

MINNESOTA LTAP TECHNOLOGY EXCHANGE

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New Snow & Ice Control Guidebook from LRRB



SNOW & ICE CONTROL GUIDEBOOK

June 2016
LRRB Report #2016RIC11

Minnesota local agencies perform winter maintenance to keep roads clear for the traveling public. To do this effectively, agencies must balance public safety, cost, and environmental concerns. The new *Snow & Ice Control Guidebook* from the Minnesota Local Road Research Board (LRRB) summarizes common snow and ice control tools and introduces the field of winter maintenance to operators and managers.

Guidebook continued on page 6

Brochure looks at policies related to farm equipment on roads

A four-page brochure from the LRRB's Research Implementation Committee takes a look at the history and current status of Minnesota policies



related to implements of husbandry (IOH), or agricultural equipment, on roadways. It also summarizes neighboring states' IOH weight restrictions and provides links to recent research. Following are some highlights from the brochure.

History

In 1993, Minnesota passed a law exempting implements of husbandry from size, weight, and load restrictions. Over the last two decades, however, farming practices have changed from family to corporation, and the size and weight of IOH have increased dramatically. As size and weight continue to increase, there is serious concern about how IOH are damaging roads.

Farm equipment continued on page 3

Insights on sign and sign post installation

Signs regulate, warn, and guide drivers as they travel from point A to point B. Their installation is essential to the safety of, and vehicle operation along, our roadways. Keith Knapp, the director of Iowa LTAP, and Mark Vizecky, MnDOT State Aid program support engineer, share their insights on signs and safety below.

Installation and placement: MUTCD

Proper sign and sign post installation requires, among other factors, consideration of lateral offset from the roadway, position along the roadway, and sign height. In addition, it is important to understand that the details of how a sign post is installed within the roadside environment can impact how the sign and sign post combination react when hit by a vehicle—potentially influencing roadway safety.

The *Manual on Uniform Traffic Control Devices* (MUTCD) provides information on when to place a sign (only in a limited number of cases), why to place a sign, how to place a sign, and where to place a sign. Each state adopts a version of the MUTCD, some via appended pages; others, like Minnesota, review, enhance, and republish the manual in its entirety. The MUTCD applies to ALL roads open to the public. It utilizes standards (SHALL), guidance (SHOULD), option (MAY), and/or support statements for regulatory, warning, and guide signs.

The position of a sign along the roadway is based on a number of factors, including type and purpose



Signs continued on page 4



SAFETY

'Road diet' guide aims to reduce collisions and congestion

Improving safety and relieving congestion on public roadways are high-priority national goals. Innovative reconfigurations such as "road diets" can help achieve these goals for motorists and non-motorists on mixed-use streets by reducing vehicle speeds and freeing space for alternative modes. Road diets can reduce collisions, increase mobility and access, and improve a community's quality of life.

The Federal Highway Administration (FHWA) Office of Safety added road diets to its Proven Safety Countermeasures list in January 2012. An FHWA website provides guidance on road-diet application, including effective use of road diets without reducing highway capacity and road-diet-related crash modification factors for use in safety countermeasure benefit-cost analysis.

The Safety Office also developed a *Road Diet Informational Guide* that includes safety, operational, and quality-of-life considerations from research and practice as well as design guidance. It takes readers through the decision-making process to determine if road diets are a good fit for certain corridors.

What are road diets?

Road diets are a safety-focused alternative to a four-lane, undivided roadway. The most common type of road diet involves converting an existing four-lane, undivided roadway segment that serves both through and turning traffic into a three-lane segment with two through lanes and a center, two-way left-turn lane (TWLTL). The reclaimed space can be allocated for other uses such as bike lanes, pedestrian refuge islands, bus lanes, and parking.

On a four-lane undivided road, vehicle speeds can vary between travel lanes, and drivers frequently slow or change lanes due to slower vehicles or vehicles stopped in the left lane waiting to turn left. On three-lane roads with TWLTLs, left-turning vehicles are separated from through vehicles, and the vehicle

speed differential is limited by the speed of the lead vehicle in the through lane. This reduces the vehicle-to-vehicle conflicts that contribute to crashes.

Benefits

Safety. Road diets can make the roadway environment safer for all users. Studies indicate a 19 to 47 percent reduction in overall crashes when a road diet is installed on a previously four-lane undivided facility. For pedestrians, road diets result in fewer lanes to cross and provide an opportunity to install refuge islands that slow vehicles in the midblock crossing area, which is where 70 percent of pedestrian fatalities occur.

Low cost. Road diets make efficient use of the roadway cross-section. The majority are installed on existing pavement within the right-of-way. When planned in conjunction with reconstruction or simple overlay projects, the safety and operational benefits of road diets are achieved essentially for the cost of restriping pavement lanes.

Quality of life. Road diets can make shared spaces more livable and contribute to a community-focused, Complete Streets environment. On-street parking and bike lanes can also bring increased foot traffic to business districts.

State of the practice

Road diets have been implemented for at least two decades and are steadily increasing in popularity. More than 600 state, regional, and local jurisdictions have adopted or have committed to adopting Complete Streets policies, establishing the expectation that all future roadway projects will adhere to the principle that streets should be designed with all users in mind rather than merely providing enough capacity for vehicle throughput. **LTAP**

(Reprinted from the FHWA Every Day Counts road diets web page.)



