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The Bridge

A quarterly newsletter from Michigan's Local Technical Assistance Program

In response to PA 175 of 2015, Michigan has now implemented a new pavement warranty program for its local road-owning agencies. Here's what that means for your agency.

Wondering about Warranties?

Michigan's New Local Agency Pavement Warranty Program

John Velat, Director
Center for Rural and Tribal Resilience

Inside

Michigan's Local Technical Assistance Program

While many agencies may have heard of warranties for paving projects, agencies' lack of information on and experience with pavement warranties may have limited or precluded their use of these warranties. Local-road-agency officials and managers also may not know how to explain the benefits and drawbacks of pavement warranties to their constituents, so they may hesitate to introduce warranties as an option on new projects. This unfamiliarity and uncertainty could lead to lost opportunities for higher constituent satisfaction or more predictable maintenance costs for many local road-owning agencies that might otherwise benefit from pavement warranties.

In response to Public Act (PA) 175 of 2015 (MCL 247.662, 247.663), Michigan now has a statewide mandate requiring local road-owning agencies to consider pavement warranties on large paving projects meeting certain criteria and providing a framework for pavement warranty use on any paving project.

Although this legislation provides a framework for adopting pavement warranties, many of Michigan's local road-owning agencies will still face the challenge of "trying to determine [whether] a warranty is going to be advantageous for [them] on a particular project...[and whether a warranty] is the right thing for them to do", according to Ray Roberts, a Marquette County Road commissioner and member of an advisory panel recently established to implement training for the Michigan Local Agency Pavement Warranty Program.

Following the passage of PA 175, representatives from the County Road Association (CRA) of Michigan, Michigan Municipal League (MML), Michigan Department of Transportation, and the Federal Highway Administration came together to form the Michigan Local Agency Pavement Warranty Program task force. This task force defined the program's guidelines and procedures for compliance with the legislation that would apply to all Michigan local-road-owning agencies. The task force passed development of the program's training on to Michigan's Local Agency Pavement Warranty Advisory Panel, comprised entirely of CRA of Michigan members—including Roberts.

To help introduce Michigan's local road-owning agencies to the new program, the advisory panel developed educational and marketing materials that explain the program and provide practical examples. The advisory panel, with the help of the Michigan Local Technical Assistance Program (LTAP) at the Center for Technology & Training, developed and delivered educational materials (see http://michiganltap.org/pavement-warranties) and will continue to provide training and technical assistance to local agencies.

What's Required?

The law and related policies direct all local road-owning agencies to participate in the Michigan Local Agency Pavement Warranty Program, but participation in the program does not mean that every paving project must have a warranty. Participation means that every local road-owning agency's jurisdiction must adopt a resolution indicating that it will *consider* pavement warranties and participate in the program. Agencies should also implement policies related to this resolution

▸ Warranties, page 10

Letter from the Editor

Strange that a *Summer/Fall* issue should be coming out in November, isn't it? Well, dear readers, here is a brief tale of a lesson we were all reminded of here at the Michigan Local Technical Assistance Program (LTAP) this past summer:

The 32.3 issue of *The Bridge* newsletter was shaping up quite nicely. Some of the engineers on staff had already reviewed articles, and the articles were at the point when they could be prepared to send to sources for their approval to print. The layout was mostly done. Meeting a late-summer publication deadline seemed promising.

One afternoon, one of our office rooms clocked in at 90+ degrees Fahrenheit due to a problem with the room's thermal regulating unit. We opened the windows and managed to cool down the room somewhat. But, when I reached over to use my tablet PC, the screen was frozen and entirely unresponsive. Ultimately, the tablet PC housing the most recent renditions of the 32.3 issue of *The Bridge* newsletter had an internal battery that was overheating and swelling, on its way to bursting someday, and—to make the situation even more interesting—the machine had been inexplicably defying our office's backup system since 2017. It ended up being a total loss, and the 32.3 issue was unrecoverable. So, these pages in front of you bring back to life and (I hope!) improve upon the lost issue of *The Bridge*.

These pages will introduce you to the new Michigan pavement warranty program. Public Act 175 of 2015 required Michigan's road-owning agencies to consider warranties on all projects with $2 million or more in paving items and with state or federal funding. You will learn about the new program, what the legislation means in terms of your various paving projects, and where you can find resources on pavement warranties.

You will also meet Stuart "Mike" McTiver in this issue. While some of you might know him as "Stuart" and some as "Mike", he is one—and the same—Stuart "Mike" McTiver who is the new engineer-manager of Luce County Road Commission. You will find out what he has been doing on Luce County roads upon filling the shoes of recently-retired Stan Ronquist.

This issue also addresses a problem that many agencies face on roads in rural areas: beavers building dams around or inside culverts. You will garner strategies to help thwart these penultimate little "engineers" and protect your culverts and roads from their dam-building efforts. And, along the way, you will learn some surprising facts about the world's second largest rodent (second only to the capybara).

Other valuable resources contained within these pages are synopses of asset management trainings that are available through the Michigan Transportation Asset Management Council and the CTT/Michigan LTAP. And, there is information about the *Roadsoft Roundup*, a newsletter facilitating ongoing technical support for those who use Roadsoft for their asset management data collection, storage, and analysis.

Finally, this issue will show how a state agency and a local agency are implementing weather-responsive management strategies, a focus area of the Federal Highway Administration's Every Day Counts round five.

What that summertime computer-meltdown tragedy reminded us is that one should always makes sure to store 3 copies of your data, on 2 types of storage media, and 1 copy should be off site. That's called the 3-2-1 rule.* Not only do large external backup drives and tiny little USB memory sticks or cards offer a digital data backup solution, but online Cloud-based products can serve as an extra layer or protection (for example, the LTAP has a business version of Google that allows us to save data to the Google Drive).

I would like to thank you for your patience for *The Bridge* 32.3. We will likely meet again very soon in *The Bridge 32.4*!

Victoria

Photo: CTT Archive

** See https://guides.library.upenn.edu/datamgmt/storage*

Photo: CTT Archive; TOC photo by Peter Losch from Pixabay

Out-engineering Nature's Engineers

How to Prevent Beavers from "Improving" Upon Your Culverts

Victoria Sage, Technical Writer
Center for Technology & Training

Have you ever called a rodent "cute"? A quick online search for "cute" rodents unsurprisingly generates several chipmunk results but, mixed in, there are some beaver results. While many could agree with classifying the beaver in that way, road agencies dealing with a beaver's wetland engineering work may see them as anything but "cute".

Surprisingly, the "cute" beaver is rather beastly: the beaver is the largest rodent found in North America and can range on average between 30 and 50 pounds, but sometimes up to 100 pounds[1].

