Florida Department of
TRANSPORTATION

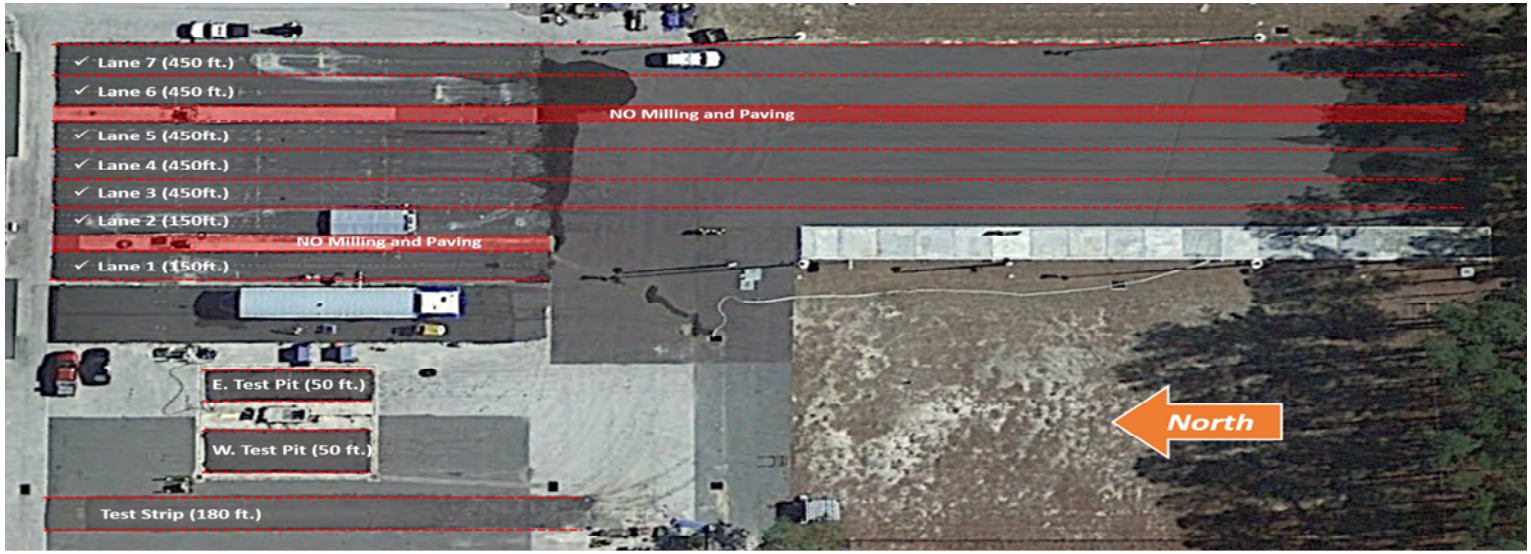
Impact of Segregation and Density on Asphalt Pavement Performance

