

UTILIZING SHRP2 RENEWAL 26 TECHNOLOGIES:

**Preservation Approaches for High Traffic Volume
Roadways in the Northeast**



Northeast Asphalt User Producer Group Meeting
October 19th, 2016 • Newark, Delaware

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Research Team

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Strategic Highway Research Program 2 (SHRP2)

- Congress authorized SHRP2 under SAFETEA-LU
 - Follow-up to previous SHRP (1987)

- Four (4) Broad Areas of Emphasis
 1. Highway Safety
 2. **Renewal**
 3. Reliability
 4. Capacity

Strategic Highway Research Program 2 (SHRP2)

➤ Renewal Focus Area

“Develop design and construction methods that cause minimal disruption to the traveling public and produce long-lived facilities to renew the aging highway infrastructure”

➤ Product Addresses

Bridges, nondestructive testing techniques, **pavements**, project delivery, utilities, and railroads

Strategic Highway Research Program 2 (SHRP2) Renewal 26

R26 - Preservation Approaches for High Traffic Volume Roadways

- Assessed state-of-practice through survey and literature review
- Outlined factors influencing treatment selection (Performance & Construction)
- Outlined treatment selection process (matrices, etc.)

SHRP2 R26

Pavement Preservation For High Volume Roadways

➤ HMA Pavement Preservation Treatments

- Crack Filling
- Crack Sealing
- Microsurfacing
- Chip Seals
- **Ultra-thin Bonded Wearing Course (UTBO) x3**
- Thin HMA Overlay
- Cold milling and overlay
- Ultrathin HMA Overlay
- Hot In Place HMA recycling
- Cold In Place HMA recycling
- Profile Milling
- Ultra-thin Whitetopping

SHRP2 R26

Pavement Preservation For High Volume Roadways

Definition of UTBO

“Also known as an ultra-thin friction course, an ultra-thin bonded wearing course may be used as an alternative treatment to chip seals, microsurfacing, or thin HMA overlays. It consists of a gap-graded, polymer modified HMA layer (0.4 to 0.8 inch thick) placed on a tack coat (heavy, polymer-modified emulsified asphalt). It is effective at treating minor surface distresses and increasing surface friction.”

Treatment Selection Matrix

Treatment Code	Treatment Name
A C S	Asphalt Crack Seal
A R S	Asphalt Route and Seal
M S	Micro-surfacing
R C S	Rubber Chip Seal
P P S T	Paver Placed Surface Treatment
THIN	1/4" Thin Overlay
A R G G O	Asphalt Rubber Gap Graded Overlay
OGFCW	OGFC w/leveling
OGFCDB	OGFC w/ 2" dense binder
FUNCC	Functional Overlay with Saw and Seal
THICKC	Thick Overlay with Saw and Seal
FUNCA	Functional Overlay (mill 2" overlay 2")
STRUC	Structural Overlay (mill 2" overlay 4")
RECL	Full Depth Reclamation
RECN	Reconstruction

