Cold Central Plant Recycled Pavements (CCPR)

Dr. David Timm, P.E.

National Center for Asphalt Technology
NCAT
at AUBURN UNIVERSITY

2018 NCAT Test Track Conference

Background

- RAP usage common
  - 81.8 million tons in 2016
  - Majority used in HMA or WMA
- Opportunity to use RAP with cold recycling techniques
  - Fewer virgin materials
  - Less fuel consumption
  - Fewer emissions
  - Faster construction time


NAPA
NATIONAL ASPHALT PAVEMENT ASSOCIATION

Asphalt Pavement Industry Survey on
Recycled Materials and Warm-Mix Asphalt Usage
2016

Information Series 138

- Cold RAP (2016) = 0.2 million tons

Cold Central Plant Recycling

Milling

Fractionation

CCPR Mixing (RAP+recycling agents)

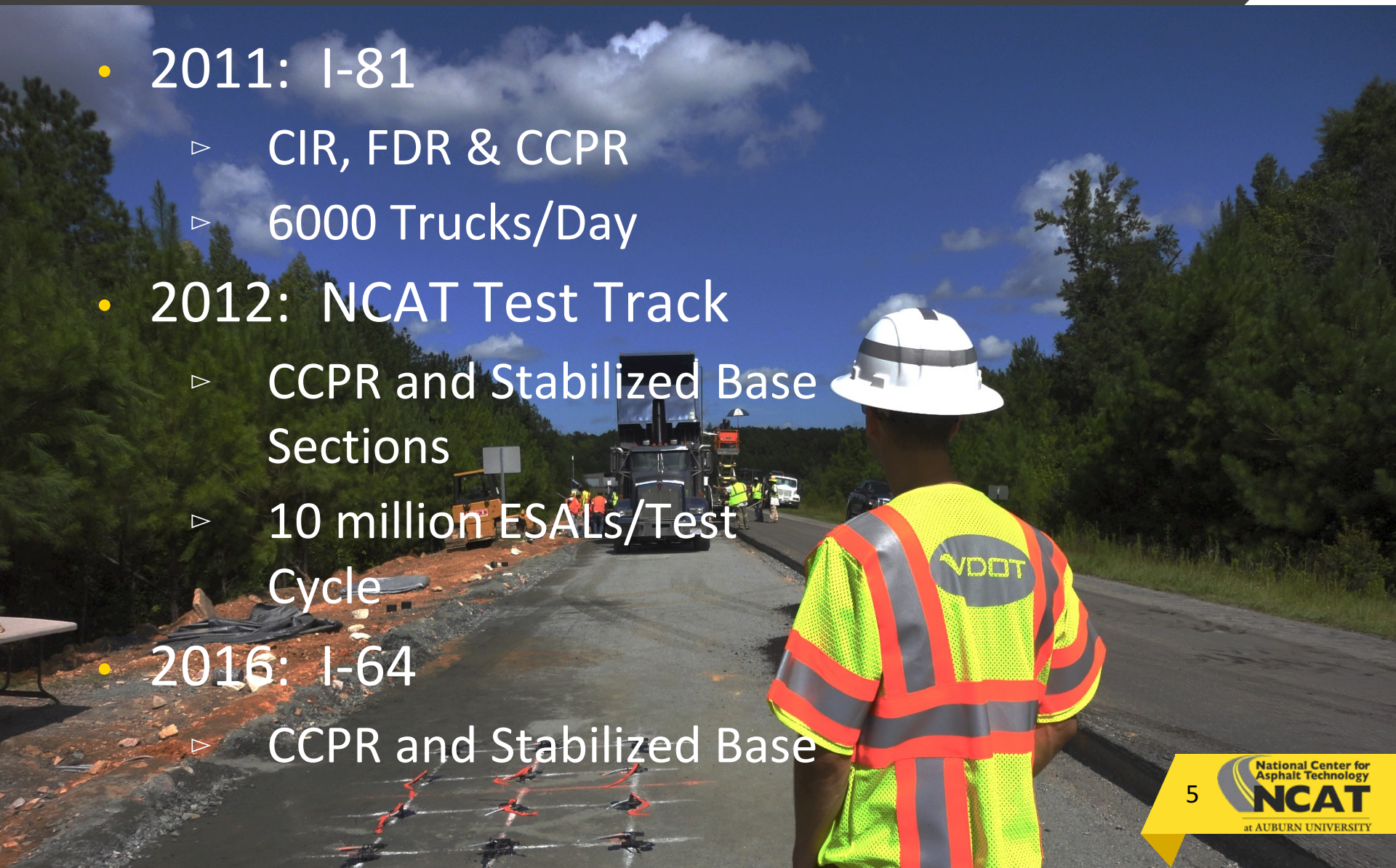
Conventional Paving

Structural Characterization of CCPR

- No current specific methodology for determining structural characteristics
  - Some studies evaluated fundamental characteristics
  - Very little study under heavy traffic conditions
  - Need a structural coefficient (0.36 to 0.39 is conservative)

VDOT Experience

- 2011: I-81
  - CIR, FDR & CCPR
  - 6000 Trucks/Day
- 2012: NCAT Test Track
  - CCPR and Stabilized Base Sections
  - 10 million ESALs/Test Cycle
- 2016: I-64
  - CCPR and Stabilized Base



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Objectives & Scope of Work

- Objectives
  - Document performance of Test Track sections
  - Evaluate Test Track sections using perpetual criteria
- Scope of Work
  - Three test sections over two cycles at Test Track
  - Accelerated trafficking (20 million ESALs)
  - Weekly performance measurements
  - Frequent FWD testing
  - Measurements from embedded instrumentation
  - Perpetual pavement analysis

