NCAT Pavement Test Track

Illinois Asphalt Pavement Association

75th Annual Meeting

March 12, 2012

25 YEARS 1986 - 2011
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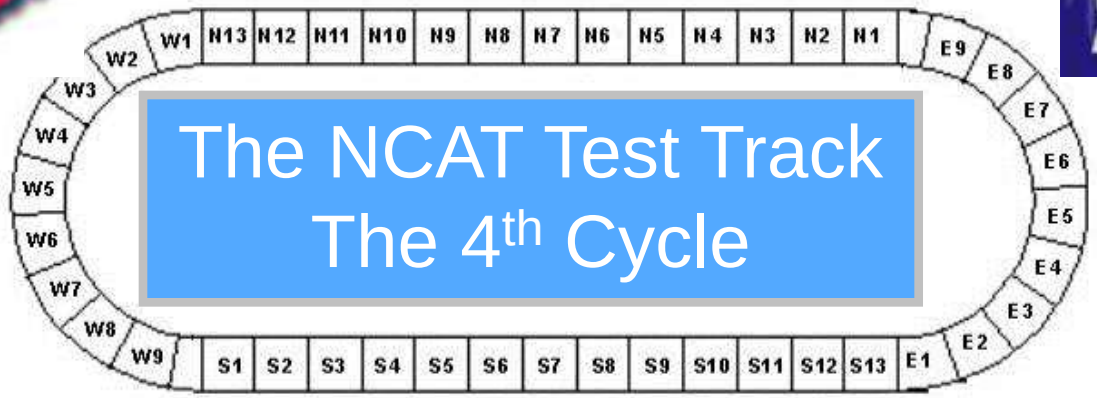
The NCAT Test Track
The 4th Cycle



Track Fleet Operations

NCAT Test Track

Types of Sections

1. Surface Layer Performance
2. Full-Depth Structural Studies

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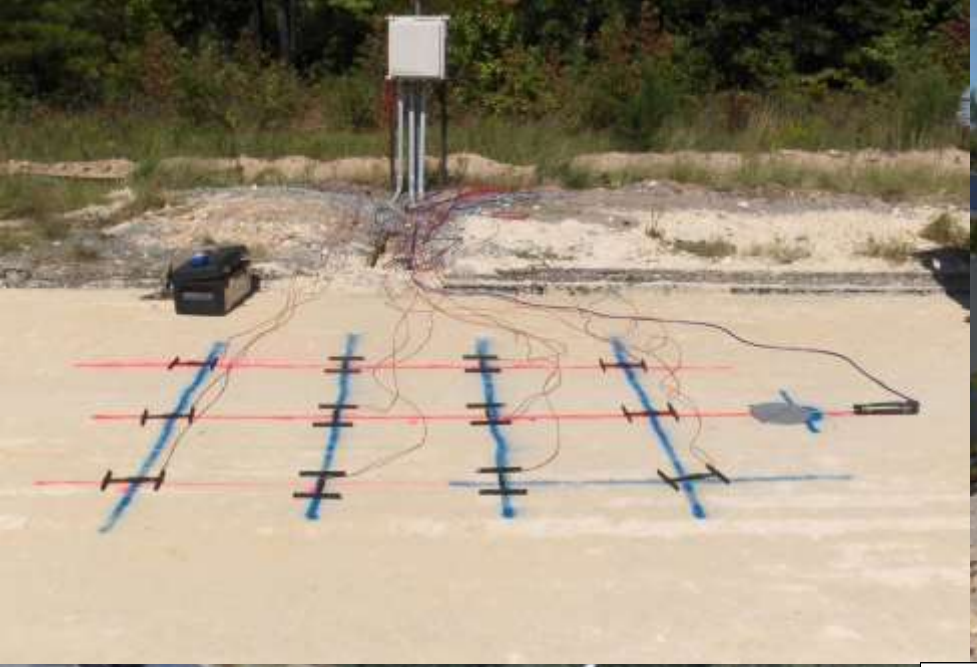

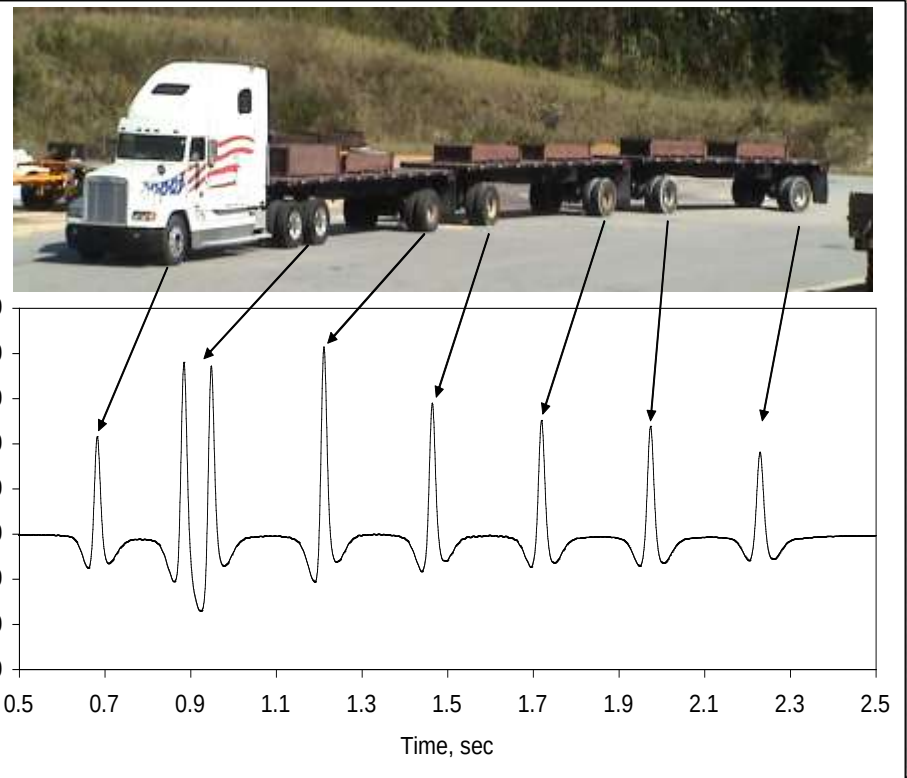
500
400
300
200
100
0
-100
-200
-300
Longtidinal Microstrain
0.5
0.7
0.9
1.1
1.3
1.5
1.7
1.9
2.1
2.3
2.5
Time, sec









NCAT
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2006 High RAP Test Sections

