

MINNESOTA LTAP

TECHNOLOGY EXCHANGE

mnltap.umn.edu

Minnesota Local Technical Assistance Program

June 2019 Vol. 27, No. 2

INSIDE:

HONORS
 Roads Scholar grads 2
 NACE awards 2

LRRB SPOTLIGHT
 RAP in gravel roads 3
 Fish passage through culverts 3

MAINTENANCE
 Stormwater ponds 4
 Liquid brine 5
 Turfgrass cultivars 6

INFORMATION SERVICES
 The Shelf & search tools 7
 Concrete grinding residue 7
 Roadside dust from car parts 7
 Bee-friendly turfgrass 7
 Public involvement apps, videos 7

WORKSHOPS AND TRAINING
 Calendar 8
 Quiz: Minnesota Madness 8

Turfgrass course: installation and management



Minnesota LTAP is now offering an online course that aims to help practitioners successfully install and manage roadside turfgrass. It provides a series of lessons on salt-tolerant turfgrasses and low-input turfgrass management for contractors, maintenance operators, and engineers.

Turfgrass continued on page 6

New spreadsheet tool helps you manage gravel roads

A new spreadsheet tool from the Minnesota Local Road Research Board (LRRB) is designed to help county engineering offices better track and manage gravel roads. It can be used as an inventory tool, providing one location for keeping all maintenance and construction data about a gravel road system. It can



also be used to track costs and optimize spending.

The tool, designed by SRF Consulting, is flexible and customizable for a variety of purposes and system sizes. A user guide provides instructions for the gravel road management tool.

There are approximately 142,900 miles of roads in Minnesota, and over half of them are dirt or gravel-surfaced. These roads often have little traffic and service remote areas, so tools for their management and maintenance have been lacking. At the same time, the time and cost to maintain and service these roads is significant. The simple tool is intended to support local agencies in their management of these roads.

The spreadsheet includes tabs where users can

Gravel continued on page 3

A natural for a career in highway maintenance



Driving is one thing that always came naturally to Cristi Field, the assistant highway maintenance supervisor in Otter Tail County. A 2017 Roads Scholar grad, Field is living proof that women are taking on more types of transportation careers. She shares highlights of her story below.

What drew you to this career?

I was a farm girl and had three older brothers. I was raised to work hard—that’s who I am. My dad drove truck, hauling large farm equipment. I got my commercial driver’s license when I was 21. I then worked for a road construction company for ten years, first as a flagger, then driving a live-bottom tractor trailer or whatever else they asked me to drive. I enjoy driving large equipment—it felt natural and came easy, and it led me to where I am. After that, I worked for MnDOT for ten years, and now I’m with Otter Tail County.

Tell us about your current position.

Last December I transitioned from highway maintenance worker to a supervisor position. My work is hands-on task planning, coordinating plow schedules and routes, [getting] numerous quotes for everything from supplies and products to equipment repairs. Other examples are handling phone calls from residents with concerns or approach requests, budgeting for future purchases, and monitoring forecasts, road conditions, and weather.

Career continued on page 8



TECHNOLOGY EXCHANGE
 Minnesota Local Technical Assistance Program
 Center for Transportation Studies
 University of Minnesota
 University Office Plaza, Suite 440
 2221 University Avenue SE
 Minneapolis, MN 55414

READ THE
EXCHANGE
 online for links to publications
 and other resources.

HONORS



Congratulations, Roads Scholars!

Congratulations to the 2018* graduates of the Roads Scholar Program!

- Rich Behne, Olmsted County
- Bruce Bersie, Wright County
- Jonathon Bratvold, Otter Tail County
- Andy Crotty, Karvakko Engineering
- Doug Dean, Jackson County
- Mark Fischbach, MnDOT
- Charles Fredericks, City of Eagan
- Eric Geyen, City of Waconia
- Anthony Hyatt, Scott County
- John Knoop, City of Coon Rapids
- Sandy Mahoney, City of Mahtomedi
- Brent Meissner, City of Maplewood
- Robert (Bob) Meyer, Olmsted County
- Darin Ness, City of Champlin
- Alvin Pederson, Otter Tail County
- Cole Rossow, Jackson County
- Jed Rhubee, Cottonwood County
- Rick Ruiz, City of Maplewood
- Bob Running, City of Maplewood
- Avery Sipola, St. Louis County
- Justin Sorensen, City of Waconia
- Jim Spreigl, City of Coon Rapids
- Brian Theis, City of Shakopee
- Dave Tucker, City of St. Francis

*Students who completed their coursework by December 31, 2018, are considered the Class of 2018. ■



Some recent Roads Scholar grads received their certificates during a ceremony at the Minnesota Roadway Maintenance Training and Demo Day in Rochester. Left to right: Stephanie Malinoff (LTAP), Grant Riemer (2017 grad), Katherine Stanley (LTAP), Bruce Bersie, Charles Fredericks, Sandy Mahoney, Doug Dean, Avery Sipola, Rich Behne, Robert (Bob) Meyer, Cole Rossow, Mindy Carlson (LTAP).

Minnesotans receive NACE awards



Frank Ticknor

Two Minnesotans were honored in April by the National Association of County Engineers (NACE) during its annual conference, held in Wichita, Kansas.

