National Center for Asphalt Technology
NCAT
at AUBURN UNIVERSITY

Alabama Thinlays (N10, N11)

Carolina Rodezno

SEVENTH
RESEARCH CYCLE

NCAT TEST TRACK CONFERENCE

ThinIays for Pavement Preservation

- Limited funds to preserve road
- Agencies need alternative preservation treatments to provide:
  - Improve surface characteristics
  - Protect underlying pavement structure
  - Extend life of the pavement
- As any asphalt mix must provide stability, durability and resistance to moisture

Background

Thinlays have been part of the NCAT Test Track since its second research cycle

2003

- Mississippi DOT sponsored section W6, paved with a ¾-inch thick, 4.75 mm NMAS low volume road mix
- Anticipated that mix would only last 500,000 ESALs, but section still in place ~60 million ESALs with no cracking, minimal rutting, excellent smoothness, and no friction deficiencies

2012

- Mississippi DOT sponsored section S3 to place a redesigned thinlay including 25% RAP and relying on locally available "surplus" sand stockpiles in Mississippi
- To date, the section has withstood 30 million ESALs with excellent performance

2015

- Tennessee DOT sponsored Section S4 to determine if a thin-lift asphalt overlay would have satisfactory rutting performance when placed as a thicker surface lift; 4.75 mm NMAS, 75 blow Marshall
- Mixture demonstrated excellent performance with respect to rutting after 20 million ESALs

Research Objective

Evaluate performance of a DGA and an SMA thinlay to provide ALDOT with thinner overlay alternatives that are durable options for pavement preservation on high volume roads

History of success with other Test Track thinlay variants

- To assess performance of thinlays a structurally sound pavement was needed underneath
- 7-inch asphalt base layer produced with HiMA binder was placed and compacted in one lift beneath the thinlays

N10 SMA Thinlay

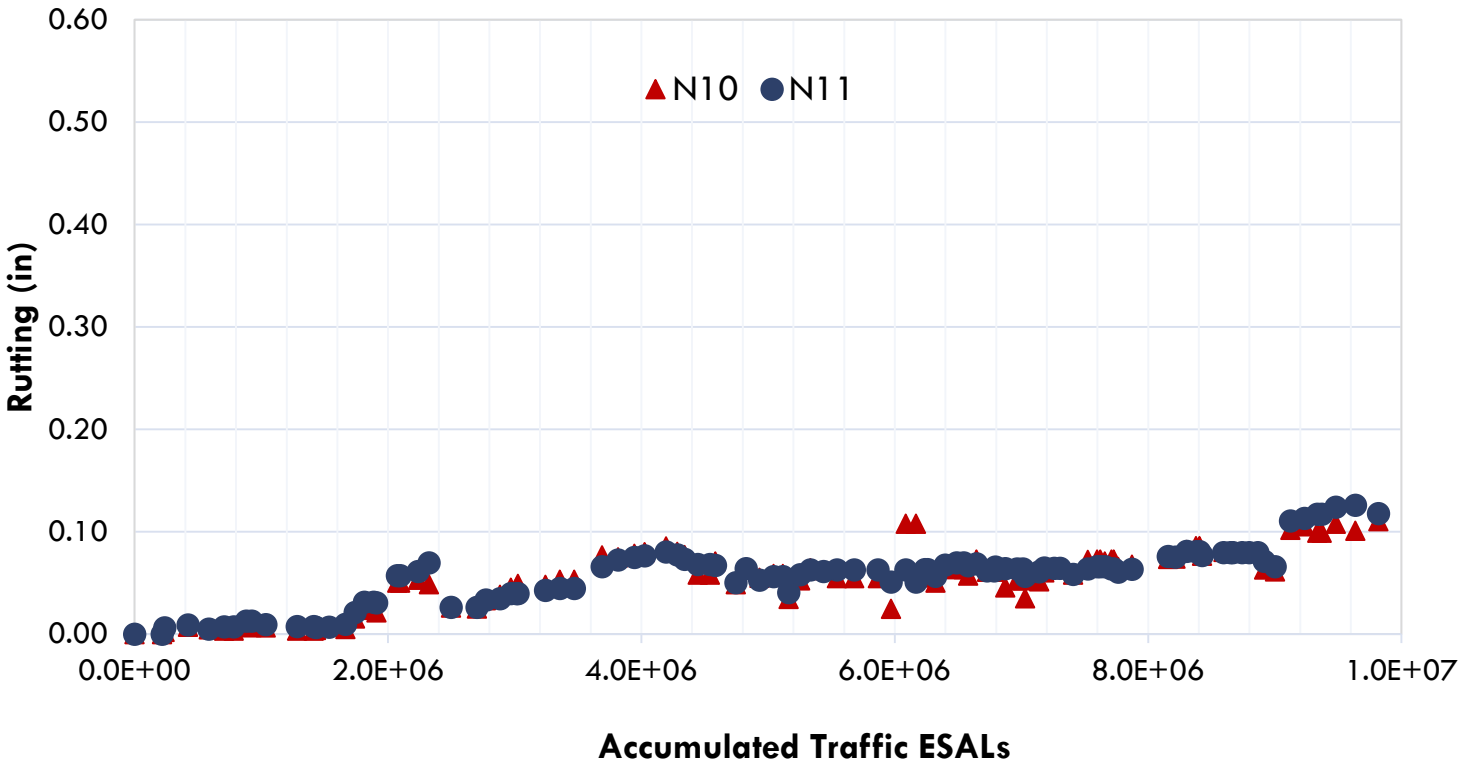
- 4.75 mm NMAS, 50 blow Marshall mix design, 80 PSY
- 6.0% $AC_{76\text{-}22}$
- As built thickness - 0.8 in
- 62% LMS, 13% GRN, 5% Fly ash, 20% F-RAP