Index Value	Alligator				Transverse					Longitudinal				Raveling			Roughness		Rutting		
	ALIG 1	ALIG 2	ALIG 3	ALIG 4	TRAN 1	TRAN 2	TRAN 3	TRAN 4	TRAN 5	LONG 1	LONG 2	LONG 3	LONG 4	RAVL 1	RAVL 2	RAVL 3	RUFF 1	RUFF 2	RUT 1	RUT 2	RUT 3
5																					
4.9																					
4.8																					
4.7																					
4.6																					
4.5																					
4.4																					
4.3																					
4.2																					
4.1																					
4					A C S	P P S T	A R G G O	OGFCW		A C S	OGFCW	A R G G O									
3.9					A C S	P P S T	A R G G O	OGFCW		A C S	OGFCW	A R G G O									
3.8					A C S	P P S T	A R G G O	OGFCW		A C S	OGFCW	A R G G O									
3.7	A C S	A R G G O			A C S	P P S T	A R G G O	OGFCW		A C S	OGFCW	A R G G O									
3.6	A C S	A R G G O			A C S	P P S T	A R G G O	OGFCW		A C S	OGFCW	A R G G O									
3.5	A C S	A R G G O			A C S	P P S T	A R G G O	OGFCW		A C S	OGFCW	A R G G O									
3.4	A C S	A R G G O			A C S	P P S T	A R G G O	OGFCW		A C S	OGFCW	A R G G O									
3.3	A C S	A R G G O			A C S	P P S T	A R G G O	OGFCW		A C S	OGFCW	A R G G O									
3.2	OGFCDB	A R G G O	FUNCA	FUNCC	A R S	OGFCDB	FUNCA	FUNCC		P P S T	OGFCDB	A R G G O									
3.1	OGFCDB	A R G G O	FUNCA	FUNCC	A R S	OGFCDB	FUNCA	FUNCC		P P S T	OGFCDB	A R G G O									
3	OGFCDB	A R G G O	FUNCA	FUNCC	A R S	OGFCDB	FUNCA	FUNCC		P P S T	OGFCDB	A R G G O		M S			M S				
2.9	OGFCDB	A R G G O	FUNCA	FUNCC	A R S	OGFCDB	FUNCA	FUNCC		P P S T	OGFCDB	A R G G O		M S			M S				
2.8	OGFCDB	A R G G O	FUNCA	FUNCC	A R S	OGFCDB	FUNCA	FUNCC		P P S T	OGFCDB	A R G G O		M S			M S				
2.7	OGFCDB	A R G G O	FUNCA	FUNCC	A R S	OGFCDB	FUNCA	FUNCC		FUNCA	OGFCDB	FUNCC		M S			M S		A R G G O	OGFCW	
2.6	OGFCDB	A R G G O	FUNCA	FUNCC	A R S	OGFCDB	FUNCA	FUNCC		FUNCA	OGFCDB	FUNCC		M S			M S		A R G G O	OGFCW	
2.5	OGFCDB	A R G G O	FUNCA	FUNCC	A R S	OGFCDB	FUNCA	FUNCC		FUNCA	OGFCDB	FUNCC		P P S T	OGFCW	A R G G O	P P S T	OGFCW	OGFCDB	OGFCW	
2.4			FUNCA	FUNCC	A R S	OGFCDB	FUNCA	FUNCC		FUNCA	STRUC	FUNCC	THICKC	P P S T	OGFCW	A R G G O	P P S T	OGFCW	OGFCDB	OGFCW	
2.3			FUNCA	FUNCC	RECN	STRUC	FUNCA	FUNCC	THICKC	FUNCA	STRUC	FUNCC	THICKC	P P S T	OGFCW	A R G G O	P P S T	OGFCW	OGFCDB	OGFCW	
2.2			FUNCA	FUNCC	RECN	STRUC	FUNCA	FUNCC	THICKC	FUNCA	STRUC	FUNCC	THICKC	P P S T	OGFCW	A R G G O	A R G G O	OGFCDB	OGFCDB	OGFCW	
2.1			FUNCA	FUNCC	RECN	STRUC	FUNCA	FUNCC	THICKC	FUNCA	STRUC	FUNCC	THICKC	P P S T	OGFCW	A R G G O	A R G G O	OGFCDB	OGFCDB	OGFCW	FUNCC
