High Friction Surface Treatments An Every Day Counts 2 Technology

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What is a High Friction Surface Treatment?

- High Friction Surface Treatments (HFST) are pavement surfacing overlay systems with:
  - exceptional skid-resistant properties that are not typically acquired by conventional materials
  - and retains the higher friction property for a much longer time.
- Commercially available resin-based products and processes
- Generally applied in short sections to improve spot locations where friction demand is critical.

Key Benefits

- ***HFST reduce crashes, injuries, and fatalities.***
- Additional benefits include:
  - Excellent pavement surface functional durability
  - Provides an efficient critical spot safety improvement for a wide variety of urban or rural locations.
  - Good benefit/cost ratio
  - A solution that can be implemented quickly
  - Minimal impact to traffic during construction
  - Negligible environmental impact.
  - Don’t receive complaints from any road user groups

HFST Aggregates

- Recommended aggregate is calcined bauxite which provide the highest resistance to polishing.
- Generally maximum size 3 mm

HFST Binder Materials

- Polymer system (proprietary blends)
  - Epoxy-resin
  - Polyester-resin
  - Polyurethane-resin
  - Acrylic-resin
- Thin layer that allows for 50% aggregate embedment depth

HFST Installation (Manually)

Manual mixing of binder and application with notched squeegee


innovation
ingenuity
Every Day Counts
imagination
invention

HFST Installation (Mechanically Assisted)

Machine mixing of binder and aggregate placement assistance.

HFST Installation

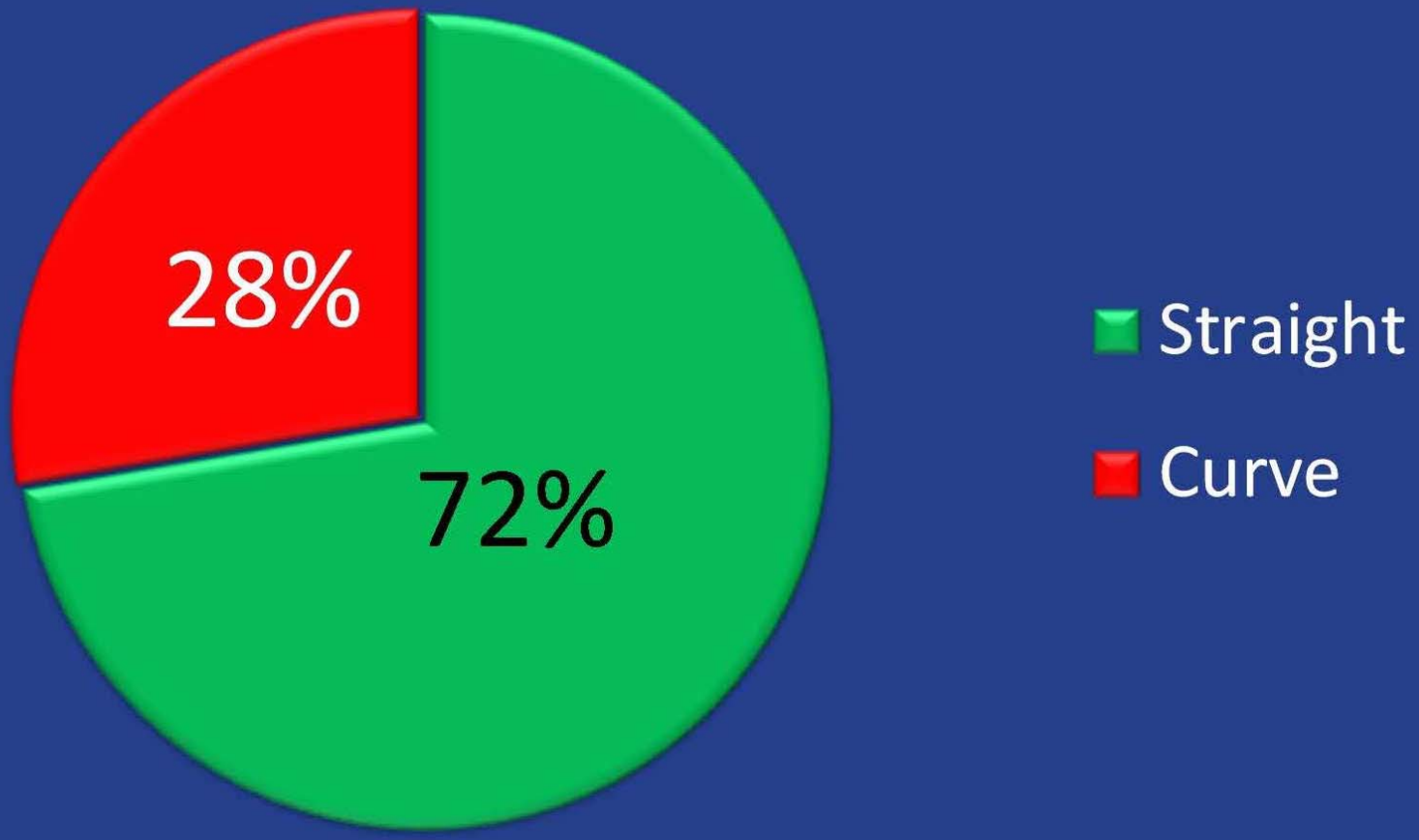
(Automated)

