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Fighting floods and water pollution



When the Coon Creek Watershed District and Anoka Conservation District embarked on a water quality project, they aimed to prevent pollutants from making their way to the nearby Mississippi River. They managed to secure grant funding to build a stormwater pond that could accomplish this goal but struggled to find a place to put it.

Floods continued on page 4

Counting right: The impact of the 2020 census on community development

Data influence development in a big way. Road maintenance, construction, public transportation: communities large and small rely on accurate data to plan and fund these projects, and the US census

is a major source of such data. With the 2020 census coming up in April, communities of all sizes will have to decide how to prepare.

The City of Circle Pines, Minnesota, has seen first-hand the importance of getting an accurate count. During the 2010 Census, the city counted 4,918 people—just shy of the 5,000 they needed to qualify for better State Aid roadway funding. This was eventually fixed, says City Administrator Patrick Antonen; special state legislation gave the city an exemption that treats Circle Pines as a city of over 5,000 and grants them corresponding annual transportation funds. If not for the special exemption, the city

Census continued on page 7

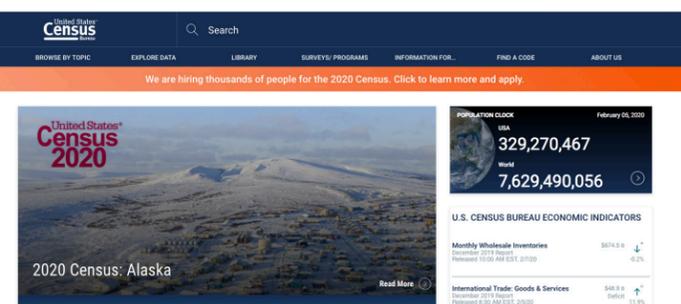


Pocket guide helps you choose PPE

Minnesota LTAP has created a pocket guide that helps you choose personal protective equipment (PPE) for 17 maintenance tasks. The handy guide is made of 3.5- x 6-inch cards bound with a key ring.

The new guide is adapted from materials created in a previous project sponsored by the Minnesota Local Road Research Board. In that project, Minnesota LTAP created a set of materials to raise awareness of workplace hazards and encourage the proper use of PPE.

The materials are customized for Minnesota and targeted to local transportation agencies. All are available for free download at mnltp.umn.edu/PPE. The website also includes links to source materials, state and federal policies, and other materials. ■



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 Minneapolis, MN 55414

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

HONORS

National Mousetrap award: pavement repair tracking app

Below is an award-winning innovation from the National LTAP Build a Better Mousetrap competition.

Potholes, cracks, bumps, and icy roads...all complaints that used to inundate the Arapahoe County, Colorado, Road and Bridge Department. "In winter months, we get as many as 30 calls a day from residents," says paving supervisor Keith Runyan. "It was difficult to track." Staying organized and on top of the reports is essential since the county requires workers to respond and take action within 72 hours.

When Runyan joined the Road and Bridge Department [seven] years ago, there was limited coordination with the GIS Mapping Department. That changed once Runyan realized the asset that could be created if the two departments worked together. "I just started exploring other departments and started seeing what technologies they

had available," he says. Runyan's curiosity paid off with the creation of the Pavement Repair Tracking Software App that offers access to crucial job information in real time.

"Before this solution, we just had a running list of names and addresses. Now I can see everything on a map," Runyan says. "It's so much easier to manage the workloads and put together daily, weekly, and even monthly work plans when you can look at it in a visual way rather than just in a spreadsheet."

The powerful tracking system lets users identify work with status-indicating icons and details about the work. "We can even attach photos," Runyan says. "I used ASTM D6433 [a standard for assessing pavement defects] and created icons to match up with the type of pavement defect. For example, small alligators represent alligator cracks. This made it easier. I didn't want to look at a dot on the map and wonder 'What is this?'"

Crews can now monitor upcoming and completed pothole and major patch work on desktop computers and mobile devices. The app provides real-time map data viewing and collection anywhere in the county, while in the office or in the field. Multiple people can edit the system at the same

time and data are exportable, so the information can be viewed in a map or a spreadsheet format.

The app gives supervisors the ability to go out in the field, get information for the team, and then easily prioritize projects. That way, crews know what they are going to see before they get there. They can determine the best repair method ahead of time and arrive prepared.

Because the app uses GIS data, there are more than 20 layers that track each category of information and can be turned on or off to simplify viewing or give multiple perspectives. In fact, the app is so beneficial, its use has spread to other departments.

How can another agency create a similar app? "The average GIS person can do whatever you want, but they don't know what you want," Runyan says. "You've got to be able to communicate that to them."

And, he adds, don't be afraid to try new things. "It helps us stay ahead of the curve." ■

(Reprinted and adapted from fhwa.dot.gov/clas /ltap.)



Submit your ideas for the 2020 Mousetrap competition!

To enter Minnesota's 2020 Mousetrap competition, please submit an entry form by May 31 at mnltp.umn.edu/research/mousetrap. For more information, contact Katherine Stanley at sell0146@umn.edu or 612-626-1023. ■

Associations honor 2019's top projects

Please see the association websites for a full list of award recipients. Congratulations to all!

City Engineers Association of Minnesota

City of Baxter – 2018 Cypress Drive Improvements.

