

# The Bridge

Linking Transportation Research and Practice



## Unconventional pavement maintenance

### Chip seals can extend pavement life from both ends of the deterioration curve

By Melanie Kueber, P.E., Research Engineer II, and Trevor Kuehl, Assistant Technical Writer  
*Center for Technology & Training*

A chip seal treatment involves spraying a layer of asphalt emulsion over an existing hot mix asphalt (HMA) pavement and then embedding an aggregate cover. It has become a popular road maintenance option for road agencies in Michigan because it requires a low capital investment to get started, a local agency maintenance crew can typically perform the work, and it provides a generous return in pavement service life for the amount of money and time invested to apply it.

In a typical application, a chip seal is performed as a preventive maintenance treatment before a pavement begins to show signs of structural distress. Based on the Pavement Surface Evaluation and Rating (PASER) scale of pavement condition—the statewide standard for rating roads in Michigan—chip sealing is recommended for pavements that have a rating of five or six. Such pavements are in the middle of their cycle of service life; they typically show moderate to severe raveling, some flushing or polishing, and age-related cracks that are no more than 1/2 inch wide.

#### Windows of opportunity

Chip sealing at the appropriate time in the life of an asphalt pavement slows the aging process and can significantly delay the need for costly capital improvements. The asphalt emulsion in a chip seal treatment seals the surface of the pavement, which prevents water intrusion and also prevents oxidation of the asphalt binder. Binder oxidation is the main cause of early



Wexford County Road Commission

*The photo on the left shows significant pavement distress, which indicates the need for heavy rehabilitation or structural improvement. The photo on the right is the same road after patching, crack sealing and a double chip seal. “Chip sealing a road that is in poor condition is like a band-aid to hold it together until we can afford to rebuild it,” explained Wexford County Road Commission County Highway Engineer Karl Hanson. “It’s an affordable way to buy a few more years of service.”*

cracking. These cracks let water in, which causes more serious distress. The aggregate cover provides a durable, high-friction wearing surface.

#### Opening the window wider

Although chip sealing is widely recognized as a good treatment option for pavements that have reached “mid-life,” some road commissions in Michigan have realized benefits from using the treatment very early or very late in the life of a pavement. The Barry County Road Commission (BCRC) chip seals newly-paved roads. “A chip seal on new pavement slows the aging process considerably,” said Heather Smith, BCRC assistant engineer. While Smith does not have exact figures on how much the practice extends the life of roads in her county, she does have several examples of roads whose deterioration rates are “off the charts” when

compared to a typical asphalt pavement deterioration curve. One such road, a 6.65 mile stretch in the northern part of the county, was constructed in 1958 and then finished with a double chip seal that same

**See *Chip Seal* on Page 3**

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Some sights, sounds and smells are instantly recognizable. The golden arches of McDonalds, the drum solo from In A Godda Da Vida, and the smell of fresh asphalt pavement all fall into the “unmistakable” category for me. I hit 40 years old this summer; my metabolism no longer allows me to indulge in food served under the golden arches, and my wife never liked Iron Butterfly’s masterpiece—she especially frowns upon it now that we’re leading a house full of kids. But I don’t think any age or any stage of life will ever get in the way of my enjoying the unique oily-smoky-hot smell of hot mix asphalt (HMA).

The attraction probably stems from a major road project that was completed near my house when I was a young boy. I remember waking up to the insistent “BEEP-BEEP” of heavy machinery every morning that summer. My friends, my younger brother and I watched for hours as men and machines blasted, scraped, dug, loaded and hauled. The ground shook and the smells of diesel exhaust, dirt, and fresh pavement hung over our neighborhood all summer. It was awesome.

For this issue I spent some time enjoying the sights, sounds and smells of a paving project in Kent County. I’ve walked around many job sites since that summer 30 years ago, but this

one was different. As part of a demonstration showcase sponsored by the Federal Highway Administration’s Office of Technical Services, this project attracted a large crowd of very interested observers (see *Michigan road agencies get a good look at the Safety Edge<sup>SM</sup>* on page 4).

