High Friction Surface Treatment (HFST)

November 9, 2015

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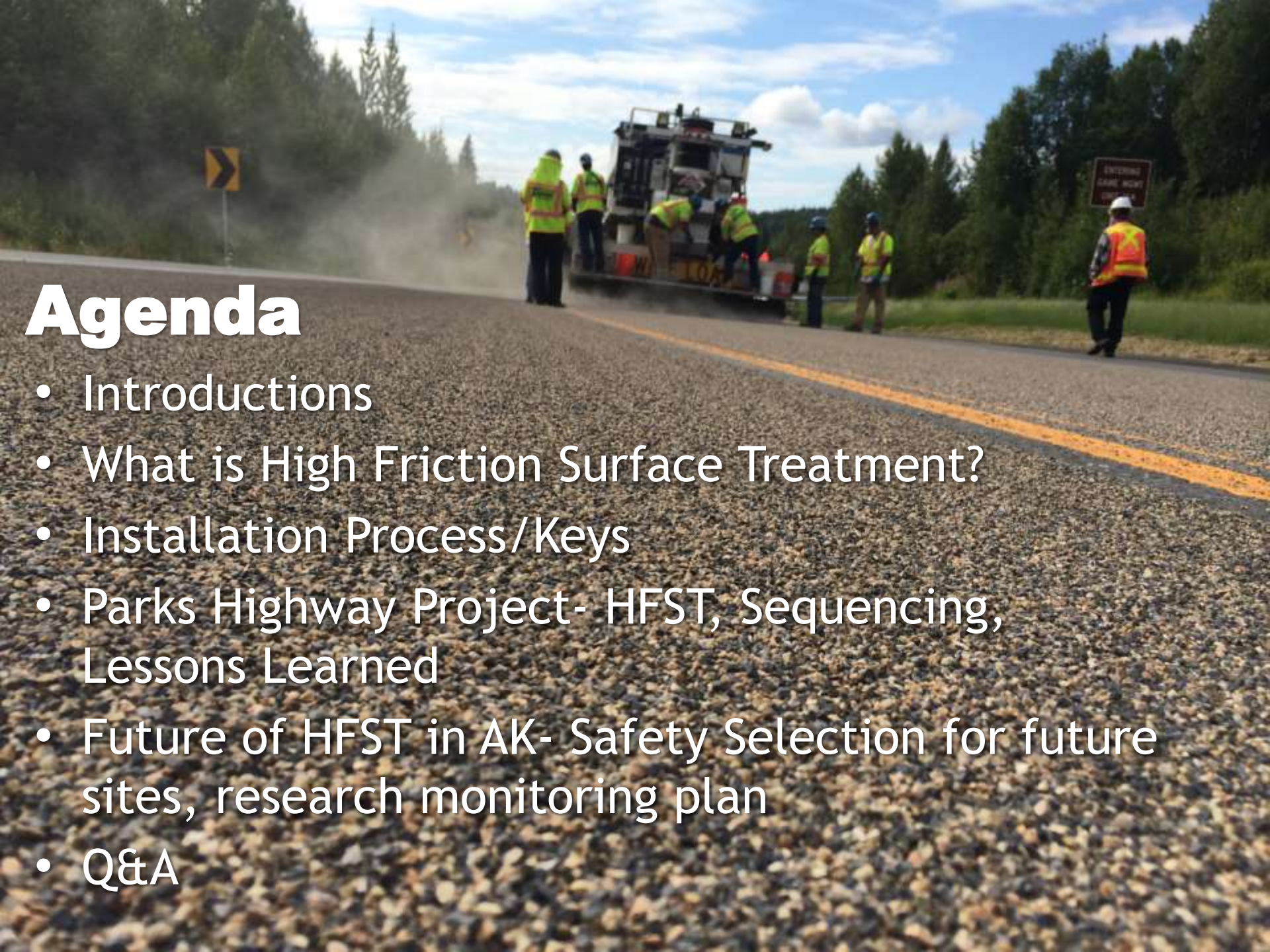


