Should you use recycled materials to melt ice and snow on your roads?

At the 2017 Road Salt Symposium, Ron Wright, manager of the Idaho Department of Transportation laboratory and a founding member of Pacific Northwest Snowfighters, talked about using recycled products to deice roads.

**Does it work?**

Wright said: “Why should you use a recycled product? Will it melt ice by itself? Test it by putting some on ice cubes in the freezer at zero degrees. Or if it’s an additive, mix blends with different ratios and put them in the freezer. You can test it yourself and see some basic characteristics or send it to our lab.”

One reason it’s important to know the freezing point of materials is to determine if the products can be stored outdoors during winter. “If it freezes at 10 degrees, you’ll have a problem when the

---

A primer: calcium chloride for stabilizing gravel roads

The 70,000-plus miles of aggregate-surfaced roads in Minnesota are essential for providing all-weather access for people and freight. Unfortunately, these roads can also be dusty and bumpy, and they require periodic replacement of lost gravel and regular blading to smooth the surface.

According to the report *Relative Effectiveness of Road Dust Suppressants* prepared by the Transportation Information Center at Colorado State University, dust from unpaved roads contributes nearly 34% of the particulate matter in the atmosphere nationwide. Loss of gravel and blading can cost a road agency several thousand dollars per mile per year.

A common tool to stabilize the aggregate surface used by counties for many years has been the application of calcium chloride. What is calcium chloride and where does it come from? How does it work? Are there adverse environmental affects? County experiences?

**What is calcium chloride and where does it come from?**

According to Dr. Steve Clark, a research scientist with EnviroTech, a principal vendor for calcium chloride in our region, calcium chloride results from the happy and stable mating of two chemicals: one calcium atom with a plus 2 electrical charge and two chlorine atoms with a minus 1 charge. It is highly soluble in water. Calcium chloride can be manufactured in several ways, including from limestone and sodium chloride and limestone and hydrochloric acid. However, it is also available as a natural brine that can be filtered and diluted or concentrated as needed for road stabilization or for ice control. A natural brine deposit in Michigan operated by Oxy Chemical is the primary source of the material in

---

Pedestrians account for more than 17.5 percent of all fatalities in motor vehicle traffic crashes, and the majority of these deaths occur at uncontrolled crossing locations such as mid-block or unsignalized intersections. These are among the most common locations for pedestrian fatalities generally because of inadequate pedestrian crossing facilities and insufficient or inconvenient crossing opportunities, all of which create barriers to safe, convenient, and
Leaders use best practices, training, outreach to reduce salt use

The Freshwater Society announced its Environmental Leadership Awards at the 16th Annual Road Symposium in February. The awards recognize those who champion efforts to reduce chloride pollution. Below, this year’s champions share how they reduced their road salt while maintaining safety.

To nominate candidates or suggest topics for the 2018 symposium, please contact Connie Fortin, 763-478-3606, connie@fortinconsulting.com.

City of Woodbury

The city has worked to get out the message that salt use causes irreversible damage to its lakes, ponds, and groundwater. It has shared the need for change with the city council, staff, and residents. The November city newsletter featured “Smart Salting” to start preparing residents for changes in practice.

Other changes include improved equipment:

• Plow trucks are now equipped with road temperature and ambient air sensors that help crews determine what material to use and the application rate.
• Crews started using and converting truck plows with a rubber blade that conforms to the road, giving a cleaner surface, using less material, and reducing noise levels.
• Trucks have computerized salters that are speed-oriented and calibrated every year to make sure the application rate is correct and at a minimum.

In addition, the city uses best practices to reduce material use and protect the environment:

• Salt is stored in an enclosed facility.
• Salt is supplemented with calcium chloride for colder temperatures to jumpstart the melting process. It also helps lower salt’s effective working temperature and reduces rock salt bounce.
• Streets are swept every spring and fall, and testing is performed to look for contamination.
• Spinner settings were reduced to get the greatest results for a safe roadway.
• A 90% salt–10% mixture is used when temperatures are below 15 degrees so there is some type of abrasive left on the road to act as sandpaper to the surface.
• Materials are tracked and application rates observed for melting, and observations are shared to improve operations and learn from each other.
• Pre- and post-event meetings are held to evaluate results and make adjustments.

City of Jordan

Jordan’s public works department saved the city $18,500 in upfront equipment costs for a pre-wetting system. The department bought an old farm sprayer and four 20-gallon plastic tanks, and used a tank it already had to make brine. A local metal fabrication company made brackets to hang the system on the trucks. This equipment cost the city only $1,500.

In the first year of use, the city used gravity to get the brine into the salt system. In the second year, the crew added small pumps on the trucks to pressurize the system and get more of the liquid onto the salt. This past winter, the city upgraded the pre-wet system by adding a second spray tip to add more brine to the salt.