Related resources:

- FHWA Every Day Counts: fhwa.dot.gov/innovation/everydaycounts/edc-3/roaddiets.cfm
- FHWA Office of Safety Proven Safety Countermeasures: safety.fhwa.dot.gov/road_diets
- Summary report: *Evaluation of Lane Reduction Road Diet Measures on Crashes* (FHWA-HRT-10-053)



Minnesotans receive honors from APWA

The American Public Works Association – Minnesota Chapter received six national awards this summer: four APWA Professional Awards and two APWA Member Awards. They were presented at the 2016 APWA PWX in Minneapolis in August.

- The City of Richfield received the Exceptional Performance Award – Journalism for development of its Sweet Streets Program. Sweet Streets is a public awareness campaign to inform residents of the public works projects in Richfield over six years (2015–2020). The campaign strategy included a website (richfieldsweetstreets.org), social media, promotional items with Sweet Streets branding, citywide postcard mailings, and various print advertisements.
- The City of Coon Rapids received the Sustainability Practices Award. The city has made the practice of sustainability a priority in all of its current operations as well as its plans for growth and redevelopment. Actions have included implementation of energy-efficient facility operations and stormwater management via minimal impact design standards.
- MnDOT received the Technical Innovation Award for its use of unmanned aircraft systems (UAS) for bridge inspections. The department looked at the use of UASs to help alleviate costs and improve the quality of inspections.
- Bolton & Menk, Inc. received the Harry S. Swearingen Award for Outstanding Chapter Achievement and Excellence in Chapter Service – Corporate Company.
- Kevin Western of MnDOT received the Citation for Exemplary Practices Award.
- Angela Popenhagen of Stevens Engineering received the Harry S. Swearingen Award for Outstanding Chapter Achievement and Excellence in Chapter Service – Individual. **LTAP**

(Reprinted from the APWA-MN website)

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

Minnesota LTAP

Center for Transportation Studies
University of Minnesota
200 Transportation and Safety Building
511 Washington Avenue S.E.
Minneapolis, MN 55455
Phone: 612-626-1077
Fax: 612-625-6381
E-mail: mnltap@umn.edu
Web: mnltap.umn.edu

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Minnesota LTAP Resource Staff

Director: Jim Grothaus, 612-625-8373, jgrothaus@umn.edu
Program Manager: Mindy Carlson, 612-625-1813, carlson@umn.edu
Program Coordinator: Kylie Bivins, 612-625-5608, bivins@umn.edu
CTAP Instructor: Kathy Schaefer, 651-366-3575, kathleen.schaefer@state.mn.us
Workshop Registration & Facilitation: Teresa Washington, 612-624-3745, washi002@umn.edu
Managing Editor: Pamela Snopl, 612-624-0841, snopl001@umn.edu
Editors: Christine Anderson, 612-624-1572, ande4255@umn.edu; Michael McCarthy, 612-624-3645, mppmccarthy@umn.edu
Design: Angie Kronebusch, 612-624-0546, akronebu@umn.edu
Student Interns: Jamie Hulkonen, Jack Glennen

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Minnesota LTAP Steering Committee

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Bert Tracy, City of Golden Valley; Minnesota Street Superintendents Association

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Local OPERA Project: Urban snow support vehicle

Project leader: Kevin Jaax

Agency: City of Golden Valley

Problem: The City of Golden Valley Street Maintenance Division responds to a variety of situations and requests during snow and ice control events. These requests range from clearing sidewalks and walkways to salting slippery areas to fueling equipment. Many of these requests require a different piece of equipment or tool. The division's response time to these requests was hindered by the need to drive back to the shop to switch equipment or get a specific tool.

Solution: The city fabricated a flatbed hook body that uses the SwapLoader system to transport the necessary equipment and tools for a variety of snow and ice control tasks.

Procedure: Staff compiled a list of tools and equipment needed to complete the

majority of winter maintenance tasks during a snow event. The city purchased a flatbed hook body that uses the SwapLoader system. Staff fabricated the hook body to include a salt/sand spreader, a 35-gallon diesel tank, tow straps, shovels, brooms, a small snow blower, a pick hammer, and type II flashers.

Results: Staff were able to respond to complaints more quickly because the necessary tools and equipment were already available on the vehicle. Using the SwapLoader system enabled the division to switch between a dump body, debris box, form box, and the urban snow support box, which saves mobilization time and allows the truck to have several uses. Fuel and labor costs have decreased now that staff do not have to go back to the shop between tasks.

Approximate cost: \$8,700

OPERA funding: \$1,500



Implementation: Before a snow event, staff hook up the flatbed hook body to a one-ton truck using the SwapLoader system. When a request comes in, staff are able to drive directly to the request location and use the necessary tools and equipment from the flatbed.

Status: Complete **LTAP**

Fact sheets and reports online

The Exchange regularly highlights projects completed under the LRRB's Local Operational Research Assistance Program (Local OPERA). Project fact sheets, along with the full project reports, are posted on the OPERA website: mnltp.umn.edu/opera.

Farm equipment from page 1

The states surrounding Minnesota have addressed this concern by establishing maximum gross weights and gross axle weights; Minnesota has not.

