

NCAT Pavement Test Track

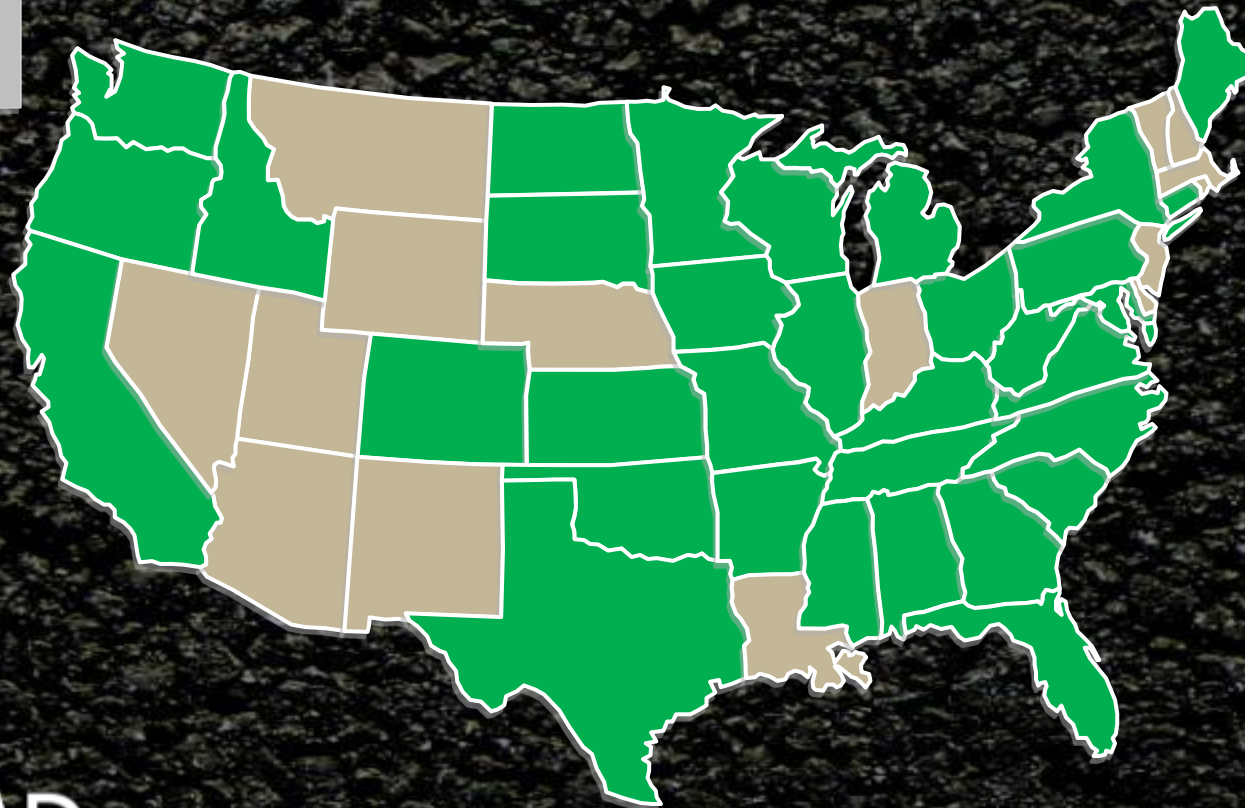
An aerial photograph of the NCAT Pavement Test Track. The track is a long, winding road that curves through a dense forest. In the lower right, there is a small building with a green roof, a parking lot, and a road that leads away from the track. The track itself is a multi-lane road with a white line marking. The surrounding area is mostly forested with green trees.

Enhanced Friction Thin Overlays

NCAT Pavement Test Track

- Help state DOTs implement positive change
- Promote real innovation for the industry
 - Mix and materials
 - Structural pavement design
 - Pavement preservation.

34 States + FHWA + Industry



Content

- Track thinlay history
- Enhanced friction thinlay
- Friction mix designs
- Takeaways

First Thinlay Experience in 2003



10 years and 33 million ESALs Later...



10 years and 33 million ESALs Later...







18 years and 60 million ESALs Later...



