Asphalt Research Update

Asphalt Expo and Conference
December 17, 2024

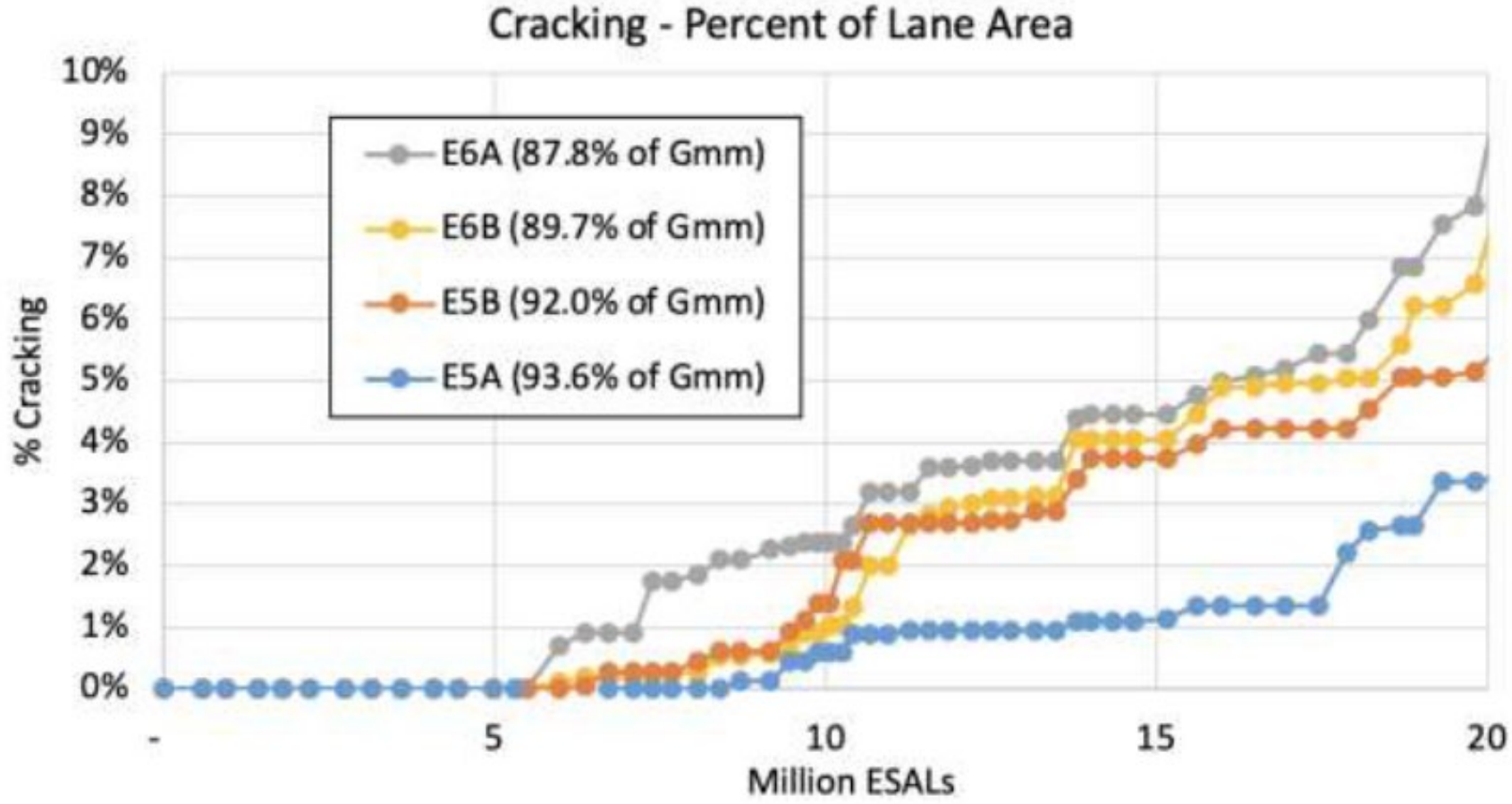
Greg Sholar

NCAT Test Track

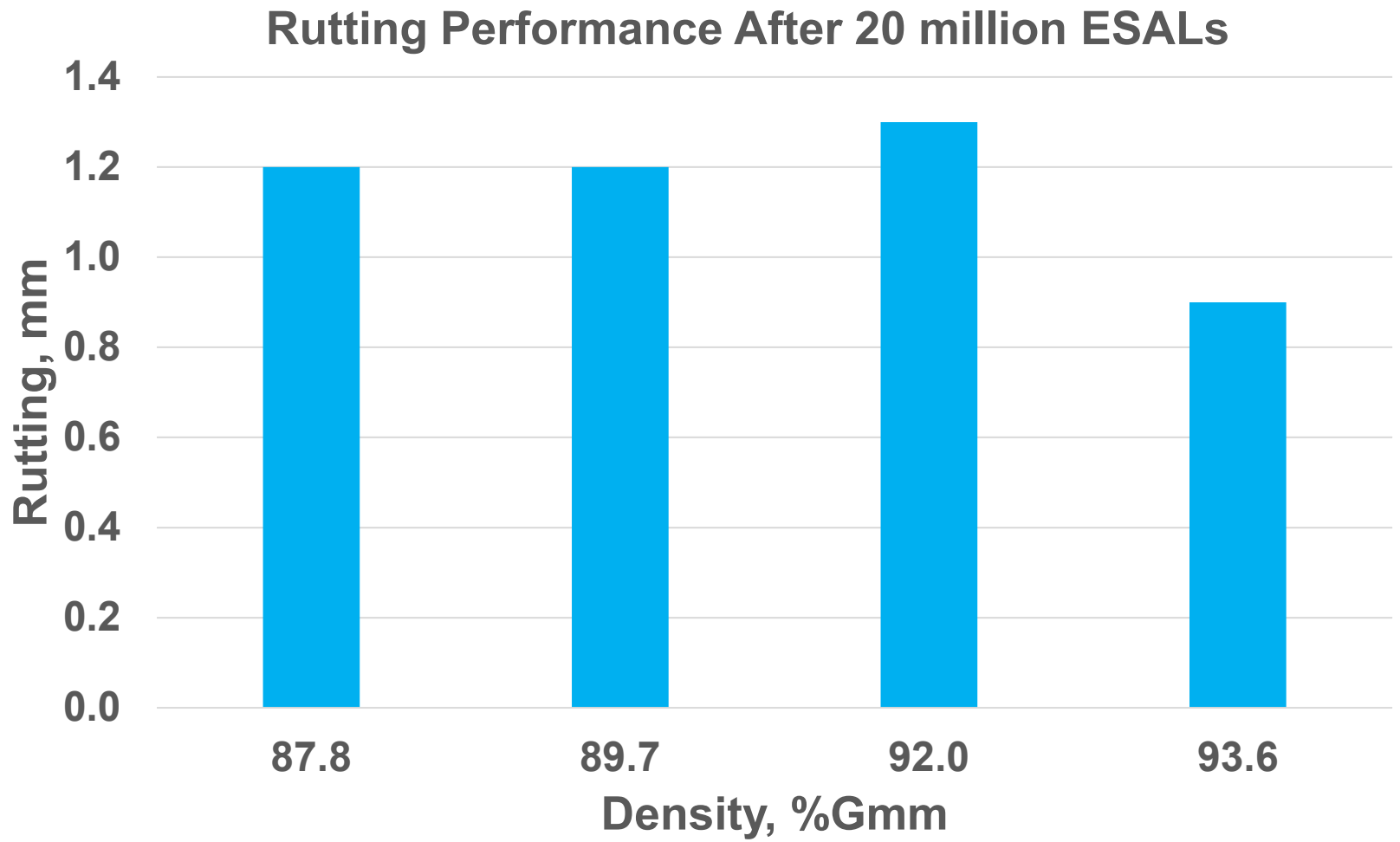
- 5 trucks
- 46 test sections
- 5 million ESALs per year
- Traffic for 2 years

NCAT Test Track

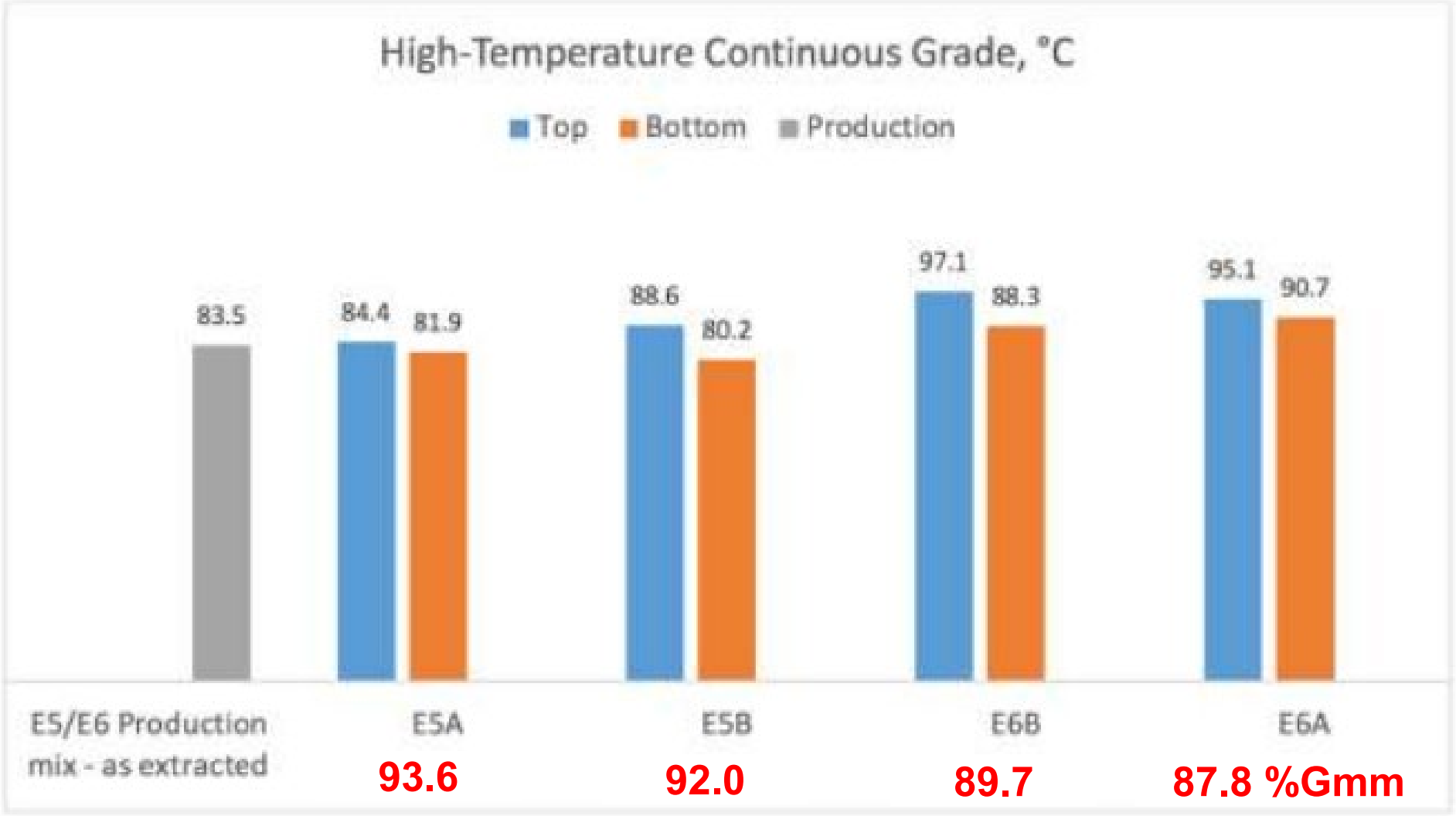
- Effect of in-place density on rutting and cracking after 20 million ESALs.