The 1993 law exempting IOH from size, weight and load restrictions was established due to influence from the agriculture industry. Changes to the law in 2009 require IOH to comply with posted bridge weight restrictions, but the change did not address the concerns of pavement damage to roads and highways. The Minnesota Department of Transportation (MnDOT), local road authorities, and industry partners are concerned about the potential damage to pavements.

MnDOT & LRRB studies

In 2001, MnDOT conducted a scoping study on the impact of agricultural equipment on Minnesota's low-volume roads. One of the recommendations from the study was to conduct an investigation using the MnROAD pavement test facility to specifically address pavement damage due to agricultural equipment.

The LRRB then participated in a five-year pooled-fund study titled "Effects of Implements of Husbandry (Farm Equipment) on Pavement Performance" at MnROAD to test the impacts of various IOH on fully instrumental pavements of different thicknesses. In addition, the project aimed to quantify the pavement damage caused by heavy farm equipment as compared to the damage caused by a typical five-axle, 80 kip semi-truck. The report was published in 2012 and provides many specific findings, with these major findings:

- Pavement was significantly impacted by IOH.
- Pavement response is governed by axle weight, not gross vehicle weight.
- Fully loaded farm equipment should not be allowed to drive on pavements as they cause significant damage. Additional increase in pavement damage occurs during certain conditions: fully saturated soil, thawed base/sub-base, and high asphalt concrete temperature.

Current law

In 1993, Minnesota law deemed all IOH as exempt from size, weight, and load restrictions on Minnesota roads, with the following exceptions: Pneumatic tires may not be operated on a public highway with a maximum wheel load that exceeds 500 pounds per inch of tire width. This law allows IOH—of any size, weight, and load—to drive on any paved or gravel roads in Minnesota with no weight or axle restrictions.

In 2009, the law was modified: a person operating or towing an implement of husbandry on a bridge must comply with state load restrictions.

LTAP

Related resources:

- Brochure: *Impacts of Implements of Husbandry on Local Roads* (LRRB-RIC 2016RIC07, June 2016)
- Full report: *Effects of Implements of Husbandry (Farm Equipment) on Pavement Performance* (MnDOT MN/RC 2012-08, Apr. 2011)

More at LRRB.org

Consolidated Asset Management for Minnesota Local Agencies (LRRB, TRS 1603, June 2016)

- Synopsis of Recycled Asphalt Pavement (LRRB-RIC, 2016RIC08, June 2016)
- Thinking of Building a Multi-Lane Roundabout? (LRRB-RIC, 2016RIC12, June 2016)
- Rural Maintenance - Supplemental Guidebook (LRRB, 2016RIC09A)
- Urban Maintenance - Supplemental Guidebook (LRRB, 2016RIC09B)
- Full Report: Temporary Traffic Control Layout Selection by Maintenance Activity (LRRB, 2016RIC09)
- Intersection Safety Technologies, Quick Reference Guidebook for Intersection Conflict Warning Systems and LED STOP Signs (LRRB and MnDOT, 2016RIC10A).
- Intersection Safety Technologies Guidebook (LRRB and MnDOT, 2016RIC10) **LTAP**

How IOH Have Increased In Size Over Time

	Grain Cart	Liquid Manure	Terragator
1965	 125 Bushel	 1,200 Gallon	 1,500 Gallon
1990	 600 Bushel	 4,600 Gallon	 1,800 Gallon
2015	 1,000 Bushel	 9,000 Gallon	 2,400 Gallon

PAVEMENTS

Evolving pavement rehabilitation technologies

Retired county engineer Al Forsberg is wearing a new hat these days: volunteer reporter for Minnesota LTAP. Al recently met with Dan Wegman, Braun Intertec Testing, and Dave Rettner, AET, two recognized experts in bituminous and concrete pavement rehabilitation and the instructors for Minnesota LTAP's Pavement Rehabilitation course. They discussed advances in pavement rehabilitation technology, an exciting topic for today's local government engineer. Here's a summary of their discussion.

Why choose rehabilitation?

Most of the local road system that is going to be paved, is. The challenge is to improve the strength, durability, safety, and ride of these roads within very constrained budgets. Pavement rehabilitation strategies are becoming a bigger part of our local road and bridge programs because they are more economical and offer several environmental benefits over reconstruction.

Our pavements are facing increasing challenges as they age with heavier loads, more traffic, and in some cases, declining availability of readily accessible, quality aggregates. Fortunately, pavement science is advancing. We have a better understanding of how aggregates, binders, traffic, costs, and risks interact. In addition, we have new tools including intelligent compaction, thermal imaging, performance measures, and whitetopping in our tool quiver.

Key steps

Several key steps are essential to develop an economical and effective pavement rehabilitation project.

Assess the condition of the road, including structural, geometric, right-of-way, and safety considerations. Choose the right tool for the problem. Today many alternatives are available, including cold-in-place recycling, stabilized full-depth reclamation, hot in-place recycling, and pulverizing the old pavement and placing a new pavement surface. Perpetual pavement designs with a flexible aggregate base, stiff intermediate layer, and wearing course have great potential for rapid and efficient pavement renewal by milling and replacing only the wear course.

For concrete, alternatives include bonded and unbonded thin overlays (whitotopping) and unbonded thicker overlays, dowel retrofit, full- and partial-depth patching, and diamond grinding. Selecting the right tool involves consideration of strength, durability, cost, ride, and, sometimes, elected official preferences. Increasingly, local

governments are calculating life-cycle costs to better consider the long-term economic consequences of their decision.