“Surplus Stockpile” Track Mixes



Off-Track Preservation Thinlays

	LOW TRAFFIC	HIGH TRAFFIC
NORTH	 CSAH 8	 US 169
	Cracking IRI Rutting	Cracking IRI Rutting
SOUTH	 LR 159	 US 280
	Cracking IRI Rutting	Cracking IRI Rutting

PRESERVATION THINLAY

Observations:

- Good to fair cracking and IRI performance
- Cracking is low severity
- Good rutting performance

MnROAD Thinlays on Cold Recycling



MnROAD Thinlays on Cold Recycling



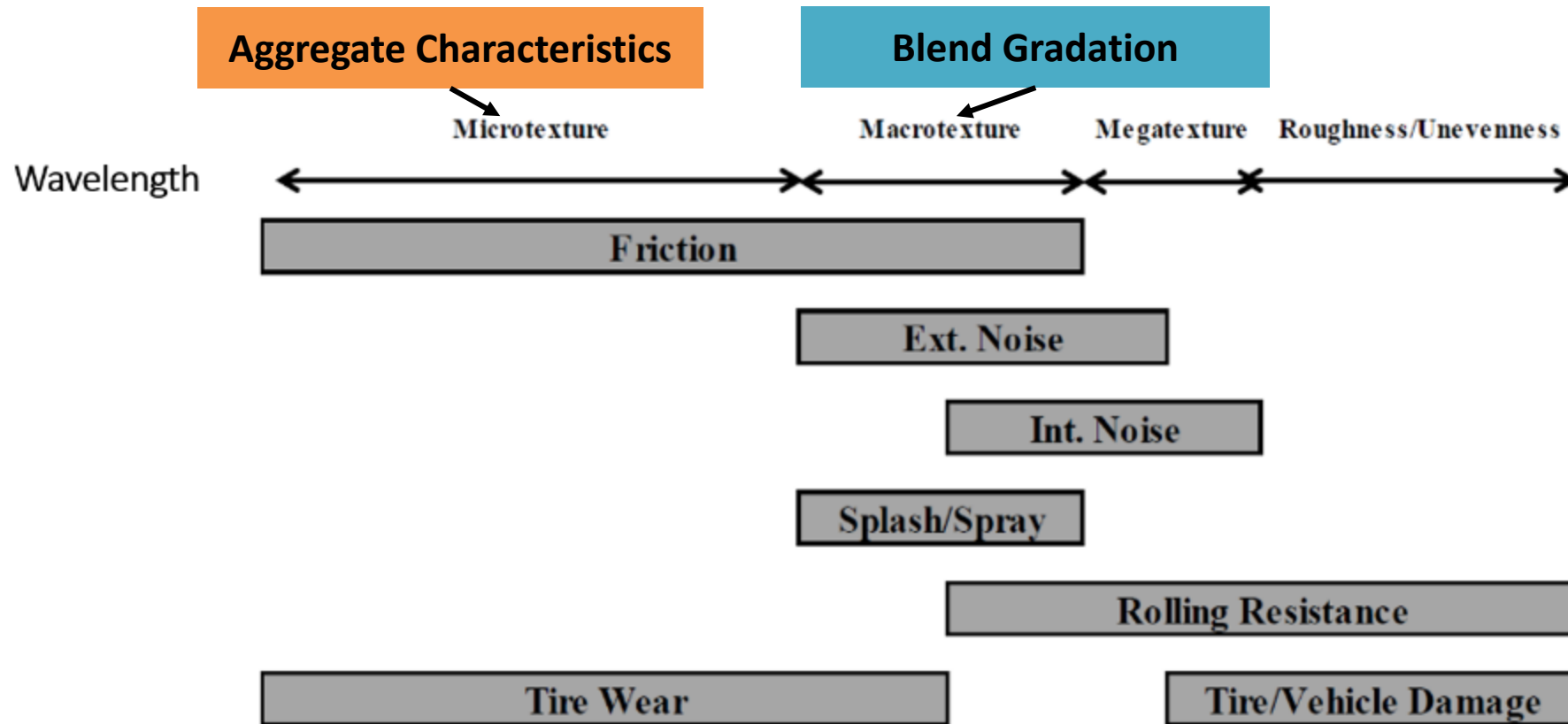
MnROAD Thinlays on Cold Recycling



Pavement Friction Basics

Pavement Friction	Accident Rates (per million vehicle km)
<0.15	0.80
0.15-0.24	0.55
0.25-0.34	0.25
0.35-0.44	0.2 (Wallman and Astrom in 2001)

Pavement Friction Basics



(Henry, 2000)