N11 DGA "Ultra" Thinlay

- 4.75mm NMAS, 60 gyration Superpave mix design, 50 PSY
- 6.1% $AC_{67\text{-}22}$
- As built thickness-0.5 in
- 58% LMS, 22% Sand, 20% F-RAP

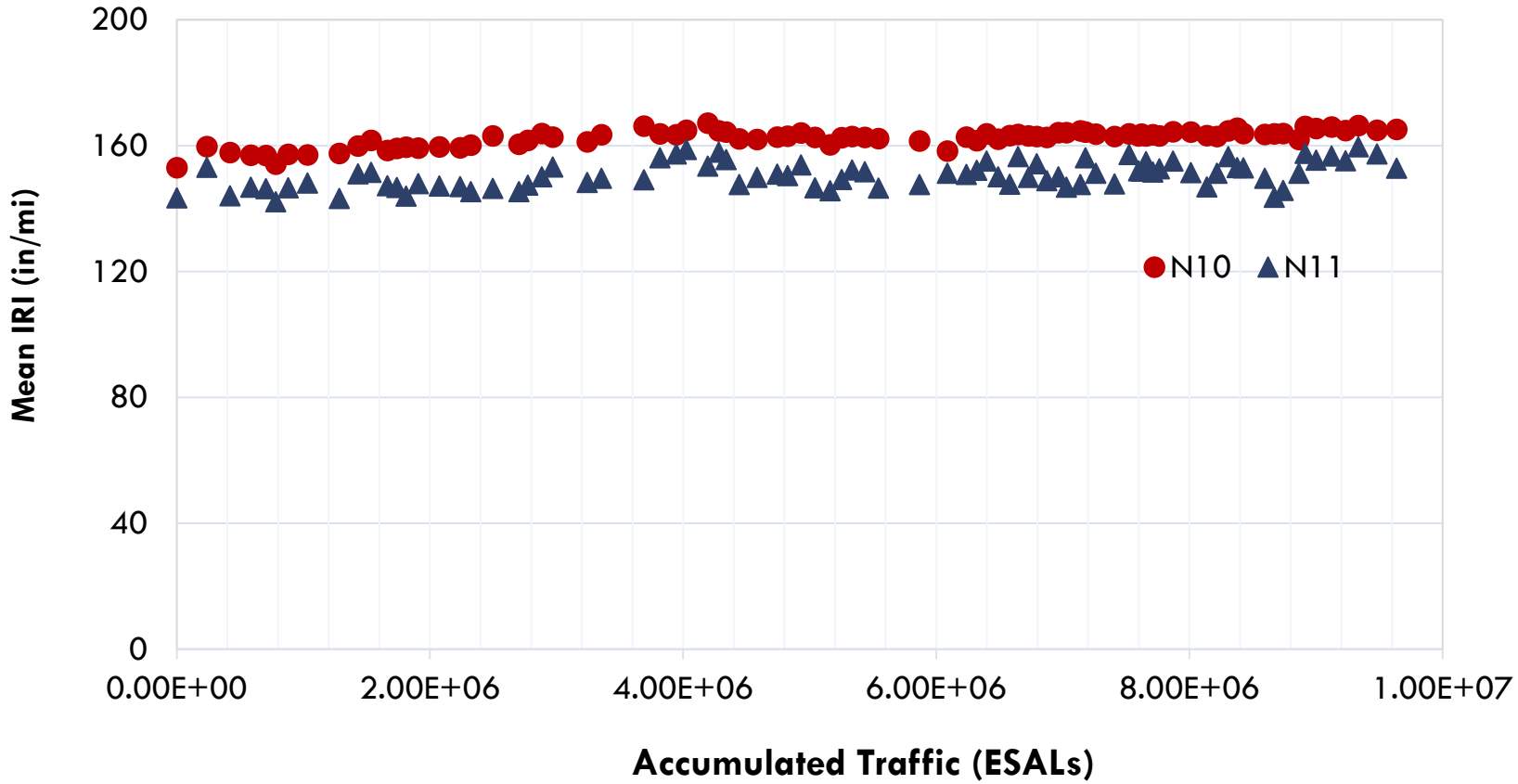
ALDOT does not allow the use of high % of carbonate aggregate on surface mixes
For this project a waiver was granted by ALDOT to be able to use limestone to rely on locally available materials