Design the tool right. A carefully considered engineering design based on experience and pavement design science will yield the most economical and effective long-term investment in the pavement rehabilitation project. Design needs to consider aggregate quality and gradation, binder amount and type, air voids, compaction, ride, craftsmanship, and, unique to concrete, ASR and D cracking, dowels, and slab width. Additional considerations include life-cycle cost, durability, risk, and newly developed performance measures such as cohesivity and fracture energy for asphalt.

Construction. There is no silver bullet. Everything has to be done well for a successful pavement rehabilitation.

- Know and understand the plans and specifications.
- Monitor and enforce the specifications, requiring trained onsite staff and/or performance measures such as the new cohesivity and fracture energy measures.
- Achieve density through monitoring, testing, and using the new intelligent compaction equipment.
- Avoid segregation of the mix—both by gradation and temperature—using new infrared thermal imaging technology.

Preservation. Research shows pavement preservation strategies are essential to achieve the

Minnesota LTAP offers pavement rehab courses in 2017

Minnesota LTAP is offering two pavement rehabilitation courses next year:

- Pavement Rehabilitation: Products, Processes, and Strategies
- Concrete Pavement Rehabilitation for Local Streets and Roads

See the calendar on page 8 for details.

greatest return on your rehabilitation investment. Bituminous preservation strategies include the traditional fog seals, seal coats, and crack sealing as well as new slurry seal designs. For concrete, strategies include diamond grinding, full-depth and partial-depth patching, and for some roads, joint seal replacement. **LTAP**

—Al Forsberg, retired Blue Earth County Engineer

Related resources:

- *Alternatives to Seal Coats* (MnDOT and LRRB, TRS 1602, Feb. 2016)
- pavementinteractive.org
- tc3.transportation.org
- asphaltpavement.org
- dot.state.mn.us/mnroad/reports
- asphaltroads.org/perpetual-pavement



McLeod County chose FDR for a pavement rehabilitation project (see article on p. 5).

Pothole repairs with taconite last longer

University of Minnesota Duluth (UMD) researchers developed two improved options for pothole repair that are ideally suited to Minnesota's cold and wet conditions. The techniques use taconite tailings—magnetite containing aggregate left over from the mining and processing of taconite for steel manufacturing. The research was part of a broader effort by MnDOT to evaluate current practices, materials, and policies for pavement patching and repair.

The first approach is a fast-setting, taconite-based compound, which was found to be especially well suited for rigid and relatively deep repairs in concrete pavements. The second approach uses a vehicle-based microwave heating system with taconite materials for in-place pothole and pavement repair; this technology proved very effective for repairing potholes in asphalt pavement at all temperatures, including very cold temperatures.

"Many taconite-based findings have lasted three years," says Lawrence Zanko, a senior research fellow

at UMD's Natural Resources Research Institute. "Our findings indicate that these two repair options have the potential to save maintenance departments thousands of dollars in labor costs annually, reduce traffic disruption caused by the frequent repair of repeatedly failing patches, and add efficiency and longevity to repairs."

The final report includes two fact sheets on the new repair methods that maintenance agencies can use as part of their toolkit of options for repairing potholes and other pavement failures.

Related resources:

- Final report: *Evaluate and Develop Innovative Pavement Repair and Patching: Taconite-Based Repair Options* (MnDOT 2016-03, Jan. 2016)
- Technical brief: *Taconite-Based Pavement Patches Show Promise for Pothole Repair* (MnDOT 2016-03TS, Apr. 2016)



A microwave heating system makes effective patches possible in winter.

McLeod County uses cement-stabilized FDR in pilot project

Gravel roads provide reliable, all-year access to landowners throughout Minnesota. Although a gravel road is not the “dirt” road citizens often complain about, it can be bumpy, dusty, and subject to soft areas during the spring thaw. Gravel roads are also costly for the county to maintain, especially for higher traffic volumes, requiring replacement gravel and regular blading.

McLeod County Road 54 was a gravel road serving growing rural residential and farm-to-market needs. As a county road, even though the 180-vehicle-per-day traffic count met standards for paving, no state or federal funds were available for a conventional reconstruction and paving project.

John Brunkhorst, P.E., county engineer, considered a number of options for improving the road, including calcium chloride application, bituminous stabilization, cement stabilization, and hot-mix paving. John determined that a cement stabilized with full-depth reclamation—CSFDR—had the best potential for improving the road within cost constraints and public acceptance.

The county retained American Engineering and Testing to perform a mix design to determine the depth of reclamation, percent cement, and optimum moisture content based on the aggregate and soil conditions. Because of the potential for expanding CSFDR to other county gravel roads, several test sections were constructed with 8-inch and 10-inch depths and 5%, 6%, 7%, and 8% cement added to determine the optimum design. The goal was to develop a durable and economical mix design with a compressive strength of about 250 psi, enough strength to support traffic but flexible enough to avoid acting as monolithic crack-prone slabs.

The year before the project, drainage was improved and the road bladed to a uniform cross section. An average of 4 to 6 inches of aggregate was in place, so full-depth reclamation would include about 4 inches of earth from the underlying road embankment.



The county has developed a testing and monitoring program to measure performance.

