

RESULTS SUMMARY

Researchers synthesized existing research on protecting DOT equipment against corrosion. They created a best practices manual that provides in-depth information about the types and causes of corrosion, and specific practices for preventing and treating corrosion on winter maintenance equipment.

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PREVENTING AND TREATING EQUIPMENT CORROSION: A BEST PRACTICES MANUAL

Winter maintenance agencies use large amounts of solid and liquid deicing and anti-icing agents to keep roads clear of ice and snow in the winter. While these chloride-based chemicals are necessary for winter road safety and mobility, they are also corrosive to the metals in motor vehicles and in winter maintenance equipment.

Need for Research

Concern about the corrosive effects of deicing agents is widespread among winter maintenance professionals. Extensive research has been conducted on corrosion mitigation strategies, including a Washington State DOT [research project](#) that served as Phase 1 of this project. Corrosion of equipment can be expensive for agencies due to reduced equipment service life, depreciation in equipment value, increased equipment downtime, added repair costs and safety risks. In a survey of highway maintenance agencies conducted as part of Phase 1, respondents reported spending an average of more than \$1 million annually on corrosion management.

Clear Roads wanted to synthesize the existing research in this area into best practices for mitigating corrosion on winter maintenance equipment, and create an easy-to-read field guide to be used by both operators and supervisors.

Objectives and Methodology

Investigators supplemented the Phase 1 WSDOT research with a literature review to identify other relevant research on chloride corrosion. Based on this information, they developed a manual of best practices for preventing corrosion on winter maintenance vehicles and equipment. The manual is intended to provide operators, mechanics and supervisors the information they need about corrosion processes, failure modes and risk management to minimize equipment corrosion and effectively address it when it occurs.

PROJECT DETAILS

Project Title: Best Practices for the Prevention of Corrosion to DOT Equipment: A User's Manual

Project Number: No. CR13-04

Project Cost: \$49,950

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Corrosion of winter maintenance equipment due to deicing agents can increase agency costs by reducing equipment service life, adding repair costs, and increasing equipment downtime.

Results

The manual provides in-depth information about corrosion. The first four chapters offer background information, including descriptions and illustrations of the various types of corrosion. These range from general corrosion that affects an entire exposed metal surface to localized forms such as galvanic corrosion (which occurs when dissimilar metals are joined) and pitting. These chapters also provide an overview of the causes and effects of corrosion, a review of the chloride materials commonly used for snow and ice control, and a summary of the equipment and materials that the Phase 1 survey found to be most at risk of corrosion.

Survey respondents considered dump trucks to be the piece of equipment most susceptible to corrosion, with 49 percent reporting a “very high” corrosion risk. Liquid deicer applicators, hoppers and front end loaders were rated next most at risk for corrosion. Specific components that agencies reported were at high risk of corrosion include electrical wiring, frames, brackets, brake air cans, fittings and spreader chutes. Cast iron, carbon steel and composites were the materials reported to be most at risk of general corrosion, while aluminum alloys were rated as most likely to suffer corrosion in localized areas.

Chapter 5, aimed at fleet managers, recommends specifications for new equipment to help prevent corrosion. These options include the use of corrosion-resistant metal alloys; equipment design improvements such as eliminating places where water or deicers can accumulate; minimizing the number of connections between different alloys; and using anti-corrosion coatings. While these recommendations may increase initial purchase costs by 10 to 20 percent, these cost

increases should be offset by reduced corrosion-related maintenance costs, increased equipment life spans and reductions in equipment downtime.

Chapter 6 provides processes for evaluating, repairing and restoring fleet vehicles, and is aimed at garage supervisors and staff.

Chapters 7 and 8, aimed at both managers and operators, discuss preventive maintenance and training and facility management needs. Preventive maintenance techniques include washing, inspecting equipment for rust spots and treating them appropriately, greasing contact points, storing equipment in dry environments, not overloading equipment with solid or liquid deicers, using salt removers or salt neutralizers after storms, and establishing supervisor spot checks to ensure that preventive maintenance procedures are being followed.

Appendices to the manual provide an overview of laboratory test methods for determining corrosion rates, a review of the U.S. Marine Corps Corrosion Prevention and Control Plan, and pictures of equipment replacements and modifications that have been used to reduce corrosion. The appendices also include a sample audit of a municipal fleet’s inventory and maintenance operations. While this audit is from the District of Columbia Fire and Emergency Medical Services Department, researchers believe its recommendations for implementing a reserve fleet and a consistent acquisition schedule are applicable to winter maintenance agencies as well.

Benefits and Further Research

This best practices manual provides a comprehensive compilation of current knowledge about the causes, prevention and treatment of corrosion on winter maintenance vehicles. The manual was designed to be a living document that can be updated to incorporate feedback and new research and best practices as they are developed.

“ This manual provides easy-to-follow recommendations that will reduce or prevent corrosion on DOT equipment. The information will be helpful to operators, mechanics, supervisors and fleet managers.”

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