WAPA

WISCONSIN ASPHALT PAVEMENT ASSOCIATION

66th Annual Conference and Business Meeting

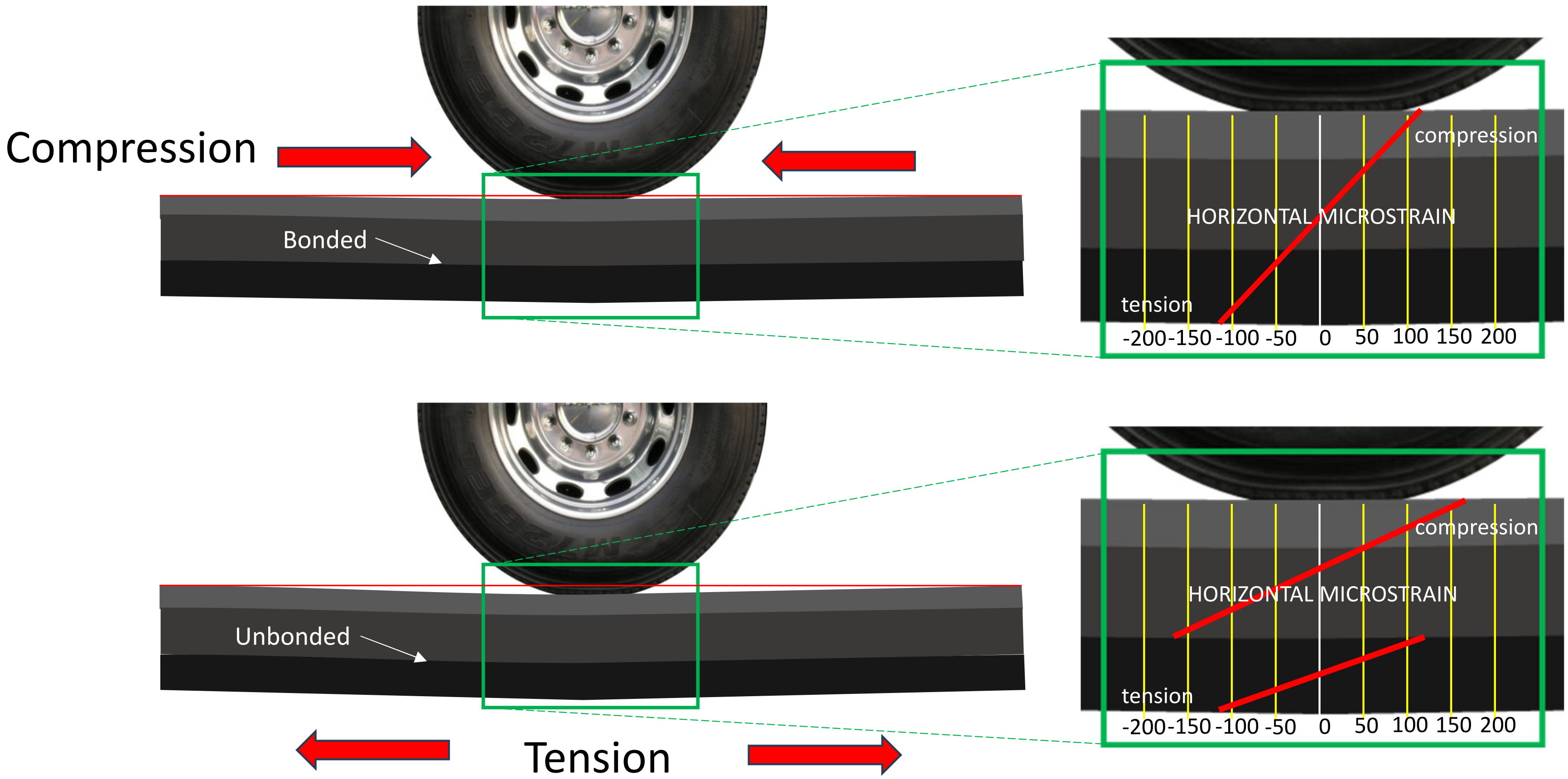
Asphalt Myths Debunked

Mark D. Blow, P.E.
Asphalt Institute

Contact Info

Myth #1 Tack is overrated

Consequences of Debonding



Courtesy of NCAT

Consequences of Poor Bonding

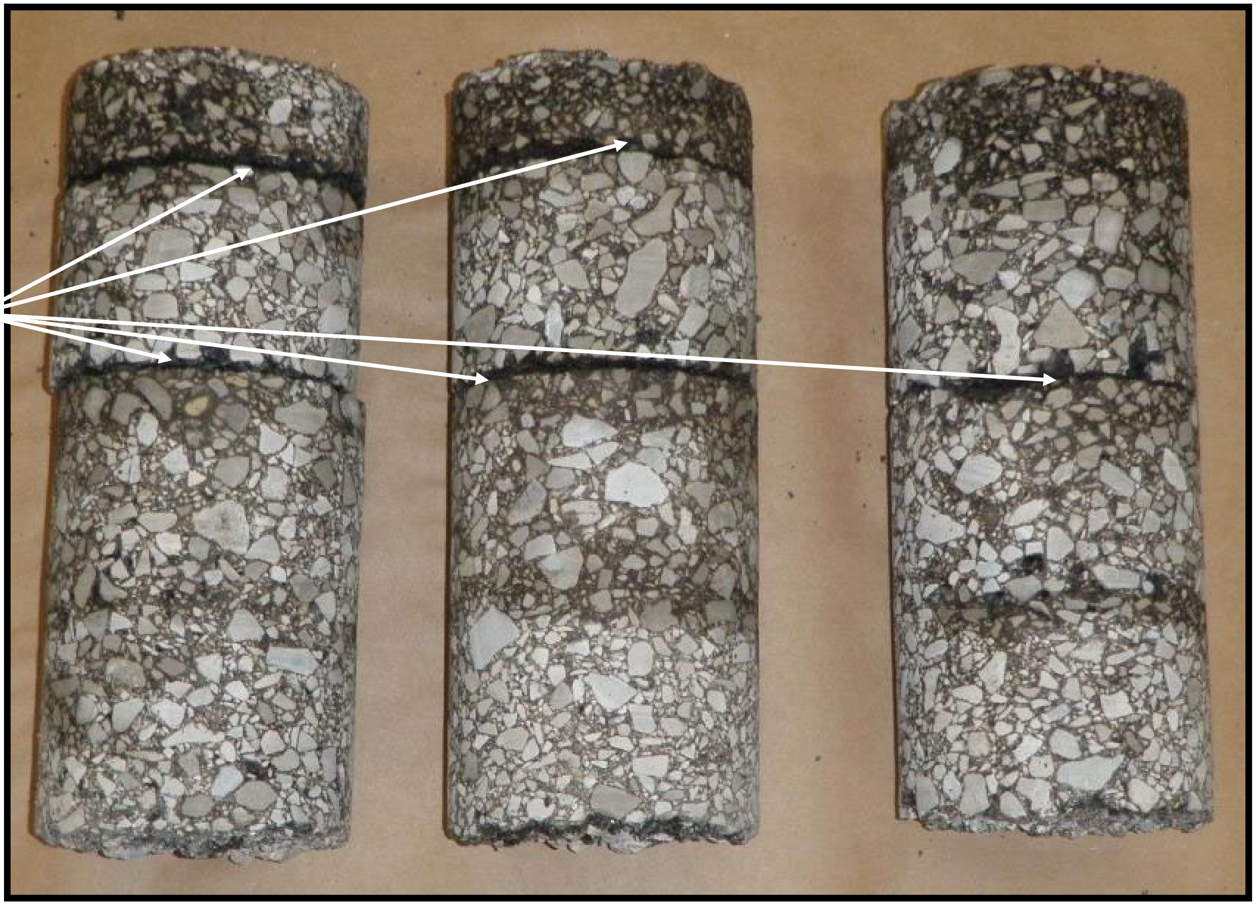
- Layer independence
  - Reduced fatigue life
  - Increased rutting
  - Slippage
  - Shoving
- Compaction difficulty

Direction of traffic?

