Northern North American lakes are getting saltier

Hilary Dugan has studied long-term changes in the chloride content of more than 400 lakes in North America and Europe. In a nutshell, she found that, as a result of winter road salt application, chloride content has increased in North American lakes.

Best practices aim to help turfgrass thrive

A University of Minnesota research team has identified best management practices for installing and establishing a type of salt-tolerant turfgrass. The study, funded by the Minnesota Local Road Research Board, specifically focused on watering practices, soil amendments, and planting date for both seed and sod.

Harsh conditions such as heat, drought, and salt use can make it difficult for roadside turfgrass to thrive. In 2014, researchers in the Department of Horticultural Science identified a new salt-tolerant turfgrass mixture that could be used on Minnesota roadsides. But when the Minnesota Department of Transportation began using the mixture, called MNST-12, the agency experienced a series of installation failures.

“Newer improved seed or sod mixes like MNST-12 may have differing requirements for successful establishment compared to other species or cultivars that contractors and other turf professionals are more familiar with,” explains Professor Eric Watkins.

Over the next several years, researchers studied how water should be applied to new MNST-12 turfgrass installations, the use of soil amendments at the time of establishment, and the effect of

Turfgrass continued on page 6

Training modules available for temporary traffic control

MnDOT State Aid has created a web page with training resources for the Minnesota Temporary Traffic Control Field Manual. The manual, which was updated into a January 2018 edition, is the document to use when controlling traffic (vehicles and pedestrians) for work of three days or less on any road open to the public in Minnesota.

The “Field Manual” is a chapter of Part 6 of the Minnesota Manual on Uniform Traffic Control Devices (MN MUTCD). It is reprinted as a separate document for use in field operations.

The web page pairs PowerPoint slides with narration to provide an easy-to-access, streamlined format. The page can help those unable to attend training in person, and it can also be used as a refresher.

A new version of the Minnesota Flagging Handbook is also available.

Read more:
- Field Manual resource page: dot.state.mn.us/stateaid/field-manual-resources.html

READ THE EXCHANGE online for links to publications and other resources.
Social media can be effective part of public engagement plans

Social media can be effective as a strategic and select part of public engagement plans, according to findings of a University of Minnesota study. The project investigated current knowledge about public engagement through social media nationwide and in Minnesota. It also developed guidance about how social media may be used to reach and engage diverse populations in the state about transportation planning and projects.

Co-principal investigators of the multiyear study were Professor Ingrid Schneid of the Department of Forest Resources and Associate Professor Kathryn Quick of the Humphrey School of Public Affairs. “Public engagement for transportation planning and programs is not only required, it’s a crucial component in policy and project success,” Schneider says. “Since 2000, advances in technology and communications provide opportunities to engage with more people in new ways.”

For their analysis, the team used multiple methods: a literature review, telephone interviews, and four case studies.

“The literature review indicated social media needs to be part of a multipronged engagement plan,” Schneider says. “While 90 percent of U.S. adults are online and 69 percent use social media, a social media-only plan may not reach people over the age of 65 or with a high school education only. Platform use also vary considerably: African Americans and Latinos, for example, use video-sharing more than other groups.”

Phone interviews of more than 800 Minnesotans found that 72 percent use social media, and 11 to 21 percent participated in some way for planning transportation programs, policies, and projects in the previous year. In addition, 36 percent expressed interest in using social media to get information, provide feedback, or make suggestions related to transportation programs, policy, and planning.

The case studies compared transportation projects in Minnesota: two with significant social media use (Richfield, Red Wing), and two with low use (Saint Paul, Detroit Lakes). Findings revealed that the two projects with higher levels of social media had more connections with stakeholders. The quality and effectiveness of those connections, however, varied. “Government social media primarily informed audiences, while community-created pages fostered deeper engagement and conversation,” Quick says. “In addition, the quality of social media, and their combination with other outreach technologies, influenced stakeholders’ perceptions of the engagement efforts.”

The project was funded by the Minnesota Department of Transportation (MnDOT) and the Minnesota Local Road Research Board (LRRB). “MnDOT and LRRB are committed to listening to and learning from the public,” says Renee Raduuez, MnDOT market research manager. “Social media provides a unique, efficient, and potentially inclusive tool in those efforts. This research brings us one step closer to understanding how we can maximize the power of social media to its fullest.”

