



NCAT TEST TRACK UPDATE: *ARDOT GAP-GRADED DRY RUBBER MIX TO REDUCE REFLECTIVE CRACKING*

Nathan Moore, P.E.
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2025 Arkansas Transportation Summit





ARDOT CURRENT CHALLENGE

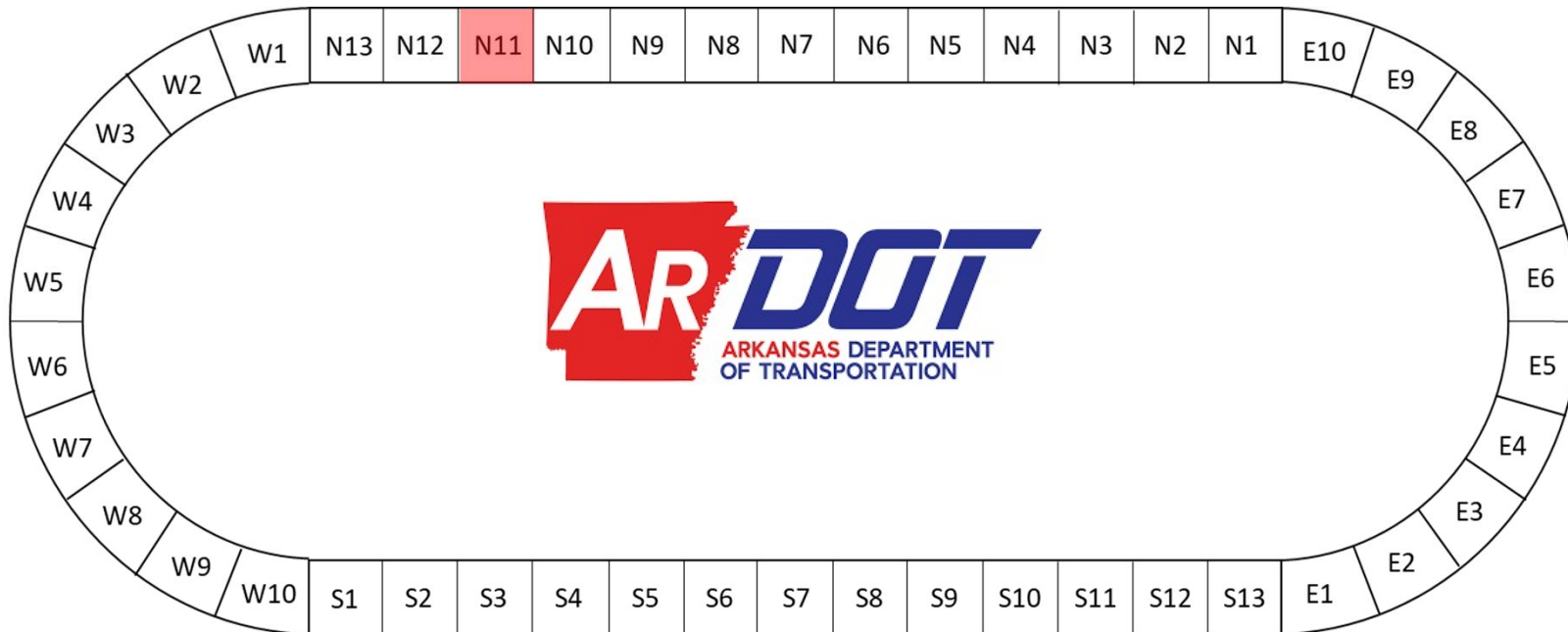
- Reflective cracking of asphalt overlays from rubblized concrete are reflecting through the new overlays in only two years or less