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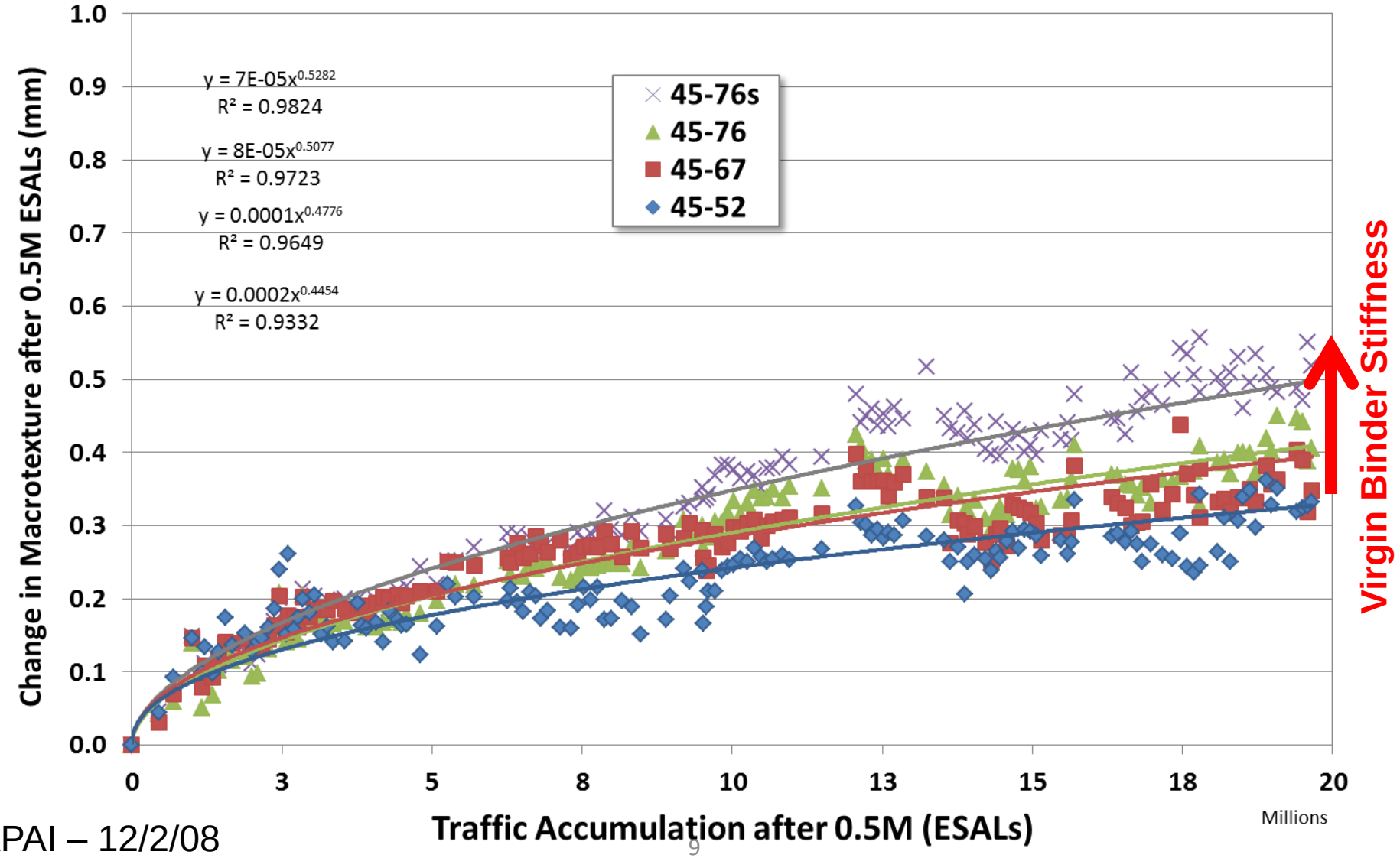
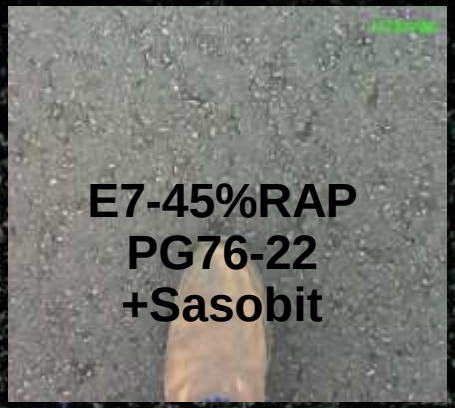
2006 High RAP Surface Mix Study



45% RAP Sections



3.5’ 13.9’ 53.9’ 145.5’

Total Length of Cracking after 2 cycles

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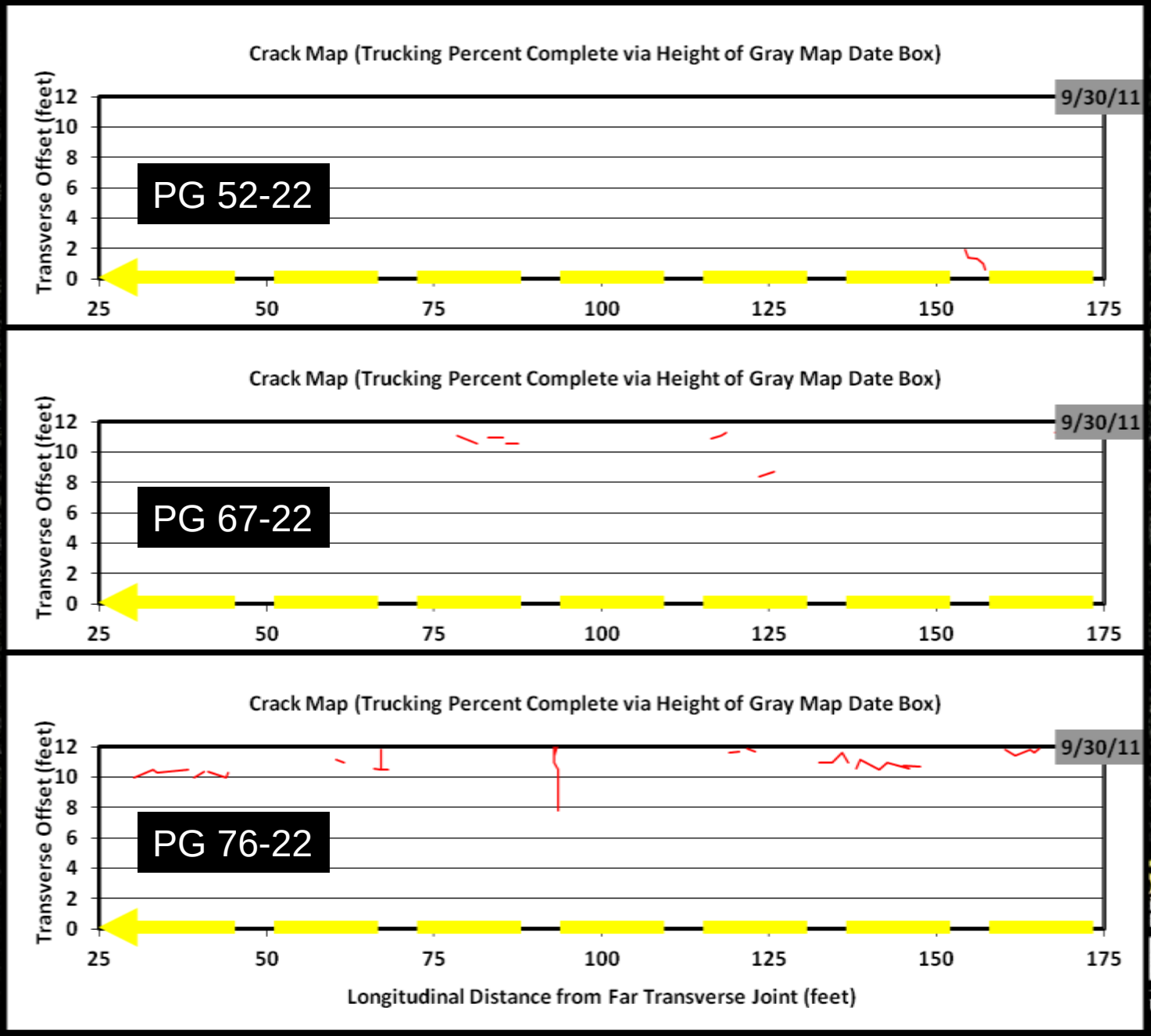
2006 45% RAP

