

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.

Continues on page 8



*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.*

Alternatives fuel more fleet replacements

More federal, state and local agencies are adding alternative-fuel vehicles to their fleet operations, most often when they replace or upgrade existing equipment.

STRICTER EMISSION STANDARDS

and the need to contain costs are combining to create a wider market in the United States for alternative fuels. With these technologies now available on heavy trucks and at a greater number of refueling locations, more federal, state and local agencies are adding alternative-fuel vehicles to their fleet operations. Most often they do it when replacing or upgrading existing equipment.

Compressed natural gas (CNG), hybrid electric, biodiesel and ethanol are among the most common alternatives. CNG is one that is holding its own in municipal fleets in Wisconsin.

Two examples of public sector fleets adopting CNG technology are the cities of Milwaukee and Oshkosh. Jeffrey Tews, Fleet Operations Manager for the City of Milwaukee, has been part of that city's experiments with CNG since as far back as 1980.

Oshkosh is newer to the technology but Public Works Field Operations Manager Kevin Uhen and Garage Manager Robert Knaup have a solid, well-documented two years of running CNG vehicles on the city's streets.



City of Oshkosh camera truck, used in sewer operations, has separate CNG engines to power it and run a compressor.

Evolving technology

The newest natural gas vehicles generally perform similar to gasoline or diesel vehicles. Because CNG has lower energy density, vehicles cover fewer miles between fill-ups, not an issue for most municipal fleets.

Milwaukee's earliest experiment with CNG, a converted city pickup truck, proved the technology was not ready for widespread use 34 years ago. Tews recalls the truck had little starting power and did not go far on a tank of fuel. Refueling took up to 16 hours and there were few locations to do it. Another drawback was loss of cargo space because of the large fuel tank. And there was resistance from operators who misperceived the fuel as explosive.

By the mid-1990s, when vehicle technology had advanced to on-board computerized diagnostics that controlled the fuel system, the city converted nine vehicles to CNG. The tanks were less bulky and the engines produced more power, but fueling locations still were scarce. However, Tews explains, the city's interest in CNG as a way to reduce environmental impact and lower fuel costs remained strong.

Significant improvements came in 2010. The new engines had more power—as high as 320 horsepower and good enough for quick acceleration. Tews decided to test the technology in larger vehicles and ordered 21 refuse trucks built to run CNG. The city found help subsidizing the \$36,000 added cost per truck for specialized equipment through grants from Wisconsin Clean Cities, the State Energy



Milwaukee refuse trucks do double duty clearing streets of snow in winter, including this CNG-powered model.

Office, the U.S. Department of Energy (DOE) and the Congestion Mitigation and Air Quality (CMAQ) Improvement Program administered by the Federal Highway Administration. CMAQ gives state and local governments a way to fund transportation projects that meet the requirements of the Clean Air Act (CAA) and its amendments. These include purchase of alternative fuel vehicles or conversions, and installation of refueling facilities.

Since Milwaukee uses its refuse trucks to plow snow during the winter, it was important the new vehicles had the power to do the job. Tews says the newest additions to the fleet get high marks for performance. They also run about 50 percent quieter than the diesel fleet and have fewer emissions.

"Our only real concern was how well they would start from a standing stop," he notes. "Turns out they have great power."

Feasibility guides decision

Public Works Operations Manager Uhen says the City of Oshkosh decided to test the alternative on refuse trucks because there already is extensive use of CNG in sanitation fleets and they could benefit from the experience of others. The Winnebago County community shifted its operation to automated collection in 2012 so it was an ideal time to purchase new side-loading garbage trucks that ran on CNG. The city fleet started with five and now has 14 CNG-powered vehicles, including vans, pickup trucks and a five-ton dump truck the parks department uses to plow parking lots during winter operations. A camera truck used in sewer operations has two CNG engines, one to power the truck and another to run a small compressor.

"We look at each potential replacement to determine if it's feasible for CNG," Uhen notes. "Does the tank location impede how the vehicle functions for the intended task, can it maneuver on city streets? These are some of the questions we ask."