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

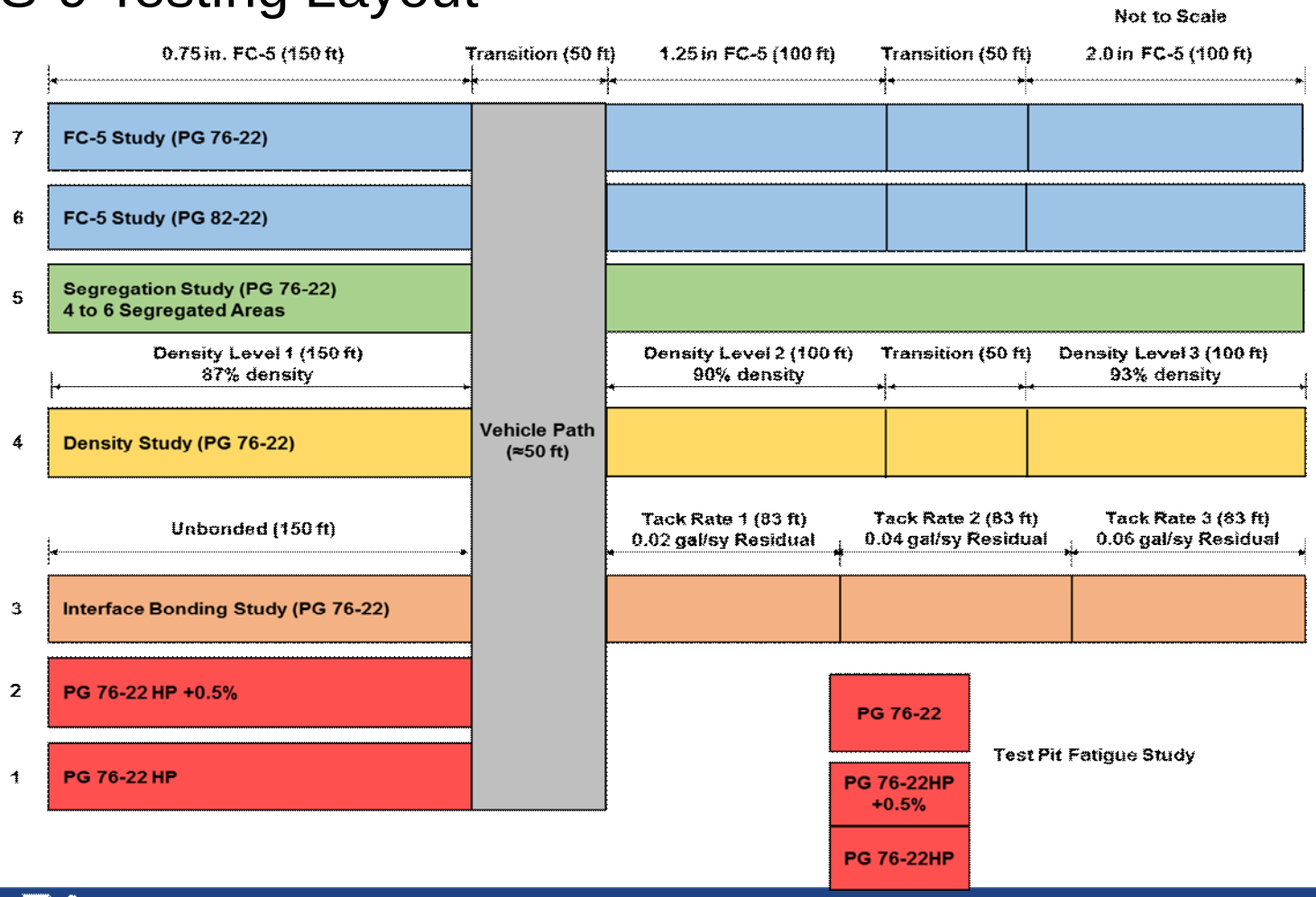
Current APT Research

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

HVS-9 Experiment

HVS-9 Testing Layout

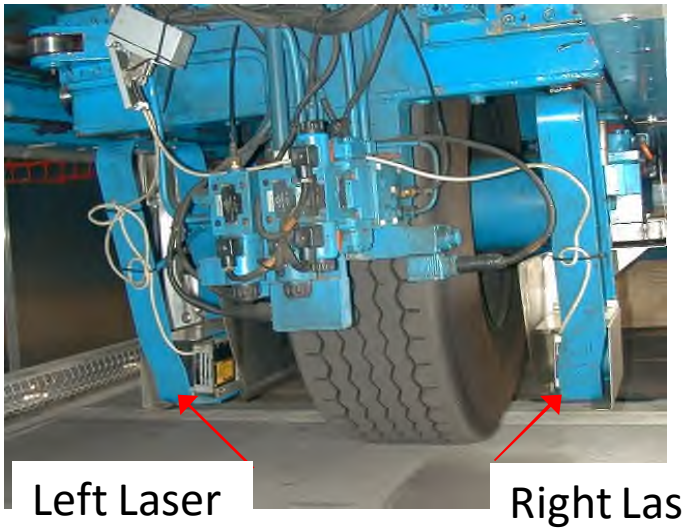


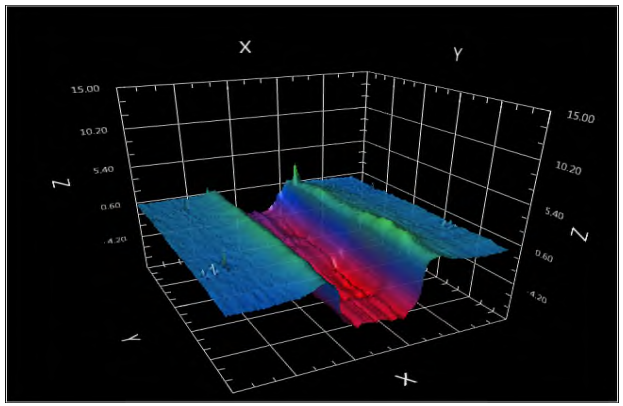
Environmental Control

- Heater elements attached to HVS test beam
- Maintain asphalt temperature at 120ºF
- 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

