Impact of Segregation and Density on Asphalt Pavement Performance
Topics of Discussion

• Overview of APT Program

• Impact of Asphalt Mix Segregation on Pavement Performance

• Performance of Asphalt Pavements Constructed Using Different Compaction Levels

• Summary
FDOT’s APT Program

- Test Track housed at the State Materials Office
  - 5 Lanes approximately 450 ft. long x 12 ft. wide
  - 2 Lanes 150 ft. long x 12 ft. wide
  - 2 Outdoor Test Pits
- Loading performed using the Heavy Vehicle Simulator (HVS) Mark IV Model.
Research Project Selection

• APT program is integrated with overall research effort
  – Planning, development, and execution of research projects performed on an annual basis

• Research projects solicited from Central and District offices, FHWA, industry, and Florida Universities
Current APT Research

HVS-9 Experiment

1. Asphalt segregation
2. Tack coat residual application rate effect on cracking resistance
3. Asphalt density
4. FC-5 thickness
5. High polymer binder
Environmental Control

- Heater elements attached to HVS test beam
- Maintain asphalt temperature at 120°F
- Asphalt temperature monitored at 2-inches below surface
Heavy Vehicle Simulator

- Loading: 9 kips
- Super Single tire
  - (Goodyear G286 A SS, 425/65R22.5)
- Wheel wander from 0 to 30 inches
- On-board laser profiler system
- Heating system
- 10,000 loaded repetitions per day
Impact of Segregation on Asphalt Pavement Performance
Asphalt Segregation Study

- Quantify the impact of segregation on pavement rutting performance

- Develop/refine methods to quantify segregation using texture measurements (CTM)

- Finalizing report
Segregated Test Sections

Asphalt Segregation Study

• 12.5-mm NMAS (Granite)
• PG 76-22 polymer-modified binder
• 450 ft. long x 12 ft. wide test lane
Test Lane Construction

- Construct the areas with varying severity levels of segregation on test lane
  - Quarter truck loads of asphalt
  - Cycled screed heater on/off
  - Cooler material introduced into paver
  - Material sampling
Construction Methods
Test Track Construction

Temperature Distribution before Compaction

Florida Department of Transportation
Non Destructive Testing

- Use nondestructive testing methods to quantify the presence of segregation in the field
  - Circular Texture Meter
  - TM2: wide spot laser

- Comparison between segregated and non segregated HVS loading areas
  - Surface texture (MPD)
  - Rutting performance
Additional Non Destructive Testing

- Sand Patch Method
- GPR Data
- Florida Texture Meter
Segregated Pavement Performance
Rutting Performance

[Graph showing rut depth vs. number of HVS passes for different categories (5A, 5BR, 5CL, 5CR, 5EL, 5ER, 5HR) with a dashed line indicating the average non-segregated rut depth.]
Performance of Asphalt Pavements Constructed Using Different Compaction Levels
Asphalt Density

- 12.5 PG 76-22 Asphalt Mixture
- Three densities were targeted
  - 87%, 90%, and 93%
  - ± 0.5% Tolerance
Density Test Sections

Asphalt Density Study

- 12.5-mm NMAS (Granite)
- PG 76-22 polymer-modified binder
- 450 ft. long 12 ft. wide test lane
Establishing Rolling Patterns

Rolling Pattern Results:

Steel Wheel Vibratory Roller
- Approx. 2200 VPM
- Approx. 4.5 MPH
# Test Track Construction

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**Target:** 90.0%  
**Target:** 93.0%
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Density affects the rutting performance of 12.5 PG 76-22 mixture

In general, rutting performance is increase with increase density for typical 12.5 PG 76-22 mixtures
Segregation Study Summary

- The APT results indicate that segregation negatively impacts the rutting performance of asphalt pavements.
  
  - The segregated loading areas detected by the current FDOT criteria resulted in 65.9% higher rutting than the non-segregated experienced areas

  - Raveling was observed during testing, but difficult to quantify.
Density Study Summary

- The APT results indicate that asphalt pavement density below 90% negatively impacts rutting performance.
  - 87% density resulted in 29.5% higher rutting than the 93% density test section
  - 87% density resulted in 10.7% higher rutting than the 90% density test section
  - 87% density resulted in 31.2% and 65.9% lower average tensile strength than the 90% and 93% density test sections, respectively.
APT Summary

• APT is a critical component of FDOT’s pavement research program

• Key to success is the careful selection of research projects that address critical issues

• Technology transfer is essential