The beaver can manipulate objects well, due to its five-fingered front paws. Its back paws are a different story: the beaver has webbed back feet. The webbing, in combination with a paddle-like tail and a liver that stores oxygen for up to 20 minutes of underwater use [2], makes the beaver a highly-proficient swimmer.

Jimmy Taylor, a supervisory research wildlife biologist and both a project and field station leader for the USDA National Wildlife Research Center, calls the beaver a "semi-aquatic mammal" and says that, despite its amphibious nature, the beaver is "clumsy on land". Because of that clumsiness, Taylor notes that beavers "increase their chance of getting depredated by predators when they're on the land".

To stay safe, beavers commonly architect their environment to suit their needs. They harness the byproducts of their need to gnaw to slow the continuous growth of their sharp incisor teeth by using gnawed-down trees to build dams and lodges. Building dams—with the trees, sticks, and mud—that are impervious to water ultimately floods an area, creating an entirely-new wetland ecosystem that gives them "an escape cover", according to Taylor.

These wetland engineering efforts are rewarded in other ways. Taylor said, "It creates the ability for certain plants on [which they like to forage] to grow."

While many beavers do engage in dam-building, not all do; those that don't, generally find themselves living safe from predators in lakes, ponds, rivers, and streams that have large, natural pools.

To attract beavers, trappers breach dams, creating water flow and water noise, which beavers will work to repair quickly. "I don't know if there has ever been a study that shows how attracted to that movement and sound beavers are," Taylor commented.[3] "But, that's certainly been used by trappers as a way to attract beavers to a trap: just create a notch in a dam to get them to come and repair it."

Engineers who work on road construction or maintenance projects face a challenge in their furry little counterpart. Damming by beavers can block culverts, and destroying dams can require heavy machinery and significant effort. When beavers take their engineering efforts inside culverts, destroy-

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In One County—The Two Names and Many Roles of Stuart "Mike" McTiver

Thomas Page, Technical Writing Intern
Center for Technology & Training

Stuart "Mike" McTiver

Whether you know him as "Stuart" or "Mike", Stuart "Mike" McTiver is the one and same hard-working engineer who's been dedicated to maintaining and improving roads in and around Luce County.

"Mike": Growing Up on a Cattle Ranch in Newberry

McTiver (pronounced Mik-tie-ver), the engineer-manager at the Luce County Road Commission (CRC), grew up just north of Newberry, Michigan. "My dad owns a 500-head cattle ranch there," McTiver shared. Although his given name is "Stuart", McTiver went by "Mike" during his childhood years. He explained, "My mom always wanted a Mike, so that's actually my middle name."

McTiver also remembers having a "love for math" and enjoyed "tinkering with things" in his youth on his father's ranch. Because of those affinities and growing up on a farm, he recalled, "I had aspirations at one time…of working for John Deere engineering new tractors." In 1999, McTiver graduated from the Newberry Area School with honors.

The "Stuart" Years: Michigan Tech and MDOT

McTiver went to Michigan Technological University to pursue his dream of working for John Deere. "When I got to college, my transcripts said 'Stuart' on them and my dorm room at Tech had 'Stuart' on the door, so it grew on me," said McTiver. So, there, he was "Stuart" to his professors and peers as he pursued a degree in mechanical engineering. During his summer semesters at Michigan Tech, McTiver worked for the Michigan Department of Transportation's (MDOT) student co-op programs at the Newberry office. McTiver remarked, "it worked out very well, it was right in my hometown." His co-op experiences led him to earn a second degree in civil engineering in addition to mechanical engineering. "With a little bit of creative thinking, it only [took me] three semesters to pick up the civil engineering degree," he explained.

After graduating in 2006, McTiver applied for positions in both civil and mechanical engineering at rail transportation companies before being offered a position at the same MDOT office in Newberry where he worked as an undergraduate student. "I started out as a design drafting engineer and took on various roles as a bridge inspection engineer," recalled McTiver, who also did some surveying, planning engineering, and permit and utility engineering over his 12 years with MDOT. "The last two years I was the assistant construction engineer."

During his time at MDOT, one of his more memorable projects was the reconstruction of a concrete section of the M-28 highway in Chippewa County. This particular section of the highway dated from the 1940s and was in "pretty rough shape." Ever willing to help out, McTiver assisted wherever he could. "I did everything from the topographic survey to designing the full set of plans for it, and even worked with construction [to answer] any questions," he recalled. The reconstruction project itself was unique in that it was to be rubblized, a process in which the existing concrete is crushed and used as the base structure for the new road. Rubblization is not a common technique in the Upper Peninsula due to longevity concerns, but the location of the project "lent itself well" to the technique with its "good sand and soil" and its being "high and dry".

Part of his duties as the assistant construction engineer also included acting as the local agency support engineer and helping road commissions and other agencies in and around Luce County with their duties through the sharing of his knowledge, expertise, and connections. "I had grown a repertoire with the road commissions in the five counties in the eastern UP," said McTiver. "And, I was quite happy at MDOT."

A Return to "Mike": Luce CRC

"Working at Luce County Road Commission was a goal I had for myself for the long term," McTiver shared. "You have more [responsibility] over all aspects of road building, road construction, and road maintenance." In 2018, Luce CRC's engineer-manager, Stan Ronquist, retired. McTiver applied for the position and was accepted, joining Luce CRC as engineer-manager in June of that year.

With his career shift, his name shifted as well. "When I came back to the county, a lot of the guys there knew me when I was a kid so they knew me as 'Mike'," said McTiver. "They were confused by this 'Stuart', and I wasn't particularly fussy so I went back to 'Mike'."

McTiver's adjustment to the new role was made easier with some knowledge he had already gleaned about the county's road network. "I was appointed for PASER rating for Luce County and all the surrounding counties," he explained. From this activity, McTiver had been able to familiarize himself with Ronquist and Luce County's road network.

But, transitioning from working at a state department to a local agency was still a big change. "It's been quite a challenge to go from having everything—all of the resources—at your fingertips like I had at MDOT to…digging through and learning where [our resources are and] figuring out and working through [problems]," McTiver said. " [I've had] wonderful support from the surrounding counties in learning the process, but it's been an interesting challenge."

In his new role, McTiver has been re-establishing procedures to communicate and cooperate with townships on road projects. "The townships are starting to come back with [revenue sharing for] projects they have interest in, so I'm starting to redevelop our local road program," he explained. Over the last ten years, townships have been less frequently approaching Luce CRC and other local road agencies with their road improvement projects. Townships in Luce County

must pay for 50% of their road improvement projects. With their limited budgets and reduced state revenue-sharing programs, those funds are often spent elsewhere first.

Despite this, McTiver and some townships are pushing ahead. "We have one township that's interested in putting in a hard surface so, in a time that we're turning a lot of roads to gravel because there's not a lot of funding, [we're getting] bids out to contractors to put in a chip seal surface on this small residential road," McTiver continued. The proposed chip seal would cover a road that has 6 to 12 inches of gravel surfacing, which Luce CRC would prep for the contractor. Although chip sealing is usually preformed on existing paved roads, chip-sealed gravel is a low-cost option for low-volume roads.