NCAT Test Track



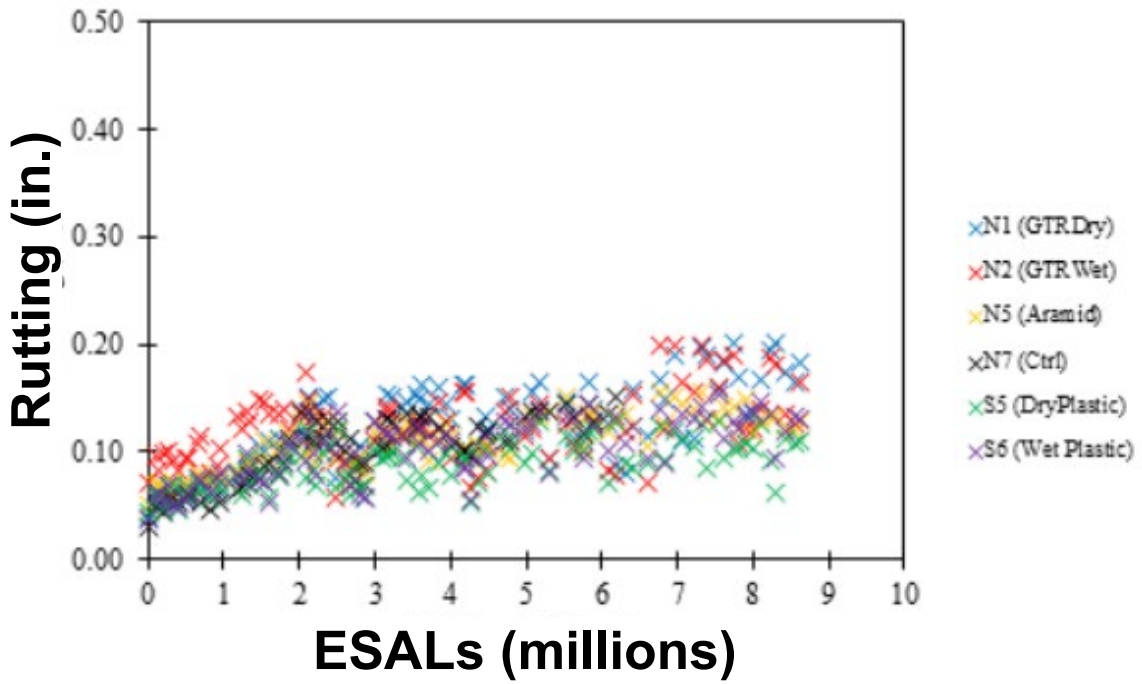
NCAT Test Track

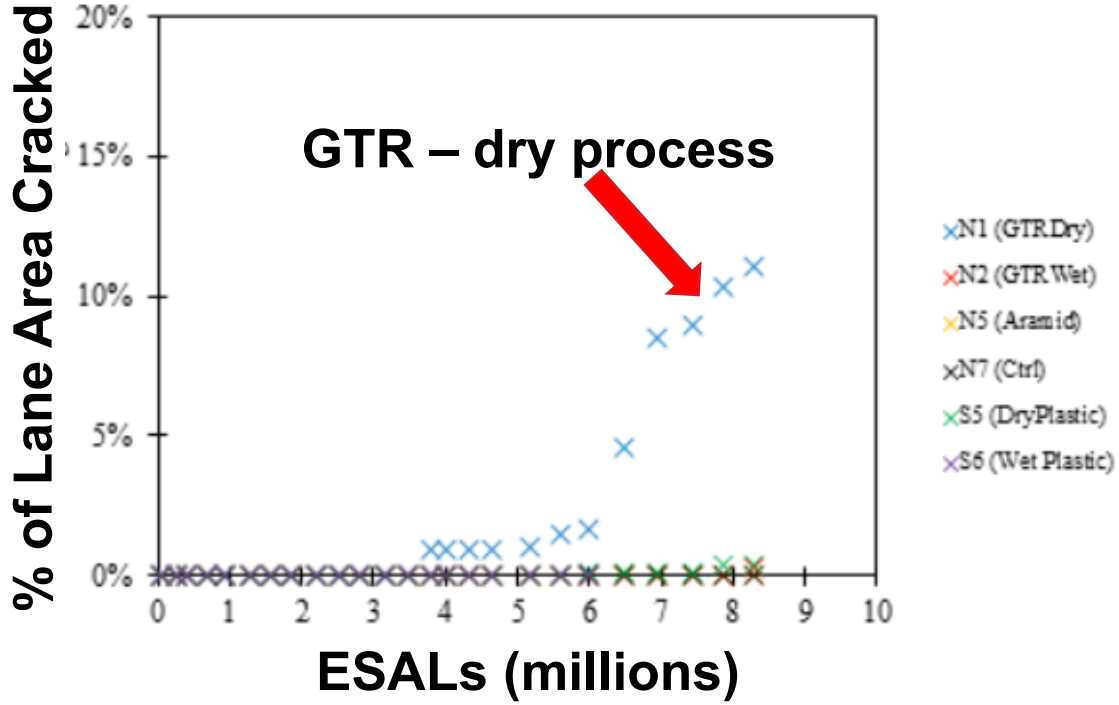


NCAT Test Track

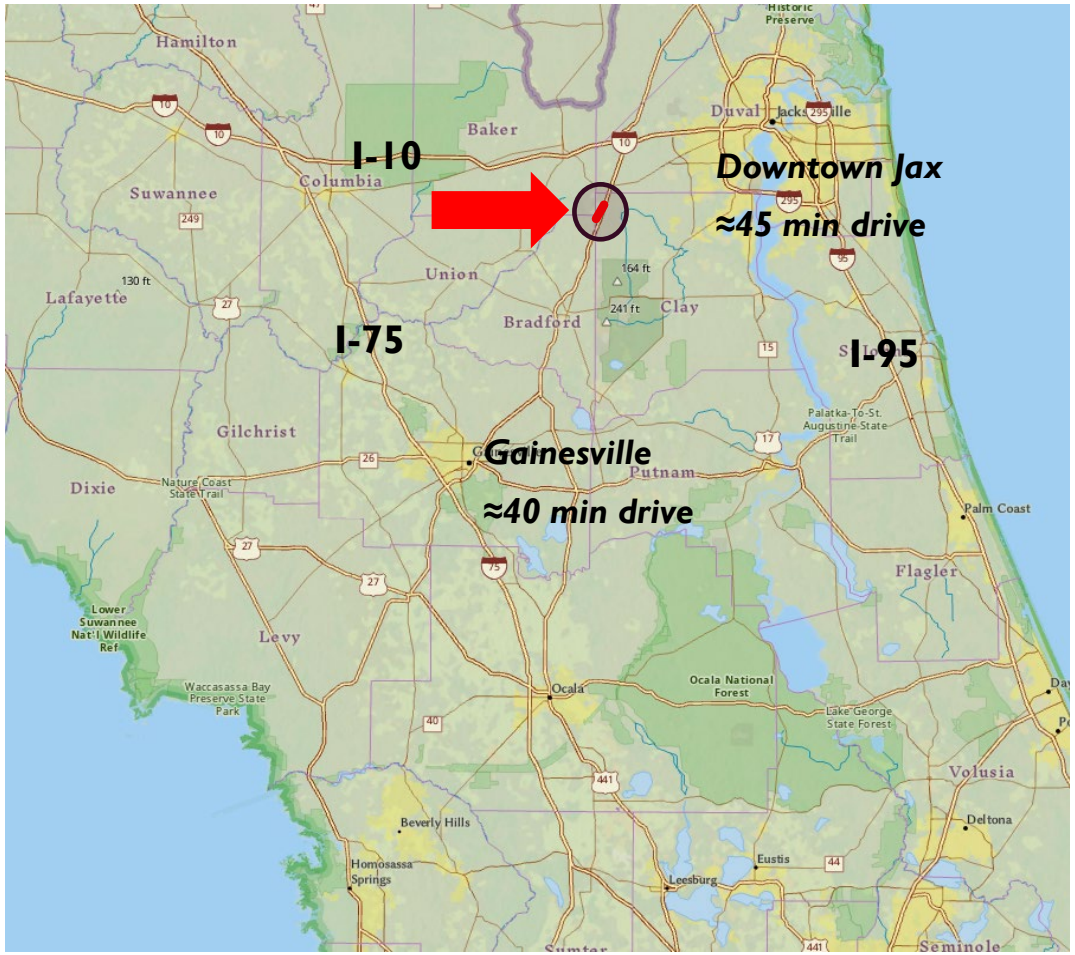
- **Participating in group study examining the effects of additives on rutting and cracking:**
  - Aramid (Kevlar) fibers.
  - Ground tire rubber (wet and dry processes).
  - Plastics (wet and dry processes).
  - Control section with no additive.

