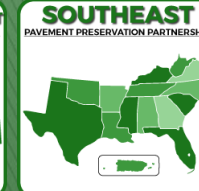


Latest Advancements in Emulsions

Dan Swiertz, PE – Asphalt Materials Inc.
09/19/23

“It is not our wealth that built our roads, but it is our roads that built our wealth.”

- JFK



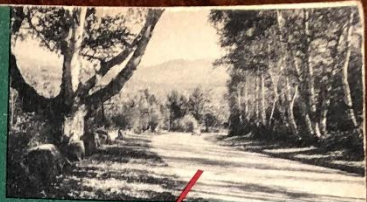
asphalt pavements

with

COLAS



highways



airports



race tracks



bridges



tennis courts



driveways



parking areas



COLAS— the modern method of applying asphalt

THE PROBLEM: Modern pavement must combine maximum durability with excellent water and weather resistance properties in order to withstand the heavy traffic, shock, displacement, abrasion, extremes of climate, wear and other adverse conditions to which it is subjected throughout its entire service life.

THE SOLUTION: These essentials must be met at minimum expenditure because low construction and maintenance costs are vital factors in determining the selection and use of modern road materials.

Asphalt has been unive upon request.
adhesive. waterproofing ar



types of COLAS products

*Price
P.C.B
Chicago*

The Colas products are manufactured in a number of different grades designed to meet specific conditions.

COLAS: A rapid setting grade for (1) penetration construction; (2) surface treating; (3) concrete cure, and (4) tack coat. *.094*

COLAS HI-VIS: A rapid setting grade for surface treating steep-graded and high-crowned roads. *.094*

COLASMIX: A medium setting grade for use with aggregate which is mostly retained on a 1/8" sieve for (1) roadmix and (2) drag treatment. *.099*

COLAS PREMIX: A medium setting grade for use with aggregate, substantially all of which is retained on a 1/8" sieve for plant mix. *.104*

COLAS HEAVYMIX: A medium setting grade for use with aggregate containing no material passing a 200-mesh sieve for (1) patching and (2) mixing at job by hand or in small mixers. *.109*



Roads



INNOVATION

Timely, preventive maintenance of our roads with better materials extends the life of pavement and costs less than reconstructing pavements after they reach failure.

The increased use of innovative materials to preserve and rebuild pavements that are better suited to today's vehicle loading and more resilient to environmental impacts has led to longer lasting pavements and lower life cycle costs. However, material innovations in pavements have not kept pace with other areas of infrastructure, such as bridge construction.

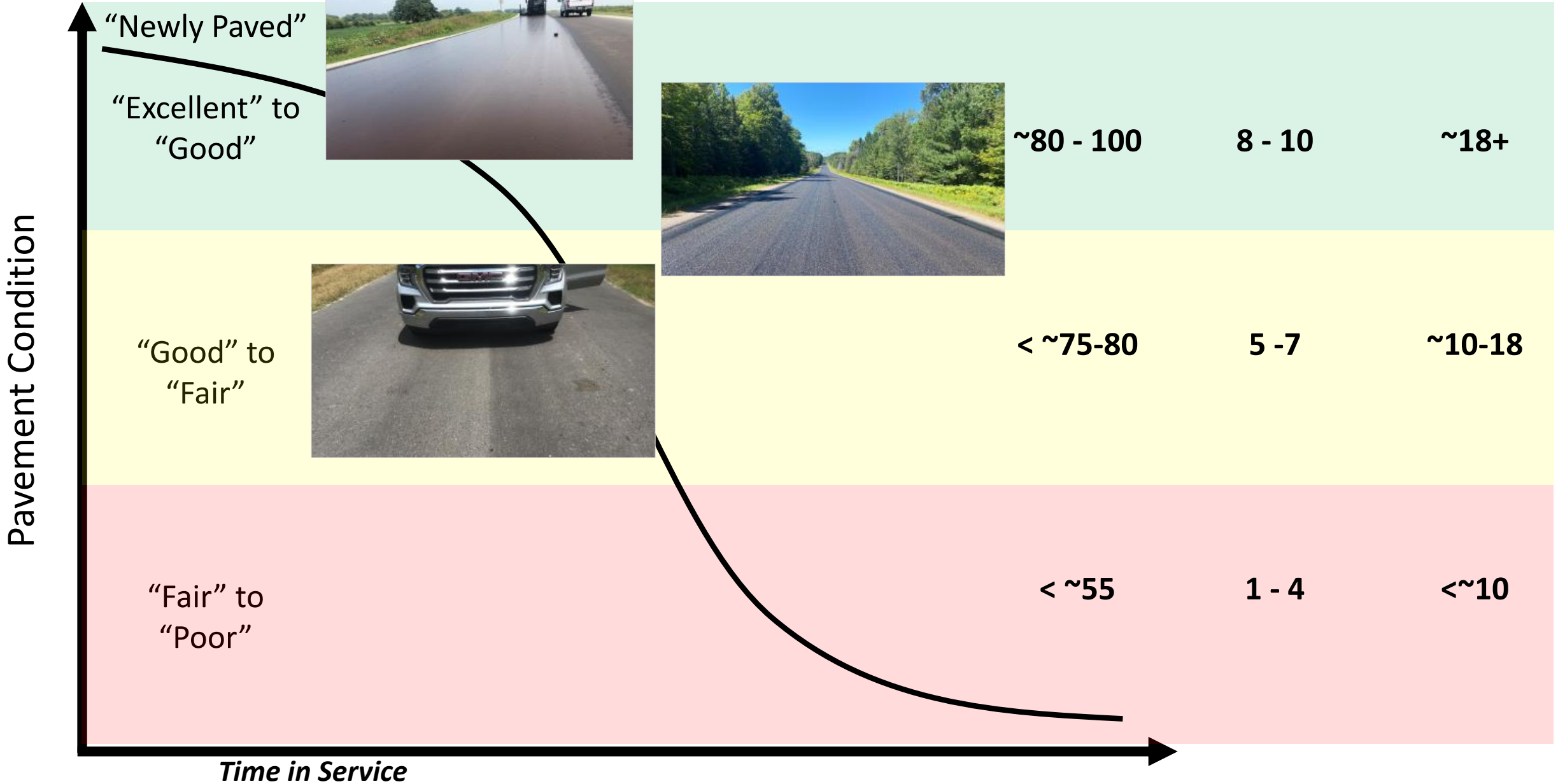
Where does “Innovation” come from?

