NCHRP 9-54 Update

Selection of the Laboratory Aging Method and Aging Temperature

Y. Richard Kim, Cassie Castorena

Farhad Yousefi Rad, Michael Elwardany

North Carolina State University

Presented to the Asphalt Mixture ETG
Fall River, MA

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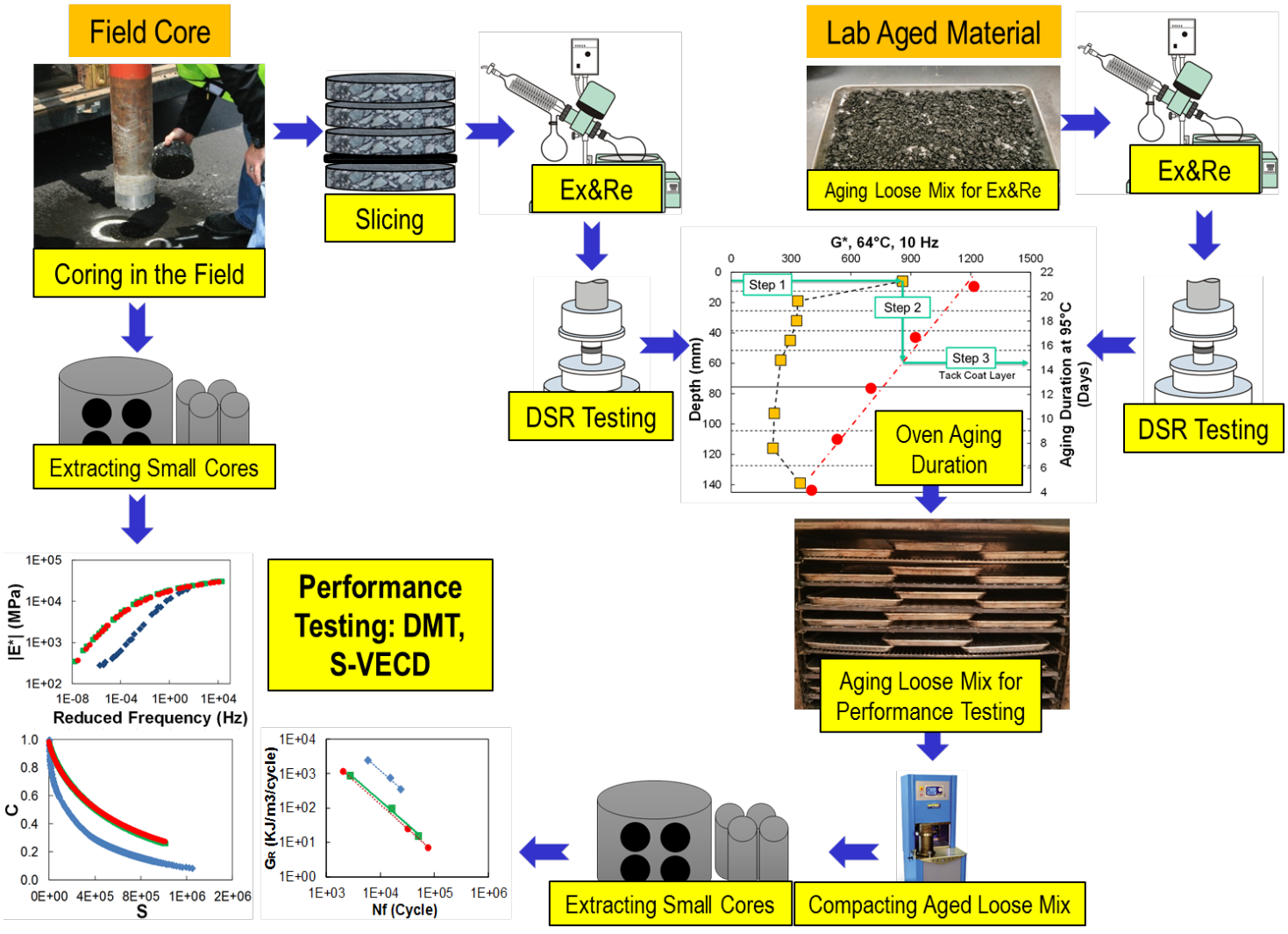
Overview

- NCHRP 9-54 objective
  - Develop a calibrated and validated procedure to simulate long-term aging of asphalt mixtures for performance testing and prediction
- Progress to date
  - Selection of the loose mixture aging method
  - Selection of 95°C as the laboratory aging temperature
  - Matching field aging levels