The Cypress Drive Improvements project was a complex multi-year effort that included constructing and expanding 0.7 mile of discontinuous roadway to



Baxter's Cypress Drive improvements project

four lanes with two roundabouts and new at-grade crossings of TH 210 and the railroad tracks paralleling TH 210, all within a developed mixed-use commercial, industrial, and residential area. The project improves multimodal travel for bicyclists and pedestrians with new trails and bike-lane facilities within the corridor. It also addresses local and regional stormwater management needs with the construction of multiple basins and a stormwater lift station.

American Public Works Association – Minnesota Chapter

City of Bloomington – Penn American Stormwater Storage Project.

This project was initiated to serve the flood-prone area immediately southeast of the I-35/I-494 interchange in Bloomington. The city chose to develop a linear storage system that combined retention and conveyance of the runoff while mitigating the impact to Upper and Lower Penn Lake. The system includes 700 feet of dual 16-foot by 9-foot box

culverts, 900 feet of 72-inch storm sewer, and more than 12 acre-feet of underground storage.

Minnesota County Engineers Association

Project of the Year: Blue Earth County CSAH 1 Reconstruction.

The reconstructed segment, from CSAH 90 to Mankato, is a Type III Natural Preservation Route, so the project needed to preserve the scenic and natural beauty of the roadway and its surroundings. The design used 3D modeling to mold the roadway into the steep landscape and eliminate some of the sharper curves. Specially designed vegetated-reinforced soil slopes accommodate the steep banks, with slopes ranging from 45 to 70 degrees. ■

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.

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Contact us

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

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OPERA project: Otta seal on an unpaved gravel road

Small communities with limited resources often struggle to maintain their local roads, many of which are unpaved. Franklin Township in Wright County, Minnesota, has about 2,800 residents, approximately 70 miles of roads—60 miles of which are gravel—and an annual levy just under \$1 million.

In need of harder surfaces to reduce maintenance costs and improve ride quality on its high-traffic gravel roads, Franklin Township officials experimented with a relatively inexpensive bituminous surface treatment, known as Otta seal, on a small section of an existing gravel road with a crushed-granite road base. Otta seal essentially is a thick mixture of asphalt and crushed rock.

Franklin Township received a \$5,000 grant through the LRRB's Local Operational Research Assistance (OPERA) Program to test the products and materials and their application, then share the results.

The township hired a contractor to apply two layers of the special Otta seal oil with an aggregate mixture over a graded and well-compacted granite base stretching 0.7 mile. The project cost about \$68,000, which included site prep, \$64,000 for material and application, and the unexpected repair of two frost boils during the first year.

Franklin Township officials chose the test section because it connects two paved roads. In addition, it connects to an adjacent similar unpaved road they're using for comparison. Part of the experiment involved no grading or dust control on the Otta seal test section. Ordinarily, grading and dust control account for most of the routine maintenance of gravel roads—and most of the ongoing cost.

The success of the Otta seal experiment depends on how long the test section lasts. Routine maintenance of a similar length of township gravel road costs about \$12,000 each year. If the Otta seal test section lasts 10 years without needing further maintenance, it would cost about \$6,800 annually—significantly less than a typical gravel road. But if it lasts only five years, the annual cost would rise to \$13,500, slightly more than a typical gravel road.

After a year and a half, the Otta seal test road is holding up. Maintenance costs have been less than neighboring gravel roads, except for the unexpected frost boil repairs. The road surface is not smooth and does not compare in quality to a fully rebuilt road with bituminous pavement, but it has eliminated the need for dust control.

Project Leader
Bill McMullen

Agency
Franklin Township
(Wright County)

Phone
763-972-2017

OPERA Funding
\$5,000



Franklin Township officials are hopeful the Otta seal experiment eventually will provide a township-wide alternative for roads with a good granite base. In addition, Franklin Township and Wright County officials intend to share their experience with other local agencies. ■

—Michael McCarthy, Minnesota LTAP editor

Local OPERA funding available: Send us your ideas!

Funding is available from the Local OPERA Program. If you or your staff have an idea—perhaps a new tool, process, or design—and you need funding to develop it, please see the OPERA web page to submit a proposal: mnlta.umn.edu/opera. ■

Boulevard turfgrass guides promote successful installations

Across Minnesota, local agencies have noted that maintaining successful boulevard turfgrass installations after road construction projects is an ongoing challenge, requiring much time, effort, and expense.

Research into turfgrasses that are resilient to the state's harsh conditions, including work by the University of Minnesota's Turfgrass Science Program, has led to many discoveries and advances. However, research results frequently take time to reach practitioners in the field.

The LRRB sought to incorporate both established best practices and new research findings about turfgrass installation into a set of informational tools. The resulting project developed these three tools:

- An easy-to-access, two-page flyer shows residents how to establish and care for new turf plantings near their homes.
- A short YouTube video also created for residents clearly and quickly illustrates how homeowners can care for newly planted boulevard turfgrass after road construction projects are completed.
- A more detailed guide provides agencies and contractors with design, construction, and maintenance practices along with resources for more information.

