



## Crack Sealing the Way to a Longer Pavement Service Life

Dean Lahti, Technical Writing Intern  
Center for Technology & Training

Choosing the right crack sealing technique based on crack and pavement variables can maximize the extension gained in a pavement's service life.

Choosing pavement treatments is a complicated balance between what's effective yet affordable for local road-owning agencies. Crack sealing is one treatment option that ensures long-lasting performance and affordable maintenance for roadways. Crack sealing is a treatment that involves sealing the crack with specialized materials to prevent water or incompressible materials from entering the crack and causing damage.<sup>1,2</sup> With new research from the Minnesota Local Roads Research Board (LRRB), agencies now have a tool for selecting the optimal crack sealing methods between rout-and-seal or clean-and-seal based on a pavement's specific variables like crack severity, pavement type, and time of the last crack treatment.

Nicholas Vos who, until recently, was a roadway maintenance engineer at the Wisconsin Department of Transportation (WisDOT), acknowledged the state does rely on crack seal as one of its first-line treatments for pavements. Backing the state's decision to use crack seal, he says, are nationwide studies.

Studies find crack sealing generally extends pavement service life between 1.5 and 3.6 years<sup>3,4,5,6,7</sup> although it can sometimes extend the pavement service life up to 3 to 5 years or more<sup>7,8</sup>. Depending on the method of crack sealing, the cost per lane mile was found to range from \$1,800 to \$3,000 in 2007 and 2019 studies, which is significantly less than treatments like chip sealing, microsurfacing, and overlay.<sup>1,7</sup> Crack sealing asphalt pavements also achieves the greatest benefit for the cost in comparison to single or double chip sealing, overlay with or without milling, and crack filling.<sup>8,9</sup> The optimal timing for crack sealing was

a key factor for realizing benefit, according to NCHRP report 523.<sup>10</sup>

A key consideration for when and how to apply crack sealing is the cause of the cracking. Cracking can be caused by aging of the pavement or structural failure of the pavement. Examples of age-related cracking include block, longitudinal, and transverse cracks.<sup>5</sup> Examples of structural cracking include fatigue and alligator cracking.<sup>11</sup> Crack sealing structural cracking is both uneconomical and technically unsound because crack sealant offers little to no benefit for the road's structure, which influences pavement surface condition.<sup>12</sup> But, crack sealing before the road deteriorates as well as choosing the right crack sealing method for the situation offers benefits such as reduced vehicle damage, increased driver safety, and reduced road maintenance.<sup>1</sup>

### To Rout or Not To Rout: Choosing the Right Method

In Michigan, sealing cracks is important because water and incompressible materials that enter that crack can cause substantial damage during the freeze-thaw cycles and during normal movement of the pavement, respectively. A 2019 Minnesota LRRB study found that sealing cracks could "extend the life of the pavement irrespective of the type of the pavement".<sup>1</sup> The LRRB study focused on the differences between clean-and-seal repairs, where the debris is blown out of cracks that are then sealed, and rout-and-seal repairs, where a groove—centered along the length of the crack—is cut and then sealed.<sup>1</sup> The study sought to determine

► Crack Sealing, page 10

### Inside



The Idea to Innovate: Michigan LTAP Great Ideas Challenge

► Page 3



Flexible Financing for Small Communities

► Page 5



Phil Strong: Improving Gogebic County Roads by 'Going Together'

► Page 6



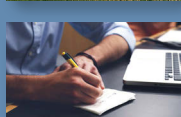
TAMC Adjusting to the Times

► Page 9



System-wide Safety

► Page 12



Note-taking: Strategies for the Digital World

► Page 14

Also: What's Going to Happen... ► Page 2  
Michigan SIB Loans ► Page 5  
TAMC Releases 2019 Report ► Page 8

### Back Page

Upcoming Events  
Engineering tech assist



Michigan's  
Local Technical  
Assistance Program

## Letter from the Editor

“My lips are chapped from the winds of change,” said author, journalist, and commentator Sarah Vowell. I laughed when I found that quotable quote because I think 2020 has made us all feel that way.

Before we talk about this year’s chapping winds, some things have remained constant in the midst of the windstorm.

### What’s Going to Happen...

...to Winter Operations Conference?

...to County Engineers’ Workshop?

...to Michigan Bridge Week?

...to the workshop I was planning to attend?

The Center for Technology & Training (CTT)—home of the Michigan Local Technical Assistance Program—is committed to providing attendees with a healthy, safe learning environment.

As necessary, the CTT is looking at ways to offer a selection of our current events online. So, you won’t miss this fall’s Winter Ops or next year’s CEW, Bridge Week, or other events. When these events are not possible in person, we will bring them to you virtually or in a hybrid format! In addition, the CTT is offering new trainings online. Follow our events on [ctt.mtu.edu/training](http://ctt.mtu.edu/training).

When we offer on-site events, the CTT is making adjustments to event capacities and food and beverage services. If current guidelines suggest forgoing on-site events due to COVID-19, the CTT reserves the right to replace the on-site session with an equivalent online event on or around the same date(s). The CTT will make every effort to provide sufficient notice of event changes to attendees. All attendees at on-site sessions will be expected to adhere to the social-distancing and face-mask guidelines of the venue as well as any additional guidelines put forth by the CTT prior to the event. ■

One notable constant is the Michigan Local Technical Assistance Program (LTAP), which is continuing to provide our road-owning agencies with technical assistance, training, resources, and—most importantly—*The Bridge* newsletter! This 33.1 issue of *The Bridge* addresses topics that continue to be relevant. This issue opens with a look at crack sealing for pavement maintenance and when and how to use it to maximize cost effectiveness and performance effectiveness.

But, road and bridge projects can’t happen without funding. So, we’ve taken a moment in these pages to look at flexible financing for small communities. Along with that, we shared information about Michigan’s state infrastructure bank as a way to access desperately-needed funding in a timely manner.

One effective way at tackling our list of projects is to collaborate with other agencies to get the job done. Phil Strong at Gogebic County Road Commission shares about his collaborative spirit in these pages, and we see how his sense of collaboration is helping him get a significant amount of work done on Gogebic County roads.

Aside from collaboration, innovation is another key to project success. We look at the Michigan LTAP’s Great Ideas Challenge. This contest challenges local road-owning agencies to share innovations that solve problems that many of us face. Sharing these innovations through the Great Ideas Challenge gives our fellow local road-owning agencies valuable insights on how to improve processes or procedures effectively.

To help keep track of our projects and meetings, we share ways that Microsoft’s OneNote can streamline note-taking. Not only that, Microsoft OneNote allows for quick and easy reorganization of folders and files, and it facilitates collaboration and sharing of notes.

Also in this issue, we delve into different approaches to making our roads safer. We begin by looking a spot approach to addressing high-crash locations. But, we move beyond that to look at the benefits of a systemic—or system-wide—approach to making safety improvements that address high-risk features of the roadway.

Finally, the Michigan Transportation Asset Management Council updates us on ongoing changes to their usually-scheduled events. And, they share their newly-released *Michigan’s 2019 Roads & Bridges Annual Report*.

Now, for the winds! The Michigan LTAP is transitioning between remote and physical office environments. No matter where we are, we will continue to serve you! Many of you look forward to attending various trainings that we offer. But, with the continuing pandemic, we are and will continue to be revamping current events and offering new events to you via remote platforms. This summer, we will be offering our asset management workshops as remote workshops and, this fall, we are looking forward to seeing you at our first ever virtual Winter Operations Conference!

So, when the winds of change chap our lips, let’s look for lip balm! Right now, lip balm is likely guised as online collaboration or remote meeting tools.

In the meantime, if there are training topics or newsletter article topics that would benefit you and your agency, please let us know. In our webinars, please share your suggestions with us in our exit polls. Or, share your suggestions with us by e-mail at [ctt@mtu.edu](mailto:ctt@mtu.edu), by visiting our conference pages and completing the Present tab form, or by visiting <http://michiganltap.org/TheBridge> and completing the Topic Suggestions form.

Victoria



2020 MICHIGAN Winter Operations Conference

MICHIGAN'S LOCAL TECHNICAL ASSISTANCE PROGRAM

Mark Your Calendar!



October 13-15  
Virtual Conference  
(more info coming soon)

[ctt.mtu.edu/winterops](http://ctt.mtu.edu/winterops)



# The Idea to Innovate (continued from page 3)

▶ same goals: safe, quality roads; we want to be productive and efficient”.

Winners of the Great Ideas Challenge are automatically entered in the Federal Highway Administration’s Local Technical Assistance Program (LTAP) Build a Better Mousetrap competition. In this competition that has been highlighting innovations from across the country for over a decade, submissions are judged on the following criteria: cost savings/benefits to the community, ingenuity, ease of transference to others, and effectiveness. Although he was unable to attend the 2017 LTAP/TTAP National Conference where winners were announced, Tom Gamez was proud that “Michigan was represented by our idea at a nationwide competition”.