VDOT CCPR Sections

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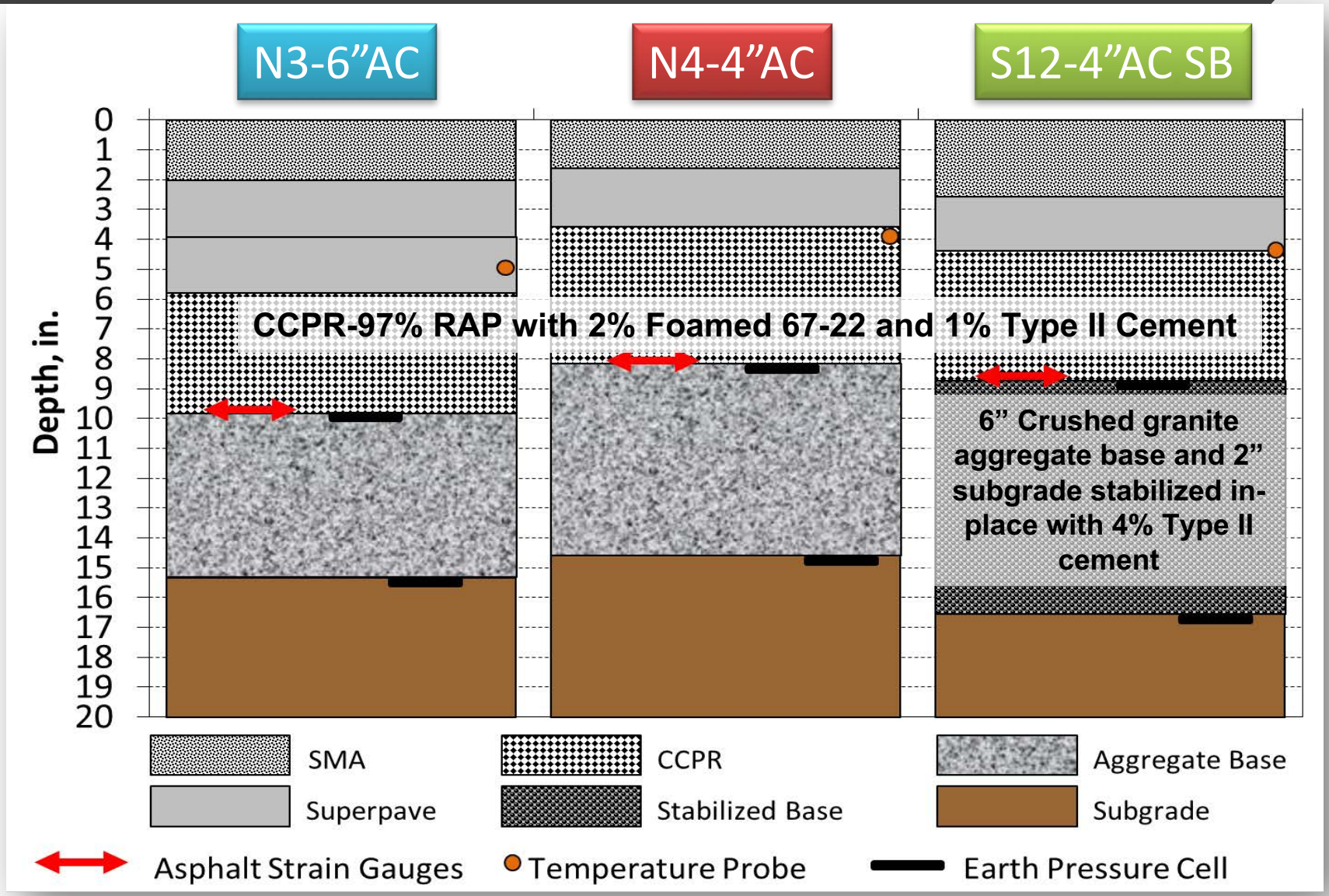
Cross Sections



Layer Parameters

Section	N3-6”AC	N4-4”AC	S12-4”AC SB
Layer Description	Lift 1-19 mm NMAS SMA with 12.5% RAP and PG 76-22 binder		
Binder Content, %	6.1	6.0	6.1
$\%G_{mm}$	95.7	95.3	95.8
Layer Description	Lift 2-19 mm NMAS Superpave with 30% RAP and PG 67-22 binder		
Binder Content, %	4.6	4.6	4.7
$\%G_{mm}$	92.9	7.4	93.3
Layer Description	Lift 3-19 mm NMAS Superpave with 30% RAP and PG 67-22 binder		
Binder Content, %	4.4	NA	NA
$\%G_{mm}$	93.6	NA	NA
Layer Description	CCPR-97% RAP with 2% Foamed 67-22 and 1% Type II Cement		
Layer Description	Crushed granite aggregate base		6” Crushed granite aggregate base and 2” subgrade stabilized in-place with 4% Type II cement
Layer Description	Subgrade – AASHTO A-4 Soil		

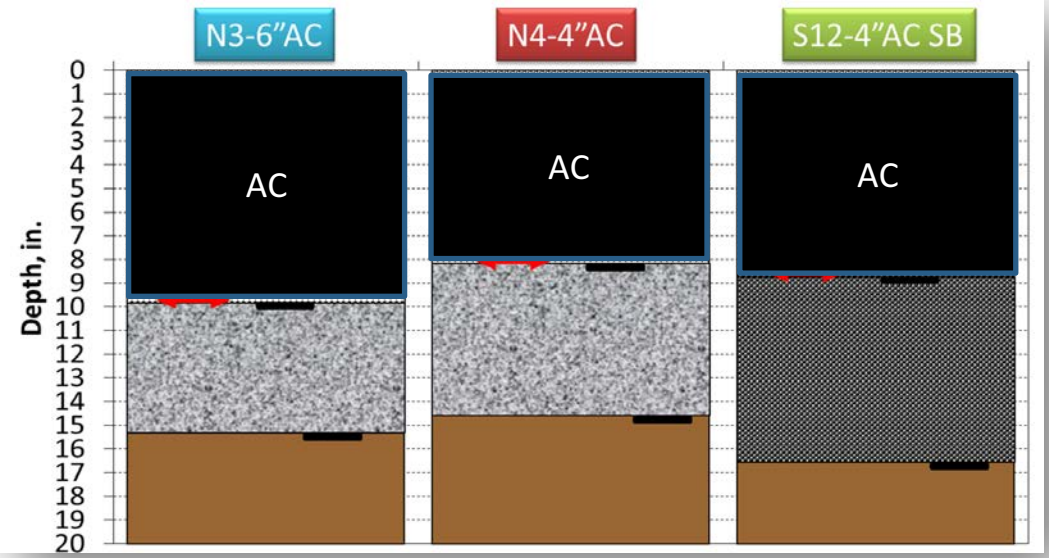
Construction

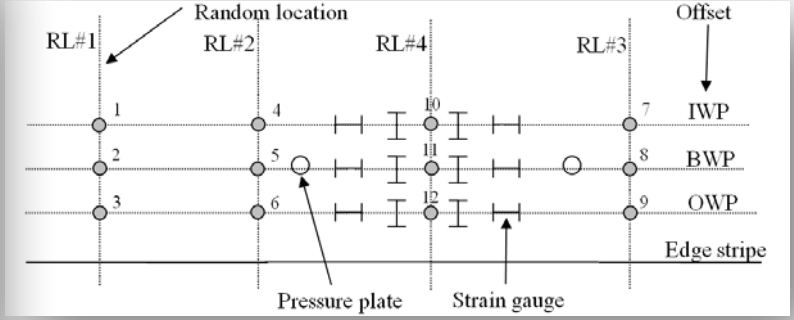
Performance Measurements

- Weekly inspection for cracking
- Weekly rut and ride quality

FWD Testing & Backcalculation

- Several tests/month
- Dynatest 8000 FWD
  - Nine sensors
- Three replicates at four drop heights
- Backcalculation with EVERCALC 5.0