County agencies may use these products—available at lrrb.org—as best practices guides for highway construction contractors, designers, and residents. ■

BOULEVARD TURF ESTABLISHMENT - BEST PRACTICES

FINISH ROAD CONSTRUCTION	SOIL PREPARATION	SEEDING OR SODDING	
<ul style="list-style-type: none"> All debris must be removed from boulevard. Till and rake subsoil so it is smooth and even. Perform walk-through prior to approval. 	<ul style="list-style-type: none"> 6" topsoil gives the best results. Soil will settle, so fill areas high. If late in season, temporary erosion control may be required until spring. 8% organic content is goal for soil. Perform walk-through prior to seeding. 	<ul style="list-style-type: none"> Determine which grass species are appropriate for your site. Seed will get better long term results but sod gives immediate finished appearance. Sod is best for erosion prone areas. Apply half of the recommended fertilizer at seeding (the other half is applied in weeks 6-8). 	<ul style="list-style-type: none"> Water one 14 days. Light water are established. When the 6" mow it with the n 70% grass measures

FROM SEED TO TURF

WEEK 1	WEEK 2	WEEK 3	WEEK 4-7	WEEK 8
<ul style="list-style-type: none"> Seed when soil temperatures are at least 50° F. Apply 1/2 of required starter fertilizer prior to seeding. Apply hydromulch per MnDOT 2575 at a rate of 2,500-5,000 lbs. acre for flat or shallow slopes. Do not use plastic netting or staples on seeded areas. Water lightly 2-3 times per day as needed to keep the soil moist. 	<ul style="list-style-type: none"> Germination will occur in 7-14 days, depending on weather and soil conditions. Continue to water seedlings as needed to keep the soil moist. 	<ul style="list-style-type: none"> Lighter, more frequent watering events are ideal for seed establishment. Apply water at a rate of 1/2" three times per week. The application of water may be tested by placing a rain gauge or water tray in the grass area. 	<ul style="list-style-type: none"> Weeds may have begun to appear. Control weeds by hand pulling. Business weeds must be completely removed from the site per the MN Department of Agriculture Noxious Weed Law. Continue to water at a rate of 1" per week, spread out over 3 applications per week. 	<ul style="list-style-type: none"> Mow when turf first reaches uniform height of 5'-6" (approximately 8 weeks after seed germination). Do not mow when the density is less than 90 percent of area coverage. Do not mow newly established turf when conditions are hot (85° F) and dry. Do not cut more than 1/3 of the grass height in a single mowing event. If walking in the new grass area shows settlement in the soil, the turf has not yet established and should not be mowed. Do not mow if mower tires form ruts.

Available under "Resources" at lrrb.org

A two-page flyer includes clear graphic presentations and text about caring for new turf after installation.

Weighing the benefits of crack-sealing techniques

In a life-cycle cost analysis of the two most common crack-sealing treatments, LRRB-funded researchers found that rout-and-seal is slightly more effective, but clean-and-seal is still the right solution for many applications. Rout-and-seal, in which crews grind a shallow trench in the asphalt over the crack and

fill with sealant, lasts about four years at an average performance level. Clean-and-seal, in which workers clean cracks with an air compressor and seal the joint, lasts about three years. Download the report at lrrb.org. ■

FLOODING

Why storms kept flooding this neighborhood

Post-storm flooding had become the norm for one southeastern Wisconsin neighborhood.

Stormwater would regularly turn streets, yards, and golf course fairways into waterways, damaging property along the way. The storm sewer system once got so overburdened during a 2014 storm, it



blew out a manhole and ripped apart the road.

The storms weren't necessarily big, and the relatively new development should have been able to withstand them. So why did this keep happening?

Getting to the root cause

To get to the bottom of the issue, the community brought on MSA Professional Services, a design engineering firm.

MSA Water Resources Team Leader Eric Thompson and his team dove in, reviewing the storm sewer system's design and crunching numbers. At first, nothing looked amiss—it appeared the original designer had done everything right.

But when they turned their attention to the area's three ponds, they discovered the golf course had modified two of them. The golf course had raised the water level of one pond and lowered the overflow of another.

The change made both ponds look more aesthetically pleasing and enhanced golf play but reduced how much stormwater they could hold by 65 percent. This was causing ponds to overflow much more frequently than planned, including onto one resident's yard and into her basement.

"I thought, 'There you go, this is where the problem is,'" Thompson explained to attendees of the Minnesota Chapter of the American Public Works Association's fall 2019 conference. "It wasn't a problem; it was *the* problem."

But moving forward would be trickier than expected. As it turned out, there was nothing the city could do about the modified pond because it legally wasn't its to maintain. The city owned a storm

sewer system that counted on ponds to help capture stormwater, but not the pond itself.

"Developing a plan and putting a stamp on it isn't the end of the project's life cycle," emphasized Thompson, reflecting on what everyone could learn from the experience. "A pond is going to be there for the life of a subdivision...But if someone doesn't understand what the functionality of it is, that functionality is going to be lost."

Problems pile on

Undersized ponds weren't the only issue. Homeowners built houses lower than they should have, with side- and rear-facing doors and windows at or near the ground surface. When water overflowed from the street or ponds, it went right into people's houses.

The team also discovered the storm sewer that runs beneath the street wasn't large enough to handle extreme storms.

"It couldn't save the day in a 100-year storm," said Thompson, referring to a storm with so much rain that there's only a 1 percent chance of it happening in any given year.

While the development was designed using the best available data at the time, more recent data about the area's rainfall projections and soil properties told a more troubling story.

Today, the threshold for a 100-year storm is 6.8 inches over a 24-hour period. Back in 2001, 6 inches of rain would have been considered a 100-year storm (based on data published in 1969). A 0.8-inch increase may not seem like a lot, but translates to nearly 20 percent more runoff in such a storm.

Pond continued on page 5

Floods from page 1



Mitigation measures include a flood control ditch.

