



Adding aramid fibers—similar to the material used to make bullet-proof vests—to pavements can make them stronger and more durable. One Michigan agency is innovating with aramid in their pavements.



## Weaving Technology into Asphalt: The Latest in Fiber-reinforced Pavements

Grace TenBrock, Engineering Intern  
Center for Technology & Training

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Kevlar® fibers can be found in bullet-proof vests, helicopter blades, chain saw chaps, and many other applications because of their light weight and exceptional strength<sup>1</sup>. Kevlar® is a para-aramid—a somewhat stronger and more elastic version of aramid fibers, which are known for their heat-resistance and strength. These unique qualities of aramid have been lending themselves to new uses in the pavement industry, where they can strengthen—or reinforce—asphalt.

Fiber-reinforced asphalt (FRA) is a normal asphalt mix that is infused with natural or synthetic fibers for various reasons. Some people like Lance Malburg, engineer at the Dickinson County Road Commission (CRC), are hoping that aramid fibers will add strength, durability, and crack resistance to their paving projects. While not entirely unanimous, numerous lab tests have been concluding that asphalt with fibers has more strength and durability than asphalt without fibers<sup>2,3</sup>.

#### A Proof of Concept: Enhancing Pavement Performance

A team of researchers led by Hassan Fazaeli, whose work was published in *Construction and Building Materials*, noted that FRA improved asphalt-mixture workability resulting in extended asphalt life, reduced environmental pollution, and reduced costs<sup>3</sup>. FRA also has a longer fatigue life, higher fatigue cracking resistance, better resistance to shear deformation, less permanent deformation, and a 40-times-higher resistance to crack propagation<sup>4</sup>. Other sources agree with these conclusions, adding that FRA has improved tensile strength, resilient modulus, stiffness

modulus, and pavement rutting resistance<sup>5</sup>.

Outside of the laboratory, case studies have supported the pavement-strengthening effects of FRA. Separate studies were conducted by the Federal Highway Administration (FHWA) and Arizona State University with help from the City of Tempe, Arizona. Both studies installed a fiber-reinforced asphalt next to a control asphalt on the same road. The FHWA's study concluded that "fatigue cracking of the fiber-reinforced section was measurably better than that of the polymer-modified section"<sup>5</sup>. The Arizona study, by Kloush and team, spanned two years and concluded that the control section had about three times as many low-severity cracks as the reinforced section<sup>4</sup>. Studies by the University of Arizona and Ohio Department of Transportation reached similar conclusions.

Asphalt that is reinforced with aramid has been used in Illinois, southern Wisconsin, and extensively in Ohio, but it has yet to be widely accepted in Michigan. Nonetheless, a few agencies in Michigan have been including other types of fibers other types of fibers in asphalt to gain qualities like increased porosity and increased oil retention, and not increased strength. One of these agencies is the Michigan Department of Transportation (MDOT), who uses cellulose fibers in their gap-graded superpave mixture for paving high-volume roadways. The fibers are intended to prevent drain-down of the asphalt binder and to provide stability to the mix. MDOT has not used fiber-reinforced asphalt for strengthening pavement to date, but they have an interest in the technology and are evaluating local agencies' FRA pavements to determine if

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## Letter from the Editor

It's the first of May and, today, some of us are excited at the forecast of snow! We just might break a record in Houghton County with not only the most snow in the Calumet area, but the most snow in Houghton County *ever!* Our totals this winter range from 177.6 inches in downtown Houghton to 353.2 in Calumet's Tamarack Location, almost tying the county's 354.1-inch record set in 1978/1979.

But, along with that kind of excitement—at least what a few of us might call “excitement”—come some very real concerns. Potholes. Ruts. Edge deterioration. Frost heaves. Cracking.

In this issue, we look at how Dickinson County got innovative in the face of significant cracking. Last year, they added fibers—similar to those fibers used in making bullet proof vests and chainsaw chaps—to a pavement to see if they can reinforce their pavement against significant reflective cracking in the wheel path, which overlies the pavement's joint. Herein, you will begin the journey with Lance Malburg and Brent Swanson in discovering how aramid fibers help or hinder a busy portion of their road network.

These pages will also introduce you to the Minnesota Local Road Research Board (LRRB). This uniquely-structure board receives dedicated funding to conduct research on needs specific to the local-agency-owned road network. Because of that exclusive focus in their research, the LRRB has backed studies that have benefitted not only Minnesota agencies but local road-owning agencies nationwide. We will also take a peek at some of the LRRB's recent project highlights.

This issue also addresses how fraud can impact government agencies. You will learn some surprising statistics that can guide you in detecting whether fraud is happening at your agency. And, you will gain some useful resources for being proactive in preventing fraud.

Finally, in these pages, you will meet Michigan's Local Technical Assistance Program's (LTAP) new engineers. Zack Fredin and Peter Meingast joined us in 2018. They are helping to advance our Bridge Load Rating Program, our Bridge Design System project, and other resources that we offer through the LTAP. You will likely see one of them at our on-site training events, too.

Even though some of us are hoping for just one more inch of snow to break the record, we can still take a moment to look forward to spring since we will not meet again until the summer. Surely, now is the time of year when many of us think about spring. “It's spring fever,” Mark Twain once wrote. “That is what the name of it is. And when you've got it, you want—oh, you don't know quite what it is you do what, but it just fairly makes your heart ache, you want it so!” So, let it snow...then, let spring burst forth!

*Victoria*

# 'Wheels' and 'Bridges' of the Michigan LTAP

## Meet the New CTT Engineers

Sarah Lindbeck, Technical Writing Intern  
Center for Technology & Training

The Center for Technology & Training (CTT) is excited to announce two new additions to the engineer research team. Peter Meingast and Zack Fredin have quickly adjusted to their roles and have already been involved in some exciting projects at the CTT.

Peter Meingast was a familiar face at the CTT from his time working as a student intern between 2014 and 2017 while he attended Michigan Technological University. During that time, he obtained a bachelor's degree in civil engineering and began his master's degree in structural engineering. Upon completion of his master's, Peter traveled to Oregon where he worked as a structural engineer doing projects for residential buildings, schools, and hospitals.

Returning to the CTT in a full-time position was an easy transition for Peter. Chris Gilbertson, senior research engineer and associate director of the CTT, referred to him as "the jack-of-all-trades within the CTT". He also added that "Peter's structural background allows him to help with a variety of ongoing structural research".

Peter showed his comfort at being the "jack-of-all-trades" when listing the projects and tasks that he does. He continued, "I'll help with anything from the Bridge Design System to the Bridge Load Rating to Roadsoft projects. I analyze and compile data, write literature reviews and proposals, and help with papers and research projects, and I even work on class development and help with the conferences and those things." Currently, one of his biggest projects is the development of online trainings and an on-site class that teach warranty information to elected officials and local agency technical staff. A recent law allows local agencies to opt for warranties on paving projects in excess of \$2 million, and the trainings are going to "describe and help show exactly what this law entails and what a warranty is in general". Peter says he enjoys working on the trainings because "it's really cool to try to figure out new and engaging ways to deliver certain material".