- New product “categories” to address a need, add value;
- Updating existing tech to accommodate new demands/market conditions;
- Incremental improvement on existing products/processes to address changing materials & use (traffic) variables



"The Road to 30"

Approximate PCI: *Approximate* PASER Score: *Approximate* RSL:



"Newly Paved"



"Excellent" to "Good"



"Good" to "Fair"



"Fair" to "Poor"

Time in Service



Product Category: Penetrating Emulsion

- Category genesis:
 - ✓ No “remedial” options for in-situ density correction;
 - ✓ Topical CL treatments vs. stripe adhesion;
 - ✓ Safety of traditional fog seals
- What is a “penetrating” emulsion:
 - ✓ Asphalt emulsion that is chemically modified to enhance physical penetration into interconnected voids in substrate
 - “Chemical modification”: Act on surface tension; not using light petroleum distillates (fuel)
 - “Physical Penetration”: Residue remains distinct phase within mixture
- Handling, storage, application mirrors traditional asphalt emulsion

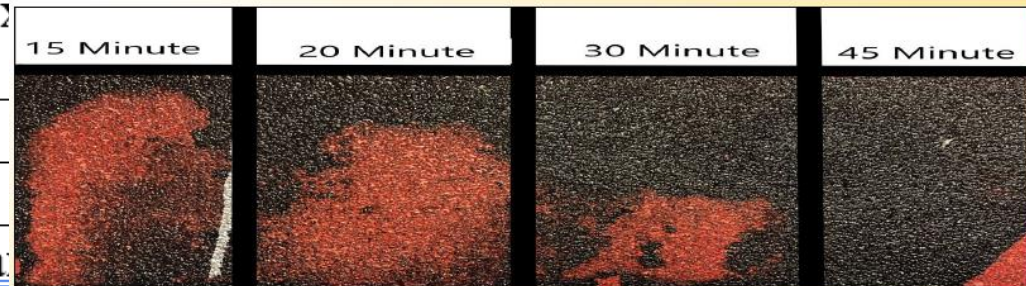
Penetrating Emulsion: Specification

“It’s SS-1h dilute!”

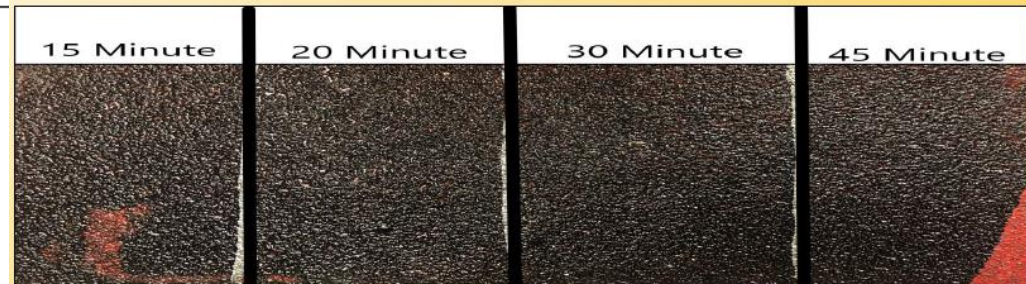
Tests on Emulsion	Test Method	Test Requirement
Viscosity, 25C, SFS	AASHTO T72	50 max
Sieve test, %	AASHTO T59	0.1 max
Identification test*, %	Test Method A	60 min
Water resistance test**, %	Test Method B	60 min
Residue by distillation***, %	AASHTO T59	30 min
Oil in distillate by volume of emulsion	AASHTO T59	1.0 max
Tests on Residue		
Penetration, 25C, 100g, 5s, dmm	AASHTO T49	150 <u>ma</u>
Solubility in trichlorethylene, %	AASHTO T44	97.5 <u>ma</u>