Washington County's Frank Ticknor received the 2018 Project Manager of the Year Award. Ticknor, the Washington County design engineer since 2013, leads a team that delivers 25 to 30 transportation projects every year.

Ticknor was recognized for his work on the downtown Afton revitalization project. In 2008, Washington County partnered with the City of Afton to develop a plan to completely reconstruct the 160-year-old "Old Village of Afton." It was an eight-year process that assembled a project vision, procured stakeholder funding, prepared preliminary and final designs, provided construction administration, and coordinated with tribal communities to protect the Rattlesnake Effigy Mound.

"Frank's work with levee construction and sanitary and treatment systems [has] exponentially improved the lives of Washington County's residents," said Tim Hens, NACE president

and Genesee County, New York, highway superintendent. "Due to his efforts, Washington County was able to successfully deliver a major public works undertaking, successfully meeting 100-year flood protection benchmarks on time."

McLeod County Engineer John Brunkhorst received the 2018 Rural County Engineer of the Year Award. "John's work has improved the safety of his county's roads and transportation infrastructure, and he is regarded as a national authority on concrete overlays," Hens said. ■

Steering Committee update

A big welcome to Tim Kieffer, the public works maintenance manager for the City of Golden Valley. He will represent the Minnesota Street Superintendents Association on the Minnesota LTAP Steering Committee. He succeeds Will Elwell of Scott County. Our thanks to them both for their service! ■

Technology Exchange

The **Minnesota Local Technical Assistance Program** is part of the Federal Highway Administration's Local Technical Assistance Program (LTAP). LTAP is a nationwide effort designed to foster and improve information exchange among local practitioners and state and national 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.

The University of Minnesota is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, color, creed, religion, national origin, sex, age, marital status, disability, public assistance status, veteran status, or sexual orientation. This publication is available in alternative formats upon request.

Any product mentioned within should not be considered a product endorsement. Authors' opinions/findings do not necessarily reflect the views of Minnesota LTAP.

Contact us

Technology Exchange is published quarterly. For free subscriptions, mailing list changes, or extra copies, contact us at the address or phone number below.

Technology Exchange welcomes contributions and suggestions from its readers. Submit ideas and other comments to Pamela Snopl, managing editor.

Minnesota LTAP

Center for Transportation Studies
University of Minnesota
University Office Plaza, Suite 440
2221 University Avenue SE
Minneapolis, MN 55414
Phone: 612-626-1077
Email: mnltp@umn.edu
Web: mnltp.umn.edu

© 2019 Minnesota Local Technical Assistance Program (LTAP), University of Minnesota

Minnesota LTAP Staff

LTAP Director: Stephanie Malinoff
LTAP Program Director: Mindy Carlson
LTAP Program Coordinator: Katherine Stanley
CTAP Instructor: Kathy Schaefer
Workshop Registration & Facilitation: Teresa Washington
Managing Editor: Pamela Snopl
Editors: Christine Anderson, Michael McCarthy
Designer: Angie Kronebusch
Freelance writers: Paul McDivitt, Megan Tsai

Photo Credits

Shutterstock, MnDOT, LRRB, FHWA, NACE, Jacques Finlay, Jefferson County Highway Department

Minnesota LTAP Steering Committee

Chair: Mitch Rasmussen, State Aid for Local Transportation Division, MnDOT
Joe Campbell, Federal Highway Administration
Mike Flaagan, Pennington County; Minnesota LRRB Research Implementation Committee
David Hann, Minnesota Association of Townships
Greg Isakson, Goodhue County; Minnesota County Highway Engineers Association
Tim Kieffer, City of Golden Valley; Minnesota Street Superintendents Association
Steve Lillehaug, City of Shakopee; City Engineers Association of Minnesota
Laurie McGinnis, Center for Transportation Studies
Tom Peters, Office of Maintenance, MnDOT
Chris Petree, City of Rochester; American Public Works Association – Minnesota Chapter
Lyndon Robjert, Carver County; Minnesota LRRB
Rich Sanders, Polk County; Minnesota County Engineers Association
Paul Sandy, City of Brainerd; City Engineers Association of Minnesota

Printed on 50% recycled fibers, including minimum 30% postconsumer waste.



Study suggests 70 percent RAP for gravel road surfaces

Road agencies frequently use recycled asphalt pavement (RAP) in gravel roads. The asphalt content in RAP can bind with dust from crushed rock or gravel, helping manage fugitive dust. A study in Wyoming found that using RAP in new gravel surface applications at less than 50 percent of the aggregate resulted in good road performance and kept dust to a minimum.

In light of the findings from Wyoming, the LRRB and MnDOT sponsored a study to determine the optimal level of RAP in an aggregate mixture for Minnesota gravel road surfaces. The goal for these new applications would be to offer good driving stability while also controlling fugitive dust.

In lab and field testing, researchers examined mixtures of RAP and aggregate for new gravel road surface layers. Results suggest that mixtures with 70 percent RAP content can reduce dust generation and, after a year of service, can match all-aggregate gravel road performance with a smoother ride.

