HIGH FRICTION SURFACE TREATMENTS

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This document is a technical summary of the FHWA Research and Technology Evaluation: High Friction Surface Treatments Final Report (FHWA-HRT-21-014).

Introduction

This TechBrief summarizes an evaluation of the effects of the Federal Highway Administration's (FHWA's) investment in high friction surface treatments (HFST) research, the availability and quality of such research, the deployment of the technology, and the safety impacts of HFSTs in the United States. HFSTs are high-quality aggregates that can be applied to existing or potential high crash areas to immediately and dramatically reduce specific crash types and their related injuries and fatalities.[1]

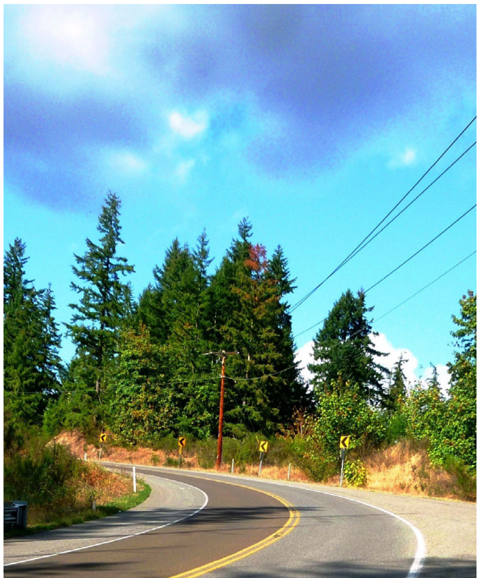
Background

HFSTs enhance skid resistance by bonding calcined bauxite, a polish-resistant aggregate, to a pavement surface using a polymer-resin binder. HFSTs are applied along portions of roadways that are susceptible to vehicle slippage (e.g., curves under precipitation, lacking a cross slope, or with nonoptimal superelevation).[2]

Several lead-adopter States and product vendors initiated HFST deployment in the early 2000s when HFST suppliers began marketing the treatment as a safety measure to transportation agencies in the United States.[3] Documented domestic use of HFSTs as a safety measure on curves began in 2004. The Tennessee Department of Transportation and the city of Bellevue, WA, installed epoxy-resin overlays on curves, ramps, and intersections. They reported significant improvements in friction for all sites.[4]

In 2008, FHWA began partnering with States to install and study HFSTs through a national demonstration program.[1] In 2010, the Evaluation of Low Cost Safety Improvements Pooled Fund Study (ELCSI-PFS) initiated research to evaluate the safety performance of a range of surface improvements, including HFSTs.[5] Because of the safety benefits demonstrated in research from the United Kingdom and New Zealand, as well as early State experiences with HFSTs, Every Day Counts Round 2 (EDC-2) (2013–2014) included HFSTs.[1]

The ELCSI-PFS has continued to support research, including the Development of Crash Modifications Factors (DCMF) Program, on HFSTs. This research included an advanced statistical analysis of crash, road-friction, and pavement data from four States. From this research, the authors developed crash modification factors and conducted a benefit cost analysis. The DCMF for HFSTs study showed a 57 percent reduction in expected crashes at curves for all crash types and an 83 percent reduction for wet-weather crashes.[1]



FHWA Research and Technology Evaluation TechBrief

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Findings

By evaluation area, the overall findings are as follows:

Availability of HFST safety and performance data

FHWA contributed to an increase in the availability and quality of information on HFSTs in the United States in four ways: furnished early performance research funding, collaborated with the States for demonstrations and data collection, contributed HFST informational materials on roadway departures and HFSTs by FHWA Office of Safety, and provided FHWA Resource Center leadership and technical assistance. Research gaps related to HFST durability, HFST performance, and alternative aggregates are potential barriers to future HFST deployment.

Change in awareness, knowledge, and attitudes

Collaborative forums convened by FHWA in partnership with States, including EDC-2, peer exchanges, and the ELCSI-PFS Technical Advisory Committee, effectively raised awareness of HFSTs among potential users and provided opportunities for learning and exchange. State inclusion of HFSTs in informational materials, Strategic Highway Safety Plans, and HFST specifications demonstrates growing acceptance of HFSTs as a safety measure, while State referencing of FHWA resources indicates the role FHWA investment played in this acceptance.

Adoption as a safety measure

The total number of HFST locations increased between 2004 and 2018, with the highest number of locations installed between 2013 and 2016. Currently, 44 States have at least one HFST installation, while 13 States have 50 or more HFST installations. Direct funding from FHWA as well as technology transfer contributed to this growth. Some of the most successful HFST programs share two notable traits: State-level HFST champions and improvement of HFST specifications. Barriers to HFST deployment frequently consist of a combination of co-occurring challenges, including concerns over performance, construction and installation issues, perception of cost, and issues with specifications.

Safety impacts of HFSTs

HFSTs can significantly reduce fatalities and other injuries from roadway departures; however, a wide range of estimated crash-reduction results can lead to uncertainty for potential deployers. Studies show HFSTs are a cost-beneficial safety investment, especially in areas that experience a large number of wet-weather crashes. The DCMF study monetized cost savings as $19,300,113 for 146 curve installations.

Recommendations

The report provides a number of recommendations based on findings, input of interviewees, and other research conducted.

Recommendations to facilitate technology transfer include the following:

Maintain active engagement with States that are early in their respective HFST-adoption curves. FHWA can identify and support interested States that are earlier in their adoption curves and would also benefit from technical assistance and engagement from more experienced States.

Update the HFST website to enhance usability and ensure its position as a comprehensive resource. The site should be reorganized for more effective curation and improved information dissemination purposes.

Disseminate these results through another round of targeted HFST promotion with revised materials, including updating and adding further detail to the existing high-level High Friction Surface Treatment Curve Selection and Installation Guide.[(6)]

Continue to provide technical assistance and presentations on HFST through the FHWA Resource Center. With the retirement of a longstanding champion of HFSTs from the Resource Center, it will be more important for the Resource Center to maintain its role as a resource and advocate for HFSTs. This goal can be realized by continuing to partner with industry, States, and academia to address research gaps related to HFST durability, performance, and alternative aggregates. Specific research gaps include identifying how States overcame project challenges and failures as well as finding more information on the durability of alternative aggregates.

Recommendations for potential adopters include the following:

Designate a strong State champion. The champion can help new adopter States move past challenging (or failed) first installations. Moreover, the champion can be an important resource for mediating between safety and materials professionals while educating potential adopters on the need for calcined bauxite.

Improve data collection efforts before and during HFST installations to help States better assess factors that contribute to both installation successes and failures.

References

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