

A Bergkamp machine applies micro surfacing consisting of polymer-modified asphalt emulsion, mineral aggregate, filler, water, and other additives on a prepared pavement surface.



# ASPHALT EMULSIONS PLAY PIVOTAL ROLE IN SHIELDING \$2.4T US ROADS

By Paul Fournier

A little known volunteer group of highway technology professionals are quietly transforming the language and mechanics related to asphalt emulsions, and in the process revolutionizing the way that billions of dollars will be spent preserving the nation's roadways.

The diverse collection of academics, engineers, contractors, producers and agency officials is known officially as AASHTO Pavement Preservation Emulsion Task Force (ETF for short). ETF has been working for the past five years to create a set of national standards, predicated on performance, for emulsion-based pavement preservation treatments. As part of this effort, ETF is advancing changes in asphalt emulsion technology and encouraging state Departments of Transportation and local agencies to incorporate these new developments into their pavement preservation programs.

## Protecting \$2.4 Trillion Investment

Emulsion-based surface treatments are employed for roadway preventive maintenance and are considered by the Federal Highway Administration (FHWA) as a major component of pavement preservation. Some agencies use the terms pavement preservation and preventive maintenance interchangeably for these treatments, which include chip sealing, slurry seals, micro surfacing and fog seals, among

others. The emulsion-based treatments are generally inexpensive when compared to traditional treatments using hot mix asphalt.

The FHWA notes that out of an estimated 4.1 million miles of public roads in the U.S., about 2.8 million are paved – most with asphalt. About 1 million miles of these are owned and operated by the states, and 1.8 million miles are owned by local governments. Of the paved state roads, more than 90 percent are asphalt with the remainder divided between concrete pavement and composite pavement. All told, the nation's roads are estimated to be worth more than \$2.4 trillion, according to The Asphalt Pavement Alliance (APA), a coalition of the Asphalt Institute, the National Asphalt Pavement Association, and the State Asphalt Pavement Associations.

Preserving this immense roadway investment requires enormous financial expenditures. In 2014, a total of \$165 billion was spent for national, state and local roads, bridges and tunnels, according to BidNet, a market research company based in New York. As the elements take their toll on roadways and new highways are developed in states across the country, there will be a continual need for construction services to maintain new and existing infrastructure. And the company predicts that the federal government has strong incentives to spend billions of dollars on highway infrastructure.

## Preservation Origins

At one time FHWA allowed little or no federal funds to be spent by the states on road maintenance, but that began to change in the early 2000s thanks in part to the work of the late Jim Sorenson, considered a pioneer in the development of pavement preservation systems. A senior construction and preservation engineer for FHWA's Office of Asset Management, Sorenson spent much of his time as a strong advocate of pavement preservation, explaining these principles to various segments of the transportation construction industry. He partnered with state DOTs and worked closely with organizations that promoted the concepts of pavement preservation. Sorenson believed that the benefit-to-cost ratio for pavement preservation far exceeds that of reconstructing a road that has been allowed to deteriorate too long and he estimated that for every \$1 invested in preservation, there is a \$6 return in extended service life.

