

# Illinois Interchange



Illinois Technology Transfer Center

Vol. 2010-02

## EMBEDDED LEDS IN SIGNS

### Purpose

Embedded Light Emitting Diodes (LED) in sign faces improve safety at intersections by enhancing driver awareness of traffic-control signs.

### Alternative Names

Solar-powered LED road signs, flashing LED-enhanced solar-powered traffic signs, LED-enhanced signs.

### Operation

LEDs can be embedded in standard highway warning and regulatory signs to outline either the sign itself or the words and symbols on the sign. The LEDs may be set to flash or operate in steady mode. LEDs may be illuminated 24 hours a day, or be activated by vehicles or pedestrians. Due to the low power requirements of LEDs, signs with embedded LEDs can typically be powered using stand-alone solar panel units.

This treatment is applicable for regulatory and warning signs at unsignalized intersections with the intended purpose of improving the



Example of pedestrian crossing warning sign with embedded LEDs and solar unit.

visual conspicuity of the signs. Typical locations where LED-embedded signs can be implemented include:

- Locations with sight visibility limitations (horizontal curves, dusk/dawn glare, etc.);
- Locations with documented problems of drivers failing to recognize an intersection; and
- At STOP signs – this treatment may help to increase the rate of vehicles stopping and to avoid drivers failing to detect the STOP sign.

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Please pass this on to other interested parties in your office.



Illinois Department of Transportation  
Bureau of Local Roads and Streets



Federal Highway Administration



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## Potential Benefits

In general, embedded LED units are used to:

- Improve driver compliance with regulatory signs through improved conspicuity; and
- Enhance visibility and recognition of regulatory and warning signs to drivers, especially under low-light or low-visibility conditions.

## Agency Experience

A study on safety effects of LEDs embedded in STOP signs, conducted by the Texas Transportation Institute in 2004, found:

- A 28.9 percent reduction in the number of vehicles not fully stopping; and
- A 52.9 percent reduction in the number of vehicles moving through the intersection without significant slowing.

A similar study, conducted by the Virginia Transportation Research Council in 2007, found:

- A statistically significant decrease in vehicle approach speeds ranging from 1.9 to 3.4 miles per hour (mph) with an average of 2.7 mph (a 7 percent decrease) indicated that



LEDs are embedded in the symbols and lettering on this truck warning sign.

LED STOP signs positively affected driver behavior.

- Speed decreases tended to be greater during the night than during the day.

E. D. Arnold, Jr., and K. E. Lantz, Jr., "Evaluation of Best Practices in Traffic Operations and Safety: Phase 1: Flashing LED Stop Signs and Optical Speed Bars."

LED lights have been used in signs in Florida and Wisconsin and have been evaluated in STOP signs in Virginia and Texas. Naval Station Mayport in Florida installed a pedestrian walk sign with embedded LEDs.

## Implementation Considerations

- Due to low power usage, solar applications make the use of this treatment flexible enough for nearly any location.
- LEDs may be set to flash 24 hours a day or be vehicle or pedestrian activated.

## Manual on Uniform Traffic Control Devices (MUTCD) Specifications

- If used, the LEDs shall be the same color as the sign legend, border, or background. If flashed, all LED units on an installation shall flash simultaneously at a rate of more than 50 and less than 60 times per minute. The uniformity of the sign shall be maintained without any decrease in visibility, legibility, or driver comprehension during either daytime or nighttime conditions. MUTCD, Section 2A.08.
- MUTCD, Section 2A.08 contains further information that should be consulted when installing a sign with embedded LEDs.
- Lighting elements for illuminated signs (e.g. LED-embedded signs) should be replaced on a regular maintenance schedule. MUTCD, Section 2A.22.



Example of stop sign with embedded LEDs and solar unit.

## Costs

During the course of the 2007 Virginia Transportation Research Council study, the costs for 48-inch, 36-inch, and 30-inch signs embedded with LEDs were estimated at \$1,860, \$1,640, and \$1,600, respectively. This included the cost of the solar power supply, but did not include an additional \$175 for post and anchor or the cost of installation.