Knaup, who manages fleet garage operations, says he sees little difference in performance between the city's CNG- and gas-or-diesel-powered vehicles. "They can be a little sluggish on take off but enough power overall," he explains. "And the

operators are happy with them because they run quieter and give a more comfortable ride."

He adds that reports CNG would pose a problem in cold winter temperatures because of condensation buildup proved groundless. "Cold as it got this winter, we didn't have any issues with the new trucks functioning properly."

Filling up

Oshkosh purchases its natural gas supplies from fueling stations run by Kwik Trip at two store locations in the city. They are among the more than 100 stations Kwik Trip operates in Wisconsin, Minnesota and Iowa that have the capacity to supply the alternative-fuel needs of large trucks.

Joel Hirschboeck, Superintendent of Commercial Fuels for the Wisconsin-based company, says the program began by serving private fleets 15 years ago. It provides fueling stations for diesel, gasoline and alternatives like CNG. The commercial fuels program expanded eventually to include public fleets and now Kwik Trip has fuel contracts with towns, cities and counties across the three-state region.

They also have 75 CNG vehicles in their own fleet, which Hirschboeck says gives Kwik Trip technicians ongoing experience with advances in the technology.



Wisconsin-based Kwik Trip supplies public fleets with alternative fuels, including CNG. More than 100 of its stations have refueling bays like these for large trucks.

As part of the fuels program, they provide maintenance and installation of specialized equipment, and help train customer fleet technicians to maintain their own equipment.

Uhen says his fleet department benefits from Kwik Trip's experience with alternative fuels. But he adds that plans in Oshkosh to construct a new public works facility raises the question of whether to invest in a city-run CNG fueling operation, something that would allow the city to meet and manage the cost of expanding alternative-fuel needs in future.

Milwaukee uses a We Energies fueling station and two filling stations on city property (both also available to the public) for

Kwik Trip's commercial fuels program expanded eventually to include public fleets and now the company has fuel contracts with towns, cities and counties across the three-state region.

Continues on page 4

"We look at each potential replacement to determine if it's feasible for CNG," Uhen notes. "Does the tank location impede how the vehicle functions for the intended task, can it maneuver on city streets?"



Milwaukee uses both fast-fill and time-fill methods for refueling its CNG fleet. In fast fill (left), the vehicle hooks up for a full fill on the spot. The station can service 11 trucks with a full fill in one hour. Time fill (right) takes longer but handles several trucks overnight when they are not in use and electricity rates to run the pumps are lower. Milwaukee's time-fill process also keeps data on fuel consumption by truck to document exact costs.

CNG fleet replacements

from page 3

Comparisons reported by the U.S. Department of Energy Alternative Fuels Data Center show the cost of CNG as of April was \$2.15 gge (gasoline gallon equivalent), \$3.65 per gallon for unleaded gasoline and \$3.97 per gallon for diesel.

its current fleet of CNG-powered trucks. Tews says they designed the existing city-owned stations, built using federal dollars, to manage an increase in the city's fleet of CNG-powered vehicles over five years. He anticipates adding more city-owned stations to reduce wait times for fill-ups and give fleet operations more control over costs.

Budget bottom line

Compressed gas costs half as much or less than traditional fleet fuels and price fluctuations are modest. Comparisons reported by the U.S. Department of Energy Alternative Fuels Data Center show the cost of CNG as of April was \$2.15 gge (gasoline gallon equivalent), \$3.65 per gallon for unleaded gasoline and \$3.97 per gallon for diesel. Milwaukee and Oshkosh both claim measurable savings from the use of CNG in fleet vehicles.

"That fact alone makes adopting CNG worthwhile," observes Milwaukee's Tews when talking about the payback on the city's investment in alternative-fuels technology. He says Fleet Operations currently saves \$6,500 per year for each truck using CNG, meaning overall fuel costs will decrease with every vehicle they add to the fleet. That could come soon with eight light-duty CNG vehicles and 22 more CNG refuse vehicles on order. "Once we have



A side-load refuse truck in the Milwaukee CNG fleet.



