Develop Mix Design and Analysis Procedures for Asphalt Mixtures Containing High-RAP Contents – TPF 5(294)

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FHWA Asphalt Binder Expert Task Group
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Study Detail View
Design and Analysis Procedures for Asphalt Mixtures Containing High-RAP Contents and/or RAS

General Information

Study Number: TPF-5(294)  Status: Cleared by FHWA
Lead Agency: Louisiana Department of Transportation and Development
Contract Start Date:  Contract/Other Number:
Partners: FL, LA  Last Updated: Oct 20, 2013
Est. Completion Date:  Contract End Date:

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Financial Summary:
Contract Amount: Total Commitments Received: $196,000.00 100% SP&R Approval: Approved

Commitments by Organization:

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<th>Year</th>
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Background

- Practice of including RAP and/or Recycled Asphalt Shingles (RAS) in new asphalt mixtures has increased in recent years
  - economic and environmental benefits
- RAP has been widely used
  - Wearing Course: 15%
  - Binder Course: 20%
  - Base Course: 30%
- RAS has emerged as a material of interest to the paving community
- RAP and/or RAS are valuable components in asphalt mixtures
  - With increased demand and limited supply of aggregate and binder
- Concerns
  - Hardened and oxidized asphalt binders
  - Causing premature cracking in pavements
Asphalt Mixture Design: Concern

• Optimum asphalt cement content
  – Quantity
  – NOT QUALITY
  – RAP and/or RAS

- Asphalt cement
- Aggregate
- Air

VOLUME
M ASS

Total Volume
Total Mass
Objective

- Evaluate fatigue/fracture tests that can be conducted on plant mixtures (lab or field compacted) from participating states
  - ranking the quality of RAP and or RAP/RAS mixtures as compared to virgin mixtures.
Scope

- Two field projects
  - Each field project
    » Two mixtures: Conventional, RAP and/or RAS
      - Conventional may include 15% RAP
  - Four mixtures

- Collect Mix Design / Pavement Design Record
  - JMF
  - Loose mixtures
  - Cores
    » Challenging

- Standard Materials Characterization
  - Binder
    » Solvent Extraction
  - Aggregate properties
  - Mixture
**Binder Experiment**

- **Binder Rheology**
  - PG grading
  - MSCR
  - GPC (Gel permeation chromatography)
  - SARA
  - Others

**GPC**

- GPC separates molecules on the basis of size (like sieving!).
- When a mixture of molecules dissolved in a solvent is applied to the top of the column, the smaller molecules are distributed through a larger volume of gel than is available to the large molecules. Consequently, the large molecules move more rapidly through the column, and in this way the mixture can be separated (fractionated) into its components.
**Mixture Experiment**

- **Specimen Types**
  - Plant produced laboratory compacted (PL)
  - Plant produced field compacted (PF, Cores)
    - Challenging
  - Triplicates

- **Fracture/fatigue testing**
  - Semi-circular bend test, SCB
  - Overlay tester test, OT
  - Energy Ratio Test
  - Beam Fatigue Test
  - Direct Tension Cyclic Fatigue
    - SVECD

- **Per mixture and Specimen type**
  - 5 tests x 3 = 15 mixes
Field Project

- FLDOT
  - SR 80 Palm Beach County
  - Ranger Construction
  - West Palm Beach area
  - Mix 1: Mix with 50% RAP
  - Mix 2: Mix with ~20% RAP

- FHWA
  - Advance Use of Recycled Asphalt in Flexible Pavement Infrastructure: Develop and Deploy Framework for Proper Use and Evaluation of Recycled Asphalt in Asphalt Mixtures
  - 11 Lanes
Data Analysis

- Each test will be ranked
- Develop a score card
Each test will be ranked
- Specimen preparation
- Instrumentation
- Standard test method
- Testing
- Training
- Interpretation
- Sensitivity to mix composition parameters
- Routine Application
- Correlation to field performance
- Data Analysis
- Repeatability
- Cost