

Rubberized HMA Experience

Pittsfield Township, Washtenaw County

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Background

- August 2023
 - Met with Dr. Zhanping You
 - Research of rubberized HMA mixes
 - Funding opportunity
 - EGLE Scrap Tire Program
 - Applications due Sept. 2023 for FY2025



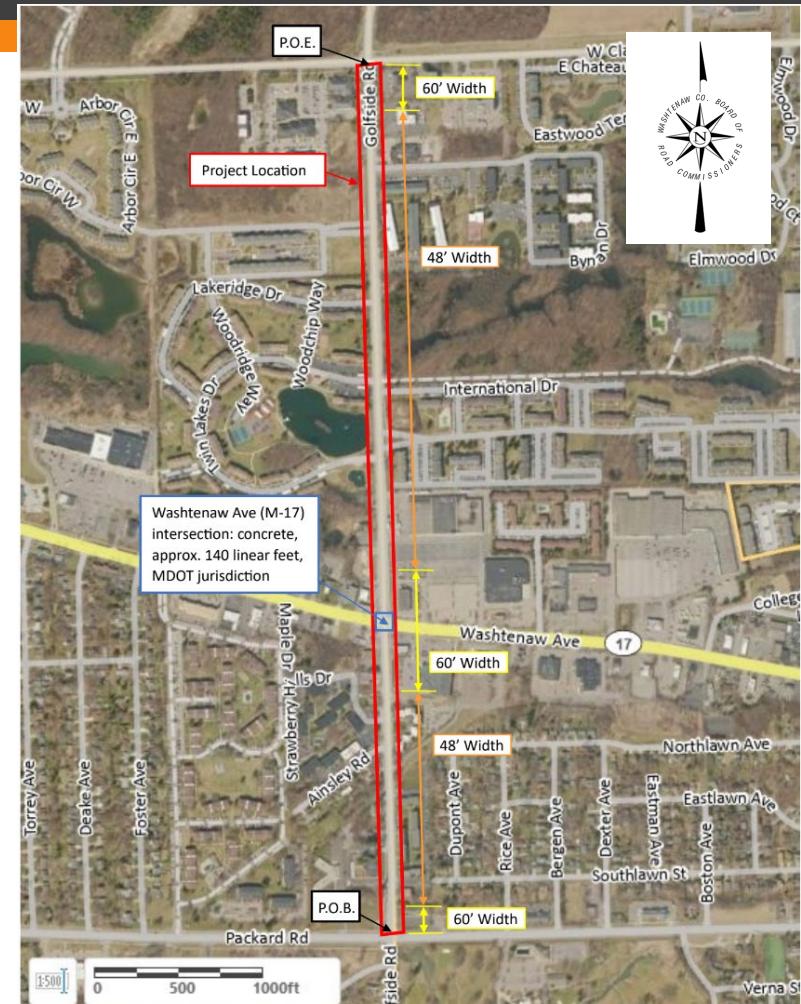
Rubberized HMA Mixes

- November 2023
EGLE Rubberized Pavt Workshop
- Research performed over the past 20+ years
- Cracking and rutting resistance
- Similar results to polymer-modified pavements



EGLE Scrap Tire Grant Application

- **Golfside Road**
 - Packard Rd to Clark Rd
 - AADT: 13,500
 - 12% Commercial
 - PASER: 2
- **TIP FY25 Federal Aid**
 - FY25 Fed Aid Buyout Planned



EGLE Scrap Tire Grant Application

- Packard Rd to Washtenaw Ave (M-17)
 - 4" HMA Mill & Fill
- Washtenaw Ave (M-17) to Clark Rd
 - 2" HMA Mill & Fill
- 4,600 Tons HMA (total)
 - 3,700 Tons HMA, Ground Tire Rubber (GTR)
 - 900 Tons HMA (conventional)
 - 7,600+ Scrap Tires Used



Rubberized asphalt pavement

Conventional asphalt pavement

EGLE Scrap Tire Grant Application

- Total Estimated Project Cost: \$1,000,000
 - \$770,000 Construction
 - \$240,000 MTU Research
- Requested \$380,000 (EGLE guidance)
 - \$260,000 Construction
 - \$120,000 MTU Research
- Goal: Cover HMA \$\$ between Conventional and GTR + a little more



Bump in the Road...