NCAT Test Track



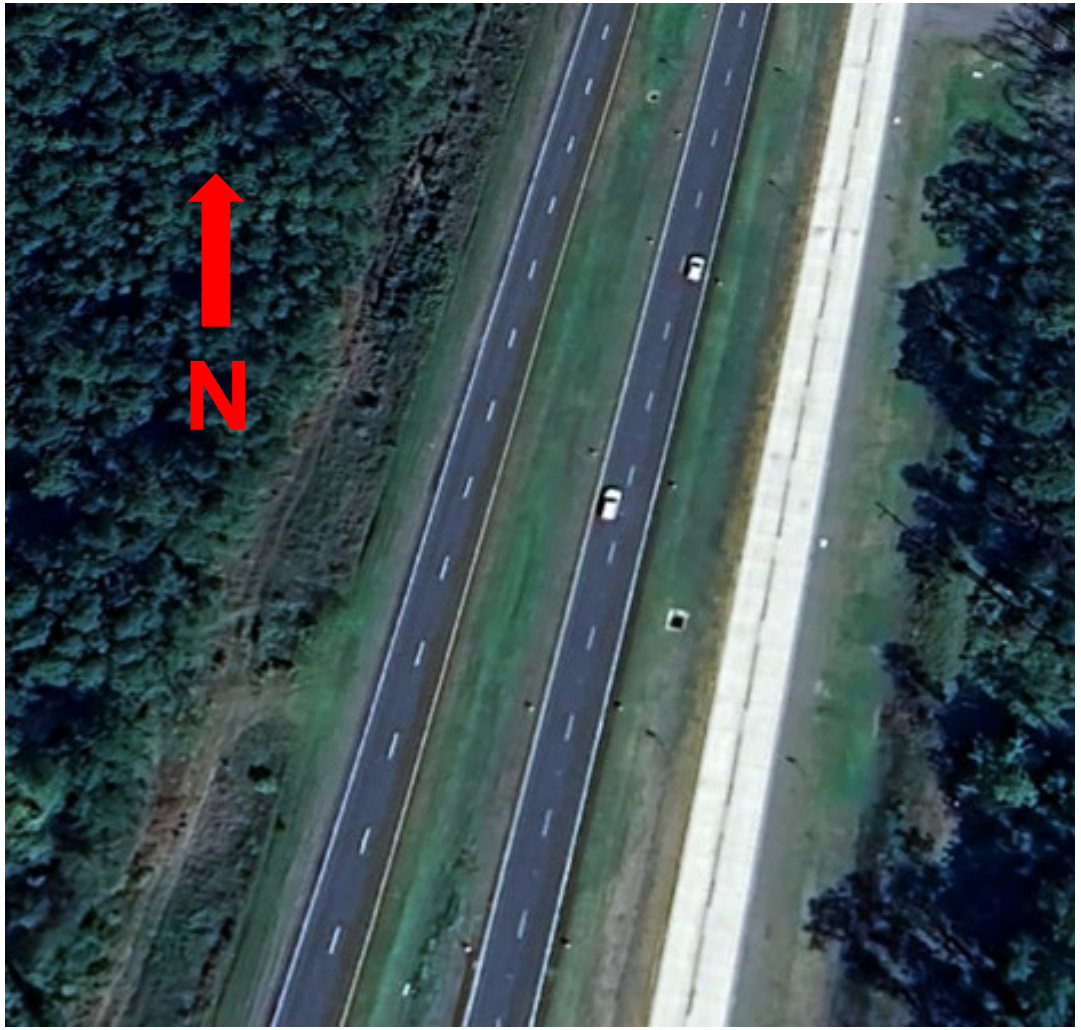


Asphalt Test Road



- US 301 (SR 200) in Clay County.
- Approximately 2.3 miles long.
- 12 test sections, 1000 ft. long.

Asphalt Test Road



- **Southbound travel lanes:**
  - Asphalt Test Road
- **Northbound travel lanes:**
  - Concrete Test Road
- **Middle lanes:**
  - Diversion Lanes
- **Traffic started Sept. 26, 2024.**

Asphalt Test Road

- **Five Primary Studies**
  - Base Study
  - Thick Lift HMA Study
  - Reflective Cracking Mitigation Study
  - Alternative Mix Design Protocol Study
  - Open Graded Friction Course Study

Asphalt Test Road – Base Sections

- Milled all existing asphalt pavement.
- Excavated the existing base down to the stabilized subgrade.
- Reconstructed the base sections with various materials.

Asphalt Test Road – Base Sections

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")

Asphalt Test Road – Asphalt Sections

8A Reflective Cracking	8B Reflective Cracking (Control)	9 Superpave 5	10A Deep Lift (HP)	10B Deep Lift (76-22)	11 FC-5 Only (Control)	12 FC-Q (FC-7) Only
0.75" FC-5	0.75" FC-5	0.75" FC-5	0.75" FC-5	0.75" FC-5	1.0" FC-5	1.0" FC-Q(7)
1.75" Type SPM	3.0" Type SPM	3.0" Type SP5	1.5" Type SPH, HP Binder	1.5" Type SPM	Existing Asphalt	Existing Asphalt
1.25" CRM	Saw cut cracks		6.0" Type SPH, HP Binder	6.0" Type SPM		
Existing Asphalt	Existing Asphalt	Existing Asphalt				
Existing Base	Existing Base	Existing Base	Existing Base	Existing Base	Existing Base	Existing Base

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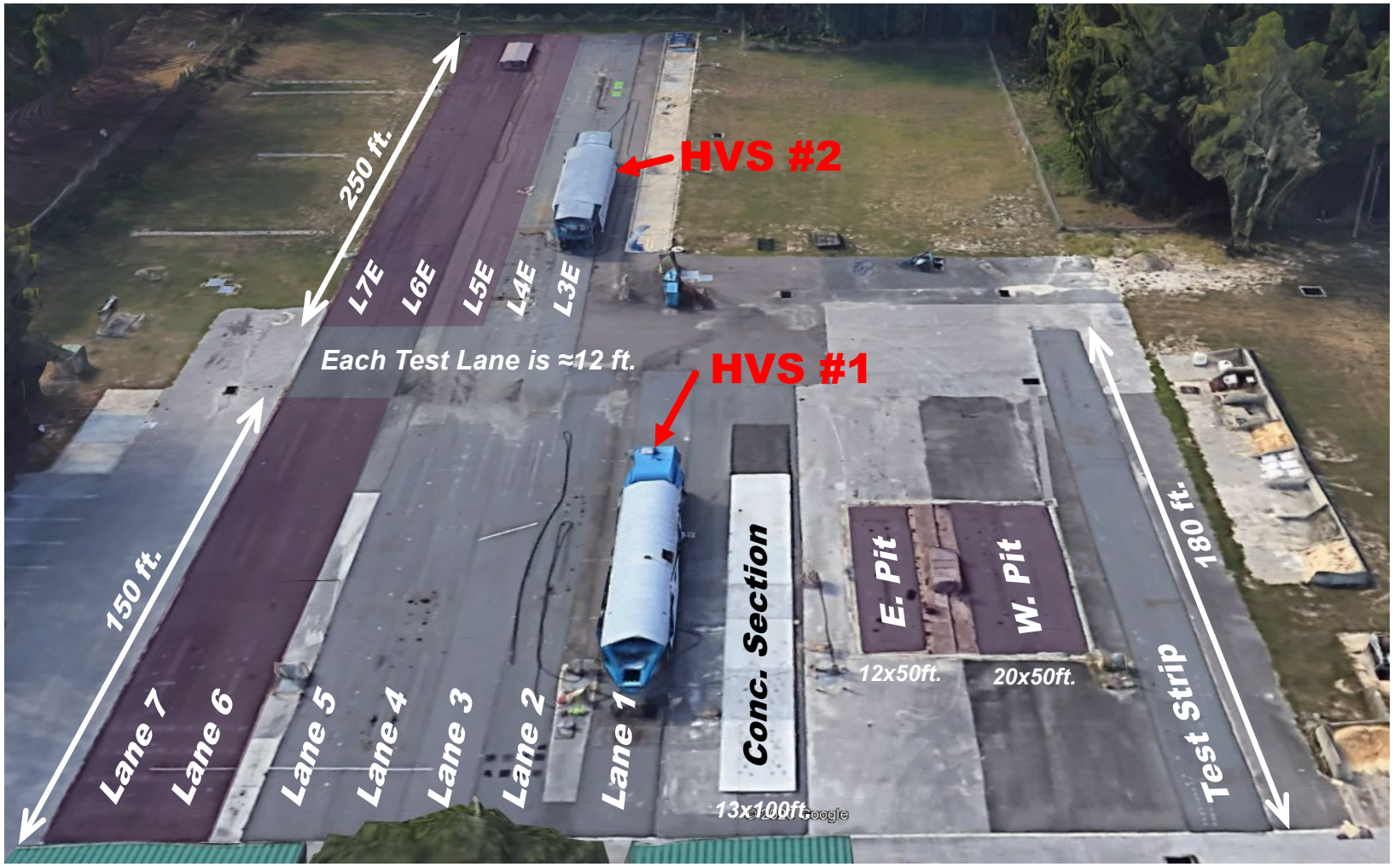
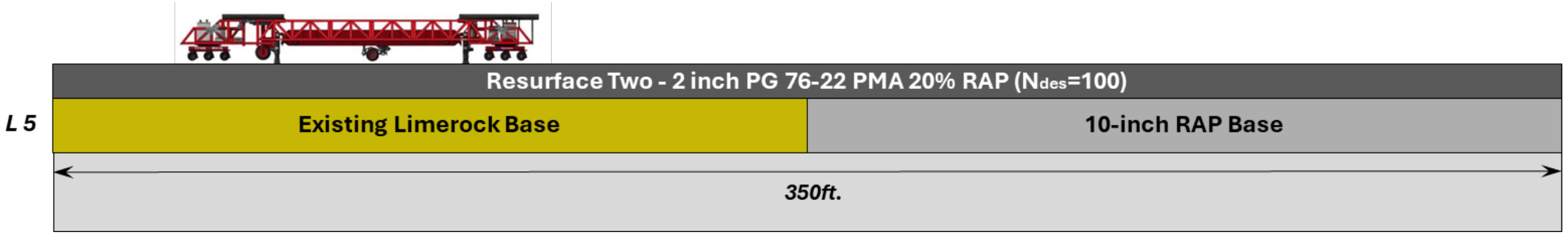
FDOT Heavy Vehicle Simulator

FDOT Heavy Vehicle Simulator



FDOT Heavy Vehicle Simulator – RAP Base Study

- **Objective: Evaluate un-stabilized RAP as a base.**
- **Construction:**
  - Two 5-inch layers of RAP base.
  - Two 2-inch layers of HMA (SP-12.5, PG 76-22 with 20% RAP).



