Development of a RAP Characterization Process for Alabama

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Outline

- Define RAP
- Benefits of RAP
- Use of RAP in mix design
- Characterization
- ALDOT Research Plan
- Status of Research

What is RAP?

- Reclaimed Asphalt Pavement
  - Aggregate
  - Asphalt

Benefits of RAP

- Economics
  - Aggregate
  - Asphalt
  - No/Low hauling costs
- Environment
  - Reduces demands of non-renewable resources
  - Reduces landfill space demands

How Do You Use RAP?

- Account for RAP in mix design
- Characterize RAP
  - Asphalt PG
  - Aggregate properties
  - Aggregate gradation
  - Asphalt content

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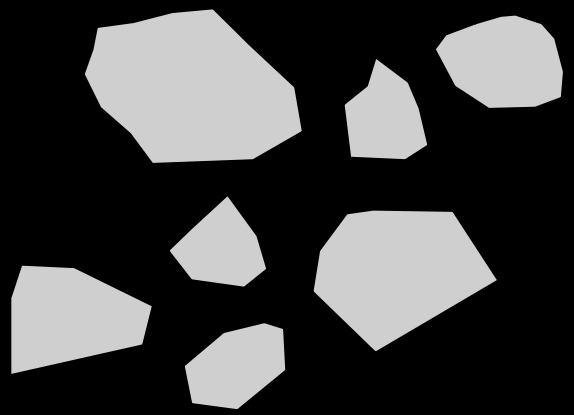
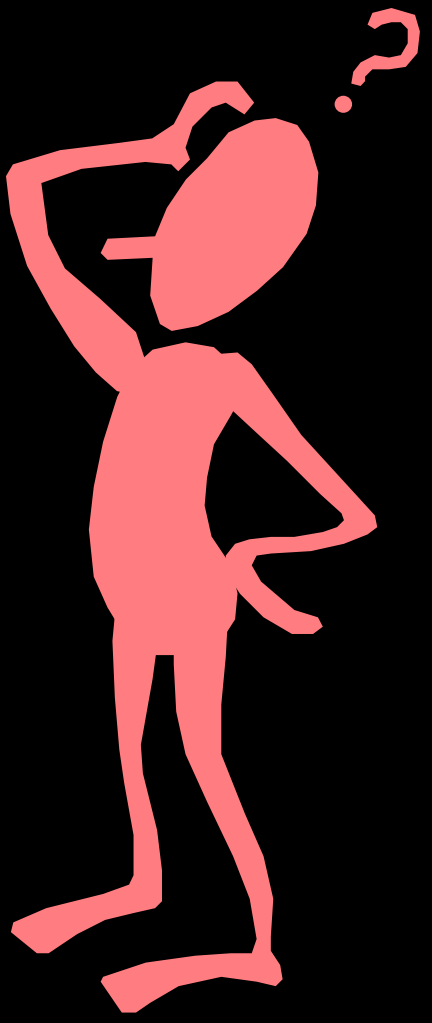
Traditional RAP Characterization

- Solvent extraction
  - Reclaim aggregate
  - Asphalt content
- Extracted asphalt recovery
  - Allows for PG classification
  - Idea of blended binder properties



Why A New Method?



Obstacles

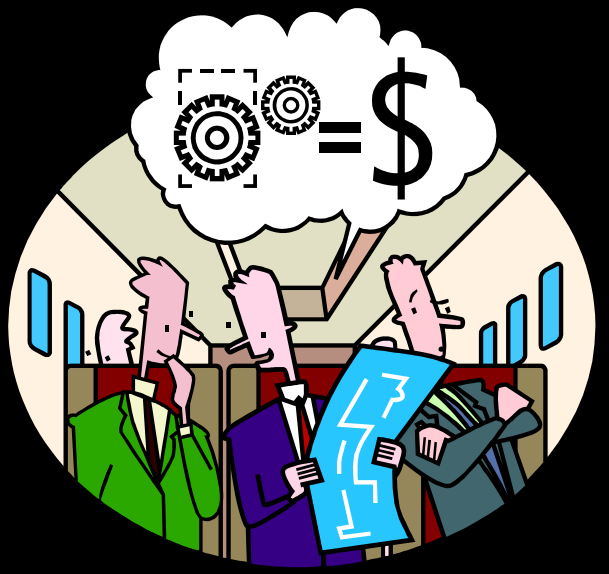
- Characterization of RAP via solvents
  - Environmental concerns
  - Health concerns
  - Change in binder properties

Solution

- Characterize RAP without using traditional solvents
- Mix tests → Effective binder grade