Oshkosh's CNG fleet includes vans like this one.

more trucks running CNG, I expect savings of around \$270,000 a year on fuel costs overall."

In Oshkosh, two years of data comparing CNG to diesel shows the shift to the alternative produced a good return. Knaup says with a savings of 33 cents per mile on fuel and the lower cost of maintenance on the new vehicles, the city found CNG 70 cents cheaper to run than diesel. After just two years, that is significant.

Eco bottom line

Decreasing the carbon footprint of its fleet operations is a sustainable goal for many public agencies. Kwik Trip's Hirschboeck follows the data and reports that CNG-powered vehicles reduce greenhouse gases by 25 percent and particulate matter by 90 percent.

Milwaukee's Tews believes the numbers are real. "We don't know just how much our alternative fuel efforts contributed to EPA reports of a considerable reduction in emissions in Milwaukee over the last year," he observes. "But Fleet Operations is doing its part."

CNG maintenance

The main difference between maintaining a CNG-powered vehicle and a conventional vehicle is the fact they require more frequent spark plug replacement. Replacements are costly but Oshkosh's Knaup says there are long-term savings that include less downtime.

Tews says another item on the maintenance list for CNG vehicles is the periodic inspection and recertification of the fuel tanks, a federal requirement.

Local governments also need to make sure maintenance facilities are adequate for handling CNG vehicles safely. Milwaukee is working to refurbish the

garage areas where maintenance crews work on the vehicles by upgrading ventilation systems, machinery and light fixtures to comply with NFPA (National Fire Protection Association) codes. Improvements include methane sensors that activate the ventilation system to do an air exchange and keep running until methane levels drop. Milwaukee's Fleet Operations also trains operators and mechanics in proper maintenance practices and safe operation for CNG equipment.

Growing numbers

Private and public sector fleets that want to cut costs and reduce polluting emissions represent a growing market for U.S. equipment manufacturers developing new heavy-duty natural gas vehicles. For some fleets, using qualified system retrofitters to convert conventional fuel vehicles to natural gas is a viable option to replacing them.

Decreasing the carbon footprint of its fleet operations is a sustainable goal for many public agencies. Running CNG-powered vehicles reduces greenhouse gases by 25 percent and particulate matter by 90 percent.

There is growing interest in alternative fuels among local governments in Wisconsin. Milwaukee and Oshkosh are two of 17 local public agencies in the state that belong to the Wisconsin Smart Fleet program (<http://wismartfleet.org>). The program is a joint effort of the Wisconsin State Energy Office and Wisconsin Clean Cities (WCC), a trade association that promotes the use of alternative fuels and technologies. Smart Fleet provides public and private fleets with help evaluating where they can add clean, renewable fuels to their operations while keeping costs under control.

Local governments also need to make sure maintenance facilities are adequate for handling CNG vehicles safely.

Local governments can learn more about the benefits of adding CNG or other alternatives to their fleets by checking out the resources provided here and contacting fleet managers who are putting these alternatives to the test. ■



The Oshkosh Parks Department attaches a plow blade to this CNG-powered one-ton truck to clear parking lots of snow in winter.

Madison tests hybrid electric trucks

ELECTRICITY is another source government fleets are testing to power select vehicles. The City of Madison deployed two heavy-duty hybrid electric utility trucks and one heavy-duty plug-in hybrid electric three years ago for erecting and maintaining traffic signals.

Battery-powered electric motors power all three vehicles along with internal combustion engines that run on conventional or alternative fuels. The batteries charge up when the operator uses the brakes or the engine runs. The plug-in hybrid also can use an electric power source to recharge.

Madison Fleet Service Program Manager Art Meyer reports the city's Traffic Engineering crews like the fact the trucks run silently in electric operating mode when standing stationary at a work site all day. In that situation, the trucks operate for six hours or more off the battery. When it gets low, the combustion engine powers up automatically and completes an 80 percent recharge in about 15 minutes.

