N9 OK DOT OGFC Friction and Bond Strength Study

Mike Heitzman PE, PhD

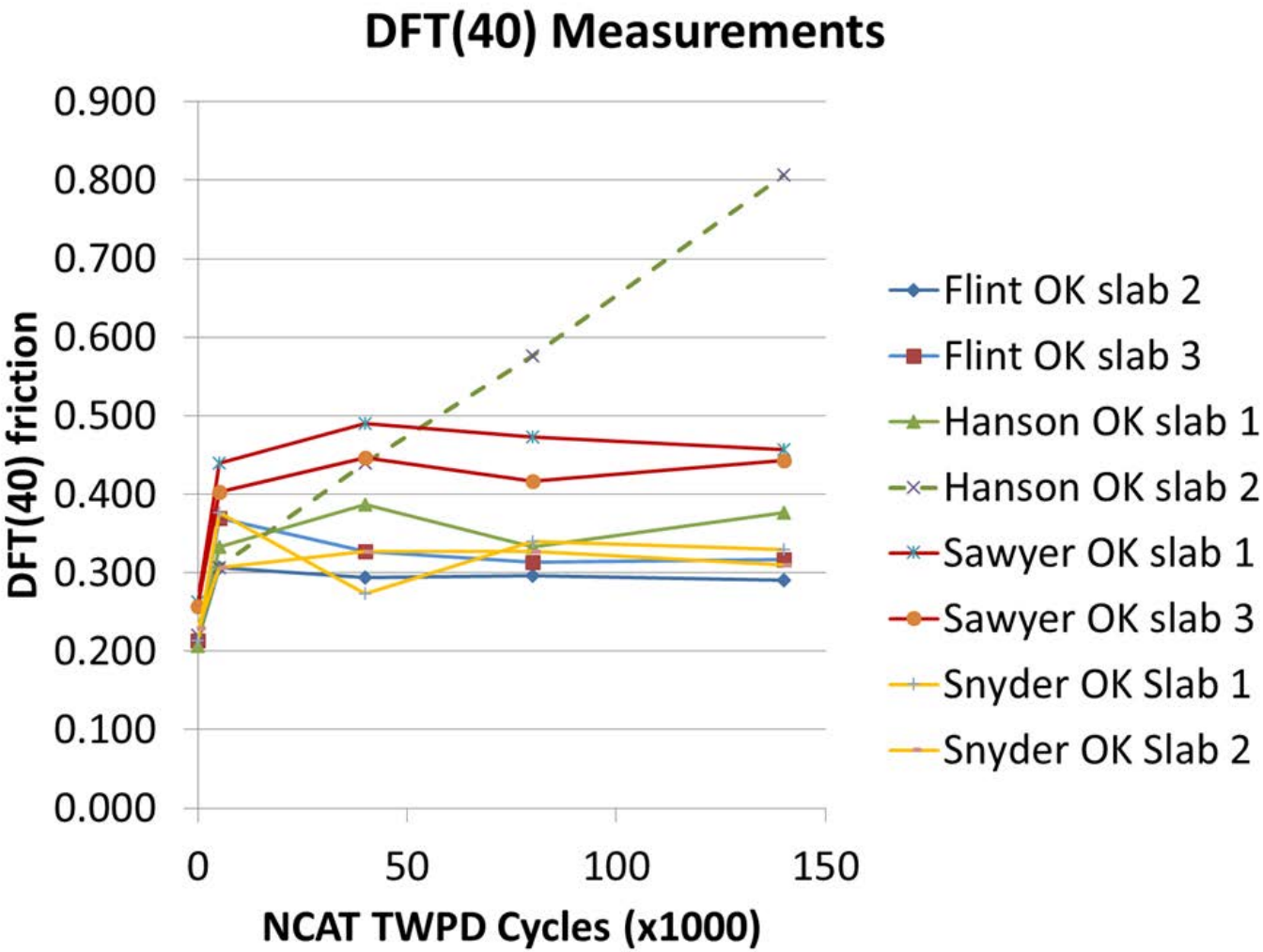
National Center for Asphalt Technology
NCAT
at AUBURN UNIVERSITY

2018 NCAT Test Track Conference

Study Objectives

- Compare high friction aggregate sources with accelerated lab friction testing
- Compare Test Track friction performance with previous OK DOT Test Track sections
- Compare tack coat performance

Aggregate Selection Using Accelerated Lab Friction



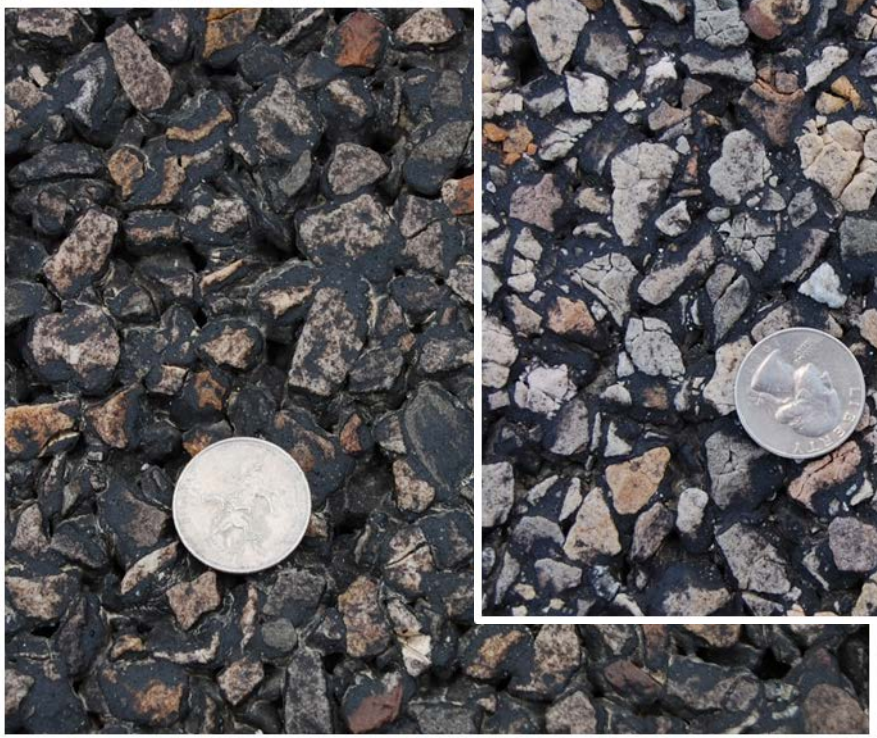
Mix Design and Construction

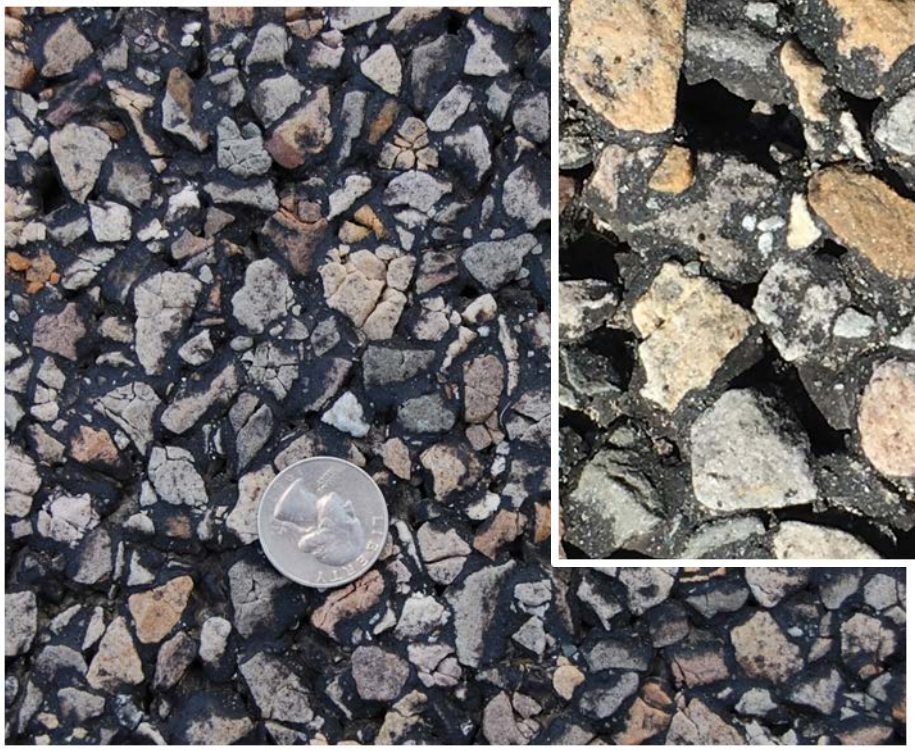
- OGFC
- 12.5 mm NMAS
- Sandstone
- 7% PG 76 -28
- 0.3% fiber
- 19.00 mm thick