8–10 years est. Interstate Pavement (I-70)

Cores Showing Debonding

Bonding
Failures



Successful Tack Coat

The Ultimate Goal:

Uniform, complete, and adequate coverage

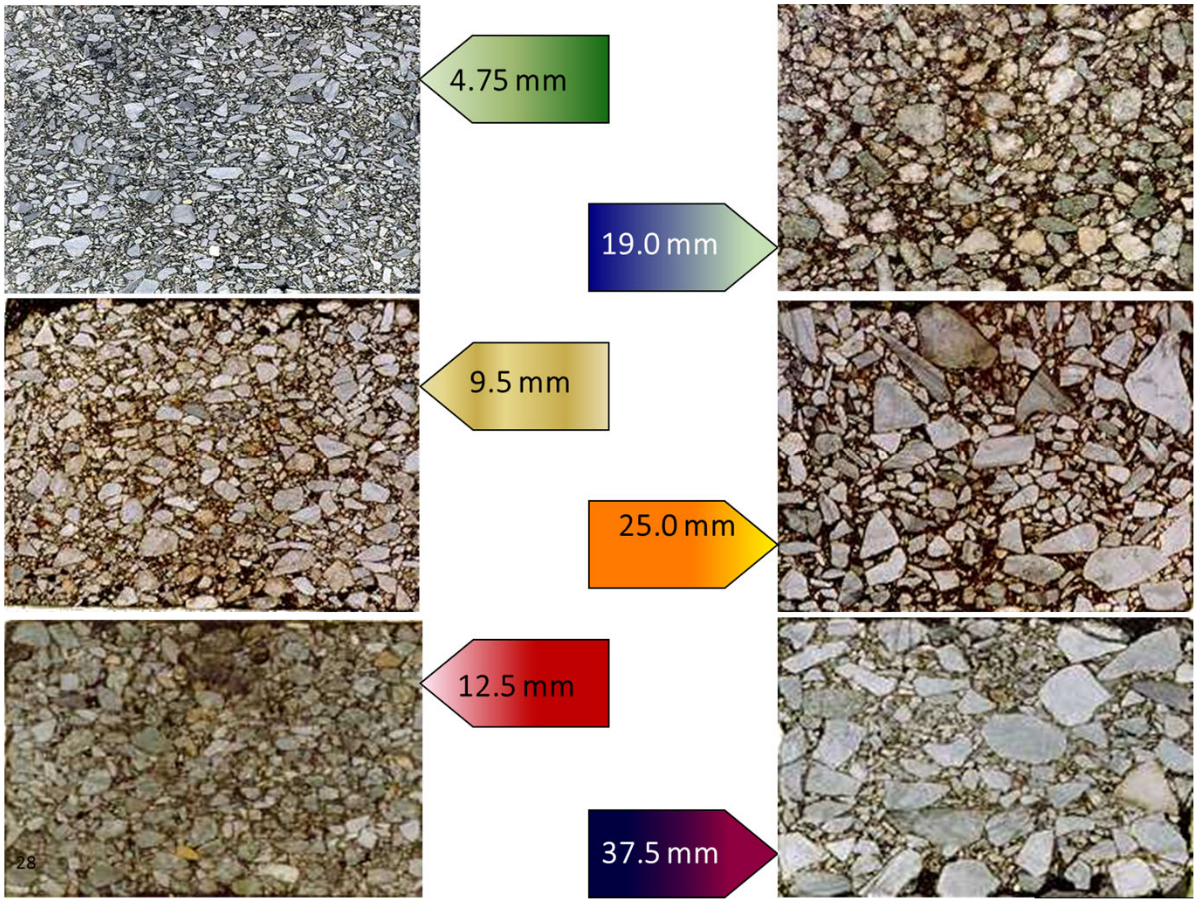
Myth #2 – Large Stone Mix is Stronger

NMAS definition

Nominal Maximum Aggregate Size

One sieve size larger than the first sieve to retain (cumulative) more than 10%

Mixture Aggregate Sizes



NCAT Test Track 1st Cycle

Coarse, intermediate, and fine gradations.

No differences in rutting performance!

Courtesy of NCAT

Aggregate Size vs. Strength

Mixture Facts:

- Larger Aggregate Size ≠ Increased Strength
- Higher coarse aggregate = lower asphalt content
- Finer aggregate mixtures are less permeable, more compactible and more durable

Mixture Strength is determined by:

- Aggregate shape, strength and texture
- Binder type and quantity
- Field placement and compaction

