Rumble Strips: Road Safety Heroes…

and pavement *villains?*

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NCPP Skill Share Webinar – Rumble Strip Preservation

What the literature tells us:

Performance

- Assessments are most often "anecdotal in nature" (Himes et al., 2017)
- May introduce "micro-cracks", damage propagation (Weaver et al., 2023)
- Changes in water permeability have been linked (DeCarlo et al., 2023)

Functionality

- There is little standardization in terms of geometry (Himes et al., 2017)
- Geometry strongly impacts functionality (Donovan et al., 2024)

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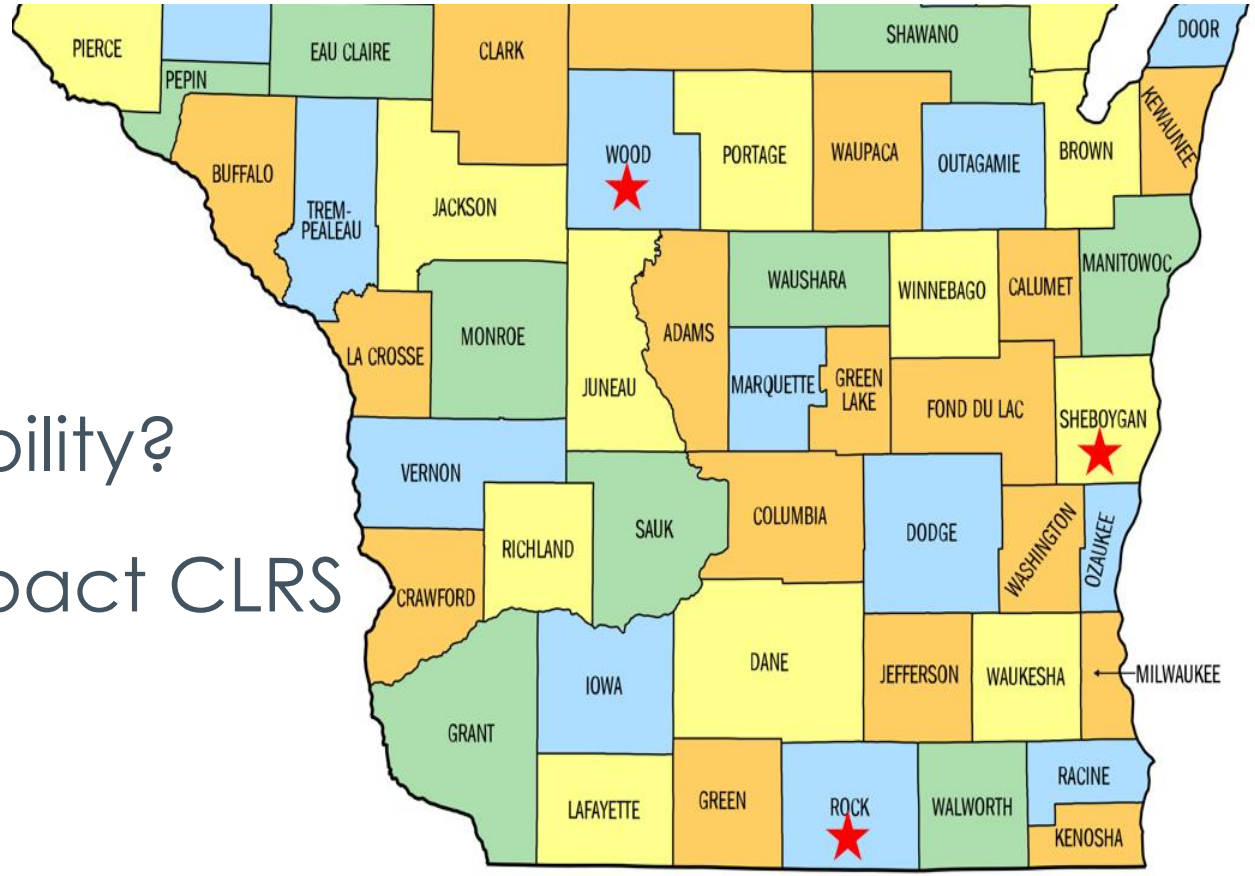
NRRA: Materials-Based Methods to Improve Rumble Strip Durability

National Road Research Alliance

- Do CLRS damage the pavement (or create conditions that facilitate damage)?
- Can material treatments offset damage and/or promote durability?
- How do material treatments impact CLRS functionality as a safety tool?