If you could scratch and sniff the cover story for this issue, you’d smell asphalt there too. The story includes two examples of how counties are using chip seal maintenance treatments (very differently) to extend the life of their roads.

On page 6 you can read about how Bud Clark has established the City of Rochester Hills sign shop as a convenient resource for other city departments. The Rochester Hills sign crew also has a convenient procedure for installing signs. The four-step process, which takes five minutes or less, is covered on page 7.

Before you pass this issue along, make sure you take a few minutes to read the brief on the back cover. It’s a summary of Bryan Pickworth’s award-winning

strategy for managing winter operations for the City of Farmington Hills. He will cover it in greater detail at the Michigan Winter Operations Conference on November 10 in Midland.




## The Bridge

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## LTAP Steering Committee

The Local Technical Assistance Program (LTAP) is a nationwide effort financed by the Federal Highway Administration and individual state departments of transportation. It intends to bridge the gap between research and practice by translating the latest state-of-the-art technology in roads, bridges, and public transportation into terms understood by local and county highway or transportation personnel.

The LTAP Steering Committee makes recommendations on, and evaluations of, the activities of the Local Technical Assistance Program.

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**Chip Seal from Page 1**

year. Other than chip seals in 1971 and 1976, no maintenance was performed on the road until 2000, when BCRC applied a 2.5 inch asphalt overlay and a chip seal.

“Before we did the overlay in 2000, the road was rated a three [on the PASER scale],” Smith explained. “At the time, it was over 40 years old; that’s way beyond its expected life, even with the two chip seals in the 70s.” Since the work done in 2000, Smith’s team crack sealed the road in 2009, and then applied another chip seal last year. Today it has a PASER rating of eight.

By protecting the hot mix asphalt (HMA) layer of their pavement from oxidation and cracking, BCRC prevents water infiltration, which can lead to more serious structural damage.

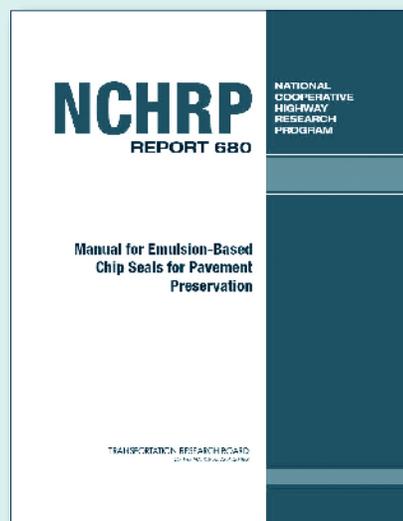
**The other extreme**

On the other end of the pavement deterioration curve, Wexford County Road Commission (WCRC) uses chip seals to hold together roads that have deteriorated far beyond the usual window of opportunity for that treatment. “Chip sealing a road that has a PASER rating of two is not a recommended maintenance practice,” explained WCRC County Highway Engineer Karl Hanson, “It’s more like a band-aid to hold the road together until we can afford to rebuild it.”

According to Hanson, the key to making chip seals worthwhile on such pavements is to do a lot of patching and crack sealing before applying the treatment. Hanson employs a four-step preparation process before applying a chip seal on a road that is in poor condition. First, his maintenance crew sweeps the road

thoroughly to remove loose sand, gravel, and small chunks of pavement. Next, they use a DuraPatcher® to patch potholes and fill in any large areas of deterioration. After that, they seal all cracks that are ½ inch or larger before finally applying “spot” chip seals over the major pothole patches. After a road is patched and crack sealed, his crew applies a double chip seal to finish it.

“A mill and overlay or a crush and shape would be more appropriate on these roads, but we don’t have the money for that,” Hanson said. “Chip sealing at this point in their life makes them look and ride better, and it holds the pavement surface together more effectively than just patching potholes as they appear. It’s an affordable way to buy a few more years of service and minimize future patching expenses.” 