Madison purchased its hybrid electric vehicles with funds from the Wisconsin Clean Transportation Program (WCCTP), a joint four-year project of the Wisconsin State Energy Office and Wisconsin Clean Cities. (WCC). The program's goal was to reduce petroleum consumption and emissions by increasing the use of alternative fuel technologies. It also presented a chance to advance the technologies, says Lorrie Lisek, WCC Executive Director. "Our primary goal of



getting vehicles on the road so Wisconsin could start the shift to cleaner fuels had the added benefit of giving manufacturers useful information for fine-tuning the equipment," she explains.

A final report on results from the program is due soon. But early data shows participating agencies replaced more than 6.4 million gallons of petroleum during that time with alternatives like hybrid electric.

Meyer describes Madison's experience with hybrid electric technology as largely positive but says they did encounter maintenance issues related to integration of the hybrid system with that of the chassis manufacturer, and reliability of the first-generation hybrid components. "Since we are operating early versions of the hybrid units, it is difficult for us to know what's possible with the newer and technologies out there now," Meyer notes. "What we did see were the benefits of a no-idling alternative for sign and signal maintenance along with its potential for use in other operations." ■

Contacts

Joel Hirschboeck
Kwik Trip
608-793-6034
jhirschboeck@kwiktrip.com

Robert Knaup
City of Oshkosh
920-232-5386
rknaup@ci.oshkosh.wi.us

Art Meyer
City of Madison
608-246-4544
ameyer@cityofmadison.com

Jeffrey Tews
City of Milwaukee
414-286-2459
Jeffrey.Tews@milwaukee.gov

Kevin Uhen
City of Oshkosh
920-232-5382
kuhen@ci.oshkosh.wi.us

Resources

www.afdc.energy.gov/fuels/

U.S. Department of Energy Alternative Fuels Data Center discusses current and emerging fuels, tools for comparing alternatives and costs.

www.energyindependence.wi.gov

Wisconsin State Energy Office website with links to fuel technologies and information on vehicles.

Keep low-volume roads and paths in service

Keeping low-volume pavements in good shape raises the question of how local governments can maintain them cost effectively at a high level of service for all users.

RECREATIONAL TRAILS and bicycle paths are increasing by the mile across Wisconsin, popular year round with joggers, walkers, bicyclists, skateboarders, inline skaters and other users. Keeping low-volume pavements like these in good shape raises the question of how local governments can maintain them cost effectively at a high level of service for all users.

Most strategies for extending the life of asphalt surfaces on streets and highways apply to bicycle and pedestrian trails, but there is growing interest in ways to modify preservation treatments like fog seals and chip seals for use on trail pavements.

An ongoing study on preventive maintenance for recreational trails by the Minnesota Department of Transportation Office of Materials and Road Research examines these and other surface treatments to identify practices that will extend the useful life of trails and paths. A study report, published by MnRoad in 2009, includes recommendations to help local road agencies adopt the ones that fit their needs.

Start at construction

Study author Thomas Wood, a Research Project Supervisor with MnDOT, says that as public agencies respond to the demand and open more recreational trails, they do not always make preventive maintenance part of the package. "Yet it is an important consideration for extending pavement life if they want to maintain those trails at the lowest cost."

Wood pinpoints one important principle the MnRoad team tested that is producing positive results: Incorporate maintenance treatments into the construction process and continue them at regular intervals. The team applied a simple fog seal to newly paved trail sections with the goal of filling voids in the asphalt material and preventing it from early deteriora-



Bicycle and pedestrian trails benefit from preservation treatments similar to those used on roads with motor vehicle traffic, modified to extend pavement life at a reasonable cost.

tion due to moisture. The approach highlights the difference between building a typical roadway and constructing a trail.

"Road builders depend on the movement of vehicle traffic to complete compaction and increase the density of the fresh paving material," explains Wood. "Since recreational trails don't see that kind of traffic, they can become pervious quickly if not sealed as part of construction."