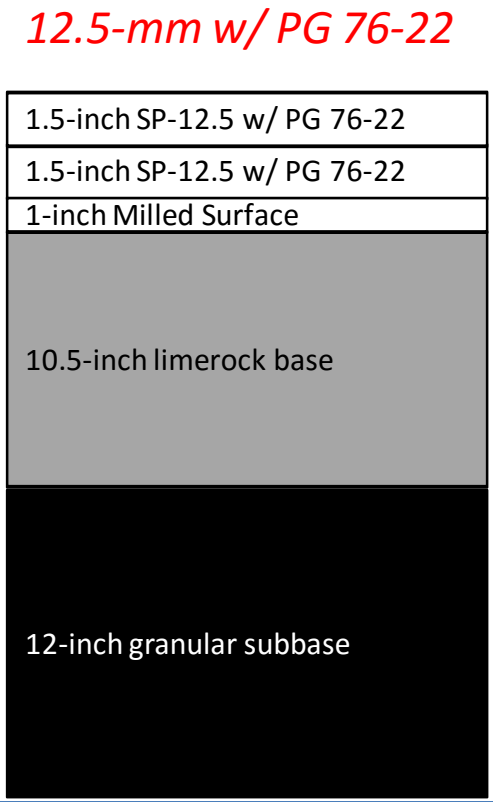
Asphalt Segregation Study

- 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

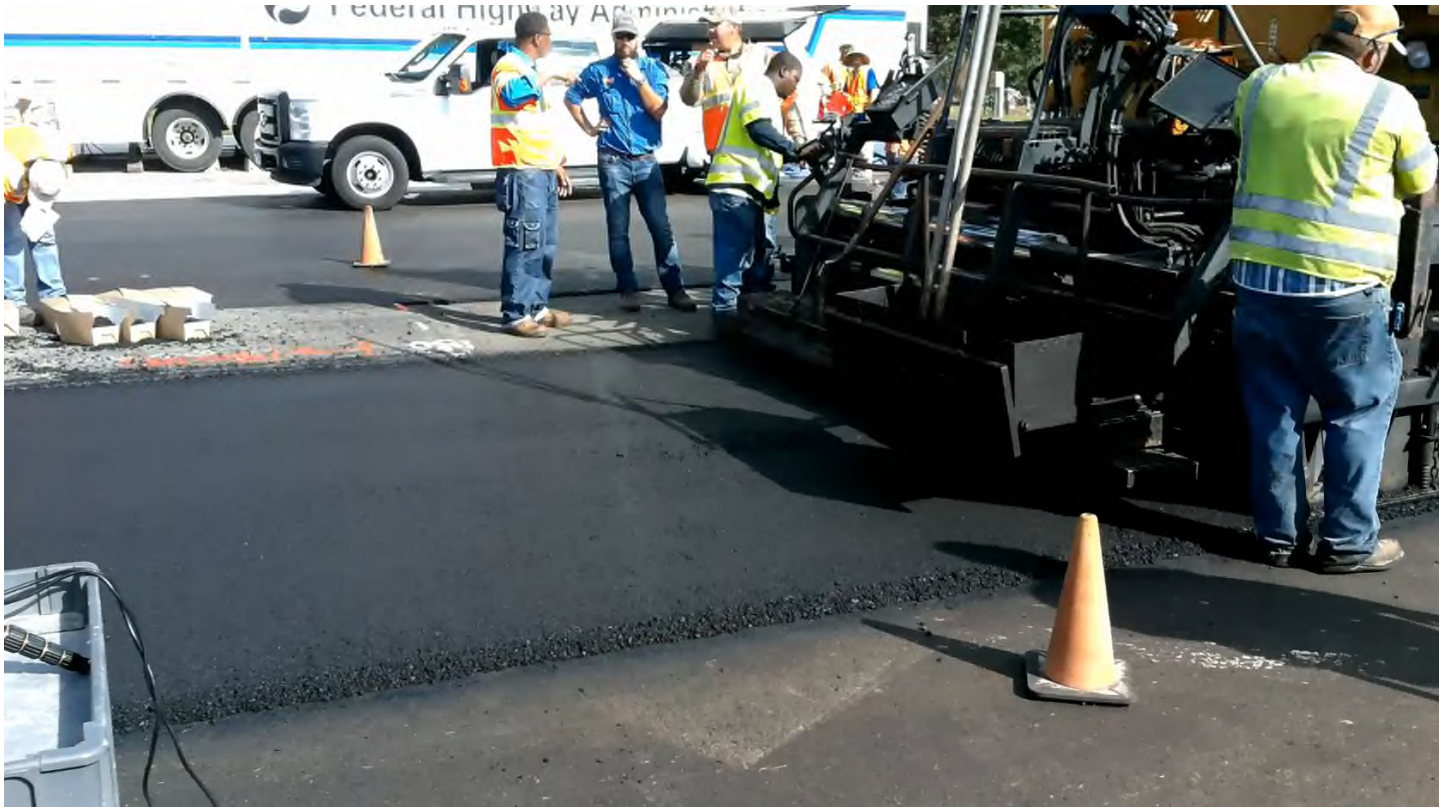
- 12.5-mm NMAS (Granite)
- PG 76-22 polymer-modified binder
- 450 ft. long x 12 ft. wide test lane