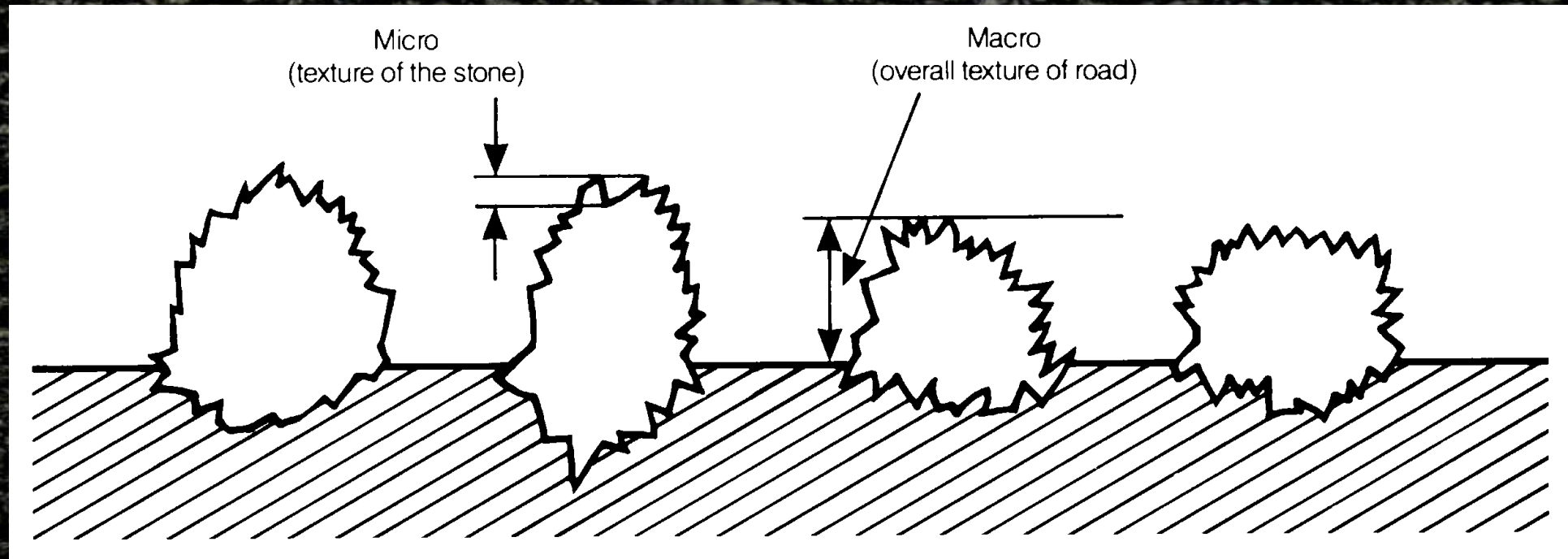
Pavement Friction Basics

- Trailer testing with a wet ribbed tire is “standard”
- Microtexture dominates when tread depth $> 4/32$ ”
- Sustained “abrasiveness” of aggregate particles
- Profile amplitude of frequencies less than 0.5 mm
- Macrotexture important when tread depth $< 4/32$ ”
- Amplitude of frequencies between 0.5 and 50 mm
- Stockpile tests are surrogates for mix friction.

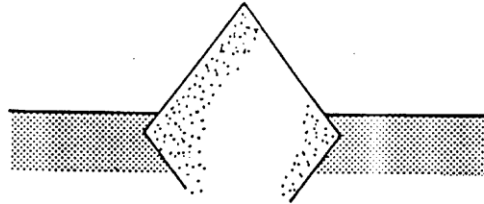
Wet Trailer Testing with Ribbed Tire



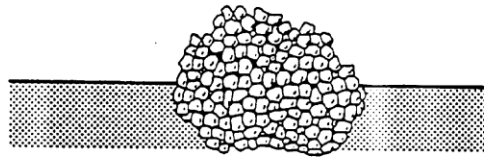
Microtexture versus Macrotexture



Differences in Microtexture



1 Very hard materials



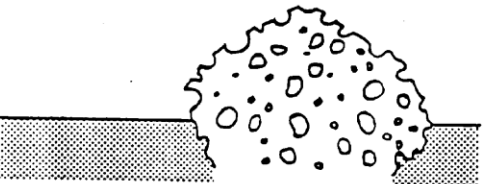
2 Conglomerations of small hard particles



