AAPA's 14th International
Flexible Pavements Conference

Sydney
25–28 September 2011

Matching Accelerated Pavement Testing to Pavement Design and Performance

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APT – Not Just Another New Thing

- 1912 UK Road Machine
- 1922 Bates Experimental Road
- 1952 WASHO then AASHO (1956) Road Tests
- 1967 Washington State University Track
- 1970 South African HVS
- 1973 Danish Road Testing Machine
- 1984 Australian ALF
- 1989 New Zealand CAPTIF
- 1994 MnRoad
- 1996 WesTrack
- 2000 NCAT Pavement Test Track
- 2002 University of Waterloo CPATT

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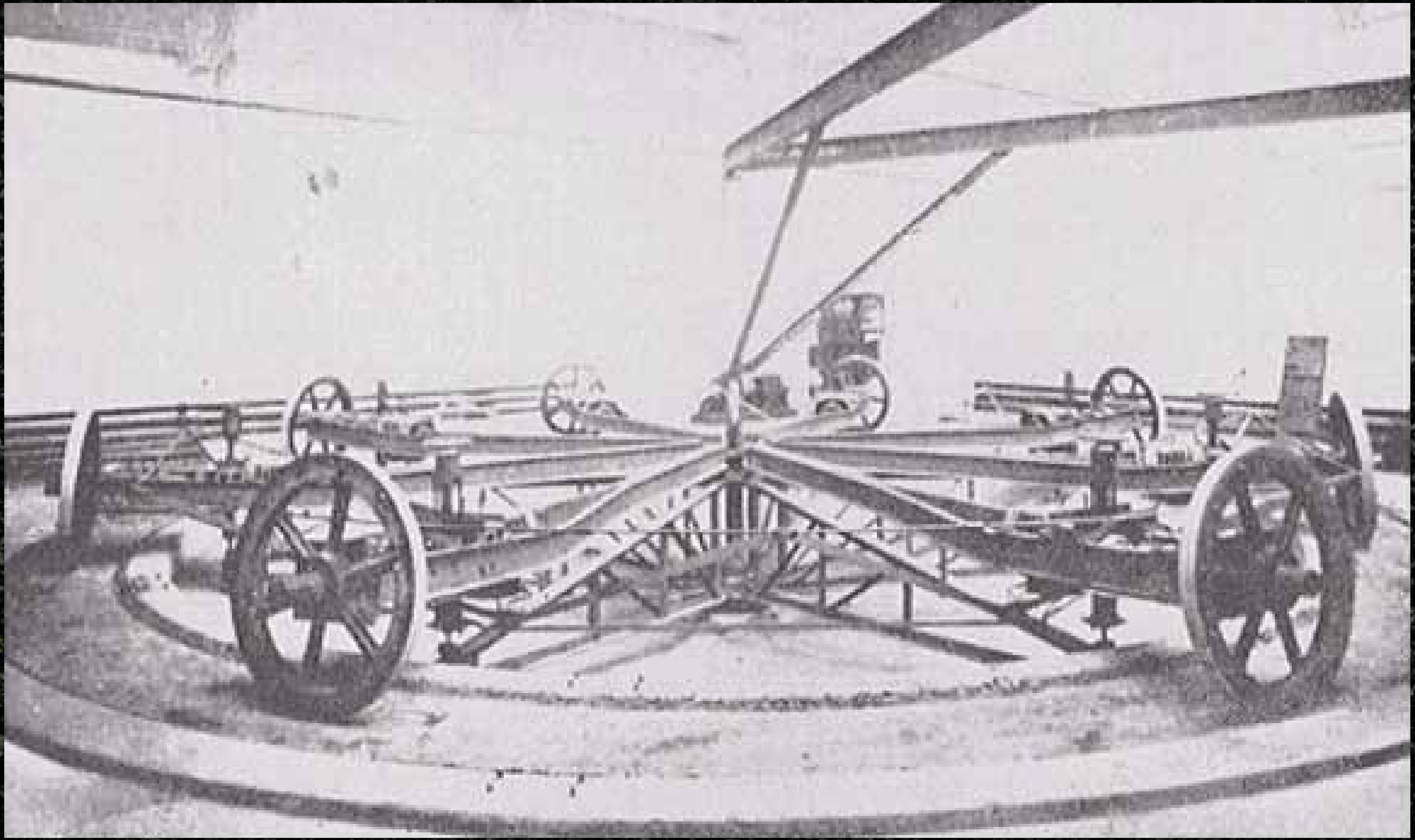
UK Road Machine$_{1912}$



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Australian ALF$_{1984}$

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NCAT Pavement Test Track$_{2000}$

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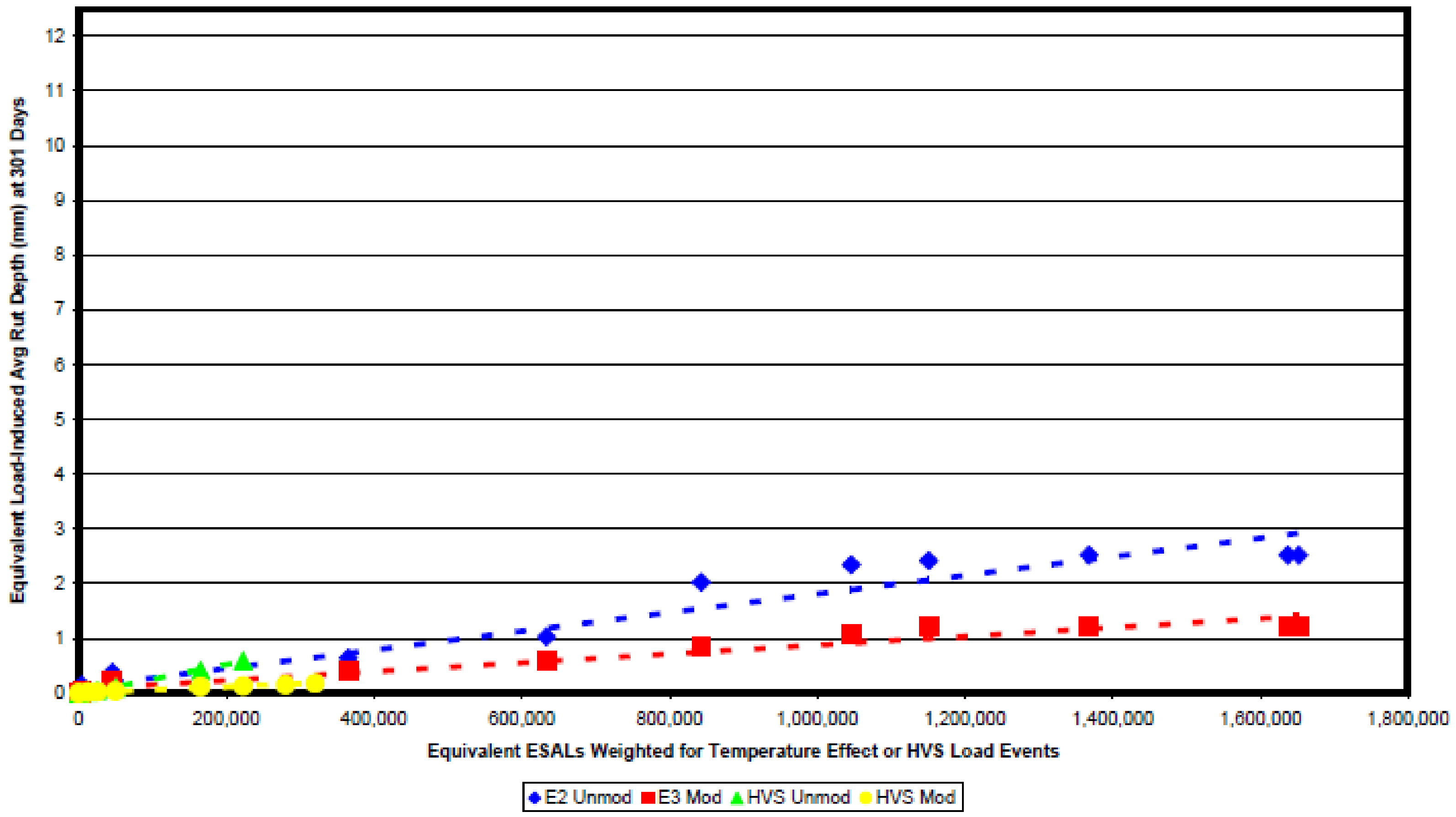
Relating APT_{Track} to APT_{HVS}