With the improved pre-wet system, the city also changed how it plowed streets. It salts only the hills and intersections until the snow has stopped, and adds Road Guard™ Plus to the salt brine when temperatures get below 10 degrees. These changes in practice have not only cut the salt use in half but also reduced equipment wear and tear and saved thousands of dollars in fuel.

St. Cloud VA Facilities Management

Since 2011, all Garbage Operations employees have attended Winter Parking Lot and Sidewalk Maintenance Training and have become certified in snow and ice control best management practices. Employees have agreed to apply best management practices.
Local OPERA Project: Concrete form hook box

Project leader: Kevin Jaax
Agency: City of Golden Valley
Problem: The City of Golden Valley Street Maintenance Division is responsible for miscellaneous concrete work throughout the city. To improve the division’s concrete output, 200 feet of four-inch steel forms and 200 feet of six-inch plastic forms were purchased. Initially, these forms were stored in an offsite storage facility, and city staff would load what was needed into the back of a service truck. In most circumstances, multiple trips were required to transport all of the necessary equipment and tools to the job site. In addition, staff had to climb into the back of the truck and search for tools, which wasted time.

Solution: The city purchased and fabricated a concrete form hook box that uses the SwapLoader system to organize and transport tools, materials, and equipment.

Procedure: Staff compiled a list of tools, equipment, and materials needed to complete multiple concrete projects. The city purchased a flatbed hook-box frame and the required metal to fabricate storage boxes and shelving. A 55-gallon drum of curing compound and a pump were also incorporated into the form box. Every tool and piece of equipment was assigned its own area.

Results: Using the SwapLoader system enabled the division to switch between a dump body, debris box, and the form box, which saves mobilization time and allows the truck to have several uses. The Street Maintenance Division’s efficiency increased because all of the concrete forms and tools are now organized, secured, available on site, and reachable from the ground. The hook box has also improved safety by eliminating the need for employees to climb in and out of the back of the truck looking for tools.

Approximate cost: $3,400

Status: Complete LTAP

Rehabbing roads with full-depth reclamation is cost-effective, durable

Full-depth reclamation (FDR) of asphalt pavement is often used on rural roadways to reduce costs for materials and hauling. New research indicates that FDR is also a good option for rehabilitating urban and suburban roadways and most likely outperforms traditional mill-and-overlay in cost and durability.

With FDR, road builders use trains of recycling equipment to pulverize, lift, grind, remix, and repave asphalt in a single pass. This recycling puts less demand on petroleum resources and new aggregates. Despite its benefits, FDR has yet to be adopted widely by cities and county public works departments. In part, this is due to the challenge of using trains of equipment on urban and suburban roads that feature curbs, manholes, and driveways. Mill-and-overlay also has lower initial costs.

“Our goal was to provide evidence of FDR’s cost-effectiveness, guidelines for FDR project selection, and, ultimately, performance-based specifications,” says Mihai Marasteanu, a professor with the University of Minnesota’s Department of Civil, Environmental, and Geo-Engineering and the study’s principal investigator.

Researchers also sought to provide testing protocols, procedures for analyzing life-cycle costs of FDR compared with conventional rehabilitation methods, and ways to use the MnPAVE computer program to determine long-term performance expectations for FDR.

“When we compared the simulated life-cycle costs of FDR with known results for traditional mill-and-overlay mixtures, we found that FDR is more cost-effective over a 35-year period than traditional methods,” Marasteanu says. “In addition, mill-and-overlay must be redone every 18 years, causing more inconvenience and costs for road users than the longer-lasting FDR.”

The City of Shoreview has used FDR effectively by using individual machinery units rather than long, connected recycling trains. “This research helps us translate full-depth reclamation projects in Shoreview into hard cost-benefit, return-on-investment numbers,” says Mark Maloney, Shoreview public works director. “It validates what we’ve been doing and gives cities what they need to justify the cost of using FDR in urban settings.”

“Before, all we had was anecdotal information,” Marasteanu says. “Now we have laboratory testing methods that are easy to use and can be incorporated in performance prediction models.”

The project was sponsored by the LRRB and the Minnesota Department of Transportation. LTAP

Resources:
- Research report: Full Depth Reclamation (FDR) for Suburban/Urban and Local Roads Application (LRRB and MnDOT, 2016-37, December 2016)

Synthesis looks at local bridge removal policies and programs

Given budgetary pressures, many local agencies lack the funding to maintain all bridges in their roadway networks. Reducing the number of bridges is one way that local agencies can reduce their maintenance costs. However, bridge removal projects can be controversial, and local officials are often reluctant to choose this option.

A new Transportation Research Synthesis from the LRRB and MnDOT provides the results of a survey of state DOT bridge offices about bridge removal practices, criteria, and funding programs. A literature review of bridge design manuals, inspection manuals, and state and local bridge programs supplements the survey findings.