- EGLE Application submitted Sept. 2023
- FY25 Fed Aid Buyout cancelled Dec. 2023
- Grant Awarded March 2024
- Bounced towards MDOT bid letting
- But...
 - No approved MDOT SP for Rubberized HMA
 - Became an unsurmountable hurdle
 - BOUNCE AGAIN



Alternative Project Approved July 2024

- Ellsworth Road
 - “Leftover” FY24 Fed Aid Buyout Project
 - Platt Rd to Carpenter Rd
 - AADT: 16,574
 - 2” Mill & Fill (**700 Ton HMA, 5EML** / **2700 Ton HMA, GTR**)



SECTION IN **BLUE** TO PLACE HMA, 5EML PER LOG

SECTION IN **RED** TO PLACE HMA, GTR PER LOG



Local Bid

- WCRC Advertised March 2025 for April 2025 Bid Opening
 - Engineer's Estimate: \$675,000
 - No pre-bid meeting held
- One Bid Received
 - Bid: \$950,400
 - 40% over Engineer's Estimate



Rejected
the bid!

Local Bid #2

- Considered returning EGLE grant
- Decided to re-bid with clarifications
- Included mandatory pre-bid meeting
- Bid opening May 2025

- One bid received
 - Bid: \$746,800
 - 10% over Engineer's Estimate



Moving
Forward!

Preparing for Construction



- Coordination between WCRC, MTU, Crumb Rubber Supplier, Contractor, and EGLE
- MTU help with JMF
- Test mixes

Modified HMA

- Elastiko Crumb Rubber (CR) Product
 - Run through very fine sieve
 - No. 30 sieve
 - Dry, less than 1.25% moisture content
 - Tires screened for metal and fibers
- 1.05-ton bulk sacks



HMA JMF's

- Similarities between 5EML and GTR
 - Gradations
 - GTR slightly less fines
 - Theoretical Maximum Density (TMD)
 - Asphalt Content (AC)
- 10% CR addition by weight of neat binder (binder without RAP)