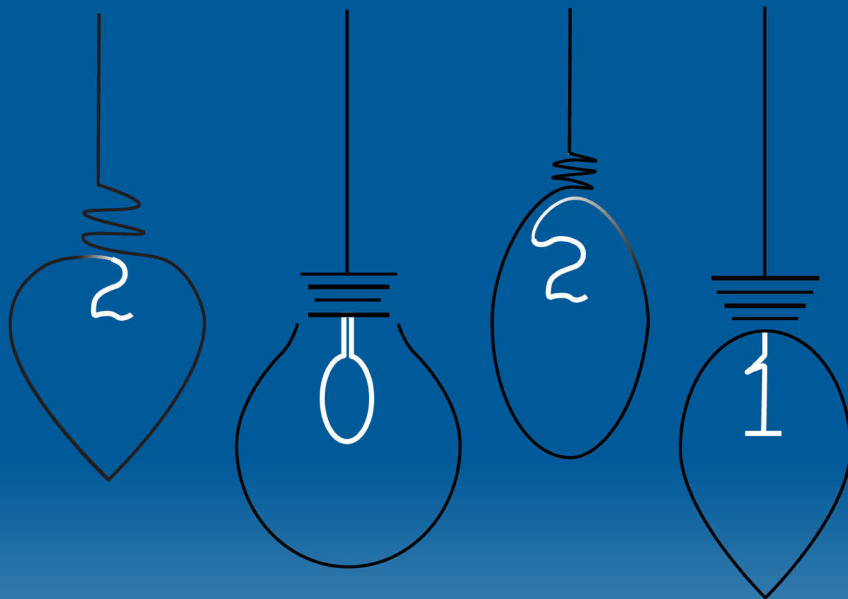
The 2018 Build a Better Mousetrap winners include a mobile app used to track potholes, a building built out of recycled materials, and a portable manhole that can

be used for indoor training purposes. One intriguing innovation from Louisiana shows the value of collaboration—and with a Michigan-based company no less. Lafayette Consolidated Government worked with East Jordan Ironworks to design a better cover for curb inlet catch basins that involved a lighter, hinged cover so a single employee could lift it without straining themselves. The curb cover is only slightly more expensive than conventional options, and the agency feels the benefits far outweigh the costs because the new design is easy to use, reduces workers’ compensation claims, and increases efficiency. Working with equipment manufacturers is one way of turning an innovative idea into standard practice within an agency or potentially even an entire industry.

Ottawa County Road Commission received an Honorable Mention in the 2019

Build a Better Mousetrap competition for their Box Tailgate Extension. To view a write-up of their innovation along with other winners from across the nation, visit <http://michiganltap.org/sites/ltap/files/greatideas/2019fhwa-buildabettermousetrap.pdf>.

Competitions like these only work when there is participation. Ingham CRD plans to dive into the 2020 Great Ideas Challenge with “another idea our staff has created that we plan to submit”. Randy Nagelkirk retired this April, so it remains to be seen if Ottawa CRC will be submitting more great ideas. His parting words are encouraging, though: “It’s been a good job, it’s been fun...I’ll leave it for somebody else to do, and I hope they get involved in [the Great Ideas Challenge] because I do think that it’s a win-win for everybody.” ■



## Prizes

### First Place

- Engraved hardwood first place award plaque
- \$600 toward registration fee or travel costs for any transportation-related training or event
- \$200 LTAP Bucks certificate
- News release for distribution to media in winner’s local area
- Entry in the 2020 National LTAP’s “Build a Better Mousetrap” Competition

### Second Place

- Framed second place award certificate
- \$100 LTAP Bucks certificate

\*Remaining entries will be entered into a random drawing for a \$50 LTAP Bucks

## How to Enter

Go to <http://michiganltap.org/GreatIdeas>  
OR  
Submit a card at one of our events

Great **Ideas**  
Michigan LTAP

2021 Challenge

Shining a spotlight on local road agency innovations  
for a brighter Michigan

## Michigan SIB Loans

Sarah Lindbeck, Technical Writing Intern  
Center for Technology & Training

County Engineer Kevin Harju recalls the time a \$4 million check arrived at Houghton County Road Commission (CRC). “My bookkeeper came into my office and handed me the envelope—regular mail with a single stamp—and inside was a check for \$4 million,” he begins the remarkable story. “So my bookkeeper brought it to the bank, and the tellers didn’t really know what to do with it because they’d never seen someone walk through the front door with a \$4 million check to be deposited.” Harju laughs when he tells the story, but that \$4 million State Infrastructure Bank (SIB) loan would help Houghton County recover from a devastating flood in 2018 that destroyed much of the county’s infrastructure, known as the Father’s Day Flood (see *The Bridge* 31.4).

Michigan SIB loans are available to any Act 51 eligible public entity. The SIB loan program complements traditional funding sources by helping finance urgent projects quickly and flexibly. The Michigan Department of Transportation (MDOT) will consider funding for any stage of a project. Their review of the loan application can take up to 30 days and, if the project is approved, it is usually 6-12 weeks for the loan recipient to receive the money.

The goal of the Michigan SIB loans is to provide a quick funding source with low borrowing costs. Because of the way these loans are structured, county road commissions often use them in times of emergency. Houghton CRC urgently needed funding to fix and replace their transportation infrastructure following severe flooding in 2018.

Midland County experienced severe flooding this summer, and they are also turning to a SIB loan for assistance. Director of Finance Brenda Gordert explained that the \$2 million SIB loan for which the CRC is applying would help cover the \$16 million cost of repairing Curtis Bridge. She explained, “This bridge is a long detour, and we want to try to have it open before winter hits so people aren’t having to detour around in the bad weather.”

Midland CRC is still paying off a five-year loan from the SIB. In June 2017, four major bridges washed out in a previous flood Midland County experienced. Gordert was happy to report “by December 2017 we had all four bridges open to traffic with the help of our SIB loan”.

Although SIB loans can be a vital source of emergency funding, that is not the only application for a SIB loan. Organizations can

► continued on page 8

# Flexible Financing for Small Communities

Peter Mancauskas, FHWA Center for Innovative Finance Support  
Reprinted from Spring 2019 *Public Roads* magazine

Decreasing resources and increasing demands require Federal and State transportation agencies to explore innovative financing tools for infrastructure projects. State infrastructure banks (SIBs) are one such tool. Compared to relying entirely on grant-based financing, SIBs can offer accelerated project delivery, provide lower borrowing costs, and facilitate completion of financial plans. “A federally funded SIB, much like a private bank, can offer a range of loans and credit enhancement products to public and private sponsors of highway, transit, or rail projects,” says Mark Sullivan, director of the Federal Highway Administration’s Center for Innovative Finance Support. As transportation agencies repay loans or other forms of credit assistance to the SIB, the bank’s initial capital is replenished to support a new cycle of projects.

Initially established by the National Highway System Designation Act of 1995, Federal SIBs are now active in 29 States. They have provided more than 950 loans for a total of more than \$3.1 billion to fund transportation projects throughout the country. In addition, several States have established separate SIBs with State funds.

FHWA is looking to expand lending through the SIB program, especially in smaller communities where it can be more difficult to secure the required funding for transportation projects. This has become more important now than in the past, as gas tax revenues have not kept pace with the

demands on the transportation system.

## The Advantage of Flexibility

By offering low interest rates and negotiable repayment terms, an SIB provides a low-cost option for capital funds to a wide range of project sponsors.

For example, Missouri has sponsored two innovative methods to use its SIB. Through the Missouri Department of Transportation’s Cost Share Program, which builds partnerships with local entities to pool efforts and resources to deliver State highway and bridge projects, local governments use SIB loans to fund their share of the project costs. Missouri also uses SIB loans to accelerate payments of the State’s share of project costs that may be programmed in future years. In these loan agreements, local entities are responsible only for interest payments, while the State makes the principal payments.

In Texas, the most common SIB loans are local governments borrowing for utility relocations on roadway projects. This type of loan provides valuable assistance, financing the costs that cities and towns are solely responsible for and enabling municipal projects to move forward sooner than they could with traditional funding options.

## Looking Ahead

FHWA’s Center for Innovative Finance Support recently conducted a series of roundtables and an informal survey with its

► continued on page 8

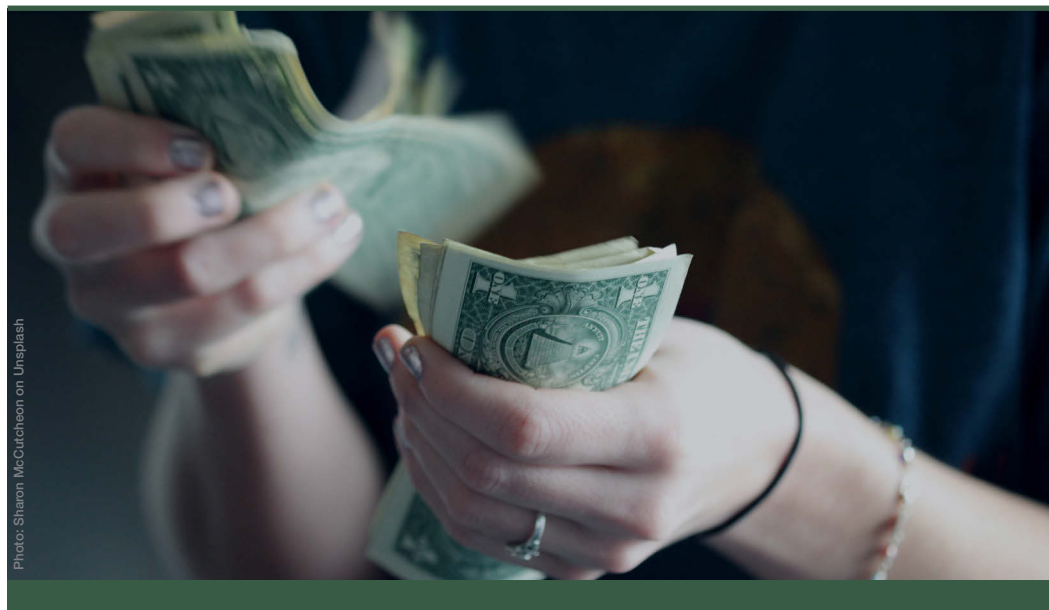


Photo: Sharon McCutcheon on Unsplash

# Phil Strong: Improving Gogebic County Roads by 'Going Together'

Victoria Sage, Technical Writer  
Center for Technology & Training

There's an African proverb that says, "If you want to go fast, go alone. If you want to go far, go together." Half a world away, the truth of that proverb can be witnessed in the strategies that Phil Strong is using to manage Gogebic County's road network.