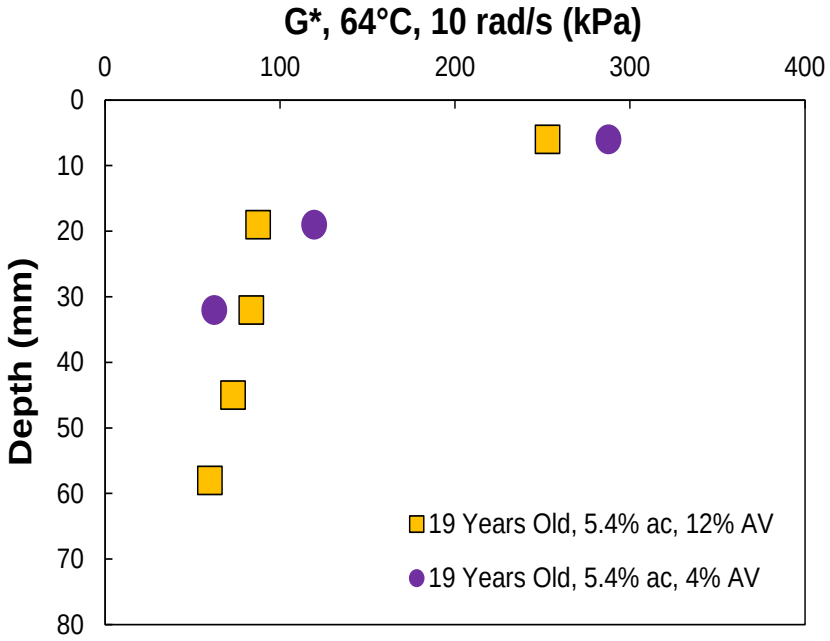
Experimental Steps



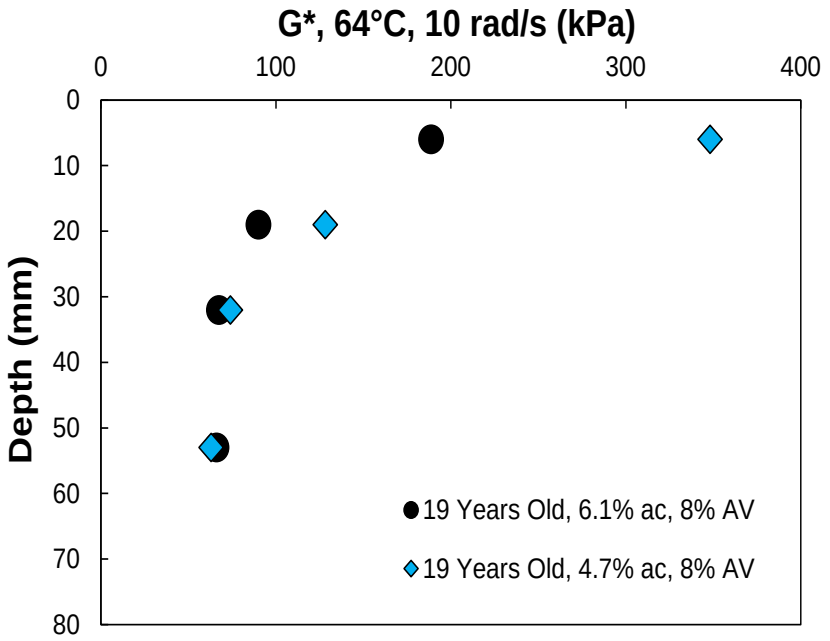
WesTrack Project

Factors that May Affect Aging Gradient

Effect of Air Void Content

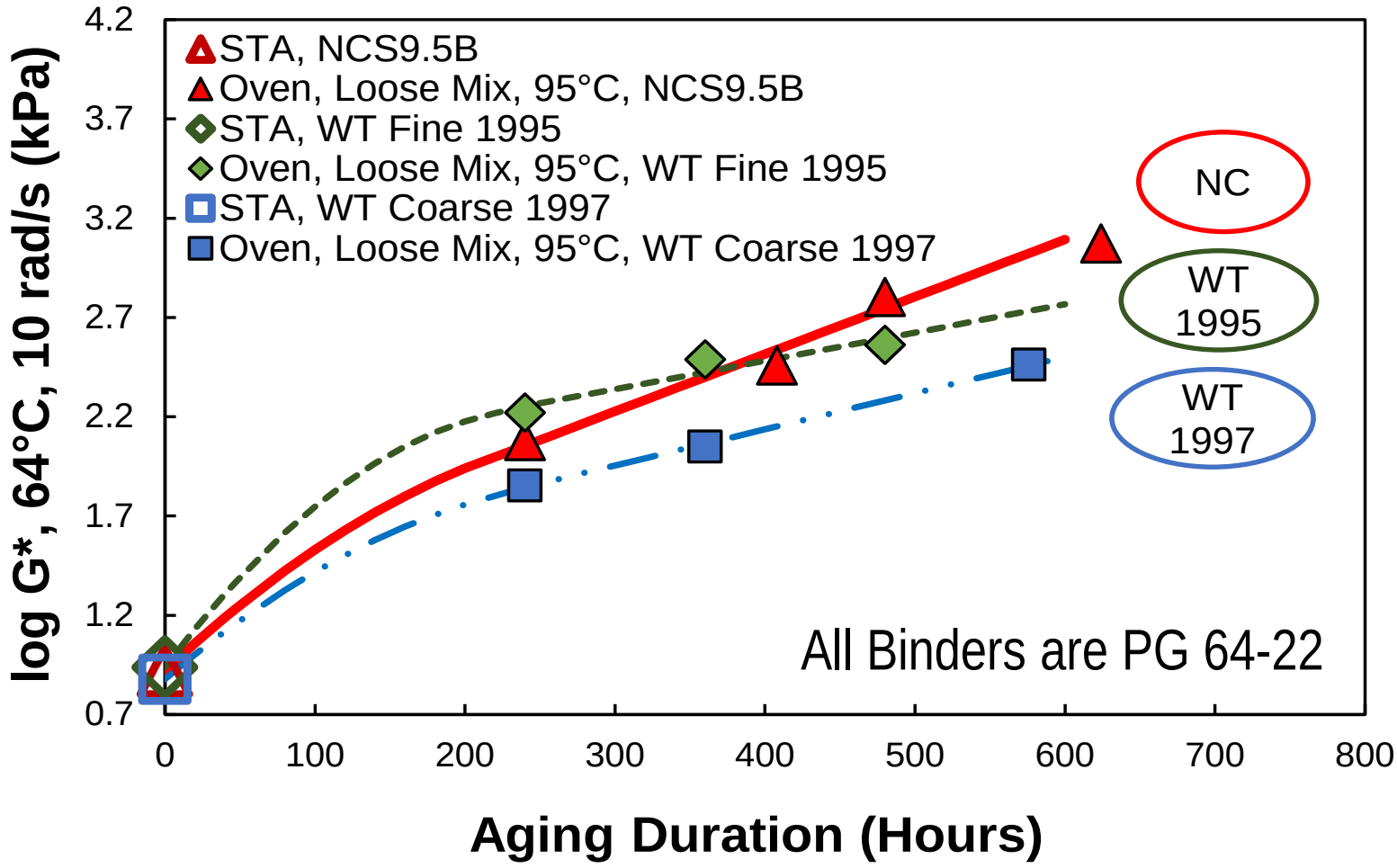


Effect of Asphalt Content



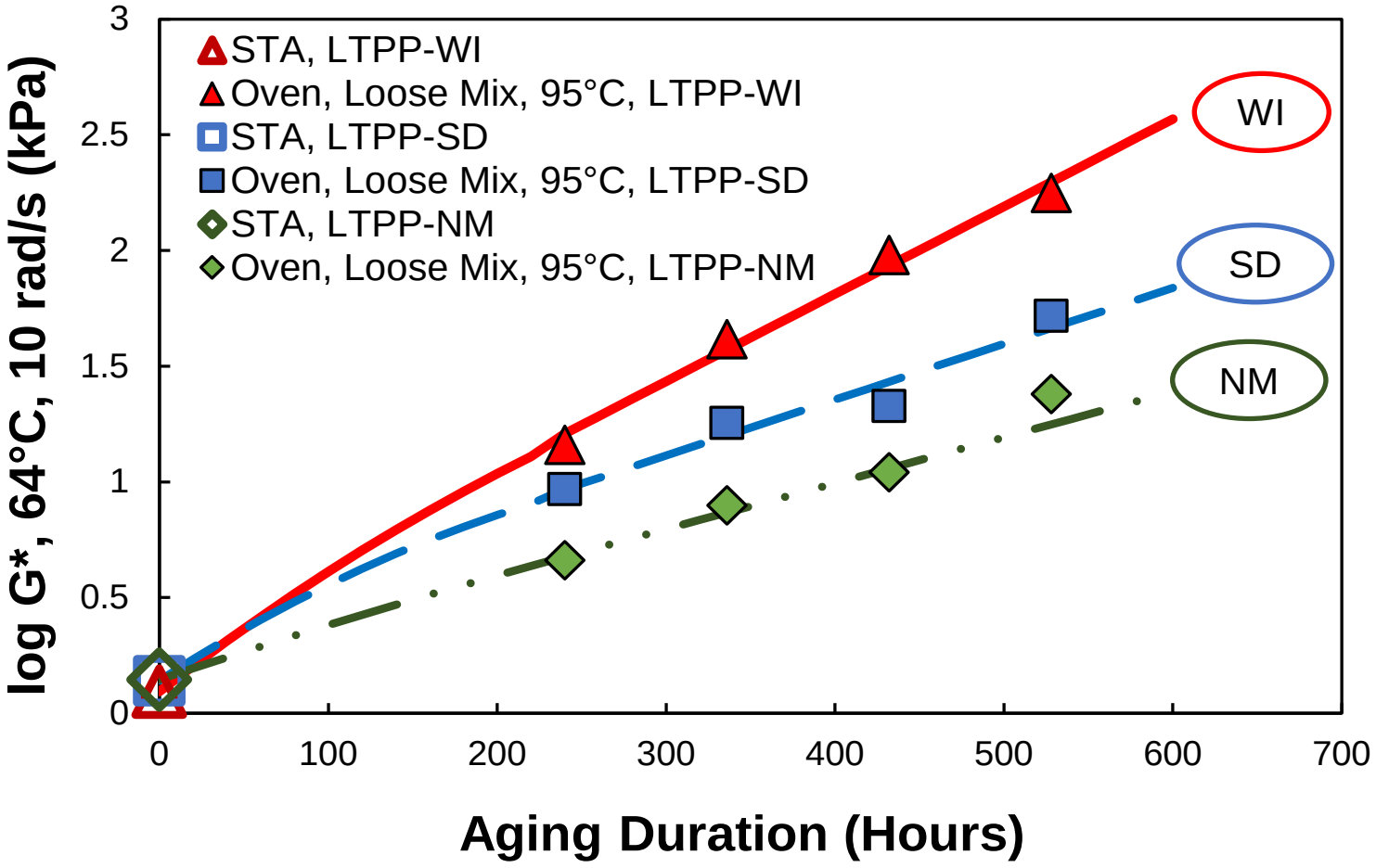
WesTrack Project

Different Oxidation Rates of Binders with Similar PG-Grades



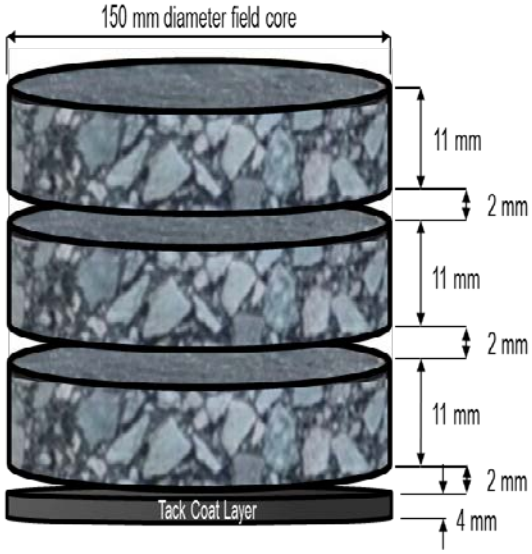
LTPP Sections

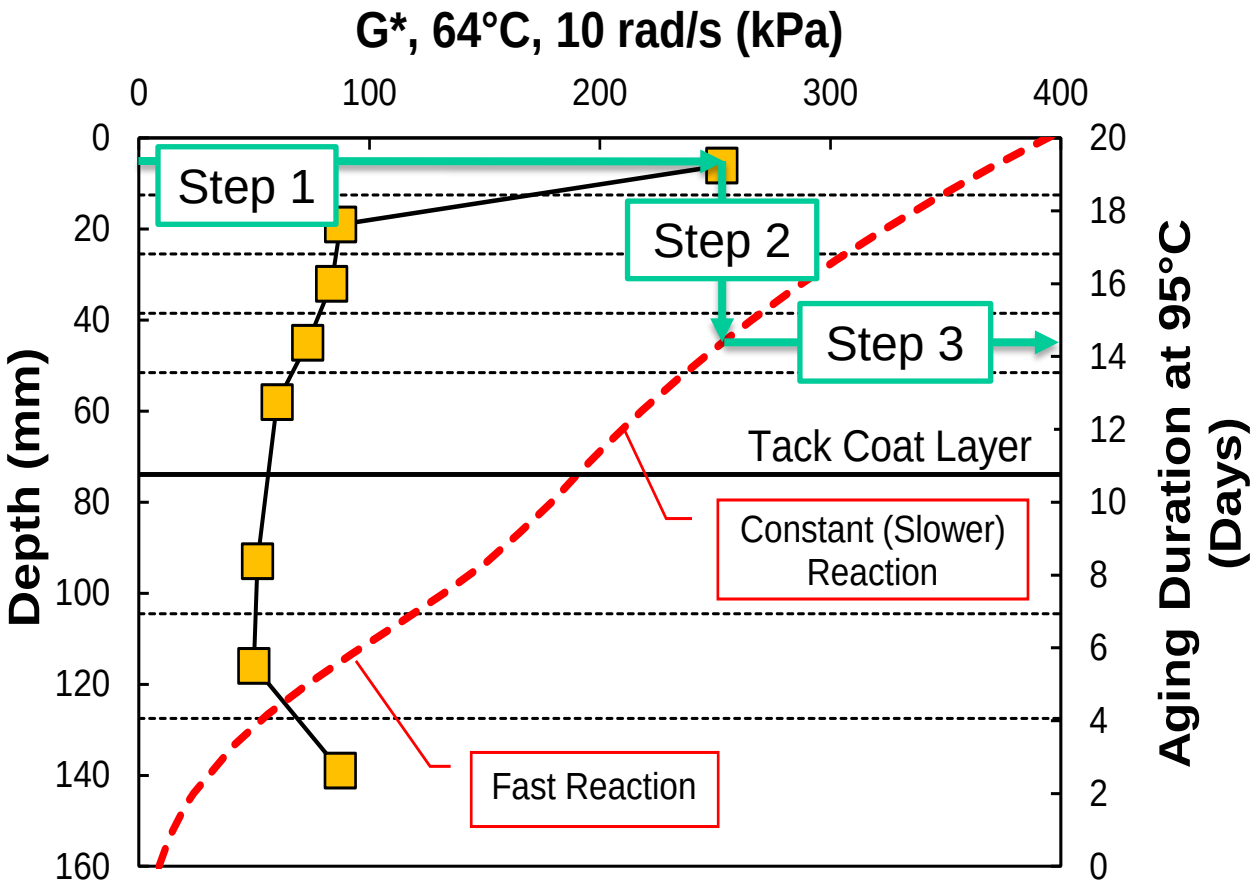
Laboratory Aging Rates at 95°C