Mix Type

NMAS grading is different than older "Topsize" Grading

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

NMAS - Minimum compacted thickness

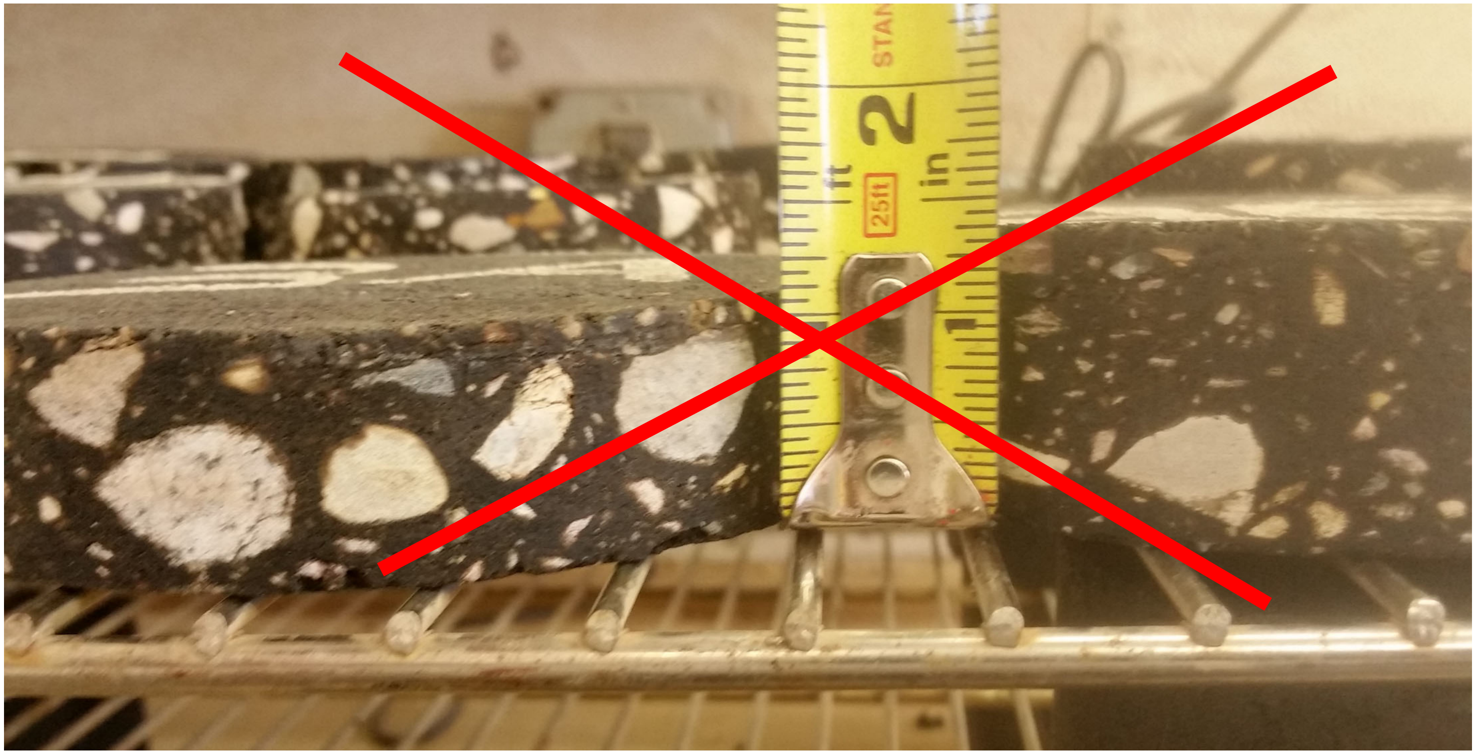
✓4 times nominal aggregate size

✓3 times nominal aggregate size for fine graded mixtures

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

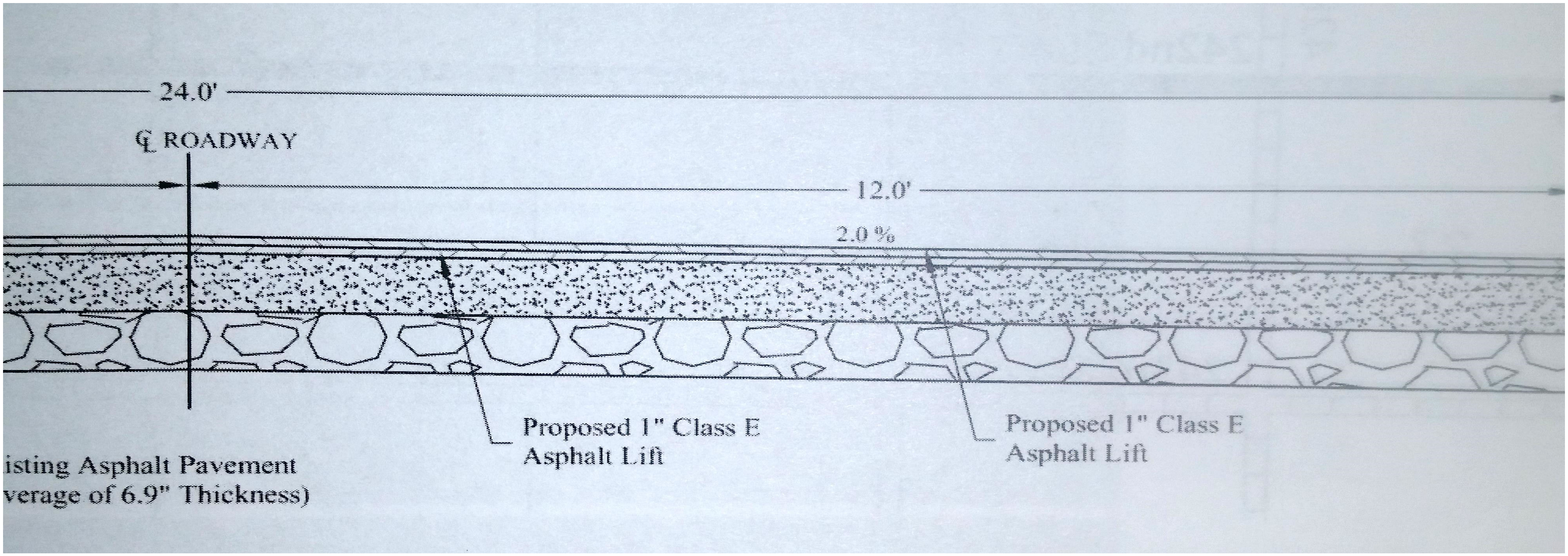
Myth #3 – Thin lifts are easier to compact

Lift Thickness



Thin lift overlays require finer mixture types!!

Lift Thickness



Improved Density

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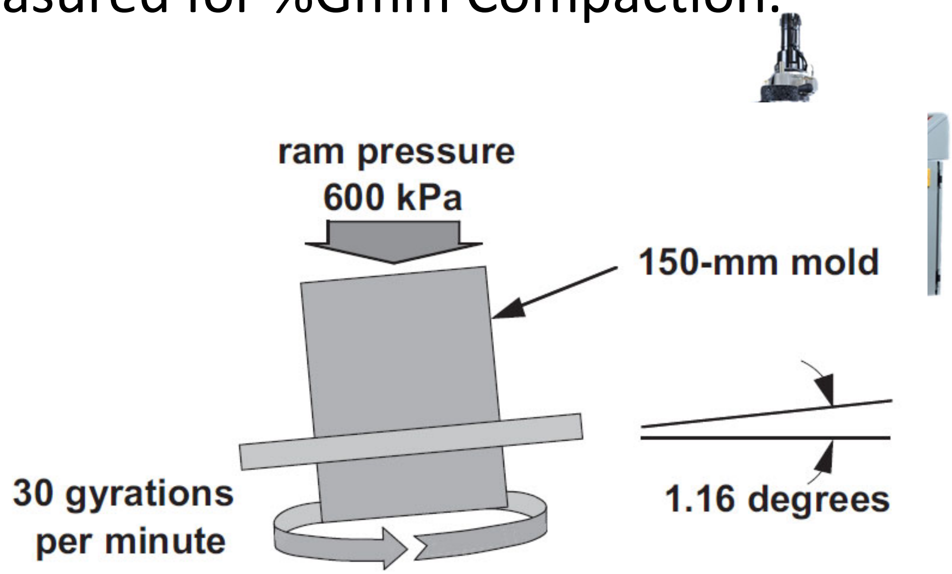
Why are thicker lifts easier to compact?

- Slower paver speed.
- Mix cools slower, providing longer compaction time.
- More room to manipulate the mix into a denser mass.

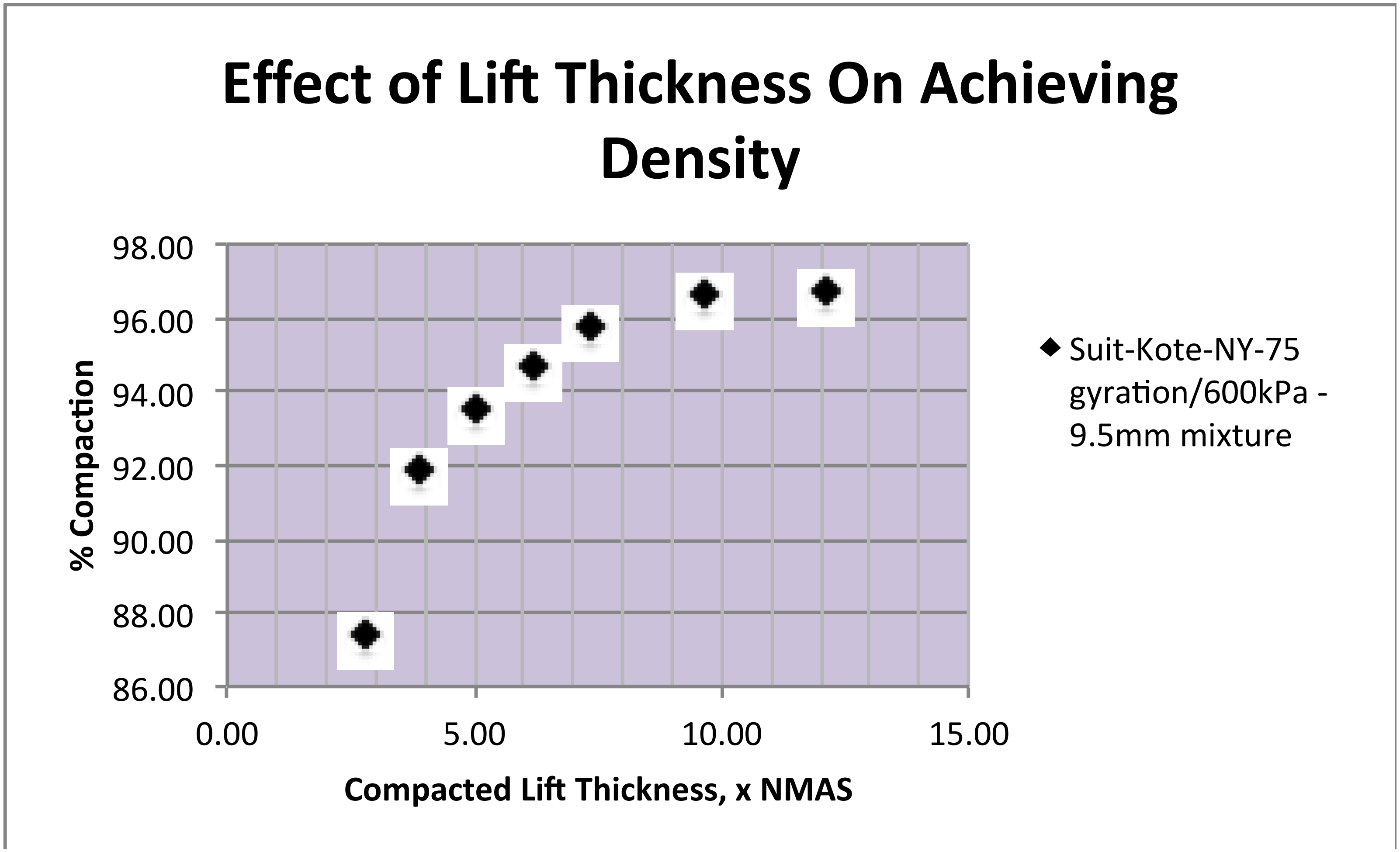
1 " T	13' W	350 Tph	83 fpm
3 " T	13' W	350 Tph	28 fpm

