



Vol. 33, No. 4 – Spring 2021

The Bridge



A quarterly newsletter from Michigan's Local Technical Assistance Program

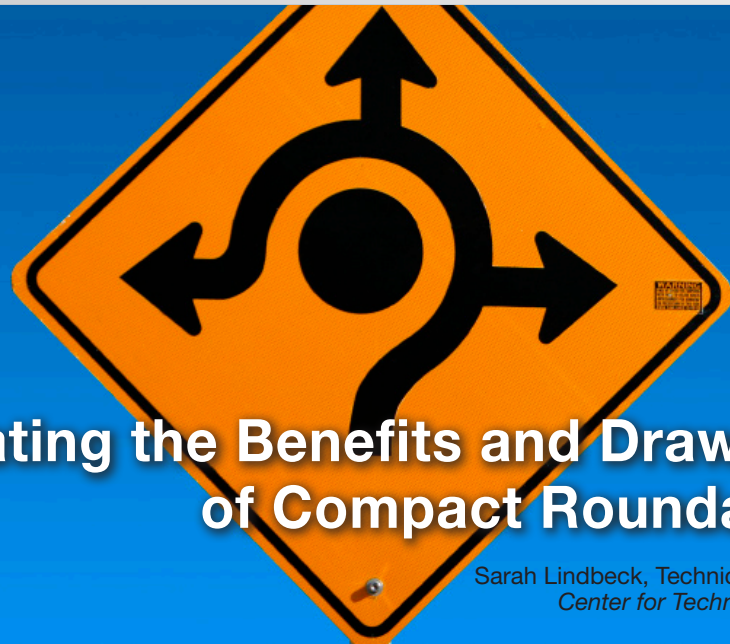


Photo: Shutterstock

Compact roundabouts are attractive due to their lower cost in comparison to traditional roundabouts and their improved safety in comparison to other intersection types.

Navigating the Benefits and Drawbacks of Compact Roundabouts

Sarah Lindbeck, Technical Writing Intern
Center for Technology & Training

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Michigan's Local Technical Assistance Program

People wait with great anticipation for innovation but, when innovation actually comes along, it can be difficult to recognize and adopt for many. Innovations like compact or mini roundabouts require champions to advocate for them in their communities. Mark McCulloch, senior project engineer at Washtenaw County Road Commission (CRC), has been a champion for innovative roundabout solutions in his community with great success.

What is a Compact or Mini Roundabout?

Urban compact or mini roundabouts are similar to traditional roundabouts except the diameter of a compact roundabout is 110 feet or less as opposed to the more extensive 110 to 200 feet of traditional roundabouts. Washtenaw CRC has seven compact roundabouts on their road network, and, according to McCulloch, they're "no different from a traditional size roundabout" for the average vehicle. He explains, "You circle counterclockwise, yield to vehicles on your left until there is a safe gap to enter the intersection, and then exit as you normally would with a larger size roundabout."

Larger vehicles may not be able to navigate around the tighter circle, but compact-roundabout designers planned for that with a fully-traversable, concrete center island that large trucks can use to off-track, or drive up and over part of the center island. The center island is elevated approximately three to four inches with a slope down to the outer edges of the island. Mini roundabouts are smaller and commonly made within an existing intersection.

Compact and mini roundabouts are single-lane

roundabouts intended for use on lower-traffic volume roads. These intersections often have splitter islands between the lanes approaching the intersection. Compact and mini roundabouts are differentiated primarily by size; the inscribed circular diameter of a compact roundabout is between 90 to 110 feet while a mini roundabout is 45 to 90 feet. The terms "compact" and "mini" are used interchangeably by some organizations.

Both roundabout types have pavement markings that commonly include yield lines and there may even be arrows depicting the appropriate flow of traffic around the roundabout. Signs leading up to the intersection are vital, and various road design techniques may be used along the approaching roadway to slow traffic approaching the intersection if it is placed in a high-speed area.

Why Compact Roundabouts and Where?

The primary reasons an agency would choose to build a compact roundabout over a traditional one are the cost and available right-of-way. Jeff Shaw, program manager for intersection safety in the Federal Highway Administration's (FHWA) Office of Safety, estimates that compact roundabouts can be built for approximately \$200,000 to \$400,000 while traditional roundabouts would generally cost at least twice as much.

Building roundabouts with a smaller footprint is extremely cost effective because of how much less time it takes. Compact roundabouts have been built in as little as 48 hours in areas that are able to close the roads in the intersection.

Another way they save time and money is

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Letter from the Editor

“Share your knowledge. It is a way to achieve immortality,” said the Dalai Lama. How is that possible? Senator Marsha Blackburn provides some insight, saying, “Everyone has a transferrable commodity—knowledge. Sharing your unique expertise and making introductions for someone creates a lasting legacy.”

What’s your lasting legacy?

Everyone has some knowledge or expertise that can create a lasting legacy. “In some corner of your life,” pointed out author Kent Nerburn, “you know more about something than anyone else on earth. The true measure of your education is not what you know, but how you share what you know with others.” For me, that expertise is writing and editing. In the past when I have shared my writing or my editorial expertise with others, I have had the opportunity to witness the impact that resulted from sharing my expertise. Friends have thanked me for sending a well-timed letter that made a difference in their day. Colleagues and friends have felt a debt of gratitude when I have provided editorial advice on their written works that has led to publication in academic journals or acceptance to medical school.

By sharing my expertise, I have created a legacy with colleagues and friends and can share in their joy.

This issue of *The Bridge* is about just that: knowledge and sharing that knowledge. We present two articles about other local road-owning agencies’ knowledge. Washtenaw County Road Commission (CRC) and the Federal Highway Administration have shared their insights on mini and compact roundabouts in these pages. They share why they have built or endorse this novel trend in roundabout construction, and about the safety and financial benefits they have experienced with use of mini or compact roundabouts.

Kent CRC and Washtenaw CRC have also shared the safety practices they use for culvert data collection in these pages. These local road-owning agencies have extensive experience collecting culvert data. They have detailed their practices so other local road-owning agencies can share in their knowledge.

We also have Baystate Roads’ discussion on pavement asset management as a pothole-prevention strategy. Accenting this reprint, we have developed a tear-out sheet that you can post and share with agency staff and constituents about pothole formation, maintenance, and reporting.

Finally, in this issue, we give you concrete strategies for sharing knowledge. Many local road-owning agencies have experienced employees who are retiring or changing jobs. Agencies unfortunately may also face situations in which employees are injured and can no longer do their jobs. But, managers and supervisors can use knowledge-transfer strategies to ensure experienced employees are sharing their knowledge with less-experienced employees. We share those strategies in these pages.

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 or virtual events, please share your suggestions with us in our exit polls or event evaluations. Or, share your suggestions with us by e-mail at 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

Now What? Update on CTT Events

Here’s what’s happening to

...County Engineers’ Workshop.

