58th Annual IAC

Maximizing Pavement Life – Part 2

Considerations for Construction Practice

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Asphalt Institute

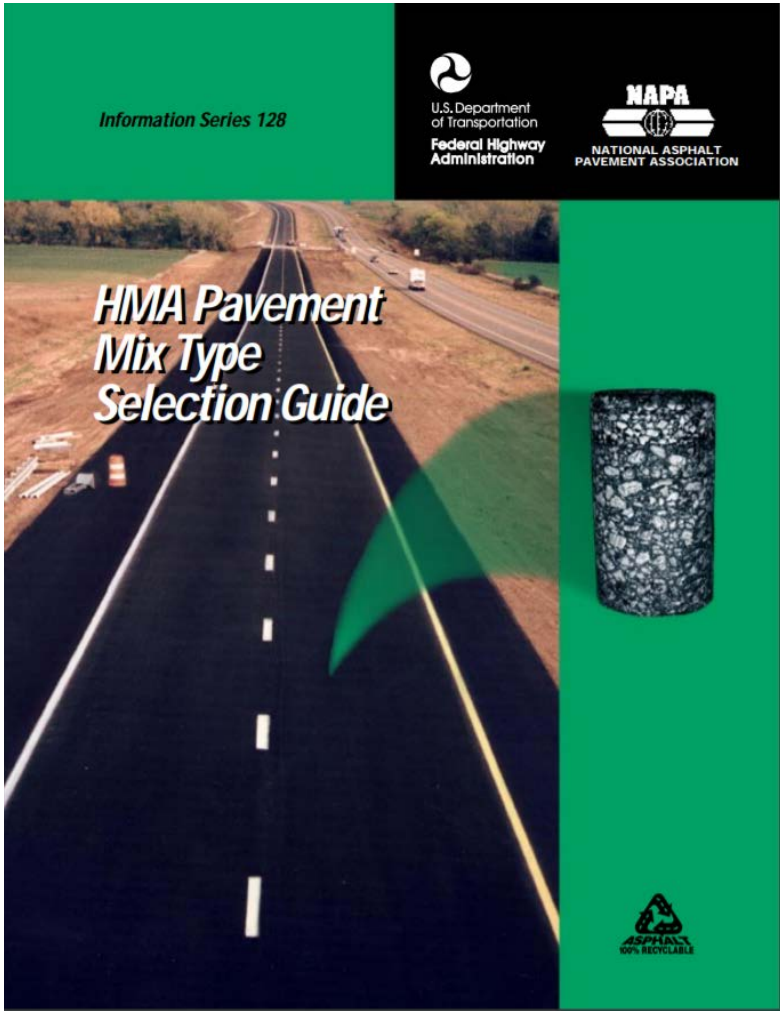
Oct. 25, 2018

Moscow, Idaho

Lift Thickness and Mix Type

Design - Section 3

Mix Type



https://www.fhwa.dot.gov/publications/research/infrastructure/pavements/asphalt/HMA.pdf

Recommended Lift Thickness

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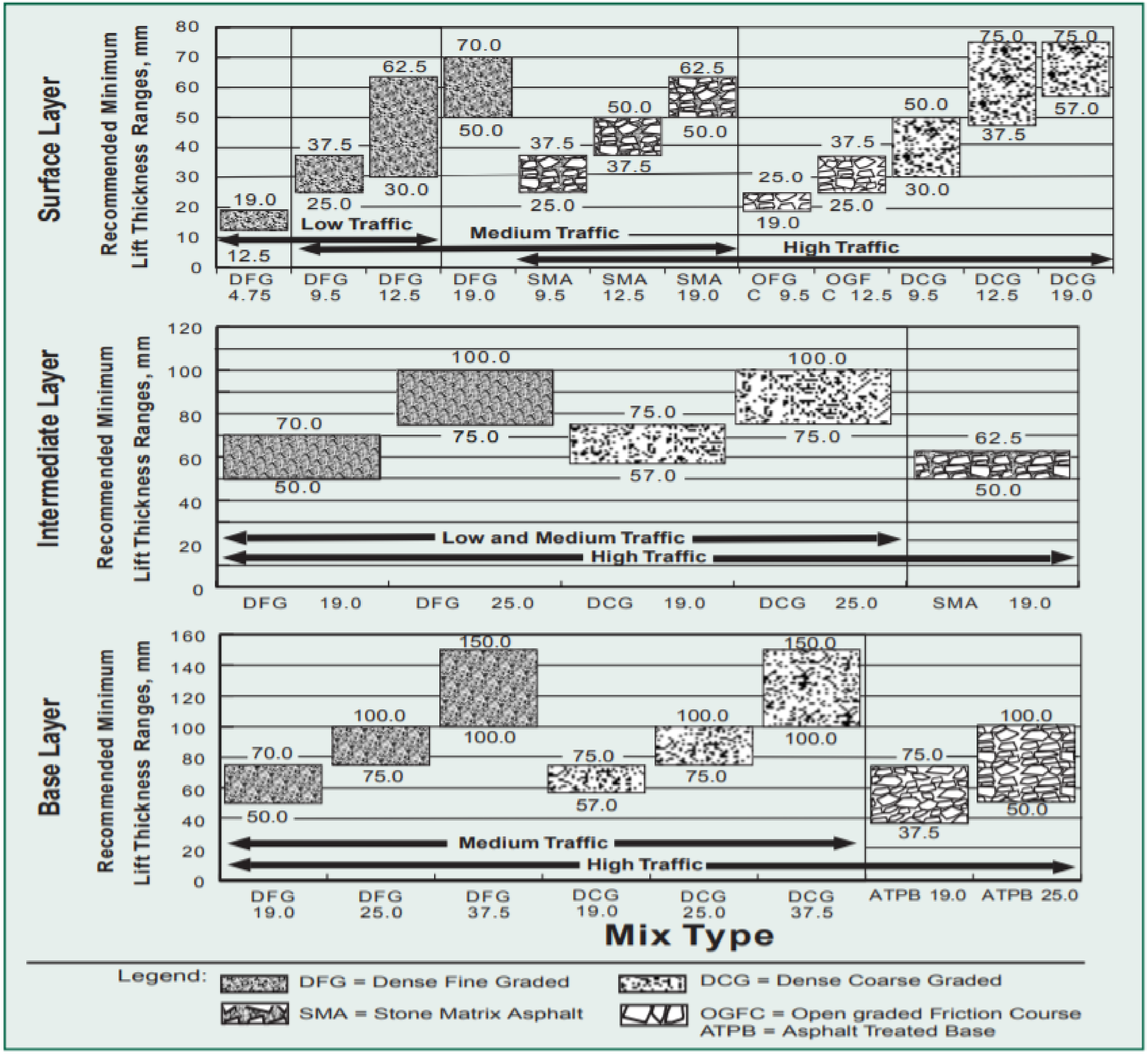
FIGURE 3: Recommended Mix Types for Surface, Intermediate and Base Courses



Mix Type

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NMAS grading is different than older “Topsize” Grading

Old Rule of Thumb - Minimum lift thickness = 2x Topsize

NMAS - Minimum compacted thickness

✓4 times nominal aggregate size

✓3 times nominal aggregate size for fine graded mixtures

- Thicker lifts are easier to compact
- Cool slower providing longer compaction time

Minimum -----------NOT MAXIMUM !

