NCAT PAVEMENT TEST TRACK

TRACK RESEARCH HISTORY

(Change Necessitates Full Scale Accelerated Performance Testing)

Bates Experimental Road (1922-1923)
Effect of Solid Rubber Tires

WASHO Road Test (1952-1954)
Effect of Post War Truck Loads

Mn/ROAD (1994-present)
Effect of Load Limits on Spring Thaw
(& Mechanistic Response)

AASHO Road Test (1956-1961)
Effect of Varying Loads and Buildups

NCAT Track (2000-present)
Effect of Truck Traffic on Both
Mix & Structural Performance

Westrack (1996-1998)
Effect of Superpave Design
(& Performance Specifications)

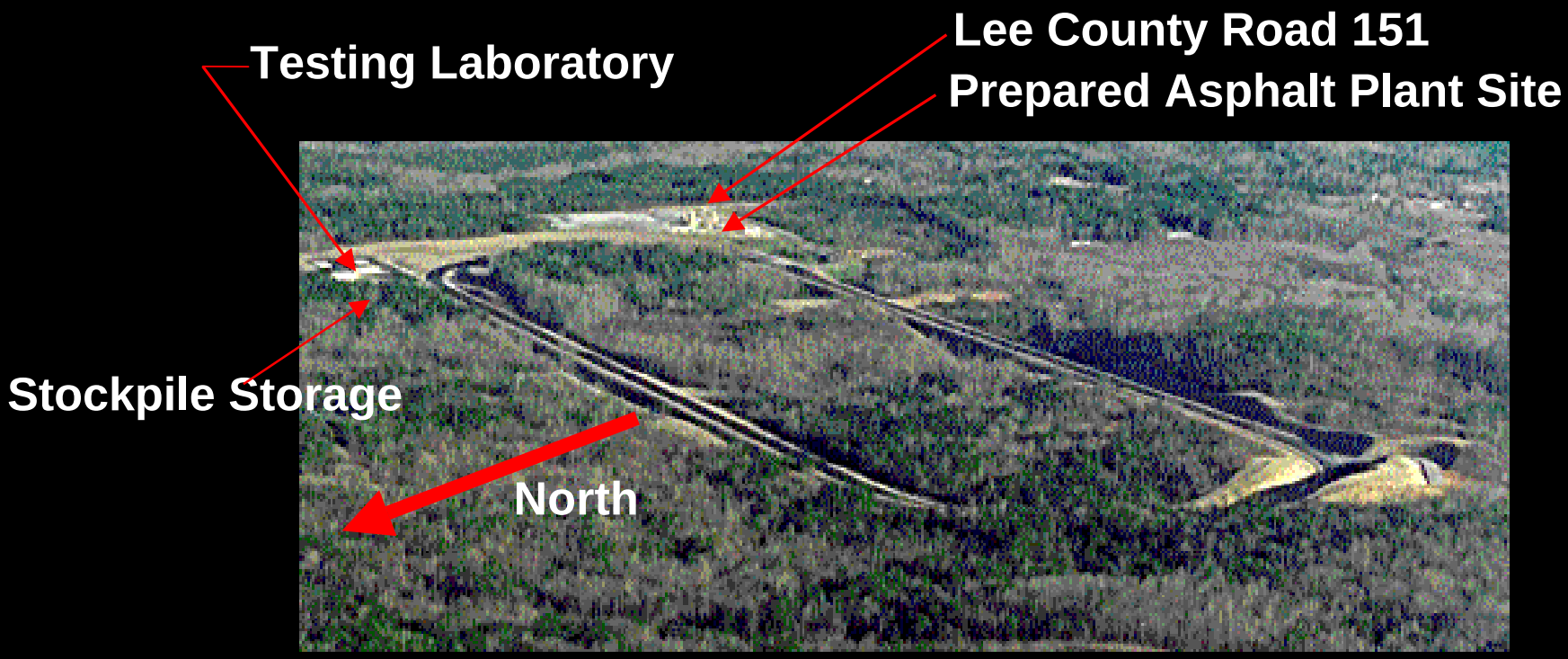
NCAT Pavement Test Track

National Center for Asphalt Technology
NCAT
AUBURN UNIVERSITY
277 Technology Parkway • Auburn, AL 36830

- Established by 1986 NAPA-AU Joint Agreement
- Financial Endowment “Seed” from Contractors, Suppliers, & Equipment Manufacturers via NAPA-REF
- Facilities and Faculty from Auburn University
- “Improve the Performance of HMA Pavements via Practical Research, Education, and Information Services”
- Broke Ground at Test Track in September of 1998…

NCAT Pavement Test Track

NCAT TRACK



- Materials and Methods (Not Thickness) were 2000 Study Variables
- Materials, Methods and Thickness Studied in 2003 Experiment
- Anticipate Larger Structural Experiment in 2006 Track

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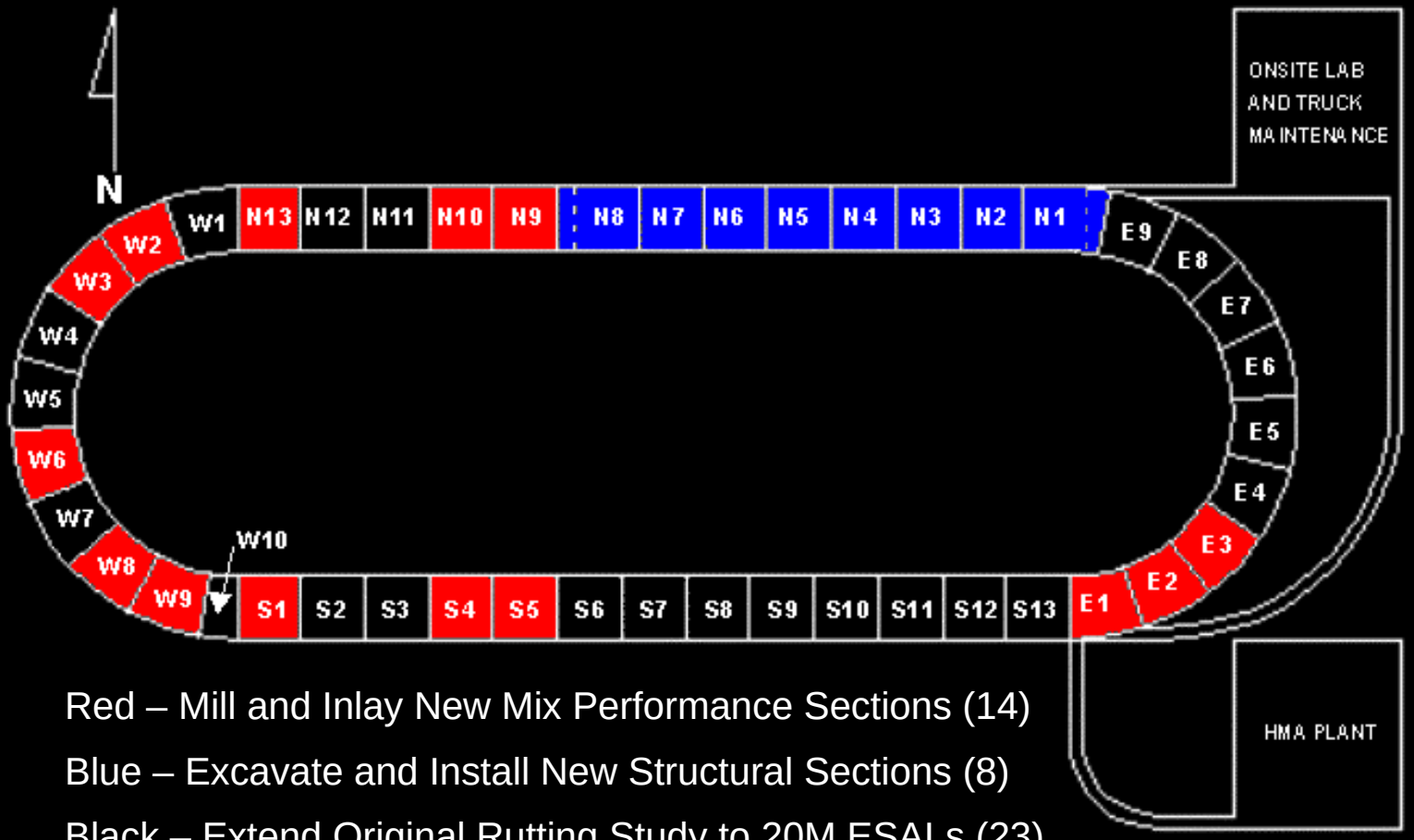
2003 MIXED EXPERIMENT



Red – Mill and Inlay New Mix Performance Sections (14)

Blue – Excavate and Install New Structural Sections (8)

Black – Extend Original Rutting Study to 20M ESALs (23)

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TRUCKING OPERATIONS

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WHEELPATH DEVELOPMENT

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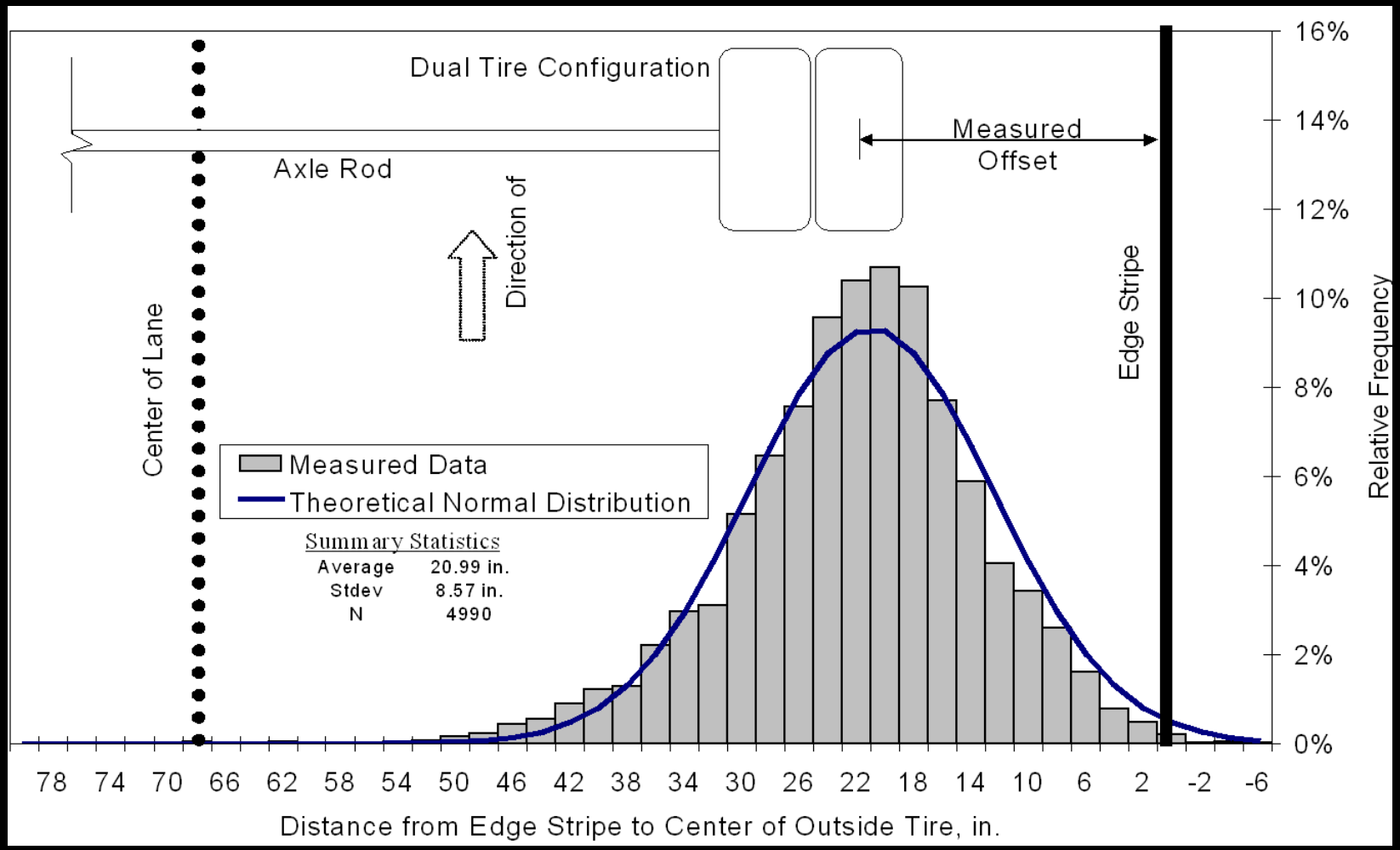
INTERSTATE SIMULATION