Control Section:		An Est. C. 1990		Job Number:		Joint Venture Company:		Ellsworth Road	
Rubberized HMA		Route & Location:		Ellsworth Road					
Contractor:		Plant Number:		Plant Location:					
Cadillac Asphalt, L.L.C.		60-06		857 S. Wagner Rd., Ann Arbor, MI 48111					
Bituminous Mixture:		'5EML T1 MOD (3.5%) 55601.6428		Modified with 10% Dry Rubber by weight of total Asphalt Binder					
PIT NAME		Drake	Newport	Drake	Plant 1	Drake		Pit	Pit
PIT NUMBER	81-92	58-11	81-92	82-019	81-92		60-06	60-06	
AGGREGATE TYPE	2NS	L. Sand	Mansand	SF MFG	3/8 x 4		BHF	Rap	
BLEND %		23.0	12.0	18.5	10.0	16.0	1.5	19.0	
(10% Minimum)		23.0	12.0	20.0	10.0	16.0		19.0	
P 1/2 (37.5 mm)		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
P 1 in. (25.0 mm)		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
P 3/4 in. (19.0 mm)		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
P 1/2 in. (12.5 mm)		100.0	100.0	100.0	100.0	99.9	100.0	97.9	100.0
P 3/8 in. (9.5 mm)		100.0	100.0	100.0	99.5	96.3	100.0	92.9	90-100
P NO. 4 (4.75 mm)		96.2	92.1	87.1	71.7	10.2	100.0	73.1	90 Max
P NO. 8 (2.36 mm)		71.1	57.1	55.2	48.9	2.4	100.0	56.3	47-67
P NO. 16 (1.18 mm)		44.9	33.0	32.2	33.7	1.4	100.0	43.2	33.6
P NO. 30 (0.90 mm)		24.0	18.6	18.8	26.0	1.2	100.0	32.5	21.7
P NO. 50 (0.60 mm)		9.0	10.3	8.7	20.1	1.0	99.0	21.4	12.6
P NO. 100 (0.100 mm)		3.1	7.1	3.3	13.6	0.9	95.0	13.3	
TOTAL		1.7	6.2	1.9	7.8	0.8	90.0	9.6	2-10
Crush Count 1/2 Face		25	100	97.5	100	97.50 / 95.00		94.4	75 Min
LA Abrasion Yield / Value		8.21	20.19	1.21	1.21	1.21		N/A	< 35
MAX ANGULARITY INDEX (METHOD A)		47		46.91	48.1				43 Min
AVI Nomograph & Quarries		243	254	297	365	297		240	260 min
COARSE AGGREGATE BULK SPECIFIC GRAVITY #6					3.315	2.86		2.705	2.734
COARSE AGGREGATE BULK SPECIFIC GRAVITY #8									Combined Gsb
FINE AGGREGATE BULK SPECIFIC GRAVITY		2.644	2.577	2.66	3.315			2.705	2.674
FAT & ELONGATED %									10 Max
SOFTSTONE %		0.5		0.3	0.5	0.1			< 5
ASPHALT CEMENT SUPPLIER		MPM Oil Monroe, MI ABS 6505		Asstd		64-28		MPM Oil Monroe	
NAME (First & Last)		Shelly Moultrup		Final AC:		1.029		PHONE NUMBER	
SUMMITTE S-IFI SIGNATURE				Date:		64-28		248-640-1960	
						7/22/2025		FAX NUMBER	
AC Content		Gmm		Gmb					
5.98		2.504		2.416					
VMA		Air Voids		VFA					
15.98		3.50		78.1					
TMD:		156.2							
Marsh:		150.8							

Plant Processes

- Hi-Tech CR Feeding System
- Alarm when weight falls below 800 lbs
- Loaded every ~45 minutes



Loading the Feeder System



Loading the Feeder System



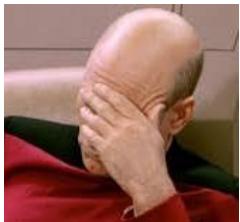
Trial Batches

- August 15th
 - First trial batch produced
 - Air voids over 12%
(target was 3.5%)
- August 18th
 - Pre-Production Mtg
- August 22nd
 - Next Trial Batch Produced
- August 23rd
 - Production scheduled!!



Production Issues

- Feeder delivered with broken load cell
 - Feed rates were ~1.5-2% higher than target
- Test batches never met target air and AC content
 - Fines content too high, was then adjusted
 - CR added as 10% of TOTAL asphalt instead of neat asphalt
 - Oven temps in the lab too low



- Plant broke down on August 24th



More Production Issues

- August 23rd
 - Contractor initially scheduled production day
 - GTR never tested within limits
- Rescheduled GTR production to August 24th...
 - ...and then rescheduled to August 26th
- Revised station limits of **GTR** vs. **5EML** (control)
- GTR quantity reduced due to use of CR for test batches



Paving Operations

- Planned for August 23 & 24 (Saturday & Sunday)
 - 5EML placed August 23
 - GTR placed August 26 & 27
 - 70-73°F highs with clear skies
- Maintained eastbound / westbound traffic with flagging operations



Paving Operations

- Mix arrived 300-325°F
- Trucks on site 10-15 mins
- Delayed rolling recommended
- Crew feedback was all positive
 - No buildup in trucks or paver
 - No odor
 - No difference in laydown