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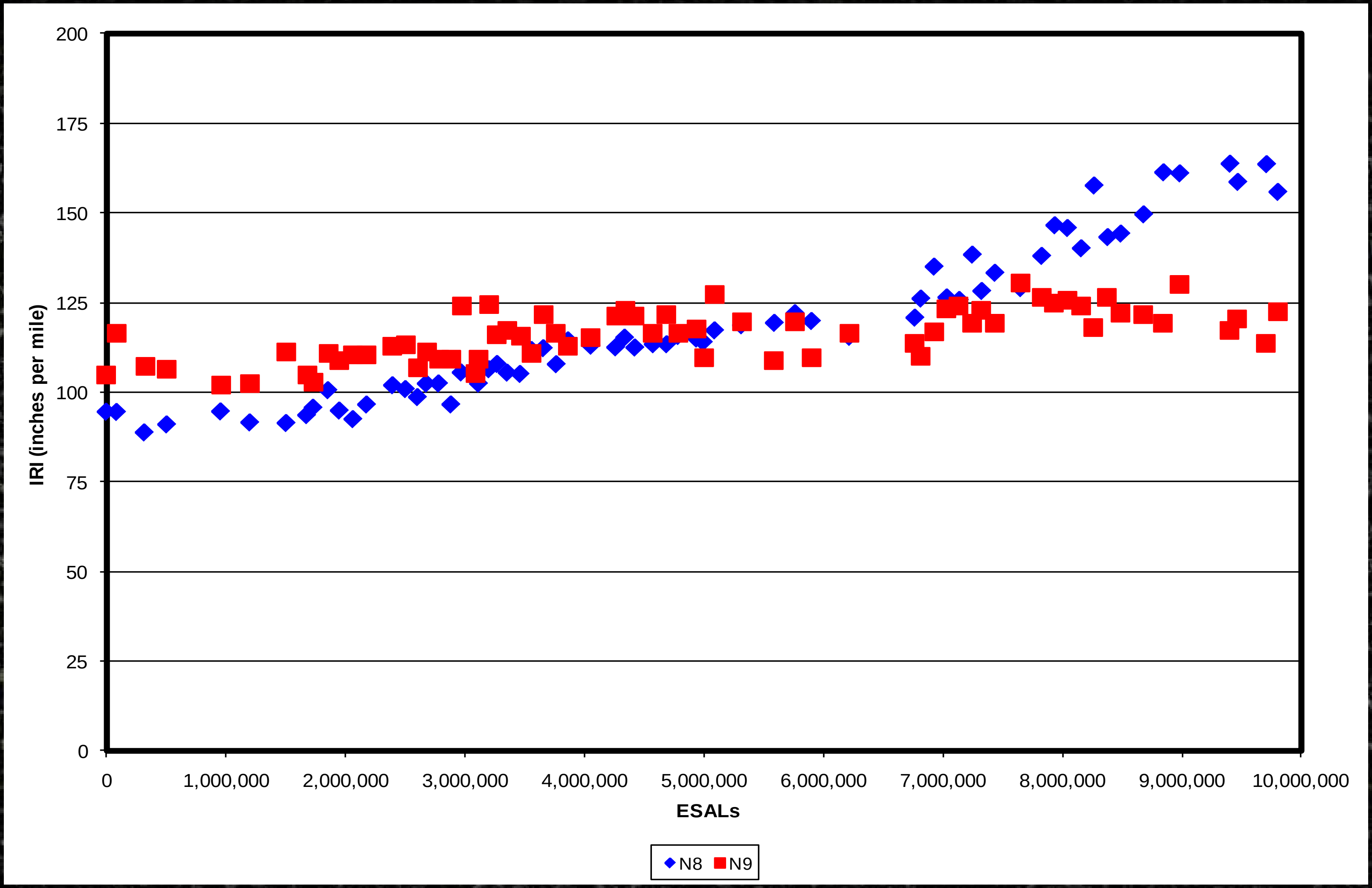
Relating APT to Infrastructure

- APT rutting relates well to infrastructure rutting
- Speed, age, and temperature can be problematic
- Master curves from AMPT may improve modeling
- Loaded wheel testers still being used by many
- Cracking and durability are greatest challenge
- Crack initiation and propagation are the key

Roughness vs Traffic (Weak Subgrade)



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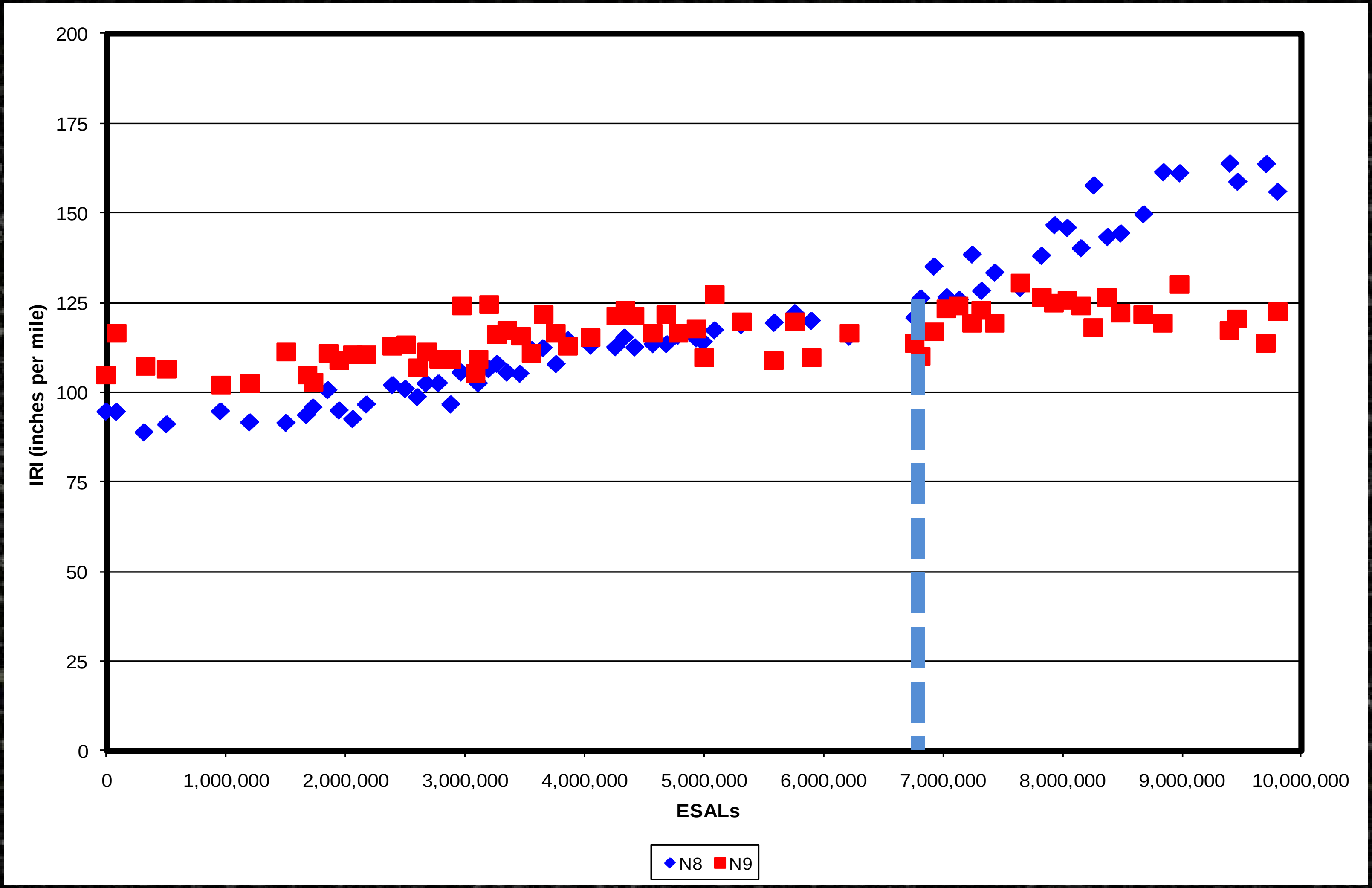
Roughness Increased at 6.8M ESALs