Agenda

- Introductions
- What is High Friction Surface Treatment?
- Installation Process/Keys
- Parks Highway Project- HFST, Sequencing, Lessons Learned
- Future of HFST in AK- Safety Selection for future sites, research monitoring plan
- Q&A

Introductions:

- Cliff Barber-American Civil Constructors West Coast, Inc.
  - Phone: 707-310-0225 Email: cbarber@accbuilt.com
- Jonathan Tague, P.E.- Alaska DOT &PF
  - Phone: Email: jonathan.tague@alaska.gov
- Anna Bosin, P.E.- Alaska DOT &PF
  - Phone: 907-269-6208; Email: anna.bosin@alaska.gov

High Friction Surface Treatment

- Horizontal curves make up only 5 percent of the nation's highway miles. Yet, more than 25 percent of all fatal crashes occur on horizontal curves.

- High friction surface treatment (HFST) is a technology that dramatically and immediately reduces crashes and the related injuries and fatalities.

- With friction values far exceeding conventional pavement friction, high friction surface treatments are applied to existing high-crash locations to help motorists maintain better control in both dry and wet driving conditions.

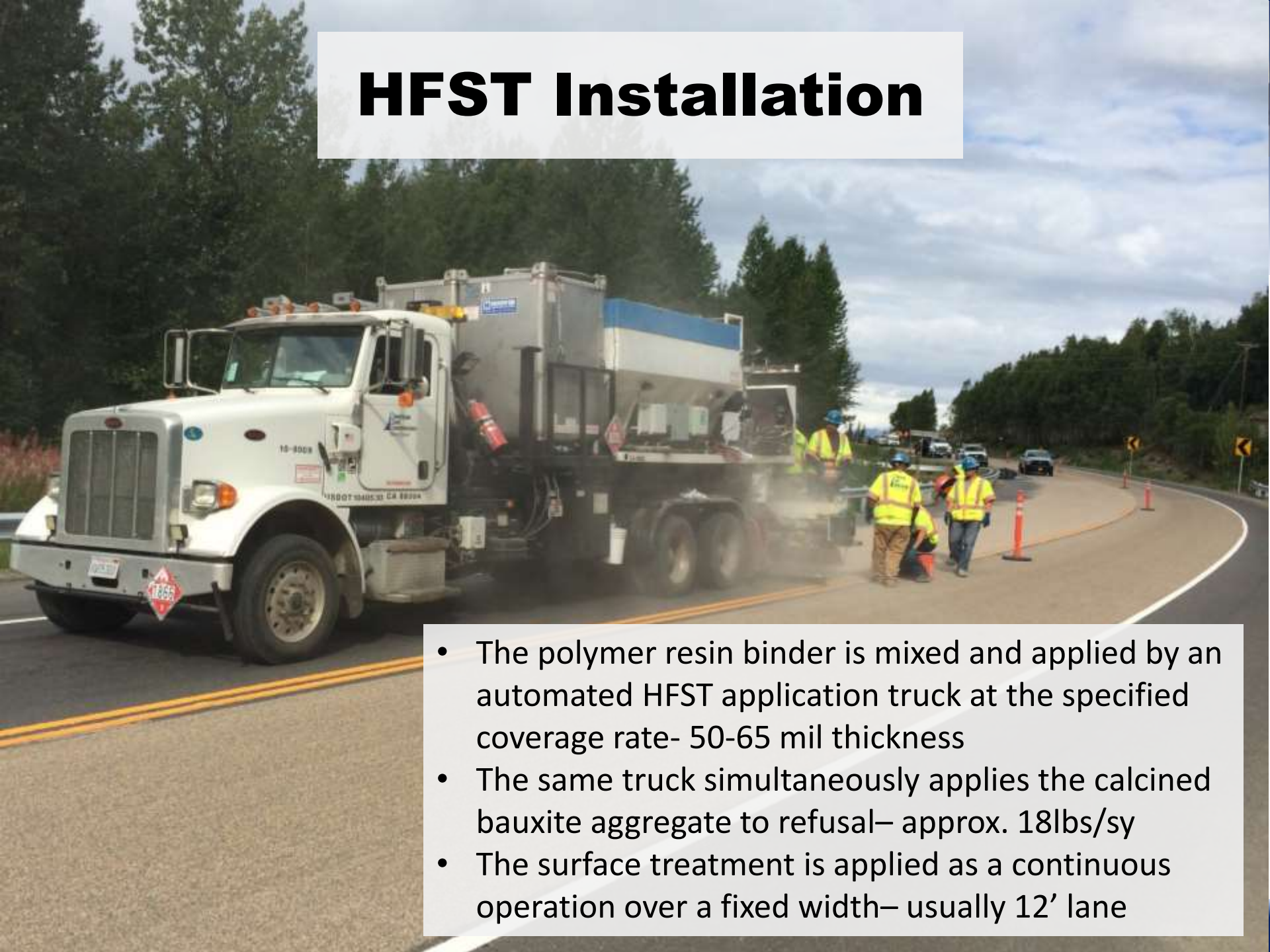
What is High Friction Surface Treatment?