Application of binder and aggregate by machine (limited hand work)

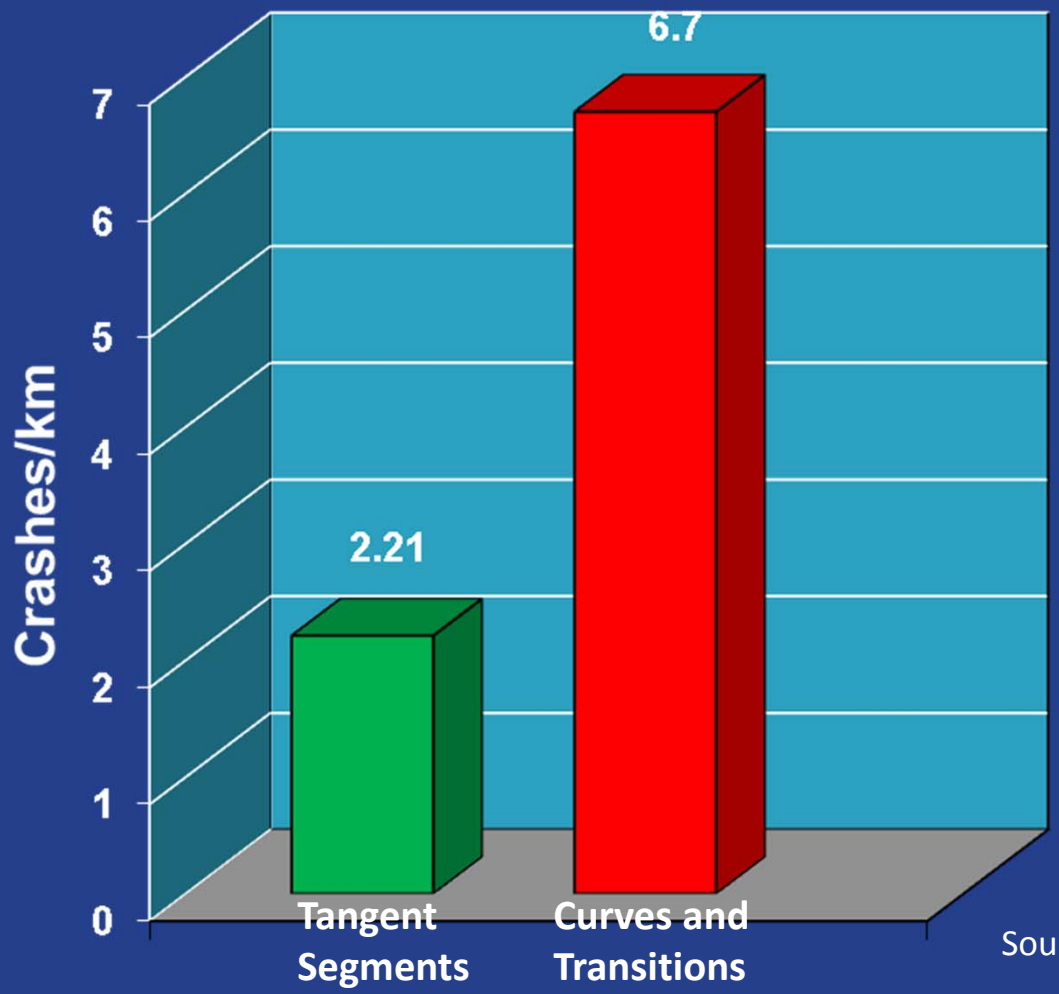
AUTOMATED APPLICATION

HFST Finished Product

Fatal Horizontal Curve Crashes



Horizontal Curves and Safety



Average crash rates for horizontal curves is about 3 times that of tangent segments