## Learn More

Michael Winn, Virginia DOT  
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[http://www.virginiadot.org/vtrc/main/online\\_reports/pdf/07-r34.pdf](http://www.virginiadot.org/vtrc/main/online_reports/pdf/07-r34.pdf)

Ed Rice, Intersection Safety Team  
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*This summary is one in a series describing Innovative Intersection Safety Treatments. The summaries identify newer technologies and techniques to improve intersection safety developed since NCHRP Report 500, Volumes 5 and 12, were published in 2003 and 2004, respectively. These treatments show promise for improving safety but comprehensive effectiveness evaluations are not yet available.*

## NOW, SOME GOOD NEWS!

By Megan Holt Swanson, Safe Routes to School Coordinator

In a time of shrinking budgets and increasing demands, it seems like bad news is always lurking just around the corner. How about some good news for a change?

The good news is that the planning and application period for the Illinois Safe Routes to School (SRTS) program is currently open. SRTS is a federally funded program that promotes students to walk and bicycle to school. Projects are 100% federally funded requiring no local match. We plan on combining our FY 2010 and estimated FY 2011 apportionments providing approximately \$15 million in funds unless federal guidelines change and require us to modify these plans.

Since 2007, Illinois SRTS has awarded almost \$22 million in funding to schools, local governments and non-profit agencies across the state. By using a combination of non-infrastructure (evaluation, education, encouragement, enforcement) and infrastructure (engineering) strategies, SRTS communities are working to increase the safety and number of students walking and biking to school. As a local stakeholder, you can play an important role in helping to identify how SRTS can fit into your community.

Guidelines allow one infrastructure application and one non-infrastructure application per school district area. The infrastructure application addresses engineering needs that the community and school district have identified and must be submitted by a governmental entity such as the municipality, township, county or park district affiliated with that school district. We require these governmental entities to coordinate these



infrastructure improvements with the highway agency that has jurisdiction. The application can have a maximum of three projects totaling \$250,000. The minimum amount for any individual project is \$2000. All infrastructure projects must be located within two miles of a school serving children in grades kindergarten through eighth.

Local governments, school districts and not-for-profit organizations may act as project sponsors for non-infrastructure projects. The non-infrastructure application may address education, encouragement, enforcement or evaluation needs. The maximum amount per application is three projects totaling \$100,000. The minimum amount for any individual project is \$2000.

The entire planning and application process is on-line only. The school travel plan (STP) is available now. A tool used to assist the school district, municipality and community stakeholders in evaluating the current needs and future improvements for the area, the STP also guides the team in implementing each of the Five E's and encourages coalition building within the community. An approved STP is a requirement for

any organization that is interested in applying for SRTS funding in Illinois.

The final deadline to submit the STP is November 12, 2010 at 5:00 p.m. If you would like the opportunity to receive coordinator feedback and the opportunity to make changes prior to the November 12 deadline, the STP must be submitted by 5:00 p.m. on November 1.

The application process opens on October 1 and closes on December 15, 2010 at 5:00 p.m. It is available only to schools and communities with an approved STP. The project reviews will begin in January 2011, and we anticipate an announcement in mid-late 2011.

For more information on Safe Routes to School, please visit our website: [www.dot.il.gov/saferoutes](http://www.dot.il.gov/saferoutes). We are planning several training sessions and webinars later this summer and into the fall. As these opportunities are finalized, we will post them at the SRTS Training link on our website. You may also contact Megan Holt Swanson, Illinois Safe Routes to School Coordinator via e-mail at [DOT.SafeRoutes@illinois.gov](mailto:DOT.SafeRoutes@illinois.gov), with questions about the program.

## 2010 TOP TEN PUBLIC WORKS LEADERS

R. Mark DeVries, McHenry County Division of Transportation



Throughout his career in public works, R. Mark DeVries has been involved in operations. Beginning as an operator and plow driver for a local township highway department and continuing in the tradition when hired by the McHenry County Division of Transportation in 1984, he has been involved in all aspects of

maintenance. DeVries also operated most of the County's equipment, specializing in road grader operation. Since being promoted to Maintenance Superintendent in 2001, he has been responsible for planning, assigning, and supervising the work of personnel engaged in the maintenance of the County Highway System.

