)
  - Reduce VMA 1% - Reduce Pavement Life 3-4 years
- Initial resurface cost lower by 3%
- Annualized resurface cost increased 10-15%
  - **Shoot the messenger.**

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### Additional Considerations

- Is VMA a function of Traffic Level?
  - Maybe one size does not fit all
- Do you believe the ME Design Guide?
  - Validation of materials characteristics & performance
- How much do we really **KNOW** about asphalt?

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### Remember....

" Pavement Engineering is the art of molding materials we do not wholly understand into shapes we cannot precisely analyze, so as to withstand forces we cannot assess, in such a way that the community at large has no reason to suspect our ignorance"

