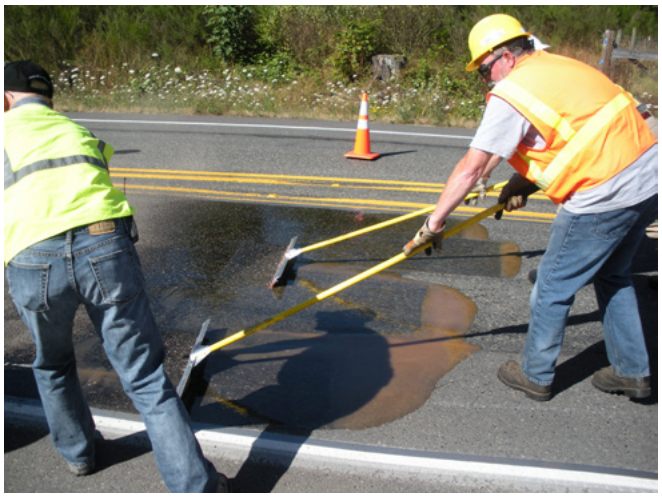
Kansas
LTAP Fact Sheet
A Service of The University of Kansas Transportation Center for Road & Bridge Agencies

High Friction Surface Treatment Starting to Take Hold on the Local System

By Lisa Harris



A Thurston County, WA, crew places calcined bauxite aggregate over an acrylic resin binder at this HFST project in 2014.

In a Fall 2013 fact sheet we introduced you to a technology called High Friction Surface Treatment (HFST), designed to treat short sections of road where there have been crashes due to skidding or there is a high risk for skidding. This new fact sheet will provide an update on HFST use in Kansas and in other states, including by some local governments, and examine why this can be an effective safety strategy for local agencies.

What's happening in Kansas

State system. Our previous fact sheet mentioned that the Kansas Department of Transportation (KDOT) contracted to have HFST installed at four locations on the state system, with some lessons learned along the way. Since then, KDOT has moved ahead with a few more surface treatment projects. KDOT let two HFST projects in 2014 using calcined bauxite as aggregate. A third project will be let in 2015 using flint as aggregate.

One of the KDOT projects is in District One, to help reduce roadway departure incidents taking place on five curved ramps located at the K-7/K-32 interchange (Wyandotte County), Merriam Lane (Johnson County), K-18 (Riley County) and two at the I-70/K-177 interchange (Riley County). The pavement will only be treated where the added grip is needed, generally on the curved portion of the ramp. The ramps chosen were recommended by KDOT area engineers where they thought increased friction would be beneficial.

This past August, Mill Valley Construction Inc., project contractor, applied the HFST to the southbound K-7 to K-32 exit ramp, on a 150-foot curved stretch.

KDOT has developed a spec for installing HFST using calcined bauxite and another one for a surface treatment using flint. Most states specify calcined bauxite for surface treatments due to its hardness relative to other aggregates, and it is recommended by FHWA for "critical" locations where extra polishing is anticipated, like curves. KDOT plans to routinely measure the skid resistance of its applications over the next three years.

Local system. In Fall 2013 we mentioned that KDOT Traffic Safety, at that time, was offering to fund High Friction Surface Treatments for local agencies with specially-set-aside federal safety funds. However, no local agencies responded to that offer. [We'll describe what other funding is currently available for HFST for locals later in this fact sheet.]

We have since learned that one local agency is planning to install HFST on an improvement project using federal funds—the Unified Government of Kansas City/Wyandotte County. The Unified Government and KDOT's Bureau of Local Projects (BLP) agreed on installing HFST as part of a design exception because a horizontal curve in the project did not meet current design criteria. Purchasing additional property for altering the curve was not advisable because a business would have to be moved. According to BLP's Dawn Hueske, the design exception considers safety, costs to meet full criteria, and driver expectation. In this case, an agreement was reached to mitigate the deficient curve

Why is HFST a good technology for local governments?

It's effective. HFST has proven effectiveness at curves, intersections, and grades with road departure and skidding problems. Crash reductions at some locations have been impressive. Bexar County, TX, reported going from a crash every weekend to just a few crashes a year, after HFST installation on a curve.

