GAINING TRACTION

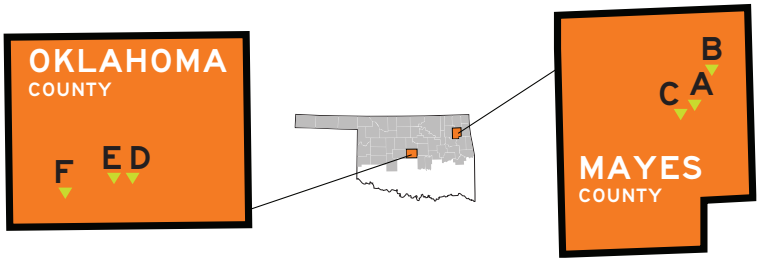
WITH HIGH FRICTION SURFACE TREATMENT

Above: Site B near Spavinaw on SH-20 in Mayes County is treated with HFST.

Dramatic, immediate, and economical are three adjectives that traffic safety engineers are using to describe a lifesaving pavement application called High Friction Surface Treatment (HFST). In fall 2018, the Oklahoma Department of Transportation (ODOT) will be increasing its efforts to decrease fatalities and prevent crashes by applying HFST as part of a multi-county Systemic Curve Treatment Safety Improvement Plan.

"When we first began using high friction surface treatment, we did a system-wide screening to see where this technology really made sense. This rural two-lane highway near Salina, where we were observing high speeds and run-off-the road crashes fit the criteria," said ODOT Assistant Chief Traffic Engineer David Glabas. "ODOT Division Eight had done everything they could to improve the safety of the highway, including adding rumble strips and oversized chevron signs. During the HFST application process, the neighbors were showing up and thanking us."

In 2013, the Oklahoma Department of Transportation (ODOT) and the Federal Highway Administration (FHWA) saw an opportunity to address a particularly challenging stretch of roadway on a horizontal curve in northeast Oklahoma with this cost-effective treatment. Two of the original three sites on SH-20 in Mayes County are slated for scheduled re-application in the new curve safety plan.



FIRST LOCATIONS USING HIGH FRICTION SURFACE TREATMENT (HFST) IN OKLAHOMA FROM OLDEST (A) TO NEWEST (F) APPLICATION, MAY 2018

Left: As of July 2018, Oklahoma has used HFST in Mayes and Okalhoma counties.

PRODUCED BY TRIBAL TECH FOR THE OKLAHOMA STATE INNOVATION COUNCIL WITH THE SUPPORT OF A 2017 INNOVATION INCENTIVE AWARD FROM THE OKLAHOMA DEPARTMENT OF TRANSPORTATION AND THE FEDERAL HIGHWAY ADMINISTRATION

Above: In Fall 2018, HFST will be added to SH-20 near Locust Grove, Okla.

"Before high friction surface treatment was applied, we were seeing a high rate of crashes occurring on SH-20, especially in wet conditions," noted ODOT Division Eight Maintenance Engineer Trapper Parks. "Although we're noticing some aggregate loss at these sites now, they're still producing good friction numbers."

Critical safety functions such as the vehicle's ability to stop, turn, and stay in the proper lane begin with the tires' ability to contact the pavement and the driver's ability to maintain control. Annually, over 25 percent of all highway fatalities in the United States occur at or near horizontal curves, with the average crash rate on these curves at approximately three times the crash rate on tangent sections, according to FHWA. When roads are wet, friction is further reduced. A water film thickness of 0.002 inches reduces the tire pavement friction by 20 to 30 percent of the dry surface friction. (Publication Number: FHWA-HRT-14- 065 Date: February 2015.)

WHAT ARE HFSTS?

High Friction Surface Treatments are pavement-surfacing systems with exceptional skid-resistant properties, not typically provided by conventional materials. Calcined bauxite is a mineral aggregate, which when combined with an epoxy-resin binder, adds protection and friction to the roadway.

The high-performance properties of the binder lock the aggregates firmly in place, creating a durable surface capable of withstanding extreme roadway friction demands, such as heavy braking, severe horizontal curves and steep grades. HFST can be implemented quickly compared to other alternatives, satisfying many agencies' concerns with environmental issues and lengthy construction schedules.

High Friction Surface Treatment has a course finish of rough-edged aggregate.