“The 70 percent RAP mixture seemed to be about the best combination,” says Professor Charles Jahren of Iowa State University, the principal investigator. “We put RAP down in fall 2017, and by the next summer, it was working much like a regular gravel road.” ■

Learn more:

- Technical summary: *Study Suggests 70 Percent RAP for Minnesota Gravel Road Surfaces* (LRRB/MnDOT, 2019-11TS, Apr. 2019)



Mounds of RAP at a gravel pit in Carlton County offer road agencies an alternative to natural gravel and crushed aggregate for gravel roads. But RAP has to be used in the right proportion with gravel.

Gravel from page 1

enter their road segment inventory, maintenance record, desired thickness, and segment evaluation. Other tabs have an evaluation guide and raw GIS data for Minnesota county roads from the 2018 MnDOT Linear Referencing Network.

The developers prepopulated many of the input cell locations, but users may also choose to customize those options very easily. ■

Learn more:

- Download the spreadsheet: lrrb.org/gravel-road-management-tool
- *Gravel Road Management Spreadsheet Tool Supplemental Guidance* (LRRB 2019RIC03, March 2019)
- Minnesota LTAP's Low-Volume & Gravel Roads topic page: mnltp.umn.edu/topics/lowvolume

Desired Thickness

Instructions:
This tab allows the user to select a segment from the "Road Segment Inventory" tab and enter a measured thickness of gravel and a desired thickness or gravel. Based on the length of the segment and the average maintained width from the "Road Segment Inventory" tab, a total cubic feet of gravel is calculated. The user can then add the price per ton of gravel to calculate a total gravel cost.

KEY: Dark Blue Cells contain prepopulated formulas

Example Data Entry:

Segment ID	Type of Gravel	If other, spec	Length of Segment (mi)	Avg Maintained Width (ft)	Date of Measurement	Measured Thickness (in)	Desired Thickness	Difference	Cubic Feet Needed	Gravel Cost Ton	Total Gravel Cost
MainStreet:135th-165th	Pit Run		4	18	5/10/16	7	8	1	31680	\$20.00	\$633,600
155th-145th-90th	Pit Run		5.5	20	7/12/17	7	8	1	48400	\$20.00	\$968,000
145th-125th-Ronney	CL1		2	19	7/8/17	9	6	0	0	\$15.00	\$0
SycamoreRd:120th-MNTHL_95	CL5		0.5	17	8/1/18	8	9	1	3740	\$67.90	\$253,945
125thHwy:SchoolHouse-MNTHL_95	Local pit		2	20	4/17/17	4	8	4	70400	\$22.00	\$1,548,800

Segment ID	Type of Gravel	If other, spec	Length of Segment (mi)	Avg Maintained Width (ft)	Date of Measurement	Measured Thickness (in)	Desired Thickness	Difference	Cubic Feet Needed	Gravel Cost Ton	Total Gravel Cost
MainStreet:1st-2nd	CL1		10	10		5	8	3	132000	\$20.00	\$1,054,000
WalnutDr:5th-10th	Pit Run		5	4				0	0		\$0
CSA#124:CR10 CR_78			4	6				0	0		\$0

This tab allows the user to select a segment from the "Road Segment Inventory" tab and enter a measured thickness of gravel and a desired thickness of gravel. Based on the length of the segment and the average maintained width from the "Road Segment Inventory" tab, a total cubic feet of gravel is calculated. The user can then add the price per ton of gravel to calculate a total gravel cost.

Culvert designs allow fish passage

Minnesota transportation practitioners now have access to a comprehensive culvert design guide to help preserve stream connectivity and promote the safe passage of fish and other aquatic organisms through culverts.

“Minnesota’s 140,000 miles of road and 92,000 miles of streams and rivers meet at tens of

thousands of places,” says Matt Hernick, an associate engineer with the U of M’s St. Anthony Falls Laboratory. “Because of the variety of ecological regions in the state, the range of culvert geometries, and other factors, no single solution can work for culverts statewide. The new guide fills this information void.”

Culverts are a cost-effective solution to allow traffic to cross over smaller waterways, but they have historically been designed with only flood flows and the safe passage of vehicles in mind, and not the health of streams and the organisms that depend on them

The 221-page guide is amply illustrated with photos, charts, and more. Sections include culvert design, the current regulatory context, site assessment, analysis and tools, best practices, and a design method selection chart.

Benefits for users may include more-efficient design and permitting processes and lower construction costs. The project was sponsored by MnDOT and the LRRB. ■

Learn more:

- Technical summary: *Optimal Culvert Designs for Aquatic Organisms and Stream Connectivity* (LRRB/MnDOT, 2019-02TS, Jan. 2019)



MAINTENANCE

Road salt and stormwater ponds don't mix

Jacques Finlay is new to road salt research, and, unsurprising for those who have been following the issue, he does not come bearing good news.

"I'm here to add to your list of worries about road salt," Finlay told the crowd at the 18th Annual Road Salt Symposium in February.

Finlay presented his research on stormwater ponds—those small ponds scattered around the Twin Cities and the state that are supposed to filter runoff from roads and other surfaces before it enters our freshwater streams, rivers, and lakes.

"They're primarily put into service, modified or created, to improve water quality by trapping contaminants and controlling floodwaters," Finlay said. Unfortunately, they're not working as they should.

Finlay is a professor in the University of Minnesota's Department of Ecology, Evolution and Behavior and is also associated with the University's Saint Anthony Falls Laboratory and the Institute on the Environment. His lab "investigates the ecology of freshwater ecosystems, and their interactions with surrounding natural and human-altered landscapes."