Micro-mill Existing Surface

N9 Surface Changes

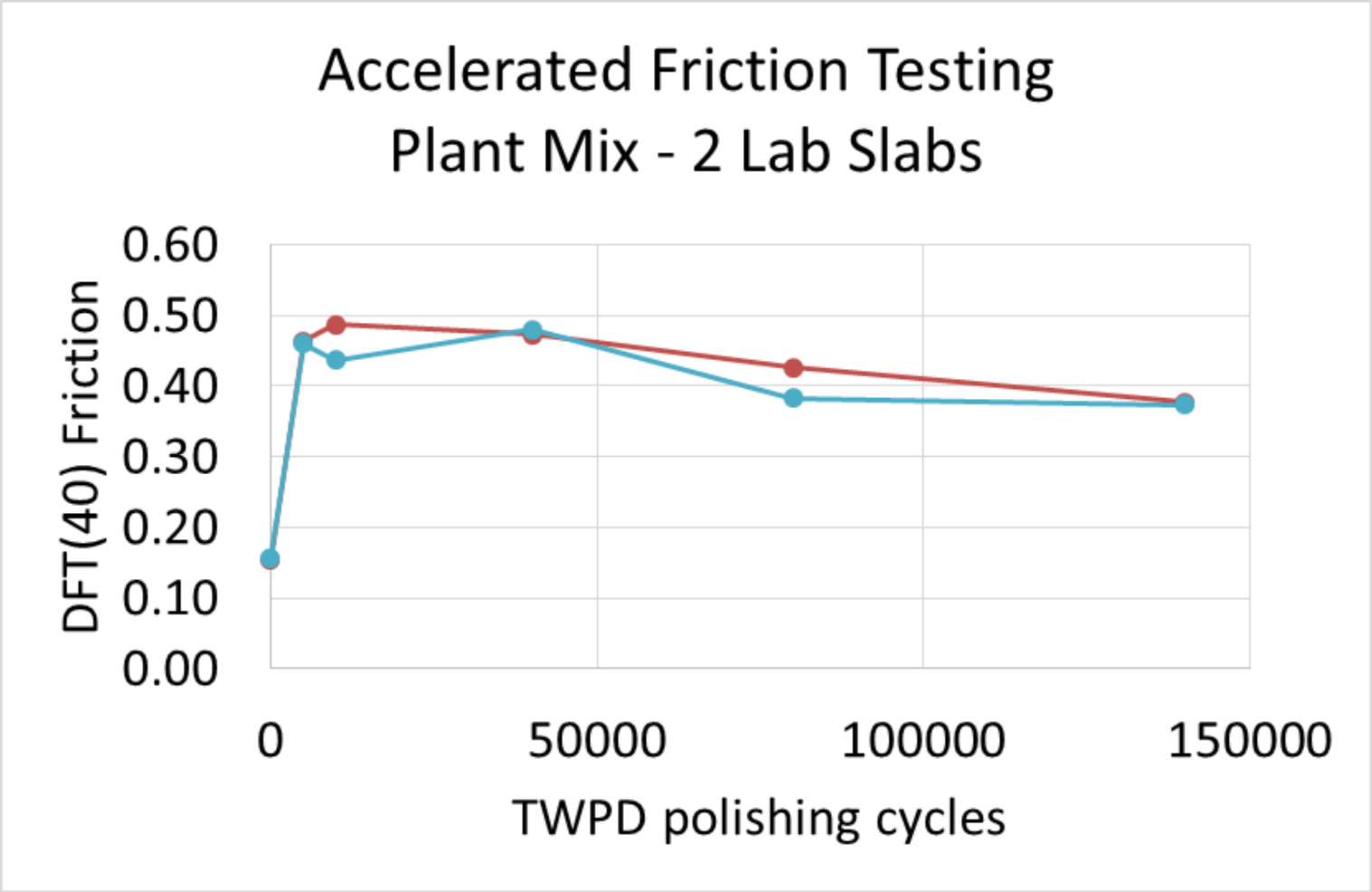
Feb 2016 July 2016 April 2017





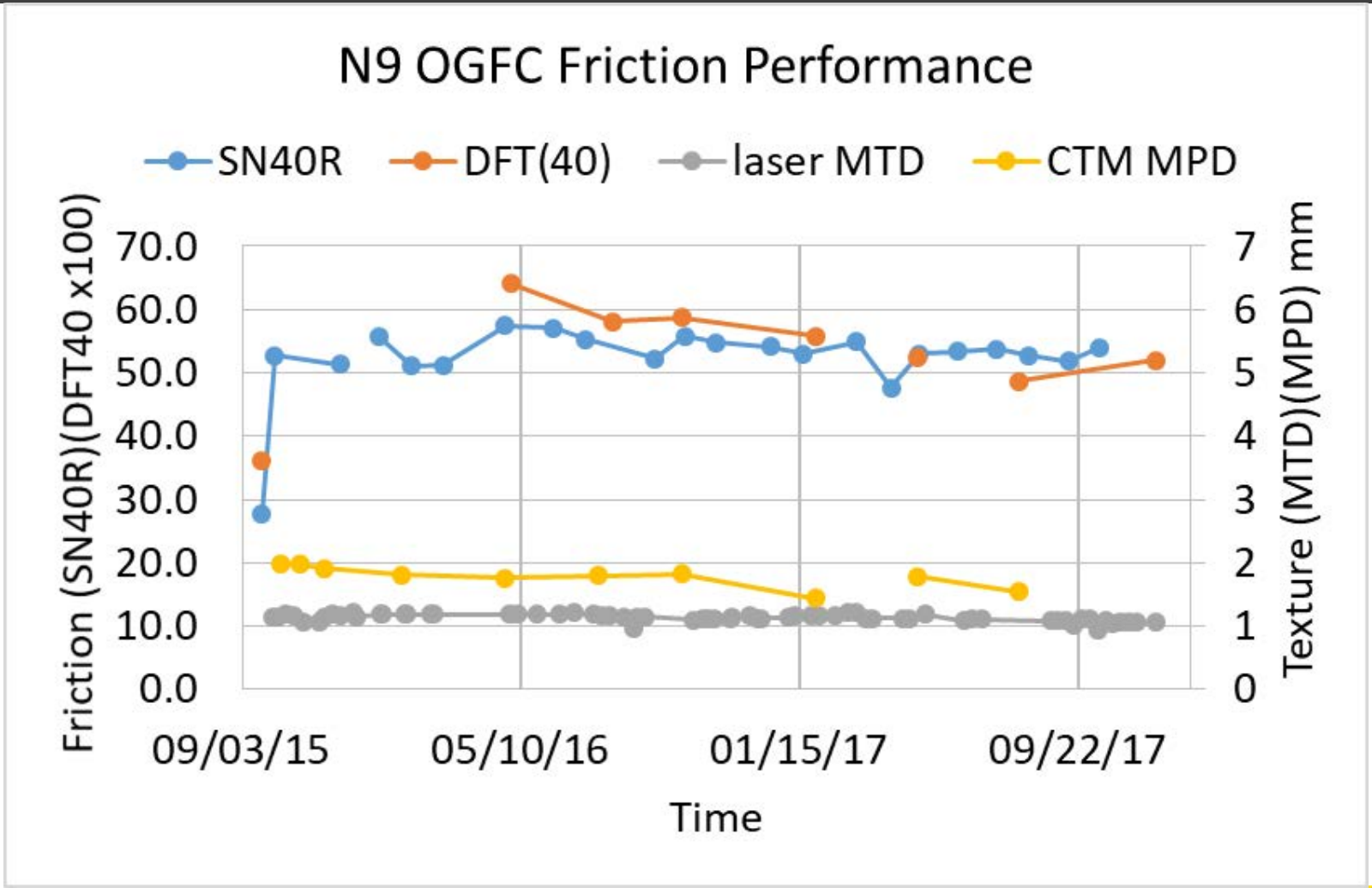
National Center for Asphalt Technology NCAT at AUBURN UNIVERSITY