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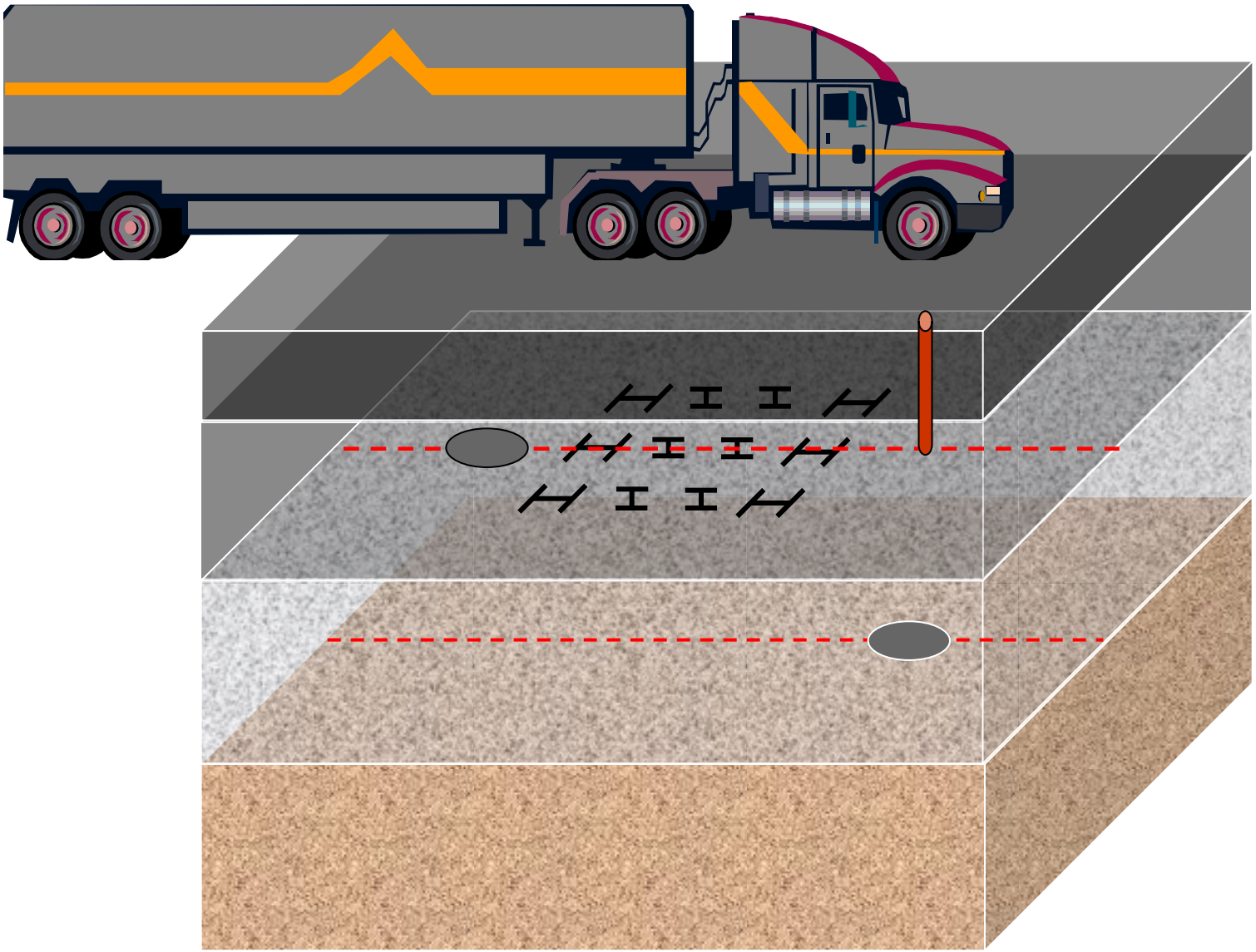
Instrumentation



Cracking Performance @ 20 MESALs

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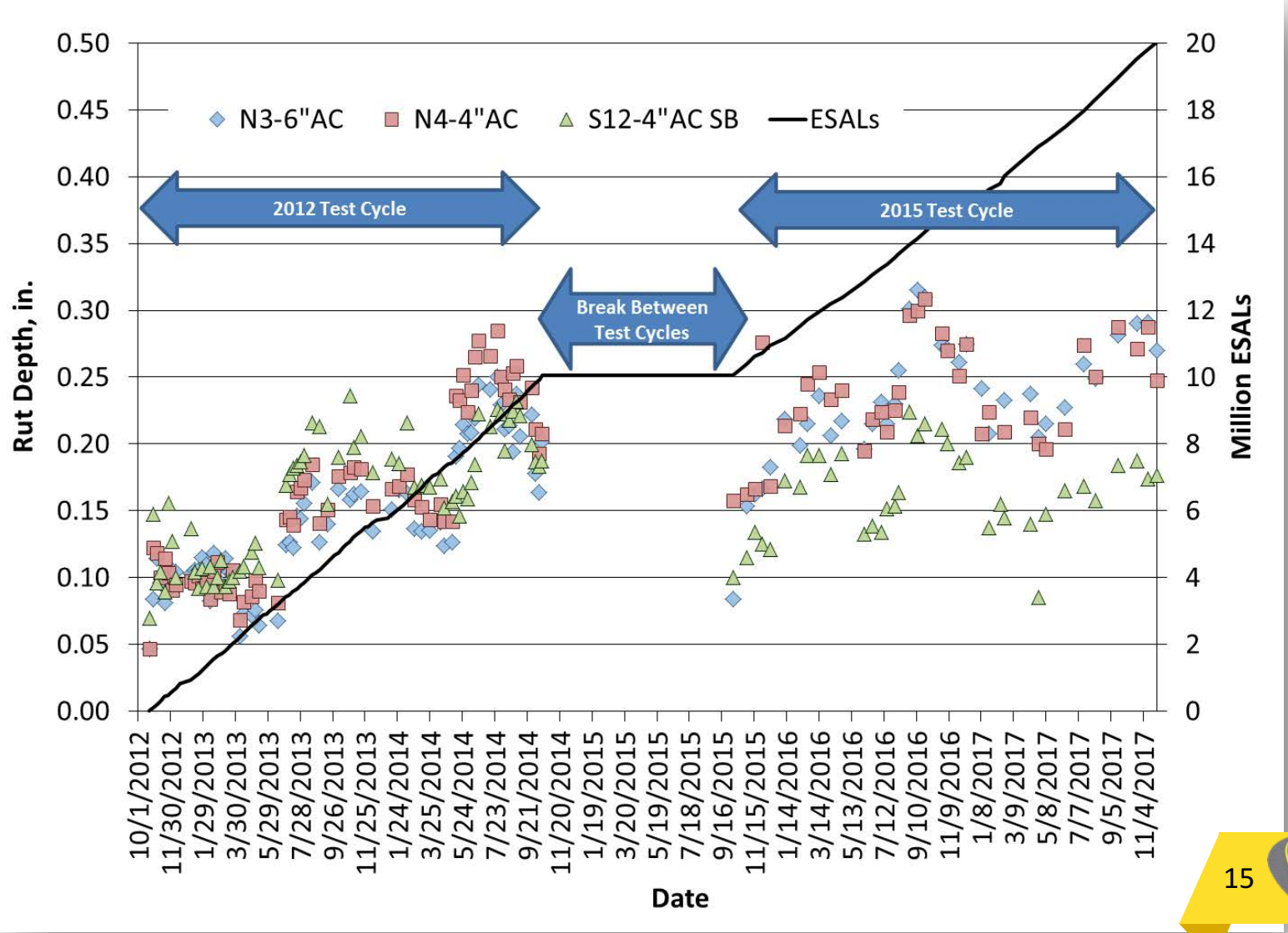
Rutting Performance