Local Bridge Removal Policies and Programs (LRRB and MnDOT, TRS1702, March 2017) is available at LRRB.org. LTAP
Slurry for more sustainable road salt use

At the 2017 Road Salt Symposium, Marty Wolske and Steve Lueken presented information on how agencies can reduce both their road salt budgets and salt’s negative effects.

Referring to a Marquette University study, Wolske, a manager at Highway Equipment Company of Cedar Rapids, Iowa, said road salt reduces crashes by 88%, injuries by 85%, and crash costs by 85%. However, citing a Minnesota Pollution Control Agency report, he said annual damage to infrastructure, vehicles, vegetation, human health, and the environment due to road salt in Minnesota is from $280 million to $1.17 billion. He said the same report showed that reducing annual road salt use by 10% in the Twin Cities metro area would reduce the combined costs of infrastructure damage and material use by between $36 million and $124 million.

Then Wolske showed that a 70–30 mixture of rock salt and salt brine can actually reduce salt use by much more than 10%: “Using a 150-pound rate example, 45 pounds of dry salt will be replaced with 45 pounds of brine. That amount of brine contains 11 pounds of dissolved salt, which means you’re using 116 total pounds of salt, thus reducing your overall salt use by 6%.”

In addition to reducing both material cost and damage to infrastructure, vehicles, vegetation, and human health, Wolske said slurry sticks to the road better, thus reducing waste due to bounce and starting the melting process sooner. He said Waukesha County, Wisconsin, has reduced its salt use by more than 23% when using the 70–30 mix. Waukesha, shop supervisor in MnDOT’s District 6-West ( Owatonna), showed how his workers outfit trucks to dispense salt slurry. He said about 75% of his trucks are set up for slurry. However, unlike equipment that mixes rock salt and liquid at the spinner disk, his slurry is mixed in the sander. The trucks are equipped with saddle tanks, pumps, and flow meters. In tandem-axle trucks, his shop also has installed 800-gallon tanks in the boxes; with the saddle tanks, those trucks carry about 1,000 gallons of brine.

Lueken showed photos and videos of an auger with modified nozzles that direct the brine more precisely onto the roadway, thus avoiding overspray onto the truck. Lueken also showed how reinforced plastic tubing and spray bars are used to shoot slurry directly at centerlines and wheel tracks to melt hard-packed snow and ice. —Richard L. Kronick, LTAP freelancer

**Salt awards from page 1**

Practices to reduce chloride impacts.
Facilities Management purchased a new salt spreader after the initial training class in 2011. The new spreader has allowed operators to use brine to pretreat paved surfaces before storms and allows for pre-wetting rock salt before it hits paved surfaces. The first year the new spreader was put into use, the St. Cloud VA achieved a 50% reduction in rock salt use.

**Park Nicollet Health Services**

Over the past few snow seasons, Park Nicollet increased its commitment to help the environment. As a result, it greatly reduced the amount of salt used and reduced costs. Process improvements included increased use of liquids, pretreatment, and pre-wetting. Use of liquid brine began in the winter of 2013–14 to reduce the volume of granular salt. This showed a 45% salt reduction in 2014–15 and an additional 28% reduction in 2015–16. Landscape damage caused by salt has been reduced by more than 75%.

**Curt Pape – Minnesota Department of Transportation, Individual Award**

Curt Pape was instrumental in bringing the Maintenance Decision Support System (MDSS), Mobile Data Computer, and automated vehicle location to MnDOT. This system provides real-time route-specific information to the driver about weather and pavement condition and recommendations about how much salt to use to restore the bare driving-lane condition in the time allowed by performance target. The system records the pavement and weather conditions, the recommendations, and the amount of salt actually applied to the road by the driver. The use of MDSS has shown promising results, with a range of up to 50% salt savings. —LTAP

**What’s the pH?**

One important fact to know about anything you plan to put on your roads, Wright said, is its pH: “pH tells you if a material is acidic, basic, or neutral, expressed as a number between zero and 14. Seven is neutral; below seven is acidic; above seven is basic. Fruit juice, coffee, and vinegar are acidic; ammonia, lime, and baking soda are basic.”

Pacific Northwest Snowfighters’ acceptable pH range is between 6 and 9. We’re concerned about damage to groundwater, surface water, soil, vegetation, and people. We also don’t want you using stuff that will burn the fur off you!”

**What will it cost?**

When considering a new product, Wright said it’s important to run a cost-benefit analysis: “What’s it going to cost to transport? Are there special mixing requirements or does it require special equipment?” He added that it’s important to know the disposal cost for leftover material, which will change depending on whether the material is going to a landfill or into the sewer system. For example, cheese whey requires additional processing at a sewer plant. He also stressed the importance of knowing the cost to the environment and the cost of damage to infrastructure. In the U.S., remediation of infrastructure corrosion costs over $26 billion a year, he noted.