Peter sees his role at the CTT as a wheel that works with others to drive innovation in Michigan's transportation sector. "We're here as a support system to all local agencies to make sure everything runs smoothly," he said

of the CTT. He added, "But it's interesting to hear all of their points of view too. It's more of a relationship than just us helping them."

Peter has many hobbies and interests, especially when it comes to outdoor activities. He does "anything from surfing Lake Superior to snowboarding, fly fishing, and hunting." It may be surprising that he comes from Rockford, one of the biggest cities in Illinois, but it is not surprising at all that he is a perfect fit for the Upper Peninsula of Michigan.

The other new face in the office is Zack Fredin, a dedicated family man from Ishpeming, Michigan. Following high school graduation, he attended Michigan Technological University where he received a civil engineering degree. He then secured a position with OHM Advisors as a civil engineering consultant doing municipal and structural work. His desire to return to the Upper Peninsula and obtain his masters in civil engineering transportation led him back to Michigan Tech, where he worked with the school's Enterprise program before joining the CTT.

"I'm excited to work on anything to do with bridges," declared Zack, who just assumed a role of research engineer at the CTT. He noted, "Many local agencies have bridges;

and, helping to assess those bridges, helping agencies keep them in good condition, and educating others in how to look at those bridges is really important." Zack hopes to be a 'bridge' himself, linking information and research with other civil engineers and local agencies so that they are equipped with the knowledge they need to improve Michigan infrastructure.

Already, Zack has been expanding the load rating program, updating the load rating trainings, and working with the software engineers at CTT to improve the Roadsoft traffic signal modules. Gilbertson said of Zack, "He jumped right in and has already proven to be a valuable asset to the center."

When he is not working, Zack likes to be outside in the Keweenaw Peninsula, as well as other locations that he frequents with his family. He has a wife who also works at Michigan Tech and two sons aged four years and nine months old. He said, "Really, my biggest thing is I just like spending time with my family."

Peter and Zack are both enthusiastic about

► continued on next page



New engineers at the Michigan LTAP.  
Left: Peter Meingast. Above: Zack Fredin.  
(Photos: CTT Archive)

# Research ‘in Your Back Yard’: Minnesota’s Local Road Research Board

Victoria Sage, Technical Writer  
Center for Technology & Training



Minnesota  
Local Road  
Research Board



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## Welcome to the LRRB

*The mission of the LRRB is to serve local road practitioners through the development of new initiatives, the acquisition and application of new knowledge, and the exploration and implementation of new technologies.*

READ  
MORE

LRRB Welcomes Research Ideas From Minnesota Transportation Practitioners!

SUBMIT IDEAS

## FEATURED PRODUCTS

In 1959, the state of Minnesota did something novel. It legislated that one-half of one percent of the Highway User Trust Fund’s annual funding for county and city agencies would go to local road research, specifically. This small move did two things: it ensured a certain level of buy-in by using local dollars to fund the effort, and it positioned Minnesota at the forefront of research on issues unique to local roads and local agencies. The result of that small move was the formation of an entity known as the Local Road Research Board, or LRRB.

### A Research Board to Benefit Local Roads

“The Local Road Research Board does research that will benefit local roads and MnDOT roads within the state of Minnesota and nationally,” said Polk County Engineer

Rich Sanders, defining the board that formed in response to the 1959 legislation. The LRRB, gathers ideas from local agencies, selects research projects from among those ideas, commissions researchers to conduct the research, and presents Minnesota agencies with the results of that research.

“I’ve submitted ideas in the past,” said Sanders. “They funded it, and now Polk County is benefitting from that research and the implementation that they have done.”

Searching the LRRB site reveals a handful of projects performed in Polk County. Among others, a 2015 study performed by Wenck Associates, Inc., and David Braslau Associates, Inc., and backed by the LRRB investigated noise levels of rumble strips on two-lane rural roads in Polk County. Consequently, Sanders received research-backed evidence that he could use to explain

to upset landowners in their jurisdiction the extent of the effect that rumble strips have when it comes to noise level. This study also equipped Minnesota’s local road-owning agencies with the research-backed conclusion that the Pennsylvania design was the quietest followed by the California design and the Minnesota design.

“The latest effort I’ve been working on is unified permitting in the state of Minnesota,” said Sanders. “We’re trying to get unified permitting going so that industries can apply at one location and get permits across jurisdictions, counties, cities, and state.” He says the LRRB has already funded two phases of investigation into this type of permitting and is hoping a third phase will get them closer to implementing this process.

Projects done for local agencies have ranged from testing pickle brine as an anti-

## New CTT Engineers (continued from Page 3)

► working with the people at the CTT as well as all the other people across the state who collaborate and interact with the CTT. Peter says he “appreciates the opportunity to learn from more experienced colleagues and see the unique perspectives that everyone else brings to the team.” Zack added, “There’s a lot of people here in Michigan that we

interact with, and it’s going to take time to get to know everybody and to understand what they do and what I can do to help them.” Both Peter and Zack are looking forward to learning more and growing in their roles as they bridge their knowledge and the CTT resources with local agencies and help drive infrastructure improvements in Michigan. ■

icing strategy to providing advice about the effectiveness of speciality warning signs. The LRRB distributes the outcomes of these projects in various forms, including videos, handbooks, posters, presentations or trainings, and spreadsheet tools.

## From Good Ideas to Actionable Results

To get to the point of possessing research-backed conclusions, Sanders and the hundreds of other local agency personnel who have had or want to have LRRB-backed projects submit their ideas to a year-long selection process before the projects are assigned to performing agencies.

The process begins in October when the statutorially-established county and city screening boards, which represent every district and are collectively responsible for authorizing the local share of state transportation funding for the LRRB, meet to mine ideas. They receive ideas from local agencies that submit their ideas either by MnDOT's IdeaScale or through an LRRB board member.

"The last two rounds of this [idea-mining process], we've gotten over two hundred ideas on needs," exclaimed Mitch Rasmussen, assistant commissioner for MnDOT's State Aid division. Rasmussen also notes that, for "any project that is local-system research-oriented, the state automatically directs [it] toward Local Road Research Board", which is on "equal standing with the MnDOT research program". He commented, "The state recognizes that the LRRB is a high-value, high-functioning entity."

The screening boards use the October LRRB meeting to evaluate the research ideas they've received in relation to the local road-owning agencies' needs, according to Rasmussen. The ideas are also organized by the Board's outreach consultant into research, implementation, outreach, or synthesis categories and prepared for online voting to allow local agencies to select their top choices.

