Florida's Concrete Test Road Project Overview

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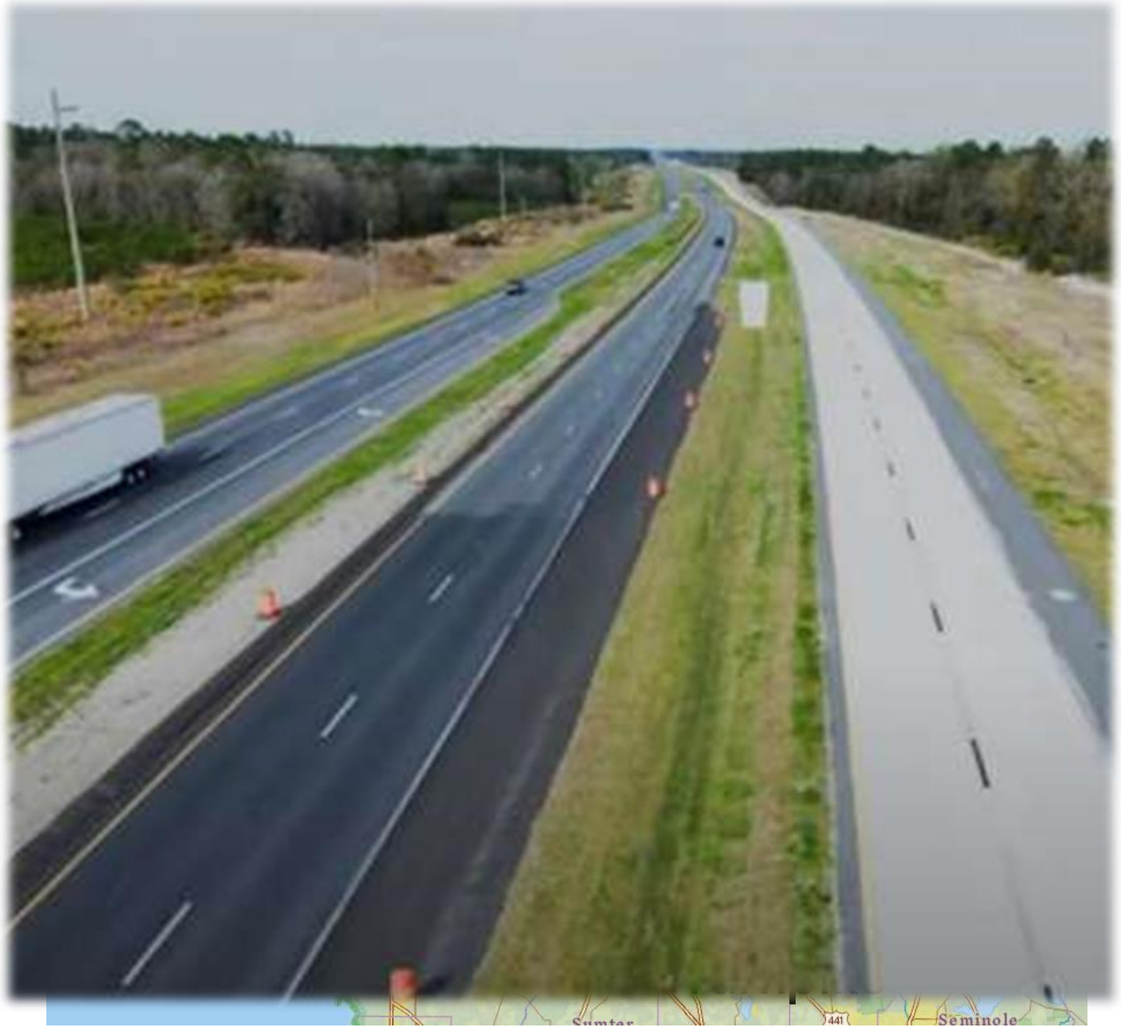
Presentation Outline

- Review of Test Sections
- Initial Performance Measurements
- Early Observations

Concrete Test Road: Location

- Clay County, US 301 (SR 200)
- Adjacent to Existing NB Lanes
- Significant Truck Corridor Connecting SW & NE Florida
- Interconnects Multiple Seaports and Rail Yards



Test Road Research Needs

- Structural Test Section
  - Appropriate thickness
  - New base options
  - RAP as a concrete aggregate
- Drainage Test Section
  - Edge drain effectiveness
- Calibration Test Section
  - Cracking model coefficients
  - Time to friction loss
  - Warp/curl gradient
- Alternative surface textures

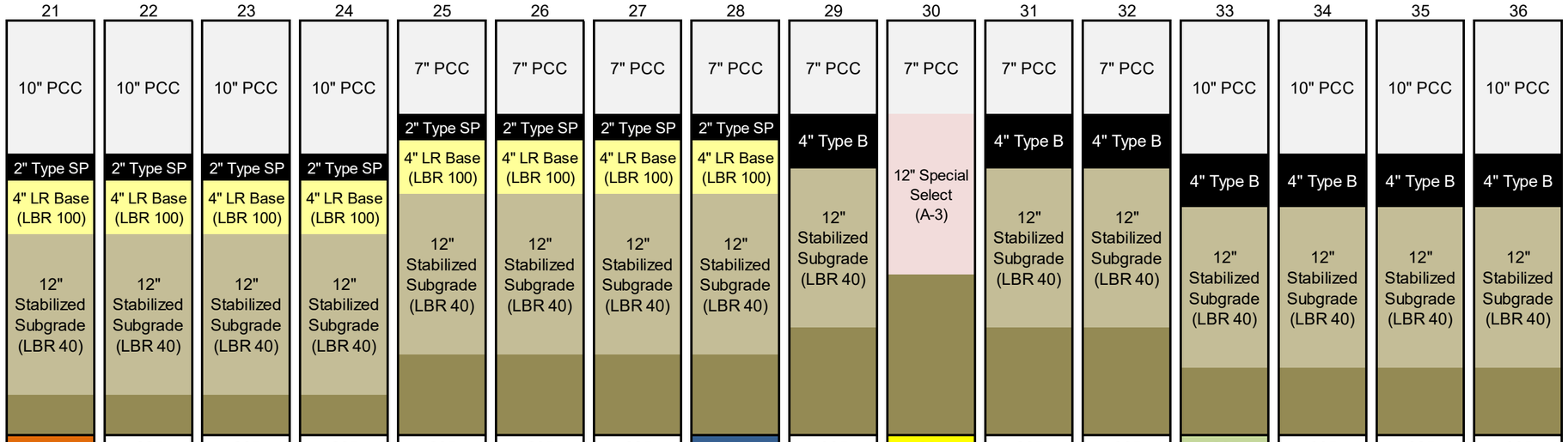
Concrete Test Road: Section Design

- Structural Experiment
  - Four Thicknesses (6 to 10 inches)
  - Multiple Base Materials (Asphalt, Limerock, A-3 Soil)
  - RAP & Fiber Mix Designs

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	10" PCC (RAP)	10" PCC	8" PCC	10" PCC (RAP)	7" PCC (RAP)	6" PCC	7" PCC	7" PCC	6" PCC	7" PCC (RAP)	7" PCC	7" PCC	7" PCC	10" PCC	8" PCC	6" PCC	7" PCC	6" PCC 6' X 6' Slabs with Fiber	7" PCC	6" PCC 6' X 6' Slabs with Fiber
													4" LR Base (LBR 100)			2" Type SP	2" Type SP	2" Type SP	4" LR Base (LBR 100)	2" Type SP
	4" Type B	4" Type B	4" Type B	4" Type B	4" Type B	4" Type B	2" Type B	4" Type B	4" Type B	4" Type B	2" Type B	12" Special Select (A-3)	12" Stabilized Subgrade (LBR 40)	2" Type SP	2" Type SP	4" LR Base (LBR 100)	4" LR Base (LBR 100)	4" LR Base (LBR 100)	4" LR Base (LBR 100)	4" LR Base (LBR 100)
	12" Stabilized Subgrade (LBR 40)	12" Stabilized Subgrade (LBR 40)	12" Stabilized Subgrade (LBR 40)	12" Stabilized Subgrade (LBR 40)	12" Stabilized Subgrade (LBR 40)	12" Stabilized Subgrade (LBR 40)	12" Stabilized Subgrade (LBR 40)	12" Stabilized Subgrade (LBR 40)	12" Stabilized Subgrade (LBR 40)	12" Stabilized Subgrade (LBR 40)	12" Stabilized Subgrade (LBR 40)			4" LR Base (LBR 100)	4" LR Base (LBR 100)	12" Stabilized Subgrade (LBR 40)	12" Stabilized Subgrade (LBR 40)	12" Stabilized Subgrade (LBR 40)	12" Stabilized Subgrade (LBR 40)	12" Stabilized Subgrade (LBR 40)
														12" Stabilized Subgrade (LBR 40)	12" Stabilized Subgrade (LBR 40)					
Length (ft)	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	125
Joint Spacing(ft)	15	15	15	15	13	12	13	13	12	13	13	13	13	15	15	12	13	6	13	6
Edge Drain	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y

Concrete Test Road: Section Design

- Drainage Experiment
  - Two Thicknesses (7 & 10 inches)
  - Three Base Types
  - With & without Edge Drains & Joint Sealant



	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Length(ft)	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225
Edge Drain	Y	N	N	Y	N	N	Y	Y	Y	N	N	N	Y	N	Y	N
Joint Sealant	Y	N	Y	N	Y	N	N	Y	N	Y	N	Y	Y	Y	N	N
Joint Spacing(ft)	15	15	15	15	13	13	13	13	13	13	13	13	15	15	15	15

Concrete Test Road: Section Design

- Cracking Calibration Experiment
  - Two Thicknesses (7 & 10 inches)
  - Two Joint Spacings (13 & 17 feet)

	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
	10" PCC	10" PCC	10" PCC	10" PCC	10" PCC	10" PCC	10" PCC	10" PCC	7" PCC	7" PCC	7" PCC	7" PCC	7" PCC	7" PCC	7" PCC	7" PCC
	4" Type B	4" Type B	4" Type B	4" Type B	4" Type B	4" Type B	4" Type B	4" Type B	4" Type B	4" Type B	4" Type B	4" Type B	4" Type B	4" Type B	4" Type B	4" Type B
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Length(ft)	234	234	238	238	234	238	234	238	234	238	238	234	234	238	234	238
Joint Spacing (ft)	13	13	17	17	13	17	13	17	13	17	17	13	13	17	13	17
Set Gradient	Low	High	Low	High	High	High	Low	Low	High	Low	High	Low	High	Low	Low	High

Concrete Test Road: Instrumentation

- **Pavement Response**
  - 760 Environmental Strain Gauges
  - 470 Dynamic Strain Gauges
  - 250 Fiber Optic Strain Gauges

- **Temperature and Moisture**
  - 156 Thermocouple Trees
  - 40 Moisture Probes

Concrete Test Road: Instrumentation

- Environmental Condition
  - 2 Weather Stations
  - 4 Monitoring Wells
- Effectiveness of Edge Drain
  - 7 Edge Drain Sensors
  - How Much Water Is Drained?
  - How Long Do They Remain Functional?