Rutting and Cracking

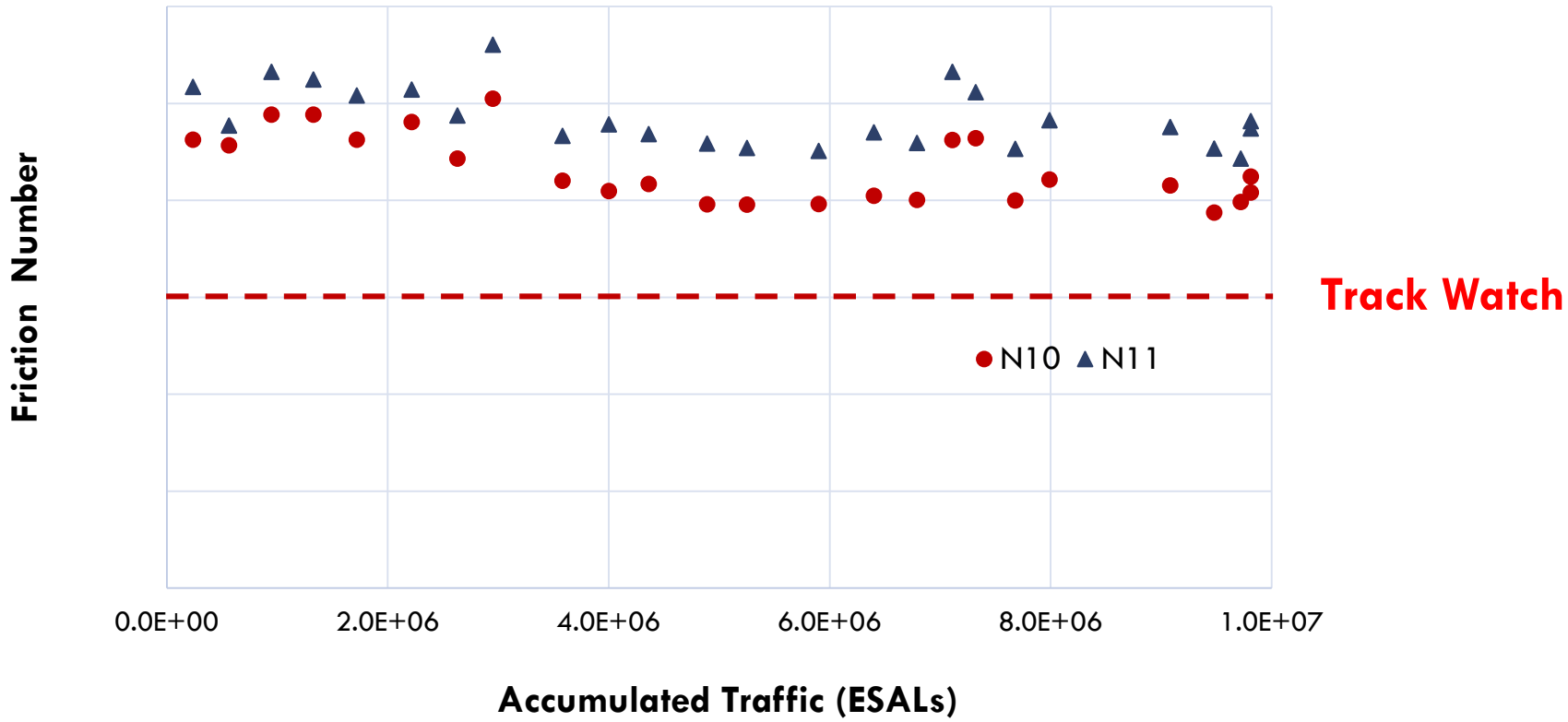


No cracking in any of the sections

International Roughness Index (IRI)