**New Maintenance and Safety Resources****Manual for Emulsion-Based Chip Seals for Pavement Preservation**

**Excerpt:** Emulsion-based chip seals are the most commonly used chip seal type in the United States. These seals are frequently used as pavement preservation treatments on flexible pavements to seal fine cracks in the underlying pavement’s surface and prevent water intrusion into the base and subgrade. Because chip seals are not expected to provide additional structural capacity to the pavement, benefits ideally are accrued by their application early in a pavement’s life before a great degree of distress is exhibited. Although a large body of research is available on chip-seal design practices, the design process in the United States remains empirical in nature—based on experience and judgment. Procedures that consider the surface condition of the existing pavement, traffic volume, environment, and other relevant factors in determining the characteristics and application rates of aggregates and binder have not been widely used in the United States.

On the Web:

[http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp\\_rpt\\_680.pdf](http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_680.pdf)

**Roadway Safety Manuals for Local Rural Road Owners****Intersection Safety (FHWA-SA-11-08)**

On the Web:

[http://safety.fhwa.dot.gov/local\\_rural/training/fhwasa1108/ch1.cfm](http://safety.fhwa.dot.gov/local_rural/training/fhwasa1108/ch1.cfm)

**Roadway Departure Safety (FHWA-SA-11-09)**

On the Web:

[http://safety.fhwa.dot.gov/local\\_rural/training/fhwasa1109/sec\\_1.cfm](http://safety.fhwa.dot.gov/local_rural/training/fhwasa1109/sec_1.cfm)

**Road Safety Information Analysis (FHWA-SA-11-10)**

On the Web:

[http://safety.fhwa.dot.gov/local\\_rural/training/fhwasa1110/](http://safety.fhwa.dot.gov/local_rural/training/fhwasa1110/)

# Michigan road agencies get a good look at the Safety Edge<sup>SM</sup>

by John Ryyanen, Editor  
Center for Technology & Training

A 2.65 mile asphalt paving project on a twisting two-lane road in Ada Township, Michigan in early July generated attention from local, state and federal transportation officials. The occasion was the first use of the Safety Edge<sup>SM</sup> paving technique in Michigan. The *Safety Edge* technique, developed jointly by the Georgia Department of Transportation and the Federal Highway Administration (FHWA) based on a research concept, creates a 30 degree taper along a pavement's edge to eliminate dangerous drop-offs. It is not intended to replace regular shoulder maintenance; rather, when shoulder gravel settles or is worn away, the *Safety Edge* provides a gradual and safer transition between the pavement and the shoulder until maintenance can be performed. Local road agencies in Michigan have been hesitant to use this new paving technique because of concerns about reduced durability and the perception that it may be difficult to maintain shoulder gravel on the tapered edge.

## First-hand experience

Kent County Road Commission (KCRC) owns the road on which the *Safety Edge* was installed in Ada Township, and they coordinated its installation. Managing Director of KCRC, Jon Rice learned about the *Safety Edge* initiative through his involvement with the National

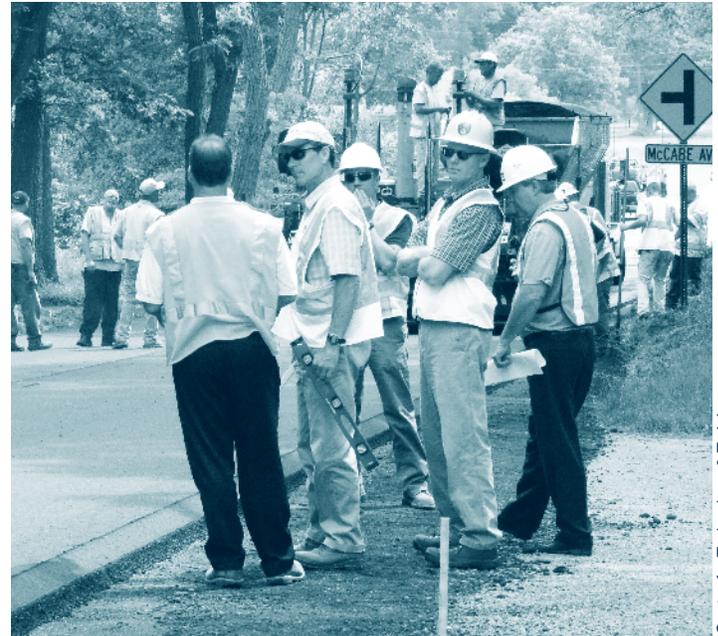
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*Placing the Safety Edge involves attaching a wedge-shaped "paving shoe" or a specially designed end gate to the screed of a Hot-Mix Asphalt paver.*