Although Strong moved around a bit while he was growing up, he spent a handful of years in Ironwood. He subsequently attended Michigan Technological University in Houghton, Michigan. During his time at Michigan Tech, he interned at the consulting firm Coleman Engineering in Ironwood. Following graduation, Strong moved to Madison, Wisconsin, for his first full-time professional position.

"That was the big town," said Strong of Madison. There, he worked for Strand Associates, a large consulting firm. He spent four years in that position before he "boomeranged back up to the Upper Peninsula" to work full-time for the consulting firm where he interned. "I worked [at Coleman] for about a decade...on a large variety of projects," he said. "It was a nice thing."

His consulting projects included planning, designing, and inspection on projects ranging from roadway rehabilitation/reconstruction and

slope stabilization to local municipality water and sewer replacement and environmental sampling. His projects covered an area from Marquette, Michigan, to Bayfield, Wisconsin, and from Ironwood, Michigan, to Wausau, Wisconsin. "You add in travel [between project sites], and it gets a little old," Strong lamented.

During his time at Coleman, Strong was also involved in a unique array of projects related to Gogebic County. In 2016, Gogebic County's road network suffered significant damage due to a catastrophic storm event (see *The Bridge* 30.2). Strong worked on design, Department of Environmental Quality permitting, and construction documents for the 2016 and 2017 MDOT Emergency Relief Projects along the severely-damaged Lake Road.

Even though he enjoyed working at Coleman, he eagerly took an assistant engineer position with Gogebic County when that opened in mid-May of 2018. "I was interested in focusing my efforts on my home turf of Gogebic County," he shared. "That was very appealing to me."

Within six months, Strong found himself adjusting to his position alongside a newly-hired manager and engineer technician in

the fall of 2018. "It was a bit of a transition period," he noted. "The new team of [the new manager] Barry Bolich, [the new engineering technician] Mark Miljevich, and me, it's a unique situation: we're all relatively new, so learning the processes together as a team is kind of neat." Both Strong and Bolich's "let's work together" outlook is permeating the team at the road commission.

But, Strong's collaborative efforts began to radiate beyond his immediate team. Being new to the position of county engineer, Strong turned toward his peers. "[I've been] tapping into other counties for advice on what they've been doing," he said. "When I don't know the answer, I reach out to Mike Maloney [of Ontonagon County Road Commission], Doug Tomazoski [of Iron County Road Commission], Lance Malburg [of Dickinson County Road Commission], to neighboring engineers for advice as opposed to spinning my wheels internally."

He's also tapping into applications he heard about at the 2018 County Engineers' Workshop. "Christopher Bolt from Jackson County did a presentation about cold-in-place recycling, and I think I have a project for



Gogebic CRC's new team. From left: Phil Strong, county highway engineer; Barry Bolich, manager; and Mark Miljevich, engineer technician.

Photo: Courtesy of Gogebic CRC



Restored culvert crossing, one of Phil Strong's projects following Gogebic County's 2016 storm event. The new culvert is an 8-by-6-foot, 20-foot-deep precast concrete box culvert. (Photos: Courtesy of Gogebic CRC)

using that technique," he said. "I see real benefit for that project if we can revitalize that existing asphalt and gain a higher structural number than just pulverizing the existing asphalt...before we overlay the cold-in-place recycled material with hot-mix asphalt."

Strong's sense of 'going together' is also permeating his projects as well. In 2020, Gogebic County roads will be seeing improvement to roads jointly owned with the City of Ironwood: Country Club Road, which runs between US-2 and Old County Road, and Ayer Street, which runs through the City of Ironwood. The two road-owning agencies are teaming up for the road work and relying on a Small Urban Grant to help get the work done. "[We're going] together to make this whole stretch nice," said Strong.

Two other projects lined up for this summer for Gogebic CRC are being made possible not only through Federal Highway Administration's Federal Land Access Program (FLAP) grants, which are administered by the Michigan Department of Transportation (MDOT) Local Agency Program but also through coordination with Ottawa National Forest. One project is stabilizing and replacing some culverts and stabilizing washed-out embankments on Black River Road, the sole access road to Ottawa National Forest's Black River Harbor that was damaged during the 2016 storm event. The other project is replacing a 128-foot-long, 12-by-6-foot box-culvert crossing on the Sylvania Wilderness and Recreation Area's access road, Thousand Island Lake Road, in the Ottawa National Forest. For that project, Strong notes that Gogebic CRC is also using federal Surface Transportation Funds to pay for the project. "It's a big undertaking," he said. "A large detour, digging down to install the new box culvert over the

middle branch of the Ontonagon River, filling it up, restoring the guardrail, and finishing the last half-mile of paving [needed on that road]." Since both projects have limits extend beyond Gogebic CRC's right of way, Strong has been coordinating with Ottawa National Forest for permits and drainage improvements.

Also this summer, Gogebic CRC is teaming up with the Michigan Western Gateway Trail Authority to add three miles of paved surfacing to a section of the non-motorized-vehicle Iron Belle Trail extending from the Wisconsin border in Ironwood to Moore Street in Bessemer. That effort is receiving funds from the Department of Natural Resources Trust Fund as well as the MDOT Transportation Alternative Program Grant and other local grant funding. The new extension will be between Bessemer and Ramsay.

Strong credits his predecessor for establishing many of the collaborations he has had on Gogebic county road projects.

The county will also be doing two solo projects: a total replacement of the Blackjack Bridge near the Blackjack Ski Resort and a pulverize and repave of Planter Road in Wakefield Township's Industrial Park to bring it up to all-season trucking standards. The two projects are being made possible by MDOT Local Bridge Program funding and MDOT State D funding, respectively. Although they're 'going alone', Strong said the county is working with Coleman Engineering on the Planter Road project. "We can't be in six different places at once," he laughed. "So, we're hiring consultants to assist us with this."

Looking forward, Gogebic County is proposing work to improve a perched culvert along Sucker Lake Road. On both sides of the road is Ottawa National Forest property. Gogebic CRC is working with Ottawa National Forest to pro-

pose a jointly-funded aquatic organism passage structure that will allow for better passage of fish species. Strong explained, "There was an opportunity to apply for funds to improve fish habitat and, if it ends up with the county having a nicer new culvert, then we'll have happy fish and we'll have a safer road."

Even outside of work, Strong is not 'going alone'. While he enjoys cross-country skiing, biking, and just spending time outside, he says the "hardest thing I have ever done" is running the Fall Superior Trail 100-mile race, which starts at Gooseberry Falls and ends at Lutson Mountain in Minnesota. "I finished!" he said of his experience running that race. "I had a rotation of three people pace me through the [last] 60 miles, which was really neat to be able to share that [accomplishment with them]."

Reflecting on the importance of serving as a county engineer in his "home turf", Strong said, "There's definitely satisfaction in the work that we do for improving safety and accessibility for the general public." But, he also acknowledges the challenges they face. "It's not just one project," he pointed out, comparing the county-level work to his consulting experiences. "I have 600 miles of road, 61 bridges, and 2200 culverts that are all mine, and we have to prioritize them to keep them all in working order. There's not enough funds to keep everything up to how you want, so you have to look at road usage and keep heavily-travelled roads up to a higher standard than roads with many hunting camps on them, for instance."

Nonetheless, because he's 'going together' on efforts to improve Gogebic County roads, his funds are going farther this year. "Four of my six projects this year are due to collaboration, so this year it's having a significant impact." ■

▶ also use SIB loans to help finance projects they would like to get done on a shorter timeline. MDOT gives priority to applicants who have the potential to pay their loan back quickly so the money can be recycled to assist other organizations with their projects.

Macomb County uses SIB loans for yet another purpose: The department of roads applies for the loan on behalf of townships within the county, enabling the townships to match local funding much easier and quicker than they could on their own. They have used the money to build a small roundabout and do several paving projects in various townships throughout Macomb County. Bryan Santo, director of Macomb County Department of Roads, commends the program because “it allows these communities to take out a very low interest rate loan to invest in their infrastructure needs and accelerate transportation



Photo: Thomas Brehner from Pixabay

projects that they normally wouldn't be able to do in any one year”.

The SIB loans in Macomb county range from 1-3% interest over a 10-12 year period. Santo appreciates SIB loans for being a great opportunity to “partner us, a local government agency, with the communities to move forward and be able to build their infrastructure projects”.

