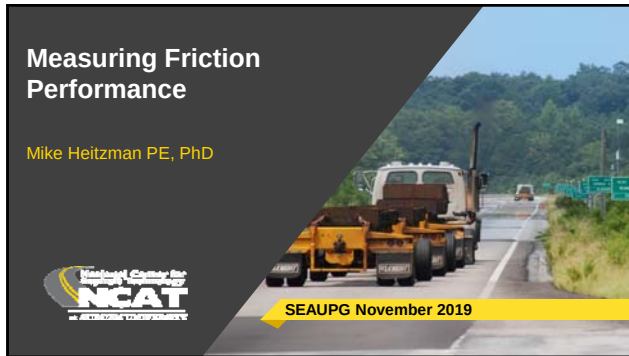




NCAT Friction Studies

- FHWA Alternative Aggregates for HFST
- FHWA Asphalt Bound Friction Surfaces
- OK DOT Optimize OGFC Aggregate
- MI DOT Classify HFST Aggregates
- MS DOT Improving Thin Asphalt Surfaces
- WV DOT Use of Local Friction Aggregate

2 NCAT

What is HFST?

- AASHTO PP 79-14
 - Polymer binder resin 25-32 ft²/gal
 - Calcined bauxite 12-15 lb/yd² (Al₂O₃ 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

3 NCAT

HFST Alternative Studies

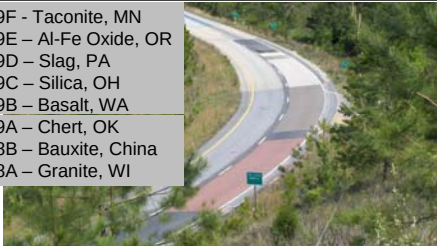
FHWA Alternative Aggregates for HFST

- ▷ 8 aggregates, lab TWPD/DFT & Test Track
- ▷ Test Track W8 & W9, April-2011

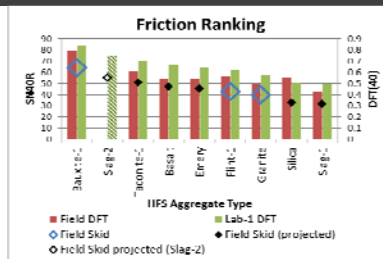


W8-9 HFST Test Sections

W9F - Taconite, MN
 W9E - Al-Fe Oxide, OR
 W9D - Slag, PA
 W9C - Silica, OH
 W9B - Basalt, WA
 W9A - Chert, OK
 W8B - Bauxite, China
 W8A - Granite, WI



W8-9 HFST Test Sections



HFST Alternative Studies

FHWA Asphalt Bound Friction Surfaces

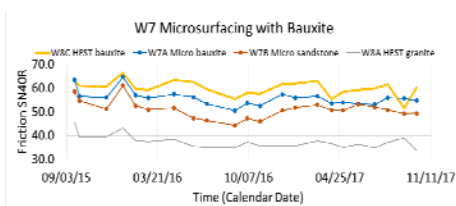
- ▷ Micro-surfacing & SMA, 2 aggregates
- ▷ Calcined Bauxite & Limestone blend
- ▷ TX Sandstone
- ▷ Micro-surfacing placed Sep-2015, W7
- ▷ SMA placed Apr-2017, W3