2			FUNCA	FUNCC	RECN	STRUC	FUNCA	FUNCC	THICKC	FUNCA	STRUC	FUNCC	THICKC	P P S T	OGFCW	A R G G O	A R G G O	OGFCDB	RECN	FUNCA	FUNCC
1.9			FUNCA	FUNCC	RECN	STRUC	FUNCA	FUNCC	THICKC	FUNCA	STRUC	FUNCC	THICKC		OGFCDB	A R G G O	A R G G O	OGFCDB	RECN	FUNCA	FUNCC
1.8			FUNCA	FUNCC	RECN	STRUC	FUNCA	FUNCC	THICKC	FUNCA	STRUC	FUNCC	THICKC		OGFCDB	A R G G O	FUNCA	FUNCC	RECN	FUNCA	FUNCC
1.7			STRUC	THICKC	RECN	STRUC	FUNCA	FUNCC	THICKC	FUNCA	STRUC	FUNCC	THICKC		OGFCDB	A R G G O	FUNCA	FUNCC	RECN	FUNCA	FUNCC
1.6			STRUC	THICKC	RECN	STRUC	FUNCA	FUNCC	THICKC	FUNCA	STRUC	FUNCC	THICKC		OGFCDB	A R G G O	FUNCA	FUNCC	RECN	FUNCA	FUNCC
1.5			STRUC	THICKC	RECN	STRUC	FUNCA	FUNCC	THICKC	FUNCA	STRUC	FUNCC	THICKC		OGFCDB	A R G G O	FUNCA	FUNCC	RECN	FUNCA	FUNCC
1.4			STRUC	THICKC	RECN	STRUC	FUNCA	FUNCC	THICKC	FUNCA	STRUC	FUNCC	THICKC		OGFCDB	A R G G O	FUNCA	FUNCC	RECN	STRUC	THICKC
1.3			STRUC	THICKC	RECN	STRUC	FUNCA	FUNCC	THICKC	FUNCA	STRUC	FUNCC	THICKC		FUNCC	FUNCA	FUNCA	FUNCC	RECN	STRUC	THICKC
1.2			STRUC	THICKC	RECN	STRUC	FUNCA	FUNCC	THICKC	FUNCA	STRUC	FUNCC	THICKC		FUNCC	FUNCA	FUNCA	FUNCC	RECN	STRUC	THICKC
1.1			STRUC	THICKC	RECN	STRUC	FUNCA	FUNCC	THICKC	FUNCA	STRUC	FUNCC	THICKC		FUNCC	FUNCA	FUNCA	FUNCC	RECN	STRUC	THICKC
1	RECN		STRUC	THICKC	RECN	STRUC	FUNCA	FUNCC	THICKC	FUNCA	STRUC	FUNCC	THICKC		FUNCC	FUNCA	FUNCA	FUNCC	RECN	STRUC	THICKC
0.9	RECN		STRUC	THICKC	RECN	STRUC			THICKC		STRUC	FUNCC	THICKC		FUNCC	FUNCA	FUNCA	FUNCC	RECN	STRUC	THICKC
0.8	RECN		STRUC	THICKC	RECN	STRUC			THICKC		STRUC		THICKC		FUNCC	FUNCA	FUNCA	FUNCC	RECN	STRUC	THICKC
0.7	RECN		STRUC	THICKC	RECN	STRUC			THICKC		STRUC		THICKC		FUNCC	FUNCA	FUNCA	FUNCC	RECN	STRUC	THICKC
0.6	RECN		STRUC	THICKC	RECN	STRUC			THICKC		STRUC		THICKC		FUNCC	FUNCA	FUNCA	FUNCC	RECN	STRUC	THICKC
0.5	RECN		STRUC	THICKC	RECN	STRUC			THICKC		STRUC		THICKC		FUNCC	FUNCA	FUNCA	FUNCC	RECN	STRUC	THICKC
0.4	RECN		STRUC	THICKC	RECN	STRUC			THICKC		STRUC		THICKC		FUNCC	FUNCA	FUNCA	FUNCC	RECN	STRUC	THICKC
0.3	RECN		STRUC	THICKC	RECN	STRUC			THICKC		STRUC		THICKC		FUNCC	FUNCA	FUNCA	FUNCC	RECN	STRUC	THICKC
0.2	RECN		STRUC	THICKC	RECN	STRUC			THICKC		STRUC		THICKC		FUNCC	FUNCA	FUNCA	FUNCC	RECN	STRUC	THICKC
0.1	RECN		STRUC	THICKC	RECN	STRUC			THICKC		STRUC		THICKC		FUNCC	FUNCA	FUNCA	FUNCC	RECN	STRUC	THICKC
0	RECN		STRUC	THICKC	RECN	STRUC			THICKC		STRUC		THICKC		FUNCC	FUNCA	FUNCA	FUNCC	RECN	STRUC	THICKC