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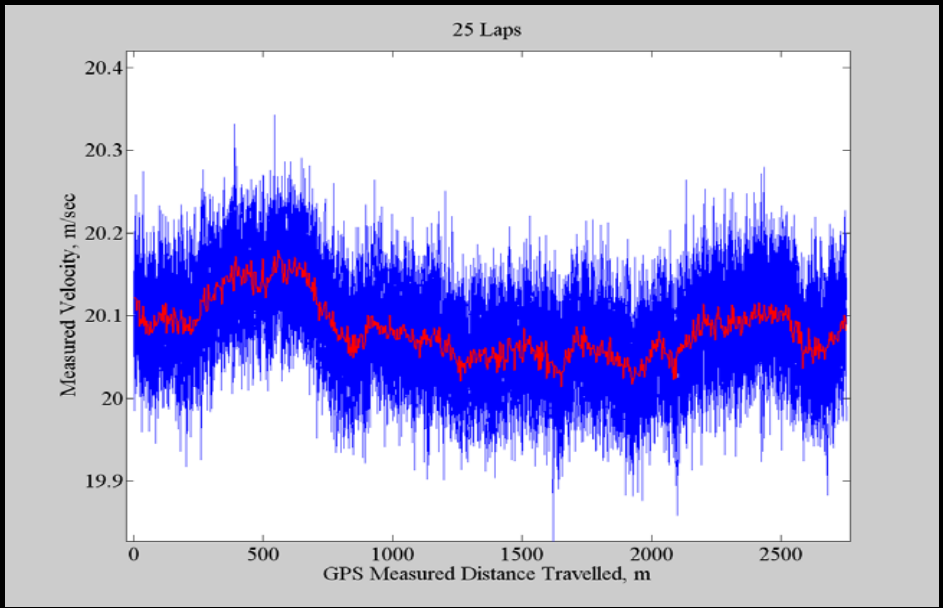
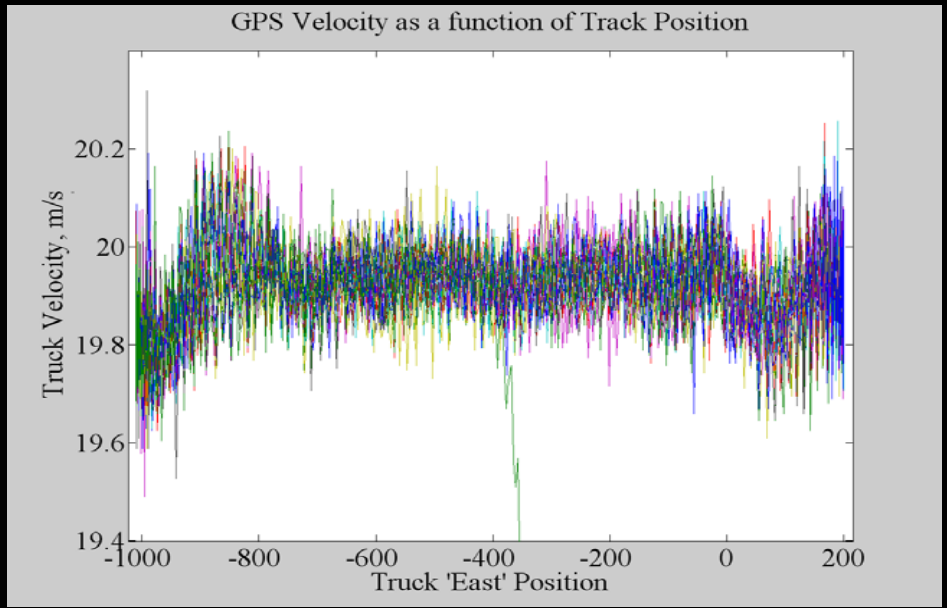
EFFECT OF PAVEMENT TYPE





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EFFECT OF PAVEMENT TYPE

NCAT Pavement Test Track

EFFECT OF PAVEMENT TYPE

- **Coarse Superpave Mix**
- **Stone Matrix Asphalt Mix**
- **Open Graded Friction Course**

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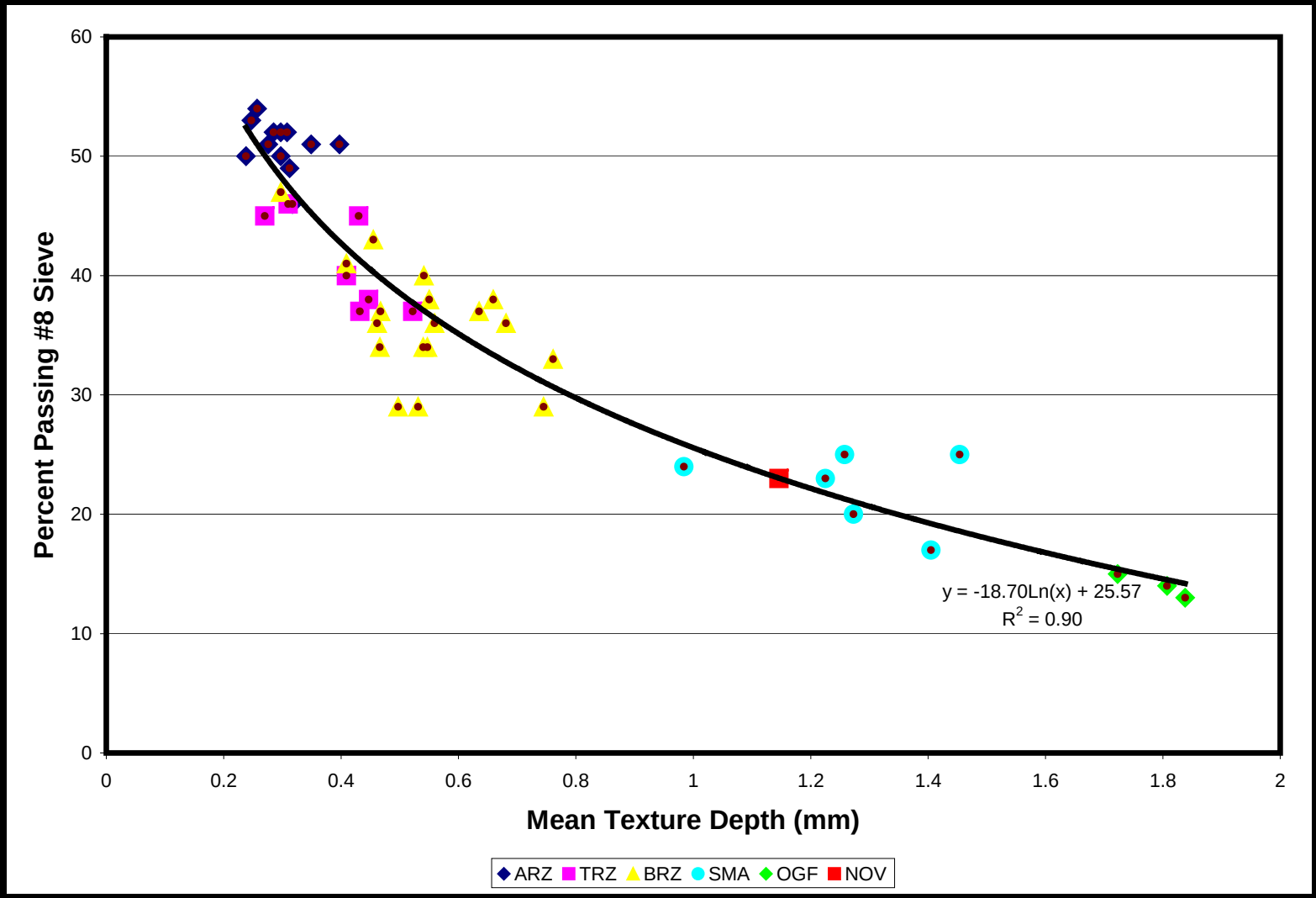
EFFECT OF PAVEMENT TYPE



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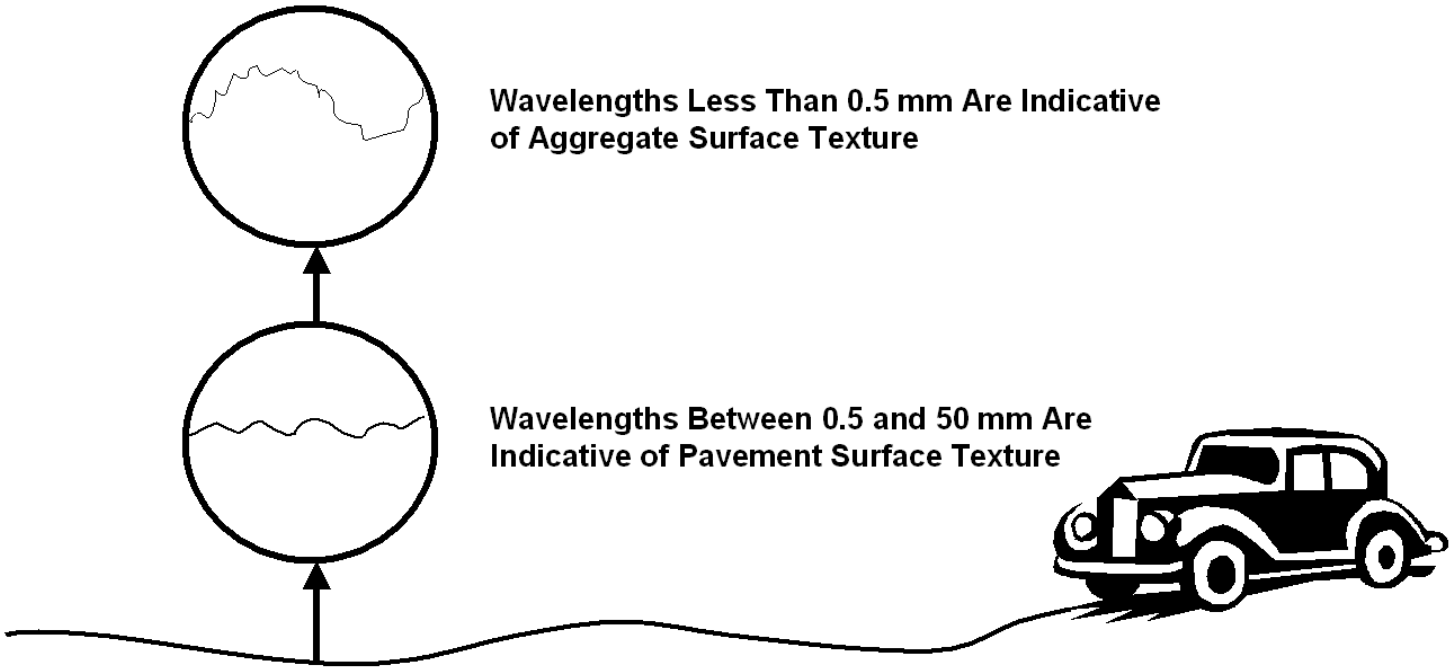
EFFECT OF PAVEMENT TYPE

Roadway Wavelengths

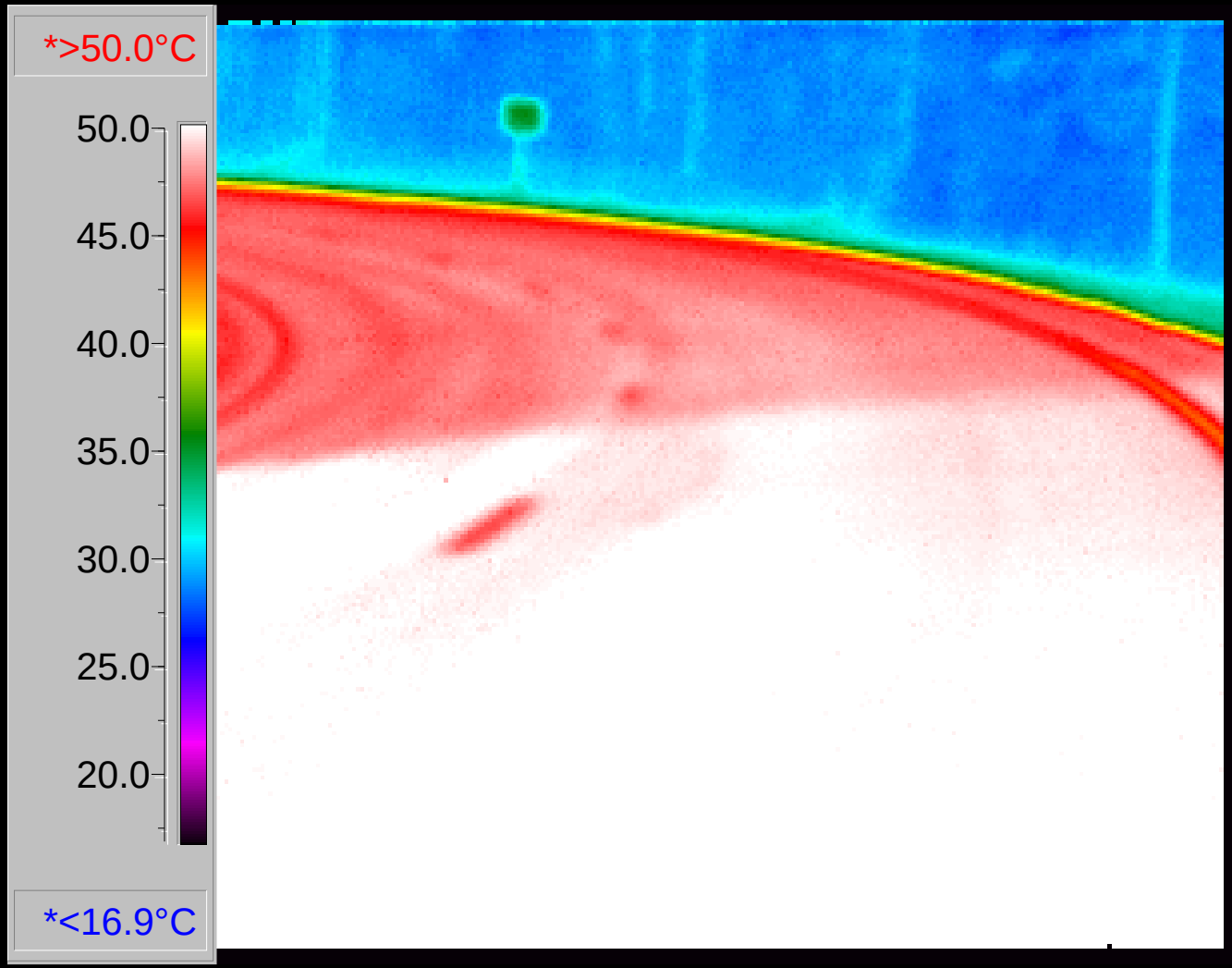


Wavelengths Less Than 0.5 mm Are Indicative of Aggregate Surface Texture

Wavelengths Between 0.5 and 50 mm Are Indicative of Pavement Surface Texture

Wavelengths Between 50 mm and 60 m Are Indicative of Roadway Surface Roughness

SMA_{near} vs $OGFC_{far}$ (SAME AGG)