Mixtures can vary significantly

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Table 1

Requirements	**Class D**		**Class E**		**Class G**	
	Type 1	**Type 2**	**Type 1**	**Type 2**	**Type 1**	**Type 2**
Sieve	**Percent Passing**					
1 inch	100		100		100	
3/4 inch	97-100	100	97-100	100	97-100	100
5/8 inch						
1/2 inch	75-95	97-100	75-95	97-100	75-95	97-100
3/8 inch						
#4	45-75	60-80	45-75	60-80	45-75	60-80
#8	30-55	40-60	30-55	40-60	30-55	40-60
#16	20-45	25-50	20-45	25-50	20-45	25-50
#40	10-30	15-35	10-30	15-35	10-30	15-35
#200	3.0-7.0	4.0-8.0	3.0-7.0	4.0-8.0	3.0-7.0	4.0-8.0

Table F - Gyratory Controlled QC/QA Gradation*[1]

	Control Points (percent passing)	
Sieve Size	Min.	Max.
3/4 inch	100	
1/2 inch	90	100
3/8 inch		85
#8	30	55
#200	2.0	7.0

Lift Thickness

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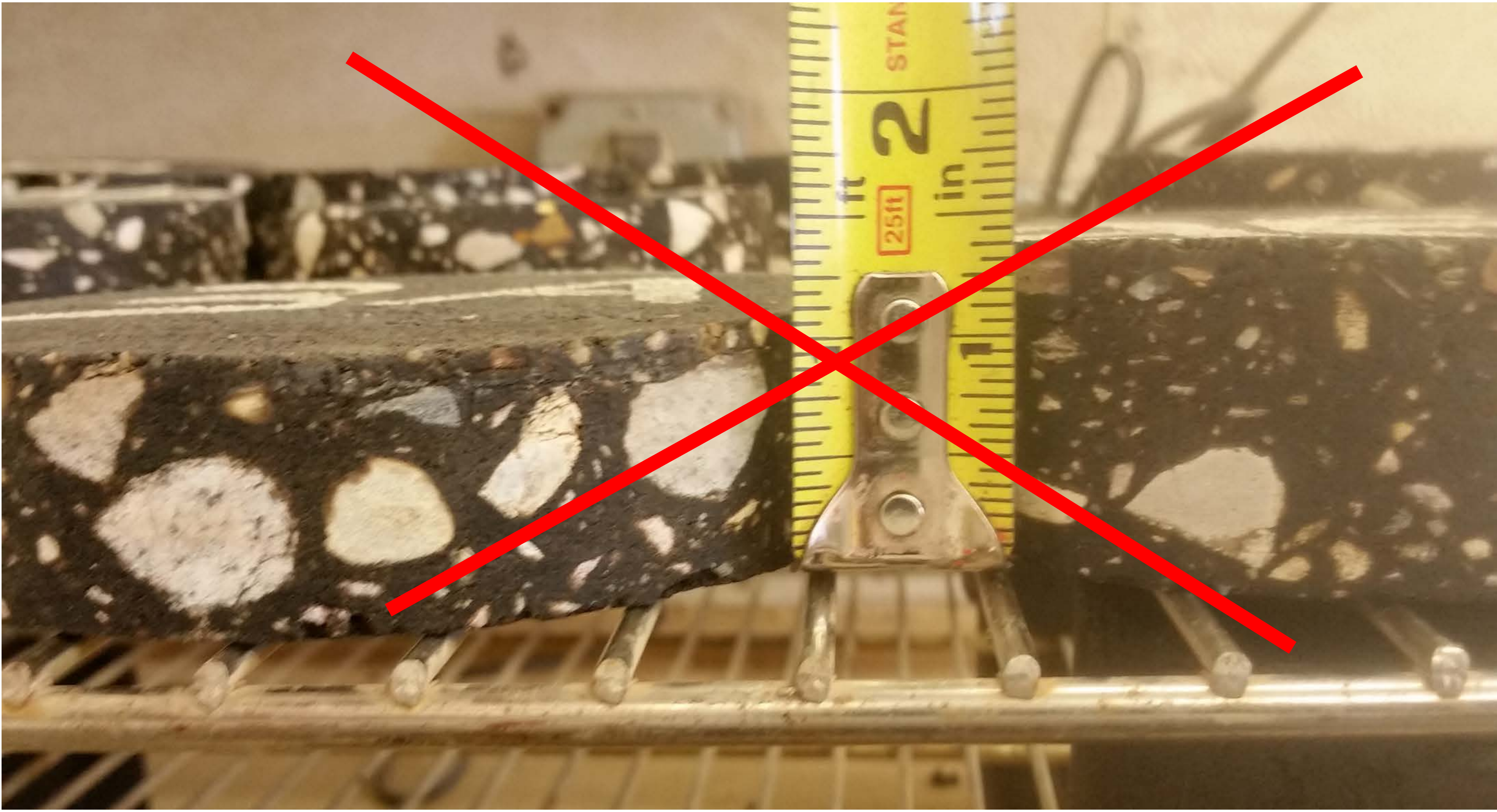