Project Identified.

Route 3 N Burlington-Tyngsboro

- Location: I-95(Rt 128) to NH State Line
 - 20.6 Centerline Miles
 - 6 Travel Lanes+ Shoulders & Breakdown lanes
 - 1M SY of Mainline
 - 400K SY of Shoulder & Breakdown Lane
 - Route 3N Widening completed approx. 10 years ago.
 - Minor rutting (0.2” average).
- Ideal Candidate for Pavement Preservation
 - Minor Cracking & Light Surface Raveling

ROUTE 3 NORTH PROJECT



NEAUPG

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AHSRC
Highway Sustainability Research Center

PAVEMENT CONDITION A CLOSER LOOK....



Demonstration Treatments

- **Ultrathin Bonded Overlays (UTBO)**
 - UTBO with PG 64-28 Binder (Control)
 - UTBO with PG 58-28 Asphalt Rubber Binder (Rec.)
 - UTBO with PG 64V-28 Binder (Polymer Modified)
- **Maltene Rejuvenator Seal (Breakdown Lane)**
 - Asphalt fog seals compared to rejuvenating seals
- **Fog Seals (High Speed Shoulder Only)**
 - CRS-2 (Unmodified Emulsified Binder)
 - Gilsonite Emulsion
 - CRS-2Pd (Polymer Modified Emulsified Binder)
- **Texture added to breakdown lane & shoulders.**
 - Skidabrader and Boiler Slag “aka Black Beauty”.

Wet Reflective Recessed Thermoplastic (All SB Striping)

ROUTE 3 NB

<p>MM 92.190 MA/NH State Line</p> <p>SEGMENT #3 7.731 Miles</p>	<p>Fog Seal Maltene & Shot Blasting (Skidabrader)</p> <p>UTBD Control</p> <p>UTBD Control</p> <p>UTBD Control</p> <p>Fog Seal Control & Boiler Slag (Black Beauty)</p>	<p>↓</p> <p>MEDIAN</p> <p>↑</p>	<p>Fog Seal Control & Boiler Slag (Black Beauty)</p> <p>Fog Seal Control & Shot Blasting (Skidabrader)</p> <p>UTBD Control</p> <p>UTBD Control</p> <p>UTBD Control</p> <p>Fog Seal Maltene & Shot Blasting (Skidabrader)</p>	<p>MM 92.190 MA/NH State Line</p> <p>SEGMENT #3 7.731 Miles</p>
<p>MM 84.459 MM 84.448 Bridge Over Parkhurst Rd</p> <p>SEGMENT #2 6.764 Miles</p>	<p>Fog Seal Maltene & Shot Blasting (Skidabrader)</p> <p>UTBD Asphalt Rubber</p> <p>UTBD Asphalt Rubber</p> <p>UTBD Asphalt Rubber</p> <p>Fog Seal Polymer & Boiler Slag (Black Beauty)</p>	<p>↓</p> <p>MEDIAN</p> <p>↑</p>	<p>Fog Seal Polymer & Boiler Slag (Black Beauty)</p> <p>Fog Seal Polymer & Shot Blasting (Skidabrader)</p> <p>UTBD Asphalt Rubber</p> <p>UTBD Asphalt Rubber</p> <p>UTBD Asphalt Rubber</p> <p>Fog Seal Maltene & Shot Blasting (Skidabrader)</p>	<p>MM 84.459 MM 84.448 Bridge Over Parkhurst Rd</p> <p>SEGMENT #2 6.764 Miles</p>
<p>MM 77.684 MM 77.645 Bridge Over Concord River</p> <p>SEGMENT #1 6.022 Miles</p>	<p>Fog Seal Maltene & Shot Blasting (Skidabrader)</p> <p>UTBD Polymer</p> <p>UTBD Polymer</p> <p>UTBD Polymer</p> <p>Fog Seal Gilsonte & Boiler Slag (Black Beauty)</p>	<p>↓</p> <p>MEDIAN</p> <p>↑</p>	<p>Fog Seal Gilsonte & Boiler Slag (Black Beauty)</p> <p>Fog Seal Gilsonte & Shot Blasting (Skidabrader)</p> <p>UTBD Polymer</p> <p>UTBD Polymer</p> <p>UTBD Polymer</p> <p>Fog Seal Maltene & Shot Blasting (Skidabrader)</p>	<p>MM 77.684 MM 77.645 Bridge Over Concord River</p> <p>SEGMENT #1 6.022 Miles</p>
<p>MM 71.623 Bridge Over Route 128</p>				<p>MM 71.623 Bridge Over Route 128</p>