Regarding these different SIB funding options available to transportation agencies, Gordert declares, “They're all very good resources, and we use them all!” Although Midland and Houghton Counties also used funds from the Federal Emergency Management Agency (FEMA) and Federal Highway Administration (FHWA) Emergency Relief Fund for repairs following their floods, Gordert admits that, while they are “very good programs”, those funding options are “not as timely, they don't come through as fast, as the SIB loan did”. The SIB loan gives agencies a check in their hand when it is needed so that important work can be done in a timely manner to repair or improve Michigan infrastructure.

More information on SIB loans can be found at [michigan.gov/SIB](http://michigan.gov/SIB) or by contacting the SIB loan coordinator, Jessica Pierce at [piercej3@michigan.gov](mailto:piercej3@michigan.gov). ■

## Flexible Financing

(continued from Page 5)

▶ partners to determine what additional assistance the SIB program could provide. Many participants responded that the program could benefit from marketing assistance, specifically to local and rural borrowers.

As a result of the feedback, the center is developing marketing and training tools for a lending opportunity that rural and smaller communities can benefit from called Local Innovative Match Assistance (LIMA). With this funding initiative, local sponsors of Federal-aid projects can directly finance their non-Federal share through the SIB program where available. LIMA provides them with access to at- or below-market-rate loans and eliminates the burden on rural and small communities of having to secure the funds necessary for a required local match for federally funded projects.

For more information, contact Peter Mancauskas at [Peter.Mancauskas@dot.gov](mailto:Peter.Mancauskas@dot.gov). ■

*Reprinted from Public Roads, vol 83, no 1, #FHWA-HRT-19-003 (Spring 2019). U.S. Department of Transportation Federal Highway Administration Research and Technology. Available: <https://tinyurl.com/fhwa-pr83-1>.*

# TAMC Releases Michigan's 2019 Roads & Bridges Annual Report

On April 30, 2020, the Transportation Asset Management Council (TAMC) submitted its annual report to the State Transportation Commission, Michigan Infrastructure Council, and Michigan Legislature per Michigan Compiled Law (MCL) 247.659a(9). This year's report targets its legislative and broader audience and highlights road and bridge conditions along with investment reporting.

The 2019 TAMC annual report provides new ways for local agencies to communicate the story of road and bridge conditions and infrastructure needs to their local elected officials. In addition to new graphs for forecast conditions, non-federal-aid pavement conditions, and cycle of life, the TAMC report introduces a severe category—formerly a subset of poor—for bridge condition in order to give greater visibility to the local agency bridge program's dire need for increased funding. The TAMC also added a special section highlighting the new asset management plan requirements and the resources available to assist in developing an asset management plan,

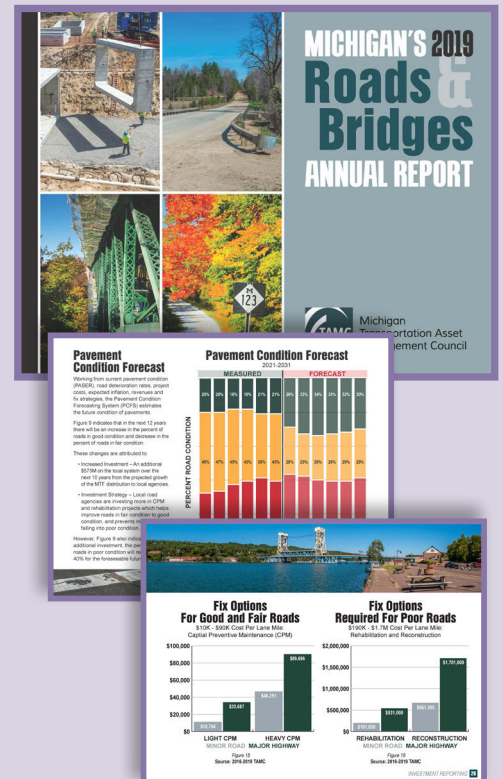
which is a critical tool for funding efforts.

This year's report underscores significant funding needs and how the TAMC plans to use its data in pursuit of a statewide investment strategy.

Furthermore, the report highlights that the 2019 paved federal-aid-eligible roads condition slightly improved from 2018. In 2019, 39% of these roads were in poor condition, 40% were in fair condition, and 21% were in good condition. Forecasted conditions indicate an improvement in the good condition but also an increase in the poor condition.

The TAMC Annual Report and its supportive data elements are a collaborative effort with help from MDOT; county, city, and village road agencies; and regional and metropolitan planning organizations. Michigan Technological University's Center for Technology & Training along with DTMB's Center for Shared Solutions provided data summaries and technology and training support.

View the report at [michigan.gov/tamc](http://michigan.gov/tamc). Questions? Contact Dave Jennett at [jennettd@michigan.gov](mailto:jennettd@michigan.gov). ■





# TAMC Adjusting to the Times

Administration, Communication, and Education Committee  
Michigan Transportation Asset Management Council

The Michigan Transportation Asset Management Council (TAMC), like many entities, has had to adjust to the impacts of COVID-19 and adhere to Governor directives to stay safe and stay healthy. Learning to collaborate using digital tools like Microsoft Teams, Skype, Zoom, and Sharepoint was a major adjustment. Many team members also found their “office hours” no longer fit the pattern of 8-5 because they were not the only ones at home: children were home, too, and needed parents’ help navigating remote schoolwork. Nonetheless, the TAMC 2020 program is navigating these challenges and continues to move forward, making modifications as the year unfolds.

One modification was significant: the 2020 PASER Training classes were cancelled for the year. The TAMC struggled with this decision because PASER Training is a cornerstone of the program. They deemed virtual PASER Training was not feasible in 2020 and in-person trainings were not able to adhere to the restrictions on group gatherings. This restriction on group gathering also led to the cancellation of the TAMC 2020 Spring Asset Management Conference.

Nonetheless, the TAMC is planning a virtual fall conference for the end of October 2020. This multi-day, web-based event will feature local- and state-agency speakers and will address a wide range of asset management topics.

Data collection efforts also saw some adjustments in 2020. To accommodate agencies’ need to collect data, it was decided that raters who certified in 2018, 2019, and 2020 would be eligible to rate roads for the 2020 collection year. Unfortunately, new local road-owning agency staff or region-level partners will not be able to train at this time. By allowing previously-certified raters to rate in 2020, agencies and planning organizations should hopefully have access to staff qualified to collect PASER data and could possibly assist other agencies that might not have available certified staff.

However, 2020 data collection efforts will focus on non-federal-aid networks only. Federal-aid PASER data collection three-person teams have been temporarily suspended due to the group size and distance limitations set in place by the pandemic response orders and restrictions on Michigan Department

of Transportation staff participation. The TAMC has cancelled the 2020 federal-aid data collection requirement and will be requiring agencies to submit 100 percent of their federal-aid data in 2021. The fiscal year 2020 budget for federal-aid data collection is extended to June 30, 2021. The TAMC is encouraging local road-owning agencies to focus their 2020 data collection effort on rating their non-federal-aid network, which is a key component to managing local roads.

More information on 2020 PASER data collection is in a TAMC letter dated August 7, 2020: [https://www.michigan.gov/documents/tamc/TAMC\\_Letter\\_on\\_2020\\_PASER\\_8-7-20\\_698757\\_7.pdf](https://www.michigan.gov/documents/tamc/TAMC_Letter_on_2020_PASER_8-7-20_698757_7.pdf). The latest TAMC updates can be found on [michigan.gov/tamc](http://michigan.gov/tamc).

Despite the challenges, the TAMC’s program areas were able to work through the COVID-19 changes, specifically delivering the 2019 story of Michigan’s roads and bridges based on investment reporting and data collection. The major outputs were the 2019 TAMC Annual Report and transparency tools, such as TAMC’s dashboard and interactive map (see TAMC article on page 8).

Another TAMC focus area that required modifications was the Investment Reporting Tool (IRT) trainings. For those training, an online format already existed. On-site trainings were cancelled and were transitioned to webinars in addition to online support.

Attendance for these trainings increased since local road-owning agencies could easily continue working on required investment reporting. Consequently, investment reporting due dates remain dependent upon fiscal year, and the first round of TAMP submissions remain due on October 1, 2020. One thing to note is that many agencies planned projects may have been impacted by budget shortfalls and changing work environments. The IRT allows agencies to update data at any time. For local road-owning agencies that may be at risk maintaining their schedule, the TAMC and Act 51 teams may grant accommodations similar to those granted in the past upon request.

During this time of change, the TAMC accomplished several milestones: They released the annual report and 2019 data updates. The TAMC continues to push forward on improvements in planned projects data entry along with culvert maps and dashboards based on 2018 pilot data. Look for these on the TAMC website and stay tuned as the new features become available.