Taken as a whole, the findings suggest at least four main opportunities to strengthen meaningful social media engagement:

• Social media cannot stand alone but be used as a substitute for more traditional and collaborative public engagement methods. Additionally, it is most effective when it is shared and dynamic: Pay attention and contribute to community-created social media pages, and provide a regular diet of new information and updates for people to stay engaged.

• Consider the demographic qualities of the key stakeholders to determine how social media can be most useful.

• Employ best practices for social media management, such as using hashtags to organize data, posting dynamic content (project videos, live streams), and clearly stating social media guidelines.

• Expand and/or develop research and evaluation plans to understand and assess future social media engagement efforts.

Read more:
• Effective Social Media Engagement Options for Minnesota’s Diversifying Population (LRRB/MnDOT, 2018-08)
• Addressing Citizen Requests for Traffic Safety Concerns (LRRB 2017RICO5)
• Stakeholder Attitudes, Knowledge and Engagement in Local Road Systems Planning and Decision Making (LRRB/MnDOT, 2017-39)

Technology Exchange

The Minnesota Local Technical Assistance Program (LTAP) is part of the Federal Highway Administration’s Local Technical Assistance Program (LTAP). LTAP is a nation-wide effort designed to foster and improve information exchange among local practitioners and federal, state, and local transportation agencies. Minnesota LTAP is administered by the Center for Transportation Studies at the University of Minnesota, and cosponsored by the Minnesota Local Road Research Board and the Minnesota Department of Transportation.

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Base stabilizer guidebook helps agencies select additives

A new guidebook from the Minnesota Local Road Research Board (LRRB) will help city and county engineers select the most promising stabilizing additives for individual road reclamation projects. The guide describes base stabilization, its benefits and best uses, and the best stabilizers for rehabilitating local roads.

Base stabilization entails mixing a stabilizing additive into an acceptable base aggregate material, imported with or without recycled material or from reclaimed hot-mix asphalt, creating a new bound pavement layer. More than 200 base-modifying products may be used for stabilization in Minnesota.

“In the past, rehabilitating pavement meant removing the asphalt or overlaying it, which was not cost-effective,” says Guy Kohlnhofer, county engineer of Carver County Public Works maintenance operations staff are searching for new options to reduce the amount of chloride that reaches our waters from road salt operations. Using food production byproducts such as pickle brine are among the alternatives maintenance staff have been exploring.

Carver County regularly uses salt brine as part of its winter maintenance operations, which has become a widely accepted practice for controlling snow and ice. In the right situation, salt brine can be a more effective alternative to traditional road salt. An opportunity to obtain a free supply of sodium-rich pickle juice from a nearby canning facility seemed like a natural candidate worthy of consideration as a source of brine for county anti-icing and deicing operations. In addition, recycling the pickle brine could reduce the amount of the waste byproduct.

The Carver County Public Works Department began testing samples of the pickle juice in 2016 with some encouraging results. But further testing showed the brine from the pickle cannery had variable salinity and pH levels that could damage maintenance equipment. Given the variables involved, staff determined it would be difficult to manually control the manufacture of the brine into a usable liquid. VariTech Industries recommended purchase of the Brine Boss®, an automated brine-blending system to manufacture the 23.3 percent brine solution needed for effective ice control operations. In addition, staff found adding potassium hydroxide to the pickle brine neutralizes the pH level.

Carver County staff received a grant through the LRRB’s Local Operational Research Assistance (OPERA) Program to help purchase the brine-making system and support further research into the viability of using pickle brine in winter maintenance operations. Staff also restored an old VariTech 600 brine maker obtained from MnDOT for the project.

After extensive testing and analysis, VariTech engineers and Carver County staff concluded that pickle brine acquired from the cannery had to be exactly the same (salinity, vinegar content, and sugar content) for each and every batch or the system sensors would fail. But it turned out that the pickle brine supplier could not provide chemically consistent batches, and the VariTech system was unable to produce a consistent blend of 23.3 percent brine solution using pickle brine. As a result, Carver County staff determined they were unable to continue using pickle brine for snow and ice control.

Nevertheless, this project benefits other agencies considering the use of food production byproducts. The Carver County project demonstrates that there can be an alternative anti-icing product. As technology continues to advance, Carver County may revisit the use of pickle brine as a viable snow- and ice-control option.