McTiver's also looking forward to other upcoming projects that his agency will be facing. "I'm anticipating some culvert projects [coming soon]," he said. "For a small county like us, they will certainly be a challenge as far as resources and manpower to do the design and figure out the construction method." Nonetheless, McTiver is facing the challenge of limited resources head on: "You have to be somewhat driven and self-motivated [when working at a road commission] to want to do the best you can with the resources you have…[you have to] have a good, strong background in math, science, and engineering principles but, at the end of the day, a little bit of creativity goes a long way."

When he's done for the day with planning upcoming reconstruction projects, coordinating with townships on maintenance and construction projects, or even taking out the trash, McTiver can be found spending time with his family. He also enjoys pheasant hunting, white-tailed deer rifle hunting, and pike or walleye fishing. "Actually, I have a deer head on the wall here in the office," McTiver noted.

McTiver says that the best part about working for Luce CRC is "the people that I work with, not just at this road commission but at the family of road commissions". He's edified by their "willingness to share their knowledge and the friendships that are made" between the road commissions. McTiver also feels "blessed [by] being able to find a career that I enjoy [while] living in my hometown."

While he may be "Stuart" to some and "Mike" to others, McTiver is combining his knowledge and experiences to use resources creatively to maintain and improve Luce County's road network. For him, it's not just about a job; it's about his hometown. ■

Rubblization project on M-28 near Raco, Michigan. Top: completed project; bottom: rubblization in progress (Photos courtesy of the Michigan Department of Transportation)

Nature's Engineers (continued from page 3)

ing their dam-building engineering work is much more difficult.

A first course of action for road-owning agencies is prevention. The US Forest Service offers a guidance document, *How to Keep Beavers from Plugging Culverts*, for preventing, eliminating, and frightening or discouraging beavers.[4] Taylor co-authored a follow-up document with Russell Singleton, *The Evolution of Flow Devices Used to Reduce Flooding by Beavers: A Review*.[5] This follow-up document provided more insights on the devices listed in the US Forest Service guidance document and focuses on the potential benefits of waterflow devices. To prevent damming, the US Forest Service and Taylor & Singleton say the following:

- **Culvert guards or grills:** mesh or grill designed for the upstream end of the culvert to prevent beavers from building dams inside culverts but, according to Taylor & Singleton, provide the perfect canvas for beaver damming

Culvert guard (Photo: CTT Archive)

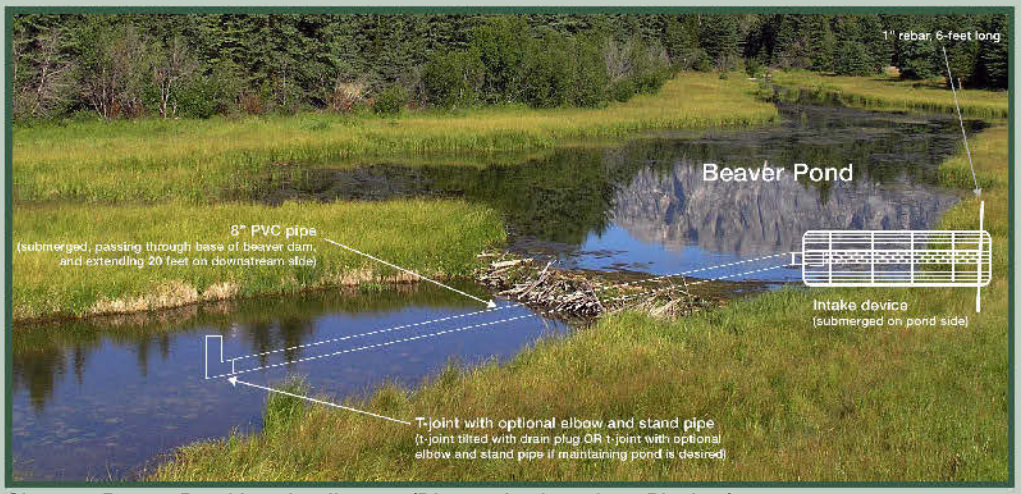
- **Wire-mesh culvert extensions:** heavy-gauge wire-mesh extension added to culvert to make plugging of the culvert more difficult, but Taylor & Singleton note that they have a reported 30% failure rate, contributed to by the lack of sound-dampening properties and the meshwork that collects debris
- **Culvert fences:** fencing placed around an area in front of the culvert along with directing of water flow and its noise away from the culvert to make damming efforts more difficult (requiring larger area) and to reduce cues that spur damming, but have very little filtering effect
- **T-culverts:** culverts constructed from a smaller metal culvert inserted into the side of a large end-capping culvert with the end-capping culvert having a mesh placed over its ends; however, its application is limited to moderate- to normal-flow streams, both ends of the culvert being able to sit in calm water, and having a solid substrate, according to Taylor & Singleton
- **Enlarged cylinders:** wire-mesh extension that is much larger than the culvert to keep beavers at a considerable distance from the culvert
- **Pipe systems:** structures that provide water-level control while keeping the dam in place
  - Three-log drains: three hardwood logs placed together in a triangular arrangement, wrapped in sheet metal, and then inserted perpendicularly through a dam to allow water to continue flowing through the dam (much like flowing through a culvert); a similar concept can be applied to a streambed using stones, logs, tiling, or perforated drain pipe so that, if a beaver builds a dam on top, the dam will remain permeable
  - Flexible pipe or corrugated/perforated tubing: tubing installed through culvert inlets or beaver dams to allow water flow without other cues that encourage damming; Taylor & Singleton note that flexible pipe provides some filtering but only recommend it in conjunction with fencing
- **Waterflow devices:** structures incorporated onto culverts to divert water flow and noise, which cue beavers to build dams
  - Clemson Beaver Pond Levelers: water intake pipe, meshwork, and riser to eliminate or divert water noise although Taylor & Singleton note that these systems still require maintenance
  - Flexible pipe with fencing: according to Taylor & Singleton, a deception-and-exclusion system that provides filtering of water using the flexible pipe and a fenced area around the upstream end of the pipe (or the inlet)

While all of the prevention approaches do require ongoing maintenance to ensure the devices remain effective or to clear away any buildup beavers may have begun on the devices, the waterflow devices require the least maintenance and are generally the most effective.