To be selected for a research project, the submitted idea needs to be "just a good idea", explains Sanders. Each county and city engineer gets a chance to cast up to twenty votes on the research endeavors they'd like to see placed into action. The top 30 to 35 ideas, based on the voting, become the LRRB's focus at the March meeting. For this smaller set of good ideas, the Board requests detailed needs statements, which can subsequently be used in the request for proposals, for an

even-smaller set of top ideas.

In June, the LRRB meets with its Research Implementation Committee (RIC) to categorize the 30 to 35 ideas as research or implementation and to funnel the research projects to the LRRB and the implementation projects to the RIC. This helps the LRRB to narrow its list of ideas to 20 or 25. At this point, the LRRB estimates the magnitude of each potential project in light of the budget set at the preceding October's meeting, develops requests for proposals (RFPs), and sends the RFPs to those entities or agencies identified as best candidates for the research and to their distribution list.

Rasmussen says that the RFPs ask researchers to consider the return on investment that the local agencies will receive as a result of the research. "We are asking them to quantify the benefit of the outcome of their research," he said. "And we're doing several processes to collect quality value from our customers—things that you can't measure in dollars or cents but make their job easier."

The LRRB reconvenes in October to review the received proposals and selects their top choices. Those selected candidates offer a presentation on their proposal at the two-day December meeting, which wraps up with projects being awarded and MnDOT Office of Research Services assuming the research process, executing contracts, and assigning project managers.

Each research project must produce a final written report as well as some sort of executive summary. "The executive summaries [give us a] shorter document," Rasmussen said. "For some product, we are producing short videos instead of doing an executive summary." The final products must also address next steps, whether they are implementation or additional research.

## The State Process: Separate, but Parallel

From the state department of transportation's view, organizing local-road research under the LRRB is beneficial because the state is able to direct more of its own research dollars into trunk highway research since low-volume-roads research is being handled by the LRRB, according to Rasmussen. "I think we get more research done in this state at the trunk highway level than many other states," he speculated.

The state's trunk-highway research group and the LRRB run their own separate—but

parallel—research project selection process. Rasmussen serves on both groups to help ensure the research investments are coordinated and efforts aren't being duplicated. If a project overlaps with value to both the trunk-highway and local-roads systems, a cost-share is arranged between the two groups.

## Struggles and Successes

The LRRB is not without its own challenges. "We tend to get the same sub-set of folks serving and being active," Rasmussen commented. "Out of the 235 county and city engineers and other professional staff, we maybe see the same 50 participating." However, Sanders points out that the LRRB's structure encourages broader engagement through term limits for board members. "You get fresh views on the board every six years," he explained. "It's important to have a good blend of individuals on your board...a good blend of city engineers, county engineers, and MnDOT staff."

Engagement isn't the only struggle. "Sometimes, we'll have people who will identify a problem that we have already done, that we have products for, and they're not aware of it," he noted. "So, how do we do a better job of marketing what we do, of getting the products in front of the people who need them?" Recently, the LRRB has re-vamped its website—[www.lrrb.org](http://www.lrrb.org)—to make it more user friendly and to highlight its latest research endeavors. Between that and a broader use of multi-media, they're hoping local agencies will be able more easily to access the tools they need.

Nonetheless, Sanders pointed to how local agencies benefit from the outcome of LRRB work: "[It gives us] good data that educates us on different aspects of our work." He says the LRRB also produces tools that local agencies can use to educate the residents they serve.

One thing is for certain, though: Minnesota's local agencies don't have to worry about the funding for their specific research needs. "We have dedicated funding," said Rasmussen. "It's rarely debated, the funding. It's just always there because it's dedicated."

Sanders noted, "To have a research board focused just on local issues is a benefit." ■

Check out the  
LRRB's resources at:  
[lrrb.org](http://lrrb.org)

# Strategies for Disseminating Information

Adapted from Yale Center for Clinical Investigation – CARE: Community Alliance for Research and Engagement

## Key questions to ask before you begin:

- **Goal:** What are the goals and objectives of disseminating this information? What impact do you hope to have?
- **Audience:** Who is affected most by this information? Who is interested in learning about this information? Is this of interest to a broader community?
- **Medium:** What is the most effective way to reach each audience? What resources does each group typically access?
- **Execution:** When is the best time to disseminate this information? Who will be responsible for getting the information out there?

## Why is that?

In communication theory, three things make for effective communication: having a clear message, knowing your audience, and understanding your position as a speaker. The key questions above are helping you get a better idea about what your message is, who your audience is, and how you as the speaker can get your message to your audience most effectively. That way, you'll be able to zero in on the most effective medium and time for communicating your message.

## When writing up your information, make your content...

- **Responsive:** Consider your target audience(s) when deciding on the document type.
- **Concise:** Keep you content short and to the point, placing important information in easy-to-find spots (e.g. first or last sentence in a paragraph, call-out boxes).
- **Interesting:** Present only the information that is new and/or compelling.
- **Highlight key points:** Use headings to flag key sections. Use bulleted lists sparingly, including only one finding or conclusion per bullet.
- **Logical:** Arrange all points in a logical order.
- **Useful:** Include actionable conclusions and recommendations.

- **Attractive:** Pay attention to the document design, make room for “white space” (space on the page where there is no text or image), and print or post online in color.

## Why is that?

Responsive, interesting, and attractive content both demands your audience's attention and engages it. Concise content gets remembered. Research into simple, concise PowerPoint slides showed they achieved maximum retention while wordier slides led to information overload. Highlighting key points and logical ordering enables your audience to devour your content quickly. And, useful content gives them tools to do their jobs more efficiently and effectively.

## Consider these media to engage different audiences...

### Participating agencies (e.g., in a pilot study):

- Flyers, brochures, research briefs
- Summary documents
- Newsletter
- Seminars/forums
- Letters of thanks
- Feature articles or news briefs in agencies' outreach materials
- Report to funding agency

### Communities (e.g., state, cities, towns)

- Flyers, brochures, posters
- Summary documents
- Seminars/forums
- Local events
- Articles or news briefs in local media
- Articles or news briefs' in any collaborating agencies' outreach materials
- Policy brief or policy position statement

### Policy makers

- Summary documents
- Policy position statements
- Press releases

### Media

- Summary documents
- Press releases
- Posts on list serves and websites

## Need a summary document for a road project? Include this!

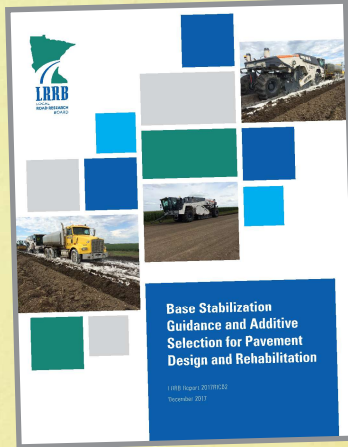
You'll want to include these points in a summary document for disseminating information about your agencies' projects:

- **Title block:** Include the route, start and end intersections, the SP\*, and the project website\*. \* if known/available
- **Project map:** Prepare a map that's easy to read with clear reference points.
- **Schedule:** Include dates for the approval of environmental document, consent of municipality, approval of geometric layout, establishment of construction limits, original and current lettings, beginning and end of construction, and other milestones.
- **Project history:** Include purpose/need for the project, other factors influencing the project's development, and any past official actions. For bridge projects, include year built, condition rating, and previous work.
- **Project benefits and risks:** List major benefits and risks to the scope, schedule, and cost.
- **Project description:** Summarize the project's scope, location, key components, and construction activities.
- **Cost estimate:** Include the projects STIP approval date. Express project costs using inflation rates. List current estimate as single cost or as a range.
- **Recent changes and updates:** Note changes or updates since any prior communications about the project.
- **Key cost estimate assumptions:** Provide cost estimating details such as year of estimate, inflation rates, and risks that affect funding.
- **Design completed:** Use a 1-100% scale to express percentage completed of the planning, scoping, and design phases.
- **District information:** List district contact information (agency, district number, district office address and phone number, district engineer, project manager, prior communication dates, revised dates).

[www.dot.state.mn.us/pm/documents/12-08\\_project\\_summary.doc](http://www.dot.state.mn.us/pm/documents/12-08_project_summary.doc)

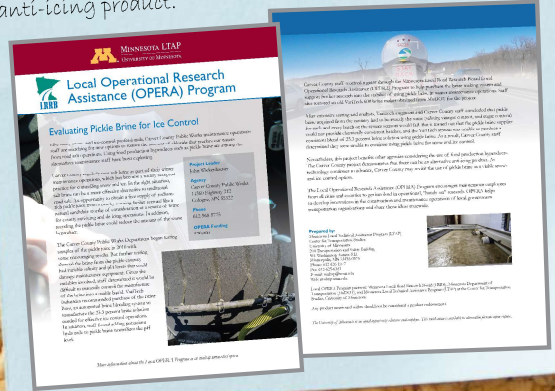
## Base Stabilization Guidance & Additive Selection for Pavement Design & Rehab

A new guidebook provides guidance on base stabilization methods...and the selection of suitable nonproprietary stabilization additives for individual specific projects. ...Significant improvements have been made in base stabilization practice that include design specifications and methodology, experience with the selection of stabilizing additives, and equipment for distribution and uniform blending of additives.



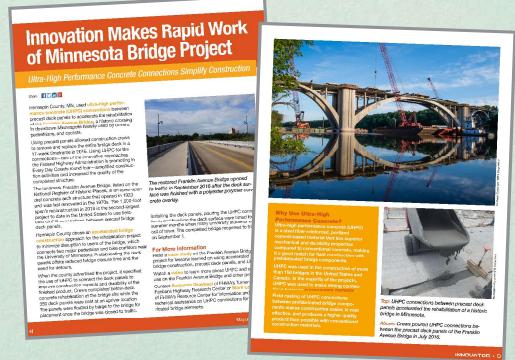
## Carver County Evaluates Pickle Brine for Ice Control

To reduce the amount of chloride that reaches our water, Carver County Public Works evaluated pickle brine as an alternative practice for controlling snow and ice in 2016. ...Staff concluded that pickle brine acquired from the canneries had to be exactly the same (salinity, vinegar content, and sugar content) for every batch or the system sensors would fail. Unfortunately, the pickle brine supplier could not provide chemically consistent batches...[Nonetheless], the project demonstrates that there can be an alternative anti-icing product.



## Innovation Makes Rapid Work of Hennepin County Bridge Project

Using ultra-high performance concrete connections between precast deck panels greatly accelerated the rehabilitation of a heavily traveled bridge in downtown Minneapolis. Learn more in this feature story from the FHWA Center for Accelerating Innovation's Innovative Newsletter.



## Fleet Management Tools for Local Agencies

LRRB Report 2017R001  
June 2016

Continued on next page

## Addressing Citizen Requests For Traffic Safety Concerns

A new LRRB guidebook provides local agency staff with a best practice approach to addressing common citizen requests for traffic safety concerns (i.e. signing and pavement markings...). This guidebook focuses on the importance of communication with citizens when responding to traffic safety concerns or requests. It also provides guidance on logging requests, steps for following up on a request, standard responses, and an explanation of why a requested strategy may or may not be the appropriate solution.



## Pervious Concrete A Success for Lakeside Neighborhood

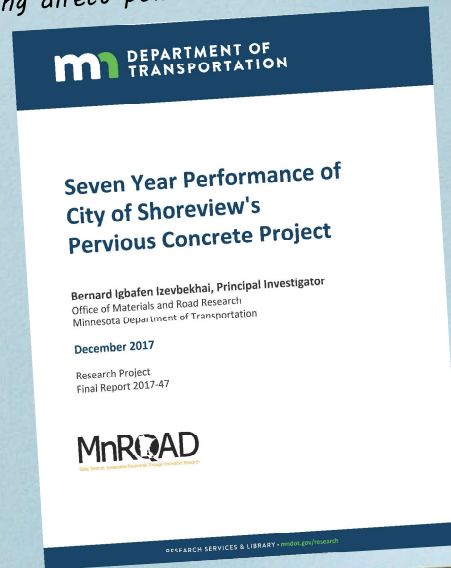
The city of Shoreview was on the right track when it took the unusual step of paving a residential neighborhood with pervious concrete to control stormwater and pollutant runoff into a nearby lake, according to a recently released seven-year performance study....

The pervious pavement performed well in filtering stormwater. ...Water infiltration and sound absorption rates were higher than traditional concrete, although rates declined over time because organic material continued to clog pavement pores despite vacuuming twice a year.

Initial construction of the pervious concrete streets and stormwater filtration system was slightly more costly than construction of comparable asphalt pavement with culverts. Life cycle costs...showed somewhat lower costs for pervious pavement. ...

For more resources and information, visit [lrrb.org](http://lrrb.org)

...[Monthly vacuuming could negate the need for diamond grinding after 10 years.] ...Additional benefits...included complying with the federal Clean Water Act, recharging groundwater and avoiding direct pollution of Lake Owasso.





► the technology could be applied to their trunkline system.

Dickinson CRC recently used fibers in one of their construction projects too, but they used synthetic aramid fibers for adding strength and crack resistance instead of increasing oil retention. Depending on which characteristics agencies are looking to improve, certain fibers can be selected and added to asphalt to provide the desired benefits to a pavement.

## FRA Rolls Out on a Michigan Local Road

Despite the positive studies on FRA, few agencies have used the technique on the roads in their jurisdiction. Additionally, agencies interested in using FRA on projects receiving federal funding need to go through additional steps in order to implement it and should seek guidance from MDOT Local Agency Programs on the process.