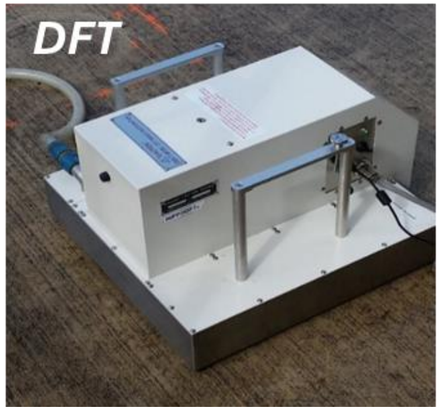
Concrete Test Road: Data Migration

- Sensor Data Transfer

FDOT Network
SMO SQL Database

Concrete Test Road: Performance Monitoring

- Testing Equipment



Florida Department of
TRANSPORTATION

Performance Monitoring Update

Smoothness

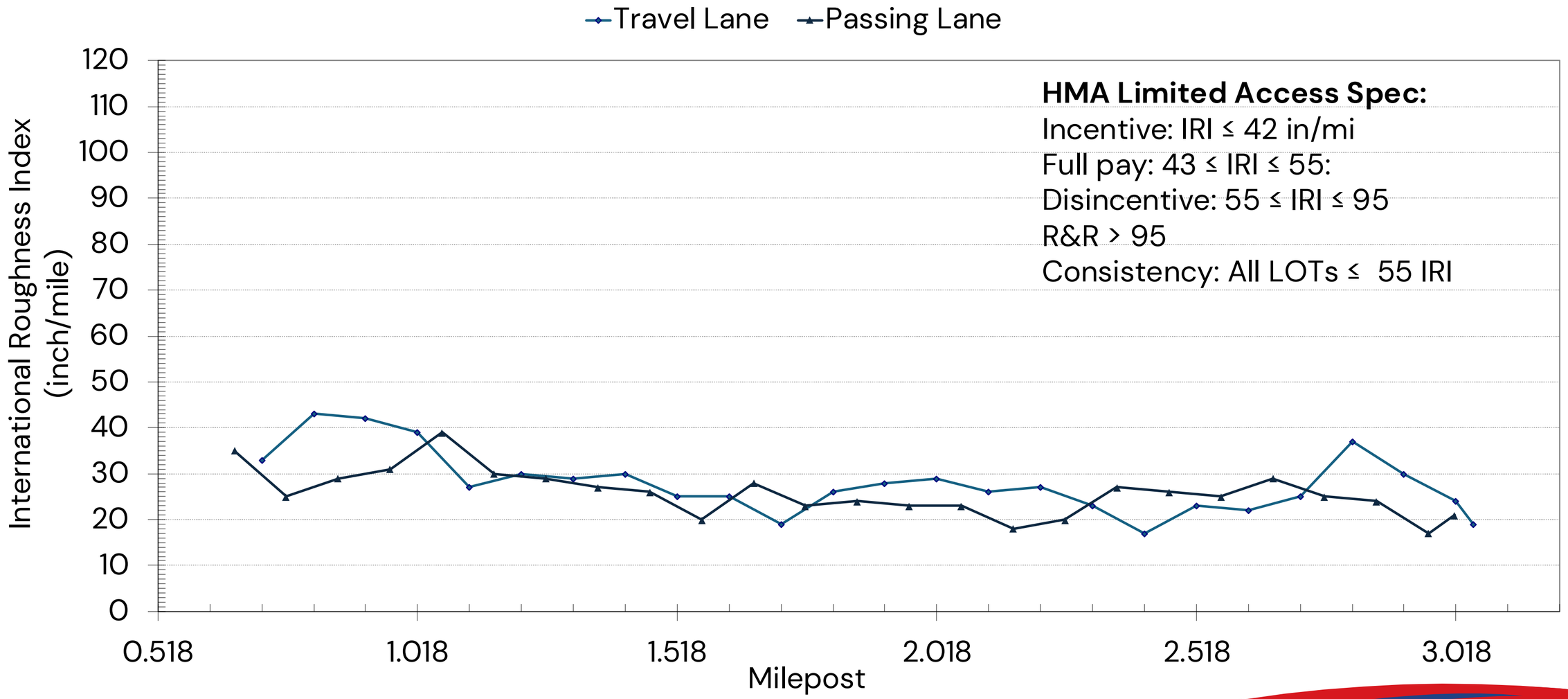
Friction

Macrotexture

Edge Drains

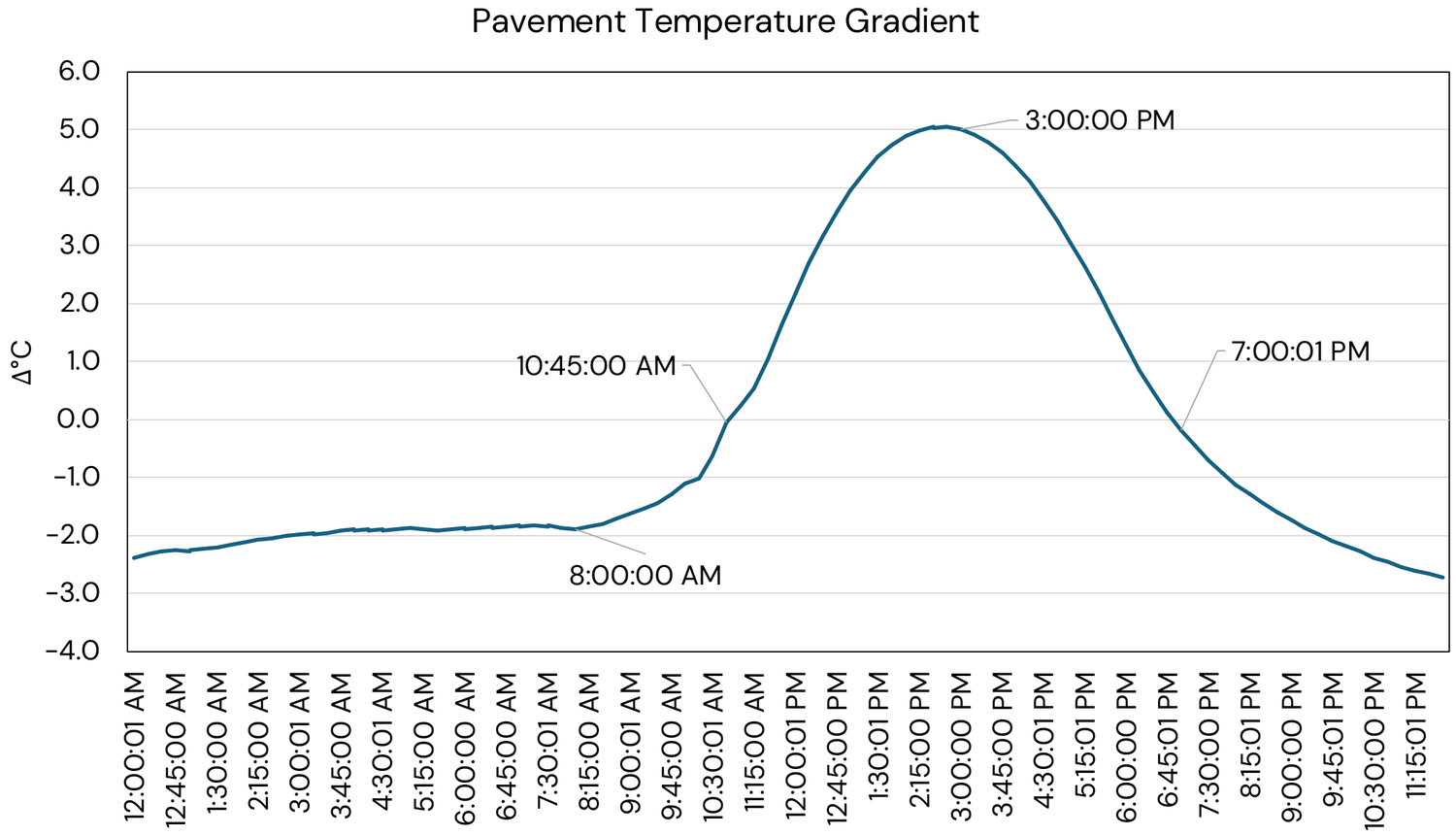
Cracking

Baseline Smoothness

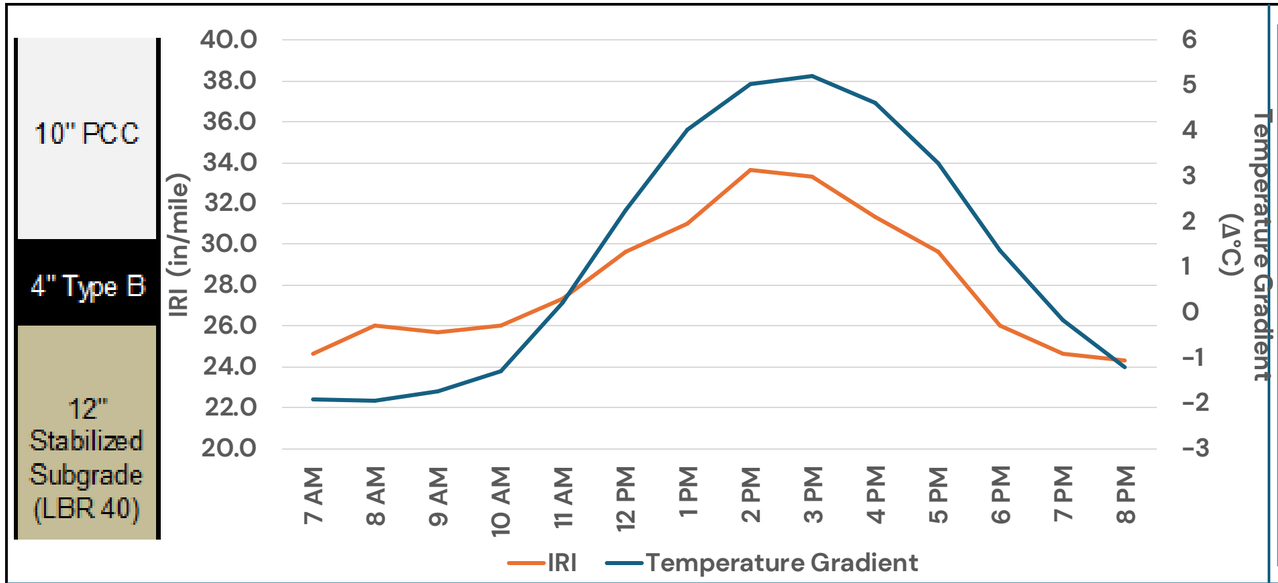


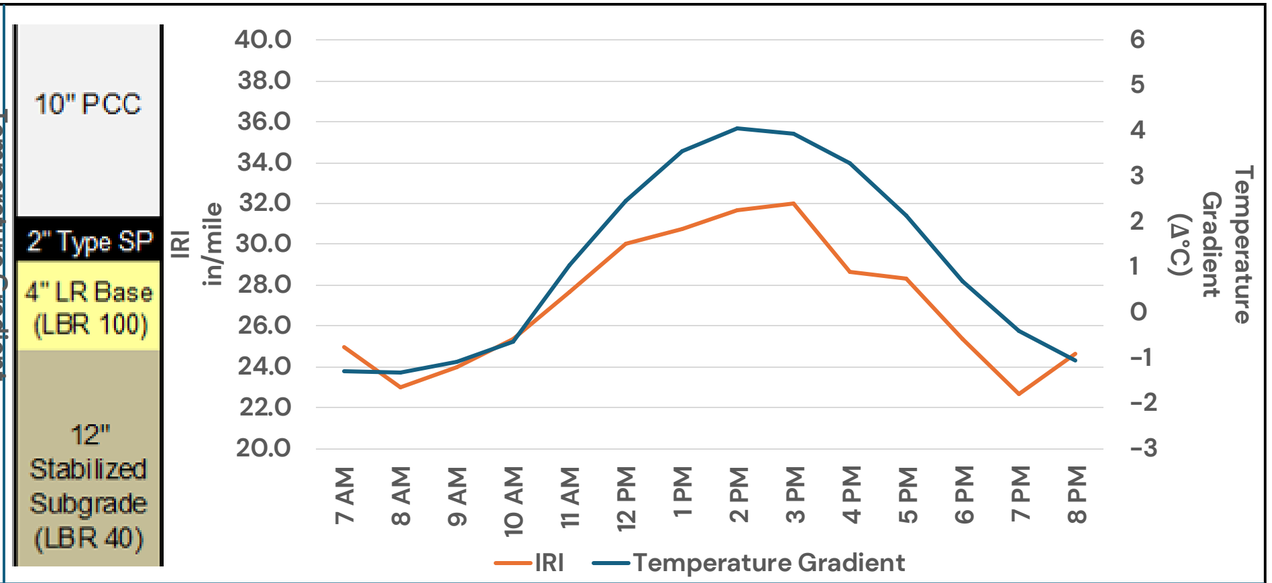
Diurnal IRI Variation

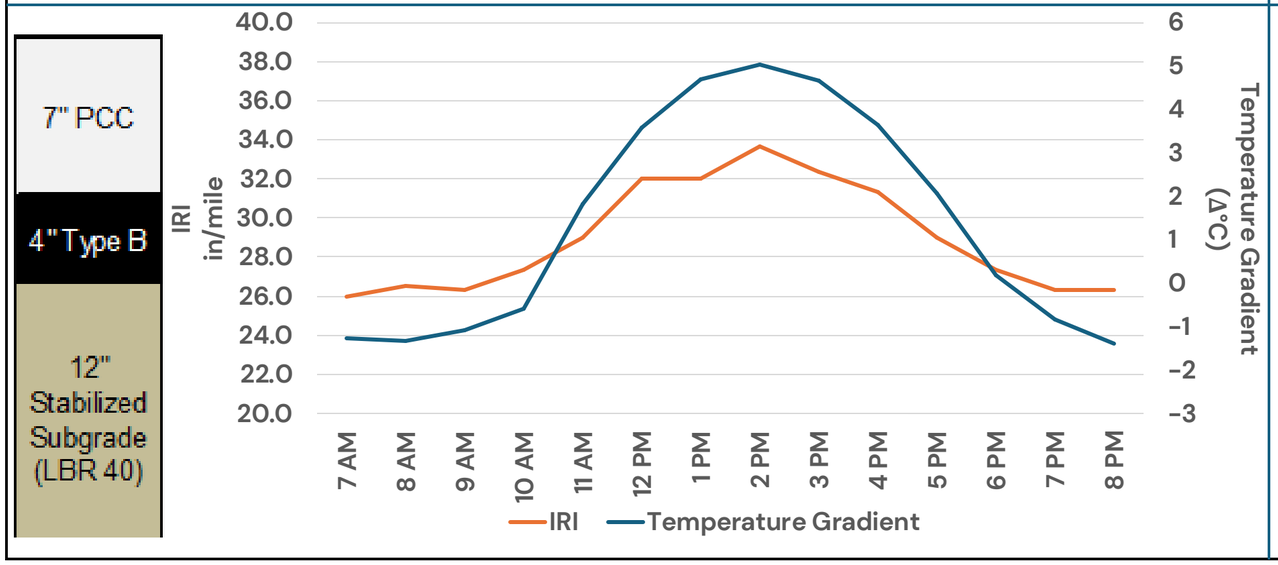
- IRI scan of Concrete Test Road every hour on the hour from 7 AM to 8 PM