Compaction

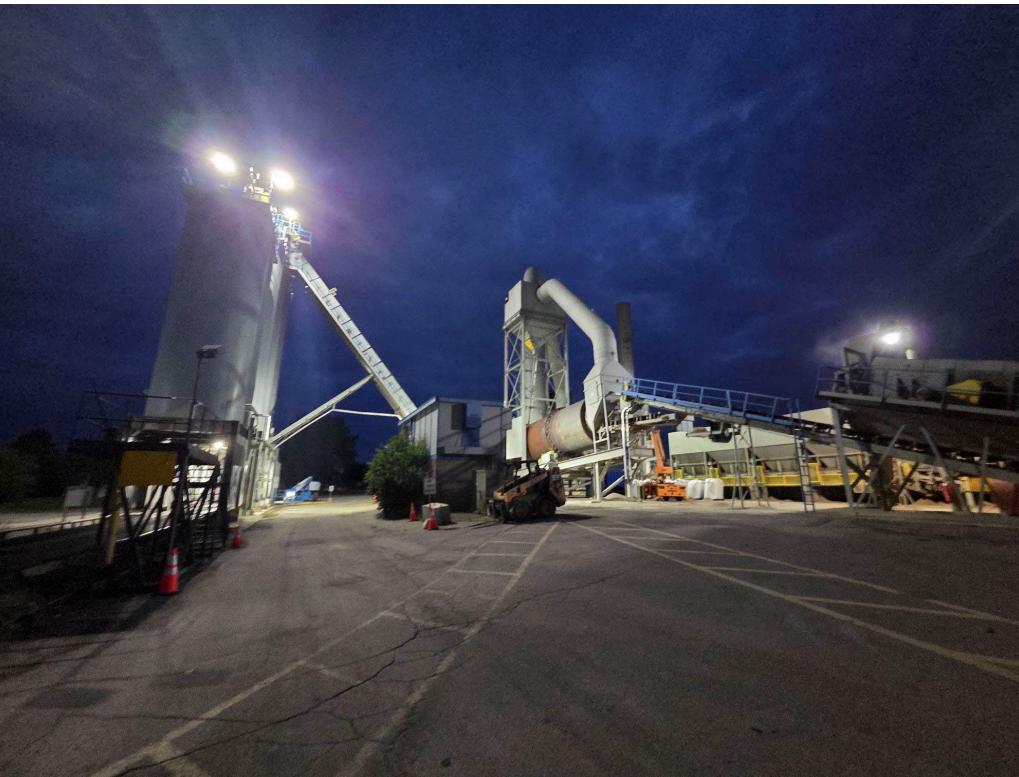
- Standard MDOT requirement 92-98% of TMD
- Compaction differences
 - 5EML
 - Mean 95.4% compaction
 - Standard deviation 1.6%
 - GTR
 - Mean 95.4% compaction
 - Standard deviation 1.3%



Drone Photos



Lessons Learned



- Mandatory pre-bid meeting
- Bid selection
 - Contractor willing and able to work through challenges
 - Cadillac staff was patient and excited about this process
- Test batches well in advance of production
- Be prepared for EGLE reporting and reimbursement requirements

Cost Breakdown

- HMA cost ~25% more than typical Mill & Fill
 - Standard 5EML ~ \$334,000
 - Actual HMA costs = \$419,115
 - GTR 1,785 Tons = \$276,715
 - 5EML 996 Tons = \$142,400
- EGLE grant essentially covered the difference



Final Thoughts

- Used ~7,000 tires used
- Increased cost may be worth promise of longevity
- When milled in the future, CR will act as RAP
- Plant operators and paving crew enjoyed using the GTR over mixes with added polymer
- The media LOVES this type of project



Mama, I Made It



WXYZ Channel 7 Report - <https://www.wxyz.com/news/region/washtenaw-county/washtenaw-county-tests-innovative-rubber-asphalt-made-from-scrap-tires-to-improve-road-durability>

Stories also from: WEMU, MLIVE, & 94.7 WCSX

Thank you!