EDC

The technology is part of FHWA's Every Day Counts (EDC) program, which encourages the deployment of innovative underutilized innovations that shorten project delivery, enhance roadway safety, reduce traffic congestion, and improve environmental sustainability.

STIC
State Transportation Innovation Councils

Key components to the success of innovation deployment programs such as EDC are the state-based approach and the State Transportation Innovation Council (STIC) concept.

Oklahoma's STIC is a task force that meets quarterly to bring together public and private transportation stakeholders to evaluate innovations and spearhead their deployment in the state. HFST is just one of several EDC innovations that have been promoted through FHWA since 2011.

"Oklahoma's innovation council is a unique opportunity for representatives from transportation agencies, industry and academia to collaborate and pursue innovations that will help deliver a modern and efficient transportation system in our state," said ODOT Director of Capital Programs and STIC Chair Dawn Sullivan.

Above: This spot on SH-20 near Salina., is the first site where HFST was applied in Oklahoma.

HFST BACKGROUND IN OKLAHOMA

Bryan Cooper, Field Services Manager, ODOT Office of Research and Implementation, remembers when this technology was first discussed. "I was at the Kansas City EDC Summit when I first heard about this," stated Cooper, "and as the manager of the long-term pavement performance program, I was anxious to be involved." Since then, Cooper has been tasked with monitoring field-implemented EDC projects. With HFST, he is charged with visual monitoring of pavement condition at the sites.

Above: The OSU research team, from left to right, professors Josh Li and Kelvin Wang with Research Engineer Justin Thweatt and Senior Research Scientist Cheng Chen.

On the HFST project, Cooper has been collaborating with Oklahoma State University (OSU) researchers, professors Kelvin Wang and Josh Li.

Left: ODOT Skid Tester; Above: OSU GripTester. Photos courtesy Josh Li.

While ODOT uses the Locked-Wheel Skid Trailer (ASTM E274-06) to measure the steady-state friction force on a locked test wheel as it is dragged under constant load and at constant speed (typically at 64 km/h [40 mph]) over a wet pavement surface, OSU uses the GripTester, also used in recent years by FHWA on many demonstration projects in the United States.

The GripTester is designed to continuously measure longitudinal friction along the wheel path. It provides greater spatial variability detail and is ideal for project and network level friction management. Research performed by Li and Wang shows that even HFST-treated sites that are exhibiting wear demonstrate clear skid resistance improvements.

"Pavement friction matters" said Wang, pointing to FHWA's research that states that "22% of crashes occur in adverse weather conditions, in which 73% occur on wet pavements, which are largely related to friction."

LEARN MORE

Experience the interactive report with maps and the ODOT High Friction Surface Treatment video at: https://spark.adobe.com/page/azmar0vudRI2P/

Download or view before photos of future HFST sites in Oklahoma, at: https://www.flickr.com/photos/karlajs/albums

HFST'S LONG TERM PROJECTIONS IN OKLAHOMA

For ODOT Traffic Safety Engineer Matt Warren, HFST is an Oklahoma success story. Warren collaborated with FHWA Pavement and Material Engineer Waseem Fazal on a 2016 report that shared project information, research results and crash data, noting that "initial results were very satisfactory."

The report included results from Mayes County and an Accelerated Innovation Deployment Project of HFST installed in 2015 on I-40 westbound near SE 29th St, I-40 westbound near Town Center Drive, and I-44 westbound over Airport Road, all in the Oklahoma City metropolitan area. The three sites were chosen based on previous crash history and pavement condition.

CONTINUED P. 6

Above: A Fall 2018 application of HFST on SH-20 near Locust Grove, will reduce crashes, injuries and fatalities on this stretch of road in Mayes County. HFST will also be applied in Rogers, Sequoyah, LeFlore, Lincoln and Tulsa counties.

2018: NINE NEW LOCATIONS

A lifesaving pavement application will be applied by the Oklahoma Department of Transportation (ODOT) in nine locations in Eastern Oklahoma Fall 2018.

As part of a $1.24 million multi-county safety improvement project, the Oklahoma Department of Transportation (ODOT) an innovative surface treatment will reduce run-off-the-road collisions by giving drivers more traction on tight curves and in wet conditions in six counties: Rogers, Mayes, Sequoyah, LeFlore, Lincoln, and Tulsa.