...Michigan Bridge Week.

...Highway Maintenance Conference.

...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 high-quality educational experience in a healthy, safe learning environment.

The CTT will be offering its regularly-scheduled on-site events in an on-site format during the remainder of 2021 and thereafter. However, the CTT is exploring hybrid options to make attendance at some of our on-site events more accessible to those who are unable travel. So, we hope you won’t miss CEW, Bridge Week, Winter Operations Conference, or other CTT events! Follow our events on ctt.mtu.edu/training.

At any time, 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 events must adhere to guidelines of the venue as well as any additional guidelines put forth by the CTT prior to the event. ■

Mark Your Calendar!
February 8-10, 2022

For more information, visit:
ctt.mtu.edu/CEW

MICHIGAN
CEW 2022
County Engineers’ Workshop

Seeing Through the Eye of the Culvert... with Safety

Victoria Sage – Technical Writer
Center for Technology & Training

Culverts. Approximately 196,000 of them underlie Michigan’s local roads alone. Road users drive over them and, many times, barely notice culverts are there. According to 2018 data, the replacement value of culverts owned by Michigan’s local road-owning agencies is \$1.48 billion.¹ At the same time, 33 percent of those culverts are in poor or severe condition.¹

The high value of Michigan’s culvert assets commands that attention be given to the aging and deteriorating nature of its culvert infrastructure. As such, inventory and condition data is increasingly important for managing and maintaining culvert assets. By using their culvert inventory and condition data, Michigan local road-owning agencies can apply asset management principles to their culvert infrastructure, using optimal fixes tailored to each culvert’s design and construction at a time when those fixes will be most cost effective.

Why Gather Culvert Data

Inventory and condition data for transportation assets like roads, bridges, culverts, and traffic signals form the foundation for good asset management practice. 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 continu-

ous physical inventory and condition assessment and investment to achieve established performance goals”.² Local road-owning agencies collect and store asset inventory and condition data in in-house-developed files or databases or in software like Roadsoft. Agencies like Kent County Road Commission (CRC) and Washtenaw CRC have been using this culvert data to track their culvert assets and make data-driven decisions on maintaining these assets.

Later this year, the Michigan Transportation Asset Management Council (TAMC) will be releasing a culvert guidebook to help local road-owning agencies in developing their culvert data collection program. The manual will include a rationale, guidance on how to collect culvert inventory and condition data, and references for where to find further information on equipment and safety for culvert data collection efforts.

Culverts, Bridges, and Storm Sewers: What’s the Difference?

Culverts can be defined as linear drainage conduits underneath a public roadway (not under a driveway), a definition that was used for the Michigan TAMC’s culvert pilot report in 2018.¹ The differentiating factor between culverts and bridges is span length: while the Federal Highway Administration considers “bridges” as those structures having a com-

bined span (if consisting of several openings) of equal to or greater than twenty feet and thus eligible for inclusion in the National Bridge Inventory, culverts have a combined span of less than twenty feet. Unlike storm sewers, culverts are open at both ends and do not include intermediate drainage structures (e.g., manholes, catch basins).

Gathering Data Safely

To gather culvert data requires local-road-owning-agency team members to visit each culvert site, assess the culvert’s inventory features, and inspect its condition. Collecting inventory and condition data may involve inspecting areas that have difficult access, confining spaces, dark areas, and high water.

Local road-owning agencies—like Kent CRC and Washtenaw CRC—are responsible for setting policies and procedures for staff involved in culvert data collection efforts. So, how do local road-owning agencies collect culvert data safely?

Agencies can draw on resources related to bridge and culvert inspection that are available from state and federal agencies to their culvert data collection practices. For example, the American Association of State Highway Transportation Officials’ (AASHTO) *Culvert & Storm Drain System Inspection Guide*³ Chapter 3 outlines inspection

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► procedures and provides safety guidance. The Michigan Department of Transportation's *Michigan Structure Inspection Manual (MiSIM)* Chapter 13 covers bridge inspection safety issues that may be applicable to culverts.⁴ And, the Occupational Health and Safety Administration (OSHA) has guidelines for inspecting confined spaces⁵, areas with high water⁶, and areas near utility lines⁷.

To these resources, local road-owning agencies add their own field experience to determine when and how to apply safety guidance from state and federal agencies to each of their culverts' unique circumstances.

Local Road-owning Agencies Share Tips for Safe Culvert Data Collection

Mike TenBrock, project engineer for Kent CRC, begins by assessing culverts as belonging to one of three groups: "ones you can enter by wading,...ones you can enter by a small boat,...and ones you can't get into and have to look down the barrel".

Sometimes, seasonal or weather-related increases in water levels temporarily prevent inspecting culverts. However, TenBrock said some culverts are always inaccessible: "We don't want our people going into those culverts. It's not worth it,...the benefit is so trivial compared to the risk."

For those culverts, he says Kent CRC relies on other cues to determine culvert condition. "Sometimes you see a little distress [on the roadway]—a classic transverse crack where the culvert lies, that's a key you are

getting movement with the culvert."

Determining whether a culvert is accessible for safe inspection is the first step in a culvert data collection program's safety efforts (see Questions to Ask Yourself, next page, for consideration when determining safe access to a culvert).

When formal guidance on culvert data collection practices is absent, TenBrock bases all his culvert data collection decision making on the "Grace Rule". He explained, "My main rule of thumb in anything we do is: I wouldn't ask any of my people to do what I wouldn't ask my own kids to do for me." Referencing his daughter Grace, TenBrock continued, "It boils down to what we will call the 'Grace Rule'; that's the litmus test we use."

Working Where Spaces Seem Confining

Sometimes culverts can have low clearances between water inside of it and the crown of the culvert or can have relatively narrow widths. In addition, perspective and interior darkness can make both the opening at the opposite end of the culvert and the culvert itself seem smaller than it actually is.

Aaron Berkholz, senior project manager for Washtenaw CRC's Design and Construction section, explained, "A culvert is open at both ends, so they aren't necessarily defined as a confined space; but, there's a certain aspect of it that's confining...there's only the entry and exit at one end or the other."

Berkholz says the Washtenaw CRC

interior inspection process is done near the ends of the culvert. "It's not been our practice to walk the entire length of the culvert," he shared.

For Berkholz, deciding how to collect culvert data safely is a matter of being conscious of the condition and the risk and having the appropriate field experience. The data collection team members should assess a culvert before entering it (see Questions to Ask Yourself, next page, for consideration when determining safe entrance into a culvert).

To that, TenBrock added, "We advise our people, if it looks like you can't easily be retrieved or tended to if you encounter distress in the culvert, then you shouldn't go in there."

Working around Water

Accessing areas around and in the culvert during data collection sometimes necessitates wading through the stream that passes through the culvert. "When you waded into a stream, you have to be thoughtful about the velocity and the depth of the water," reflected Berkholz. "It's amazing, the force of the water."