- Dr. Zhanping You
 - Michigan Tech Univ.
- Red Clark
 - Asphalt Plus
- Kirsten Clemens
 - EGLE - Scrap tire



QUESTIONS/COMMENTS

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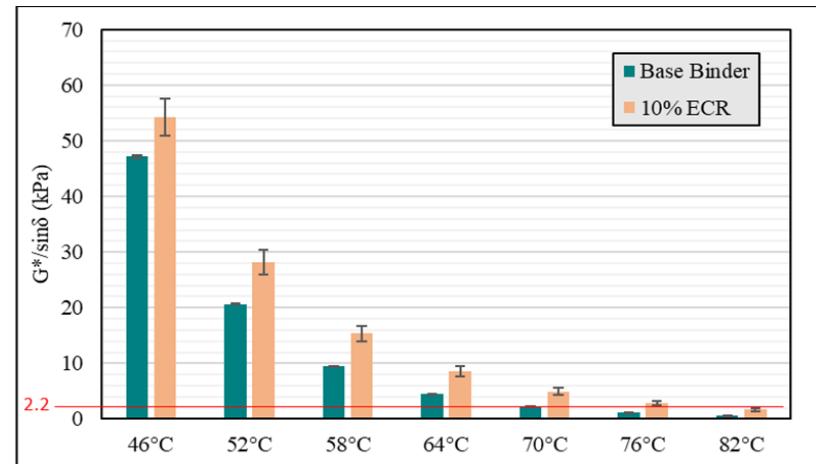
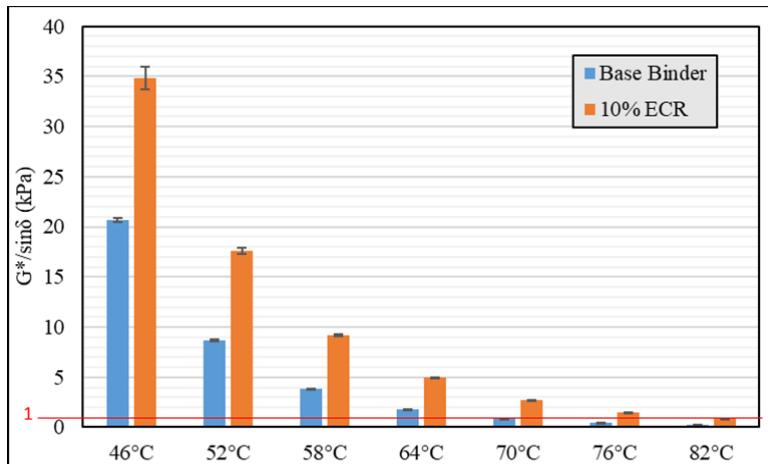
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Performance Evaluation - Binder

Dynamic Shear Rheometer (DSR)

