



Utilization of Cold Central Plant Recycled Asphalt in Long Life Pavements

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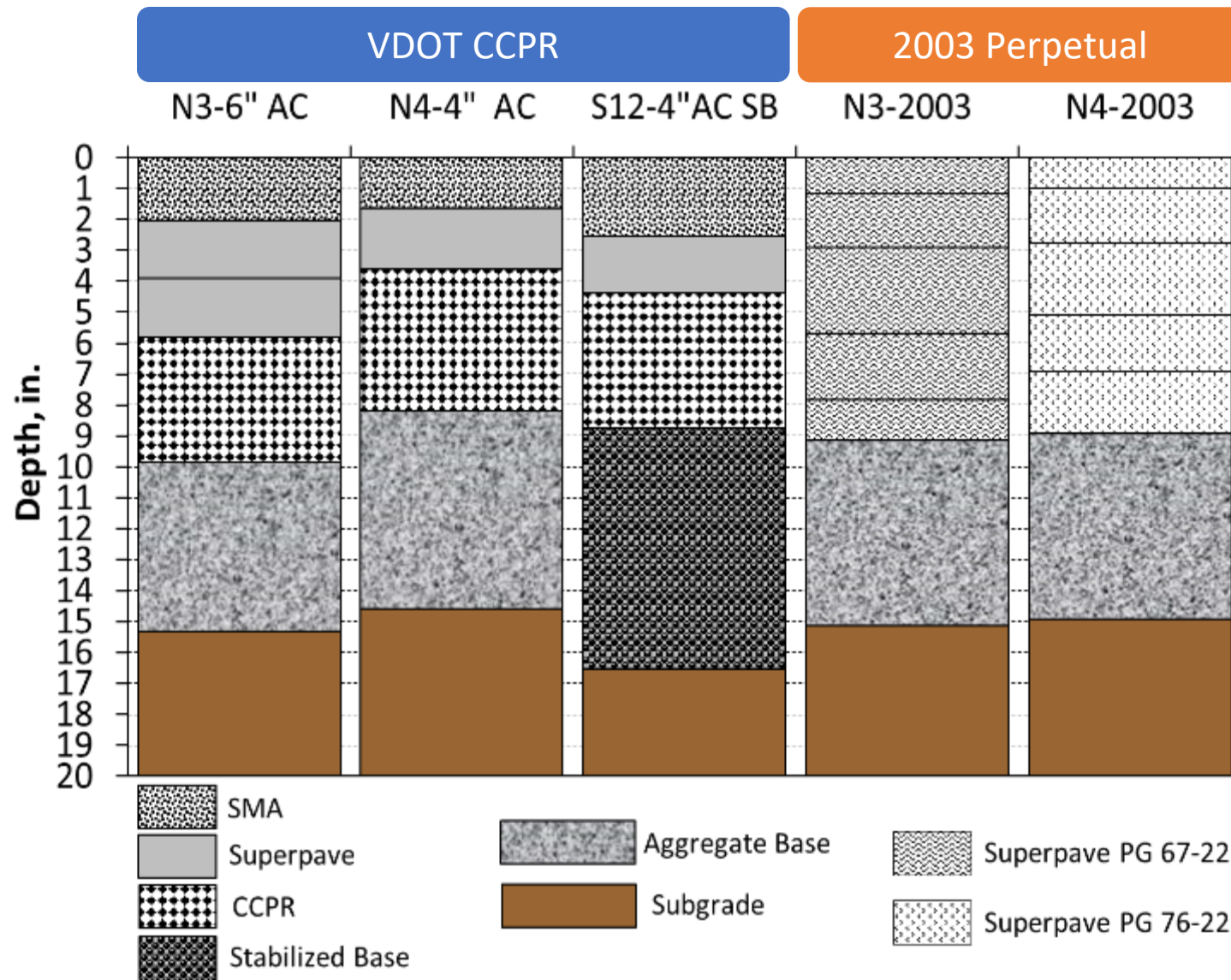
SEVENTH
RESEARCH CYCLE

NCAT TEST TRACK CONFERENCE

Long-Life (Perpetual) Pavements

- No deep structural distresses
- Minimal structural improvements
- Many design concepts developed at Test Track
 - ▣ Validated with perpetual pavement award winners
- Typically have not featured high recycled contents
- VDOT CCPR sections placed in 2012 behaving like perpetual pavements
 - ▣ Performance very similar to perpetual sections built in 2003 research cycle
 - ▣ Need to compare/contrast behavior

Test Sections



Cracking Performance

- Minor cracking observed in 2003 sections
 - ▣ Top down (N4) and related to instrumentation (N3)
- No cracking observed at surface in S12
 - ▣ Forensic trenching revealed some cracking in cement stabilized foundation
- Minor cracks appeared in N4 at 29.6 MESALs