To guide their culvert data collection practices when working around and in the associated stream, both Berkholz and TenBrock call upon wisdom gained through their fishing experience.

TenBrock shared, "I learned this from trout fishing: if [you multiply] the speed of the water and the depth...and the product of that equation is anything that approaches



Photo: G.T. Archive

Questions to Ask Yourself



Difficult Access¹¹

1. Is a safe inspection possible?
 - ▶ If question 1 is answered YES, then proceed with caution. If question 1 is answered NO, then the culvert should be noted as inaccessible.
2. Is any external equipment needed to access the culvert (e.g., rope and harness)?
 - ▶ If question 2 is answered YES, data collection team members should be appropriately trained on the use of the equipment before proceeding.

Confining Spaces¹¹

1. Is the space enclosed or partly enclosed?
2. Is the space at atmospheric pressure during the occupancy?
3. Is the space designed primarily as a place of work?
 - ▶ If questions 1 and 2 are answered YES and question 3 is answered NO (typical for culverts), then ask:
4. Is the space liable at any time to have an oxygen deficiency or excess?
5. Is the space liable at any time to have an atmosphere that contains potentially harmful levels of contaminants?
6. Is the space liable at any time to cause engulfment?
 - ▶ If question 4, 5, OR 6 is answered YES, then the culvert should be treated as a confined space and:
 - Team members collecting culvert data should have the appropriate confined space training before entering the culvert.
 - Team members collecting culvert data should comply with their agency's confined space policy.

nine, you're going to be swept up off your feet and end up downstream." What TenBrock references is known as the "3x3 rule", a rule based on water that has a depth of 3 feet and is flowing at a velocity of 3 feet per second; when the product of the depth and velocity exceed 9 feet squared (or 0.8 meters squared) per second, a person entering the water is at risk of being swept away.⁸ So, even as little as 1 foot of water can be treacherous if its velocity exceeds 9 feet per second.

Hui, an engineer on Berkholz' team at Washtenaw CRC, is experienced in culvert data collection. "I've had instances where I wore my waders and the water came up to my hips and then, all of a sudden, [I stepped into] a hole and the water went past my waders," he shared.

"Having a survey rod[—something that is relatively indestructible—]helps a lot," recommended Hui. "You can poke and pry and see if the ground is soft before you go into it and can also measure how deep [any water or mud are]"

Berkholz, who has encountered holes himself while fishing, added that it's important to be "thoughtful about the depth of the water you are considering wading into" when collecting culvert data.

In early spring and late fall, temperatures of water passing through culverts can hover around the freezing mark, making hypothermia a potential hazard. Therefore, TenBrock recommends having a warm truck nearby when collecting culvert data and a change of clothes.

Because of the risks involved when working around water or in confining spaces, both Kent CRC and Washtenaw CRC employ a buddy system. "We travel in pairs typically," explained TenBrock. Berkholz added, "We definitely want to employ the buddy system where we need to so we promote our safety."

When the agencies do send out personnel to collect culvert data on solo data collection efforts, they make sure the risks are lower. "If you send people out alone, their threshold for risk should be reduced considerably in terms of entering culverts, walking, wading, that sort of thing," explained TenBrock.

Hui has performed numerous solo culvert data collection efforts. "I always let someone else know I am out [looking at] culverts, [I put it] on my schedule in the calendar [with the] culverts I'm looking at and their locations [and] lengths," he said. "So, there's no question I'm out there and there's no question where I would be if someone needed to look for me."

Hui emphasizes the importance of having

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Clockwise from top left: data collection during the 2018 TAMC culvert data collection pilot study; corrugated metal pipe culvert; concrete culvert during construction in Baraga County (Photos: CTT archive).

► the right personal protective equipment (PPE) and tools—safety vest, work boots, waders, and a survey rod—for these data collection efforts, but more importantly, he takes with him common sense: “I think a lot of it is common sense—if [the stream] is going fast, if it is a strong current, don’t go into it.”

Of Snakes and Ticks and Poisonous Plants

Culvert data collection requires data collection team members to work in and around potentially sharp objects, sloped surfaces with soft soils, a variety of vegetation and insects and animals, and road or highway traffic. Team members also chance working in adverse weather conditions as they work outdoors.

When it comes to collecting data on culverts that potentially have sharp edges, Hui said, “We always have our gloves, we always have something that can prevent us from touching the culvert directly.”

Hui is also careful in approaching the culvert. “I think over time you develop an understanding of how soft or slippery a soil can be, how steep that embankment is leading up to the culvert,” he shared. “We are taught to step sideways as we are going down [hills or the embankment], [so] you can have as much surface area under your foot as possible as you are trying to [go] down something steep, and [to use a] survey rod, some kind of support you can have in your hand.” He has learned this with time and experience collecting culvert data.

That survey rod also comes in handy in snake country, according to TenBrock. “It’s a good idea to walk with a rod...and poke your way through any grass areas you can’t see...and walk with a heavy foot,” he advised. “Rattlesnakes are so camouflaged, you won’t see the snake, but typically they will slither away.” TenBrock shared that others at Kent CRC have encountered Massasauga rattlesnakes in their field work.

Equally as dangerous are ticks with their potential to spread Lyme disease. “At this time of year, we’re starting to get into tick season, so insects are another thing we look out for,” explained Nate Murphy, an engineer on Berkholz’ team at Washtenaw CRC. “Tuck your pants in your socks and do a check afterwards. Ticks are not something to take lightly.”

Berkholz says Washtenaw CRC uses a video during employee orientation to educate

employees on safe practices when it comes to ticks. The agency also provides employees with additional information as necessary as well as tick repellents.

“Should you find a tick on yourself,” said Berkholz, “we have guidance on how to remove it and on things like saving the tick in case you do develop a rash or symptoms.”

In addition to educating employees on ticks, Washtenaw CRC’s orientation includes information on identifying poison ivy and poison oak and what to do if an employee comes into contact with one of these plants.

Safety Begins at the Road

Berkholz, Hui, and Murphy highlight the importance of roadside safety when collecting culvert data. They note their work near the shoulder for culvert data collection is typically brief enough that it doesn’t require a lane closure. The Federal Highway Administration’s *Manual of Uniform Traffic Control Devices*⁹ Part 6 and the Michigan Department of Transportation’s *Michigan Manual of Uniform Traffic Control Devices*¹⁰ Part 6 outline principles and procedures for working on or outside of the shoulder of the road.

Berkholz believes that distracted driving is a big concern when working near live traffic. “There’s a world of distractions, of someone just not being mindful of their driving habit,” he said. “Keep your head on a swivel and be aware of the traffic being present... [and have drivers] know that you are there.”

“Keeping alert,” concurred Murphy, “I think that’s a very important part of being safe in the field.”

