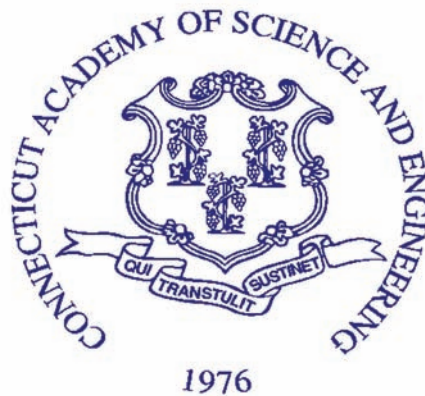


IMPROVING WINTER HIGHWAY MAINTENANCE: CASE STUDIES FOR CONNECTICUT'S CONSIDERATION

APRIL, 2006

A REPORT BY

THE CONNECTICUT
ACADEMY OF SCIENCE
AND ENGINEERING



FOR

THE CONNECTICUT DEPARTMENT OF
TRANSPORTATION

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This study was initiated at the request of the Connecticut Department of Transportation on April 25, 2005 . The project was conducted by an Academy Study Committee with the support of Lisa Aultman-Hall, PhD, Project Manager, and James Mahoney and Scott Zinke, Project Research Engineers. The content of this report lies within the province of the Academy's Transportation Systems Technical Board. The report has been reviewed by Academy Members Peter G. Cable, PhD, and Gale F. Hoffnagle. Martha Sherman, the Academy's Managing Editor edited the report. The report is hereby released with the approval of the Academy Council.

Richard H. Strauss
Executive Director

Disclaimer

The contents of this report reflect the views of the authors who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Connecticut Department of Transportation or the Federal Highway Administration. The report does not constitute a standard, specification, or regulation.

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16. Abstract The Connecticut Department of Transportation (ConnDOT), Bureau of Engineering and Highway Operations is responsible for winter highway maintenance operations. Many transportation agencies in the United States and Canada have been involved in improving winter highway maintenance operations through use of various materials, application methods, and improved weather information and systems. The goal of this study was to provide a literature-based best practices/case studies review of alternative approaches for winter highway operations in use today or planned within the US or other countries that may be applicable for use in Connecticut.			
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EXECUTIVE SUMMARY

The traditional de-icing approach to winter highway maintenance, utilizing sand and salt¹, has been used in Connecticut for at least 35 years. De-icing is a strategy by which ice and/or compacted snow is removed from the roadway by either a chemical or mechanical means or both. These treatments are typically applied at a later stage of a winter storm and continued past the end of the storm.

Over the last decade, a large number of transportation agencies throughout the United States have turned their attention to improvements in winter highway maintenance operations to accomplish three critical goals: reducing costs, increasing safety and minimizing environmental impacts. In particular, the use of sand as an abrasive in winter highway maintenance is being reduced or eliminated in many jurisdictions. Sand has potentially negative human health impacts, limited traction at higher traffic volumes, and requires significant effort and cost to collect and dispose of in the spring season. Anti-icing is a non-mechanical process by which a chemical, usually salt brine², is applied to a roadway prior to or very early in a winter storm event. Pre-wetting is the process of mixing the salt or abrasives with a liquid chemical (usually salt brine or water) preceding application on-road. This mixing initiates the liquefaction or dissolving of the salt. Pre-wetting reduces the amount of bouncing and scattering that takes place when the material hits the roadway, thus reducing waste.

Case studies indicate that a coordinated management system based on quality weather data (including local forecasts, and in particular utilizing road weather information systems and forecasts, as opposed to atmospheric forecasts) and centered on a philosophy of anti-icing (including use of liquids such as salt brine and pre-wetting) can result in many positive winter highway maintenance benefits.

The case studies show that a shift in overall philosophy of winter maintenance from de-icing to anti-icing can result in almost complete elimination of sand and some increase in the use of salt. The monetary savings will most likely accrue from a significant reduction in spring clean-up. Safer road conditions were reported. No negative concerns about this transition in philosophy were raised by any individual interviewed for this study. Although salt has some negative environmental consequences associated with its use and is a concern of the Environmental Protection Agency (EPA), the elimination of or significant reduction in the use of sand will have positive environmental and potentially health benefits. Interviewees emphasized the need for a coordinated management system to maximize benefits, including new technology and equipment, increased information and communication systems, and continuous quality improvement.

¹ "Salt" used alone refers to sodium chloride (NaCl) unless otherwise specified.

² "Salt brine" refers to brine made with sodium chloride (NaCl), unless otherwise specified. NaCl is most commonly used in creating salt brine, but its use becomes ineffective at temperatures below 15°F. The use of salt brine at lower temperatures requires the use of salts other than NaCl. Furthermore, an adequate water supply is needed for any brine production.

The following actions are suggested for consideration by winter highway maintenance decision makers in Connecticut:

1. Implement the improved winter maintenance procedures being used extensively in other states and procure the modern equipment required to do so.
2. Implement variable application of materials by local area to increase efficiency in terms of material use; this will require the expanded use of advanced weather information systems and decision support systems.
3. Utilize basic education programs, the Connecticut Local Technology Assistance Program, coordination with police and other critical stakeholders, and the media, to achieve culture changes for the public and state highway maintenance crews.
4. Continually seek to improve winter maintenance operations by monitoring advances in procedures, materials, and technologies, both nationally and internationally.