Friction –Skid Number



Laboratory Performance Tests

- HWTT (AASHTO T 324)
- Cantabro (ASTM D7064)
- IDEAL-CT (ASTM D8225-19)
- I-FIT (AASHTO TP 124)

Test Results

HWTT (at 50°C)

Mix ID	Average Rut Depth (mm)	
	10,000 passes	20,000 passes
N10	3.5	5.0
N11	1.6	2.0

Cantabro

Mix ID	Replicates	Average Cantabro loss (%)
N10	5	5.8
N11	6	6.1

Test Results

IDEAL-CT

Mix ID	Replicates	Average CT Index (RH PMLC)	Average CT Index (CA PMLC)
N10	5	50.4	21.8
N11	6	12.7	8.2

IFIT

Mix ID	Replicates	Average FI (RH PMLC)
N10	9	2.4
N11	7	1.6

Summary of Findings

- After 10 million ESALs sections performed well, with no cracking and minimum rutting
- IRI for both sections were high from the beginning of cycle but remained stable over time. This was attributed to the rough underneath base layers placed in a single pass prior to placement of surface layers
- LWFT results showed that both sections had friction values above safety threshold. This indicates that despite high percentage of limestone used for these mixes, sections had an adequate friction performance at the end of cycle

Summary

- HWTT results indicated that mixes were not susceptible to rutting, supported with minimal rutting in both sections
- Cantabro results suggested that mixes had adequate and comparable durability
- I-FIT results showed statistically similar FI results for both mixes, but lower than criterion established for Illinois DOT surface mixes. On the other hand, IDEAL-CT results showed significantly higher CT_{index} values for mix N10 compared to N11. Despite these results, there was no indication of any field cracking
- The results of this study indicate that it is feasible to construct alternative thinlays in Alabama and achieve satisfactory performance
- Continuing trafficking was recommended in these sections and selected by Alabama to evaluate their long-term performance

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Kentucky Longitudinal Joints (S7A and S7B)

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Background

- In 2015, KYTC sponsored the construction of section S7A with a standard Kentucky mix, and section S7B with a finer blend and lower design gyration mix to improve performance of longitudinal joint and overall mix durability
- NCAT recommended mix design improvements for S7B
- Mill/pave both inside and outside lanes on the Track
- At the end of the cycle, sections showed no cracking, and minimum rutting. In addition, field permeability on longitudinal joint showed that permeability value on Section S7B was less than 20% of that measured on Section 7A