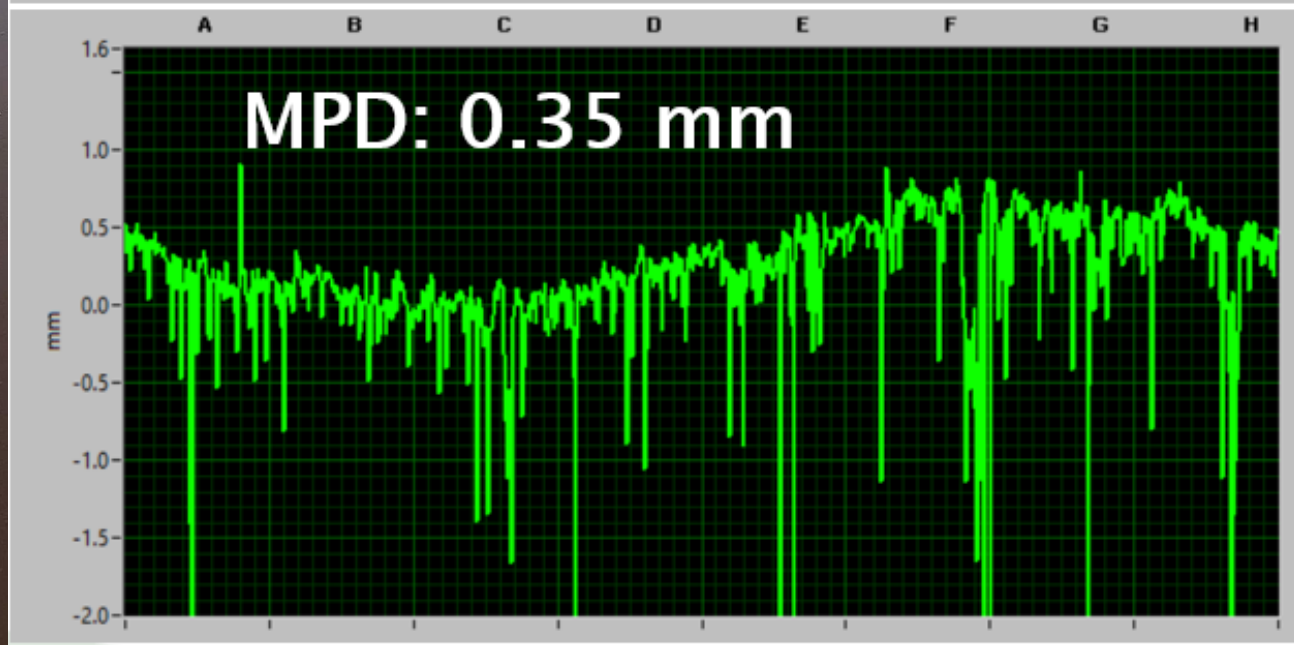
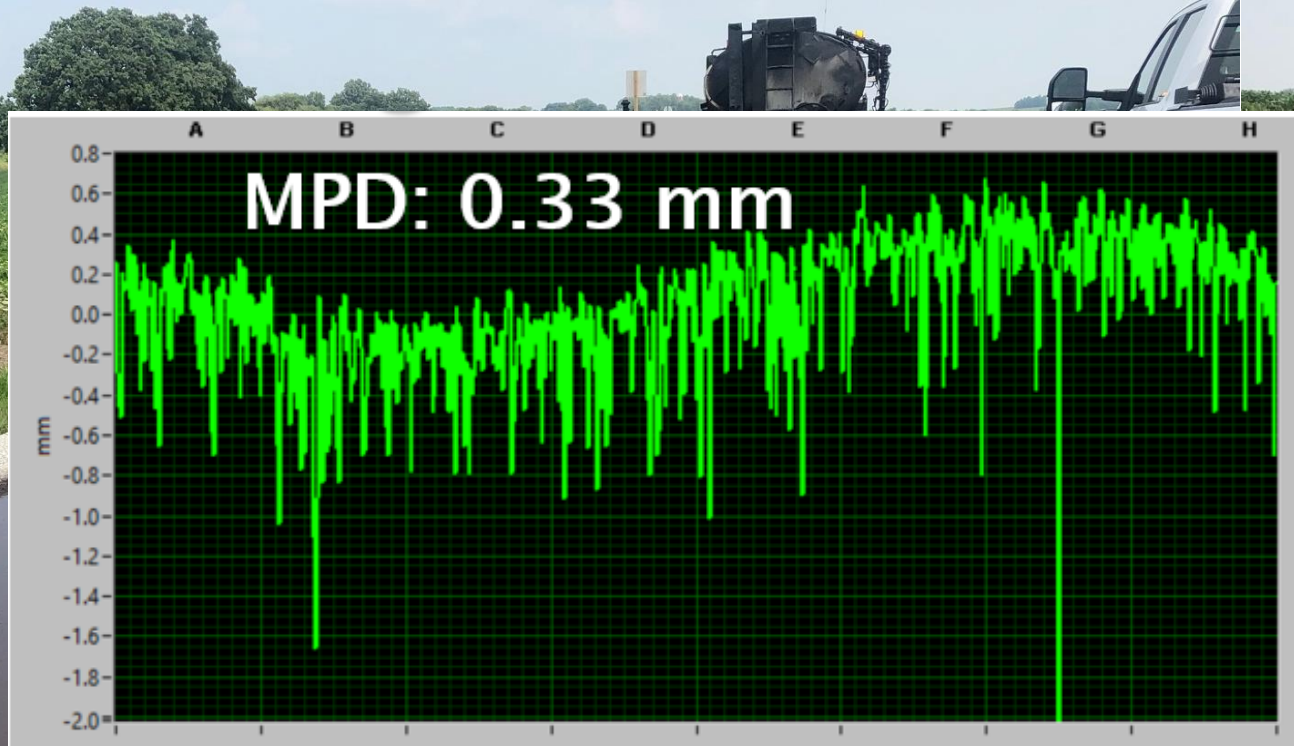
No. 500 sieve