Nonetheless, Dickinson CRC became one of the first to use this new technology on a mill-and-fill project repairing the second busiest road in the county, Breitung [Cutoff] Avenue. Breitung Avenue is a “major road into the Kingsford area from US-141” and is

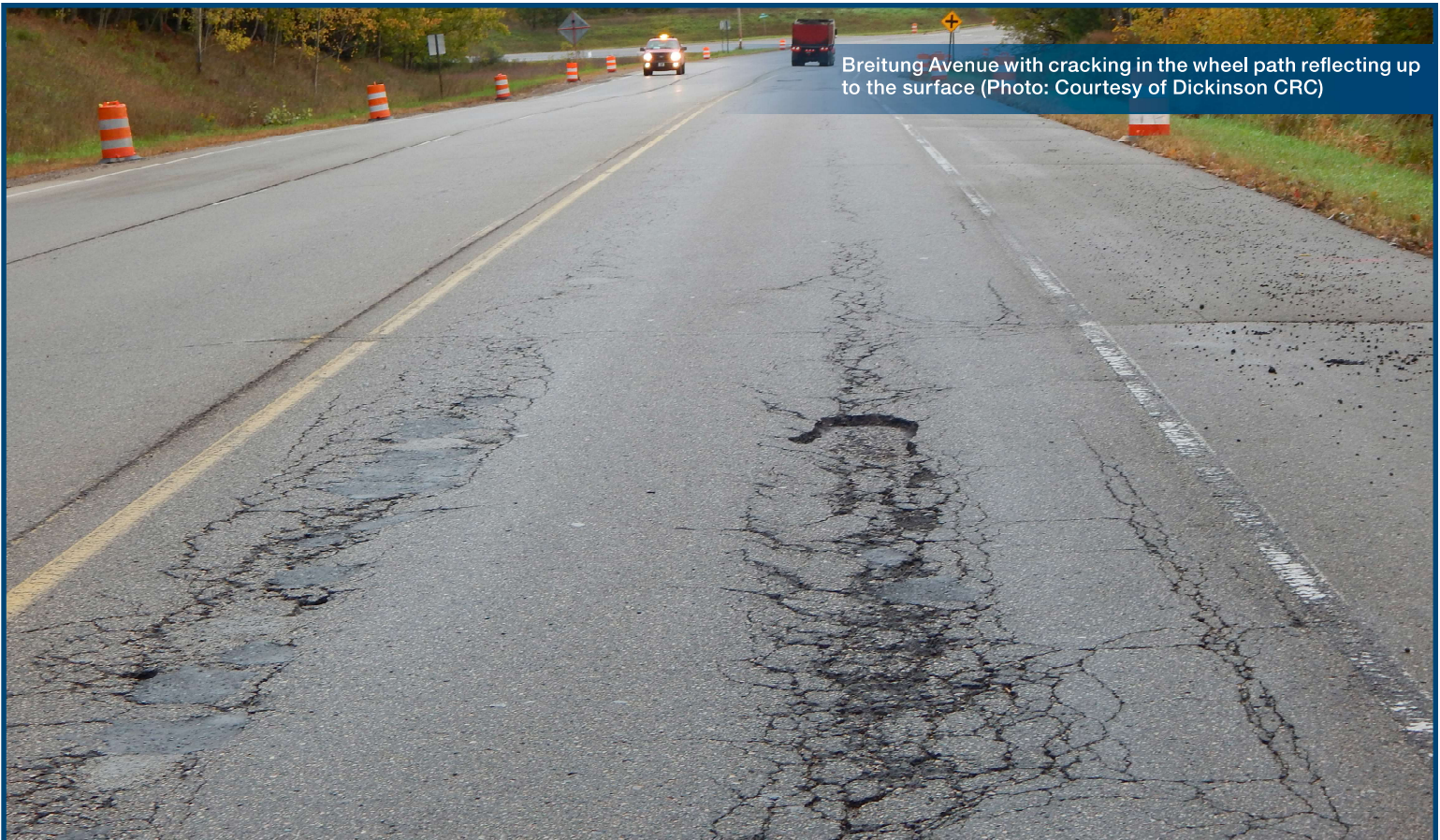
heavily travelled, according to Malburg. The road was showing “signs of failure mostly in the upper layers of the pavement”, exhibiting alligator cracking, debonding, rutting, and “the top layer was reflecting up the stresses that were below”. With an initial PASER of 2 and 3, this project would’ve normally been a crush and shape. However, in the search for a less-invasive, quicker, and cost-effective project that would allow the busy road to remain open, Malburg decided to try using fiber-reinforced asphalt in a mill and fill after reading about it for years, hoping that FRA will reduce cracking, rutting, shoving, and other pavement deterioration.

That decision made sense, financially speaking. A crush and shape is normally the ‘go-to’ for this type of project, which had an estimated price tag of \$800,000 plus additional time spent pulverizing and grading, according to Malburg. Limited monetary funds would’ve only allowed about half of the project to be completed with a crush and shape, so the agency had to determine how to fix nearly two miles of road on a strict budget. FRA became the candidate of choice because, at \$330,000, it was more cost effective than other methods and allowed comple-

tion of the entire project. Adding fibers to the standard asphalt mix cost Dickinson CRC \$30,000 alone. But, Brent Swanson, Dickinson CRC’s engineering technician with significant paving experience, points out that the extra \$30,000 will hopefully save the agency the time, money, and traffic disruption required to do crack seal work this coming summer due to FRA’s reduction of cracking. “We’re hoping to make up for that \$30,000 both in construction and in future maintenance”, stated Malburg.

Using FRA on this section of road was especially attractive because of a widening of the road about 15 years ago. Malburg noted “The widening joint was right in the wheel path and that crack just blew up and made one wheel path really nasty.” Swanson added “the longitudinal joints didn’t line up, which means on an overlay project it’s almost impossible to overlay a different longitudinal joint and not get reflective cracking”. In an attempt to counter this reflective cracking and stay within their limited budget, the Dickinson CRC opted to try FRA, their thought being that the fibers would add support across the longitudinal joint and reduce

► continued on next page



## ► cracking.

The project itself took about four days to complete almost two miles of roadway, a much shorter timeline than they would have had for a crush and shape. The top inch-and-a-half of old pavement was milled off, revealing an intact base, and replaced with FRA containing aramid fibers. Additionally, Dickinson CRC was able to keep the road open throughout the entire paving process: Malburg said, “In the three lane section we kept traffic going both ways, in the two lane section we had flag controls.”



Feeding aramid fibers into the asphalt (Photos: Courtesy of Dickinson CRC)

## A Little Effort for Stronger Pavement

In spite of initial apprehension and concern for how the actual FRA application would take place, Malburg and Swanson commented that few special considerations had to be taken when paving with FRA. The contractor experienced a bit of a learning curve when setting up the fiber injection system at the plant, but it was “very user friendly” as long as the temperature was kept within an acceptable range, which should be jointly defined by the contractor and the manufacturer, for working with the aramid fibers.