Cement Treated Base Cracking in S12



N4



N4



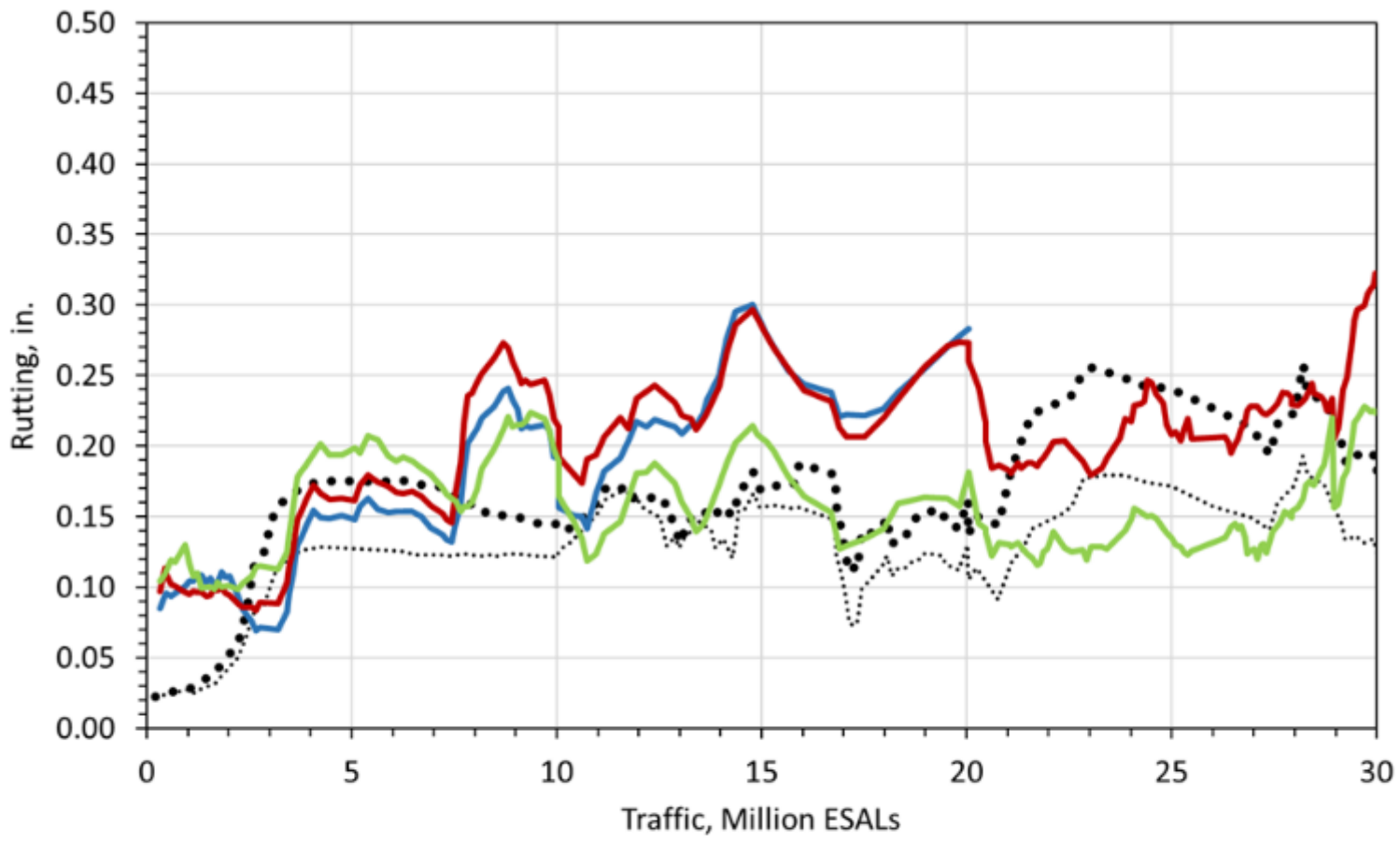
N4



N4

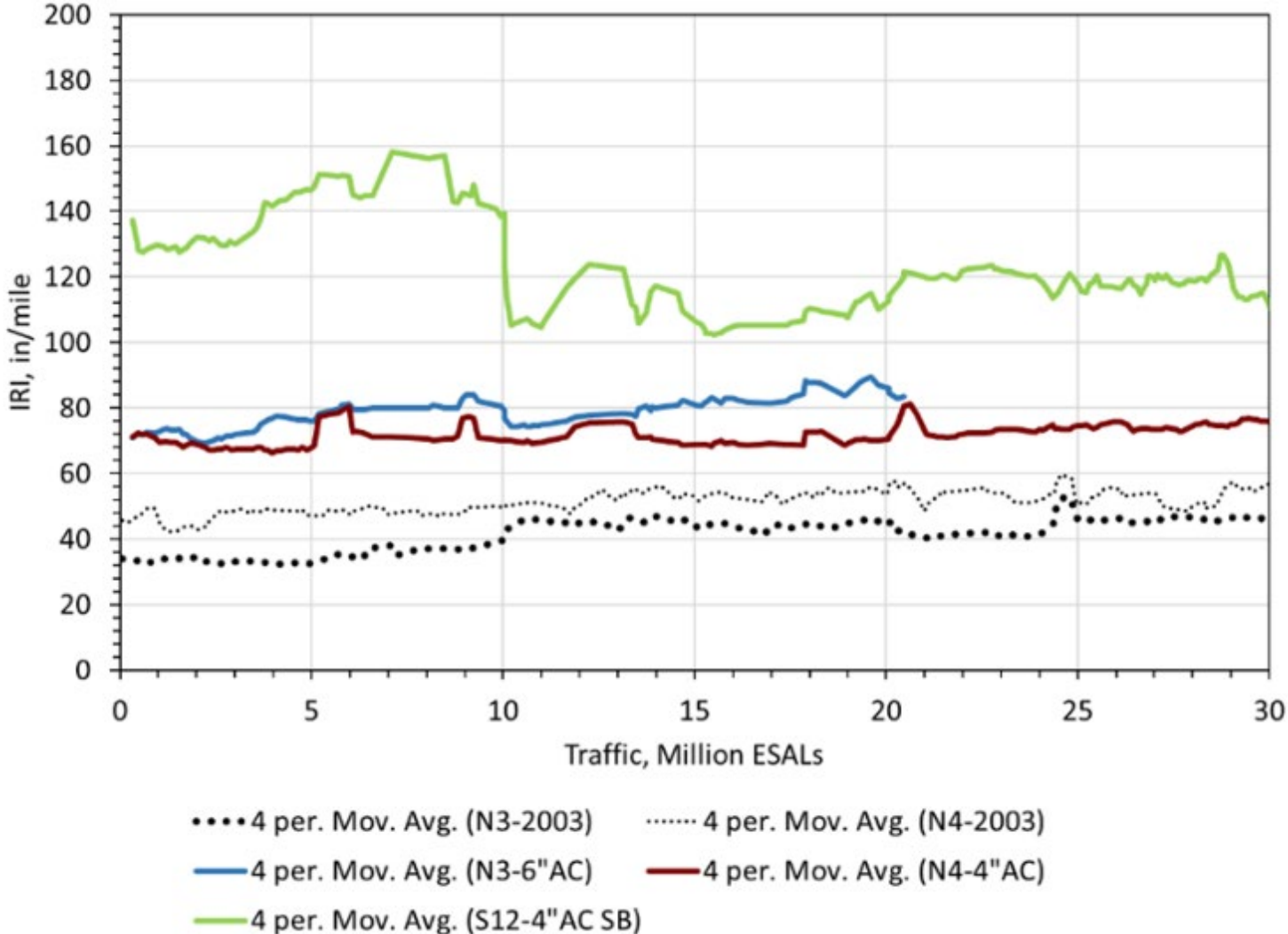


Rutting Performance