Getting Started

“If there’s a [road-owning agency] that hasn’t started looking at their culverts as a safety factor for the motoring public, I think it’s incredibly important that they start this process of identifying...[their culvert] assets,” urged Murphy. “Then, [they should] develop that safety protocol that is necessary for anyone who goes out in the field.”

Berkholz, Hui, and Murphy call out one-on-one training—or shadowing an experienced person who has collected culvert data—as most helpful for learning how to collect culvert inventory and condition data safely.

They say agency training and resources are also helpful. Agencies can follow the Michigan TAMC website (michigan.gov/tamc) and the Center for Technology & Training website (ctt.mtu.edu/asset-management-resources and ctt.mtu.edu/training) for resources and training related to culvert inspection, culvert condition assessment and asset management as they become available.

In the end, though, TenBrock advises others to “use common sense, use an abundance of caution”. He says that even though culvert data collection is not “high-stakes danger”, problems still arise. “A little bit of caution goes a long way.” ■

RESOURCES

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Managing Your Agency's Other Network: Facilitating Knowledge Transfer in Your Knowledge Network

Hannah Bershing – Technical Writing Intern
Center for Technology & Training

Sometimes, innate know-how can't be put into words. How, for example, can the "feeling" of a road be explained? How does the expert plow driver or motor grader operator articulate his or her understanding of the roads and their conditions? Innate know-how can be passed on or transferred to others; but, it can also be lost if it is not transferred before an employee retires, changes jobs, or can't perform his or her job duties for whatever reason.

"It's natural for folks to work a career with our agency, 25 to 30 years, and ultimately retire," shared Jim Harmon, director of operations at Washtenaw County Road Commission (CRC). "They gain a tremendous amount of knowledge and experience, and that experience is a value."

In contrast to these experienced employees, Dustin Brighton, who has been teaching chainsaw safety and other courses to Michigan's road-owning agencies since 2001, pointed out, "Just basic knowledge, basic tools that were taught in shop class in schools and trades, the [younger] employees don't have that." He adds that "there's a lot of assumptions made by the older generations

that the younger generations should have the same knowledge they have" so experienced employees often inadvertently omit "a lot of the basic knowledge that needs to be shared".

Knowledge Transfer and Why It is Important

In organizations like county road commissions and municipal road departments, knowledge of systems, processes, policies, and procedures is essential for managing and maintaining road networks efficiently and effectively.^{1,2} This knowledge is held in three dimensions: as explicit knowledge, as implicit knowledge, and as tacit knowledge. It is important to understand the different dimensions of knowledge because these dimensions affect how knowledge exists and is shared.

Explicit knowledge is knowledge that can be written down or documented. It's the knowledge about systems, processes, policies, and procedures that can be found in an employee manual or on an agency's website. As an analogy, teenagers or other adults who want to learn how to drive a passenger vehicle can read a driver's training handbook or a vehicle's user manual. Doing so, new or inexperienced drivers gain explicit knowledge on driving. In turn, they can easily share this knowledge with others by writing out or verbalizing what they have read.

Implicit knowledge is the skill a person has to apply explicit knowledge. New or inex-

perienced drivers, for example, have implicit knowledge after they absorb the content of the handbook or user manual and then use or apply that knowledge to operate the vehicle. A driver can talk about and share how they changed lanes or shifted gears. Typically, employees can talk about and share their implicit knowledge with others.

But, the third dimension—tacit knowledge—is the hardest type of knowledge to articulate. Tacit knowledge is the innate know-how that only comes from personal experience. It is the experienced driver knowing how to handle a vehicle on a certain day because of the "feel" of the road, for example, adjusting one's driving technique because of slippery pavements or rough surfaces. Tacit knowledge can't be taught through a book or through observation but can only be acquired through doing and feeling how the equipment or the material responds; however, there are strategies that agencies can use to accelerate employees' acquisition of tacit knowledge. It's the technical experts at an agency who "perform no miracles" but have a "command" over the task and "achieve" their work that possess tacit knowledge.³ It's the type of knowledge possessed by the "expert" plow driver or "expert" motor grader operator or "expert" maintenance foreman.

While tacit knowledge is the most valuable of the three, all dimensions and types of

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It's the technical experts at an agency who "perform no miracles" but have a "command" over the task and "achieve" their work that possess tacit knowledge.

All types of knowledge possessed by all employees at an agency come together to form an agency's "knowledge network".
...Like a road network, a knowledge network needs to be managed and maintained.

▶ knowledge possessed by all employees at an agency come together to form an agency’s “knowledge network”. When more employees contribute their knowledge to an agency’s knowledge network, the network becomes “increasingly valuable”.⁴ But, in their book *The Rhetoric of XML*, J.D. Applen & Rudy McDaniel (2009) contend that knowledge is only as good as the ability one has to share it, saying, “The most brilliant ideas die with the genius that came upon them if [one] is incapable of conveying these ideas to others.” The value of tacit knowledge and the importance of being able to share that knowledge becomes most evident with the knowledge gap that’s created when an experienced employee leaves or retires.⁴

Even though there are many inherent roadblocks to articulating and sharing tacit knowledge, strategies still exist for transferring that knowledge within an agency’s knowledge network.

Managing the Unmanaged

Like a road network, a knowledge network needs to be managed and maintained. When a knowledge network is left unmanaged, knowledge transfer either doesn’t happen or happens incompletely, according to Harmon and Brighton. Brighton underscores the central element in an agency’s knowledge-transfer process: someone is needed to manage the process. He noted, “There’s certain jobs that are highly desirable, like running certain equipment, and a lot of [experienced] employees aren’t willing to share that knowledge unless somebody forces them to [do so].”

Facilitate the Process

Local road-owning agencies need “someone to facilitate [knowledge-transfer] conversations”, like a supervisor or safety staff member because stories or conversations about one’s tacit knowledge often don’t happen “organically on their own”, Brighton says.



Having someone to facilitate the knowledge-transfer process ensures that employees can transition between jobs or retirement smoothly and are cross-trained in case of emergency situations, and it is the managers and supervisors who need to be involved in managing and maintaining the knowledge-transfer process.

Brighton suggests that it’s up to the local road-owning agency’s managers or supervisors to identify the tasks that rely on tacit knowledge and the specific knowledge of those tasks that need to be shared as a first step in the knowledge-transfer process. In the learning-to-drive analogy, the state department of motor vehicles has a structured process to teach driving skills to new or inexperienced drivers. The state facilitates the learning of driving knowledge and skills through a tiered training program with written and practice-based exams that demonstrate drivers have acquired driving skills and with a final certificate upon successful completion.

Calming the Apprehensive

Requesting knowledge transfer between employees can create apprehension, and rightly so. “[Experienced] employees feel threatened when [less-experienced] employees come in, thinking they’re going to take their job or take their position or their piece of equipment,” explained Brighton.