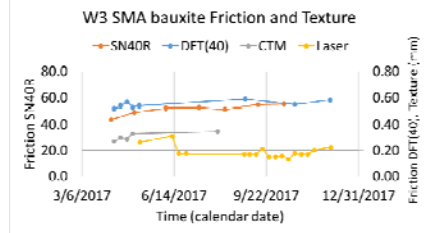
W7 Split Test Sections



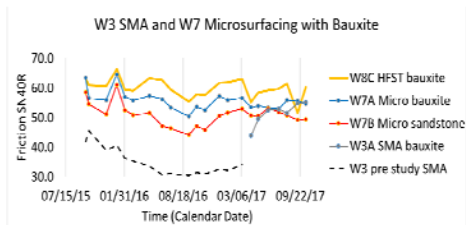
W7 Friction Performance



W3 Friction and Texture Performance



FHWA Friction Summary

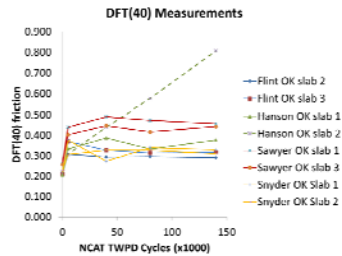


HFST Alternative Studies

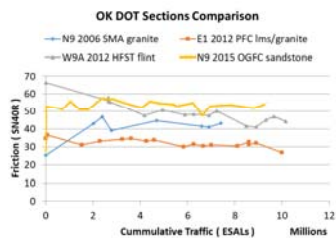
- OK DOT Optimize OGFC Aggregate
 - ▷ 4 aggregates, lab selection, TT performance
 - ▷ Sandstone on TT, N9, Sep-2015
- MI DOT Classify HFST Aggregates
 - ▷ 11 aggregates, lab TWPD/DFT
 - ▷ 2016



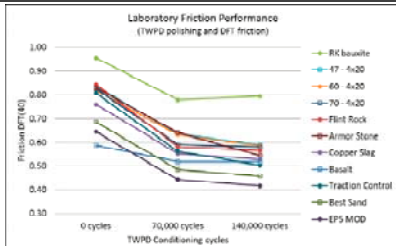
OK DOT Aggregate Selection Using Accelerated Lab Friction



Other OK Pavement Surfaces



MI DOT HFST Aggregate Study

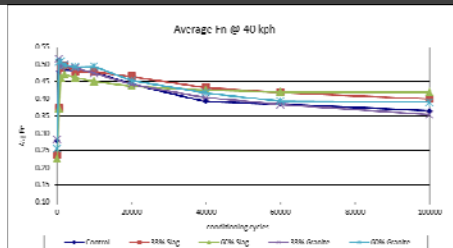


Friction Aggregate Studies

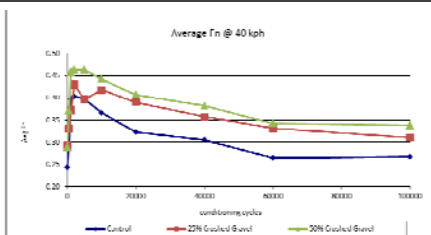
- MS DOT Improving Thin Asphalt Surfaces
 - ▷ Thin AC surfaces, 2 aggregates, lab TWPD/DFT
- WV DOT Use of Local Friction Aggregate
 - ▷ Aggregate proportion, Lab TWPD & TT
 - ▷ 50% dolomite std, study 70% and 90%
 - ▷ Placed Oct-2018



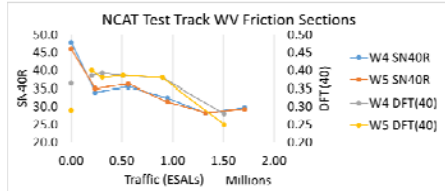
MS DOT – Lab Test 9.5 mm Mix



MS DOT – Lab Test Thin-lift Mix



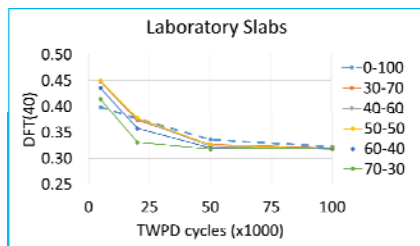
WV Study – Test Track



19



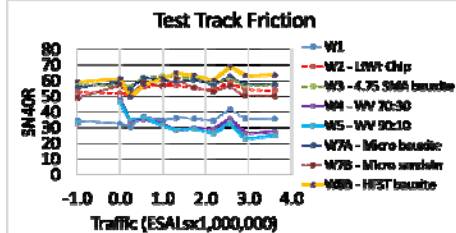
WV Study – Lab Results



20



Test Track Friction Update



21



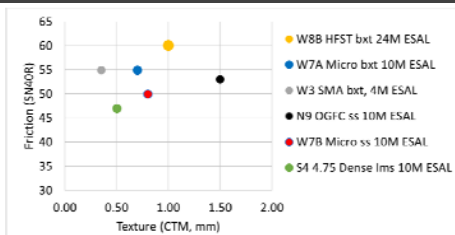
Surface Selection

- Friction performance
- Macro-texture
- Binder cost
- Aggregate cost
- Surface life

22



What are acceptable surface criteria?



23



NCAT Three Wheel Polishing Device



24