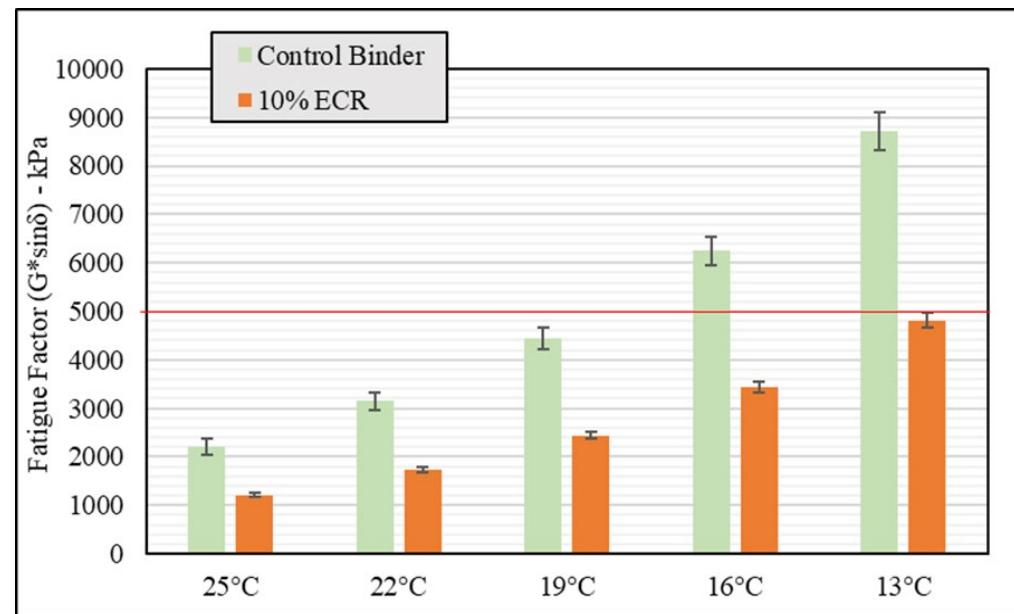


- Addition of ECR improved rutting resistance by leading to higher rutting factor values
- High temperature PG grade was improved from 64°C to 76°C

Performance Evaluation - Binder

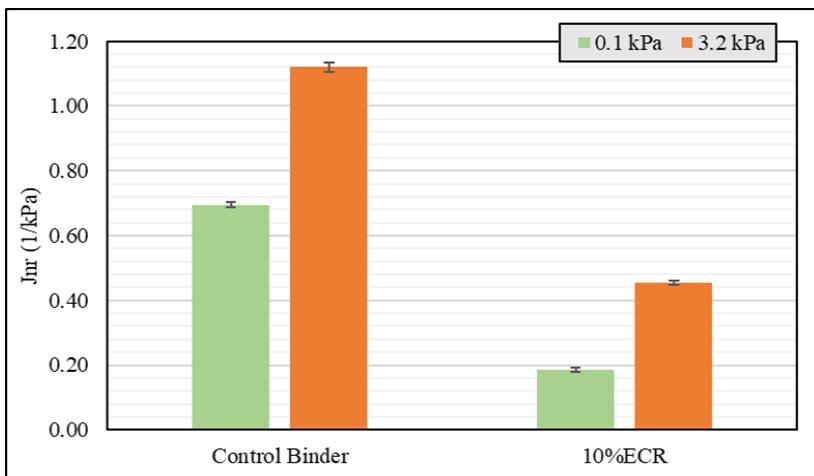
Dynamic Shear Rheometer (DSR)

- ECR improved the fatigue resistance of the control binder by leading to lower fatigue factor results

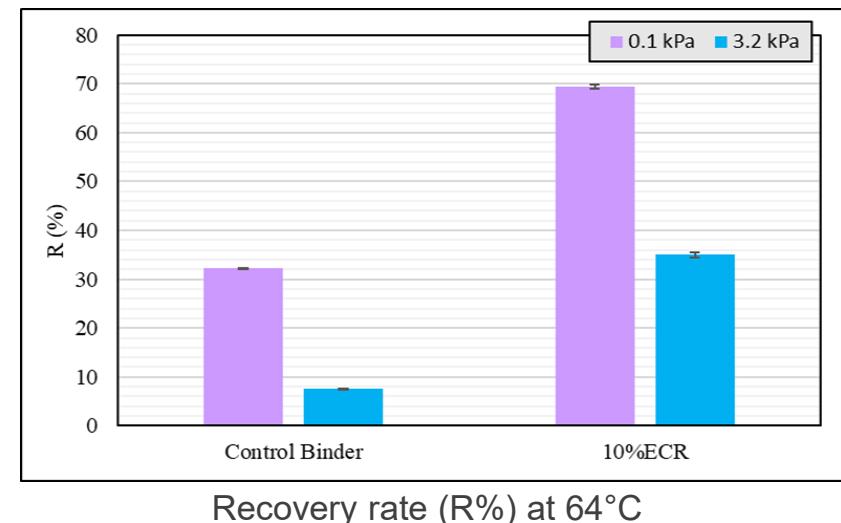


Performance Evaluation - Binder

Multiple Stress Creep Recovery (MSCR)