Source: Glennon, et al, 1985 study for FHWA

HSIS

HIGHWAY SAFETY INFORMATION SYSTEM

The Highway Safety Information System (HSIS) is a multi-State safety database that contains crash, roadway inventory, and traffic volume data for a select group of States. The participating States—California, Illinois, Maine, Michigan, Minnesota, North Carolina, Ohio, Utah, and Washington—were selected based on the quality of their data, the range of data available, and their ability to merge the data from the various files. The HSIS is used by FHWA staff, contractors, university researchers, and others to study current highway safety issues, direct research efforts, and evaluate the effectiveness of accident countermeasures.

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Federal Highway Administration

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SUMMARY REPORT

Development of a Speeding-Related Crash Typology

Speeding, the driver behavior of exceeding the posted speed limit or driving too fast for conditions, has consistently been shown to be a contributing factor to a significant percentage of fatal and nonfatal crashes. Between 1990 and 2006, the frequency of speeding-related (SR) fatal crashes ranged from 11,000 to 13,000 each year, and the percentage of SR total fatal crashes ranged between 30 and 33 percent according to data observed in the Fatal Analysis Reporting System (FARS).[1] Thus, speeding is a significant safety issue warranting attention based on its size and impact on society. While the United States has seen progress in other major safety issues such as occupant restraint use and driving under the influence of alcohol, little if any progress has been made with speeding. In response to this issue, the United States Department of Transportation has instituted the *Speed Management Strategic Initiative*, seeking more effective ways to manage the crash-related effects of speeding.[2] In support of this initiative, this study examined recent crash data through the development of an SR crash typology. Such a typology can help define the crash, vehicle, and driver characteristics that seem to result in a higher probability of SR crashes. Thus, the goal of this study was to determine the "what," "where," "when," and "who" descriptors of SR crashes in order to provide guidance to the future development of new treatments and to better target new and existing treatments to subgroups of drivers and types of roadways (e.g., two-lane rural) or roadway locations (e.g., unsignalized intersections).

Literature Review

While numerous research studies have explored the effects of speed on crash frequency and severity and on the effect of treatments aimed at managing speed (e.g., *TRB Special Report 254*), two studies have developed typologies similar to those developed in this effort.[3] Bowie and Walz used data from the 1986 Crash Avoidance Research Data (CARDfile) from six States as well as from the Indiana Tri-Level Study and the 1989 FARS data. (See references 4–6 and 1.) Based on CARDfile, speed was a factor in about 12 percent of all crashes.[5] Data from the Indiana Tri-Level Study indicated that excessive speed was a factor in 7.1 to 16.9 percent of crashes.[6] Key findings from the FARS data indicate that fatal SR crashes are usually single-vehicle and that there is a higher percentage of SR crashes on rural roads, on curves, and at night.[1] In these fatal crashes, males were more likely than females to be speeding, and drivers under the influence of alcohol were more likely to be speeding than those who were not drinking. Occupant restraint usage was lower for SR drivers. In addition, more than 45 percent of all motorcycle drivers involved in fatal crashes were speeding.

Hendricks, et al. examined data from in-depth investigations and driver interviews from a sample of 723 relatively severe crashes involving 1,284 drivers collected in a special study as part of the National Automotive Sampling System Crashworthiness Data System (NASS CDS) program.[7,8] Researchers

Speeding- Related Crash Typology

When crash types were examined for these drivers excessively speeding, researchers found that speeding was the leading cause of single-driver right or left roadside departure with traction loss and the third leading cause of head-on crashes.

…primarily on curves, at night, on local or collector roadways, and during clear weather.