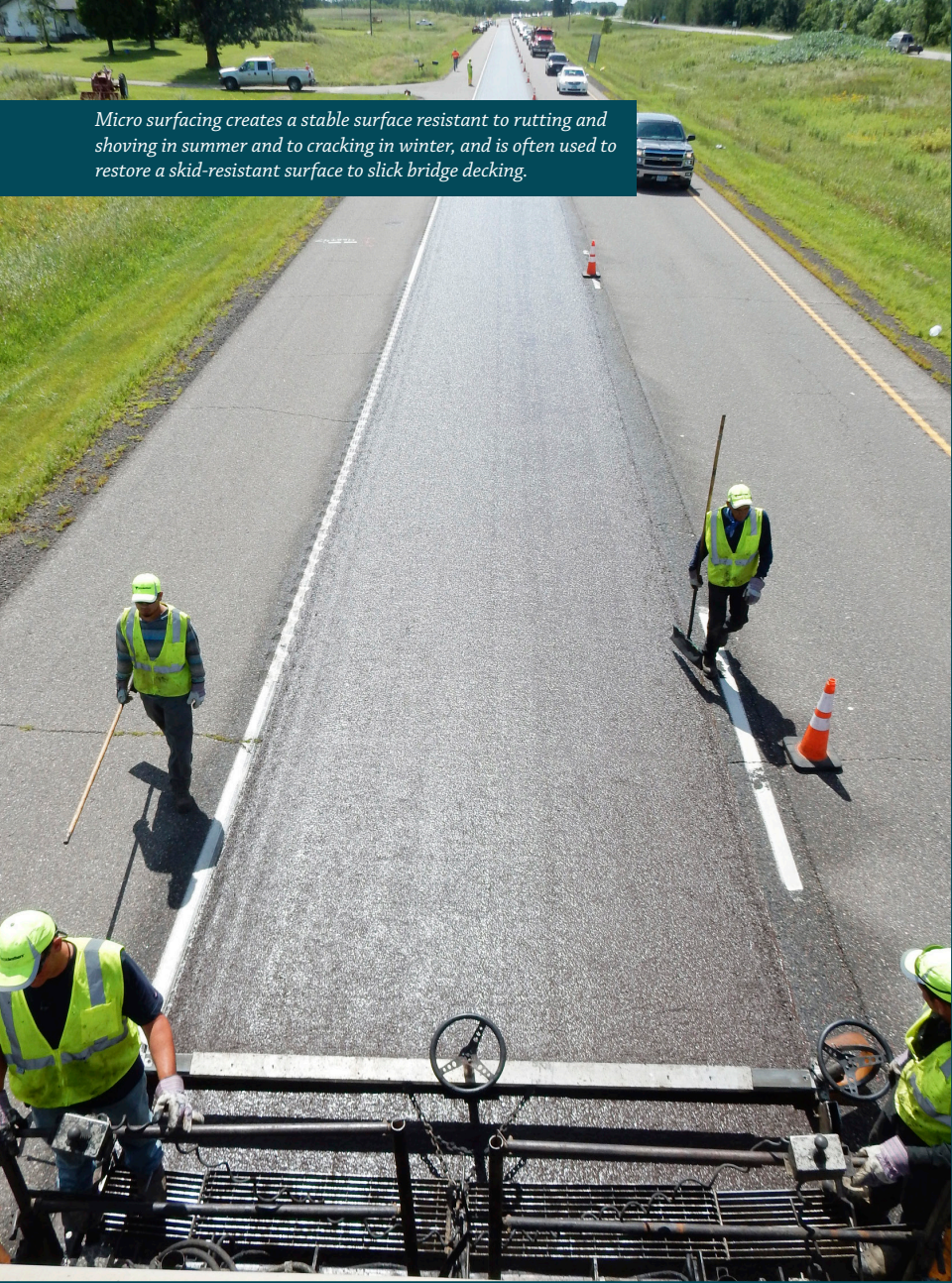
Today, FHWA points out that an effective pavement preservation program addresses pavements while they are still in good condition, before the onset of serious damage. By applying a cost-effective treatment at the right time, the agency believes pavement is restored almost to its original condition. The cumulative effect of aging, weather and abrasion is postponed, and

the pavement can continue to provide a safe, smooth and cost-effective service to the taxpayer. This proactive and systematic preservation treatment postpones costly rehabilitation and reconstruction. For funding considerations, FHWA regards pavement preservation as having three components: preventive maintenance, minor rehabilitation (non-structural), and some routine maintenance activities.

## The Emulsion Advantage

While asphalt emulsions are the key ingredient of most pavement preservation treatments, they are relatively simple products created by combining asphalt, water, and a small amount of an emulsifying agent in a colloid mill that shears the asphalt into tiny droplets. The emulsifier, usually a surface-active agent such as ordinary soap, keeps the asphalt droplets in a stable brown suspension with a thin consistency, which can be used in cold processes for road construction and maintenance. Once the emulsion is applied in the field, the asphalt begins to stick to the surrounding aggregate or other surface, and the emulsion "breaks," with its color changing from brown to black. As the water begins to evaporate, the emulsion begins to behave like pure asphalt binder, and is described as being set.

Micro surfacing creates a stable surface resistant to rutting and shoving in summer and to cracking in winter, and is often used to restore a skid-resistant surface to slick bridge decking.



An Etnyre distributor mounted on a Peterbilt truck applies a cationic rapid-setting, polymer modified (CRS-2P) asphalt emulsion as part of a chip seal operation.



A Crafcro SS125 is used to help seal pavement cracks, which is a preventive maintenance practice that extends pavement life and is considered a form of pavement preservation.