Virgin Binder Stiffness



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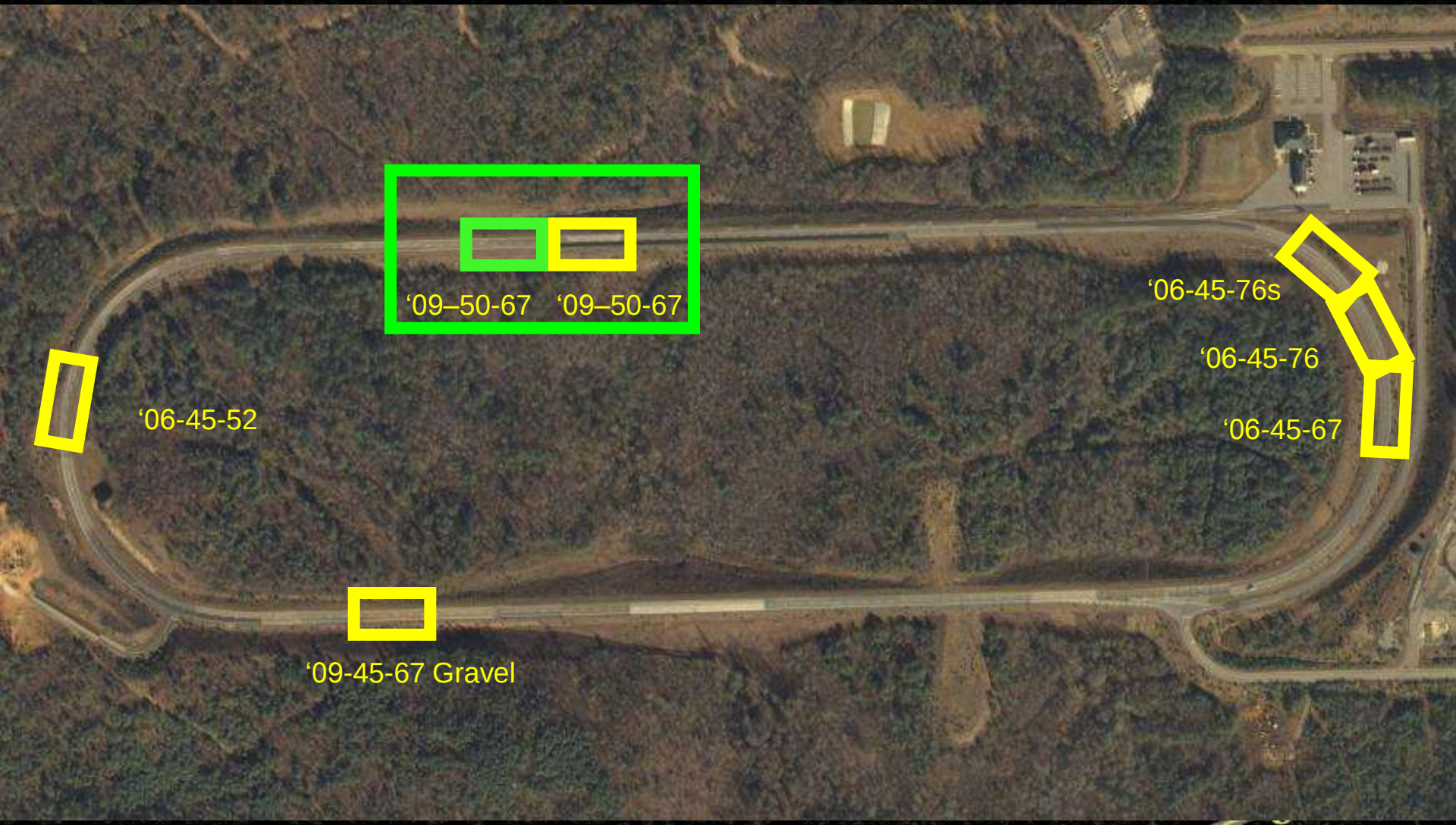
2009 High RAP Test Sections



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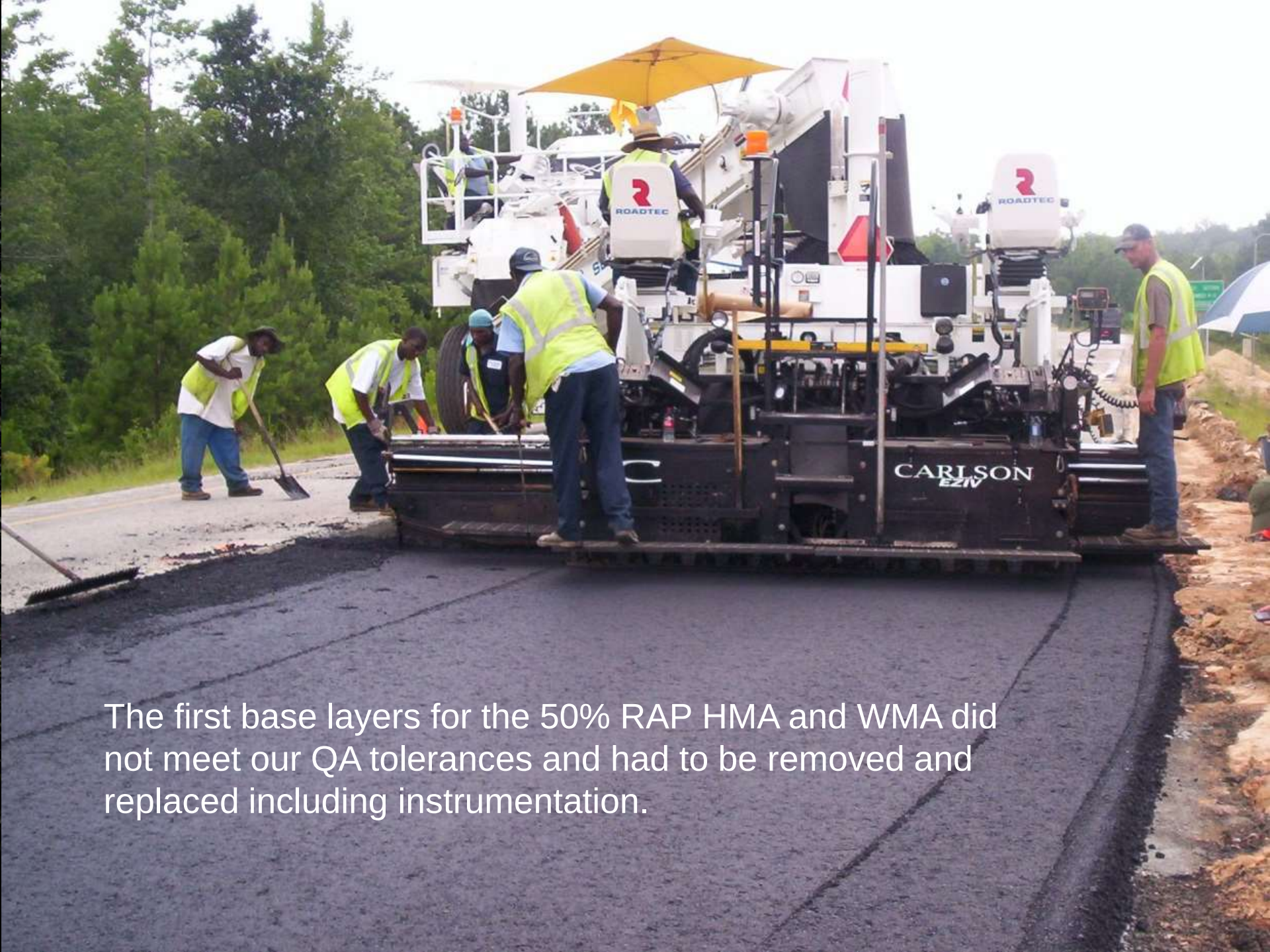
Control and 50% RAP Test Sections

