

Florida's Experience with Crumb Rubber



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*Slides Courtesy of FDOT
State Materials Office*



FL GTR Topics

- Background
- Implementation
- Specifications
- Quality Control/Acceptance
- Applications
- Performance
- Usage
- Successes/Challenges
- New Changes



1988 State of Florida Legislation

- Comprehensive solid waste legislation
- Established County Solid Waste Authorities
- Directed state agencies to increase use of recycled products
 - Florida DOT
 - Recycled plastics (fence posts)
 - Motor oil
 - ***Ground tire rubber***



Implementation Activities

1988 - 1990

- Research
 - FDOT – in-house
 - University of Florida
 - NCAT “State of the Art” Report
- Constructed Experimental Projects
- Identified potential Uses:
 - 2 HMA applications
 - 1 SAMI application
- Emissions study
 - Emission and Worker exposure levels



Implementation

- Implementation

- Constructed Demonstration projects - 1993
- Implemented on all projects - January 1994

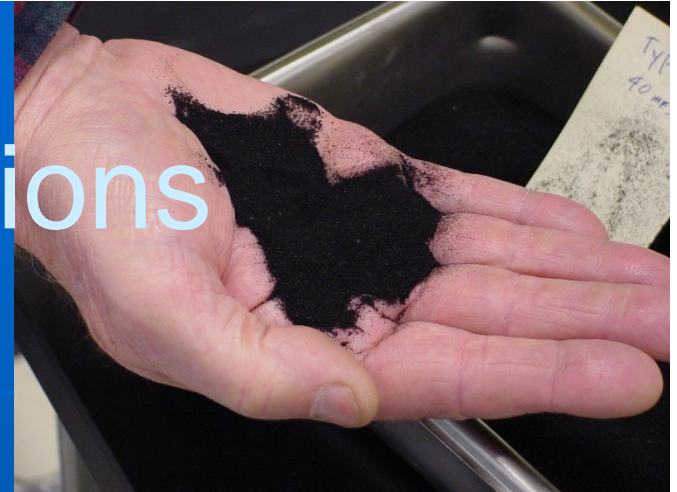


Specifications

- Ground Tire Rubber
 - 20, 40 & 80 mesh
- Binder Types
 - ARB-5 (5% GTR)
 - ARB-12 (12% GTR)
 - ARB-20 (20% GTR)
- Applications
 - Open-graded friction courses
 - Dense-graded friction courses
 - Asphalt Rubber Stress Absorbing Membrane Interlayer



GTR Specifications



- Physical requirements
- Chemical requirements
- Must be produced from ambient grinding methods
 - Better surface texture
- Gradation

919-3 Physical Requirements.

The physical properties of the ground tire rubber shall be determined in accordance with FM 5-559, and shall meet the following requirements:

Specific Gravity 1.06 to 1.20

Moisture ContentMaximum 0.75%

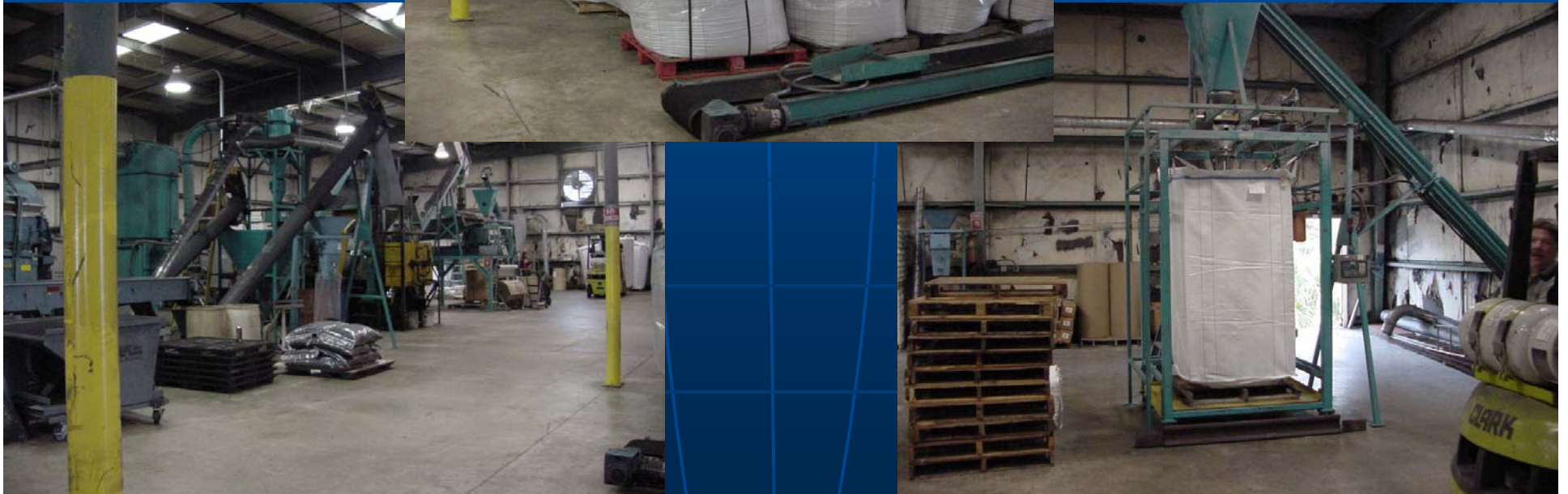
Metal ContaminantsMaximum 0.01%

Gradation - The gradation shall meet the limits shown in Table 919-1 for the type of rubber specified.

Table 919-1 Gradations of Ground Tire Rubber			
Sieve Size % Passing	Type A	Type B	Type C
No. 16	---	---	100
No. 30	---	100	70-100
No. 50	100	40-60	20-40
No. 100	50-80	---	---

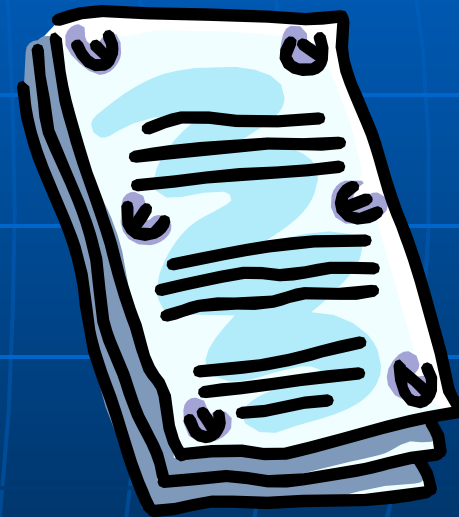


Typical Tire Grinding Process



Asphalt Rubber Binder Specification

- Recipe specification:
 - Amount of GTR
 - Type of binder
 - GTR size
 - Reaction temperature
 - Reaction time
 - Minimum viscosity