OPERA, which encourages maintenance employees from all cities and counties to get involved in operational, “hands-on” research, helps to develop innovations in the construction and maintenance operations of local government transportation organizations and share those ideas statewide.

More information about the Local OPERA Program is at mnltap.umn.edu/opera.

—Michael McCarthy, LTAP editor
Real performance characteristics of deicing salts

Scott Koefod, principal scientist for the Cargill Salt Group, spoke at the 18th Annual Road Salt Symposium on how to optimize the use of deicing salts. He presented results of improved methods he has developed for measuring and predicting the performance of deicers. He acknowledged the importance of practical field experience, but added that knowledge of the actual performance properties of deicing salts can only help users to choose the right products and the right mixtures.

Koefod presented Figure 1, which shows the ice-melting effectiveness of the three most commonly used liquid deicers per dollar of dry deicer over the range -60°F to 32°F:

*Figure 1: Ice-melting capacity of three deicers expressed as lbs. of ice melted per dollar of dry deicer over the range -60°F to 32°F.*

“In this graph,” Koefod said, “we can see why rock salt ([NaCl](#)) is the most common deicer: It’s far and away the most cost-effective. If we’re at temperatures not too far below freezing, we can get over 3,000 pounds of ice melted for every dollar of salt put on the road. But we also see why the practical working temperature of salt is said to be above 20°F. Below 20°F, effectiveness drops off. And in the real world, we often want to deice below 20°F.”

Next, Koefod showed the graph in Figure 2. It compares melting capability, not per dollar, but per pound of dry deicer weight:

*Figure 2: Ice-melting capacity of three deicers expressed as lbs. of ice melted per pound of dry deicer over the range -60°F to 32°F.*

“This shows something I’m not sure people realize. The three deicers have almost the same ice melting power per pound,” Koefod said. “The better performance of [MgCl$_2$](#) and [CaCl$_2$](#) at cold temperatures is due to differences in ice-melting rate rather than capacity. So, no matter what deicer we use, there’s a limit to how much ice can be melted at cold temperatures—and it drops off substantially below 20°F. But he added that there are ways to maximize the ice-melting performance and rate of deicers. “The best way to do that,” he said, “is with liquids.”

He then showed that, within the first hour after being put down at -4°F, dry NaCl will melt almost no ice, but MgCl$_2$ hydrate will melt about a pound of ice and CaCl$_2$ hydrate will melt almost two pounds of ice. “If we wait three hours,” said Koefod, “we get a little more ice melting from salt—and if we wait 48 hours, NaCl will melt as much as either MgCl$_2$ or CaCl$_2$. So now we see that, even though salt has about as much ice-melting power as either MgCl$_2$ or CaCl$_2$, salt is not very effective at low temperatures because it melts ice too slowly. The problem is that we simply can’t wait 48 hours for salt to do its work.”

Koefod emphasized that, though we can’t improve the inherent ice-melting capacity of salt, we can increase how fast it melts ice at low temperatures by wetting the salt with liquid deicers. He showed that, when a blend of rock salt and liquid deicer is put on icy pavement at -3°F, over the first 10 minutes the ice melting from the liquid dominates: “In those first ten minutes, the liquid releases about 80% of its ice-melting capacity, whereas the rock salt only releases about 10% of its ice-melting capacity. But then you have rock salt crystals sitting in the diluted brine—and the salt begins to dissolve so that it replenishes the brine’s deicer supply, allowing the brine to melt more ice. So eventually the salt does its work and we get the full benefit of its ice-melting capacity.”

Koefod concluded that “the more concentrated the brine, the faster it will melt the ice, and the slower it will dissolve the salt. Conversely, the more diluted the brine, the slower it will melt the ice, and the faster it will dissolve the salt. And over time, these processes will reach equilibrium.”

Koefod then showed that the choice of liquid makes a difference (Figure 3):

*Figure 3: Choice of pre-wetting brine makes a difference.*

“Figure 3 shows that, at -3°F, the ice-melting speed of rock salt wetted with plain salt brine (the short red line) is much slower than rock salt wetted with CaCl$_2$. But Koefod qualified: “These measurements were made in best-case conditions—continuous mixing of salt, liquid, and ice as well as a high ratio of liquid to rock salt.”