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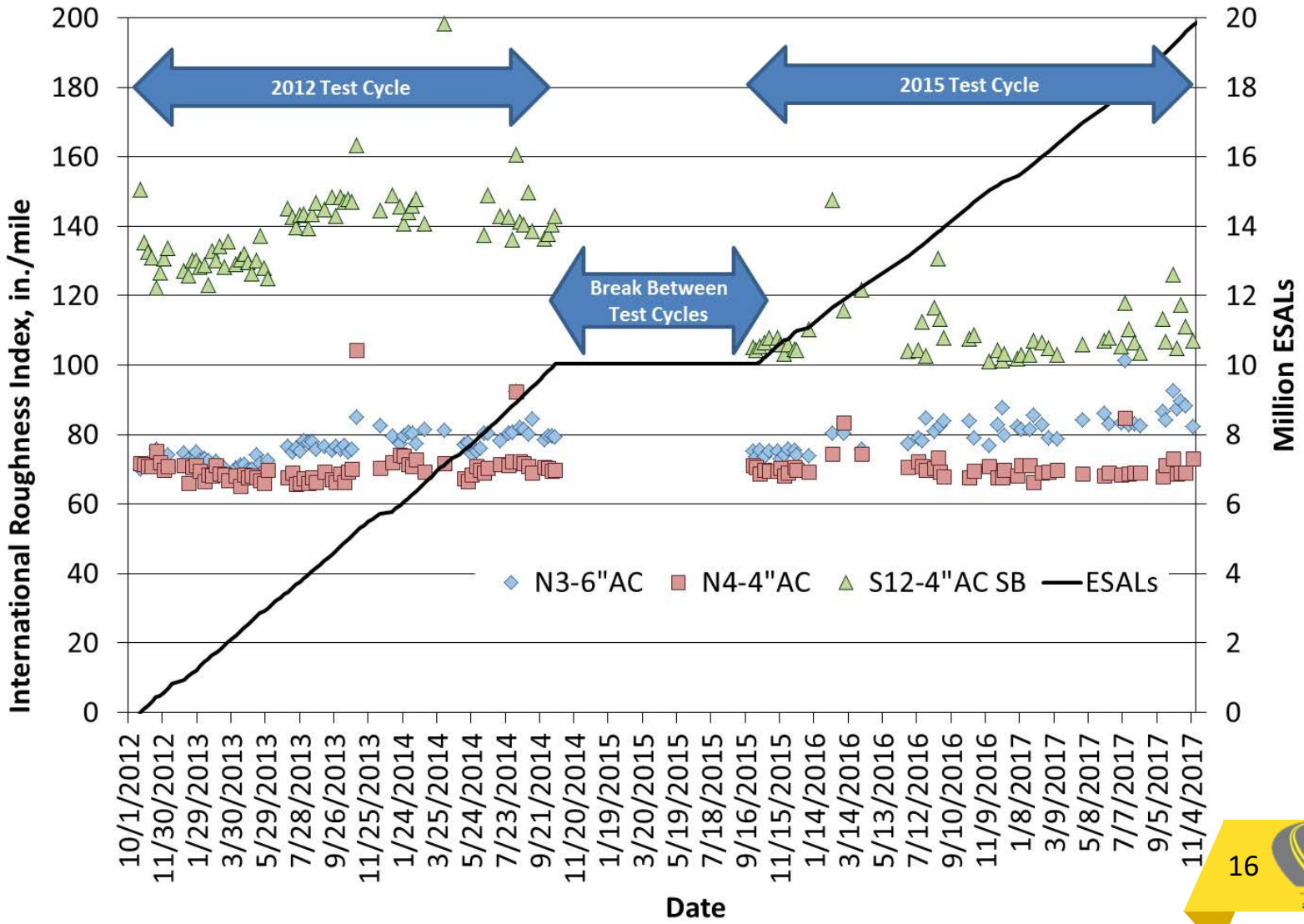
Ride Quality (IRI)



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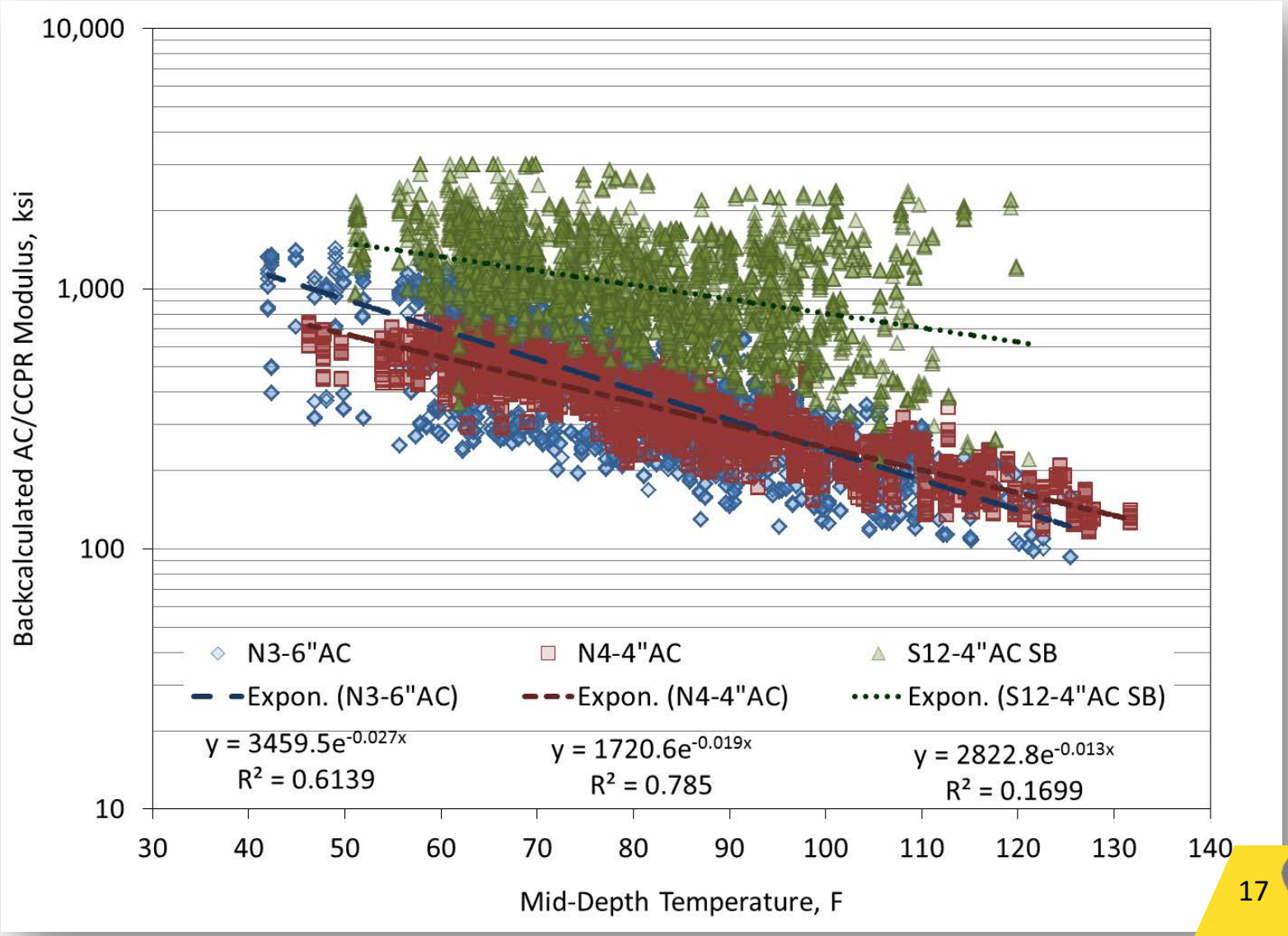
Backcalculated Modulus vs Temp