Results after six years show that early application of the fog seal on the test sections is doing its job of

keeping out water. Trail owners did a second application at the six-year mark, using a fog seal with CCS-1h.

Chip seal and crack treatments

Existing surfaces tested in the study were good candidates for chip seal, a pavement preservation method that protects against moisture and oxidation, increases surface friction and seals cracks. A treatment that performs well on highways, Wood recommends using a finer size aggregate (1/8 inch) for chip



Chip seal on a recreational trail features a finer-grade aggregate to reduce surface roughness for riders and walkers. Its application prevents deterioration from moisture and sun, and seals cracks.

Trails weather the seasons and the impact from some of the same maintenance practices as streets and highways. They belong on a similar schedule for road condition ratings.

sealing trails and paths. People cycling, walking or skating on these pavements are more sensitive to surface roughness. Indestructability is not the goal, he says, but finding an option that satisfies users' needs.

Crack treatments are another low-cost tool that slows wear on both high- and low-volume roads. The MnRoad report lists three effective solutions on trails. Crack sealing or crack filling for fine to moderate cracks, and rout and seal, which involves routing out a reservoir along the crack and filling it with sealant. For recreational trails and bicycle paths, the report recommends using the rout and seal method on transverse cracks only since longitudinal routing creates a hazard for narrow-tire bicycles and inline skates. In all cases, says the MnRoad report, use sealant of minimal width and a flush fill with little or no overband.

Wood emphasizes that crack treatments do not deal with underlying distresses like vegetation penetrating the asphalt surface or sub-grade movement. Road officials need to watch for those problems when planning future reconstruction.

Add to ratings process

Public road agencies should evaluate the condition of recreational trails routinely to spot and address problems early. Trails must weather the seasons and the impact from some of



MnRoad researchers compared rate of water flow through the asphalt on treated and untreated sections of study trails using a permeameter like this.

the same maintenance practices as streets and highways. They belong on a similar schedule for road condition ratings.

Wood reports that at least one Minnesota community is using a web-based rating system to rate its trail pavements that is comparable to the PASER (Pavement Surface Evaluation and Rating) system Wisconsin road officials know. He suggests that using PASER to evaluate trail surface condition is a workable option. At a minimum, says Wood, walking the network of trails to check for trip hazards and distresses is a good way to track the condition of these low-volume pavements and gather information to develop preventive maintenance plans.

Evaluation of the MnRoad test sections after six years revealed no visible problems. It is evidence,

One important principle the MnRoad team tested that is producing positive results: Incorporate maintenance treatments into the construction process and continue them at regular intervals.

Wood says, that steps taken during construction and regular preventive maintenance made a difference. He expects the trails to last 25 to 30 years.

Limits of design

Another issue for low-volume roads is how they hold up to recommended maintenance practices. Builders often design them at an asphalt thickness, aggregate base thickness and width meant for smaller and lighter loads, which can limit maintenance options. Traditional maintenance equipment for snow and ice control, and other maintenance operations could damage the pavement or be difficult to maneuver. Pickup trucks and small tractors are among plowing options many street and highway departments deploy on trails and paths during snow events.

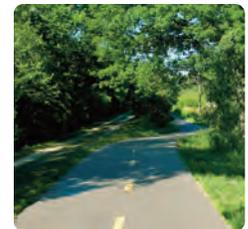
To protect the structural integrity of a trail when doing a fog seal treatment, Wood recommends carrying less than a full tank of emulsion to minimize the weight of the truck.

Develop program

Early and regular preventive maintenance, including steps that start at construction, make good sense on recreational trails and bicycle paths. Incorporating trail preservation in their larger pavement maintenance programs, road agencies meet the needs of avid users and protect local investments in a popular and economically important transportation network.

Local governments in Wisconsin can refer to the resources listed here to learn more about the methods and results from Minnesota's trail maintenance project and find maintenance checklists useful for developing a preservation program of their own to keep low-volume roads and paths in service. ■

Early and regular preventive maintenance, including steps that start at construction, make good sense on recreational trails and bicycle paths.