Furthermore, if experienced employees are apprehensive or resistant to showing less-experienced employees how best to do the job, Brighton suggests that less-experienced employees may end up feeling as though they are getting partial or inadequate training.

Create a Team Atmosphere

To relieve or prevent apprehension, Harmon believes in the importance of developing a “team atmosphere”, a strategy of transferring knowledge through socialization.⁴

According to Harmon, a team atmosphere goes beyond experienced employees simply moving forward information. He says it’s about experienced employees “sharing” their knowledge and experiences. “We like to tap into their [knowledge and experience] and have them impart that on less-experienced employees,” he said.

Harmon sees this knowledge-transfer process flourishing through team work in his agency’s winter road maintenance program. He shared, “The heavy trucks we use...to plow snow from the road and the variety of

ways to apply material to de-ice the road to provide traction control for motorists, they have become, in the past ten years, much more sophisticated, and less-experienced employees and [experienced] employees have had to learn new skills and adapt to this new equipment.” By having his experienced employees and less-experienced employees working together, his combined workforce has managed to “embrace the equipment, really bringing it to bear and using it to its fullest in order to perform winter maintenance more efficiently, more effectively, more safely”.

Communicate Respect

Brighton says diffusing experienced employees’ apprehension and encouraging them to share their tacit knowledge relies on communicating a “respect” for their knowledge and putting them in “leadership training positions that allow them to share that knowledge”. Brighton continued, “[It’s about] really showing everyone else—the younger employees around them—that you’re respecting this [experienced] person, that you’re listening to them, and that you think everyone else should too.”

In the learning-to-drive example, new or less-experienced drivers often think they know how to drive before they actually do and are apprehensive to learn from others. But, often they don’t know what to do when they encounter situations like hydroplaning or a slush-covered road. Experienced drivers have knowledge about how to handle those types of complex driving situations, and it’s the parents and drivers’ training programs who communicate respect for experienced drivers.

Making Irrelevance Relevant

The way in which the knowledge-transfer process is initiated can not only exacerbate apprehension but also leave experienced employees with little understanding about their crucial role in maintaining an agency’s knowledge network and an increasing sense of resistance to sharing their tacit knowledge. When less-experienced employees are to be cross-trained on a task or are onboarded, experienced employees are often told to “show them the ropes” and train the less-experienced employees on how to do their jobs. “It seems that [management sometimes] just tells [experienced employees] ‘hey, you’re taking this [person] out today and you’re going to show [that person] how to do your job,’” shared Brighton, noting that this

approach both feeds apprehension and leaves employees with little or no understanding about why knowledge transfer is necessary.

In his work with local road-owning agencies, Brighton has witnessed many interactions between experienced and less-experienced road-owning-agency employees. Experienced employees have “really no reason to [share their knowledge] unless someone asks them to,” he observed.

Explain the Process

By helping experienced employees understand the importance of knowledge transfer for cross-training or onboarding purposes, resistance to sharing tacit knowledge can be decreased. “Instead of just throwing somebody out there and forcing them to train on that job, talk to your [experienced] employees ahead of time and get their buy in and let them know what your plan is and what you want the outcome to be from the training, and work toward that goal,” said Brighton. “That way, when they train [less-experienced] employees, they’re not caught off guard”.

In driving a passenger vehicle, there’s two ways to arrive at a destination: one is simply to provide the address of the destination, the other is to give them step-by-step directions or show them on a map how to get to the destination. Both the person providing directions and the driver want the driver to arrive at the destination. Rather than just providing the address, explaining the process of how to arrive at the destination benefits both the person providing the directions and the driver: the driver can successfully arrive at the destination even without an address and solely based on his or her understanding of the road network while the person providing the directions has a better guarantee of the driver’s success in arriving at the destination.

Structuring the Unstructured

Aside from seeing no need to transfer knowledge, the lack of knowing how to share or convey information to others is another problem in the knowledge-transfer process, an insight that aligns with Applen & McDaniel’s point about brilliant ideas. While experienced employees may be able to go out and do their jobs with great expertise, it can often be difficult for them to explain their way of assessing different variables of a task and the way those variables impact the decision-making process while doing the task. For

instance, how does one explain to a new or inexperienced driver the feeling of a passenger vehicle as it is starting to hydroplane? Or how does one explain how to steer when tires are being pulled by slush?

Share Stories

Elizabeth Veinott, a professor at Michigan Technological University, has been involved in knowledge transfer in work environments. “Stories are one way that we naturally record and share information across people and work organizations,” she said of the knowledge-transfer process. “Stories are typically informal, [and sharing stories] is typically an informal process, like ‘we ran into this challenge, what do we do about it’, and talking to people in the organization someone says ‘I had that happen, this was what the situation was when it happened, here’s my story.’” Veinott explains that transferring knowledge through stories makes the knowledge easily remembered because they “exercise our memory schema and story structure”. The stories-to-useable-knowledge pathway is well researched and has been used to capture tacit knowledge by major companies like IBM, notes Veinott.

As an example, people often share stories about what happened when they hydroplaned or hit the gravel shoulder. They vividly share their remembrances of the situation and what they did to correct for it. This sharing serves as a knowledge-transfer process for drivers who have not had the same experiences yet.

Veinott points out that stories that encapsulate tacit knowledge can be elicited by asking the right questions. “Everyone has stories and everyone likes to tell stories so, instead of saying ‘what should I do here’, say ‘tell me about a time when...’ or ‘have you ever had this happen’”, she said, explaining that when questions are asked about another’s knowledge in an open-ended way it helps to advance the communication process.

Managers or supervisors can ask the right questions through use of surveys or interviews. These tools capture and share experienced employees’ tacit knowledge with their less-experienced employees, suggest Veinott and Brighton. Surveys help with “finding out about employees they have with skill sets they’re not even aware of”, says Brighton. He

“All of us have a diverse background and experience, knowledge, and talent—embrace that diversity, and it’ll be pretty astounding what you can accomplish together as a team.”

—Jim Harmon

suggests that once agencies know the skill sets of their workforce, they build on those skill sets in their training programs and even have their skilled employees trained to teach the other employees. Veinott says structured interviews can unpack stories and the encapsulated tacit knowledge by working through stories in a particular way.

For less-experienced employees, asking the right questions of experienced employees may be the only tool available for them to learn from experienced employees who don’t work alongside them.⁵ For example, new or less-experienced drivers who find themselves driving alone can ask other drivers how to handle a vehicle when they encounter adverse weather conditions or experience such situations as having a tire blow out. However, much of the knowledge transfer then depends upon being able to ask the right questions and the experienced employee’s ability to articulate factors related to his/her tacit knowledge.⁵ Unfortunately, using this method of knowledge transfer potentially omits vital details that can only be communicated non-verbally. A way around this is to use mentorship when possible.

Establish Mentorship

“We really look to the knowledge and experience [of experienced employees] in the form of mentorship,” said Harmon of the Washtenaw CRC culture.