Asphalt Rubber Binder Specifications

Table 336-1

Asphalt Rubber Binder

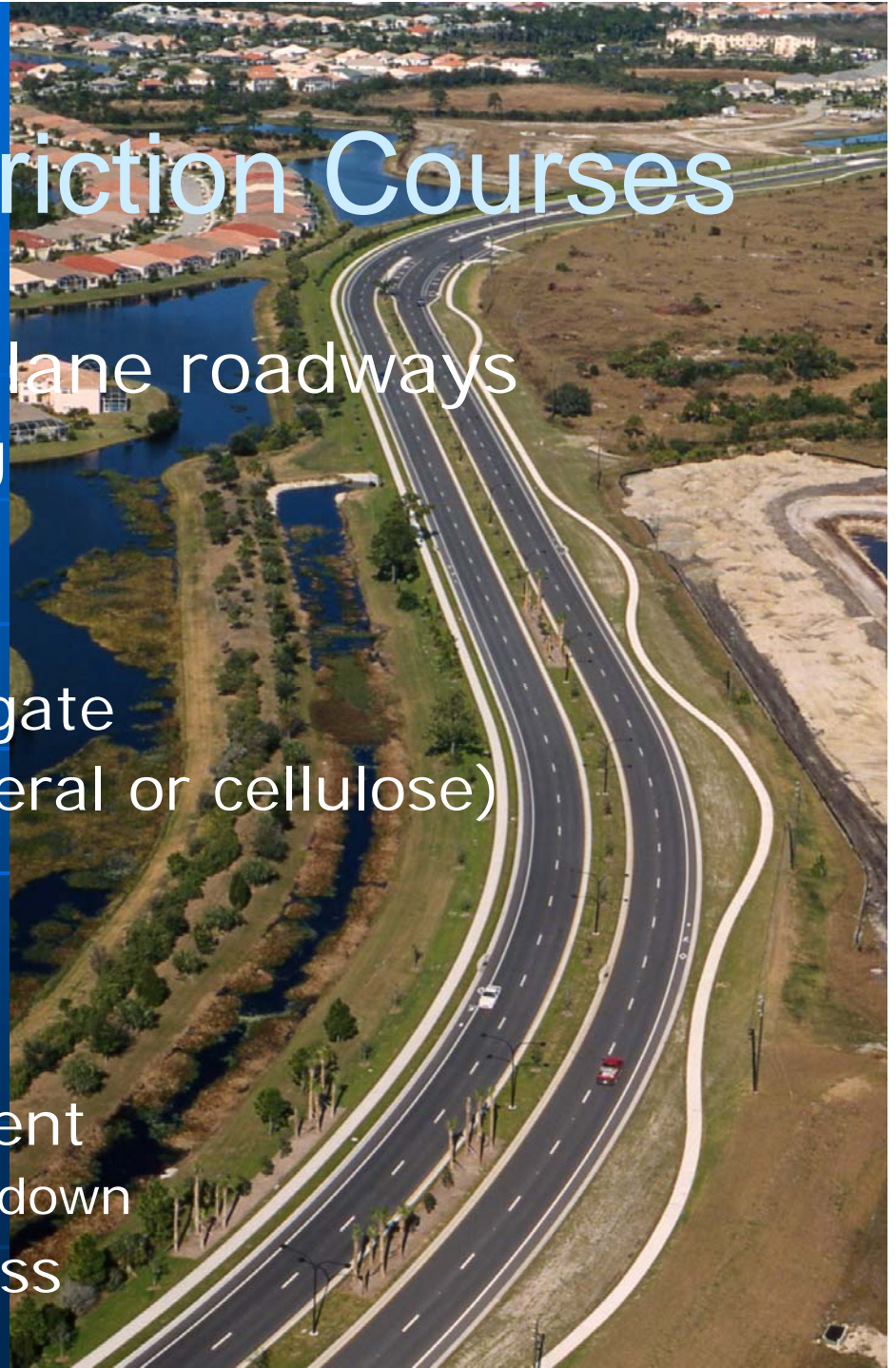
Binder Type	ARB 5	ARB 12	ARB 20
Rubber Type	TYPE A (or B) ⁽¹⁾	TYPE B (or A) ⁽²⁾	TYPE C (or B or A) ⁽²⁾
Minimum Ground Tire Rubber (by weight of asphalt binder)	5%	12%	20%
Binder Grade	PG 67-22	PG 67-22	PG 64-22
Temperature Range	300 - 335°F	300 - 350°F	335 - 375°F
Minimum Reaction Time	10 minutes	15 minutes (Type B)	30 minutes (Type C)
Unit Weight @ 60°F ⁽³⁾	8.6 lbs/gal.	8.7 lbs/gal.	8.8 lbs/gal.
Viscosity Range ⁽⁴⁾	4.0 - 6.0 Poises @ 300°F	10.0 - 15.0 Poises @ 300°F	15.0 - 20.0 Poises @ 350°F

Asphalt Rubber Blenders



Open-Graded Friction Courses

- All high speed, multi-lane roadways
 - Minimize hydroplaning
- FC-5
 - ARB-12
 - Polish resistant aggregate
 - Stabilizing fibers (mineral or cellulose)
 - Placed $\frac{3}{4}$ " thick
- Improve durability
 - Minimize raveling
 - Increased binder content
 - Less Construction draindown
 - Increased film thickness