3 Dispersions of hard particles in a softer matrix



4 Materials which fracture in an irregular angular manner

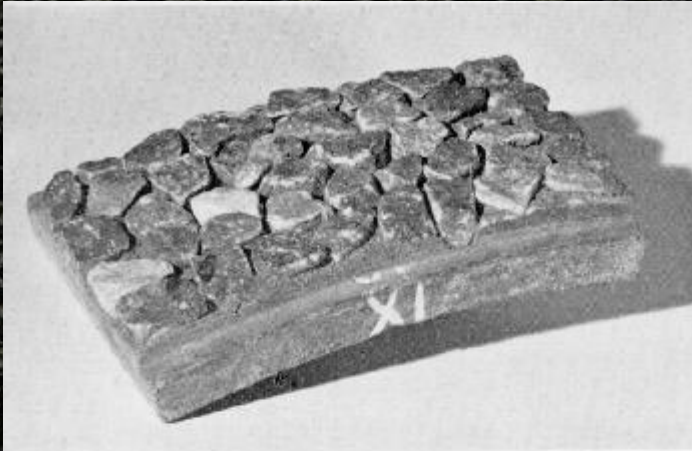


5 Vesicular materials

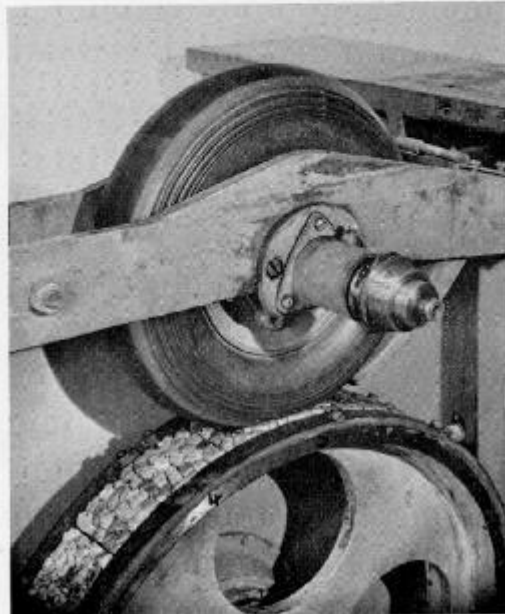
Stockpile Indicators

- Chemical and physical property stockpile testing
- Sustainability related to people, planet, and profit
- Diminishing availability of virgin aggregate quarries.

