Asphalt Research Updates

Mohab El-Hakim

Asphalt Operations & Research Engineer

2025 FLORIDA ASPHALT EXPO & CONFERENCE

NEXT MILE ❄ NEXT LEVEL

ACAF Asphalt Contractors Association Of Florida, Inc.

FDOT Research Avenues

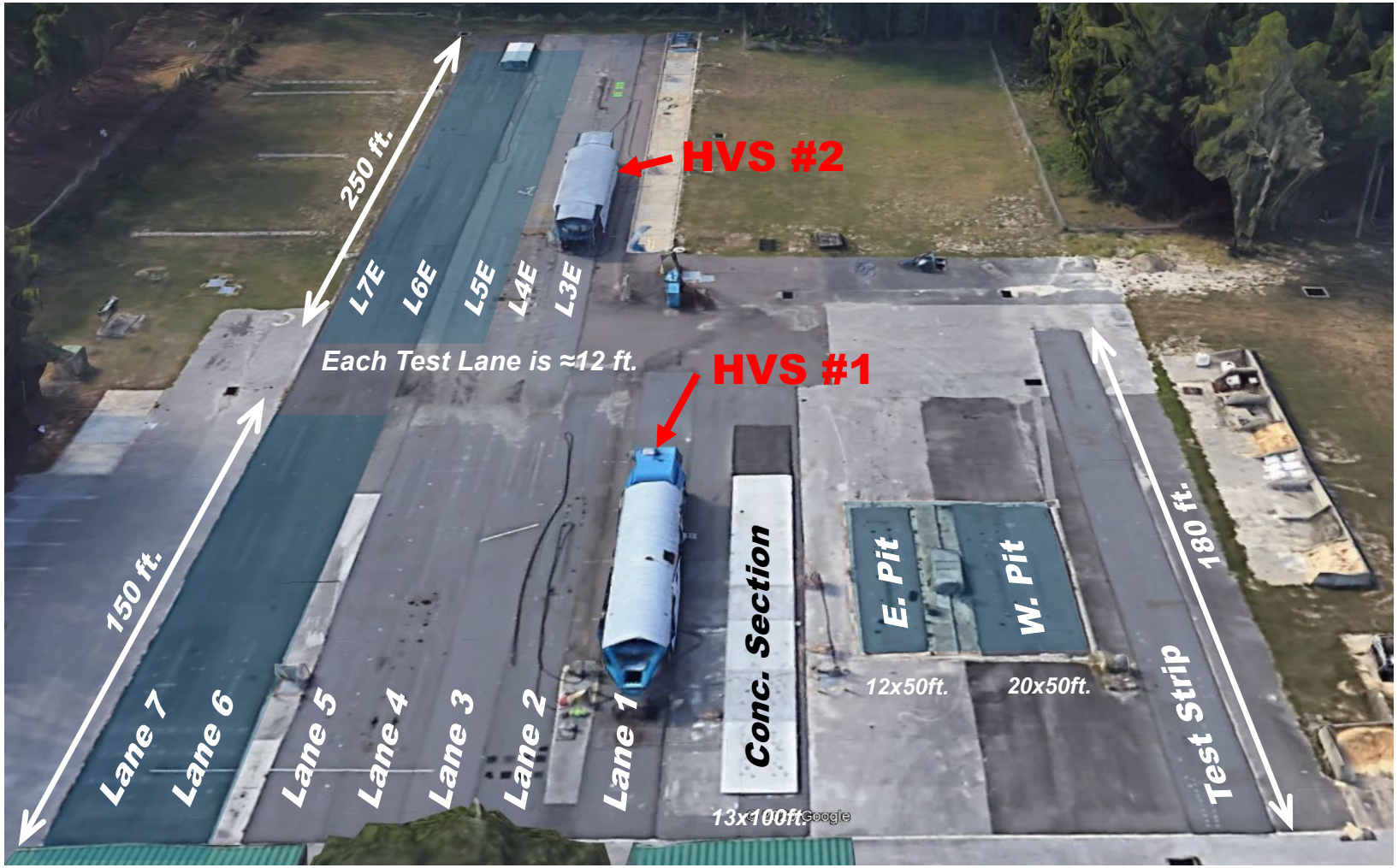
State Materials Office (SMO) Research Lab

Accelerated Pavement Testing (APT)

Field Trials (e.g. Test Road on US 301)

National Center for Asphalt Technology (NCAT) Test Track

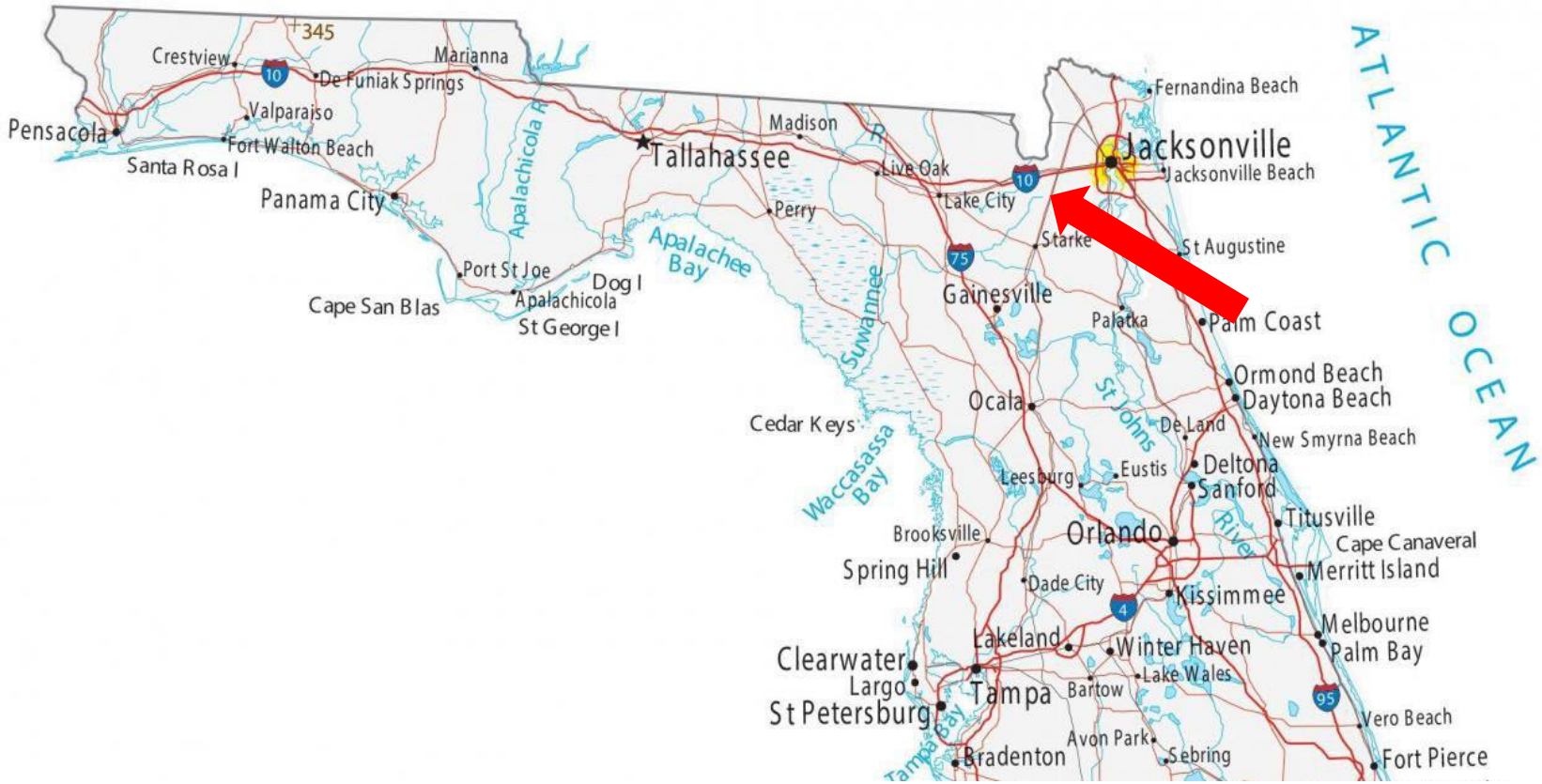
FDOT Accelerated Pavement Testing



1.5 in. AC Top
1.5 in. AC Middle
1.5 in. AC Bottom
10.5 in. Limerock Base
12 in. Stabilized Subgrade