Layer	Surface		Intermediate		Base	
Thickness	1.25 in.		2.75 in.		3.0 in.	
NMAS	9.5 mm		19.0 mm		19.0 mm	
Mix	Control	50% RAP	Control	50% RAP	Control	50% RAP
Virgin PG	76-22	67-22	76-22	67-22	67-22	67-22
Fine RAP	0	15%	0	20%	0	20%
Coarse RAP	0	35%	0	30%	0	30%
% RAP Binder	0	37%	0	50%	0	50%

- The same mix designs were used for 50% RAP HMA and 50% RAP-WMA mixes of the same layer.
- All mixes were fine-graded



The first base layers for the 50% RAP HMA and WMA did not meet our QA tolerances and had to be removed and replaced including instrumentation.

Mix Information: QA Results

Property	Base		
	Control	50% RAP HMA	50% RAP WMA
Plant Mix Temp. °F	335	325	275
Pb, %	4.7	4.7	4.6
Pbe, %	4.2	4.1	4.0
Lab Air Voids, %	4.0	4.2	4.1
Vol. of Eff. Binder, %	9.9	9.6	9.6
Rec. Binder Grade	77.1 -24.1	95.0 -12.8	88.7 -17.7
In-place Density, %	92.6	95.0	94.2

Mix Information: QA Results

Property	Intermediate		
	Control	50% RAP HMA	50% RAP WMA
Plant Mix Temp. °F	335	325	275
Pb, %	4.4	4.4	4.7
Pbe, %	3.9	3.8	4.1
Lab Air Voids, %	4.4	4.5	3.7
Vol. of Eff. Binder, %	9.1	9.1	9.1
In-place Density, %	92.8	92.9	93.1

Mix Information: QA Results

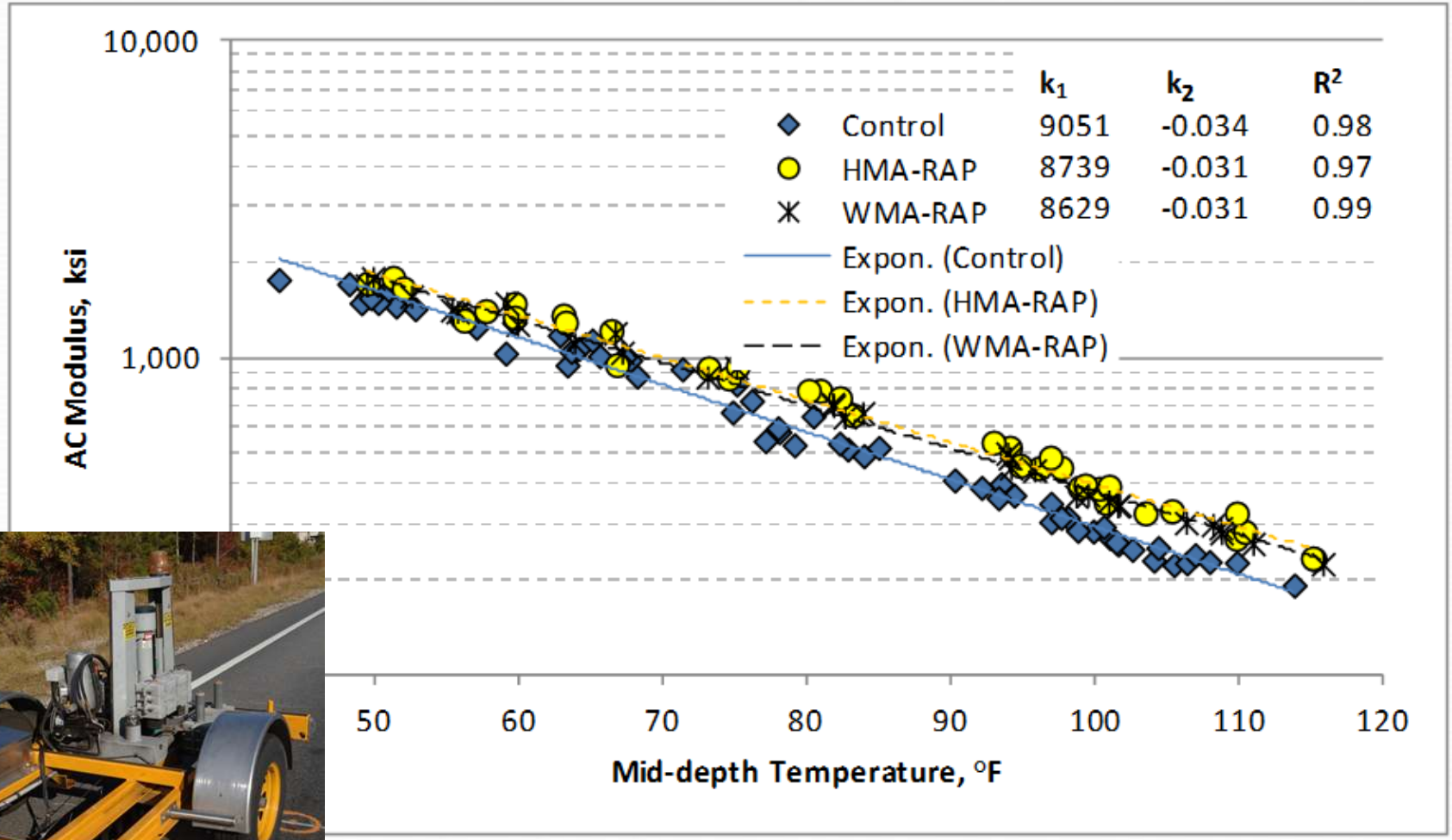
Property	Surface		
	Control	50% RAP HMA	50% RAP WMA
Plant Mix Temp. °F	335	325	275
Pb, %	6.1	6.0	6.1
Pbe, %	5.4	5.2	5.3
Lab Air Voids, %	4.0	3.8	3.2
Vol. of Eff. Binder, %	12.5	12.0	12.3
Rec. Binder Grade	81.7 -24.7	87.8 -15.4	83.8 -17.7
In-place Density, %	93.1	92.6	92.1

Performance

Test Section	Rut Depth (mm)	Texture Change (mm)
Control	7.1 mm	0.227 mm
50% RAP HMA	1.8 mm	0.178 mm
50% RAP WMA	3.7 mm	0.189 mm

NO CRACKING

Back-calculated AC Modulus vs. Temp.