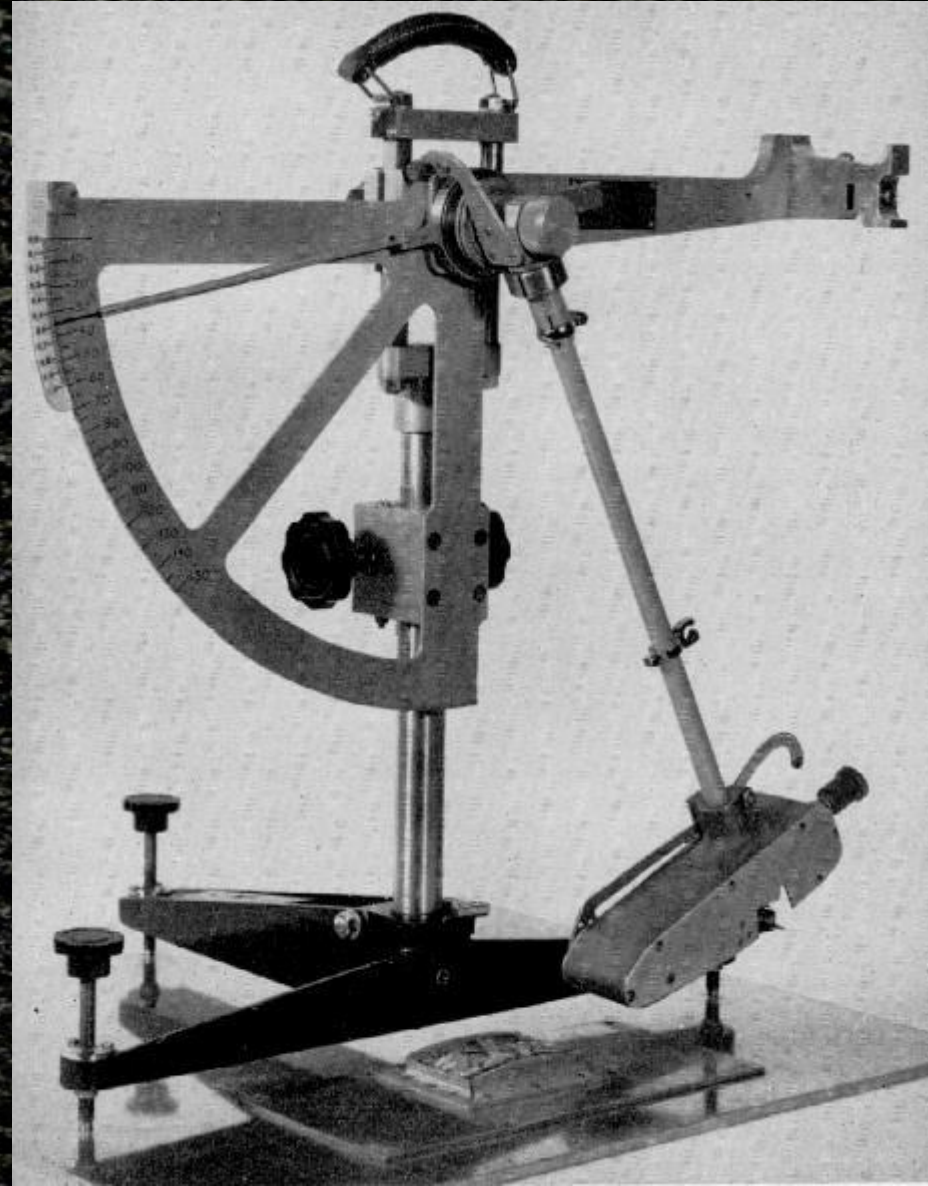
Stockpile Indicators



(a) Specimen prepared for test.



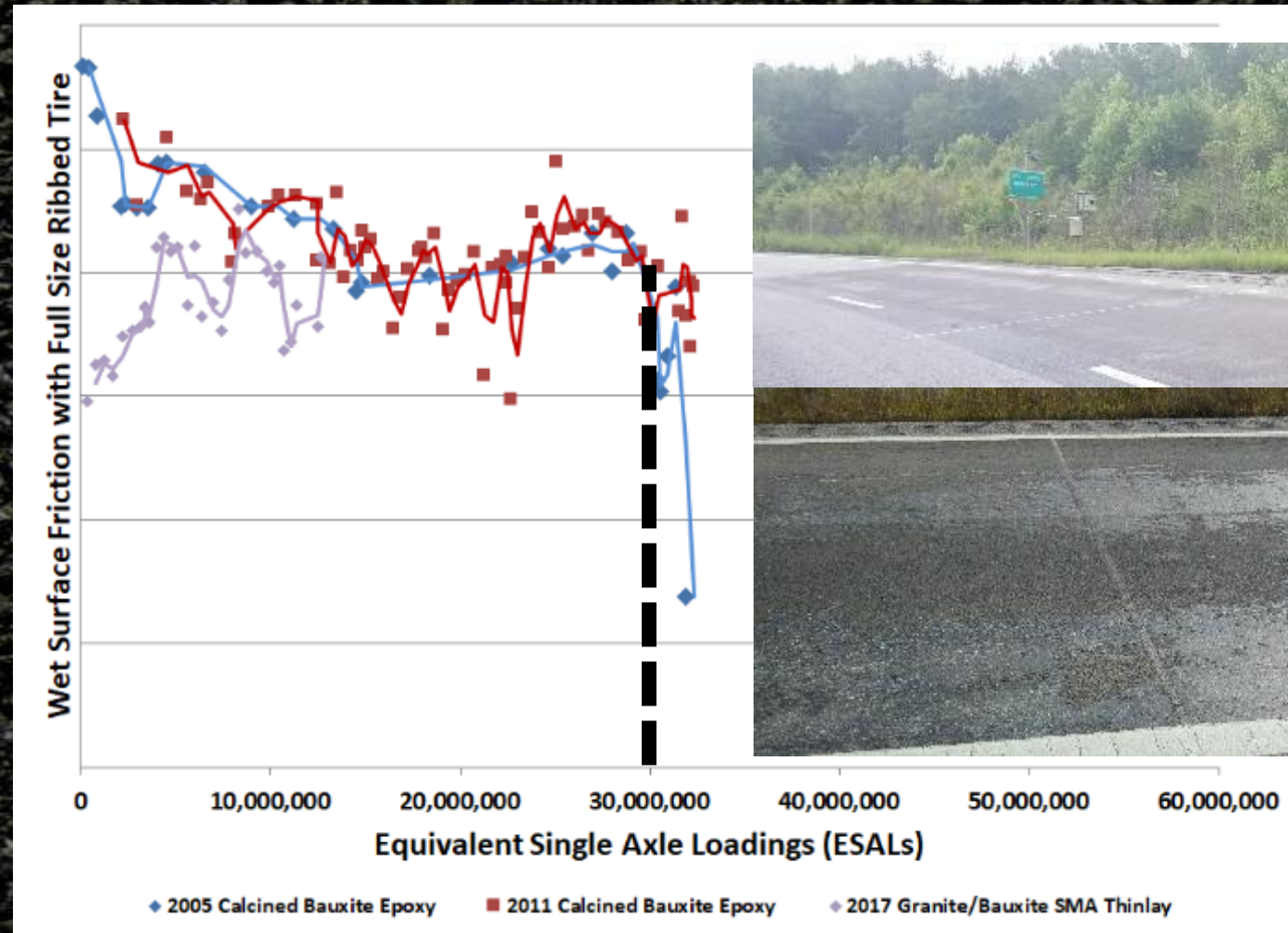
(b) Specimens on machine ready for test.