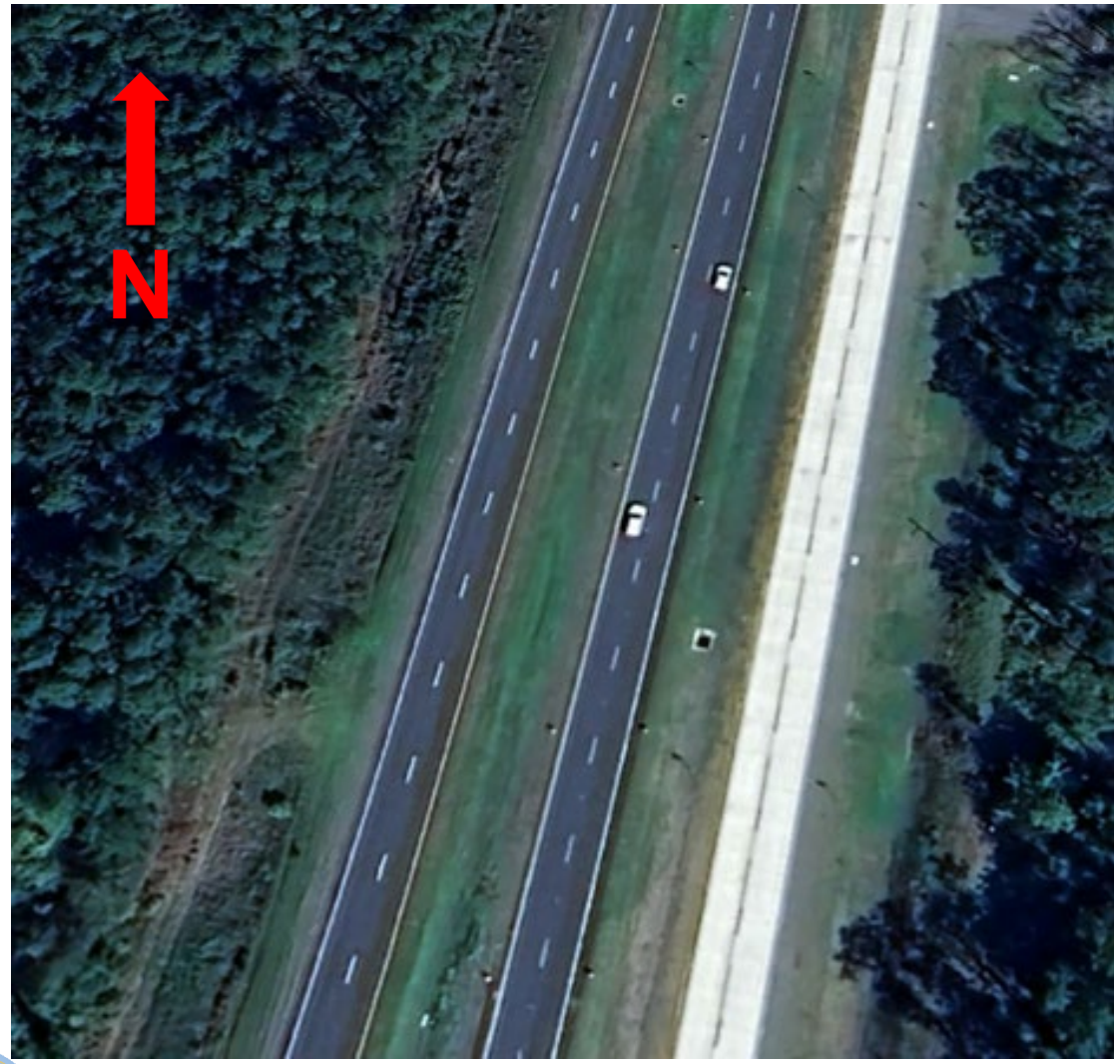
Typical Cross Section

Asphalt Test Road (US 301)



- US 301 (SR 200) in Clay County.
- Approximately 2.5 miles long.
- 12 test sections, 1000 ft. long.

Asphalt Test Road (US 301)

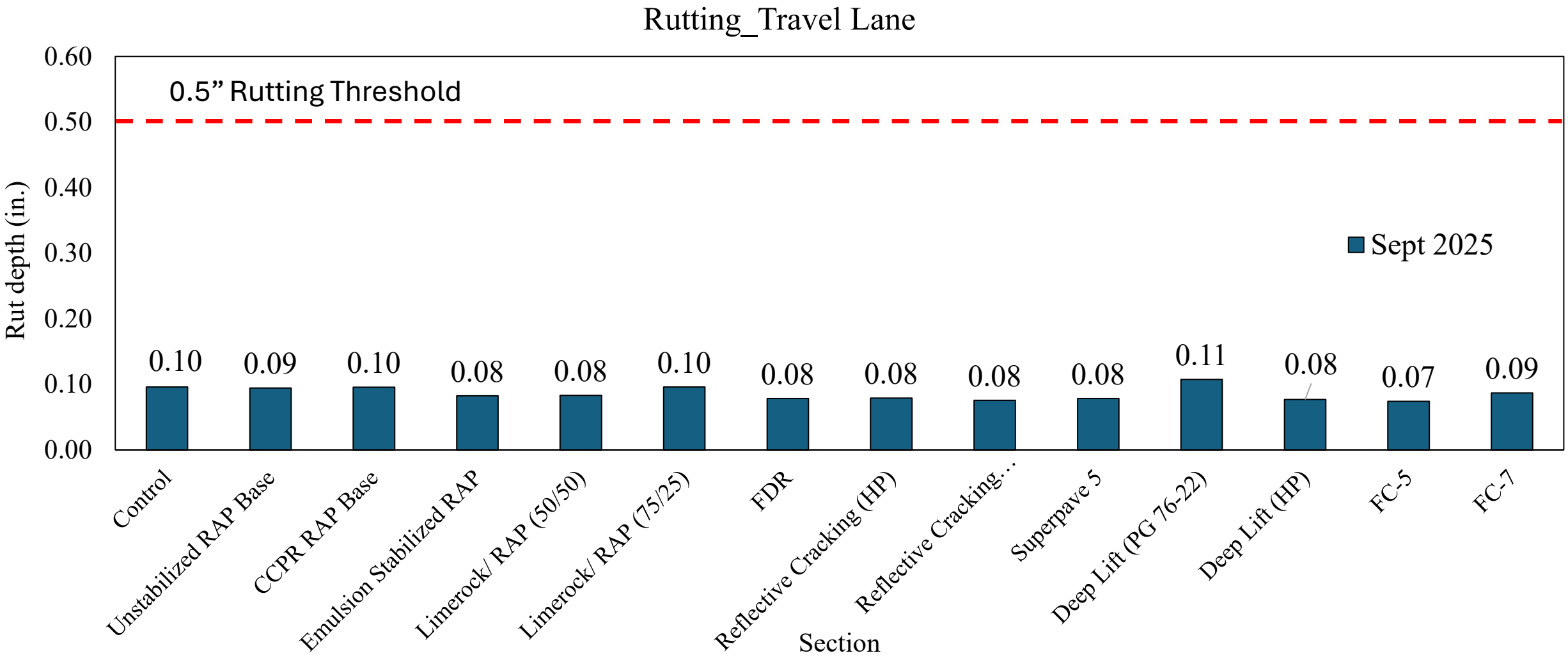


- Southbound travel lanes:
  - Asphalt Test Road
- Northbound travel lanes:
  - Concrete Test Road
- Middle lanes:
  - Diversion Lanes

Asphalt Test Road (US 301)

- 12 Sections: 1,000 feet in length, both southbound travel lanes
- Construction began October 23rd, 2023
  - Opened to traffic end of September 2024
- Five Primary Studies
  - Base Study
  - Thick Lift Study
  - Reflective Cracking Mitigation Study
  - Alternative Mix Design Protocol Study
  - Open Graded Friction Course Study