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OGFC @ ¼” PER HOUR

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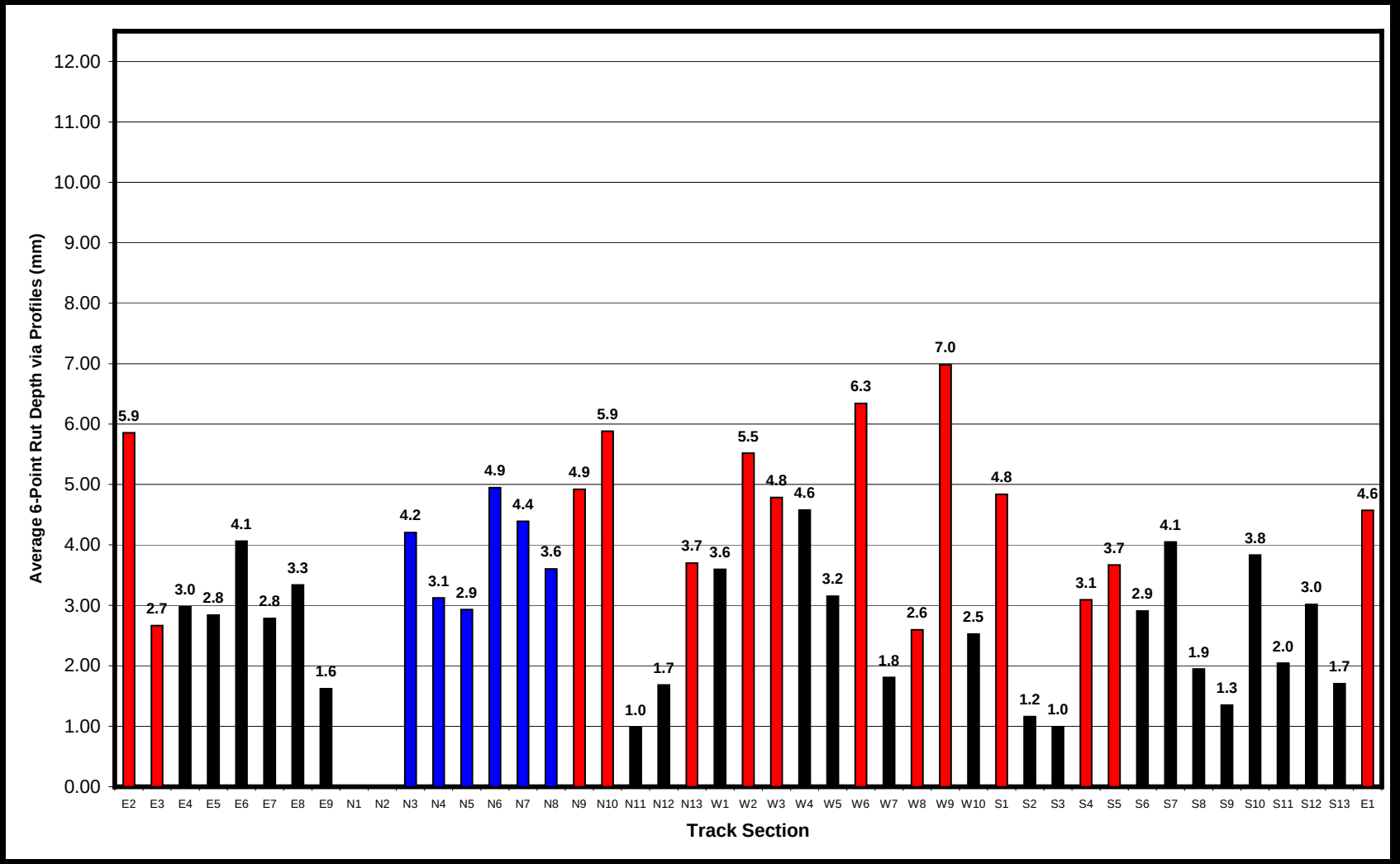
RUTTING VIA PROFILES



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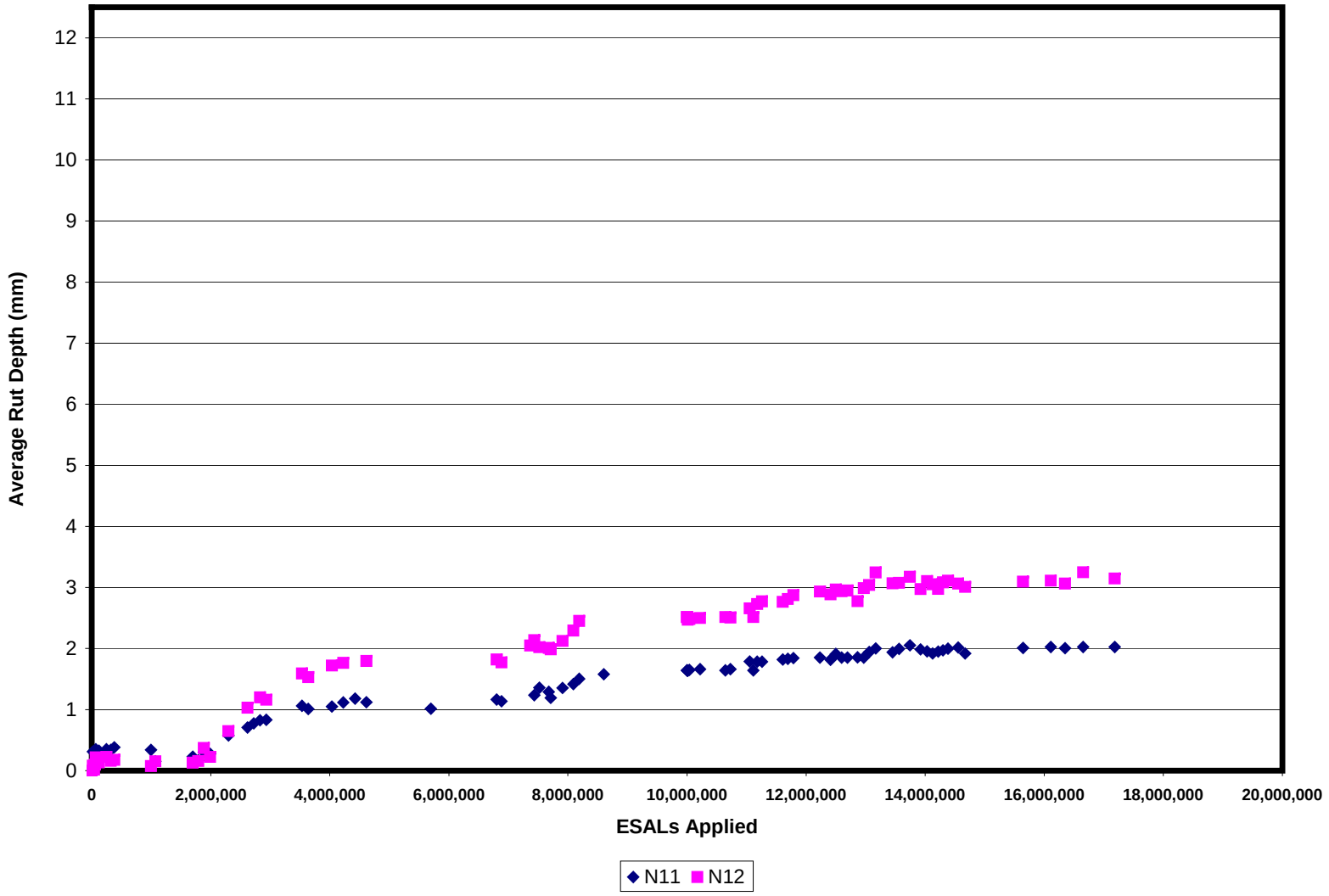
RUTTING VIA PROFILES



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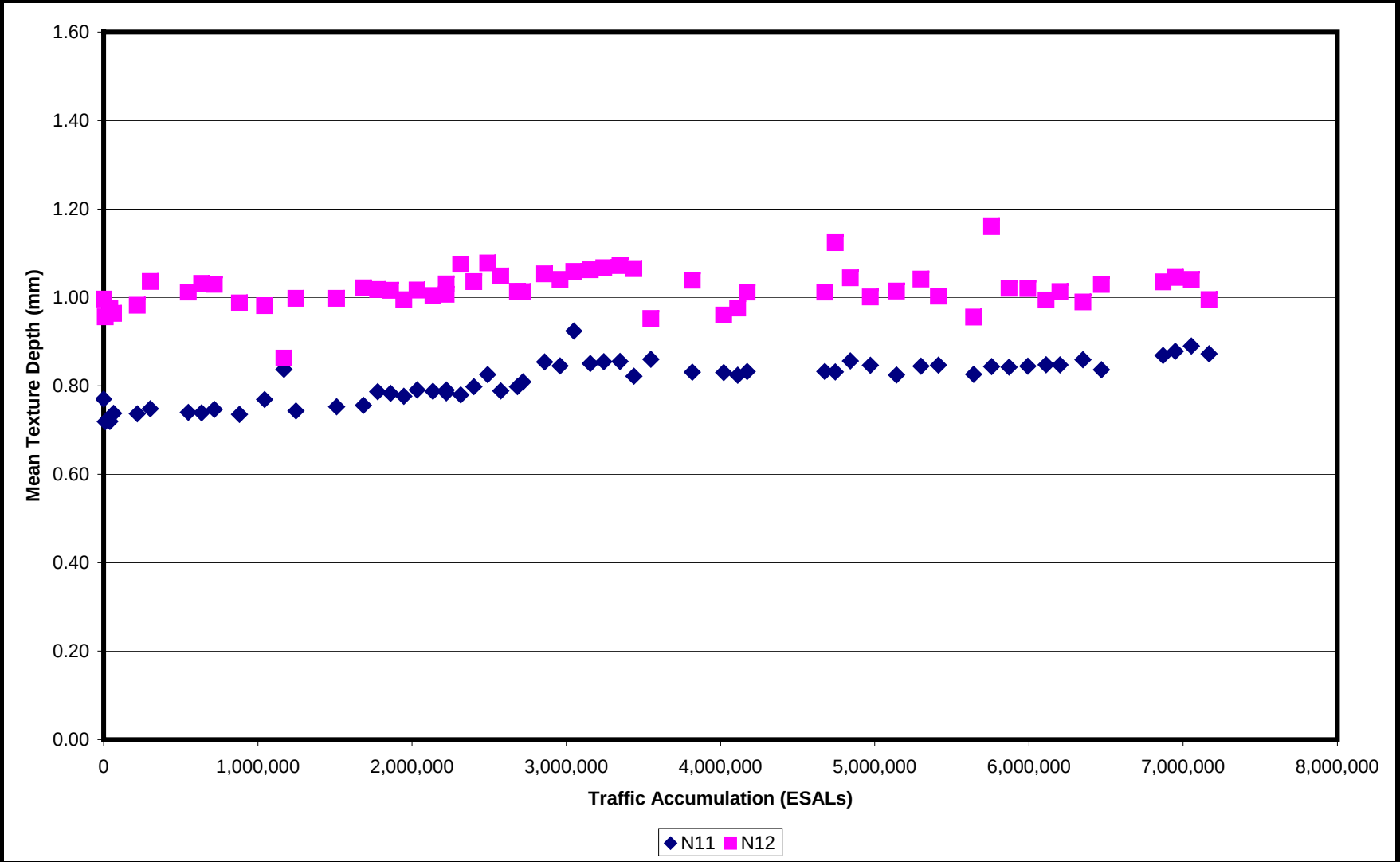
CHANGING TEXTURE



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TRANSVERSE JOINTS

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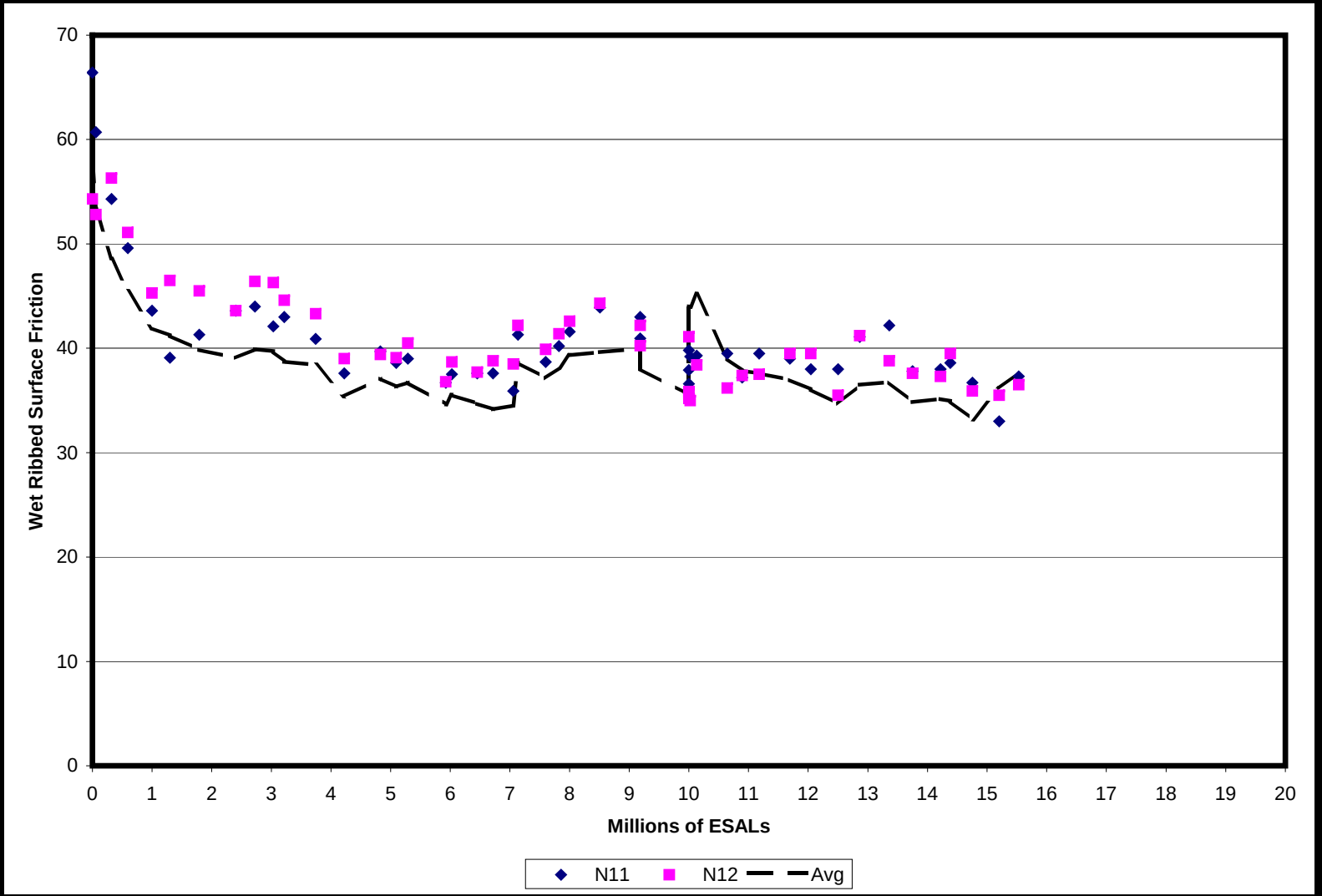
SURFACE FRICTION