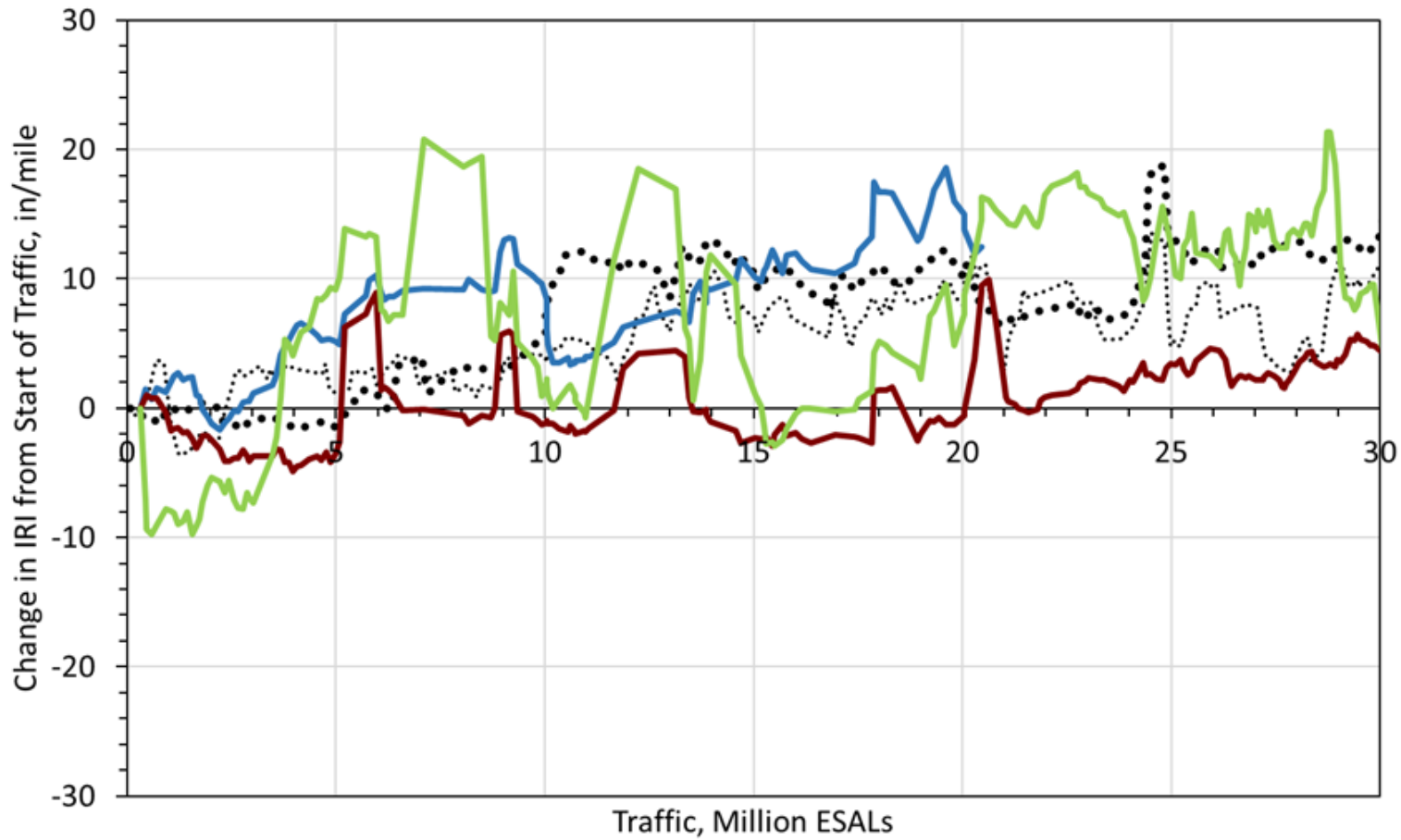


- 4 per. Mov. Avg. (N3-2003)
- 4 per. Mov. Avg. (N4-2003)
- 4 per. Mov. Avg. (N3-6"AC)
- 4 per. Mov. Avg. (N4-4"AC)
- 4 per. Mov. Avg. (S12-4"AC SB)