Notably, though, FRA doesn’t require agencies to buy special equipment to apply it. The aramid fibers come bound into filaments, typically with a coating of Sasobit® wax that facilitates both handling of the lightweight fibers and distribution in the asphalt mix.<sup>6</sup> At the asphalt plant, a small tube and air compressor blows the small, straw-like filaments into the recycled-asphalt-pavement collar of the asphalt plant, where it is mixed with aggregate and asphalt cement. Important during the production process are adequate heat and thorough mixing. Swanson explained that “the fibers are all compressed into little tiny pellets and, when they go into the drum and heat is applied [the coating is] supposed to melt off and [the pellets] kind of burst [and release the fibers].” Other than that, the FRA is produced and applied like normal.

During the paving process, the paving crew also had to ensure their tools were clean at the end of the day because “that oil would harden and you weren’t going to scrape it off like a normal asphalt mix”, according to Swanson. The asphalt mix was the same mix they have used on other projects with the exception of the aramid fibers.

Prior to the project, Malburg inquired about and researched the precautions necessary when using FRA, and manufacturer literature indicated that it is neither toxic or dangerous nor required any precautions beyond those for normal hot-mix asphalt (HMA) paving. Studies that have been performed on the health effects of working with loose aramid fibers suggest that it would be subject to the typical dust-related concerns. A 1983 study indicated that because Kevlar® meets the standards for a “nuisance dust”, or a dust that produces minimal adverse effects over time when exposed to a realistic concentration, “the inhalation of Kevlar® fibers will not pose a fibrosis hazard at levels encountered in the workplace”.<sup>7</sup> More recently, a 2009 review of para-aramid by Ken Donaldson of Queens Medical Research Institute and commissioned and funded by DuPont, a manufacturer of Kevlar®, found that there have been no documented cases of disease related to aramid exposure.<sup>8</sup> Additionally, Donaldson found that aramid is only potentially harmful when breathed as a fibrils, which is a smaller particle produced by machining or grinding the fibers.<sup>8</sup> Donaldson also noted that “p-aramid fibrils present a very low hazard to workers exposed to it in the workplace” even at high exposure levels.<sup>8</sup> These studies suggest that appropriate precaution should be taken until more is known and recommend following manufacturer directions and safety equipment specifications.

Burning or smoldering conditions cause

aramid fibers to release toxic, irritating, and hazardous products; nonetheless, aramid fibers do not melt and are fire resistant<sup>9</sup>. Aramid fibers also do not decompose until subjected to temperatures greater than 752 degrees Fahrenheit (400° Celsius)<sup>9,10</sup>. The FHWA states that HMA is produced in the 219- to 338-degree-Fahrenheit (104-170° Celsius) range<sup>11</sup>, so making or recycling FRA would not create toxin-releasing conditions.

Aside from melting FRA for recycling, pulverizing might be an option at the end of a pavement’s life. It is customary to pulverize old asphalt pavements and either leave them in place and use them as a base or recycle them. However, it is not clear at this time how the presence of fibers influences the recycling of the pavement, either positively or negatively.

## Enhancing Pavement Performance

Although the FRA has only been on Breitung Avenue since last fall and has not been through a full freeze-thaw cycle yet, the initial results look promising. “The cracks have slowed way down”, said Swanson. Troublesome spots that were expected to crack have not shown signs of distress yet, and cracks from the longitudinal joint where the road was widened have not appeared on the surface. Swanson commented that “right now we’re not getting anything coming up over those widening areas, which I know for a fact if it was a traditional overlay those would’ve been through right now”. Though the joint

is close to a wheel path and is therefore a high stress area, cracks have yet to reach the surface. However, the spring thaw will be the real test of what cracks reflect to the surface.

Dickinson CRC is monitoring their section of FRA by driving it periodically when the pavement is visible, and plans to do a thorough inspection after the spring thaw. In the future, they plan to visually inspect the pavement a few times a year, and noted that they could roughly compare it to nearby M-95, which was overlaid with traditional asphalt—the same mix but without fibers—during the week that Breitung Avenue was paved. Both roads are exposed to the same conditions and experience similar amounts of traffic. Likewise, both projects were mill-and-fills and are expected to show some reflective cracking, but the FRA seems to be resisting cracking so far.

Regarding the current condition of the road, Swanson noted, “We had one little problem area on that road originally and we do have a handful of cracks in a 500-foot area—that was a bad area to begin with.” Malburg says that although there are cracks, they are staying much tighter, and he believes “that’s the fiber holding them together”. Additionally, areas with frequent transverse cracks in the base layers are currently not

showing any cracks on the surface. Because FRA has been reported to be 35 to 50 percent stronger than traditional asphalt and to have a longer lifespan, Malburg and Swanson anticipate this FRA mill and fill will last much longer than a traditional mill and fill. “We’re hoping in five years we are still at a [PASER] six, maybe in the seven range”, commented Malburg. This would be a lifespan more similar to a crush and shape but without all of the construction disruption and multi-day road closures.

### A Solution for Future Pavement Performance?

This experimental technology does offer some promise. In laboratory testing, a study led by L.M.G. Klinsky et al. suggested that hot-mix asphalt (HMA) with fibers was comparable to control HMA “[r]egarding the resistance to the potential of moisture induced damage,” but also noted that this was expected because the control asphalt was of very high quality<sup>2</sup>. Nonetheless, tensile-strength values were about twenty percent higher for FRA both before and after moisture conditioning, so Klinsky et al. concluded that “fiber-reinforced HMA would perform equally or better in this category”<sup>2</sup>.

Despite laboratory tests proving the

strength of FRA, the civil engineering field has been slow to adopt it. Although most studies agree that FRA is a trustworthy technology that strengthens and reinforces traditional asphalt, only time and real-world use will determine if fiber-reinforced asphalt really is the next big innovation in pavement construction. The engineering team at the Dickinson CRC are currently happy with their section of FRA and suggest other agencies “do their research” and consider FRA. “Fibers won’t stop vertical movement”, cautioned Malburg, “but they should slow down the temperature cracking or horizontal shifting and keep your cracks tight—should.” The team thinks it needs more research and field trials before wholeheartedly recommending it. “My gut tells me it’s going to be a good thing. The theory behind it makes great sense,” stated Malburg. “I would personally like to do another job with it more on overlays and mill and fill, something where you’ve got pavement underneath.”

Swanson added, “It’s not going to be the right fix for everything, you have to take into account all of your circumstances and the condition of your road. But, I believe there is always going to be the right circumstance where its beneficial.” ■



Breitung Avenue with surface of one lane milled and other lane open to traffic (Photo: Courtesy of Dickinson CRC)

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Check out past issues of *The Bridge* newsletter at [michiganltap.org](http://michiganltap.org).