NCAT Test Track 1st Cycle

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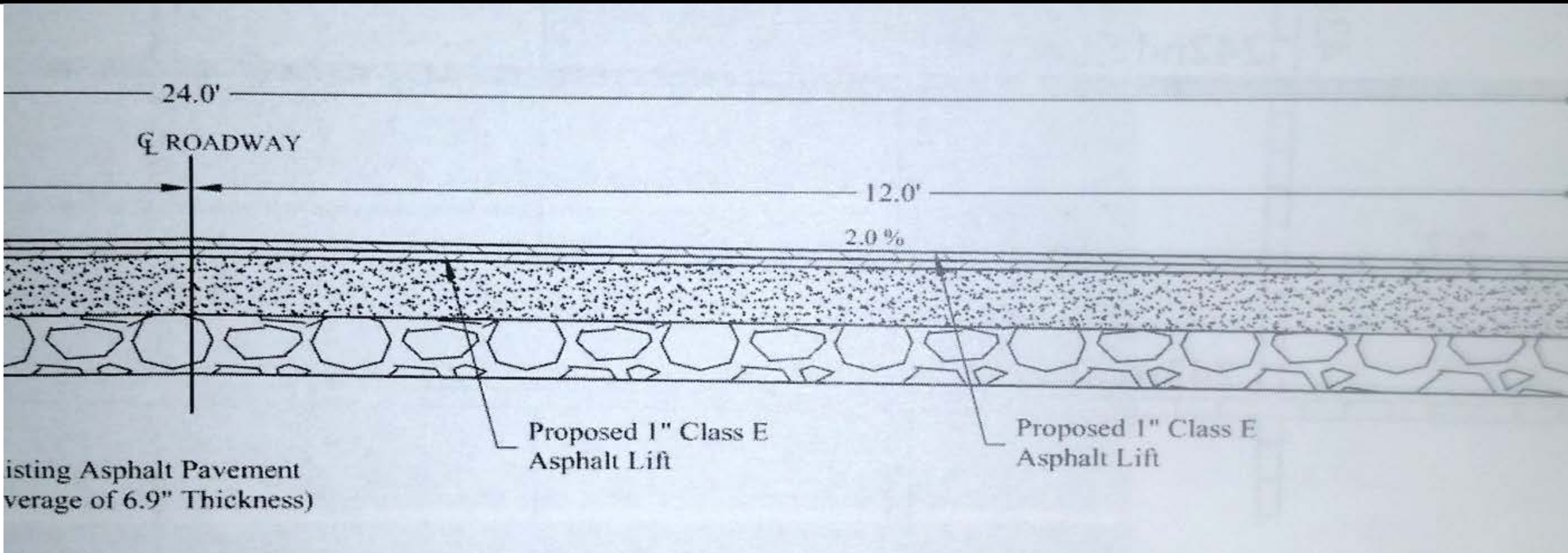
Coarse, intermediate, and fine gradations. No differences in rutting performance!