Test Lane Construction

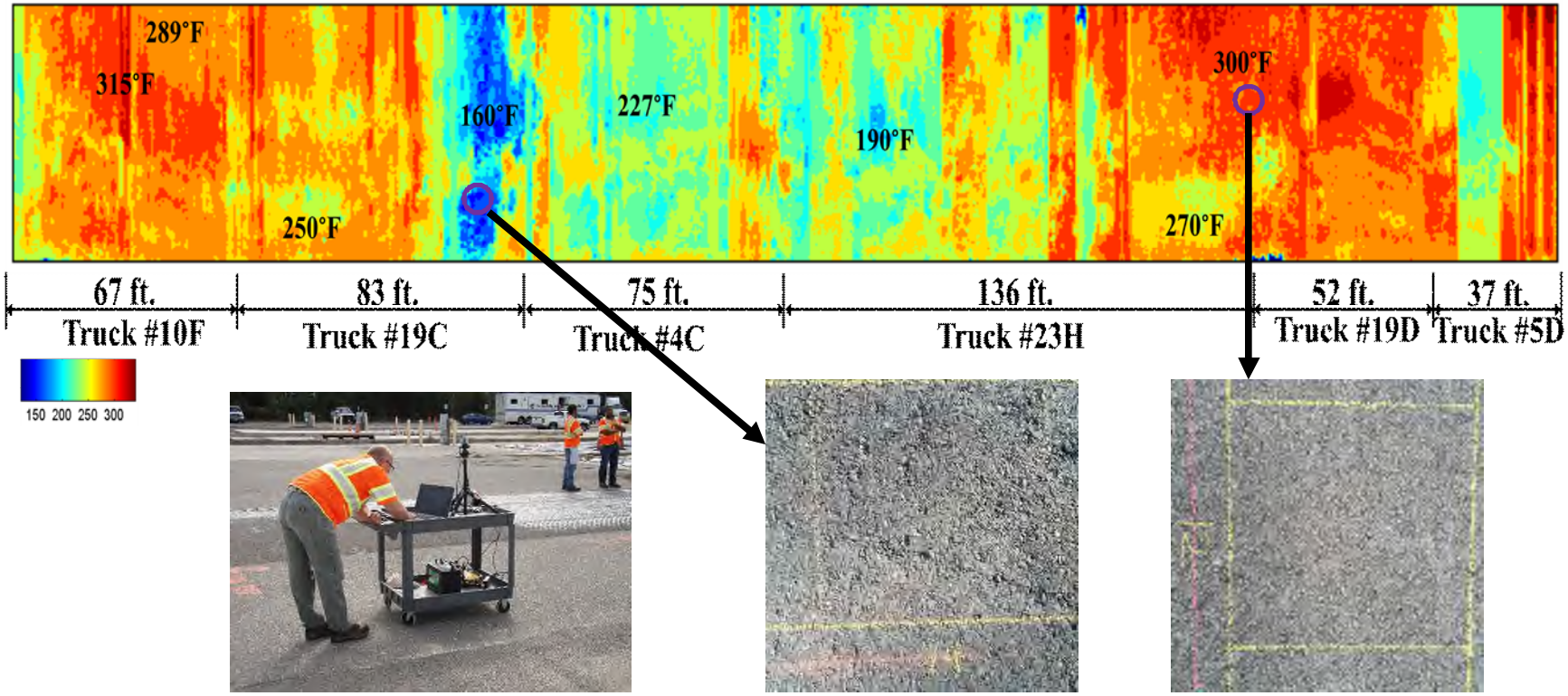
- Construct the areas with varying severity levels of segregation on test lane
  - Quarter truck loads of asphalt
  - Cycled screed heater on/off
  - Cooler material introduced into paver
  - Material sampling