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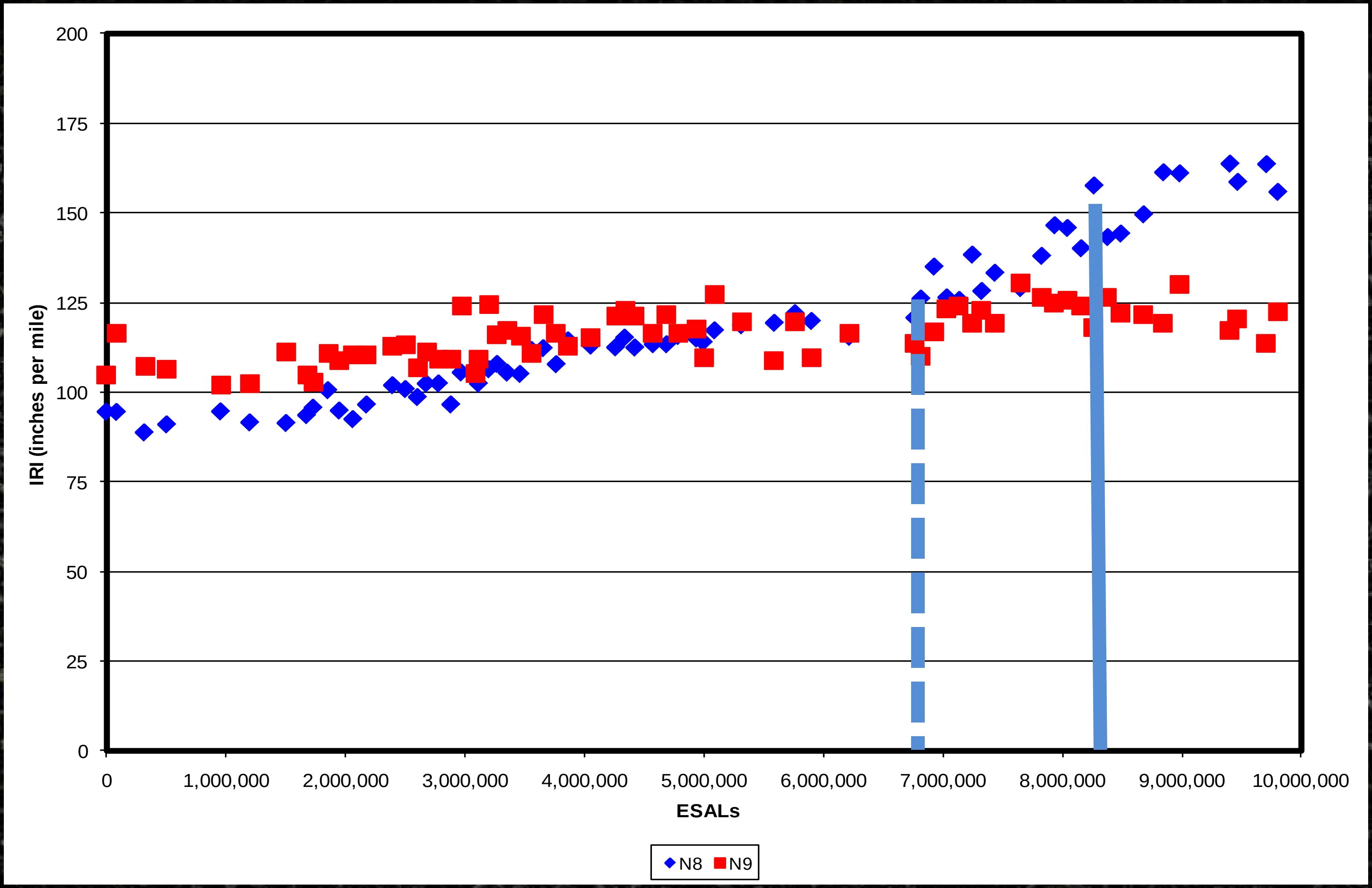
Cracking First Mapped at 8.3M ESALs



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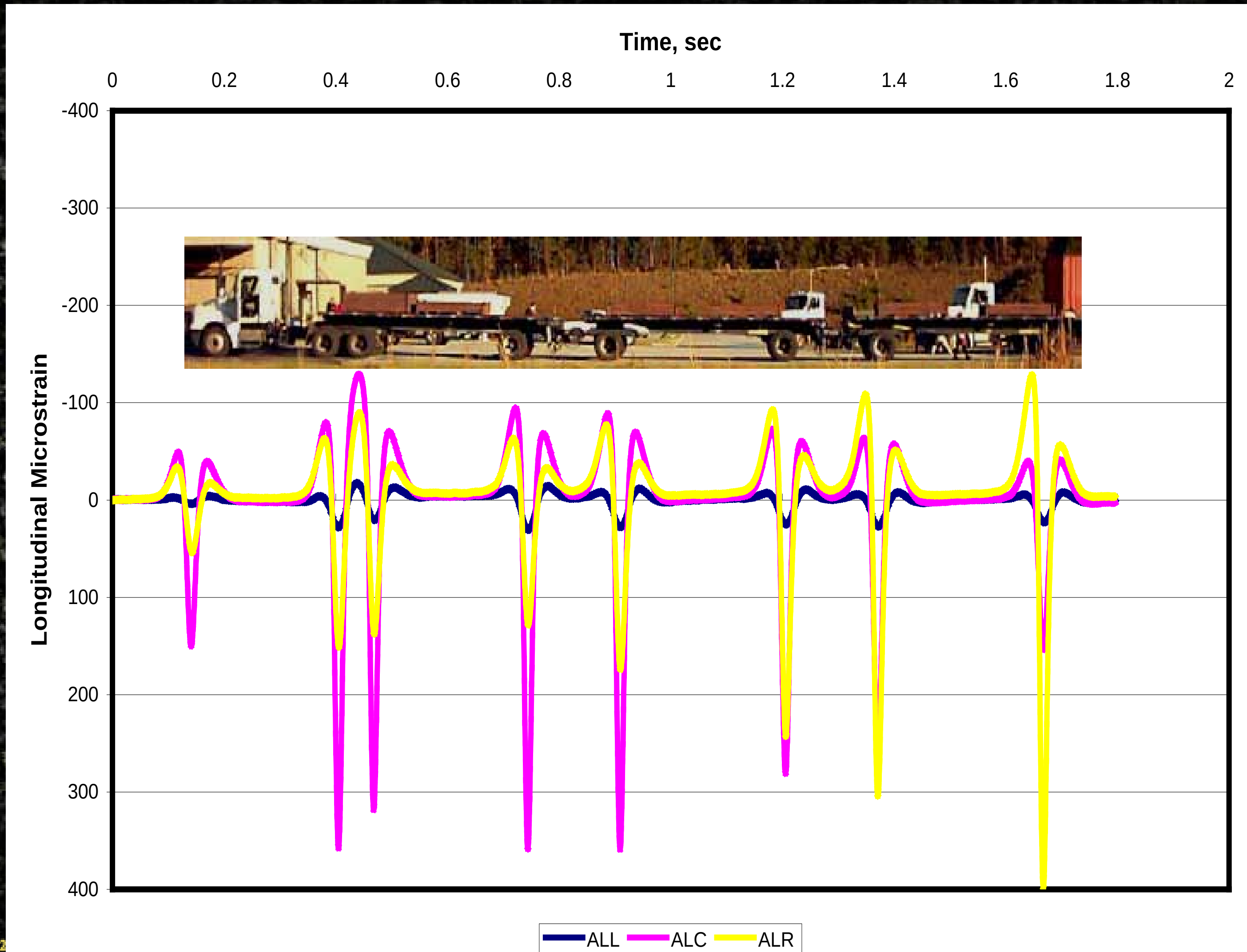
High-Speed Strain Response