Courtesy of NCAT

Lift Thickness



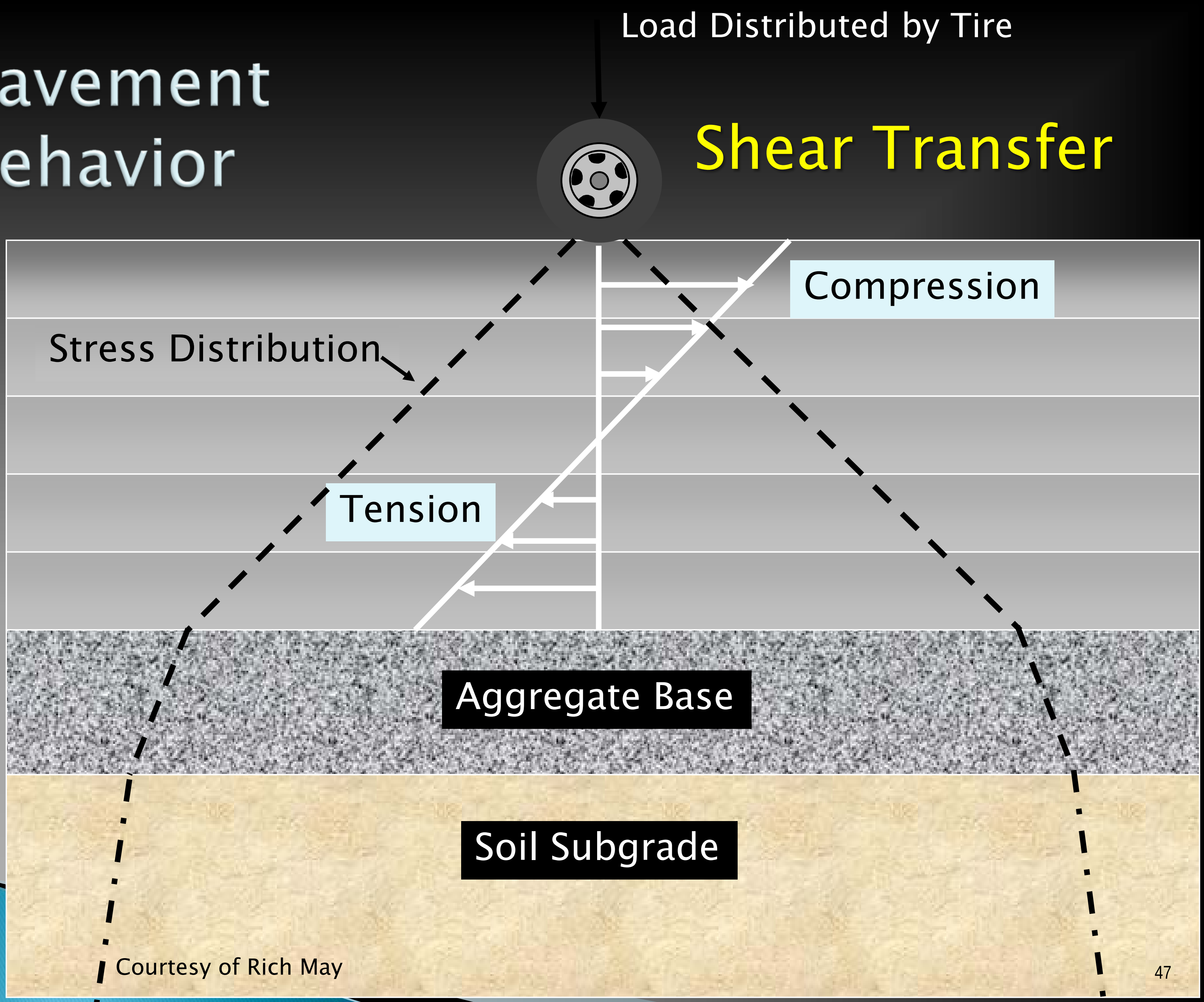
Construction

1. Tack Coat
2. Longitudinal Joints
3. Density

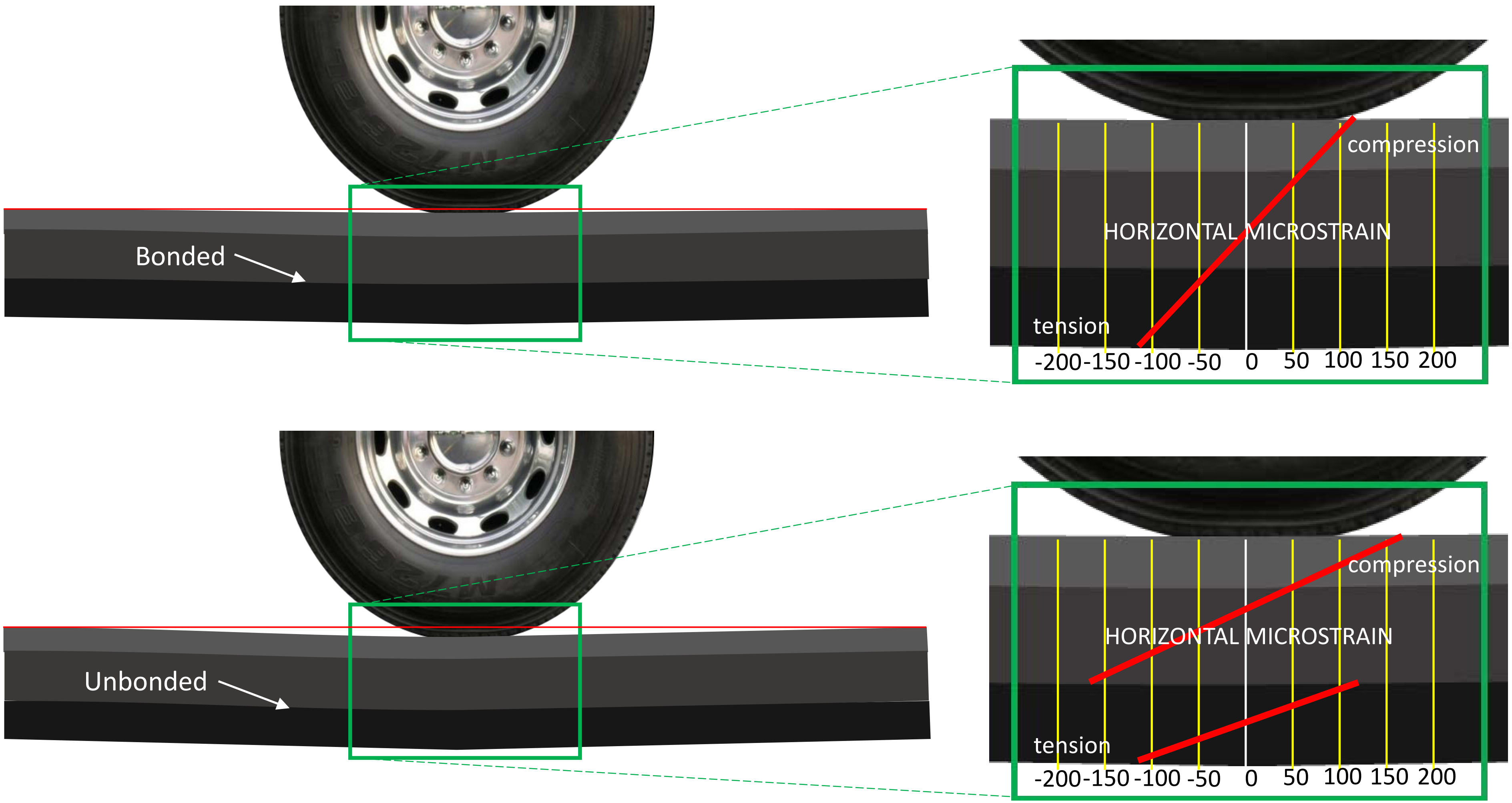
Tack Coat

Construction - Section 1

Pavement Behavior



Consequences of Debonding



Courtesy of NCAT

Proper Tack Coat

Surface Type	Residual Rate (gsy)	Appx. Bar Rate Undiluted* (gsy)	Appx. Bar Rate Diluted 1:1* (gsy)
New Asphalt	0.020 – 0.045	0.030 – 0.065	0.060 – 0.130
Existing Asphalt	0.040 – 0.070	0.060 – 0.105	0.120 – 0.210
Milled Surface	0.040 – 0.080	0.060 – 0.120	0.120 – 0.240
Portland Cement Concrete	0.030 – 0.050	0.045 – 0.075	0.090 – 0.150

Longitudinal Joints

Construction - Section 2

Longitudinal Joints

Core #2 (No Overlap)

Core #7 (No Overlap)

Core #9 (Overlap 1 ½")

Core #10 (Overlap 1 ½")

Bridenbaugh & Colella

Ski Best for Smoothness

(reference is average over length of ski)

Versus Joint Matcher, which is best for joint (reference is exact location just in front of auger)