They were working with a highly developed Fridley watershed, packed with commercial, industrial, and residential buildings and intersected by railroad tracks, gas mains, sewer mains, roads, and overhead power lines.

"There were not a lot of places to put water-quality projects or places to negotiate," Bryce Cruey explained to attendees of the Minnesota Chapter of the American Public Works Association's fall 2019 conference. Cruey is an associate senior engineer with Wenck, the project's design engineering firm.

A storm rolls in

Just as they were closing in on an agreement that made everyone happy—including Treehouse Foods, which owned the property for the proposed pond—a storm pummeled the area, flooding parts of the food manufacturer's facilities and parking lots.

"They got 6 to 8 inches of rain in about seven hours," said Cruey, describing the September 21, 2016, storm. "That's a lot of rain."

Unable to drain effectively, stormwater crept up the tires of truck trailers, rose to the level of the loading dock, and poured into the facility. It reached depths of 10 feet in some areas. This halted operations at Treehouse Foods, damaging its facility and other properties in the area.

As it turned out, flooding was a persistent problem for the food producer. This stemmed in part from the site's spot at one of the watershed's lowest points. When the pond, street, or other nearby areas couldn't drain stormwater, it would make its way onto Treehouse Foods' property.

To make matters worse, the area relies on an aging stormwater system that

doesn't have the capacity to adequately drain extreme storms like the one Treehouse Foods faced.

"Needless to say, there were a lot of problems that came to light," Cruey said. Thinking back to the team's reaction at that time, he added, "we really thought the water quality project was a good one, but we knew we had to address the flood concerns, too."

Forging forward

A central part of their solution included forging ahead with the original plan to increase the size of the pond. By expanding its storage capacity, they could reduce how much pollutant-laced water would make its way into the creeks and rivers.

To further boost the pond's pollution-fighting capabilities, designers also added an iron-enhanced sand filter bench to the perimeter. The sand collects particles, while the iron removes dissolved phosphate from the stormwater before it drains to the nearby creek and the Mississippi River. Otherwise, too much phosphorus in the water can cause excessive algae growth, which reduces the oxygen that fish and other aquatic life need to survive.

The team also installed a flood control ditch and splitter structure to store and reroute excess stormwater and graded the site along the parking area. The approach ultimately diverts stormwater to the pond, where it's stripped of its pollutants.

Combined, these measures are designed to protect nearby surface waters and make it harder for stormwater to wind up back in Treehouse Foods' parking lots and facilities.

By working together, these groups created a solution that benefits both Treehouse Foods and the iconic river Minnesotans work so hard to protect. ■

—Michelle Hoedeman, LTAP freelancer

U of M offers stormwater seminar series

The Minnesota Stormwater Seminar Series brings experts from around the country to the Minneapolis campus. Seminars are streamed and archived for later viewing.

Upcoming seminars are "Maintaining and Upgrading the Performance of Stormwater Management Ponds" (April 23) and "Bioretention Media/Vegetation" (May 14).

For more information, please visit wrc.umn.edu/projects/stormwater/swseminars. ■

How communities can prepare for floods

Big floods often change how a community approaches emergency preparedness and response. After a devastating flood in 1978, the City of Rochester embarked on a massive flood control effort, building structures such as channels and reservoirs.

"All these are great, but the city still has residual risks," said Barr Engineering's Joe Waln, speaking to attendees of the Minnesota Chapter of the American Public Works Association's fall 2019 conference. "They want to know, 'If it floods, what will it look like?'"

Fortunately, there are publicly available tools that can answer this question for Rochester and other cities. Waln identified three ways communities can use these tools to better understand and plan for flood risks.

1. Check flood forecasts

The National Weather Service has gauges that measure flood levels of rivers and streams all over the country. Some provide short-term flood forecasts in the form of a line graph that depicts the flood stage (in feet) over a several-day period, for both the actual stage and the multi-day forecast.

2. Use inundation maps

The National Weather Service and US Geological Survey maintain a range of flooding-related data, including inundation map libraries.

Inundation maps make it easier to interpret what stream gauge levels like "stage 18" or "stage 22" mean for a given community, including if it could cause flooding. Users can even determine which flood-stage level would cause a specific area to flood.

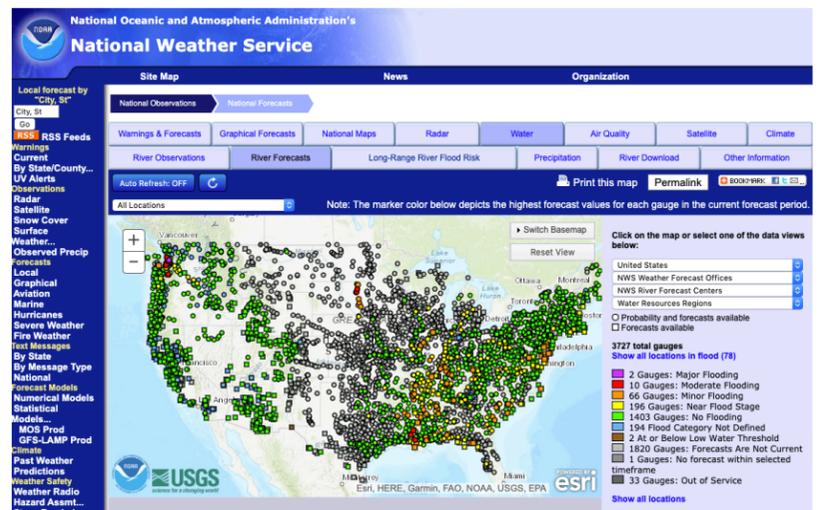
Rochester, for example, developed a way to integrate inundation maps and other datasets into its GIS system. This makes the data more accessible and helps city officials understand and act on flood forecasts.