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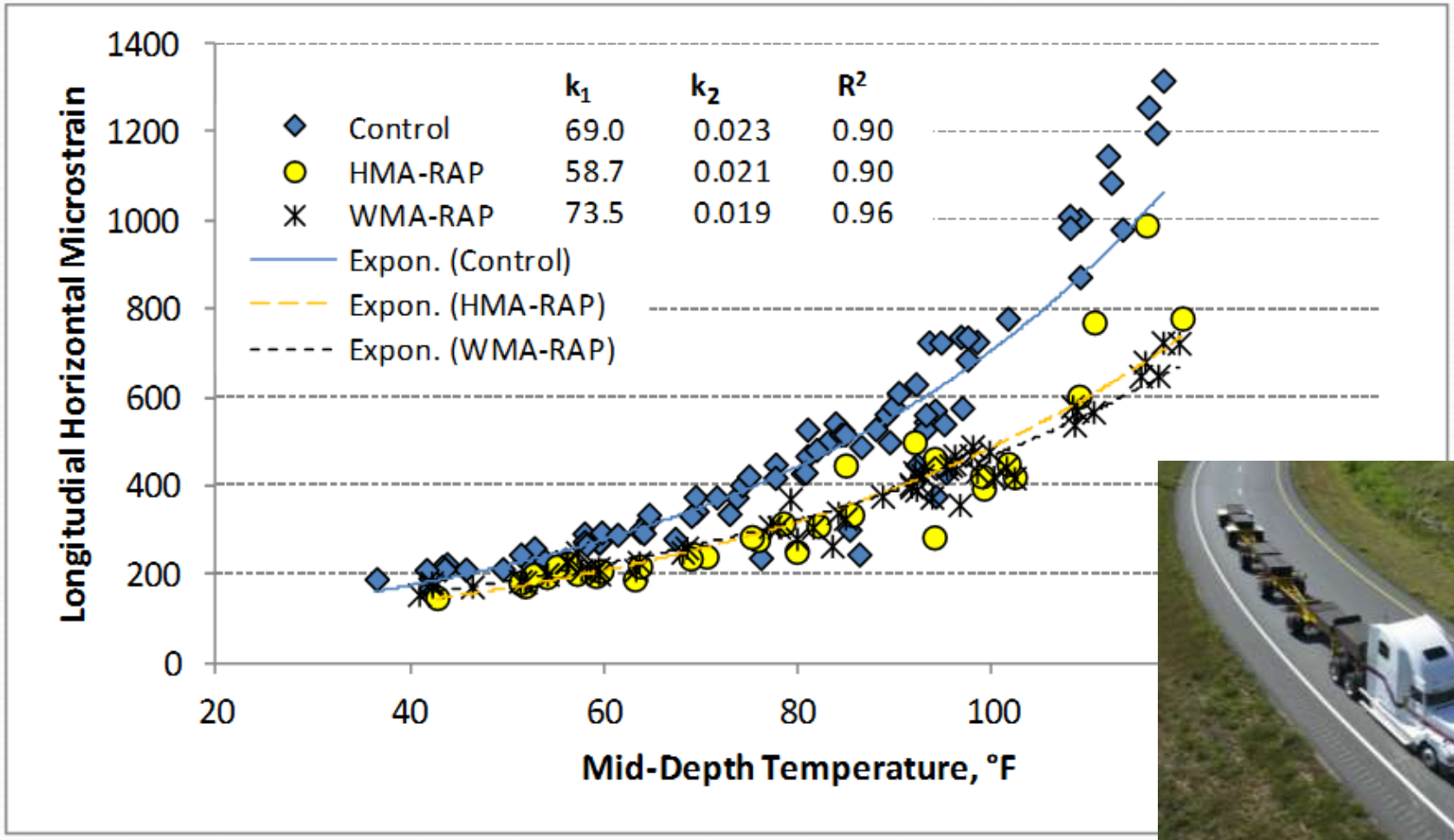
Critical Strain vs. Temperature



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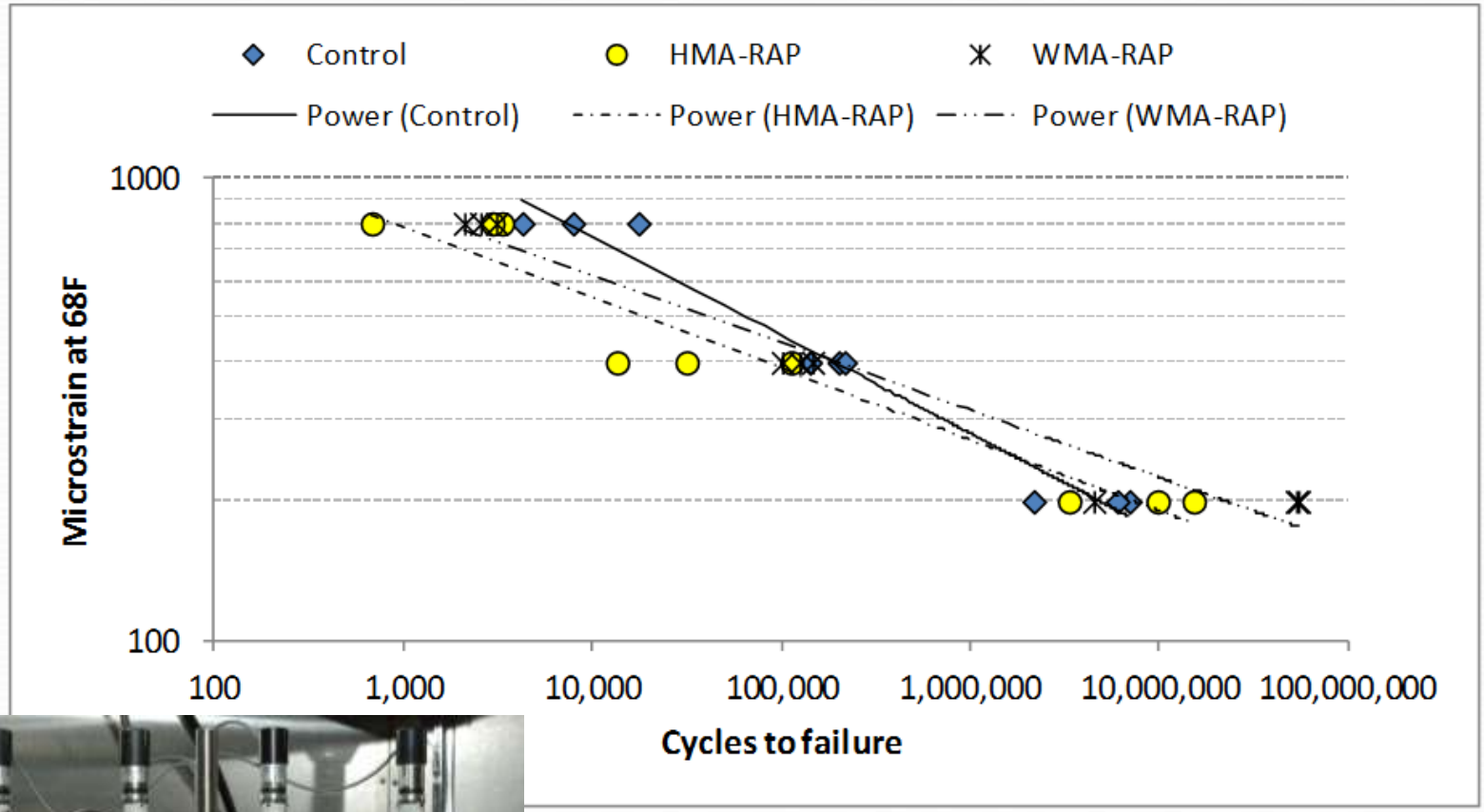
Bending Beam Fatigue Results