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LONGITUDINAL JOINTS

TOP-DOWN CRACKS IN OLD MIXES

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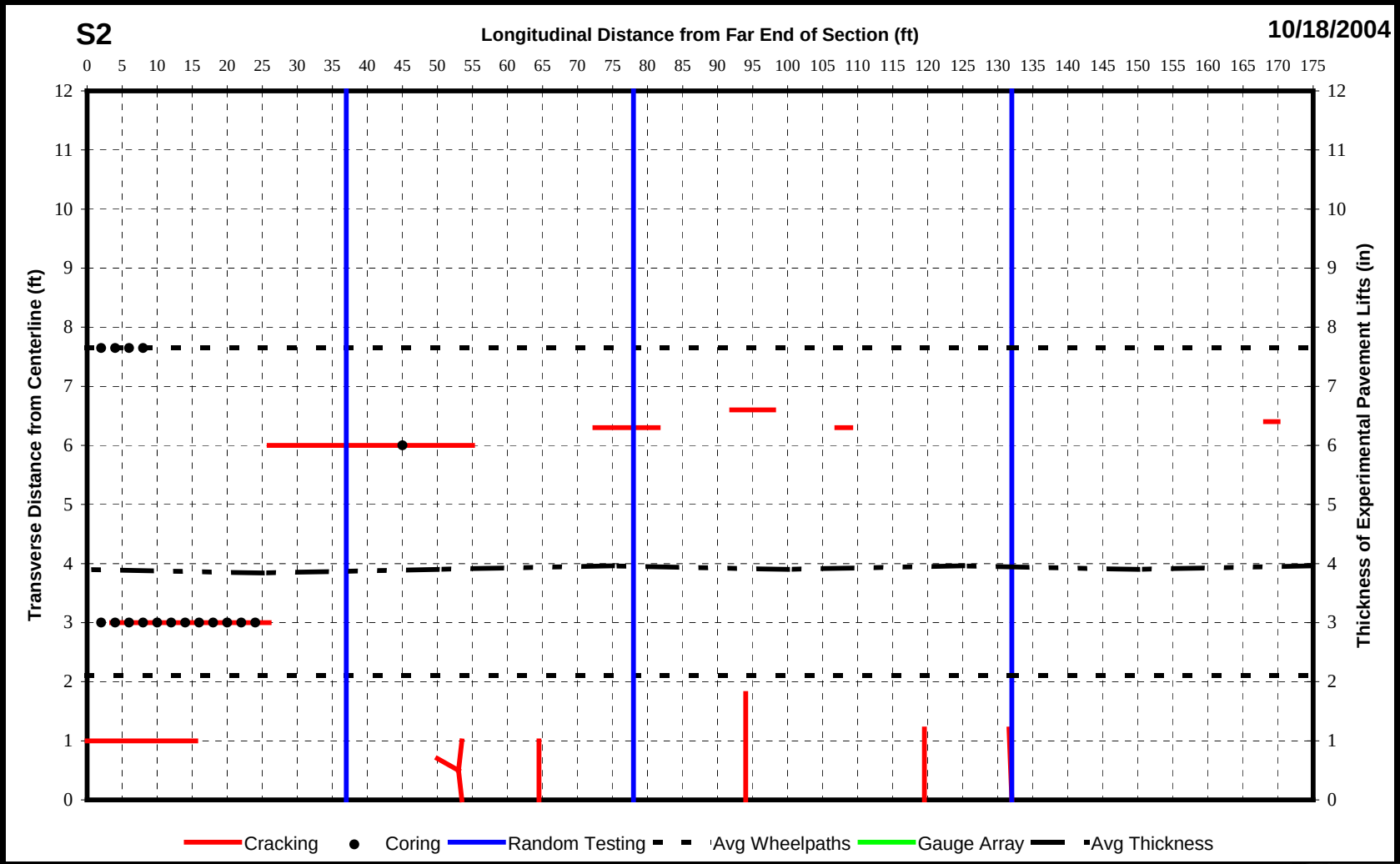
S2 CRACK MAP



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BOTTOM-UP CRACKS IN NEW MIXES

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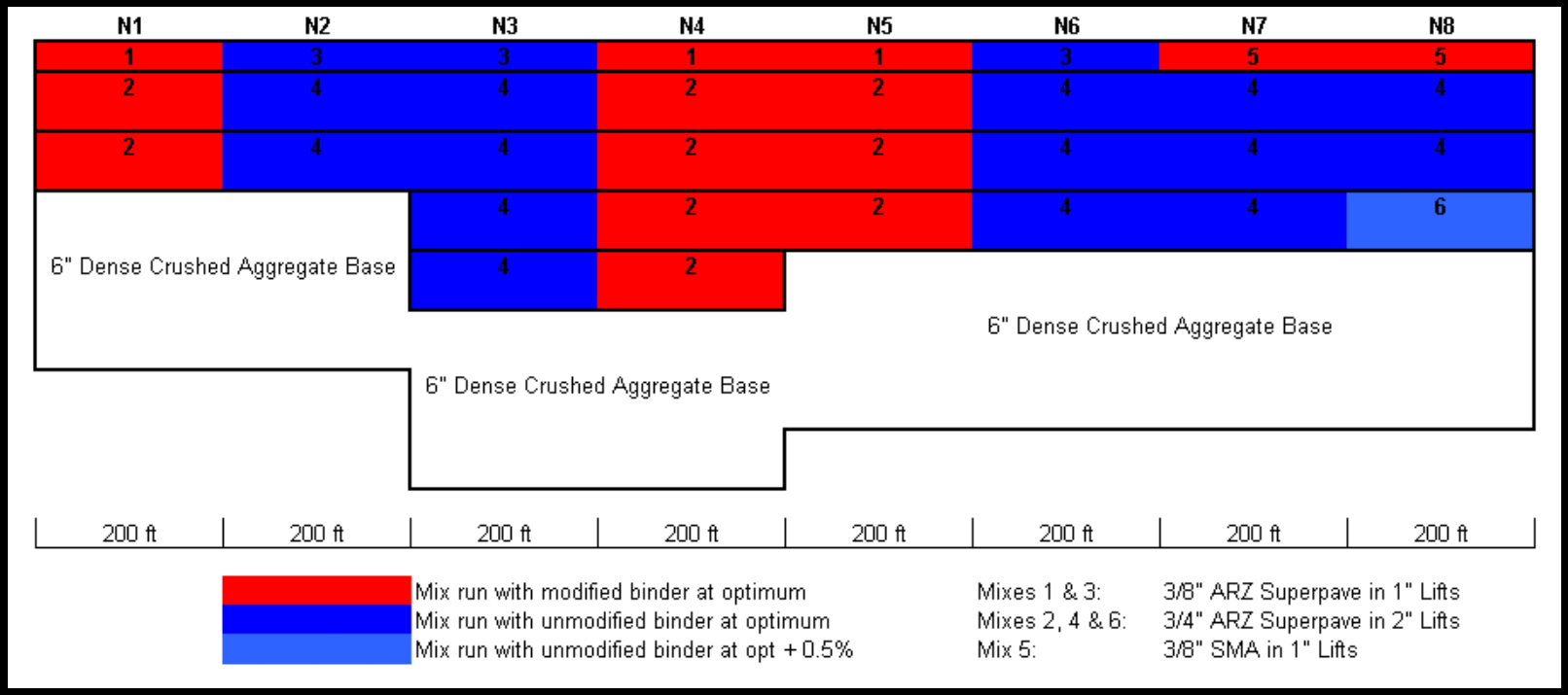
STRUCTURAL STUDY

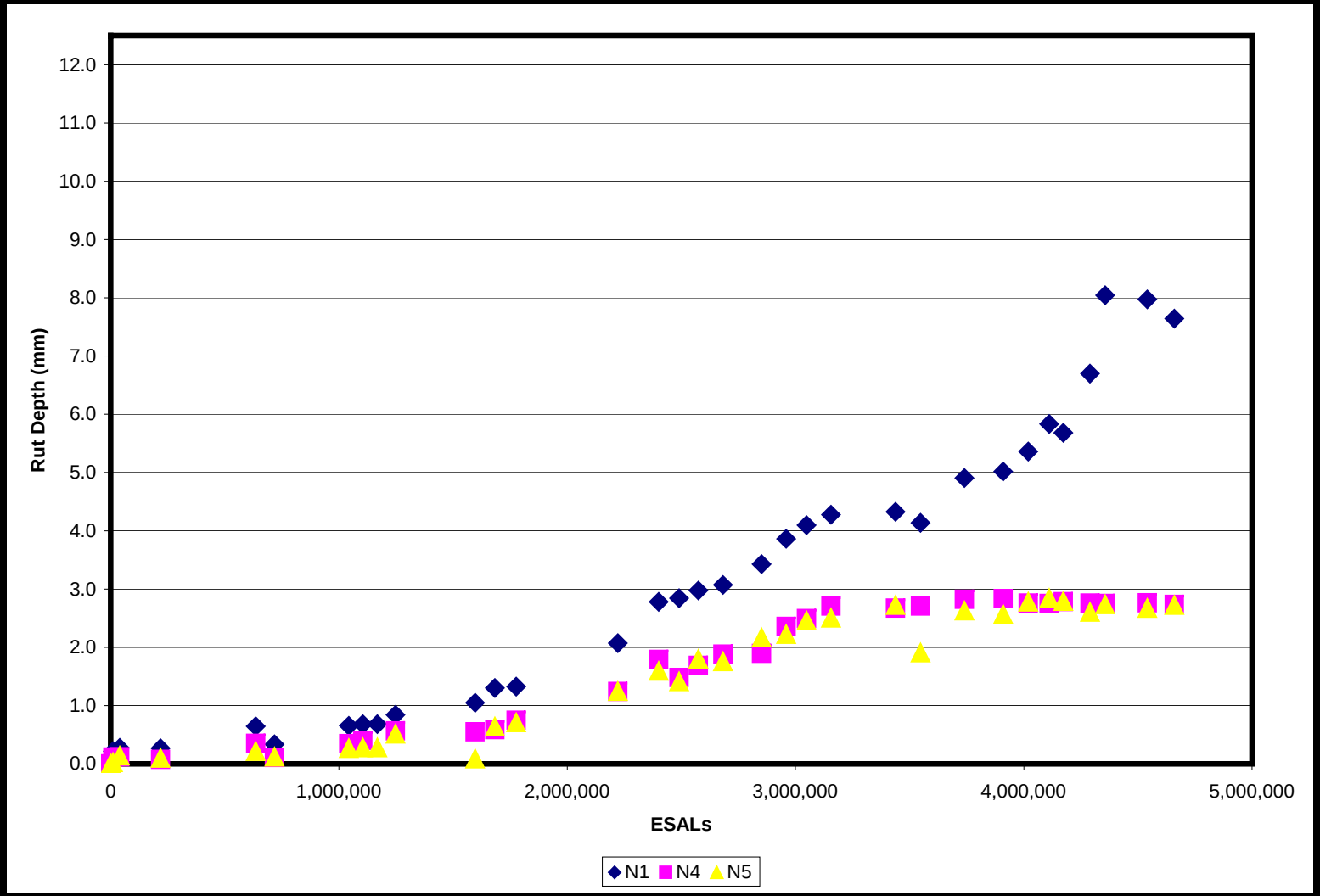


NCAT Pavement Test Track

STRUCTURAL STUDY OBJECTIVES

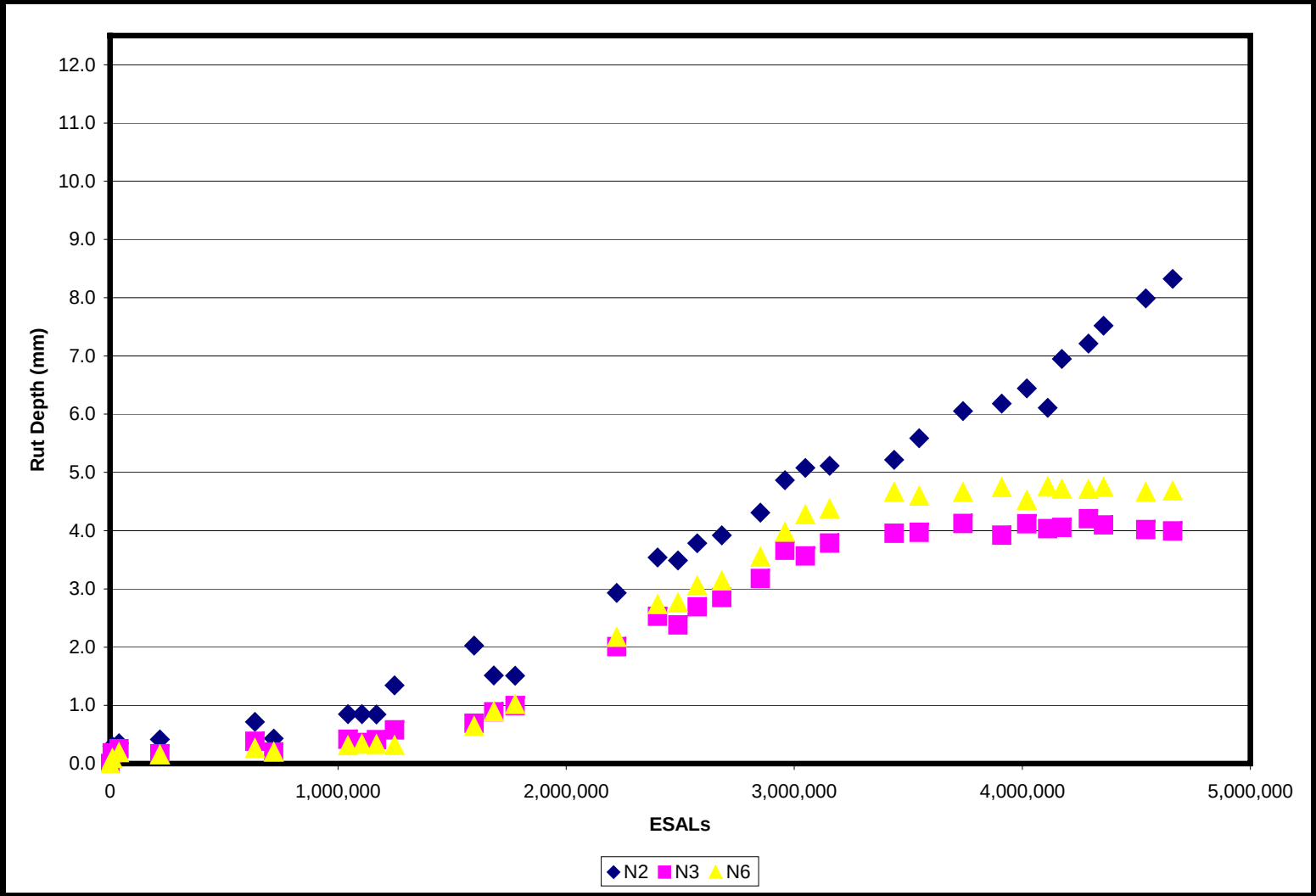
- Determine Actual Layer Coefficients for ’93 AASHTO Design Describing New Mixes, Materials and Methods
- Provide an Initial Validation of the Upcoming Mechanistic Design Guide (Mechanistic and Performance Models)
- Prepare for Comprehensive Validation Experiment on the 2006 Track (3RD Cycle of Testing)