HFST is a low-cost safety countermeasure which is composed of a polish-resistant calcined bauxite aggregate bonded to the pavement surface using a polymer resin binder.

What is High Friction Surface Treatment?

HFST is designed to be installed as a thin overlay, it is applied as a single surface layer on the majority of pavement surfaces. Two layers of HFST are recommended for open graded “friction” courses or on bridge decks

HFST Installation



- The polymer resin binder is mixed and applied by an automated HFST application truck at the specified coverage rate- 50-65 mil thickness
- The same truck simultaneously applies the calcined bauxite aggregate to refusal– approx. 18lbs/sy
- The surface treatment is applied as a continuous operation over a fixed width– usually 12’ lane

HFST Installation

- Only short term traffic control is required
- HFST typically cures in 1-2 hours, varies with surface temperature, but cure rate may be adjusted with some resins
- After cure, surface is swept with a mechanical broom street sweeper to remove excess aggregate
- Friction testing is typically performed prior to return to traffic

HFST Installation Keys

- May be installed over new or old pavements, AC or Concrete.
- Pavement must be a minimum of 30 days old prior to installation.
- Shotblasting of concrete surfaces is recommended
- All surfaces are swept and blown off with compressed air prior to application
- Pavement must be dry, surface temperature 40-105 deg F
- Existing Striping/markings/markers usually removed and replaced
- May be placed in traveled lanes only or to edge of pavement
- Bridge joints protected, Drains or manholes in roadway covered

AK HFST- Parks Highway

Parks Hwy HFST Completed (Denali in the background)

AK HFST- Eagle River

Alaska Department of Transportation & Public Facilities

HFST on Parks Hwy MP 123.5-146 Rehab

Jonathan Tague, P.E.

11/09/2015

Parks Hwy MP 123.5-146 Rehab

- Prime Contractor: QAP
  - HFST Subcontractor: American Civil Constructors

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Location

- 2 lanes– 2540’ long
  - 7,637 SY Total

Sequencing

- Minimum pavement cure dictated schedule.

Bid Item

- $40.00 per Square Yard
  - Includes
    - All materials, equipment, manpower
    - Resin Manufacturer's Technical Supervisor
    - Acceptance testing: polymer resin

Acceptance Testing

- Aggregate
  - Manufacturer's Cert. / Onsite gradation
- Polymer Resin Binder
  - Third party lab: ASTM D638
- Surface roughness
  - ASTM E1911

Lessons Learned

- Minimum pavement age: 1-3 months.
- Plan ahead for additional quantity.
- Side streets may be blocked for an hour or more.
- Limited options for repair.

Lessons Learned

- Install HFST before striping.