Non-recoverable creep compliance (Jnr) at 64°C



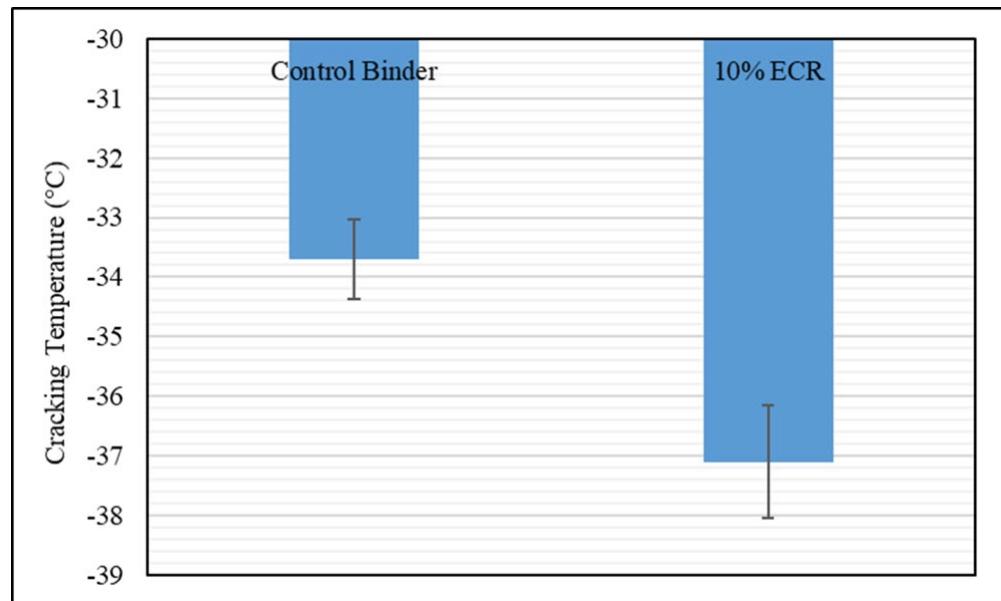
Recovery rate (R%) at 64°C

- Addition of ECR improved the rutting resistance performance by leading to higher recovery rate and lower Jnr values

Performance Evaluation - Binder

Asphalt Binder Cracking Device (ABCD)

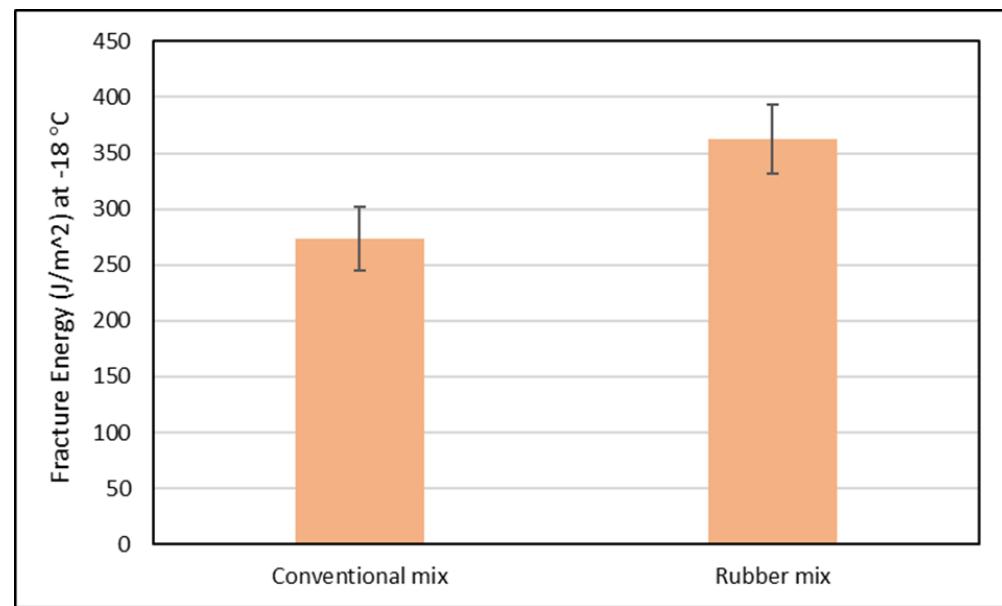
- Addition of 10% ECR led to lower cracking temperature compared to control binder