Asphalt emulsions do not require a petroleum solvent to make them liquid, and in most cases they can be used without additional heat. Both factors contribute to energy savings and a safer work environment. Furthermore, emulsions reduce asphalt viscosity, enabling lower temperature applications, and there are little or no hydrocarbon emissions created with their use. These features make asphalt emulsions ideal binders for pavement preservation treatments. This fact, coupled with a federal willingness to make funds available for preventive maintenance, has sparked a rising demand for the product. It is estimated that 10 to 20 percent of all asphalt produced today is used in the form of asphalt emulsions.

And this demand is likely to accelerate as America's roadway infrastructure ages and deteriorates. One out of every 5 miles of highway pavement is in poor condition, and the nation's roads have a significant and increasing backlog of rehabilitation needs, says the American Society of Civil Engineers in its 2017 Infrastructure Report Card.

### Loosening Strings But Not Entirely

Although the feds have been loosening the purse strings and providing more funds for pavement preservation, it took years of soul-searching on the part of FHWA to arrive at the point where significant sums were allocated for pavement preservation use. And there are serious strings still attached to the money. In 2004, pavement maintenance was made eligible for federal funding for the first time. However, the DOTs were required to have pavement maintenance programs in place to obtain those funds. In 2009, more federal funds were authorized but state spending of this money had to be linked to highway asset performance. So states would not only have to maintain their pavements but also show the resulting performance.

"Therefore, the DOTs have to use pavement preservation measures as a way to reach performance goals in a cost-effective manner," said Larry Galehouse, Director Emeritus of the National Center for Pavement Preservation (NCP) based at Michigan State University. A professional engineer and licensed surveyor, Galehouse collaborated with Michigan State University and the Foundation for Pavement Preservation (FP2) to establish the NCP in 2003. This was America's first formal organization to offer a national focus on pavement preservation in collaboration with industry, government, and academia. NCP works with them to advance and improve pavement preservation practices through education, training, research and outreach, and maintains a collection of preservation-related technical documents on its website.

### ETF Migrates to NCP

Galehouse was director when NCP assumed responsibility for asphalt emulsion-related research functions from an FHWA Emulsion Task Group that Jim Sorenson originated.

As public agency demand for pavement preservation funds and information rose, AASHTO developed a state-funded Transportation Systems Preservation Technical Services (TSP-2) center to foster cooperation among private industry, academia, consultants, and federal and state agencies. The Center was based at NCP.

Founded in 1914, AASHTO is a non-partisan

association representing member highway and transportation departments in the 50 States, the District of Columbia and Puerto Rico. AASHTO's primary work is technical, which includes developing and maintaining voluntary standards and guidelines for the design, construction, maintenance, and operation of transportation facilities. Its TSP-2 center disseminates information to AASHTO member agencies for preserving their highway infrastructure, and serves as a clearinghouse with the latest information on preservation measures. NCP manages TSP-2's website under contract with AASHTO.

In 2015 the ETF moved under the umbrella of AASHTO's TSP-2, and NCP is now contracted to manage ETF as well.

### Lack of Standards Hurts Progress

Galehouse said a major shortcoming of emulsion technology/treatments was the lack of formal national standards available in the AASHTO/ASTM format.

"It is well known that for a technology to be widely accepted by state and local agencies, National Standards for that technology must be developed and made available," he said.

Galehouse served as NCP Director until he retired in 2017. He was succeeded by Dr. Judy Corley-Lay, who has a Ph.D. in Engineering and more than 40 years of experience and professional registration in civil engineering.

Despite being officially retired, Galehouse manages TSP2 and is a key participant in the activities of Messaging & Implementation (M&I), the largest of seven working subcommittees of the ETF. Other subcommittees are Residue Recovery and Testing, Spray and Mix Design Group, Supplier Certification and Quality Assurance, Recycling Emulsions, Rejuvenators, and Research. There is also a Special Working Group dedicated to developing performance grading for emulsion asphalt, similar to the PG of SUPERPAVE asphalt binder.

### ETF Leaders Bring Diverse Perspectives

ETF is headed by Co-Chairs Colin Franco of the Rhode Island DOT, and Chris Lubbers of Kraton Polymers USA LLC. The Task Force consists of about 80 expert representatives from all stakeholders of asphalt emulsion technology. These volunteers hail from five states, three universities, seven producers, five industry associations, AASHTO, and FHWA, among other entities.