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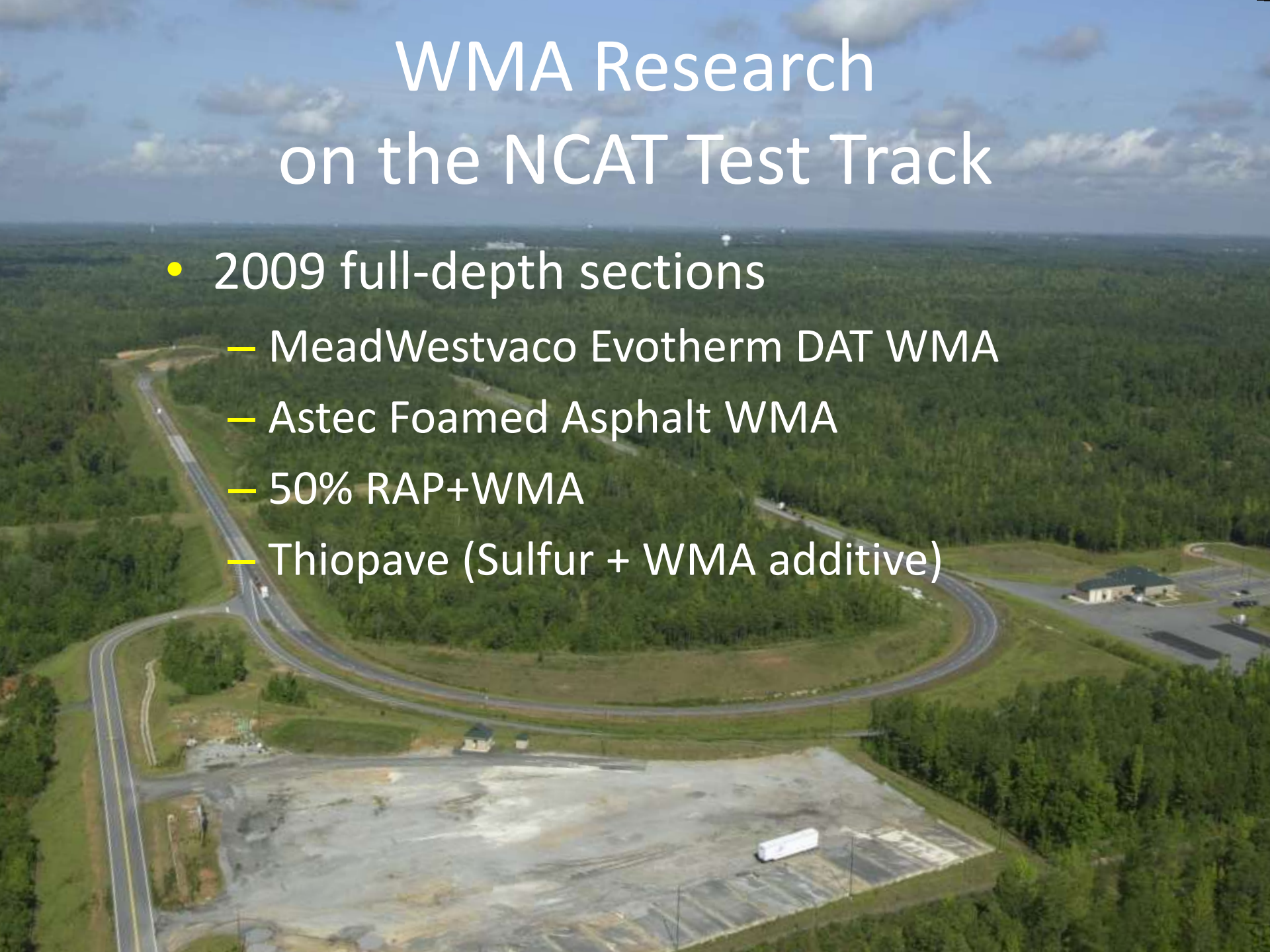
Cracking Test Results

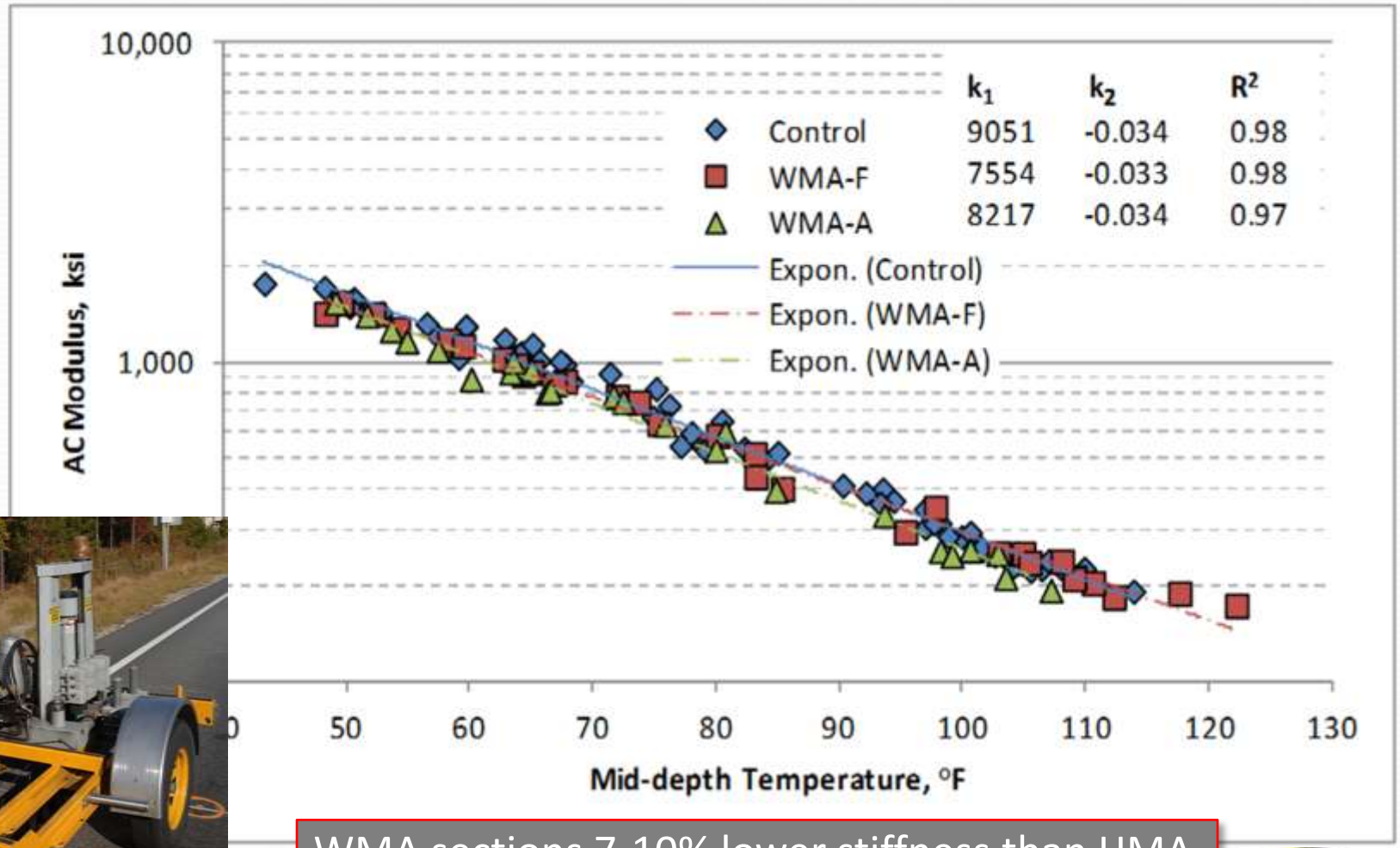
Mix	Fracture Energy (kJ/m^2)	Energy Ratio	Thermal Cracking T_{crit} (°C)	Endurance Limit (με)
Applicable Layer	Surface			Base
Control HMA	8.1	11.1	-26.4	92
50% RAP	1.6	5.5	-22.5	100
50% RAP WMA	3.4	3.8	-23.1	134

WMA Research on the NCAT Test Track

- 2009 full-depth sections
  - MeadWestvaco Evotherm DAT WMA
  - Astec Foamed Asphalt WMA
  - 50% RAP+WMA
  - Thiopave (Sulfur + WMA additive)



Back-calculated AC Modulus vs. Temp.