In his role with McHenry County, DeVries restructured the maintenance operation and implemented changes in the organization, which modernized the division's daily operations, as well as the snow removal operations. While overseeing all aspects of maintenance, DeVries has been instrumental in major changes in winter maintenance, taking the agency from a primarily reactive role to a proactive agency that is

recognized internationally as a model in winter maintenance operations, innovative accomplishments, and environmental best practices.

DeVries chairs APWA's Winter Maintenance Subcommittee and the Excellence in Snow and Ice Control Award Committee. He has presented at numerous seminars across North America as well as in-state. He has shared his experiences with local agencies as well as at local seminars and expos. He also volunteers for the Illinois Local Technology Transfer Program, and teaches flagging safety and snow and ice removal for new operators for all local agencies in northern Illinois.

**Congratulations Mark!**



## LED UTILITY OUTDOOR LIGHTING PRESENTATION

Progress Energy is an investor owned utility that has one million outdoor lights in service throughout portions of NC, SC and Florida. The City of Raleigh, NC was the first LED City for CREE and currently has over 63 LED test installations. The city's strong desire for LED street lighting encouraged Progress Energy Carolinas to develop the first line item bundled lease utility rate for LED street and area lights in the US. Bob Henderson, LC, CLEP led this introduction of LEDs at Progress Energy. The challenge was to develop options to deal with the higher cost of LED fixtures that would earn the allowed return for the utility without having a severe impact on municipal street light budgets. In short a win-win was needed.

Bob will describe some of the barriers and steps taken to break these barriers to introduce and gain utility commission approval of a new rate and associated LED products. He will also discuss other associated lighting decisions along the way. Some of the program topics will include the new rate format and change-out policy, CCT preference and environmental issues, vendor questions about LED luminaries, mA ratings and more.

For more information contact Intelligent Lighting Creations, Inc., 2461 East Oakton Street, Arlington Heights, IL 60005 or phone 847/933-9792.

Register at <http://chicago.insiteadvice.com>

## DISTRACTED DRIVING CREATES DANGEROUS SITUATIONS

By Murray Pendleton, Chairman, Connecticut Police Chief's Association, Highway Safety Committee

Driving large municipal trucks and special purpose vehicles, including cars, can be challenging enough even when full attention is given to the road and potential hazards. It only takes a second for a crash to happen. Distractions occur when drivers concentrate on something other than operating their vehicles—such as engaging in cell phone conversations. NHTSA (National Highway Traffic Safety Administration) estimates that 25% of all crashes involve some form of driver distractions.

National surveys show that most drivers at least occasionally engage in behaviors that draw some of their attention away from their driving task. The most common of these behaviors include such general activities as:

- Talking or texting on a cell phone;
- Talking with passengers;
- Changing radio stations or CD's;
- Eating or drinking while driving

Operating municipal trucks is unique. The fact that most of the trucks have special equipment requires more attention to detail, leaving no room for distractions.

Driving is a full-time job, and operating snowplows, trash pick-up trucks, fire engines, etc. while using a

cell phone, reading a road map, or talking to fellow employees is potentially dangerous.

- Make adjustments to vehicle controls such as radios, air conditioning, or mirrors before beginning to drive or after the vehicle is no longer in motion;
- Don't reach down or behind the driver's seat, pick up items from the floor, open the glove compartment, clean the inside windows, or perform personal grooming while driving;
- You should not eat or drink while driving, but if you do, get something that is not messy and that you can hold in one hand. Set your food up next to you before you take off and make sure you use a cup holder for your drink.
- Know where you are going and how to get there before you start out.

For more than 10 years studies have been conducted which focus on the risks associated with various types of distractions. There clearly is ample information to believe a distracted driver is at an increased risk of a crash. Your complete attention to driving is not only in the best interest of you and your passengers but can clearly save lives as well as reduce serious injuries.

