CLEAR ROADS
research for winter highway maintenance

RESEARCH BRIEF

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ROADWAY DEICING WITH SALT BRINE VS. GRANULAR SALT

RESULTS SUMMARY

In field tests comparing the direct liquid application of salt brine versus granular salt, safety and mobility results were similar, with salt brine using 40 to 72 percent less salt.

PROJECT DETAILS

Project Title: Evaluation of Direct Liquid Application of Salt Brine vs. Granular Salt as Measured Through Various Performance and Safety Metrics

Project Number: CR22-04

Project Cost: $125,000

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Need for Research

Previous research has shown that salt brine applications in winter road maintenance have effectively reduced salt use and increased pavement friction. But some members of the public still perceive salt brine as less efficient and not as safe as traditional granular salt. This perception may lead to questions or concerns that undermine winter maintenance strategies and require valuable staff time and resources to address.

Agencies needed strong evidence to support using direct liquid application (DLA) of salt brine in place of granular salt that they could convey to relevant stakeholders and concerned members of the public.

Objectives and Methodology

The goal of this project was to directly compare the operational and safety performance of DLA of salt brine to granular salt use. The project began with a review of relevant literature that focused on pertinent performance measures, including safety, accessibility, mobility, environmental and operational efficiency metrics.

Using information from the literature review, researchers developed a survey of practice that was distributed to state and local winter maintenance staff to collect agency practices, experiences, policies and performance assessments used to quantify the effectiveness of winter maintenance treatments.

Next, using information from the literature review and survey responses, investigators developed a field data collection protocol to directly compare the performance of DLA of salt brine with granular salt. This protocol consisted of route information; route sampling of study and control locations; and data on materials used, storms and performance measures.

Field testing evaluated operational and safety performance on parallel routes in two separate Wisconsin counties. In each case, salt brine was applied in one direction (study route) and granular salt was applied in the opposite direction (control route) with friction data collected during storms.

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Treating roads by directly applying salt brine provides similar performance results compared to traditional granular salt but uses significantly less salt.

The National Performance Management Research Data Set (NPMRDS) was used to collect vehicular speed on routes during storms. The team used this information to measure friction deficit (FD) and travel disruption (TD), which were used to evaluate the performance of salt brine during winter storms and treatment effects.

Results

The literature review indicated that determining the effectiveness of winter maintenance treatments can be very challenging. Performance measures commonly assessed in previous evaluations included materials used, cost, time to bare/wet pavement, storm severity and crash rates. Other less frequently used metrics were surface friction and travel speed.

Survey responses revealed that DLA of salt brine is the most common treatment for anti-icing and deicing. To determine effectiveness, agencies often rely on subjective or resource-based performance measures such as material use or time to bare/wet pavement. Few agencies collect data on friction or travel speed to evaluate performance.

Field testing results showed similar friction performance on the study and control routes. Further, vehicle speeds and the time from the beginning of a storm to reaching bare/wet conditions were similar for both treatment applications.

Control route applications used 200 to 300 pounds of granular salt per lane mile, and study route applications ranged from 35 to 50 gallons of salt brine per lane mile. The lanes treated with DLA of salt brine used 40 to 72 percent less salt while maintaining similar operational and safety performance.

The implementation of TD and FD metrics was effective for evaluating winter storm and treatment effects. More specifically, TD can estimate the average traveling time lost during a storm, and FD can estimate the overall FD hours from normal conditions.

Benefits and Future Research

The results of this project were used to create a one-page infographic demonstrating the relative effectiveness and benefits of using DLA of salt brine for winter storm maintenance. This resource highlights the findings of the project and is now available to state and local agencies, such as transportation and law enforcement, and to the public.

The TD and FD metrics for evaluating winter storm and treatment effects will be considered for future evaluations as they effectively leverage readily available data for performance assessments.

"These findings present clear evidence that roadway deicing with direct liquid application of salt brine effectively treats roads after winter storms and uses less salt than traditional salt applications."

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