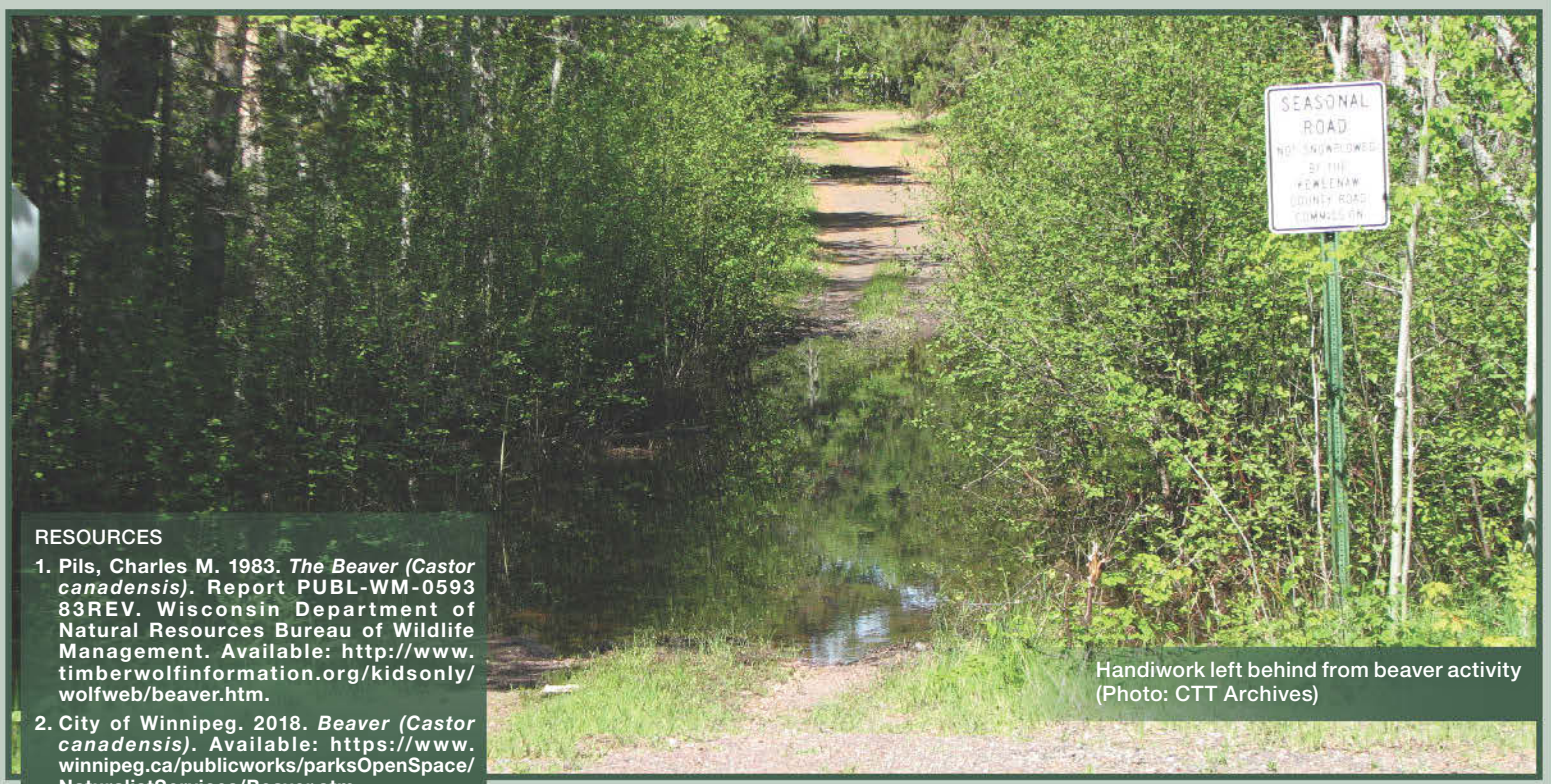
Beyond prevention, hazing can frighten or discourage beavers. Common hazing tactics include sound and motion devices, electric barriers, and repellents. However, beavers quickly become accustomed to these techniques, and electric barriers can be dangerous if not properly maintained. Fencing can be an option but is often cost-prohibitive to cover an area large enough to discourage beavers from migrating around the fence.

Trapping and shooting are the other options for eliminating beavers in an area. Trapping can be used to relocate beavers; however, trapping entire beaver families or colonies can be complicated and, if the area is good habitat, beavers are likely to return. Trapping of animals is subject to state and federal laws and regulations; questions can be addressed to the State Department of Wildlife. Alternatively, shooting can be effective but is also subject to laws and regulations. Taylor & Singleton argue that trapping and shooting can be a part of a comprehensive management plan, which would also include prevention devices like waterflow devices.

The US Forest Service guide *How to Keep Beavers from Plugging Culverts* details these methods (https://www.fs.fed.us/t-d/pubs/htmlpubs/htm05772830/toc.htm). ■



Clemson Beaver Pond Leveler diagram (Diagram's photo from Pixabay)



Handiwork left behind from beaver activity (Photo: CTT Archives)

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Did you know...?

- Beavers have a second set of transparent eyelids, which help them see underwater.[6]
- A beaver's tail is flat, covered with leathery scales and a few coarse hairs, and stores a substantial amount of body fat.[7] While swimming, beavers use their tails as a four-way rudder, being able to turn their tails in four directions.[7,8] On land, beavers use their tails as a counterbalance when carrying heavy logs. When feeling threatened, beavers slap the water with their tail to frighten predators and warn other beavers of potential danger.[7]
- Beavers have organs, called castor sacs, in their rears that produce a substance called castoreum. The substance was highly desired for perfume a few decades ago. Castoreum has a complex scent that many people describe as musky and leathery.[11,12]
- Beavers are vegetarian. Since they do not hibernate, they stockpile wood and aquatic vegetation under water, and swim from their lodges to their stockpiles in the winter when their lakes or ponds freeze over.[9]
- Beavers live in lodges, not dams: lodges are built from sticks and mud in open water whereas dams are built on rivers and streams to create a pond if there isn't any open water available.[9] Alternatively, beavers may also live in bank dens, which are dens excavated into the banks of lakes, rivers, or streams and have underwater entrances similar to lodges.[13]
- The two species of beaver—North American and European—look similar but are genetically incompatible.[6]
- Beavers are socially monogamous: they generally stay with the same colony and same mates for life. However, they pair with new beavers if the colony breaks up or if one of their mates die.[10, 13]
- Beavers often co-habitate with muskrat.[6]

Asset Management Trainings

According to Public Act (PA) 325 of 2018, asset management is "an ongoing process of maintaining, preserving, upgrading, and operating physical assets cost effectively, based on a continuous physical inventory and condition assessment and investment to achieve established performance goals". To care for Michigan's road, bridge, culvert, and traffic signal assets in the most effective and efficient manner, PA 325 requires local agencies with 100 or more certified lane miles to develop an asset management plan that summarizes asset inventory and conditions, performance goals, revenues and expenses, risk of failure, and coordination efforts with other entities or asset owners. This core "compliance plan" should include supporting data, which may consist of asset-specific asset management plans. Local agency staff and their consultants can take advantage of trainings offered through the Michigan LTAP.