Steps to Match Field Aging Levels in the Laboratory

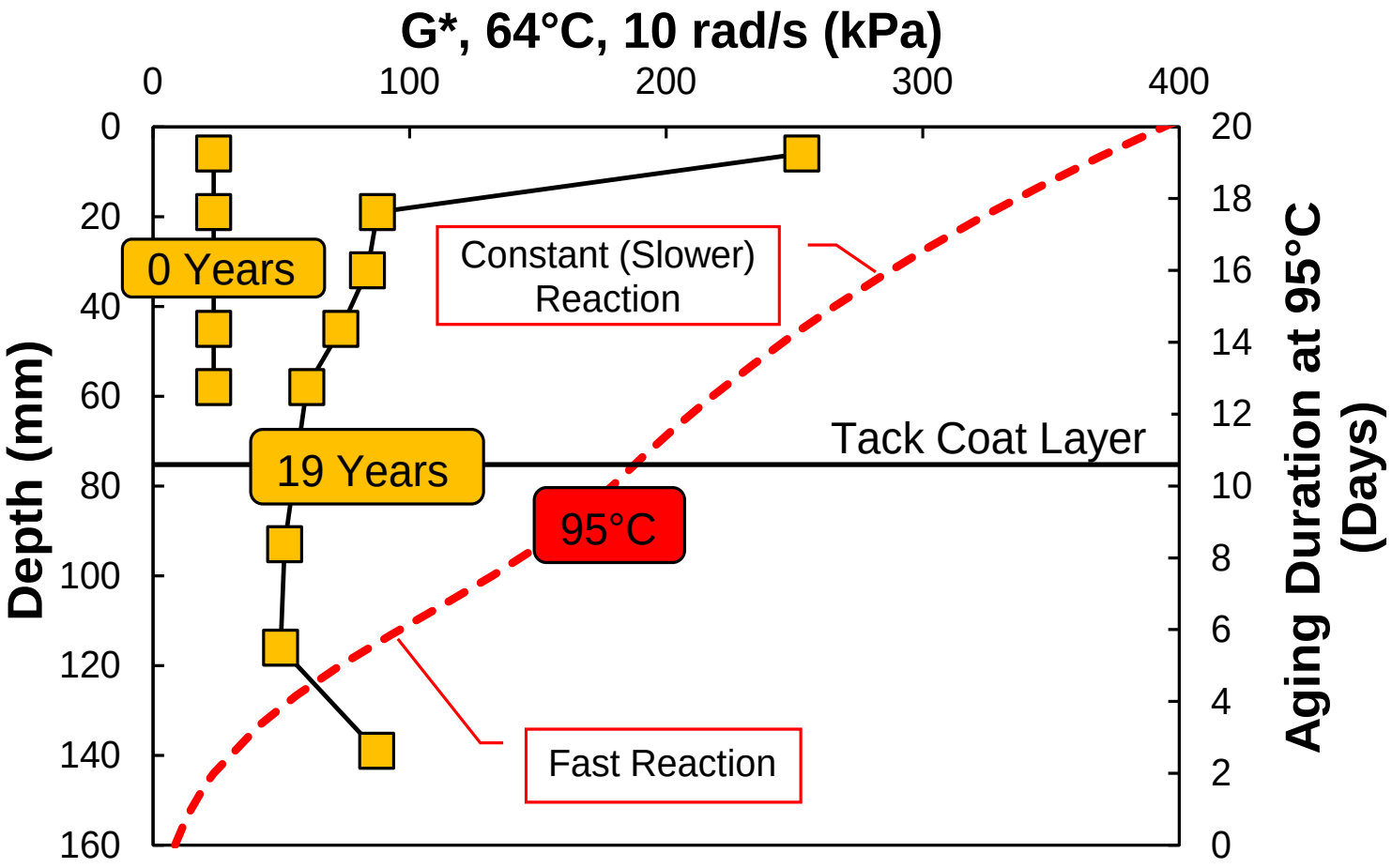
Field





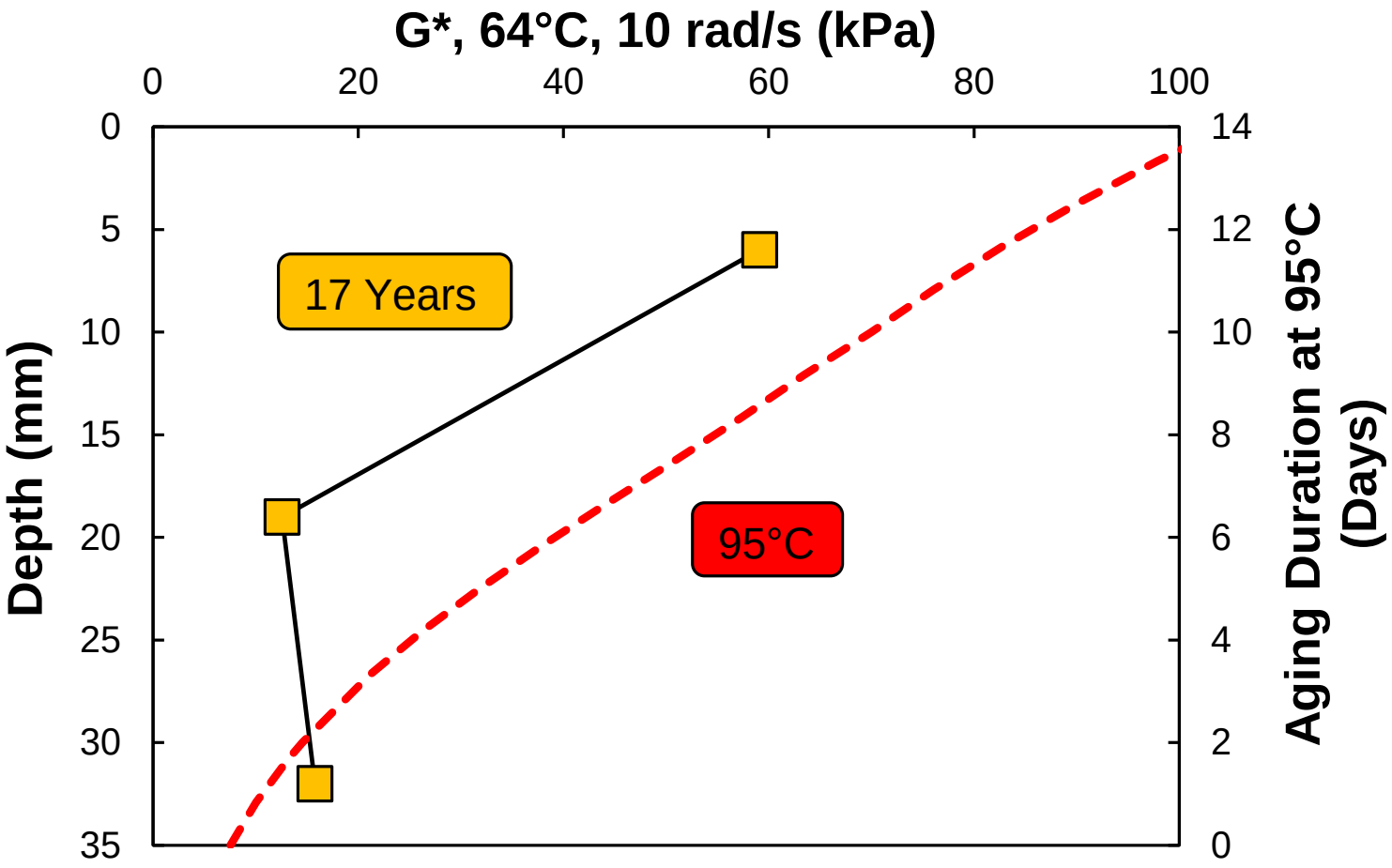
WesTrack Fine Section 1995

Field Aging Gradient and Laboratory Aging Rates



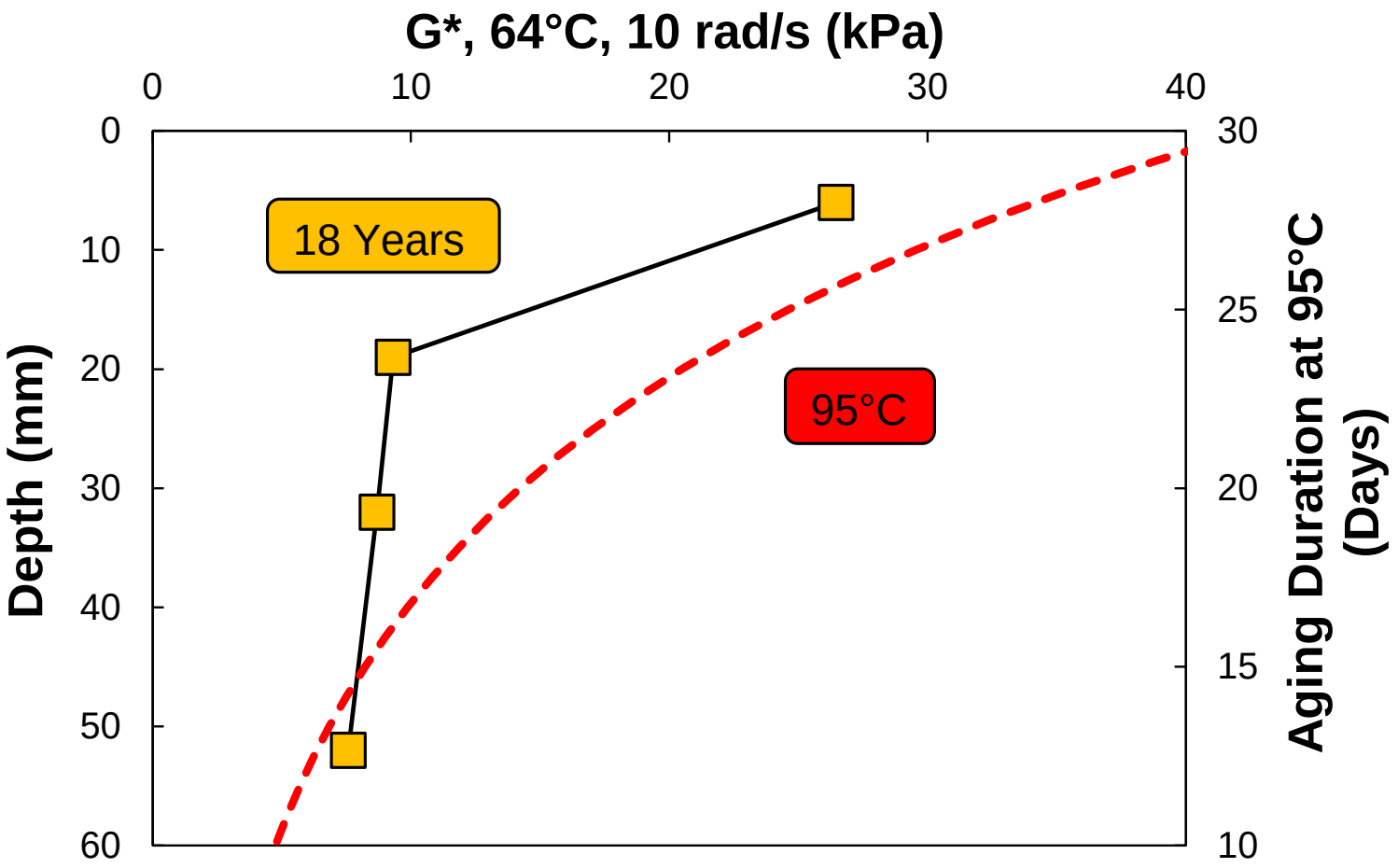
WesTrack Coarse Section 1997

Field Aging Gradient and Laboratory Aging Rates



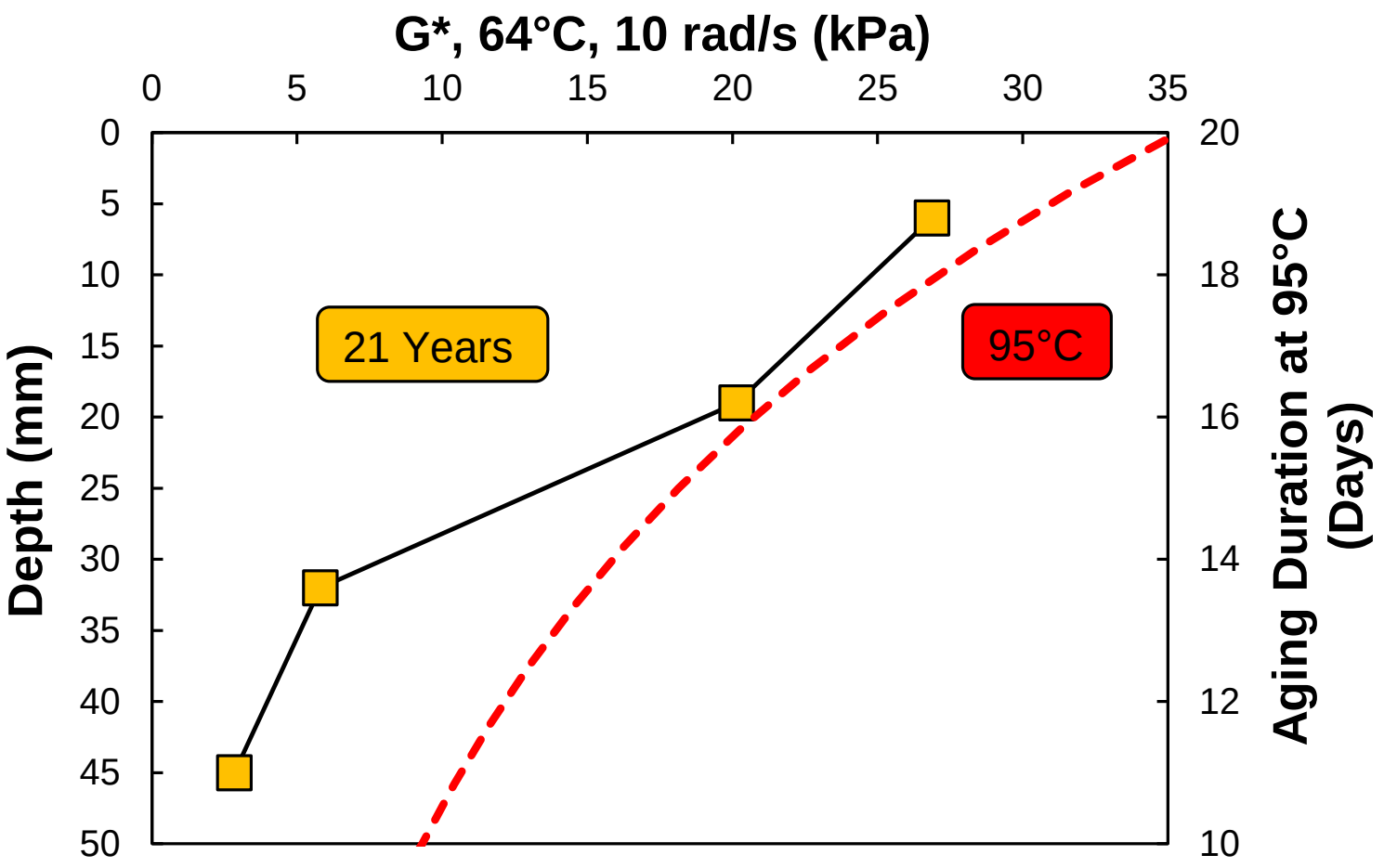
LTPP New Mexico

Field Aging Gradient and Laboratory Aging Rates



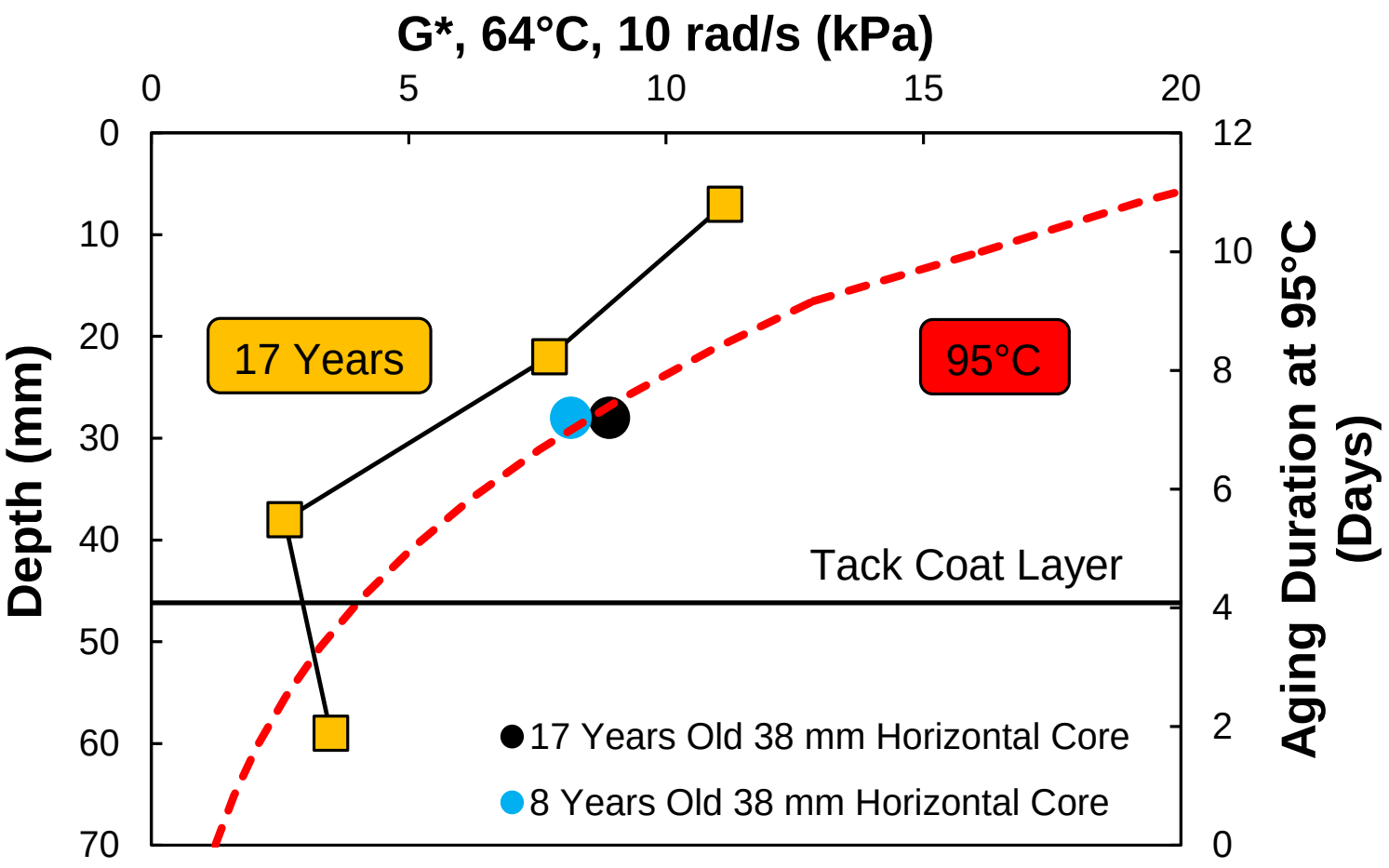
LTPP South Dakota

Field Aging Gradient and Laboratory Aging Rates



LTPP Wisconsin

Field Aging Gradient and Laboratory Aging Rates



WesTrack Project

Required Durations to Match Field Aging Levels

Field Section	Climate Zone	Location	Age	Depth	Required Durations at 95°C
WesTrack Fine 1995 5.4% AC, 8% AV	Dry, Non-Freeze	Western Nevada	19 Years	6 mm	14.4 days
				19 mm	5.6 days
			0 Year	6 mm	2 days
				19 mm	2 days
WesTrack Coarse 1997 5.7% AC, 8% AV	Dry, Non-Freeze	Western Nevada	17 Years	6 mm	8.4 days
				19 mm	2.1 days
			2 Years	6 mm	4.5 days