High Friction Surface Treatment- Next for AKDOT&PF

Anna Bosin, P.E. Research Engineer
Research, Development and Technology Transfer (RD&T2)

Safety Screening at AKDOT&PF

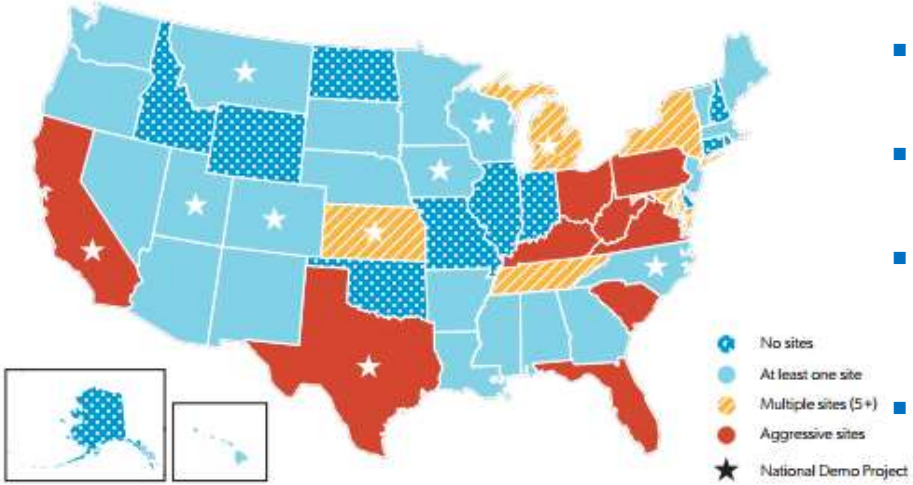


FIGURE 1: *High Friction Usage*

- FHWA Everyday Counts Initiative in 2014
- HSIP Central Region Nomination that evaluated crashes at (2006-2010 study period):
  - The outside lane of curves on high speed rural roadways;
  - Intersection approaches on steep grades;
  - Curves where existing super elevation is less than desirable;
  - Severe SVROR motorcycle crashes have occurred;
  - Geometric constraints limit reconstruction/upgrade of steep grades or curves;
  - Not at bridge locations.

Safety Screening Cont.

2014 HSIP Project Crash Screening Summary

Posted Speed Limit (MPH)	Treatment Sites	Rural	Severe Crash* (KI +SI)	Minor Crash (MI)	Curve**	Grade**
55	4	2	3	14	4	0
50	1	0	4	1	0	1
45	29	24	38	60	24	11
35	1	0	5	14	0	1
45-30 Transitions	2	0	4	36	1	2
TOTAL	**37**	**26**	**54**	**125**	**29**	**15**

*KI=Fatal Crash, SI=Severe Injury Crash
**Some sites have both curves and grades

- Studies report 20-30% crash reductions for all crashes and 50% crash reductions for wet-weather related crashes;
- Staff worked closely with FHWA, MOA, and Outside DOTs to select optimal sites;
- Initially 37 sites were approved;
- Scope reduced to 28 sites due to scheduling, pavement condition, and costs;
- Wide variety of sites in Kenai, Anchorage, and Mat-Su Borough that include intersection approaches as well as urban and rural horizontal curves.

Research of 28 HSIP HFST Sites

- Although expensive ($30-$40/SY), FHWA studies indicate it is a cost-effective strategy for addressing SVROR crashes;
- HSIP conducts own safety related cost-effective analysis. (3 years post-construction)
- *But how does HFST hold up in Alaska?* Freeze thaw cycles, plow impact, de-icing applications, and studded tire wear are all elements that other locations did not specifically monitor

DFT Test at Eagle River

Research Monitoring Plan:

1. At Construction (2016);
   a. Pavement condition, cure time between new pavement and HFST application,
   b. Surface prep, temps, equipment application rates;
   c. Initial Dynamic Friction Tester (DFT) friction values
2. Long Term Performance (3 years);
   a. Visual overall conditions;
   b. DFT testing per ASTM E 1911 using AKDOT&PF's Tester annually;
   c. Rut depths, cracking, IRI (Highway Pavement Management System Data collection);
   d. Raveling, binder exposure, condition of adjacent striping;
   e. Adjacent control site values of non-HFST treated pavement.
3. Final Report (anticipated Dec. 2019)