A mentorship strategy that Brighton recommends is to allow experienced employees to “be in a leadership position” and share their knowledge in an instructional setting. He uses this strategy when he teaches his chainsaw safety classes. Even though Brighton is positioned as an authority when he’s teaching, he prompts knowledge transfer of the experienced employees in the classroom by “being very humble in approaching...the experience of the experienced employees and allowing them to have some say...and engaging them specifically on their experience”. This strategy gives a voice to experienced employees and allows them to share or externalize their tacit knowledge.

Knowledge transfer, according to Harmon,

► continued on page 14

Compact Roundabouts (continued from page 1)

►in the right-of-way acquisition phase. In a traditional roundabout project, the required intersection footprint would typically increase in size and land may need to be acquired in order to accommodate the additional space being used. This phase can be time consuming because the transportation agency must go through a legal process to buy property, and every business and private property owner needs to be notified and fairly compensated. Compact roundabouts can eliminate this phase in the project altogether because they are usually small enough to fit within an existing right-of-way footprint. In McCulloch's opinion, compact roundabouts are not only the cheaper and smaller option, but also an "effective [option] from the standpoint of the safety or performance that you would expect from a larger size roundabout."

Safety is a major reason roundabouts are preferable to other intersection types. Roundabouts naturally slow traffic and eliminate 90 degree angles, so accidents are sideswipe, rear-end, or run-off-road collisions rather than head-on or t-bone collisions. Accidents also occur at much lower speeds than typical intersection crashes. Shaw explains that he is trying to address "target zero" by promoting roundabouts at the FHWA. According to Shaw, target zero is "the idea that there should be a goal to have zero fatalities on a road system", and roundabouts help meet that goal because they significantly reduce the "fatalities and serious injuries at these locations". Studies by the FHWA and the Insurance Institute for Highway Safety have found a 90-percent reduction in fatal crashes at roundabout intersections.¹ McCulloch estimates there are eight to twelve property-damage-only crashes per year per compact roundabout in the Washtenaw CRC road system, but he agrees with Shaw that those involved in the crashes are mostly "making calls to their insurance agent afterward—not an ambulance."

Ramp terminals are ideal locations for compact roundabouts. A ramp terminal is the intersection of an exit ramp and a crossroad. These locations already require a stop, so adding a roundabout increases efficiency and safety because with roundabouts there is a constant flow of traffic. Locations where vehicles are entering or exiting a highway, like ramp terminals, often involve left turns. Roundabouts make left turns easier than other intersection types because the flow of a roundabout is all one direction with exiting being either straight ahead or continue to



Compact roundabout at Baker-Dan Hoey intersection, City of Dexter (photo courtesy of Washtenaw CRC)

the right, so those making a left turn do not have to fight against the flow to make their turn. Compact roundabouts are especially suited to these locations because they can usually accommodate the traffic volumes and are as efficient and more cost effective than traditional roundabouts.

Traffic volumes are a key consideration when deciding between a compact roundabout versus a traditional roundabout because smaller roundabouts may experience gridlock at large traffic volumes. McCulloch recommends looking at "peak hour factors", which he explains are "when entry volumes coming into the roundabout intersection are at their highest in the morning and evening". A 90-foot-in-circumferential-diameter mini roundabout can accommodate about 1,600 to 1,700 vehicles in peak hours. However, McCulloch says it is necessary to increase the diameter accordingly if projected peak-hours traffic volumes exceed these values. Then, from traffic data, he says to "project what you think the traffic will be in 10 to 20 years because it's important to build for today as well as forecast what the need will be in the future".

Winter Maintenance with Compact Roundabouts

Winter weather conditions can present a couple challenges to consider when designing a compact roundabout. Signs cannot be placed in the center of a compact roundabout due to the fully-traversable island, making it more

difficult for drivers to recognize a compact roundabout after a snowfall. Clear signage leading up to the roundabout and frequent plowing of the lane can mitigate confusion.

While other large vehicles can drive straight through the intersection, plow trucks need to circumnavigate the center island to clear the driving lane of snow. Compact roundabouts should be designed with a plow truck's turning radius in mind. One roundabout in Washtenaw County forces the plow driver to back up one or two times to make a 360-degree pass around the center island when clearing the driving lane because the turning radius around the center island is too tight for the plow truck to make a full turn around it. McCulloch heard from an experienced plow driver that if the intersection diameter was just five feet wider, the plow could complete the full turn around the roundabout seamlessly. He reminds engineers to double check all the variables in projects like this where every foot can make a difference. He adds, "My opinion of the ideal roundabout size is 100 to 110 feet. But you don't always have the money or the space for that." In those cases, it is important to ensure winter maintenance vehicles can still do their job.

McCulloch explained that while Washtenaw County "[does] not experience significant snow amounts to require winter maintenance activities of the center island", regions with heavier snowfall may need to

clear the entire center island in addition to the driving lanes so large trucks can navigate the intersection.

The Greatest Challenge Facing Compact Roundabouts

“They’re too small,” McCulloch says, “that’s what the public’s reaction will be [to a compact roundabout being placed in their community]”. Public support is critical for local public transportation agencies that are funded through taxpayer dollars. The greatest challenge an agency faces when looking to build a relatively-new and unfamiliar innovation like a compact roundabout is public approval.

To overcome that challenge, Shaw advises beginning the discussion before there is even a specific location in mind for a compact roundabout. “Educate your community on [compact] roundabouts as early as you can—start talking about them as a safer type of intersection and explain the benefits.” He believes that, by bringing up the issue early before it is a matter that could affect members of the community personally, agencies can have “a conversation about roundabouts rather than a conversation about that roundabout at that intersection and why that won’t work”.

Brian Walsh, state traffic design engineer from the Washington State Department of Transportation, added the importance of showing examples when presenting compact roundabouts to the public. “If they can see a [compact roundabout] and share it with people, they’ll all be on the same page about what it looks like, the size of it, the traversable middle, and what it’s like driving through it,” he said. “You can make a believer out of people.”

McCulloch, Shaw, and Walsh were featured as speakers for the 2019 Mini Roundabout Symposium, hosted by the Center for Technology & Training and held in Washt-

enaw County, Michigan. Over 100 engineers from several states attended the symposium in order to collect their own empirical data on compact roundabouts. Symposium participants visited two compact roundabout sites in Washtenaw County to see how they worked. Shaw points out that “there is an estimated 7,000 roundabouts in the United States now, so that means there are a lot of communities and a lot of agencies, planners, and engineers that have experience, so ask your peers for help or advice”. He commended both Washtenaw County for being a local agency “reaching out, wanting to share their experience with peers across the state and even outside of Michigan” at the 2019 Mini Roundabout Symposium and Michigan’s Local Transportation Agency Program (LTAP) at the CTT for being “uniquely positioned to provide support and a platform to help the symposium happen.”