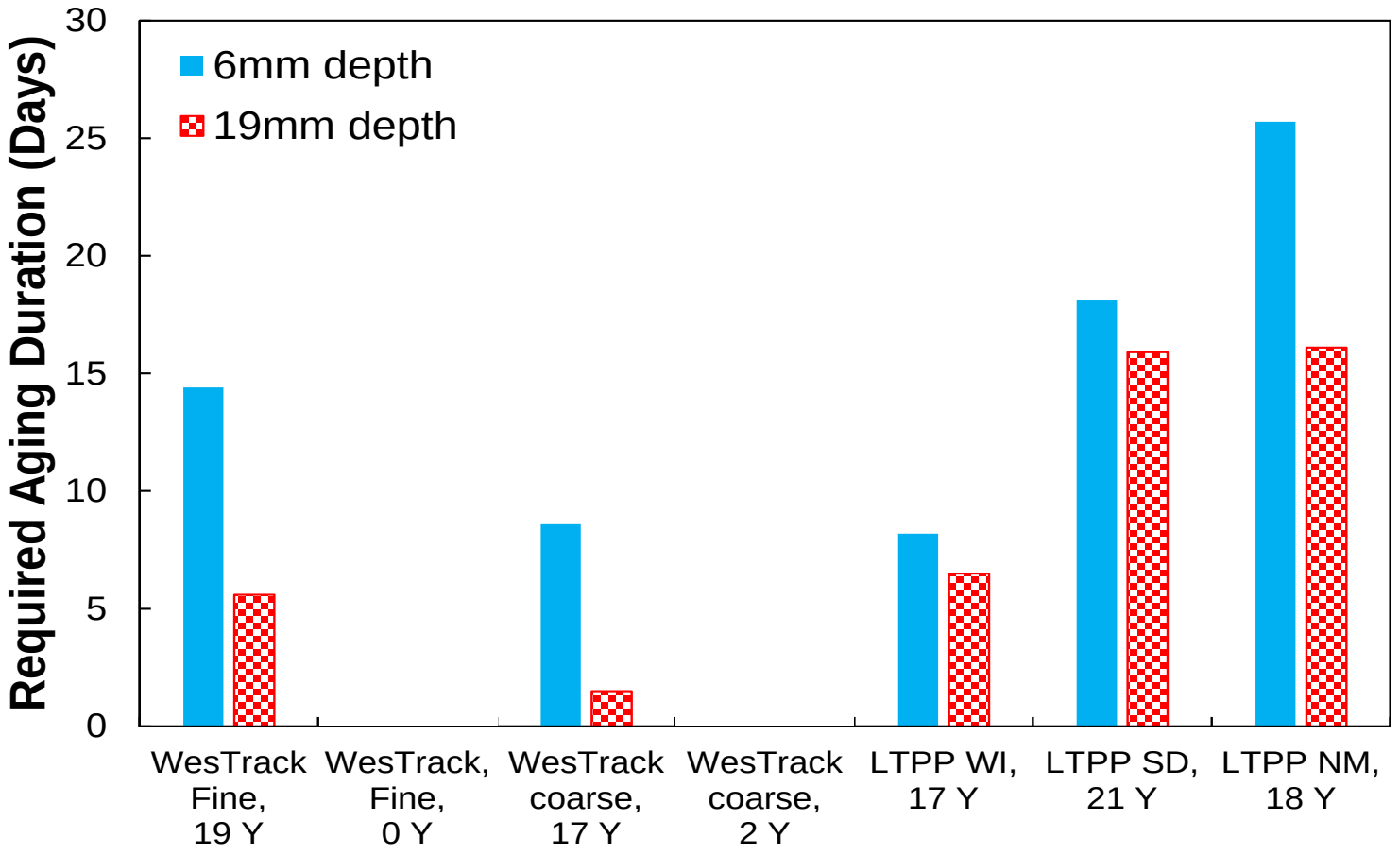
LTPP Sections

Required Durations to Match Field Aging Levels

Field Section	Climate Zone	Location	Age	Depth	Required Durations at 95°C
LTPP Wisconsin	Wet, Freeze	Marathon County, WI	17 Years	6 mm	8.2 days
				19 mm	6.5 days
LTPP South Dakoda	Dry, Freeze	Campbell County, SD	21 Years	6 mm	18.1 days
				19 mm	15.9 days
LTPP New Mexico	Dry, Non-Freeze	Grant County, NM	18 Years	6 mm	25.7 days
				19 mm	16.1 days