It can save you money. HFST is often considered for a location when other safety measures, such as increased signage, pavement markings and rumble strips, have not been successful in reducing crashes. Compared with re-engineering the curve, HFST is a much more economical next step. Treatments using calcined bauxite aggregate typically last 10 years or more.

Local crews can install it. HFST can be installed by a machine or manually. Local agencies can buy their own materials and install them with their own staff. If you use your own crew, you can install a short section, see if that addresses the problem, and put down more later if needed. Material can sit in the shed.

with advanced signing, street lighting, pavement markings and HFST.

With just this one example in Kansas, we looked further afield, in other states, for some examples of HFST installed by local governments or installed by states on two-lane roadways with local characteristics.

Thurston County, WA, is one example of a local government using the technology.

"It's pretty amazing, actually," said Scott Davis, county traffic engineer. Davis has known about the technology for a while, but did not consider it for previous safety programs largely because it is more expensive than other run-off-the-road countermeasures like chevrons, rumble strips, and pavement markings. Davis noted that Thurston County is running out of these lower-cost countermeasures. For example, all of the county's curve signs are constructed of high intensity prismatic sheeting, most if not all the curves have MUTCD-required curve signing, and center and edge lines exist on all the county arterial/collector roads. He noted there are limitations on where rumble strips can be installed due to proximity to homes, lack of pavement structure, or shoulders—and there are just a few locations left where Thurston County can effectively use this proven countermeasure too.

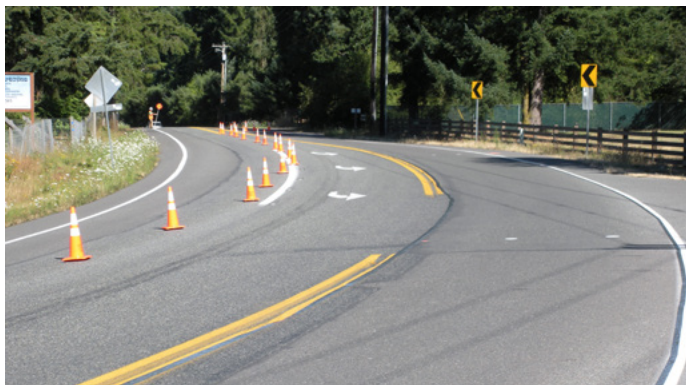
Davis said he was "re-motivated" at the 2013 American Public Works International Congress in Chicago when he learned about the striking effectiveness of an HFST project in Wisconsin. "Crash reductions were phenomenal—something like 100 down to two at an interstate ramp," he said. Davis learned that HFST had become a recommended technology of FHWA's Every Day Counts (EDC) Program, which has funding for demonstration projects. "At the time I was re-introduced to HFST, I was looking for another relatively low cost and proven countermeasure that could help in some of the more interesting sites in Thurston County," Davis said.

To become more comfortable with using the technology in his county, Davis wanted to see firsthand the product being laid down. He also wanted to get more comfortable with the maintenance aspect of HFST. He talked with the FHWA Division office and the Local Technical Assistance Program (LTAP) office in Washington State about organizing a demo. "Partnerships are important in most things we do, but having the support of those two offices was crucial to getting an EDC-funded demo project," he said.