Initial Plan

- Characterize Asphalt
  - Effective PG from mix test
- Characterize Aggregate
  - Ignition oven
  - Environmentally friendly solvent
- Quantify Asphalt
  - Ignition oven
  - Environmentally friendly solvent



Effective PG Methods

- Dynamic Modulus
- Bending Beam Rheometer
- Dynamic Shear Rheometer Torsion Beam

Dynamic Modulus

- Elastic Modulus
- Repeated loads → displacement measured
- Temperatures
  - 14, 40, 70, 100, 130°F
- Frequencies
  - 0.1, 0.5, 1, 5, 10, 25 Hz

Bending Beam Rheometer

- Binder thermal cracking test
- Applies load at center of beam
- Tested at low temperature
  - -1 and -11°F
- Stiffness of mix

Dynamic Shear Rheometer

- Controlled strain mode (0.01%)
- Dimensions
  - 10mm X 12mm X 50mm
- Temperatures
  - 50 - 169°F
- Frequencies
  - 0.01, 0.02, 0.05, 0.1, 1.0, 5.0, 10.0, and 15.0 Hz
- Mix complex shear modulus

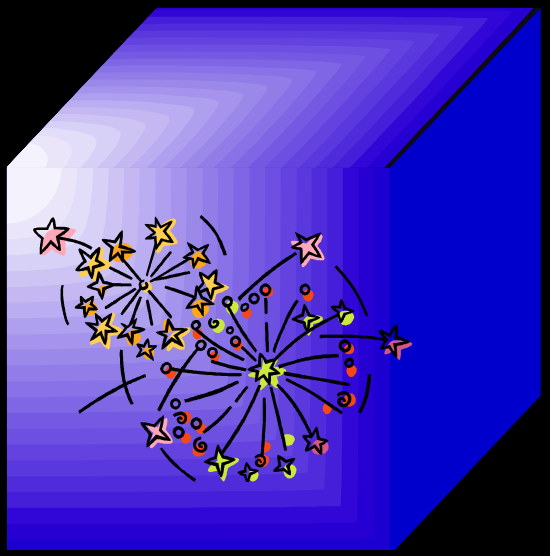
How do mix results give you binder properties?

Binder Changes

- Previous research shows mix test sensitive to binder PG changes
- Detect changes in binder
- Evaluate RAP binder and mix binder
- Stiffer binder → stiffer mix
  - Appropriate for area?

Need A Model!

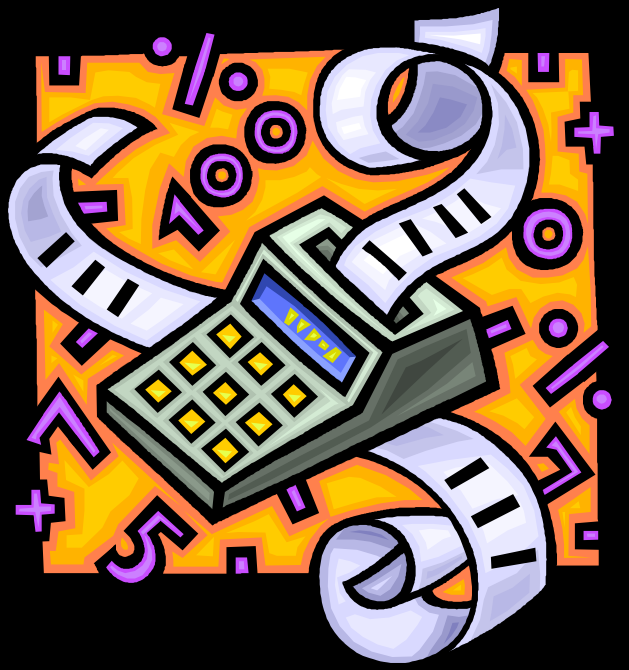
Mix Information



Binder Information

Hirsch Model

- Developed in 1962
- Mechanical behavior of HMA
- Back calculate binder properties from:
    1. Mix properties (E*, S, G*mix)
    2. Voids in mineral aggregate
    3. Voids filled with asphalt



Experimental Plan

- Evaluate effective binder techniques
- Select a method(s)
- Develop preliminary specification
- Apply to RAP mixes

Where Are We At?

- Evaluate methods
  - Collected material
  - Characterized RAP via traditional method
  - Working on evaluating 100% RAP specimen
- Next for evaluation stage
  - Evaluate blended RAP and virgin material
  - Different % of RAP

Future Plans

- Write a preliminary specification
  - Characterize RAP
  - Characterize blended asphalt
- Apply to Alabama materials
- Make adjustments to specification

Feedback

- Interested in feedback

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RAP Survey

- RAP Experience Survey for Contractors
  - Variability
  - Operations

- http://www.ncat.us

Questions?