"They can quickly bring these maps up and print them for emergency responders," said Waln, who worked with the city to integrate the data into a tool. "It improves response time."

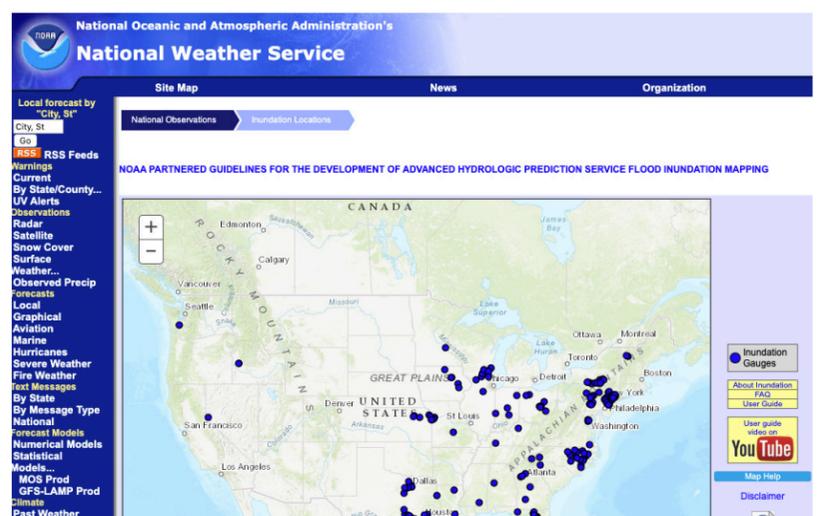
3. Identify action triggers

Once a community understands what a flood of a certain magnitude looks like, Waln recommends identifying the flood stages that would trigger closing a road, evacuating residents, or deploying emergency responders. He stressed inundation maps and other tools are key to this step: "Have the information available so you can say, 'When this happens, this is what we're going to do about it.'"

—Michelle Hoedeman, LTAP freelancer



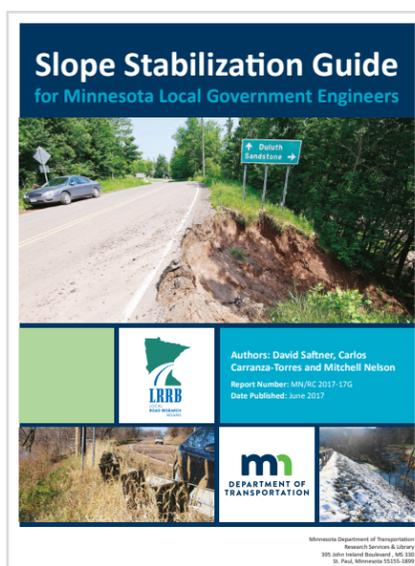
The National Weather Service website has flood-level gauges and inundation maps.



Flooding mitigation publications

Minnesota LTAP has compiled this selection of flood-related publications:

- *Development and Regionalization of In Situ Bioslopes and Bioswales* (MnDOT, 2019). Available at Irrb.org.
- *Iron-Enhanced Swale Ditch Checks for Phosphorus Removal* (MnDOT and LRRB, 2019). Available at Irrb.org.
- *NCHRP Synthesis Report 527: Resilience in Transportation Planning, Engineering, Management, Policy, and Administration* (TRB, 2018). Download the full report after entering your email address via the TRB website: trb.org/Main/Blurbs/177737.aspx



- *Slope Stabilization Guide for Minnesota Local Government Engineers* (MnDOT and LRRB, 2017). Available at Irrb.org.
- *Design Considerations for Embankment Protection During Road Overtopping Events* (MnDOT, 2017). Available at Irrb.org.
- *Urban Flood Mitigation and Stormwater Management* (CRC Press, 2017). This book focuses on green methods and modelling techniques for effective urban drainage to manage stormwater and control flooding. You can borrow the book from the MnDOT Library: call 651-366-3791 or email library.dot@state.mn.us.
- *Highways in the River Environment - Floodplains, Extreme Events, Risk, and Resilience, 2nd Edition* (FHWA HIF-16-018, 2016) fhwa.dot.gov/engineering/hydraulics/pubs/hif16018.pdf

Learn more:

- MnDOT Flood Mitigation page: dot.state.mn.us/floodmitigation
- Minnesota LTAP Disaster Management topic page
- Minnesota LTAP librarian: 612-626-8753, ctslib@umn.edu ■

Pond from page 4

Similarly, a soil map generated before 2018 would have said the development sat atop hydrologic soil group B, a soil type that holds water relatively well. Since then, half that same area was reclassified as soil group C, a more finely textured soil that causes more water to run off elsewhere (e.g., onto the street). Simply having a soil type that absorbs less water can cause 20 percent more water to run off.

"We've got 20 percent [more runoff] through more rain and another 20 percent through worse soil. And on top of that, we've got a system that

really wasn't up to snuff," said Thompson. "It just seemed like everything went wrong."

Working toward a solution

To fix the flooding issues, Thompson and team worked with the golf course to add a small pond in the rough (a less-manicured area of a golf course next to where the game is played). It's a happy medium: the system can now withstand the older 6-inch, 100-year storms while being discreet enough to not affect golf play.