"This is not a pavement rehabilitation project and our goal is not a pretty looking highway," said ODOT Traffic Engineering Manager Jami Short, referring to the roughened appearance of road sections that have been treated with High Friction Surface Treatment (HFST). "We're establishing more friction at these sites with a goal to save lives."

Roads wind through the Ouachita, Winding Stair and Kiamichi Mountains in LeFlore County, where ODOT Division Two Engineer Anthony Echelle and his team strive to reduce the number of collisions, injuries and fatalities. In 2016, the Oklahoma Highway Safety Office recorded 15 fatal crashes in the county. "We're always ready to bring in anything that will further enhance safety. We have lots of curvy roads and places where using a treatment like HFST can make a difference," said Echelle, who is keen to begin the safety enhancements this fall.

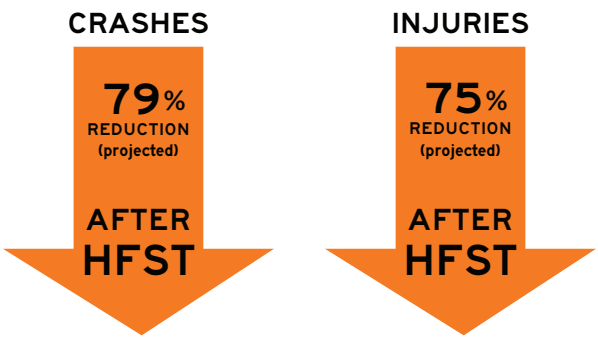
The curve safety project will allow ODOT to install curve advisory signs, LED blinking lights, lowered-speed limit signs, guard rails and HFST along a stretch of US-259 that passes through the Kiamichi Mountains.

The project will also benefit drivers in Sequoyah County. "We've been concerned by the crashes on SH-82 north of the SH-82 and SH-100 junction in Sequoyah County," said ODOT Division One Traffic Engineer Justin Calvarese. "We're hoping that the HFST provides additional traction so that drivers are less likely to crash at that location."

HIGH FRICTION SURFACE TREATMENT

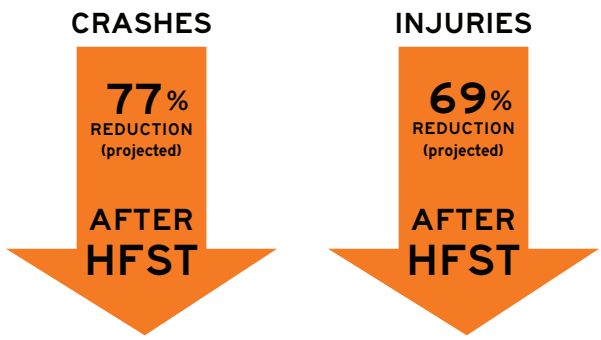
IMPACT

MAYES COUNTY, OKLAHOMA



OF CRASHES AND INJURIES
5 YEARS BEFORE AND 3 YEARS AFTER HFST APPLIED

OKLAHOMA CITY METRO-AREA



OF CRASHES AND INJURIES
5 YEARS BEFORE AND 1.5 YEARS AFTER HFST APPLIED

LONG TERM PROJECTIONS CONTINUED

Warren analyzed and provided crash data at locations before and after HFST was applied.

At the treated sites in Mayes County, 26 crashes and four severe injuries were observed in five years before treatment. For the same locations after treatment, two crashes and zero severe injuries were recorded during a period of three years. The projected benefits after treatment are an estimated 79% reduction in crashes and 75% reduction in severe injuries and fatalities, according to Warren.

For the metro OKC HFST locations, 159 crashes and eight severe injuries occurred in five years at the sites before installation. After the treatment application, 11 crashes with no severe injuries occurred during a 1.5-year time-period. Here, Warren noted a projected performance of approximately 77% reduction in crashes, 69% in severe injuries and fatalities.

"With guardrail and cable barrier, you only mitigate the injury after the crash happens," said Glabas, "When you can't change the geometry of the road, HFST becomes a very economical solution to prevent crashes."

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STORY BY KARLA SISCO AND PHOTOS BY AMY M. ECHO-HAWK

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