FDOT Heavy Vehicle Simulator – RAP Base Study

FDOT Heavy Vehicle Simulator – RAP Base Study

FDOT Heavy Vehicle Simulator – RAP Base Study

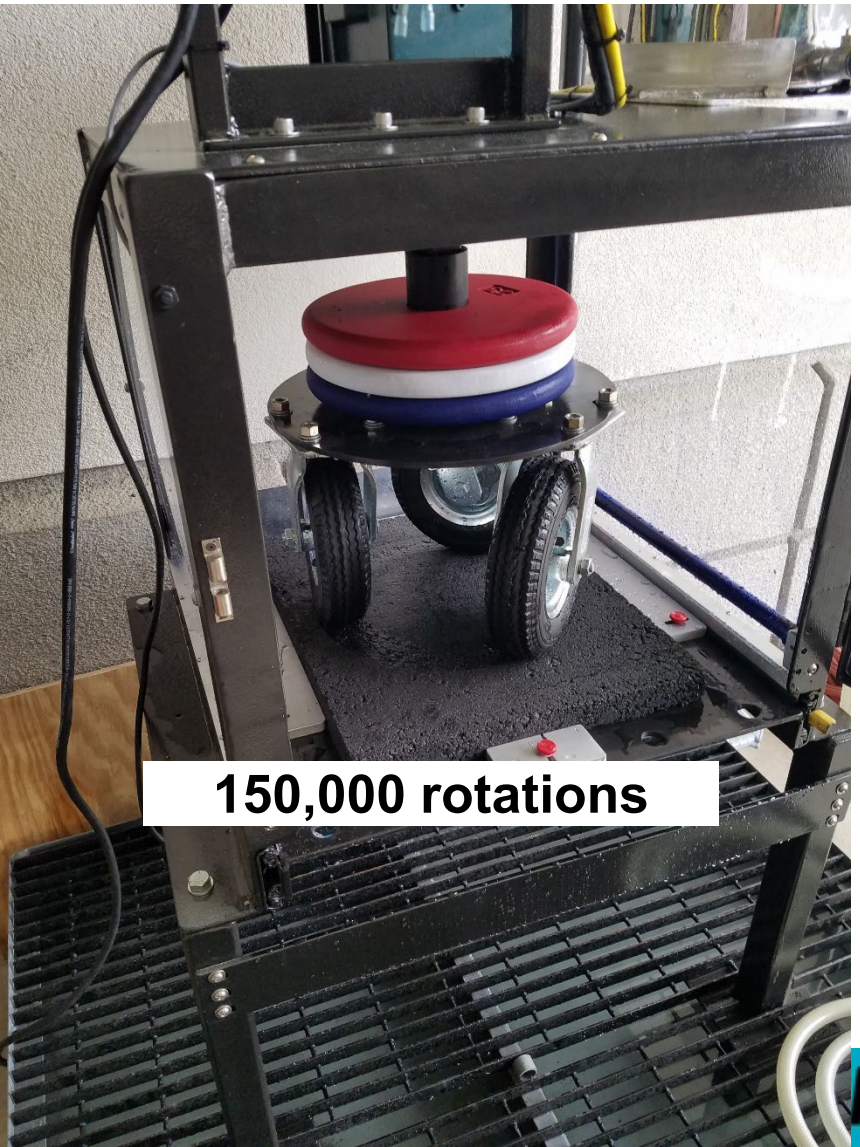
- Top layer nuclear gauge density: 85.5% Gmm.
- Bottom layer nuclear gauge density: 84.3% Gmm.
- Density readings were corrected for moisture.

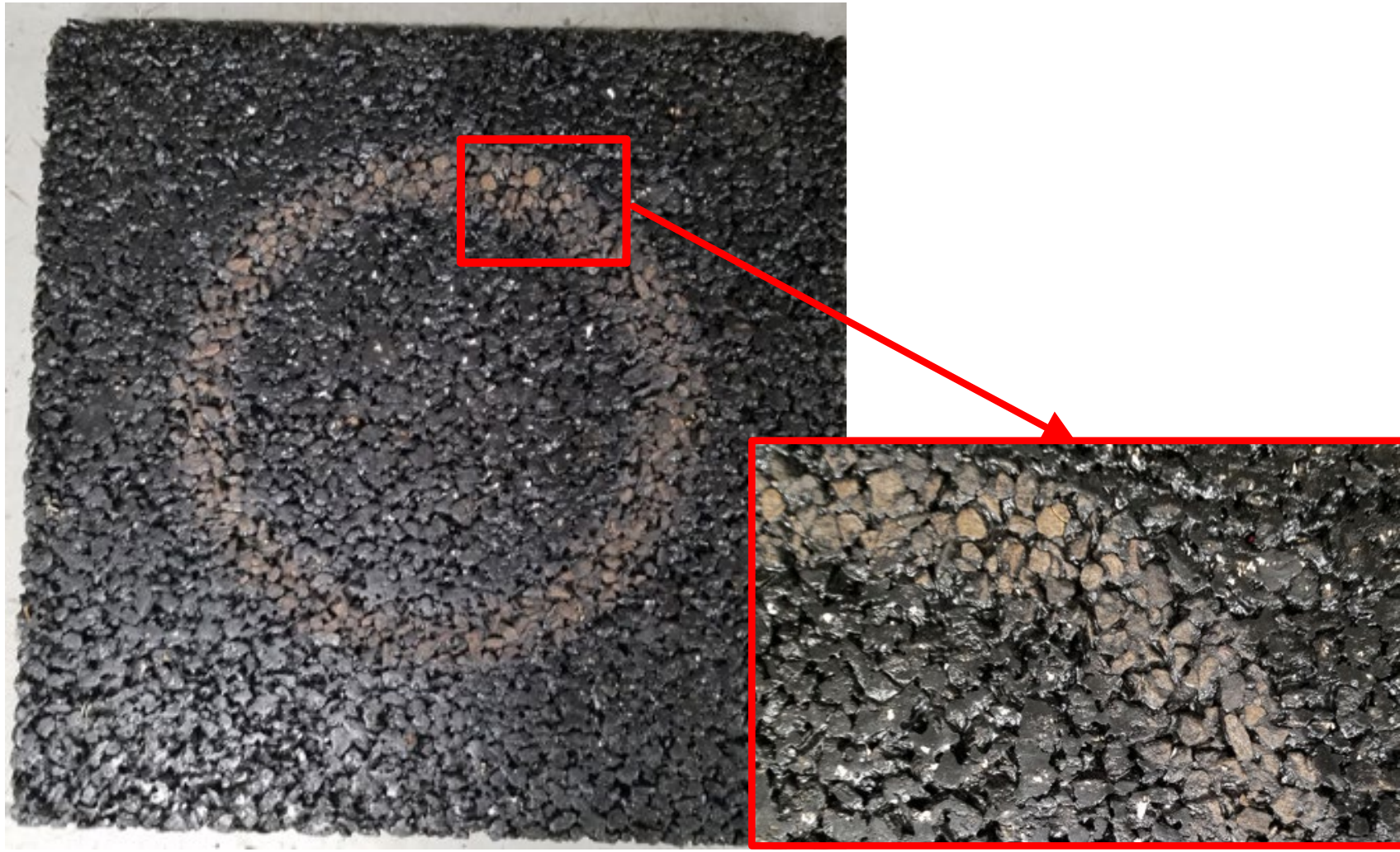
FDOT Heavy Vehicle Simulator – RAP Base Study

- **High temperature testing for rutting.**
  - 100,000 Passes of 9-kip Load.
  - Super Single Tire.
  - Uni-directional Passes.
- **Ambient temperature testing for cracking.**
  - 500,000 Passes of 15-kip Load.
  - Dual Tire.
  - Bi-directional Passes.

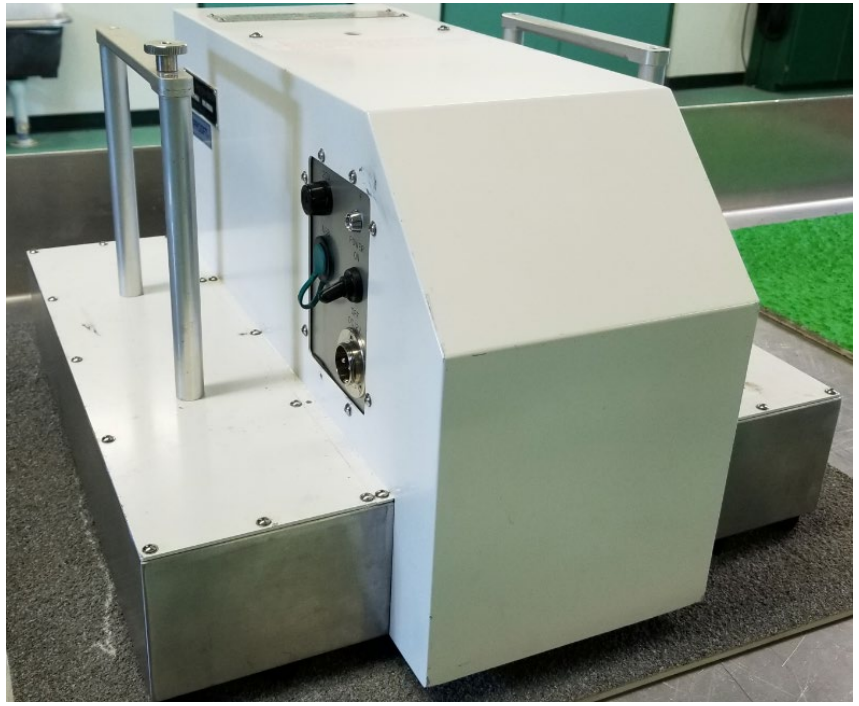
Pavement Wearing and Friction Determination