Ride Quality - IRI

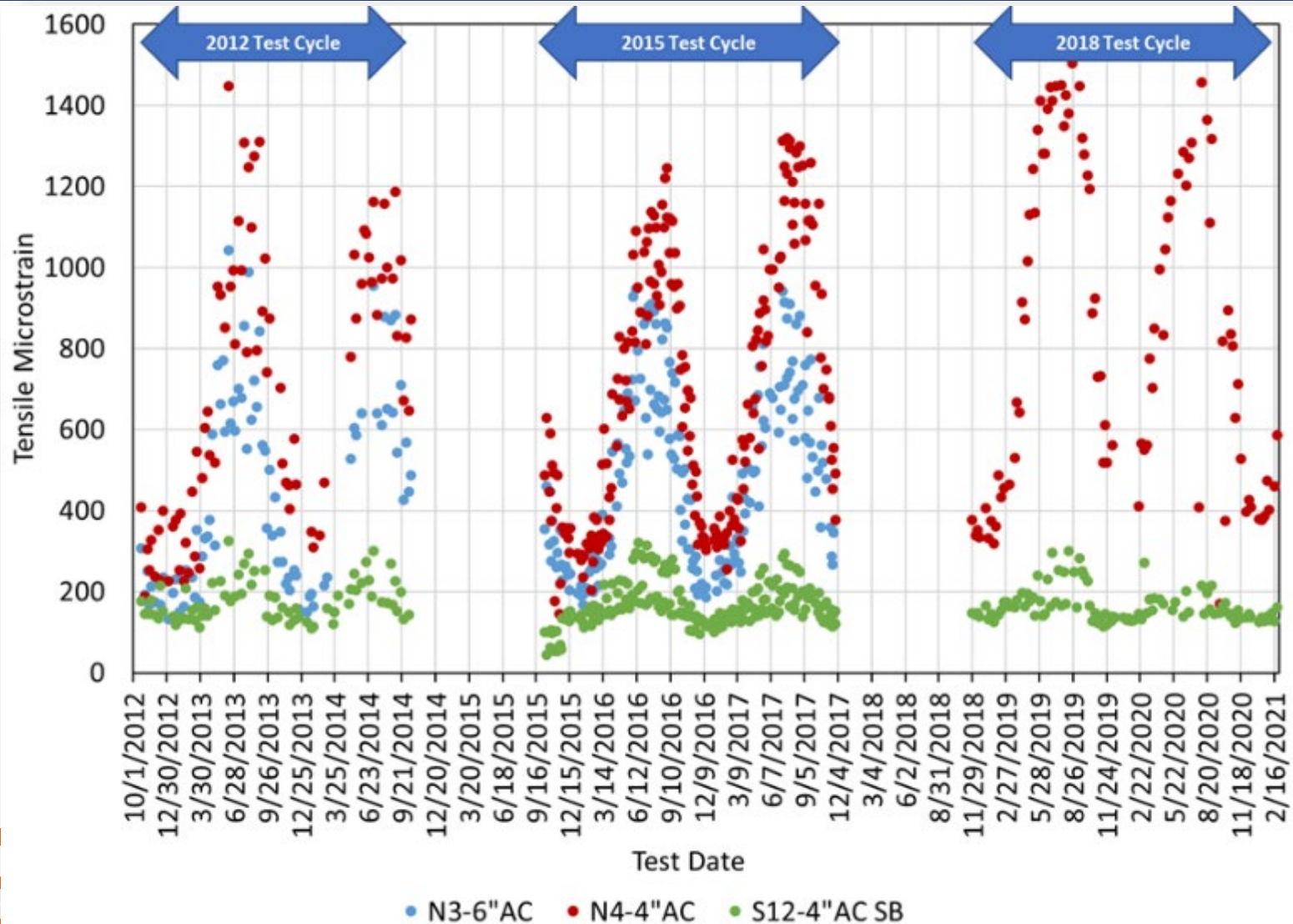


Ride Quality - Δ IRI

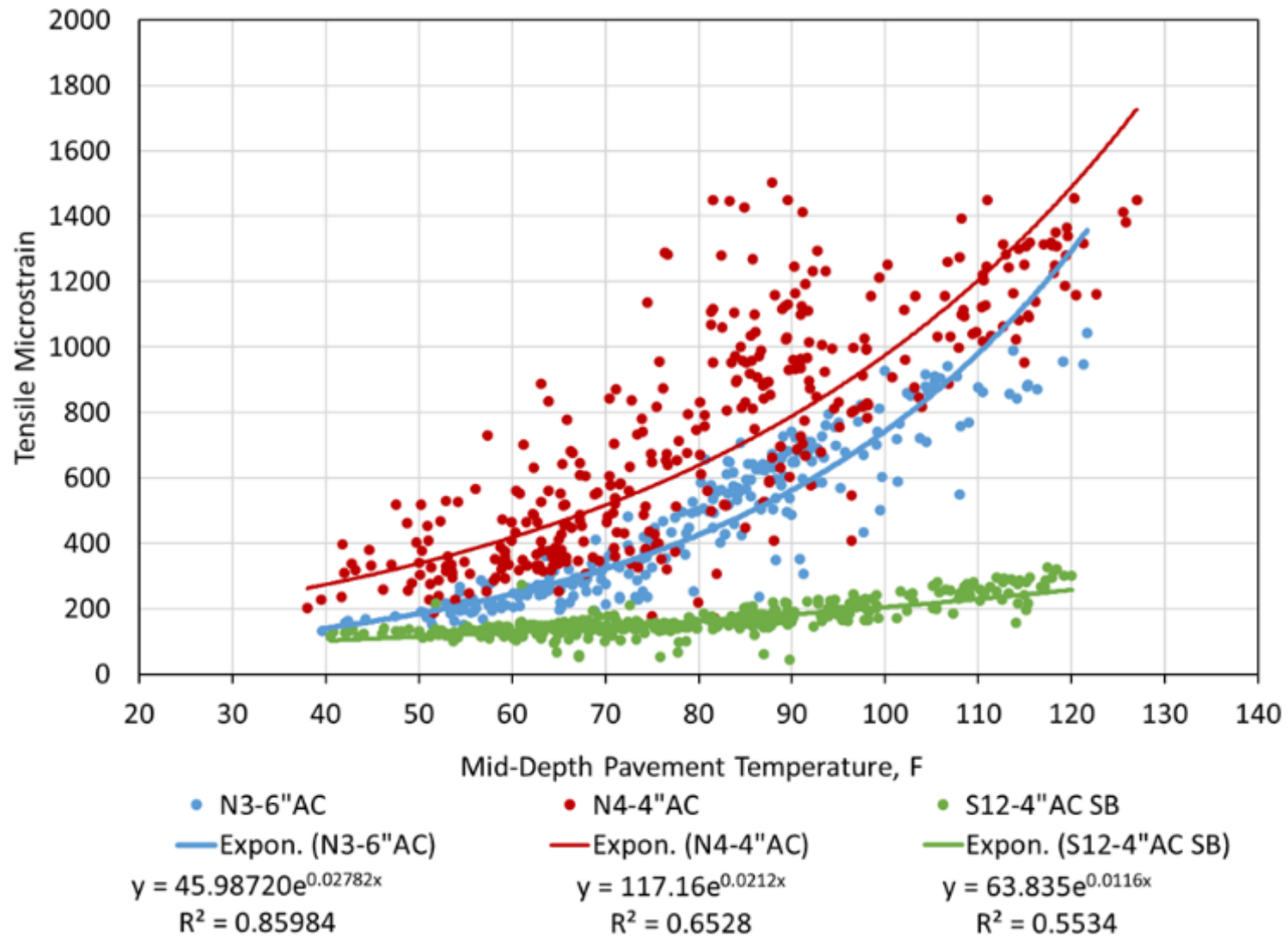