McCulloch is optimistic about the future of roundabouts, saying, “I honestly feel we’re only scratching the surface on these types of intersections and there’s more for us to learn about them to continue to make these intersections more fruitful for everyone.” He adds that “everyone” includes bikers and pedestrians in addition to vehicles.

Walsh and Shaw agree with McCulloch that roundabout innovation will continue. Shaw shared that a comprehensive safety analysis is being done as part of a pooled fund project to which multiple states are contributing and the FHWA is leading. The project will look at dozens of compact roundabout projects across the country over multiple years to discern crash modification factors. Crash modification factors are found by looking at before and after data to see how a road improvement affected the accident rate. This data could be helpful for convincing the public to implement compact roundabouts in their communities, and it could also indicate where compact

roundabouts could be improved. Shaw also mentioned that FHWA is looking closely at turbo roundabouts as a potential solution in some locations. He described a turbo roundabout as “a version of a multilane roundabout that includes raised separation between the circulatory lanes of the roundabout.”

Embracing innovations like compact roundabouts—or, at the very least, giving them adequate consideration—is important because innovations often aim to increase the safety of communities at a lower cost to taxpayers. Communicating with and educating the community on a consistent basis can make it easier to create support for new road improvement ideas that will be important as roundabouts and other transportation asset design techniques become even more advanced. McCulloch has been committed to advancing innovative roundabout design techniques in his career, and he presents this challenge to other transportation agency personnel: “What can you do to make them better?” ■

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Mini roundabout at Moon and Beamis Road, Washtenaw County, Michigan (photo courtesy of Washtenaw County Road Commission)

Potholes are NOT Inevitable: An Asset Management Perspective from Massachusetts

Cynthia Shaedig, Project Coordinator
Baystate Roads, Reprinted from M3 Quarterly

Potholes are not inevitable. This sentence flies in the face of many people's assumptions. "Of course they are," many will say. But I beg to differ.

Traditional two-inch mill and pave was completed on the entire road in 2004. Crack seal and micro surfacing maintenance was done on the right lane in 2010.

Using a common saying, "A picture is worth 1,000 words," I make my case. Half of the road is clearly distressed, while the other half, having received a preventive maintenance measure, is in pretty good condition.

So how did this happen?

Half the road is in one town, the other half in another. In 2010, the two towns had very different approaches to managing road networks. Over the course of 14 years, the road surface on the left began deteriorating and continued to do so. The road on the right shows little deterioration due to having received preventive maintenance, and the parts that do are directly related to the deterioration on the left half.

So potholes aren't inevitable. If the road has a good base to begin with, potholes can be prevented with proper maintenance.

And what does a good maintenance program look like?

The purpose of pavement management and pavement preservation, is to develop a plan to improve the overall condition of your roads a little each year. Putting all of your resources into only fixing the roads in the worst condition, results in the overall condition of your network becoming a bit worse each year. A preservation approach involves investing in the maintenance of your good roads. The approach can require a public education effort, to help the public understand why you are maintaining roads that still look good.

There are many maintenance options ranging from crack-sealing, fog sealing, conventional chip seals, asphalt rubber SAMs [stress-absorbing membranes] and SAMIs [stress-absorbing membrane interlayers], micro-surfacing, cape seals, bonded wearing course, hot in-place recycling, cold in-place recycling, hot mix asphalt overlays, and mill and fills. ■



Photo: Courtesy of Baystate Roads

Michigan Preventive Maintenance Resources

The best way to get started with pavement management and preservation is to develop and use an asset management plan. The Center for Technology & Training offers many asset management planning resources to local road-owning agencies, including:

- Pavement asset management training, template, and tool
- Bridge asset management training, template, and tool
- Compliance plan training, template, and tool

For more information, visit <http://ctt.mtu.edu/training> and <http://ctt.mtu.edu/asset-management-resources>.

Reprinted from Baystate Roads: Potholes Are Not Inevitable. In: M3 Quarterly, Spring 2020. UMass Transportation Center Baystate Roads. Available: <https://www.umasstransportationcenter.org/Document.asp?DocID=796>.

Layout, this page and facing page: Thomas Page, Technical Writing Intern – CTT.

Inform Your Constituents!

Want to teach your residents and road users in your area about potholes? Tear out the next page or print a digital copy of it from <http://michiganltap.org/TheBridge> and post it to your agency's bulletin board or website.





Quick Pothole Resource Guide

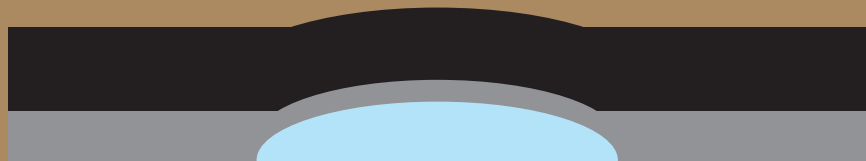
How Are Potholes Made?



As pavement ages, small cracks are naturally created that lead through the pavement to the underlying road bed.



Throughout the year, water seeps into these cracks and infiltrates into the road bed. This water infiltration weakens the road bed and can cause a pothole on its own.



As the winter commences, this infiltrated water freezes and expands in the road bed. The expansion of the ice pushes the pavement and the road bed upwards.



In the spring, the ice melts and the road bed falls back down. The solid pavement does not fall down but forms a cavity under the road.



As vehicles drive over this cavity, it collapses and a pothole is formed.

Occurs All Year

Occurs Seasonally during Freeze/Thaw Cycles

Pothole Safety Tips¹

Potholes are hazards to you and your vehicle. Here are tips for navigating a pothole safely:

1. The best way to drive over potholes is to not do it at all. Avoid the pothole entirely if you can safely do so.
2. If you must, drive over the pothole at a slow speed. Slower speeds are safer, decreasing damage to your vehicle. But, don't go so slowly that you cause a traffic backup!
3. Keep your tires properly inflated. Over- or under-inflated tires are more likely to pop when driving over potholes.
4. Sometimes, puddles can be potholes in disguise! Puddles that seem shallow could hide a deep pothole, especially in spring.

Fixing and Filling Potholes²

Potholes are filled by road crews using one of two types of asphalt patches:

- Cold patch is more flexible but less durable. Cold patch can be applied with minimal preparation and are well-suited for quick and emergency patches.
- Hot-mix asphalt repairs are stronger and more durable, but require more time and preparation to apply.

Potholes are filled with patch material and compacted to set the patch. Vehicle traffic continues the compaction of the patch.

Who Should You Tell About Potholes?