PA 325 Overview & TAMC Resources Webinar

In this webinar-based session, the Michigan Transportation Asset Management Council (TAMC) will overview the new asset management-related legislation impacting local road-owning agencies. The TAMC will explain what they have been doing to help local agencies comply with PA 325, overview the new resources to fulfill requirements of the legislation, and answer questions.

Compliance Plan Training Webinar

This webinar will help local agency personnel and/or their consultants to produce a "compliance plan"—a transportation asset management plan that contains information required to comply with PA 325. Participants will learn how to use a Word document template of the compliance plan and the tools to merge their data into the template. Appendixes containing supporting detail about the compliance plan information will be covered in the Bridge Asset Management Training and the Pavement Asset Management Plan Training events (see below).

Bridge Asset Management Training Webinar & Workshop Series

This series consists of two webinars that overview basic and advanced principles of bridge asset management. A hands-on workshop guides agency staff and/or their consultants who manage local agency bridges in turning their inventory and condition data (i.e., data stored in MiBridge and inspection recommendations) and cost estimates into a bridge asset management plan. Participants will learn how a bridge-specific transportation asset management plan can benefit their agency and can serve as an appendix in the compliance plan.

Pavement Asset Management Plan Training

This hands-on workshop guides local agency staff and/or consultants who manage local agency pavement assets in turning their inventory and condition data (i.e., data stored in Roadsoft) and cost estimates into a pavement asset management plan. Participants will learn how a pavement-specific transportation asset management plan can benefit their agency and can serve as an appendix in the compliance plan.

Center for Technology & Training & Michigan's Local Technical Assistance Program on behalf of TAMC Michigan Transportation Asset Management Council

Design by Hannah Bershing with layout assistance by Thomas Page

Bridge Asset Management Training Webinar & Workshop Series

In the first webinar, participants will be introduced to bridge asset management and will learn about the evaluation of bridge condition and its related needs and maintenance operations. The second webinar will cover cost estimating and optimization of bridge preservation actions; it will also show how these knowledge areas come together in a bridge asset management plan. The hands-on workshop provides participants with templates and guides them in customizing the templates with agency-specific asset information. Participants will walk away with the tools to complete their own, unique asset management plan and will start drafting their plan during the workshop.

Intro to Bridge Asset Management Webinars

Webinar 1: Introduction to Bridge Asset Management, Bridge Condition—Evaluating and Assessing Needs, Available Maintenance Options

Webinar 2: Cost Estimating and Optimizing Bridge Preservation Actions

Workshops

8:30 a.m.: Sign-in & continental breakfast
9:00 a.m.: Workshop sessions
Lunch (provided)
2:00 p.m.: Adjourn

Pavement Asset Management Plan Training Workshop

Managing pavement assets is about choosing the best-quality, most cost-effective solutions directed at the right place at the right time. To preserve the integrity of our pavement assets, data alone is not enough: being proactive by having an asset management plan in place for maintenance and corrective solutions helps agencies to realize their asset management goals. The hands-on workshop provides participants with templates and guides them in customizing the templates with agency-specific asset information. Participants will walk away with a draft of their own, unique asset management plan or the tools to complete the plan that they started during the workshop.

Workshops

7:30 a.m.: Sign-in & continental breakfast
8:00 a.m.: Workshop sessions
Lunch (provided)
4:30 p.m.: Adjourn

Visit ctt.mtu.edu/training for more opportunities

Warranties (continued from Page 1)

▶ that guide when they will elect to use warranties on their various paving projects.

Keith Whittington, city engineer/street administrator and capital improvement plan coordinator for the City of Marquette, became involved in using pavement warranties long before PA 175. He recalled, "We were trying to get a quality product without having the burden placed on tax payers to have [a paving project] redone due to it not being placed appropriately the first time."

Even though the law says that agencies must consider pavement warranties for all projects that have $2 million in paving items and receive any amount of state or federal money, a warranty is still not required. An agency may forego warranty use as long as they demonstrate that they considered a warranty and can justify their reasons for not using a warranty on projects in excess of the $2 million threshold. That threshold only applies to paving items and not to the total project cost. Therefore, even very large projects with total costs significantly in excess of $2 million may not have enough paving items to trigger the requirement to consider a pavement warranty. Furthermore, agencies do not have to consider warranties for any projects that do not use state or federal funds.

The legislation's other requirement is reporting-related: road-owning agencies shall report on warranty use during their regular Act 51 reporting process.

What's Covered?

Pavement warranties differ from the common consumer product warranty, in which the manufacturer or the retailer repairs and/or replaces a defective product that a buyer purchases. With regard to pavements, Roberts explained, "The pavement warranty provides additional assurance to the owner that the contractor's workmanship and materials have met specifications and the design life of the pavement."

Roberts continued, "When you go through inspections and get to the end, if there's an issue with the pavement with respect to deficiencies in the pavement surface, then you get into a negotiation with the contractor." When a problem arises, Whittington says that the agency and the contractor need to dialogue—"they discuss back and forth to determine if it was a workmanship problem or a material problem, or just a natural phenomenon." Once an agency and a contractor have agreed on what caused the deficiency and who is responsible, Roberts says that they then determine what type of repair work is needed and what sections of the road met the pre-determined repair and/or replace threshold.

Why Warranty?

Roberts admits that "there's extra work involved with doing a warranty" and that "contractors will sometimes add to the bid [price] because of the warranty...and the life of the warranty period". Extra work often includes more-intensive inspection processes and documentation. Even with the extra work, both Roberts and Whittington think the benefits outweigh the additional efforts and costs.

"We get a much better product," said Whittington, "...and I think the contractors take extra care to do a better job." In fact, the City of Marquette passed a resolution to use warranties on all elements of every paving project.

In some cases, the road-owning agency may have unique requirements for the planning, specification, and construction processes that could lead to the project being unwarrantable. Despite requiring all elements of their paving projects—not just the paving items—to be warrantied, Whittington says the City of Marquette has not encountered difficulty finding contractors to do their projects.

Potential challenges related to warranties include increased up-front costs, regular inspection cycles, reduced bid pools, and mediation or litigation if the contractor does not agree with the agency's evaluation of defects. Some projects may require additional work to ensure the design meets warrantable standards. On smaller projects, the benefits of having a warranty may not be in line with the additional cost for the warranty. Further, only those deficiencies above threshold values that are attributed to materials or labor are covered, and this may lead to constituent confusion about what is covered or not covered. In spite of these challenges, many jurisdictions in many states regularly apply warranties to many different types of work, and continue to do so because they have become satisfied with the overall outcomes.