The general construction process was as follows:

- Cement was spread on the grade by a GPS-calibrated semi-trailer spreader.
- A reclamation machine, basically a GPS-enhanced rototiller with the capability to add precise amounts of moisture, tilled the section to the design depth and injected the appropriate amount of water. Sections of 200 to 300 feet were constructed to ensure shaping and compacting would take place before the cement-stabilized mixture set.
- A pad foot roller compacted the material.
- A motor grader bladed the section to a 4% crown. Offset staking provided horizontal alignment control.
- A smooth drum roller performed final compaction.
- A bituminous tack coat, double seal coat, and fog seal were applied to seal the surface and act as a final wearing course.

American Engineering and Testing assisted during construction with field tests to ensure the specifications for moisture, cement content, and density were achieved.

The county has developed a testing and monitoring program to measure performance of the various test sections, including MnDOT ride quality measurements, FWD strength, and perhaps ground penetrating radar evaluation. Local OPERA funds from the LRRB will be sought to assist with monitoring.

Preliminary conclusion: strength is adequate. Establishing realistic public expectations for ride is important. It is a stabilized gravel road, not a high-level pavement. The county is also evaluating the desirability of centerline striping.

McLeod County has developed a carefully engineered pilot project throughout the planning, designing, and construction process. It is planning a testing and monitoring program so sound conclusions can be drawn. We look forward to future reports. **LTAP**

—Al Forsberg, retired Blue Earth County Engineer

Signs from page 1

of the sign being installed. In many cases, the information provided for these locations is guidance that allows reasonable adjustment to “field” conditions (i.e., driveway locations, centerline pipes, mailboxes, etc.).

Drivers need to be able to detect, recognize, decide, and react to the sign's shape, color, and message while maintaining control of their vehicle. We can only “digest” a limited amount of information at any particular time. The MUTCD describes standardization of location (MUTCD Section 2A. 16), e.g., lateral positioning or offsets and minimum height of the signs (MUTCD Section 2A.18) for rural and urban situations. In rural areas, for example, the minimum height measured from the bottom of the sign to the elevation of the near edge of the pavement is five feet (MUTCD Section 2A.18).

AASHTO Roadside Design Guide

The AASHTO *Roadside Design Guide* has chapters that focus on roadside topography, a variety of roadside features (e.g., signs, signals, etc.) and roadside barriers in addition to many other topics. It also provides information about how sign and sign post combinations are tested and how some installation details could affect the combinations' reaction when hit by a vehicle.

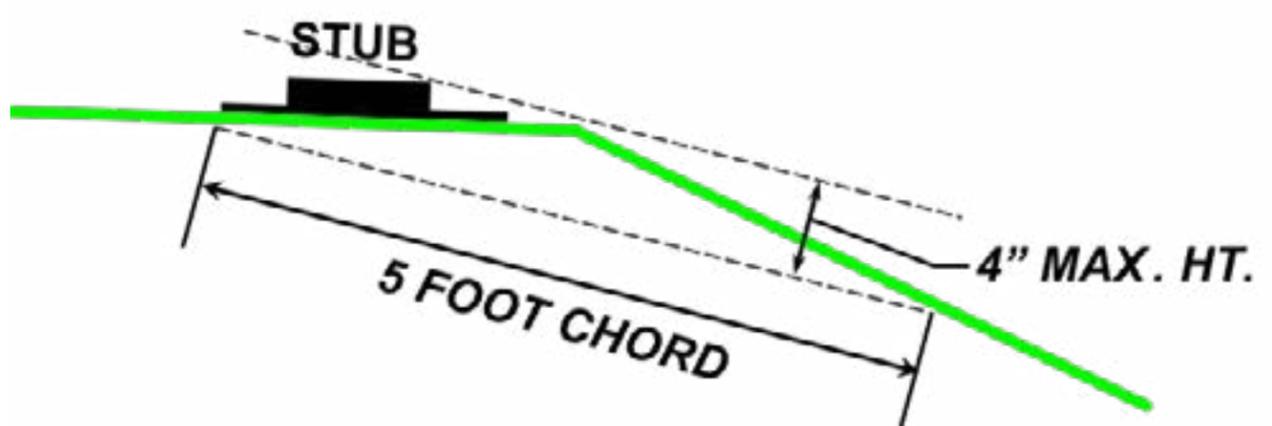
For example, there is crash-test-based information about stub height. The guide indicates:

...[s]upports placed on roadside slopes should not allow impacting vehicles to snag on either the foundation or any substantial remains of the support. Surrounding terrain should be graded to permit vehicles to pass over any

non-breakaway portion of the installation that remains in the ground or rigidly attached to the foundation. The AASHTO *Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals* establishes a maximum stub height of 100 mm (4 inches) to lessen the possibility of snagging the undercarriage of a vehicle after a support has broken away from its base and minimize vehicle instability if a wheel hits a stub.

The figure below, a recreation of Figure 4-1 in the AASHTO *Roadside Design Guide*, shows how the maximum stub height is measured.

Another example is the research-based information and discussion provided in the AASHTO *Roadside Design Guide* about how minimum top-of-sign heights on bending or yielding posts may result in penetration of the passenger compartment. This information could be used to determine both sign height and the selection of the type of sign post used along high-speed streets and roadways.