WMA sections 7-10% lower stiffness than HMA

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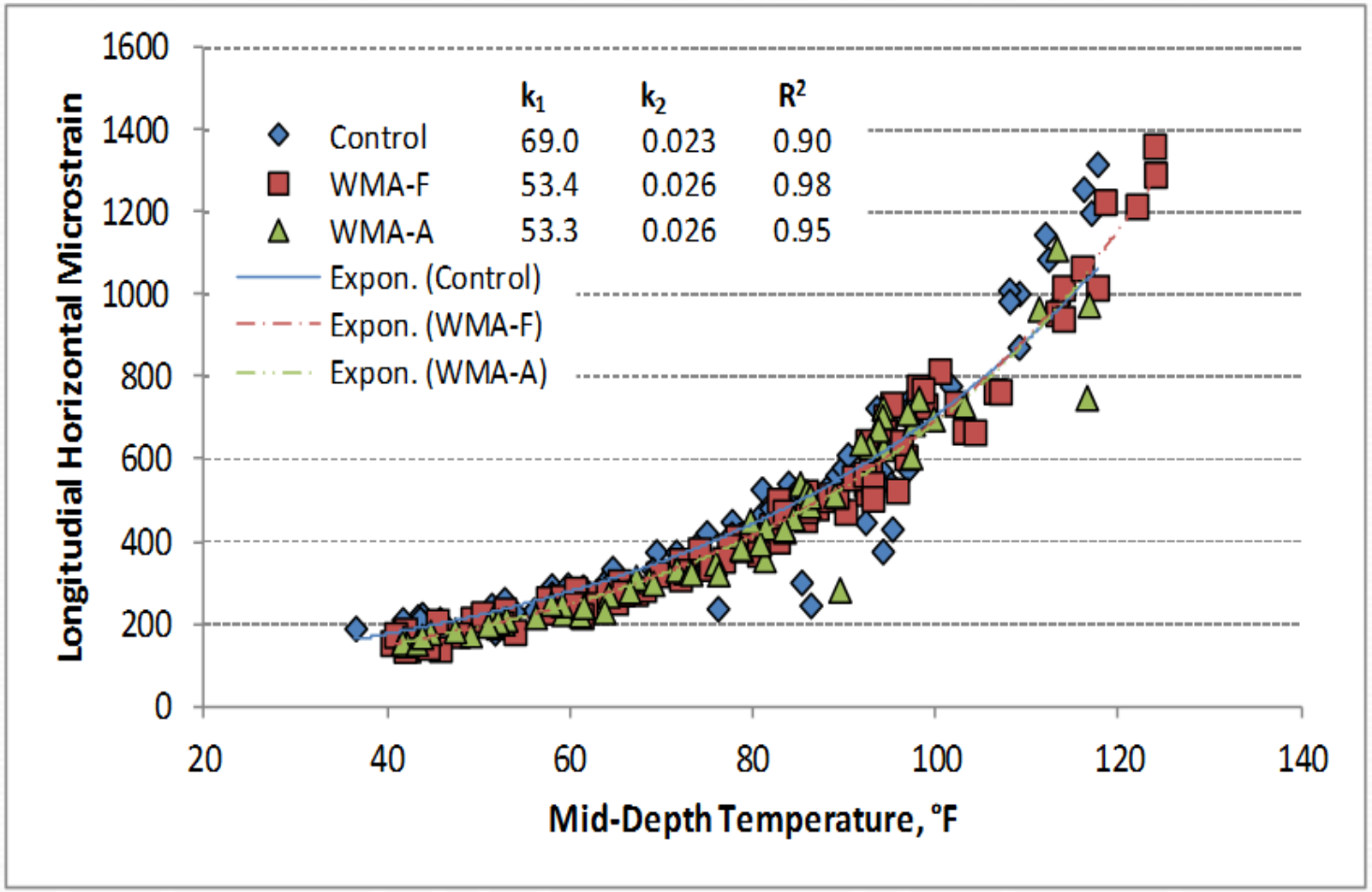
Longitudinal Strain vs. Temp.