FC-5 Nassau County



Open Graded Friction Course - FC 5

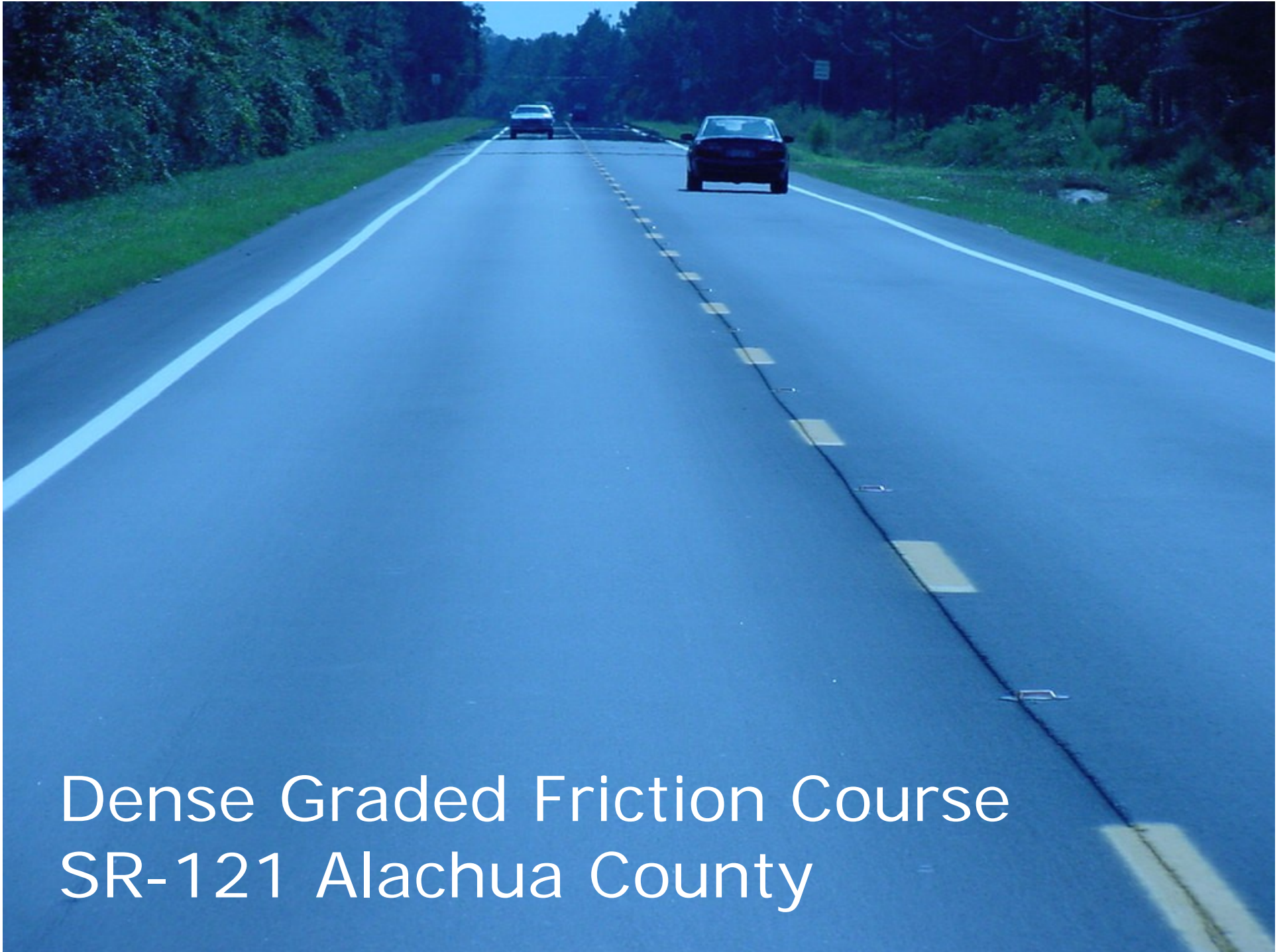


Raveling OGFC I-75 Marion County



Dense Graded Friction Courses

- FC-9.5, FC-12.5
 - Superpave mixes
 - ARB-5
 - Fine graded mixes
 - Polish resistant aggregate
- Improve rutting resistance
 - Increased binder stiffness (PG 70-22)



Dense Graded Friction Course
SR-121 Alachua County

Asphalt Rubber Membrane Interlayer (ARMI)

- Asphalt Rubber Stress Absorbing Membrane Interlayer (SAMI)
- Used to prevent moisture intrusion and reflective cracking
- Used over milled asphalt surfaces and cracked & sealed concrete pavements

Asphalt Rubber Membrane Interlayer

- ARB-20
 - PG 64-22
 - 20% GTR (20 Mesh)
- Application Rate: 0.6 – 0.8 gal/sy
- Cover material: No. 6 Stone
 - One aggregate layer thick

A large truck-mounted spray applicator is shown in operation on a road. The truck is moving from left to right, and a wide, dark, textured strip of material is being applied to the road surface. The applicator consists of a long horizontal bar with many small, downward-facing nozzles. A thick mist of spray is visible behind the applicator. The road surface is light-colored and appears to be asphalt or concrete. The background shows a grassy area and trees.