**Recycled from page 1**

temperature goes below 10 and you’ve got a 20,000-gallon tank of stuff that looks like a big Seven Eleven slushy!” He showed the test sample (see photo below)—an additive material in which ice had formed at the bottom. “When you pour it into a number 10 sieve, which is about the size of the filter on most trucks, you get this coagulant that will jam up your system.”

**Will it improve another product?**

Wright said ice Ban® and other agricultural byproducts allow chlorides to stick to the road better and work longer. “When we first started using Ice Ban it had a strong odor! However, that product has evolved and is better now,” he added.

**Is it consistent?**

Wright said he calls some products sent to his lab “Hollywood samples because they’re the best of the best. But is it going to do what it’s supposed to do every time? Maybe you need some quality-control testing.”

**What’s the pH?**

One important fact to know about anything you plan to put on your roads, Wright said, is its pH: “pH tells you if a material is acidic, basic, or neutral, expressed as a number between zero and 14. Seven is neutral; below seven is acidic; above seven is basic. Fruit juice, coffee, and vinegar are acidic; ammonia, lime, and baking soda are basic. Pacific Northwest Snowfighters’ acceptable pH range is between 6 and 9. We’re concerned about damage to groundwater, surface water, soil, vegetation, and people. We also don’t want you using stuff that will burn the fur off you!”

**What will it cost?**

When considering a new product, Wright said it’s important to run a cost-benefit analysis: “What’s it going to cost to transport? Are there special mixing requirements or does it require special equipment?” He added that it’s important to know the disposal cost for leftover material, which will change depending on whether the material is going to a landfill or into the sewer system. For example, cheese whey requires additional processing at a sewer plant. He also stressed the importance of knowing the cost to the environment and the cost of damage to infrastructure. In the U.S., remediation of infrastructure corrosion costs over $26 billion a year, he noted.

**What’s the pH?**

One important fact to know about anything you plan to put on your roads, Wright said, is its pH: “pH tells you if a material is acidic, basic, or neutral, expressed as a number between zero and 14. Seven is neutral; below seven is acidic; above seven is basic. Fruit juice, coffee, and vinegar are acidic; ammonia, lime, and baking soda are basic. Pacific Northwest Snowfighters’ acceptable pH range is between 6 and 9. We’re concerned about damage to groundwater, surface water, soil, vegetation, and people. We also don’t want you using stuff that will burn the fur off you!”

**What’s the pH?**

One important fact to know about anything you plan to put on your roads, Wright said, is its pH: “pH tells you if a material is acidic, basic, or neutral, expressed as a number between zero and 14. Seven is neutral; below seven is acidic; above seven is basic. Fruit juice, coffee, and vinegar are acidic; ammonia, lime, and baking soda are basic. Pacific Northwest Snowfighters’ acceptable pH range is between 6 and 9. We’re concerned about damage to groundwater, surface water, soil, vegetation, and people. We also don’t want you using stuff that will burn the fur off you!”

**What’s the pH?**

One important fact to know about anything you plan to put on your roads, Wright said, is its pH: “pH tells you if a material is acidic, basic, or neutral, expressed as a number between zero and 14. Seven is neutral; below seven is acidic; above seven is basic. Fruit juice, coffee, and vinegar are acidic; ammonia, lime, and baking soda are basic. Pacific Northwest Snowfighters’ acceptable pH range is between 6 and 9. We’re concerned about damage to groundwater, surface water, soil, vegetation, and people. We also don’t want you using stuff that will burn the fur off you!”
this area. The material can be concentrated through evaporation to produce a solid. Magnesium chloride has very similar dust and ice control characteristics. It is generally a byproduct of potash production. The cost of both materials is similar and relatively low; the logistics of transportation largely determine the difference in delivered cost.

How does calcium chloride work?
The hygroscopic properties of calcium chloride attract moisture from the air. The moisture and electrostatic attraction of the small, minus 200 screen particles create particles heavy enough to stay in place rather than being blown or washed away. Thus, the fine particles, critical for binding the aggregate together, remain in place. The moisture and calcium chloride may also act as a lubricant to facilitate compaction of the aggregate. Calcium chloride depresses the freezing point of water and is very effective for snow and ice control at very low temperatures. Depending on the solution of calcium chloride solids to water, it can be stored at temperatures much lower than sodium chloride brine.

Counties using calcium chloride for both dust control and deicing have an interesting apparent paradox in storing the material over the winter. To keep the solution from freezing, you add water. Dr. Clark shed some light on this: for dust control, the calcium chloride solids are the effective agent and a high concentration of solids is desirable. For deicing, the proximity of the solids makes it easier for them to attach to each other and solidify into frozen calcium chloride. Diluting the solution moves the solids away from each other, lowering the freezing point (eutectic point of 30% calcium chloride is 60 degrees below zero Fahrenheit).