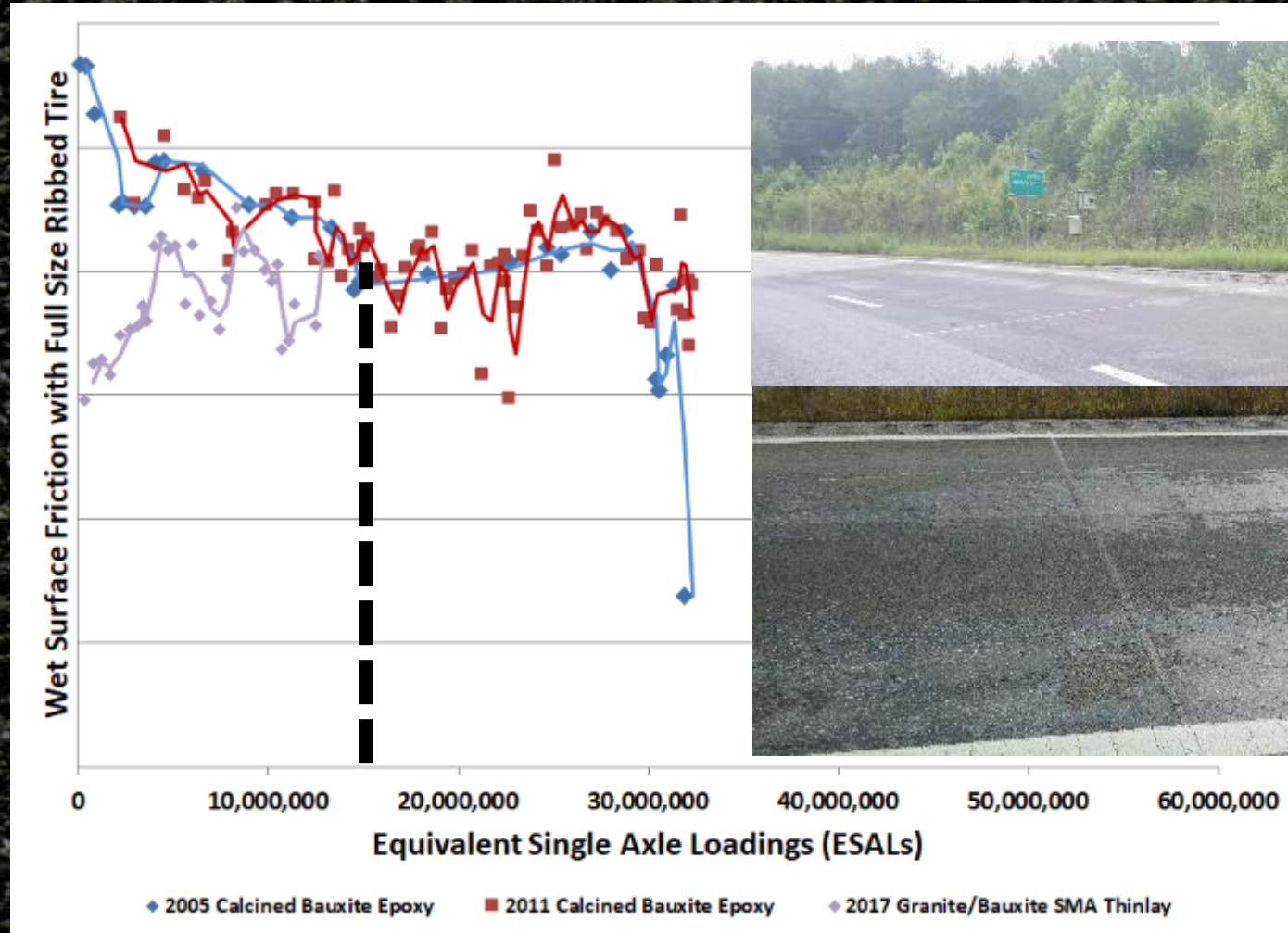
Enhanced Friction Asphalt Surfaces

- 40% calcined bauxite in the Track thinlay section
- Potential for regionally available lower quality bauxite/other
- 4.75 mm NMAS SMA for single size super sacked material
- Transition in and out of bauxite blend to meet safety needs
- Estimated 20% cost savings per square yard vs HFST
- Avoid terminal wear, reduced friction condition of HFST?