Construction Methods



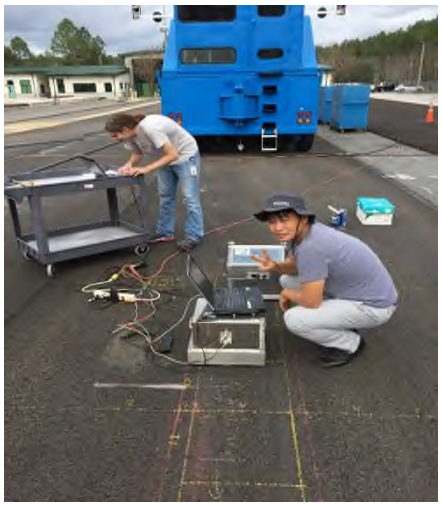
Test Track Construction

Temperature Distribution before Compaction



Non Destructive Testing

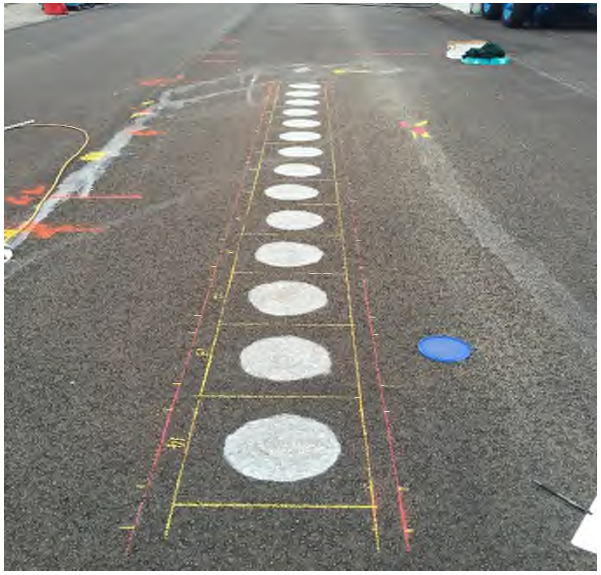
- Use nondestructive testing methods to quantify the presence of segregation in the field
  - Circular Texture Meter
  - TM2: wide spot laser



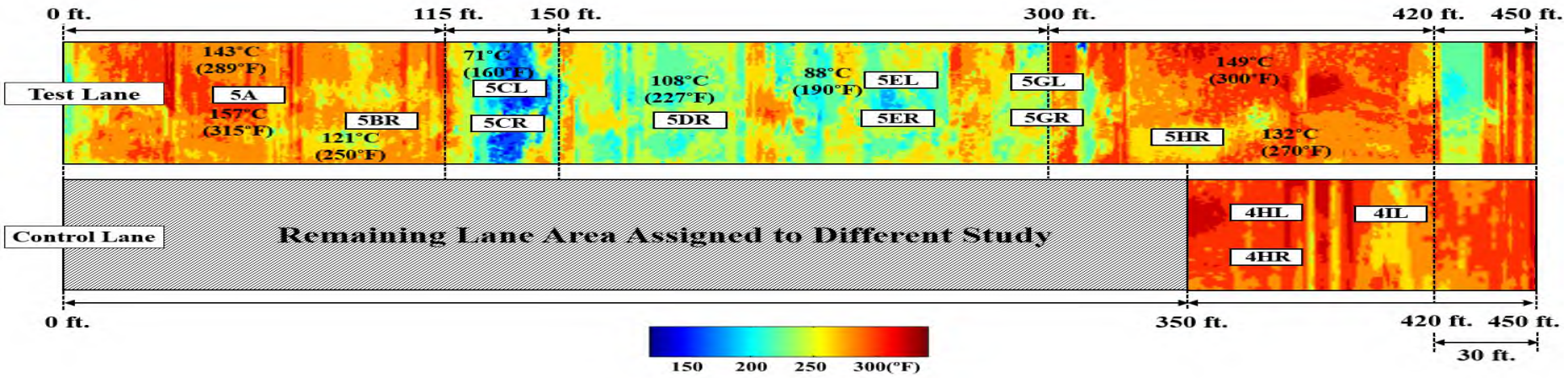
- Comparison between segregated and non segregated HVS loading areas
  - Surface texture (MPD)
  - Rutting performance