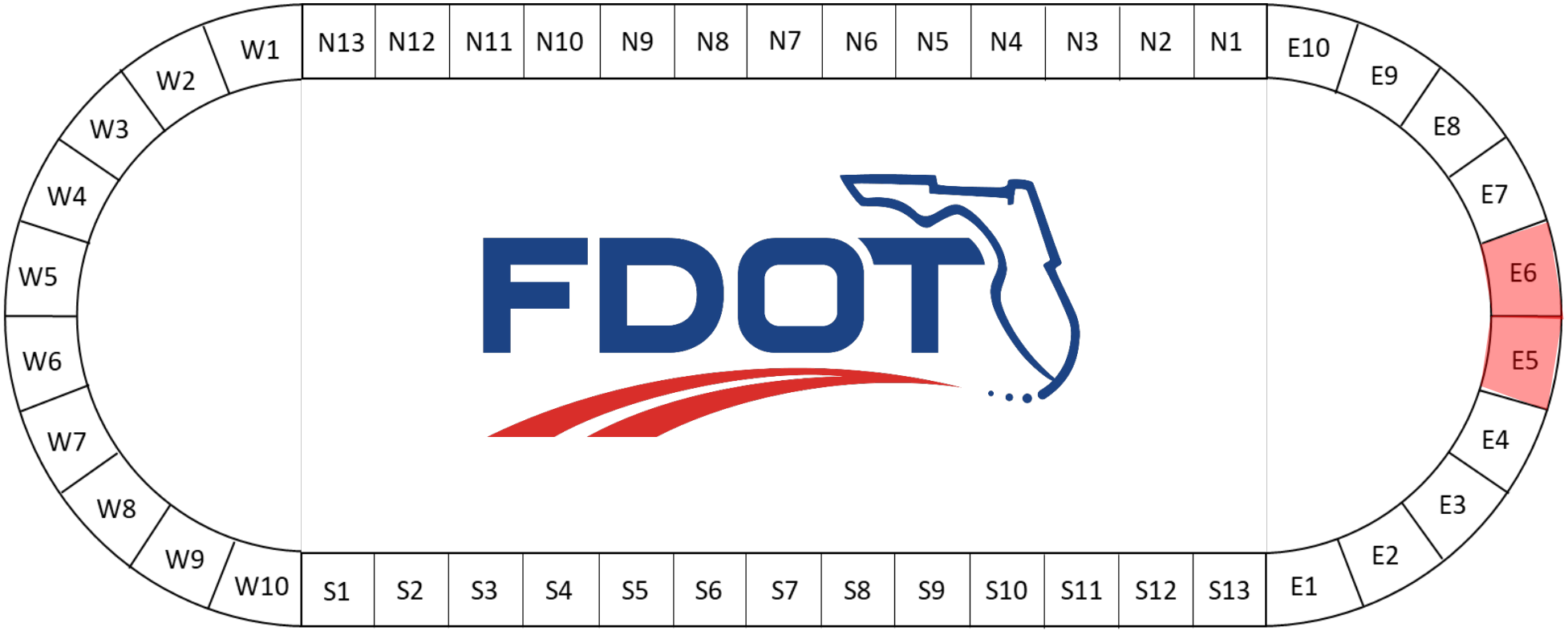
Asphalt Test Road (US 301)



NCAT Test Track

- Auburn, AL
- 5 trucks
- 46 test sections
- 5 million ESALs /year

In-Place Density Study @ NCAT Test Track

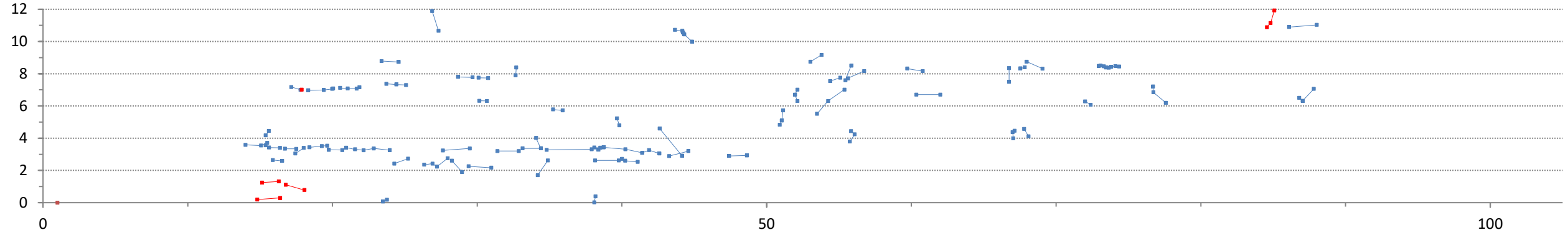


In-Place Density Study @ NCAT Test Track

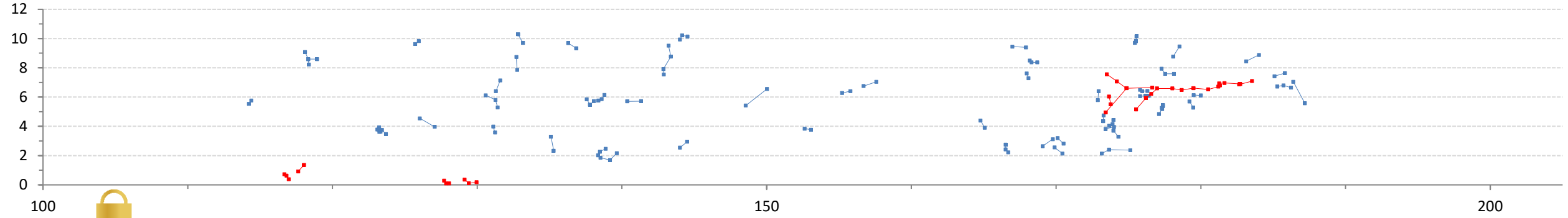
Sub-section	In-Place Density, % of Gmm	
	As-Constructed	Dec. 2024 20+ MESALs
	Average	
E5A	93.6	96.0
E5B	92.0	94.5
E6B	89.7	92.2
E6A	87.8	92.5

In-Place Density Study @ NCAT Test Track

E5A: 93.6% of G_{mm}, 8.4% Lane Area Cracking (0.6% Reflective)



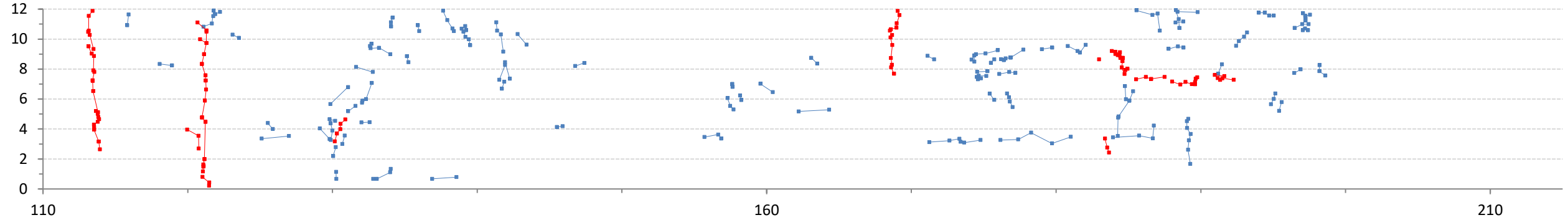
E5B: 92.0% of G_{mm}, 6.3% Lane Area Cracking (1.9% Reflective)



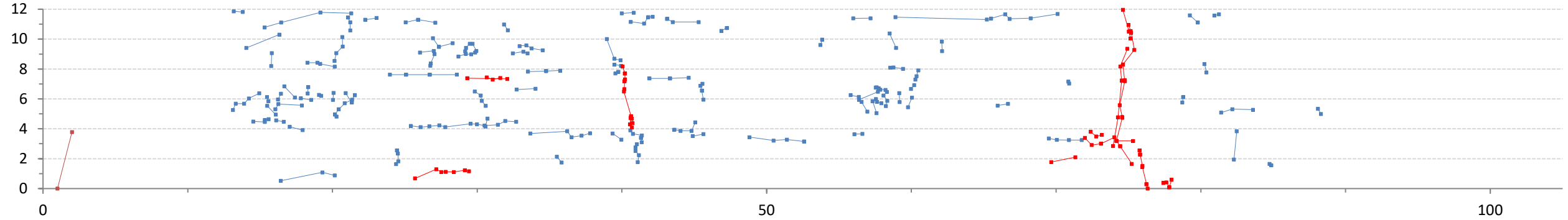
Crack Maps July, 2025

In-Place Density Study @ NCAT Test Track

E6B: 89.7% of G_{mm}, 11.6% Lane Area Cracking (3.7% Reflective)



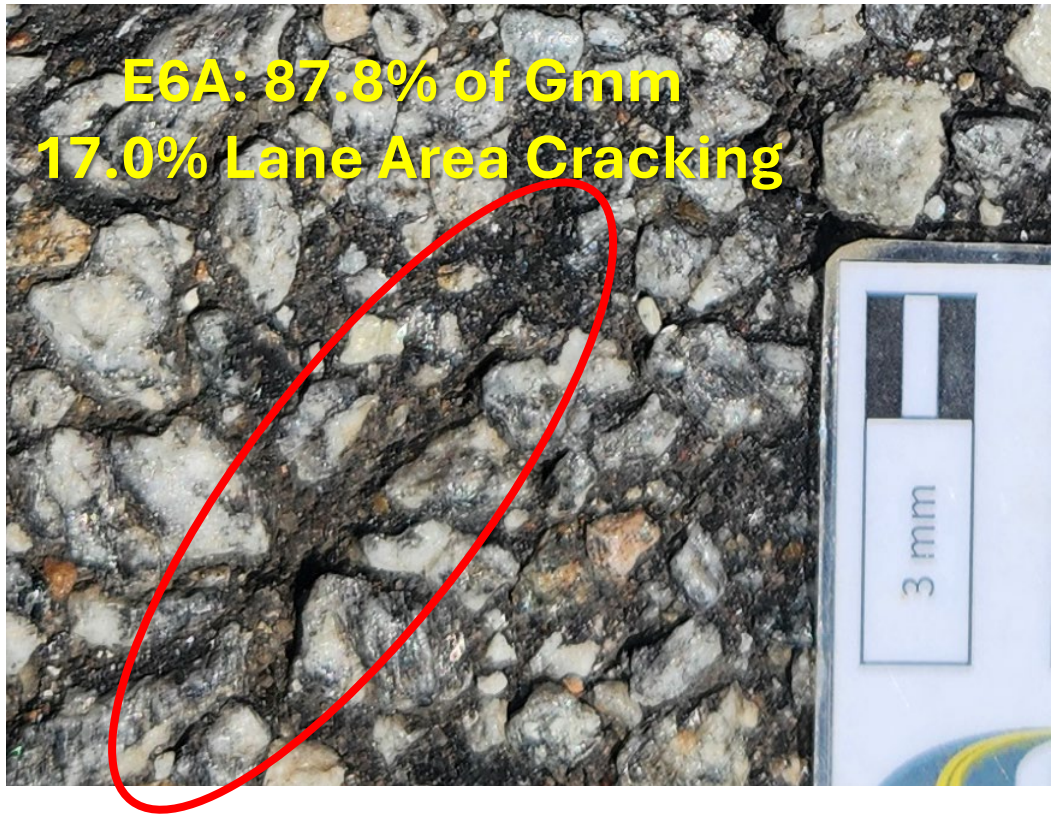
E6A: 87.8% of G_{mm}, 17.0% Lane Area Cracking (4.2% Reflective)