Want More Info on Research?

http://www.dot.state.ak.us/stwddes/research/index.shtml

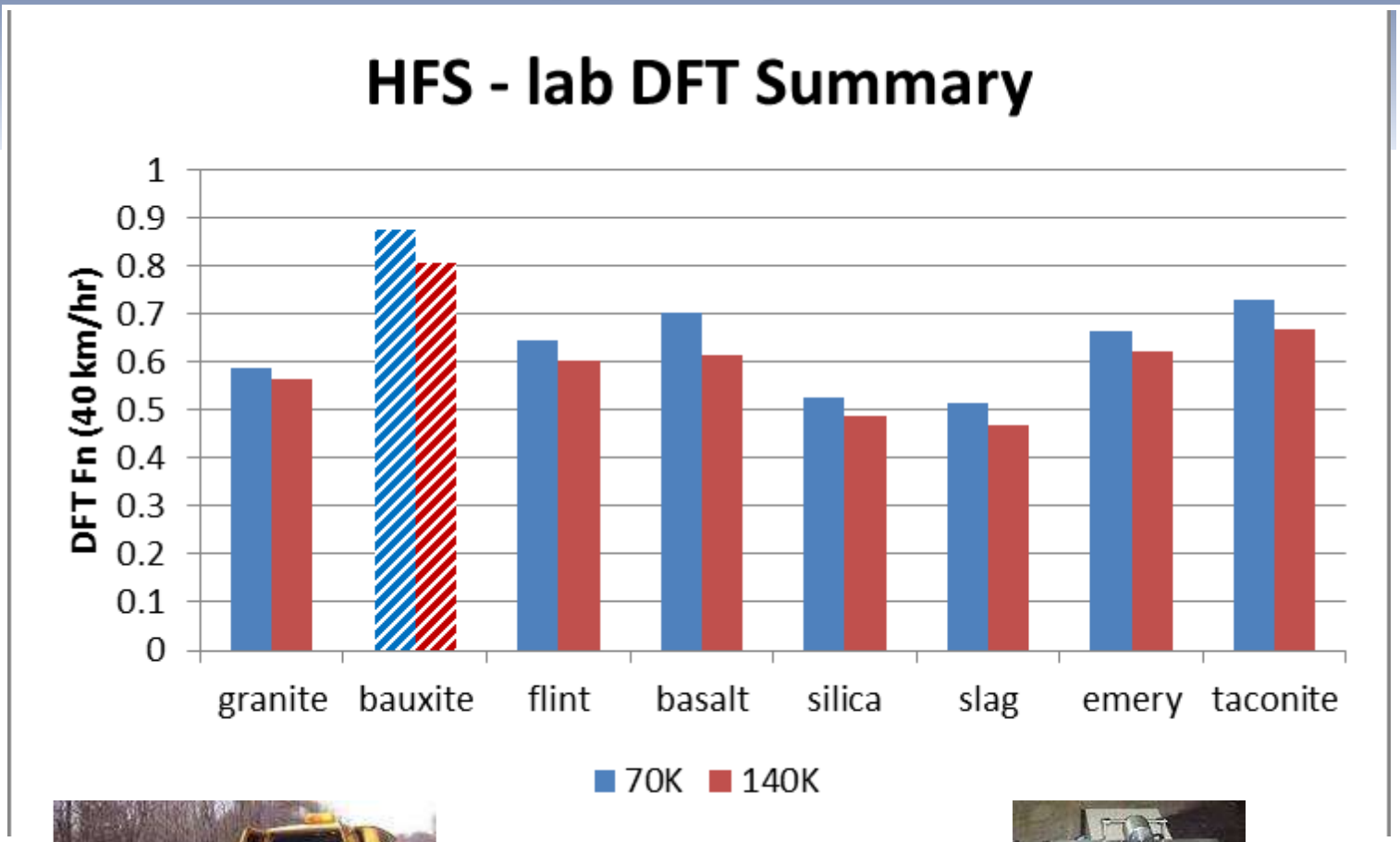
High Friction Surface Treatment saves lives!