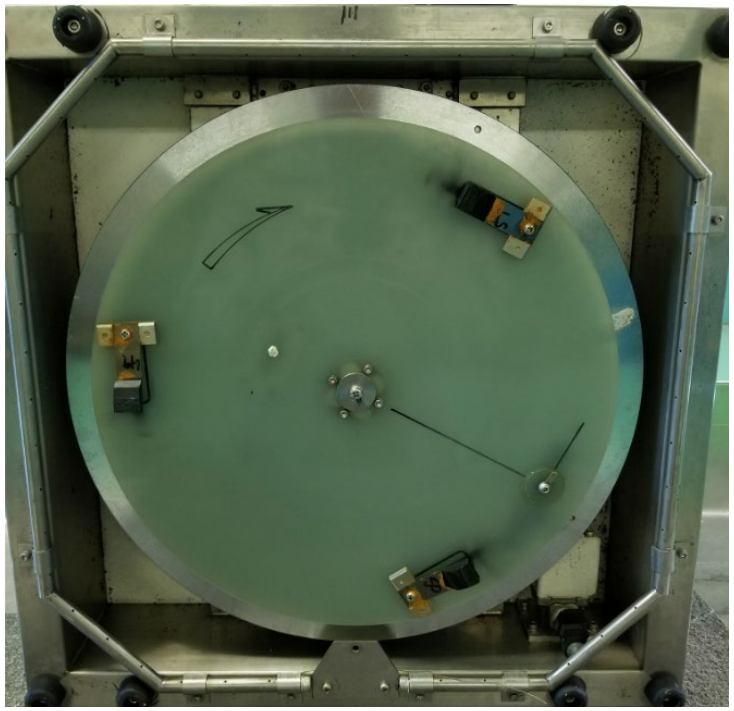
Pavement Wearing and Friction Determination





Pavement Wearing and Friction Determination

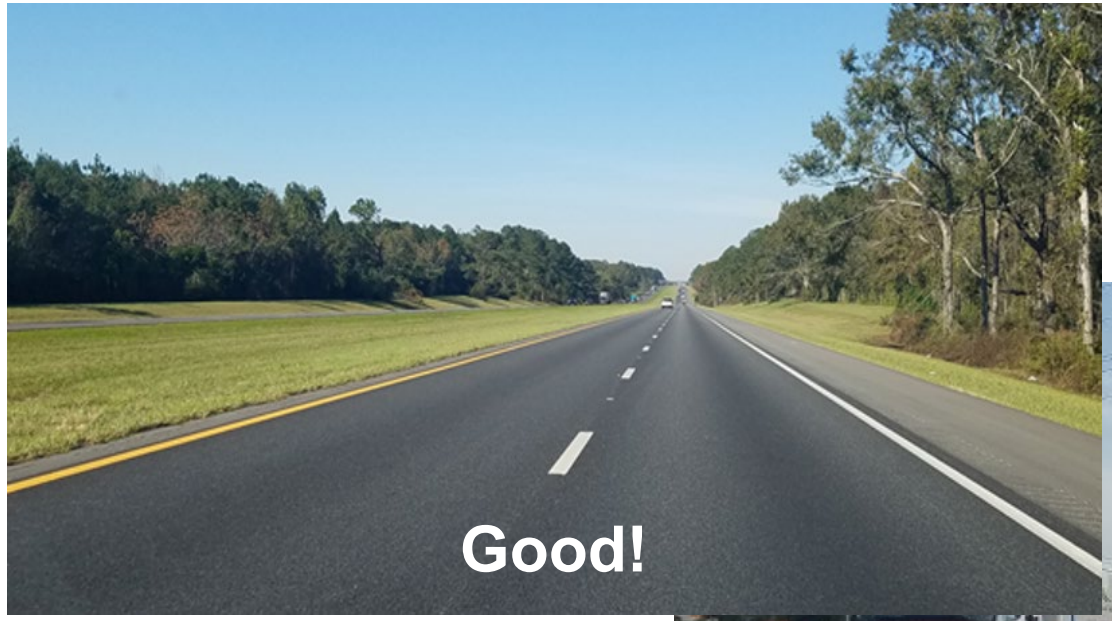




Pavement Wearing and Friction Determination

- **Allows expedited evaluation.**
- **Previous process required a roadway test section and the application of six million vehicle passes.**
- **Results so far:**
  - Approved 20% RAP in limestone dense graded friction course.
  - Approved Basalt, Gabbro, and Quartzite as approved friction aggregates with up to 20% RAP.

OGFC for Suburban Environments (NCAT)



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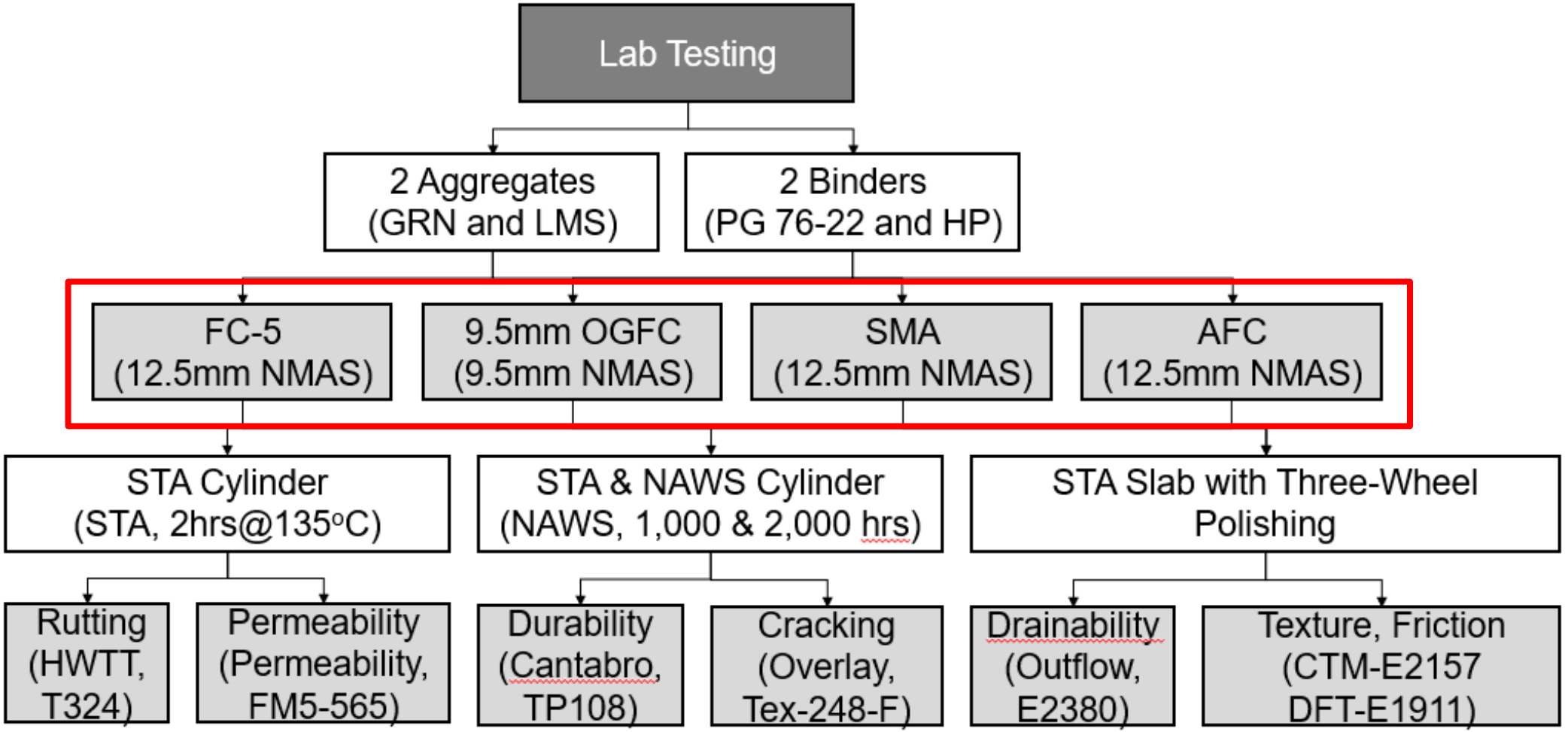