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Lay out various research cells within project

VRAM is under upper layer, centered at joint

Application of VRAM where applicable

Paving of upper layer

Quality Control testing of finished upper layer

Milling of CLRS – Std. WisDOT geometry

Standard “paired” geometry

“Sinusoidal” geometry (“Mumble Strip”)

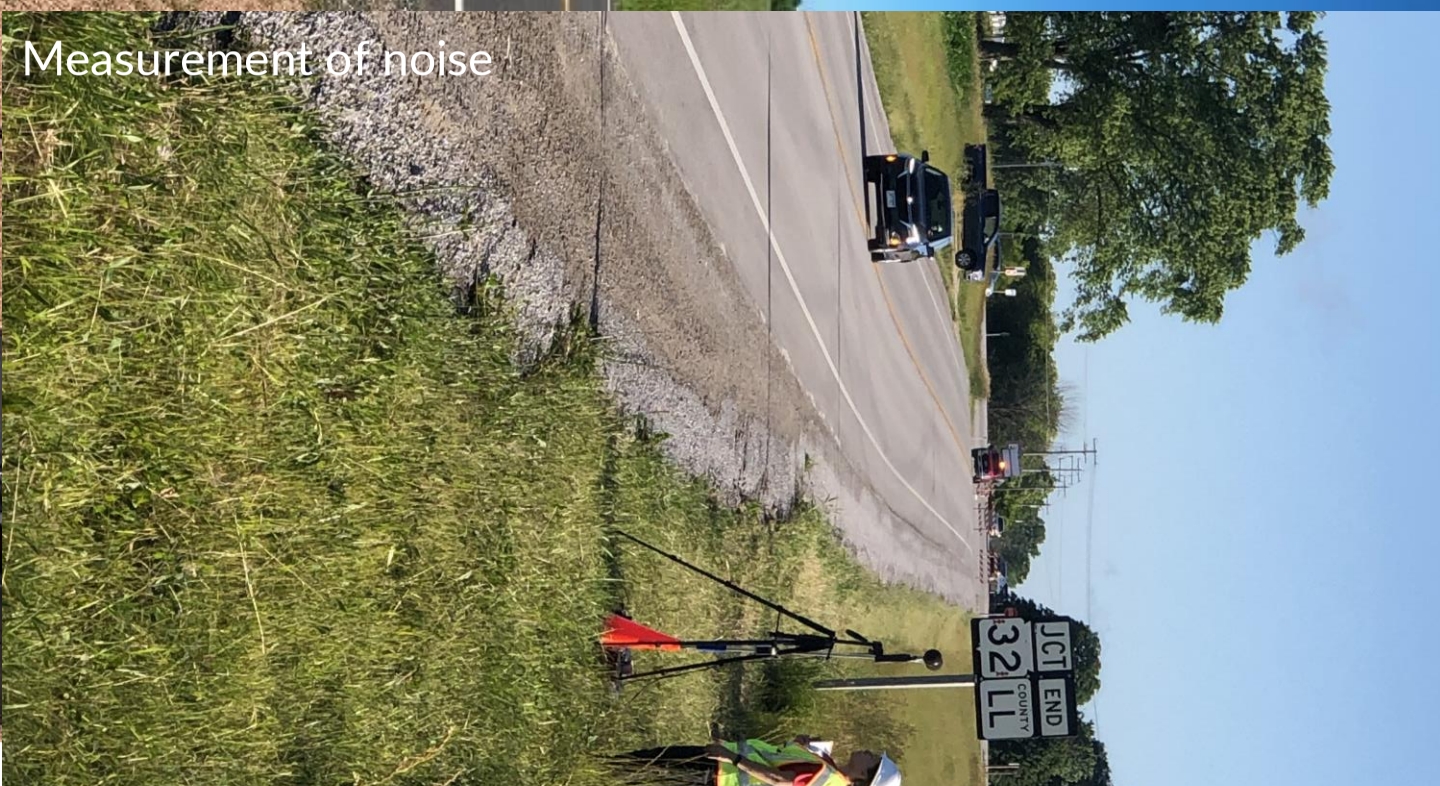
Application of emulsion fog–
Centerline option