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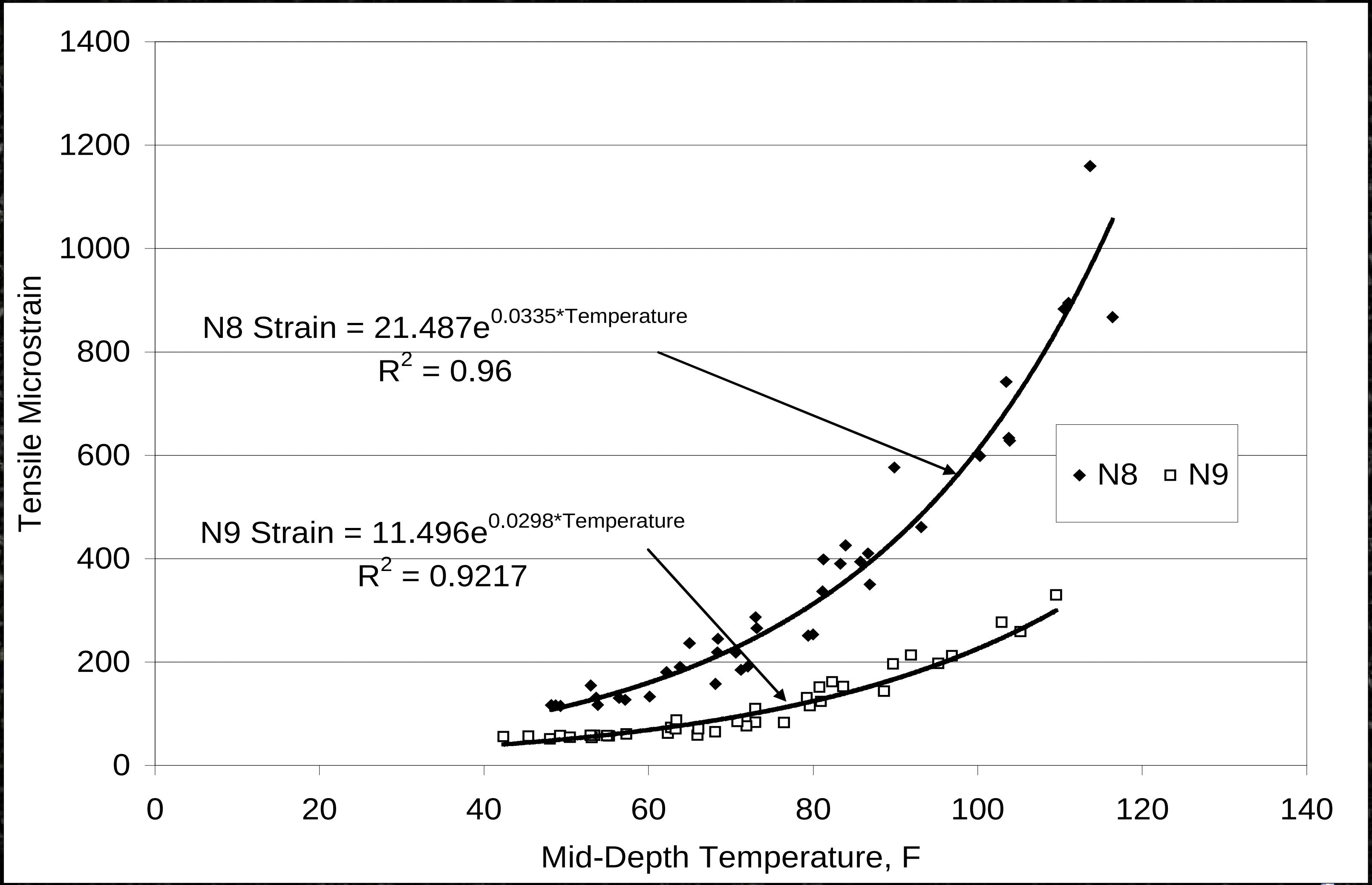
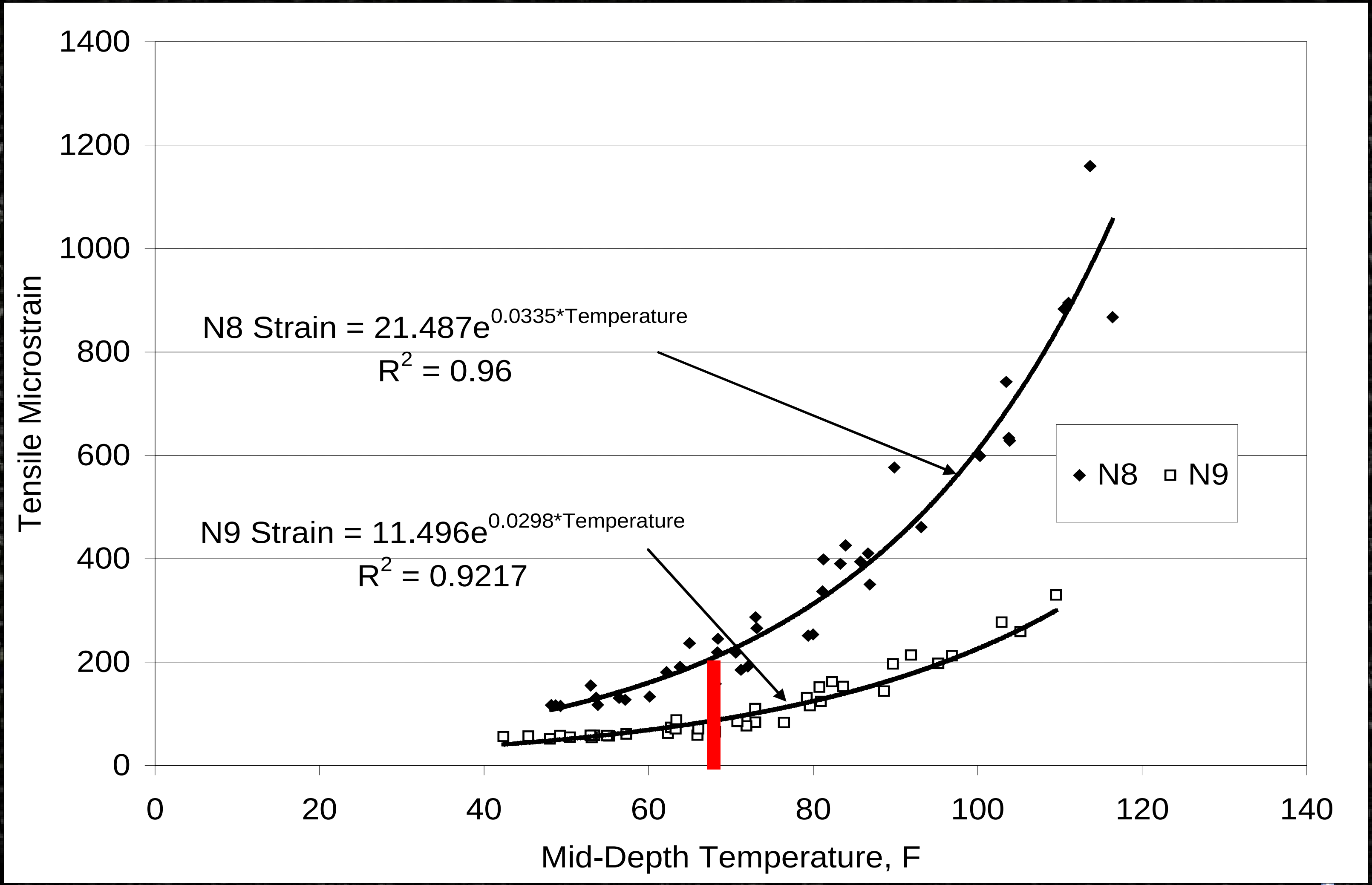
Effect of Pavement Thickness