He went on to discuss in more detail how the liquid-to-salt ratio and the mixing action of traffic can affect deicer performance. Because MgCl$_2$ and CaCl$_2$ liquids are more expensive than salt brine and because they can make a driving surface slippery under some conditions, agencies often prefer to use blends—10 to 30% MgCl$_2$ or CaCl$_2$ brine mixed with lower-cost salt brine. And those blends will still produce a substantial increase in salt’s ice-melting speed, even at such cold temperatures.

Koefod said the mixing done in his tests may simulate mixing caused by traffic action (although he notes that traffic can also knock salt off the road, and the balance between these two effects needs more study). He showed that, when there is vigorous mixing, rock salt wetted with plain salt brine melts ice up to 30 times faster than if the deicers are static. In other words, rock salt wetted with NaCl brines is more dependent on a mixing mechanism (perhaps from traffic) for maximum effectiveness, and the value of brines that include some MgCl$_2$ or CaCl$_2$ may be more apparent where there is less mixing action from traffic. But he added: “The best of all possible worlds is having both. If I have both high mixing action and a MgCl$_2$-based or CaCl$_2$-based pre-wetting agent, that yields the fastest ice melting and the most effective and efficient use of rock salt at these very cold temperatures.”

Koefod then addressed the next obvious question: What is the optimum amount of pre-wetting agent to use? To answer that question, he presented the graph in Figure 4, which shows the ice-melting rate of MgCl$_2$ brine over a range from 32 gallons per ton to 387 gallons per ton—and with very little mixing.

**Water-softener brine recycled for sidewalks**

Steve Brown Apartments in Madison, Wisconsin, uses recycled bitter softener brine for winter sidewalk maintenance. The spent softener brine would otherwise go directly down the drain and pollute the river where it is discharged. Before reusing the water softener brine, the property management business ordered 2,000 to 2,500 lbs. of salt per year. Today, it only needs 500 lbs. to add into its reclaimed brine to bring it to the right concentration. The project champion, Mike Gesch, earned an environmental leadership award at the 18th Annual Road Salt Symposium for his ingenuity. —Richard L. Kronick, LTAP freelancer
Field-testing multiple factors that affect plowing and deicing

Stephen Druschel of Minnesota State University, Mankato, loves his students. In his presentation at the 18th Annual Road Salt Symposium, he said “They throw themselves at this work! They get $15/hour and $500 worth of gear, and they think they’ve died and gone to heaven!”

The students received this pay and got to work with the high-tech gear—motion-activated cameras—as they helped Druschel investigate the effectiveness and efficiency of snowplow blades and pavement deicers. “Effectiveness is keeping cars on the roadway,” said Druschel, “and efficiency is about lowest cost, lowest labor—as well as environmental efficiency.”

“Every plow driver is a scientist,” said Druschel, a civil engineering professor. “They observe, hypothesize, test, and evaluate. It’s the scientific method—all done in the cab of a truck.” But Druschel wanted to go beyond behind-the-wheel science to perform controlled tests of the effectiveness and efficiency of various equipment, materials, and techniques.

Comparing cloud formation at different speeds

Druschel and his cadre of assistants did their research on lanes laid out in the large parking lots of Canterbury Downs and ValleyFair in Shakopee, Minnesota, during the winters of 2013–14, 2015–16, and 2016–17. “On a typical day,” he said, “we deployed 40 cameras and took 10,000 time-lapse photos.” For example, Druschel compared cloud configurations coming from a plow at three different speeds (Figure 1).

“The clouding effect on the driver’s side is the one that really counts,” Druschel said. “That’s where the guy who can’t stand that you’re going so slow will try to pass the truck. If they go through a big cloud, they will have zero visibility for a moment—and if they cut in too soon, they’re going to hook the plow and it will be a very bad day for everybody. We found that small adjustments of the plow speed make a huge difference.”

Comparing cloud formation from different plow types

With help from Carver County Public Works, Druschel compared nine different plows on separate lanes for several factors. “This is geek heaven in the world of plows,” Druschel said. “We tried one-ways, dozer plows, poly plows, and different cutting edges.” For example, he showed that a one-way steel blade (Figure 2) produced a smaller cloud than a one-way poly blade (Figure 3).