Lab Testing Lift Thickness in a SGC

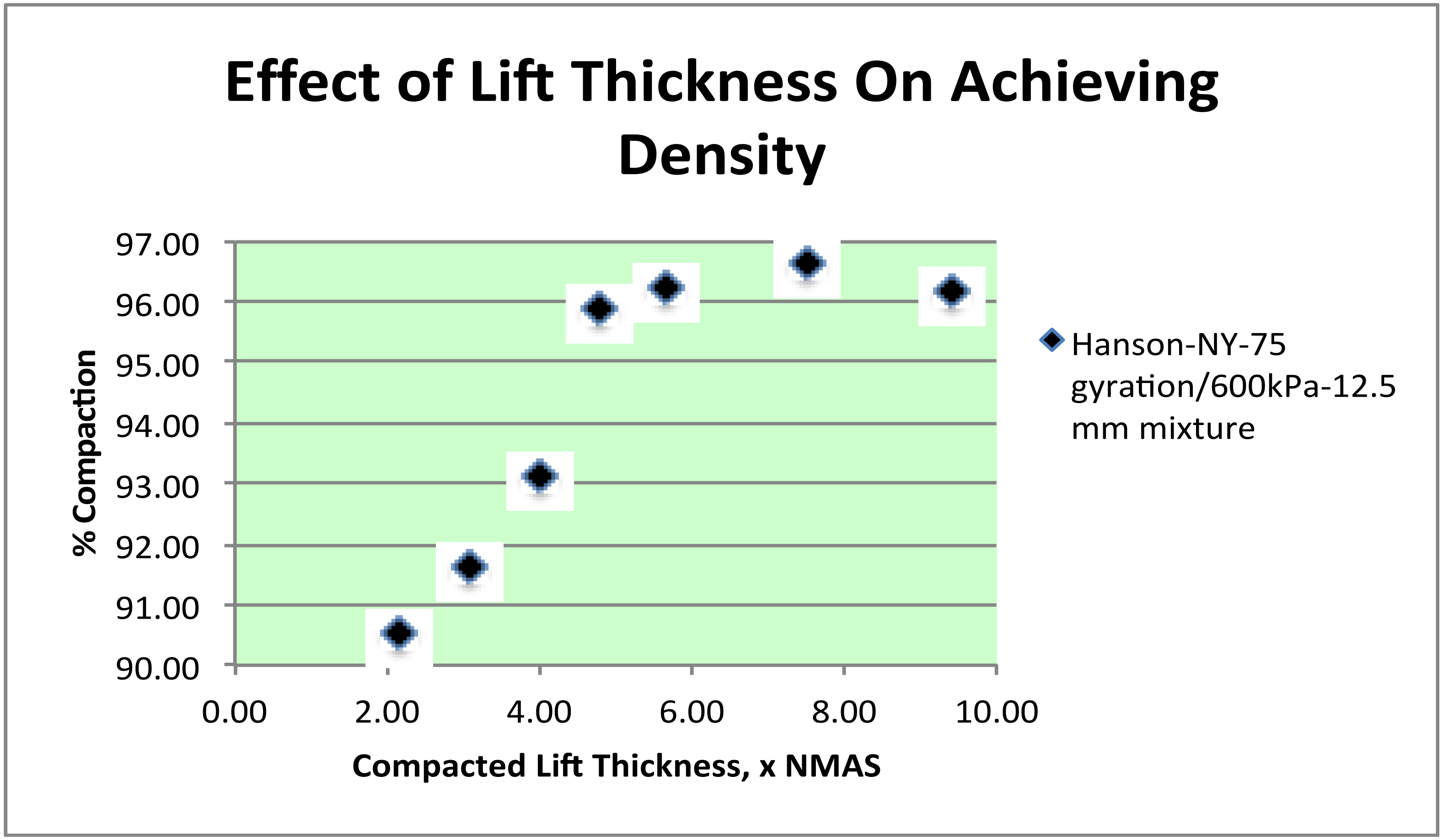
Two different mixtures were tested in a Superpave Gyratory Compactor at different thicknesses and measured for %Gmm Compaction.



9.5 mm crushed gravel @ 75 gyrations



12.5 mm Limestone mix @ 75 gyrations



Myth #4 - PMA is Too Expensive!

“Rule of 92”

PG 64 - 34 => 64 - - 34 = 98

Probably modified

Depends on asphalt source

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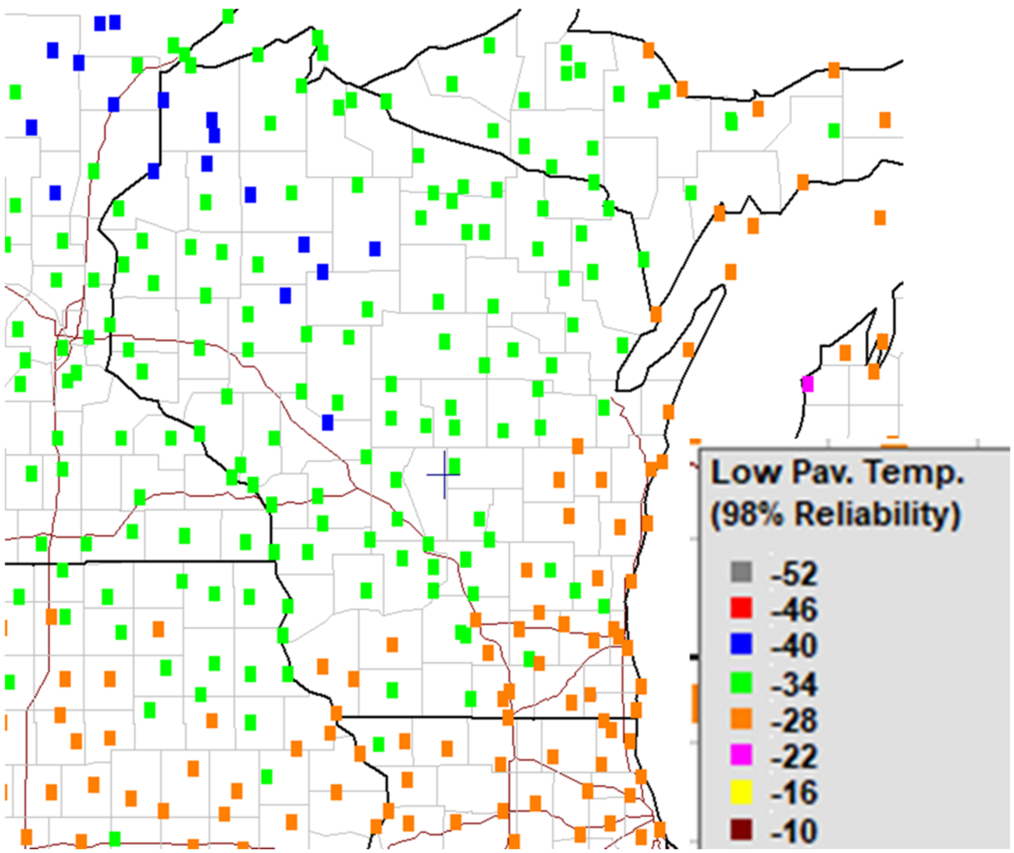
National Binder Technician Certification PROGRAM

Performance Grades (AASHTO M320)

