

CROSSROADS



WISCONSIN TRANSPORTATION INFORMATION CENTER – LTAP at the University of Wisconsin–Madison

High friction surface improves safety on curves

Skids and run-off-road crashes on horizontal curves account for more than 28 percent of highway fatalities in the U.S. every year.

CURVING ROADS pose a danger when drivers go too fast, are distracted or encounter a pavement slick with rain or melted snow. The Federal Highway Administration reports that skids and run-off-road crashes on horizontal curves account for more than 28 percent of highway fatalities in the U.S. every year. Maintaining surface friction on sharp curves, near steep grades or at busy intersections is important for reducing crash rates.

A safety-focused technology that addresses such site-specific issues is HFST, or high friction surface treatment. Part of the FHWA's Every Day Counts initiative, HFST refers to the application of a durable aggregate to the pavement using a polymer binder. The treatment restores or creates an anti-skid surface on existing pavements in otherwise good condition.

Wisconsin is among Midwest states testing the benefits of HFST on state and local roads. Projects completed in the past three years demonstrate a measurable change in crash trends after application, says David Jolicoeur, a Safety Engineer with the FHWA Wisconsin Division office in Madison. Jolicoeur is working with the Wisconsin Department of Transportation to introduce the technology to local governments as a viable option that gives drivers safer control on roads affected by wet weather. WisDOT reminds road agencies that HFST also qualifies for Highway Safety Improvement Program (HSIP) funds.

Dramatic improvement

A good example of HFST in action is the West to North Ramp on the busy Marquette Interchange in downtown Milwaukee. The two-

lane ramp has a history of crashes, especially during wet weather. The risk was so predictable, says WisDOT Traffic Safety Engineer Stacey Pierce, the sheriff sometimes closed the ramp as conditions deteriorated.

Installing HFST changed all that, producing a dramatic reduction in crash incidents. From an average of approximately 79 crashes per year during the previous three years, the latest data show the ramp had only two crashes in the first year after applying the friction treatment.

Pierce works out of WisDOT's Southeast Region office and is collaborating with FHWA's Jolicoeur to evaluate other suitable sites for HFST. She describes the decrease in crashes on the interchange ramp post-HFST as astounding. "I've never seen anything like it. It's made us more aggressive now in applying the technology on other pavements that exhibit similar problems."

Most of these pavements are on roadways with a significant proportion of wet-weather crashes among total recorded crashes. Pierce says current and future sites include a tunnel in the Mitchell Interchange and S-curve locations. The regional office also approved a low-cost chip seal project with HFST aggregate on a steep hill in Washington County as an interim step to help reduce crashes on the roadway while it awaits major reconstruction.

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*This ramp on the Marquette Interchange in Milwaukee averaged about 79 crashes annually, many during wet weather. The first full year after application of a high friction surface treatment, crash numbers dropped dramatically. **INSET:** HFST extends to the shoulder of the road.*

High friction surface on curves

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Reduce all costs

HFST also produced a significant reduction in crashes on an interstate bridge in Cedar Rapids, Iowa, according to John Vu, District 6 Construction Project Engineer with the Iowa Department of Transportation. The Iowa DOT selected the site for improvements in partnership with the FHWA Iowa Division.

Crash data for the location shows a total of 54 crashes over the five years before installing HFST, an average of more than 10 crashes per year. Property damage, including repairs to infrastructure, averaged nearly \$200,000 annually.

Vu says the bridge deck with its distinct horizontal curve was a good candidate for HFST. Wet conditions and the road surface—polished smooth from decades of traffic—were contributing factors in the recorded crashes. In the 12 months following installation of the high friction surface, there were four crashes on the roadway with damage or repair costs totaling \$9,500.

Safer travel was a clear benefit of installing the high friction surface improvement on a small section of the bridge that spans the Cedar River. The Iowa DOT anticipates the treatment also will improve performance and life span of the bridge deck because the epoxy-aggregate application keeps winter road salt from migrating to the deck surface and breaking it down. It is sufficient reason, says Vu, to explore more locations where HFST could make a difference.