Environmental considerations
Calcium chloride is not toxic; in fact, it is used to increase the water hardness in swimming pools and as a food additive. However, there are growing environmental concerns about chloride released by sodium chloride salt and the potential for chloride release from calcium chloride salt. Application in a uniform manner, at an appropriate rate, and on a properly shaped and graded aggregate surface is important in binding the calcium chloride to the road surface.

County experiences
Olmsted, Dodge, and Blue Earth County practices were reviewed as examples of the widely used product. Olmsted County policy for many years has been to apply calcium chloride for a 300-foot reach at each residence on its county crushed-limestone-surfaced roads at no charge. One application in the spring is made by contract. It has enjoyed the support of the public and elected officials. The material reduces dust, loss of aggregate, and amount of blading needed substantially. However, by capturing the fines as the lime asphalts and aggregate, the fines accumulate, and after a rain the surface may become slimy. This can be corrected by adding clean crushed aggregate with few fines and mixing with a blade. Since the material is hygroscopic, it attracts moisture in the winter and spring, when surface moisture makes it easier for the material to spread and thus reduce aggregate loss would become cost-effective. This is highly variable depending on climate, traffic, and aggregate quality. Cost-effectiveness will depend on replacement aggregate cost and cost to treat the road. The study found for an aggregate replacement cost of $5 per ton and a cost to treat with calcium chloride of $2,800 per mile, treatment to reduce aggregate loss would become cost-effective at 105 ADT. Higher replacement aggregate costs will tend to reduce the feasible ADT; higher calcium chloride treatment costs will tend to increase the feasible ADT. This is only one limited study in another region with different climate conditions and aggregate sources from ours, so caution is advised.

Is calcium chloride treatment cost-effective?
The Colorado State University report referenced earlier found a 50–70% reduction in fugitive road dust emission when treated with calcium chloride. It also found a 42–61% reduction in aggregate loss. This is highly variable depending on climate, traffic, and aggregate quality. Cost-effectiveness will depend on replacement aggregate cost and cost to treat the road. The study found for an aggregate replacement cost of $5 per ton and a cost to treat with calcium chloride of $2,800 per mile, treatment to reduce aggregate loss would become cost-effective at 105 ADT. Higher replacement aggregate costs will tend to reduce the feasible ADT; higher calcium chloride treatment costs will tend to increase the feasible ADT. This is only one limited study in another region with different climate conditions and aggregate sources from ours, so caution is advised.

Road research breaks new ground
The MnROAD road research facility has begun work on its third phase of research. Dozens of new experiments are planned along MnROAD’s test tracks in rural Albertville: 3.5-mile sections of Interstate-94 (mainline and bypass) and an adjacent 2.5-mile low-volume closed road. Research will support state and local needs. Stay up-to-date on construction by signing up for e-mail alerts at mndot.gov/mnroad. A complete summary of planned research is available at mntransportationresearch.org. LTAP

Minnesotans receive national awards
The National Association of County Engineers honored two Minnesotans at its annual conference in April: • Richard West, Otter Tail County, 2016 Rural County Engineer of the Year • Darin Mielke, Carver County, 2016 Program/Project Manager of the Year In addition, Polk County’s Rich Sanders was named president-elect.

June 2017 5
Help eradicate dangerous plants from Minnesota

Thirteen plant species are currently on Minnesota’s eradicate list. “These species are known to cause environmental or agricultural harm in Minnesota and other states,” says Dawn Littleton, Minnesota Extension invasive plants program coordinator.

Three of the species to watch for are shown below. The full list and additional information (including videos) are online. Be sure to report any sightings immediately—see the “Arrest the Pest” article below.

If you would like a class on identifying any plant that is causing concern, please contact Littleton at 507-536-6301, litt0129@umn.edu. Extension also holds classes in the spring.

Palmar amaranth. This fast-growing weed, native to the southwestern United States and southwestern Mexico, is a summer annual. Its green leaves are smooth and arranged in an alternate pattern that grows symmetrically around the stem. It looks similar to our native pigweeds such as tall waterhemlock, redroot, and smooth pigweeds. It has developed resistance to multiple classes of herbicides and their different modes of action, making it very difficult and expensive to control. It grows 2 to 3 inches per day and commonly reaches heights of 6 to 8 feet, greatly inhibiting crop growth. Reported yield losses have been up to 91% in corn and 79% in soybean in some states. The weed can also significantly increase production costs for corn, soybean, and other crops. In September 2016, Palmer amaranth was initially discovered and confirmed in Minnesota. Thirteen sites have been documented in Yellow Medicine and Lyon Counties.