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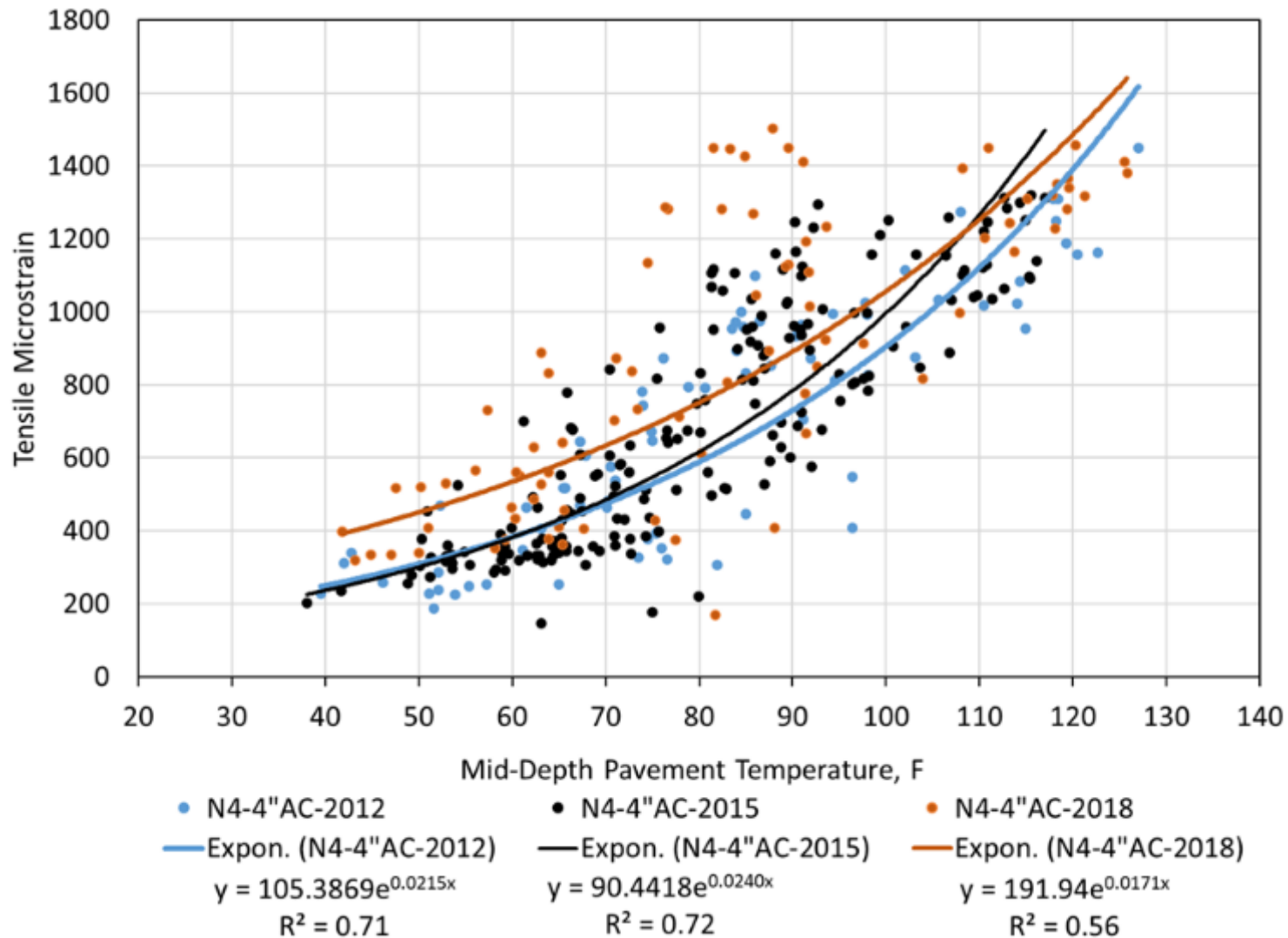
Measured Strain Responses