STRUCTURAL SECTION RUTTING



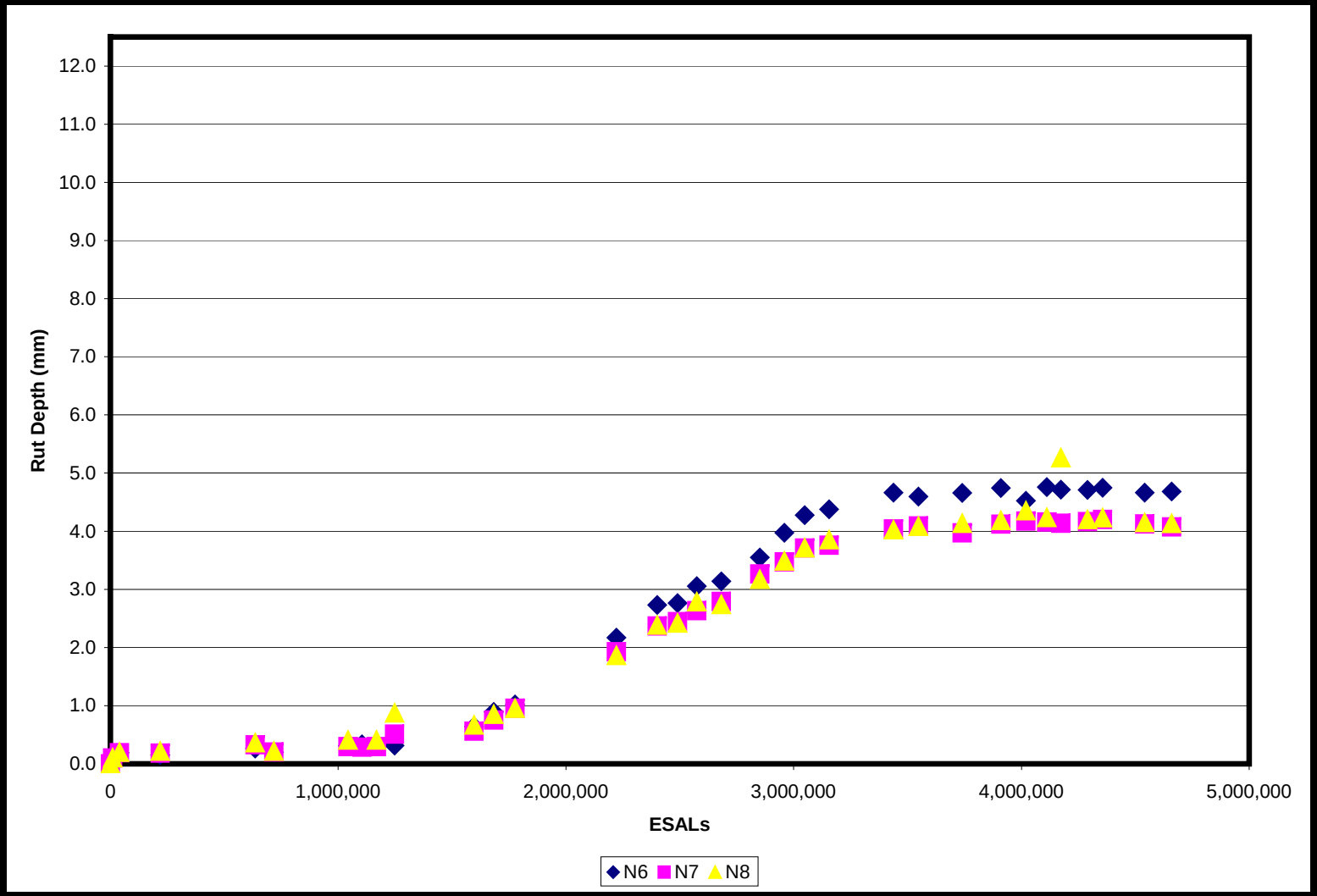
NCAT Pavement Test Track

STRUCTURAL SECTION RUTTING



NCAT Pavement Test Track

STRUCTURAL SECTION RUTTING



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RESPONSE INSTRUMENTATION

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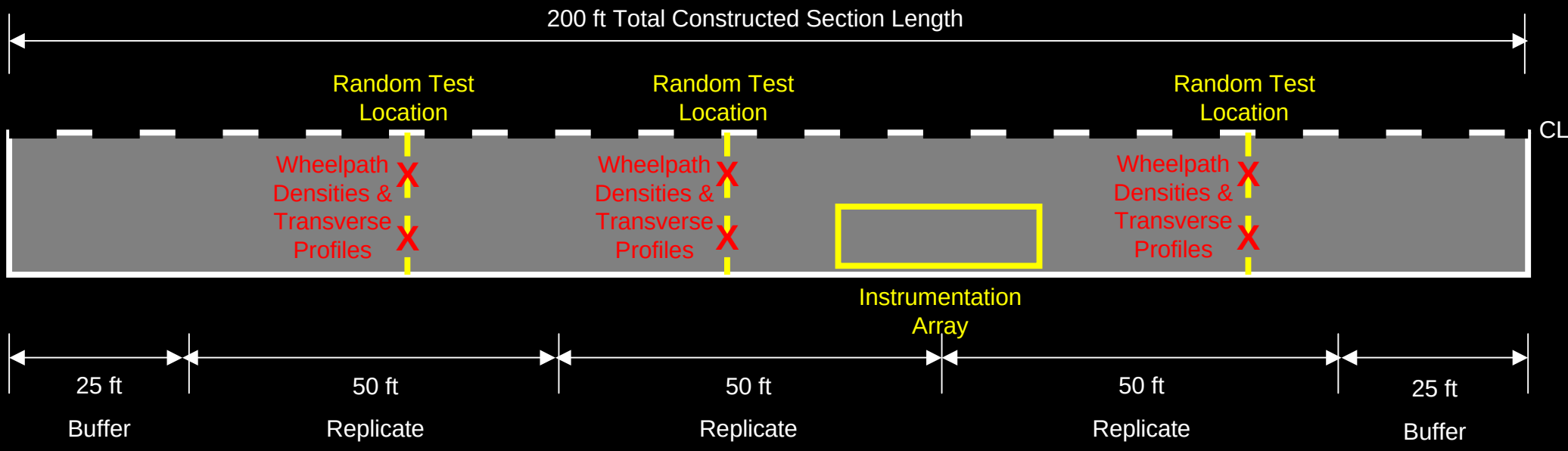
FIELD PERFORMANCE TESTING



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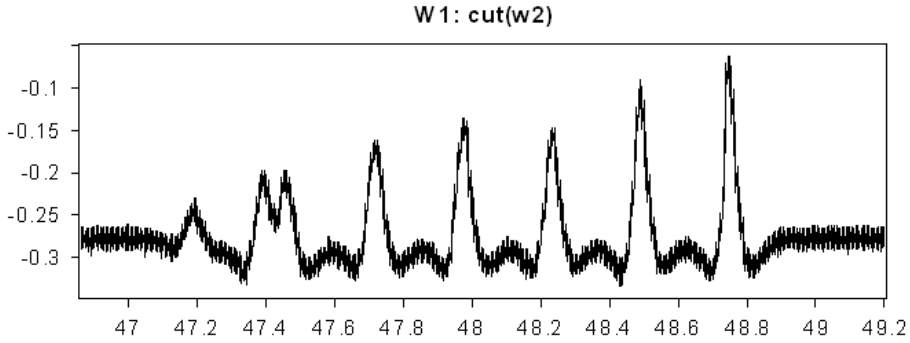
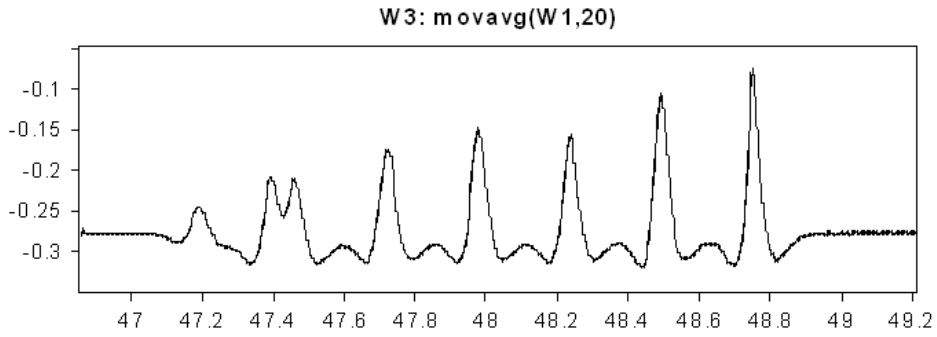
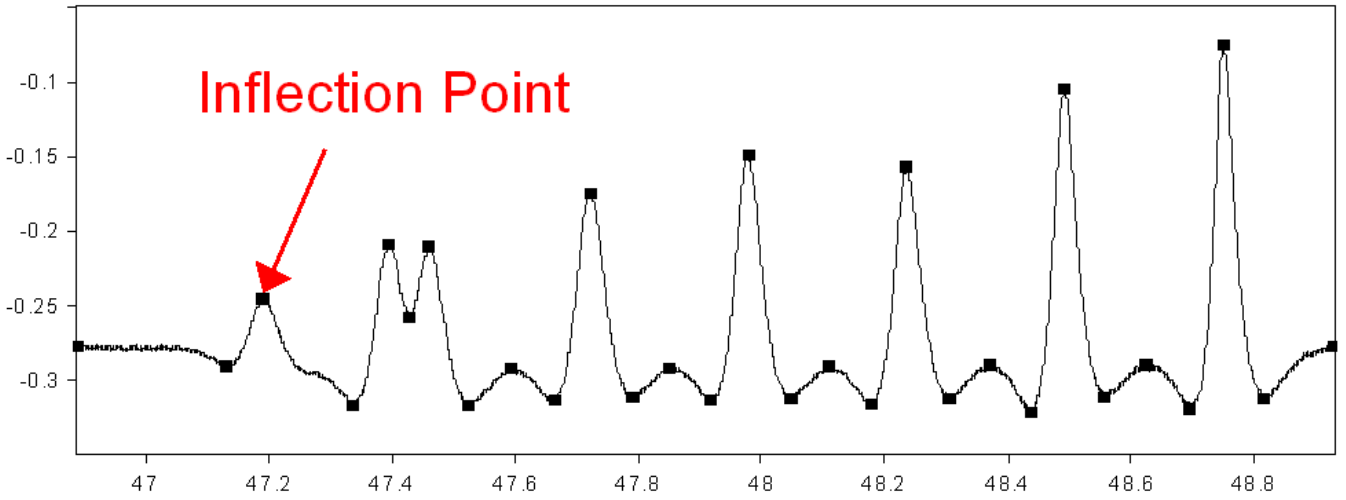
STRAIN SIGNAL PROCESSING





W4: inflect(W3,60,350,4.5)

	1: Unknown	
1:	46.889807	
2:	47.130626	
3:	47.191080	
4:	47.334972	
5:	47.394927	
6:	47.428902	
7:	47.459879	
8:	47.523831	
9:	47.591780	
10:	47.663226	
11:	47.722681	
12:	47.791130	



