

# Synthesis of Information on Anti-icing and Pre-wetting for Winter Highway Maintenance Practices in North America

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## EXECUTIVE SUMMARY

In the northern states and Canada, transportation agencies face a difficult challenge to keep roadways open and safe during heavy snowfall, low visibility, and icy conditions. Each winter, large amounts of solid and liquid chemicals, along with abrasives, are applied onto the roadways to keep roads clear of ice and snow. The widely used chemicals include: sodium chloride, calcium chloride, magnesium chloride, potassium acetate, calcium magnesium acetate, and agricultural byproducts. They can melt ice and snow by lowering the freezing point of the snow-salt mixture.

Winter highway maintenance practices in North America have traditionally been based on reactive strategies where the launch of maintenance operations relied on signs of snow and ice accumulation. After snowfall, the *deicing* process uses granular materials that penetrate accumulated snow and ice in order to break the bond that has formed with the roadway. Once the bond is broken, the layer of snow and ice can be easily removed by mechanical means such as snowplows. In addition, through *sanding* operations, abrasives such as sand are applied onto the roadways to provide temporary traction in slippery conditions. Such reactive strategies are generally reliable and well understood.

One concern regarding reactive maintenance practices is the increased potential for accidents and injuries due to poor road conditions while maintenance crews are being deployed. Another problem with reactive practices is the quantity of materials and labor hours needed to maintain the desired level of service for winter roadways.

In the past decade or so, an improved approach termed *anti-icing* has been adopted by winter maintenance personnel, which is the early application of chemicals to help prevent black ice and prevent or weaken the bond between ice and the roadway surface. While it is possible and appropriate under certain circumstances to use solid chemicals for anti-icing, liquids are more commonly used. Another innovative practice in winter road maintenance is termed *pre-wetting*, i.e., the addition of a liquid chemical to an abrasive or solid chemical before it is applied to the road. The pre-wetting of solids is performed either at the stockpile or at the spreader.

As improved maintenance strategies, anti-icing and pre-wetting are seeing increased implementation in North America. One of the greatest challenges of the implementation has been the misunderstanding of the benefits and outcomes of their use. Members of the general public and organized groups such as trucking associations have been critical of these strategies, which may be a result of insufficient information, limited understanding and speculation. Therefore, research is needed to synthesize the information on these strategies in an objective manner.

The Pacific Northwest Snowfighters Association (PNS) was formed by technical experts from Idaho, Montana, Oregon, Washington, and British Columbia and later joined by Colorado to address the needs of winter highway maintenance with environmentally-friendly and fiscally-responsible solutions and to develop specifications for winter maintenance chemicals. The mission of PNS is “to serve the traveling public by evaluating and establishing specifications for

products used in winter maintenance that emphasize safety, environmental preservation, infrastructure protection, cost-effectiveness and performance.”

Through this project with PNS, the authors at the Western Transportation Institute at Montana State University (WTI) synthesized information obtained from a literature review and agency surveys on the advantages and disadvantages of anti-icing and pre-wetting for winter highway maintenance. Concerns discussed include: driver safety, human health, environmental stewardship, corrosion, costs, etc.

The research indicates that compared with traditional methods for snow and ice control, anti-icing and pre-wetting lead to decreased applications of chemical products, reduced use of abrasives, decreased maintenance costs, improved roadway friction, and lower accident rates. Anti-icing has been recognized as a pro-active approach to winter driver safety. Pre-wetting has shown to increase the performance of solid chemicals or abrasives and their longevity on the roadway surface, thereby reducing the amount of materials required.

The information in this report will benefit maintenance agencies and transportation officials who seek to fully understand the benefits derived from improved winter maintenance technologies, identify areas for improvement within their own jurisdiction, and learn about related experiences from other agencies.