They also increased the capacity of a portion of the storm sewer system by replacing 1,000 feet of 48-inch pipes with larger ones. This ultimately made the whole system work better.

After experiencing flooding in 2014, 2016, and 2018, the neighborhood now has the proper infrastructure in place. Should the pattern continue with a big storm in 2020 or beyond, they'll be ready for it.

—Michelle Hoedeman, LTAP freelancer

MAINTENANCE

Heavy metals: new plowing technology gives MnDOT an edge

When heavy snowstorms threaten to close roads, snowplow drivers are the ones on the front lines. During any given storm event, the Minnesota Department of Transportation will have a little more than 800 trucks out working to clear the roads, often with plows on the road for 24 hours straight.

“We want to reduce that [time to] bare lane because we never get calls saying it was just too good a drive into work during today’s storm,” said Jed Falgren, MnDOT state maintenance engineer.

At the Road Salt Symposium on October 24, presenters offered perspectives on how to reduce salt use while also improving road safety for drivers. Increased plowing efficiency is one way to do this, and Falgren had a variety of exciting new technologies to share in his update about MnDOT’s heavy metal tools.

New, improved blades

A standard snowplow has at least three blades: the front plow, the underbody plow, and the wing. Minnesota has around 34,000 lane-miles of roadway, and snow conditions can change dramatically at any point along the way. MnDOT has 25 different front plow blades alone that it can utilize in these different situations, and it’s always looking for new, improved designs. “When we buy a plow,

there [are] lots of things we can look at,” Falgren said.

All plow blades are protected by a replaceable cutting edge—usually made from carbide steel—that slides on the road. Newer innovations with rubber-encapsulated carbide-steel cutting edges have also proven effective. MnDOT has been looking into rubber-encapsulated ceramic cutting edges that reduce friction and allow trucks to drive at higher speeds and better keep up with traffic. “We’re driving on a freeway,” Falgren said, “and one thing we know about driving slow on a freeway is you make a heck of a great target.”

The jury is still out on this design: ceramic is more brittle than steel but the lack of friction reduces wear, so further evaluation is warranted.

New materials and designs are often suggested to MnDOT, and the testing process involves a lot of trial and error. Tests are carried out by MnDOT’s eight districts, he said, and the Clear Roads research program also provides a great forum for sharing research with other states battling snow and ice.

Icebreakers

The real heavy metal game-changer in recent years has been the icebreaker. Equipped with a front-mounted drum spiked with metal tines, the machine is designed to poke thousands of tiny holes in the surface of hard-packed snow or ice. This breaks up the ice and makes it easier to scrape away with an underbody plow. It has the added benefit of creating a porous surface that’s easy to salt, reducing salt waste and increasing salt effectiveness.

“We had a situation on Interstate 94 last year near Alexandria where we had a very serious accident,” Falgren said. Traffic had to be diverted off the interstate, but a heavy storm had created 3 to 4 inches of snow compaction on the alternate route. “They pulled the icebreaker out, went through, came in and treated it, and less than 30 minutes later they were looking at bare, wet pavement.”

Units cost a little under \$40,000 each, and drum replacements run about \$30,000. MnDOT has had success using them on ice ranging from ¼ inch to 4 inches in thickness.

An edge against winter

Road maintenance during Minnesota snowstorms requires a varied arsenal. New innovations in plow blade and icebreaker technology give MnDOT an edge when the elements are working against them. ■

—Sophia Koch, LTAP freelancer



Creating a low-salt future with innovative alternatives

Keeping Minnesota roads clear in the winter is a large order. Traditionally, road maintenance crews have relied heavily on salt, but recent shifts in understanding have led researchers to realize that salt comes at a cost.

“There are multiple aspects to this chloride issue that we need to tackle,” said Andy Erickson, research associate at the St. Anthony Falls Laboratory at the University of Minnesota and a presenter at the Road Salt Symposium in October 2019. “There are high costs to the environment and to our infrastructure.”

Fortunately, the U of M has been working on the problem. At the gathering, Erickson outlined some of the more promising practices that he and others

at the U have been developing.

Alternative chemicals

Every deicing chemical has its pros and cons. Potassium acetate, for example, has been used by MnDOT for deicing bridges in certain parts of the state, and it works at colder temperatures than chloride. It’s less corrosive to most metals, but it does cost more and has greater impacts on galvanized steel. It also has some environmental impacts of its own; they’re just different, and the impacts have yet to be fully studied, Erickson said.

Propylene glycol is less corrosive to metals than salt and causes less environmental and infrastructure damage, but it also costs more and seems to have a negative effect on asphalt and concrete.

Alternative chemicals, in general, show a lot of promise, but their advantages and disadvantages need to be studied and weighed carefully before committing, he explained.

Sand and heat

Chloride and other chemicals aren’t the only way to break the bond between pavement and ice: U of M researchers have looked into creating hydrophobic coatings that prevent ice from sticking to pavement in the first place. They’ve also considered the possibility of conductive, heated pavements and microwaving roads.

Sand also has a lot of potential, especially if heated before application to prevent bouncing. “If you heat the sand,” Erickson said, “as soon as it hits any type of ice, it melts and then freezes into the ice, and makes the ice effectively sandpaper.”

This mitigates the need to fully clear the roads and has been shown to reduce sand usage by 50 percent or more in some cases.