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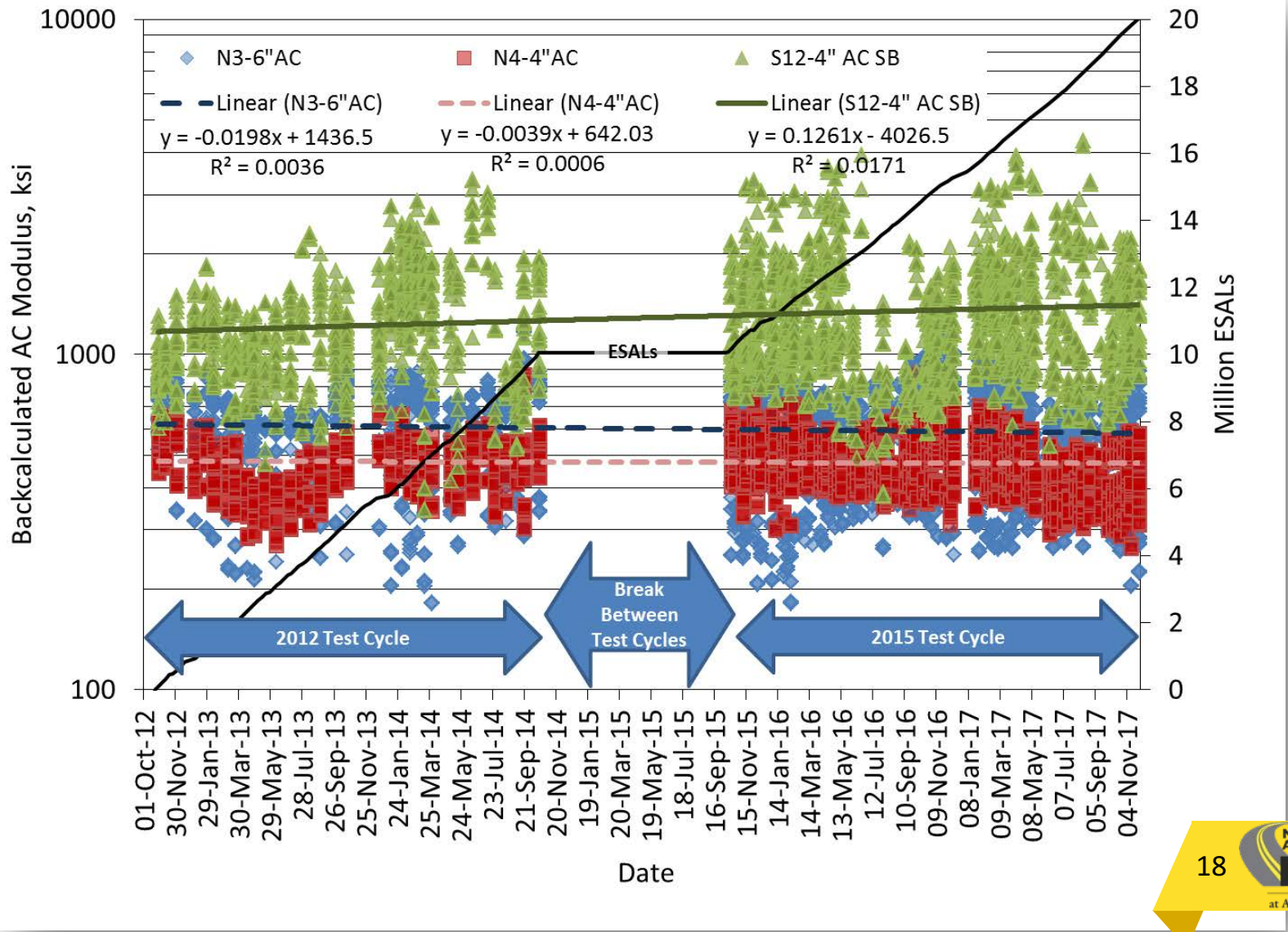
Backcalculated Modulus @ 68F