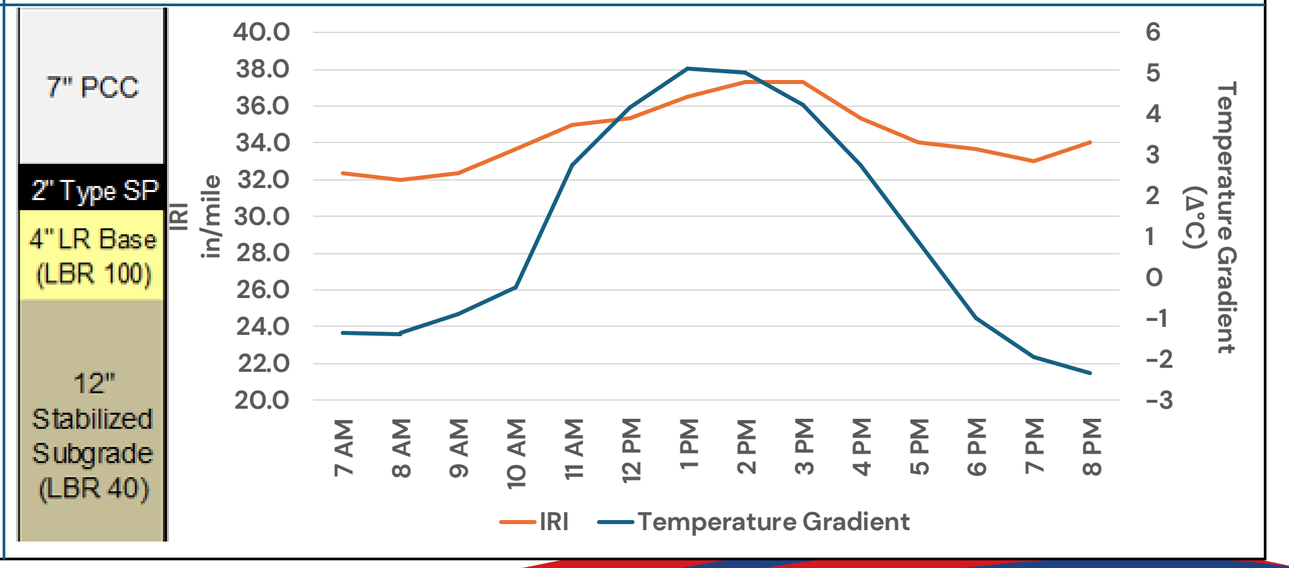


Diurnal IRI Variation





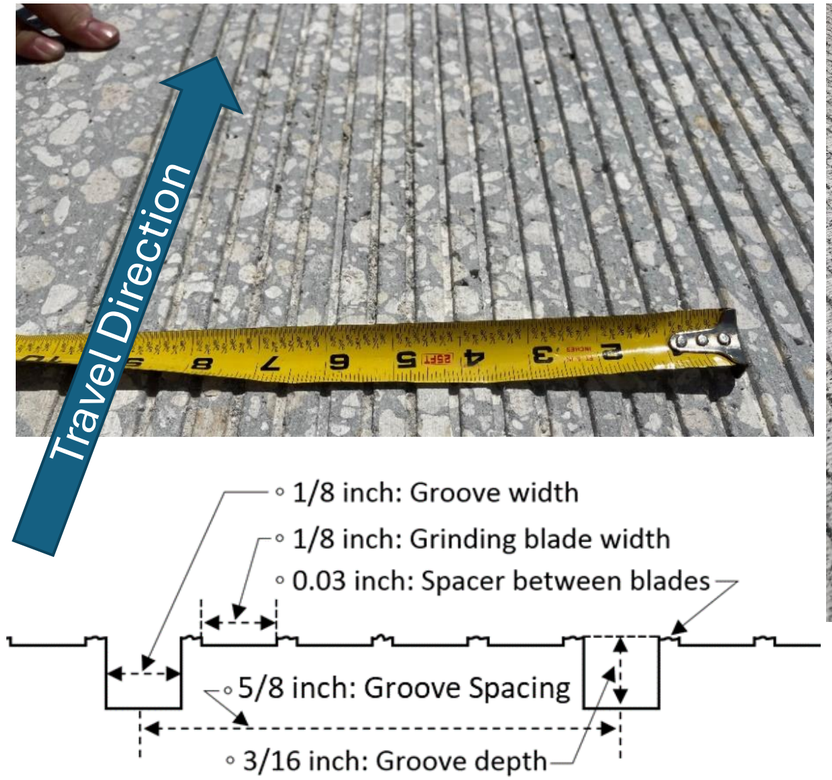




Concrete Test Road: Surface Characteristics

- Applied Texture Types

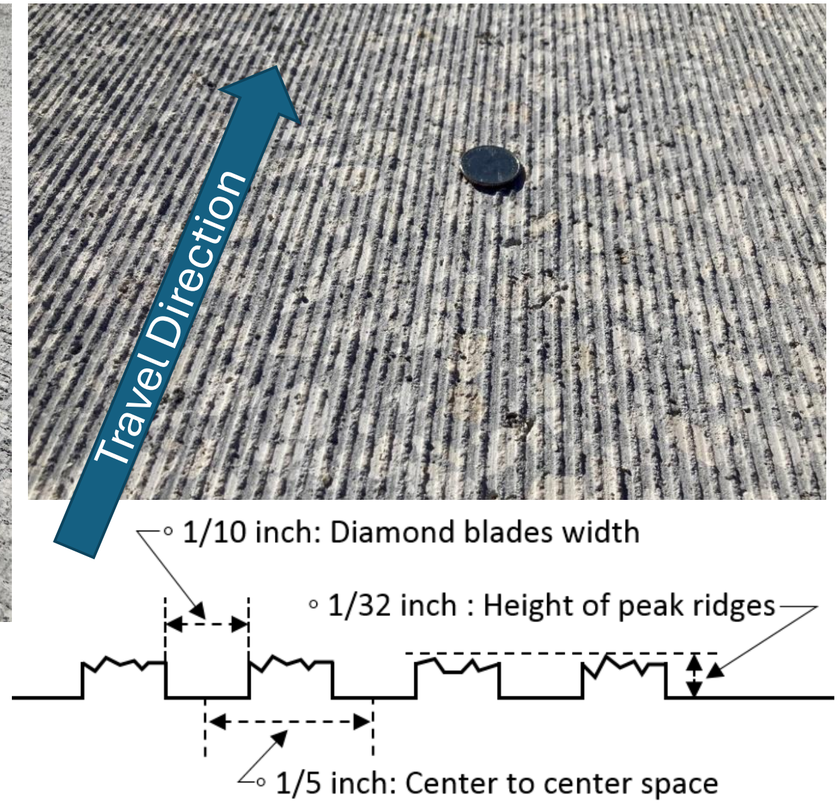
Next Gen. Concrete Surface



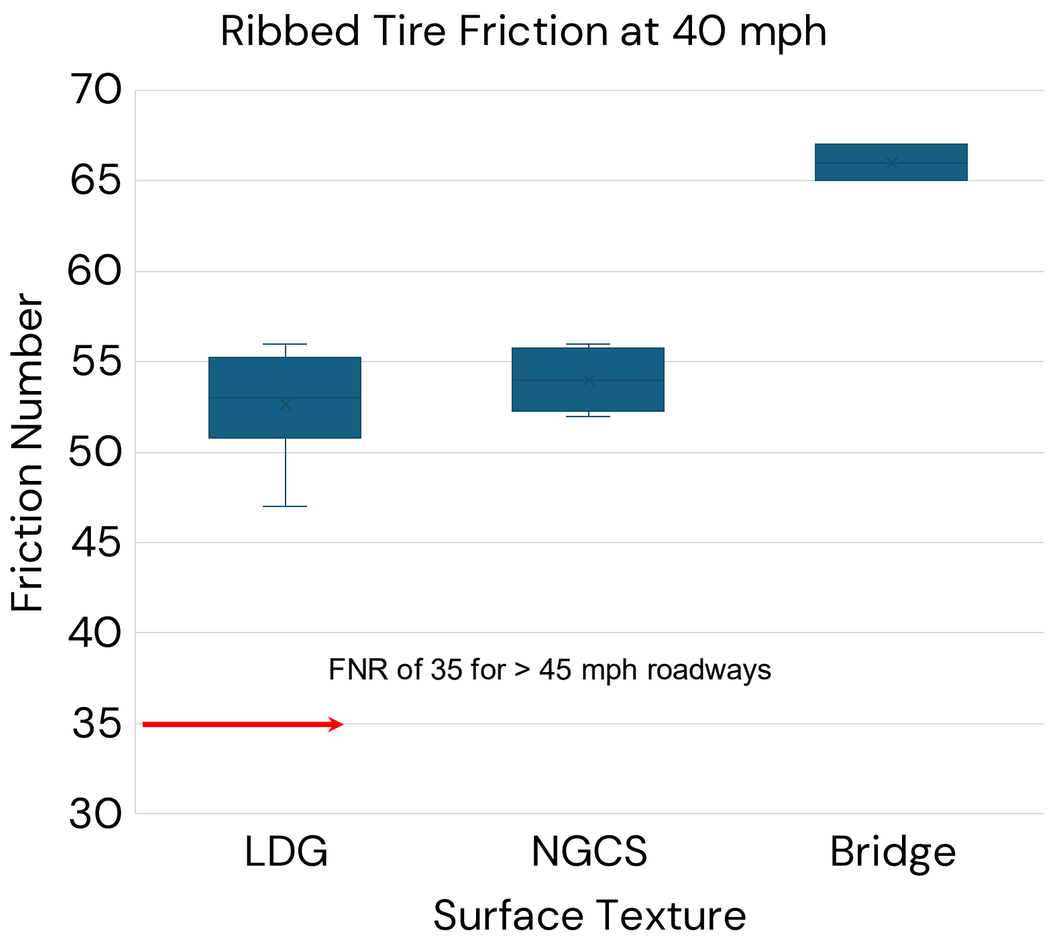
Bridge Deck Texture

L Grinding + T Grooving

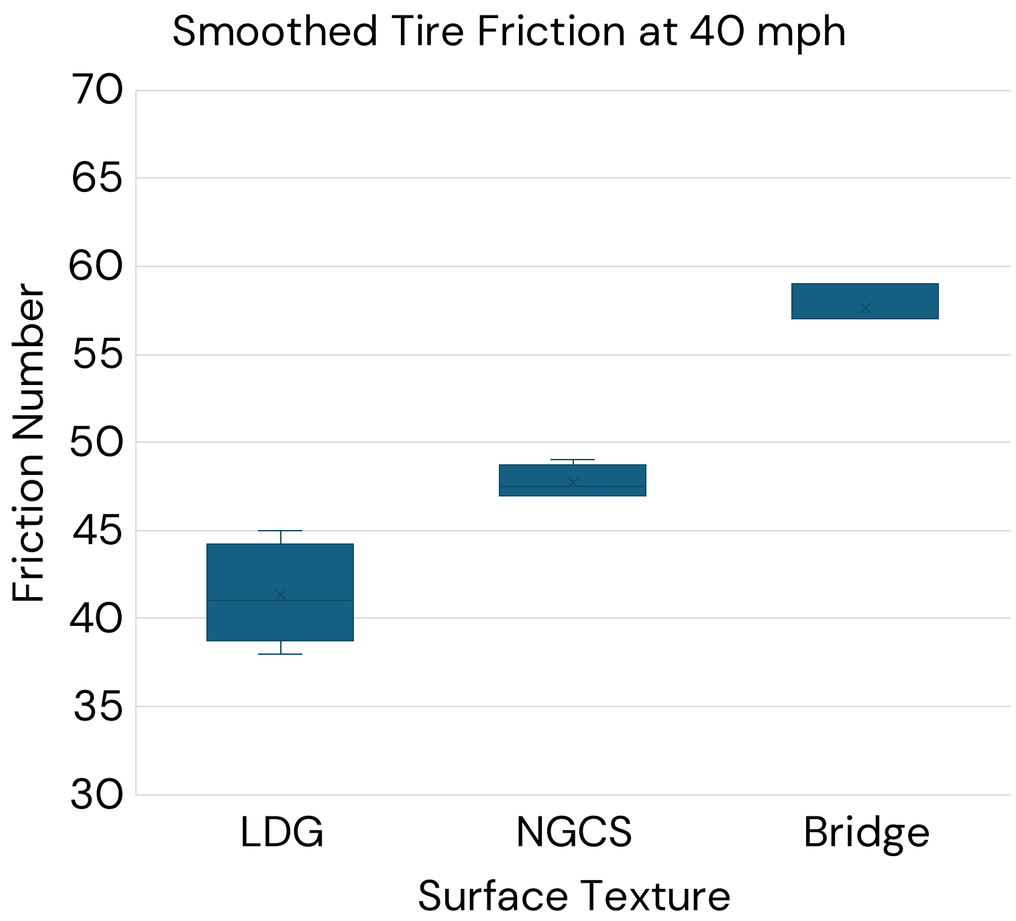
Longitudinal Diamond Grind



Baseline Friction

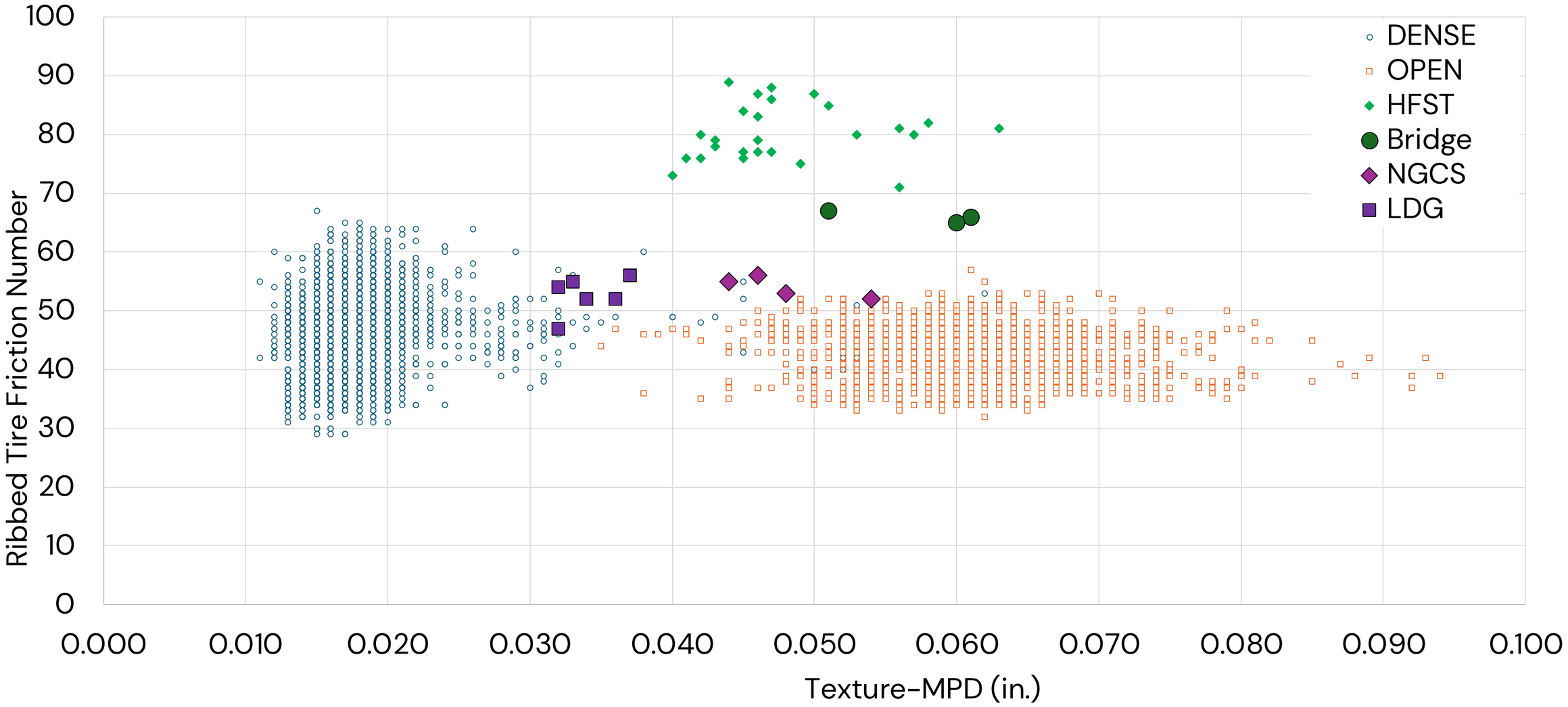


Ribbed tire is sensitive to microtexture

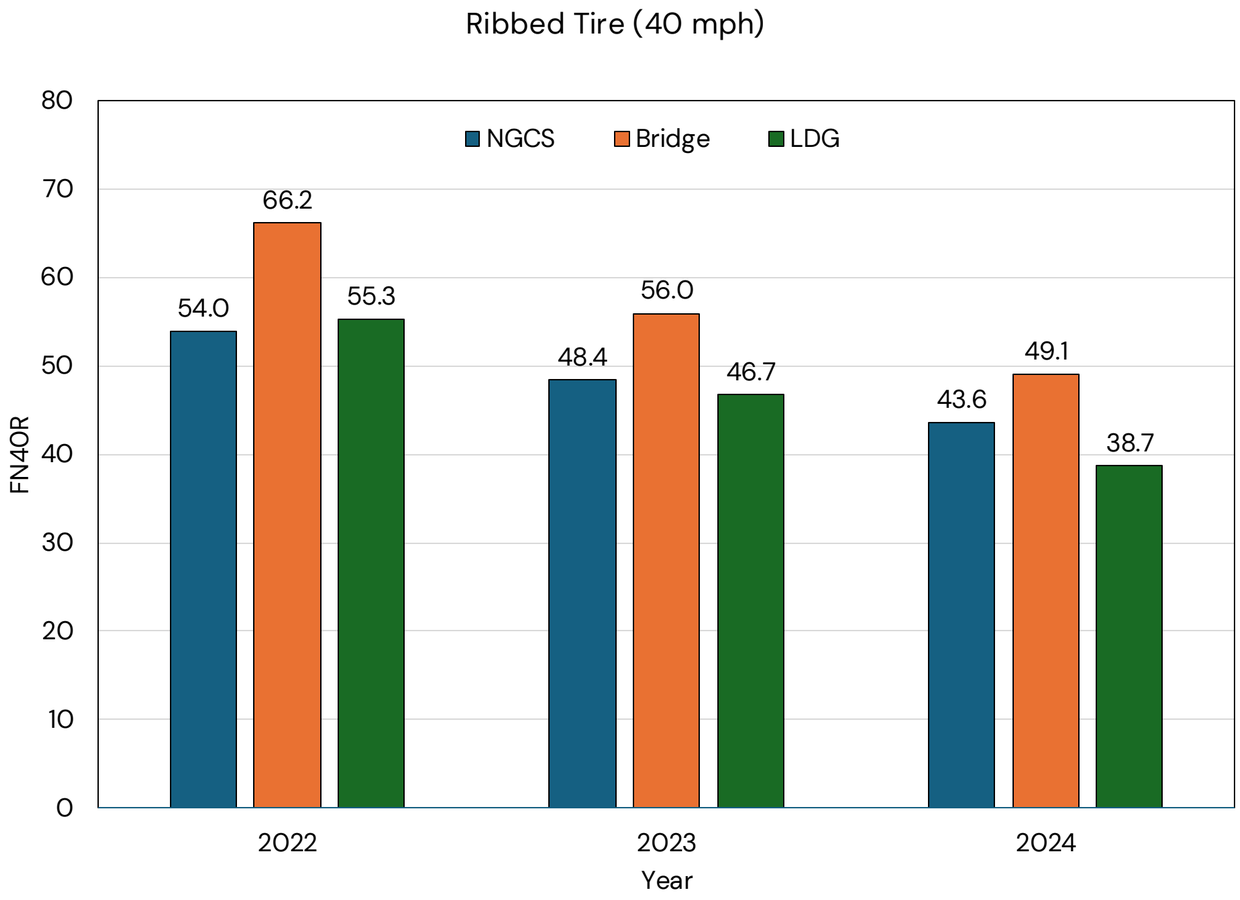


Smooth tire is sensitive to macrotexture

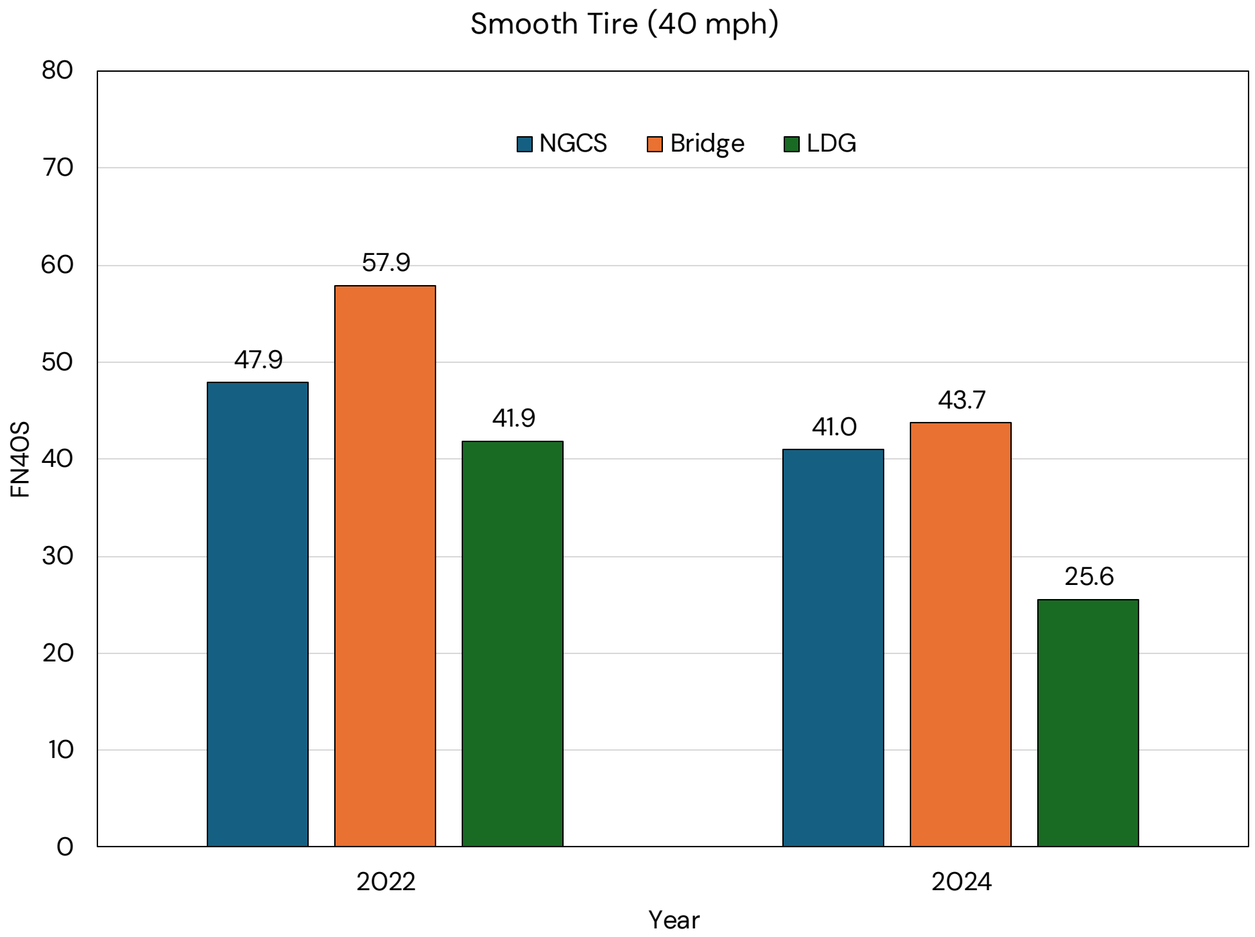