ROUTE 3 SB

Wet Reflective Recessed Polyurea (All NB Striping)

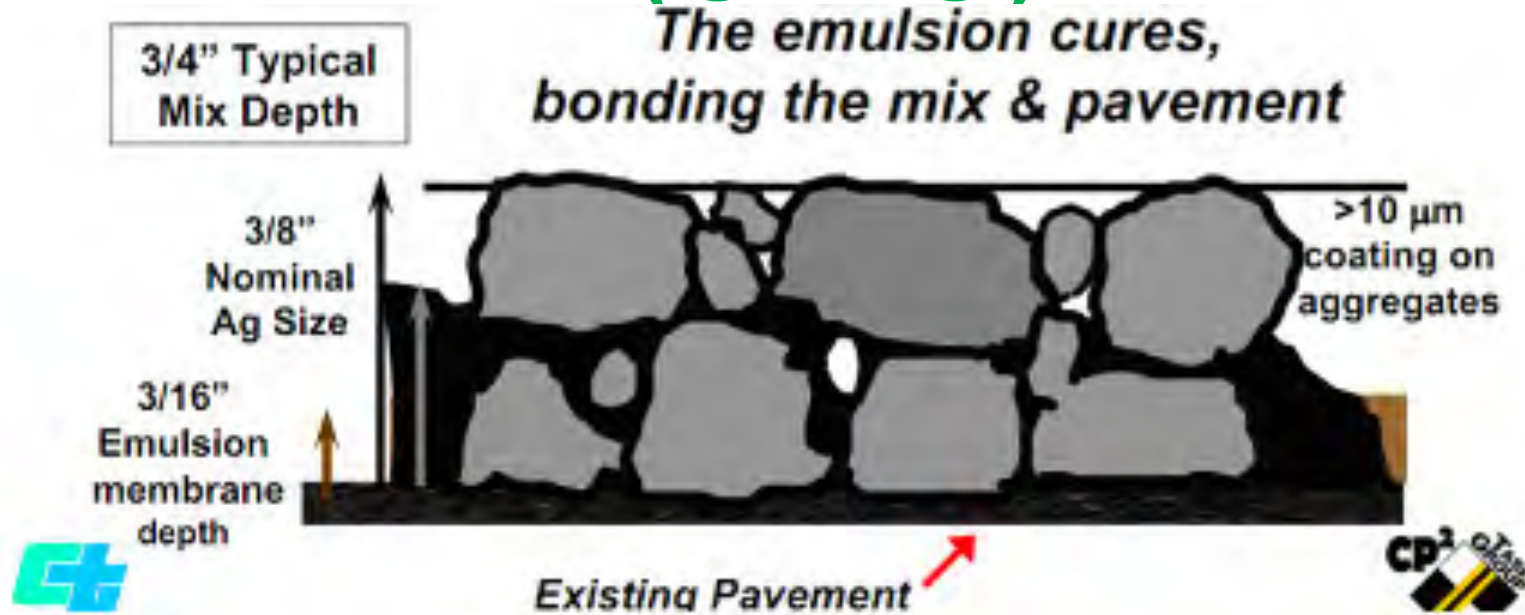
Bridge Over
Route 128

UTBO: “Spray Paver”