Local road-owning agencies in Michigan need to consider specific and potential variables related to paving projects that meet PA 175 terms, and need to decide whether using a warranty is a right decision for each of those projects. Although no agency is required to use warranties on any project, every local road-owning agency is required to participate in the Michigan Local Agency Pavement Warranty Program. Understanding of the benefits and costs will help an agency decide whether warranties are right for their different projects and will give an agency the tools to justify their decisions.

The program training, developed by advisory panel and the Michigan LTAP, includes a series of web-based training modules that can help guide an agency in their decision-making process. These modules outline the basic steps for compliance, costs and benefits associated with pavement warranties, and the warranty and inspection processes. Local road-owning agencies can also contact Steve Puuri, CRA/MML engineering specialist, for

Find the video training modules at
michiganltap.org/pavement-warranties

Access guidance documents & resources at
micountyroads.org/
pavementwarranties

assistance on pavement warranties (https://micountyroads.org/people/staff/).

From the City of Marquette's first-hand experience with pavement warranties , Whittington concluded , "I think that [a] warranty can be ...a benefit to agencies and [result in] a better product in the end." ■

How they are different...

Pavement warranties are different:

- A pavement warranty in Michigan covers specific defects for a limited time and with specific remedies. If your new road experiences more cracking than the threshold values allow, you don't get the whole road repaved, but the contractor may be required to repair the defect with crack sealing. Even if the contractor is required to make repairs, they will only be required to repair the sections of road where a predetermined threshold was met.
- Unlike with a consumer product warranty, the road owner does have significant influence and involvement in the planning, specification, and construction processes, and this may lead to an unwarrantable project. A contractor can choose not to bid on a project if the project requires a warranty that the contractor does not wish to honor.
- The number and types of defects which can lead to a warrantable remedy varies by pavement and project type. For example, a simple two-inch hot-mix asphalt overlay may be eligible for crack sealing if three transverse cracks appear in 1/10th of a mile section within one year of the overlay being completed. For a newly constructed or reconstructed concrete pavement, the warrantable threshold would be two transverse cracks in a 1/10th mile section within five years. The types of defects, warrantable thresholds, and approved remedies are specified in the warranty program (see warranty requirements and suggested corrective actions tables, right and continued on page 14).
- Warrantied projects require regular and pre-determined inspection processes, and the documentation is standardized for all Michigan Local Agency Warranty Program projects. If inspections are not completed or documented properly, defects may not be warrantable.

Hot-mix Asphalt Pavements: Warranty Requirements

Condition Parameter	Long-term Warranty (includes new construction/re-construction)		Medium-term Warranty (includes rehabilitation crush & shape & pave)		Short-term Warranty (includes single course & multiple course overlay)	
	Threshold Limits Per Segment (Segment length = 528 ft = 1/10 mile)	Maximum Defective Segments per Driving Lane-mile[c]	Threshold Limits Per Segment (Segment length = 528 ft = 1/10 mile)	Maximum Defective Segments per Driving Lane-mile[c]	Threshold Limits Per Segment (Segment length = 528 ft = 1/10 mile)	Maximum Defective Segments per Driving Lane-mile[c]
Warranty term	5 years		3 years		1 year	
Transverse cracking	3[b]	1	3[b]	2[d]	3[a, b, d]	3[a, d]
Open joints & longitudinal cracking	10% of segment length	1	25% of segment length	2[d]	25% of segment length[a, d]	3[a, d]
De-bonding	5% of segment length	1	5% of segment length	1	5% of segment length	1
Raveling	8% of segment length	1	8% of segment length	1	8% of segment length	1
Flushing	5% of segment length	1	5% of segment length	1	5% of segment length	1
Rutting[e, f, g]	Average rut depth = 3/8 in.	1[e]	Average rut depth = 3/8 in.	1[e]	Average rut depth = 3/8 in.	1[e, f]
Alligator or block cracking	Any amount	0 (none allowed)	Any amount	0 (none allowed)	Any amount	0 (none allowed)

a. For single-course overlay or for multiple-course overlays less than 2" thick, transverse and longitudinal cracking will not be warranty conditions.

b. For segments less that 1/10 mile in length, divide the segment length in feet by 528. Then, multiply the threshold limit shown in the table by this fractional number. Round the result to the nearest whole number for the new threshold limit. In no case can the threshold be less than 1.

c. The maximum allowable number of defective segments per condition for a specific driving lane is determined by multiplying the length of the specific driving lane in miles by the maximum allowable defective segments per mile as shown in the table for that condition. Round all fractional values to the nearest whole number. In no case can the maximum segments per driving lane limit be less than 1.

d. The engineer shall waive this requirement if it is determined that the cracks are reflective cracks from the surface being overlaid.

e. Rut-depth threshold applied to each wheel path individually.

f. For single course overlays constructed on existing rutted pavement without first milling, wedging, or otherwise fixing the existing ruts > 1/2-inch, the engineer shall waive this requirement.

g. The engineer will evaluate for rutting throughout the warranty period. If rutting is found in a 1/10-mile segment, the rutting will be measured in that segment at the POB and every 132 feet thereafter.
The engineer will take rut measurements with a straight, rigid device at least 7-feet long that does not deflect from its own weight or with a wire that remains taut when extended 7 feet. The engineer will place across the pavement, perpendicular to travel with at least one bearing point on either side of a rut. The straightedge is properly located when sliding it along its axis does not change these contact points. The engineer will measure rut depth at the greatest distance from the bottom of the straightedge to the bottom of the paved rut.

h. Any amount of alligator and/or block cracking is unacceptable and must be removed and replaced as directed by the engineer.

Hot-mix Asphalt Pavements: Suggested Corrective Actions

Condition Parameter	Recommended Action
Transverse cracking	Seal or cut/seal (per engineer direction)
Longitudinal cracking	Seal or cut/seal (per engineer direction)
De-bonding	Mill, resurface affected courses
Raveling	Mill, resurface affected courses
Flushing	Mill, resurface affected courses
Rutting	Microsurface or mill/resurface[a]
Alligator or block cracking	Remove & replace[b]

Note: The actual fix approved by the engineer may differ from these suggestions.

a. The engineer's recommended action depends on rut depth.

b. Removal and replacement will be required for any areas exhibiting alligator or block cracking to the extent and depth of the cracking.