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Association of County Engineers (NACE), where he serves as North-east Region Vice President and is involved on several committees that deal with roadway safety and pavement preservation. "When I volunteered through NACE to participate in the Every Day Counts meetings with FHWA, I learned they were promoting the *Safety Edge*," Rice explained. "Since we are sensitive to the issue of edge drops and also had concerns about the potential problem with maintaining gravel at the safety edge joint, I wanted to try a section here so we and other local agencies could find out more for ourselves."

Wayne Harrall, director of engineering for KCRC, selected Bailey Drive in Ada Township for the test. "Bailey Drive was a perfect place to test the *Safety Edge*," Harrall explained. "As a natural



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*A group of officials from federal, state and local transportation agencies discuss the Safety Edge paving technique moments after watching a specially-equipped paving machine pass by. The group was among 36 people who attended an FHWA demonstration showcase that included a visit to a job site in Kent County where the Safety Edge was being used for the first time in Michigan. "I wanted to try [the Safety Edge] here so we and other local agencies could find out more for ourselves," explained Jon Rice, managing director of Kent County Road Commission.*

beauty road, we can't widen it, and that stretch of road also has several horizontal curves, so holding gravel against the pavement has always been a challenge. This will be a great test."

## Easy to install

Placing the *Safety Edge* involves attaching a wedge-shaped "paving shoe" or a specially designed end gate to the screed of a Hot-Mix Asphalt (HMA) paver. To help ease the burden of adapting equipment to place the *Safety Edge*, the FHWA has established a paving shoe loaner program. Michigan's LTAP is coordinating the program in Michigan (see *Want to try the Safety Edge?*)

The paving contractor on the Bailey Drive project, Reith Reilly Construction Company of Ada, used a *Safety Edge* end gate from Carlson Paving Products on their paver. They chose to use the end gate design because it's heated like the paver screed plates, and it's easier to adjust to accommodate driveway approaches, milled joints, and other variables along the pavement edge. Geoff Fisher, Reith Reilly's paver operator on the project, appreciated the simplicity of the end gate device. Fisher had to adjust the angle of the gate from 30 degrees to 90 degrees several times to accommodate driveways and intersections on the project. "It was very convenient," he said. "Installing the safety edge didn't slow the paver at all. The end gate did exactly what it was designed to do."

## Perfect place to show and tell

Bailey Drive's proximity to Grand Rapids and its relatively central location in the state made it the perfect project for a

*Continued on next page*

The *Safety Edge* is a key element of the FHWA's *Every Day Counts* initiative, which was established to identify and deploy innovative technologies aimed at shortening project delivery, enhancing the safety of roadways, and protecting the environment. For more information, see [www.fhwa.dot.gov/everydaycounts](http://www.fhwa.dot.gov/everydaycounts).



demonstration showcase through the FHWA Office of Technical Services. Bob Conway, pavement and materials program engineer for FHWA's Michigan Division office in Lansing, worked with the FHWA Technology Partnership Programs (TPP) group in Chicago, the FHWA Resource Center in Baltimore, and Michigan's Local Technical Assistance Program (LTAP) at Michigan Technological University to organize an open house and a site visit for the project. The Ada Township Hall in downtown Ada hosted the open house. "The demonstration showcase went very well," Conway said. "With the combination of a series of presentations followed by a site visit, a good number of people got a chance to learn about the Safety Edge technique and then they went out in