Diffuse knapweed. This biennial plant thrives in disturbed habitats such as roadsides, railroad tracks, gravel pits, vacant lots, and heavily grazed pastures. Leaves are covered with short dense hairs, giving the plant a gray tint. Flowers are usually white but sometimes pink or purple. This knapweed is widespread throughout rangeland in the western U.S., but in Minnesota the only known infestation is in St. Louis County. Diffuse knapweed overtops and suppresses native vegetation, reducing species diversity and wildlife habitat. It can also increase soil erosion and cause crop loss and reduced forage for livestock. The spines on the flower heads can damage the mouths and digestive tracts of livestock.

Arrest the pest! Protect forests and crops

The Minnesota Department of Agriculture has created guidelines and an app to help Minnesotans identify and report harmful pests.

1 Take pictures and notes
   • Insects. Take pictures and notes of the plants on which the insect was found. Note any unique markings on the insect. If possible, place a coin or other easily recognizable object next to the insect to compare the size.
   • Plants. Take pictures of flowers and leaves.
   • Diseases. Note the species of plant (if known) on which you find the disease. Take pictures of the disease as well as any fruit, seeds, leaves, or flowers of the host plant.

2 Capture the insect, if possible, or take a sample of the plant
   TAKE SAFETY PRECAUTIONS BEFORE HANDLING ANY INSECTS OR PLANTS. Some organisms cause allergic reactions or skin irritation, or may sting or bite. Wear gloves when handling insects and plants.
   • Put the insect or plant sample in a sealed plastic bag. Place the insect in your freezer, or plant sample in your refrigerator.

3 Report
   Report findings to Arrest the Pest using any of the following methods:
   • Upload photos and attach them to an e-mail. Write a short description of what you saw and where you saw it. Make sure to include your contact information. Send to arrest.the.pest@state.mn.us.
   • Use the new user-friendly smartphone/tablet app. Submit your discovery within minutes of finding the pest. Download the free Great Lakes Early Detection Network (GLENDN) app from the Google Play Store or the Apple AppStore.
   • Call Arrest the Pest at 1-888-545-6684. Leave a detailed message that includes your name, location, contact number, and the type of pest that you want to report. The voicemail will be forwarded to the agency in charge of that pest.

   Learn more at mda.state.mn.us/arrestthepest.
Evaluation of Recycled Aggregates Test Section Performance (MnDOT, Feb. 2017) evaluates the performance of recycled concrete aggregate compared to other concrete pavements.

Considerations for Development of Inspection and Remedial Grouting Contracts for Post-tensioned Bridges (MnDOT, Jan. 2017) details the second phase of a two-phase project to identify best practices for the investigation of post-tensioned tendon conditions in bridge structures constructed prior to 2003. Bridges constructed prior to this date used grouting materials and practices that often resulted in the formation of air- or water-filled pockets inside post-tensioned tendons.

Modeling the Performance Properties of RAS and RAP Blended Asphalt Mixes Using Chemical Compositional Information (Center for Transportation, University of Illinois Urbana-Champaign, Jan. 2017) investigates chemical characterization and rheological properties of binders from various sources in order to study the effects of aging and increasing asphalt binder replacement levels.

Validation of Hot-Poured Crack Sealant Performance-Based Guidelines (Center for Transportation, University of Illinois Urbana-Champaign, March 2017) summarizes a research effort to validate thresholds for performance-based guidelines and grading systems for hot-poured asphalt crack sealants. This report also evaluates the short-term and long-term aging effects of hot-poured crack sealants through a differential aging test.

Historical Performance Evaluation of Iowa Pavement Treatments Using Data Analyticst (Institute for Transportation, Iowa State University, Jan. 2017) evaluates the performance of pavement treatments and estimates their performance lives to support future maintenance and rehabilitation decisions.

Evaluation of Laboratory Friction Performance of Aggregates for High Friction Surface Treatments (National Center for Asphalt Technology, Auburn University, Jan. 2017) evaluates the friction performance of aggregates in a laboratory environment.

Preventing Transverse Bumps and Cracks in New Asphalt Overlays over Crack Sealants (Colorado DOT, Jan. 2017) presents results of a five-year study designed to identify factors that relate to the appearance of bumps and consequent cracks. These bumps occur when a hot-mix asphalt overlay is placed on top of a pavement containing crack sealants.

State of the Practice for Shoulder and Centerline Rumble Strips (MnDOT, March 2017) evaluates the performance of pavement treatments and estimates their performance lives to support future maintenance and rehabilitation decisions.

Evaluation of Recycled Aggregates Test Section Performance (MnDOT, Feb. 2017) evaluates the performance of recycled concrete aggregate compared to other concrete pavements.

Considerations for Development of Inspection and Remedial Grouting Contracts for Post-tensioned Bridges (MnDOT, Jan. 2017) details the second phase of a two-phase project to identify best practices for the investigation of post-tensioned tendon conditions in bridge structures constructed prior to 2003. Bridges constructed prior to this date used grouting materials and practices that often resulted in the formation of air- or water-filled pockets inside post-tensioned tendons.