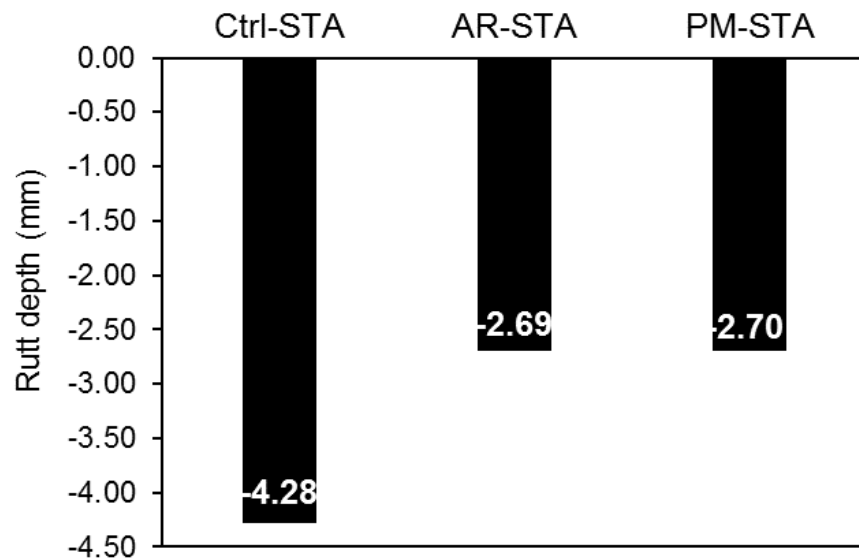
Placement of a heavy application (0.18 to 0.25 gal/sq.yd) of polymer modified emulsion immediately followed by a 5/8 to 3/4-in gap-graded hot mix overlay.

Ultrathin Bonded Overlay (UTBO)