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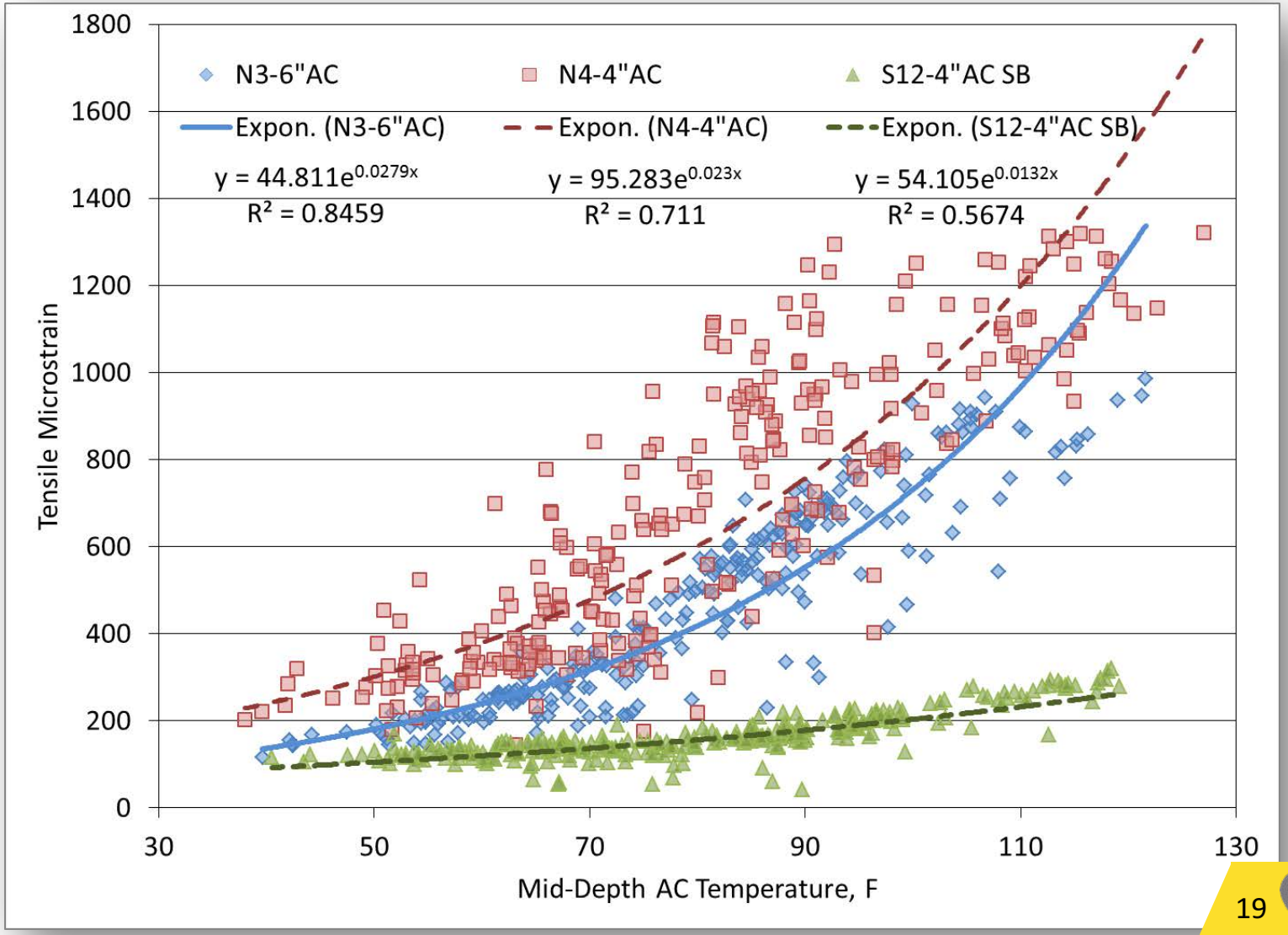
Strain Versus Temperature



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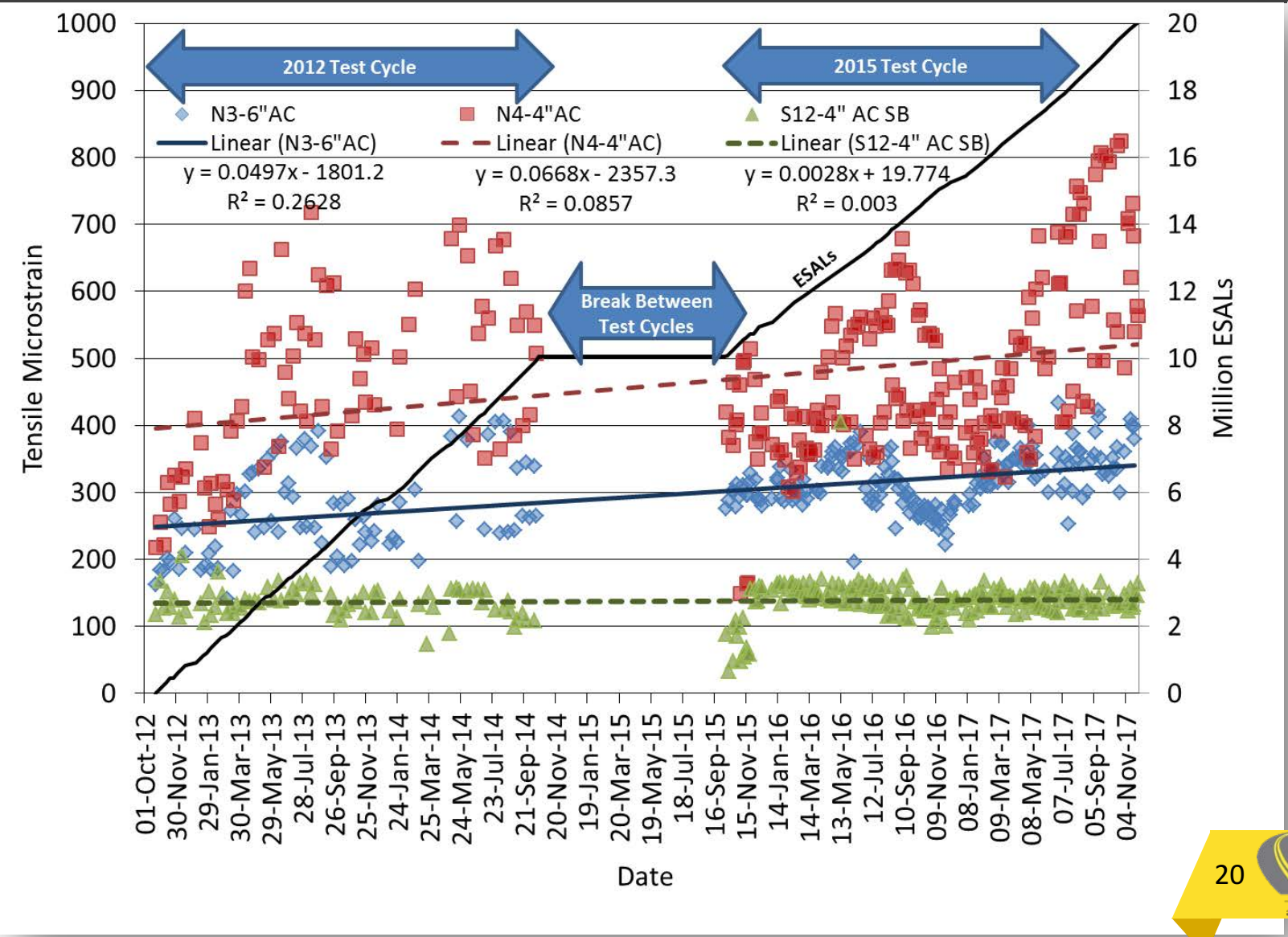
Strain @ 68F