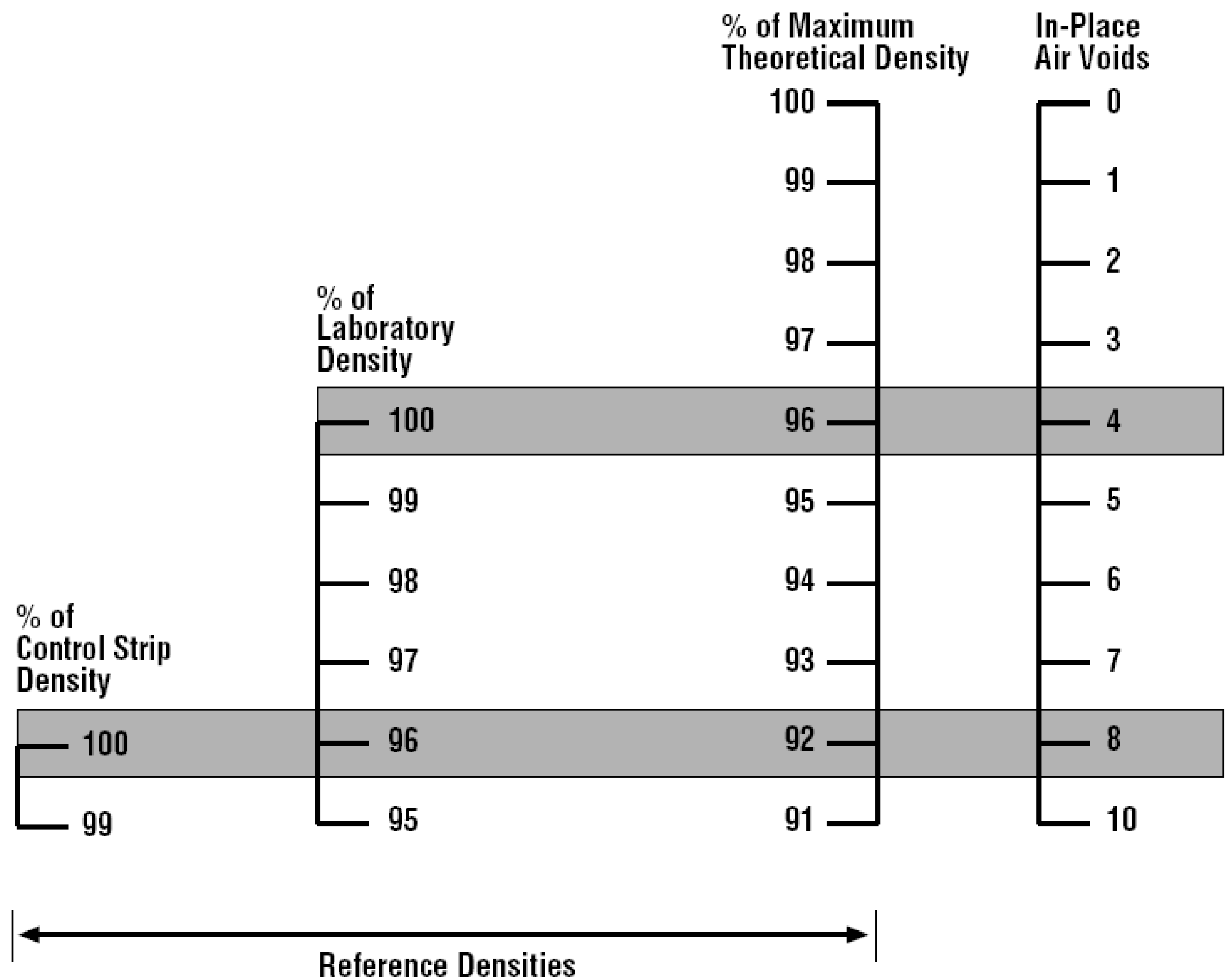
Note: If underlying pavement already smooth, some contractors feel they can get good joint with ski, but must finish 1/10” high


Destined for Failure
Likely that the hot side of joint was starved of material at these locations and bridging occurred.

