

RESEARCH BRIEF

Applying Deicing Liquids Effectively During a Storm

Across the nation and worldwide, applying granular salt to a roadway is the most commonly used deicing technique. In the last two decades, many agencies have begun to supplement their use of granular salt with liquid anti-icing treatments, such as salt brine, applied before a storm event. The practice of prewetting granular salt with brine before applying it to the roadway has expanded as well. Evolving from the success of anti-icing and prewetting, a new strategy has emerged in the last decade: applying deicing liquids such as salt brine directly to the roadway surface during a storm event.

During-storm direct liquid application, or DLA, can be performed with deicing liquids alone, or the liquids can be supplemented with a light application of granular salt (applied separately rather than as a prewetted granular or slurry application). The advantages of DLA include reduced application rates and reduced loss of material to scatter, which in turn lead to cost savings and reduced environmental impacts. DLA can be a very effective tool in some storm conditions, such as during light snowfalls and milder temperatures. And since liquids can be applied precisely at very low rates, small amounts of material can be accurately applied during light storms.

Need for Research

During-storm DLA is an emerging technique, and very little research or field testing has been conducted on how to most effectively implement it. Identifying parameters for the safe and effective use of DLA during winter storm events would allow more agencies to implement or expand their use of the technique. In addition, establishing guidelines for field-testing would provide agencies with tools to validate and improve their implementations of DLA.

Objectives and Methodology

The objectives of this project were to identify the most effective situations and methods for using DLA during winter storm events, and to determine and recommend field tests to help verify and fine-tune these best practices.

Researchers performed a literature search and carried out a survey to identify agencies with experience using during-storm DLA, and then conducted follow-up interviews with experienced agencies. The agencies contacted were located across the United States, especially in snow belt states with milder climates, and also included international practitioners, weather forecasting experts, and airport snow and ice control professionals.

Results

Based on these interviews, researchers identified the most effective circumstances and methods for using DLA during winter storms, and produced a quick-reference guide for practitioners that outlines safe and effective application parameters at a glance. Researchers identified three key parameters that agencies can use to help determine when the use of DLA is appropriate:

- **Pavement temperature:** Temperatures of 25 F or above were found to be most favorable for DLA; agencies may also consider DLA at temperatures between 20 F and 25 F. Temperature trends (whether temperatures are rising or falling) should also be evaluated.
- **Storm intensity:** DLA was found to be most effective during storms of half an inch per hour or less. Storms of between half an inch and 1 inch per hour were also identified as candidates for DLA.
- **Moisture content:** Storms with ordinary moisture content (approximately a 10:1 ratio of snow to liquid) were found to be most favorable for DLA. Storms with drier snowfall were also identified as candidates for DLA (if deicing agents are used during these storms). Researchers noted that wet snow has the potential to dilute the liquid quickly.

Investigator



"This research leveraged the experiences of practitioners across the country to identify the most effective situations and techniques for using DLA."

—Gary Peterson
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Project Champion



“This project helped identify the circumstances when liquid applications can provide a more rapid return to normal traffic conditions than granular salt, saving agencies time and money.”

–Allen Williams
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During-storm direct liquid application can be an effective addition to an agency's winter maintenance toolbox, especially for use in milder weather.

Researchers emphasized that these parameters are rules of thumb, not absolute prescriptions, and they recommended that agencies evaluate all parameters together along with other factors such as traffic, equipment availability, and application timing. Other considerations include the length of the plow route, or application cycle time: Shorter routes and more frequent treatments help reduce refreeze potential. Researchers identified 1.5 to 2 hours as a preferred cycle time, and noted that as cycle times increase, supplementing DLA with granular salt application should be considered.

The agencies interviewed identified common hurdles to successful implementations, and provided suggestions for overcoming them. Gaining buy-in from both crews and managers was identified as a challenge by numerous agencies, and interviewees suggested easing the transition by introducing DLA to an agency's winter maintenance toolbox gradually—first supplementing existing granular salt applications with liquids, then reducing granular applications as crews gain confidence in DLA's performance. Other suggestions for gaining buy-in included:

- Contacting or visiting agencies that have had success with DLA.
- Using existing equipment as much as possible to minimize costs, and matching DLA strategies to available equipment. If brine-making and blending equipment is not available, agencies can partner with nearby agencies that own this technology.
- Providing ample training for equipment operators, and allowing time for them to become accustomed to any new equipment.

To help agencies validate and improve their use of DLA, researchers developed a field-testing guide that outlines procedures and parameters for evaluating the effectiveness of DLA compared with control sections of pavement treated with other deicing methods.

Benefits and Further Research

By identifying effective application parameters and compiling best practices for DLA use, this project will facilitate the expansion of DLA as a winter maintenance strategy. The quick-reference guide provides a starting point for effective implementation of DLA, and the field-testing guidelines allow agencies to test and verify the recommended practices and improve their use of this valuable strategy.

Follow-up research could include further refinement of the application parameters and field-testing procedures, and a cost-benefit analysis of DLA compared with other techniques.

This brief summarizes project CR2009-02, “Identifying the Parameters for Effective Implementation of Liquid-Only Plow Routes,” produced through the Clear Roads winter maintenance pooled fund project, TPF-5(092). Clear Roads' lead state for this research project is Wisconsin DOT, 4802 Sheboygan Ave., Madison, WI 53707. (In early 2010, Minnesota DOT took over as the lead state for the Clear Roads winter maintenance pooled fund project under TPF-5(218).) Cliff Spoonemore of Wyoming DOT is the Clear Roads Technical Advisory Committee Chair (cliff.spoonemore@dot.state.wy.us).

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