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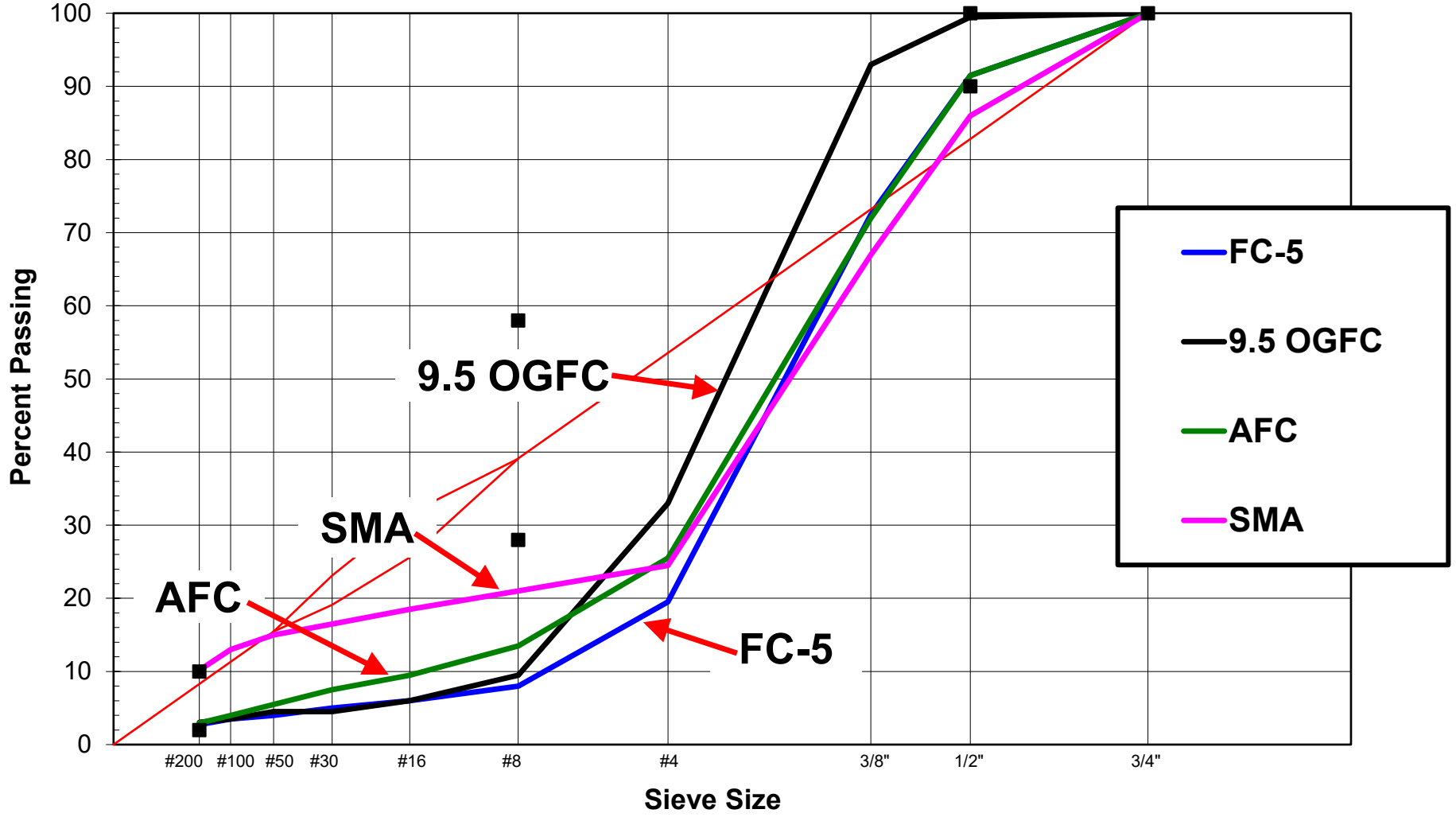


OGFC for Suburban Environments (NCAT)

Factor	Durability	Permeability	Drainability	Cracking Resistance	Rutting Resistance	Friction	Macrotexture
FC-5	O	O	O	O	O	O	O
HP	++	O	O	++	O	O	O
9.5 mm OGFC	+	O	O	O	O	O	O
Alternative FC	++	—	—	+	+	+	—
SMA	++	— —	— —	+	++	+	— —

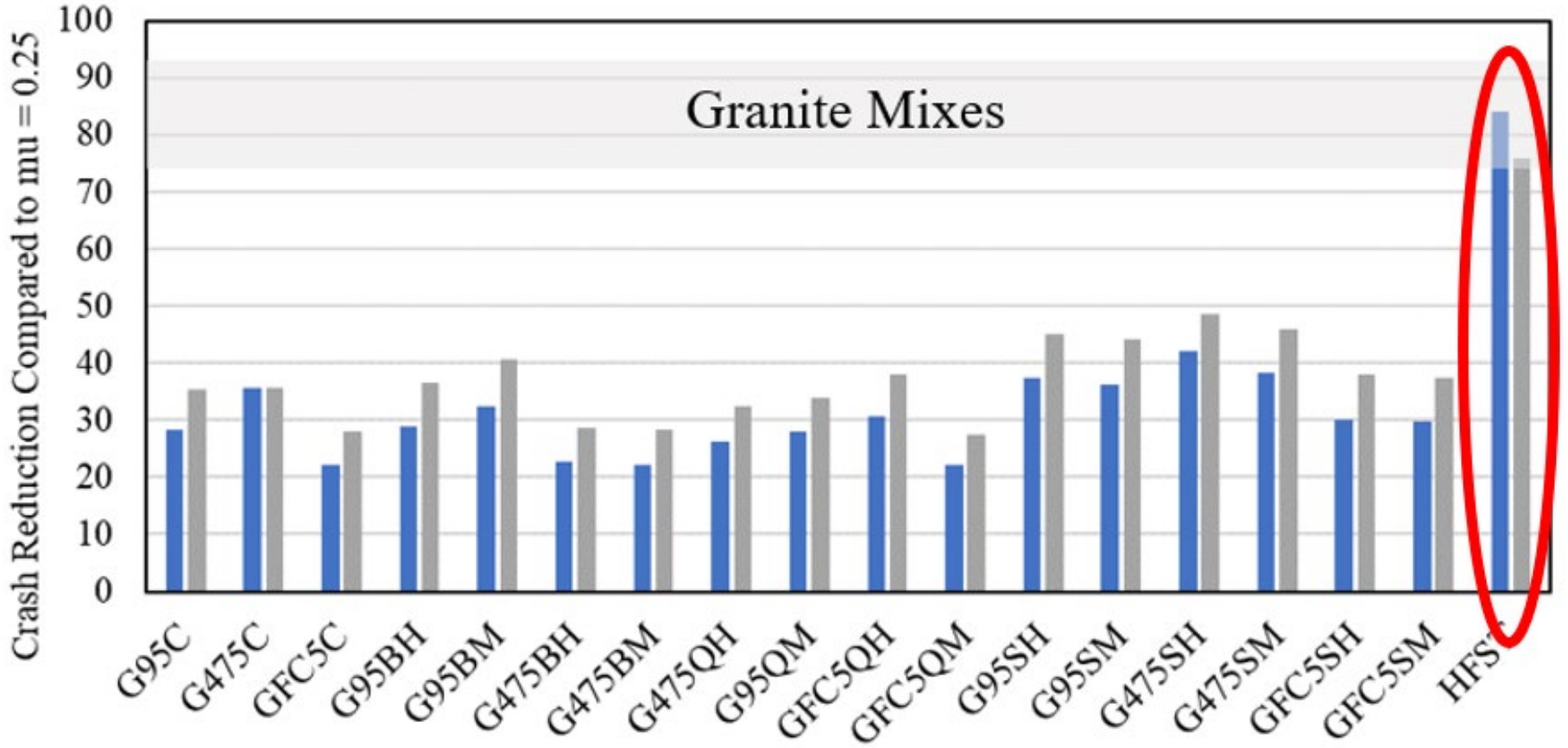
Alternative Friction Overlays (NCAT)

- Explored asphalt-based alternatives to standard High Friction Surface Treatment (epoxy with calcined bauxite aggregate).

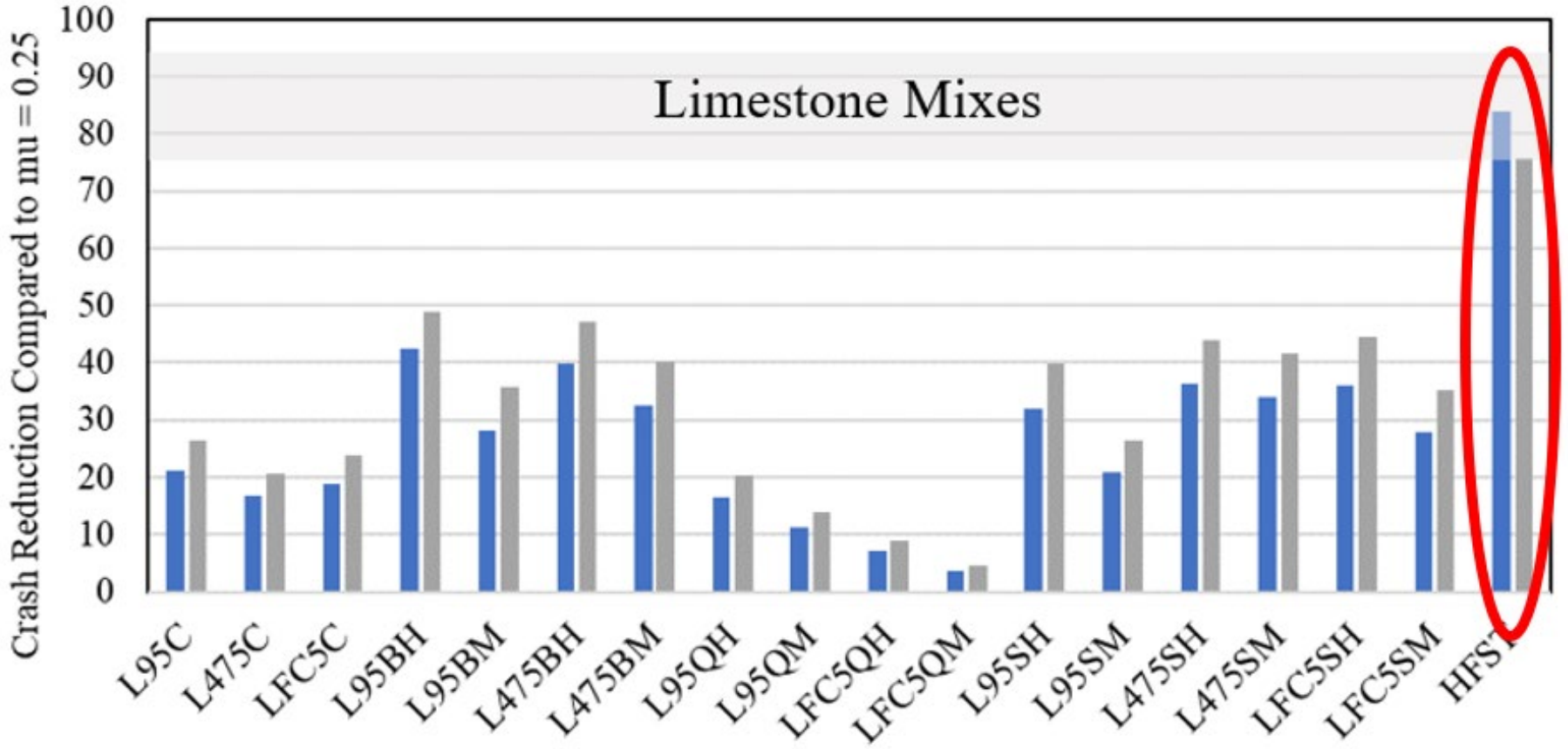
Alternative Friction Overlays (NCAT)

- Studied the addition of quartzite, slag, and calcined bauxite vs. control.
- FC-4.75, FC-9.5, and FC-5.
- Used 3-wheel polisher and DFT.