### A list of common distracters:

- Use of cell phones
- Eating/drinking/smoking
- Texting and e-mailing
- Personal hygiene
- Changing radio stations/CD's/DVD's, sight-seeing/gawking
- iPods
- In-car information screens
- Adjusting mirrors/heat/AC
- Searching for items
- GPS
- Unsecured objects
- Reading maps/directions/books/magazines/newspapers

### TEXTING IS A MAJOR DISTRACTER

The National Safety Council estimates that 80% of Americans admit to using cell phones, and 20% admit to texting, while driving. That amounts to about 100 million drivers. Driving while using a cell phone incurs a 4 times greater risk of crashing, which is equivalent to driving while drunk (with a 0.08 blood-alcohol level.) For texters, the risk is eight times greater. Talking on a cell phone while driving slows down the reaction time of even the most experienced driver. All drivers of municipal vehicles must be committed to reducing serious injuries and deaths on our roadways.

*Reprinted with permission from the Connecticut Technology Transfer Newsletter, University of Connecticut, Spring 2010 edition.*

**THIS ALL STARTS WITH YOUR COMMITMENT TO NOT BECOME A DISTRACTED DRIVER.**



## INTERACTIVE HIGHWAY SAFETY DESIGN MODEL (IHSDM)

A product of the Federal Highway Administration's (FHWA) Safety Research and Development Program, the Interactive Highway Safety Design model (IHSDM) is a suite of safety analysis tools to evaluate the safety and operational effects of geometric-design decision on highways. The following resources are available to individuals considering or using IHSDM:

**IHSDM Public Software Web Site.** The site, <http://www.ihsdm.org>, is where users can register for and download the latest release of IHSDM. It also provides access to IHSDM user documentation and information on IHSDM data requirements and technical support, summaries of selected IHSDM user applications/case studies, and IHSDM-related current events (e.g., web conferences).

**IHSDM Research Web Site.** The site, <http://www.tfhr.gov/safety/ihsdm/ihsdm.htm>, provides an overview of and background information on IHSDM, including a library of the research reports upon which IHSDM's analytical procedures are based. It also provides a link to the IHSDM Public Software Web Site.

**Highway Safety Manual Web Site.** This site, <http://www.highwaysafetymanual.org> provides information related to AASHTO's Highway Safety Manual (HSM). The 1st Edition HSM consists of Parts A (Introduction and Fundamentals), B (Roadway Safety Management Process), C (Predictive Method) and D (Crash Modification Factors). The IHSDM Crash Prediction Module

(CPM) is intended to be a faithful software implementation of HSM Part C, which includes crash prediction methodologies for two-lane rural highways, multilane rural highways, and urban/suburban arterials.

**Technical Support.** A technical support staff with intimate knowledge of IHSDM is available to answer questions and provide help to IHSDM users during normal business hours. Staff can be contacted two ways  
E-mail: [IHSDM.Support@dot.gov](mailto:IHSDM.Support@dot.gov).  
Call the IHSDM Help Line at: (202) 493-3407.

**IHSDM Training Course.** At this 2 day training course, participants learn to describe key capabilities and limitations of IHSDM evaluations, evaluate a highway using IHSDM software, and recognize when and how IHSDM can be used during the project development process. For more information, see Course No. 380071A in the National Highway Institute catalog at <http://nhi.fhwa.dot.gov>.

For more information, contact the following:

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## LOCAL AND RURAL ROAD SAFETY PEER TO PEER SAFETY PROGRAM (LRR P2P)

By Rosemarie Anderson, Federal Highway Administration

Federal Highway Administration Office of Safety has launched the Local and Rural Road Safety Peer to Peer Safety Program (LRR P2P). This new Peer-to-Peer (P2P) Program has been established as a form of technical assistance for local and rural highway agencies to resolve safety problems on the roads they own and maintain.