Enhanced Friction Asphalt Surfaces



High Friction Asphalt Surfaces



SMA with Bauxite



DGA with Hard Sand



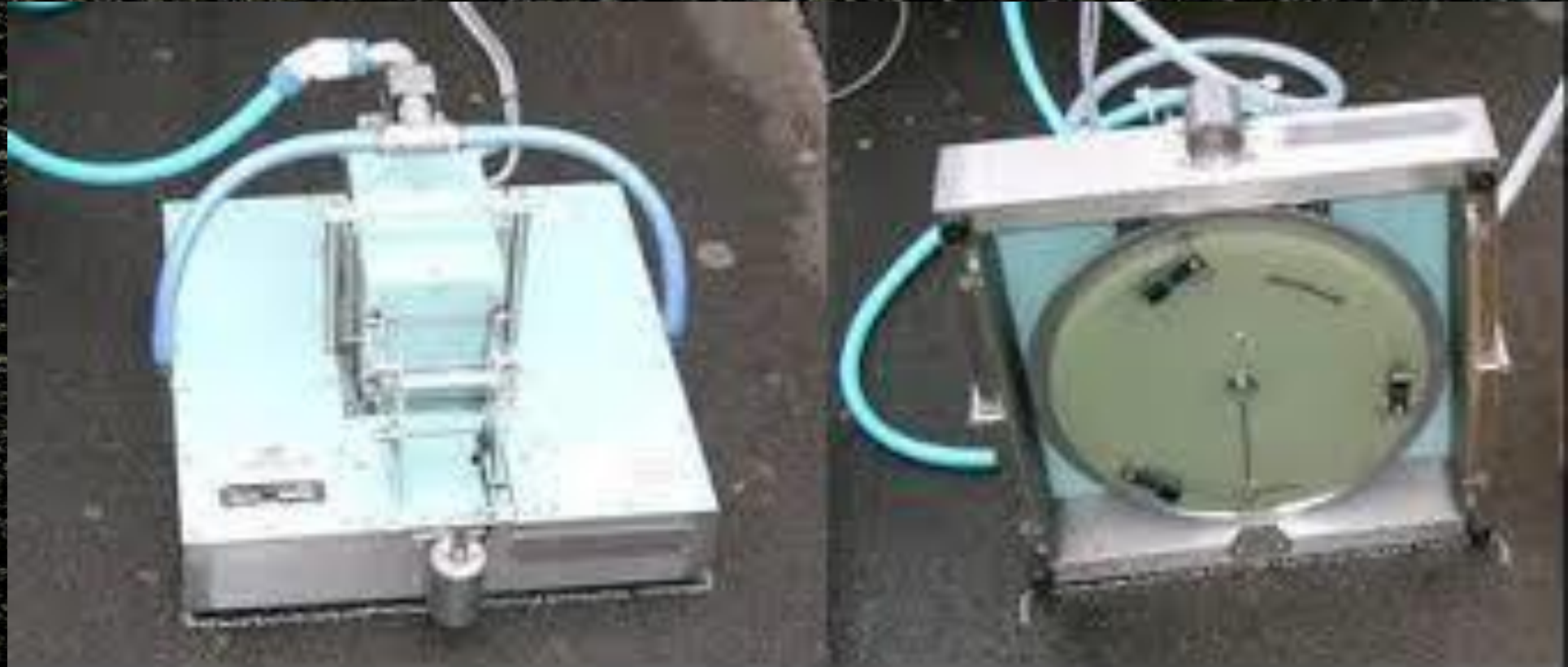
NCAT Three Wheel Polishing Device



Wheel Tracked Path



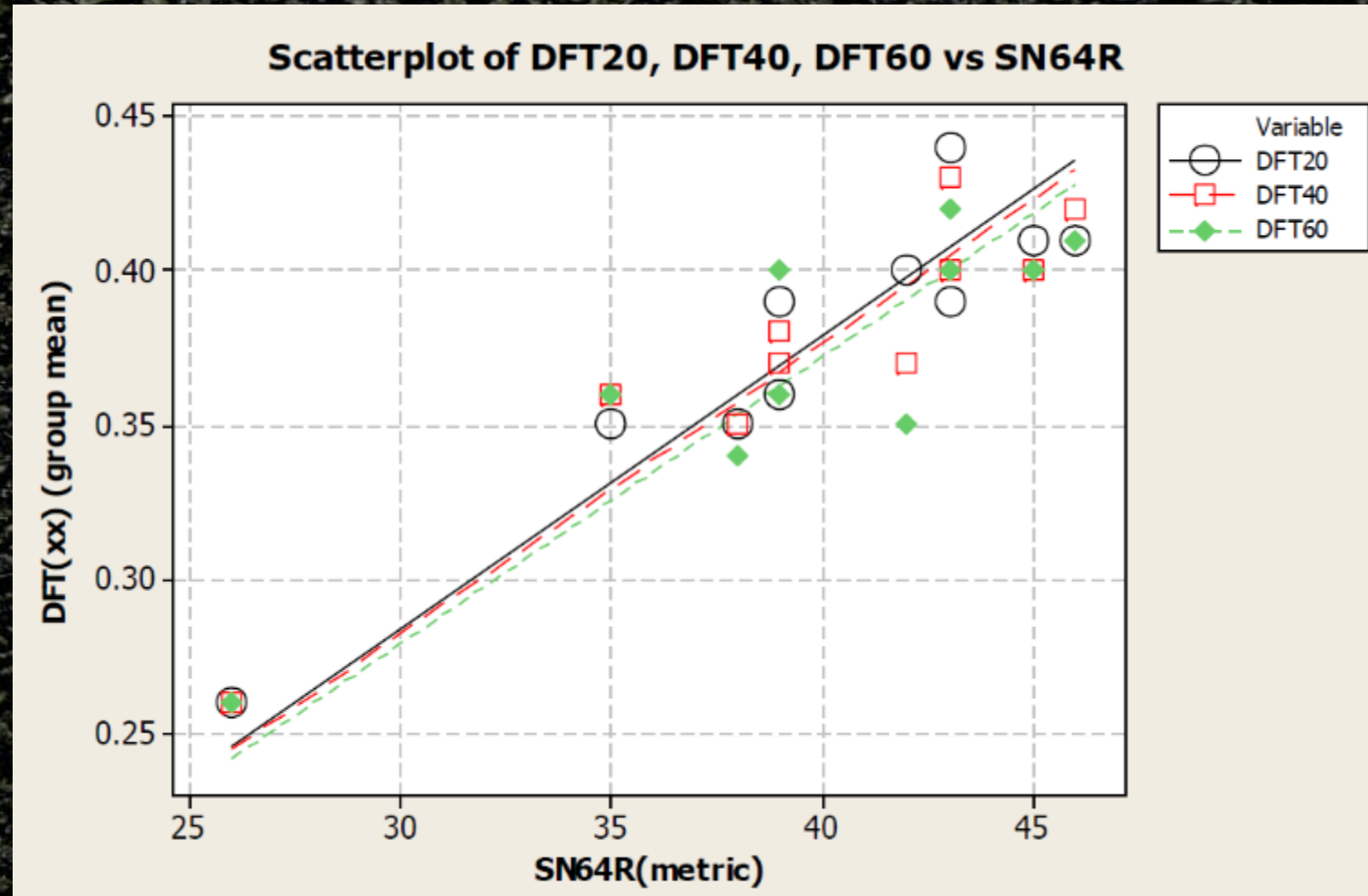
Dynamic Friction Tester



Stationary Dynamic Friction Testing



DFT versus KJ Law Trailer



Blended Mix Performance

- Behavior of blended mix materials is our concern
- Stockpile sizes, indicator properties, and NMAS
- Sustained agg microtexture and mix macrotexture
- High friction sand in coarser, larger NMAS mix
- High friction sand in finer, smaller NMAS mix
- Need to value engineer our projects and our mixes
- Tools to ensure both safety and sustainability.

Thinlay Limitations



Takeaways

- Thinlays can be more durable and crack/rut resistant
- Friction safety as function of macro/micro texture
- $\frac{3}{4}$ inch thick 4.75 SMA with bauxite as HFST alternative
- Option to switch back and forth to meet safety needs
- Laboratory tools to assess friction of any blended mix
- Proven relationship between Track and laboratory.



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