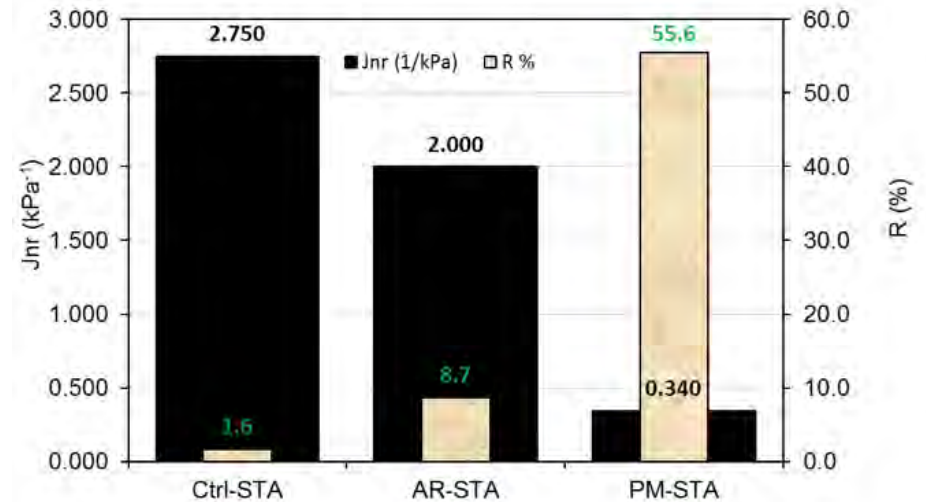


Rutting Resistant

Extracted and Recovered Binders



Hamburg Wheel Track Test at 50° C



Multiple Stress Creep Recovery test at high end PG and 3.2 kPa

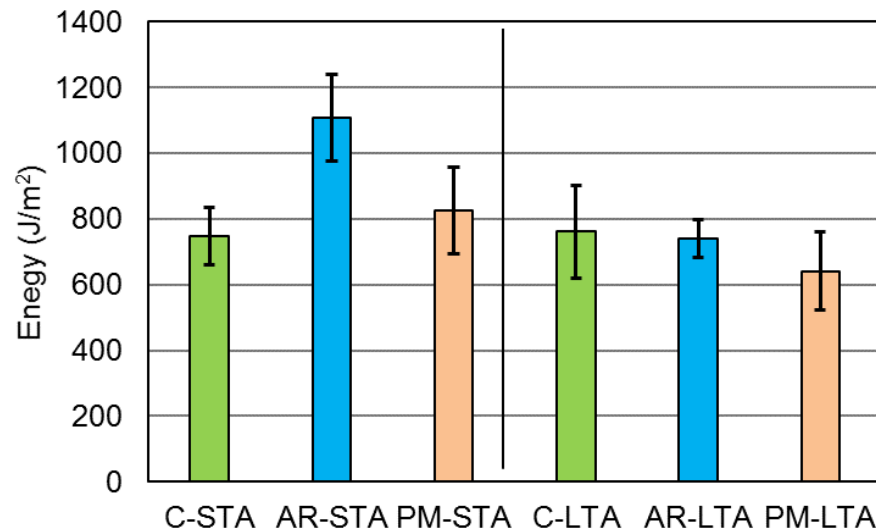
Legend:

STA = Short Term Aging
(Aging during Compaction)

LTA = Long Term Aging
(24 hours aging at 135°C)