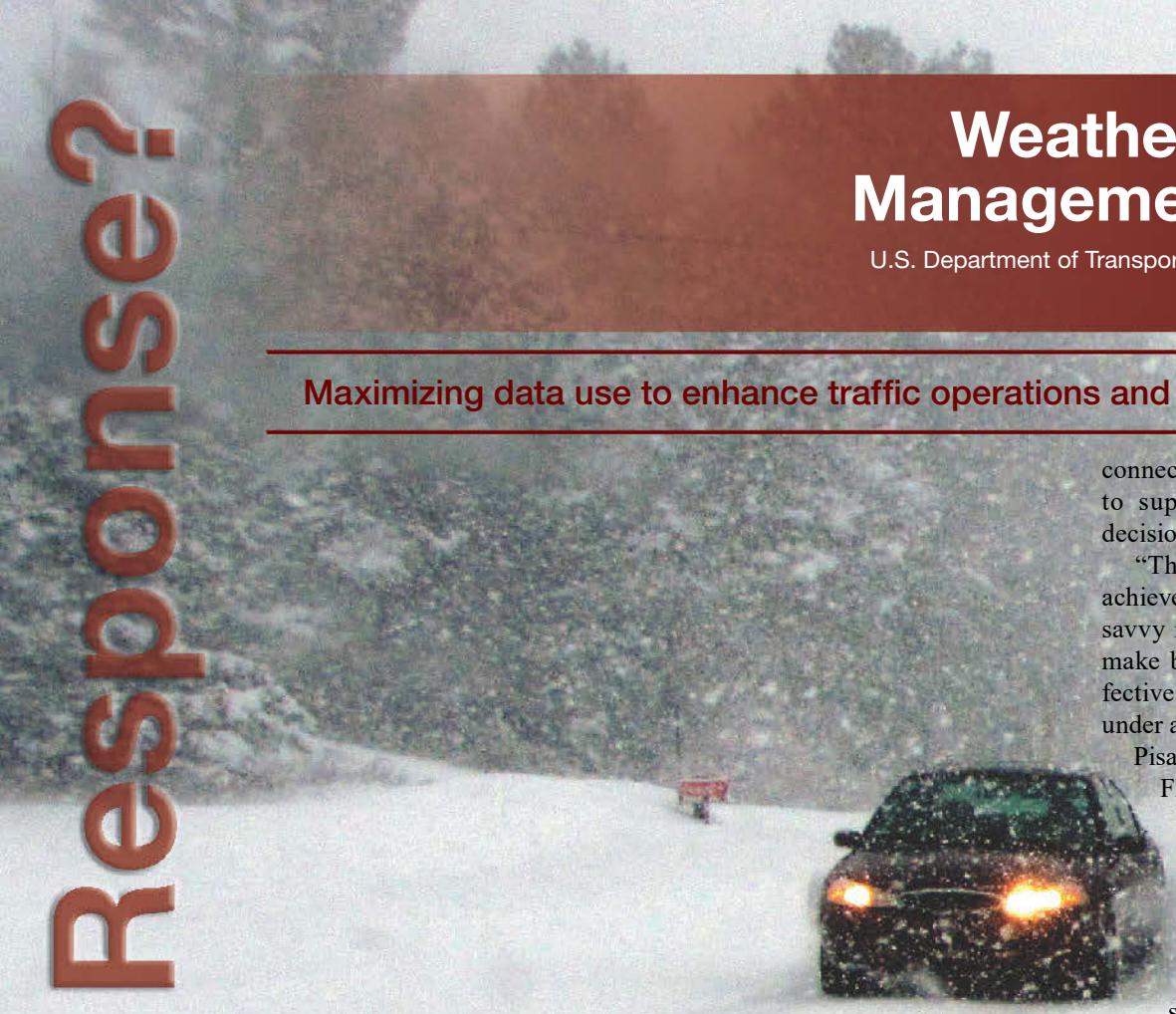
▶ continued on page 14

What's Your Response?

Weather-Responsive Management Strategies

U.S. Department of Transportation *Federal Highway Administration*
In: Innovator January/February 2019

Maximizing data use to enhance traffic operations and maintenance decisions



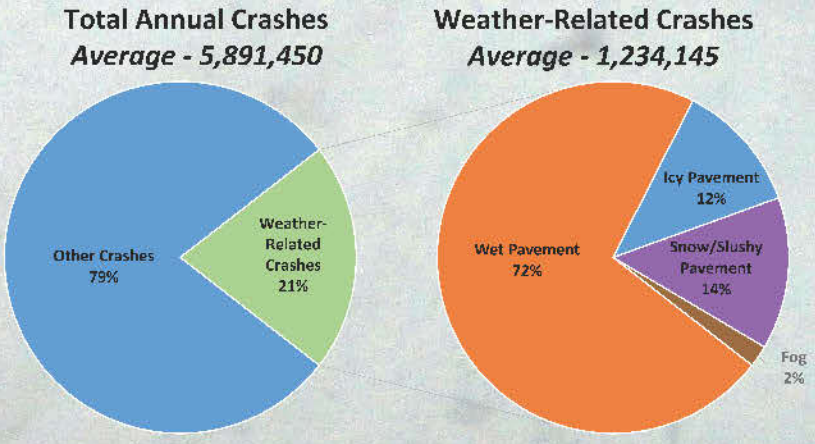
Adverse weather conditions are a factor in one out of five crashes on U.S. roads. Each year, nearly 6,000 people are killed and more than 445,000 are injured in weather-related crashes. Inclement weather also contributes to traffic delays, freight costs, and environmental impacts from road salt use.

In Every Day Counts round five (EDC-5), the Federal Highway Administration is encouraging state and local transportation agencies to adopt weather-responsive management strategies to increase the effectiveness of traffic operations and maintenance when the weather turns bad. The initiative focuses on maximizing the use of mobile and connected-vehicle data about road weather to support operations and maintenance decisions.

"The EDC-5 initiative builds on what we achieved in EDC round four in the weather-savvy roads initiative by looking at how to make better use of data and do a more effective job of managing the highway system under adverse weather conditions," said Paul Pisano, an EDC-5 team leader and head of FHWA's Road Weather and Work Zone Management Team.

The initiative promotes two types of weather-responsive approaches. Traffic management strategies such as motorist advisory systems, signal timing, and variable speed limits can help agencies improve safety and keep traffic and freight moving. Maintenance management strategies such as plowing, debris removal, and water drainage maintenance also enhance safety and mobility, while anti-icing and deicing techniques can reduce the cost and negative environmental effects of chemical use.

"Agencies can choose to implement one of both strategies," said Roemer Alfelor, an EDC-5 team leader and FHWA transportation specialist. "And these strategies apply to all weather conditions, not just winter weather."



Weather-responsive management strategies apply to all weather conditions (Graph from Innovator based on National Highway Traffic Safety Administration crash data)

Background photo: CTT Archives

Michigan's Traveler Information System

One agency using weather-responsive management strategies is the Michigan Department of Transportation (MDOT), an early adopter of integrating mobile operations (IMO) technology to collect data using agency fleet vehicles. MDOT's Weather-Responsive Traveler Information System (Wx-TINFO) brings together environmental and weather-related data from fixed and IMO sources.