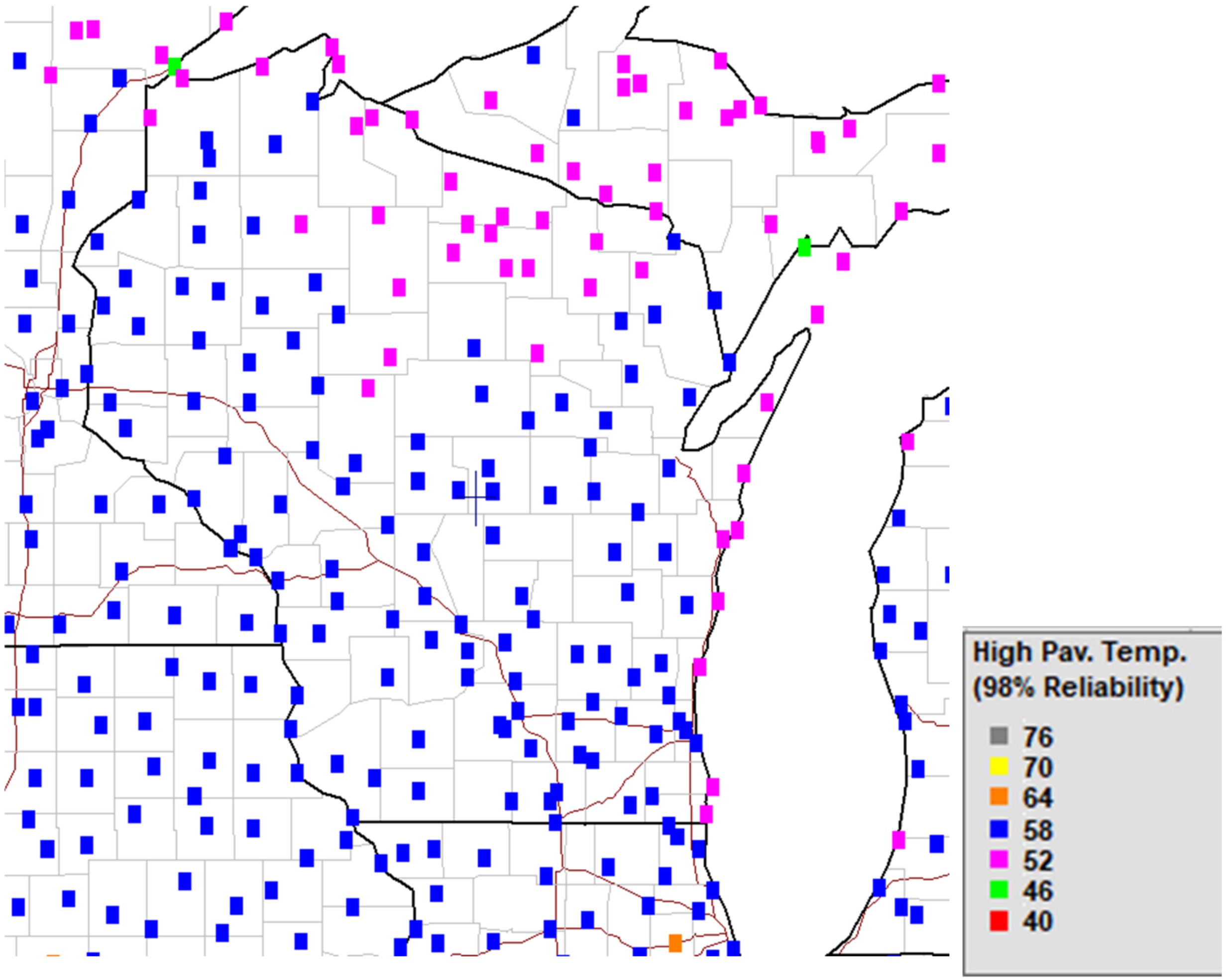
High PG	PG 52							PG 58					PG 64						PG 70						PG 76				
Low PG	-10	-16	-22	-28	-34	-40	-46	-16	-22	-28	-34	-40	-10	-16	-22	-28	-34	-40	-10	-16	-22	-28	-34	-40	-10	-16	-22	-28	-34
Original																													
≥230 °C	**Flash Point,** AASHTO T 48																												
≤ 3 Pa-s	**Rotational Viscosity** @ 135° C, AASHTO T 316																												
≥ 1.00 kPa	**DSR G*/sin** δ (Dynamic Shear Rheometer), AASHTO T 315																												
	52							58					64						70						76				
RTFO (Rolling Thin Film Oven), AASHTO T 240																													
≤ 1.00%	**Mass Change**																												
≥ 2.20 kPa	**DSR G*/sin** δ (Dynamic Shear Rheometer), AASHTO T 315																												
	52							58					64						70						76				
PAV (Pressure Aging Vessel), AASHTO R28																													
	90							100					100						100(110)						100(110)				
≤ 5000 kPa	**DSR G*sin** δ (Dynamic Shear Rheometer), AASHTO T 315 — Intermediate Temp. = [(High PG + Low PG)/2] + 4																												
	25	22	19	16	13	10	7	25	22	19	16	13	31	28	25	22	19	16	34	31	28	25	22	19	37	34	31	28	25
S ≤ 300 MPa m ≥ 0.300	**BBR S (creep stiffness) & m-value** (Bending Beam Rheometer), AASHTO T 313																												
	0	-6	-12	-18	-24	-30	-36	-6	-12	-18	-24	-30	0	-6	-12	-18	-24	-30	0	-6	-12	-18	-24	-30	0	-6	-12	-18	-24

- If BBR m-value ≥ 0.300 and creep stiffness is between 300 and 600, the Direct Tension failure strain requirement of ≥ 1.00% can be used in lieu of the creep stiffness requirement.
- Binder shall be homogeneous, free from water, contain no deleterious materials, be at least 99.0% soluble and contain no particles larger than 250 µm.

1992 Recommended LT Grades



1992 Recommended HT Grades



Download
LTPPBind 3.1

There are multiple polymer grades

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PROGRAM

Performance Grades (AASHTO M320)

High PG	PG 52	PG 58	PG 64	PG 70	PG 76
Low PG	-10 -16 -22 -28 -34 -40 -46	-16 -22 -28 -34 -40	-10 -16 -22 -28 -34 -40	-10 -16 -22 -28 -34 -40	-10 -16 -22 -28 -34

Original

≥230 °C	**Flash Point,** AASHTO T 48				
≤ 3 Pa-s	**Rotational Viscosity** @ 135° C, AASHTO T 316				
≥ 1.00 kPa	**DSR G*/sin** δ (Dynamic Shear Rheometer), AASHTO T 315				
	52	58	64	70	76

RTFO (Rolling Thin Film Oven), AASHTO T 240

Wisconsin Binder Grade Map

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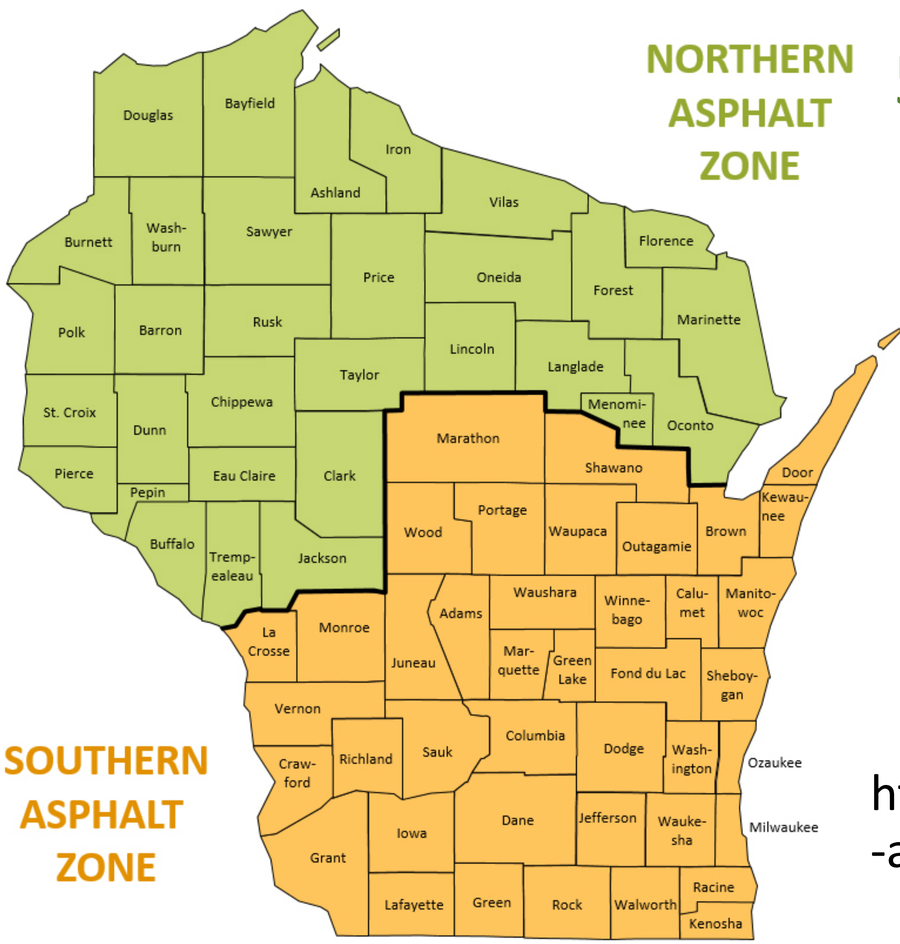
NORTHERN ASPHALT ZONE

58-34(x)



58-28(x)