Questions?

HFST Specifications- Calcined Bauxite

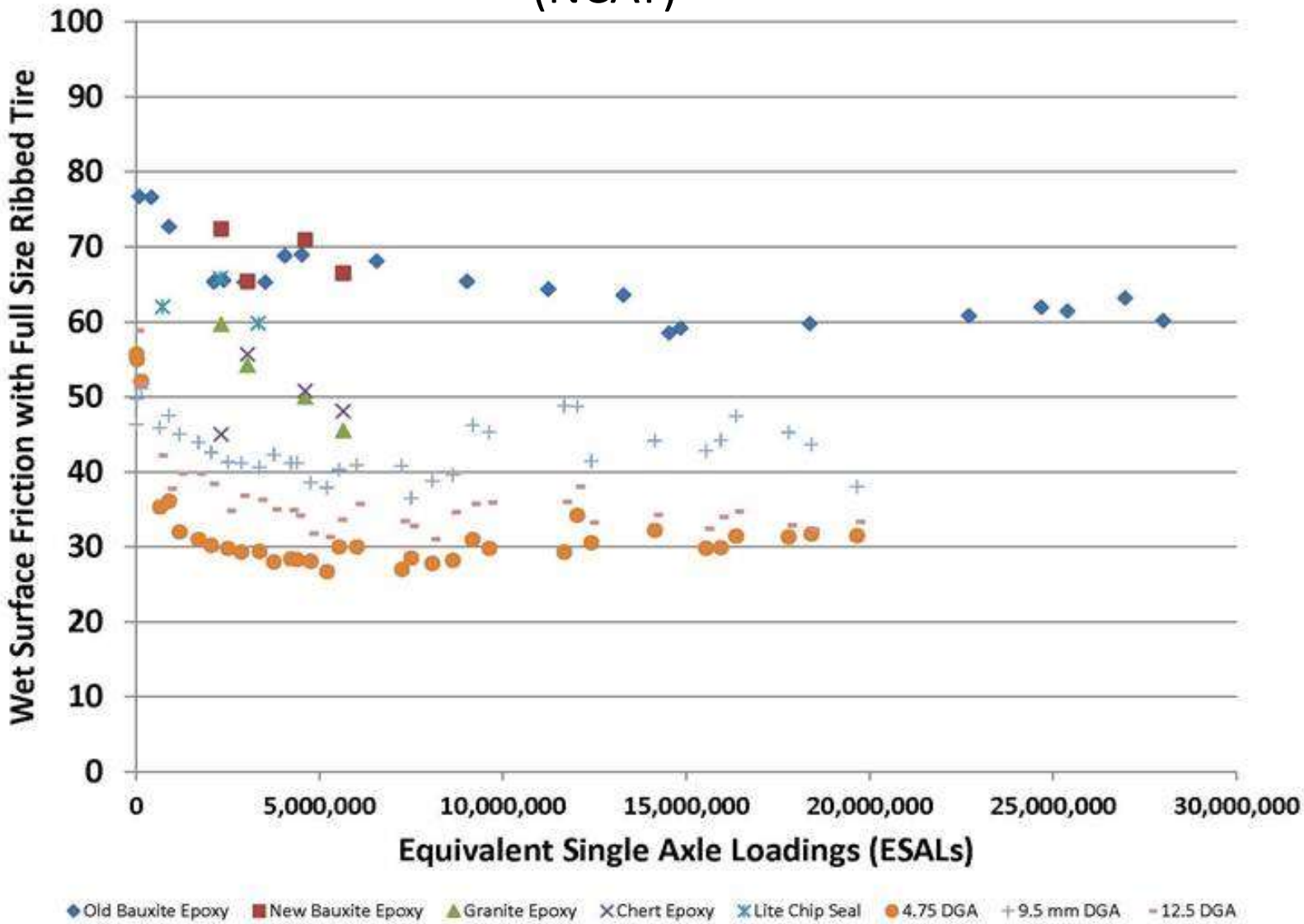
- Calcined Bauxite Aggregate- is used due to its ability to outperform other natural aggregates in resistance to polishing
- This means that the high initial friction readings are maintained at high levels even with significant traffic wear
- Can be dark gray, light grey or buff in color