From *Roadside Safety for Local Agencies training* (Frank Julian)

An important safety-related activity

The MUTCD and the AASHTO *Roadside Design Guide* are resources to use for sign and sign post installation. The information they provide allows a better understanding of the adjustments allowed in the many decisions made during this activity and/or their potential impacts on safety and operations. When used in combination, they result in more-informed decision making related to sign and sign post installation—an important safety-related activity. **LTAP**

—Keith Knapp and Mark Vizecky

Related resources:

- *Manual on Uniform Traffic Control Devices*, Federal Highway Administration
- *Roadside Design Guide*, American Association of State Highway and Transportation Officials
- *Minnesota Manual on Uniform Traffic Control Devices*, Minnesota Department of Transportation

SNOW & ICE CONTROL

Model snow and ice management policy aims to limit liability risk

An advisory committee of snow and ice management professionals from around Minnesota has developed a new resource: the *Minnesota Model Snow and Ice Management Policy*. The model policy is intended to serve as the foundation for city and county snow and ice management policies and help

Benefits of a snow and ice control policy

- Allows the agency to manage risks
- Encourages the agency to study, develop, follow policies
- Communicates the policy to citizens and staff
- Provides an opportunity for the agency to review and monitor the processes
- Allows the agency to learn and improve

—“Is Salt Your Only Defense? Louis Smith, 15th Annual Road Salt Symposium, February 4, 2016

limit the potential liability risk from these activities. The model policy is a framework that identifies the competing public considerations that are weighed in setting specific policy and allocates roles in setting and carrying out these policies between the policymaking body (city council or county board of commissioners) and the administrative and field employees of the local government unit. The administrative and technical details of snow and ice management as developed by the city or county are intended to integrate into this framework.

The decision to develop a model policy came after a presentation at last year’s Road Salt Symposium titled “Is Salt Your Only Defense?” by Louis Smith of law firm Smith Partners PLLP. The presentation itself was in response to requests for legal guidance from cities, counties, and private operators increasingly interested in reducing application of salt and other deicers as part of their winter maintenance operations.

The model policy, a guidance document (which presents background on and explains the structure of the model policy), and a sample contract for

private snow and ice control service are available on the Minnesota Pollution Control Agency website. Information about the Road Salt Symposium, including presentation materials from the 2016 event, are on the Freshwater Society website. **LTAP**

Related resources:

- Minnesota Model Snow and Ice Management Policy (p-tr1-51a), Policy Guidance Document (p-tr1-51b), and Exhibit for Private Snow and Ice Service Contract (p-tr1-51c): **pca.state.mn.us**
- Freshwater Society: **freshwater.org**

MARK YOUR CALENDAR:

**16th Annual Road Salt Symposium
Feb. 2, Chaska**

Guidebook from page 1

This guidebook will help new staff understand:

- Snow and ice control strategies
- Snowplows and equipment
- Winter maintenance materials
- Winter maintenance technologies
- Winter maintenance policies and best practices

“The guidebook provides new maintenance workers with an overview of key aspects of winter maintenance in an easy-to-read format,” says John Brunkhorst, chair of the technical advisory panel for the guidebook and county engineer of McLeod County. “It should be a must-have for snow and ice control decision makers, especially those transitioning from operators to supervisors.”

The guidebook takes a broad look at winter maintenance, expanding on the topics covered in

the *Minnesota Snow and Ice Control Field Handbook for Snowplow Operators* produced by Minnesota LTAP. That handbook, revised in 2012, encourages progressive changes in snow and ice control practices that will help agencies reduce salt/sand use and environmental impacts while meeting the safety and mobility needs of roadway users. **LTAP**

Related resources:

- *Snow & Ice Control Guidebook* (LRRB 2016RIC11, June 2016)
- *Minnesota Snow and Ice Control Field Handbook for Snowplow Operators Second Revision* (LRRB and MnDOT, 2012)

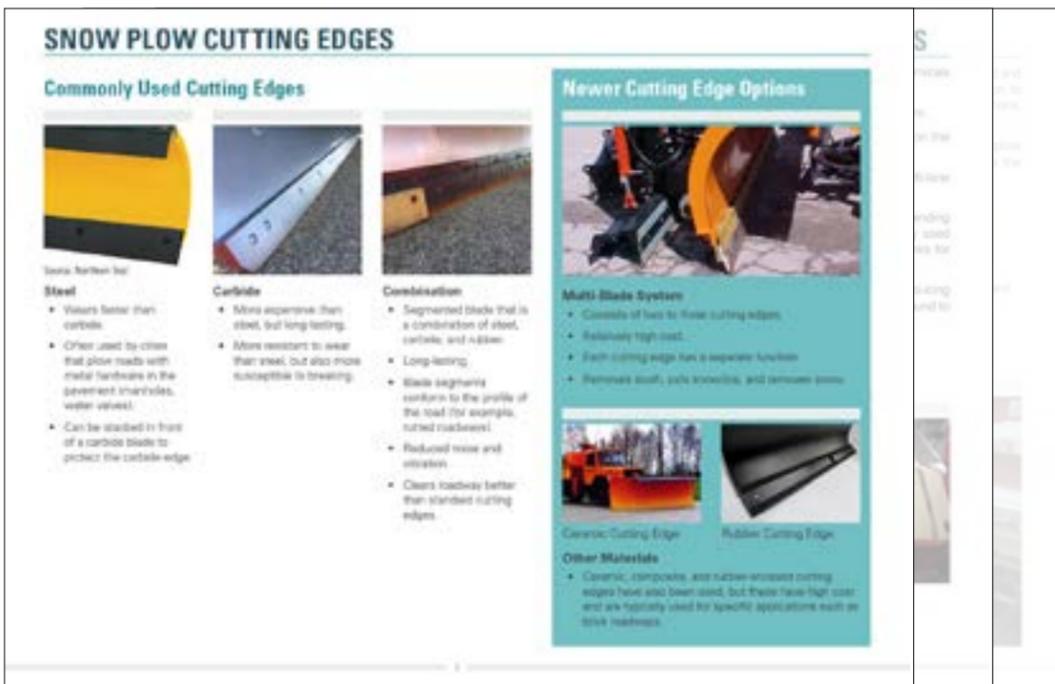
Clear Roads synthesis: GPS/AVL equipment