Effect of Pavement Thickness



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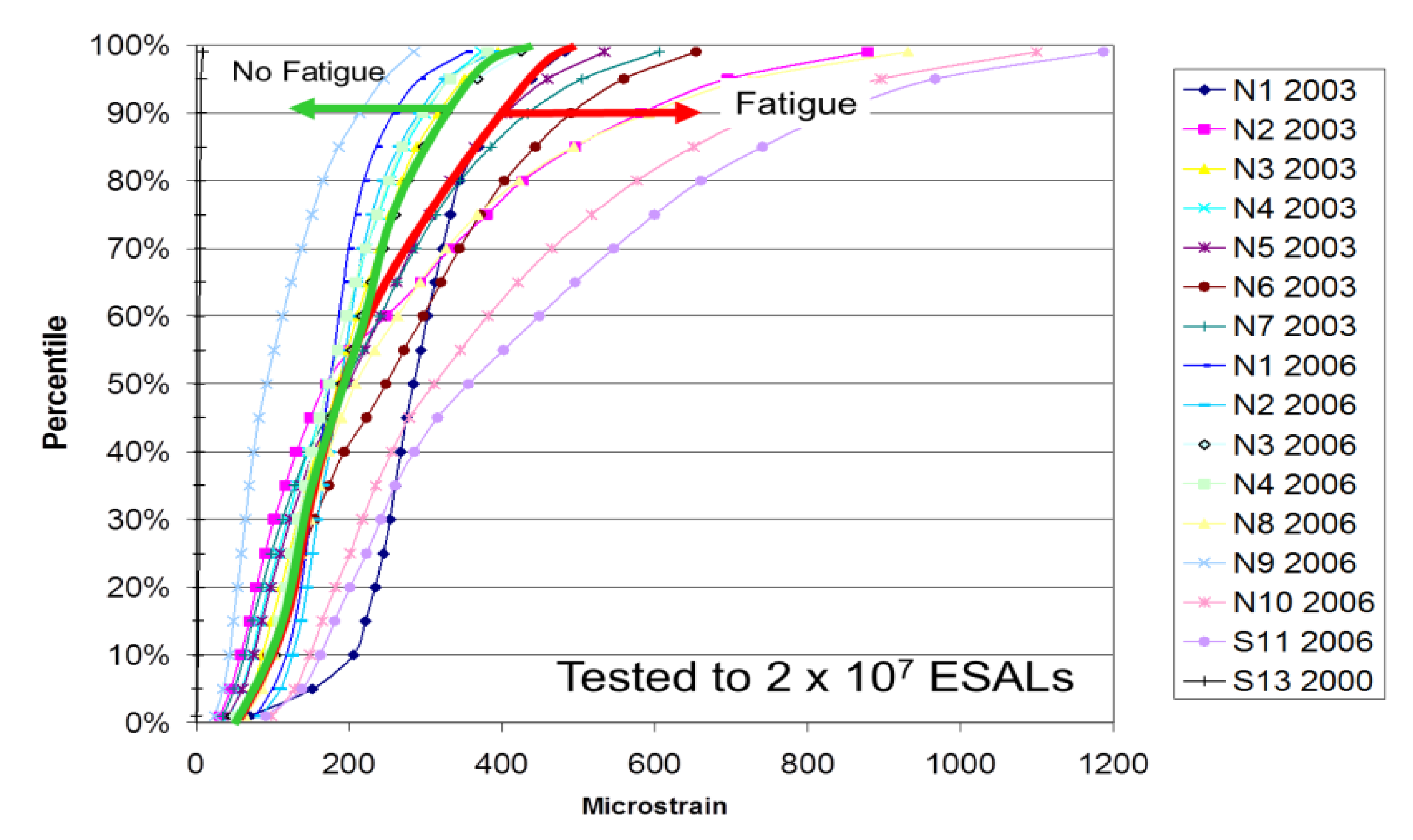
Strain Distributions on NCAT Track



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Implementation Example

- 24 inch perpetual (original) Track foundation
- Two 9 inch thick structural sections built in 2003
- 9 inch sections were found to be perpetual (LLAP)
- Changed layer coefficient from 0.44 to 0.54
- Saving $25-$50 million annually <u>in Alabama alone</u>