Stormwater

Simple changes in storm drainage infrastructure could also have a large impact. Stormwater ponds, for example, already collect salt in street-level runoff.

“So why couldn’t we use those ponds to capture salt in the spring snowmelt, pump that out so that it’s no longer in the system?” Erickson said. “That’s using existing infrastructure to address a problem.”

Disconnecting infiltration connections between surface and groundwater sources during the spring melt would be key: If the chloride-heavy water could be held long enough to remove the salt, a lot of chloride could be kept out of wells and rivers.

“I don’t need to summarize and tell you chloride is an issue,” Erickson concluded. “But we have some solutions already here today and some very interesting ideas coming very soon in the future.” ■

—Sophia Koch, LTAP freelancer



Smart Salting training

The Minnesota Pollution Control Agency started the Smart Salting training program as a way to help property managers save money and protect water resources by using less salt to deice pavement. The program includes two levels of certification:

- Level 1 is designed for individual road salt applicators and teaches best practices for maintaining roads, parking lots, and sidewalks.
- Level 2 is designed for public and private organizations and focuses on

using the Smart Salting Assessment tool to monitor salt use and take steps to minimize it.

Visit pca.state.mn.us/water/smart-salting-training to find a calendar of upcoming training dates and more information about the program. ■

—Sophia Koch, LTAP freelancer

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.

Relationships Between Weather and Roadway Safety

(Iowa State University, Institute for Transportation, September 2019)
Determines the relationships between winter weather, safety, and winter maintenance operations, with a goal to develop crash frequency and severity models that consider weather-related factors.

Evaluation of Guardrail Needs and Update of Guardrail Rating Program

(Kentucky Transportation Center, September 2019)
Describes new methodologies for prioritizing guardrail installations and identifies crash frequency and severity in order to maximize safety outcomes for roadway departure crashes.

Work Zone Mapping and Tag Deployment System

(Roadway Safety Institute, October 2019)
Establishes a database of active work zones to provide an online, real-time portal for storing, monitoring, and inspecting work zone traffic-control operations.

Biofuel Co-Product Use for Pavement Geo-Materials Stabilization Phase II: Extensive Lab Characterization and Field Demonstration

(Iowa State University,

Institute for Transportation, November 2019)

Identifies unconfined compressive strength, shear strength, freeze-thaw durability, and moisture sustainability of biofuel-treated soils.

Investigating the Optimum Performance of Snowplowable Reflective Pavement Markers

(Illinois Center for Transportation, November 2019)
Analyzes the performance of traditional cast-iron and plastic pavement markers on both asphalt and concrete pavements.

Feasibility of an Iowa Urban Service Bureau

(Iowa State University, Institute for Transportation, November 2019)
Takes input from transportation stakeholders—including Iowa LTAP, county engineers, and engineering consultants—to examine the feasibility of operating an Iowan urban service bureau.

Evaluating Effective Asphalt Content in CIR Mixtures

(MnDOT and LRRB, November 2019)
Examines the effect of emulsion reduction during the cold in-place recycling (CIR) process.

Petrographic and Petrophysical Analysis of Decades-Old Iowa Portland Cement Concretes

(Iowa State University, Institute for Transportation, November 2019)
Evaluates the evolution of pore networks in Portland cement concrete pavements to determine whether pavements constructed before 1950 can remain in service.

Ultra-Thin Bonded Wearing Course (UTBWC) Winter Maintenance

(MnDOT, November 2019)
Identifies the advantages and disadvantages of ultra-thin pavement during winter conditions.

Developing an Optimization Model for Managing County Paved Roads

(Mountain Plains Consortium, November 2019)
Assesses a pavement present serviceability index (PSI) on Wyoming roads and develops exclusive PSI pavement prediction models to be more representative for county roads.

Quantifying Pavement Albedo

(National Concrete Pavement Technology Center, December 2019)
Evaluates albedo and thermal properties of paving materials to develop predictive models. ■

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 ■

Census from page 1

would have deferred some maintenance such as seal coating, Antonen says. The legislation is not permanent; it will hold until the 2020 census and must be renewed if the situation repeats itself, he adds.

On a wider scale, Minnesota as a whole has similar stakes in the 2020 census. In 2016, according to a fact sheet from the *Counting for Dollars 2020 Project*, the state received around \$15 billion in federal program funding, \$659 million of which was allocated toward highway planning and construction. This funding is distributed, in part, based on the census.

As the US census Bureau begins sending out participation reminders in March, individual states and cities have to decide how much effort they plan to add to the process. In 2010, says Andrew Virden, director of census operations and engagement at

the Minnesota State Demographic Center (SDC), Minneapolis spent around \$100,000 of its own money on census outreach efforts. The extra money, he adds, was well worth it; the city's response rate rose by 5 percent.

The key in 2020, Virden says, will be "getting the right message to the right people." Certain communities, particularly poor, minority, and rental populations, tend to be difficult to count due to language barriers, lack of access to technology, distrust of the government, or difficulties notifying them. These "hard to count" communities stand to gain or lose a lot, Virden says; undercounts might drive away businesses, result in underfunding for public projects and maintenance, and discourage new residents.

The Minnesota SDC is trying to reach these

populations in part by putting together materials for unsupported languages and working with local community leaders. In Circle Pines, reminders are being sent out with utility bills, door-to-door census workers are making extra efforts to reach rental communities, and schools and faith groups are being used to get the word out.