Courtesy: ARDOT



ARDOT N11 TEST SECTION





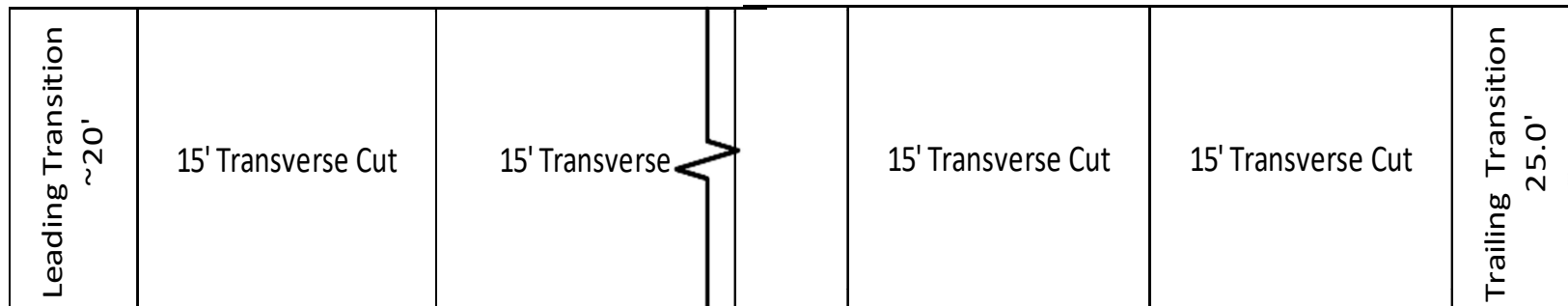
RESEARCH OBJECTIVE

- Evaluate an alternative asphalt overlay to mitigate reflective cracking from rubblized concrete
 - Proposed overlay is a gap-graded mix with dry GTR
 - Previous test track experience with asphalt rubber gap-graded mix suggests excellent cracking resistance



EXPERIMENT PREPARATION

- Mill 2.0 inch of existing 7.5 in AC layer (thick lift with HiMA)
- To simulate concrete joints, deep cuts 5/32 inch wide
- Transverse cuts at 15-foot spacing
- String placed before tack coat to prevent joint healing

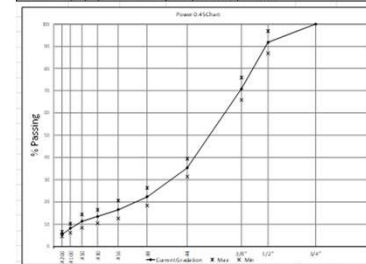


432 feet of saw cuts!

MIX DESIGN INFORMATION

- 2-in asphalt overlay
- 12.5 mm NMAS-75 blow Marshall Design
 - Similar to the 2015 CG S13 mix
- AR aggregates (sandstone 5/8" chips and screenings)
- PG 70-22 binder
- 20% GTR (by weight of the binder) added dry
 - SmartMix selected because it meets the gradation requirement for asphalt rubber

National Center for Asphalt Technology NCAT at AUBURN UNIVERSITY		National Center for Asphalt Technology Job-Mix Formula				
NCAT Project ID: IT24		NCAT Mix ID: ARDOT				
Principal Investigator: Carolina Rodeno		Mix Design Engineer: Nathan Moore				
Producer: East Alabama Paving Co. - Opelika #2		Design Completion Date: 9/2/2024				
Intended Use: NA		Intended Section: N11-1				
Mix Type: ARGG		Virgin Binder Grade: 70-22				
Nom. Max. Agg. (NMAS): 12.5mm (1/2")		Virgin Binder Specific Gravity: 1.048 This includes G _{rubber}				
Max. Agg. Size (MAS): 19.0mm (3/4")		Anti-Strip: Evotherm P25 0.5%				
Mixing Temp, °F: 310-325		SmartMix Rubber by % Binder: 20.0%				
Compaction Temp, °F: 300-310		A.S. Dose Rate for Virgin Binder: Evotherm P25 0.5%				
Other Additives: SmartMix Rubber						
AASHTO Superpave Volumetric Mix Design						
Cold Feed %	Aggregate Description	Pile ID	Source	Gsb	Gsa	% Abs.
35	Screenings		Rogens Group	2.589	2.678	1.3
64	5/8s		Rogens Group	2.553	2.702	2.2
1	BF		East Alabama Paving	2.735	2.735	0.00
Job Mix						
Sieve	Passing	% Total AC Required	Criteria	Aggregate Information	Criteria	
1 1/2"	1000	7.03	--	Agg. Bulk Gravity (Gsb)	2.629	--
1"	1000	2.403	--	Agg. Effective Gravity (Gse)	2.663	--
3/4"	1000	2.323	--	Agg. Apparent Gravity (Gsa)	2.694	--
3/2"	91.8	3.3	--	Agg. Absorption (Abs)	1.83	--
3/1"	70.9	17.9	--	Coarse Agg. Angularity (1)	100 assumed*	95 min
#4	35.4	0.15	--	Coarse Agg. Angularity (2+)	100 assumed*	90 min
#8	22.4	0.85	--	Fine Agg. Angularity (FAA)	0	45 min
#16	16.6	6.56	--	Flat and Elongated 5:1 (F & E)	0	10 max
#30	13.5	0.51	--	Sand Equivalency (SE)	0	45 min
#60	11.4			Other Information		
#100	8.3	5.86		# Blows	75	
#200	5.6			Ignition Oven CF	-0.78 w/ rubber in AC, -1.52 for virgin	
				Design Sample Mass, g	1150	
				RAP % AC (Ignition)		
				Corrected RAS % AC (TCE)	NA	
				Assumed RAS AC Contribution	NA	
				Uncorrected RAS % AC (TCE)	NA	
				RAP Binder True Grade	0	
				RAS Binder True Grade	0	
				TSR		
				Uncond. Tensile Strength, psi	NA	
				Cond. Tensile Strength, psi	NA	
				Contract % Loss	0.0	
				Additional Notes		
				Total AC is assuming rubber as part of liquid.		
				Add 5.9% AC at plant		