Jerry Roche, Safety and Traffic Operations Engineer with the FHWA in Iowa, is working with the Iowa DOT to identify 10 to 20 of these projects in the next year.

WisDOT anticipates seven-to-ten years of effective performance out of the applications, many at locations with high traffic volume.

“High friction surface treatments are a huge area of opportunity for improving safety on state and local roads,” Roche says. “We’re finding it’s effective on curves and at intersections that need a solution like this to bring down the crash rates.”

Aggregate that lasts

Installation was straightforward for both the Iowa and Wisconsin examples with minimal disruption to traffic. Each agency used calcined bauxite, a high-grade aggregate recommended by FHWA that resist polishing and delamination better than flint, granite and other hard aggregate materials.

Results in Cedar Rapids confirm this fact. After almost two years in operation, Vu says the bridge deck shows no sign of deterioration.

The interchange ramp and other HFST installations in southeast Wisconsin also are proving durable. Pierce says WisDOT anticipates seven-to-ten years of effective

This location in Cedar Rapids recorded an average of more than 10 crashes per year in the five years before HFST. One year after installation, there were four crashes on the bridge roadway.



The curve of the road, traffic volumes and its crash history made the Cedar Rapids highway bridge a good candidate for the high friction surface treatment the Iowa DOT installed in 2012.

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Manual or mechanical

Road crews can use either a manual or mechanical method to install HFST. Jolicoeur says WisDOT uses the manual method on state projects. With it, crews first spread the epoxy on the pavement surface then place an even layer of the coarse aggregate. He advises road agencies to work with a contractor familiar with mixing the epoxy even if they plan to manage the actual application with their own crews.

Mechanical application is the preferred method in Iowa, including the bridge deck example. It delivers an even layer of epoxy and aggregate, and a higher production rate—up to 2,300 yards per hour compared to as little as 200 yards per hour applied manually.

Cost per square yard for the surface treatment ranged from \$20 to \$35. Jolicoeur says about a third of that is mobilization, like deploying traffic controls. Pierce notes WisDOT looks for opportunities to include HFST as part of a larger project, which saves on costs.

Improvement not maintenance

Discussing the benefits of the durable, cost-efficient spot treatment, Jolicoeur emphasizes that HFST is not a pavement reconstruction tool. It requires an existing pavement in good structural condition but with sections where insufficient friction increases the risk of crashes.

Roche endorses this rule of thumb and adds that effective spot treatment can extend the life of a pavement at a lower cost than rebuilding a problem area.

It made sense to apply a high friction surface to the Cedar Rapids bridge pavement, for example, rather than re-deck



Two years after installation of HFST, the Cedar Rapids bridge deck shows no signs of deterioration.

the bridge to make it safer. “And where it is too expensive to purchase the right-of-way or rebuild a curve with accelerated wear from the load of tires, HFST is a durable method for increasing friction and safety over the life of the existing pavement,” Roche adds.

Measurably safer

National and state studies give HFST high marks as a pavement treatment that makes roads safer—measurably safer in most cases. Customized and targeted to road sections most in need of greater surface friction, this technology is finding its place among effective, long-lasting safety solutions that benefit local roads.

Pierce says her experience with HFST so far in Wisconsin is persua-

sive. “It is an improvement that has the potential to reduce wet-weather crashes on many roads and bridges across the state. It’s well worth our investment.”

Availability of HSIP funds to help cover costs of HFST gives local road officials another good reason to explore this technology. Learn more through the resources included here. ■

Resources

<http://www.fhwa.dot.gov/everyday-counts/edctwo/2012/friction.cfm>

HFST information and resources at FHWA Every Day Counts.

<http://www.dot.wisconsin.gov/localgov/highways/hsip.htm>

WisDOT’s Highway Safety Improvement Program resource page with information and regional contacts.



The contractors treated all three travel lanes of the Cedar Rapids highway bridge with an epoxy-aggregate to increase surface friction.

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