Application of ARB-20
Application Rate 0.6 – 0.8 gal/sy



Chip Spreader





I-10 Gadsden County



OGFC

**9.5 mm
Superpave**

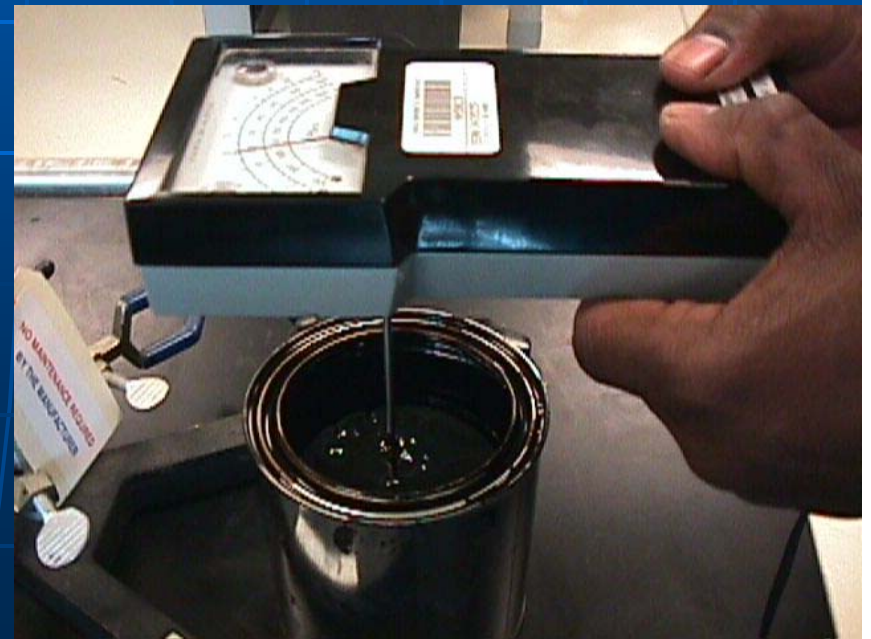
**19.0 mm
Superpave**

ARMI

**I-10
Suwannee County**

Quality Control/Acceptance Requirements

- Minimum viscosity requirement
 - Incoming shipments
 - Storage tank
- Dip-N-Read rotational viscosimeter



Performance



- Improved short-term raveling performance of OGFC
- Improved cracking resistance of OGFC
 - Unexpected benefit
- Improved rutting resistance
 - FDOT APA study
 - Relatively minor