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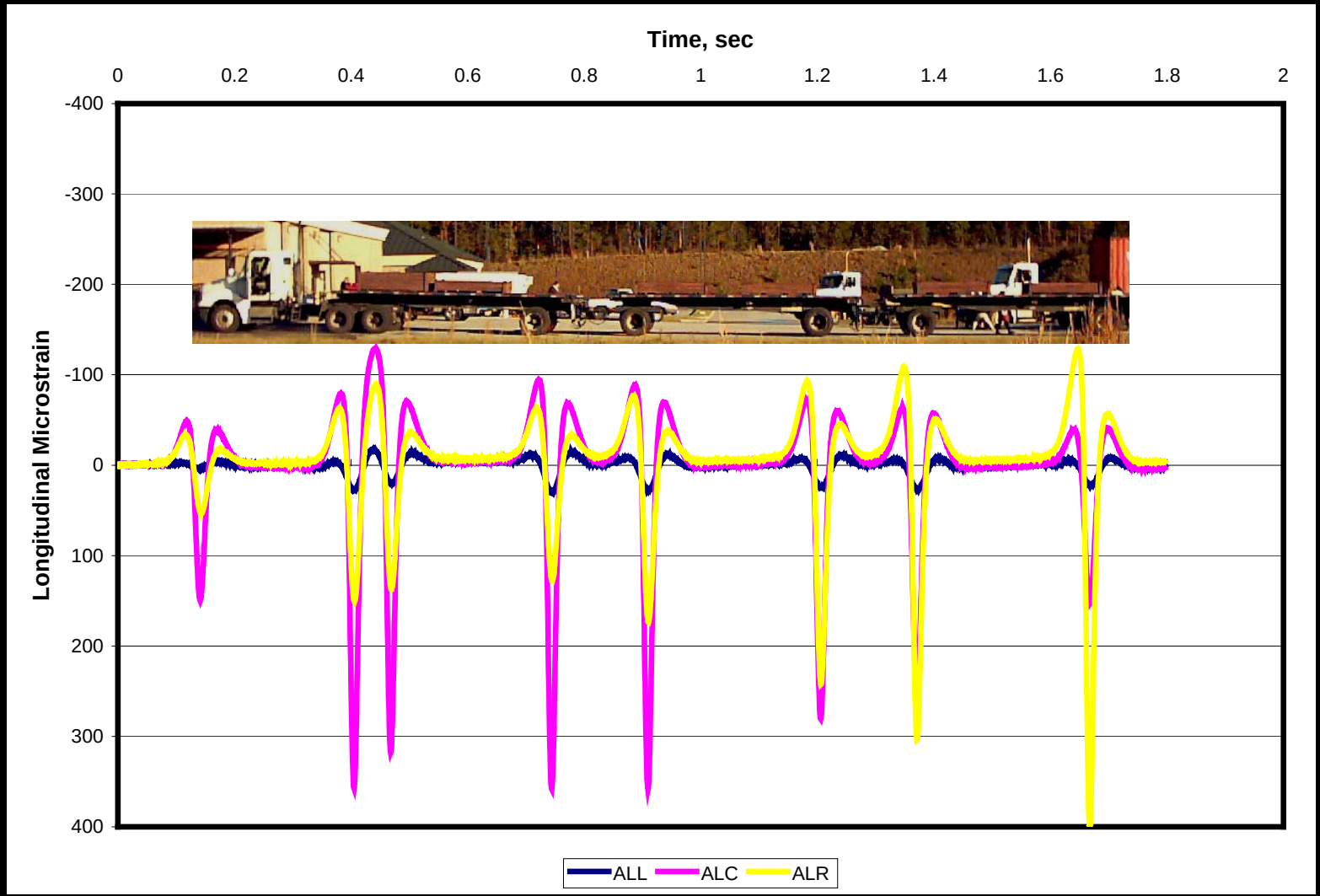
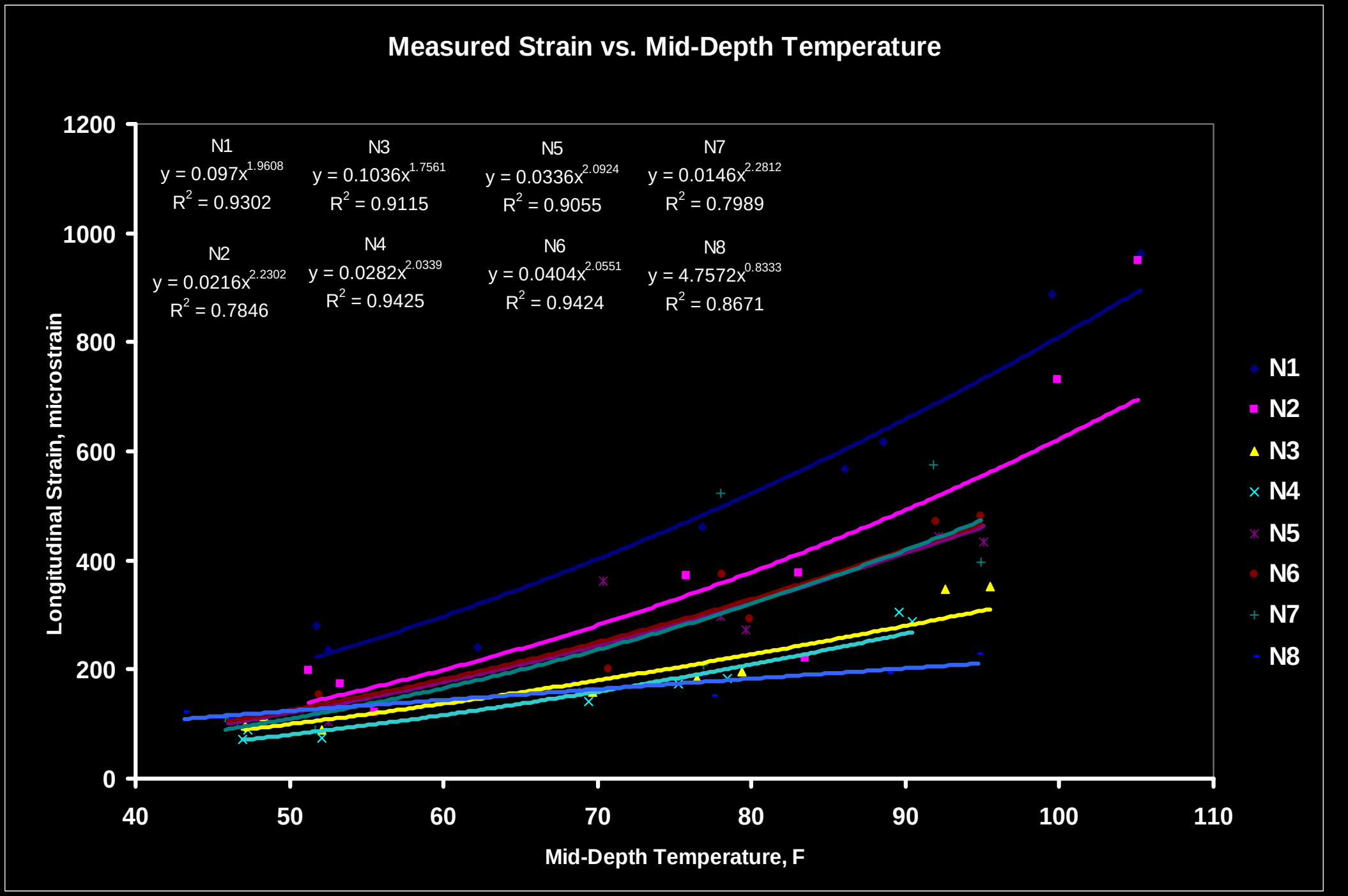
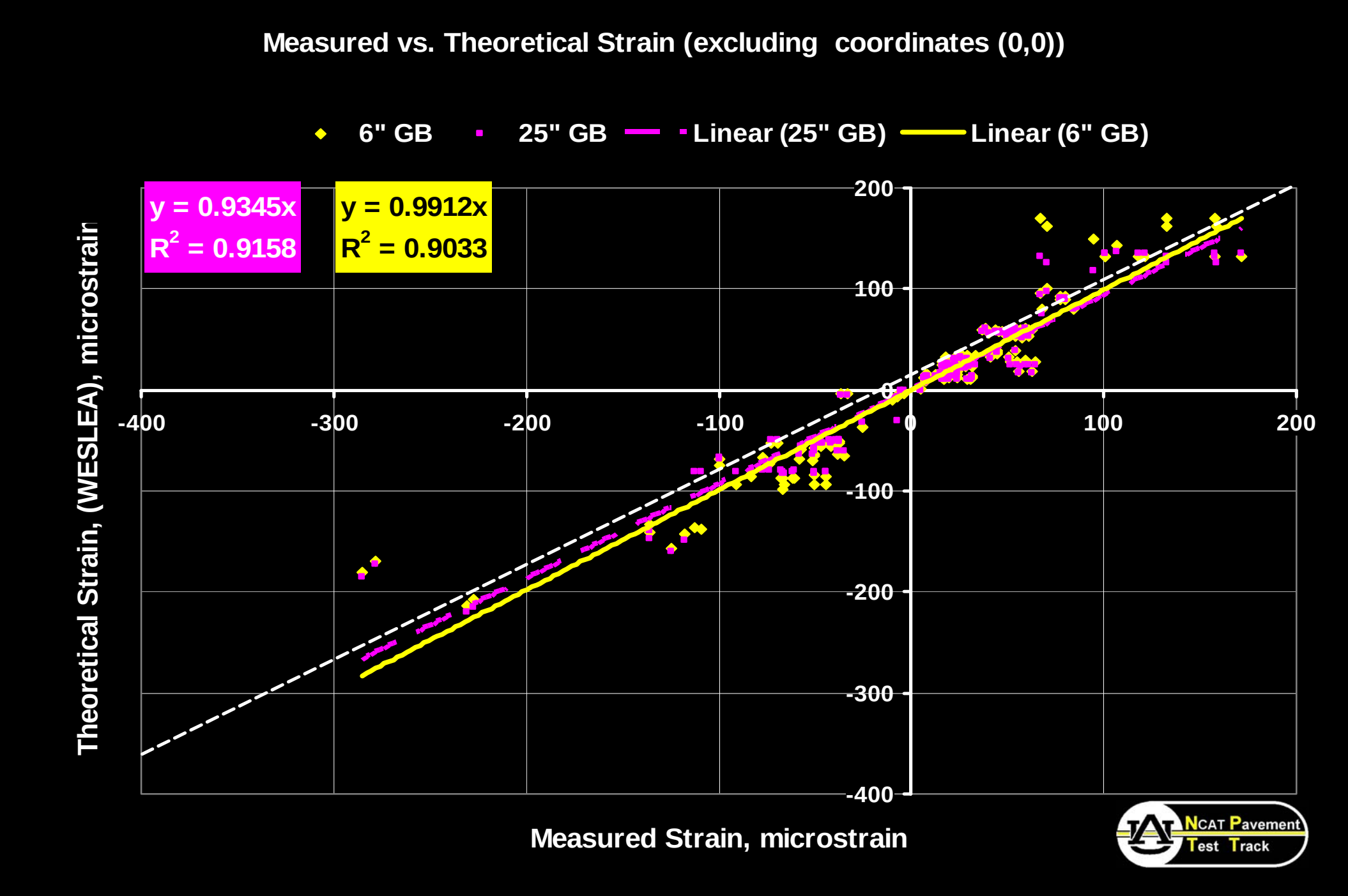
MEASURED PAVEMENT RESPONSE

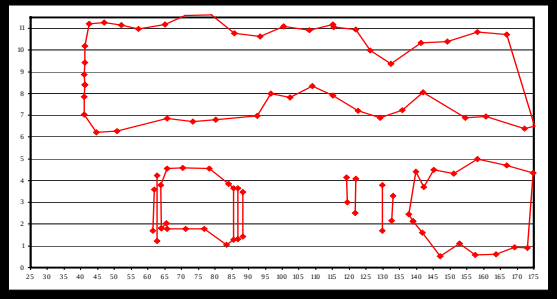


NCAT Pavement Test Track


Measured Strain vs. Mid-Depth Temperature
N1
y = 0.097x^1.9608
R^2 = 0.9302
N3
y = 0.1036x^1.7561
R^2 = 0.9115
N5
y = 0.0336x^2.0924
R^2 = 0.9055
N7
y = 0.0146x^2.2812
R^2 = 0.7989
N2
y = 0.0216x^2.2302
R^2 = 0.7846
N4
y = 0.0282x^2.0339
R^2 = 0.9425
N6
y = 0.0404x^2.0551
R^2 = 0.9424
N8
y = 4.7572x^0.8333
R^2 = 0.8671
Longitudinal Strain, microstrain
0
200
400
600
800
1000
1200
40
50
60
70
80
90
100
110
Mid-Depth Temperature, F
N1
N2
N3
N4
N5
N6
N7
N8

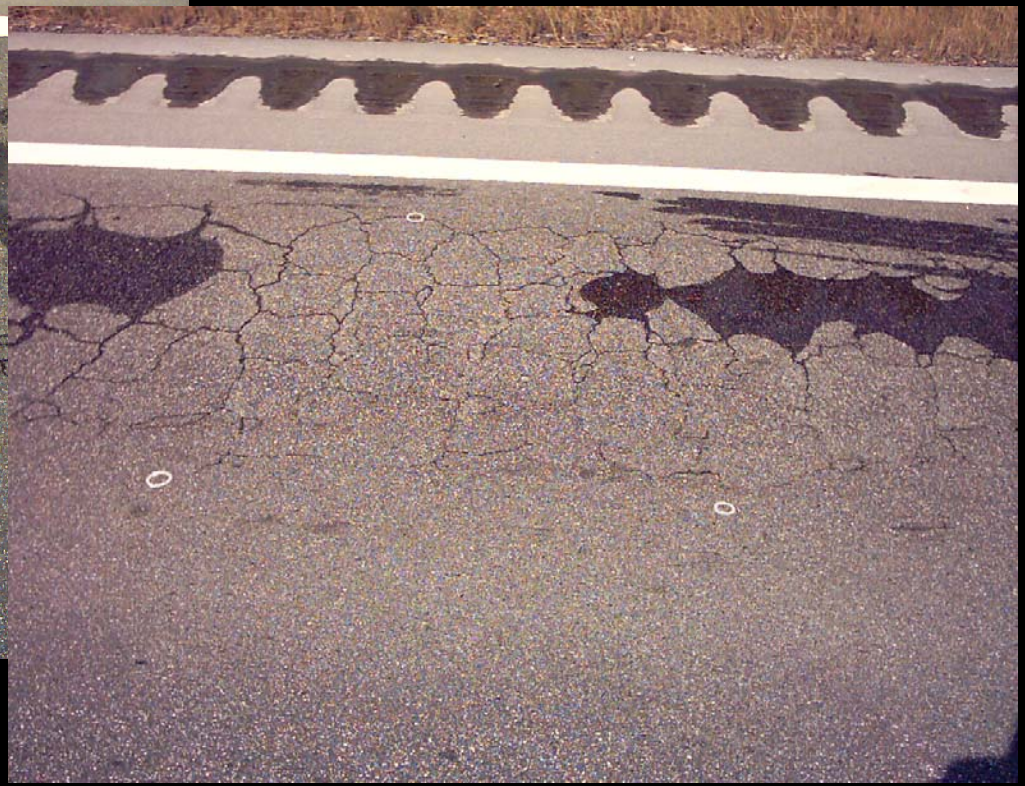

Measured vs. Theoretical Strain (excluding coordinates (0,0))
6" GB
25" GB
Linear (25" GB)
Linear (6" GB)
y = 0.9345x
R2 = 0.9158
y = 0.9912x
R2 = 0.9033
Theoretical Strain, (WESLEA), microstrain
Measured Strain, microstrain
200
100
0
-100
-200
-300
-400
-400
-300
-200
-100
0
100
200
NCAT Pavement Test Track

