

## RESULTS SUMMARY

New guidance about anti-corrosion coating products for winter maintenance vehicles and equipment will help transportation agencies determine which products will be most effective for preserving metallic assets.

## PROJECT DETAILS

**Project Title:** Best Practices for Protecting DOT Equipment from the Corrosion Effect of Chemical Deicers

**Project Number:** CR21-02

**Project Cost:** \$99,985

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**Project Champion:**

Todd Law

Vermont Department of Transportation  
todd.law@vermont.gov

**Investigator:**

Xianming Shi

Washington State University  
xianming.shi@wsu.edu

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# PROTECTING WINTER MAINTENANCE VEHICLES FROM CORROSION

## Need for Research

Transportation agencies use chemical deicers to maintain safety and mobility on roads and highways during winter storms. While effective, these chemicals are corrosive and can cause damage to winter maintenance vehicles and equipment.

Protective coatings are available to prevent this damage, and agencies routinely apply them to ferrous-based materials, such as steels and stainless steels, and non-ferrous materials, such as aluminum alloys and copper. But there are numerous coating products available for each of these metallic substrates, and they vary in price and performance. To get the best return on their investment, departments of transportation (DOTs) want to select the coating products that will meet their specific needs.

This research, which updates guidance provided in a [previous Clear Roads project](#), offers extensive testing of multiple coating products for common metallic substrates to provide insight into how the product performs relative to other products. Understanding how DOTs can effectively and efficiently use the coatings for their purposes will enable the agencies to make more informed purchasing decisions.

## Objectives and Methodology

This project's primary goal was to identify and test the most used corrosion-protection coatings for DOT vehicles and equipment that are regularly exposed to humid, salt-laden environments. Transportation agencies were surveyed to better understand snow and ice management practices and other details regarding deicer corrosion to vehicles and equipment.

Additionally, a market analysis identified the most used anti-corrosion coatings available to determine the products to be tested. From this analysis, six coatings were chosen to be tested for the project. Investigators applied four of the prod-



Choosing the appropriate anti-corrosion coating for winter maintenance vehicles and equipment will ensure agencies obtain the best return on their investment.

ucts to steel, stainless steel and aluminum, and they applied two products to copper. Coatings were tested using electrochemical impedance spectroscopy (EIS), a cyclic salt spray test, an adhesion test, a pencil hardness test and a Vickers hardness test.

The EIS and the salt spray test results were the primary indicators of coating performance in resisting deterioration and providing corrosion protection. The EIS test periodically measures the change of coating properties such as the coating's capacitance and pore resistance, which accurately indicate the performance of a coating over a specific period. The salt spray test consists of 60 cycles, which is equivalent to five years of on-vehicle exposure to corrosion. With each cycle, the coating was exposed to six hours of humidity and 15 minutes of salt exposure, and then left to dry for approximately 18 hours until the next cycle.

## Results

Survey results indicated that dump trucks, liquid deicer applicators, front-end loaders and hoppers are most susceptible to corrosion. Further, 62 percent of respondents indicated they attempt to mitigate corrosion by replacing corrosion-prone materials on vehicles and equipment with more corrosion-resistant materials.

The results of the product testing indicated that Fluid Film provides the maximum corrosion protection to steel and aluminum alloys, as it performed well in both EIS and salt spray testing. Aquapon performed the best for steel protection when used with a salt blend deicer but is more costly than Fluid Film. Armour Seal performed well in both the

EIS and salt spray testing for stainless steel and aluminum alloys but has a low adhesion strength and negligible hardness that make it a less effective option.

For copper, Deox-IT and Permatex grease both failed the 60-cycle salt spray test (showing signs of failure after only two weeks), indicating they may last for only six months after application. Additionally, results indicated they could not adequately resist corrosion in salt-laden, wet/dry environments. Therefore, using either lubricant would require regular inspections to avoid sudden failures.

Survey responses indicate that most DOTs do not dry their winter maintenance vehicles and equipment after use, which can help minimize corrosive effects.

## Implementation and Benefits

This project provides guidance to DOTs for purchasing anti-corrosion coating products to protect winter maintenance vehicles and equipment. Agencies can use the results presented in this report to determine which products will be most effective for their operations. The results will be made available to DOT staff and winter maintenance managers.

DOTs may want to revisit the practice of not drying vehicles after winter maintenance use. However, since the costs of corrosion losses are not specifically known at this time, it may be difficult to evaluate the cost savings from installing drying stations.

"This project provides DOTs with up-to-date information on how to protect our valuable winter maintenance equipment from deicing product corrosion in order to make the best purchasing decisions for their winter maintenance operations."

Project Champion Todd Law

Vermont DOT

[todd.law@vermont.gov](mailto:todd.law@vermont.gov)