"We're lucky that we have great elected officials and enough staff," Antonen says. "We're just trying to get the word out more than anything." ■

—Sophia Koch, LTAP freelancer

LEARN MORE AT CENSUS.GOV

MnDOT uses WebMDSS for weather-responsive management

Weather-responsive management strategies (WRMS) can help agencies affected by winter weather conditions to improve their road maintenance activities. More than 16 state transportation agencies currently use automated processes such as maintenance decision support systems (MDSS) to support winter maintenance and operations.

MnDOT uses WebMDSS, a web-based application, to manage its roadways and resources during inclement weather. The application provides road advisories, warnings, and treatment information and recommendations for road maintenance, and serves as the primary resource for forecasting. The tool allows MnDOT staff to make more informed decisions for maintenance planning and tactical actions through detailed, hour-by-hour, weather and pavement forecasts at the maintenance route level. These

informed decisions result in improved mobility and safety, as well as cost savings and reduced environmental impacts from reduced material usage. For example, reports on speed while applying chemicals, average precipitation, material usage by route, and sander status support MnDOT's efforts to track material usage in a more efficient manner.

Using existing mobile observation capabilities, MnDOT provides the public with information to make informed travel decisions. In addition to weather condition information in the agency's 511 traveler information system, MnDOT provides road condition images taken from active plows in the field. This provides additional information on current and anticipated roadway dangers and conditions. Traffic operators can also use these images to create messages to post on dynamic message signs where

needed, keeping motorists informed with real-time information.

To learn more about MnDOT's use of WebMDSS, please visit MnDOT's RWIS website—rwis.dot.state.mn.us. To learn more about how WRMS can help your agency provide better response to winter weather events, email David.Johnson@dot.gov with the FHWA Office of Operations. ■

(Reprinted from EDC News, Jan. 30, 2020.)

EACH YEAR, NEARLY

6,000
PEOPLE

in the US are killed in weather-related crashes.



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.

Answer to test on page 8:
George Washington, in 1790
Michigan, 0.6 percent

WORKSHOPS & TRAINING



CALENDAR

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

Fundamentals of Construction Inspection

March 10, Mankato
March 18, Willmar
March 24, St. Paul

Extending Pavement Life through Pavement Preservation Techniques, Strategies, and Preventative Maintenance

(1 RS Maintenance credit) LTAP
Apr. 14, Baxter

Minnesota Truck-Weight Education Training

(1 RS Maintenance credit) LTAP
Locations throughout the state in March and April

ATSSA Northland Chapter "How To"

(0.5 RS Maintenance credit) LTAP
March 17-18, Fargo

Annual CPAM Concrete Paving Workshop & Awards Banquet

March 19-20, Duluth

Seal-Coat Operations & Micro/Slurry Surfacing: A Workshop for Practitioners

(1 RS Maintenance credit) LTAP
March 25, Mankato
Apr. 1, Medina
Apr. 9, Alexandria

Gravel Road Maintenance and Design

(1 RS Maintenance credit) LTAP
Apr. 14, Crookston
Apr. 21, Rochester
Apr. 28, Brainerd

Minnesota Roadway Maintenance Training and Demo Day

(1 RS Maintenance credit) LTAP
May 7, Fergus Falls

Transitioning into Leadership: Essential Skills for Supervisors

(1 RS Leadership credit) LTAP
May 13, Brainerd

National Road Research Alliance Pavement Workshop

May 19-21, Shoreview

ONLINE TRAINING: Anytime, anywhere!

Math Basics for Maintenance Technicians
(1 RS Maintenance credit)

Installation and Management of Roadside Turfgrasses
(1 RS Maintenance credit)

Turfgrass Pathology Course
(0.5 RS Maintenance credit)

Culvert Design and Maintenance
(1 RS Maintenance credit) LTAP

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

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

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

Roads Scholar credit

You can earn credits in Minnesota LTAP's two Roads Scholar (RS) certificate programs by attending LTAP and CTAP workshops and other cosponsored events. To learn more or enroll in the program, visit mnltp.umn.edu/roadscholar.

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.

Demo Day to showcase chainsaw safety training

The Minnesota Roadway Maintenance Training and Demo Day will be held May 7 at the Otter Tail County Highway Facility in Fergus Falls. Attendees will earn one Roads Scholar Maintenance credit.

This year Demo Day is showcasing chainsaw safety training. The session will focus on the importance of chainsaw safety, the dangers of running a chainsaw, and proper chainsaw maintenance. Outdoor demonstrations will include:

- PPE/assessing the situation
- Sharpening/gassing the saw and prep
- Notching/felling/roping
- Body position – cutting off the stump

Other Demo Day topics include gravel road maintenance and design and CDL/load securement.



Ethics training is online

"Professional Ethics: Dilemmas and Solutions" is available on the CTS website. The two-hour online training reviews 10 commonly encountered ethical dilemmas and their appropriate solutions.

Cost is \$65. For more information, please visit cts.umn.edu/education/ethicsonline or contact Katherine Stanley at sell0146@umn.edu for assistance. ■

Census trivia

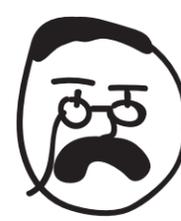
Who was president when the first census was done?



George Washington



Andrew Jackson



Theodore Roosevelt

Only one state lost population during the last census period (from 2000 to 2010). Which state was it?



Iowa



Michigan



Ohio