SS-1H Diluted

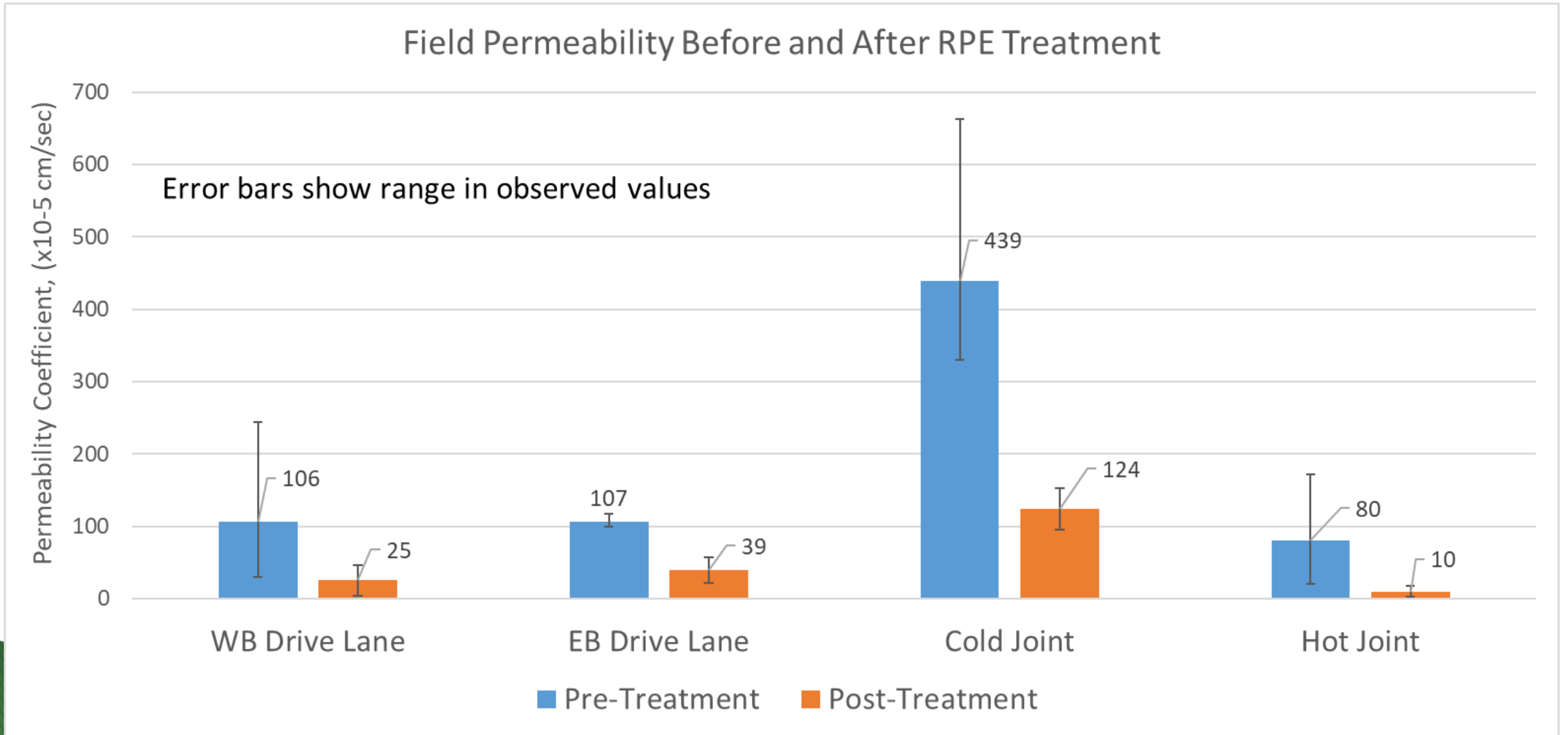


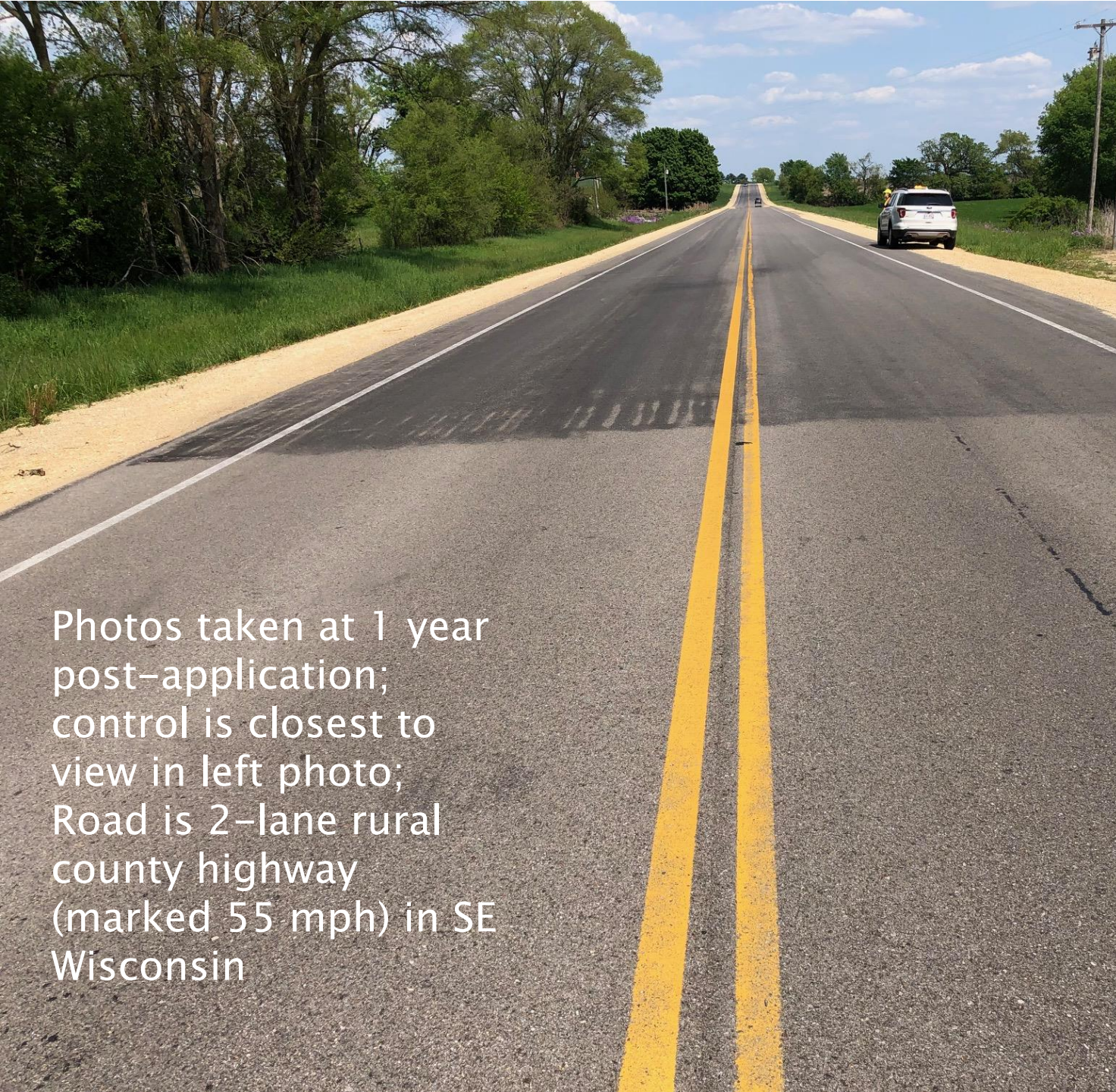
RPE



Existing surface texture
present at about 3–5 minutes
post-application

Field Data (Example from SE Wisconsin 2022):





Photos taken at 1 year post-application; control is closest to view in left photo; Road is 2-lane rural county highway (marked 55 mph) in SE Wisconsin



Same road from another perspective

Penetrating Emulsion: CL Treatment





“Rejuvenating” a Product: Scrub Seals

- ▶ Need for a change: Materials and specifications
 - “Rejuvenation” science
 - Expanded material database
 - Experience
- ▶ If this treatment provides unique value, a reasonable specification can be drafted

“Historical” Scrub Seal Material Specification:
These materials worked, but were limiting