Early NCAT Testing of HFST Aggregates



Dynamic Friction Tester
ASTM E-1911

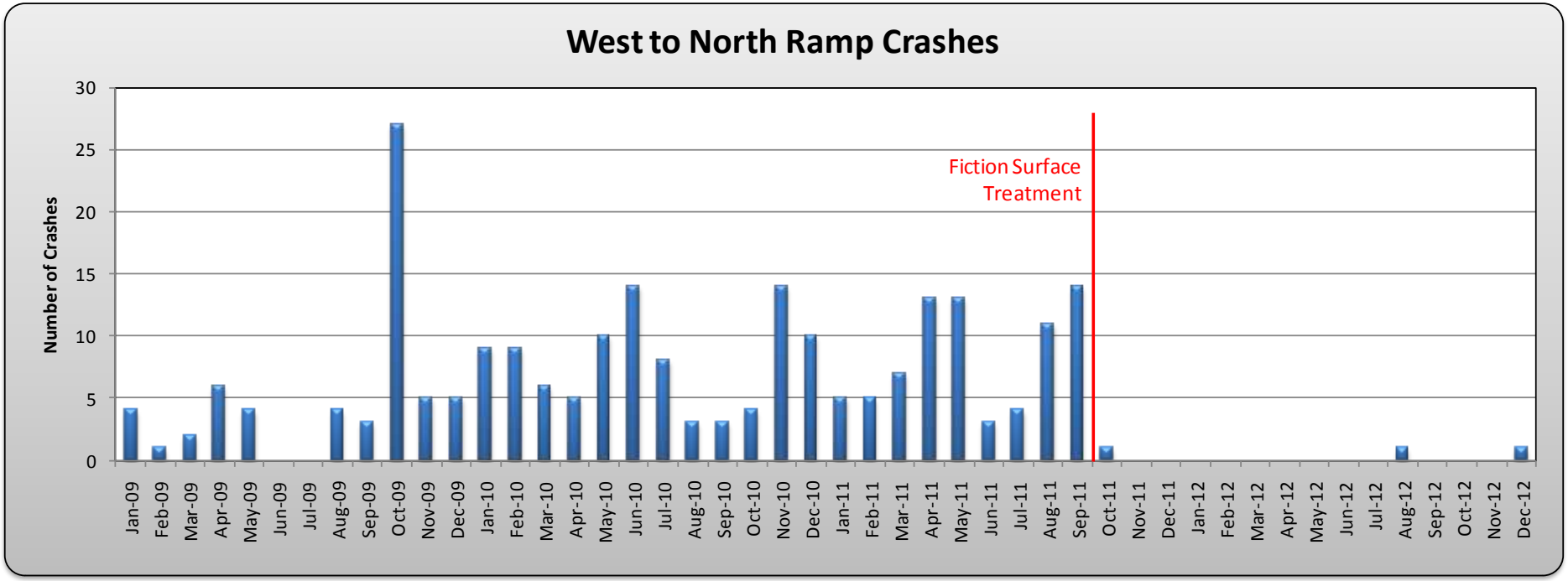
The National Center for Asphalt Technologies, Auburn University. AL (NCAT)