FATIGUE CRACK DEVELOPMENT



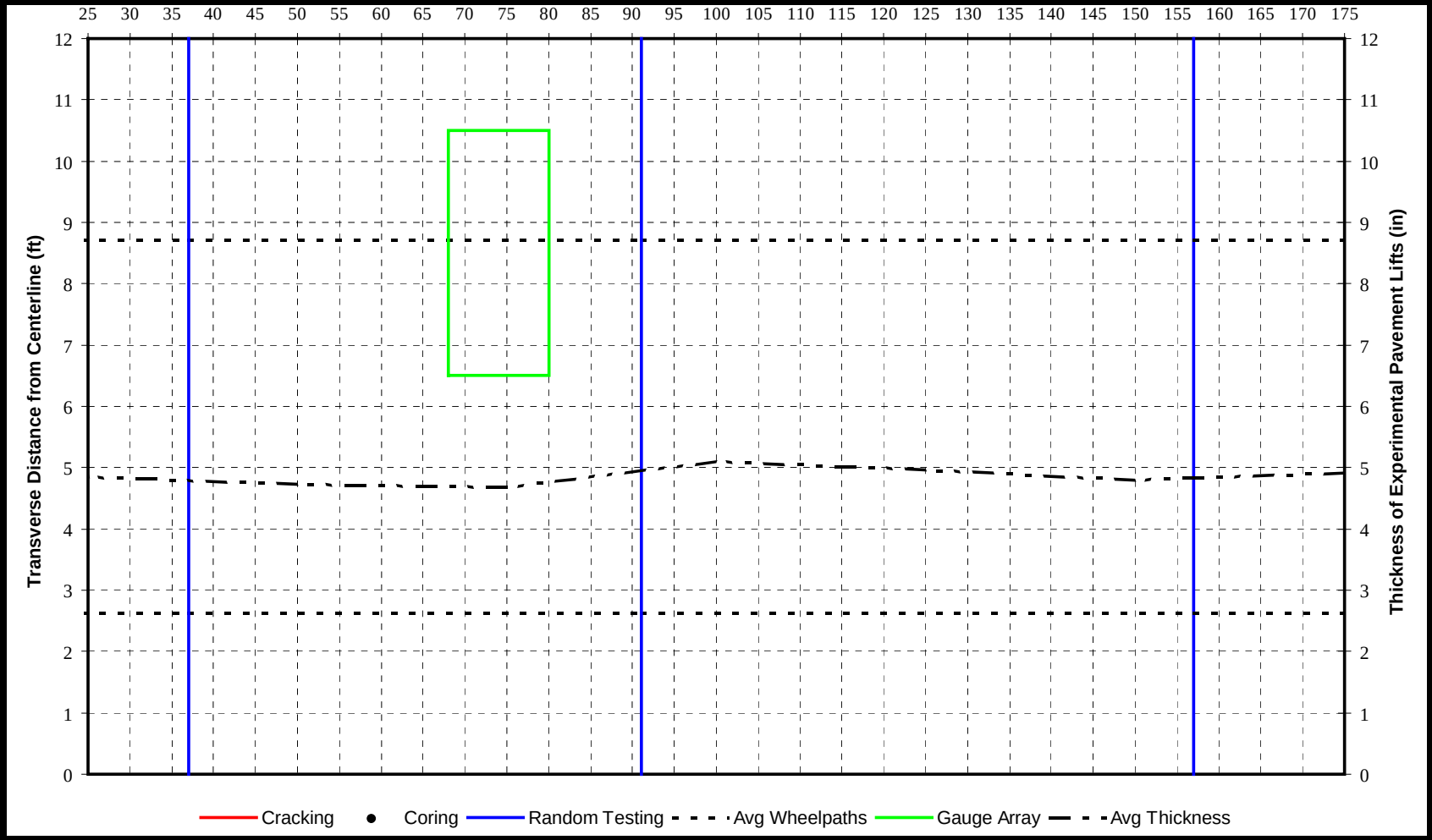
NCAT Pavement Test Track

N1 & N2 – 10/11/04 (4.1M)

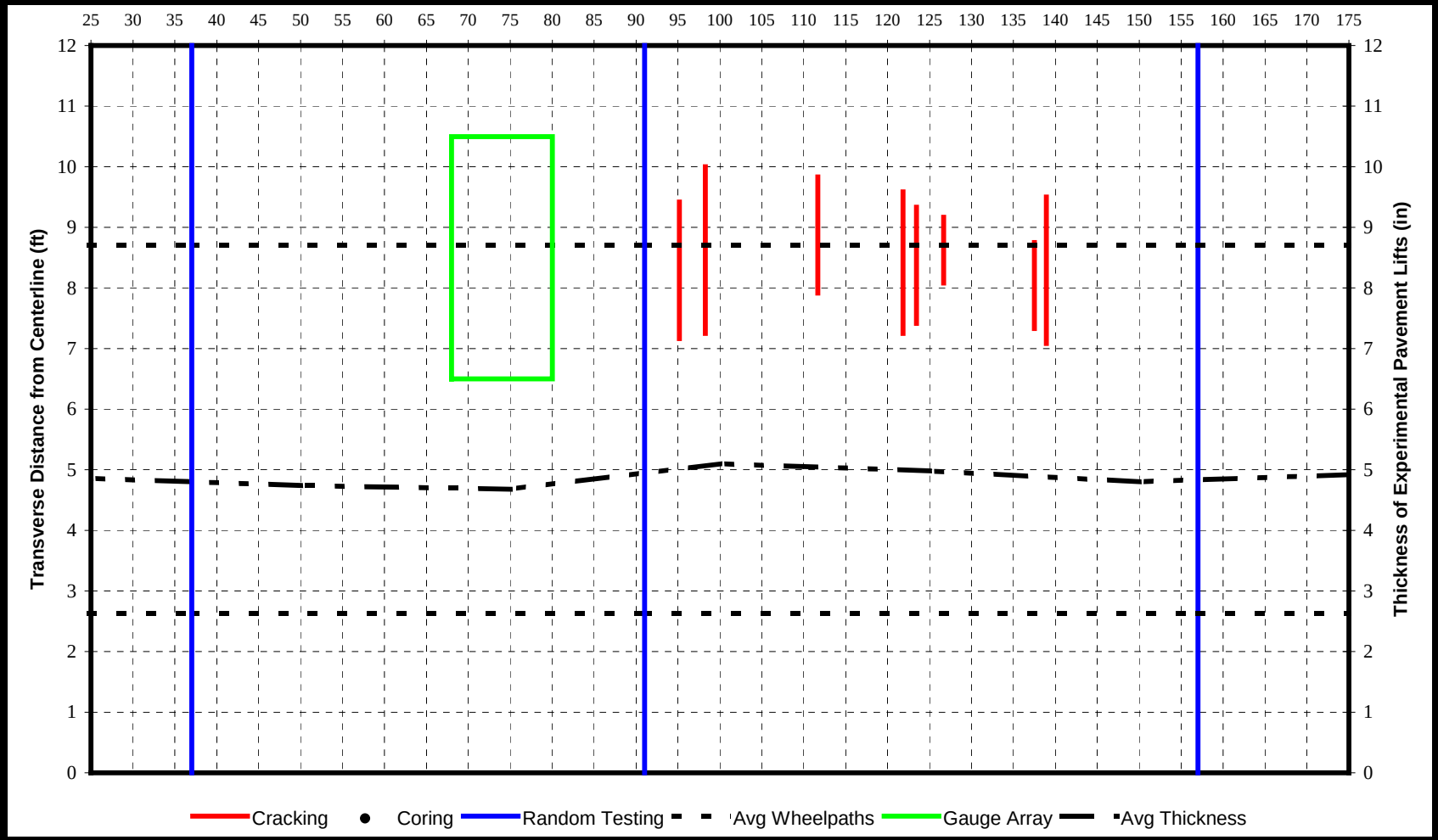


HISTORY OF N2

N2 CRACK MAP – 10/21/03 (0.0M)



N2 CRACK MAP – 6/21/04 (2.6M)



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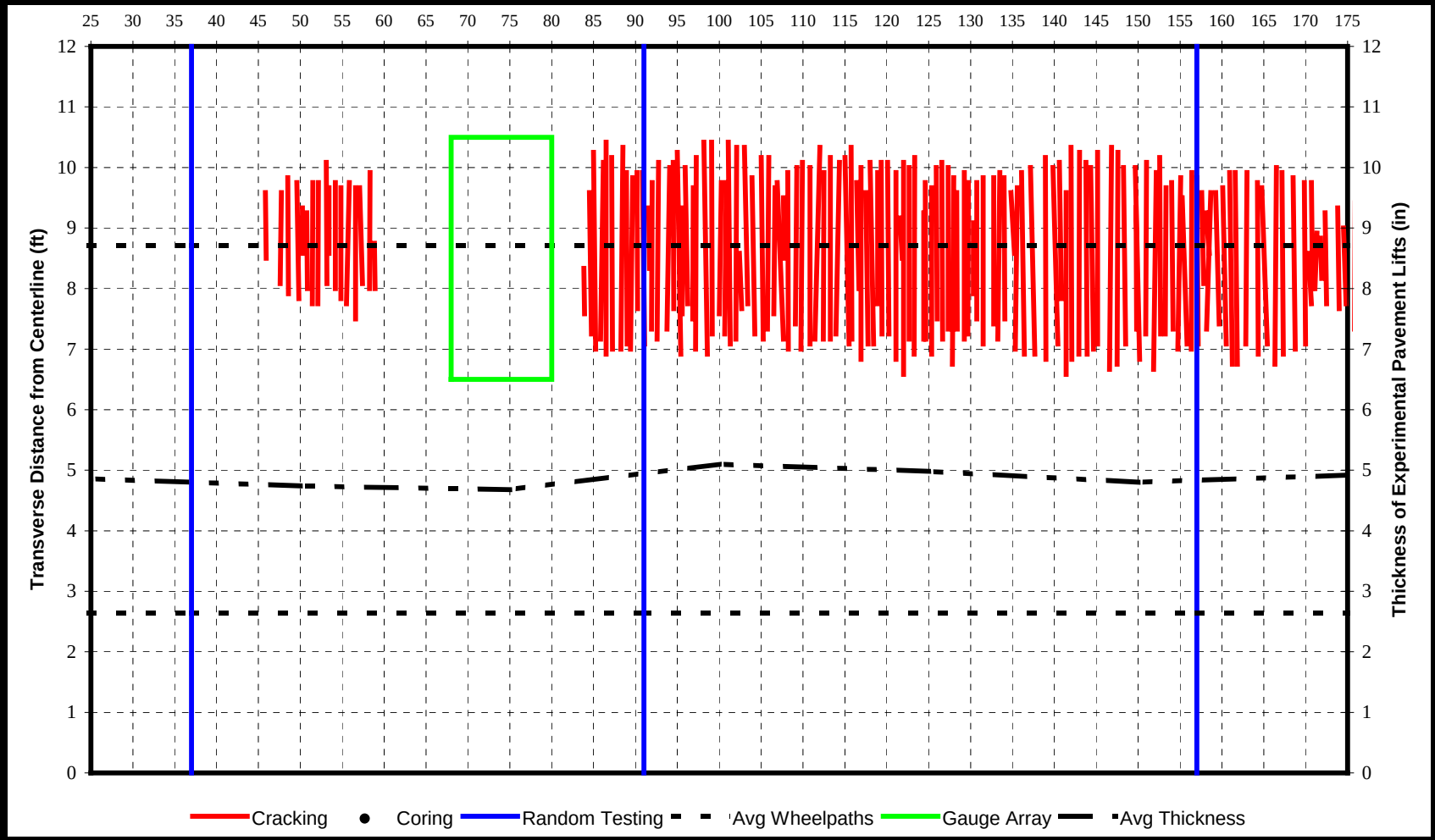
N2 CRACK MAP – 6/28/04 (2.7M)



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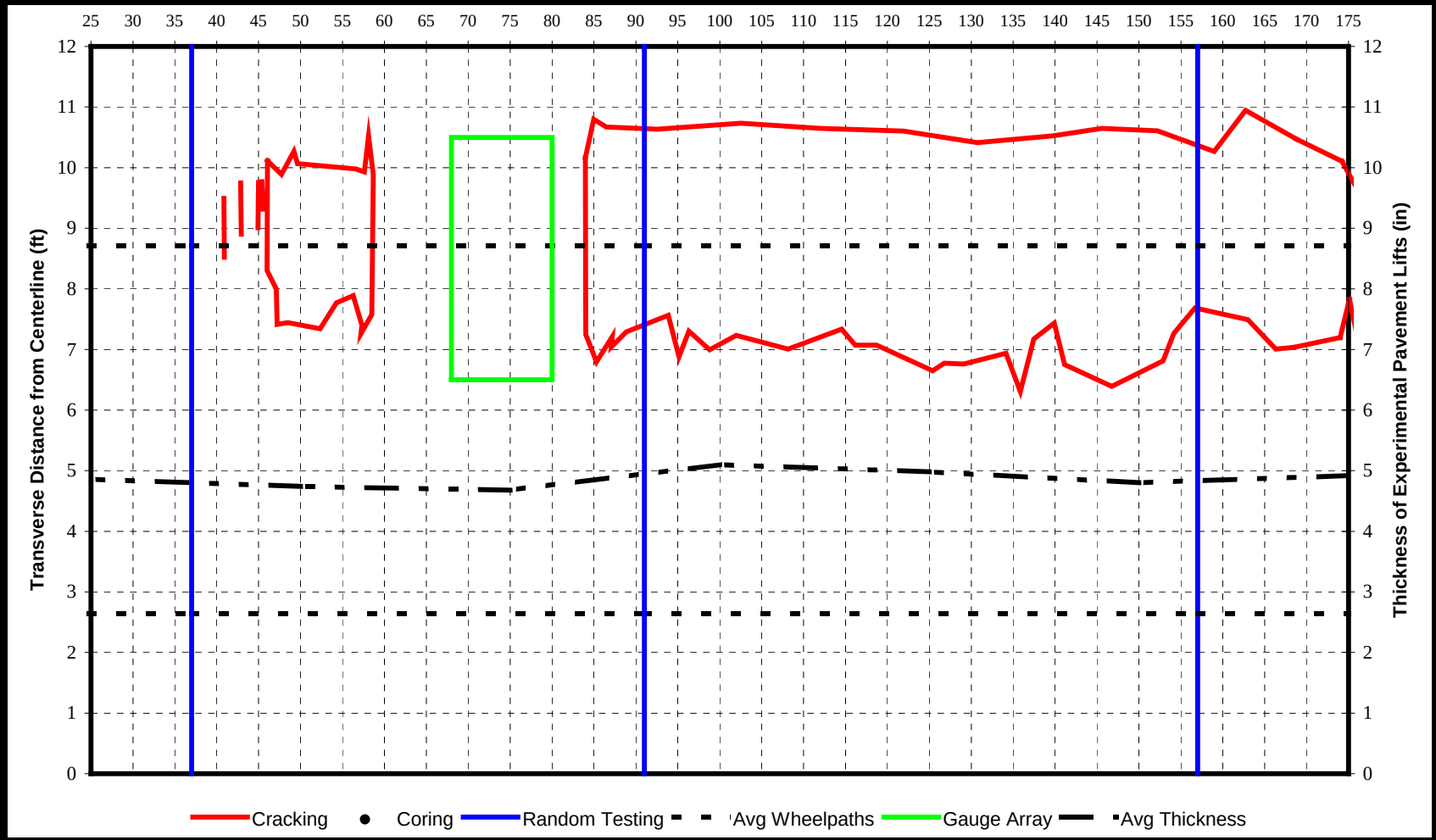
N2 CRACK MAP – 8/2/04 (3.2M)