MILLING

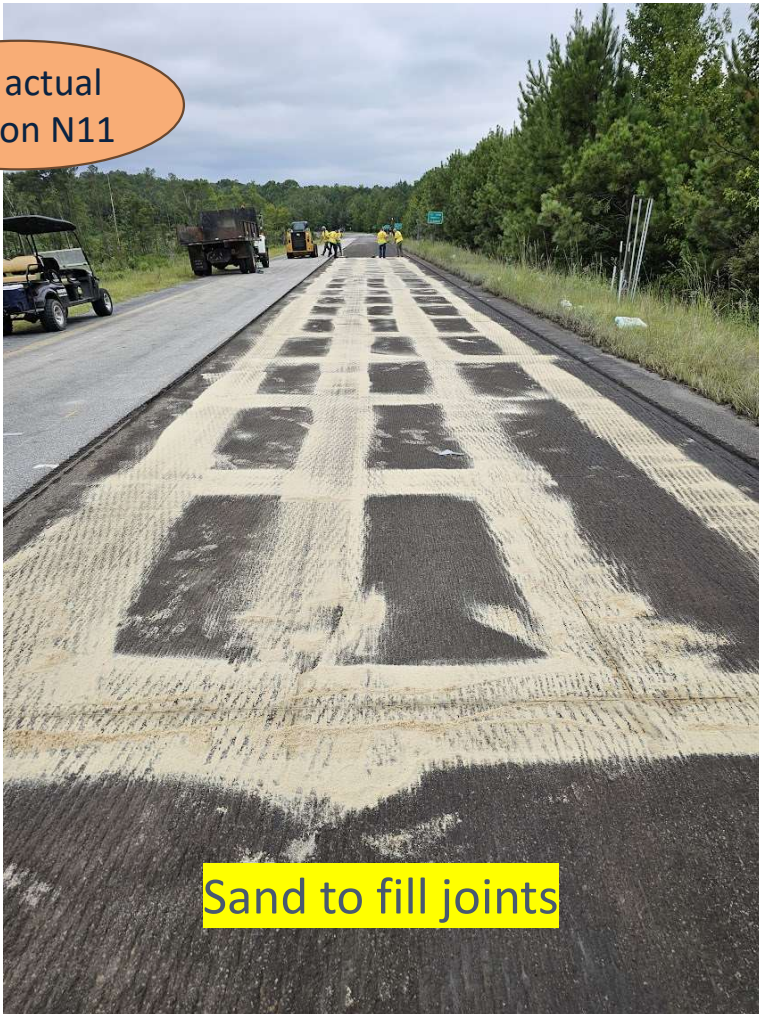


SAW CUTTING



SANDING JOINTS

Not actual
Section N11



FILLING JOINTS WITH STRING



TACK AND REMOVE STRING



LIBERTY TIRE - "SMART MIX"



Smart Mix is a pre-swelled rubber with extender oil
Added at 20% by weight of virgin binder