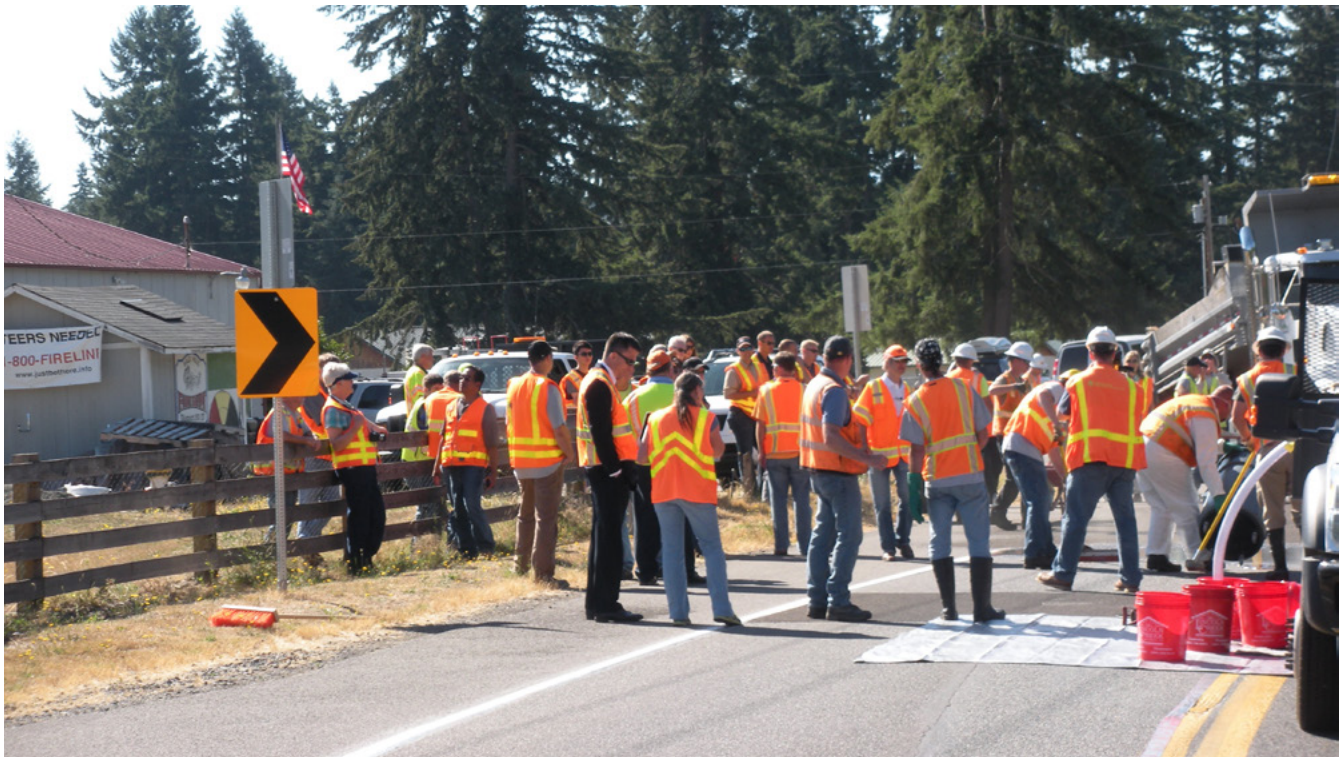
Mike Moravec of the FHWA Office of Transportation Performance Management and Frank Julian of the FHWA Resource Center organized the HFST demo that included a contractor installation at one site and a county maintenance crew installation at another site. FHWA paid for the contractor, materials for both sites, and provided training for the county crew. The county provided labor. A technical team and vendors provided direct oversight for installation.

Davis, Washington LTAP, and FHWA developed a list of candidate sites using a combination of crash history and systemic risk analysis of roadway characteristics. Other considerations included sites that could provide enough room to stage and mobilize equipment and provide space for everyone observing to be safely off the road.

The first site, for the vendor demo, was a curve on the county's HFST candidate list. The second site was further down on the county's list, but it made the cut because it was close to the first site and there was an adjacent



This is the site of the Thurston County demo using county staff, before treatment. A photo of the curve after treatment is above, left.



Photos on pages 1-3 courtesy of Thurston County

Above, *35 people, including 21 from local agencies, attended the county-applied demonstration of high-friction surface treatment in Thurston County, WA, in 2014.* **Below,** *the county crew prepares and applies the resin binder.*