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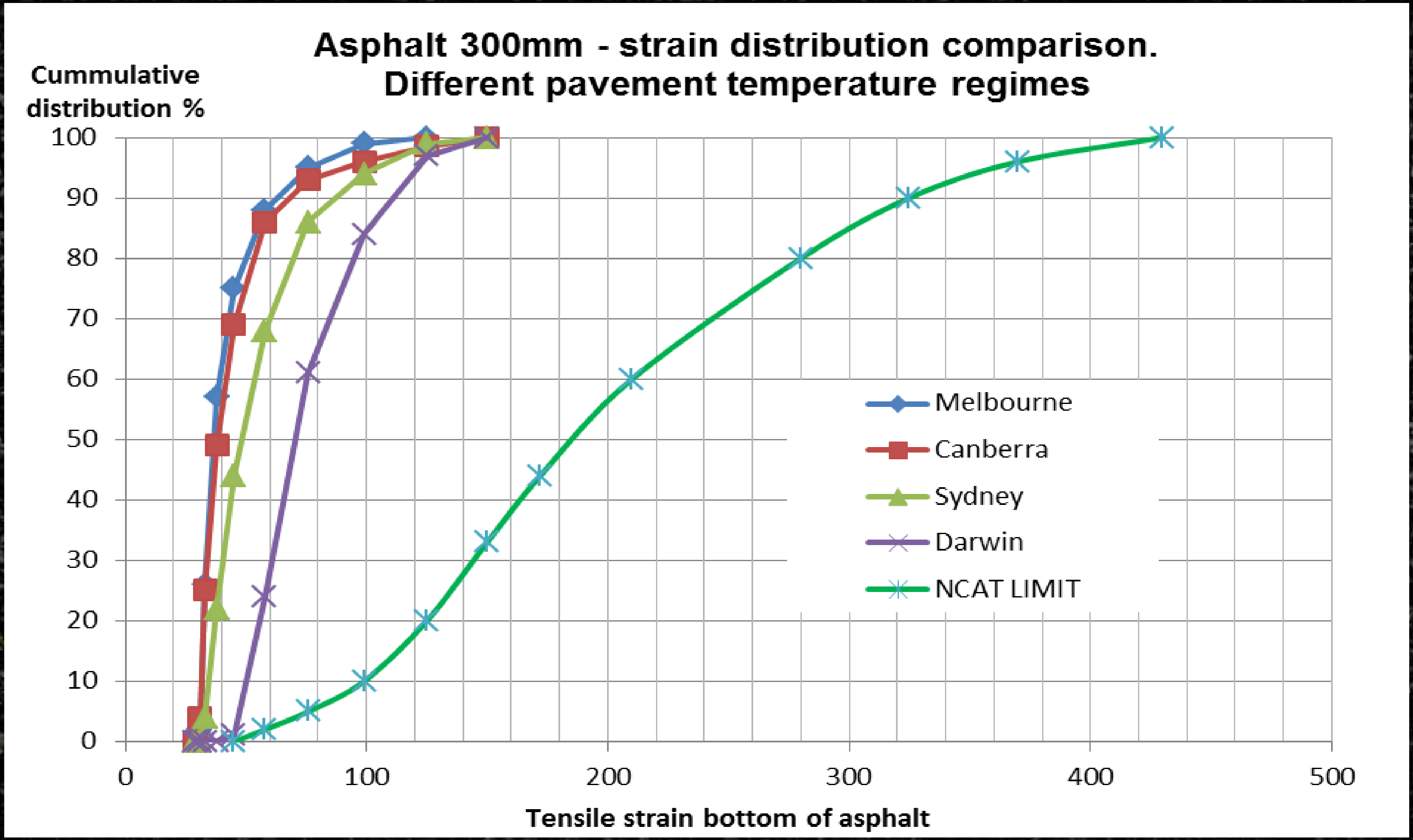
Potential Impact in Australia



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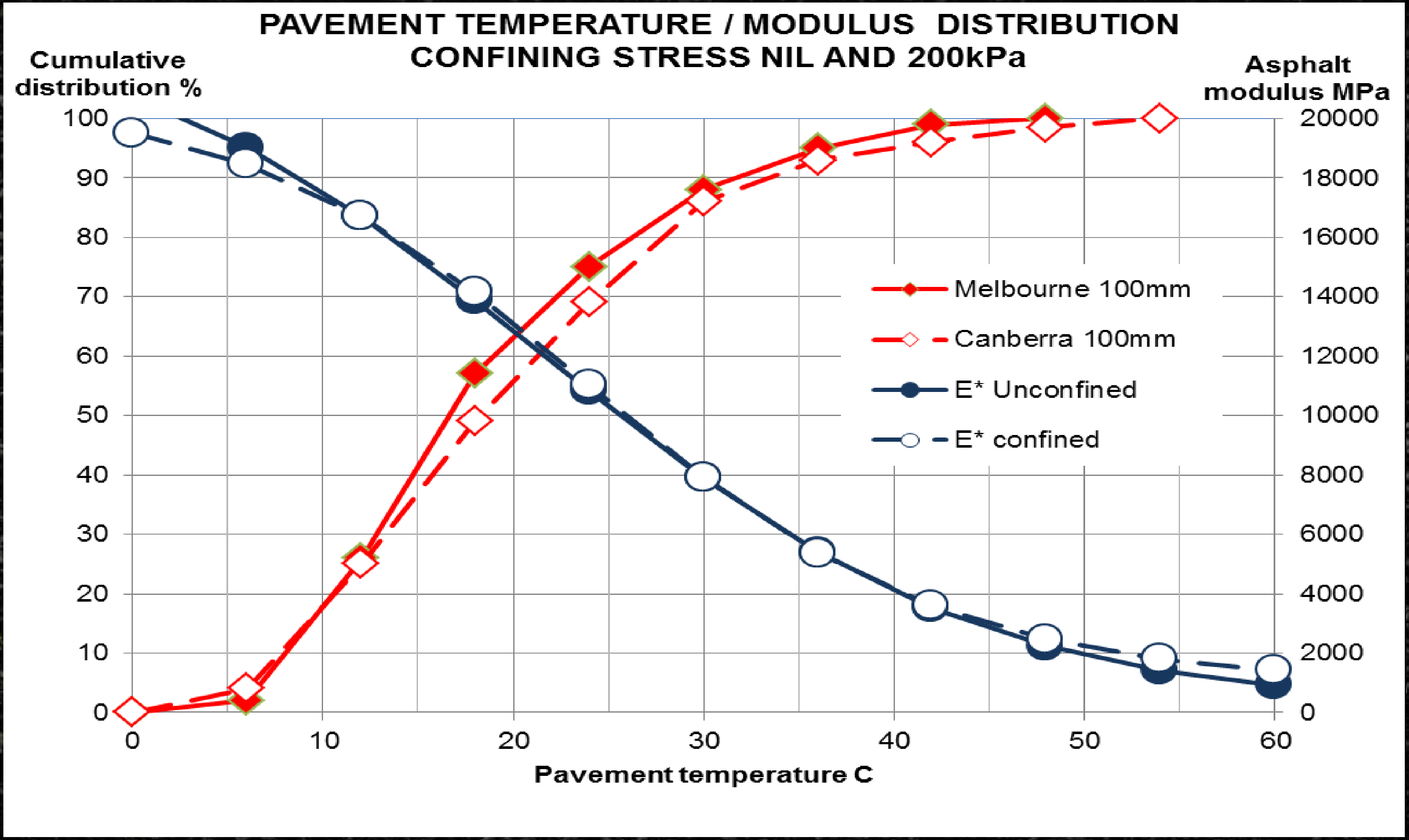
Modulus Varies with Temperature



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Factors Affecting Mix Modulus

- Mix size and gradation
- Bitumen type and content
- Aggregate type and proportions
- Air void content