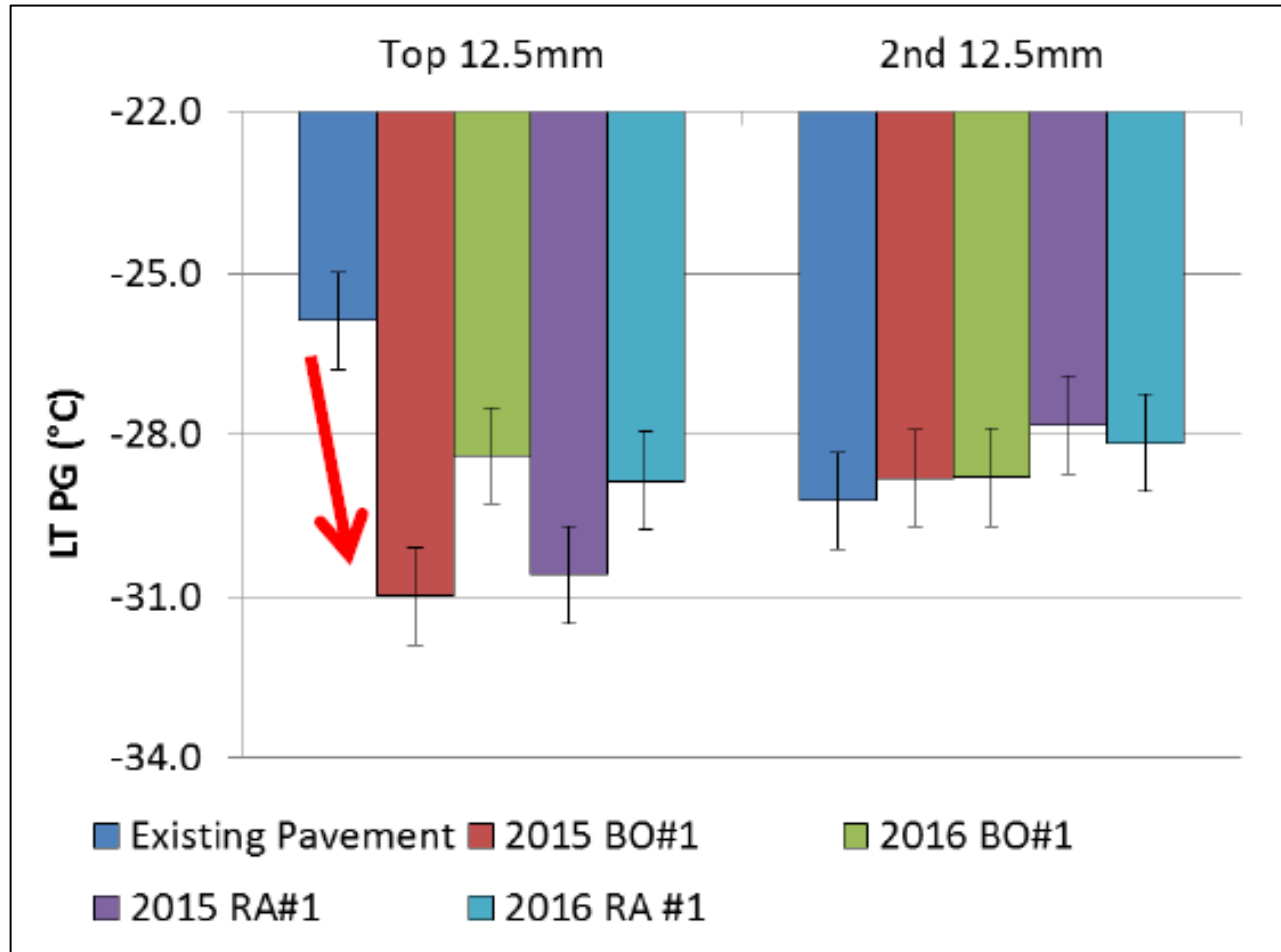
Test on Emulsion	Method	Specification
Viscosity, Saybolt Furol at 50°C [122°F]	ASTM D7496	75 - 450
Residue, %, min.	ASTM D6997 ⁽¹⁾	65
Particle Charge Test	ASTM D7402	Positive
Sieve Test, %, max.	ASTM D6933	0.1
Oil Distillate, %, max.	ASTM D6997	1.0
Demulsibility, DSS, 35 mL, %, min.	ASTM D6936	50
Specific Gravity of residue of recovered latex, min.	WE-EM - 100-2 ⁽⁵⁾	1.15
Test on Residue ⁽¹⁾	Method	Specification
Penetration, 25°C [77°F], min.	ASTM D5	80
Penetration, 4°C [39.2°F], min.	ASTM D5	40
Elastic Recovery, 10°C [50°F], %, min.	ASTM D6084 ⁽²⁾	45
Test on Latex	Method	Specification
Specific Gravity, min.	ASTM 1475	1.08
Tensile strength, die C dumbbell, psi, min.	ASTM D412 ⁽³⁾	500
Swelling in rejuvenating agent, %, max., 48 hours exposure @ 104°F	ASTM D471 ⁽⁴⁾ Modified	40% Intact Film
Test on Rejuvenating Agent	Method	Specification
Flash point, COC, °F	ASTM D92	> 380
Hot Mix Recycling Agent Classification	ASTM D4552	See Section II