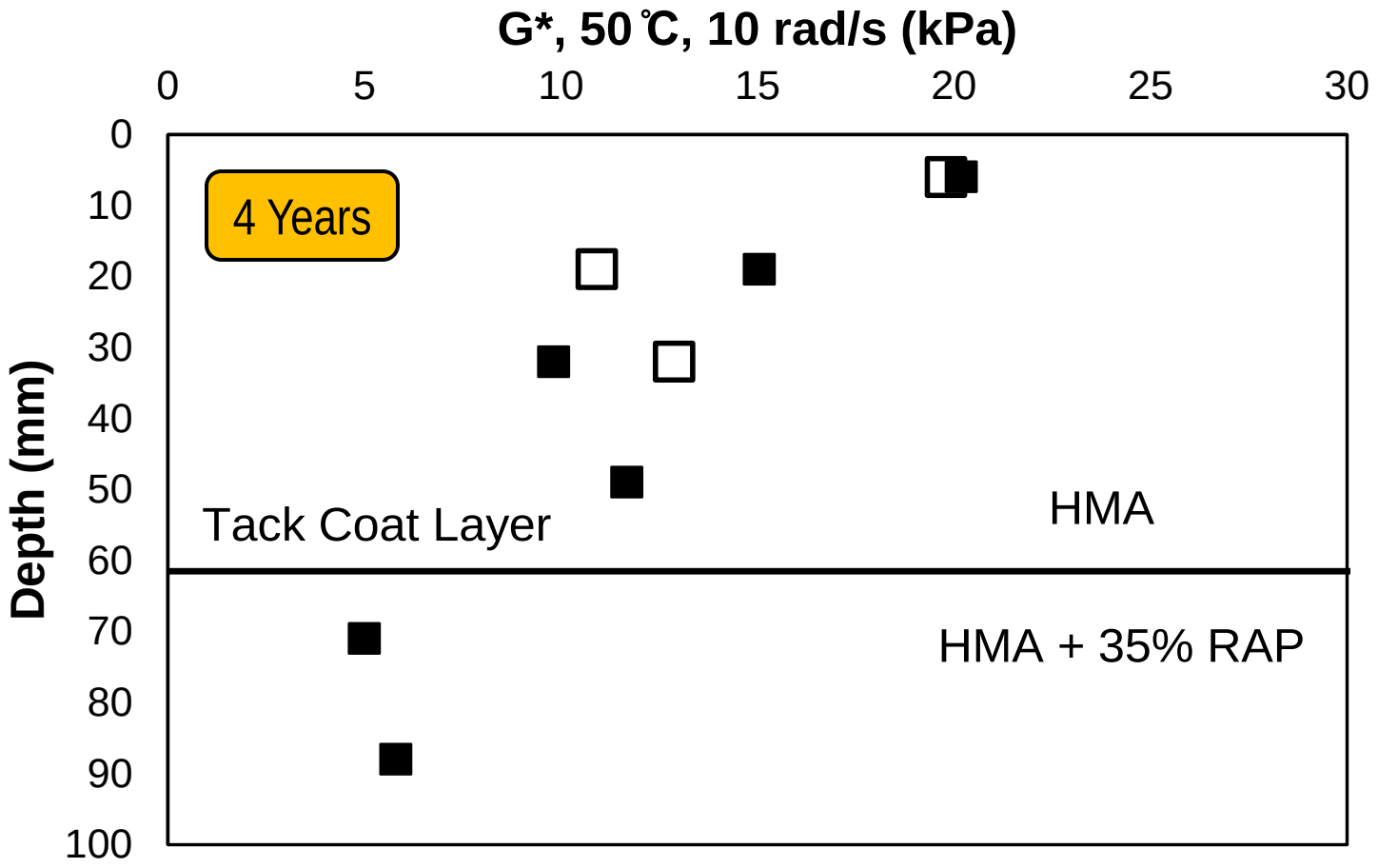
General Summary

Required Durations to Match Field Aging Levels



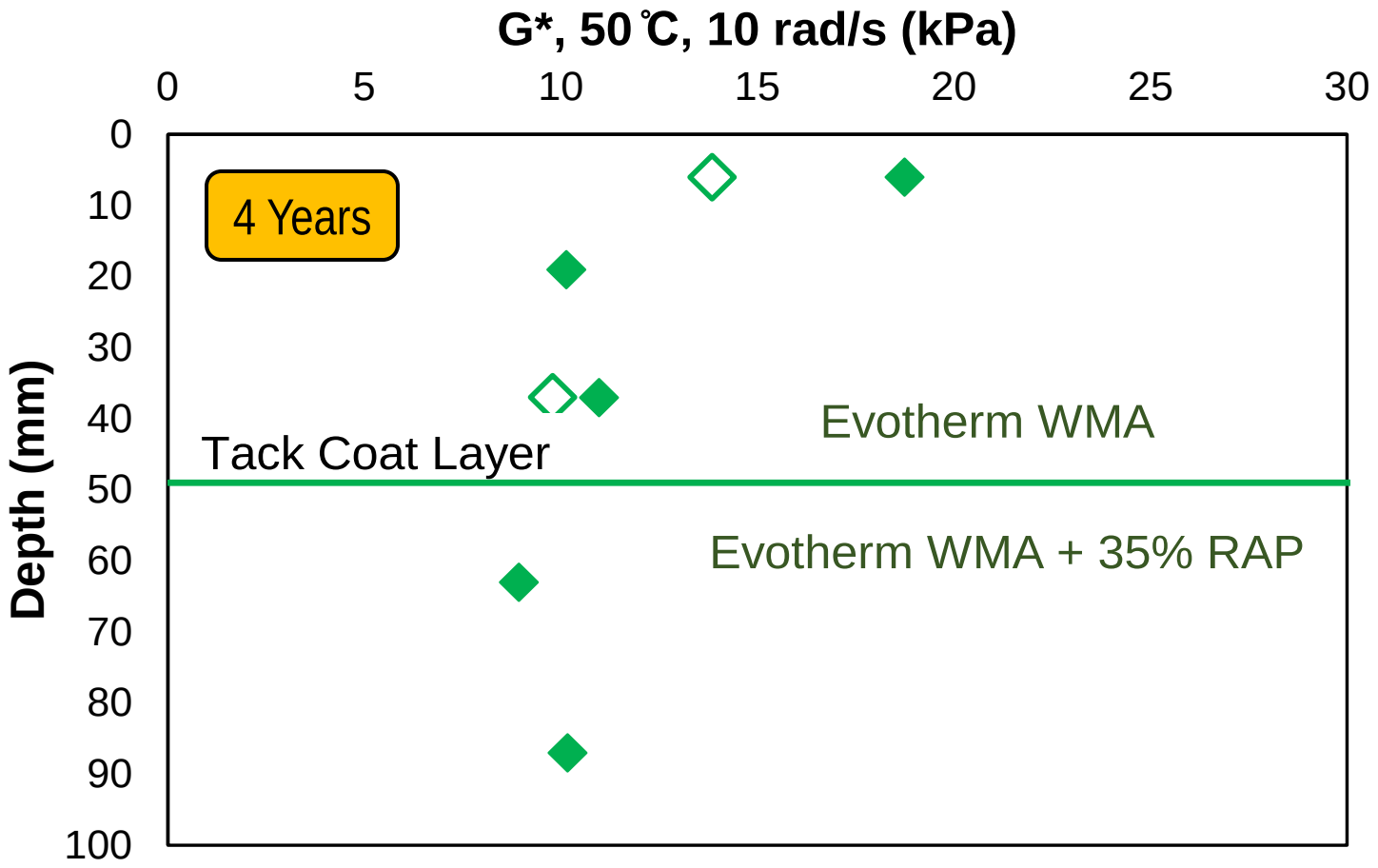
Manitoba – HMA

Field Aging Gradient and Variability



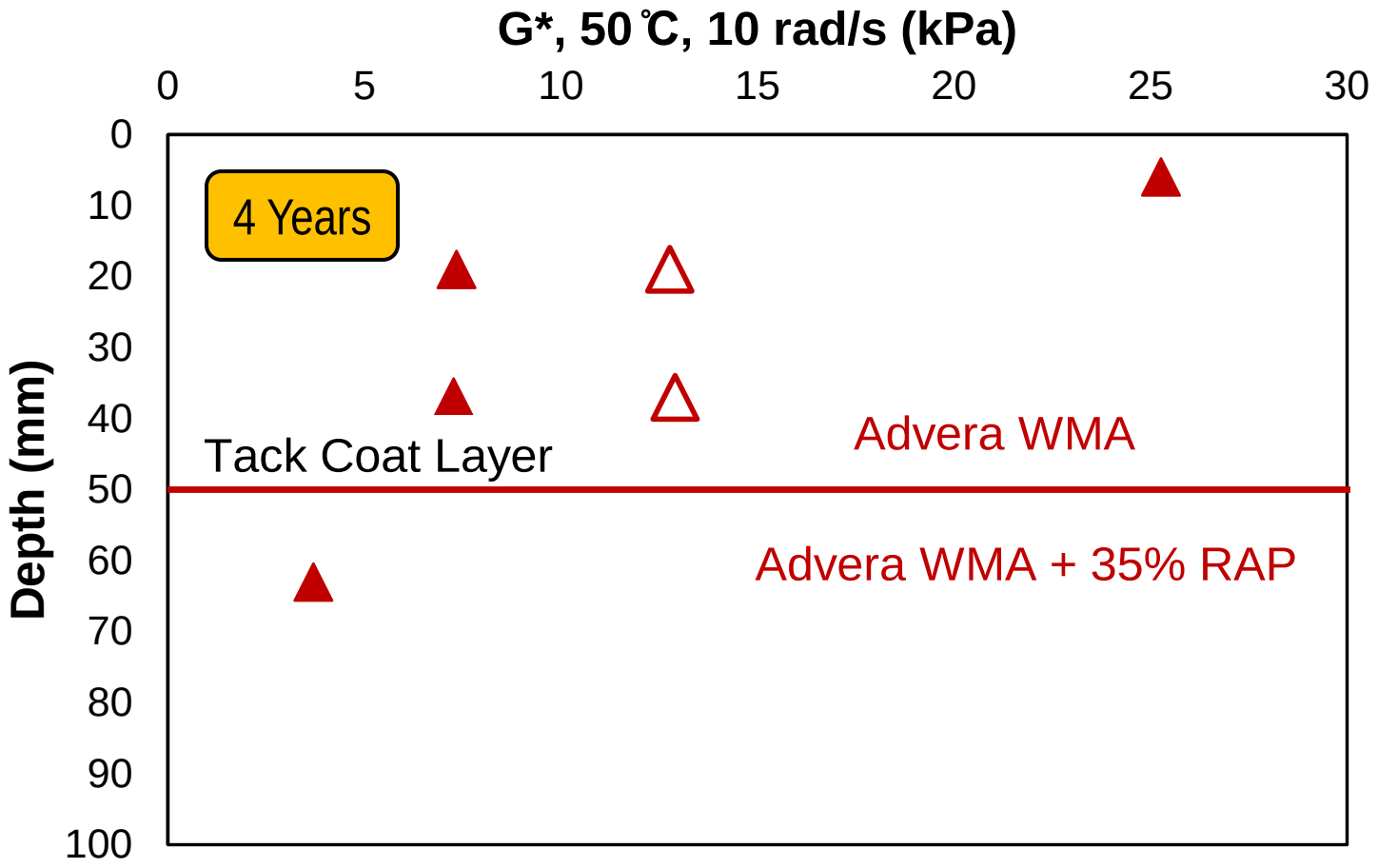
Manitoba – Evotherm WMA

Field Aging Gradient and Variability



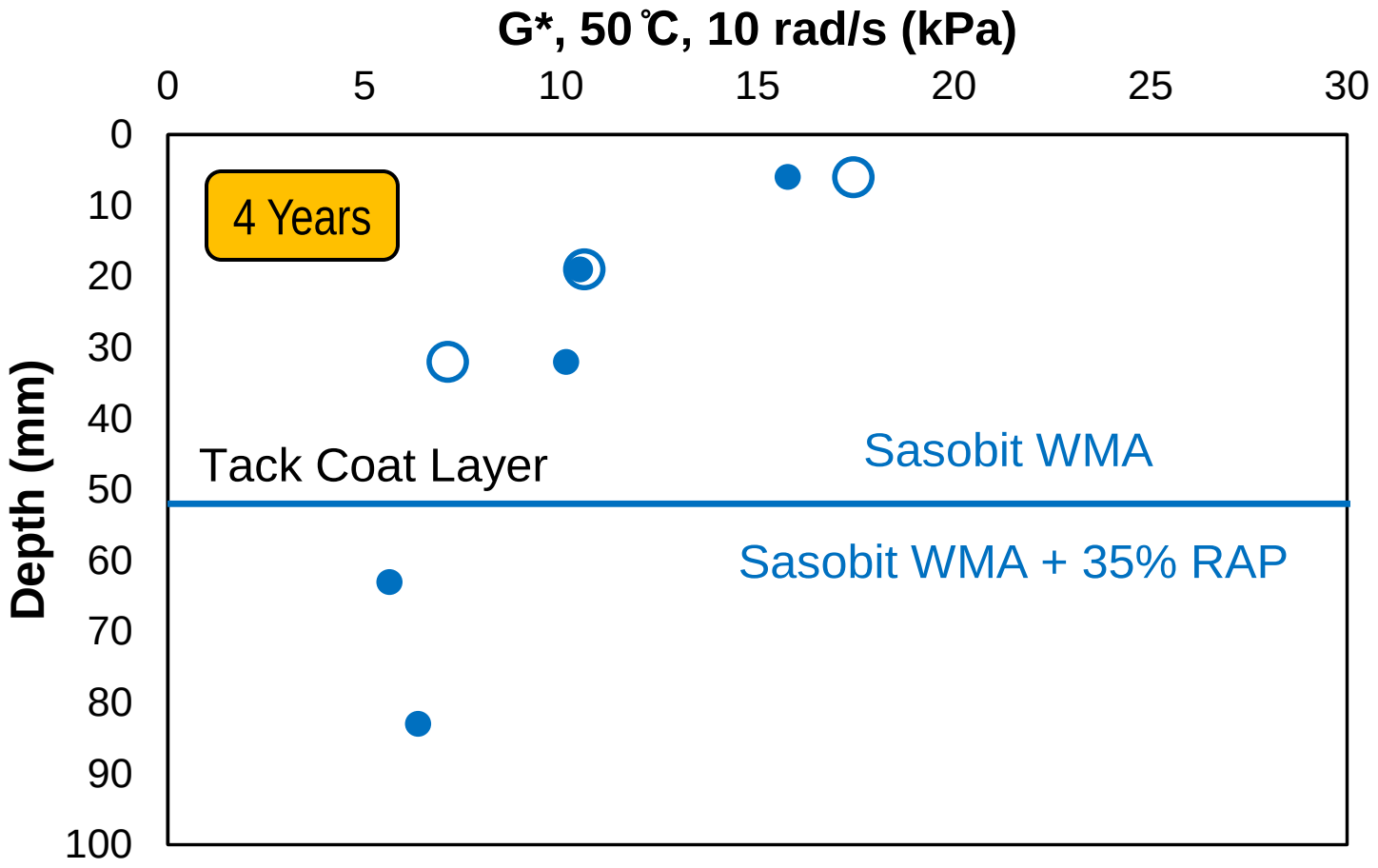
Manitoba – Advera WMA

Field Aging Gradient and Variability

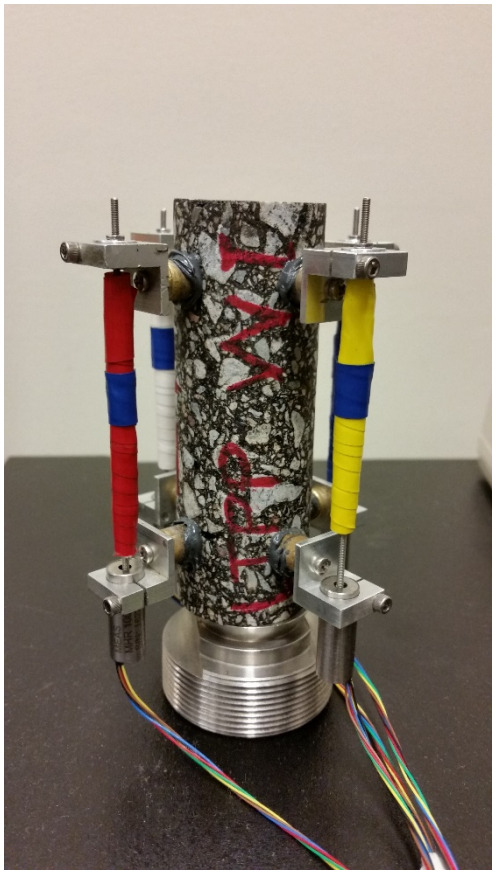


Manitoba – Sasobit WMA

Field Aging Gradient and Variability