Plant Mix Slab TWPD Polishing



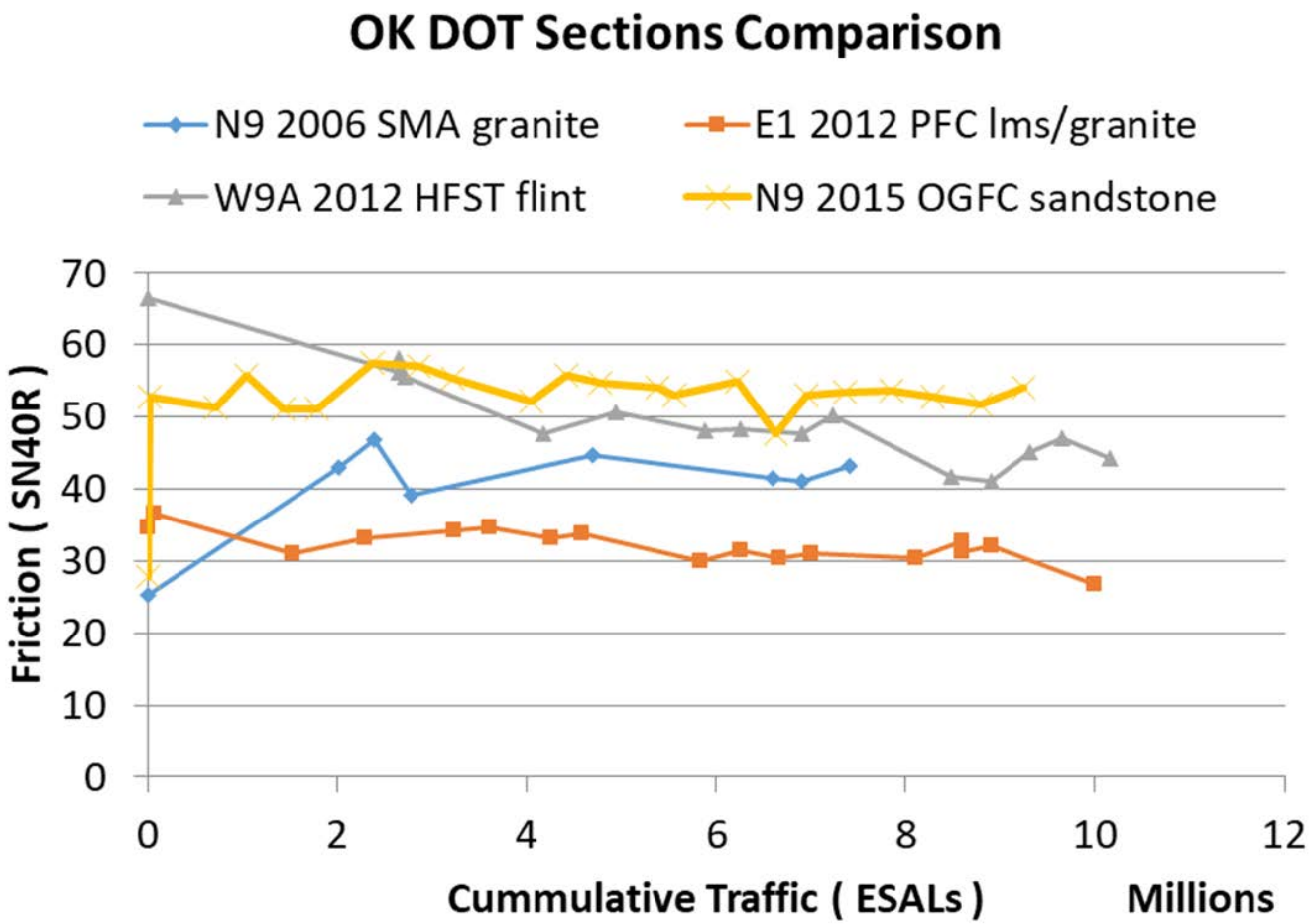
National Center for Asphalt Technology NCAT at AUBURN UNIVERSITY

Friction and Texture Performance



National Center for Asphalt Technology NCAT at AUBURN UNIVERSITY

Other OK Pavement Surfaces



National Center for Asphalt Technology NCAT at AUBURN UNIVERSITY

Bond Strength Study

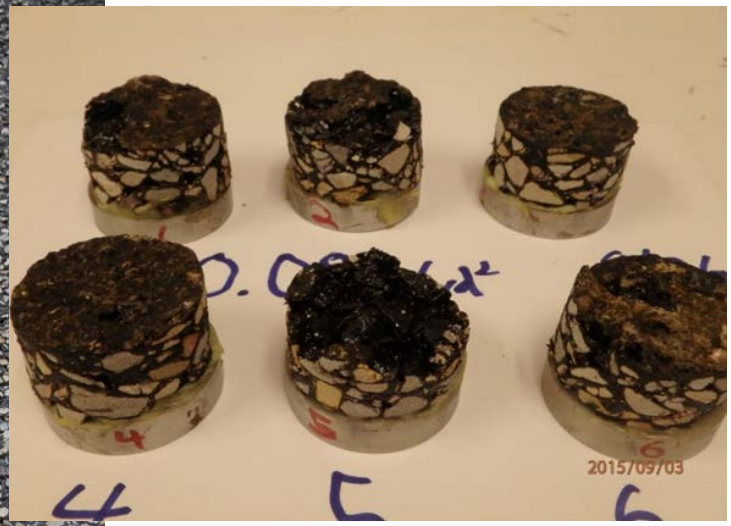
N9B tack rate = 0.15 gal/sy N9A tack rate = 0.08 gal/sy

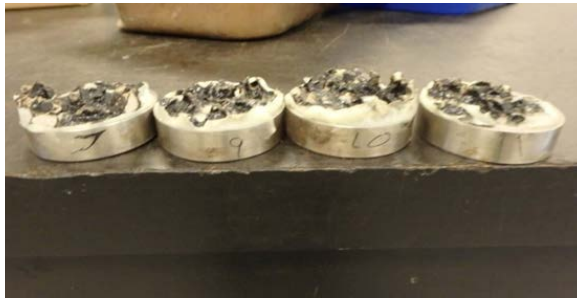
National Center for Asphalt Technology NCAT at AUBURN UNIVERSITY

Field Pull-out Test Results

Date	Surf Temp	Tack Rate	Load (kN)	Comment
Aug-21 (day 7)	132 F	Low	NA	Broke in OGFC
		High	NA	Broke in OGFC
Aug-28 (day 14)	80 F	Low	0.2	Broke at tack interface
		high	0.3	Broke in OGFC
Sep-17 (day 34)	65 F	Low	0.7	Broke at tack interface
		high	1.0	Broke in OGFC
Oct-19 (day 66)	60 F	Low	0.6	Broke at epoxy interface
		high	0.6	Broke at epoxy interface