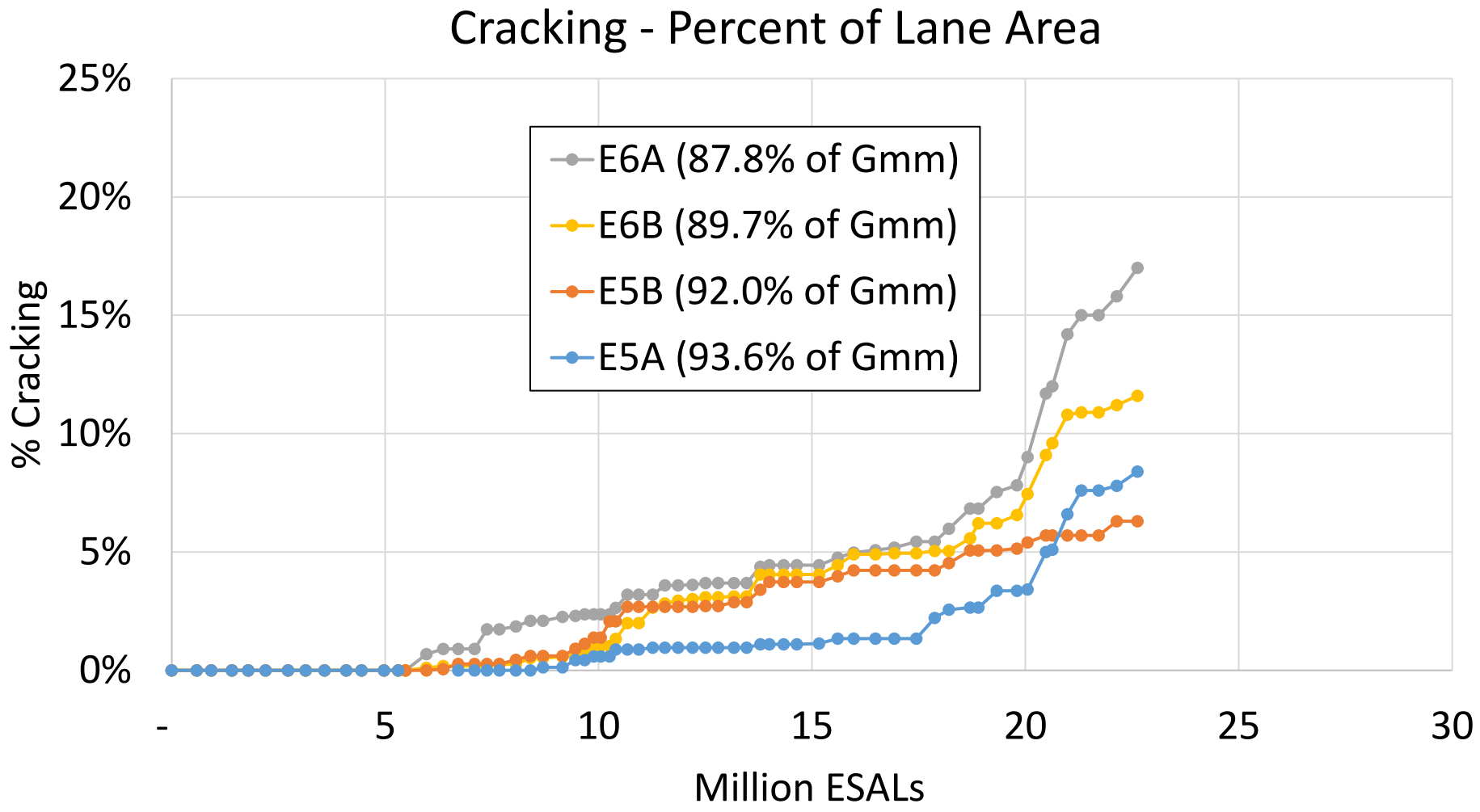
Crack Maps July, 2025

In-Place Density Study @ NCAT Test Track

In-Place Density Study @ NCAT Test Track



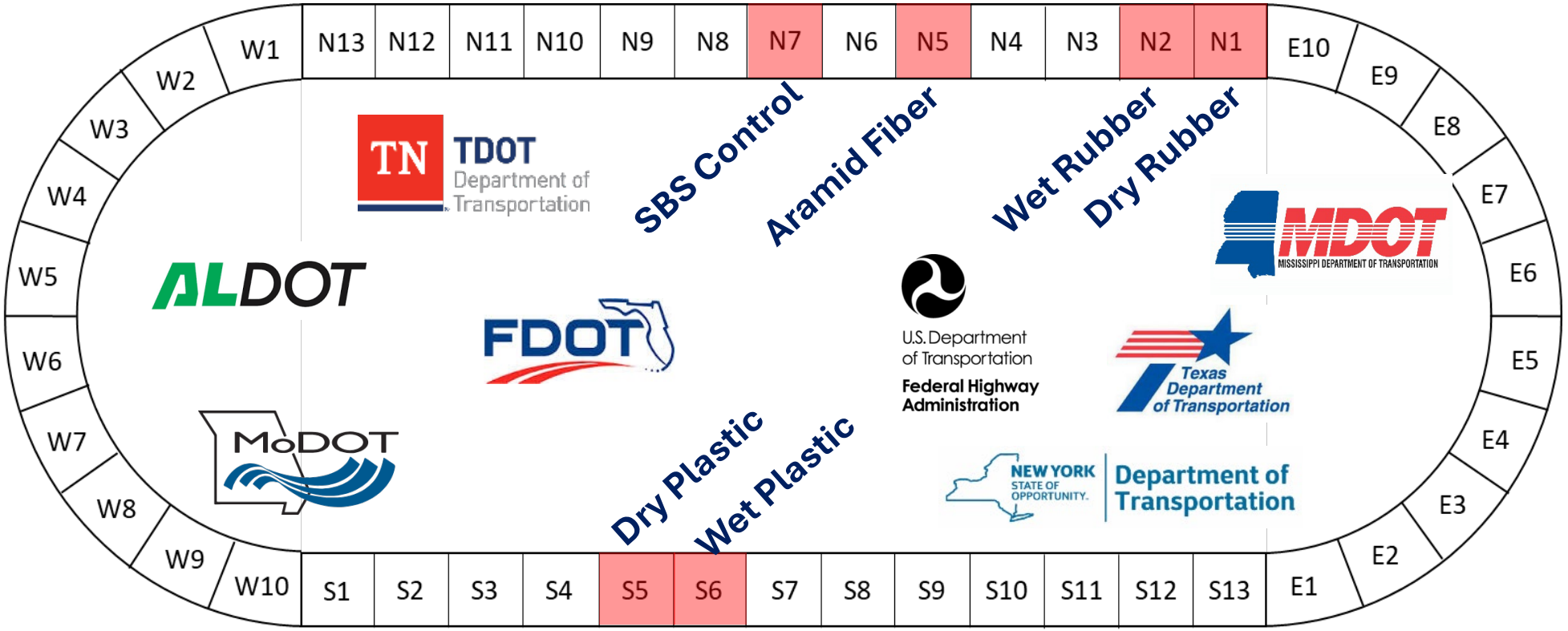
In-Place Density Study @ NCAT Test Track