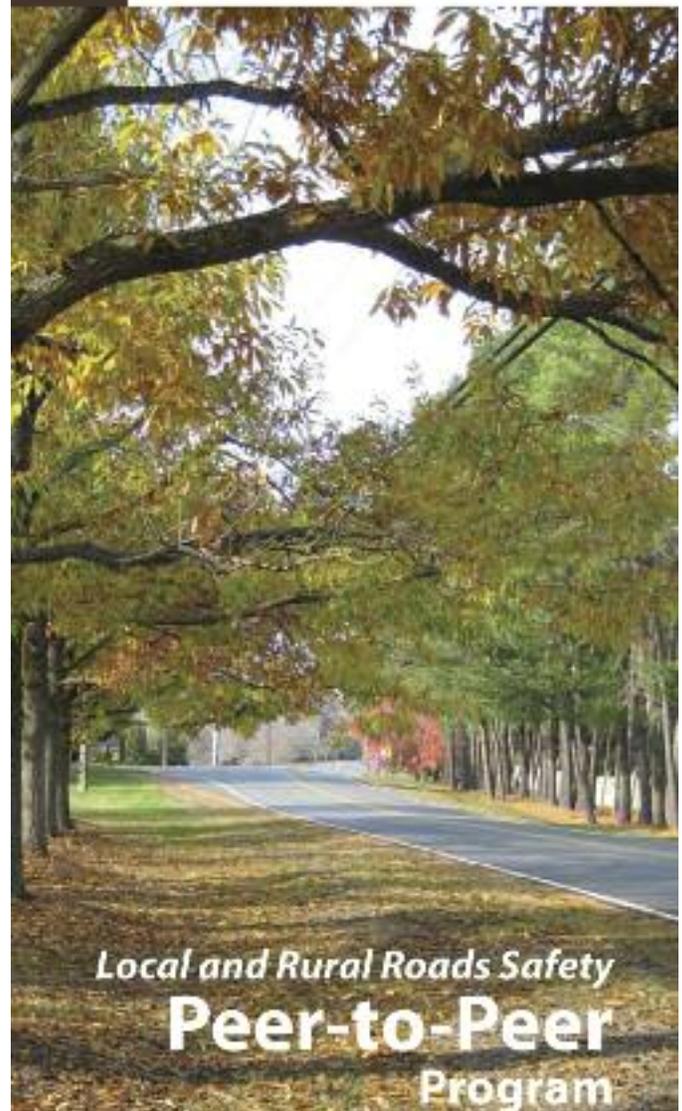
In order to reduce fatalities and serious injuries on our Nation's road network, local and rural highway practitioners have to routinely integrate safety in their projects and programs. The majority of the nation's roadway are owned, operated and maintained by numerous small agencies and it is the aim of this program to provide access to road safety information, knowledge and resources needed to address safety issues these practitioners face.

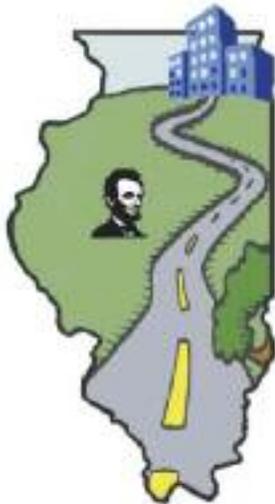
The LRR P2P is a free volunteer-oriented program that will provide peer assistance through several venues. Assistance can be in the form of phone calls, email exchanges, general instruction or site visits depending on the agency's needs. Experts with knowledge in various local and rural road safety issues have volunteered their time to provide assistance to their peers requesting help.

Guidance can be provided on determining locations that need immediate attention; on low cost safety improvements that can be installed quickly to address specific safety needs; and on various funding options available for safety improvements on local and rural roads to name a few. More information on this P2P program is available on the FHWA Safety website [http://safety.fhwa.dot.gov/local\\_rural/training/fhwasa10014/](http://safety.fhwa.dot.gov/local_rural/training/fhwasa10014/) where a brochure can also be downloaded. A limited number of hard copies are also available for distribution.

The first step in initiating this free resource is contacting the P2P coordinator. This can be done by phone, fax or e-mail. The coordinator will analyze specific needs and determine the best peer based on those needs.

For general information on the Local and Rural Road Safety P2P program please contact me at the Office of Safety Programs, Federal Highway Administration, 202-366-5007 (v), 202-366-3222 (f) or by e-mail at [rosemarie.anderson@dot.gov](mailto:rosemarie.anderson@dot.gov).





## Snow and Ice Training Courses (Enrollment open to Local Agencies Only)

The Technology Transfer Training is offering Snow and Ice Training Courses to Local Agency Employees. Participants will learn snow removal and ice control operations; including major components, equipment adjustment and calibration and proper snow and ice control methods. There is no fee for attending this course, but space is limited to 25 students and based on a first come, first served basis. If you are interested in attending, please complete the registration form below and mail to: Illinois Department of Transportation, Bureau of Local Roads and Streets, Technology Transfer Center, 2300 South Dirksen Parkway, Room 205, Springfield, IL 62764; or fax at 217/785-7296.

