



HIGH FRICTION SURFACE TREATMENTS

Horizontal curves made up only 5 percent of our Nation's highway miles in 2008. Yet, more than 25 percent of highway fatalities in the United States occur at or near horizontal curves each year. While some of the factors contributing to these crashes include excessive vehicle speed or distracted driving and driver error, at some locations, the deterioration of pavement surface friction may also be a contributing factor. Variable friction creates the need to consider pavement improvements for surface characteristics, particularly for friction, at certain locations in order to increase safety.

High friction surface treatments (HFST) are the site-specific application of very high-quality, durable aggregates using a polymer binder that restores and maintains pavement friction where the need for a safer pavement surface is the greatest. Maintaining the appropriate amount of pavement friction is critical for safe driving. Vehicles traversing horizontal curves require a greater side force friction, and vehicles at intersections require greater longitudinal force friction.

In locations such as sharp horizontal curves and where vehicles may brake excessively, the road surface of standard pavements may become prematurely polished, thereby reducing the available pavement friction. This loss of friction contributes to vehicles losing control or skidding at high speed, causing drivers to turn abruptly or brake excessively. Negotiating a sharper curve requires an increased friction demand, and that greater demand causes greater shear forces on the surface aggregate, thereby leading to even more polishing of the surface aggregate.

The HFST technology is unique in its ability to address site-specific issues. While the largest numbers of problem locations are likely to be on the local and collector systems, there are also high-volume intersections, interchange ramps, and selected segments of Interstate alignments where these treatments would also be beneficial. This innovation has application to State departments of transportation (DOTs), counties, cities, tribes and federal lands agencies across the country.

BENEFITS

- ▶ **Reduce crashes, injuries and fatalities.** Kentucky placed HFST on 26 curves and to date has seen an average reduction from 6.2 to 1.9 crashes per year at those locations. Additionally, the National Cooperative Highway Research Program (NCHRP) 617 indicates a crash reduction of 20 percent for all intersection crashes.
- ▶ **Benefits outweigh costs.** A recent before-and-after study from South Carolina DOT for a series of curve installations indicates a cost-benefit ratio of about 24 to 1.
- ▶ **Relatively low in cost compared to geometric improvements.** The square-foot cost of HFST is not cheap, but its durability makes it worth the cost since the treatments are long-lasting and the life-cycle cost is excellent.
- ▶ **Durable and long-lasting.** HFST provide a durable and long-lasting solution to pavement locations where insufficient friction is a contributing factor in crashes.
- ▶ **Customizable to specific State and local safety needs.** Road owners can use where most needed, such as two-lane urban or rural roads at horizontal curves, areas near steep grades, areas at or near lane changes and rural and urban intersections.

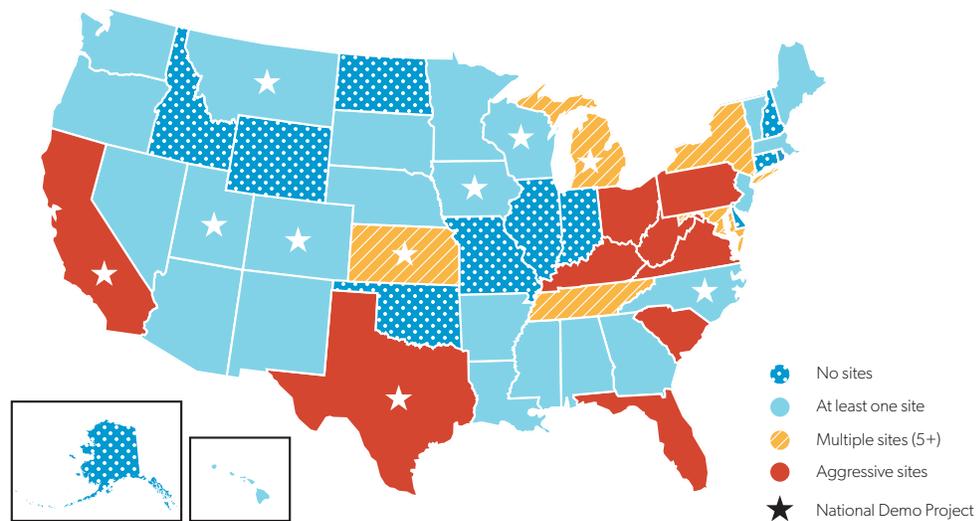


FIGURE 1: High Friction Usage

- ▶ **Produce negligible environmental impacts and minimal impact on traffic.** Project lengths are short and the materials set up very quickly so the treatments can often be applied in hours, requiring minimal impact on traffic as compared to a conventional pavement overlay project.

CURRENT STATE OF THE PRACTICE

Shown in Figure 1, at least 39 states have applied HFST on at least one project site to date. Nine of the 39 states that have HFST installed have gone on to aggressively deploy use of HFST. Strides have been made also in the development of more versatile and accurate friction measurement equipment, which plays a part in the identification and documentation of problem sites, as well as in the documentation of friction improvement provided by HFST.

SUPPORT AND AVAILABLE TOOLS

There are a variety of ongoing efforts to implement and evaluate HFST.

A few of the noted efforts include:

- ▶ The **Federal Highway Administration’s (FHWA) Office of Pavement Technologies and the Office of Technical Services – Resource Center** have installed and tested the friction improvements with various types of applications on surface characteristics and are now ready to share their findings via a series of reports that will be available next year. A number of case studies are documented at <http://www.highfrictionroads.com> as a part of this effort.
- ▶ Converting the results of the many projects into crash modification factors for these types of treatments is underway as part of the **FHWA’s Evaluation of Low-Cost Safety Improvements Pooled-Fund Study**.
- ▶ The Office of Safety has included HFST in their countermeasures recommended on curves when developing the **Roadway Departure Safety Implementation Plan in Roadway Departure Focus States**.

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Every Day Counts (EDC), a State-based initiative of FHWA’s Center for Accelerating Innovation, works with State, local and private sector partners to encourage the adoption of proven technologies and innovations aimed at shortening and enhancing project delivery