SOUTHERN ASPHALT ZONE

https://www.wispave.org/wisconsin-asphalt-bid-mix-specification-tool/

Quantifying the Effects of PMA

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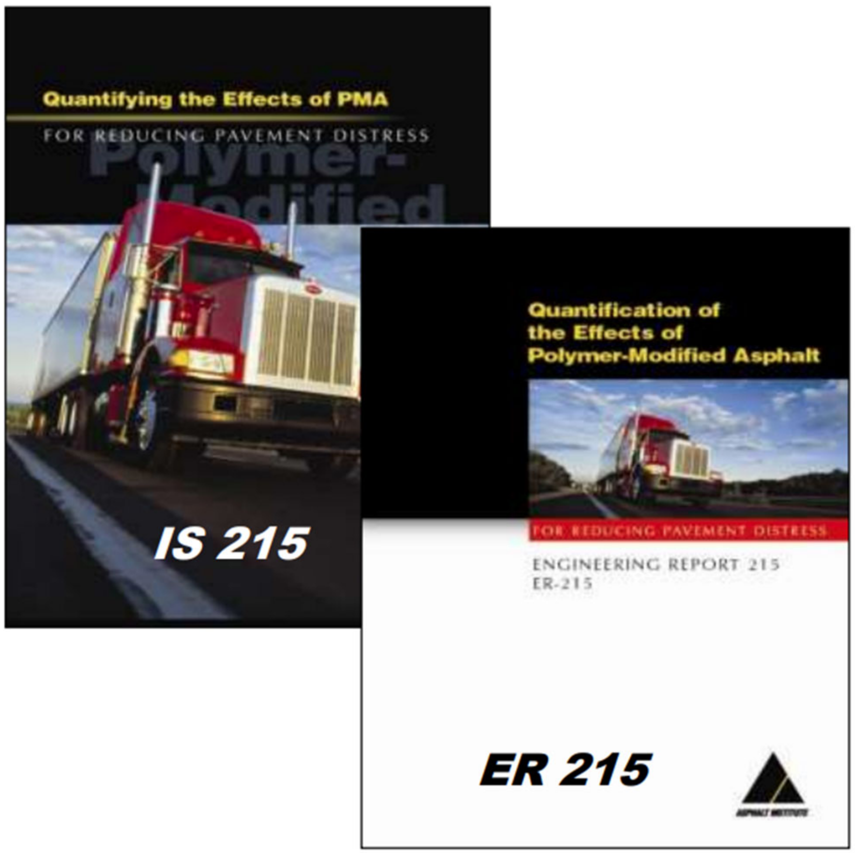

This study (published in Feb 2005) used national field data to determine enhanced service life of pavements containing polymer modified binders versus conventional binders. The data is from a variety of climates and traffic volumes within North America.

IS-215 Survey of 49 States

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Table 1. Summary of Reasons Why Agencies Use PMA Mixtures

Reason for Using PMA Mix	Rutting	Thermal Cracking	Fatigue Cracking	Stripping, Moisture Damage	Durability	Raveling	Tenderness
Primary	58%	21%	0%	0%	0%	0%	0%
Secondary	37%	47%	0%	21%	47%	11%	11%
Total	95%	68%	0%	21%	47%	11%	11%

IS-215 LTPP Rut Depth Data

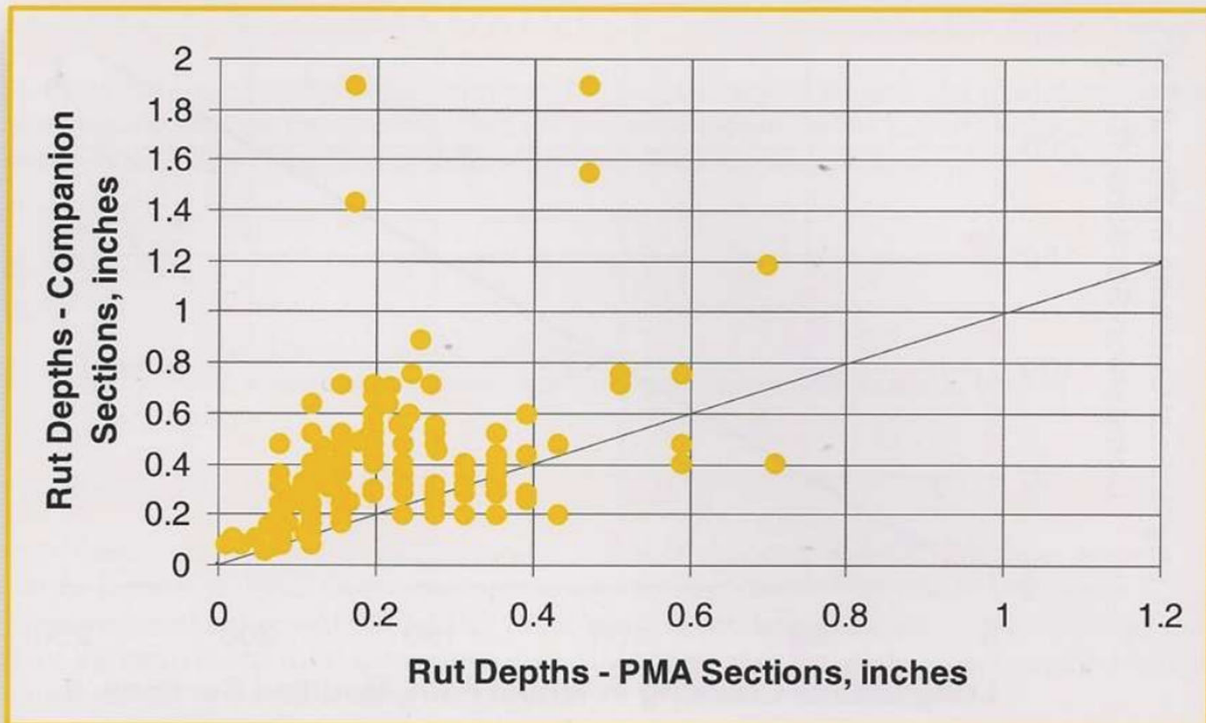

Figure 1 Graphical comparison of the rut depths measured on sections with PMA and the companion sections — those without PMA mixtures.

IS-215 LTPP Reflective Cracking Data

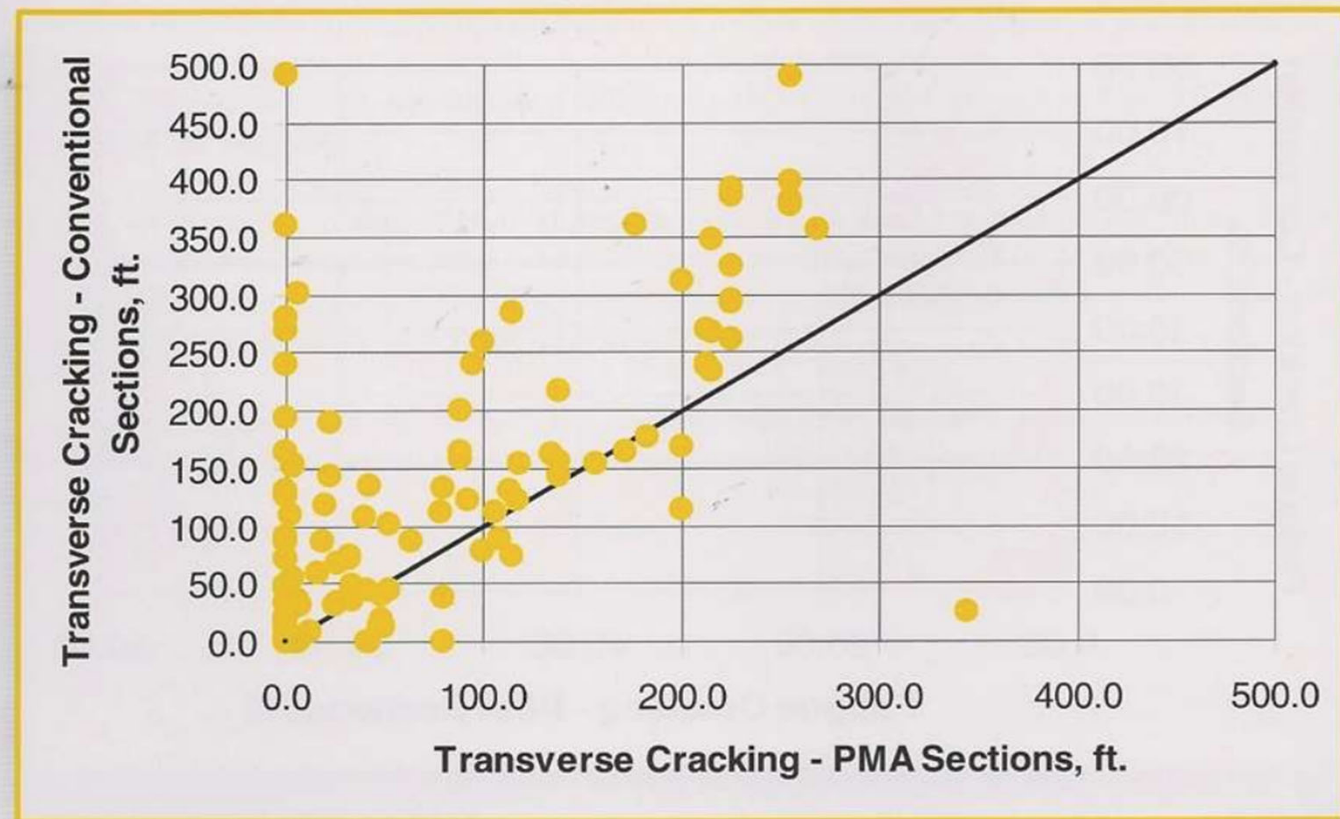

Figure 4 Graphical comparison of the length of transverse cracks measured on sections with PMA and the companion sections – those without PMA mixtures.