Global Positioning System and automatic vehicle location (GPS/AVL) technology can turn winter maintenance vehicles into mobile data collection systems. Clear Roads researchers developed an equipment guide that describes how winter maintenance agencies are currently using GPS/AVL technology. The guide is a useful resource to other agencies that are looking to implement or expand their use of GPS/AVL. Researchers also developed a synthesis of issues that agencies need to consider when implementing GPS/AVL equipment and developing policies related to GPS/AVL. **LTAP**

Related resources:

- Final report: *Synthesis on GPS/AVL Equipment Used for Winter Maintenance* (July 2016)
- Two-page brief: *Resource Guide Aids GPS/AVL Implementation* (Sept. 2016)

The average
GPS/AVL SYSTEM COSTS
\$3,843
to install and
\$39.30
in monthly recurring costs
per vehicle.
—Clear Roads



The 20-page guidebook has many helpful photographs, tables, and images.

Snow & ice control training from CTAP

Don't forget: the Circuit Training and Assistance Program (CTAP) offers two training options related to snow and ice control:

- Snow and Ice Control Material Application
- Snowplow Salt and Sander Controller Calibration Hands-on Workshop

To schedule a one-day, on-site training session, call Kathleen Schaefer, CTAP instructor, at 651-366-3575, or e-mail **kathleen.schaefer@state.mn.us**. Also check out **mnltap.umn.edu/training** for other courses.

Puzzle clues:

A Clear Roads analysis found the following benefit/cost ratios for these three winter maintenance strategies. (*Benefits and Costs of Winter Maintenance Strategies, 2015*)



Plowing: 5.3



Salt brine: 3.8



Rock salt: 2.4

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.

Sinusoidal Rumble Strip Design Optimization Study (MN/RC 2016-23, June 2016)

Presents the results of sound level monitoring of four types of centerline rumble strips installed along a highway in Minnesota.

Evaluation of Bio-Fog Sealants for Pavement Preservation (MN/RC 2016-20, June 2016)

Investigates the field performance and mechanical properties of asphalt mixtures from pavement sections treated with biosealants in order to understand how sealants improve pavement performance.

Validation of Gyrotory Mix Design in Iowa (IHRB Project TR-667, July 2016)

Determines if the current asphalt mix design gyrotory levels are creating mixes that will attain target densification under traffic.

Safety Impact of Differential Speed Limits on Rural 2-Lane Highways in Montana (FHWA/MT-16-006/8224-001, July 2016)

Determines conditions under which differential speed limits or uniform speed limits should be utilized on two-lane rural highways.

Geogrid Reinforced Aggregate Base Stiffness for Mechanistic Pavement Design (MN/RC 2016-24, July 2016)

Quantifies the effect of microstructural properties on the macroscopic properties in pavement design, including the stress-strain curves produced during triaxial tests at different confinements.

Impact of Curling and Warping on Concrete Pavement (IHRB Project TR-668, July 2016)

Describes field investigations at different sites with Portland cement concrete (PCC) in order

to better understand the curling and warping behavior of PCC.

Safety Evaluation of Intersection Conflict Warning Systems (FHWA-HRT-16-035, June 2016)

Evaluates the safety effectiveness of intersection conflict warning systems, systems designed to reduce the frequency of crashes by alerting drivers to conflicting vehicle paths on adjacent approaches at unsignalized intersections.

Procedures for Waste Management from Street Sweeping and Stormwater Systems (FHWA/OH-2016-14, May 2016)

Summarizes tools for tracking and quantifying the amount from material collected from street sweeping and storm water system cleaning activities.

70 MPH Study (FHWA-PA-2016-009-PSU WO 13, June 2016)

Assesses the speed and safety performance of rural sections of the state's interstates that raised their speed limits to 70 mph.

Alternative Aggregates and Materials for High Friction Surface Treatments (BDR74-977-05, May 2016)

Evaluates the state's use of high-friction surface treatments to reduce wet weather crashes on tight curves, intersections, and bridge decks.

Improvements to Highway Guardrail Assemblies (Report No: FHWA/LA.15/14-1TIRE, May 2016)

Examines the properties of raw materials

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 www.mnltap.umn.edu/publications/library.

Other great resources are:

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

for guardrails, the production and testing of molded guardrail blockouts, and finite element analyses and design optimization of the guardrails.