Modeling the Performance Properties of RAS and RAP Blended Asphalt Mixes Using Chemical Compositional Information (Center for Transportation, University of Illinois Urbana-Champaign, Jan. 2017) investigates chemical characterization and rheological properties of binders from various sources in order to study the effects of aging and increasing asphalt binder replacement levels.

Validation of Hot-Poured Crack Sealant Performance-Based Guidelines (Center for Transportation, University of Illinois Urbana-Champaign, March 2017) summarizes a research effort to validate thresholds for performance-based guidelines and grading systems for hot-poured asphalt crack sealants. This report also evaluates the short-term and long-term aging effects of hot-poured crack sealants through a differential aging test.

Historical Performance Evaluation of Iowa Pavement Treatments Using Data Analyticst (Institute for Transportation, Iowa State University, Jan. 2017) evaluates the performance of pavement treatments and estimates their performance lives to support future maintenance and rehabilitation decisions.

Evaluation of Laboratory Friction Performance of Aggregates for High Friction Surface Treatments (National Center for Asphalt Technology, Auburn University, Jan. 2017) evaluates the friction performance of aggregates in a laboratory environment.

Preventing Transverse Bumps and Cracks in New Asphalt Overlays over Crack Sealants (Colorado DOT, Jan. 2017) presents results of a five-year study designed to identify factors that relate to the appearance of bumps and consequent cracks. These bumps occur when a hot-mix asphalt overlay is placed on top of a pavement containing crack sealants.

State of the Practice for Shoulder and Centerline Rumble Strips (MnDOT, March 2017) evaluates the performance of pavement treatments and estimates their performance lives to support future maintenance and rehabilitation decisions.

Search tools & links
The Minnesota LTAP library page features custom search engines to help you find information. Bookmark mnltap.umn.edu/publications/library. You can search:

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

Other great resources:
- LIRRB’s site: lirrb.org
- MnDOT Library’s catalog: dot.state.mn.us/library. LTAP

Develops a rumble strip decision-support guide to inform agencies on center lane rumble strips (CLRS) and shoulder rumble strips (SRS) installation. The report also documents the current state of the practice for CLRS and SRS.

Using Failing Weight Deflectometer Data with Mechanistic Empirical Design and Analysis, Volume II: Case Study Reports (FHWA, March 2017) examines the use of the failing weight deflectometer as part of mechanistic empirical pavement design and rehabilitation procedures. LTAP

Pedestrian from page 1

Pedestrian safety countermeasures: The Federal Highway Administration (FHWA) is promoting the following pedestrian safety countermeasures through the fourth round of Every Day Counts (EDC-4):

- **Road diets** can reduce vehicle speeds and the number of lanes pedestrians cross. They can also create space to add new pedestrian facilities.

- **Pedestrian hybrid beacons** (PHBs) are a beneficial intermediate option between rectangular rapid flash beacons (RRFBs) and full pedestrian signals. PHBs provide positive stop control in areas without the high pedestrian traffic volumes that typically warrant signal installation.

- **Pedestrian refuge islands** allow pedestrians a safe place to stop at the midpoint of the roadway before crossing the remaining distance. This is particularly helpful for older pedestrians or others with limited mobility.

- **Raised crosswalks** can reduce vehicle speeds.

- **Crosswalk visibility enhancements**, such as crosswalk lighting and enhanced signaling and marking, help drivers detect pedestrian crosswalks—particularly at night.

**PEDSAFE online tool**

Countermeasures are being promoted through FHWA’s PEDSAFE, an online tool that helps transportation agencies diagnose and treat pedestrian safety issues. PEDSAFE provides a decision process to select the most applicable countermeasures for a specific location. It also includes numerous case studies that describe how communities across the country have implemented these safety improvements. See pedsafe.org to learn more. LTAP

MnDOT manual helps agencies count bike, pedestrian traffic

As part of an ongoing effort to institutionalize bicycle and pedestrian counting in Minnesota, MnDOT has published a new manual designed to help city, county, state, and other transportation practitioners in their counting efforts. Topics in the Bicycle and Pedestrian Data Collection Manual include data collection sensors, how to perform counts using several types of technologies, and data management and analysis. Several case studies illustrate how bicycle and pedestrian traffic data can be used to support transportation planning and engineering. LTAP
Beat the heat: water, rest, shade

Heat-related illnesses can be deadly. Thousands become sick every year and many die due to preventable heat-related illnesses.

Heat-related illness: know the signs
It’s important to know the signs of heat-related illness—acting quickly can prevent more serious medical conditions and may even save lives.