As a reminder, the TAMC will keep agencies up to date with changes resulting from the response to the COVID-19 pandemic. In the meantime, TAMC hopes everyone is healthy and safe. ■

*Article also in Michigan APWA’s Great Lakes Reporter, Summer 2020.*



Photo: CTT Archive

which of the two repair methods offered better value over time. If rout-and-seal were to deliver a longer-lasting repair, it may be more cost-effective than clean-and-seal over time.<sup>1</sup>

The research team found the cost per lane mile for rout-and-seal is 1.8 times greater than clean-and-seal repairs.<sup>1</sup> Rout-and-seal repairs are more expensive because they require more time and sealant.<sup>1</sup> Since rout-and-seal requires more manpower and resources, clean-and-seal is more cost-effective in the first few years following treatment.<sup>1</sup>

Between the two sealing methods, the average life-expectancy of the crack seal for rout-and-seal and clean-and-seal repairs were four years and three years respectively.<sup>1</sup> Survey data from “state-aid engineers, and personnel from MnDOT districts, counties, and cities” found that rout-and-seal resulted in a longer life-expectancy, with 2 to 15 years from installation until failure.<sup>1</sup> Clean-and-seal had a shorter life-expectancy, with 2 to 10 years from installation until failure.<sup>1</sup>

Because of the cost-benefit trade-off between the two methods, the LRRB research yielded decision trees for identifying the appropriate repair.<sup>1</sup> The two decision trees help agencies choose a crack sealing method based on variables like soil subgrade types, design life, and analysis periods. The first decision tree can be used in maintenance decisions and takes the variables into account.<sup>1</sup> The second, more-simplified decision tree can be used by the preventive maintenance crews and is useful when data on the decision variables are limited.<sup>1</sup>

One local agency using crack sealing extensively is the Marathon County Highway Department in Wisconsin. “We usually do a lot of rout[-and-seal],” said Kris Baguhn, maintenance superintendent for the department. “Although lately, we’ve been doing a

lot of [projects where we] just blow out [the cracks] with no rout crack sealing.” Despite rout-and-seal’s slight edge in benefit, Baguhn says that clean-and-seal has less silica dust exposure and requires less labor. He also notes that their decision between rout-and-seal and clean-and-seal is based on project and size of the cracks, with clean-and-seal being the choice for larger cracks.

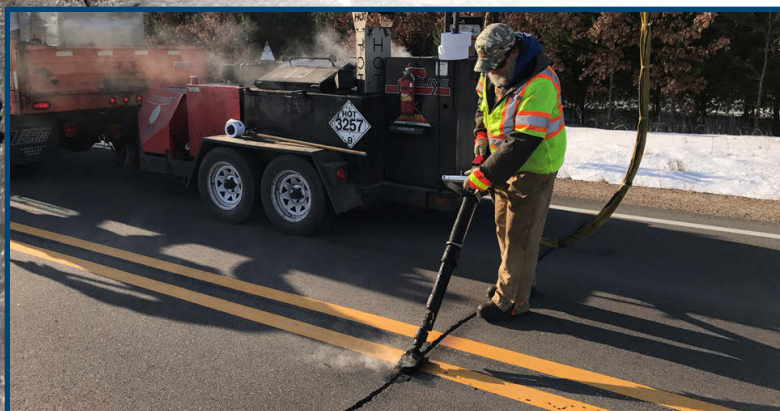
## Materials Make a Difference

Two common crack sealants are the hot-pour and cold-pour varieties. Other types of sealant are medium-cure oil and sand, and asphalt emulsion; however, these types are not as common.

Hot-pour sealant is often recommended for all crack widths but demonstrates the greatest benefit in cracks ¼-inch to 1-inch wide.<sup>7,13</sup> This type of sealant starts out as a solid that is heated to approximately 375-degrees Fahrenheit on-site in order to be applied as a liquid and cured.<sup>7,14</sup> Hot-pour sealant can be applied in a range of weather conditions.<sup>14</sup> Once cured, hot-pour sealant forms a spongy, flexible solid that allows for expansion and contraction as the ground freezes and thaws.<sup>14</sup> Types of hot-pour sealant include elastic-type sealant, polymer-modified sealant and crumb-rubber sealant. The properties of polymer-modified sealant make it a common choice during winter, and crumb-rubber sealant takes advantage of recycled materials.

Cold-pour sealant is generally recommended for thinner cracks and has a low viscosity that helps it to penetrate cracks more easily.<sup>11,13</sup> This type of sealant is a liquid that is applied without heating. To cure properly, ambient temperatures should be 50 degrees Fahrenheit or higher.<sup>13</sup> Once cured, it forms a hard, inflexible solid that does not expand or contract with changing temperatures.<sup>14</sup> This lack of flexibility may lead to the repair’s failure as the sealant can eject as the ground freezes.<sup>14</sup> Cold-pour sealant shrinks more than hot-pour sealant and creates a weaker bond with the asphalt.<sup>14</sup> Nonetheless, a 2002 study from the Texas Department of Transportation found that cold-pour sealant still achieved a life-expectancy of up to two years while hot-pour sealant achieved a life-expectancy of up to five years.<sup>11</sup>

For larger cracks, Baguhn says they typically crack seal with polymastic on the county roads. “Polymastic is a rubber product that has some aggregate in it,” Baguhn said. “It gets hard, like a hockey puck. [The ag-



Crack sealing an asphalt pavement (Photo: Courtesy of Marathon County Highway Department [Wisconsin])

gregate] gives it structure and integrity. It's a little bit flexible but it's not like a regular rubber crack filler and it's not quite as flexible." The polymastic fills large cracks, and stretches and moves as the road expands and contracts seasonally.

### Sealed for the Short Term

According to Baguhn, crack sealing prevents water from entering the pavement structure. The intrusion of water can lead to weakening of the pavement's base and to freeze-thaw cycles that will weaken a pavement over time. Freeze-thaw cycles can result in significant thaw weakening, a problem exacerbated by traffic loads.<sup>7,13</sup>

Crack sealing only provides short-term protection, however. Baguhn observed, "There's quite a few roads where you crack seal them and then, two or three years later, it cracks again and you have to reseal it," says Baguhn about the county's rotating maintenance schedule.

Crack sealing can only preserve a road so long. Vos observed, "I believe there's a point where the road is too far gone for crack sealing." Attempting to crack seal a pavement that is in the state of advanced deterioration would result in rapid loss of the sealant, suggests Vos. For that reason, he says it's important to monitor deterioration.

To preserve roads with crack sealing, Vos perceives the most cost-effective technique is "waiting two years" after paving because "so much [reflective cracking] shows up in the second year...[and then], for a two-inch pavement, waiting till [year] four or five before sealing it again".

"[Before I got to the DOT]," Vos observed, "a lot of roads weren't crack sealed, and the deterioration that happened on them was a lot quicker than the roads that were crack sealed," observed Vos. He explains that the DOT will establish a maintenance plan for crack sealing "right after paving based on the thickness of the pavement". While maintaining pavements is a race to keep "water and incompressibles out of the pavement", Vos acknowledges one of the biggest drivers for this maintenance schedule is budget.

"We've had a couple roads that came apart on us, and the budgets drive [our maintenance so we juggled some roads around," Baguhn said. "Sometimes we can find money in the budget, like through capital improvement programs, to do something when it's logical."

### Asset Management in the Decision-Making Process

With budget being a big driver for road maintenance, Michigan has adopted and become a nationwide leader in asset management practices. Managing pavement assets in Michigan often includes the use of crack sealing. However, tools to help decide the best circumstances and optimal timing for crack sealing have been limited up until the Minnesota LRRB study was released.

Many Michigan road agencies use the Roadsoft software suite for managing their road assets and determining the best strategy to extend pavement service life. Roadsoft's Extended Service Life (ESL) Calculator models the tangible extension in pavement service life measured in terms of the benefit, or the improvement in pavement condition over time as a result of the treatment. The calculator helps to relate this measurement to a dollar value for road agencies. Modeling can help achieve an extended pavement service life by predicting how much time can be added to pavement service life based on the chosen fix and when that fix is applied.

The ESL Calculator's capabilities were tested in two studies, one in 2014 and the other in 2018, with data from 600 Michigan agencies filtered through different tiers of criteria selection. While these studies demonstrate the usability of the ESL Calculator for determining chip-seal-treatment candidates, these studies could not form conclusions on crack seal treatment because the sensitivity of the PASER system cannot quantify rating changes due to crack seal treatment.<sup>15,16</sup> The Minnesota's Local Road Research Board fills the gap in that knowledge with the products of its 2019 study: two decision trees.

The two decision trees aid in determining when and how to use crack seal treatments for extending pavement service life. The first decision tree can be used with pavement management systems. With this decision tree, the choice for rout-and-seal versus clean-and-seal depend on the variables of "crack severity, pavement type (new vs. overlay), pavement analysis period and design life, traffic level, and crack seal occurrence number" (or the number of times crack sealing has been done to the cracks in question).<sup>1</sup> The second decision tree can be used by maintenance operations. With this decision tree, the choice for rout-and-seal versus clean-and-seal depends on the variables of "crack severity, traffic level, and crack sealing occurrence

number".<sup>1</sup> In both cases, high-severity cracks would suggest use of clean-and-seal while low- to moderate-severity cracks would suggest use of either rout-and-seal or clean-and-seal depending upon the other variables.