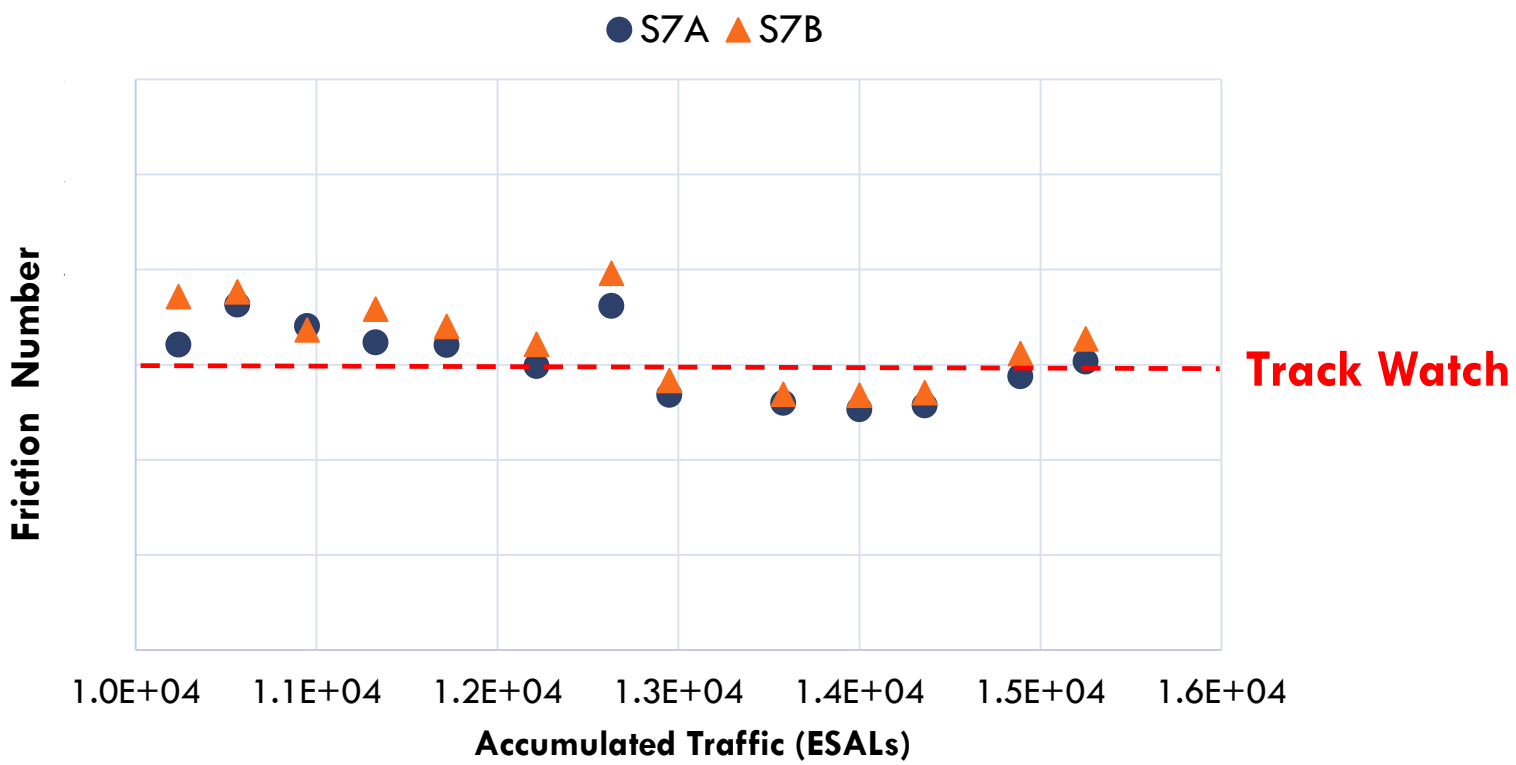
Recommendation-Finer Mix with Lower N_{des}

Quality Parameter	S7A Conventional	S7B Proposed
Design Gyrations	100	65
NMAS(mm)	9.5	9.5
Passing #4 (4.75mm)	51	79
Passing #8 (2.36mm)	26	46
Passing #16 (1.18mm)	16	32
Plant Binder Setting	5.6	6.2
RAP Aged Binder Ratio	12.8	10.3
Air Voids	3.0	2.6
As-Built Lift Thickness, in	1.3	1.4
Average Mat Density	92.1	95.1

Research Objective

Traffic continuation on sections S7A and S7B to assess the long-term performance of the longitudinal joint and overall mix durability after enduring two cycles of trafficking, which corresponds to 20 million ESALs.

Friction after 11.2 Million ESALS



Shotblasting Treatment (12/15/2019)