<b>Snow and Ice Control</b>			
FY2011-037	Wilmington	October 26, 2010	8:00 a.m. - 12:00 p.m.
FY2011-038	Peoria	October 27, 2010	8:00 a.m. - 12:00 p.m.
FY2011-039	Effingham	October 28, 2010	8:00 a.m. - 12:00 p.m.

Contact Information (Please Print)

Name of Agency	Contact Person
Mailing Address	Telephone
City-State-Zip	Fax

**Student Name**

	FY2011- _____

# PAVEMENT TECHNOLOGY ADVISORY DEICING/ANTI-ICING CHEMICALS

from IDOT's Bureau of Materials and Physical Research's PTA-D8 (eff. 1/2009)

## BACKGROUND

The rise in cost of traditional deicing/anti-icing chemicals as a result of supply shortages leads to greater competition from other products on the market. Some of these products are relatively new (i.e. agricultural byproducts), while others have been around for some time and are prohibited by moratorium for use in Illinois (i.e. magnesium chloride (MgCl<sub>2</sub>)).

Many of the products are very effective deicing/anti-icing chemicals but can do considerable damage to pavements and bridges. This document will provide resources for information as well as general guidelines to assist in selecting products. For guidance on application procedures, consult Chapter 6 of the Snow and Ice Manual or contact the Weight Enforcement Engineer of the Bureau of Operations at (217) 782-2984.

## RESEARCH

Recent research findings have demonstrated specific mechanisms of deterioration in concrete exposed to magnesium chloride and calcium chloride chemicals. The research was performed by Dr. Larry Sutter from the Michigan Technological University. The two-page project summary at the following link will provide more resources. <http://www.misti.mtu.edu/pdf/projects/SDDOT-Sutter.pdf>

Illinois's experience using agricultural byproducts is limited. These products are said to improve the spreading characteristics of the salt, potentially resulting in reduced spread rates and less frequent spreading. Using these materials appears to reduce corrosion on spreading equipment and the need for regular vehicle

washing, as well as potentially reducing the amount of salt used. The potential deleterious effects to concrete have not been studied. Potential concerns are the types of chloride used to modify the byproduct to make them effective for deicing, as well as the skid resistance of the surfaces after the residue remains.

## MAINTENANCE STRATEGIES

There are several maintenance strategies that can be employed to assist with snow and ice control.

1. Reduce accumulation of snow through geometric designs or use of snow fences.
2. Better predict when to apply chemicals through use of the Road Weather Information System (RWIS).
3. Improve application of chemicals with electronic distribution systems and brine for frost prevention.
4. Maximize chemical benefits by pre-wetting solid chemicals with brine, which allows chemicals time to work before removal process or re-application.
5. Reduce the amount of chemicals used.

## ILLINOIS SPECIFIED AND PREFERRED CHEMICALS

Illinois currently allows the use of the following chemicals:

**Sodium Chloride (NaCl):** This chemical is allowed in the form of either Rock Salt or Evaporated & Solar Salt meeting AASHTO M143 Type I, Grade 1. This chemical may be applied either directly or as brine with a 23% concentration. The effective temperature for its application is  $\geq 15$  °F.

**Calcium Chloride (CaCl<sub>2</sub>):** This chemical is applied as brine either directly on bridge decks or as a pre-wetting agent on rock salt for use on pavements. The brine has a 32% concentration. Its use should be limited to the coldest temperatures, below 20 °F, due to its deleterious effects on concrete.

## ALTERNATIVE PRODUCTS

There are no current Illinois specifications for alternative products. The use of these products should be based upon a lack of traditional, specified deicing and/or anti-icing products. If interested in using an alternative product, contact the Weight Enforcement Engineer of the Bureau of Operations at (217) 782-2984 to determine if it will be allowed for use.

The following categories were taken from the Pacific Northwest Snowfighters (PNS) website. This is a well respected organization that performs extensive testing and research on various products marketed for deicing and anti-icing. If you have questions about a particular product, consult the lists at the following link: <http://www.wsdot.wa.gov/partners/pns/pdf/PNSQPL9-28-07.pdf>.