Contact

Thomas Wood
Minnesota Department
of Transportation
651-366-5573
thomas.Wood@state.mn.us

Resources

www.lrrb.org/media/reports/2011RIC05.pdf

MnRoad *Preventive Maintenance for Recreational Trails 2009* study report from MnDOT.

www.lrrb.org/media/reports/200925.pdf

Minnesota Local Road Research Board publication *Maintenance of Recreational Trails*, published in 2011, details a range of trail maintenance activities, including steps to slow pavement deterioration.

High friction surface on curves

from page 1

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.

performance out of the applications, many at locations with high traffic volume.

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.

Cost per square yard for the surface treatment ranged from \$20 to \$35. About a third of that is mobilization, like deploying traffic controls.

Contacts

David Jolicoeur
FHWA Wisconsin Division
608-829-7520
david.jolicoeur@dot.gov

Stacey Pierce
Wisconsin Department of Transportation Southeast Region
262-548-5958
stacey.pierce@dot.wi.gov

Jerry Roche
FHWA Iowa Division/
Resource Center
515-233-7323
Jerry.Roche@dot.gov

John Vu
Iowa Department of Transportation
319-730-1505
john.vu@dot.iowa.gov

Training programs and demos

HIGH FRICTION SURFACE TREATMENTS (HFST) are the subject of a distance delivered presentation and live local discussion on June 26 co-sponsored by the Wisconsin Transportation Information Center (TIC), the Wisconsin Department of Transportation and the Federal Highway Administration under the FHWA EDC Exchange initiative.

Inspect for retroreflectivity

PUBLIC AGENCIES responsible for maintaining traffic signs at minimum retroreflectivity levels should have a sign management or assessment method actively in place as of June 14 that complies with federal standards outlined in the *Manual on Uniform Traffic Control Devices* (MUTCD). The standard requires agencies to monitor and maintain the condition of regulatory and warning signs. Guide signs also must meet minimum standards but there is no specific compliance date. Agencies should add them as resources allow.

"Quite a few local governments in Wisconsin are following the standard for inspecting and maintaining the visibility of safety-critical signs," says Wisconsin Transportation Information Center Director Steve Pudloski. "For others, the MUTCD requirement is an important reminder of the part visible signs play in keeping our roadways safe after dark."

Meeting Minimum Sign Retroreflectivity Standards, a current TIC fact sheet on the topic, is a useful resource for local governments as they incorporate their selected monitoring tool into sign operations. The publication compares various management and assessment methods and discusses how each one works as a stand-alone or in combination. There is information on sheeting materials and developing a sign inventory. ■

Resource

<http://tic.egr.wisc.edu/Publications.lasso>
Download or order *Meeting Minimum Sign Retroreflectivity Standards*, TIC Bulletin #23, from TIC online resource library for detailed review of how to meet federal standards for regulatory and warning signs.

Register to attend in Madison or Chippewa Falls. Participants from across the state can join the discussion live from 1 to 3 pm.

Presenters will describe how application of high-quality aggregates using a polymer binder restores pavement friction and improves safety on curves, intersections, ramps and bridges.

A TIC /Every Day Counts **Safety Edge Demonstration Day** on July 29 in Johnson Creek. The program includes a field demonstration of asphalt paving that incorporates Safety Edge technology. The Jefferson County Highway Department will host and do the installation of Safety Edge on a two-lane asphalt road project.

The edge treatment eliminates pavement edge drop-off that can cause and magnify the severity of run-off-the-road crashes. Safety



Edge also improves safe travel on local rural roads significantly when combined with other low-cost safety improvements. The technique is easy to implement in asphalt paving and asphalt overlay projects using a specially designed shoe attached to the paver.