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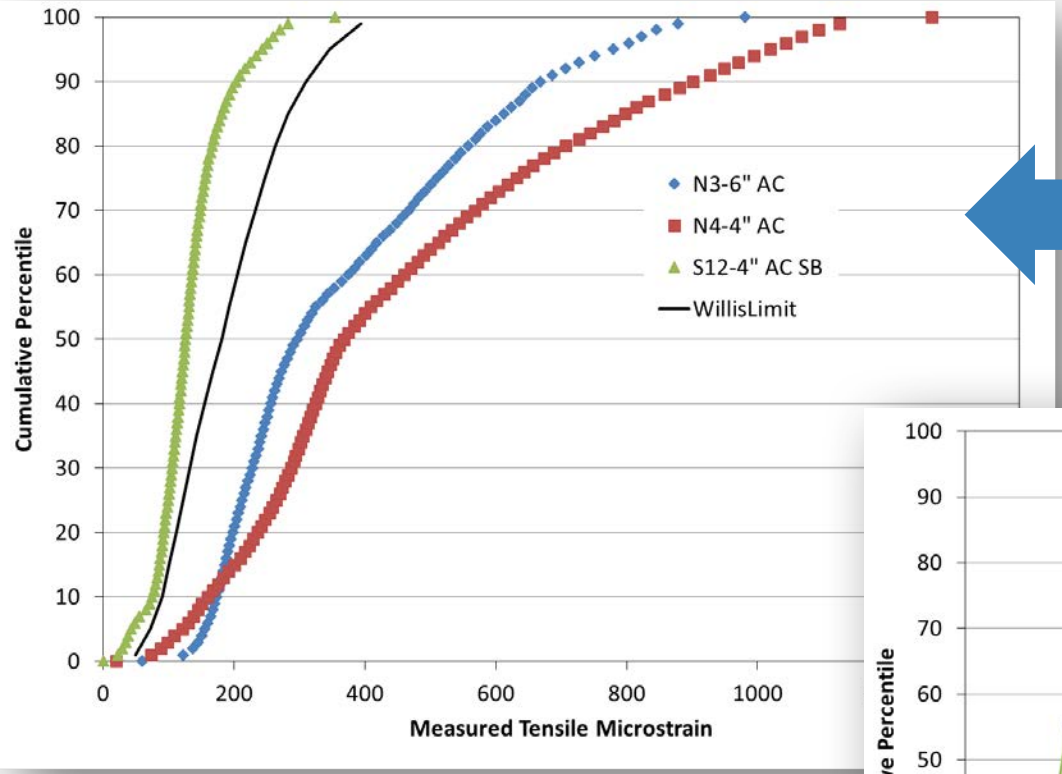
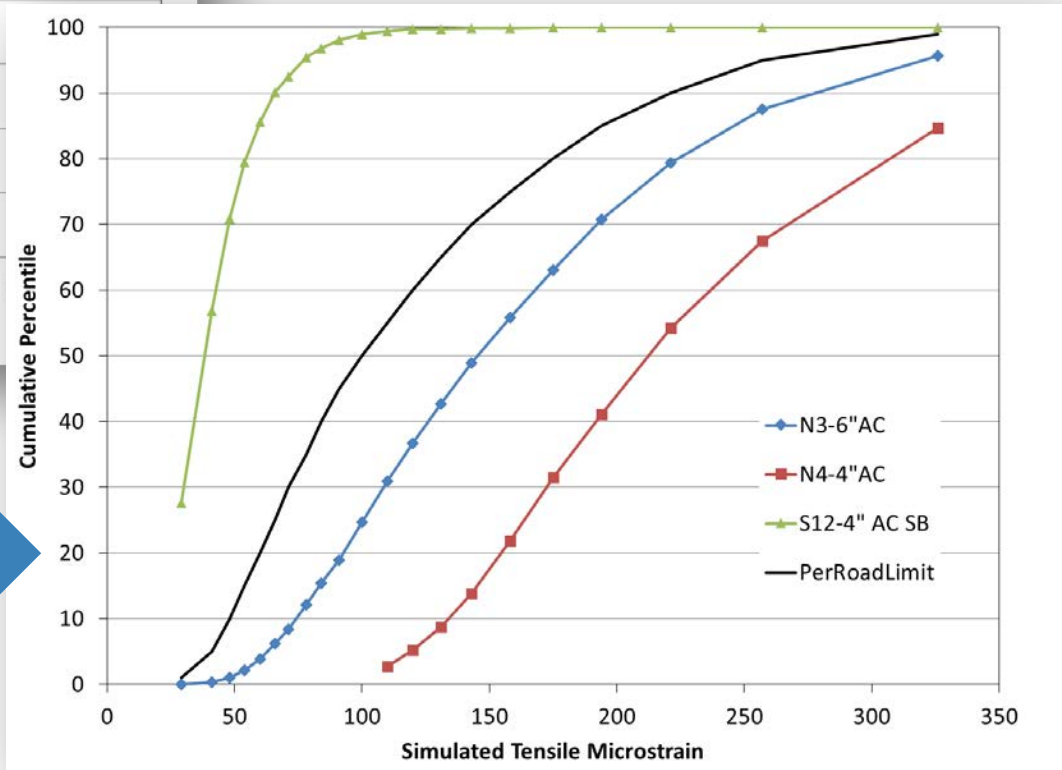
Perpetual Pavement Analysis – As Built