Additional Non Destructive Testing

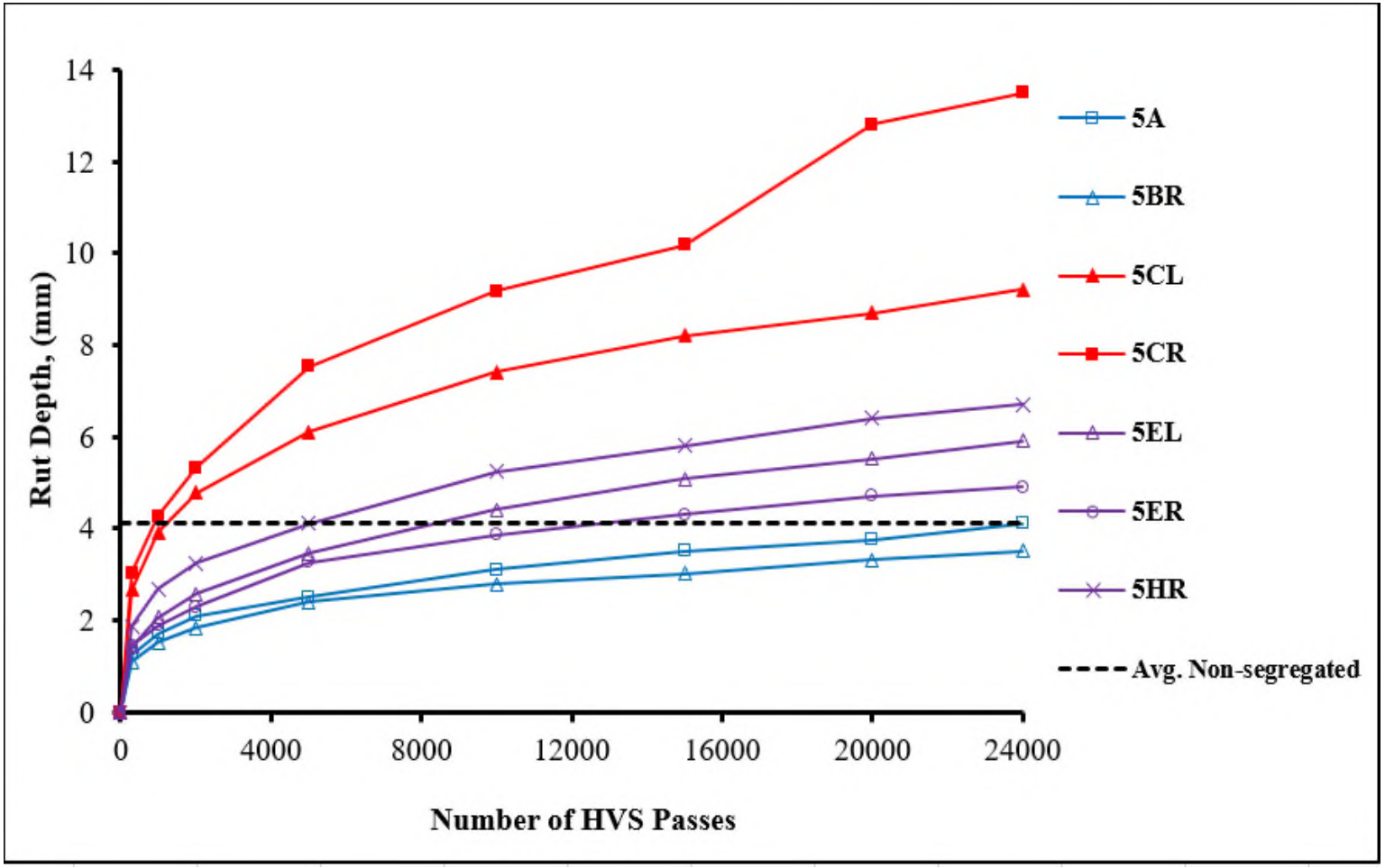
- Sand Patch Method
- GPR Data
- Florida Texture Meter