According to the Minnesota Pollution Control Agency, the Twin Cities metro area applies an estimated 365,000 tons of road salt each year, and roughly 78 percent of that is either transported to groundwater or remains in local lakes and wetlands. Research shows that salt concentrations are increasing in water bodies across the state.

This is a problem because road salt pollutes water with chloride, which negatively impacts fish and other aquatic life.

'That's a lot of salt'

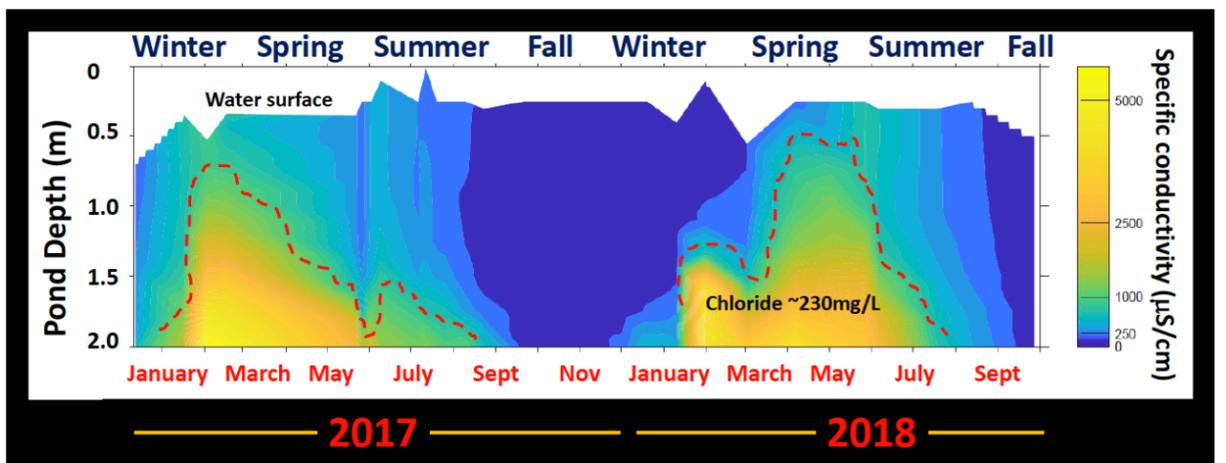
In 2018, Finlay's team surveyed 38 stormwater ponds. In the shallow ponds (those less than three feet deep) chloride levels were evenly mixed. The levels were above water-quality standards, but not extreme given their proximity to roadways, according to Finlay. However, in the deeper ponds, road salt accumulated in the bottom.

"It's accumulating at such high levels in some ponds that we need a new frame of reference," Finlay declared. "That new frame of reference, unfortunately, is seawater."

In one of the six deeper ponds, chloride levels near the bottom of the pond were approaching those of salt water. "That's a lot of salt sitting there in the bottom waters of these ponds."

Chloride impacts

Snow melt adds chloride to stormwater ponds in the spring and late winter, and the chloride can stay in the ponds for months—longer than Finlay expected. Because the salty snowmelt entering



Seasonal patterns of salt accumulation and flushing. Water below the red line indicates a "salt blob."

these ponds is heavier than pure water, the salt sinks to the bottom, forming a salty layer at the bottom of the ponds, with fresher water on top.

Chloride pollution has three main impacts on stormwater ponds:

- **Chloride toxicity:** Finlay said that the levels of chloride in many of these ponds is "way above the standard for aquatic life." In addition, there is some evidence that warmer summer temperatures enhance the toxicity of chloride.
- **Heavy metals:** Salt also acts as an extractant, or mobilizer, for metals bound in the sediment at the bottom of stormwater ponds. High levels of salt can increase the concentrations of toxic heavy metals in these ponds.
- **Mixing:** Stormwater pond waters are supposed to mix well, but road salt impairs this mixing. Ideally, these ponds would be mixing often to ensure oxygen reaches the sediments. "They're mixing very, very infrequently," Finlay explained. This lack of mixing means that there are very low levels of dissolved oxygen in the bottom waters of the water profile, which is bad for animal and plant life.

From dragonflies to frogs, Finlay described these salty ponds as "ecological traps." "Many of the organisms that might use these ponds don't know that," Finlay said.

Phosphorus pollution

In addition to chloride, road salt may impact phosphorus pollution, famous for turning freshwater lakes and ponds into scummy, green soups of algae.

"Stormwater ponds are used to trap that phosphorus before it gets into our lakes, but some early evidence that we're seeing, in the Twin Cities at least, is that one in three ponds are not doing their job," Finlay explained.

"[Salt is] accumulating at such high levels in some ponds that we need a new frame of reference. That new frame of reference, unfortunately, is seawater."

—Jacques Finlay

Phosphorus should be sinking to the bottom of stormwater ponds, where it is stored in the sediment. Instead, it is recirculating in the water column, where it can move downstream and into our lakes. We do not yet understand the role that road salt plays in phosphorus very well, but previous work suggests that it may have an impact, Finlay said.

Potential solutions

Finlay sees two main potential solutions for dealing with stormwater ponds' salt problem. First, the obvious: reduce road salt inputs. He said the focus should be on reducing inputs to particularly sensitive ponds.