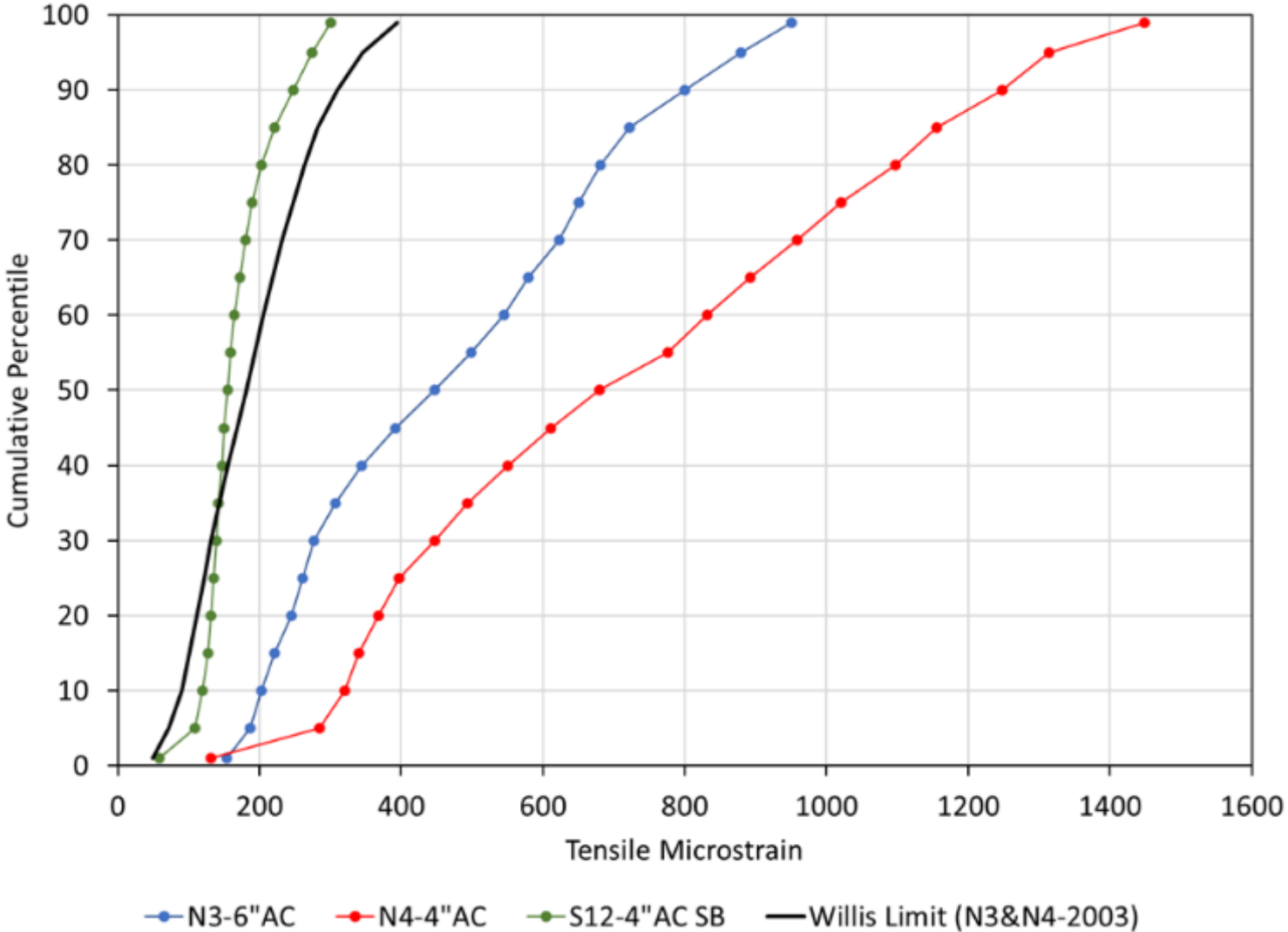
Measured Strain versus Temperature



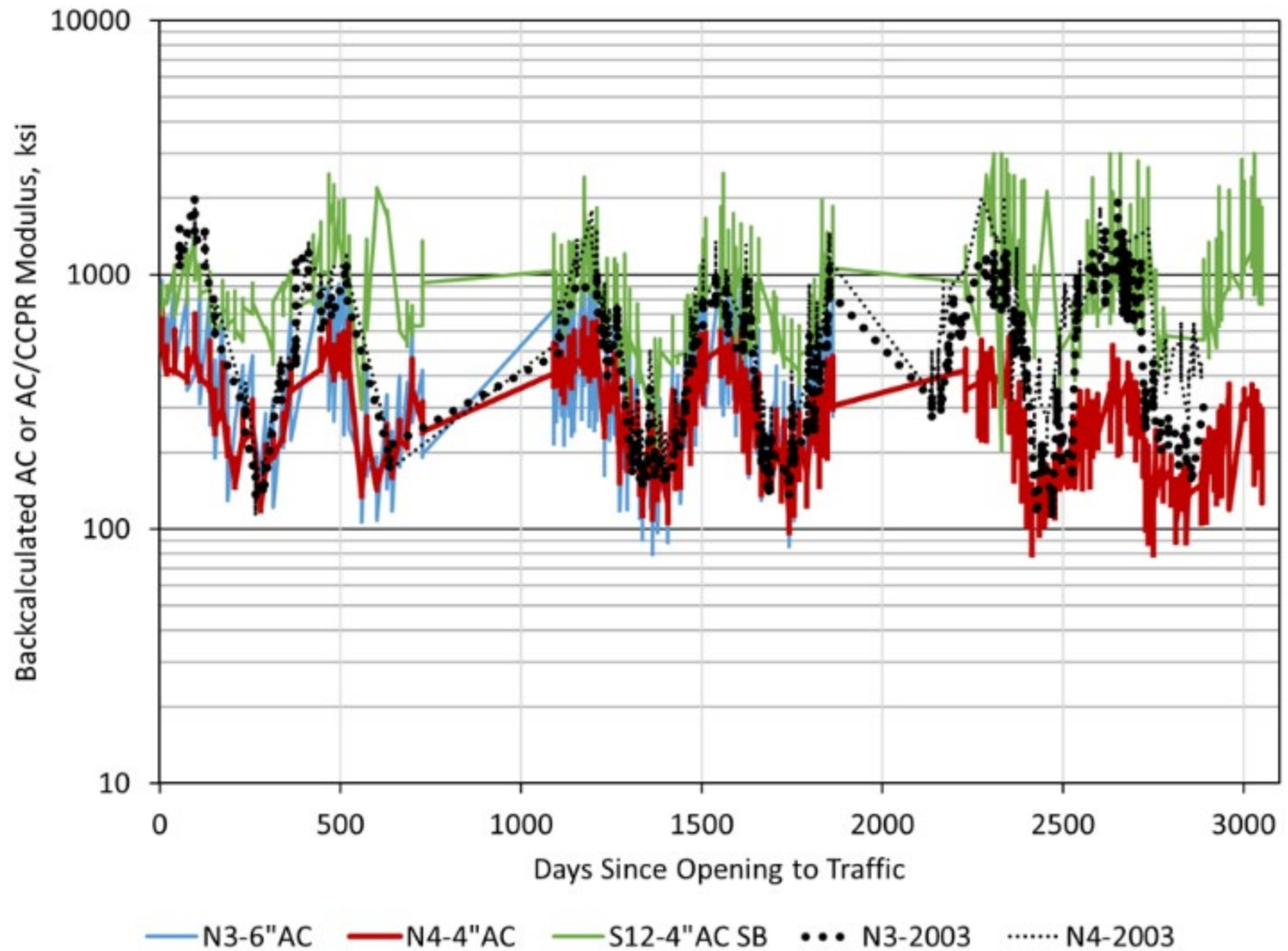
N4 Measured Strain versus Temperature



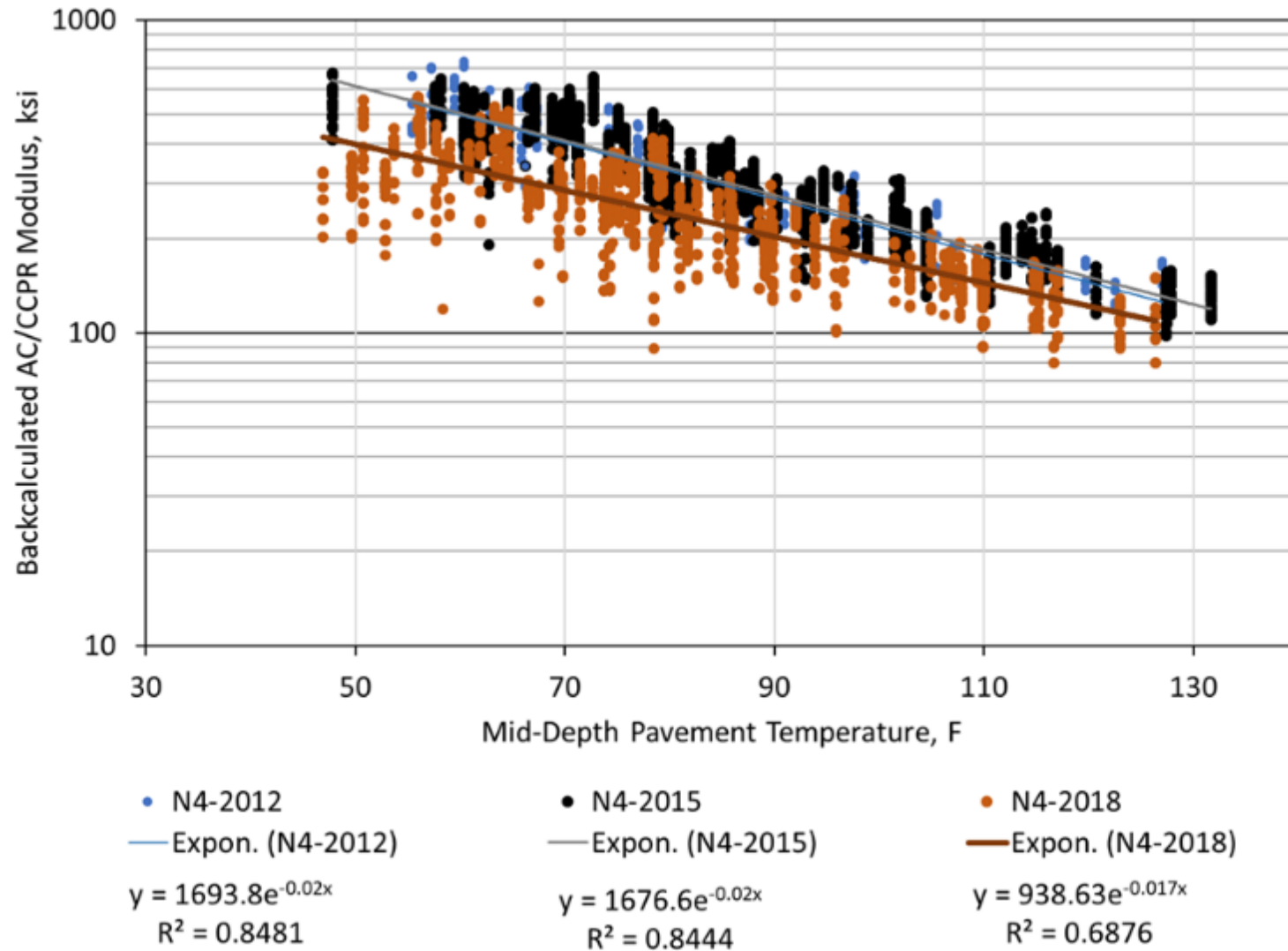
Strain Distributions



Backcalculated Moduli



N4 AC/CCPR Backcalculated Moduli



Economic Analysis

← VDOT Unit Costs

Material	Unit	Unit Cost, \$	Assumed Density, lbs/ft ³
Asphalt surface (SMA)	Tons	106	146
Asphalt base (dense graded)	Tons	95	146
CCPR	Tons	45	136
FDR	Square Yard	8	-
Aggregate Base	Tons	20	152

34% lower cost
than 2003 Sections

31% lower cost
than 2003 Sections

<i>Layer thickness, inch</i>					