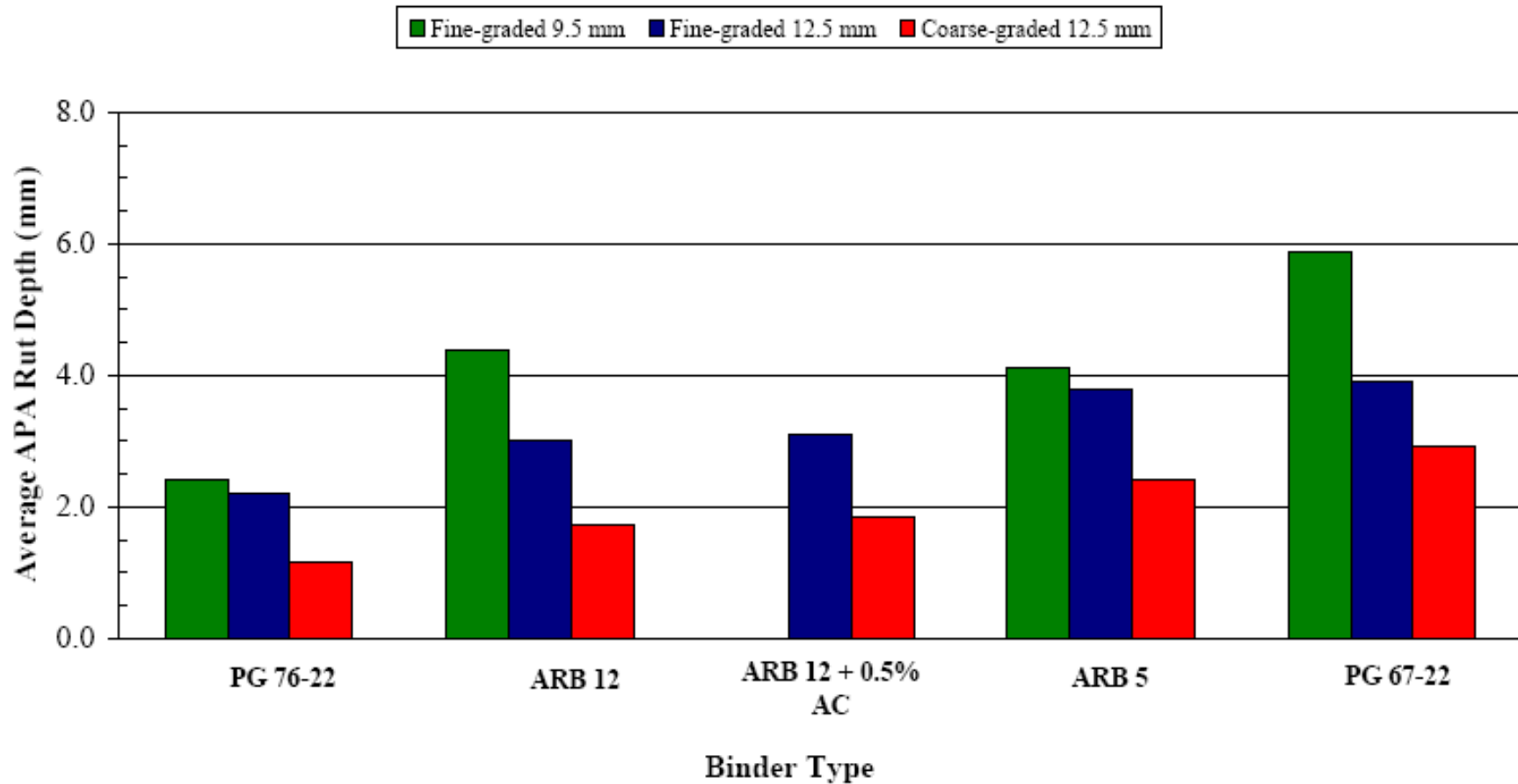


SR-16 Bradford County

With ARB

Without ARB

APA Rutting Study



Florida

2010 Census:

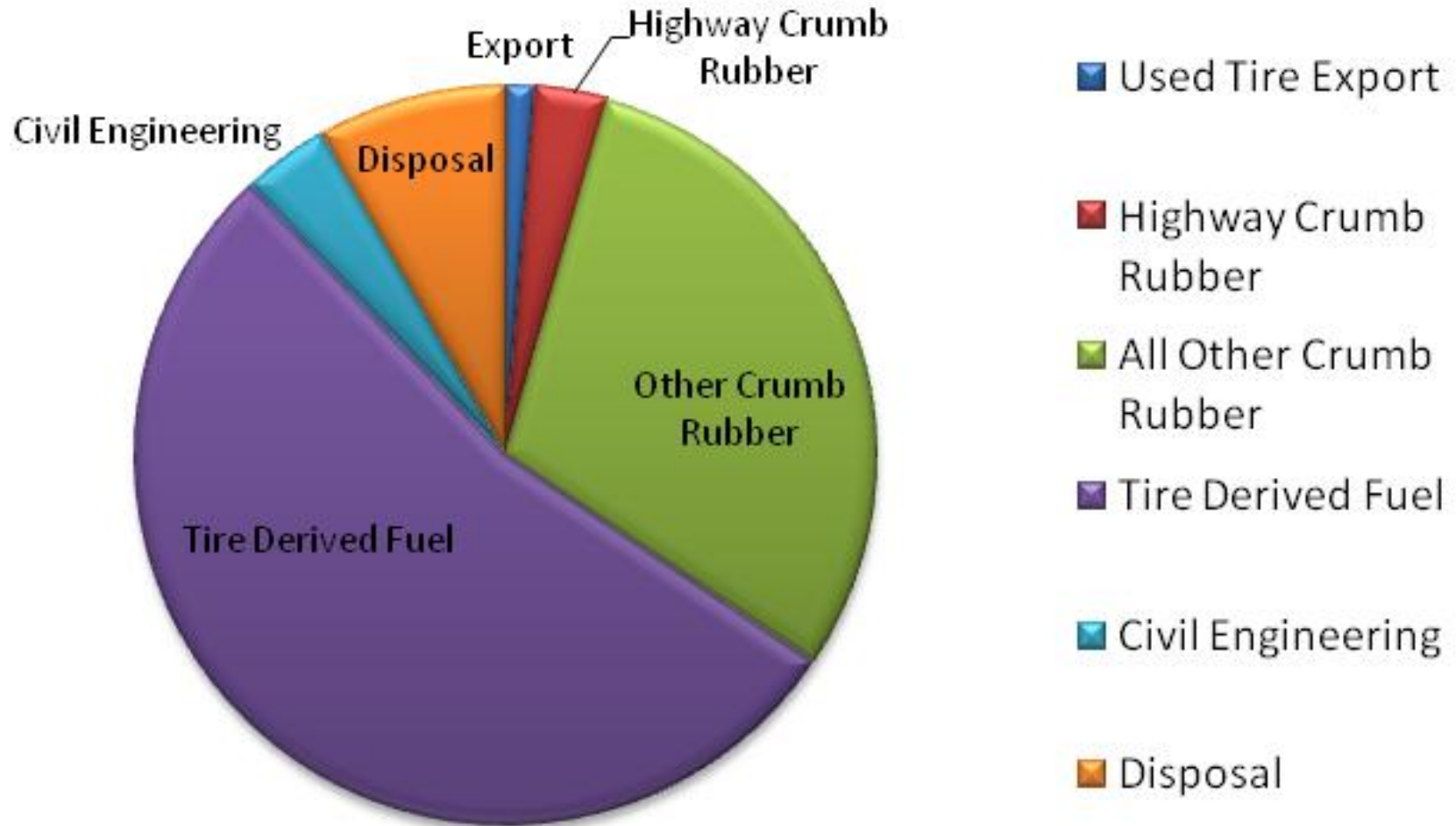
- 18.5 million people

Generating Annually:

- 15 Million automobile tires
- 900,000 truck tires
- 19.5 Million Passenger Tire Equivalents (PTE's)



Usage



19.5 Million PTEs

2011/2012 Usage

- Unmodified Asphalts – 33%
 - 100,440 tons (liquid)
 - PG 67-22 and 4 Recycling Agents
- Polymer Modified Asphalt – 51%
 - 159,582 tons (liquid)
 - PG 76-22
- Asphalt Rubber – 16%
 - 49,925 tons (liquid)
 - ARB-5, ARB-12, ARB-20

Why has Florida's Program been Successful?

- Lower rubber percentages
 - Minimal impact on production operations
 - Minor equipment changes
 - Minimal impact on paving operations
 - Increased laydown temperatures
- Supplier terminal blending
- Constant market
- FDOT/Industry cooperation



Challenges

- Short Term Storage
- Long Term Storage
- Settlement
- Multiple Binders / Limited Tankage
- Handling Heavy Binders
- Mix Properties



Current Status

- FDOT using more PG 76-22 with SBS polymers
 - Used on all high volume roadways
 - Reduction in GTR usage
 - Continue to use asphalt rubber on all other facilities
- Joint Task Group: Improve & use GTR
 - Evaluating “hybrid” binders for last year
 - Considering a PG 76-22 w/GTR
 - Minimum GTR content
- ARMI research and rutting
- FDOT committed to using GTR!

New GTR Changes for July 13

- PG76-22R: replaces ARB-5 & ARB-12
 - Min of 7.0% GTR
 - Phase angle: Max 75°C
 - Polymer optional: SBS or SB
 - Waived solubility
 - DSR – 2mm gap
 - Separation Test: ASTM D7173 7°C max
- GTR: 100% pass #30, removed ambient grind requirement



Thank You....