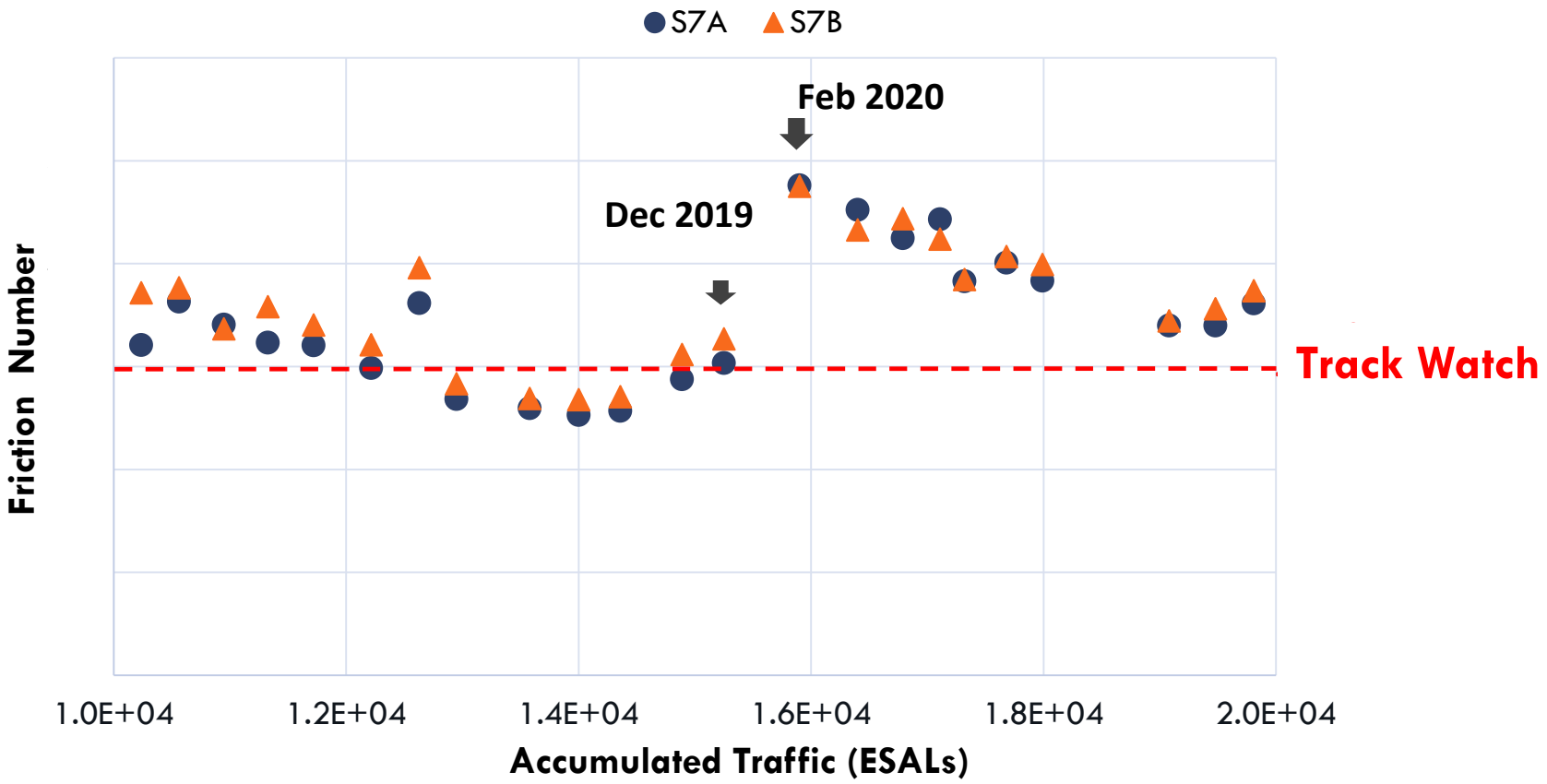
Shotblasting S7A &S7B

Steel Shots

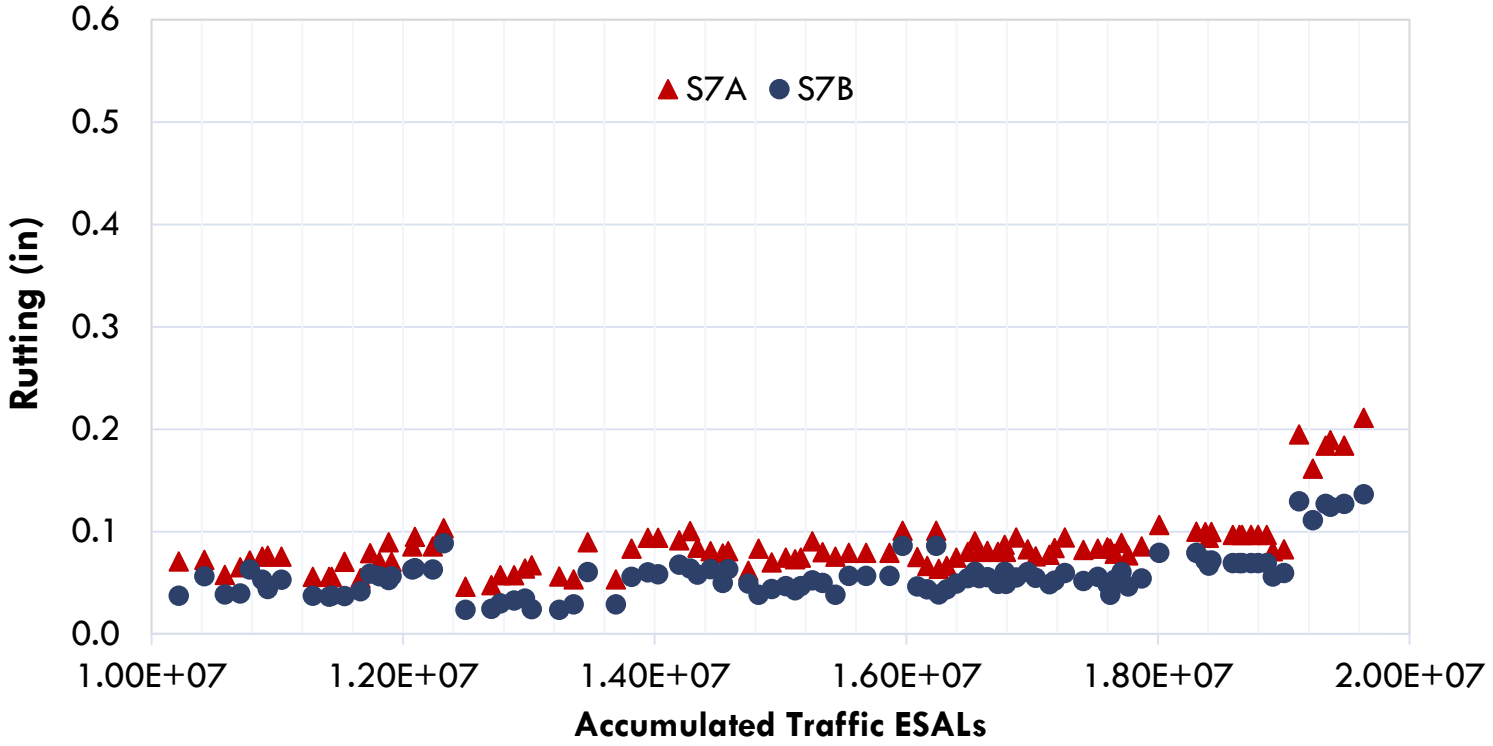
Shot blasted Section

- Shot blast to regain microtexture of polished aggregate

Friction Measurements After Treatment

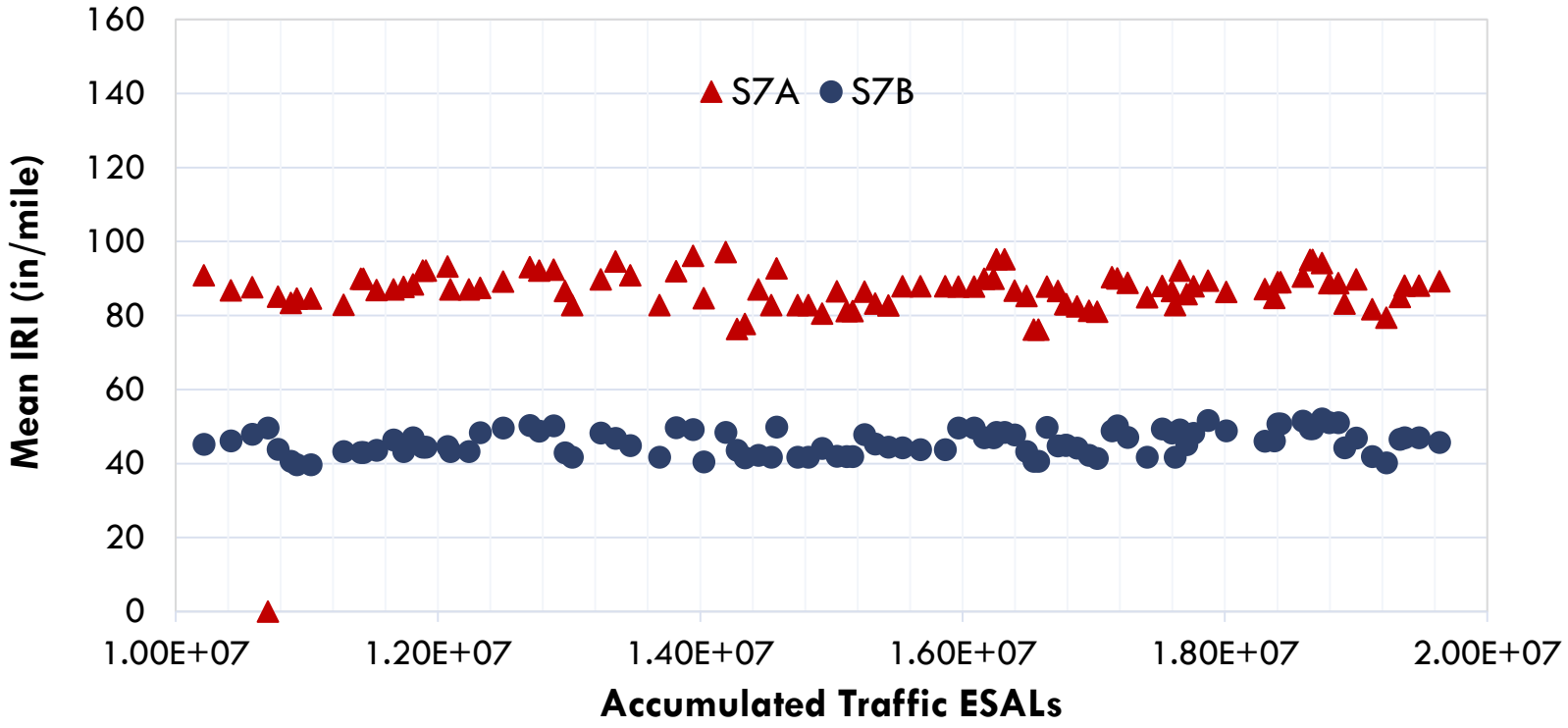


Rutting and Cracking

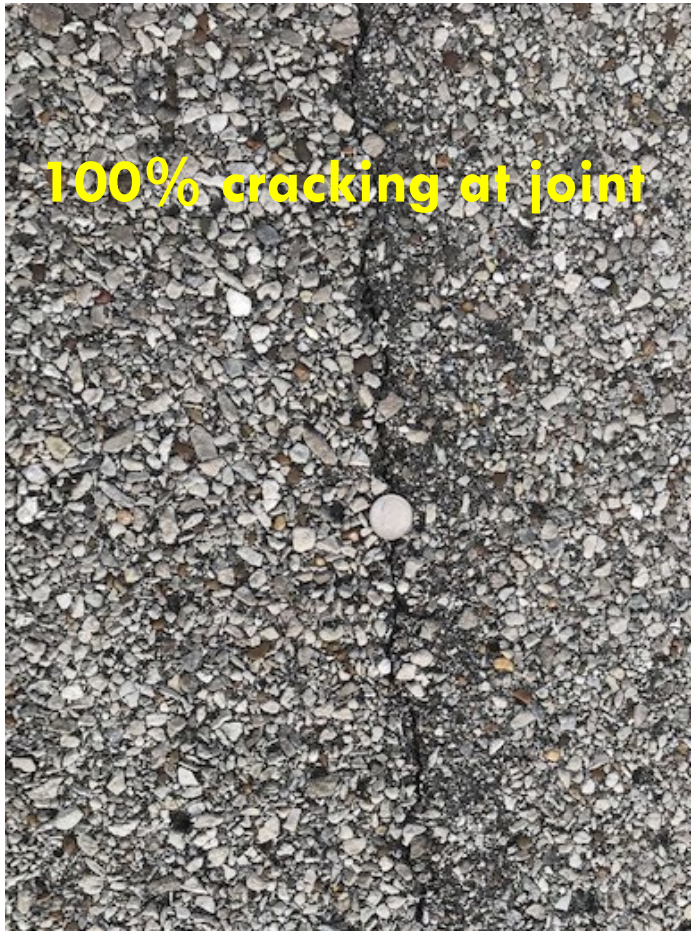


No cracking in the sections

IRI


160
140
120
100
80
60
40
20
0
S7A
S7B
Mean IRI (in/mile)
1.00E+07
1.20E+07
1.40E+07
1.60E+07
1.80E+07
2.00E+07
Accumulated Traffic ESALs

Longitudinal Joint Cracking



S7A

S7B

Meaningful to measure permeability of the cracked joints

Summary of Findings

- After 20 million ESALs, no cracking was observed in the sections, but low severity cracking developed at the joints. At the end of the cycle, Section S7A had 100% cracking at the joint, while Section S7B had 64%
- Rut depths were 0.2 in and 0.14 mm for Sections S7A and S7B, indicating that mixes were not susceptible to rutting
- IRI and surface texture remained constant through the research cycle, with Section S7B having lower values compared to Section S7A
- Shotblasting treatment demonstrated an effective solution to improve friction characteristics of asphalt pavements when polishable aggregates are utilized
- Friction results will complement “BMD+friction” on the 2021 Track

Questions and Answers

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