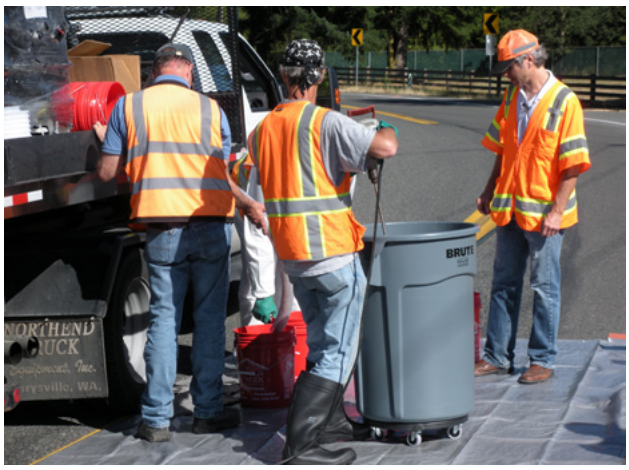
school that provided space for staging equipment, hosting a peer exchange, and observing the work.

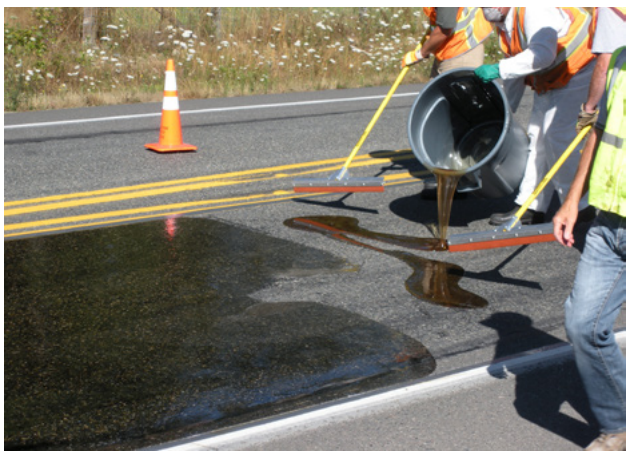
Because there was extra material left over from the first two sites, the team decided to add a third site. This site was first on the county's HFST candidate list—a downhill grade to a stop-controlled T-intersection. County staff did the installation at this site. Davis said it involved 11 people for the labor, plus some supervisors.

Thurston County hosted a peer exchange that coincided with the scheduled HFST installation by county maintenance staff. The intent was to allow attendees not only to learn about HFST in a classroom environment but also see an actual installation by local forces. Davis said 35 or so individuals attended, 21 of whom were from local governments. Davis said the weather cooperated—no small feat in Washington State. He also said, in his opinion, "Our folks did it an amazing job—the work was done fast, and it was high quality. I believe these thoughts were shared by all those that attended the peer exchange."

Davis said the installation of HFST "goes pretty quick." For example the county's maintenance crew laid about 440 ft of HFST in one lane in two hours, with an hour of prep before. After installation, the treatment needs to sit a little while to cure out. Based on Thurston County's experience, Davis said a county could easily do a one-lane segment in half a day with mobilization and demobilization. If doing two lanes, Davis recommended scheduling two days, although the crew would not be working full days at the site.

When asked if he had any tips for other agencies in





Where is HFST effective?

High friction surface treatment is effective at locations where extra traction is needed to avoid skidding—such as ***curves, intersections, and grades.*** Contributing factors to crashes at low friction locations include weather, speeding, worn tires, and over-steering at curves, per Frank Julian, FHWA.

Sites can be chosen using crash analysis or systemically, looking at high-risk characteristics.

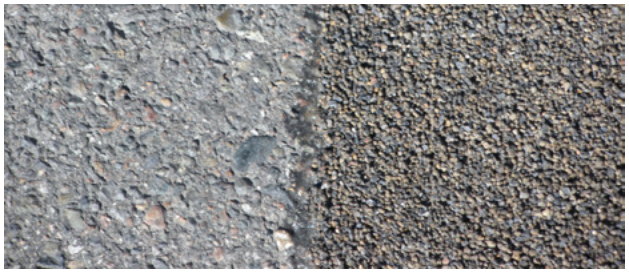
using the materials, Davis said both of the materials used for the binder (acrylic resin or epoxy) are considered hazardous for various reasons, so you need to have folks who have hazmat certification to haul the materials. "Read and follow the MSDS sheets," he said. Thurston County provided the appropriate safety gear and discussed the materials and precautions with staff prior to installation.