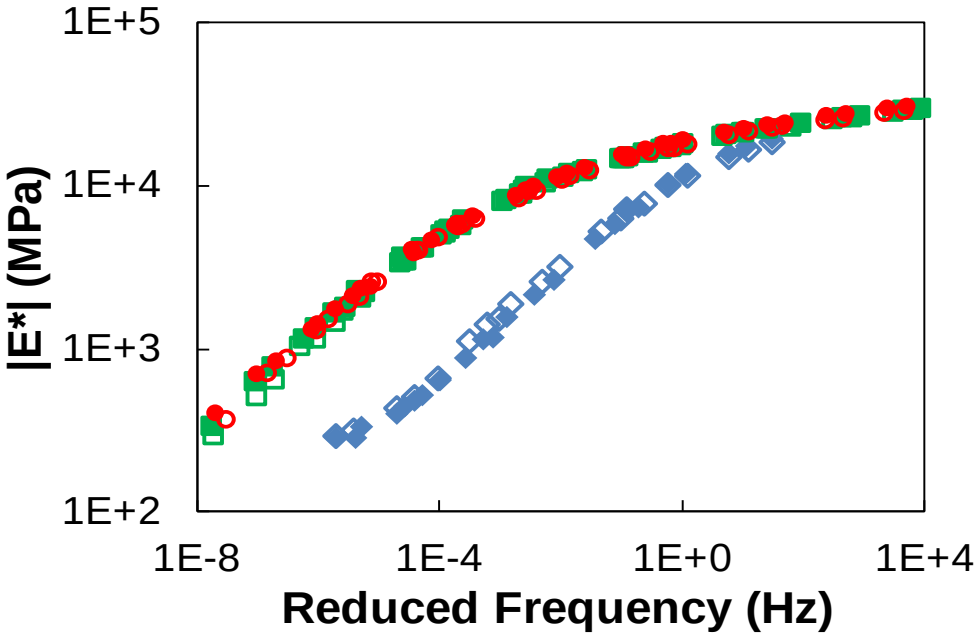
Fatigue Testing on Field Cores

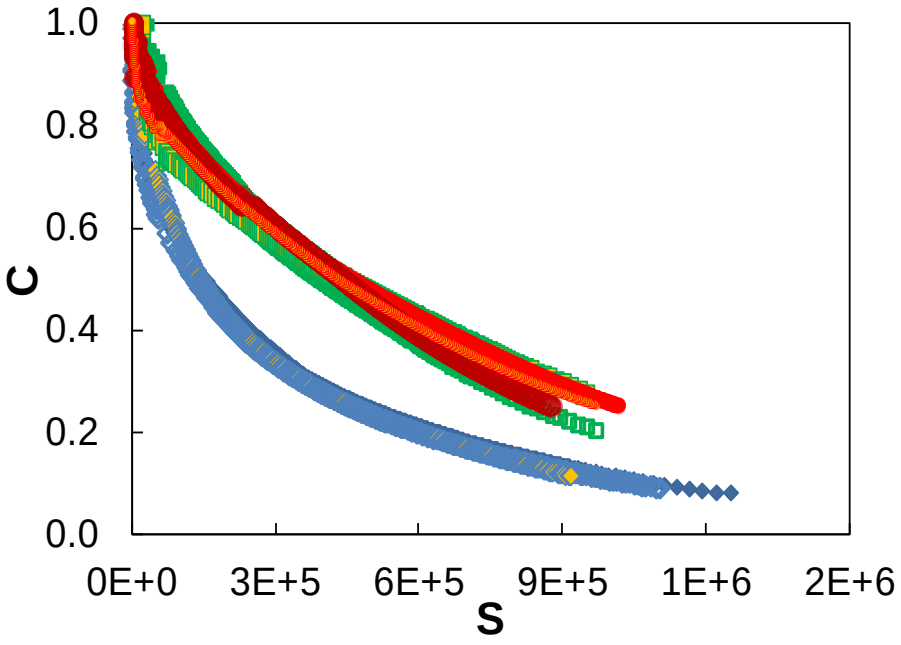


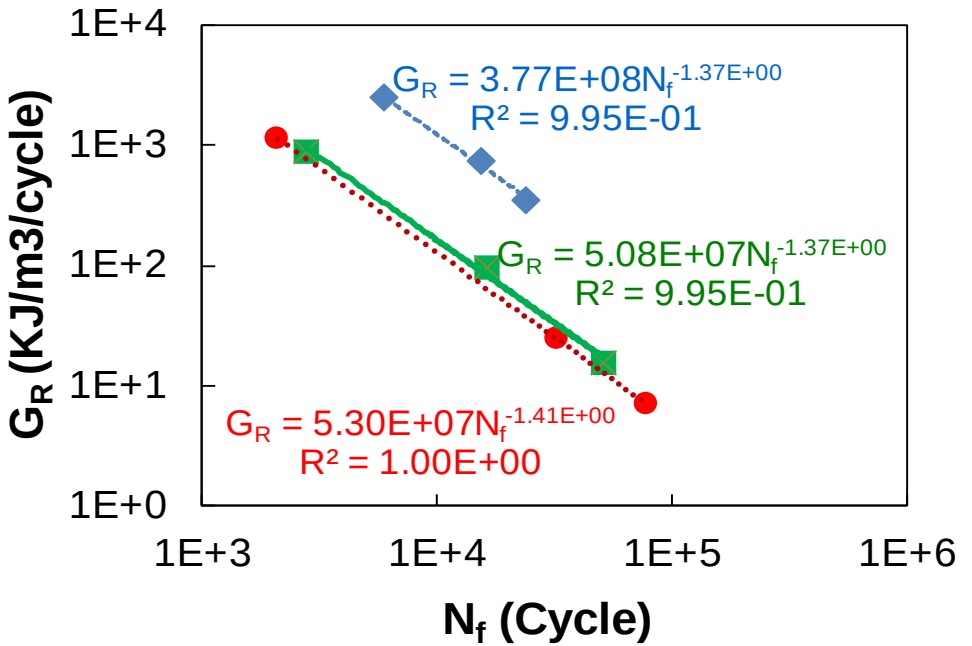
Performance Test Results

FHWA ALF-SBS Mix

- Short-term Aged
- Oven, Loose Mix, 135°C, 52 hours
- Oven, Loose Mix, 95°C, 21 days



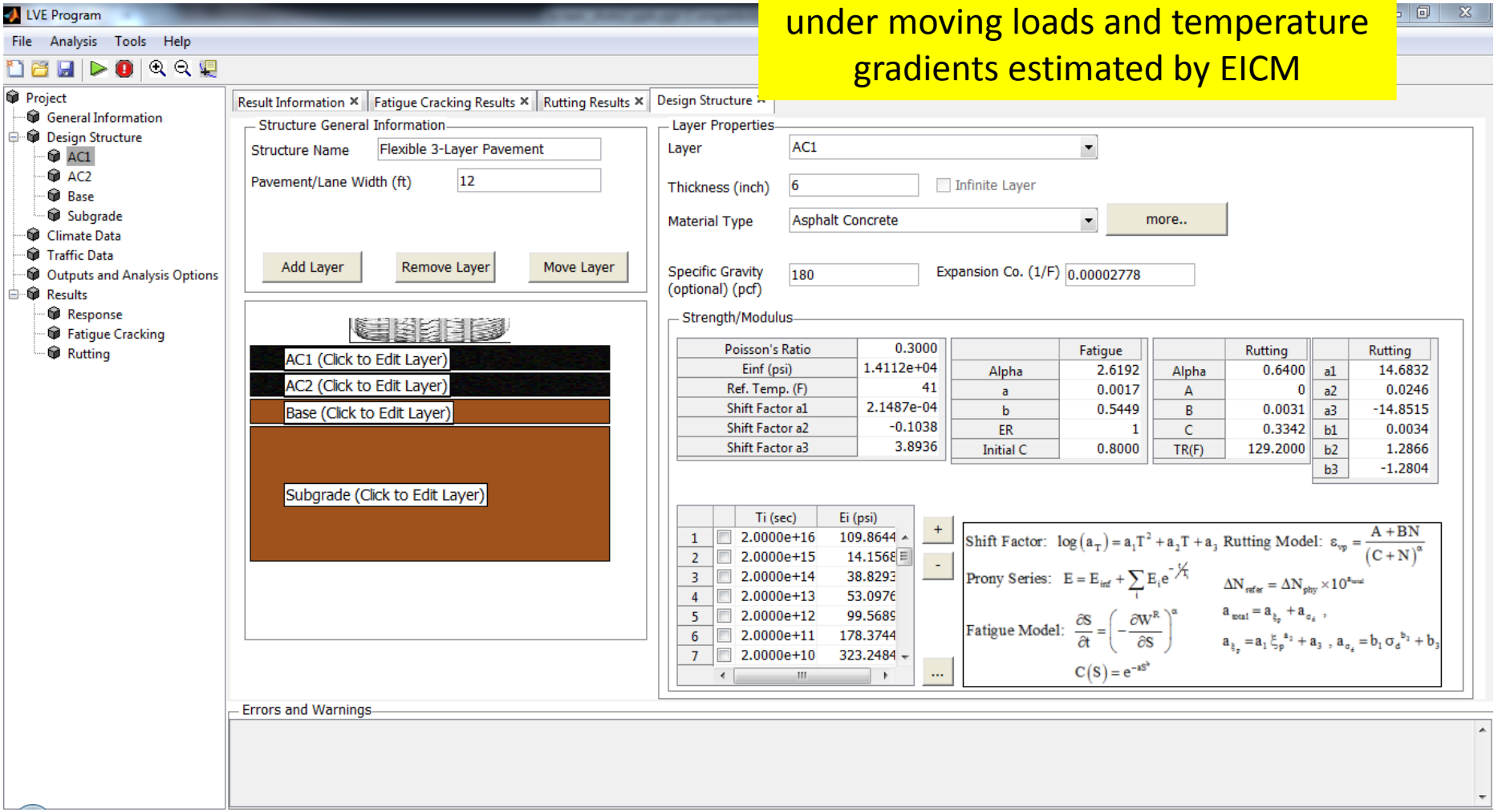




Pavement Performance Prediction

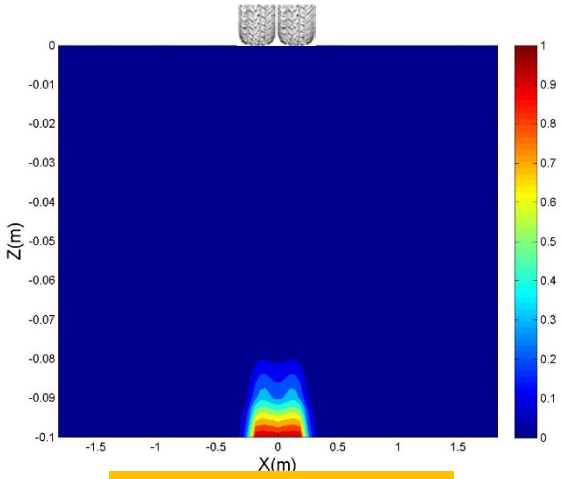
LVECD Program

3-dimensional viscoelastic analysis under moving loads and temperature gradients estimated by EICM