Low & Intermediate Temperature Performance

Low Temperature Cracking

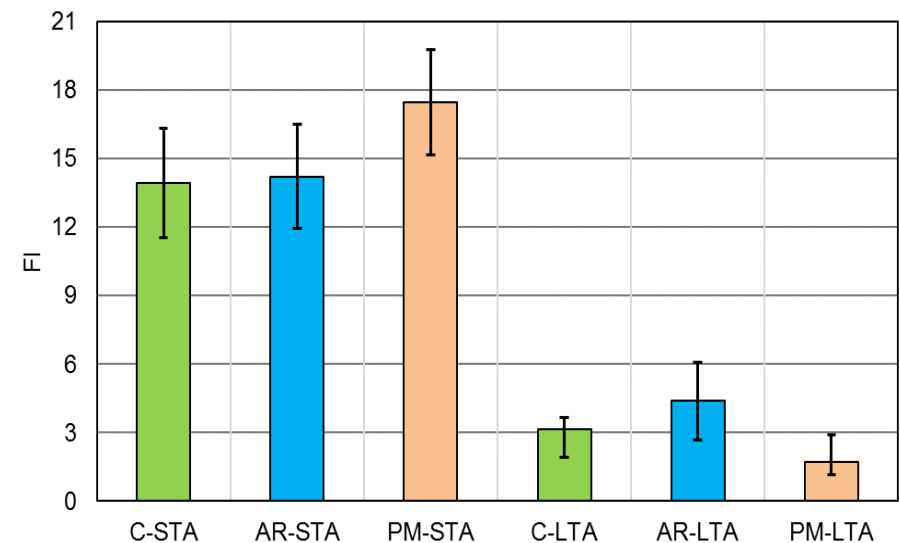


Disc Shaped Compact Tension test at -18° C
ASTM D7313

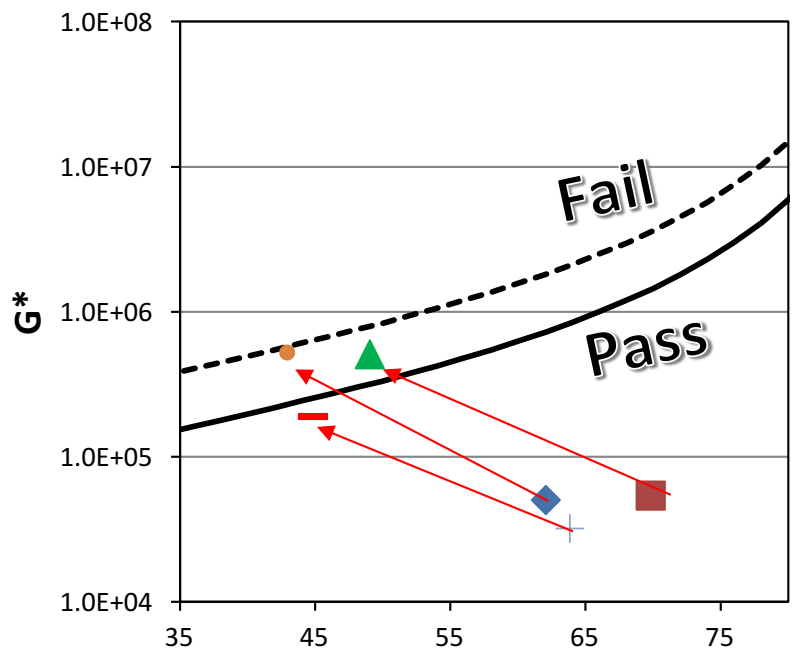
Semicircular Bending test at 25° C
AASHTO TP 105



Intermediate Temperature Cracking

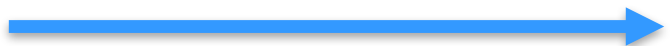


Master Cure & Black Space Parameters

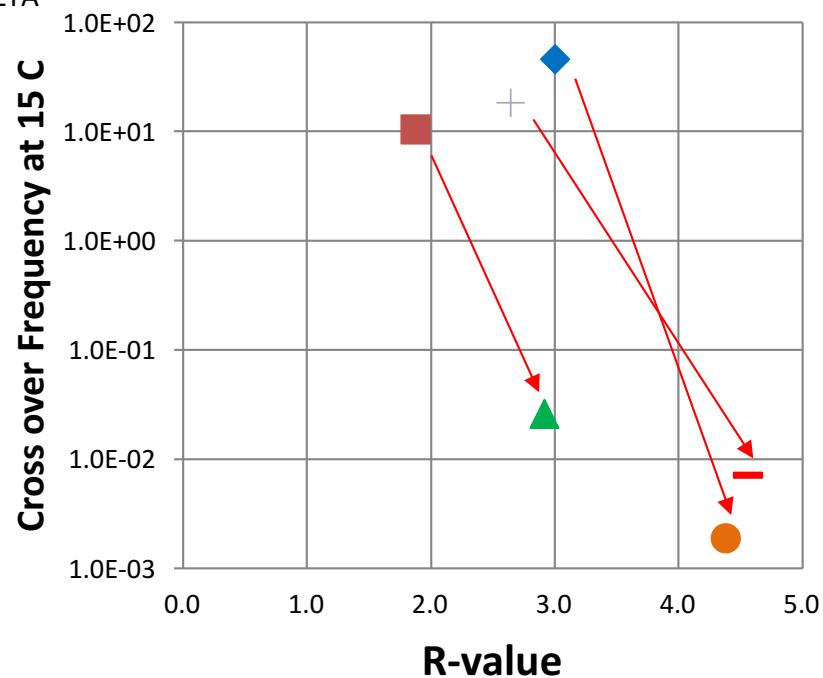


Black Space Diagram

ω_0 – R-value Space Diagram



- Series4
- Series5
- PM-LTA
- PM-STA
- Ctrl-STA
- Ctrl-LTA
- AR-STA
- AR-LTA



Expectations?

- Evaluate the performance of treatments.
- Benefits of polymer modified binders.
- Evaluate the effectiveness of using Fog Seals for Shoulders.
- Ride Quality Expectations for Thin Pavements

Acknowledgements

The research data and results presented were part of a study entitled “MassDOT Implementation of SHRP 2 Technologies: Preservation Approaches for High Traffic Volume Roadways - Product R26” funded by the Massachusetts Department of Transportation.

Thank you!



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