The second potential solution is to better manage the stormwater ponds themselves. Many of the ponds they surveyed need to be excavated and retrofitted so that they better dilute and flush salty water. In addition, he highlighted the need for more research and stakeholder engagement. ■

—Paul McDivitt, LTAP freelancer



Road salt may contribute to phosphorous pollution, which turns freshwater ponds and lakes into green soups of algae.

Strategies help mitigate chloride from deicers

In a U of M study, researchers measured the transport and accumulation of chloride from road deicers in a Twin Cities metro-area watershed. The findings revealed a greater infiltration of chlorides into soil and subsurface waters than was previously assumed. The research team also examined potential strategies for reducing or mitigating the spread of chloride, including capturing low flows, seasonal runoff capture, and capture based on salinity. The research was funded by the LRRB and MnDOT. ■

Learn more:

- *Examining Deicing Chloride Accumulation and Transport Through a Watershed* (LRRB/MnDOT, 2017-50TS, Jan. 2018)

Liquid asset: County reduces road salt, saves money with brine

Jefferson County Highway Commissioner Bill Kern still remembers the first meeting he brought up the idea of using liquid brine instead of road salt for highway snow and ice removal. He was new to the department, and one of the veteran superintendents took him aside.

"[He] grabbed me by the arm and said, 'hey, if you want to stay working here in Jefferson County, don't ever bring up liquids again,'" Kern said, drawing laughs from the crowd at the 2019 Road Salt Symposium.

According to Kern, the reason for the superintendent's skepticism was that, five years earlier, the county had tried using liquids but didn't know what it was doing. It was a disaster, and they decided never to use liquids again. But when three of the veteran superintendents retired, Kern decided to give it another look.

"After reading a lot of research, looking at what other states were doing, what other places were doing, it sounded pretty smart to start using liquids," Kern explained.

Starting small

The county started small, in 2010, equipping one small truck for pre-storm anti-icing of bridge decks for frost—a common practice nowadays. Over the next four years, the entire fleet of trucks was switched over to this "pre-wet" setup.

The Jefferson County Highway Department, located between Madison and Milwaukee, maintains 520 lane miles of county highways and 550 lane miles of state highways, including Interstate 94.

During the 2015–2016 season, the county started experimenting with liquid brine use during winter storms and in post-storm clean-up, and increased liquid use in mainline anti-icing. In 2017–2018, it implemented a short-section liquid application pilot route to experiment with the use of liquid salt brine as an alternative to dry rock salt. "This is where our eyes really opened," Kern said.

They learned a lot during the pilot phase. At first, they weren't applying enough brine, so they adjusted application rates to match weather conditions and the route cycle time. They adjusted the spray nozzles to increase pressure, modified the spray bar for improved coverage, and reduced the truck's driving speed—and they began to have some success.

There were pros and cons. Brine reacts and melts snow and ice more quickly, and less salt is wasted due to bouncing off the road. For light storms, that section of highway was clearer than other sections. But it didn't do quite as well with bigger storms, where dry salt is better at penetrating deep snow-packs more quickly.

The biggest benefit, however, came at the end of the season: the liquid route required a whopping 44 percent less salt than similar routes that winter.

Direct Liquid Application model

After that trial season, the department decided to move its whole system toward a Direct Liquid Application (DLA) model. During the 2018–2019 winter, Jefferson County deployed six liquid trucks, which allowed the road salt trucks on those routes to dial down from 500 to 600 pounds per lane-mile to 100 to 200.

"This is what we're going to do for the future," Kern said. "By next winter, we hope to have every one of our primary plow routes set up this way."

Their current fleet of liquid trucks carry



Jefferson County deployed six liquid trucks this past winter.

900-gallon tanks, but the plan is to move to dual 750-gallon tanks—1,500 gallons of brine per truck. Drivers have several different options—full lane, half lane, direct center lane, turning lanes—and access to top-notch technology.

In addition to outfitting trucks, the transition to a DLA model required new facilities as well. Their salt brine house, built in 2015, makes up to 4,000 gallons per hour. They recently expanded their storage capacity from less than 50,000 gallons to around 140,000. Both were needed as their brine usage increased 10 times in four years, from around 60,000 gallons in 2012 to 600,000 in 2018.

Cost-benefit

It's all worth it for Kern when he looks at the cost savings. A 35 percent reduction would mean over 5,000 tons of road salt he doesn't have to buy, saving the county almost \$400,000—not to mention the environmental benefits from such a significant reduction in road salt inputs.

While they're still compiling numbers from the 2018–2019 winter, Kern thinks they cut salt use around 50 percent thanks to improved employee training and the use of liquids.

"The numbers are very significant, but the most important factor was that we got the employees to buy into what we were trying to do," Kern said.

After this past winter, Kern feels they've already recouped all of the county and state costs associated with investing in brine facilities and equipment.

"Looking at liquids, I was a skeptic several years ago, too," Kern reflected. "I can tell you that I am much less a skeptic now, based on the results of our liquid use and brine pilot. We are moving all-in on implementing a salt brine liquid application model to our winter storm fighting." ■

—Paul McDivitt, LTAP freelancer

THE LIQUID ROUTE
required
44 PERCENT
less salt
than similar routes.



Truck drivers have several spray bar options.