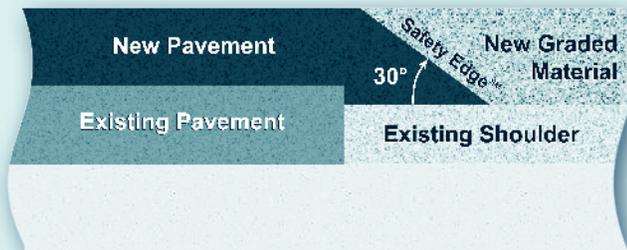
## Concerns addressed

Chief among Brown's concerns is the ability to hold shoulder gravel against the Safety Edge. Stooping down to examine the 30-degree taper left by the paver soon after it placed the 1.5-inch



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## A closer look at the Safety Edge



With the *Safety Edge*, as the shoulder material settles or erodes, a 30 degree taper provides a gradual and safer transition between pavement and shoulder for autos, motorcycles, and bicycles.

Adapted from FHWA Safety Edge Brochure ([http://safety.fhwa.dot.gov/roadway\\_dept/pavement/safedge/brochure/brochure.pdf](http://safety.fhwa.dot.gov/roadway_dept/pavement/safedge/brochure/brochure.pdf))

the field to see it in action on a job site. I can think of no better way to introduce decision-makers to new technologies and new ways of doing things."

In all, 36 people from the Michigan Department of Transportation (MDOT), engineering consulting agencies, contractors, and local road agencies attended the showcase. Larry Brown and Craig Atwood drove up from neighboring Allegan County. Brown is the County Highway Engineer and Atwood is a Project Engineer for Allegan County Road Commission. "To be honest, I've been skeptical about the Safety Edge," Brown said. "But the presentations were very informative and getting out on the job site to see the paving crew laying it down was great. This helped address some of my concerns."

Placing the *Safety Edge* involves attaching a wedge-shaped "paving shoe" or a specially-designed end gate to the screed of a Hot-Mix Asphalt (HMA) paver. The paver on the Bailey Road project in Kent County was equipped with an end gate device, which is adjustable to accommodate driveway approaches, milled joints, and other variables along the pavement edge. "Installing the safety edge didn't slow us down at all," said Geoff Fisher (adjusting the safety edge end gate above), the paver operator on the project.

top course of Hot Mix Asphalt (HMA) on Bailey Drive, Brown's concerns were somewhat alleviated. "The height and angle of the taper aren't as extreme as I had imagined. It doesn't look like it will shed gravel like I thought," he said. Brown plans to check with KCRC about shoulder gravel issues next spring, after Herral's team has had a season of experience maintaining the stretch of road.

Andrew Mergenmeier, senior pavement and materials engineer from the FHWA Resource Center in Baltimore, has heard the shoulder gravel concern before. Mergenmeier has participated in several safety edge demonstrations across the U.S. since significant deployment efforts began in 2009. He gave a presentation during the open house portion of the demonstration showcase in Ada. "From what I have seen, and based on the experiences of others, it is no more difficult to hold gravel against a *Safety Edge* than against a vertical edge," Mergenmeier said. "But if the gravel does wear away, the *Safety Edge* provides a gentle transition between pavement and shoulder—a traditional pavement edge does not."

**See *Safety Edge* on Page 7**



## Want to try the *Safety Edge*?

To help accelerate the adoption of the *Safety Edge* paving technique, Mark Sandifer, technology deployment specialist with FHWA's Technology Partnership Programs (TPP) group in Chicago, provided seven paving shoes to the National Local Technical Assistance Program Association (NLTAPA) Safety Committee to distribute among the LTAP centers in each state. Michigan's LTAP received a shoe earlier this year. Through the program, local road agencies can borrow the paving shoe free of charge for use on a paving project. For information on how to reserve the *Safety Edge* paving shoe, please contact the Michigan LTAP office at 906-487-2102.