Sampling of sections via road cores

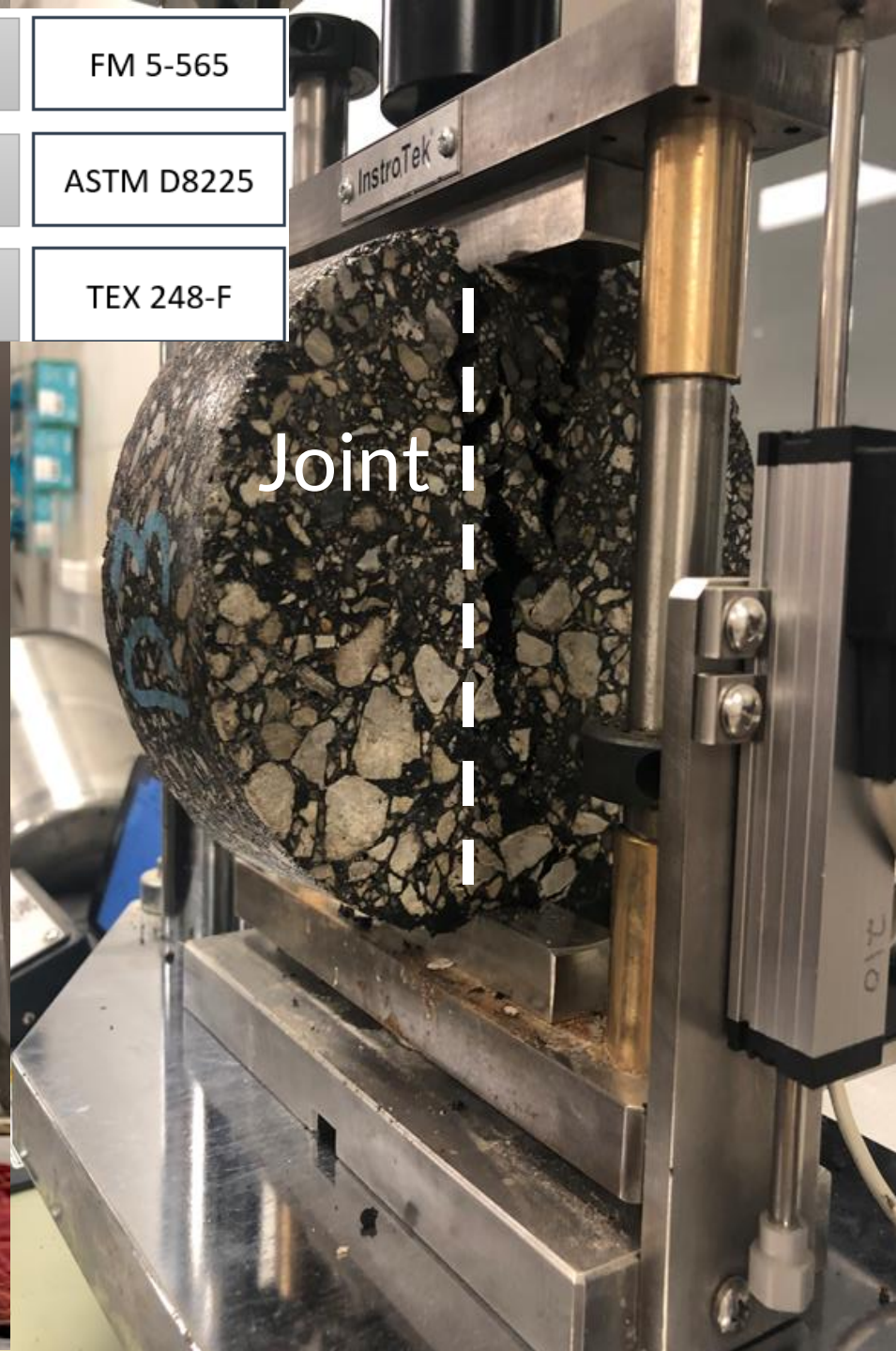
Noise testing – internal noise and vibration