IS-215 LTPP Fatigue Cracking Data

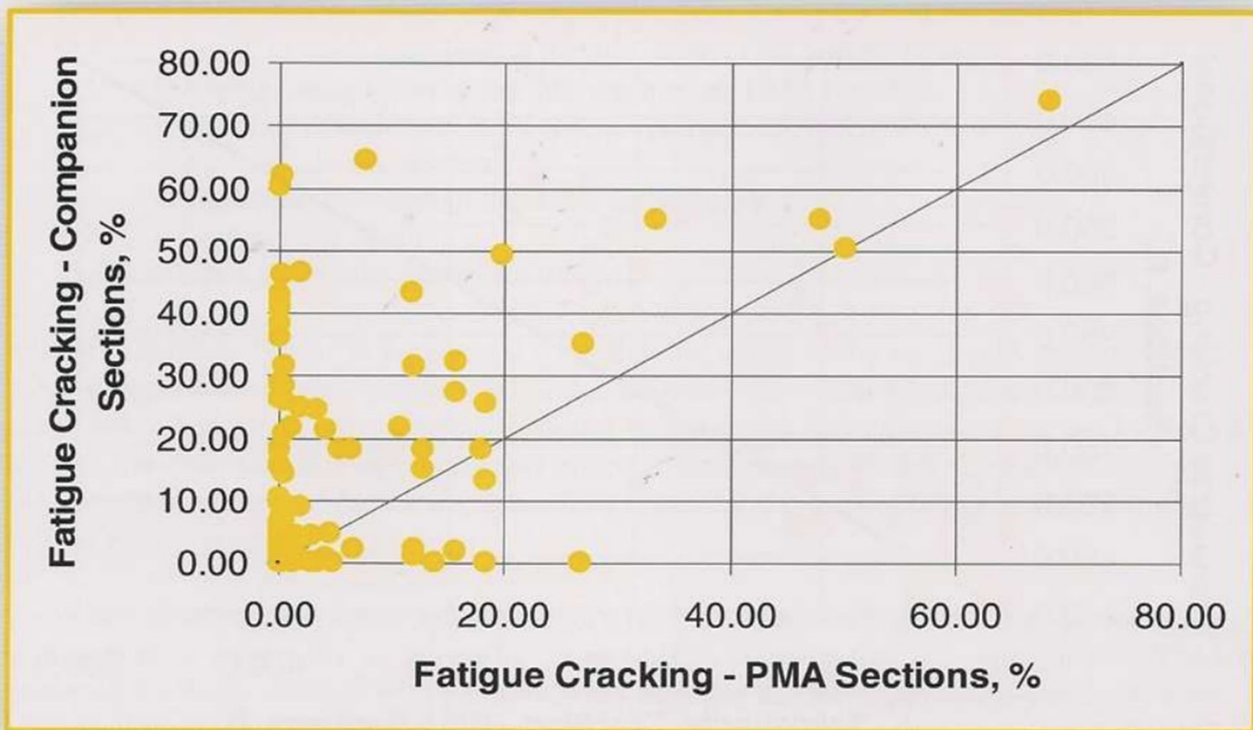

Figure 2 Graphical comparison of the fatigue cracking measured in percent wheel path area on sections with PMA and the companion sections – those without PMA mixtures.

<u>Summary</u> of Expected Increase in Service Life, Years, Based on M-E Damage Based Analysis

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Assumptions: Unmodified sections designed for 20 yr. life. Also, PMA in top 4 inches.

Site Factor	Condition Description		Added Life
Foundation	Non-expansive, coarse soils		5-10
	Expansive and plastic soils (PI>35)		2-5
	Frost Susceptible in cold climate		2-5
Water Table & Drainage	Deep		5-10
	Shallow; adequate		5-8
	Shallow; inadequate		0-2
Existing Pavement Condition	HMA	Good	5-10
		Poor-extensive cracking	1-3
	PCC	Good	3-6
		Poor-faulting & cracking	0-2

Expected Increase in Service Life, Yrs

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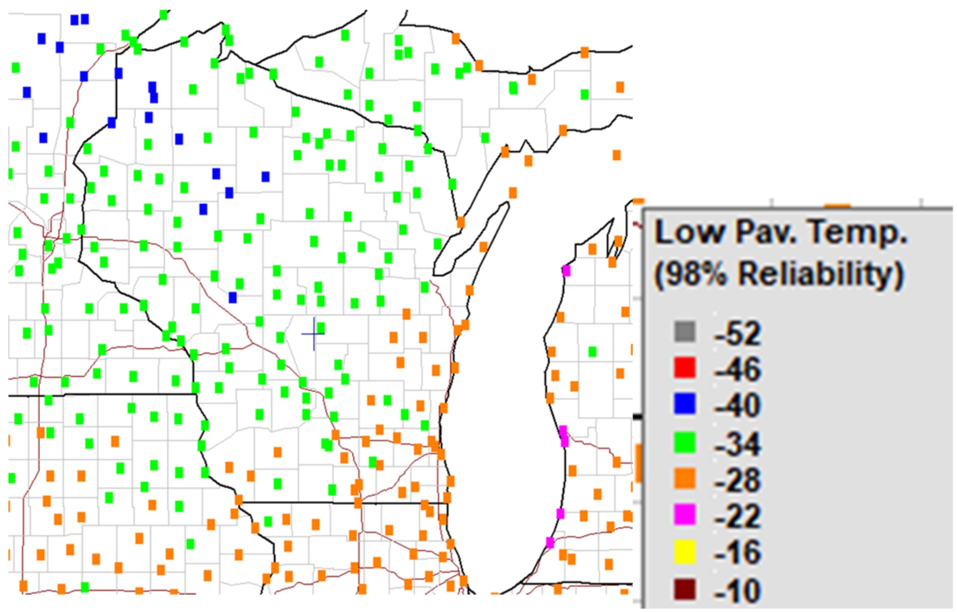
Assumptions: Unmodified sections designed for 20 yr. life. Also, PMA in top 4 inches.

Site Factor	Condition Description		Added Life
Climate; Temp. Fluctuations	Hot	Hot Extremes	5-10
	Mild		2-5
	Cold	Cold Extremes	3-6
Traffic, Truck Volumes	Low	Intersections	5-10
		Thoroughfares	3-6
		Heavy Loads	5-10
	Moderate		5-10
	High		5-10

Recommendation for New Construction

- Use -34 binders to prevent thermal cracking!
- 30+ year old design recommendations.



LTPPBind v3.1
https://infopave.fhwa.dot.gov/Page/Index/LTPP_BIND

Additional Benefits

Consider high performance binders on overlays

- Reduced rutting
- Reduced cracking
- Better crack seal performance
- Maintain existing crack resistance

  Example - Do not place an overlay with -22 binder on a pavement built with a -34 binder.

Better Joint Performance

Interstate Saw and Seal

- Orig. 1962 PCC
- 1999 - 3" HMA
- 2004 – 1.5" SMA
  - ✓PG 70-28
- 2004 – Saw/Seal
- 2009 – Sealed secondary cracks
- Photo taken in 2018

But what does it cost?

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2016 DOT Ave. Unit Bid Prices

Description		Unit	Total Quantity	Average Bid Price
PG 58-28	Asphalt Binder	Ton	15,547.30	$433.74
PG 58-34	Asphalt Binder	Ton	125,661.00	$485.86
PG 64-22	Asphalt Binder	Ton	519.60	$470.63
PG 64-28	Asphalt Binder	Ton	182,175.80	$457.38
PG 64-34	Asphalt Binder	Ton	61,502.20	$499.15

Highest to Lowest Difference = $65.41/ binder ton

@ 6% Binder = $3.92 / ton of mix

Simple County overlay

10 mile overlay, No milling

Original Contract Amount	$ 1,500,814.57
1,575.5 contract binder Tons @ $462.07/ton	$ 727,991.29
1,575.5 Tons X $65.41 per ton increase	$ 103,053.46
Increase in Project Cost	6.87%

Years needed to recover additional 6.9% expenditure		
10 year assumed life	0.69	years
20 year assumed life	1.374	years

Complicated Interstate overlay

20 + mile overlay, extensive traffic control, underdrains, etc.