Strategies for Reducing Crashes
(Where Can HFST Benefit Safety?)

1. Horizontal curves
2. Approach to intersections
3. Grades

When the pavement has:

- Marginal friction effected from weather
- Low friction
- Friction values not compatible with approach speeds and geometrics (friction demand)

PennDOT

State Route 0611, Northampton County, PA
in Segment 40 along the Delaware River
An area commonly known as the “Canal Locks”
About 5 miles south of Easton, PA

Crash Data for Rte 611Curve

Northampton Rte 611 Seg 40 (off 1000-1900) Years 1997 to 2005

21 Crashes Southbound Lane

CRASH YEAR	DIST	CO	COLL TYPE	INT TYPE	URBAN RURAL	ILLUMINATION	WEATHER	TRAVEL DIRECTION	ROAD SURFACE COND
1997	05	48	HFO	MIDB	RUR	DARK	RAIN	SOUTH	WET
1997	05	48	HFO	MIDB	RUR	DARK	SNOW	NORTH	SNOW
1998	05	48	ODSS	MIDB	RUR	DAYLIGHT	RAIN	SOUTH	WET
1998	05	48	HDON	MIDB	RUR	DAYLIGHT	RAIN	SOUTH	WET
1998	05	48	REAR	MIDB	RUR	DAYLIGHT	RAIN	SOUTH	WET
1998	05	48	HFO	MIDB	RUR	DAYLIGHT	RAIN	SOUTH	WET
1998	05	48	HDON	MIDB	RUR	DAYLIGHT	CLEAR	SOUTH	DRY
1999	05	48	HDON	MIDB	RUR	DAYLIGHT	RAIN	SOUTH	WET
1999	05	48	HFO	MIDB	RUR	DAYLIGHT	RAIN	SOUTH	WET
1999	05	48	HFO	MIDB	RUR	DAYLIGHT	RAIN	SOUTH	WET
1999	05	48	HDON	MIDB	RUR	DARK	RAIN	SOUTH	WET
2000	05	48	HDON	MIDB	RUR	DAYLIGHT	RAIN	SOUTH	WET
2000	05	48	HFO	MIDB	RUR	DARK	RAIN	SOUTH	WET
2000	05	48	HFO	MIDB	RUR	DAYLIGHT	CLEAR	SOUTH	WET
2001	05	48	HDON	MIDB	RUR	DAYLIGHT	CLEAR	SOUTH	WET
2001	05	48	HDON	MIDB	RUR	DAYLIGHT	CLEAR	NORTH	DRY
2003	05	48	HFO	MIDB	RUR	DAYLIGHT	CLEAR	SOUTH	WET
2003	05	48	HFO	MIDB	RUR	DAYLIGHT	CLEAR	SOUTH	WET
2004	05	48	HDON	MIDB	RUR	DAYLIGHT	RAIN	SOUTH	WET
2004	05	48	HFO	MIDB	RUR	DARK	SNOW	SOUTH	SNOW
2005	05	48	HFO	MIDB	RUR	DAWN	CLEAR	SOUTH	WET
2005	05	48	HDON	MIDB	RUR	DAYLIGHT	RAIN	SOUTH	WET
2005	05	48	ODSS	MIDB	RUR	DAYLIGHT	CLEAR	SOUTH	WET

Lane closure begins at 8:30 AM 6/13/07

- The 2 part epoxy resin is mixed and applied by spread ng with a serrated squeegee.
- Epoxy application begins at 9:15am

2:30 PM , Swept, Dry and Ready for Traffic

iction Testing & Crash Results

Friction Results

	Test Lane	Control Lane	
Before Installation	= avg 24 *	avg 34 *	* 11/30/06
After Installation (June 13th, 2007)			
Bauxite Aggregate	Aug '07 = avg 75	avg 34	
	Apr '08 = avg 75	avg 40	
	Nov '08 = avg 72	avg 44	
	Mar '09 = avg 74	avg 58 *	Repaved
	Nov '09 = avg 72	avg 44	
	Jun '10 = avg 71	avg 44	

Reportable Crash Results

Before Installation = 21 (south lane)

After Installation = 0 as of 4/12/2012


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ingenuity
Every Day Counts
imagination
invention
Hamilton County Ohio
Thank you!
Questions
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