Noise testing - external noise

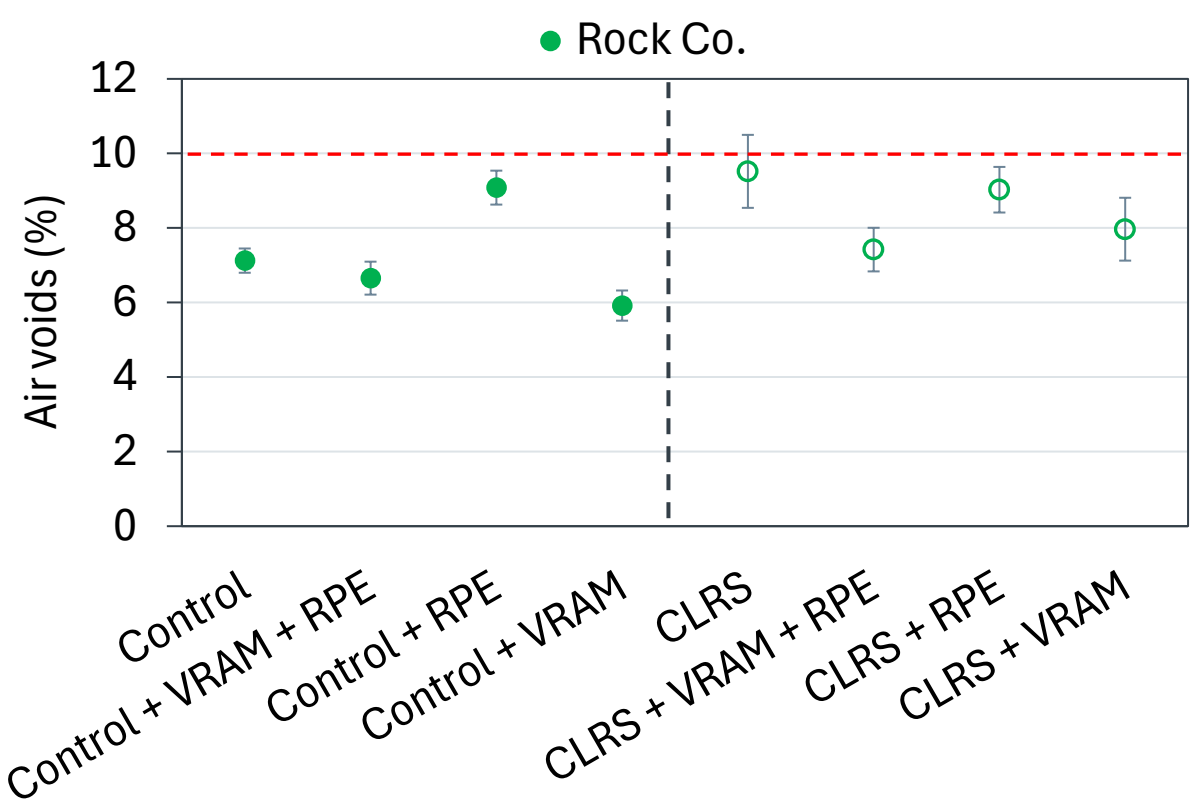
Measurement of noise

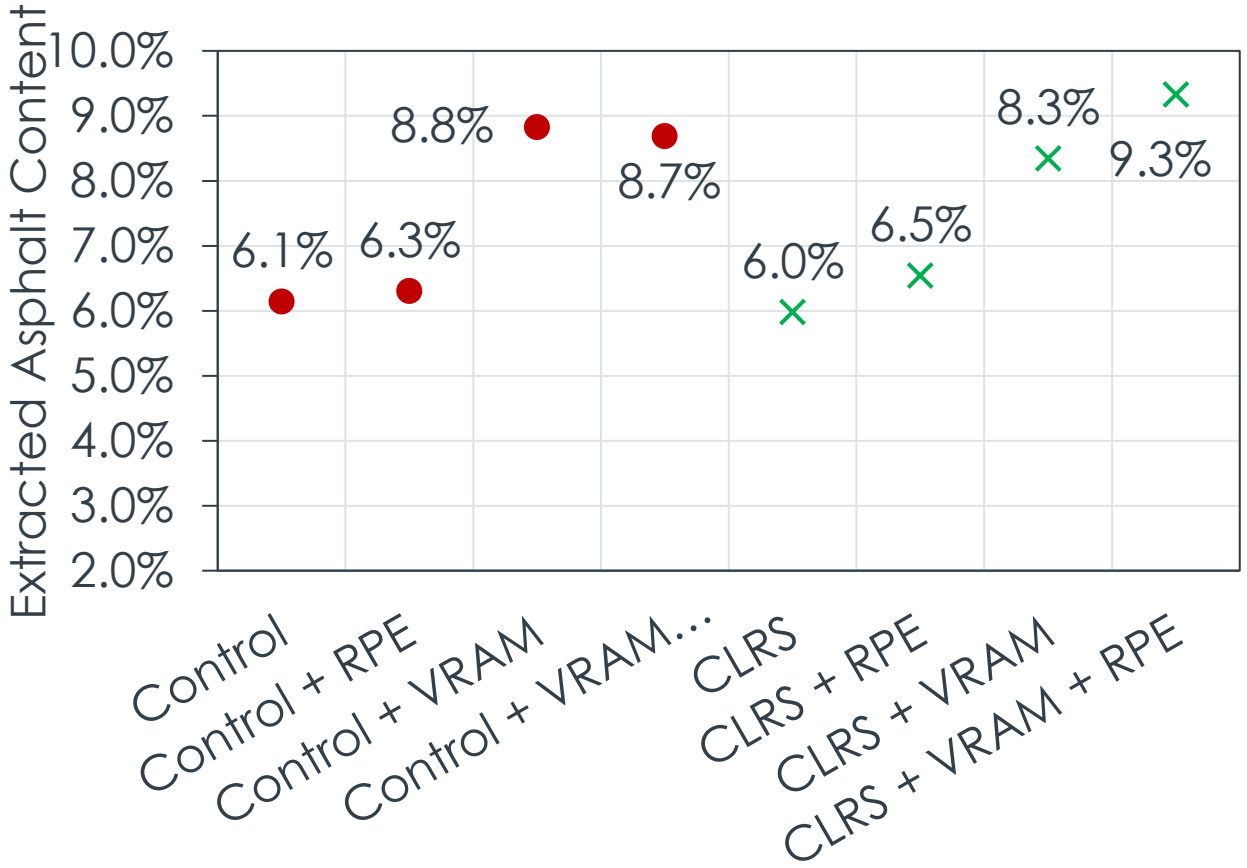


Maximum Theoretical Specific Gravity	AASHTO T209	Permeability	FM 5-565
Bulk Specific Gravity and air void content	AASHTO T166	Ideal-CT	ASTM D8225
Asphalt content and gradation	ASTM D2172, AASHTO T30	Texas Overlay Test	TEX 248-F



Example data from one project:

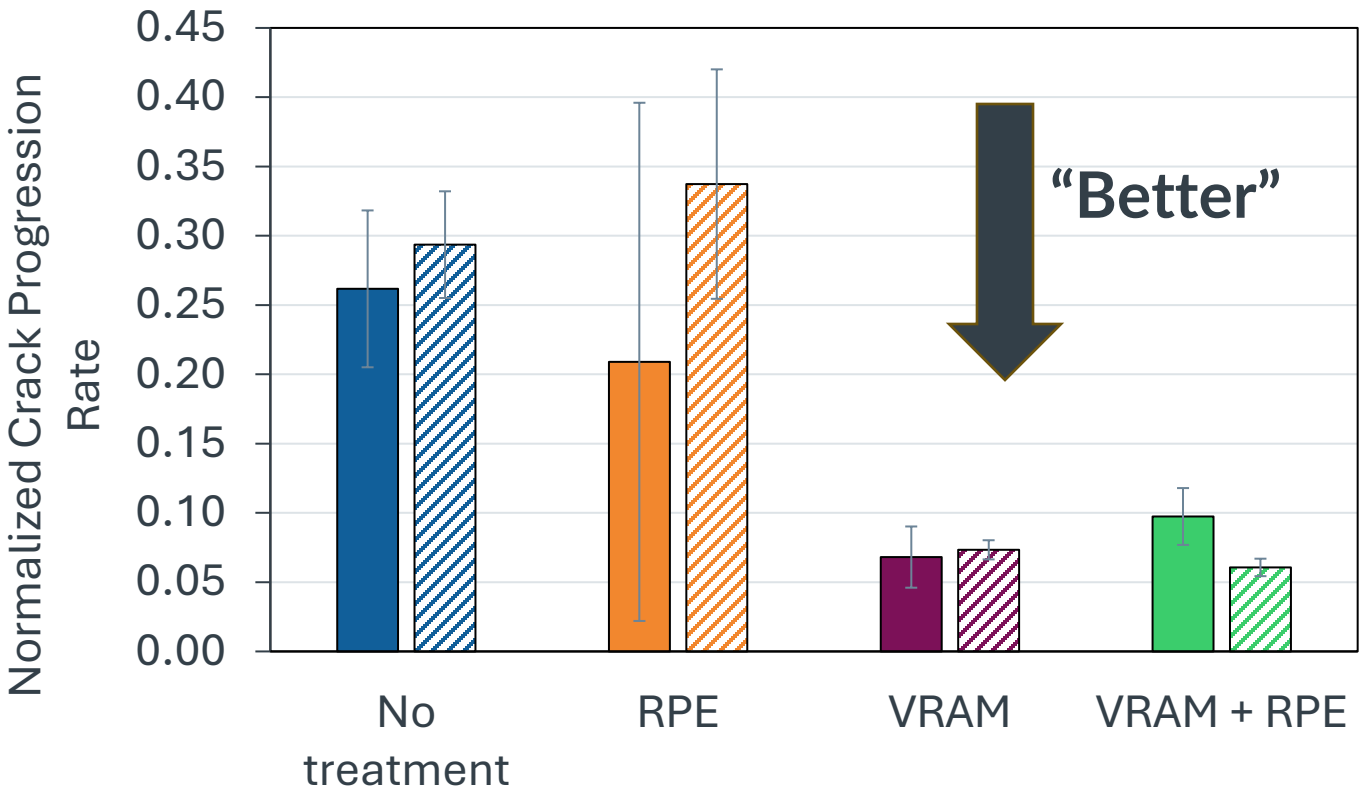


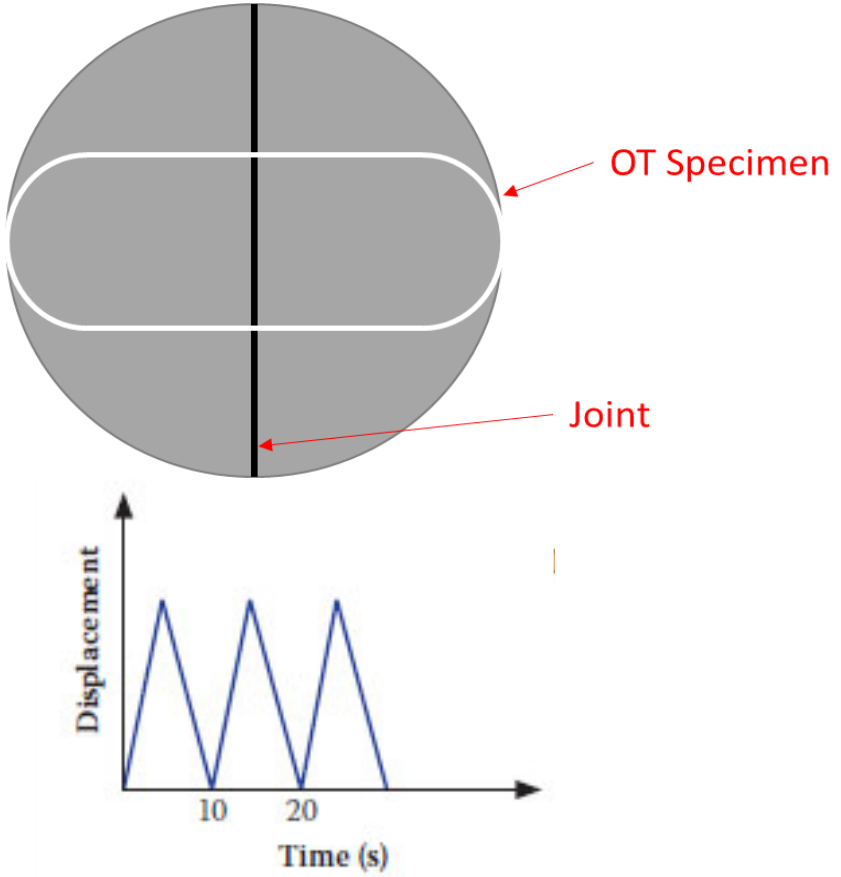


Across all three projects:

- Milling of CLRS did not cause significant aggregate degradation, but did increase air voids.
- Projects considered “impermeable” with and without CLRS (fine-dense mixes)

Example data from one project:

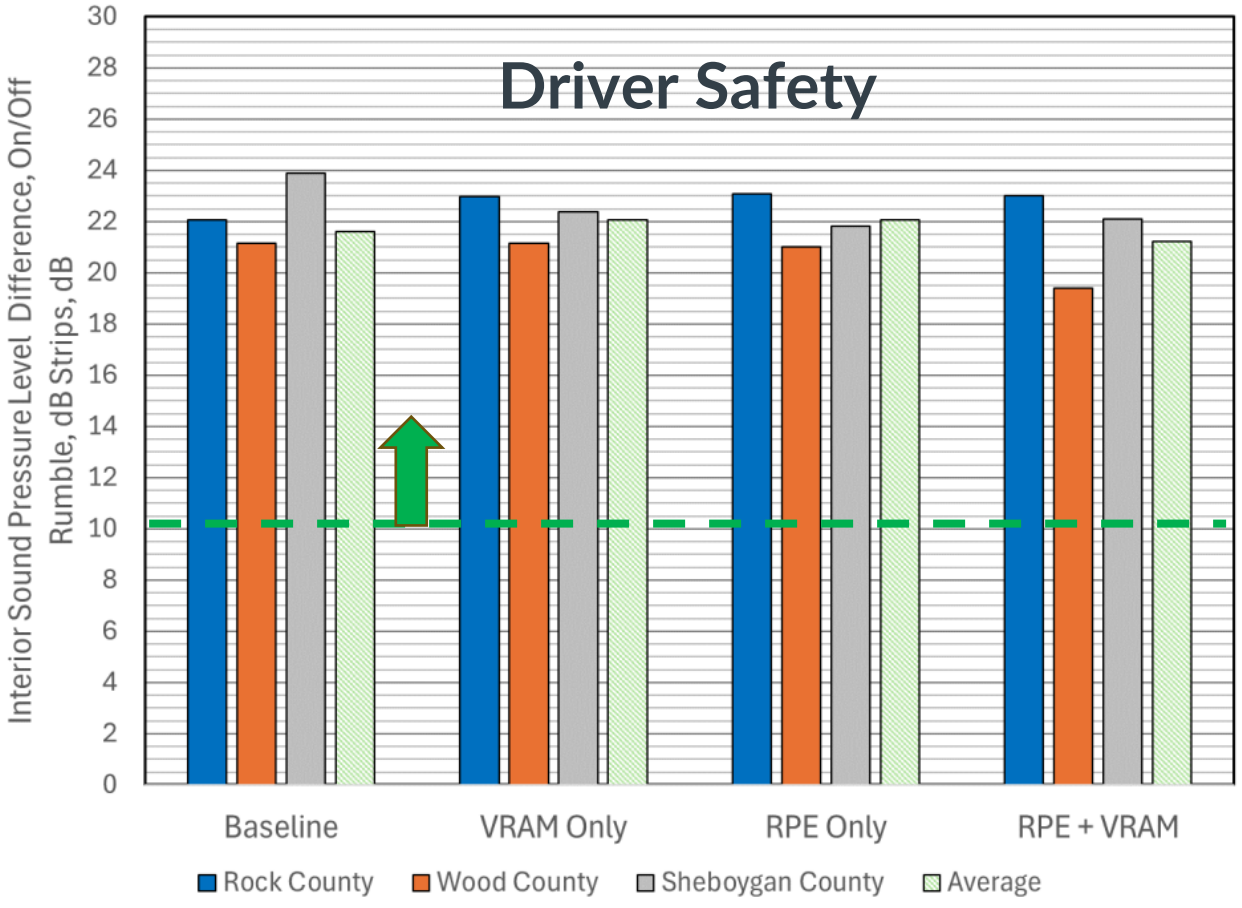


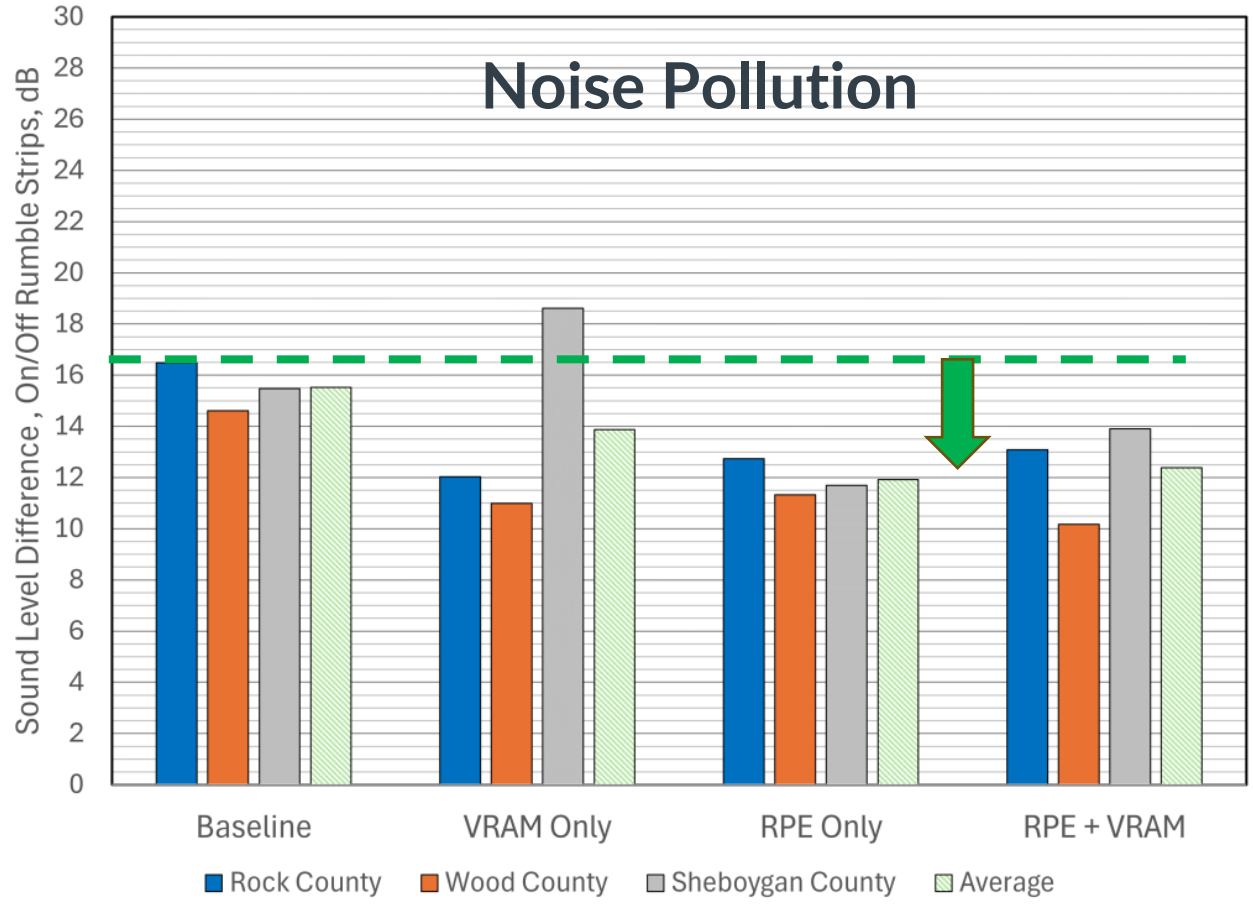


Across all three projects:

- Milling of CLRS significantly increases crack progression rate (non-load related)
- VRAM most effective – high added binder content of polymerized asphalt

Functionality (Noise)





- NCHRP 15-68: single chip seal can reduce on/off interval below critical threshold
- This study: treatments did not significantly reduce on/off internal interval.
  - Evidence that both treatments (and combination) can reduce external noise pollution

Summary (so far)

- Constructing a high-quality joint is paramount.
  - Durability of joint is primarily controlled by presence of the joint
  - Milling CLRS can impact durability parameters
- Material treatments prior to construction (VRAM) and to lesser extent following construction (RPE fog) can increase reliability.
- These treatments do not impact CLRS geometry and therefore maintain safety benefits. May also reduce external noise.
- Proposed research to understand long(er) term durability ("Aging")

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Thank You

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NRRA Project Page →

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