Photo: Shutterstock

# Fraud Awareness and Prevention for Government Entities

Ron Steinkamp, Partner – Advisory Services – Brown Smith Wallace  
Published in MO LTAP's Missouri LTAP First Quarter 2019 and in Missouri Municipal League Magazine October 2018. Reprinted with permission.

According to the 2018 “Report to the Nations” released by the Association of Certified Fraud Examiners (ACFE), occupational fraud is the largest and most prevalent fraud threat organizations may face. Businesses and government organizations across the world are vulnerable to fraud committed from within by their own employees.

This year’s report reveals important information about occupational fraud including the cost of fraud, fraud schemes, how fraud is committed and detected, red flags and the characteristics of the people who commit fraud, the impact on victim organizations and some of the key ways organizations can be proactive in preventing fraud.

## What is Occupational Fraud?

Occupational fraud is fraud committed against an organization by its own officers, directors or employees. Occupational fraud can be classified into one of three categories: asset misappropriation, corruption and financial statement fraud.

Asset misappropriation occurs when an employee steals or misuses an organization’s resources. This could include theft of cash and non-cash assets, such as inflated expense reports, false billing schemes, payroll schemes and more.

Corruption occurs when employees misuse their influence in business transactions in ways that violate their duty to the employer

for direct or indirect benefit. Corrupt acts include things like bribery, conflicts of interest, kickbacks and extortion.

Financial statement fraud occurs when employees intentionally cause a misstatement or omission of information in an organization’s financial reports. Financial statement fraud can include overstatements and understatements of income or revenues, improper disclosures, improper asset valuations and more.

## Key Findings

The ACFE 2018 “Report to the Nations” provides several interesting findings, including:

- Asset misappropriations (when an employee steals or misuses the employing organization’s resources) were the most common form of occupational fraud, occurring in 89 percent of cases with a median loss of \$114,000.
- The median duration of fraud schemes was 16 months and, the longer a scheme lasts, the more it costs the organization.
- The leading methods of detection of occupational fraud were tips (40 percent), internal audit (15 percent) and management reviews (13 percent).
- Internal control weaknesses accounted for nearly half of all fraud cases.
- Organizations that implemented anti-fraud controls realized lower fraud losses.

- Smaller organizations (those with less than 100 employees) experienced both the greatest percentage of fraud cases and suffered the largest loss.
- Organizations employing active fraud detection methods suffered from a lower median loss from fraud.
- Some of the most common behavioral red flags of people who commit fraud include living beyond their means, exhibiting financial difficulties and a lack of willingness to share duties.
- Data monitoring/analysis and surprise audits were correlated with the largest reduction in fraud loss.

For a complete list of findings, visit the ACFE online [atacfe.com](http://atacfe.com).

### Unique Concerns for Government Entities

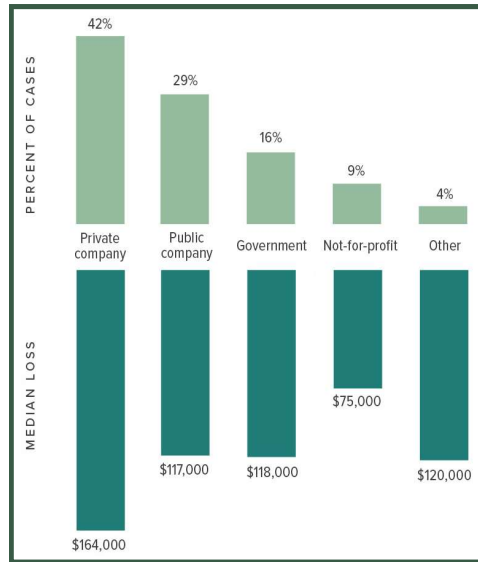
Understanding the frequency of specific fraud schemes within specific industries can help organizations assess and design controls to guard against the schemes that pose the highest threat to them. Government organizations accounted for 16 percent of all fraud cases in this study. Corruption and non-cash (stealing or borrowing supplies, tools, equipment, etc.) asset misappropriation were the most common types of fraud schemes identified as impacting government and other public administration entities.

Of those fraud cases detected within government organizations, 26 percent of frauds were found at the state/provincial level with a median loss of \$110,000 and 31 percent were found at the local government level with a median loss of \$92,000. For smaller municipalities or organizations with limited resources, these losses can be particularly devastating. Since smaller organizations typically have fewer anti-fraud controls in place due to limited resources, they are more susceptible to fraud.

### Prevention and Detection

We hear from many government organizations that fraud is not a concern because they have an annual financial statement audit. However, according to the ACFE report, only 4 percent of fraud cases are initially detected by a financial statement audit. If your organization is relying solely on reactive measures to catch potential fraud red flags, your organization is likely to be at greater risk.

Among the primary weaknesses that contributed to most of the occupational fraud



Types of organizations victimized by occupational fraud (Source: Association of Certified Fraud Examiners' 2018 report)

cases found in the study were a lack of internal controls, an override of existing controls and a lack of any sort of management review.

The presence of a robust system of anti-fraud controls can be a powerful deterrent, as well as a proactive prevention and detection mechanism, in the fight against fraud. Preventing fraudulent activity within your organization starts with effective anti-fraud controls. Some of the most effective anti-fraud controls that reduce the duration as well as the loss from fraud include:

- Code of Conduct.
- Proactive data monitoring and analysis
- Internal audits and surprise audits
- Fraud hotline
- Management review
- Anti-fraud policy

One of the most important actions you can

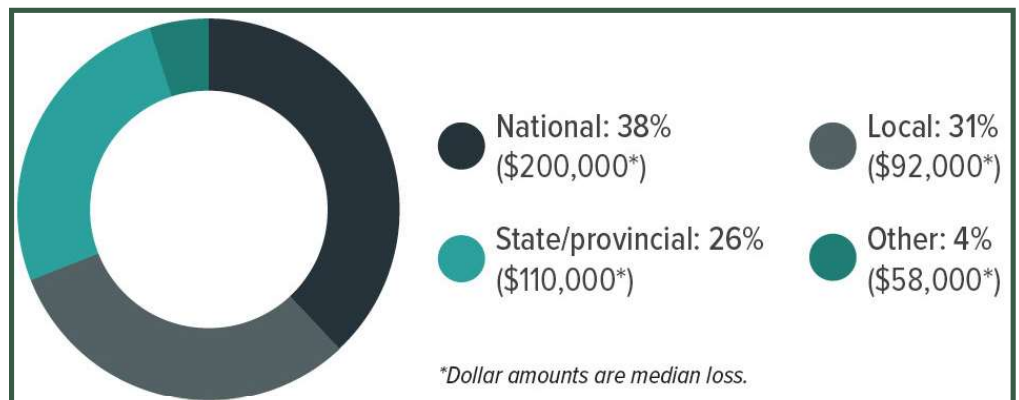
take for your organization is to complete a fraud risk assessment, particularly if you're new to that office. Any government entity could be subject to risks, and a fraud risk assessment will allow you to identify and understand where fraud risks lie and learn what potential weakness in controls could impact your organization. Once risks are identified, a plan can be developed to mitigate those risks by instituting proper anti-fraud controls and procedures.