- **Heat stroke** is the most serious heat-related illness and requires immediate medical attention. Symptoms include confusion, fainting, seizures, very high body temperature, and hot, dry skin or profuse sweating. Call 911 if a coworker shows signs of heat stroke.
- **Heat exhaustion** is also a serious illness. Symptoms include headache, nausea, dizziness, weakness, thirst, and heavy sweating. Heat fatigue and heat rash are less serious, but they are still signs of too much heat exposure.

If you or a coworker has symptoms of heat-related illness, tell your supervisor right away. If you can, move the person to a shaded area, loosen his/her clothing, give him/her water (a little at a time), and cool him/her down with ice packs or cool water.

To prevent heat illness: water, rest, shade

- Drink water every 15 minutes, even if you are not thirsty.
- Rest in the shade to cool down.
- Wear a hat and light-colored clothing.
- Rest in the shade to cool down.
- Keep an eye on fellow workers.
- Acclimate—“easy does it” on your first days of work; be sure to get used to the heat and allow yourself to build up a tolerance. Not being used to the heat is a big problem. Many of the people who died from heat stress were either new to working in the heat or returning from a break. If you have not worked in hot weather for a week or more, your body needs time to adjust. **LTAP**

Unlock your potential at the Fall Maintenance Expo, Oct. 4–5

This year's Fall Maintenance Expo includes two sessions by Erik Therwanger, coach, speaker, and author of The Think GREAT Collection. The expo takes place October 4 and 5 in St. Cloud.

In his first session, “The Leadership Connection,” Therwanger will help participants discover their greater purpose as leaders and unlock their potential, inspiring their teams to set and accomplish important goals. His second session, “The GOAL Formula,” will help attendees understand the formula necessary to accomplish any goal—personal or professional—no matter what the circumstances.

Other expo topics include catch basin freeze-ups, roundabouts/J-turns/diverging diamonds, tree trimming, snowplow spreaders, defensive driving, and communicating clearly on the jobsite.

The expo is worth 1.0 Roads Scholar Program credit. Sponsors are MnDOT, Minnesota LTAP, the Minnesota Street Superintendents Association, and the American Public Works Association—Minnesota Chapter. **LTAP**

Be careful crossing the street

Chickens want to cross roads—it’s what they do. But for both chickens and people, it can be a dangerous action, as described in the article on page 1 and shown in this issue’s puzzle.

Help the chicken cross the street, stopping halfway in the pedestrian refuge and avoiding cars. Don’t retrace your steps, or you might be stepped on by the distracted pedestrian who’s close behind your tail feathers. **LTAP**

WORKSHOPS & TRAINING

Calendar

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

**Truck-Weight Education Training**
(1 RS elective credit) **LTAP**
September 6, Markello
September 13, St. Cloud
September 20, Bemidji

**Fall Maintenance Expo**
(1 RS elective credit) **LTAP**
Oct. 4–5, St. Cloud

**Statewide Toward Zero Deaths Conference**
Oct. 26–27, Saint Paul

**CTS Transportation Research Conference**
Nov. 2, Minneapolis

**Online Training:**
Anytime, anywhere!

**Culvert Design and Maintenance**
(1 RS required credit) **LTAP**

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

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

**Work-Zone Safety Tutorial** **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 mnltap.umn.edu/roadsscholar.

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

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

**Beat the heat:** water, rest, shade

Heat-related illnesses can be deadly. Thousands become sick every year and many die due to preventable heat-related illnesses.

Heat-related illness: know the signs
It’s important to know the signs of heat-related illness—acting quickly can prevent more serious medical conditions and may even save lives.

- **Heat stroke** is the most serious heat-related illness and requires immediate medical attention. Symptoms include confusion, fainting, seizures, very high body temperature, and hot, dry skin or profuse sweating. Call 911 if a coworker shows signs of heat stroke.
- **Heat exhaustion** is also a serious illness. Symptoms include headache, nausea, dizziness, weakness, thirst, and heavy sweating. Heat fatigue and heat rash are less serious, but they are still signs of too much heat exposure.

If you or a coworker has symptoms of heat-related illness, tell your supervisor right away. If you can, move the person to a shaded area, loosen his/her clothing, give him/her water (a little at a time), and cool him/her down with ice packs or cool water.

To prevent heat illness: water, rest, shade

- Drink water every 15 minutes, even if you are not thirsty.
- Rest in the shade to cool down.
- Wear a hat and light-colored clothing.
- Rest in the shade to cool down.
- Keep an eye on fellow workers.
- Acclimate—“easy does it” on your first days of work; be sure to get used to the heat and allow yourself to build up a tolerance. Not being used to the heat is a big problem. Many of the people who died from heat stress were either new to working in the heat or returning from a break. If you have not worked in hot weather for a week or more, your body needs time to adjust. **LTAP**

(Reprinted from the U.S. Occupational Safety and Health Administration website)