“The poly plows don’t focus quite the same as a dedicated one-way,” Druschel said. “But they’re flexible and if you go through an intersection or a roundabout, you need a poly plow.”

Druschel also tested dozer plow blades (Figure 4). “The dozer plows give you a lot of flexibility,” Druschel said, “but the cast is not as tight. It entrains a lot of air and the cloud behind it is pretty miserable. The choice of equipment has a real impact.”

The effect of traffic on pavement deicing

Druschel and his assistants also tested the effect of traffic on the speed of pavement deicing. MnDOT plow drivers had reported that traffic, particularly truck traffic, could substantially improve roadway deicing. Their hypothesis was that the pressure of the vehicle creates closer physical contact between the salt grains and the snow and ice, particularly with lightly packed snow. Plow drivers also thought truck traffic might create better deicing than cars because truck tires are usually inflated to 90 psi, compared with 35 psi, which is typical for cars.

In Druschel’s test after a snowfall and at an air temperature of 28°F, two lanes were plowed and then treated with 600 pounds of rock salt per lane mile pre-wetted with 35 gallons per ton of 10% RG8 (90% salt brine). One lane received 10 passes by a car, and the other received 10 passes by a plow truck. Figure 5 shows some of the results.

The MnDOT plow drivers’ hunches were borne out: Traffic does help to accelerate deicing—and truck traffic has a better effect than car traffic. The same test was conducted on a day when the air temperature was 22°F with similar but somewhat reduced effect. Druschel concluded that temperature makes a difference and that traffic definitely accelerates deicing. “Cars help, but trucks are better,” he concluded. (For more on how traffic increases the efficiency of deicers, see the article on page 4.)

The above are just a few of the many tests conducted by Druschel and his student crews. Comprehensive technical reports are available from MnDOT.

—Richard L. Kronick, LTAP Freelancer

Read more:

• Salt Brine Blending to Optimize Deicing and Anti-Icing Performance and Cost Effectiveness: Phase III (MnDOT 2017-45, Nov. 2017)
Shoreview’s pervious concrete pavements lessen impact of stormwater runoff

A new MnDOT report evaluates the performance of pervious concrete pavements in the City of Shoreview’s Woodbridge Neighborhood. Built in 2009, the pavements were intended to reduce runoff flowing to nearby Lake Owasso. Stormwater runoff had previously been managed through culverts and other hydraulic structures.

The pervious concrete was designed for an anticipated 23% porosity and zero-sluump. The design included a 7-inch pervious concrete pavement built over 18 inches of pervious base.

MnDOT researchers monitored and evaluated the seven-year performance of these pervious concrete pavements. Based on the evaluation and tests carried out, they concluded that pervious concrete pavements successfully provide an alternative to culverts in the neighborhood. The pervious pavements infiltrated stormwater into the ground below the pavement while enhancing sound absorption.

In the 10th to 12th year of performance, based on the evaluation and tests carried out, they concluded that pervious concrete pavements successfully provide an alternative to culverts in the neighborhood. The pervious pavements infiltrated stormwater into the ground below the pavement while enhancing sound absorption.

The researchers recommend that vacuuming be done at least four times a year to mitigate reversible clogging and its secondary problems. This will also alleviate the effect of freeze-thaw cycles.

A life-cycle cost analysis showed the pervious concrete alternative to be more cost beneficial than the non-pervious alternative. This was based on the seven-year performance history and a standard rate of maintenance, as well as a projected grading in the 10th to 12th year of performance.

Read more:
- Seven Year Performance of City of Shoreview’s Pervious Concrete Project (MnDOT 2017-47, Dec. 2017)

Researchers recommend VACUUMING POROUS PAVEMENTS at least 4 TIMES per year.

### Lakes from page 1

Dugan, assistant professor of limnology (the study of inland waters) at the Center for Limnology at the University of Wisconsin in Madison, spoke at the 17th annual Road Salt Symposium.

While Minnesota license plates advertise “10,000 Lakes,” Dugan pointed out that, if smaller bodies of water are included, the state actually contains about 100,000 lakes—“so that’s a lot of surface area of water here in Minnesota.”

In addition to studying chloride content in North American and Swedish lakes, Dugan looked for correlations between each lake’s chloride content and its surroundings: Was the lake near roads? What was the ground cover: forest? agriculture? And how big was the lake?