Segregated Pavement Performance



Rutting Performance



Performance of Asphalt Pavements Constructed Using Different Compaction Levels

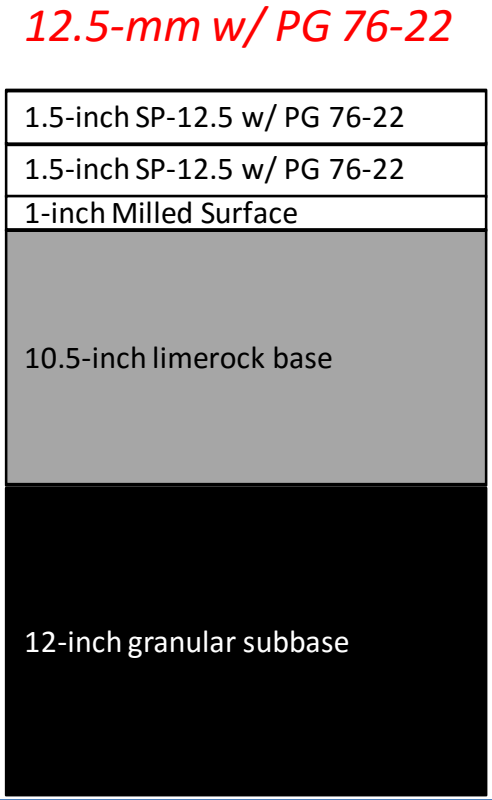
Asphalt Density

- 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

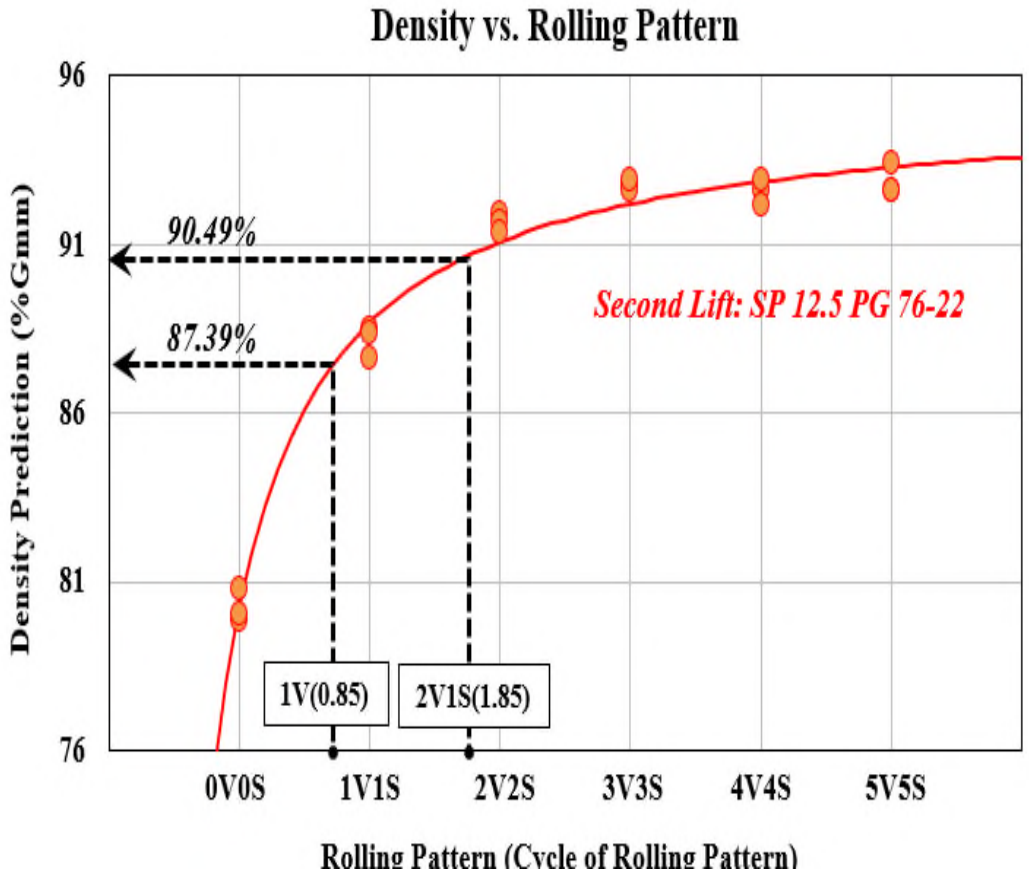


Establishing Rolling Patterns

Rolling Pattern Results:

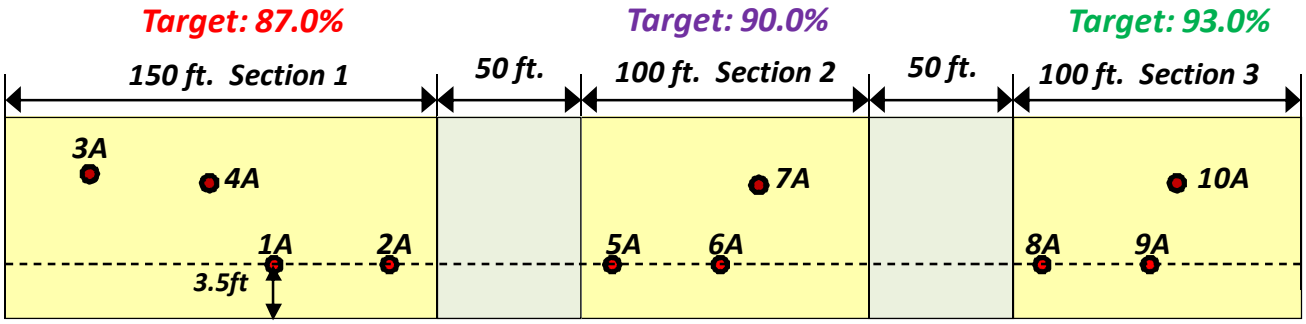
Steel Wheel
Vibratory Roller

- Approx. 2200 VPM
- Approx. 4.5 MPH



Test Track Construction

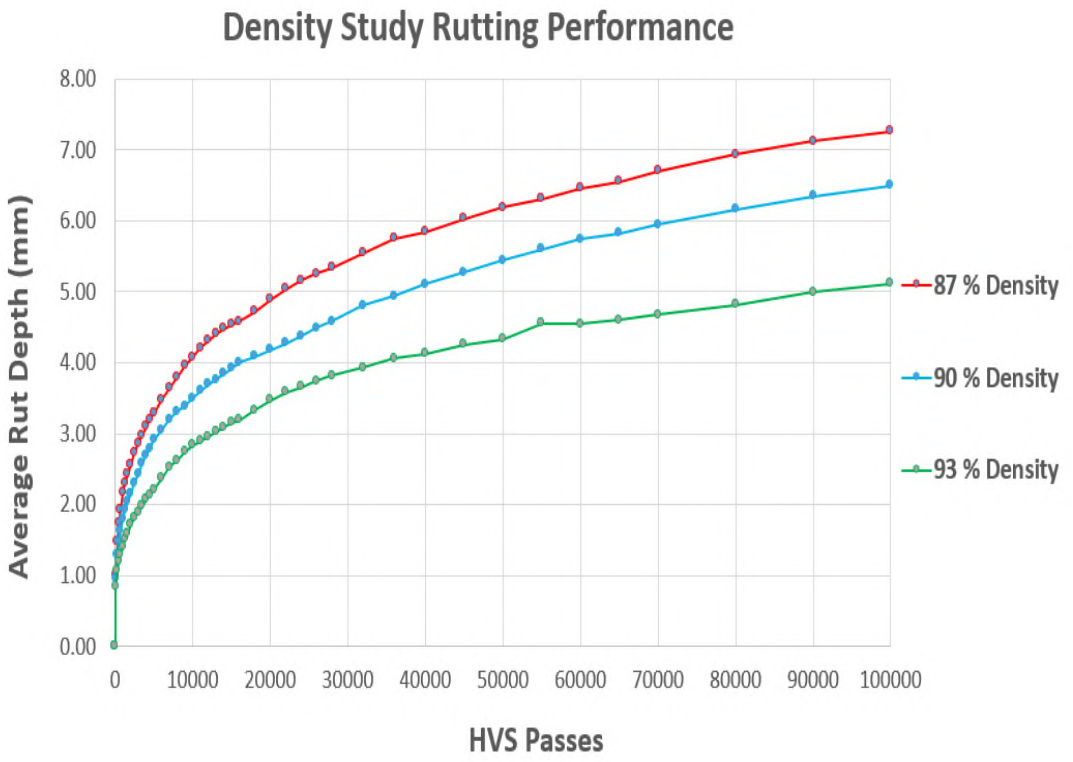
Core ID	Core Density (%)	Avg. Core Density (%)	Std. Deviation; (%)	Thickness Top Layer (inches)	Avg. Thickness (inches)	Std. Deviation; (inches)	Location (ft.)
1A	86.4	86.2	0.9	1.5	1.4	0.1	92
2A	85.1			1.3			132
3A	86.1			1.3			60
4A	87.3			1.4			85
5A	90.3	90.2	0.5	1.4	1.4	0.1	208
6A	90.6			1.5			243
7A	89.6			1.4			254
8A	93.1	93.0	0.1	1.3	1.4	0.1	356
9A	92.9			1.4			398
10A	92.9			1.5			400

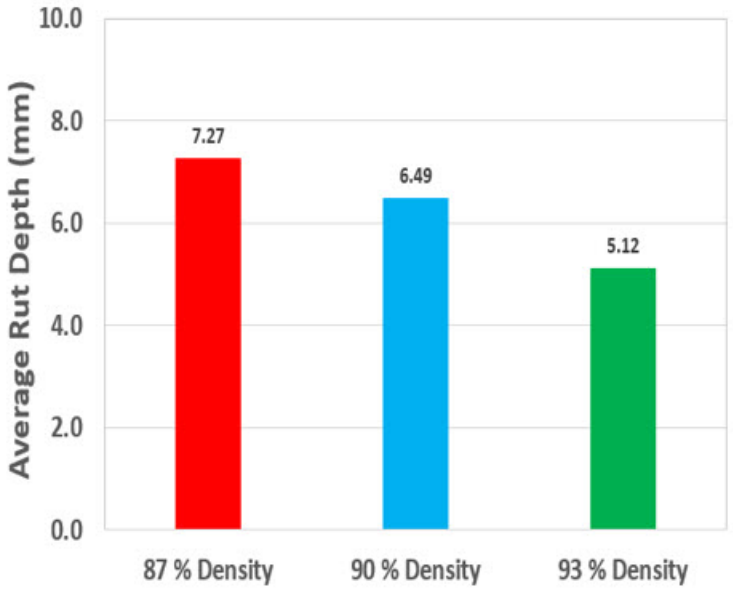


IDT Tensile Strength

Core ID	Core Density (%)	Avg. Density (%)	Tensile Strength (psi)	Avg. Tensile Strength (psi)	Std. Deviation (psi)
1A	86.4	86.3	95.8	91.3	13.4
2A	85.1		71.3		
4-1B	86.1		98.4		
4-4B	87.6		99.6		
1	89.6	90.3	100.9	119.8	14.8
2	91		132.6		
1A	90		115.1		
2A	90.6		130.4		
6	92.7	92.9	144	151.1	10.4
7	92.9		141.5		
6A	93.1		164.1		
7A	92.9		154.7		

Rutting Performance





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