Model Contract for Snow and Ice Management Services

A model contract for snow and ice management services is available on the Minnesota Pollution Control Agency website. The contract includes a section about best practices to limit environmental impact and vegetation or structure damage. Go to pca.state.mn.us/sites/default/files/p-tr1-52a.pdf. ■

35 PERCENT
less salt =
\$394,000
in cost savings.

Road Salt Symposium moves to October

Mark your calendars: the annual Road Salt Symposium is moving to the fall beginning this year. It has been held in February for nearly 20 years.

The next symposium will be held October 24, 2019, at a location to be determined. Stay tuned for details. ■

MAINTENANCE

New cultivars selected for roadside turfgrass

For nearly a decade, University of Minnesota researchers have been working to improve the health and performance of roadside turfgrasses in Minnesota, focusing mainly on salt tolerance and watering needs for select turfgrass species. In their latest project, sponsored by MnDOT and the LRRB, the researchers focused on identifying grasses that can perform best in the face of three significant stressors: salt, heat, and ice.

The researchers, led by Professor Eric Watkins of the Department of Horticultural Science, found that a mixture of turfgrass varieties and species will likely be the best solution for year-round use in Minnesota, as no one cultivar performed well in every trial.

- **Salt stress.** Tall fescue and perennial ryegrass sustained the highest percent green cover and

lowest electrolyte leakage throughout the salt stress trials. Alkaligrass, considered salt tolerant, did not perform significantly better than other grasses. Only tall fescue emerged as a salt-resistant turfgrass option, though this cultivar is vulnerable to ice cover.

- **Heat stress.** Performance varied significantly within species, suggesting a potential for breeding improvements. Some species performed poorly under heat but recovered well when returned to normal conditions. Researchers recommended Canada and Kentucky bluegrasses, tall fescue, strong creeping red fescue, and slender creeping red fescue as heat-resistant turfgrass cultivars.
- **Ice stress.** Tall fescue performed best in image and color analysis. Field observations and

"We need to use the best genetics along the roadside as possible. Using the right variety of turfgrasses improves the chances of success and can save a lot of money for public agencies."

—Eric Watkins

previous study, however, suggest that tall fescue performs poorly under ice cover. Warm season grasses died during the control cold storage. Researchers concluded that the ice trial did not properly simulate field ice cover conditions.

Based on the study results, the team developed recommendations for MnDOT guidelines on salt- and heat-resistant turfgrasses; tests related to ice-resistant cultivars were inconclusive.

The team also recommended a mixture of cultivars for field studies, which began last year as part of a second phase of the research. In phase two, researchers are using a mixture of six species selected from this study: Kentucky bluegrass, slender creeping red fescue, hard fescue, buffalograss, alkaligrass, and tall fescue. Mixtures are being planted in different combinations on roadsides for evaluation. In the meantime, MnDOT is adjusting its seed mixture recommendations for use based on the results of this and other studies. ■

Learn more:

- Technical summary: *Identifying Turfgrass Varieties That Tolerate Salt, Heat and Ice* (LRRB/MnDOT, 2019-01TS, Jan. 2019)



Researchers used digital imaging to examine green cover levels during salt and heat trials and after ice trials.

Turfgrass from page 1

The new course is designed for agencies and contractors looking to establish salt-tolerant roadside grasses, applicable to any northern US climate. The self-paced training is offered via the course management system Canvas. Cost is \$30. The workshop qualifies for 1.0 Roads Scholar Program credit and 3.0 Continuing Education Units.

The course was developed by Extension Turfgrass Science at the University of Minnesota, with financial support from the Minnesota Department of Transportation (MnDOT) and the Local Road Research Board (LRRB) under the project "Expanding the Success of Salt-Tolerant Roadside Turfgrasses through Innovation and Education." The course incorporates findings from research funded by MnDOT and the LRRB in recent years. ■

Excerpt from the online turfgrass course: Mowing principles and practices

The first, and possibly most important principle of mowing, is the 1/3 rule. The 1/3 rule states that you should not mow off any more than 1/3 of the grass plant height at any one mowing... Removing more than this might result in significant stress, scalping, slow recovery of the stand, and possibly long-term damage. It's also important to note that higher mowing heights will require less frequent mowing. For lower-maintenance roadsides that receive infrequent mowing, following the 1/3 rule may not be practical in all cases. However, following this rule should always be considered when developing a mowing program. ■



Go to mnlta.umn.edu to register.



There are more than
245,000 ACRES
OF ROADSIDE TURFGRASS
in Minnesota.

THE SHELF

Minnesota LTAP partners with the MnDOT Library to operate a state-of-the-art service that can help you track down almost any resource from Minnesota or beyond. Questions? Contact Marilee Tuite, Minnesota LTAP librarian, 612-626-8753, ctslib@umn.edu.

Rapid Detection of Concrete Joint Activation Using Normalized Shear Wave Transmission Energy (Illinois Center for Transportation, March 2019)

Explores how a multisensor array device can be used to assess the effectiveness of sawcut depth and timing on new concrete pavements as well as identify when premature slab cracking occurs.

MnDOT Slope Vulnerability Assessments (MnDOT, March 2019)

Explains the methods and results of the MnDOT Slope Vulnerability project.