The results are troubling. Dugan found that chloride levels are increasing in many lakes studied in 10 U.S. states plus Ontario—both urban and rural. And when the amount of impervious surface (mostly due to paving) near lakes was correlated with the chloride levels in those lakes, “almost every lake with increasing chloride had high levels of impervious surfaces—and lakes with decreasing chloride had no impervious surfaces nearby.”

But in Sweden, Dugan found that in all but two of the 114 lakes studied—even those close to roads—chloride levels have remained low, around 5 to 7 mg/L, since the 1980s. “Sweden has lots of roads and lots of snow—but no chloride problems in their lakes. What chloride content was in their lakes correlated with climate. In drought years, there was slightly higher chloride from evaporation. In years with lots of rain, chloride went down; the lakes got flushed out. That’s what we should see naturally. But we don’t see that in North America because the precipitation signal is drowned out by the road salt signal. The result of the study was that 1% impervious surface [near a North American lake] was enough to cause these problems because we put down road salt everywhere.” Of 38,000 lakes in the 10 U.S. states, she estimates 11,000 are at risk.

Next, Dugan addressed biological impact: “The question I always get is: Are the fish going to die? No! There will always be fish, but they may be different fish. They may be species that adapt much better to saline conditions. What we should be worried about is our native species that are adapted to fresh water—from plankton to mussels to fish. They will have a harder time the more salt you put in the water. What’s really good at living in salt water are the invasive species like zebra mussels.”

When an audience member asked whether the lack of salt use on roads in Sweden correlates with less safe roads, Dugan said, “I think it comes down to how they manage their roads. There’s almost no salt use in general. They plow their roads, and they use a lot of sand. They drive more slowly. And liability is a very different topic in Scandinavia. They don’t think about the risk of being sued if someone slips. That’s just part of winter there. It was probably like that here 50 years ago, but now we’ve moved into this more litigious mindset. That’s why we’re using so much salt—especially in commercial applications. Passing laws that limit liability would go a long way to making it possible to use less salt.”

—Richard L. Kronick, LTAP freelancer

### Turfgrass from page 1

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The 230 mg/L standard is very little salt: equivalent to one teaspoon of salt in 5 gallons of water. “The more salt we put in our water, the more stressed our ecosystem is going to be,” she said. “And while salinization of lakes comes from multiple sources, including water softeners and some fertilizers, far and away, road salt is the leading cause of chloride in these lakes.”

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—Richard L. Kronick, LTAP freelancer

### Turfgrass from page 1

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### Turfgrass from page 1

Because local agencies often rely on these MnDOT specifications as a guide for their projects, they will also benefit from the improved practices.

Read more:

### Turfgrass from page 1

of the seeding or sodding date on the success of a new planting. Based on their findings, they recommended a number of changes to MnDOT specifications.

“The knowledge and improved specifications we gained through this research will allow us to make our contractors more successful, which makes MnDOT successful,” says Dwayne Stenlund, MnDOT erosion control specialist.

### Turfgrass from page 1

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Read more:

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Read more:

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Read more:
High friction surface treatments: synthesis

MnDOT and local transportation agencies in Minnesota are evaluating the use of high friction surface treatments (HFST) as a safety strategy on roadways. To gather information for this evaluation, selected state DOTs were surveyed. A Transportation Research Synthesis presents the findings. HFST is used as a spot pavement surfacing treatment in locations with high friction demand (for example, crash-prone areas such as curves). Using a polish-resistant aggregate that is bonded to the pavement surface using an epoxy or polymer resin binder, HFST is expected to significantly enhance skid resistance and reduce crashes.

The synthesis presents findings from the survey, including information about the number and location of installations, the materials used in surface treatments, the durability of HFST, and its impact on safety. Results of a limited literature search supplement survey findings. HFST is also one of the innovations promoted by the Federal Highway Administration’s Every Day Counts program.

Arrest the pest!

The Minnesota Department of Agriculture has guidelines and an app to help Minnesotans identify and report harmful pests. Follow these three steps:

• Take pictures and notes.
• Capture the insect, if possible, or take a sample of the plant.
• Report: call, email, or use the app.

Learn more at mda.state.mn.us/arrestthepest.