Alternative Friction Overlays (NCAT)



Alternative Friction Overlays (NCAT)

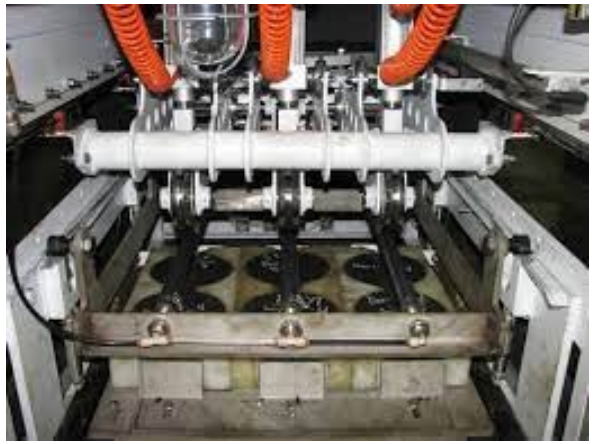


Alternative Friction Overlays (NCAT)

- **Conclusion:**
  - "None of the mixes in this study produced results comparable to HFST."

Balanced Mix Design Benchmarking of FL Mixtures

- Work performed by the University of Florida.
- Benchmarked 15 mixtures at mix design and 15 mixtures at production.

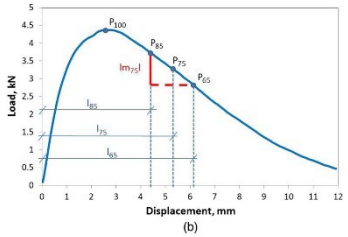


APA

Hot IDT

Ideal RT

Rutting



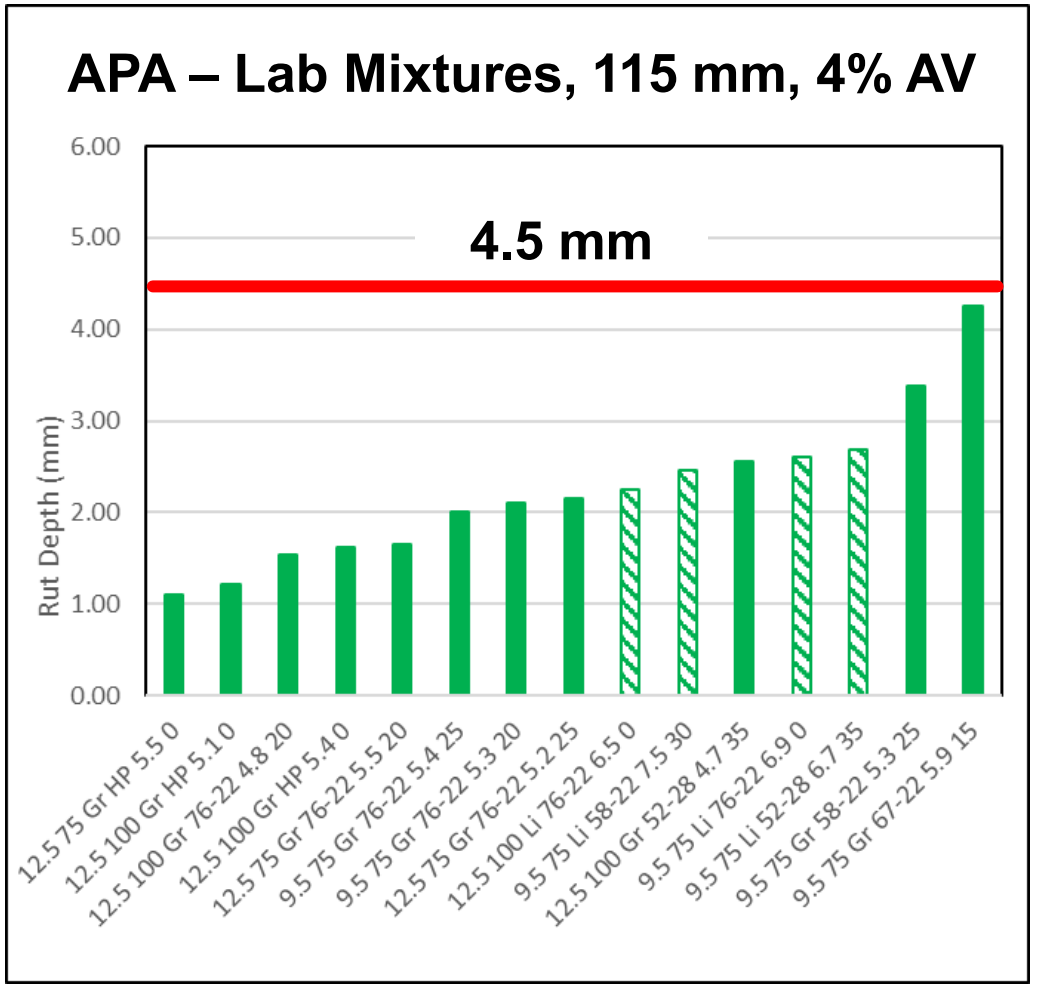
Ideal CT

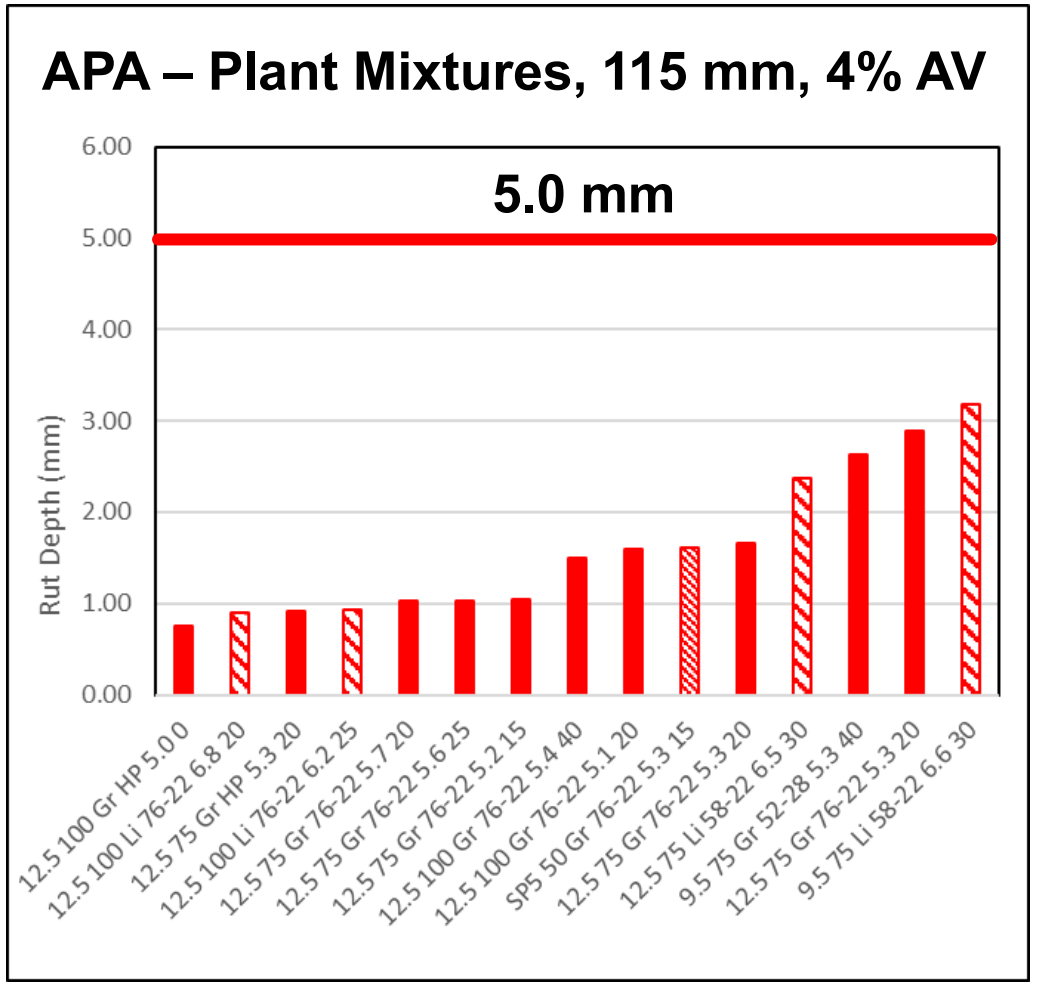
Cracking

Balanced Mix Design Benchmarking of FL Mixtures

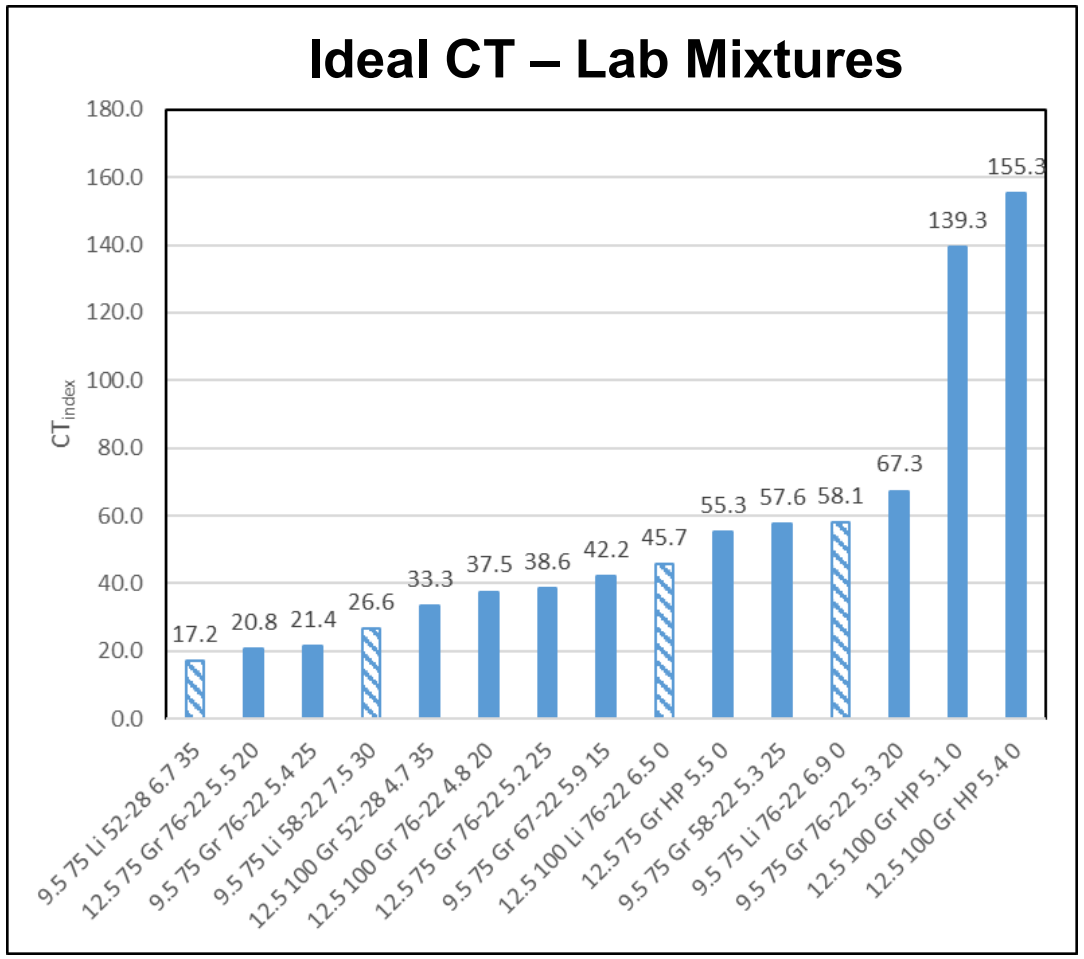
- Examined mixtures with different binder types, NMAS, aggregate type, Ndesign gyrations, and eleven contractors.
- A large number of conclusions.

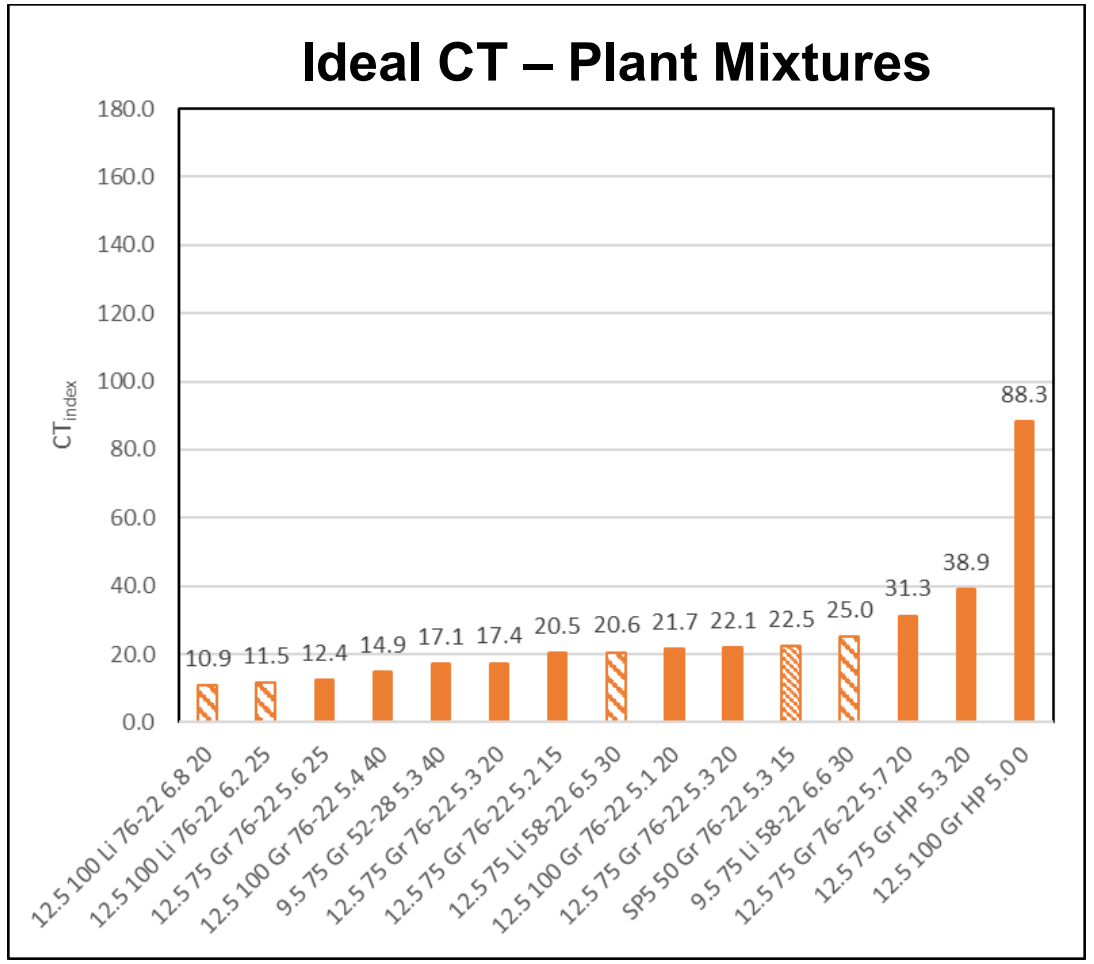
Balanced Mix Design Benchmarking of FL Mixtures





Balanced Mix Design Benchmarking of FL Mixtures