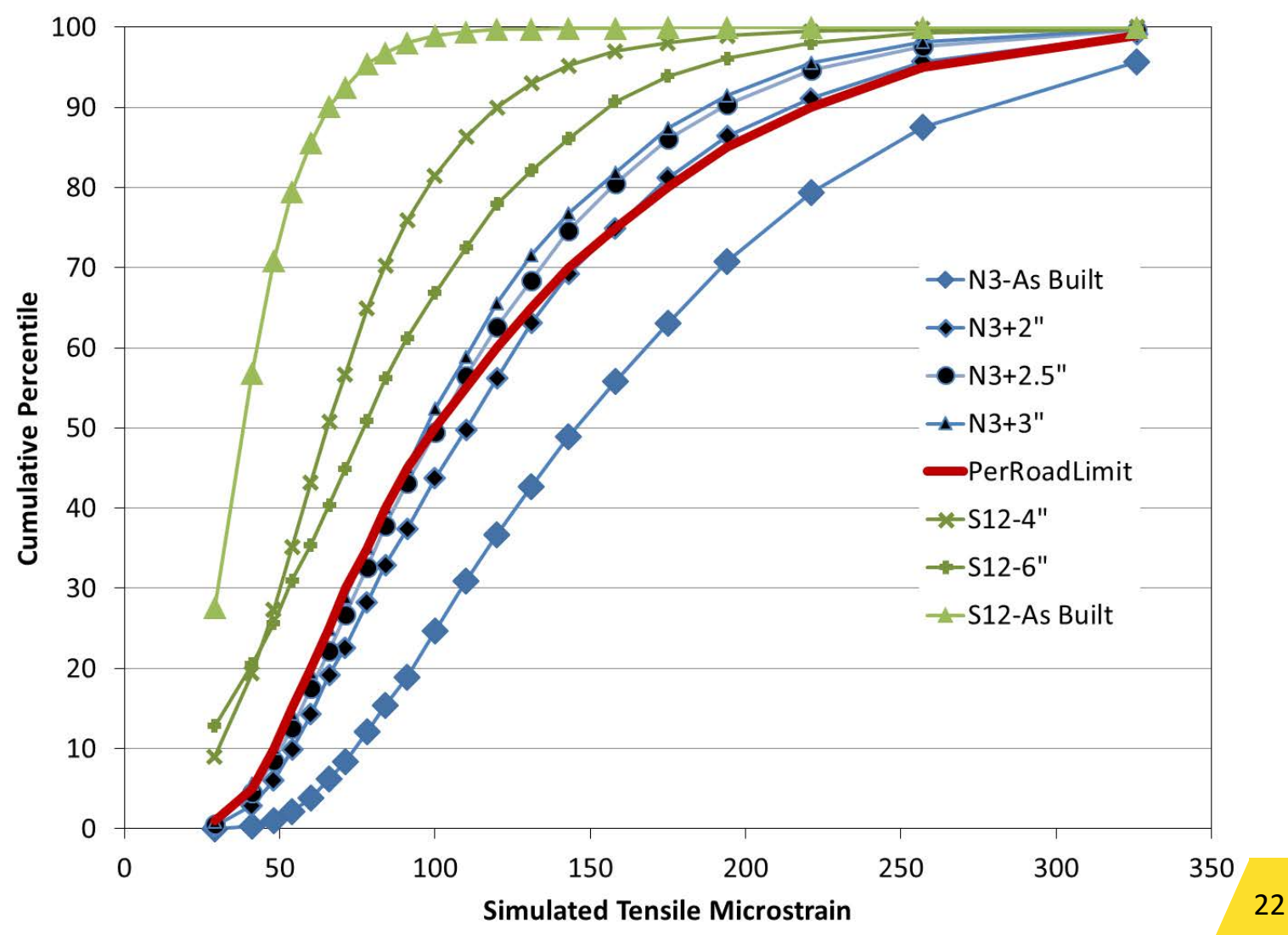


Measured

Simulated (PerRoad)



Additional Perpetual Analysis



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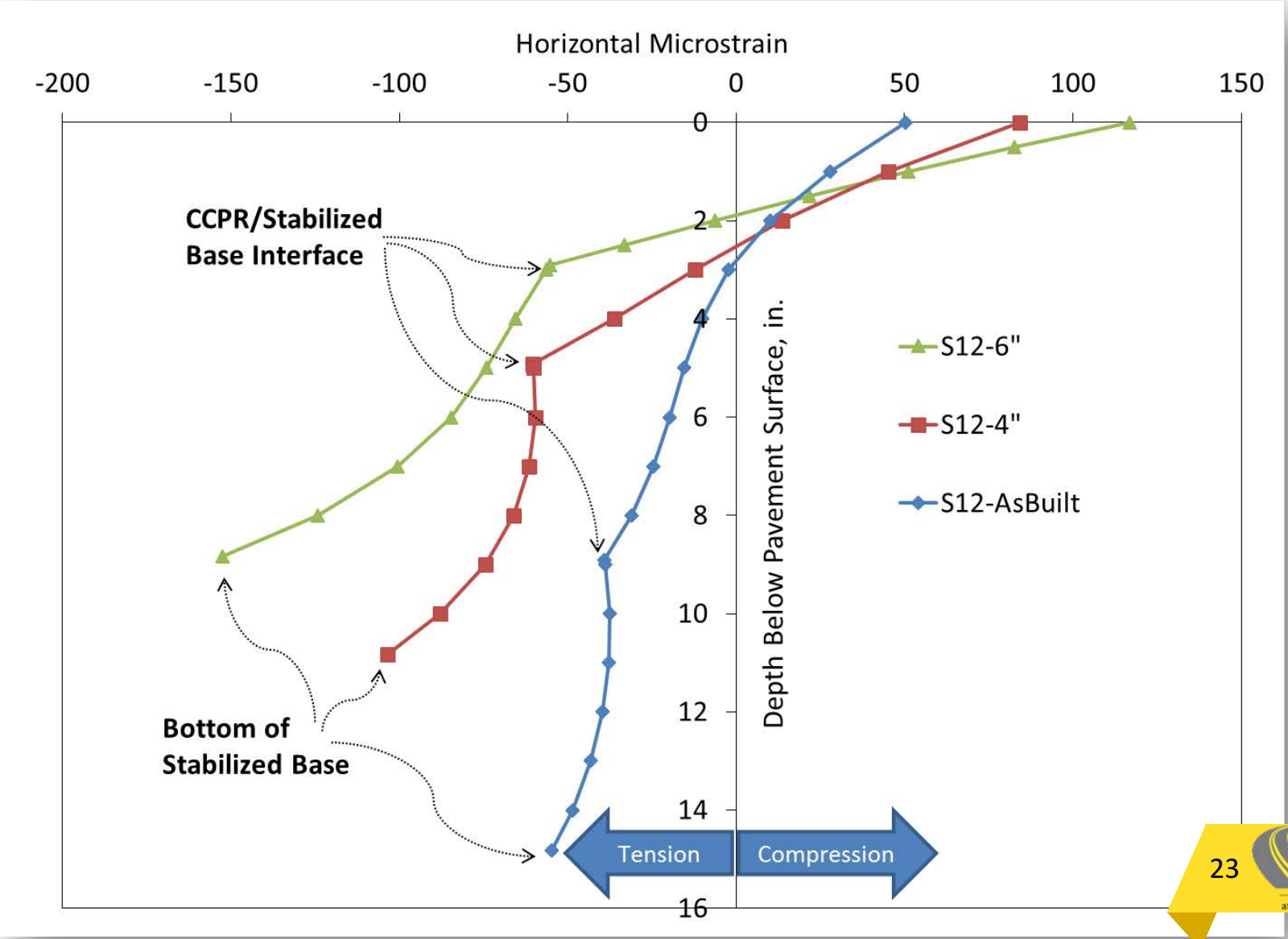
Caution with Stabilized Base



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Conclusions & Recommendations

- Excellent performance from all sections
  - Outperformed expected lives (> 16 Million ESALs)
- Treat CCPR like AC in mechanistic modeling
  - Supported by FWD and strain measurements
- S12 Expected to be perpetual using current criteria
  - Leave in place to apply additional traffic
- N3 and N4 expected to crack at some point?
  - Leave N4 in place to apply additional traffic

Thank you!

Questions?
Reach me at
timmdav@auburn.edu

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