Friction/Texture Comparison with HMA



Friction Update

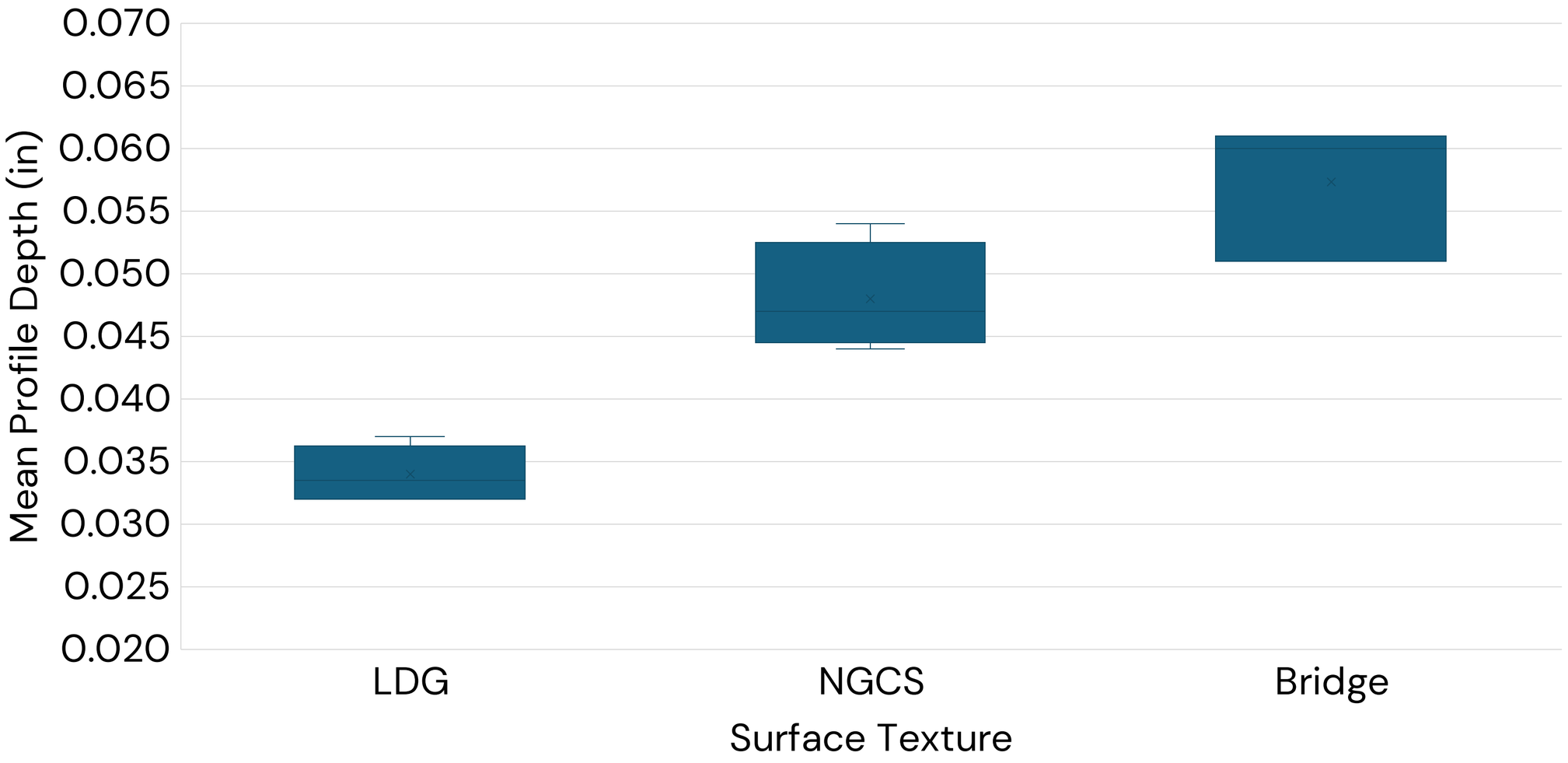


Ribbed tire is sensitive to microtexture

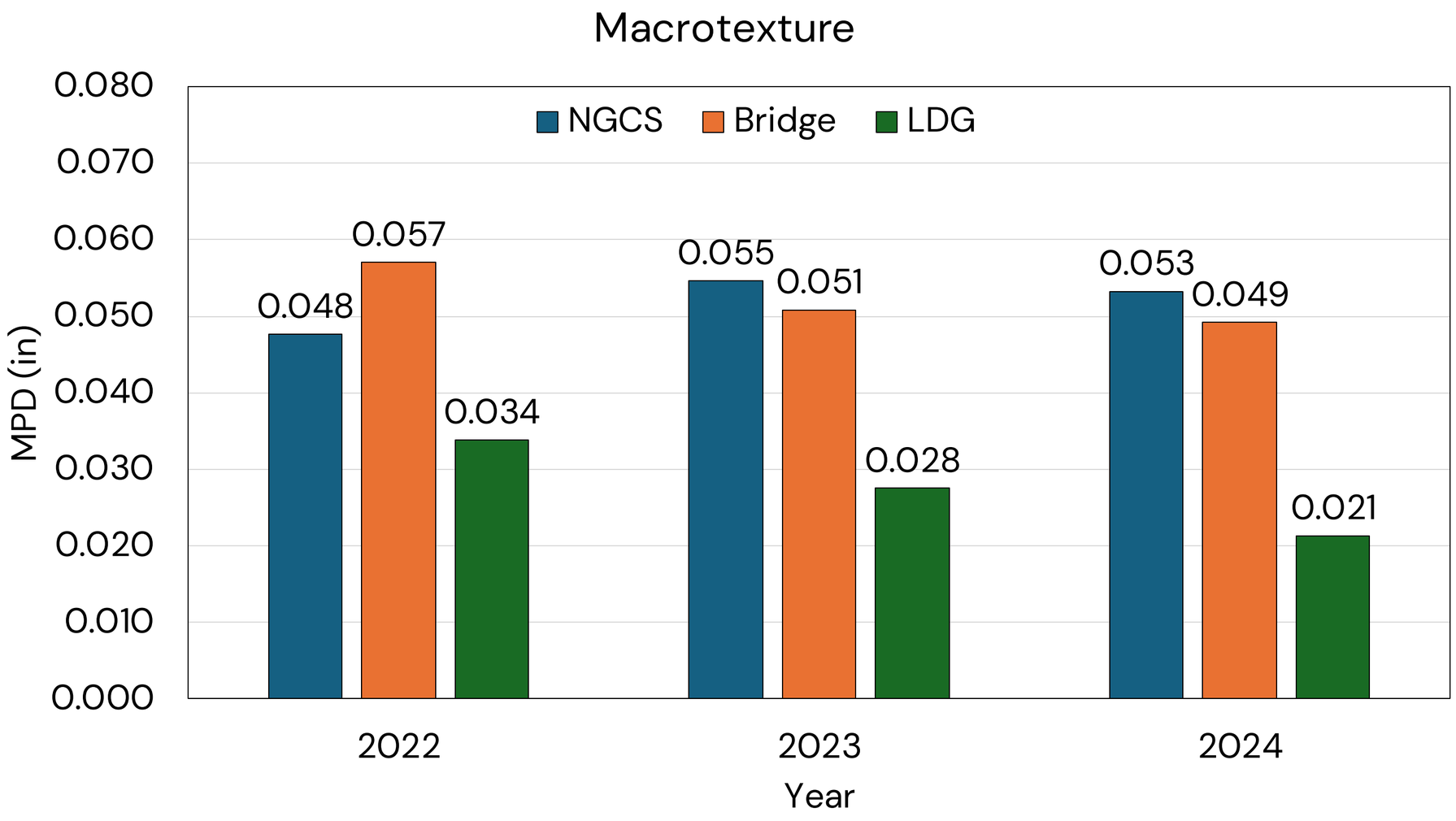


Smooth tire is sensitive to macrotexture

Baseline Macrotexture

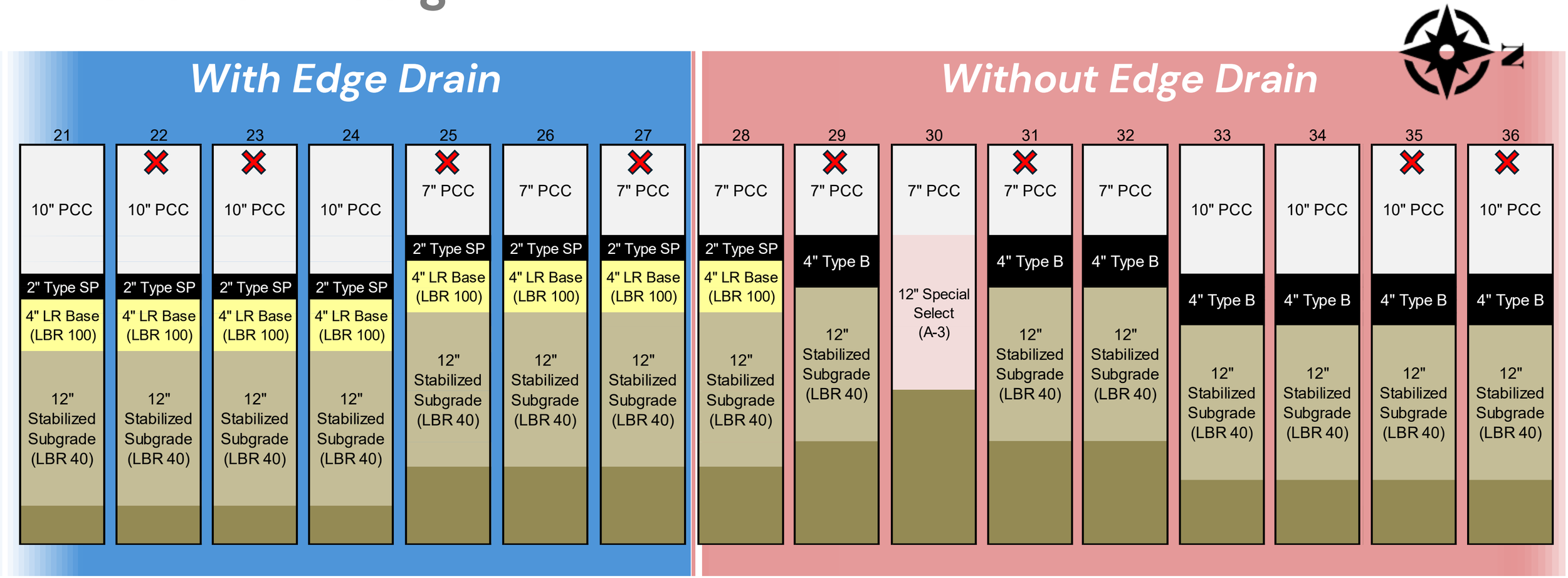


Macrotexture Update

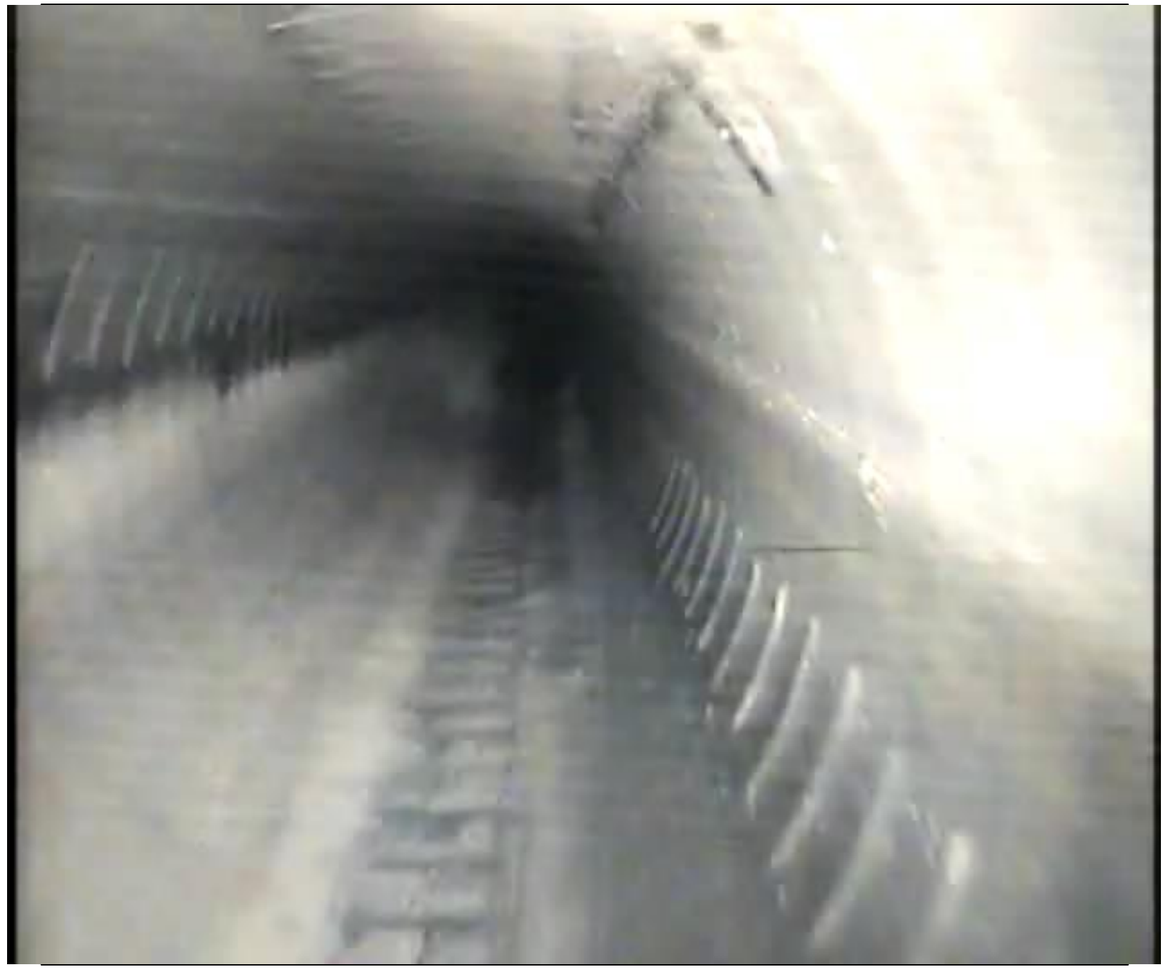


Drainage Experiment

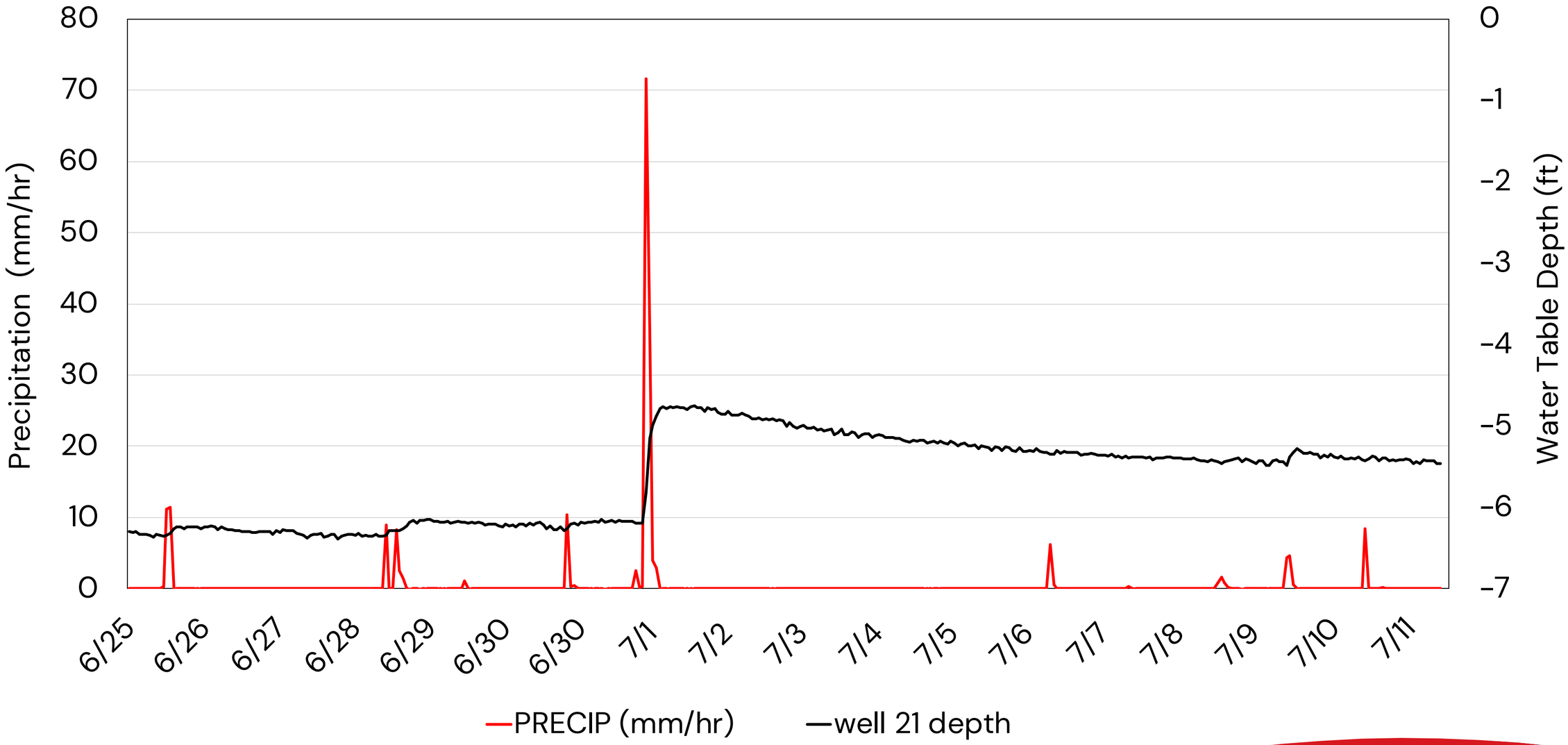
- Section Design



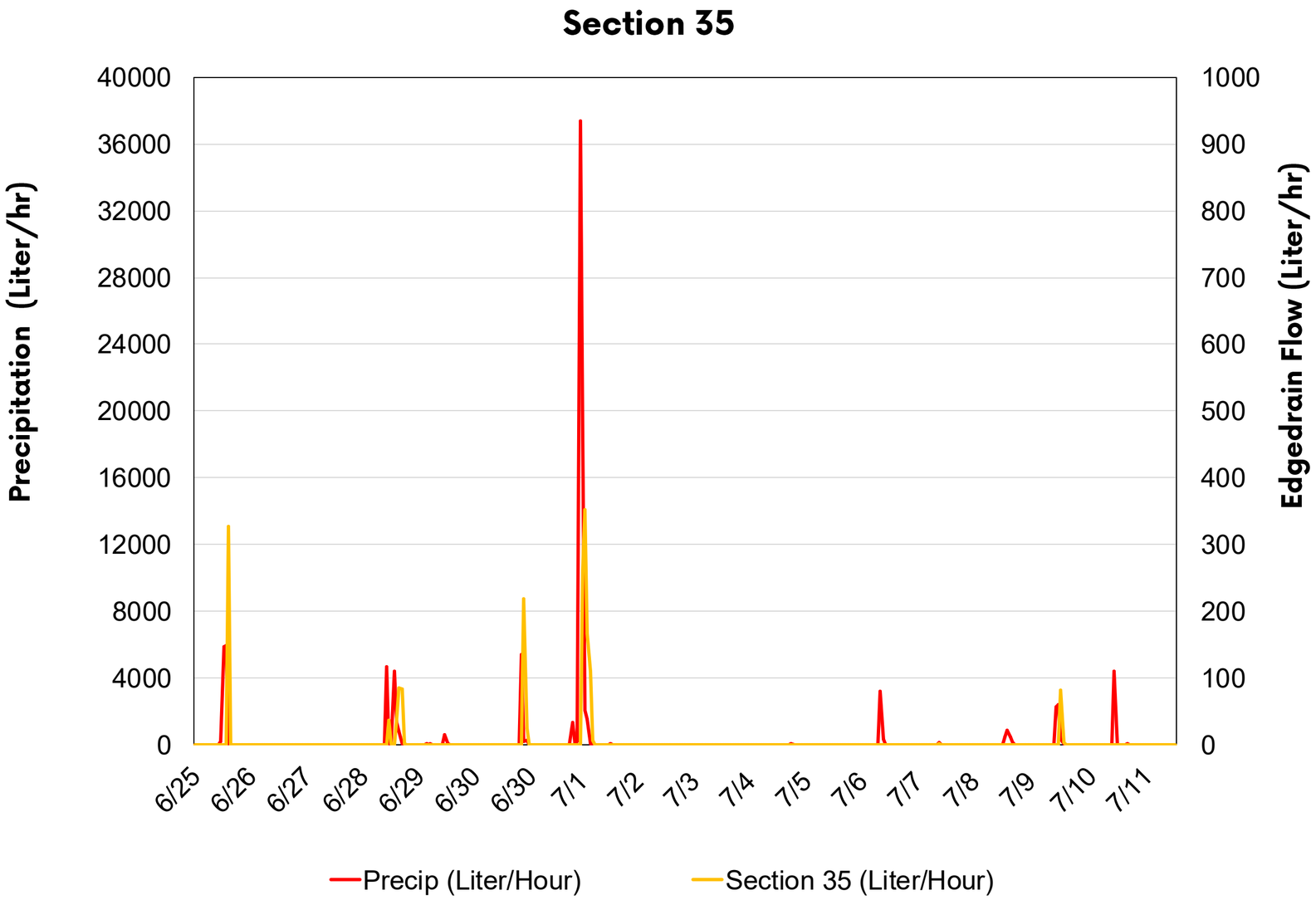
Edge Drainpipe Inspection



Precipitation and Water Table Depth



Sections without Joint Sealant



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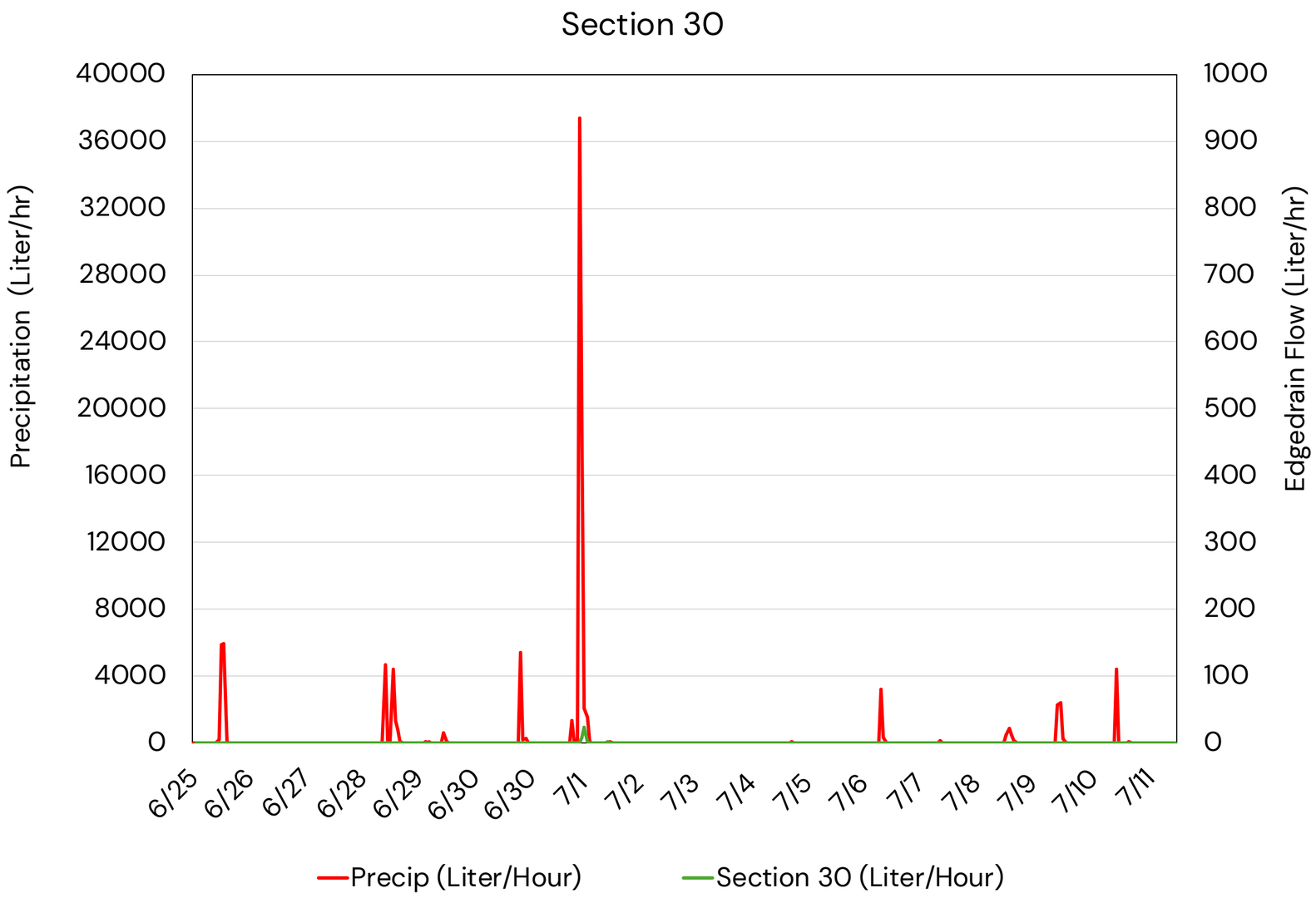