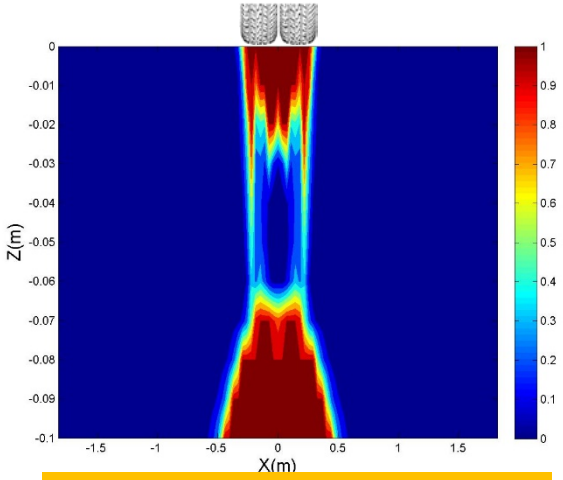


LVECD Simulation

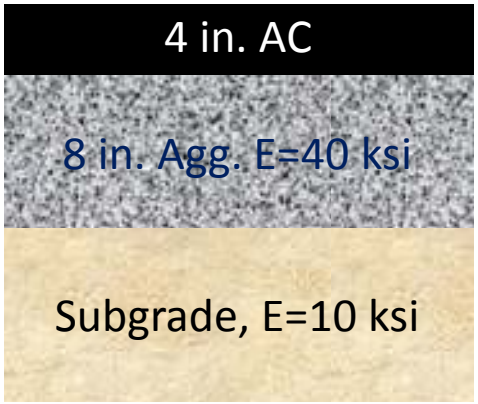
FHWA ALF-SBS Mix

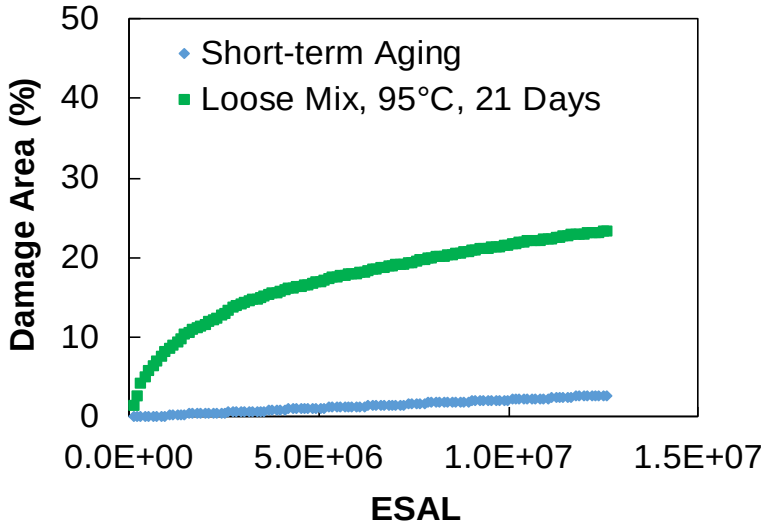


Short-term Aging



Loose Mix, 95°C, 21 Days

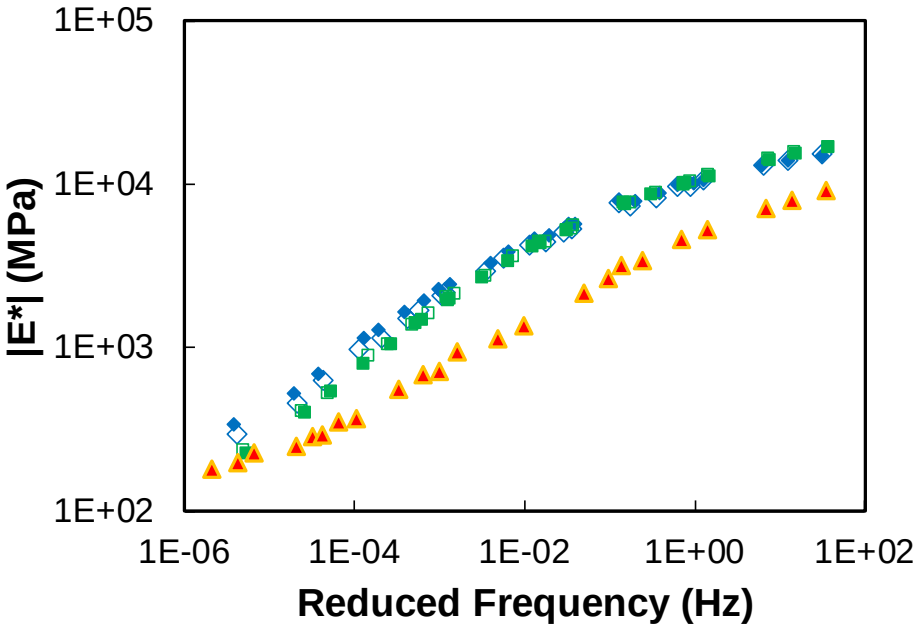


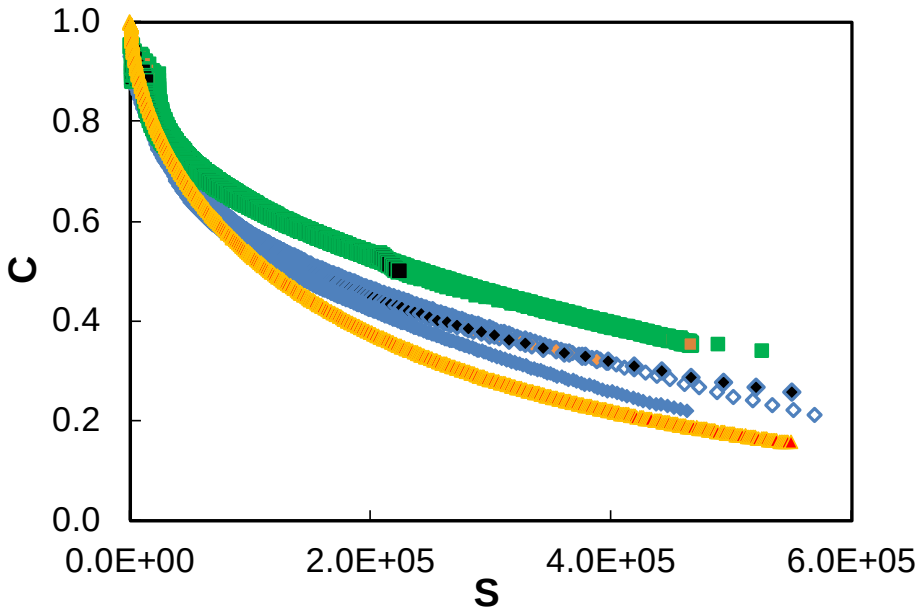


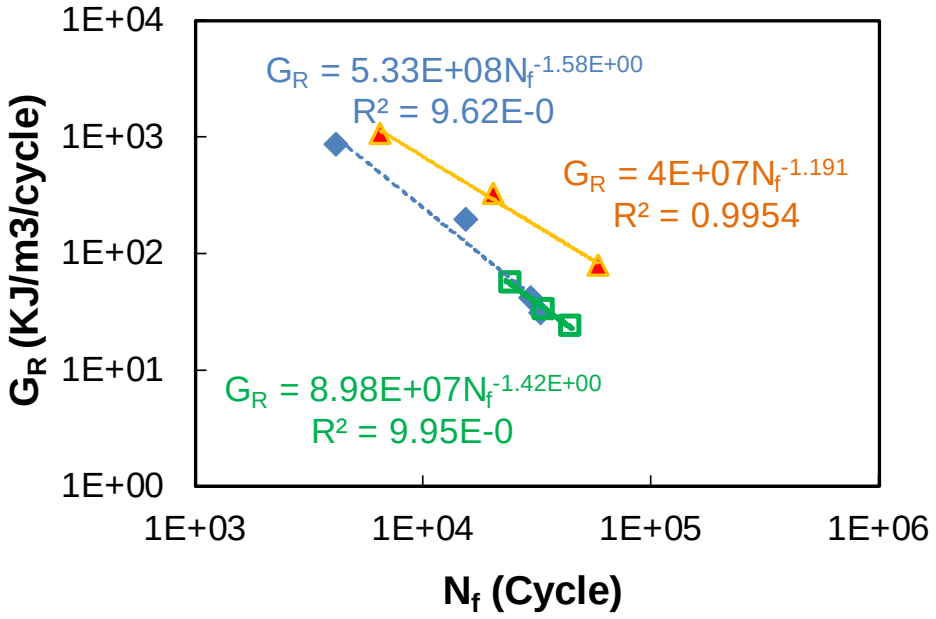
Performance Test Results

LTPP-Wisconsin

- Short-term Aged
- Field, 8 yrs Old, Bottom Lift, 5.4% AV
- Field, 8 yrs Old, Top Lift, 8% AV



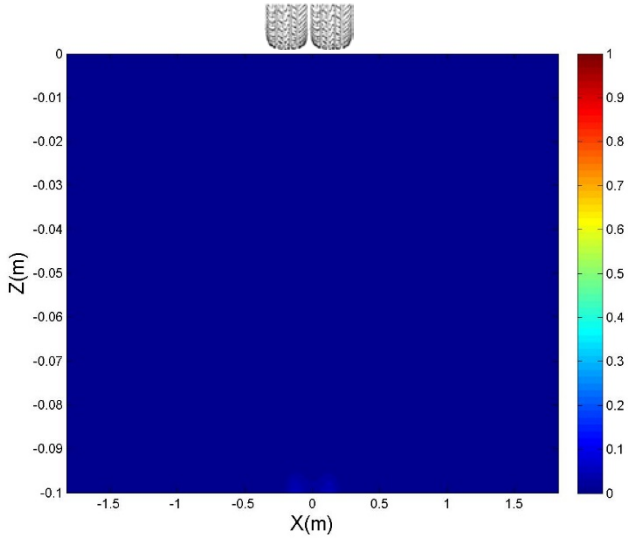




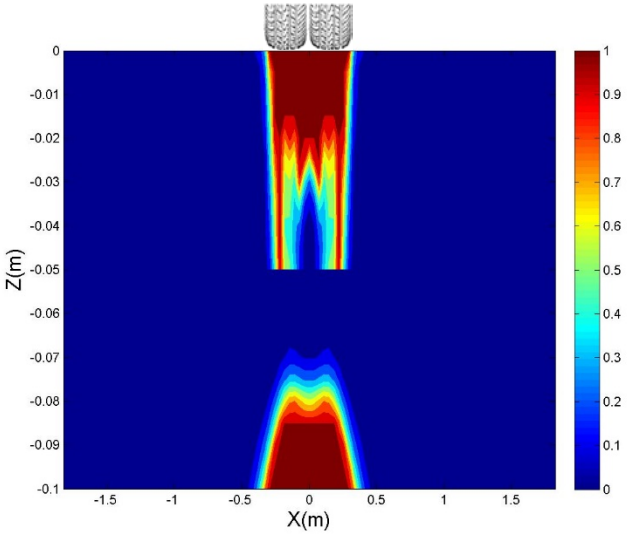
LVECD Simulation

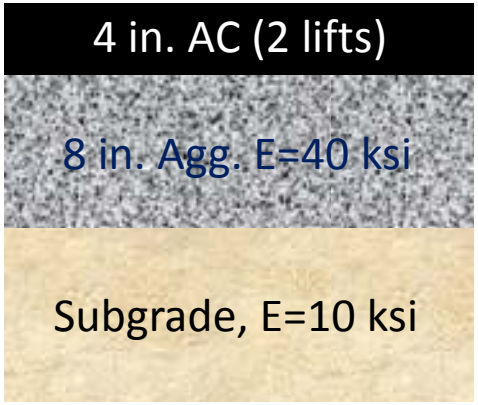
LTPP Wisconsin

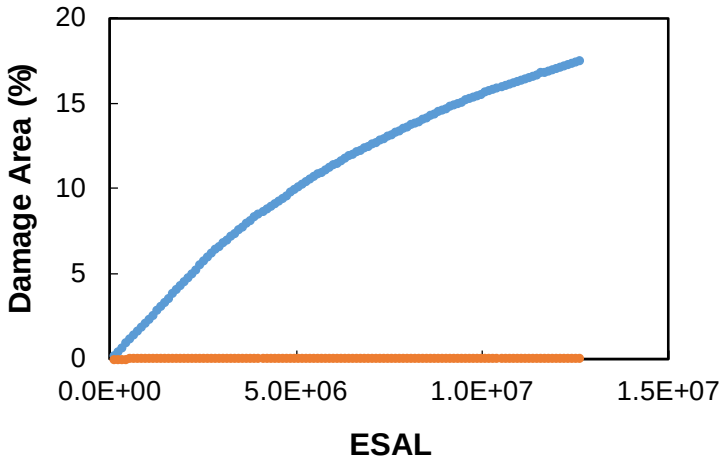
Short-term Aged, Two-lift Pavement



8-Years Old, Two-lift Pavement







Questions?