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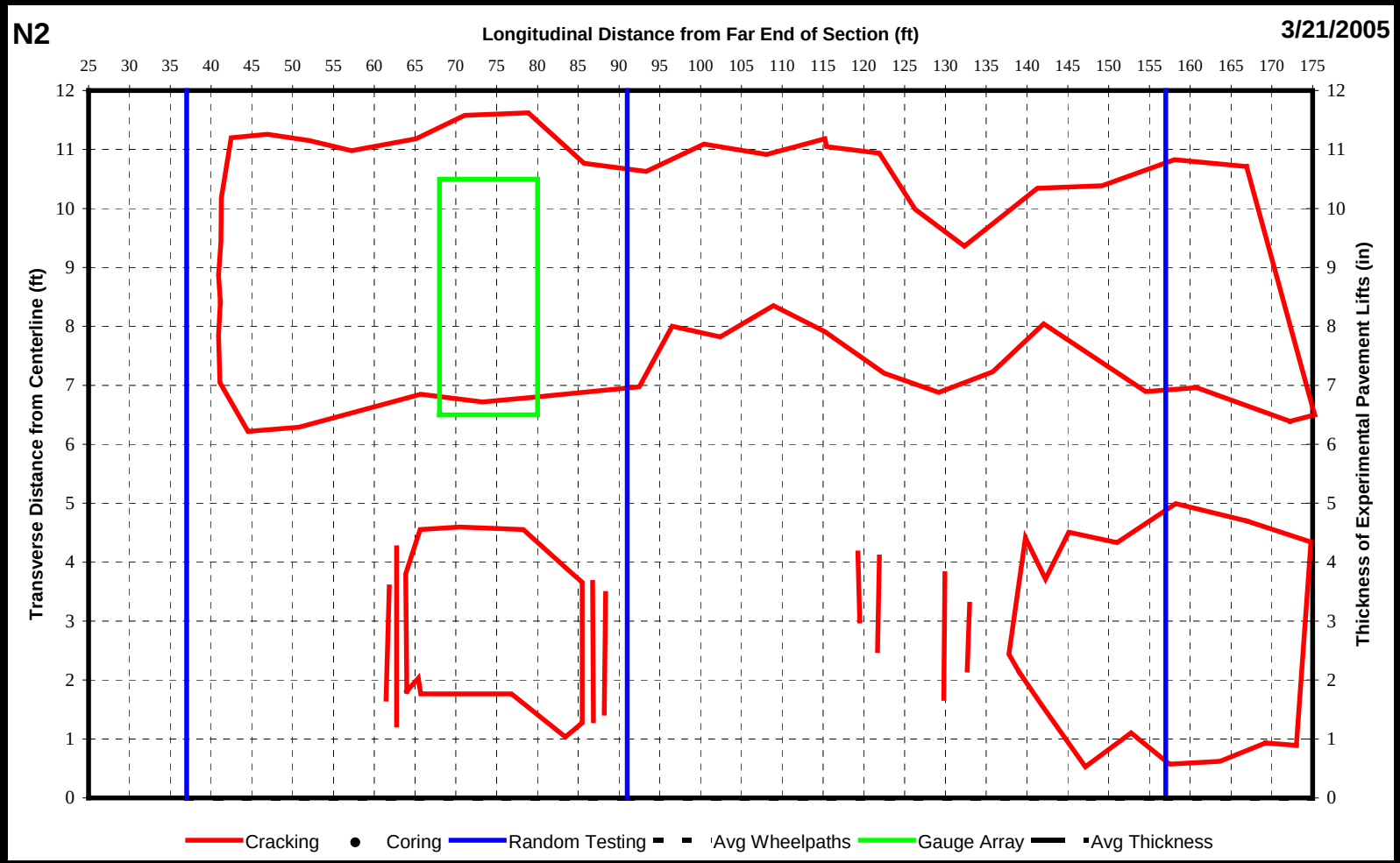
N2 FATIGUE CRACKING

NCAT Pavement Test Track

TERMINAL N2 CRACK MAP



NCAT Pavement Test Track

PRELIMINARY FINDINGS

- No Difference in Stiffness Between Modified and Unmodified Mixes, But More Elastic Recovery in Modifieds
- Strong Relationship Between Temperature, Thickness and Strain Accommodates Blending Temperature and Traffic Record into Cumulative, Comprehensive Damage Model
- Higher Longitudinal Strains Induce Transverse Cracking
- Thin Sections Failed, Lasted Longer than Predicted

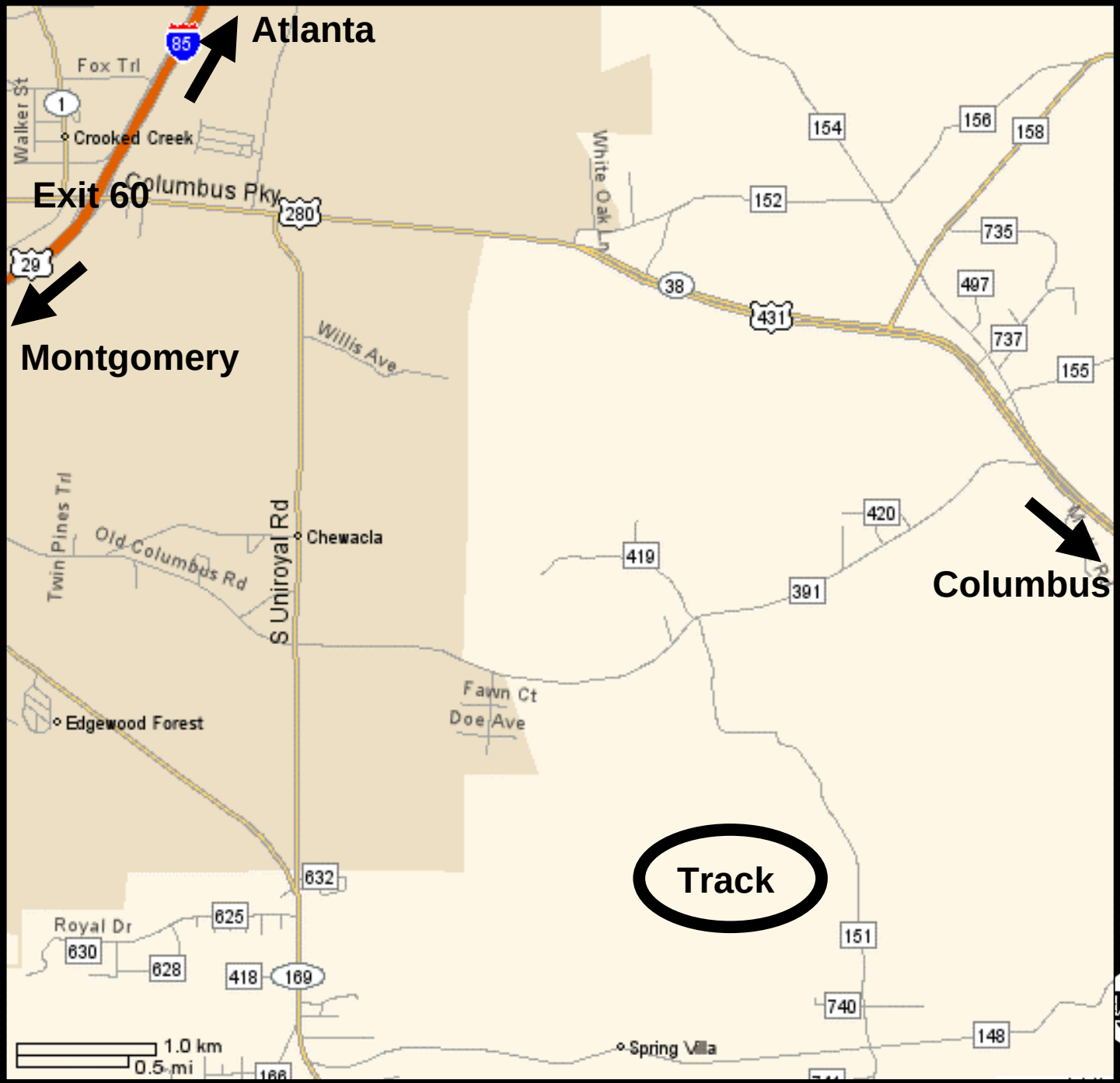
2006 TRACK RESEARCH OPTIONS

- Structural Deep Remove/Replace Sections in a Comprehensive Validation Experiment for Mechanistic-Empirical Thickness Design (**$150k** per Section per Year for 3 Years)
- Mill and Inlay New Mix Performance Sections (**$100k** per Section per Year for 3 Years)
- Continue Traffic on Existing Sections and Apply Another Design Lifetime of Trucking (**$50k** per Section per Year for 3 Years)

STRUCTURAL MILLING

APT COOPERATIVE EFFORTS

- Purdue Rutting Study on 2000 Track
- Florida Rutting Study on 2003 Track
- Purdue Structural Study on 2003 Track
- New TRB Alliance Subcommittee
- Structural Sections on 2006 Track


Atlanta
Exit 60
Montgomery
Columbus
Track
Fox Trl
Walker St
Crooked Creek
Columbus Pky
White Oak Ln
Willis Ave
Twin Pines Trl
Old Columbus Rd
S Uniroyal Rd
Chewacla
Edgewood Forest
Fawn Ct
Doe Ave
Royal Dr
Spring Villa
1.0 km
0.5 mi
85
1
280
29
38
431
154
156
158
152
735
497
737
155
420
419
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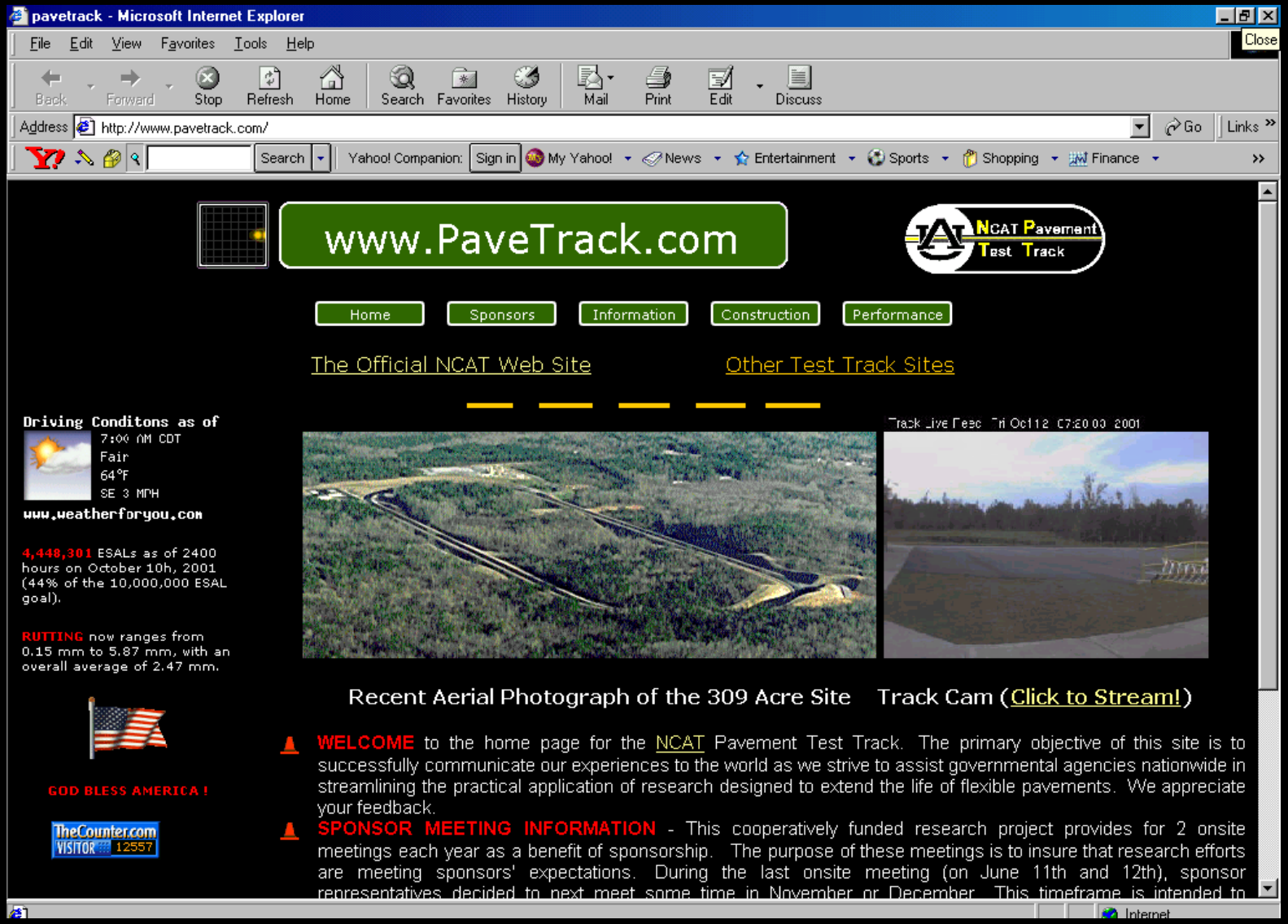
632
625
630
628
418
169
151
740
148
166



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