Apps remind you to stay hydrated

Need a reminder to stay hydrated this summer? There’s an app for that...in fact, many of them, for various devices. Some remind you throughout the day and track how much you drink. Others let you link to friends and compare stats, or sync to other health apps or websites. Check the web and app stores for reviews and details.
## Fall Maintenance Expo: Oct. 3–4

This year’s Fall Maintenance Expo takes place October 3 and 4 in St. Cloud. The expo is worth 1.0 Roads Scholar credit. Sponsors are MnDOT, Minnesota LTAP, the Minnesota Street Superintendents Association, and the American Public Works Association–Minnesota Chapter.

## Help stop the spread of invasive species

Don’t mow through weeds with ripe seed, and make sure you clean mowers and other equipment frequently. Not only will this reduce weed control costs, it will also reduce the negative impacts to pollinator habitat caused by invasive species. (Refresh your memory about this and best management practices: visit the June 2017 Exchange.)

## Detect oak wilt with nanotechnology and gold

Oak wilt fungus is an invasive plant pathogen that often goes unnoticed until it’s too late. New technology developed by U of M researchers offers a simple, affordable diagnostic test utilizing nanotechnology and gold. Currently, oak wilt detection is performed by visual diagnostic (naked eye observation), which is only possible two to three weeks after infection, or with laboratory techniques that take from six hours to two weeks and cost $60 to $120 per sample. In the field, the symptoms of oak wilt can be confused with drought stress or insect damage. The innovation by the U team enables oak wilt detection within 30 minutes of sampling and at a fraction of the cost: less than five dollars per sample. The technology uses the agglomeration of gold nanoparticles to generate a chemiluminescent signal that can be read by a hand-held reader, in the presence of the oak wilt fungus DNA.

## Is it real...or is it fake?

Can you guess if the stories below are fake or real? Answers are on page 7.

### Robot bees could pollinate crops

Robotic bees may help pollinate crops near declining bee populations, according to U of M professor Shashi Shekhar. He made his comments at the 2018 Annual Meeting of the American Association for Advancement of Science.

Harvard University researchers introduced the first “robo-bees” in 2013. Last year, Japanese researchers created a bee robot that was able to transport pollen from one flower to another. Shekhar, a computer science and engineering professor, says robo-bees are likely to be deployed within five years. He warned that security is a key concern for the technology.

On March 8, Walmart filed a patent for autonomous pollination drones. The drones would use sensors and cameras to detect the locations of crops.

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## Roads Scholar credit

You can earn credits in Minnesota LTAP’s Roads Scholar (RS) program by attending LTAP and CTAP workshops and other cosponsored events. To learn more or enroll in the program, visit mnltap.umn.edu/roadsscholar.

## LTAP workshops

LTAP workshops, along with events cosponsored by Minnesota LTAP, are marked with an LTAP at left. Check the web for details and to register online: mnltap.umn.edu. To be added to our print or electronic mailing lists, email mnltap@umn.edu or call 612-625-1813.

## CTAP workshops

Circuit Training and Assistance Program (CTAP) workshops bring LTAP services to your neck of the woods. CTAP uses a fully equipped van to provide on-site technical assistance and training. Each CTAP workshop earns 0.5 RS credit. For more information or to schedule classes, call the CTAP instructor, Kathy Schaefer, at 651-366-3575, or email Kathleen.Schaefer@state.mn.us.

## Truck-Weight Education Training

(1 RS credit) LTAP
Locations throughout the state in 2018

## Fall Maintenance Expo

(1 RS credit) LTAP
Oct. 3–4, St. Cloud

## Statewide Toward Zero Deaths Conference

Oct. 23–24, St. Cloud

## CTS Transportation Research Conference

Nov. 1, Minneapolis

## APWA-MN Fall Conference and Workshop

Nov. 14–16, Brooklyn Center

## ONLINE TRAINING:

Anytime, anywhere!

### Culvert Design and Maintenance (1 RS credit) LTAP

### Sign Maintenance and Management for Local Agencies (1 RS credit) LTAP

### Gravel Road Maintenance and Design (1 RS credit) LTAP

### Work-Zone Safety Tutorial (0.5 RS credit) LTAP

### Turfgrass Pathology Course (0.5 RS credit) LTAP

## For details and an up-to-date list of events, please see mnltap.umn.edu.