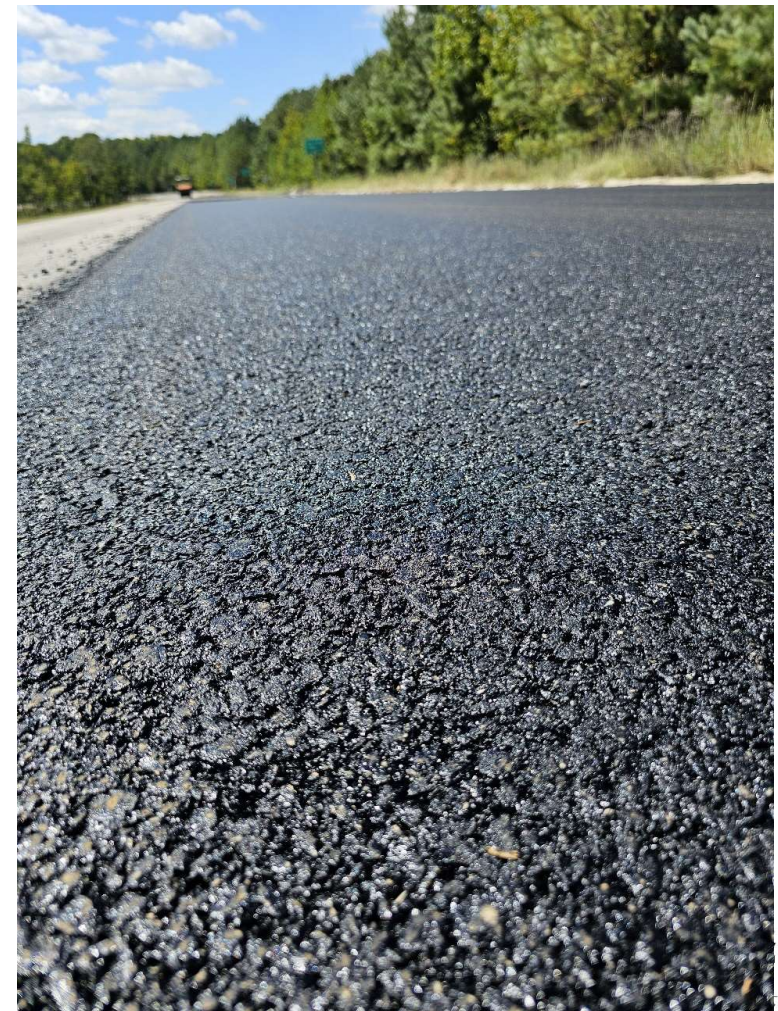


N11 MIX DESIGN AND QC DATA

Sieve Size	N11 Design	N11 QC
19 mm (3/4")	100	100
12.5 mm (1/2")	92	92
9.5 mm (3/8")	71	72
4.75 mm (#4)	35	35
2.36 mm (#8)	22	21
0.60 mm (#30)	14	12
0.15 mm (#100)	8	8
0.075 mm (#200)	5.6	5.1
AC (%)	5.9	5.9
Va (%)	3.3*	4.8
VMA (%)	16.9	16.9
VFA (%)	80	72

- UTBWC Gradation (Gap-graded)
- PG 70-22 Binder
- Virgin Mix
- 1.2% SmartMix by total blend
- Designed similar to previous S13 mix (volumetrics not exact)

N11 CONSTRUCTION 09-09-2024



N11 PLACEMENT AND DENSITY



- As built thickness: 1.8"
- In-place density: 93.8% Gmm
- Production mix (RH):
 - HWTT-3.2 mm at 20,000 passes
 - IDEAL-CT-CT_{Index} 277

FIELD PERFORMANCE AT ~4 MESALS

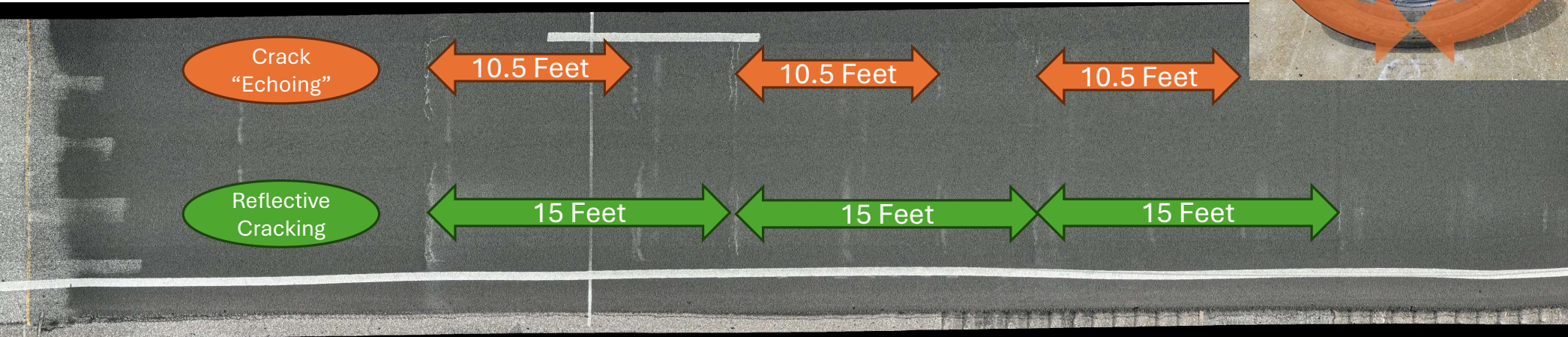
- Hairline cracks at saw cuts
- First cracks, of very low severity, were observed at the joint in early April
- No rutting & excellent friction
- Slowly rising IRI, but...