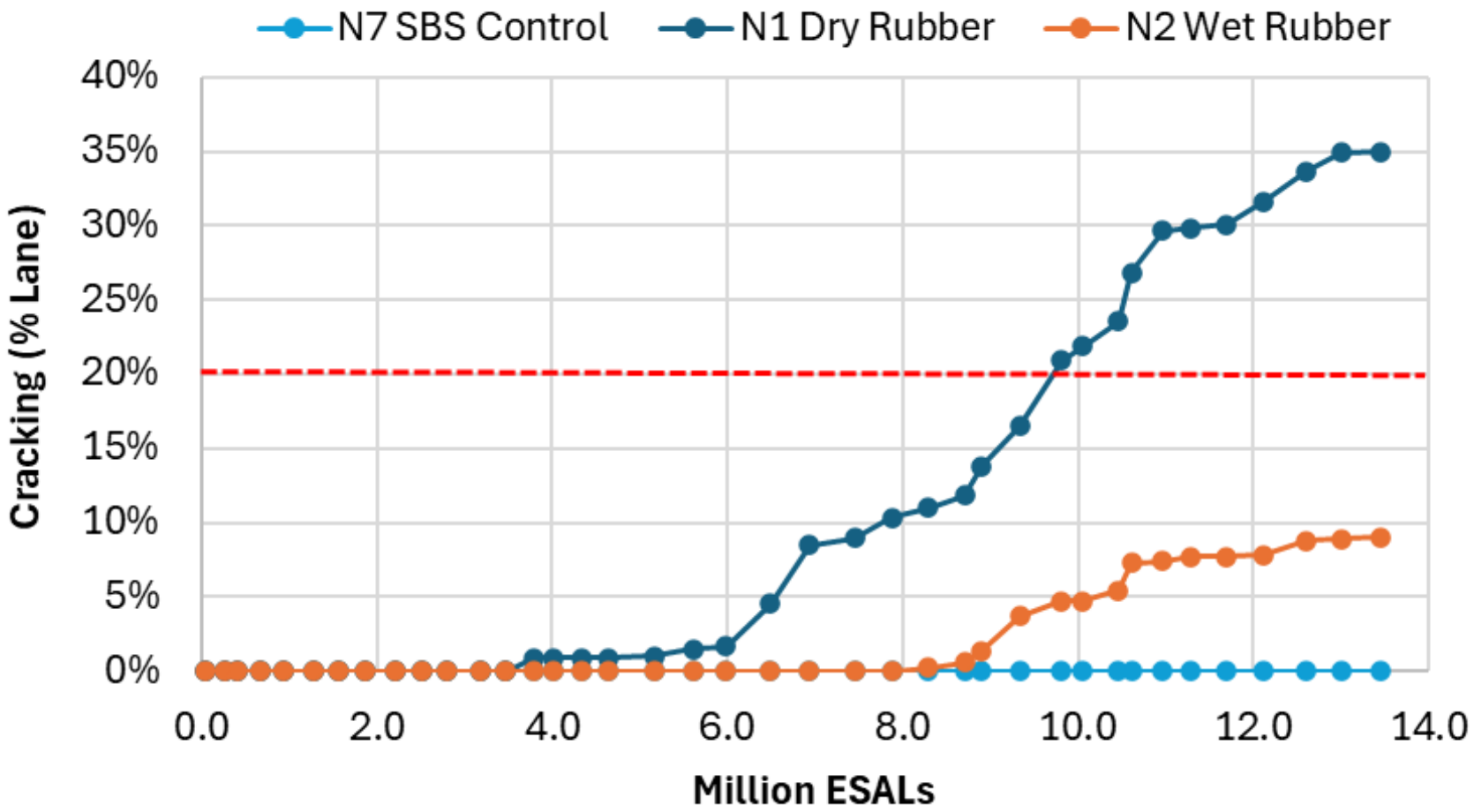
In-Place Density Study @ NCAT Test Track

- Lower as-constructed density has a negative impact on cracking resistance
- Binders from the sections with lower in-place densities have aged more as indicated by most recovered binder properties
- The binder in the upper ¾”has aged much more than the next ¾” for the well-compacted test sections.