It is critical for organizations to establish an anti-fraud culture that emphasizes fraud prevention and detection through leadership, policy, training and understanding potential risks. ■

**What can you do?**  
**Check with your insurer or legal advisor for more information. Or, the Michigan County Road Commission Self-insurance Pool can help review and improve your controls. Visit their website at [www.mcrsip.org](http://www.mcrsip.org).**

*Ron Steinkamp is a partner in the Advisory Services group of Brown Smith Wallace and leads the Public Sector Advisory Services group. With more than 20 years of experience, he focuses on internal controls, internal audit, business process improvement, enterprise risk management, fraud and forensic prevention and detection and investigation, and Sarbanes-Oxley compliance. Steinkamp's expertise spans a variety of industries, including government, manufacturing, retail, telecommunications and construction. Contact Ron at [rsteinkamp@bswllc.com](mailto:rsteinkamp@bswllc.com) for a fraud risk assessment or to discuss your fraud prevention and detection strategy.*

<https://www.bswllc.com/resources-articles-fraud-awareness-and-prevention-for-government-entities>



\*Dollar amounts are median loss.

Levels of government victimized by occupational fraud (Source: Association of Certified Fraud Examiners' 2018 report)

## TAMC 2018 Annual Report

The Transportation Asset Management Council's (TAMC) is releasing its *Michigan's 2018 Roads & Bridges Annual Report*, in May! Here's what you'll find inside:

- Reporting of Michigan's Road and Bridges Conditions for 2018
- An expanded reporting of the 2016 and 2017 investment reporting summaries as well as forecasting methods of Michigan's road and bridge conditions
- Highlights of the 2018 Local Agency Culvert Mapping Pilot Project
- Reports of 2018 training and activities for TAMC
- Enhanced content, graphics and photography



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# Great Ideas

Michigan LTAP 

## Challenge

Use promo code BRIDGE-GIC in your entry to be eligible for this extended deadline and to win a Taste of Keweenaw gift comprising of coffee, chocolate, and jam!\*

Awarded to first and second place.

[www.MichiganLTAP.org/GreatIdeas](http://www.MichiganLTAP.org/GreatIdeas)  
Enter by May 27th, 2019

\* All entries previously received are also eligible for the Taste of Keweenaw gift.

# Paving Inspection



Sarah Lindbeck, Technical Writing Intern  
Center for Technology & Training

Paving defects can occur for a variety of reasons, but they are always costly to fix and can lead to premature pavement failure. The Center for Technology & Training has created a class that will prepare employees to recognize and mitigate factors that could cause pavement defects on their own construction projects in an effort to prolong the life of roads across the state of Michigan.

Although this class is primarily intended for new employees and summer helpers, Research Engineer Pete Torola said that “anyone [in Michigan LTAP’s usual audience] can get a lot of good information out of the class, especially if they are not getting the service life out their pavements like they’ve wanted”.

This introductory course will train construction inspectors on how to inspect methods and workmanship by identifying construction quality problems and how they influence the life of the item constructed. The topics for the class sprung out of survey responses and the CRA of Michigan Engineering Committee feedback, related Torola, who developed this class as part of a CTT initiative to offer a construction training class.

“It’ll look at paving defects,” said Torola. “But, I’m also going to address why pavements fail and why it’s important to stop those defects from worsening or spreading when you do see them.” The class will also cover inspector safety and equipment, he notes.

The format will be lecture-style with iClicker questions to gauge how clearly the information is being transmitted. There will also be “stopping points”—class exercises with tips and tricks for checking things like rolling speed, paving speed, yields, and temperature.

For 2019 the class is being offered on May 15th at the Okemos Conference Center in Okemos, Michigan, and on May 29th at the Doubletree by Hilton Grand Rapids in Grand Rapids, Michigan. The class lasts from 7:45 am to 2 pm with lunch provided. Torola affirms that, after taking the class, inspectors should be able to “identify problem areas ahead of time or even while they’re occurring and have the contractor fix them so they get longer life out of their pavement”.

## The Bridge

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### About LTAP

The Local Technical Assistance Program (LTAP) is a nationwide effort funded by the Federal Highway Administration and individual state departments of transportation. The goal of the LTAP effort is to foster a safe, efficient, and environmentally sound surface transportation system by improving skills and increasing knowledge of the transportation workforce and decision makers.

### Steering Committee

The LTAP Steering Committee makes recommendations on, and evaluations of, the activities of Michigan’s LTAP.

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The Center for Technology & Training (CTT) is a part of the Department of Civil & Environmental Engineering at Michigan Technological University in Houghton, Michigan. The mission of the CTT is to develop technology and software, coordinate training and conduct research to support the agencies that manage public infrastructure. In support of this mission, the CTT houses Michigan’s Local Technical Assistance Program, which is part of a national effort sponsored by the Federal Highway Administration to help local road agencies manage their roads and bridges. For more information, visit [www.ctt.mtu.edu](http://www.ctt.mtu.edu).

# The Bridge

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- ▶ 'Wheels' and 'Bridges' of the Michigan LTAP
- ▶ Research in 'Your Back Yard': Minnesota's Local Road Research Board
- ▶ Fraud Awareness and Prevention for Government Entities



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## Upcoming Events

Register at [ctt.mtu.edu/training](http://ctt.mtu.edu/training)

### 2019 Bridge Load Rating Webinar & Workshop Series

SPRING: ~~April 25~~, May 9, May 15 – Dimondale, June 6, June 20  
FALL: August 27, September 10, September 18 – Dimondale, October 8, October 22

### 2019 TAMC Bridge Asset Management Training

SPRING: webinars I & II – ~~April 30~~ & May 7, May 14 – Howell  
FALL: webinars I & II – October 24 & October 31, November 6 – Grand Rapids, November 7 – Prudenville

### MDOT Local Agency Programs: Roadside Barriers on Local Roads webinar – May 9

### 2019 Construction Quality of Asphalt Paving Workshop May 15 – Okemos, May 29 – Grand Rapids

### 2019 FHWA & MDOT Construction Update webinar – May 22

### 2019 Spring Transportation Asset Management Conference May 22 – Gaylord

### 2019 PASER Training Final Session June 12 – Mount Pleasant

### 2019 IBR System™ Training webinar – June 18

### Mark Your Calendar: HEC-RAS 5.0.7 Training Workshop July 29 - August 1

### Mark Your Calendar: 2019 Winter Operations Conference October 15-16 – Bellaire



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