# Sign shop for hire

By Trevor Kuehl, Assistant Technical Writer  
*Center for Technology & Training*

**A** banner advertising a local community event isn't something you would expect to find in a municipal sign shop. However, in Rochester Hills, Michigan it's exactly what you'll find. Along with an assortment of standard road signs are numerous custom projects for different Rochester Hills departments, including a set of signs for navigating a new park. "The more diverse you are, the less likely your work can be outsourced," said Bud Clark, a crew leader at the Rochester Hills shop. This diversity is reflected in the projects that the Rochester Hills sign shop takes on.

*(Continued below)*



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## Opportunity

When Clark started working at the shop in 1992, his supervisor explained that doing favors for other departments was part of maintaining a positive image and would help to keep the sign shop operating smoothly. "At the time, we made custom signs and banners for another department out of the same high-intensity reflective material as our street signs—which is expensive and labor intensive to work with," Clark explained. At times, I had to cut out as many as 35 different logos or designs, which took anywhere from 8-16 hours.

Due to the excessive time and cost required to make banners, the department decided to look elsewhere. "They ended up using an outside source to fabricate their banners," Clark said. "It cost them about \$6000 to have three banners printed. I knew that there had to be a more cost-effective way to have banners made."

## Investment

Instead of attempting to hand-cut details for the banner, or outsourcing the extra work Clark decided to look into purchasing a large-format printer. "I found that purchasing our own large-format printer would only cost us about \$1200, and that after the initial expense, it would only cost us a fraction of that to produce our own custom projects."

## Results

Today the Rochester Hills sign shop helps several other small government entities by producing signs for special events and other departments within the city. Using a variety of readily-available stock and ink, the shop can produce durable signs for a low cost. According to Clark, items produced on his shop's printer with UV protected ink can last up to six years if vinyl laminate is used. "We do our best to pass along

cost savings and expertise to the people we work with," says Clark. "This isn't about turning a profit, we only charge for materials and labor."

But how can a sign shop afford the initial investment required to establish such an enterprise, especially when budgets are already tight? "It's not as difficult as you might think," Clark said. "We purchased most of our equipment using money that we earned from recycling the aluminum in our old signs. You just have to get creative and use the resources that are available. I'm always looking for things that can be improved around the shop."



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*Bud Clark (left), crew leader in the City of Rochester Hills sign shop, looks over a custom banner with Transportation Engineer Paul Shumejko (center) and Crew Member Jim Fournier (right). "Sharing resources and services with other departments and other agencies is a big part of how we operate," Shumejko said.*

## Five-minute sign installation

The City of Rochester Hills sign crew, Bud Clark and Jim Fournier, have devised a quick and easy method for installing and replacing road signs in the City. Once arriving on site, it takes them less than five minutes to attach a sign to the post and then install it on the roadside. Here's a summary of the process:

### Step 1 – Attach the sign to the post



It takes two or three sharp blows with a two-pound sledgehammer to fasten a sign to a post using a 3/8-inch solid aluminum drive rivet. Using an aluminum rivet prevents corrosion on the sign face caused by electrolysis and rust bleed.

### Step 2 – Drive the base into the ground



Using a truck-mounted hand-held hydraulic jack-hammer, the crew drives a 36-inch long sign base into the earth. The jackhammer eliminates the need for a boom or a bucket on the truck, and also minimizes problems with overhead obstructions. The sign base is two-inch square, heavy-gauge steel with 3/8-inch holes drilled every inch. To stop the sign post from sliding through the bottom of the base, they insert

a 5/16 x 3-inch bolt nine holes up from the bottom. The bolt also helps prevent the base from filling with earth as they drive it in.

### Step 3 – Mount the post in the base



Slipping the 1 3/4-inch square, high-carbon square steel sign post into the base nearly completes the operation. The combination of high carbon steel and 3/8-inch holes every inch provides breakaway protection and meets FHWA roadside requirements. The

base is designed as a permanent fixture on the roadside. In case of damage to the sign, the crew simply removes the damaged post and inserts a new one.

### Step 4 – Secure the post in the base



Two more sharp blows with a sledgehammer on a 3/8-inch aluminum drive rivet secures the sign post to the base.