The data are used for purposes such as motorist advisories and warning on roadside dynamic message signs and the Mi Drive traveler information website, which has features such as images from snowplow cameras so travelers can track where they are. "We've had a lot of good feedback from the public on that," said Steve Cook, MDOT operations and maintenance engineer.

By providing the traveling public with timely information, Wx-TINFO increases awareness of the safest trip alternatives and helps motorists make better decisions during inclement conditions, Cook said. "It also provides the ability to utilize an alert system to advise maintenance staff of necessary winter maintenance locations, including unsafe pavement and roadway conditions, and enhances response times," he said.

Want to know more about Mi Drive?

Check out *The Bridge* 31.2 on michiganltap.org/TheBridge.

A sidebar to "Road Weather Management—Weather Savvy Roads" highlights MDOT's Mi Drive.

Local-Level Technology Investment

The city of West Des Moines, Iowa, is among the local agencies that invest in technologies for more effective traffic and maintenance management. "We can't grow our infrastructure fast enough to keep up with the growth of traffic on our roadways, so we've had to turn to other methods ad a lot of that is technology," said Brett Hodne, the city's public services director.

West Des Moines uses road weather sensors to collect data such as road friction, pavement and air temperatures, and snow and ice depth, as well as cameras to record road conditions. That enables the city to monitor road conditions and adjust traffic signals based on traffic incidents or slowdowns. "Having the ability to monitor and adjust on the fly has been big," Hodne said.

Hodne cited automated vehicle location (AVL) technology as a "huge step in deicer chemical management for West Des Moines". Tying the city's AVL system into its plows and spreader controllers allowed the city to capture the amount of material spread in real time and develop strategies to help operators apply chemicals more efficiently. This led to a 30 percent reduction in deicer chemical use while maintaining the same level of service on roads. "AVL has been a tremendous tool for us to manage our salt strategy," Hodne said. ■

Did you attend 2017 Michigan Winter Operations Conference?

Brett Hodne provided our keynote address and shared secrets to introducing operational changes and new technologies. Learn more at ctt.mtu.edu/winterops!

Reprinted from Federal Highway Administration: Weather-Responsive Management Strategies. *In:* Innovator, *January/February 2019. U.S. Department of Transportation Federal Highway Administration. Available: https://www.fhwa.dot.gov/innovation/innovator/issue70/3dIssue/.*

Plowing operations on state trunkline (Photo: CTT Archives)

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Contact amanty@mtu.edu for more information.

Warranties (continued from Page 11)

Concrete Pavements: Warranty Requirements

Condition Parameter or Defect	Threshold Limits per Segment (Segment length = 528 feet)	Maximum Defective Segments per Driving Lane-mile[b]
Transverse crack	2[a]	1
Longitudinal crack	5% of segment length	1
Map cracking	10% of segment area	1
Spalling	10% of each slab[c] < 2 slabs	1
Surface scaling	15% of slab area < 1 slab	1
Corner cracking	1	1
Joint sealant failure	10% of joint length[c,d] < 2 slabs	1
Shattered slab	0	0

a. For segments less than 1/10 mile in length, divide the segment length in feet by 528. Then, multiply the threshold limit shown in the table by this fractional number. Round the result to the nearest whole number for the new threshold limit. In no case can the threshold limit be less than 1.

b. The maximum allowable number of defective segments per condition for a specific driving lane is determined by multiplying the length of the specific driving lane in miles by the maximum allowable defective segments per mile as shown in the table for that condition. In no case can the maximum defective segments per driving lane limit be less than 1.

c. Can be non-contiguous. The 10% value applies to total perimeter (four sides) of the slab.

d. Applies to all transverse and longitudinal joints on the perimeter of the slab. Non-contiguous lengths will be summed on a per-slab basis.

Concrete Pavements: Suggested Corrective Actions

Condition Parameter or Defect	Recommended Action[a]
Transverse crack[b]	Retrofit load transfer
Longitudinal crack[b]	Retrofit load transfer
Map cracking	Remove & replace
Spalling	Repair with epoxy or cement mortar[c]
Surface scaling	Diamond grind surface[d]
Corner cracking	Full-depth, tied, concrete patch
Joint sealant failure	Remove & replace seal material[e]
Shattered slab	Full-depth slab replacement[f]

a. If multiple defects are present, the engineer may revise the recommended actions up to and including removal and replacement.

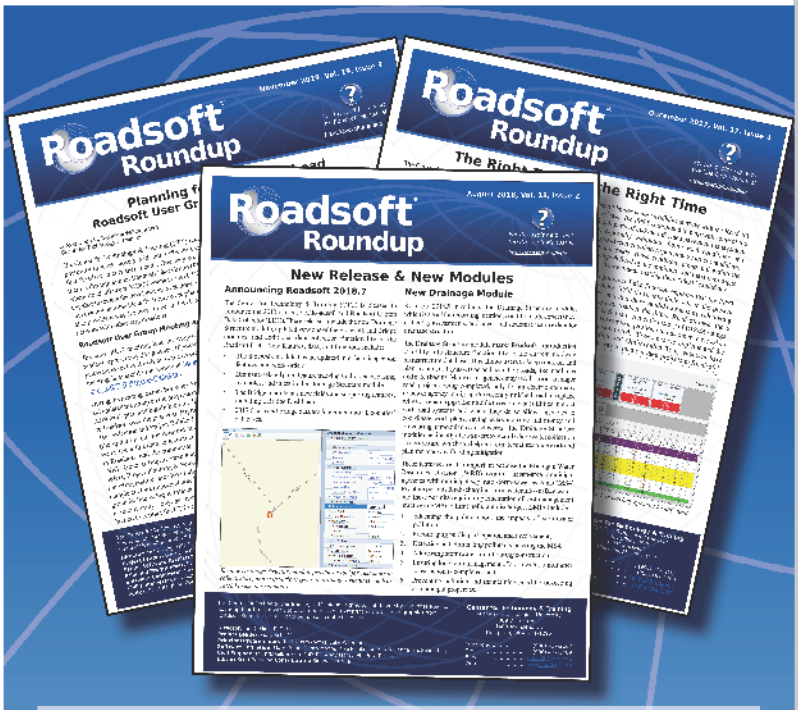
b. The engineer's requested corrective treatment will depend on the crack's location and depth. Full-depth T-cracks require retrofit load transfer (>90% load transfer efficiency) as a minimum. Full-depth/full-length L-cracks require slab removal and replacement if outside influence of lane ties.

c. The engineer's requested repair depends on the area and depth of spall, relying on most current specifications in the MDOT Materials Technology Section, Construction and Technology Division.

d. Diamond grinding applies to entire slab surface area where scaling exists.

e. Replace with existing material type. Neoprene seals are removed and replaced full width.

f. All shattered slabs must be removed and replaced.



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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 www.ctt.mtu.edu.

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.

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