Cost-effectiveness of crack sealing, as  
▶ continued on page 12

### RESOURCES

1. Barman, M. 2019. Cost/Benefit Analysis of the Effectiveness of Crack Sealing Techniques. Minnesota Local Road Research Board. Available: <http://www.dot.state.mn.us/research/reports/2019/201926.pdf>.
2. Ksaibati, K.; Carter S. 2006. Evaluating the Effectiveness of Hot-Poured Crack Surfacing Material. University of Wyoming. Available: <https://tinyurl.com/ksaibati-carter-2006>.
3. Vargas-Nordbeck, A.; Jalali, F. 2020. Life-Extending Benefit of Crack Sealing for Pavement Preservation. Auburn University. Available: <https://tinyurl.com/vargasnordbeck-jalali--2020>.
4. Lee, J.; Hastak, M.; Ahn, H. 2015. Crack Sealing and Filling: Best Practices. Indiana DOT & Purdue University. Available: <https://tinyurl.com/lee-hastak-ahn1>.
5. Mousa, M.; Elselfi, M.; Bashar, M.; Zhang, Z.; Gaspard, K. 2018. Field Evaluation and Cost-Effectiveness of Crack Sealing in Flexible and Composite Pavements. Transportation Research Record. Available: <https://tinyurl.com/mousa-et-al>.
6. Rajagopal, A. 2011. Effectiveness of Crack Sealing on Pavement Serviceability and Life. FHWA. Available: <https://tinyurl.com/rajagopal2011>.
7. PennDot LTAP. 2007. Introduction to Crack Sealing. www.cranberrytownship.org. Accessed 9 July 2020. Available: <https://tinyurl.com/penndotltap-2007>.
8. Ram, P.; Peshkin, D. 2007. Cost Effectiveness of the MDOT Preventive Maintenance Program. MDOT. Available: <https://tinyurl.com/michigangov-ram-peshkin>.
9. Mazumder, M.; Kim, H.; Lee, S.; Lee, M. 2017. Cost effectiveness of crack treatment methods: A field study. ScienceDirect. Available: <https://tinyurl.com/mazmuder-et-al>.
10. Peshkin, D. 2004. Optimal Timing of Pavement Preventive Maintenance Treatment Applications. Transportation Research Board. Available: <https://tinyurl.com/peshkin-2004>.
11. Yildirim, Y.; Qatan, A.; Kennedy, T. 2002. Performance Evaluation of Hot and Cold-Pour Crack Sealing Treatments on Asphalt-Surfaced Pavements. Texas Department of Transportation. Available: <https://tinyurl.com/yildirim-et-al-2002>.
12. AsphaltPro Staff. The Best Practices of Crack Sealing. www.theasphaltpro.com. Accessed 10 July 2020. Available: <https://theasphaltpro.com/articles/crack-sealing-best-practices/>.
13. Wrucke, A. 2018. Research Review: Crack Seal Best Practices. NDLTAP. Available: <https://tinyurl.com/wrucke-2018>.
14. Janisch, D.; Sexton, J. 1992. Crack Sealing and Bituminous Pavements in Minnesota. Minnesota Local Road Research Board. Available: <http://dotapp7.dot.state.mn.us/research/pdf/199203.pdf>.
15. Kiefer, J.; Colling, T.; Farrey, S. 2016. Effective Modeling of Extended Service Life For Pavement Treatments. Center for Technology & Training. Available: <https://tinyurl.com/ctt-kiefer-colling-farey-2016>.
16. Center for Technology & Training. Modeling ESL Treatments. ctt.mtu.edu. Accessed 10 July 2020. Available: <http://ctt.mtu.edu/modeling-esl-treatments>.

# Crack Sealing

(continued from Page 11)

► used in the LRRB study, is the benefit-cost ratio of the treatment. In this ratio, the benefit is the performance trend—or what is called the “performance index”, which is the “function of the percent of full-depth adhesive loss and cohesive failures and a percent of partial adhesive and cohesive failures”—of the treatment over time (i.e., age of the seal). This benefit is compared to costs, either initial treatment costs or costs over the life-cycle (or analysis period) of the pavement. Between the two crack sealing methods, the study found that, in terms of initial treatment costs, clean-and-seal achieved a better cost-benefit ratio but, in terms of life-cycle costs, rout-and-seal achieved a better cost-benefit ratio.<sup>1</sup> Because the benefit-cost ratio difference over the life-cycle was small, the study recommends relying on other decision factors in choosing between the two methods.

Performance effectiveness of crack sealing, according to the study, is the benefit area produced by plotting the performance trend, or the PI, over time until the seal reaches its failure. According to the LRRB study, the rout-and-seal sites had a greater average benefit area than the clean-and-seal sites.<sup>1</sup>

Because of the low-cost benefits of well-timed and well-executed crack sealing, it will remain a treatment of choice for many road-owning agencies. “I don’t think I could ever see us turning away from crack sealing,” opined Baghun. “Crack sealing is probably the biggest extender of the [pavement service] life.” ■

For agencies with drinking water, storm water, or waste water utilities...

Get free technical assistance and training for managing and financing projects on water utility systems, land-use planning, recycling, and solid-waste and energy-use reduction programs.

Learn more at [gleic.org](http://gleic.org)



**Great Lakes Environmental Infrastructure Center**  
Environmental Finance Center for EPA Region 5  
Located at Michigan Technological University

# System-wide Safety

Hannah Bershing, *Technical Writing Intern*  
Center for Technology & Training



Photo: CTT Archive

Michigan roadways experience upwards of 300,000 crashes per year. While 69 percent of those crashes involved factors of substance abuse, speeding, and young drivers (under the age of 21 years old), a 2019 report identified intersections as a factor in a significant number—31 percent—of fatal crashes in Michigan. Consequently, this begs the question: Is there an effective way to improve safety at high crash locations or locations with characteristics that are associated with crashes?

Specific locations that experience a higher than average amount of severe crashes via motorists are considered “spot locations”. Pinpointing these specific locations when addressing safety, is commonly known as a “spot” or “crash-based” approach. In identifying spot locations, locations that have experienced many severe crashes are flagged as “hot spots”. Agencies can invest in upgrades to these spot(s) that aim to mitigate or prevent future crashes. Often, these upgrades are costly, however they are targeted and tend to be quite effective once the root causes have been addressed.

While targeting hot spots is an easy way to improve safety, what can a road-owning agency do to advance safety once they have addressed all hot spots on their network? Or, how can a road-owning agency advance safety if their network has low traffic counts and no concentration of crashes at one particular location?

Pamela Blazo, Local Agency Program (LAP) safety engineer for the Michigan Department of Transportation (MDOT), has been working to bring what’s known as a “systemic approach” to safety, within reach of local agencies operating on limited bud-

gets. The U.S. Department of Transportation Federal Highway Administration (FHWA), in their Systemic Safety Project Selection Tool report, calls a systemic approach to safety a “data-driven process”.

The systemic approach identifies high-risk features at a crash site. It links those features to specific crash types, uses those features as search criteria for identifying locations with similar potential risk factors, and addresses those features with low-cost countermeasures applied to the multiple similar sites. By systemically looking at high-risk features linked to specific crash types, a systemic-safety approach aims to stretch project dollars by applying low-cost safety improvements to similar sites across a network. Low-cost systemic countermeasures often provide a smaller safety benefit per location when compared to more expensive, site-specific countermeasures; however, they achieve widespread benefit inexpensively, which makes them competitive to site-specific countermeasures.

Yet, Blazo notes significant benefits can come from systemic safety. “A systemic approach is really helpful for what we call dispersed crash types,” she explained. “Most significantly, what we’re seeing in the state of Michigan right now with regard to facilities, is lane departure crashes.” A lane departure crash is when a driver leaves their lane and either gets in a head-on crash, sideswipe crash, or runs off a road. “Those rarely happen in the same location twice; they’re often dispersed throughout an entire county or city.”

A distinct difference exists between “systemic” safety and “systematic” safety. While a systemic approach applies “countermeasures

at locations with greatest risk”, a systematic approach implements countermeasures at all locations systematically or system-wide (FHWA). Since a systematic approach improves all locations, it costs more but does not require prioritization of locations as a systemic approach does (FHWA). It is important to note that the conventional definitions of systemic and systematic are different: Systemic is a system-wide existence or occurrence whereas systematic is an intentional or methodical existence or occurrence or a planned process. When those terms are applied to road-network safety, the definitions flip, and systemic becomes the intentional application of countermeasures based on analyses whereas systematic becomes the system-wide application of countermeasures at all defined locations.

Lance Malburg, county highway engineer for Dickinson County Road Commission (CRC), called systemic safety a “proven technique that [MDOT] knows works”. He’s worked on two systemic safety projects on Dickinson County roads, addressing areas with “a lot of curves that aren’t signed”. Using a systemic safety approach, Malburg said, “We can go out and fix all of the same [issue]...applying [the proven safety technique] to multiple locations.”

For the last several years, James Wyniemko the county highway engineer for Gladwin CRC says that Gladwin CRC has been participating in the MDOT safety program. “We applied for a county-wide upgrade of warning signs and, after that, we piggybacked on stop sign treatments,” shared Wyniemko. “We are looking forward to other projects that go along with that [systemic safety] thought process.”

Although Malburg and Wyniemko have been using a systemic approach within their counties to improve safety, Wyniemko acknowledges that it’s not the exclusive option for improving safety. “You could probably argue about applying safety upgrades through the whole system versus just the areas associated with a problem,” he explained. “Certainly, there can be a need to treat a particular spot since every location is different, and unique options could be explored for that.”