For complete guidance on installing and maintaining road signs, refer to FHWA's **Maintenance of Signs and Sign Supports** at: [http://safety.fhwa.dot.gov/local\\_rural/training/fhwasa09025/](http://safety.fhwa.dot.gov/local_rural/training/fhwasa09025/).

Photos by the Center for Technology & Training

### Safety Edge from Page 5

The issue of holding gravel against the tapered edge is also covered in the FHWA report, *Safety Evaluation of the Safety Edge*, published in March 2011 (see <http://www.fhwa.dot.gov/publications/research/safety/11024/>).

### That's not all

In addition to providing a safer transition between pavement and shoulder in cases where gravel has worn away, the *Safety Edge* has proven to be more durable than a vertical edge. Mergenmeier attributes the increased durability to greater compaction of the HMA near the edge of the pavement. With a vertical pavement edge, inadequate compaction results in raveling of the pavement edge.

Mergenmeier appreciates the role FHWA demonstration showcases play in promoting and publicizing new techniques and technologies. "Sitting at your desk you can 'what-if' the *Safety Edge* to death," he said. "With the demonstration showcase you get to talk to the people responsible for designing it and making it work in the real world. This is a great way to see it in action."

Brown and Atwood are considering using the *Safety Edge* technique on Allegan County paving projects next construction season. "It really depends on whether or not our local contractors are equipped to place it," Brown said. FHWA's loan program will help. 



For more info about the *Safety Edge* from Curtis Bleech, Michigan Department of Transportation's (MDOT) pavement design engineer, and a video demonstration from the Bailey Drive project, visit the MDOT channel on YouTube® ([www.youtube.com/MichiganDOT](http://www.youtube.com/MichiganDOT)), and then search the "In the Field Series" for "Safety Edge." For a direct link to the video, go to [www.MichiganLTAP.org/pubs](http://www.MichiganLTAP.org/pubs), and then click on "MDOT Safety Edge Video on YouTube."



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# Doing more with less, and doing it better

## Experts will share their experiences at the Michigan Winter Operations Conference

In January 2010, Bryan Pickworth, road maintenance supervisor at the City of Farmington Hills, was in the middle of trying to solve a difficult problem. He was fighting his annual battle with snow and ice using five fewer road maintenance workers than the previous year, the City was paying twice as much for rock salt as they did just six years earlier, and the residents of Farmington Hills were unaware of the situation—they wanted clear, safe roads at all times and in all types of weather.

“It was looking grim,” Pickworth said. “We knew we had to make some changes.”

One year later, the City of Farmington Hills was selected as one of three recipients of the American Public Works Association (APWA) Excellence in Snow and Ice Control Award. By making their own brine, blending it with an organic additive, implementing a pre-wetting program, and making a few other adjustments, Pickworth and his team realized a 30% cost savings over traditional salting methods. They also reduced staff overtime associated with emergency call-ins during storm events, and maintained their high level of service. Not only that, but by using an organic additive (a by-product of sugar beet production) in their brine, they created a mixture that is much less corrosive to the city’s infrastructure, equipment, and environment than straight salt.

Pickworth will share more of his experiences at the Michigan Winter Operations Conference in Midland on November 10, 2011. He will be joined by other expert practitioners from city, county and state road agencies in Michigan and across the country to cover a variety of topics, including: anti-icing materials; automatic vehicle

location (AVL) systems; salt and brine storage and containment; plows, spreaders, and custom equipment; training your crew; and more.

The conference is being coordinated by a planning committee made up of representatives from cities, counties, regional planners, and the Michigan Department of Transportation. Watch your email for more information.



Farmington Hills DPW

*A 2,635 gallon tank trailer is a key piece of equipment in the City of Farmington Hills’ winter operations plan. Bryan Pickworth, Farmington Hills’ road maintenance supervisor, will discuss details of his agency’s award-winning operation at the Michigan Winter Operations Conference in Midland on November 10, 2011.*