FIELD PERFORMANCE AT ~4 MESALS

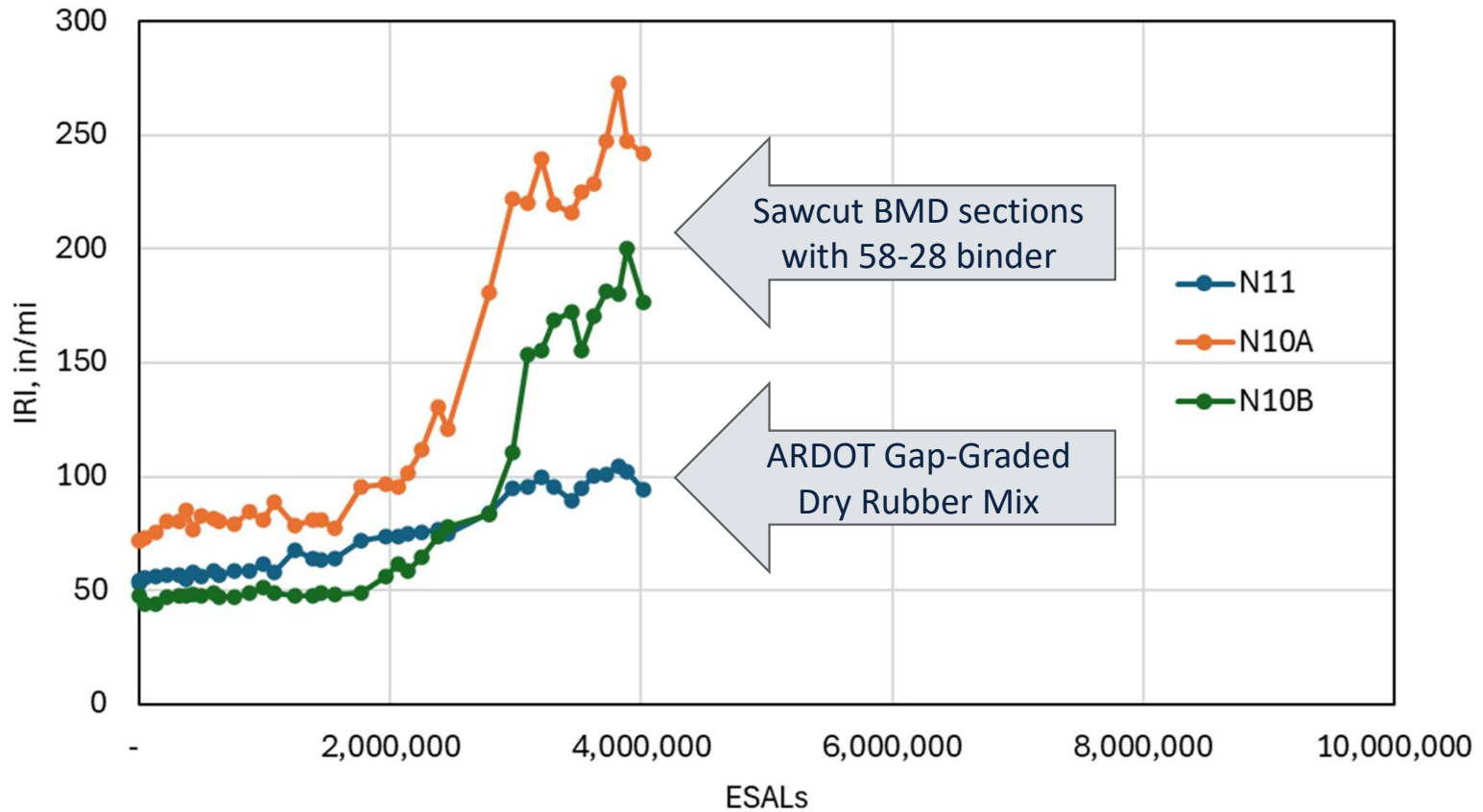
WHAT'S A CRACK?





FIELD PERFORMANCE AT ~4 MESALS

FIELD PERFORMANCE AT ~4 MESALS





SUMMARY

- Alternative ARGG mix produced and placed with no issues
- Very healthy mix (BMD & volumetrics)
- Cracks more severe at beginning of section but are less severe in the last ~125 feet
- IRI is rising, but mix is holding together extremely well compared to the other mix on a saw cut surface
- Mix has performed well in an extremely harsh environment (No load transfer between joints)
- We will continue monitoring.



THANK YOU!

Nathan Moore, P.E.
nathanmoore@auburn.edu



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