Davis also mentioned the aggregate is like marbles if not embedded in the binder. So he suggested making sure to sweep the entire road when done and post loose gravel signs as an added precaution until the site can be swept again.

Frank Julian from FHWA said he enjoyed working with Davis and the county maintenance crew. "This county is fantastic. I had so much fun working with the guys. Local folks are great, and innovative. They did the job for half the cost of a contractor," he said.

Davis estimated the cost of a 450 ft one-lane section to be $13-15,000 for materials, with 2/3 of that cost for the binder and 1/3 for the aggregate. "Although this sounds like a lot, it really is not if you have already exhausted other low-cost measures and you have no other options or are considering reconstruction," he said. Davis is looking at doing more HFST projects with the roadway maintenance crew next year.

When asked if he felt a difference in the driving surface after the installation of HFST, Davis said "I don't drive fast, so it is hard to say. However the HFST itself feels like sandpaper and I can feel a difference just walking on it. Plus a local law enforcement officer told one of the county workers he was going to try and drive faster around the curve. That's not exactly what we had in mind, though..." Davis said.



FHWA

Untreated asphalt pavement is shown on the left. High friction surface treatment, with its sandpaper texture, is on the right.

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"Too bad HFST did not make it to the next round of Every Day Counts." Davis said. "I believe this demonstration and peer exchange with the locals in action was a great way to showcase a proven safety countermeasure and get others interested to try it out. I think other states and local agencies could benefit from similar events," he said.

Davis did say that two counties that attended the peer exchange have already decided to pursue HFST. One is planning to install a mile total of segments of HFST, and the other county requested $2 million in federal safety funding (HSIP) for HFST projects.

Davis appreciated having the county maintenance crews install HFST—and watching the process. "It's interesting to see a hands-on approach. It's a lot different than seeing a contractor do it," he said. Plus his county got a safety improvement in the process, for the cost of the labor. Hosting the demo was a win-win.

The installation went very well. Davis said everyone on the crew was pleased when they got back to the shop. "They were happy with the end-product and proud of their work," he said. "Now crew members are thinking of some other uses for HFST," he said.

Davis noted that "this effort would not have been possible without a strong partnership with our local FHWA and WSDOT offices. Both are very supportive of local road safety and helped champion our HFST demo request."

Placer County, CA. Placer County recently received Highway Safety Improvement Program (HSIP) funds for a $1.5 million project to place HFST on 26 curves. The county is one of several in the state using the technology. A strong proponent in California of HFST technology, said Frank Julian, is Robert Peterson who manages the HSIP for CalTrans. "CalTrans has funded 40 HFST projects on local roads," Julian said.

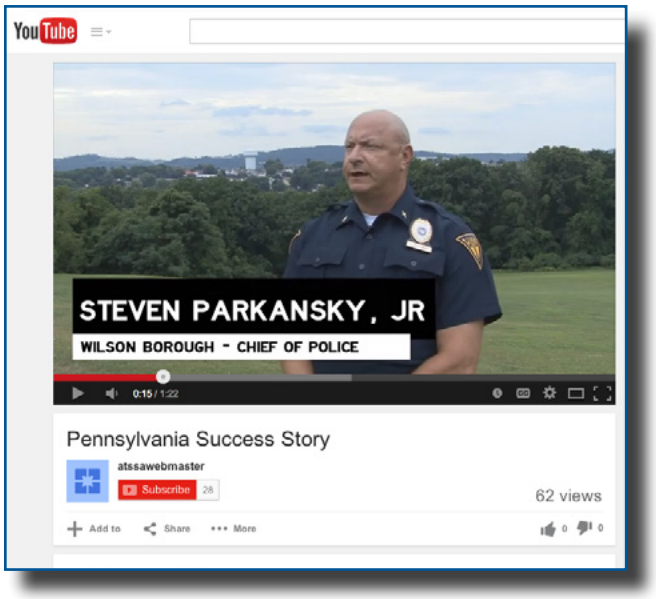
In Placer County, HFST will be installed where there is a high frequency of run-off-the-road collisions. A report to the county Board of Supervisors stated that the primary factor for these collisions varies but include improper turning, unsafe speed, driver inattention, wrong side of road and DUI."