“Modern” Example Rejuvenating Scrub Seal

- ▶ Often called CMS-2P

<u>EMULSION PROPERTY</u>	<u>MIN</u>	<u>MAX</u>	<u>TEST METHOD</u>
VISCOSITY @ 50°C (122°F) (cPs)	110	880	ASTM D7226
RESIDUE BY EVAPORATION, W%, MIN	65		ASTM D6943 ¹
SIEVE, W%, MAX ²		0.1	AASHTO T59
PARTICLE CHARGE	POSITIVE		AASHTO T59
DEMULSIBILITY 35 mL, 0.8% Sodium Dioctyl sulfosuccinate, %		20.0	AASHTO T59
STORAGE STABILITY, W%, 24 HOURS ²		1.0	AASHTO T59
RESIDUE PROPERTY (BY VACUUM DISTILLATION)			ASTM D7403
G*/SINδ @ 52°C , (kPa)	2.2		AASHTO T315
MSCR @ 10°C, %R @3.2kPa, %	55		ASTM D7405
PENETRATION @ 4°C, MIN ³	40		AASHTO T49
REJUVENATING AGENT PROPERTY			
VISCOSITY, 60°C (140°F), cPs	50	300	ASTM D4402
FLASH POINT, COC, °F	>425		ASTM D92
SOLUBILITY IN N-PENTANE, W%	99.0		ASTM D2007
MASS LOSS AFTERRTFO OR TFO, W%		6.5	AASHTO T240 OR T179
VISCOSITY RATIO		3.0	AASHTO T179

“Rejuvenation” – Scrub Seals



Data courtesy Cargill

Snake Oil Liniment

THE STRONGEST AND BEST LINIMENT KNOWN FOR PAIN AND LAMENESS.

USED EXTERNAL ONLY

FOR

RHEUMATISM
NEURALGIA
SCIATICA
LAME BACK
LUMBAGO
CONTRACTED CORDS
TOOTHACHE
SPRAINS
SWELLINGS
ETC.

CLARK STANLEY'S

Snake Oil Liniment

TRADE MARK REGISTERED

— FOR —

FROST BITES
CHILL BLAINS
BRUISES
SORE THROAT
BITES OF ANIMALS
INSECTS AND REPTILES.

GOOD FOR
MAN AND BEAST

IT GIVES
IMMEDIATE
RELIEF.

IS GOOD
FOR
EVERYTHING
A LINIMENT
OUGHT
TO BE
GOOD FOR.

Manufactured by
CLARK STANLEY
Snake Oil Liniment
Company
Providence, R. I.

Clark Stanley's Snake Oil Liniment

Is for sale by all druggists. If your druggist fails to have it tell him he can get it for you from any wholesale druggists or it will be sent to you in any part of the United States or Canada upon the receipt of fifty cents in stamps by addressing the

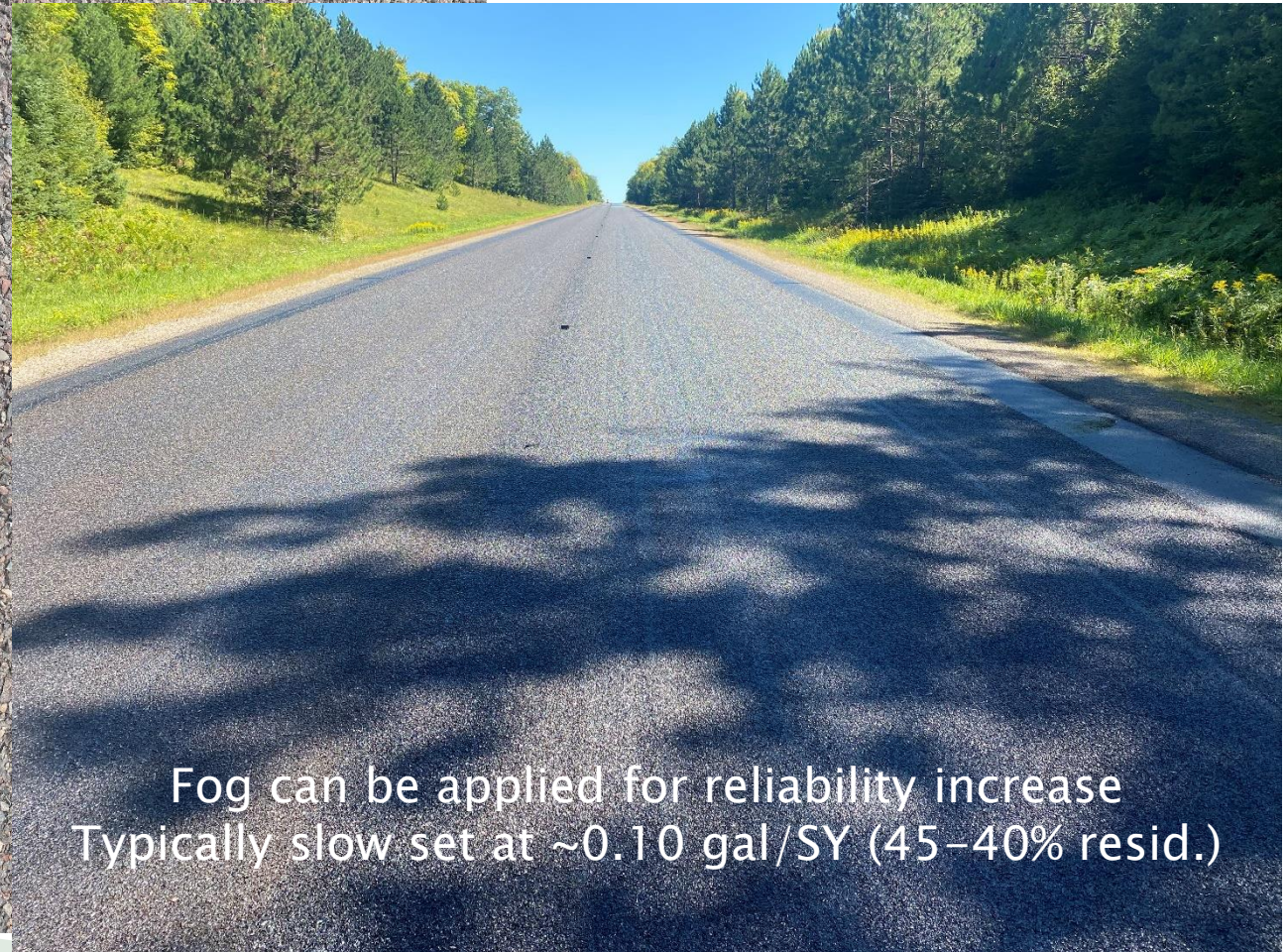
Clark Stanley Snake Oil Liniment Co.