Field Implementation and Monitoring of Behavior of Economical and Crack-Free High-Performance Concrete for Pavement and Transportation Infrastructure Constructions – Phase II (Missouri DOT, Apr. 2019)

Reports on Phase II of this project, which aimed to validate findings through field implementation and provide a guideline for the optimal use of Eco-HPC. The initial phase found that Eco-HPC can secure high resistance to shrinkage cracking and high strength and durability.

Corrosion-Free Carbon Fiber Reinforced Polymer for Prestressed Piles (Virginia DOT, Feb. 2019)

Investigates the feasibility of replacing traditional steel strands and spiral reinforcement in bridge piles with carbon fiber reinforced polymer (CFRP) strands and spiral reinforcement. CFRP is a corrosion-free material, whereas the conventional steel reinforcement used in a traditional pile is prone to corrosion when exposed to chlorides.

Personal Warning Sensor for Road Construction Workers (MnDOT and LRRB, Feb. 2019)

Demonstrates the capabilities of a work-zone intrusion alarm system, called Advance Warning and Risk Evasion (AWARE), during a Minnesota paving project. The portable radar-based technology intelligently detects and tracks potential vehicle intrusion threats, as well as worker locations, to warn both workers and errant drivers.

Investigation and Evaluation of Iowa Department of Transportation Bridge Deck Epoxy Injection Process (Iowa DOT, Feb. 2019)

Develops specifications for concrete overlays of bridge decks in Iowa.

Roller Compacted Concrete For Rapid Pavement Construction (Missouri DOT, Feb. 2019)

Develops high-performance Roller Compacted Concrete (RCC) with enhanced solid skeleton to secure greater workability, mechanical properties, and frost durability. Test results indicate that the performance of RCC can be improved with the increase in packing density of aggregate skeleton.

Cyclic Plate Testing of Reinforced Airport Pavements— Phase I: Geogrid (US FAA Air Traffic Organization Operations Planning, Feb. 2019)

Examines the effect of using geosynthetics as a reinforcement agent in airfield pavement design with pavement structures subjected to heavy aircraft loadings.

Displacement Monitoring of I-35W Saint Anthony Falls Bridge with Current Vibration-Based System (MnDOT, Jan. 2019)

Uses the currently installed accelerometers on the I-35W Saint Anthony Falls Bridge to estimate the vertical displacements of the southbound bridge. ■

Search me

The Minnesota LTAP website features custom search engines to help you find information. You can search:

- LTAP & TTAP Centers
- State DOTs
- Transit agencies
- University transportation centers

Bookmark mnltp.umn.edu/publications/library.

Other great resources are:

- LRRB's site: lrrb.org
- MnDOT Library's catalog: dot.state.mn.us/library ■

Concrete grinding: mixed impacts on roadside vegetation and soil

In a recent MnDOT-sponsored project, researchers studied the impact of concrete grinding residue (CGR) on roadside vegetation and soil. Research of this topic has been limited, and engineers and researchers presumed that the concrete dust temporarily coats roadside turf and plants, raises the soil pH, clogs soil pores and inhibits water drainage, invites invasive species to take root, and may infiltrate storm drains and waterways.

The research team, led by Halil Ceylan of Iowa State University, found that CGR may not cause lasting harm to plant growth and soil quality. Results indicate that grinding residue affected soil chemistry, temporarily boosting growth in some plant species. In fact, concrete grinding residue or slurry can, under certain conditions, be a benefit—it can act as a liming agent, changing soil pH in a positive manner. The results, however, cannot be generalized for all soil types, plant communities, concrete residue, and water sources, and follow-up research is recommended, Ceylan says. ■

Learn more:

- Technical summary: *Effect of Concrete Grinding Residue on Roadside Vegetation and Soils* (LRRB/MnDOT, 2019-06TS, Apr. 2019)

Roadside dust from car parts may pose a health concern

A University of Pennsylvania research team analyzed roadside dust to identify potential health risks from the tiny bits of tires, brake pads, and road materials that become suspended in the air when vehicles pass over. The team found that these materials may be significant sources of environmental pollution, with potential health implications. In one year-long sampling of roadsides in Germany, a site with busier traffic patterns had 30 percent more particles overall than a rural site. Dry and warm conditions were associated with a greater build-up of particles. Coarse particles can also build up on roads and wash into waterways. (From Science Daily, Sept. 10, 2018) ■



Involve the public using apps, low-cost videos

The Every Day Counts round five (EDC-5) team on virtual public involvement offers technical assistance, peer exchanges, and workshops to help agencies adopt digital tools to engage people in transportation planning and project development processes.

These virtual tools include mobile applications for sharing information about projects, particularly large or long-term projects. Apps reduce engagement barriers by enabling individuals to participate anywhere and anytime and submit comments and photos as they experience the transportation system, fostering two-way communication.

Another option are low-cost, do-it-yourself videos. Often produced on mobile phones, they can communicate project information to diverse audiences through many media channels. This technique is effective for engaging people who prefer to watch a short video rather than read a report or visit a website.