Ken Grehm, the county's public works director, said motorists wouldn't necessarily be able to feel a difference driving over the HFST surface but it would help road conditions, including when the surface is slick from rain.

Nevada County, CA, is planning to have their first HFST project installed in 2015. Their public works director, Steve Castleberry, is more than ready. He is impressed with the crash reductions experienced around the U.S. with the technology and wants to try it at home.

Castleberry initially heard about HFST through FHWA. "They were really pushing it," he said. "After getting five or six emails about it, you start to pay attention," he said.

Castleberry serves on a state safety committee with the safety engineers from CalTrans and FHWA's California Division. These individuals worked with Castleberry to identify a site to try the technology. "They were interested



ATSSA

Law enforcement officers often know the problem locations in your community—and the benefits of addressing them. In this short video clip from an HFST installation in Pennsylvania, a local police chief speaks about how the technology has benefited his community. [See Sources for a link to the video.]

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in getting the technology out there to more locations, and we were interested in helping out," he said.

The team looked at a number of sites, and none stood out initially as a top contender for HFST. However, a closer look at one location with a grade down to a traffic signal revealed that a significant number of crashes occurred during the winter, with snow and ice conditions. The site is on a north facing slope with a creek nearby. This site was chosen for the treatment to provide more grip to the pavement.

Bexar County, TX, is one of several counties in the state that have had HFST installed at problem locations. An example is on Wiseman Road where a vendor installed HFST on a curve two years ago. Robert Delaney, assistant superintendent of public works, said they had no problems with the installation, and no complaints.

The location is a sharp curve, and had a crash occurring every weekend, per Delaney. "I sure don't see that happening any more," he said. "Crashes now happen only a couple of times a year." Delaney said the surface has shown no signs of wear in the past two years.

The county has another HFST application on Wiseman Road at an approach to a T-intersection where drivers were skidding through the intersection and running through the fence on the other side. Excessive speed was indicated in a number of crashes. Crashes have gone down at this location as well, indicating that the HFST is providing a better grip for braking.

City of Bellevue, WA. Forest Drive's westbound approach at its intersection with Cole Creek Parkway regularly had vehicles sliding down the hill during icy weather. In an effort to combat the problem, HFST was applied on this approach in 2004. For the 10 years prior to the application, the City of Bellevue had recorded 2.7 accidents per year that were attributed to grade, skidding, driving too fast for conditions, or road departure. After the installation, the average went down to 0.5 crashes per year. The City has since analyzed the effect of HFST on the crash cost at that location. They found an annual crash cost reduction of about $25,000 per year to the public.

Other HFST projects

Several states are using HFST in high accident site-specific locations. These include California, Florida, Louisiana, South Carolina, Tennessee, Virginia, West Virginia and Wisconsin. We'll mention a few other states below that are using HFST on two-lane roadways:

Pennsylvania. PennDOT did a HFST project on a two-lane road at a curve in the Borough of Wilson. The curve had a high crash rate—26 crashes in a three year period—and the borough's Chief of Police Steven Parkansky called PennDOT to ask for assistance in addressing the problem. His department had taken the step of parking a police car with flashers on at the curve to try to get drivers' attention. The problem was wet conditions at the curve, he said, not drivers exceeding the speed limit.

Parkansky said the HFST treatment essentially eliminated crashes at the curve. Chief Parkansky is pictured at left in a video that describes the curve before and after. See the Sources on page 6 for a link to the video.

Also in Pennsylvania, in 2012, PennDOT's District 5-0, with six counties, contracted for a series of 12 HFST projects to mitigate off-road skidding incidents.

Kentucky. The State of Kentucky conducted a three-year evaluation of high friction surface treatments that concluded in Summer 2013. Since the evaluation began, there have been 120 HSFT locations installed statewide. Preliminary evaluation shows a 69 percent reduction in crashes in locations using HFST.