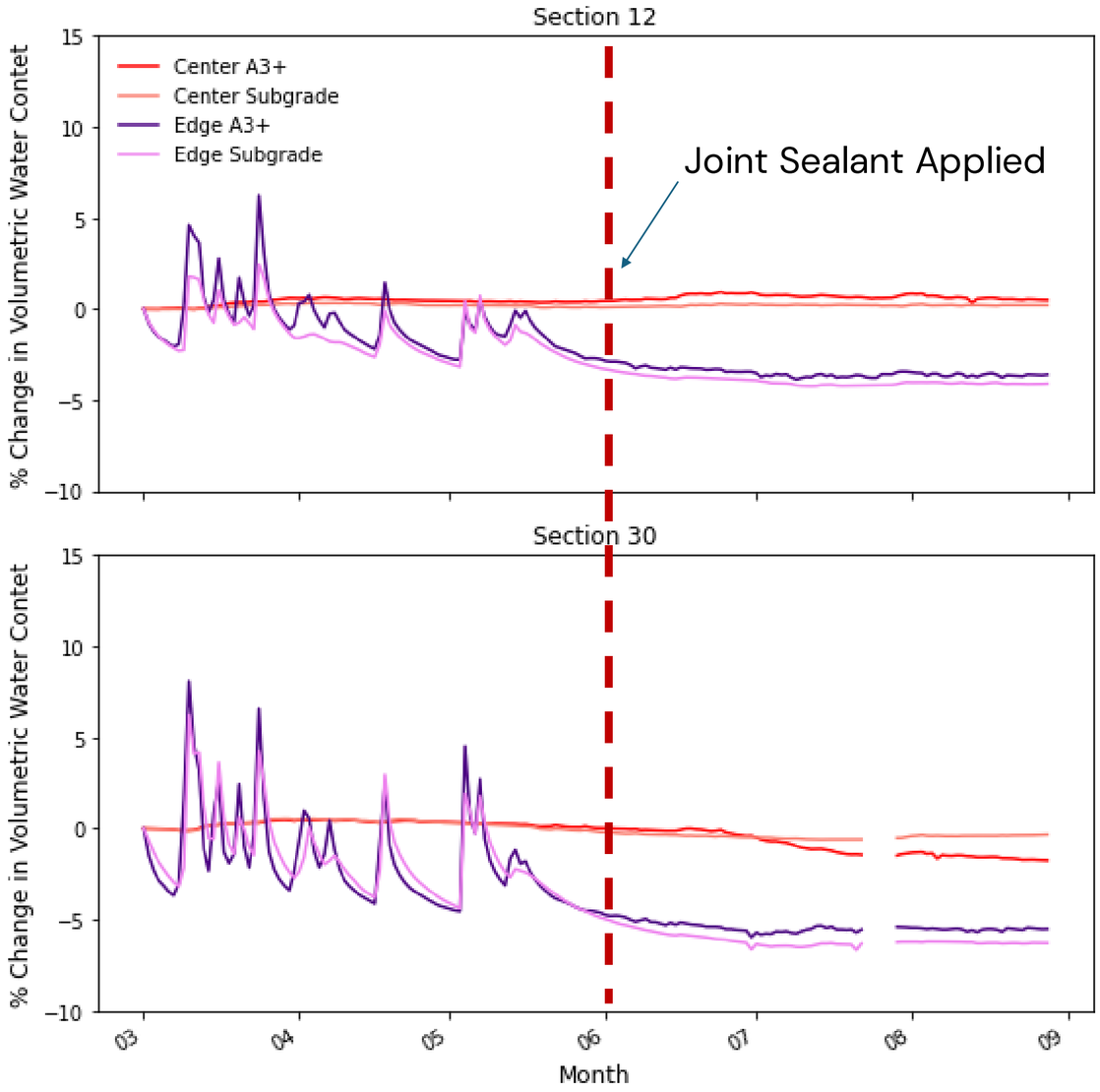


Preliminary Moisture Probe Results

- Soil moisture near the slab center are mostly consistent & stable
- Soil moisture near the slab edge & joint are more variable & at least partially due to rainfall
- Edge drain volume sensors not yet fully deployed



Edge Drain Summary & Ongoing Work

- Edge drains are functioning properly without any signs of clogging after 2 years
- Approximately 1% of precipitation on pavement surface drains through edge drain in sections with joint sealant
- Joint sealant effectively prevents water infiltration