Go to <http://tic.egr.wisc.edu> or call TIC at 800-442-4615 to register for both the *High Friction Surface Treatment* session and *Safety Edge Demonstration Day*. ■

Host a calibration demo in October

Wisconsin Transportation Information Center is looking for local public road agencies willing to host its *Winter Road Maintenance Spreader Calibration Hands-On Demonstration* workshops in October. Hosts provide a site with a training room that can accommodate 35 people or more, and a maintenance yard, truck, loader, salt and equipment operators for demonstrating calibration procedures. TIC will organize and conduct the event, and recruit instructors to demonstrate the calibration techniques. TIC also promotes the event and makes all the arrangements for a catered lunch. Agencies that host the demonstration event get the benefit of skilled calibration training for their operators and the opportunity to help other local public agencies improve their spreader calibration process.



To learn more or volunteer —
Contact Ben Jordan at 608-265-4478 or bjordan@wisc.edu.

RESOURCES

Publications

Asphalt-PASER Manual, Pavement Surface Evaluation and Rating, 2002, 39 pp. Guide to system of evaluating condition of roads and developing plans for improvements and ongoing maintenance, also applicable to low-volume roads and trails.

DVD/Video/Multi-media

Driving Modern Roundabouts: Rules of the Road, Washington State Department of Transportation, 2002, #18918, DVD, 10 minutes. Illustrates rules of the road for navigating roundabouts with video of traffic in a multi-lane roundabout. Discusses truck, pedestrian and bicycle travel through roundabouts. Useful for educating public officials and the public.

Asphalt Pavement Maintenance Series: Chip Seals, Cold In-place Recycling, Dust Control, Full-depth Reclamation, Hot In-place Recycling, Pavement Preservation, Thin Overlays, Ergon Asphalt and Emulsions, 2012, #19145. Eight segments on DVD provide overviews of primary asphalt maintenance treatments.

CROSSROADS provides road and bridge information for local officials. Published quarterly by the Wisconsin Transportation Information Center (TIC) at the University of Wisconsin–Madison, it is part of the nationwide Local Technical Assistance Program (LTAP). TIC is operated by the University of Wisconsin–Madison and sponsored by the Wisconsin Department of Transportation and the Federal Highway Administration. Please contact us for permission to reproduce articles or graphics.

- Steve Pudloski, Director*
pudloski@epd.engr.wisc.edu
- Ben Jordan, Staff Engineer*
jordan@epd.engr.wisc.edu
- Joni Graves, Program Director*
graves@epd.engr.wisc.edu
- Maren Muñoz, Program Associate*
mcmunoz@wisc.edu
- Mary Maher, Writer/Editor*
WRITING & CREATIVE CONCEPTS
- Susan Kummer, Graphic Designer*
ARTIFAX, PUBLICATIONS BY DESIGN

Web Sources

Alternative fuels program that helps public and private fleets in Wisconsin determine how to meet environmental goals and manage fuel costs.
<http://wismartfleet.org>

Public/private partnership of organizations that promotes the use of alternative fuels and technologies in Wisconsin.
www.wicleancities.org



Federal Highway Administration site with complete details on the *Manual on Uniform Traffic Control Devices* standards, including retroreflectivity.
<http://mutcd.fhwa.dot.gov>



Nonprofit American Trails group offers information on planning, building and maintaining trails and greenways.
www.americantrails.org/resources/ManageMaintain/searnsmaint101.html

Safety Opportunities in High Friction Surfacing from a list of HFST publications on the American Traffic Safety Services Association site.
www.atssa.com/Resources/HighFrictionSurfacing/Publications.aspx

Research study on using HFST to improve safety at horizontal curves, available for download from Texas Transportation Institute.
<http://tti.tamu.edu/publications/catalog/record/?id=38032>

Print copies of listed publications available free from TIC. Download or request items at [Publications](#) on TIC website. Video, CDs, and DVDs loaned free at county UW-Extension offices. Also see [Video Catalog](#) on TIC website.