At one particular location there were 55 wet weather and three dry weather crashes over a 3-year period before the installation of HFST. In the 2½-year period after the HFST installation, the same location reported only five wet weather crashes and one dry weather crash. To quote an official from the Kentucky

"The projects I love are the ones where they've done everything to try to reduce crashes. At a curve in California, they doubled up chevrons and added rumble strips, with no reduction in crashes. It would have cost 14 million to rebuild the curve, and 5-6 years to complete because it is in an environmentally-sensitive area. HFST was installed, and two years later, they still have had no crashes."

—Frank Julian, FHWA

More Information on High Friction Surface Treatment

• **High Friction Surface Treatment FAQs,** FHWA, March 2014. This 12-page fact sheet covers site conditions, installation tips, lessons learned, maintenance and operations, and more. An excellent primer on HFST. https://www.fhwa.dot.gov/everydaycounts/edctwo/2012/pdfs/fhwa-cai-14-019_faqs_hfst_mar2014_508.pdf

• A good starting point for up-to-date online information on HFST is the FHWA Every Day Counts webpage on HFST: https://www.fhwa.dot.gov/everydaycounts/edctwo/2012/friction.cfm

Transportation Cabinet, "this one project paid for all the other projects in the state."

Arkansas. Closer to Kansas, about two dozen sections of (non-interstate) state highway in Arkansas are set to receive HFST in Spring 2015, aimed at reducing crashes during wet weather. The Arkansas State Highway and Transportation Department has been using HFST on interstate ramps and now plans to use it on curves elsewhere on the state system, where a disproportionate number of fatal traffic crashes occur, according to Randy Ort of the AHTD. The projects will use an epoxy coating with calcined bauxite aggregate.

Highway department officials identified the sites based on average daily traffic and where wet pavement was a factor in at least 35 percent of the total crashes. Areas set to receive the high friction surface treatment are in nine different counties: Garland, Saline, Lonoke, Baxter, Clark, Garland, Boone, Benton and Chicot.

Training for locals on installing HFST

FHWA is developing training specifically for local governments to use their crews to lay down the material. Frank Julian from the FHWA Resource Center is the lead on this effort. One of the training materials will be a video of Thurston County's crew installing HFST at their demo site. The footage was taken by a Washington DOT film crew. When the training is made available, we'll let you know.

Closing thoughts

Julian said: "The projects I love are the ones where they've done everything to try to reduce crashes. At a curve in California, they doubled up chevrons and added rumble strips, with no reduction in crashes. It would have cost 14 million to rebuild the curve, and 5-6 years to complete because it is in an environmentally-sensitive area. HFST was installed, and two years later, they still have had no crashes."

That's the kind of success story that is getting county engineers like Davis and others to give HFST a chance to lower crashes in their own communities.

But locals agencies in Kansas don't need to have a crash history to consider HFST at high risk locations where extra traction could be helpful in preventing a crash. If you have a location you would like to try using HFST, call Steven Buckley, KDOT's safety engineer, to discuss possibilities (785-296-1148). If a KDOT project for HFST is planned in your area, maybe you can arrange to have the vendor install HFST at your site as well. Or you could become familiar with the installation process, obtain the materials, and have your crew lay it down. Either way, you could apply for HSIP funds to help fund the project, or use your Federal Funds Exchange dollars, or local funds.

HFST is helping make communities safer all across the country. Consider it for your community as well, if you have an area prone to skidding. ■

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Sources:
- Phone interviews: Frank Julian 10-19-14; Scott Davis 11-20-14; Steve Castleberry 11-20-14; Robert Delaney 11-21-14.
- Email correspondence: Steven Buckley on 11-26-14 and 12-1-14; Dawn Hueske on 12-1-14.
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- PA Route 611 link at http://www.dbiservices.com/high-friction-surfacing-treatment
- High Friction Treatments Are Gaining Traction. Kansas LTAP Fact Sheet. Reprinted from the Kansas LTAP Newsletter, Fall 2013. http://www2.ku.edu/~kutc/pdffiles/LTAPFS13-Highfriction.pdf
- Thomson, Gus. "Placer County roads to get safer with skid resistant coating," Auburn Journal, July 9, 2014.
- High Friction Surface Treatment FAQs, FHWA, March 2014. (See link in sidebar at top of this page.)