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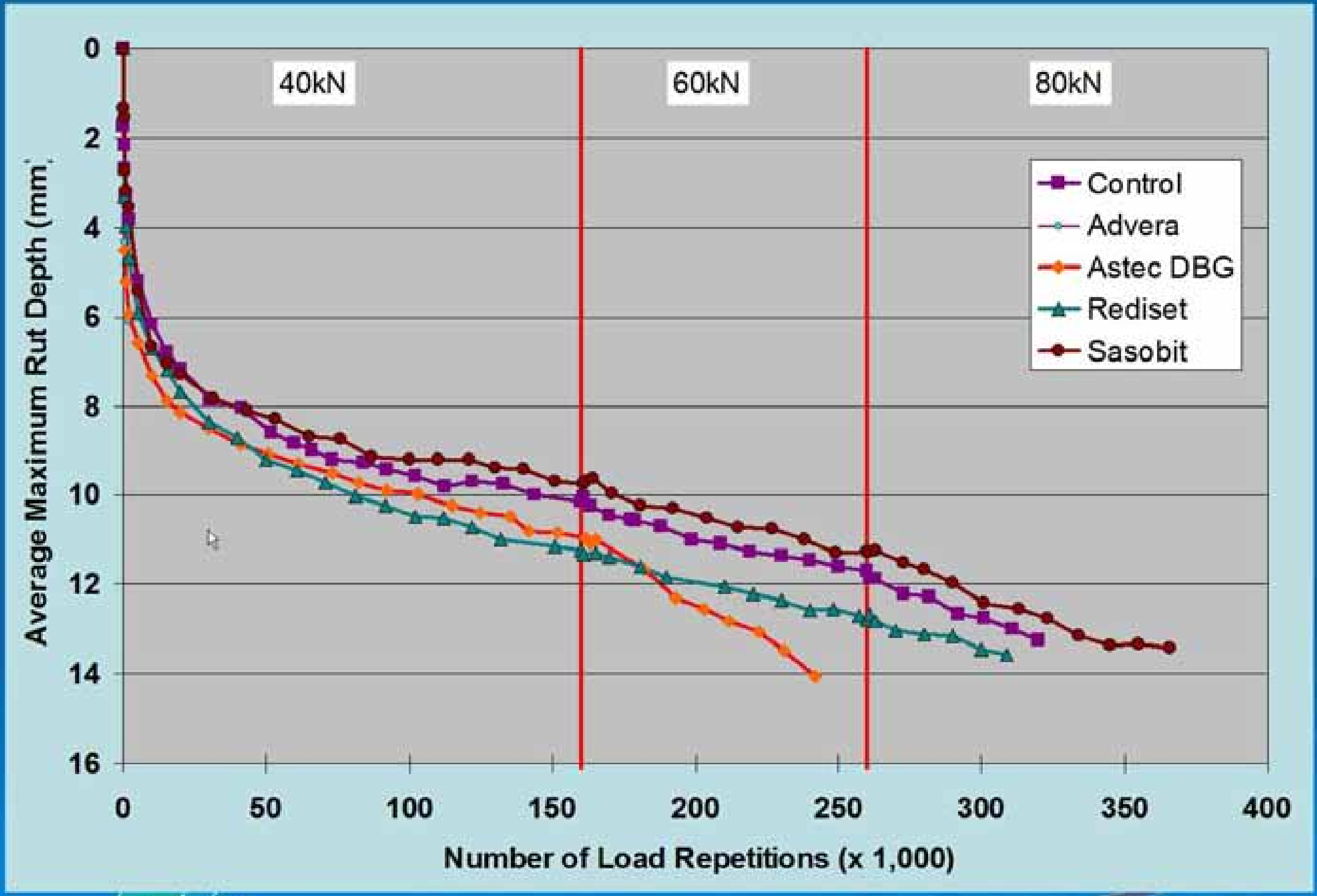
APT Testing by Caltrans