TIC website
<http://tic.engr.wisc.edu/>

CROSSROADS
is going digital

**LAST
PRINT
ISSUE**

Sign up for a
FREE electronic
subscription to
CROSSROADS
Email TODAY
tic@epd.engr.wisc.edu

FEEDBACK

CONTACT US VIA EMAIL, PHONE, FAX OR MAIL ►

NAME _____ TITLE/AGENCY _____

ADDRESS _____ CITY _____ STATE _____ ZIP _____

PHONE _____ FAX _____ EMAIL _____

Mailing list change/addition Information/resource request Idea/comment Email delivery only

EMAIL tic@epd.engr.wisc.edu
TEL 800.442.4615
FAX 608.263.3160

Wisconsin Transportation
Information Center
432 N. Lake Street Rm 811
Madison, WI 53706

<http://tic.engr.wisc.edu>

CROSSROADS
Wisconsin TIC
UW–Madison
<http://tic.engr.wisc.edu>

SPRING
2014



<http://tic.engr.wisc.edu>

- 1 High friction surface improves safety on curves
- 2 Alternatives fuel fleet replacements
- 5 Madison tests hybrid electric trucks
- 6 Keep low-volume roads in service
- 10 Training programs and demos
- 10 Host a demo in October
- 11 Inspect for retroreflectivity
- 11 Resources
- 12 Calendar

“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.”

– page 1

CROSSROADS



Wisconsin Transportation Information Center
432 N. Lake Street Room 811
Madison, WI 53706

PRSR-STD
U.S. Postage
PAID
Madison, WI
Permit No. 658

LAST PRINT ISSUE

Sign up for a **FREE** digital subscription to **CROSSROADS**

Email TODAY – tic@epd.engr.wisc.edu

CALENDAR

TIC Workshops

Details, locations and registration forms sent prior to each workshop. More information and online registration at: <http://tic.engr.wisc.edu/workshops/listing.lasso>

Every Day Counts Safety Edge Demonstration Day

July 29 Johnson Creek

Learn first hand about installing the low-cost safety treatment in asphalt paving and asphalt overlay projects. Along with the demo, take part in discussions of how Safety Edge reduces the number and severity of run-off-the-road crashes, and the significant safety benefits it produces on rural roads when combined with other low-cost improvements. TIC program hosted by the Jefferson County Highway Department with support from the FHWA and the WisDOT.
Fee: \$50

On-Site Workshops

TIC brings instruction to shop or office that fits an agency's specific needs. Train more people for the same cost or less. Contact TIC to book date and choose topic area:

- Basic Surveying for Local Highway Departments
- Basic Work Zone Traffic Control
- Flagger Training

UW-Madison Seminars

Wisconsin local government officials are eligible for a limited number of scholarships for these EPD courses held in Madison. Go to <http://epd.engr.wisc.edu> or 800-462-0876 for details

JULY

- 9-11 Effectively Managing Technical Teams P406

AUGUST

- 27 Basic Management for Public Works Supervisors P475

SEPTEMBER

- 8-9 Introductory Principles of Engineering Project Management P407
- 10 Advanced Communication Skills P480
- 11-12 Advanced Principles of Engineering Project Management P408
- 17 Management Assessment P476
- 24 Nuts and Bolts of Personnel Management P324

OCTOBER

- 6-7 Lifecycle Optimization of Strategic Assets P639
- 7-8 Managing Snow and Ice Control Operations P547
- 13-15 Mastering the Transition from Technical Expert to Manager P418
- 15 Purchasing and Inventory Control P477

OCTOBER continued

- 20-21 Using WinSLAMM v. 10.0.1: Meeting Urban Stormwater Management Goals P465
- 21-23 Essentials of Hydraulics for Civil and Environmental Professionals P400
- 21-22 Citywide Asset Management P641
- 27-28 Soil Engineering for Non-Soils Engineers and Technicians P621
- 29 Fundamentals of Government and Ethics P478

NOVEMBER

- 12 Leadership Skills for Supervisors P479

Independent Study

Project Management 100: The Basics, Plus Important Insights P718

ENROLL ANYTIME