Field Pull-out Test





National Center for Asphalt Technology NCAT at AUBURN UNIVERSITY

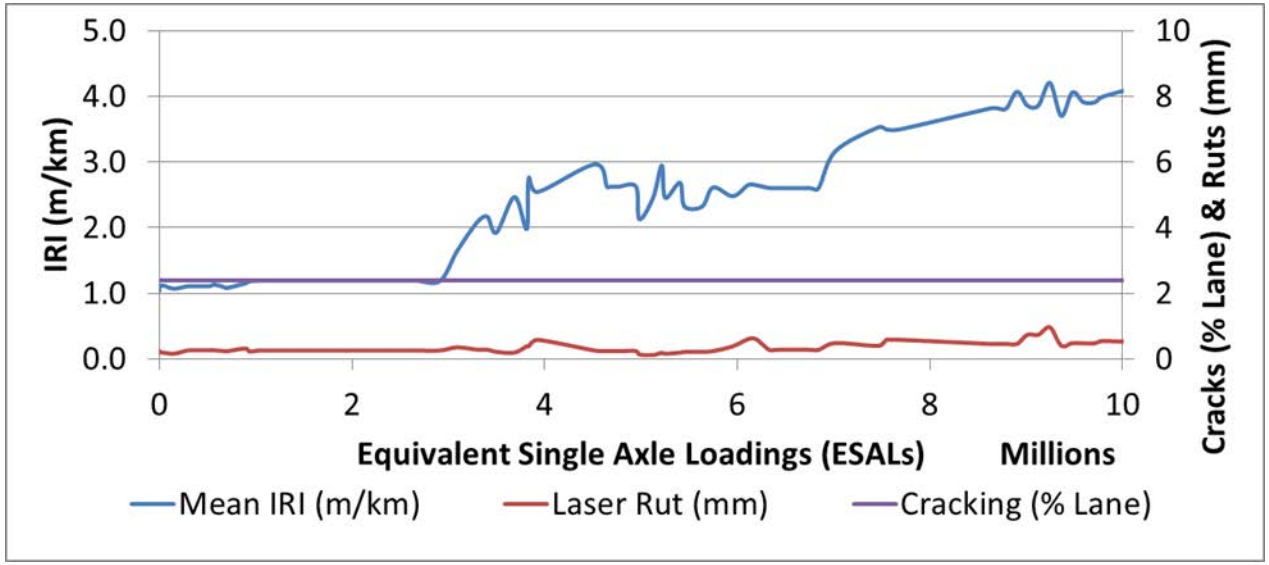
Reflective Cracks

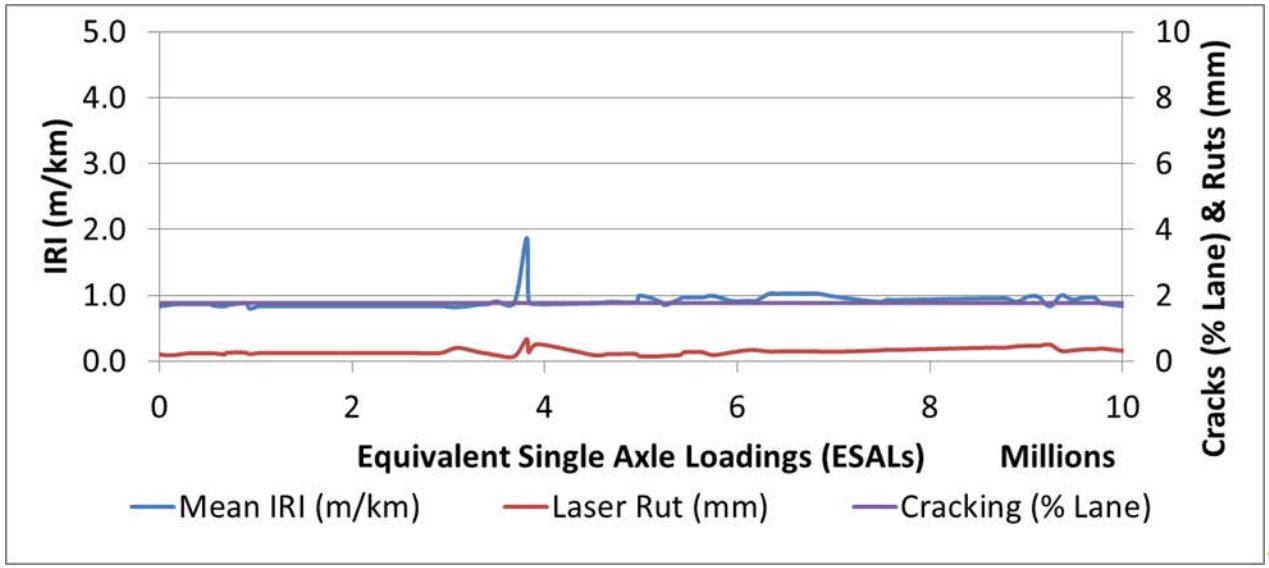
National Center for Asphalt Technology
NCAT
at AUBURN UNIVERSITY

Full Depth Core Damage

Approach Transition Repair

N9 General Performance





National Center for Asphalt Technology NCAT at AUBURN UNIVERSITY

THANKS!

Any questions?
Reach me at
mah0016@auburn.edu

2018 NCAT Test Track Conference

FHWA High Friction Asphalt Bound Alternatives

Mike Heitzman PE, PhD

National Center for Asphalt Technology
NCAT
at AUBURN UNIVERSITY

2018 NCAT Test Track Conference

Scope of Study

Can thin asphalt surface treatments perform similar to high friction surface treatments (HFST)?

What is HFST?

- AASHTO PP 79-14
  - Polymer binder resin 25-32 ft^2/gal
  - Calcined bauxite 12-15 lb/yd^2 (Al_2O_3 87%, LA Abr 20%)
  - SN40R of 65 minimum post construction
- Challenges
  - Bauxite gradation is fixed (passing No.6, retained No.16)
    - Challenge-aggregate blending
  - Bauxite cost is high: ($300/ton)
    - Challenge-aggregate surface exposure

Surface Type Selection

Surface	Binder Cost	Aggregate Amount	Macro-texture	Service Life (yrs)
HFST	$$$$	Low	Very high	6-8
Dense-graded	$$	High	Very low	10
SMA	$$	High	Low	10
OGFC	$$	High	High	10
Micro-surfacing	$	Low	Moderate	4-6
Chip seal	$	Low	high	3-5

W7 Micro-surfacing with calcined bauxite

National Center for Asphalt Technology
NCAT
at AUBURN UNIVERSITY

W7 Objectives

- Compare friction performance of two micro-surfacing treatments using different friction aggregates
- Compare friction performance to HFST

W7A Mix Design using Bauxite

- Mix design by Paragon Technical Services
- India calcined bauxite source (84% Al_2O_3), 25% retained on #8
- 50% bauxite, 49% limestone sand, 1% cement filler
- 12.5% CSS-1HP (HiMA eFlex)
- 72% coarse fraction (+ #16) was 67% bauxite

W7B Mix Design using Sandstone

- Mix design by Paragon Technical Services
- TX sandstone, 47% retained on the #8
- 12% CSS-1HP (HiMA eFlex)
- 68% coarse fraction (+ 16%)

Calcined Bauxite Supply

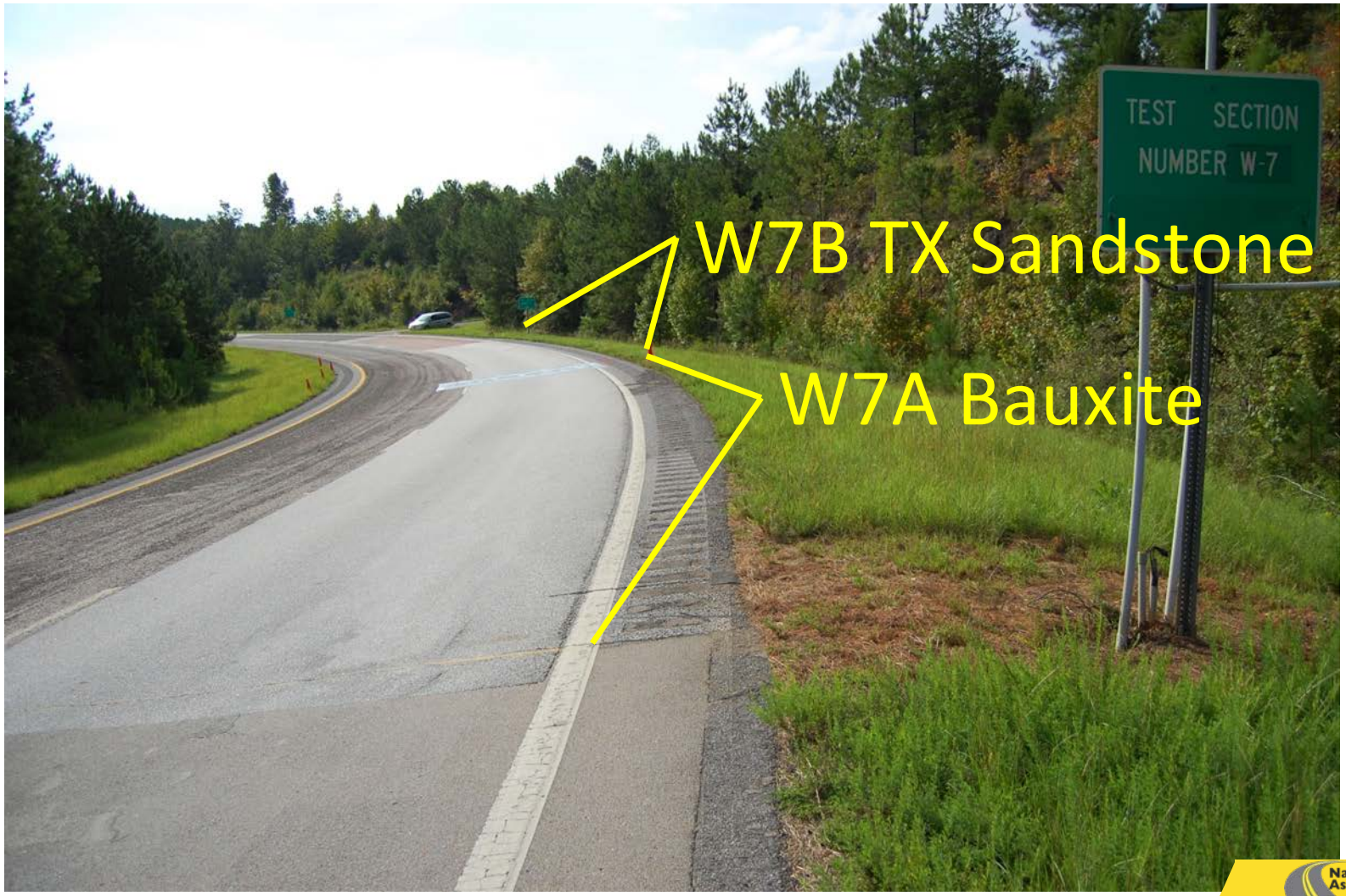
National Center for Asphalt Technology
NCAT
at AUBURN UNIVERSITY