Density

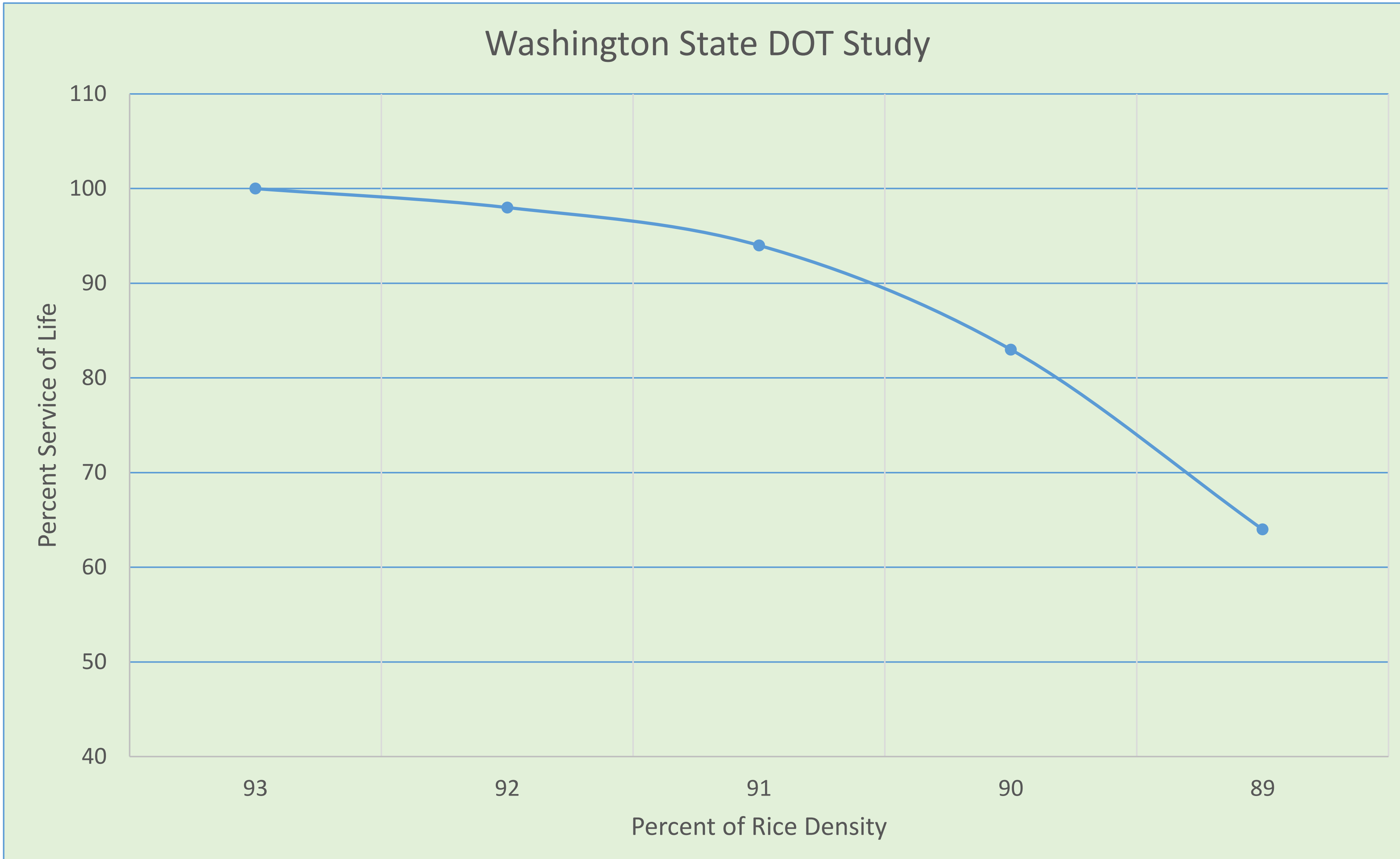
Construction - Section 3

Reference Densities

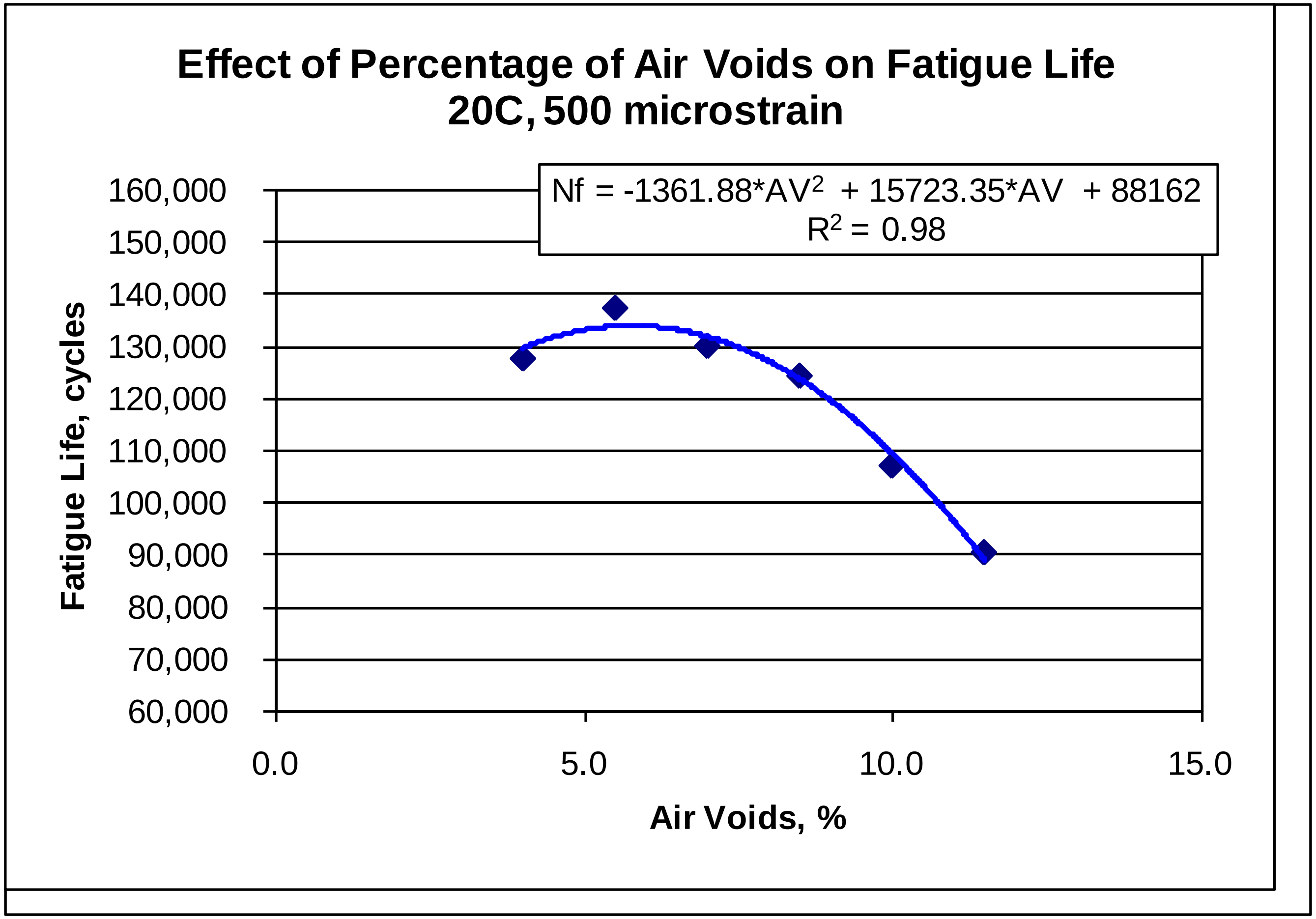


Reference MS-22, Fig. 7.09

Density vs. Loss of Pavement Service Life



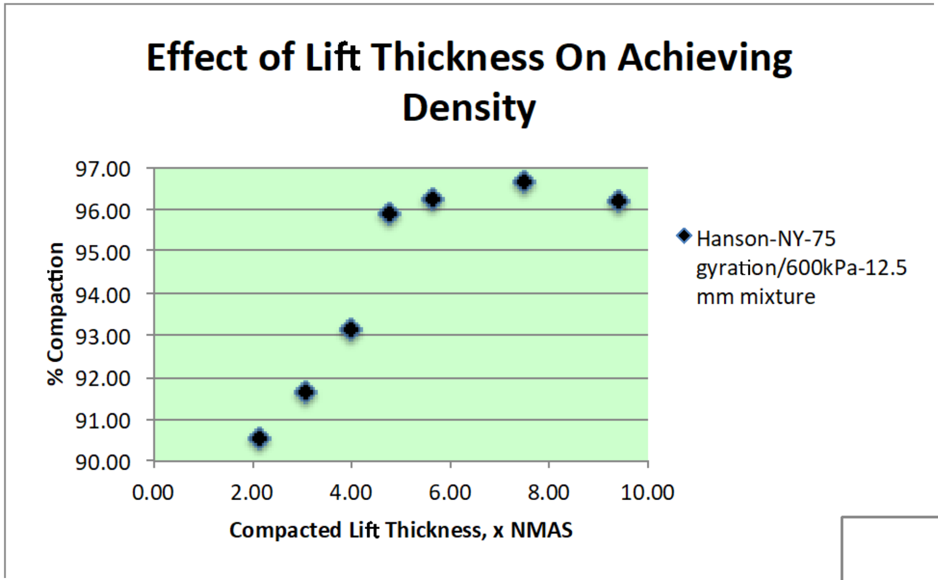
In-Place Voids vs Fatigue Life

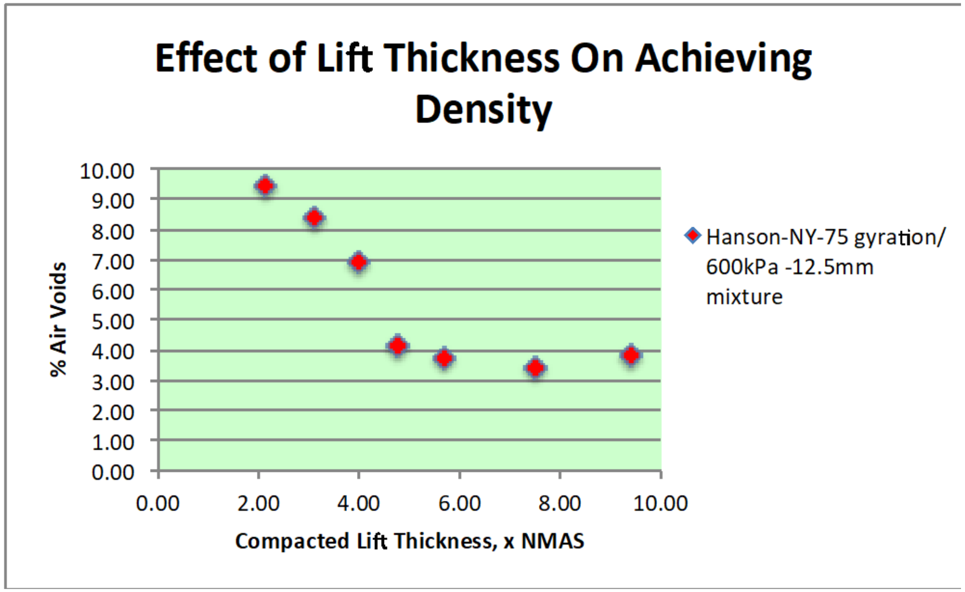


UK-AI Study

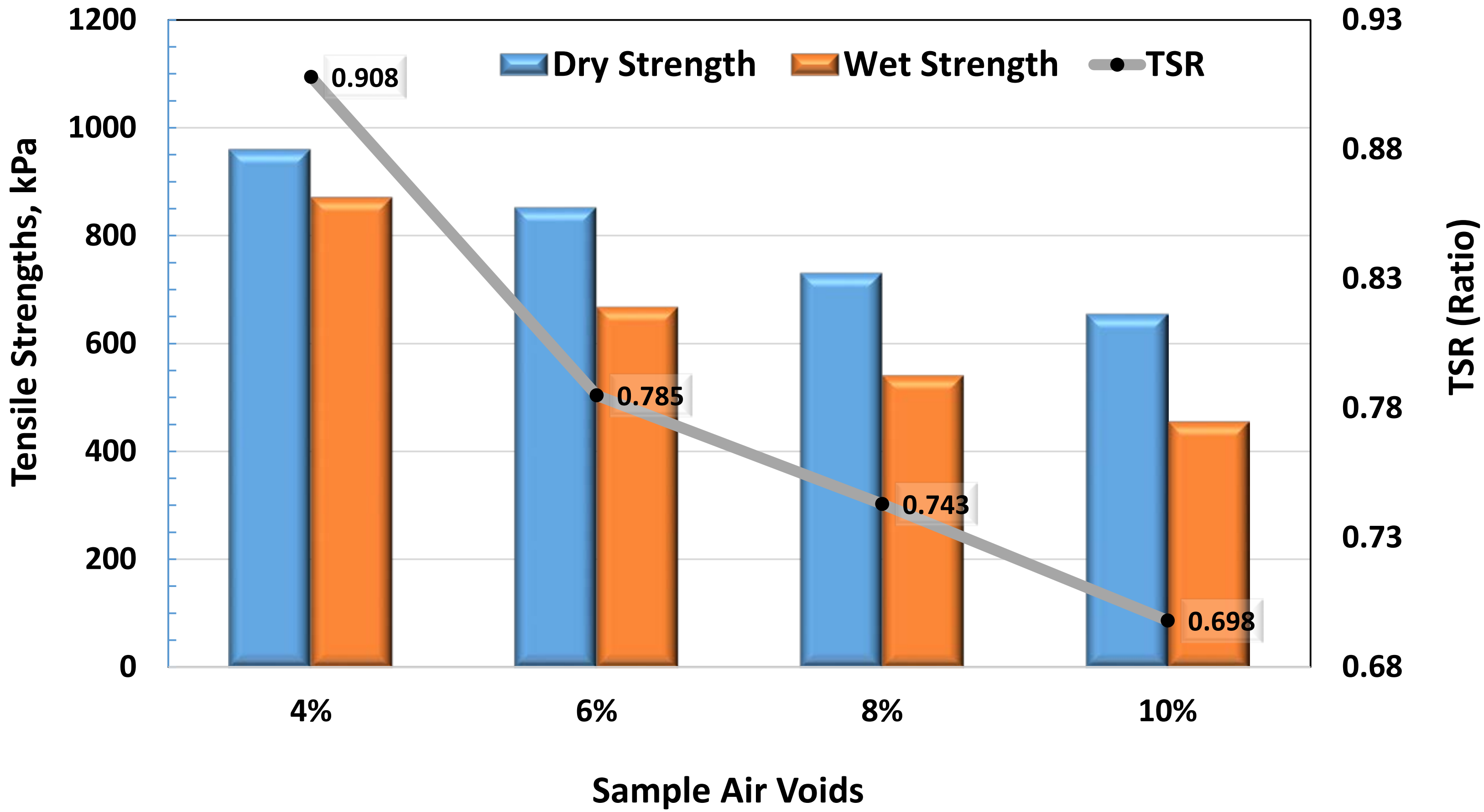
1.5% increase in density leads to 10% increase in fatigue life.

Density vs. Lift Thickness





Tensile Strength & Moisture Susceptibility vs. Air Voids
AASHTO T 283



FHWA Performance Based Mix Design

	Fatigue Cracking	Rutting
Design Air Voids For every 1% increase	40% increase	22% decrease
Design VMA For every 1% increase	73% decrease	32% increase
Compaction Density For every 1% lower in-place Air Voids **(Increasing Density Improved Both!)**	19% decrease	10% decrease