PROVIDENCE, R. I.

Our experience in upper Midwest



Same chipping/rolling
Can take a bit longer
Typically around 2
FA-2/FA-2.



Fog can be applied for reliability increase
Typically slow set at ~0.10 gal/SY (45-40% resid.)



Making a good process better

- ▶ Microsurfacing – Extensive, proven history
 - Art and Science
 - Binder (therefore emulsion) chemistries constantly changing
 - Are we getting the same performance out of micro?
- ▶ Trends in PMA and “HiMa” for durability enhancement
- ▶ “eFlex” technology – use the proven HiMa technology from the HMA community in a slurry system:
 - Understand the “distress” to improve – understand how that distress is related to materials & methods
 - Goal is to use same equipment, process, crew

eFlex® PREMIUM
MICRO SURFACING

ERGON
Asphalt & Emulsions

Early, mid-, and late-life performance improvements

Type II Slurry



Type II eFlex ES



One week after lay down.

Figures & Data: Ergon



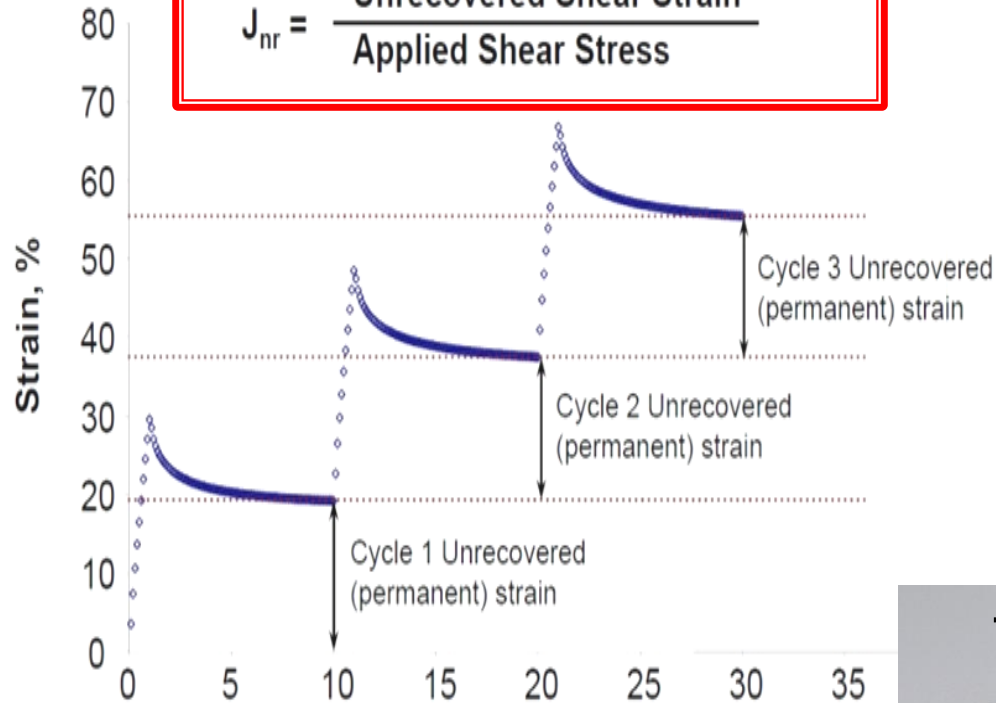
Early, mid-, and late-life performance improvements



Example:
7-year old job
Compare to
experience with
std. micro

If you cherish it, measure it:

$$J_{nr} = \frac{\text{Unrecovered Shear Strain}}{\text{Applied Shear Stress}}$$



Cantabro Abrasion Test

Trad. Slurry



5-10% loss

Trad. Micro



~5% loss

eFlex



1-2% loss

Where are we headed?

- ▶ Expect chemistries to continue to change
 - NCHRP 09-60
- ▶ Expect more “performance-driven” emulsion residue specs.
 - NCHRP 09-50, 09-63
- ▶ Specialty products can add value
 - Network management most important to lower E.A.C. of any treatment
- ▶ Resources are available and always improving
 - RoadResource, A.I., others

More info on content in this deck:
<https://asphalt-materials.com/>
<https://ergonasphalt.com/>

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