But, addressing the problems that contributed to the crashes either at specific spots or across network-wide features requires some level of analysis. “[You can look] for spot locations that exhibit crash history,” explained Blazo. “Or, you can look at risk factors

related to a specific facility type...and then look at other locations that are very similar and treat all of those similar locations.” Both approaches have advantages and disadvantages, and should be considered individually and/or in conjunction with one another for best addressing network safety.

Although a systemic approach seeks to implement low-cost countermeasures across the entire network, incorporating safety measures systemically can still present as cost prohibitive. The FHWA’s Systemic Safety Project Selection Tool has a funding framework suggesting that systemic projects are simply a part of a multi-faceted approach to safety, an approach that also includes a crash-based approach (FHWA). To determine which approach to take, the selection tool suggests assessing the number of high-crash locations, the basis of the performance measure (i.e., either total crashes or severe crashes), whether crashes are overrepresented in urban or rural areas, crash types (e.g., lane departure, head-on, right angle, pedestrian), and priority locations (e.g., signalized intersections, un-signalized intersections, horizontal curves) (FHWA).

Nonetheless, while the selection tool presents a framework for integrating systemic safety in almost any agency circumstance, a follow-up study found that the upfront costs to implement crash-based and systemic-based safety improvements are about the same. That’s because crash-based safety improvements generally have higher unit costs with units isolated at hot spots while systemic-based improvements have lower unit costs with units spread across the entire road network. These costs are coupled with a higher effectiveness attained with crash-based improvements and a lower effectiveness attained with systemic-based improvements.

It’s hard for local agencies on limited budgets to justify systemic safety improvements especially at sites with little or no crash history, acknowledged researchers Frank Gross, Tim Harmon, Geni Bahar, and Kara Peach in their FHWA report Reliability of Safety Management Methods: Systemic Safety Programs. Since a crash-based and a systemic approach have similar upfront costs, the researchers compared the effectiveness and the costs of crash-based projects (including adding left turn lanes, adding high-friction surface treatment, reconfiguring intersections, reducing intersection skew and adding left turn lanes, using Road Diet with and without resurfacing, and adding roundabouts) and systemic-based

projects (including installing cable median barriers, adding centerline and shoulder rumble strips, adding ramp curve signage, adding curve warning signage, and making low-cost intersection improvements like signals and stops). They found that a crash-based approach yielded an average benefit-cost ratio of 23.0 while a systemic-based approach yielded 70.0.

To balance the high cost of projects more effectively, variations on the traditional systemic-based approach as presented in the SSPST are surfacing as viable options: the benefit-cost threshold approach, which balances crash-based and systemic-based projects to achieve a desired minimum benefit-cost ratio, and the hybrid systemic- and crash-based approach, which combines crash-based and systemic-based methods for selecting candidate locations.

Michigan agencies have a valuable funding opportunity available to them each year. An annual Call for Projects gives agencies the opportunity to apply for federal funds for a subsequent calendar year for those projects that include safety improvements. Generally, applications are due in late spring. Funding is divided into three categories:

1. High-risk Rural Roads: This category awards a maximum of \$600,000 per project. Projects receive 90% funding with a 10% local match. Eligible locations have had a serious injury or fatality within the past five years.
2. General Highway Safety Improvement Program (HSIP): This category awards a maximum of \$600,000 per project. Eligible projects are systemic or spot projects with any upgrade that improves safety. The application requires crash reports, a cost/benefit analysis, and a time of return.
3. Streamlined Systemic: This category awards a maximum of \$200,000 per project. Eligible projects must be identified by systemic safety data and insights. Eligible work types are horizontal curve signing, center-line and edge-line rumble strips, edge-line pavement marking, dual stop/stop-ahead signing, signal backplates, and countdown pedestrian signals. The application does not require submittal of crash reports or a time of return.

Each call ranks applications in terms of the project’s impact on safety and its economic benefit. For more information, visit: <https://tinyurl.com/michigangov-safety>. ■

# Note Taking: Strategies for the Digital World

Laura Bufanda, *Front Office Intern*  
Victoria Sage, *Technical Writer*  
Center for Technology & Training

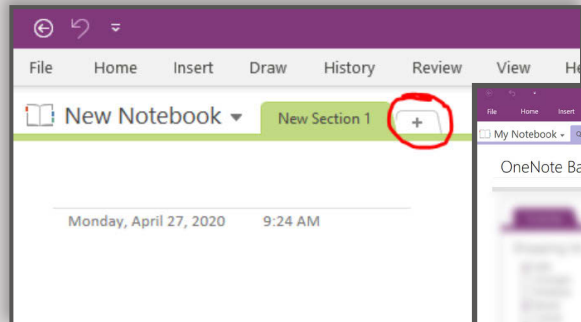
Have you ever come across new knowledge or insight on a topic that you thought you would never forget, only to find you can't recall a thing about it a few days later? Have you ever left a conference, excited to implement a new idea but, within a few days, all the notes and handouts you acquired have become victims to the ever-deepening paper pile on your desk? Or, even with the best organization of your notes and handouts, has storage space become a problem for you?

Our notes document for us what transpired at meetings, what was seen or decided on a project, or what we learned at a conference. With the recent and ongoing flux between on-site and remote office environments, the ability to share notes and collaborate has taken on new significance. Instead of paper and pen, note-taking apps like Microsoft OneNote and Evernote allow us to document meetings, projects, and conference presentations, and more quickly and easily recall them for future use.

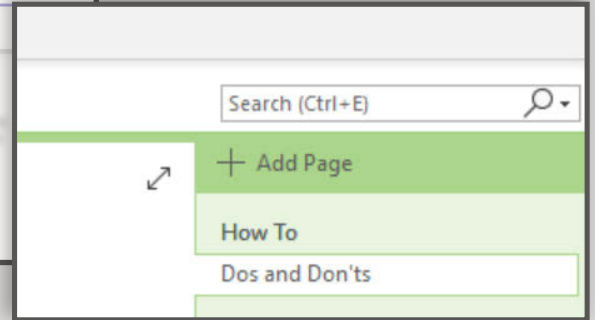
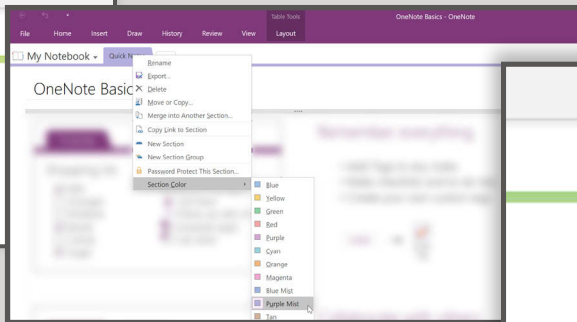
Digital note-taking apps allow for organization of notes and handouts through a robust tabbing structure and multi-page entries. Surpassing complex filing systems containing numerous multi-page documents is digital note-taking apps' wide-ranging abilities: to take notes and to search through notes using keyword searches, to link to local files and online references, to insert documents and images within the notes, and to share or export notes for collaborating with others.

Most Windows users have the Microsoft Office Suite, which includes OneNote. This digital note-taking app is also available as a free, stand-alone app. Here's a few ways OneNote can help you take your notes to another level:

## Creating and Organizing Sections and Pages



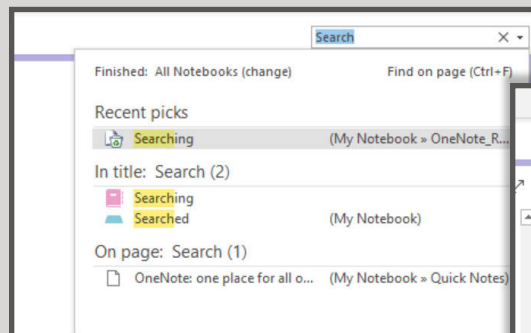
▼ Tabs can be organized by color and renamed. Color and rename options are in the right-click dropdown menu accessed through the tab, and the rename option can be done by double-clicking the tab.



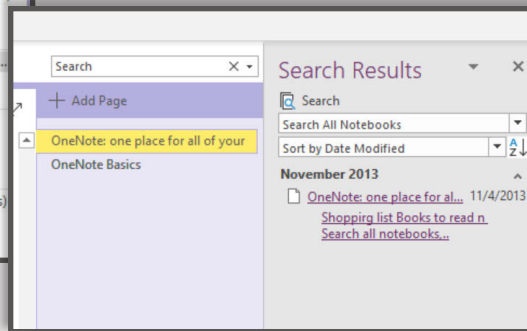
▲ OneNote notebooks consist of tabbed sections and pages, much like hardcopy folders and files. To create a section, select the + tab in the notebook's tab bar (located to the right of the first tab, *New Section 1*).

▲ Pages are the spaces for note-taking. To add a page within a tab, select + **Add Page** in the *Pages* pane or select **New Page** from the right-click dropdown menu accessed through the *Pages* pane. Rename the page by typing in the title field on the page itself or by using **Rename** in the right-click dropdown menu accessed through the page.

## Searching Notebooks



▲ Notebooks can be searched quickly using OneNotes built-in search tool. Search by entering a keyword to search in the *Search* box, above the *Pages* pane. OneNote will search through all notebooks for keyword matches. Matches will be listed under *Recent picks*, *In title: Search*, or *On page: Search*.



▲ Search results can be narrowed from all notebooks to particular notebooks using the **Search All Notebooks** dropdown menu. Results can be sorted by section, title, or date modified using the **Sort by Date Modified** dropdown.