Additive Group Study @ NCAT Test Track

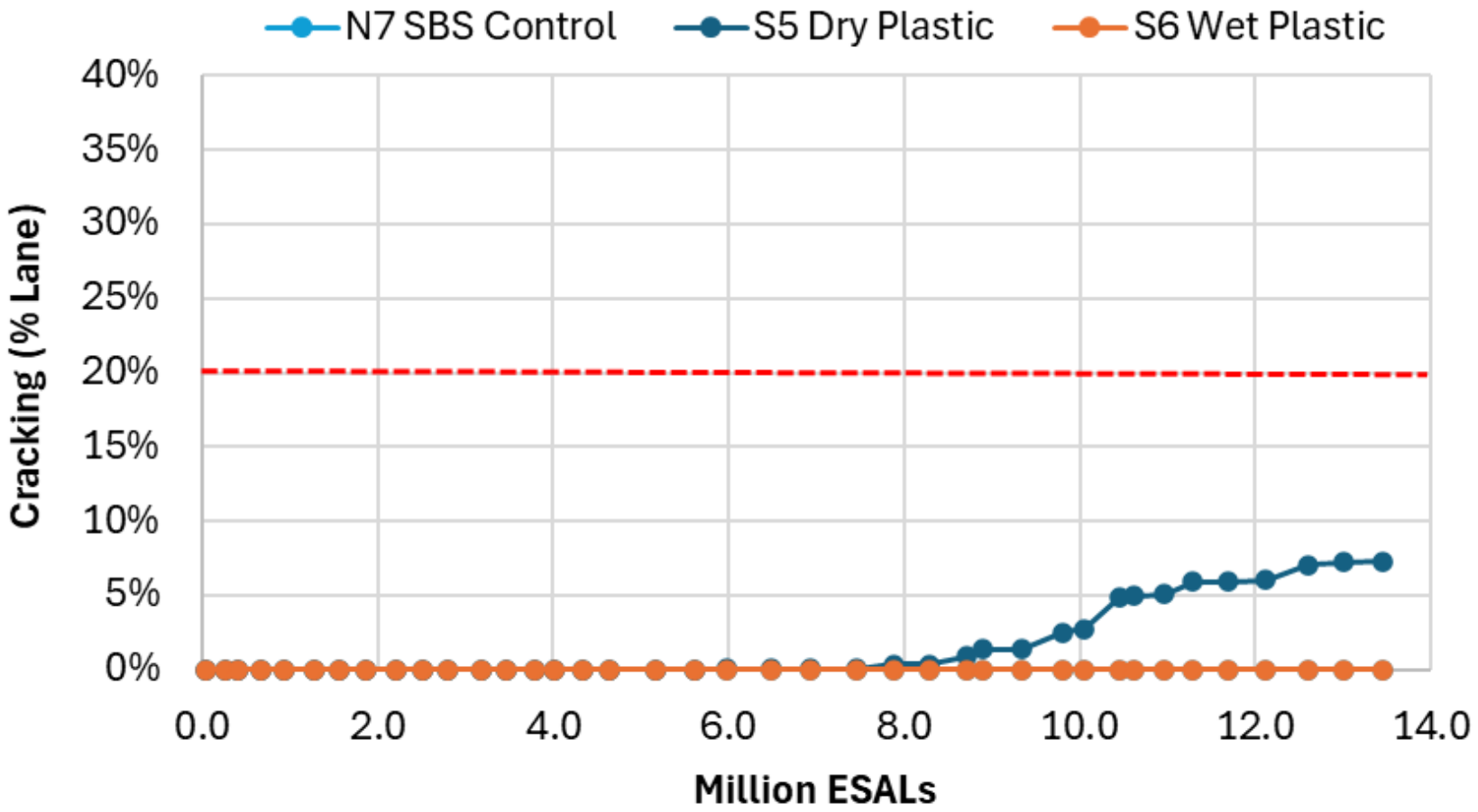


Additive Group Study @ NCAT Test Track



% Lane Cracking @ 13.5 MESALs

Additive Group Study @ NCAT Test Track



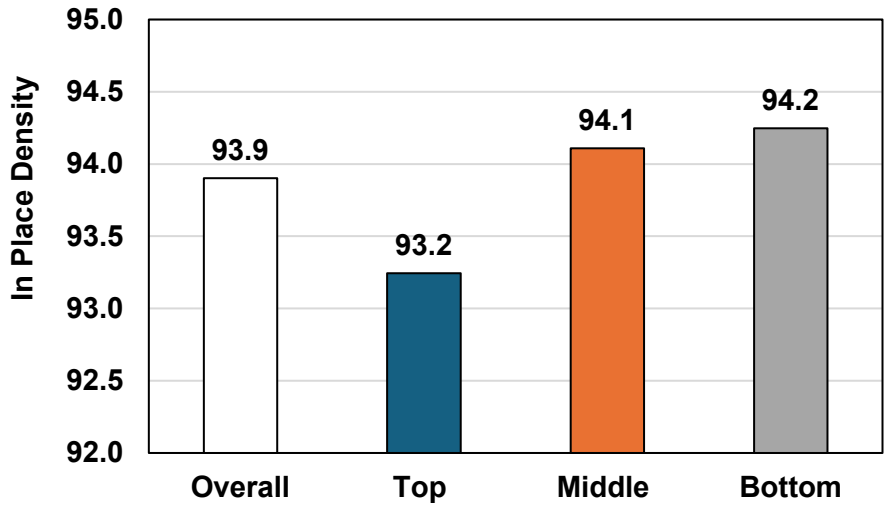
% Lane Cracking @ 13.5 MESALs

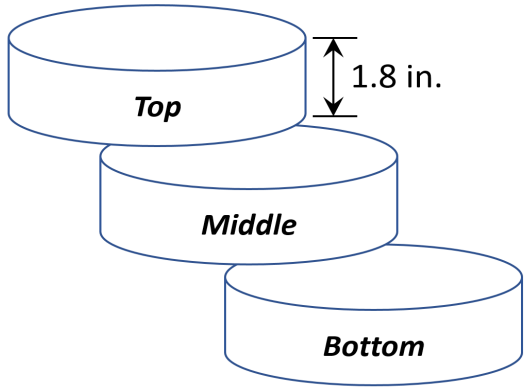
Single Lift Deep Mill/Fill @ HVS

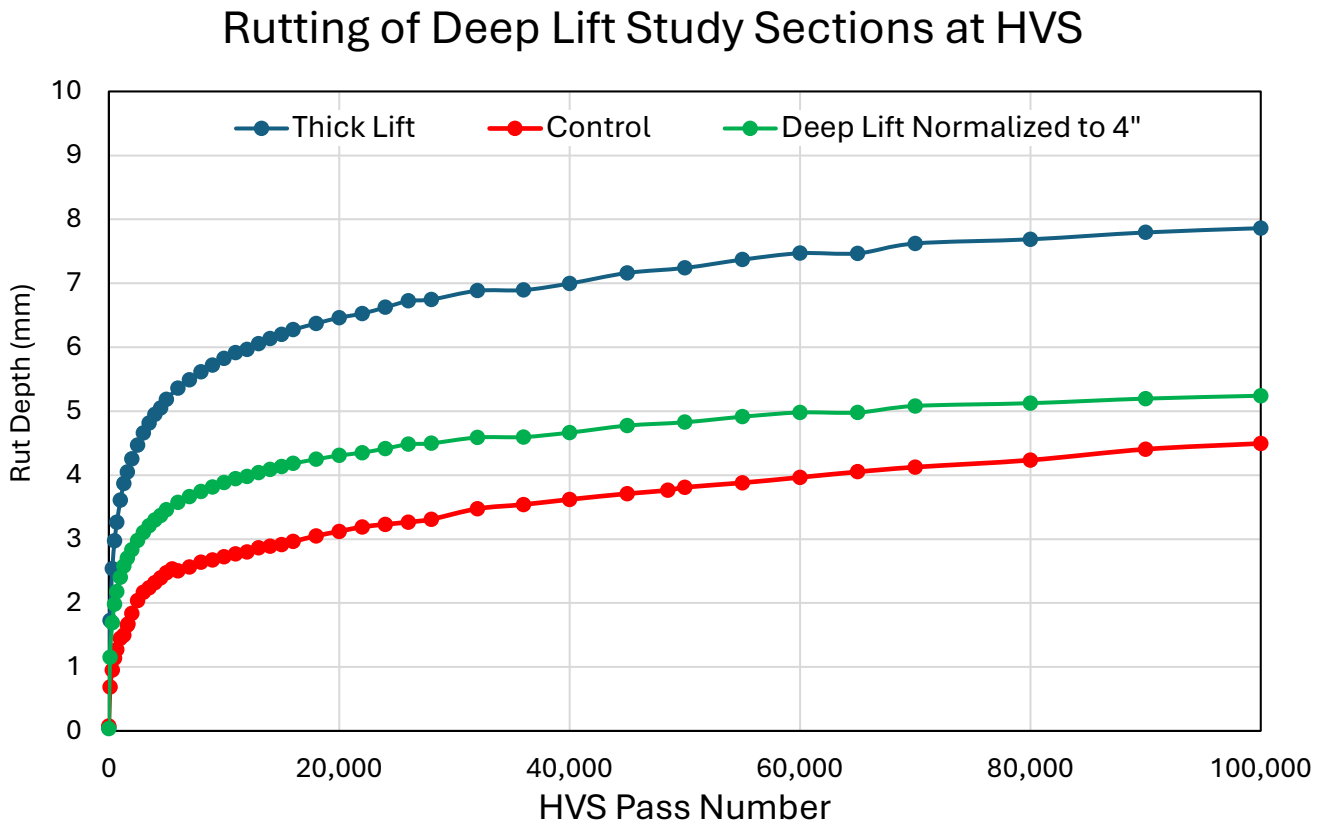
- Background
  - Multi-layer paving involves additional paving processes, resulting in longer lane closures and increased traffic disruptions.
- Objectives
  - Evaluation of constructability of the thick lift mill/fill (≥ 5”)

Single Lift Deep Mill/Fill @ HVS

In-Place Density

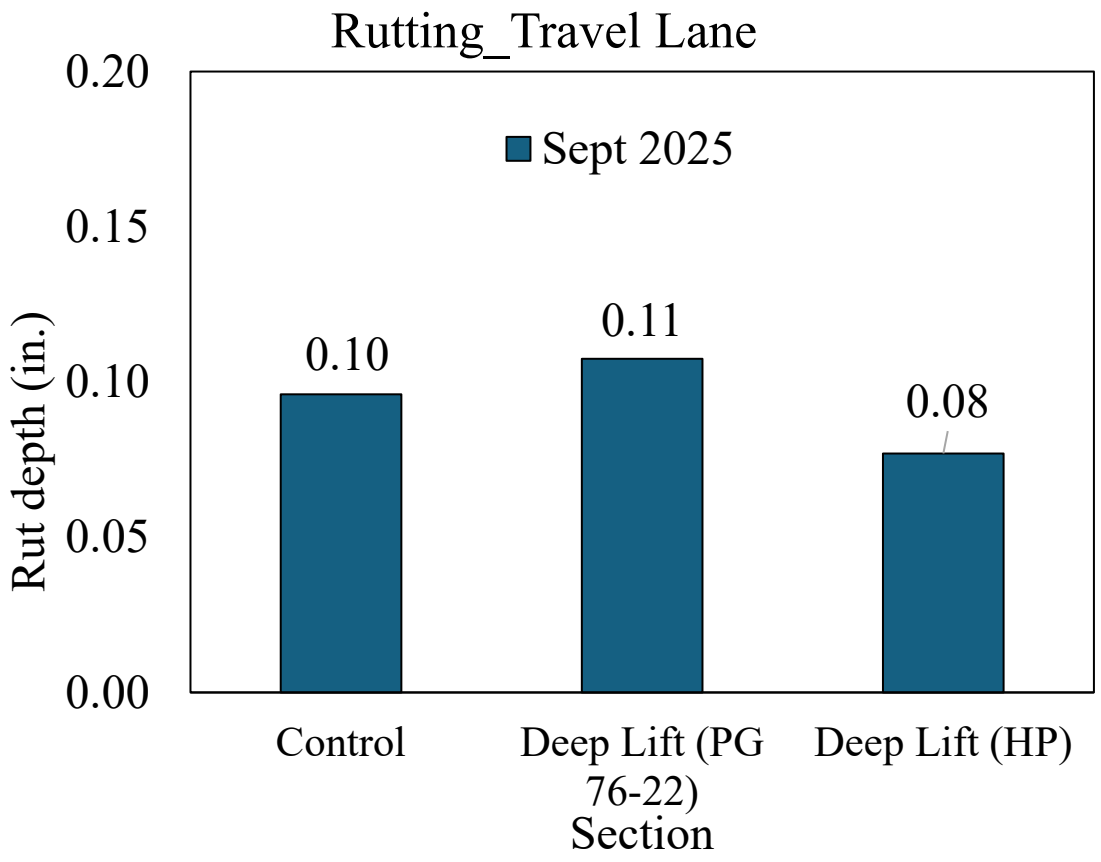






Single Lift Deep Mill/Fill @ US 301 Test Road

In-Place Density



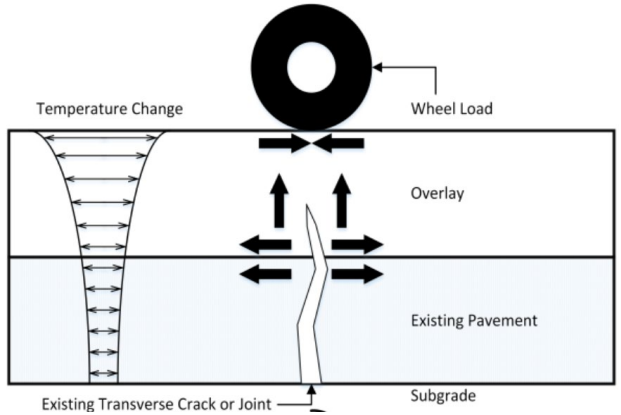
In-place density 95.9%

10A Deep Lift (76-22)	10B Deep Lift (HP)
0.75" FC-5	0.75" FC-5
1.5" Type SPM	1.5" Type SPH HP Binder
6.0" Type SPM	6.0" Type SPH HP Binder
Existing Base	Existing Base