Report potholes on local roads to your local county road commission or local municipality. Report potholes on state roads to the Michigan Department of Transportation.³ ■

RESOURCES

1. <https://www.wcroads.org/faq/potholes/>
2. <https://www.rcocweb.org/DocumentCenter/View/2371/Pothole-patching-explained>
3. https://www.michigan.gov/mdot/0,4616,7-151-9615_30883---,00.html

Layout: Thomas Page, Technical Writing Intern – Center for Technology & Training

rests on “setting a clear understanding of expectations” for experienced employees to “provide mentorship and support to help ensure the success of less-experienced employees”. He contends that, in addition to a supervisor’s role in developing and managing support for less-experienced employees, experienced employees play a critical role in being “supportive and engaging less-experienced employees, helping to answer questions, and guiding them without interfering with the...supervisor”. Harmon concluded, “As an agency, we are all working together to accomplish one mission.”

Similarly, drivers are all working together to get to their destinations safely. Less-experienced drivers can benefit from learning safe driving techniques by working with an experienced driver they look up to, know, or trust. Having the right driving mentor who is committed to sharing his or her knowledge can inspire less-experienced drivers with the desire and enthusiasm for learning to drive well.

Mentorship can follow a structured four-step model presented by Leonard, Barton & Barton (2013) in the Harvard Business Review. Their “OPPTY process” can guide a mentorship program for sharing tacit knowledge, or innate know-how:⁵

- O - observation

A less-experienced employee shadows an experienced employee and analyzes what the experienced employee does.

- P - practice

The less-experienced employee identifies a specific expert behavior or task that the experienced employee does and attempts to do it on his/her own but with supervision and feedback from the experienced employee.

- P - partnering/joint problem solving

The less-experienced employee works actively with the experienced employee to analyze tasks and problems and address challenges or develop solutions.

- TY - taking responsibility

When ready, the less-experienced employee takes over a part of the experienced employee’s role.

With each step of the OPPTY process, less-experienced employees must reflect upon and internalize how experienced employees do their tasks, and both the less-experienced employees and the experienced employees should understand or be shown how this process benefits one’s self.

Protecting the Vulnerable

“If [experienced employees] are not willing to share knowledge and help their fellow employees, they’re the one that are going to have to take responsibility for the situation,” Brighton argued. “When something goes wrong, they’re going to have to answer for it.”

At the same time, Brighton observed, “I see less-experienced employees are resistant to learning from experienced employees because of the approach that they get from the experienced employees.” With that resistance, less-experienced employees will eventually settle for figuring things out on their own, he says. Less-experienced employees can end up perceiving that listening to experienced employees has no benefit, driving an axe in the knowledge transfer process.

Be Invested

Brighton finds that encouraging experienced employees to be invested in the success of less-experienced employees comes down to considering the consequences of not sharing that knowledge.

Sometimes, for example, it is easier for experienced drivers to find humor in the consequences that less-experienced drivers have when handling their vehicles with less skill in snow and slush. While it might result in humorous stories to leave the less-experienced driver in ignorance and while it might be difficult for experienced drivers to articulate safe driving techniques, a person who intentionally withholds information about safe driving techniques would be partly responsible for any accidents that may occur. Making the effort to share safe driving tech-

niques benefits everyone who uses the road in getting to their destinations safely.

Harmon has found that less-experienced employees are generally open to taking in knowledge they’ve learned from experienced employees and putting it into practice. “They want to learn from people that have experience, people that can be trusted and are relevant to them with that appropriate information.” Making the knowledge of experienced employees available for less-experienced employees to access and internalize is especially important when confronting the generational knowledge gaps that Brighton noted. Brighton contends that agencies need “to start at ground zero” in building less-experienced employees’ basic knowledge and skills base.

Notably, less-experienced employees do play a valuable role on the team, in Harmon’s eyes. They bring with them “fresh” and “diverse” ideas. “We naturally get used to doing things in a certain way, and it’s okay to test those practices,” he explained. “People join our agency with a range of experience and knowledge, and we’ve found benefit in challenging some of our long-standing ideas.”

Advice for Knowledge Transfer

“Don’t hoard information,” Harmon emphasized. “Approach and provide leadership and support that helps less-experienced employees prosper and grow as they progress in their careers and embrace them as members of your team.” He reflected, “All of us have a diverse background and experience, knowledge and talent—embrace that diversity, and it’ll be pretty astounding what you can accomplish together, as a team.” What Harmon, Brighton, and Veinott know from their knowledge-transfer experiences supports what Applen & McDaniel theorize in saying, “[t]he maintenance of...[a] tacit knowledge base allows a community to gain an identity and to be aware of how this identity changes with the addition of new members and the exit of existing members”.¹ ■



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Motor Grader Training

Training Opportunities by Request

Maintaining unpaved road surfaces requires operators to use specialized skills, abilities, knowledge, and applied techniques that are only acquired over time.

Operators must continually improve upon their skills and knowledge through practice and by learning new insights about unpaved road maintenance.

The Center for Technology & Training is offering a new 2021 Motor Grader Training for local road-owning agency employees.

Learn more at
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or contact ctt@mtu.edu.

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Road design/construction/maintenance
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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 ctt.mtu.edu.

The Bridge

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

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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

Engineering

Chris Gilbertson, PhD, PE Associate Director
Pete Torola, PE Research Engineer
Andy Manty, PE Research Engineer
Zack Fredin, PE Research Engineer
Grace TenBrock Engineering Intern

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

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Michigan Technological University

Civil and Environmental
Engineering

The Bridge

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Vol. 33, No. 4 – Spring 2021

- ▶ Navigating the Benefits and Drawbacks of Compact Roundabouts
- ▶ Seeing through the Eye of the Culvert...with Safety
- ▶ Managing Your Agency's Other Network: Facilitating Knowledge Transfer in Your Knowledge Network
- ▶ Potholes are NOT Inevitable
- ▶ Quick Pothole Resource Guide



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
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Houghton, Michigan
49931

Upcoming Events

REGISTER & MORE INFORMATION AT ctt.mtu.edu/training

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

2021 Asset Management Trainings

Compliance Plan Training Webinar: September 1

Bridge Asset Management Training: webinar 1 – August 31, webinar 2 – September 2, workshop (Lansing or virtual) – September 8

Pavement Asset Management Plan Training: workshop (Lansing or virtual) – September 7

2021 Michigan Winter Operations Conference

October 19-20 – Bellaire and/or virtual

Mark Your Calendar: 2022 County Engineers' Workshop

February 8-10 – Bellaire

Mark Your Calendar: 2022 Michigan Bridge Week

March 15-17 – Ypsilanti

Mark Your Calendar: 2022 Highway Maintenance Conference

WORKSHOP: April 26 | CONFERENCE: April 27 – Bellaire

More training opportunities!

Visit ctt.mtu.edu/webinars-and-workshops to learn about webinars and workshops offered by the Michigan LTAP/Center for Technology & Training

Mark Your Calendar for the 10-year Anniversary



2021 MICHIGAN **Winter** Operations Conference

October 19-20 • Bellaire, Michigan • Shanty Creek Resort



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