- Continue to monitor sensors (edge drains, soil moisture, weather, groundwater, strain) & relate to pavement performance

Cracking
7″ Slab Observations

Performance Predictions

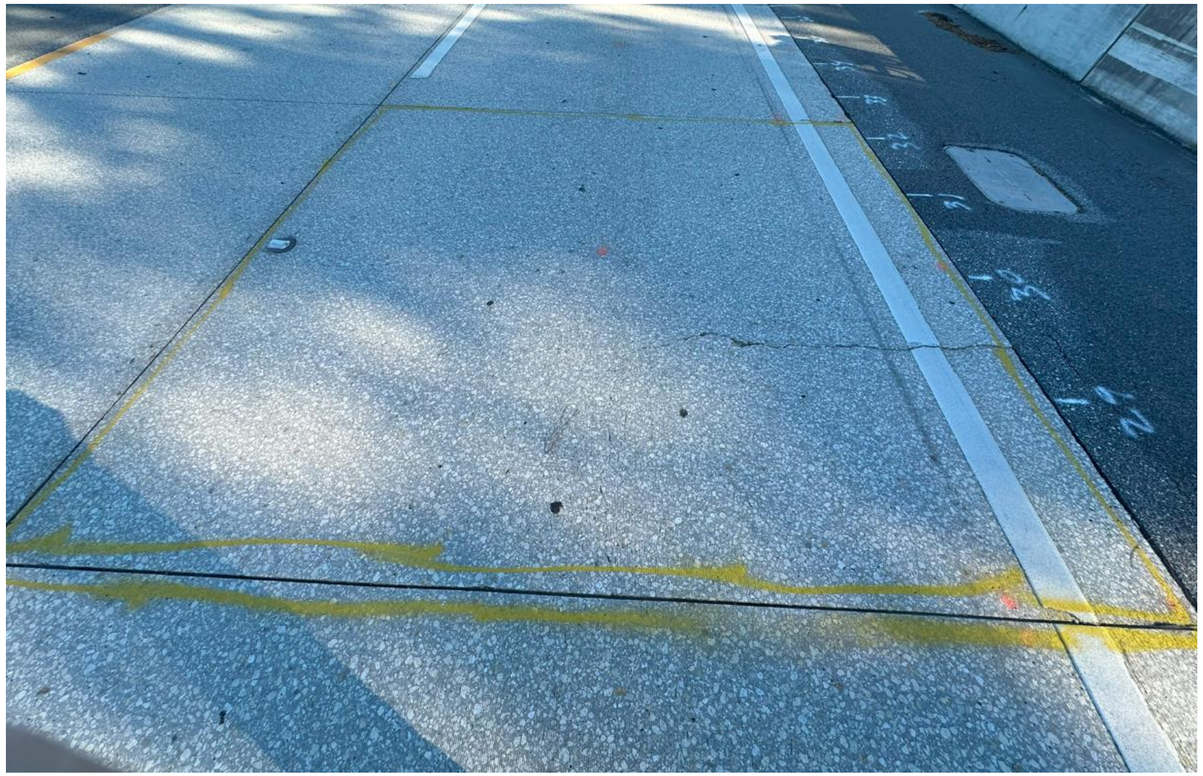
- Research plan developed to produce early failures
- Initial Pavement ME cracking performance predictions indicated 10% of 7" slabs will have cracks ≈ 2 years
  - Recently observed cracked slabs in four sections
    - ≈ 10% slabs in outside lane have cracked in these four sections
    - ≈ 2% slabs in outside lane have cracked in all 7" slab sections

7″ Slab Observations

- 25 sections with 7″ slabs
  - Cracked slabs observed in 17 slabs from four test sections