In-place density 94.8%

Crack Relief Mixture @ HVS

- Background
  - Deeper pavement cracks require milling and filling at greater depths, which increases resurfacing costs and time
- Objectives
  - Evaluate the effectiveness of the crack relief asphalt mix in preventing bottom-up reflective cracking



Crack Relief Mixture @ HVS

1.50 in. Control
1.50 in. Control
2.5 in. Sawcut Existing Layer

Lane 1 – Section 1

1.50 in. HP Mix
1.00 in. HP CRM
2.5 in. Sawcut Existing Layer

Lane 2 – Section 1

2.00 in. Control
1.00 in. HP CRM
2.5 in. Sawcut Existing Layer

Lane 3 – Section 3

1.50 in. Control
1.00 in. HP CRM
2.5 in. Sawcut Existing Layer

Lane 3 – Section 1

1.50 in. Control
1.25 in. HP CRM
2.5 in. Sawcut Existing Layer

Lane 3 – Section 2

1.50 in. Control
1.00 in. PG 76-22 CRM
3.5 in. Sawcut Existing Layer

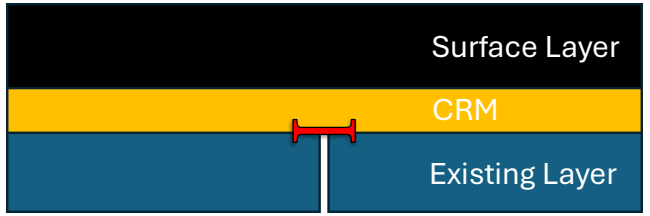
Lane 4 – Section 3

1.50 in. HP Mix + 20% RAP
1.00 in. HP CRM
2.5 in. Sawcut Existing Layer

Lane 4 – Section 1

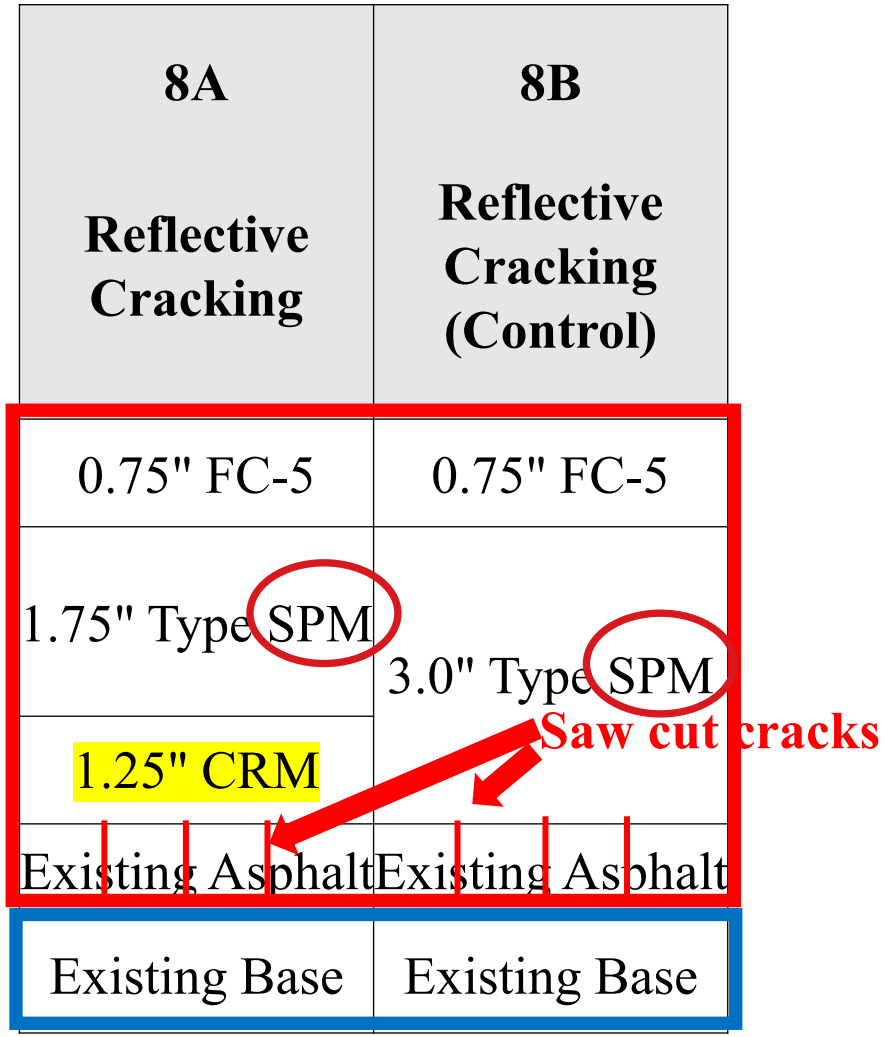
1.50 in. Control
1.25 in. PG 76-22 CRM
3.5 in. Sawcut Existing Layer

Lane 4 – Section 2



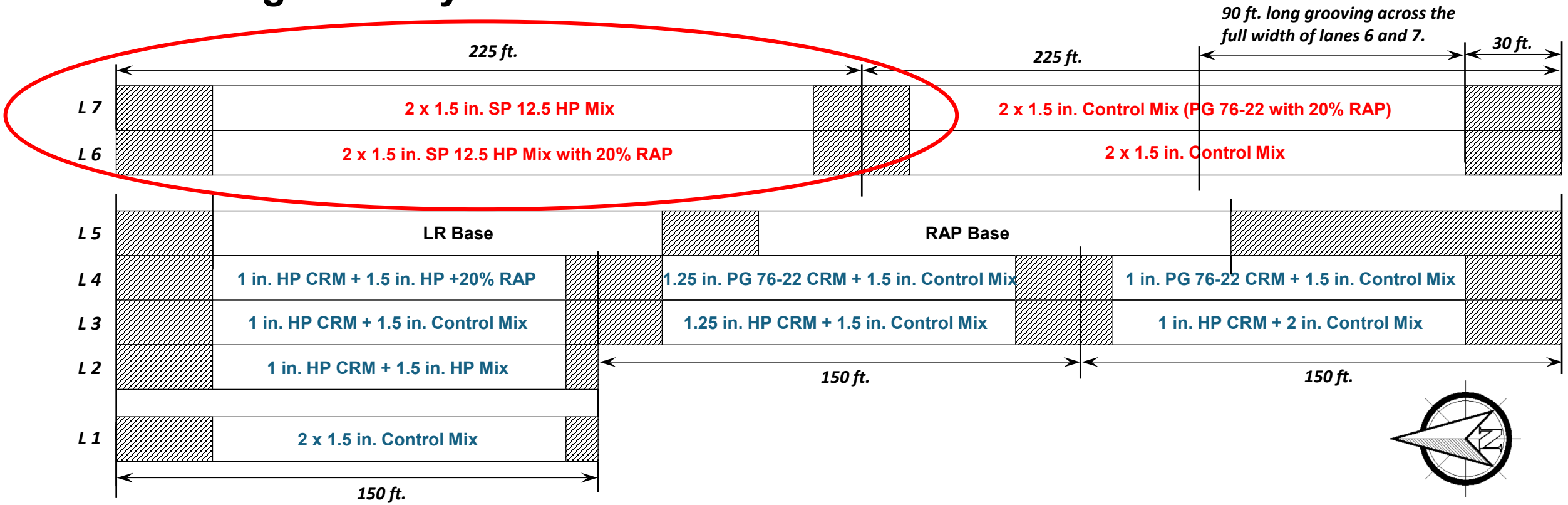
Crack Relief Mixture @ US 301

- Cracking is monitored under wheel-path and outside wheel-path
- After 12 months of traffic, insignificant cracking (<1% cracking) on both control and crack-relief sections