## Tips & Tricks

- For more advanced organization, pages can contain subpages. The **Make Subpage** option is available in the right-click dropdown menu accessed by clicking on the desired main page in the *Pages* pane.
- Re-organization is possible by moving sections or pages. The **Move or Copy** option is in the right-click dropdown menu accessed through the desired location. Or, moving sections or pages can be done using a drag-and drop technique in the *Notebook* pane.

Layout by Sarah Lindbeck, *Technical Writing Intern* — CTT

The Bridge is published quarterly by the Center for Technology & Training (CTT) through Michigan's Local Technical Assistance Program at Michigan Technological University. Subscriptions are free of charge. To request a subscription, contact the CTT.

## Michigan's Local Technical Assistance Program

Center for Technology & Training  
Michigan Technological University  
309 Dillman Hall  
1400 Townsend Dr.  
Houghton, MI 49931-1295

Telephone ..... 906-487-2102  
Fax ..... 906-487-3409  
E-mail ..... CTT@mtu.edu  
Website ..... MichiganLTAP.org

© Copyright 2019 Michigan Technological University. To obtain permission to reprint any articles or graphics from The Bridge, please contact the CTT.

The Bridge is printed with soy-based ink on recycled, acid-free paper (50% recycled, 10% post-consumer waste). 4,000 copies mailed this edition.

## Michigan LTAP Staff

### Administration

Tim Colling, PhD, PE ..... Director  
Christine Codere ..... Sr. Project Manager, Training & Operations  
Cynthia Elder ..... Workshop Coordinator  
Allison Berryman ..... Software Support Specialist/ Financial Assistant

### Writing

Victoria Sage, MS ..... Editor, Technical Writer  
Sarah Lindbeck ..... Technical Writing Intern  
Hannah Bershing ..... Technical Writing Intern  
Thomas Page ..... Technical Writing Intern  
Dean Lahti ..... Technical Writing Intern  
Grace TenBrock ..... Engineering Intern

### Engineering

Chris Gilbertson, PhD, PE ..... Associate Director  
Pete Torola, PE ..... Research Engineer II  
Andy Manty, PE ..... Research Engineer  
Zack Fredin, PE ..... Research Engineer  
Peter Meingast ..... Research Engineer

### 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.

### Federal Highway Administration

Kurt E. Zachary, PE 517-702-1832  
Local Program Engineer, FHWA

### Michigan Department of Transportation

Bruce Kadzban, PE 517-335-2229  
Local Agency Programs, MDOT

### County Road Association of Michigan

Larry W. Brown, PE 616-813-5538 lbrown@alleganroads.org  
Allegan County Road Commission

### Sponsored by:

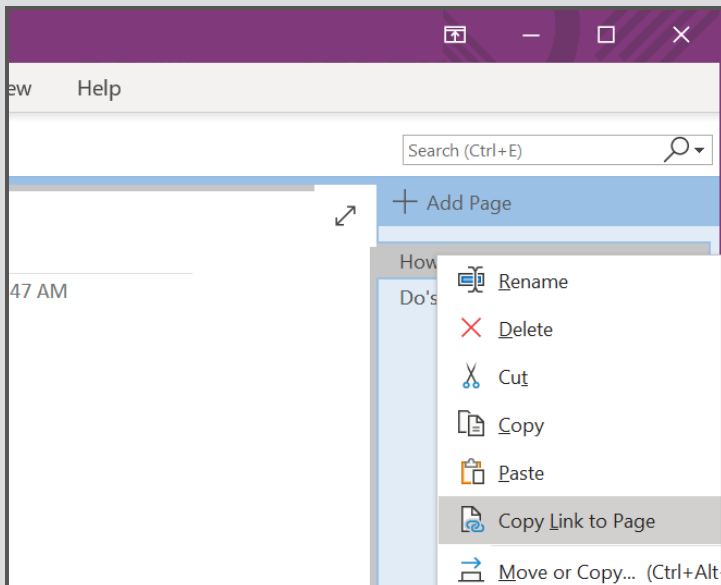


U.S. Department of Transportation  
Federal Highway Administration

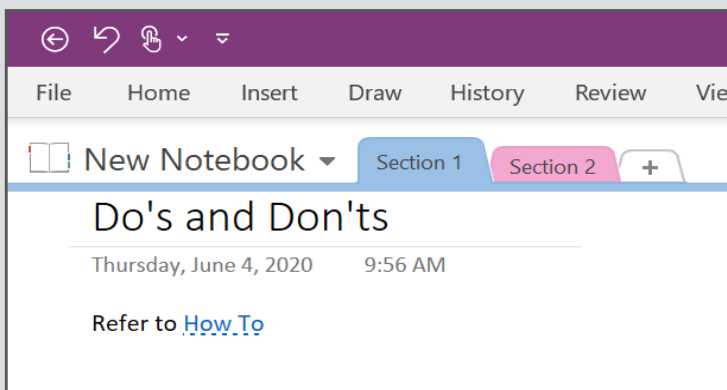


Michigan Technological University  
Civil and Environmental  
Engineering

## Linking Content



▲ One significant advantage to using the OneNote digital note-taking app versus a hardcopy system is linking digital files, like those received through e-mail or generated from online sources, into notes. Digital files can be linked to a notes page by right-clicking on a notebook, section, page, or paragraph and selecting **Copy Link to [element type]** from the dropdown menu.



▲ Linked files can be placed anywhere on the page by selecting the desired place for the link and pasting using the right-click technique to access the dropdown menu with the **Paste** option or using **Ctrl + V** on the keyboard. The linked file will be indicated in blue.

## Tips & Tricks

- Instead of a locked file cabinet, OneNote allows for password-protected sections. The **New Password** option is in the **Review** ribbon **Password** group. Only users with the password can access the section.



Michigan's  
Local Technical  
Assistance Program

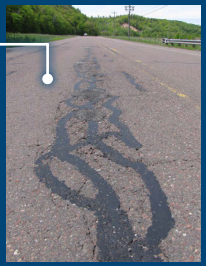
The Center for Technology & Training (CTT) is a part of the Department of Civil & Environmental Engineering at Michigan Technological University in Houghton, Michigan. The mission of the CTT is to develop technology and software, coordinate training and conduct research to support the agencies that manage 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 [ctt.mtu.edu](http://ctt.mtu.edu).

# The Bridge

Bridging the gap between research & practice since 1986

Vol. 33, No. 1 – Summer 2020

- ▶ Crack Sealing the Way to a Longer Pavement Service Life
- ▶ The Idea to Innovate: Michigan LTAP Great Ideas Challenge
- ▶ Flexible Financing for Small Communities
- ▶ Phil Strong: Improving Gogebic County Roads by 'Going Together'
- ▶ TAMC Adjusting to the Times
- ▶ System-wide Safety
- ▶ What Can OneNote Do for Me?



## Michigan's Local Technical Assistance Program

Michigan Technological University  
309 Dillman Hall  
1400 Townsend Drive  
Houghton, MI 49931-1295  
906-487-2102

Non-Profit Organization  
U.S. POSTAGE PAID  
Permit No. 11  
Houghton, Michigan  
49931

## Upcoming Events

REGISTER & MORE INFORMATION AT [ctt.mtu.edu/training](http://ctt.mtu.edu/training)

\* See page 2 for more information about on-site and online events

### 2020 Bridge Load Rating Webinar & Workshop Series

*Spring: April 21, May 12, May 20 (workshop), June 2, June 23*  
*Fall: August 27, September 10, September 16 (workshop), October 1, October 22*

### 2020 Compliance Plan Training

*webinar: April 16; June 24; September 1*

### 2020 Pavement Asset Management Plan Training

*webinar: May 19; remote workshop: June 1-5*  
*workshop: August 25 – remote*

### 2020 Bridge Asset Management Webinar & Workshop Series

*webinars 1 & 2: February 11 & 13; April 14 & 16*  
*workshop: Feb 21 – Baraga; Apr 21-24 – remote; August 24, 26-28 – remote*

### 2020 Culvert Asset Management Training

*Culvert Data Collection using Roadsoft webinar: September 17*  
*Culvert Condition Evaluation webinar: September 24*

### Mark Your Calendar: 2020 Winter Operations' Conference

*October 13-15 – Virtual conference (see What's Going to Happen, p. 2)*

### Mark Your Calendar: 2021 County Engineers' Workshop

*February 9-11 – Bellaire (see What's Going to Happen, p. 2)*

### Mark Your Calendar: 2021 Michigan Bridge Week

*February 16-18 – Ypsilanti (see What's Going to Happen, p. 2)*

### Mark Your Calendar: 2021 Highway Maintenance Conference

*WORKSHOP: April 27 | CONFERENCE: April 28 – Bellaire (see p. 2)*

# Engineering tech assist

## We're here to help you:

Tim Colling, PhD, PE, traffic safety & asset management • Chris Gilbertson, PhD, PE, bridges/structures • Pete Torola, PE, paved & unpaved road design, construction, and maintenance • Andy Manty, PE, paved & unpaved road design, construction, and maintenance • Zack Fredin, PE, bridges/structures

Learn more at [ctt.mtu.edu](http://ctt.mtu.edu)  
or contact [ctt@mtu.edu](mailto:ctt@mtu.edu)