	CCPR N3	CCPR N4	CCPR S12	2003 N3	2003 N4
AC	5.8	3.6	4.4	9.1	8.9
CCPR	4.0	4.6	4.3	-	-
Agg Base	5.5	5.2	-	6.0	6.0
FDR	-	-	7.8	-	-
<i>Pavement Section Cost, \$/SY</i>					
	\$48.90	\$37.04	\$44.20	\$56.52	\$55.37
<i>Structural Number (SN)</i>					
	4.62	3.80	5.40	4.74	4.64
<i>Structure Normalized Pavement Section Cost, \$/SY/SN</i>					
	\$10.57	\$9.74	\$8.18	\$11.93	\$11.93

Conclusions & Recommendations

- All sections exhibited excellent performance
 - Very limited cracking at surface...CTB is cracked
 - Rutting < 0.25"
 - Δ IRI < 15 in/mile
- Strain responses steady in N3-6" and S12-4" AC SB
 - N4-4" early signs of possible distress
 - Minor cracking at 29.6 MESALs
- Cumulative strain responses show...
 - S12-4" AC SB may be perpetual
 - N3-6" and N4-4" exceeded criteria
 - New criteria needed?

Conclusions & Recommendations

- All CCPR sections were more cost effective than 2003 perpetual sections
 - N4-4" AC was 34% less expensive than 2003 sections
 - S12-4" AC SB had normalized cost 31% less than 2003 sections
- S12-4" AC SB contains 76% recycled material
- Need to conduct life cycle assessment on all sections
- Recommend leaving N4-4" AC in place for more trafficking

Discussion



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