RAP in HP Mixtures @ HVS

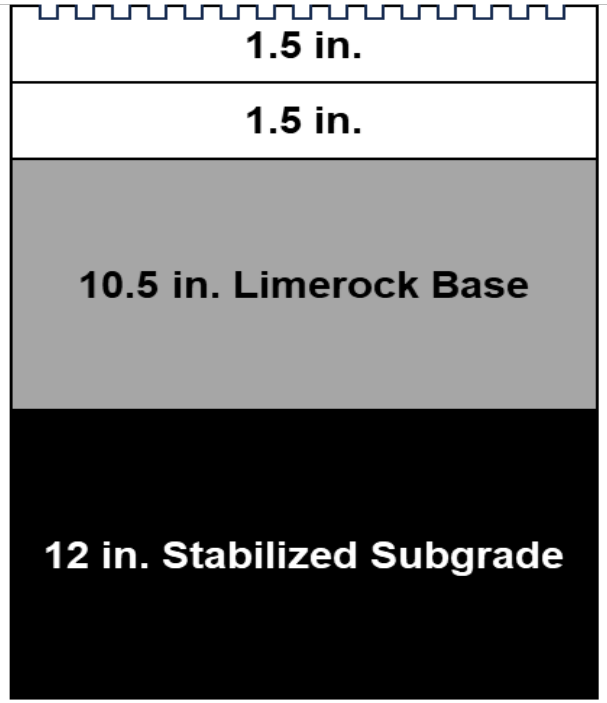
✓ Testing Plan Layout



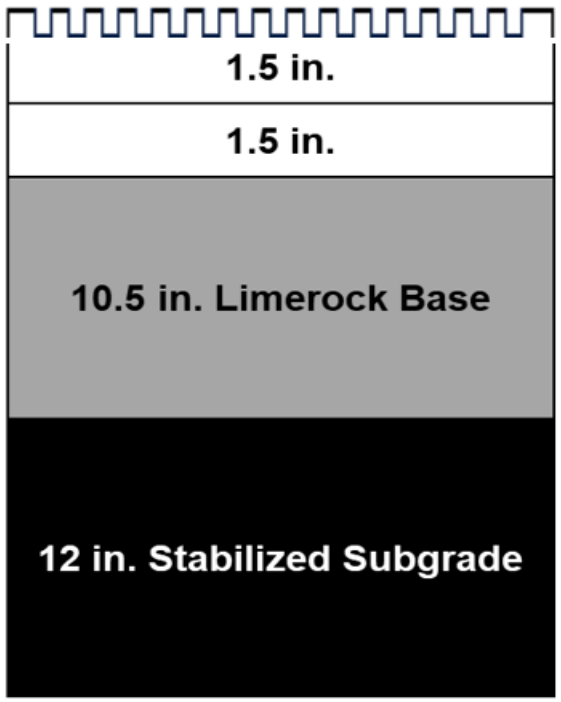
Longitudinal Grooving Study @ HVS

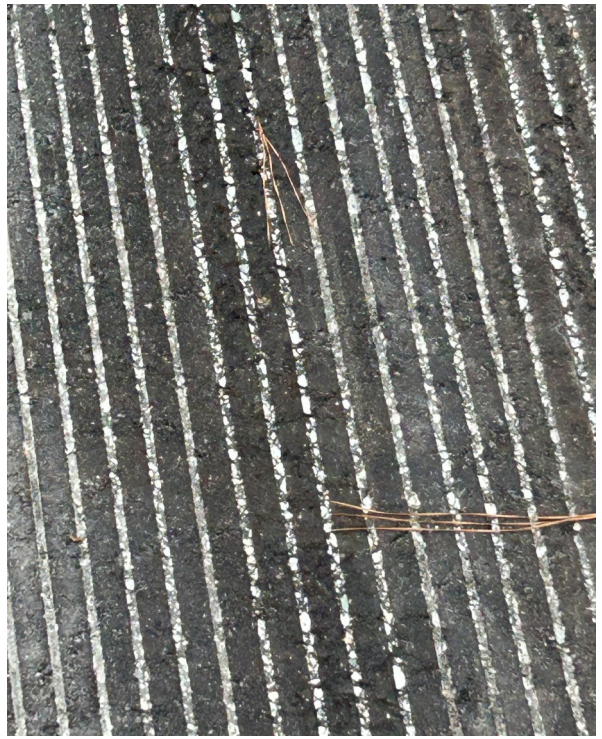
- Grooving pattern #1: ¾” (19 mm) spacing, 1/8” (3 mm) width, 1/8” (3 mm) depth
- Grooving pattern #2: ¾” (19 mm) spacing, 1/8” (3 mm), 1/4” (6 mm) depth

Grooving pattern #1



Grooving pattern #2

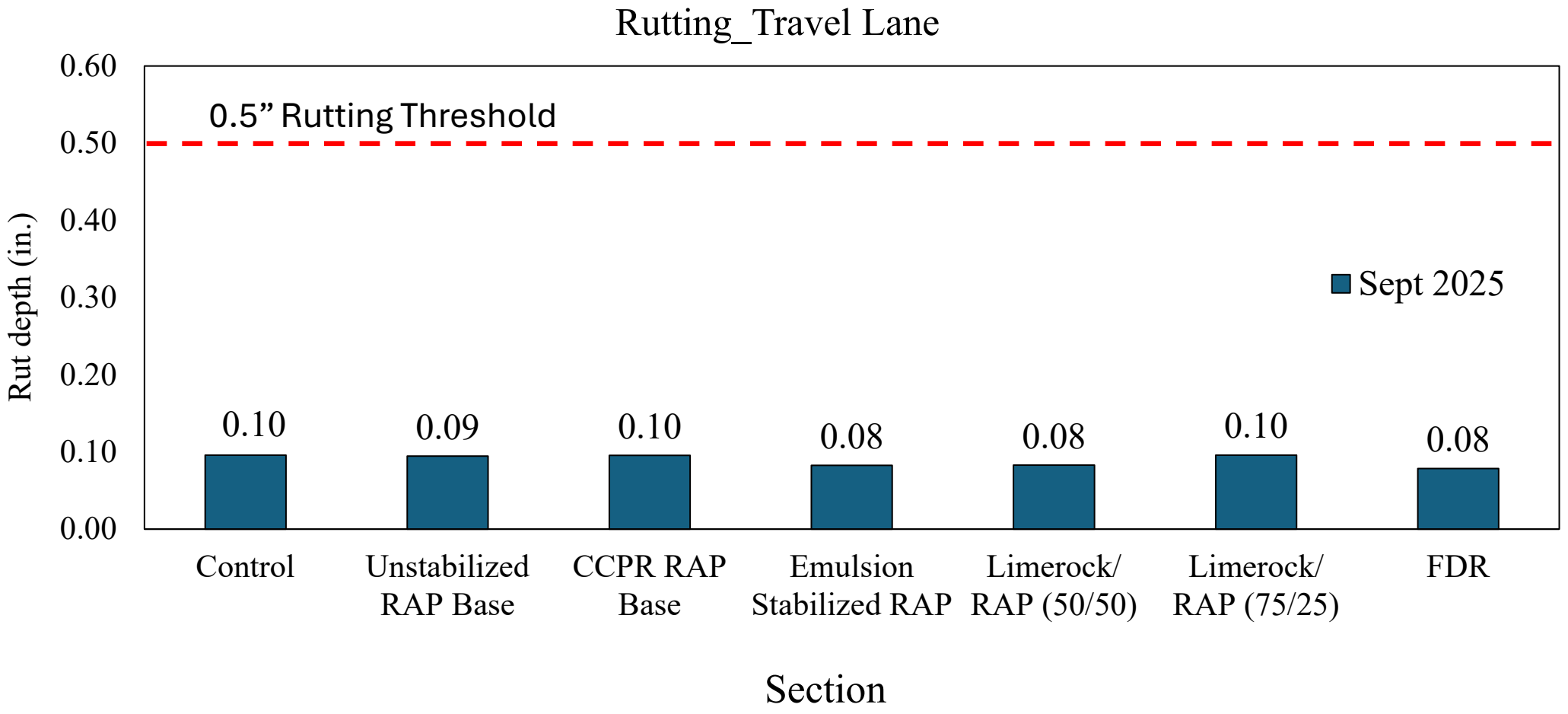




RAP Base Study @ US 301

1 Control	2 Unstabilized RAP Base	3 CCPR RAP Base	4 Emulsion Stabilized RAP Base Mixed in Place	5 Limerock/ RAP Base (50/50)	6 Limerock/ RAP Base (75/25)	7 Full-Depth Reclamation
0.75" FC-5	0.75" FC-5	0.75" FC-5	0.75" FC-5	0.75" FC-5	0.75" FC-5	0.75" FC-5
2" Type SPM	2" Type SPM	2” Type SPM	2" Type SPM	2" Type SPM	2" Type SPM	2" Type SPM
4" Type SP	4" Type SP	4" Type SP	4" Type SP	4" Type SP	4" Type SP	4" Type SP
12" Limerock	12" Unstabilized 100% RAP Base	12" CCPR RAP Base	12" Emulsion Stabilized RAP Base	12" Limerock/ RAP Base (50/50)	12" Limerock/ RAP Base (75/25)	12" FDR (Mill 6.75")

RAP Base Study @ US 301



RAP Base Study @ HVS

RAP Base Study @ HVS

- Five Testing areas (3 rutting experiments and 2 cracking experiments)
- Testing is in-progress
- One rutting and one cracking experiments are in preparation

In-Progress Outsourced Projects

- 15% RAP in FC-5 mixtures (NCAT)
- 20% RAP in High Polymer mixtures (FSU)
  - These projects will study the impact on mixture performance (especially cracking and raveling).

Thank you
Comments/Questions?

Mohab El-Hakim, Ph.D., P.E.
Asphalt Research Engineer
mohab.el-hakim@dot.state.fl.us
Office: 352-955-6632