Caltrans

UCPRC

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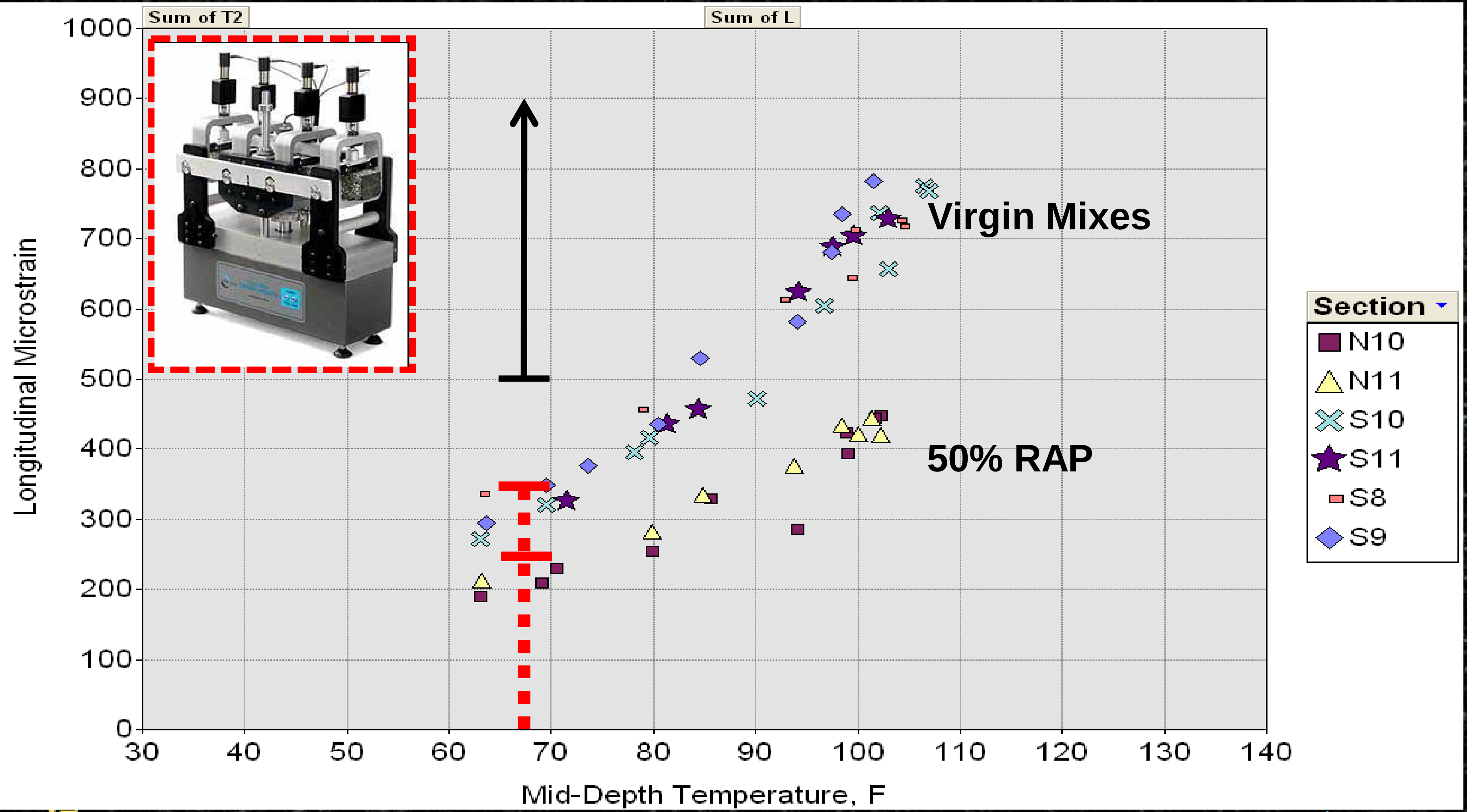
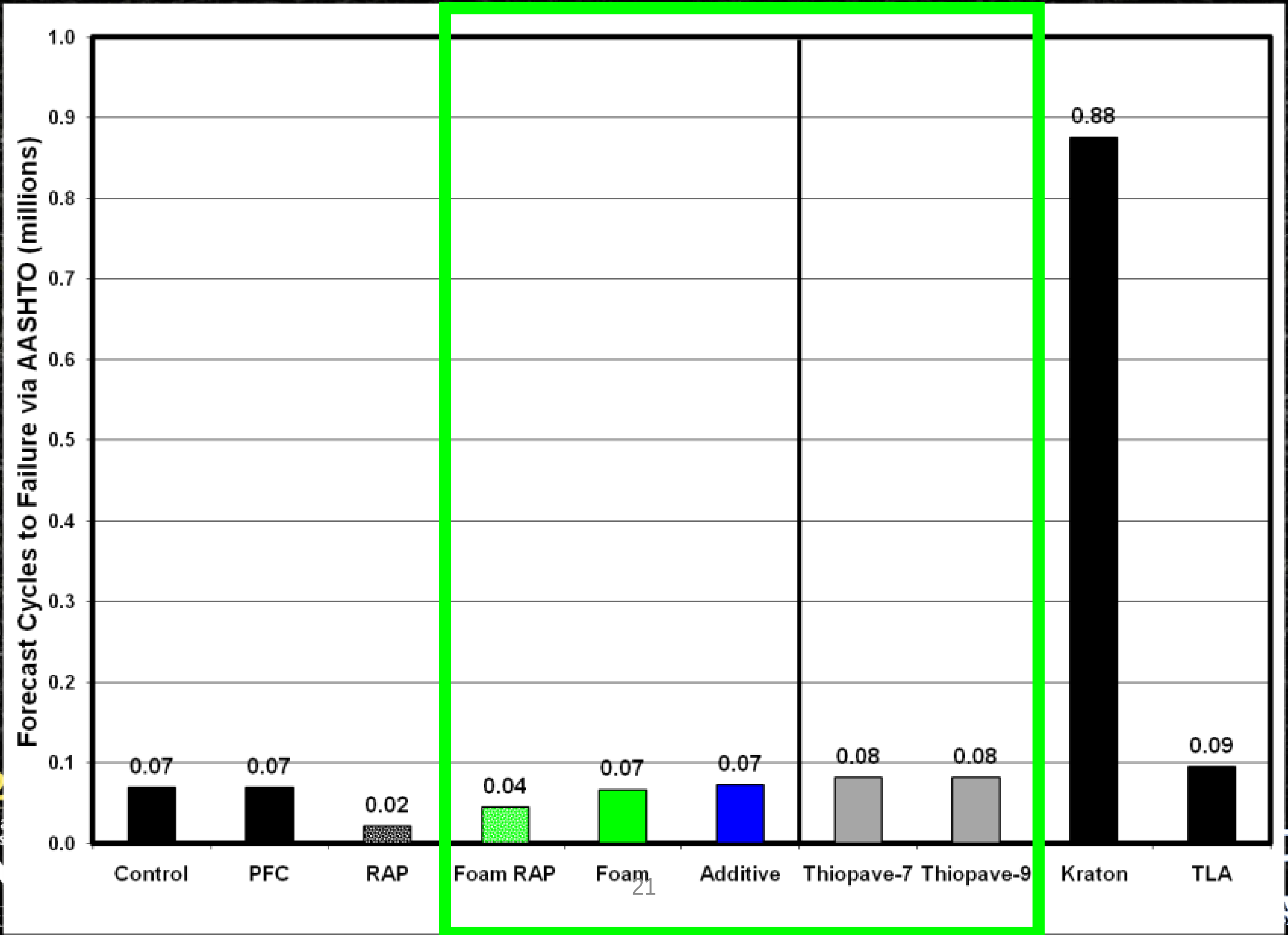
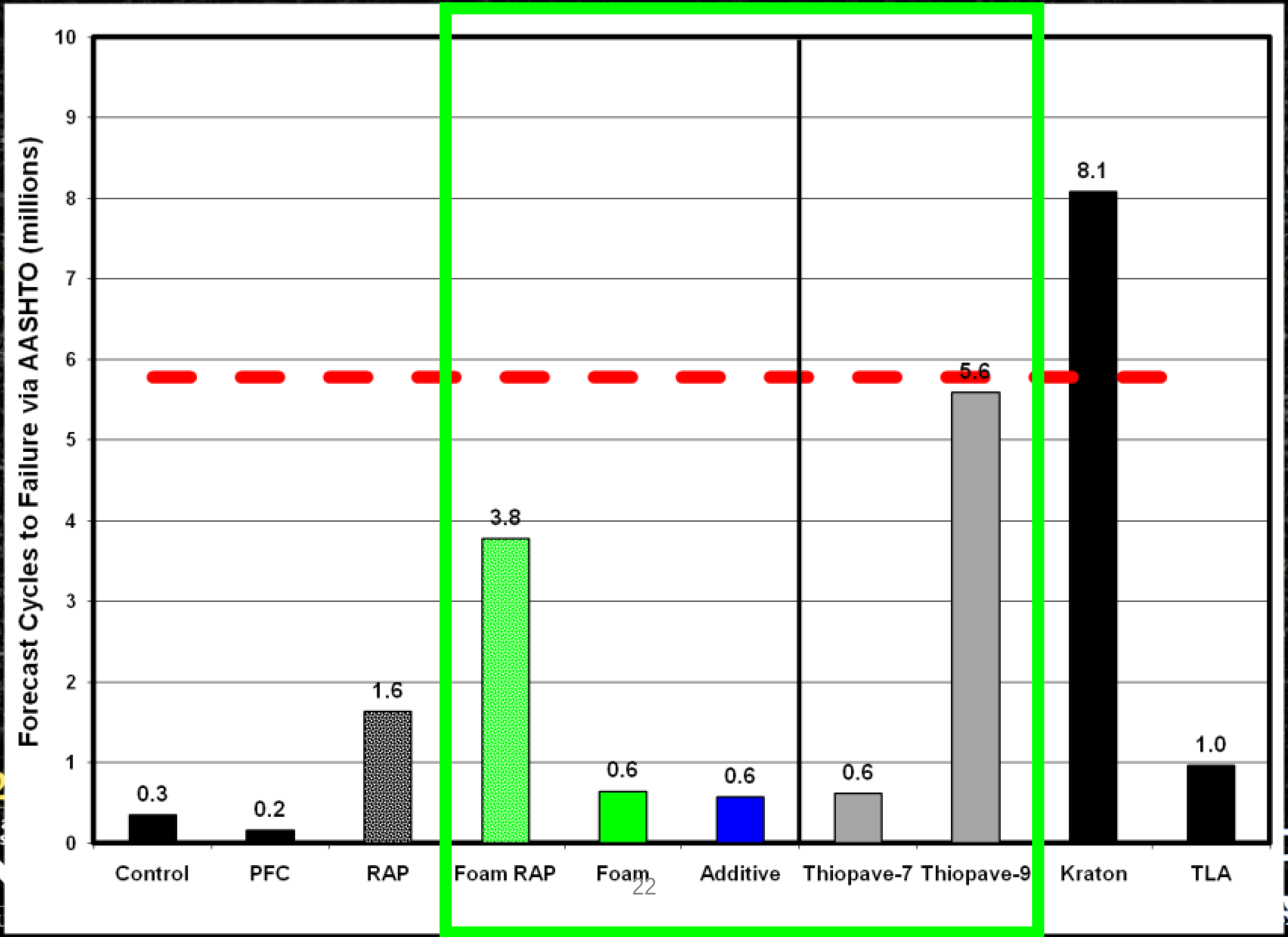
2009 Group Experiment Results



Beam Performance Expectations$_{500}$



Beam Performance Expectations$_{Actual}$



Ideal Characterization vs Depth

- Upper layers (age hardening, high temperatures)
  - Laboratory rut testing (AMPT, APA, Hamburg, etc.)
  - Durability and top-down cracking (fracture energy)
- Middle layers (limited age hardening)
  - Thickness reduction via stiffer materials
- Lower layers (no age hardening, lower temps)
  - Fatigue resistance (bottom-up cracking)
  - Need for practical, multi-strain mix evaluation

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Long Life Asphalt Pavement Design

- Laboratory mix characterization
- Determination of design parameters
- Pavement response predictions
- Construction of strain distribution
- Confidence via comparison to APT limit

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Questions ?