Bauxite and Limestone Blending

Placing Micro-surfacing

National Center for Asphalt Technology
NCAT
at AUBURN UNIVERSITY

W7 Split Test Sections

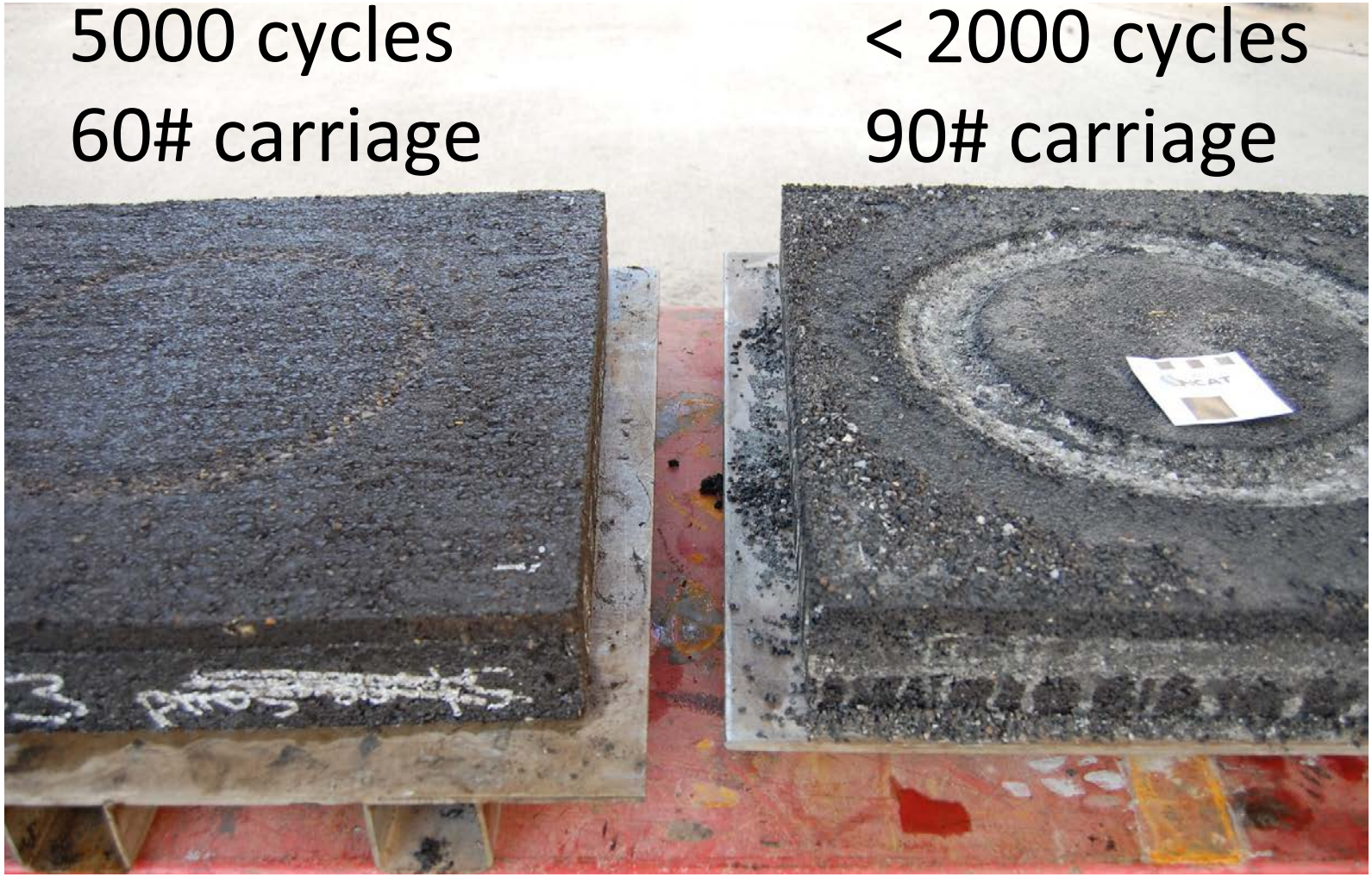


National Center for Asphalt Technology
NCAT
at AUBURN UNIVERSITY

Preparing Slabs for Lab Testing

National Center for Asphalt Technology
NCAT
at AUBURN UNIVERSITY

TWPD Polishing Micro-surfacing



National Center for Asphalt Technology NCAT at AUBURN UNIVERSITY

W7 Surface Changes

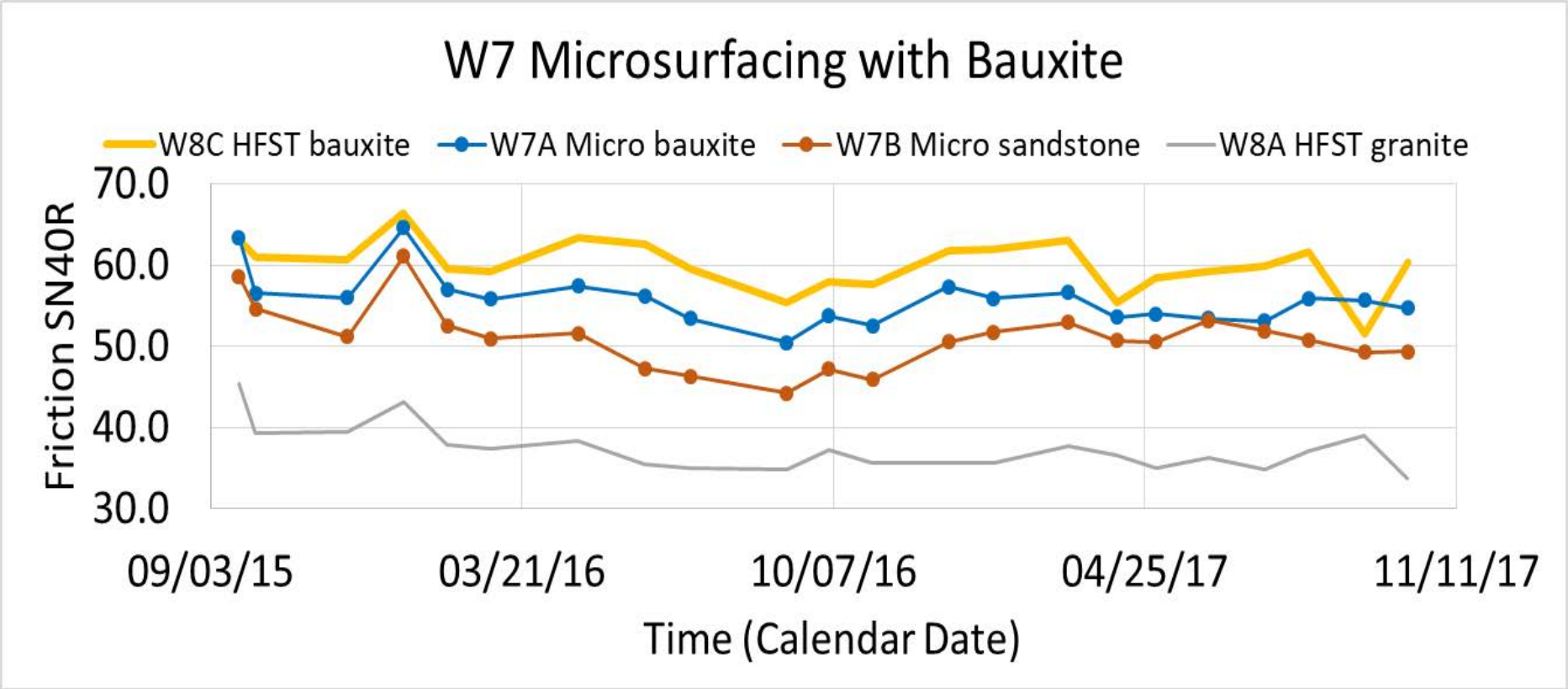
Feb 2016 July 2016 Apr 2017






National Center for Asphalt Technology NCAT at AUBURN UNIVERSITY

W7 Friction Performance



W3 SMA using Bauxite