No Statistical Difference between WMA and HMA sections

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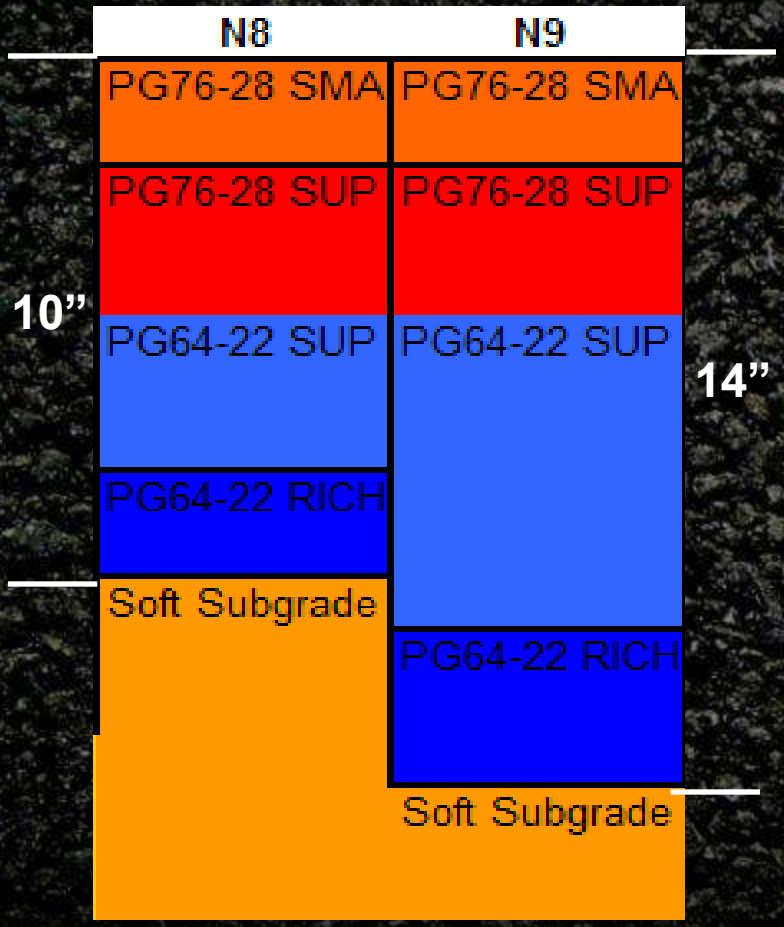
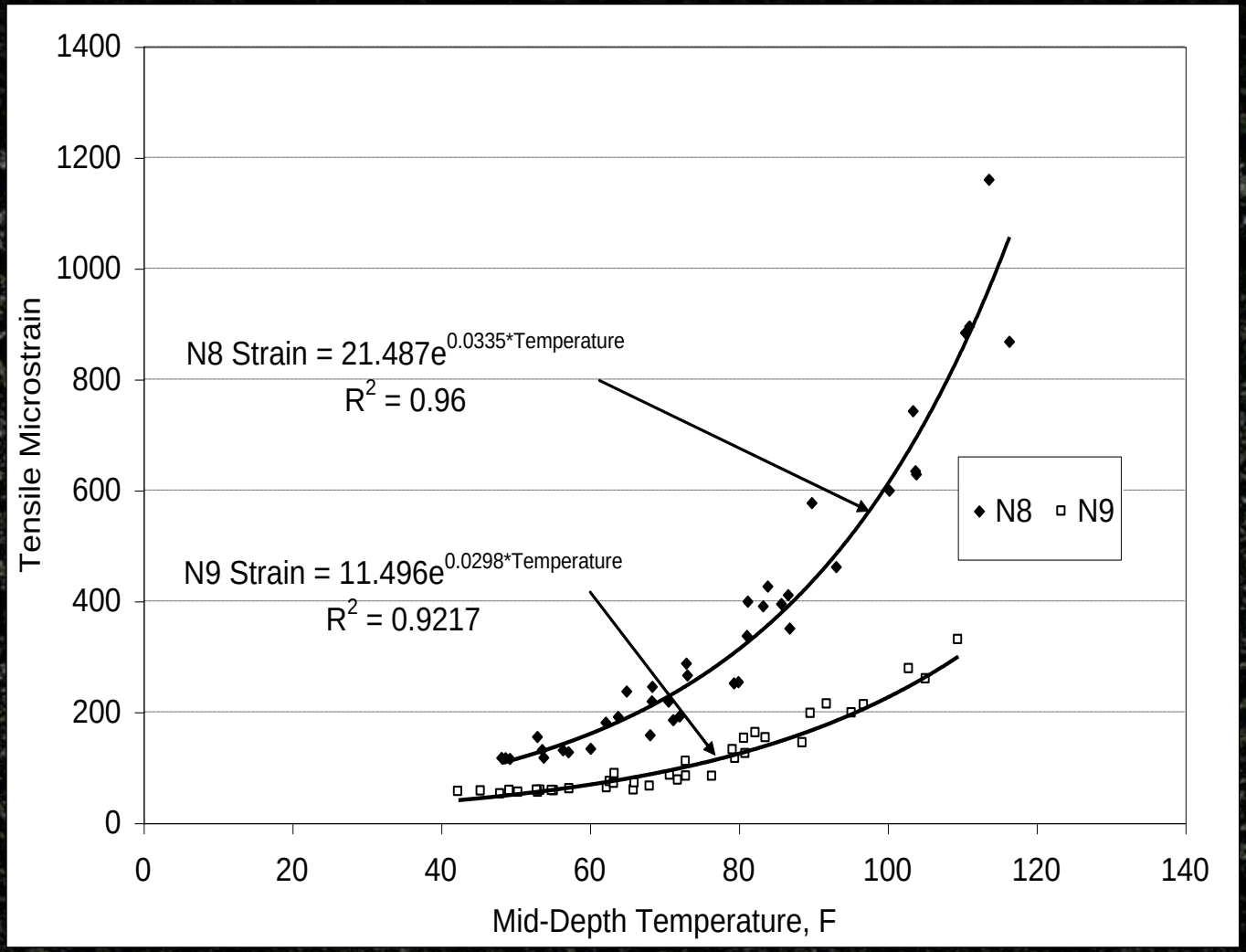
Oklahoma Perpetual Pavement

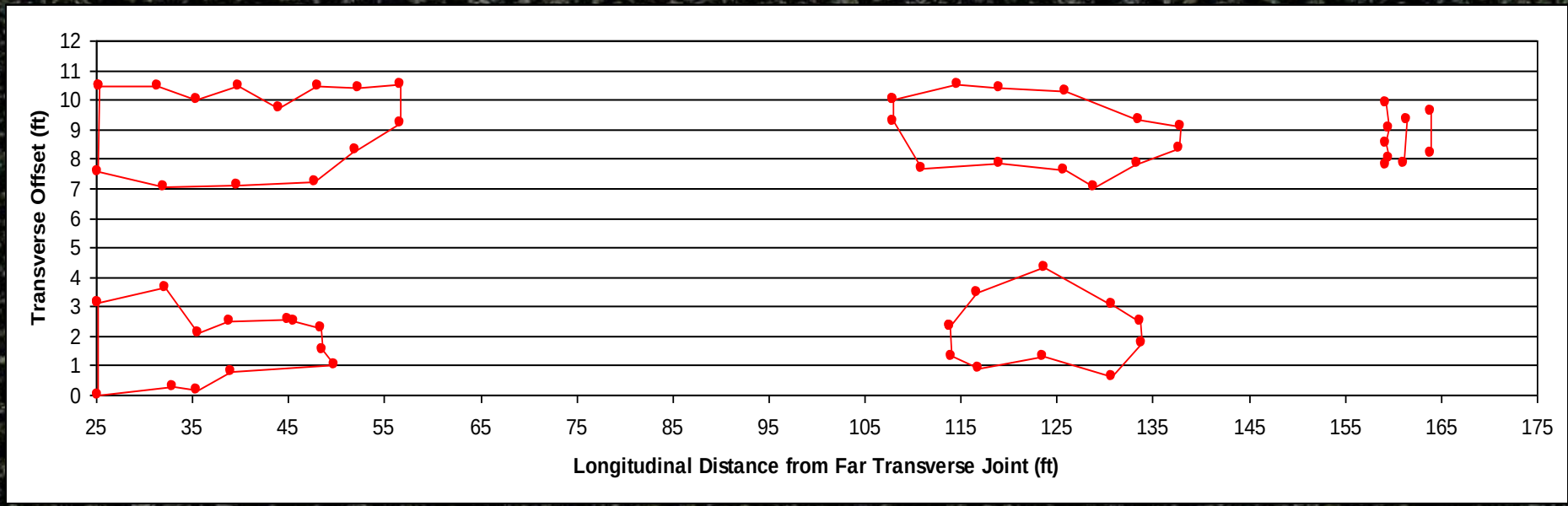


N8 and N9 – Strain vs. Temperature



N8: 10” OK Section: Fatigue Cracking

N8 on 11/10/08 (9.7M ESALs)




7/28/09

Conventional Repair Failed

High Polymer Inlay Still Looks Good

OK Perpetual Pavement on Soft Clay

Still performing very well after 20 million ESALs

Other Findings from the 4th Cycle

- MEPDG over-predicts rutting, corrected by calibration
- Relaxed F&E specification for GDOT, saves big $
- Correlation of APA, Fn, Hamburg with field rutting
- GTR can replace SBS polymer
- Porous Friction Courses
  - Heavy tack coat helps resist top-down cracking
  - Thicker OGFC is better, permeabilities are stable
  - Can use coarse RAP in mix design
  - 28% structural value of DGAC

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Thank You

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