The following list provides the PNS categories of deicing and/or anti-icing products. Also included are generic guidelines for selection purposes.

- **Corrosion Inhibited Liquid Magnesium Chloride** – Not allowed in Illinois by moratorium due to deleterious effects on concrete.

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- **Corrosion Inhibited Liquid Calcium Chloride** – Illinois has limited experience with byproducts; therefore, these should be used with caution due to concerns with skid resistance and residue remaining on pavement. Ensure the product is not enhanced with magnesium chloride. Calcium chloride is known to have deleterious effect on concrete. Limit use of these products to temperatures below 20 °F.
- **Non Corrosion Inhibited Liquid Calcium Magnesium Acetate (CMA)** – Not recommended for use on concrete. Research has shown various problems on airport runways due to expansive alkali silica reaction products forming as a result of the use of susceptible aggregates and CMA solutions. Illinois's deicing chemical testing does not include CMA.
- **Calcium Magnesium Acetate (CMA) Solid** – Not recommended for use on concrete. Research has shown various problems on airport runways due to expansive alkali silica reaction products forming as a result of the use of susceptible aggregates and CMA solutions.
- **Corrosion Inhibited Sodium Chloride** – Ensure the product is not enhanced with magnesium chloride. Caution should be taken with agricultural byproducts due to concerns with skid resistance and residue remaining on pavement.
- **Corrosion Inhibited Sodium Chloride Plus 10% Magnesium Chloride** – Not allowed in Illinois by moratorium.
- **Corrosion Inhibited Sodium Chloride Plus 20% Magnesium Chloride** – Not allowed in Illinois by moratorium.

- **Non Corrosion Inhibited Solid Sodium Chloride** – Make sure product meets AASHTO M143 Type I, Grade 1.
- **Standard Gradation, Road Salt, Moisture less than 0.5%** – Make sure product meets AASHTO M143 Type I, Grade 1.
- **Standard Gradation, Road Salt, Moisture less than 5.0%** – Make sure product meets AASHTO M143 Type I, Grade 1.
- **Fine Gradation, Brining Salt, Insoluble Material less than 1%, Moisture less than 0.5%** – Make sure product meets AASHTO M143 Type I, Grade 1.
- **Fine Gradation, Road Salt, Moisture less than 0.5%** – Make sure product meets AASHTO M143 Type I, Grade 1.

#### Liquid Corrosion Inhibited Products

- Potassium Acetate (KA) – Little is known about these products. Lab testing was inconclusive; product failed to melt ice during testing for

- scaling and freeze/thaw. Potassium acetate is a suspect in the Denver CO airport runway concrete failures.
- 12.5% CMA / 25% KA – Do not use CMA on concrete.
- 25% KA / 30% Carbohydrate material – Little known about either product; therefore, use caution.
- 20% NaCl / 2% CaCl<sub>2</sub> – Combination that is likely used in Illinois already.
- 25% CaCl<sub>2</sub> / 2% MgCl<sub>2</sub> / 3% other chlorides – Not allowed in Illinois by moratorium.
- Sodium Chloride Brine – Used in Illinois. Make sure not enhanced with magnesium chloride, which is not allowed in Illinois.

If you have any questions regarding the use of a product or the information presented here, please contact:

Weight Enforcement Engineer  
Bureau of Operations  
2300 S. Dirksen Parkway  
Springfield, IL 62764  
(217) 782-2984





The Technology Transfer (T2) Program is a nationwide effort financed jointly by the Federal Highway Administration and individual state departments of transportation. Its purpose is to transfer the latest state-of-the-art technology in the areas of roads and bridges by translating the technology into terms understood by local and state highway or transportation personnel.

The Illinois Interchange is published quarterly by the Illinois Technology Transfer Center at the Illinois Department of Transportation. Any opinions, findings, conclusions, or recommendations presented in this newsletter are those of the authors and do not necessarily reflect views of the Illinois Department of Transportation, or the Federal Highway Administration. Any product mentioned in the Illinois Interchange is for informational purposes only and should not be considered a product endorsement.

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Visit our website at [www.dot.il.gov/blr/t2center.html](http://www.dot.il.gov/blr/t2center.html)

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