Asphalt Rubber in HMA Surfaces
Florida DOT Experience

Gale Page

The King of Asphalt and a Prince of a Man
UNIVERSITY OF FLORIDA FOOTBALL

THE BITE IS BACK!
Summary of Presentation

- Background / How We Got into Using Scrap Tires
- FL Implementation of Asphalt Rubber
- FL Specs for Asphalt Rubber in HMA
- Performance Particularly in OGFC
- Binder Usage in FL
- Construction Issues
- The Future is Hybrid Binder
In the Beginning...

- State Law 1988 Comprehensive Solid Waste
  - FDOT: Recycled Tires, (Plastics, Motor Oil)
- Research on Asphalt Rubber in HMA
  - FDOT in-house
  - NCAT State of the Art Report, 1989
  - University of Florida assistance
- 3 Experimental Projects, 1989-1990
  - 2 OGFC and 1 Dense Grade
Implementation

- Westinghouse Emissions Study, 1993
- 3 Demonstration Projects around the State, 1993
- On all Projects let after January, 1994
- “Used more scrap tires annually than any State”
  - Only 4% annual scrap tires to pavement / 53% fuel
Florida Specifications

Binder Type and Application
- ARB-5 in Dense Grade Surface HMA (+stiffness)
- ARB-12 in Open Graded Surface HMA (+tot binder)
- ARB-20 in membrane Interlayer (SAMI)

| Table 336-1 |
|---|---|---|
| **Asphalt Rubber Binder** | **ARB 5** | **ARB 12** | **ARB 20** |
| **Binder Type** | ARB 5 | ARB 12 | ARB 20 |
| **Rubber Type** | TYPE A (or B)* | TYPE B (or A)** | TYPE C (or B or A)** |
| **Minimum Ground Tire Rubber** | 5% | 12% | 20% |
| (by weight of asphalt binder) | | | |
| **Binder Grade** | PG 67-22 | PG 67-22 | PG 64-22 |
| **Minimum Temperature** | 300°F | 300°F | 335°F |
| **Maximum Temperature** | 335°F | 350°F | 375°F |
| **Minimum Reaction Time** | 10 minutes | 15 minutes (Type B) | 30 minutes (Type C) |
| **Unit Weight @ 60°F*** | 8.6 lbs/gal | 8.7 lbs/gal | 8.8 lbs/gal |
| **Minimum Viscosity ****** | 4.0 Poise @ 300°F | 10.0 Poise @ 300°F | 15.0 Poise @ 350°F |
Florida Specifications

- It’s a Recipe/Method Specification
  - Size of GTR (max)
  - Minimum amount of GTR
  - Grade of PG Binder
  - Interaction Temperature (R)
  - Interaction Time (minimum)
  - Minimum Viscosity (QC)
    - Storage tank/Incoming shipments
  - Note unit weight (Plant asphalt meter)
FC-5 Nassau County
FC-5 OGFC macro texture
Fine graded FC-12.5 texture
- Improved short-term raveling performance OGFC
  - 10-15 years... So far...so good
- Improved cracking resistance of OGFC
  - Unexpected benefit
- Published TRB TRR 1681 (1999) (& FL DOT reports)
- Some improved rut resistance FC-9.5, FC-12.5
  - FDOT APA study
  - Relatively minor
Raveling OGFC
I-75 Marion County

(old slide / only 2 trucks)
APA Rutting Study

![Bar Chart]

- **Fine-graded 9.5 mm**
- **Fine-graded 12.5 mm**
- **Coarse-graded 12.5 mm**

**Bar Chart Description**

- **Y-axis:** Average APA Rut Depth (mm)
- **X-axis:** Binder Type

- **Legend:**
  - PG 76-22
  - ARB 12
  - ARB 12 + 0.5% AC
  - ARB 5
  - PG 67-22

**Bar Chart Analysis**

- PG 76-22: Low rut depth
- ARB 12: Moderate rut depth
- ARB 12 + 0.5% AC: Lower rut depth than ARB 12
- ARB 5: Higher rut depth than ARB 12
- PG 67-22: High rut depth
Estimated FL Asphalt Binder Usage

Based on 5 million tons of HMA

- Neat Binders 112,000 tons 40%
  - PG67-22, PG64-22
  - 4 Recycle Agents
- Polymer Modified 126,000 tons 45%
  - PG76-22
- Asphalt Rubber 45,000 tons 15%
  - ARB-5, ARB-12
Asphalt Rubber Construction Issues

- The Rubber in the Binder settles out
  - Can Coat the heating coils
  - Variable Binder material properties
  - Fat spots in pavement

- Another Binder to handle
  - PG67-22, PG64-22 (neat asphalts)
  - ARB-12, ARB-5 (asphalt rubber)
  - PG76-22 (polymer modified)
  - 4 Recycle Agents (low viscosity asphalts)
Florida began using Polymer Binder 2001
- Decision based on FL APT & NCAT
- + Rut resistance of good HMA mix

Use Polymer on Interstate
- Last structural layer or last 2 layers

2004 Decision to use polymer Interstate OGFC
- Based on limited testing at UF (+rut & crack resistance)
- Simplify construction

Direction to make rubber work like polymer
Hybrid Binder

- Called by some: Terminal Blend Crumb Rubber
- One Way to Address Shortage of Polymers
- Ground Tire Rubber plus Elastomeric Polymer
- Proprietary Processes (But same issue with Polymer)
- Can Replace 3 Current FL Specified HMA Binders
  - PG76-22 (polymer modified)
  - ARB-12, ARB-5 (asphalt rubber)
- If you can do Polymer, you can do Hybrid
  - Asphalt Supplier or HMA Contractor
The Future is NOW

- FHWA Modifier ALF Research

Section 5 Hybrid Binder
Research at U of Florida

- Hybrid meets Solubility Requirement
  - It’s homogeneous / Rubber is not just in solution
- Can meet all PG+ Requirements: Polymer Modified
  - MSCR, Elastic Recovery, Phase Angle
- Mix tests verify rut and crack resistance = Polymer
  - Using Dissipated Creep Strain Energy (DCSE) & Energy Ratio
- UF Report Available in March 09
- Hopefully, a basis for change in FL
Hybrid Binder Implementation

- Road Map for FL DOT Actions
- Takes a Policy Decision to Use  (just like with Polymer)
  - Good Engineering  (get the performance)
  - Environmentally responsible  (be green)
  - Improve & Simplify Construction Issues  (KISS rule)
- Replace Asphalt Rubber & Polymer Binders
  - First, ALLOW as alternate binder
  - Second, REQUIRE its Use
- Work w Suppliers on timetable
Thank You....Questions?