The Utah Department of Transportation (UDOT) explains its approach to using videos in "DIY Video for Public Involvement." UDOT spent an average of \$340 per video to develop updates on a major project and promote the videos on social media. At an average of 11,600 views per video, the cost per view was 3 cents. ■

Learn more:

- Every Day Counts: fhwa.dot.gov/innovation/everydaycounts



Study finds public support for bee-friendly turfgrass

A study led by U of M researchers suggests that there is widespread public support for public land managers who wish to add flowering lawns to their suite of green infrastructure options. Flowering bee lawns integrate low-growing flowers into mowed turfgrass to increase the availability of bee forage. The paper, coauthored by Professor Eric Watkins, is in the journal *Landscape and Urban Planning*, Vol. 189. ■

Answer to test on page 8:
Road salt applied in the Twin Cities metro area each year: estimated 365,000 tons
Acres of roadside turfgrass: 245,000+
Roadways: 142,000+
Streams and rivers: 92,000 miles



Every Day Counts is the FHWA's initiative to advance a culture of innovation in the transportation community in partnership with public and private stakeholders.

WORKSHOPS & TRAINING



CALENDAR

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

Minnesota Truck-Weight Education Training

(1 RS credit) **LTAP**
 Sept. 4, Rochester
 Sept. 11, Duluth
 Sept. 12, St. Cloud

Fall Maintenance Expo

(1 RS credit) **LTAP**
 Oct. 2–3, St. Cloud

Statewide Toward Zero Deaths Conference

Oct. 23–24, St. Cloud

Road Salt Symposium

(1 RS credit) **LTAP**
 Oct. 24, location TBA

CTS Transportation Research Conference

Nov. 7, Minneapolis

APWA-MN Fall Conference and Workshop

Nov. 20–22, Brooklyn Center

ONLINE TRAINING: Anytime, anywhere!

Installation and Management of Roadside Turfgrasses
 (1 RS credit) **LTAP**

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

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**

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 mnltp.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: mnltp.umn.edu. To be added to our print or electronic mailing lists, email mnltp@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.

Career from page 1

What are some career rewards and challenges?

I take pride in my work and do my best every day. I try to be a better, more efficient person than I was yesterday. I feel like a big sponge in this new role—I absorb everything, and I love to learn. Always being available to staff and citizens for questions is probably my biggest challenge.

What are some physical aspects of the job?

Maintenance work included some heavy lifting. It might be shoveling hot mix to patch roads or changing cutting edges or tires on trucks.

How do you maintain a work/life balance?

I've always put family first—nothing is more important. Second is to remember to take time for self-care, to reset and re-adjust when life gets too busy.

Any surprises in your job?

Every day—it never fails to surprise me. It could be weather related, public concerns, or road hazards.

What can people learn from your career path?

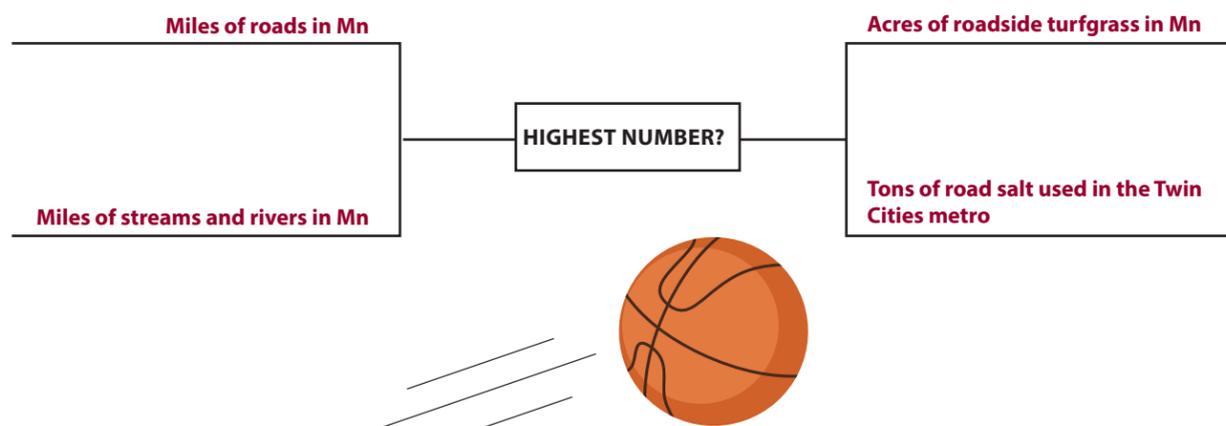
Everybody has opportunities, but it's up to you to look for them. Every day I wake up, I get to decide if I will have a good day or bad day. The opportunities are there, but it takes determination to chase them and follow up on them. When someone asks me "How can you do that?" or says, "I could never do that," I like to simply ask them "Have you tried?" You must be willing to try something new before you can truly say "I can't." ■



Cristi Field

Minnesota Madness: A Final Four of Maintenance

In honor of Minnesota hosting the NCAA Men's Basketball Final Four this spring, we've created our own Minnesota Madness. After reading the stories in this issue, pick the higher number for each bracket. Answers are on page 7. ■



Women in Public Service events

Hamline University in St. Paul offers an annual conference and ongoing seminars about women in public service. The events bring together professionals from throughout the public sector to share stories, develop new knowledge and skills, and network with one another to support women in public service.

The annual conference examines the changing face of government and the way business is conducted in the public sector, with particular emphasis on how we support women and the next generation of public servants. The 2019 conference is Friday, November 1. Registration is scheduled to open September 16. Seminars take place during the spring and are determined after each conference. ■

Learn more:

- Hamline.edu/women-in-public-service