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New Crack Relief Mixture (UF)

- Used for prevention of reflective cracking (bottom to top propagation). Not for top-down cracking.

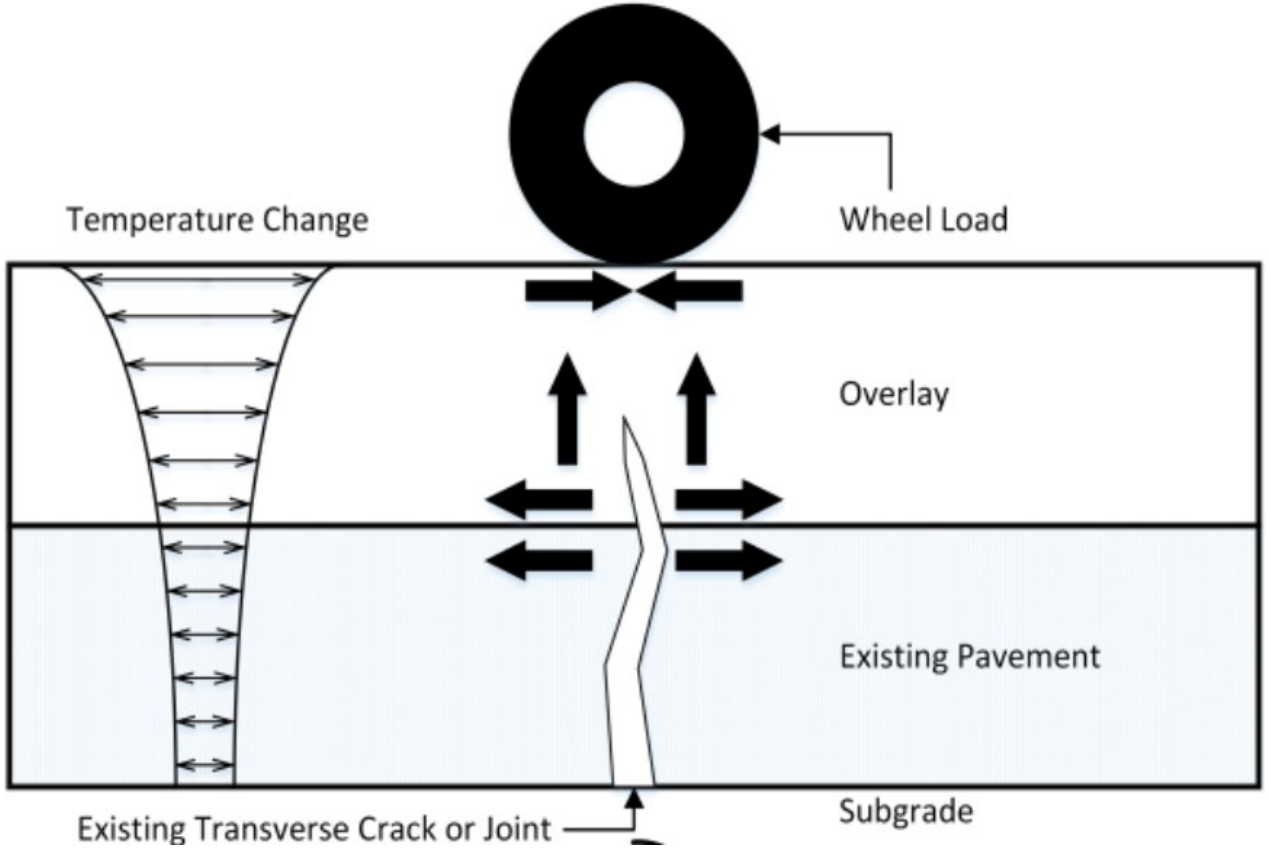

Photo by: Nithin Sudarsanan

New Crack Relief Mixture (UF)

- Placed on Asphalt Test Road.
- Layer thickness: 1.0 to 1.25” thick. (1.25” on Test Road).
- SP-9.5 coarse graded mix.
- PG 76-22 or HP binder. No RAP. (HP used on Test Road).
- Ndesign = 50.

- Air voids = 2.0%
- VMA = 17% minimum.
- Target density = 96.5 %Gmm.
- Minimum density = 93.0 %Gmm.

Photo by: Nithin Sudarsanan

Evaluation of RAP in FC-5 and High Polymer Mixtures

- Two separate projects.
- 15% RAP in FC-5 mixtures.
- 20% RAP in High Polymer mixtures.
- Will study the impact on mixture performance (especially cracking and raveling).

Evaluating Asphalt in Flooded Conditions (UF)

- Goal is to assure asphalt mix durability when submerged in water and at times trafficked.

Thank you.
Comments/Questions?

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