Original Contract Amount	$ 22,565,024.00
12,976.4 contract binder Tons @ $425.78/ton	$ 5,525,138.00
12,976.4 Tons X $65.41 per ton increase	$ 848,786.32
Increase in Project Cost	3.76%

Years needed to recover additional 3.8% expenditure		
10 year assumed life	0.38	years
20 year assumed life	0.75	years

Small Town Urban / Grading

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1 mile 3-Lane, grading, C&G, sidewalks, lighting and new asphalt surface

Original Contract Amount	$3,521,707.00
9518.5 Ton recycled mix bid @ 4.7% binder	
447.7 contract binder Tons @ $730.00/ton	$326,821.00
571.1 (6%) virgin binder Tons X $795.41 per ton	$454,258.70
Project Binder cost increase	$127,437.70
Increase in Project Cost	3.62%

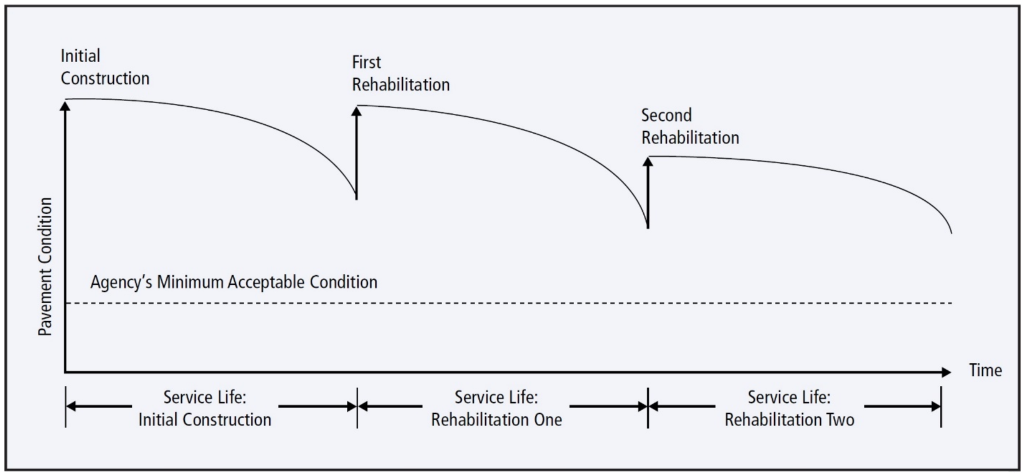
Years needed to recover additional 3.62% expenditure		
10 year assumed life	0.36	years
20 year assumed life	0.72	years

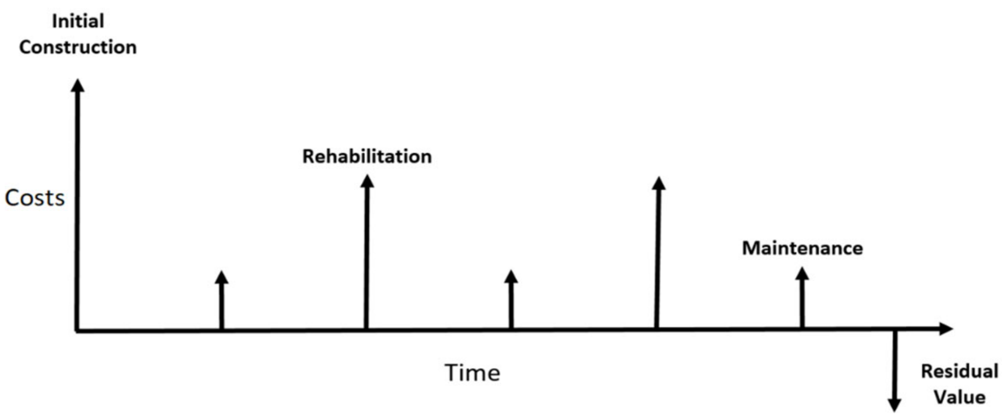
That Small Town Project Today

That Small Town Project Today

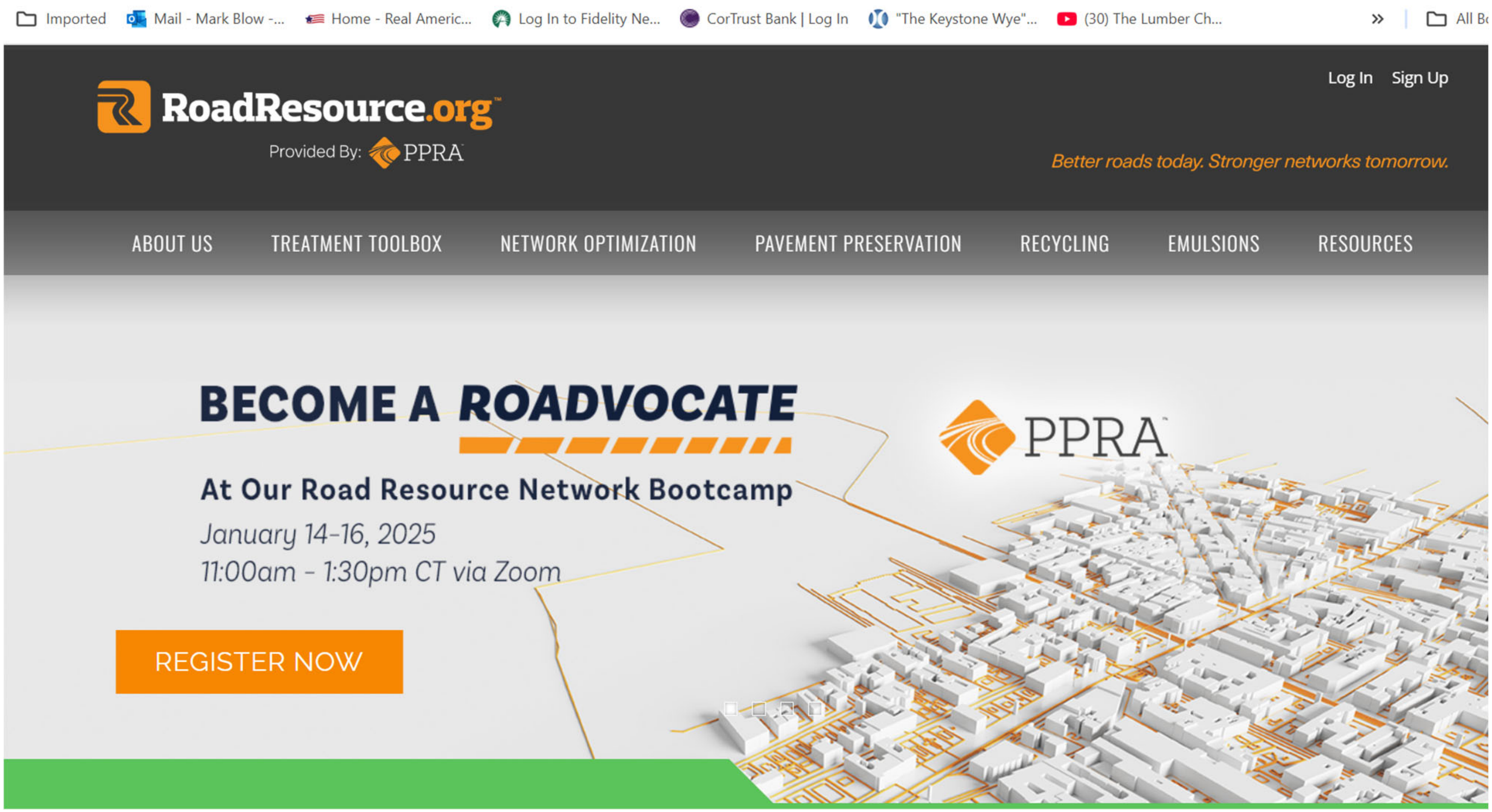
Pavement Management Sytems

PMS' are crucial to track pavement performance !!





RoadResource.org



Additional Educational Opportunities

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mdtc The Asphalt Institute Mix Design Technology Certification Program

pic The Asphalt Institute Paving Inspector Certification Series

nbtc The Asphalt Institute National Binder Technician Certification Program

netc The Asphalt Institute National Emulsion Technician Certification Program

AIRFIELD ASPHALT CERTIFICATION PROGRAM

APTW The Asphalt Institute Airport Pavement Technical Workshop

https://www.asphaltinstitute.org/training/seminars/

Thanks to our members

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Mark Blow
mblow@asphaltinstitute.org
605-351-8649

Contact Info

Thank You - Questions ?