* Old bauxite and epoxy installed 2003

Does HFST have a successful track record?
Marquette Interchange, Wisconsin

Post-Application Incident Statistics



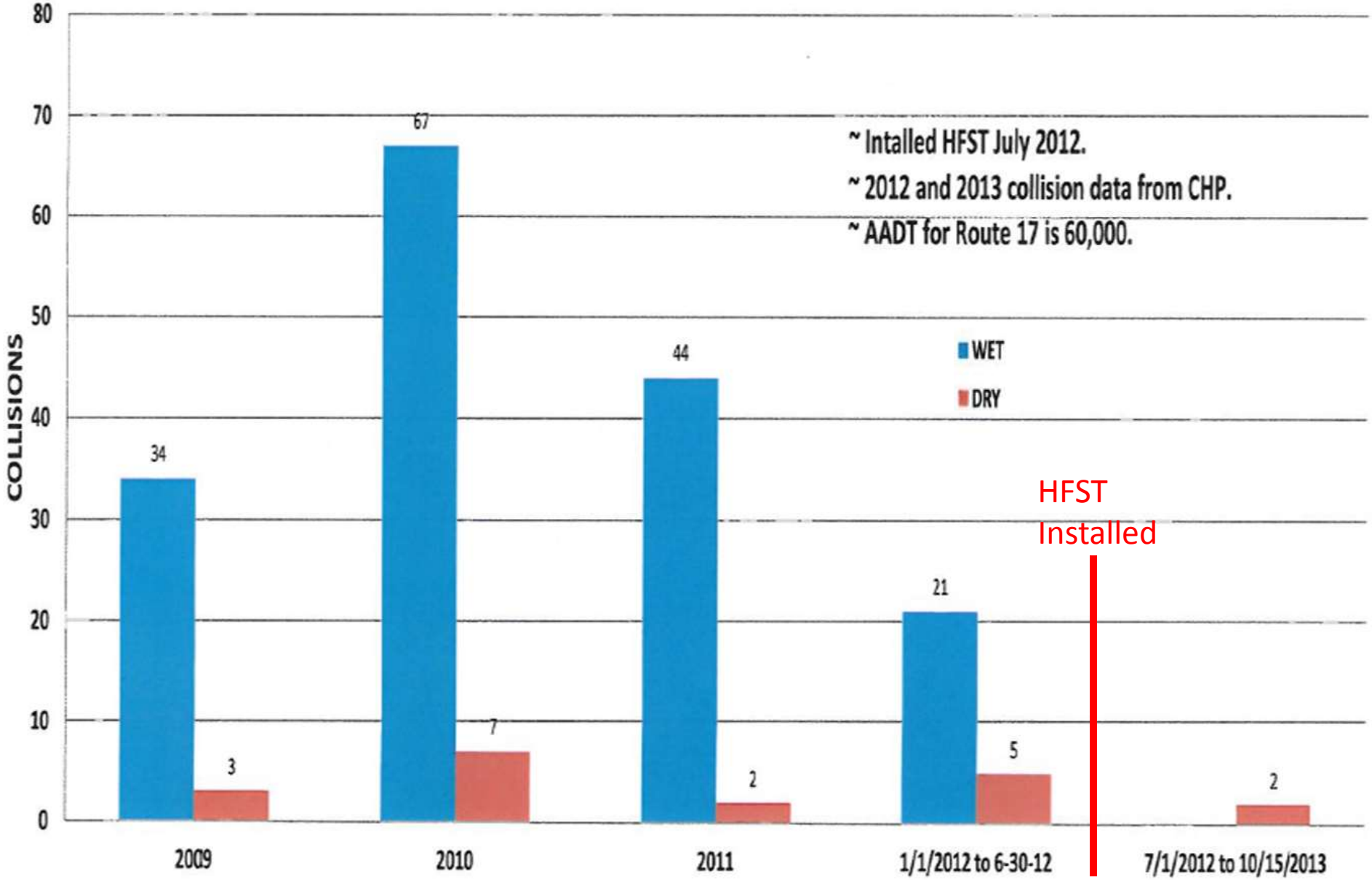
97% REDUCTION

Caltrans HFST Case Study:

Summit's Deadliest Curve Gets Special Treatment-

Laurel Curve will get guardrail, pavement treatment and more warning signs.

"Laurel Curve accounted for one in three crashes on Highway 17 between 2004 and 2010."

(From NBC Bay Area.com March 20, 2012)

Collisions at Santa Cruz Route 17, Post Miles 9.4 to 9.6 in the Southbound direction, from 1/1/09 to 10/15/2013