ETF Co-Chair Colin Franco, P.E., contributes a comprehensive state agency perspective to ETF proceedings based on his 36-year career with RIDOT. As the agency's Associate Chief Engineer, he is in charge of RIDOT's Materials and Quality Assurance operations. In commenting on the origin of ETF, Franco said there was a need for such an effort because there has not been enough support with regard to research, established literature and widespread agreement for asphalt emulsions compared to hot mix asphalt. To rectify this imbalance, ETF has been developing material specifications and construction guides for asphalt emulsion-based pavement preservation surface treatments.

Franco said that currently there are many different standards governing asphalt emulsions but they are not official national specifications and usually were written by material producers.

"We need to get rid of this balkanization of standards. They have a built-in bias because

they are for proprietary emulsions,” he said. “We need one unified national set of standards. When you have national standards, you have an accumulation of best practices.”

ETF Co-Chair Chris Lubbers, Technical Sales Manager for Kraton Polymers, provides industry perspective for the group.

“The most important thing for us is that we are being funded by and for AASHTO, which provides a direct tie-in for industry to the state agencies,” Lubbers said. He also explained that

the various standard, practice, and guide documents that the ETF has developed and progressed through the AASHTO Committee on Materials & Pavements (COMP) will have additional legitimacy because they will be disseminated directly from AASHTO to the member state agencies.

Lubbers also said that national normalization offers AASHTO authentication, credibility, vetted quality, and improved performance of asphalt emulsion materials – similar to the features attributed to hot mix asphalt for many years. He added that these stakeholders will also profit by ETF deliverables that provide further support for state agencies to use asphalt emulsion-based surface treatments on higher traffic volume roads

and highways. At present, most state DOTs promote using these products primarily on low volume roads. Lubbers indicated the new AASHTO standards should inspire confidence in such materials on the part of specifiers as well as contractors and producers.

### Deliverables Progress But Names Confuse

Making progress with deliverables, ETF recently completed materials specification and construction guides for owners or contractors on three of the most commonly used treatments – chip seals, micro surfacing, and fog seals. The specifications describe:

- Emulsified asphalt chip seal as the application of emulsified asphalt, followed immediately by a single layer of aggregate chips to a prepared surface
- Micro surfacing as the application of a mixture containing polymer modified emulsified asphalt, mineral aggregate, mineral filler, water, and other additives that are properly proportioned, mixed, and spread on a prepared pavement surface
- Emulsified asphalt fog seal as the application of emulsified asphalt, either diluted or undiluted, to a

prepared pavement surface that may be followed immediately by a light application of blotter sand.

To illustrate the need for national standards and as an indication of the difficulty of achieving this, numerous terms have been used by agencies and contractors for chip seals, such as “seal coat,” “surface treatment,” “surface seal,” “surface dressing,” and “sprayed seal.” A variety of labels are also used for other treatments as well.

“The biggest challenge for the Task Force will be getting the DPW and DOT agencies to try the new specifications and construction guides we are developing,” said Larry Tomkins, P.E., Chairman of ETF’s M&I subcommittee, and Vice President, Sales and Marketing, for Ergon Asphalt and Emulsions Inc.

### Getting Out the Word

Among M&I specific tasks is creating awareness of ETF’s activities to establish new emulsion standards. The subcommittee is also involved in the organization of training sessions on newly adopted ETF construction guides, and arranging pavement preservation demonstration projects using the new asphalt emulsion standards.

“AASHTO sent out a survey a few years ago about formalizing and standardizing specifications for using chip sealing and micro surfacing,” Tomkins said. “About half of the agencies that responded said they were not interested; some didn’t even know about existing specifications; and a number were comfortable with what they’ve been using. Some of them have been using these treatments for 20 or 30 years or so, and are happy with the way they’re doing it. Other agencies may not be using these treatments at all and are not even interested in using them.

“And there are others who may be using some of the treatments without any formal specifications at all.

“So we have to deal with many agencies who may have very different experiences with these treatments or no experiences at all. To be successful at this, we have to educate them, explain how it will be beneficial for them to try the new specs, and what other agencies have used the specs successfully. “We have to do a lot of outreach and develop effective messaging, for this to work,” he said.



An Etnyre chip spreader broadcasts aggregate over a high-volume roadway in a typical application of emulsified asphalt chip seal to a prepared surface.