Performance Evaluation - Mix Samples

Disc-Shape Compact Tension (DCT)

- Addition of rubber enhanced the low-temperature cracking resistance of conventional asphalt mixture
- Rubber mix had a 32.5% improvement in fracture energy

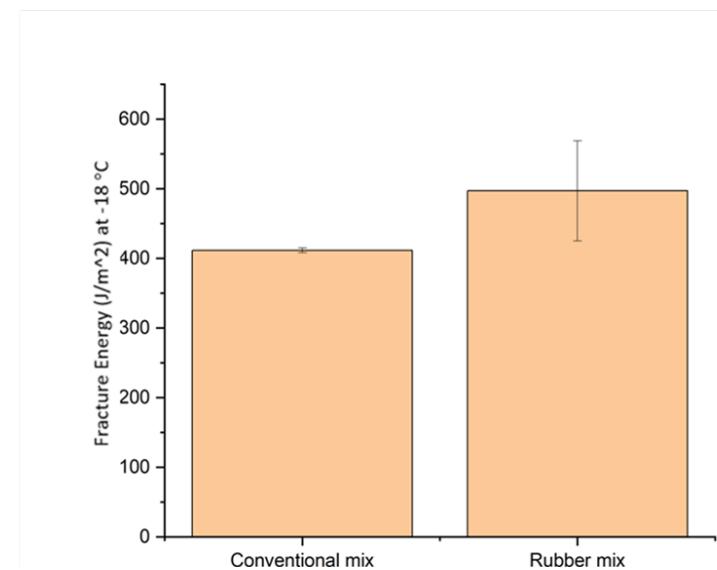


DCT test results at -18°C

Performance Evaluation – Core Samples

Disc-Shape Compact Tension (DCT)

- Field core rubber modified sampled showed higher fracture energy
- Rubber mix had a 20% higher fracture energy than conventional mix

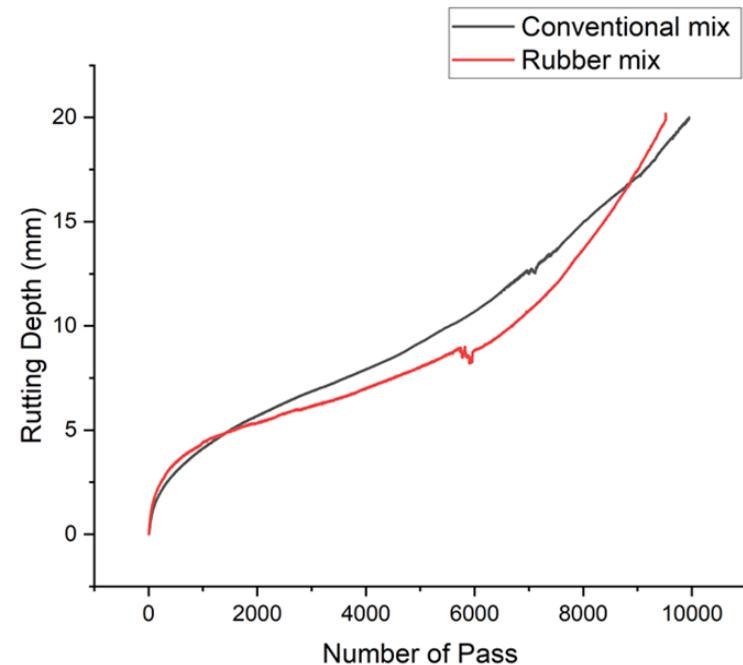


DCT test results at -18°C

Performance Evaluation – Core Samples

Hamburg Wheel-Track Device (HWTD)

- Rubber modified mix showed equivalent rutting resistance to the conventional mix based on # of passes and rutting depth





Saline River

Saline River

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Washtenaw County
Michigan 48176

42.146408, -83.872273



Street View

Klager Rd

Klager Rd

Feldkamp Automotive

Feldkamp Rd

Klager Rd

Feldkamp Rd

Feldkamp Rd

Saline River