New instructional video: spreadsheet tool for flashing yellow arrows

A new instructional video guides practitioners through the use of a spreadsheet tool that can help determine when it's safe to use flashing yellow arrows for permitted left turns. Traffic engineers can use the spreadsheet tool to determine at which times of day crash risk is sufficiently low for flashing yellow arrows to be implemented safely at a specific intersection.

The tool was developed as part of a project sponsored by the LRRB. The tool and video are online at lrrb.org. **LTAP**



Summer camps introduce the next generation to transportation

Anoka County and Golden Valley hosted field trips this past summer as part of two summer camps led by the Center for Transportation Studies (CTS). The camps are designed to help introduce the next generation to transportation topics and careers and build the workforce of tomorrow.

One camp was the second annual National Summer Transportation Institute (NSTI) in July, which gave 27 students a hands-on introduction to transportation. The interactive two-week day camp, open to students entering grades 7–9, featured classroom and lab sessions with transportation experts as well as field trips to facilities across the Twin Cities.

One of the activities was seeing how road signs are made at the Anoka County Highway

Department. "Our thanks to County Engineer Doug Fischer and Andrew Witter for taking the time to make this happen," says Mindy Carlson, Minnesota LTAP manager. "The campers had a great time."

Other favorite activities included getting to see bridge construction up close during a boat tour of the St. Croix Crossing bridge site and investigating equipment at MnDOT Maintenance and Truck Fabrication facilities.

NSTI is part of a national program designed to attract a diverse range of students to education and career opportunities in transportation. It was sponsored by CTS with funding from the Federal Highway Administration administered by MnDOT.

Tentative dates for next year's camp are July

WANT TO HOST A FIELD TRIP?

If your agency would like to host a student field trip, please contact Mindy Carlson at 612-625-1813, carlson@umn.edu.

17–28, 2017. Student application materials will be available in early 2017.

The other camp was the MnDOT Career Exploration Program, a day camp designed to introduce underrepresented youth to potential careers at MnDOT. Sixteen campers ages 14–25 attended the program, where they learned about various trade-related job fields as well as civil engineering. Campers also went on field trips, attended classes on how to apply and interview for jobs, and took tours of the U of M and St. Paul College.

One of the field trips was to an asphalt preservation pilot project on August 17 in Golden Valley. "As we were planning activities for this camp, the pilot project seemed like a good opportunity in the metro area," says Carlson. "Bert Tracy graciously agreed to provide a heavy equipment operator demonstration for our program." **LTAP**

SCHOLARSHIPS AVAILABLE

A number of scholarships are available for students interested in a transportation-related field. To learn more, visit cts.umn.edu/education/current/scholarships.

Golden Valley staff led by Bert Tracy (in front of truck door) hosted a field trip for day campers.

WORKSHOPS & TRAINING



Calendar

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

16th Annual Road Salt Symposium

(1 RS elective credit) **LTAP**

February 2, Chaska

Pavement Rehabilitation: Products, Processes, and Strategies

(1 RS required credit) **LTAP**

February 9, Baxter
February 15, Blaine
February 17, Rochester

Minnesota's Transportation Conference

March 1-2, St. Paul

61st Annual Asphalt Contractors' Workshop/Quality Initiative Workshop

March 29, Brooklyn Center

Truck-Weight Compliance Training

(1 RS elective credit) **LTAP**

March 8, Alexandria
March 9, St. Cloud
March 15, Arden Hills
March 16, Bloomington
March 22, Rochester
March 23, Albert Lea
March 29, East Grand Forks
March 30, Roseau
April 5, Mankato
April 6, Marshall
April 19, Duluth

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**

April 20, Bemidji
September 6, Mankato
September 13, St. Cloud
September 20, Bemidji

ATSSA Northland Chapter "How To"

(0.5 RS elective credit) **LTAP**

March 21-22, Fargo

Roads Scholar credit

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

LTAP workshops

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

MnDOT Environmental Stewardship Conference: Rules and Tools for Changing Environments

April 19, St. Paul

Second Annual National Road Research Alliance Conference

May 18

Concrete Pavement Rehabilitation for Local Streets and Roads

(1.5 RS elective credit) **LTAP**

April 26-27, Minneapolis

More word fun! Lead vs. led

The words "lead" and "led" can be confusing.

When "lead" is a verb, it means to guide or direct. It's in the present tense, and pronounced like "bead": *Good coaches lead by example.*

When "lead" is in the past tense, it's spelled "led," and pronounced like "bed": *They led the team to victory last week.*

"Lead" can also be a noun or adjective. In that case, it means the soft element in pencils and other materials, and it's pronounced like "bed": *Lead paint is hazardous.*

But remember this: The famous rock band is Led Zeppelin. Accounts vary, but the name seems to have come from musicians joking that the band would go down like a "lead zeppelin" (balloon). The band changed the name to prevent mispronunciation. **LTAP**

Settle in & catch up on your online training!

A cozy fire, warm drink...and online training from Minnesota LTAP! Cold winter days are a great time to make progress on your training to-do list. You don't even need to shovel or plow to get started. **LTAP**



A-mazing winter maintenance

The three snowplows in the maze are using three different winter maintenance strategies:

- Plowing
- Salt brine
- Rock salt

Before you return to the shop, you must use all three strategies. Start with the most cost-effective strategy, then go to the next-best option, and then the least effective. And then call it a day. Clues about the three strategies are on page 6.

Of course, we hope your own routes aren't so a-mazing! **LTAP**