    - Structural test section 12 (2 slab replacements)
    - Drainage test sections 30, 31 & 32 (4 slab replacements, 5 surface repairs)
    - Calibration test section 50 (1 slab replacement, 5 surface repairs)
- Base types of sections with cracked slabs
  - A-3 (2 sections)
  - 4″ Type B (3 sections)
- 2 of 5 sections with cracked slabs had edge drains
- 4 of 5 sections with cracked slabs had sealed joints
- Joint spacing
  - 13 ft (4 sections)
  - 17 ft (1 section)

Cracked Slab Photos

Transverse Cracking



Transverse Cracking

7″ Slab Summary & Ongoing Work

- Slab rehab
  - Slabs with major cracks to be replaced with 9″ slabs
  - Slabs with minor cracks/spalls will have shallow repairs
- Investigation
  - Cores
    - Verify slab thickness & crack depths
    - Compressive strength
  - Nondestructive testing
    - FWD, GPR, MIT Dowel Scan/Ultrasonic, LCMS
  - Review Pavement ME inputs
  - Review & analyze strain gauge data

Findings After 2 Years

- Sensors are providing valuable information
- Edge drains & joint sealant are performing as intended after 2 years
- Thinner slabs are beginning to crack as expected
- Significant amount of data is already available

Thank You!

Follow-up questions?

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