National Center for Asphalt Technology
NCAT
at AUBURN UNIVERSITY

W3 Objectives

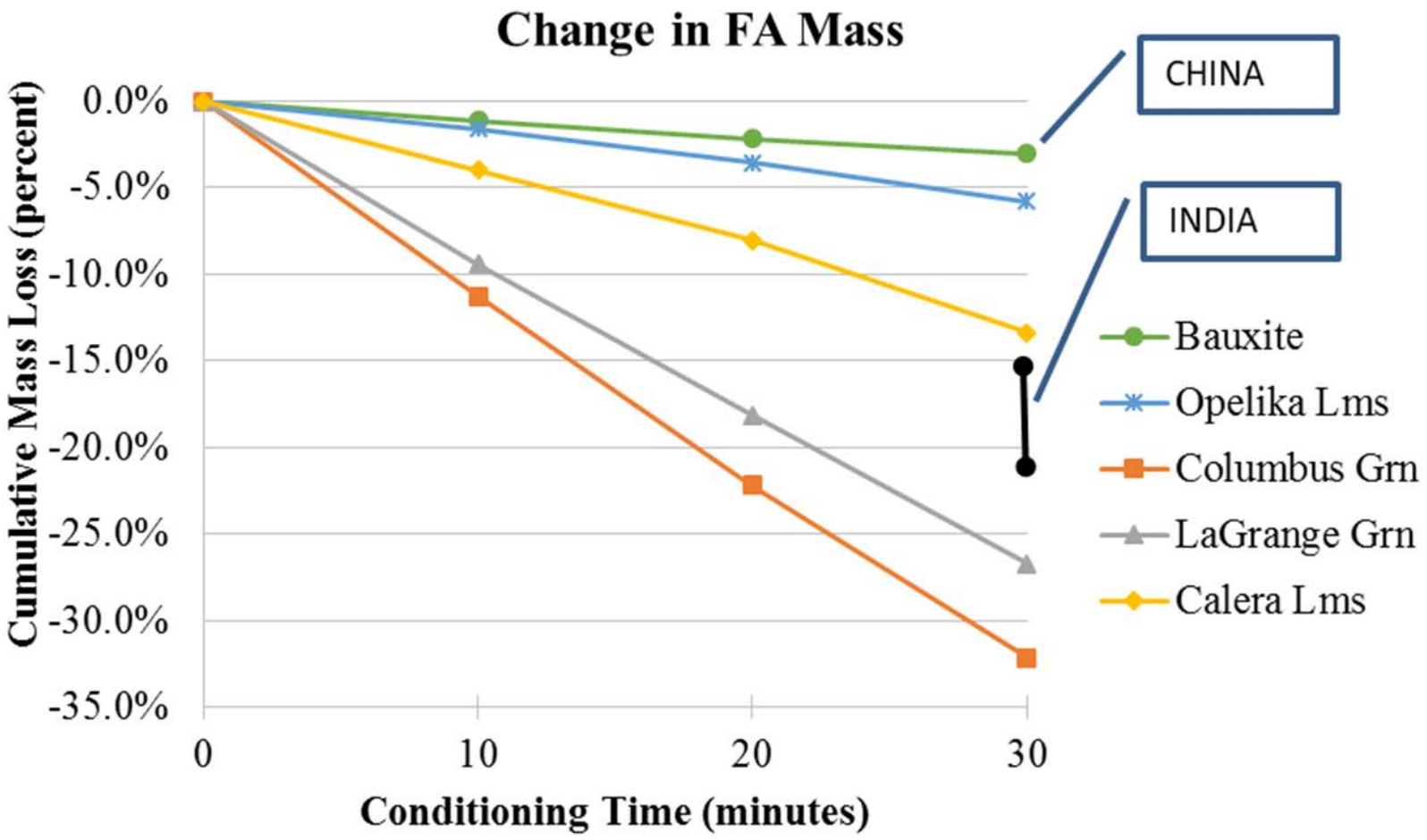
- Measure friction performance of SMA with calcined bauxite as the predominant coarse aggregate
- Compare friction performance with HFST sections and previous W3 SMA
- Surface placed April 4, 2017

W3 Mix Design

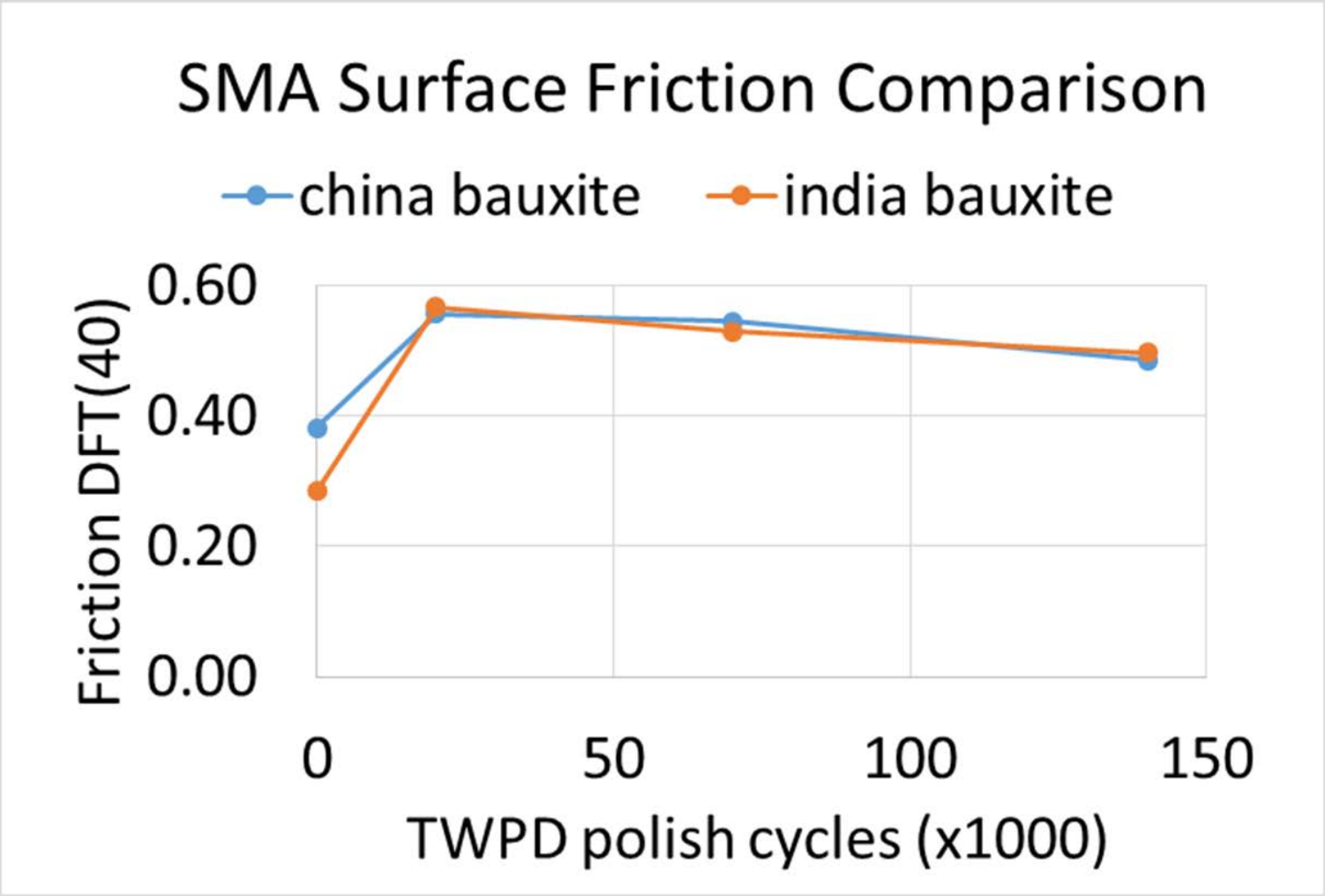
- Original JMF Sep 2016
  - 4,75 mm NMAS, 50-blow Marshall
  - **China bauxite**, 7% AC, 4% voids
- Final JMF Mar 2017
  - 4.75 mm NMAS, 50-blow Marshall
  - 40% **India bauxite**, 59% limestone,1% filler, 8.3% PG 76 -22, 5% voids
  - CA 50% = +No 16 (2:1 bauxite:limestone)