Courtesy of Nelson Gibson

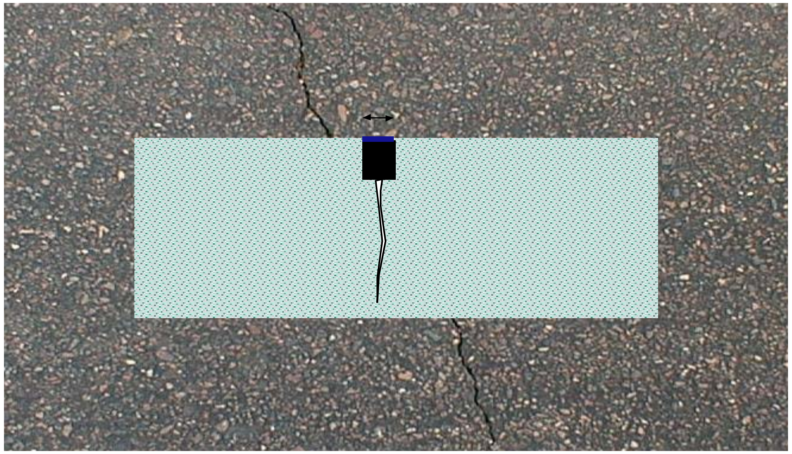
Maintenance

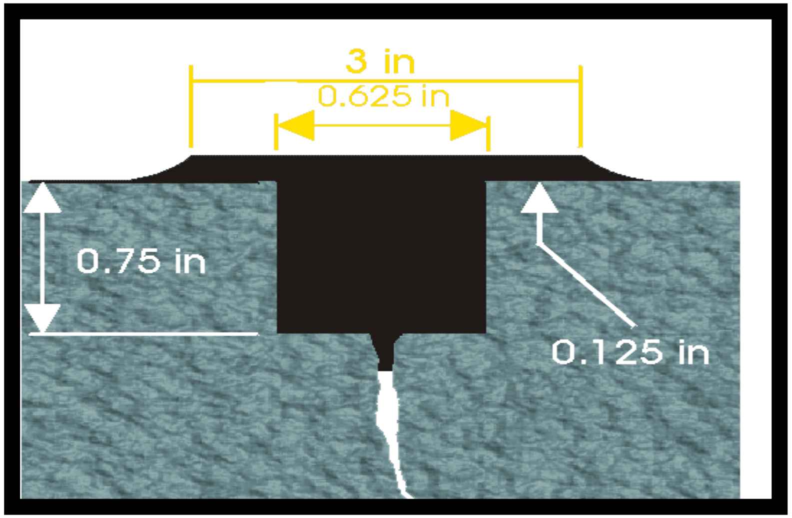
Crack Sealing & Surface Treatments


Think permeability .....
Photo: Wes McNett

Crack Sealing

Crack Sealing





Surface Treatments

Minnesota Research

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Minnesota Department of Transportation

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Optimal Timing of Preventive Maintenance for Addressing Environmental Aging in Hot-Mix Asphalt Pavements

R. Michael Anderson, Principal Investigator
Asphalt Institute, Inc.
Lexington, KY

December 2014

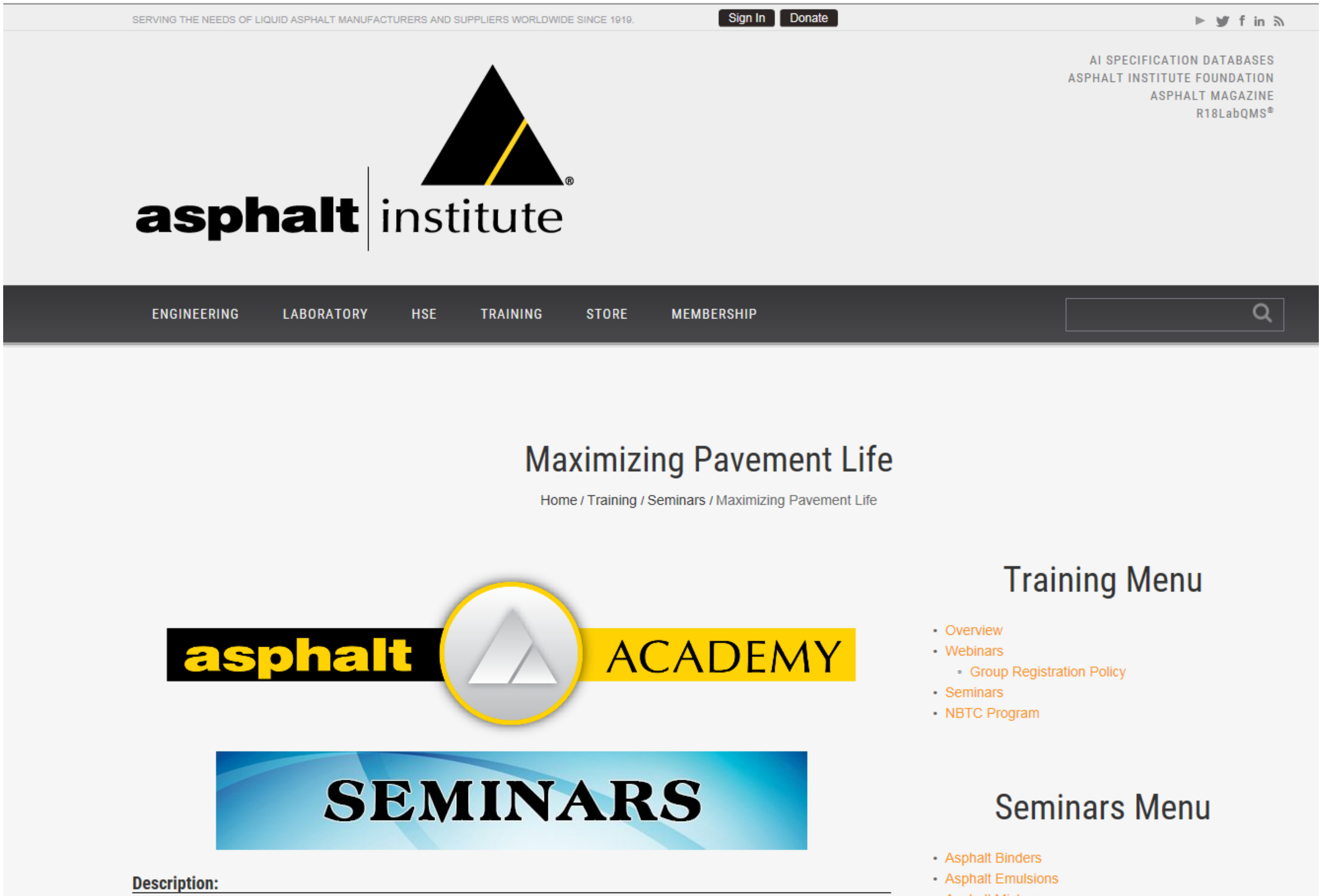
Research Project
Final Report 2014-45

Office of Transportation System Management

LRRB
LOCAL ROAD RESEARCH BOARD

The TH 56 test section confirmed the hypothesis, with mixture testing indicating that the subsections with chip seals applied more than two years after construction had essentially the same fracture energy properties as the unsealed control subsection. The findings from this test section imply that to mitigate damage from environmental aging, the initial treatment from a preservation standpoint should occur within the first two years of the pavement's life. After that, while some benefits may still be obtained from treatment, it appears that the damage from environmental aging may have already substantially occurred.

New 2-day Workshop in 2019



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Thank you for your attention

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Discussion/Questions?