China Bauxite vs India Bauxite

Bauxite Comparison Micro-Deval

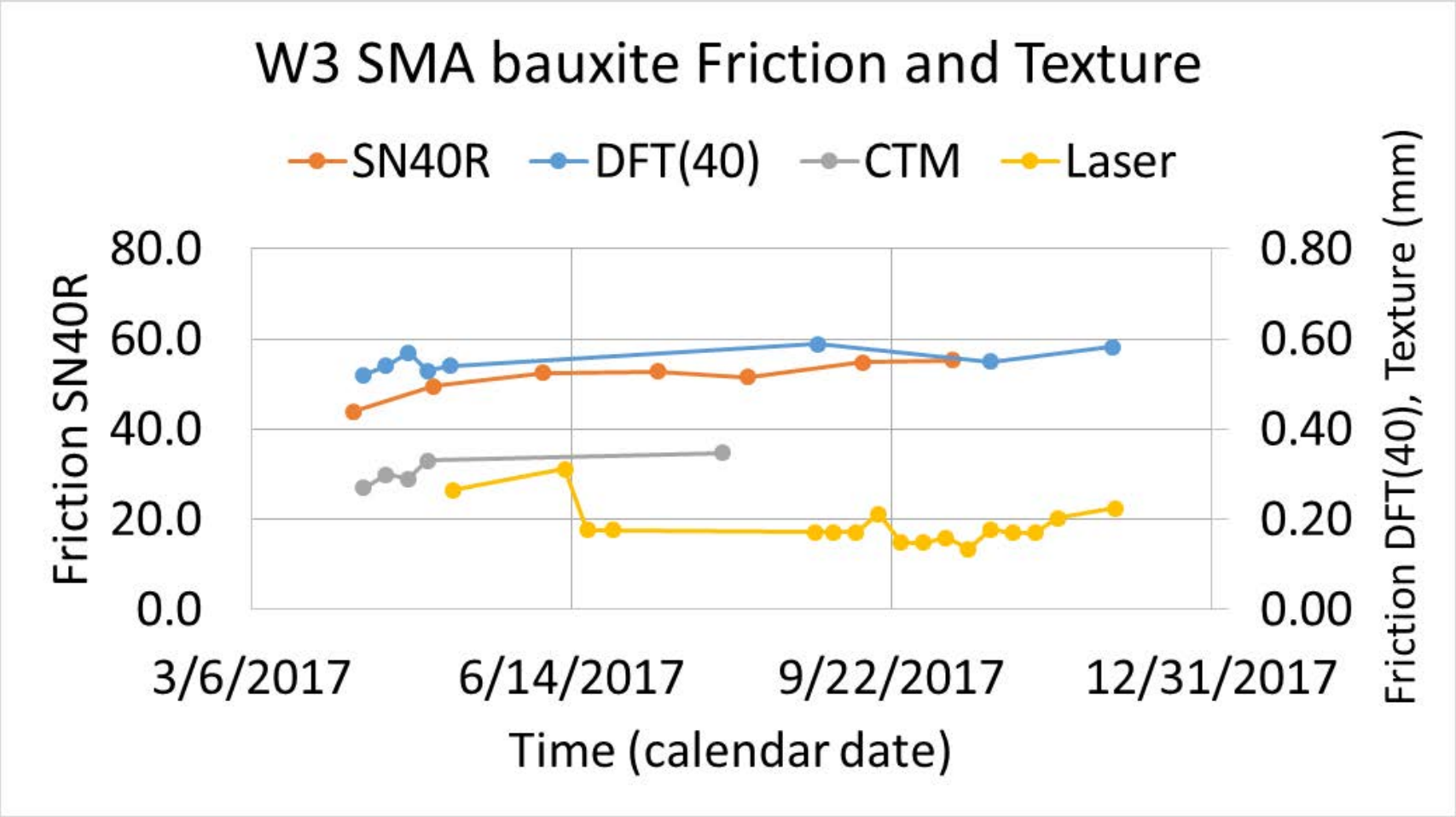


Bauxite Comparison - Friction

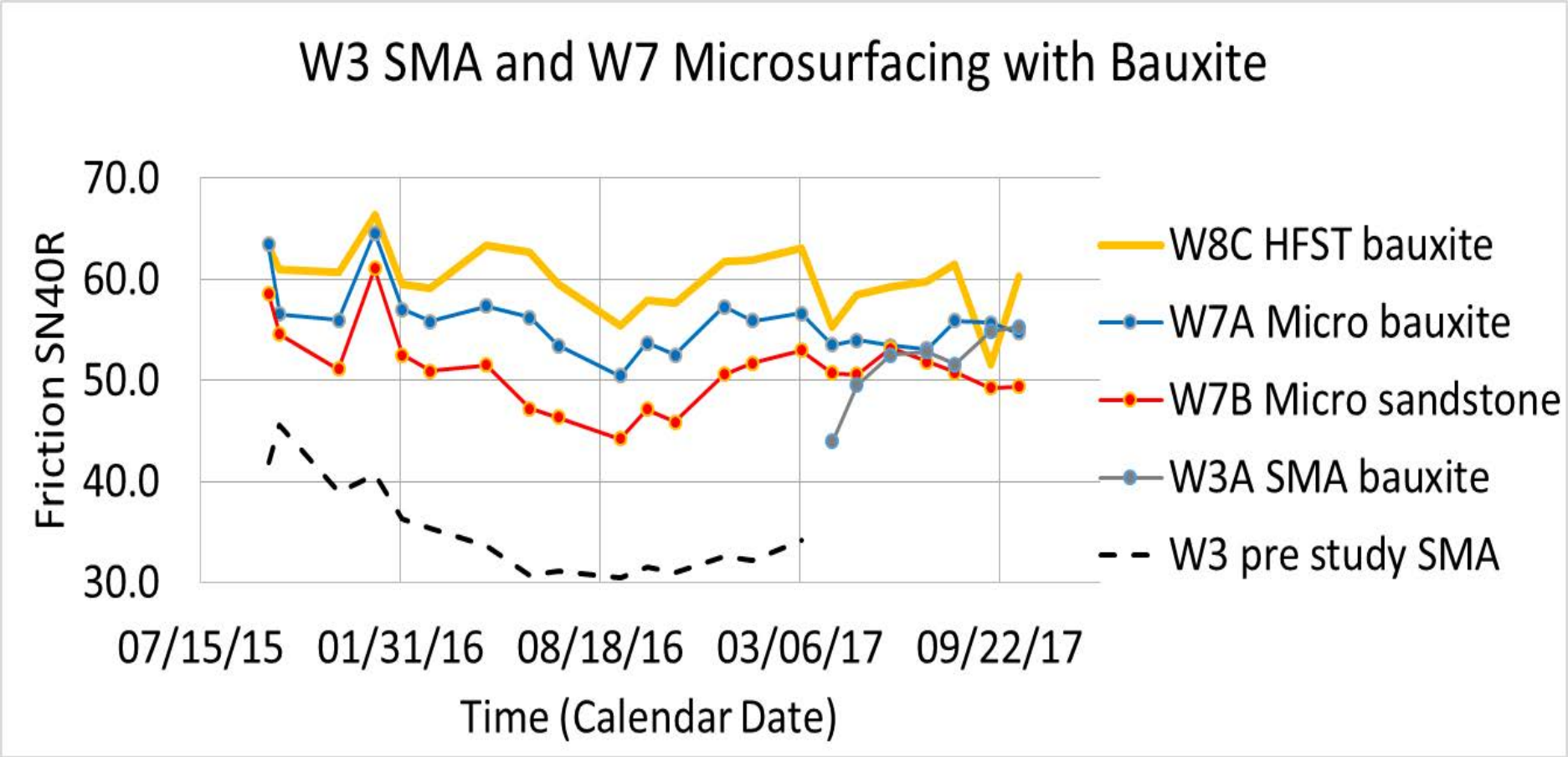


W3 Construction

W3 Friction and Texture Performance

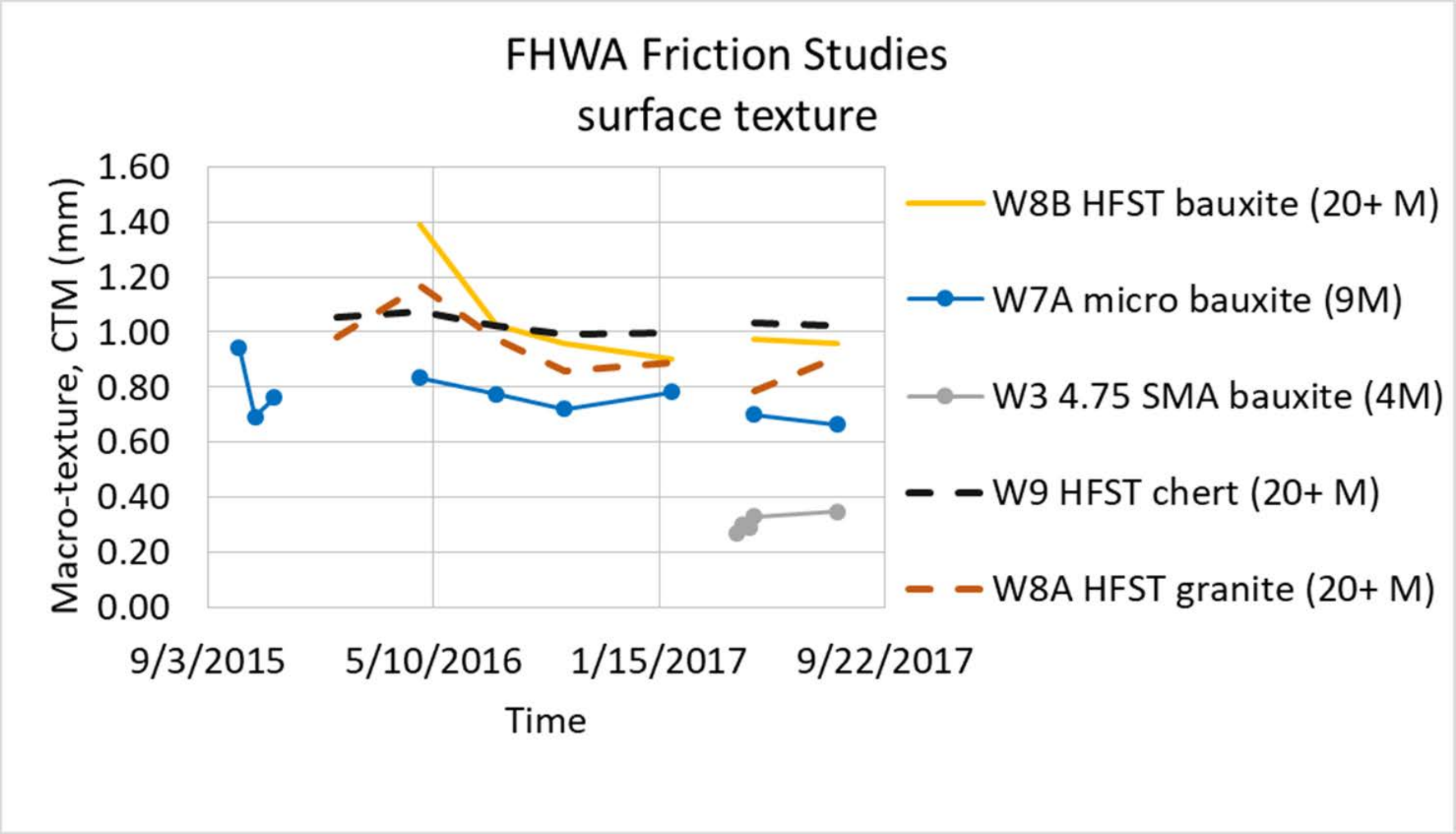


FHWA Friction Summary



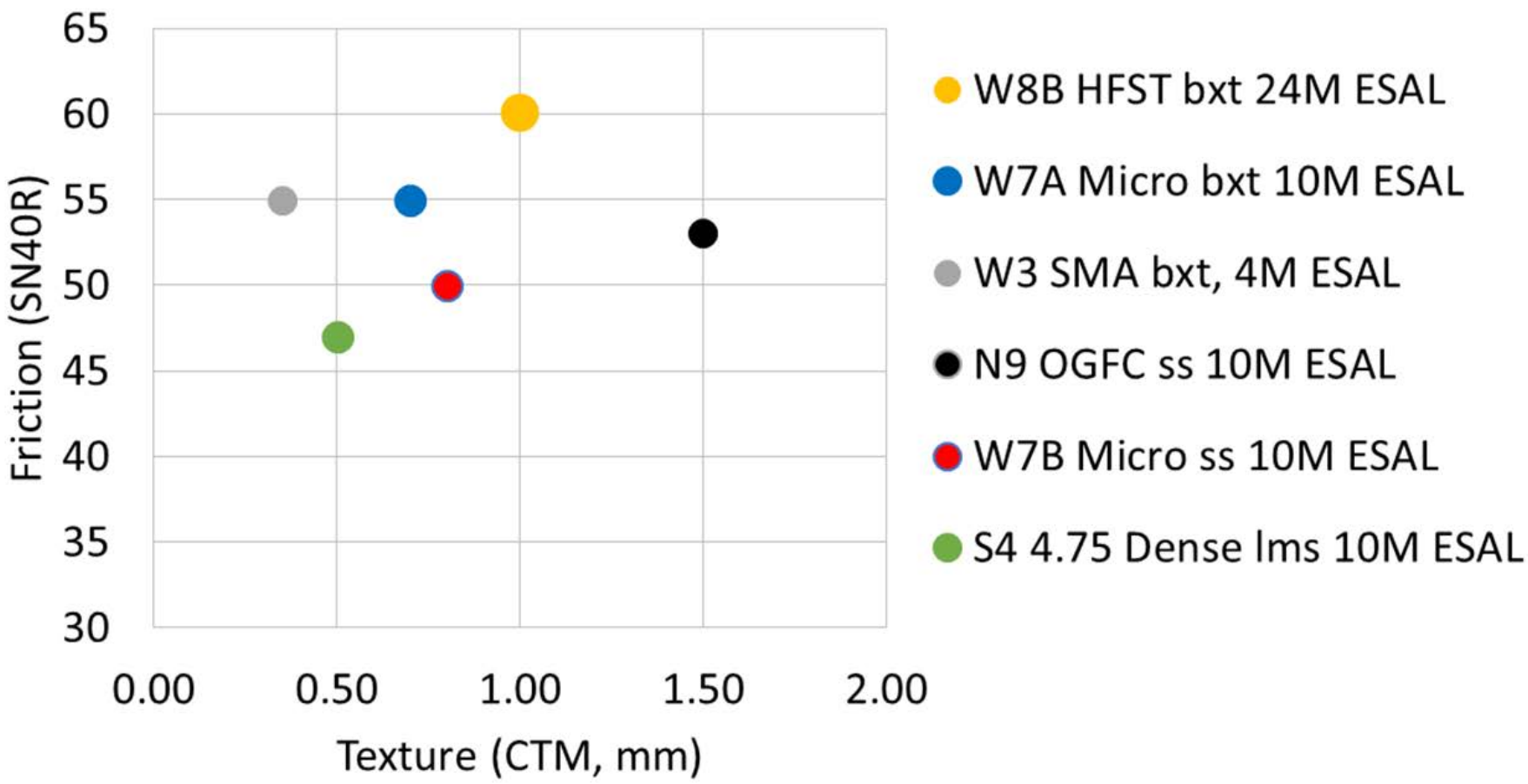
National Center for Asphalt Technology NCAT at AUBURN UNIVERSITY

FHWA Texture Summary



National Center for Asphalt Technology NCAT at AUBURN UNIVERSITY

What are Acceptable Surface Criteria?



National Center for Asphalt Technology NCAT at AUBURN UNIVERSITY

THANKS!

Any questions?
Reach me at
mah0016@auburn.edu

2018 NCAT Test Track Conference