



Moving toward more sustainable snowfighting

4 tips to improve your winter operations and safeguard the environment

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Introduction

Vehicle collisions on snowy and icy US roads kill 1,300 people each year and injure 116,000.¹

And research shows those numbers would be far higher without the heroic efforts of winter maintenance teams de-icing our roads and highways. But enhancing your road-salting practices with newer processes and tools—including the right telematics system—can have a big impact on your municipality’s bottom line, while lessening your impact on the environment.

There’s no question: Winter operations save lives. Research published by the University of Waterloo’s Department of Civil & Environmental Engineering found “clear evidence on the safety benefit of salt application, reducing collisions from 20% to as high as over 85%.”²

Those data confirm the findings of an earlier study by Marquette University, which randomly studied hundreds of miles of US highways across several states—and discovered that after de-icing, the rate of injury collisions fell by a factor of seven to nine.³

Unfortunately, though, the safety benefits of today’s standard de-icing practices carry with them significant costs—both literally and in terms of their effects on the environment. This whitepaper will delve into each of these challenges and offer suggestions on how your winter maintenance program can address them both.

1 US DOT, Federal Highway Administration: [Snow and Ice](#)

2 Highways.org: [Safety Impacts of Using De-Icing Salt](#)

3 Marquette University Transportation Research Center: [Accident Analysis of Ice Control Ops](#)



The environmental challenges

For all of the value it contributes as a road de-icing compound, sodium chloride in the form of rock salt on our roads can cause detrimental effects to nearly everything around it: drinking water, vegetation, wildlife, even bridges and motor vehicles.

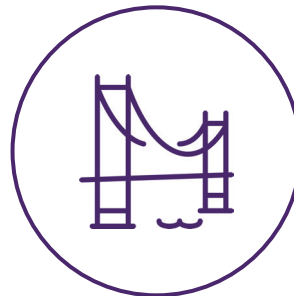
Fresh water



Food chain



Infrastructure



Damage to fresh-water supply

More than a third (37%) of the drainage area across the US—a key source of fresh water—has seen a significant increase in salinity in the last few decades, with de-icing among the main causes for the increase.¹

According to research published in Popular Mechanics, urban streams near roads in snowy regions regularly test 20 to 30 times the EPA's safety threshold for salinity levels.² And a study cited by Columbia University's Climate School found that road salt was likely behind the elevated chloride levels that contaminated the water supply of Flint, Michigan.³

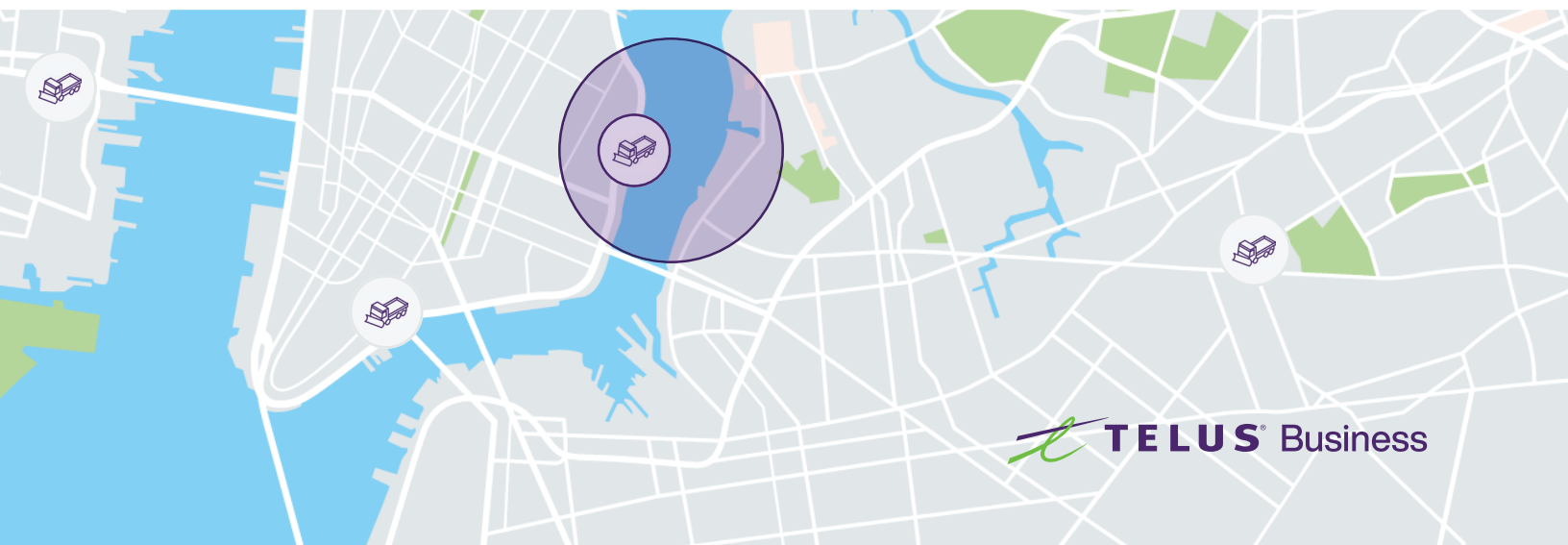
Damage to the food chain

When road salt inevitably splits into its constituent parts, sodium and chloride, it can cause significant problems for roadside plants, nearby bodies of water, and the local wildlife.

Research cited in Smithsonian Magazine, for example, found that road salt can reduce the size of rainbow trout hatchlings by 30%, lowering the average number of eggs these fish lay and making them more vulnerable to predators. Related research in the article found road salt kills zooplankton, a baseline resource for entire ecosystems, which means it negatively affects organisms higher up on the food chain.⁴

“Most discussion of environmental stewardship is broad and abstract — ‘protecting the planet,’ ‘preserving nature for future generations.’ But in the case of winter maintenance operations, the environmental opportunity is both tangible and significant. By implementing the right solutions and processes, your agency can literally help preserve the vegetation, drinking water, and even the health of roads and bridges within your purview.

– Paul Anderson, General Manager
FOCUS by TELUS and
SkyHawk by TELUS



Damage to our infrastructure

In this paper, we're defining the "environmental" challenges to include both the natural and human-made world. And the corrosive effects of road salt on our infrastructure—highways, roads, and bridges—costs the US an average of \$5 billion a year.⁵

Additionally, research from AAA found that road salt causes more than \$3 billion a year in rust-related vehicle damage alone. And this is to say nothing of the more significant safety effects these chemicals have on vehicles—including damage to brake lines, exhaust systems, and fuel tanks.⁶

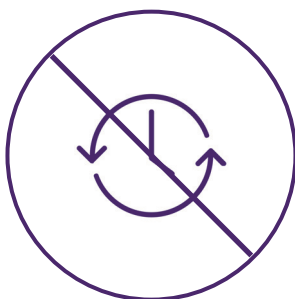
Now that we've reviewed the negative impact standard de-icing practices can have on local, regional, and national scales, let's discuss the undue financial toll it could be taking today on your winter operations.

The challenges to your bottom line

Few winter maintenance programs take advantage of the wealth of valuable data—both real-time and historical—available today to help their operations run as smoothly and cost-effectively as possible.

For the typical municipality—perhaps including yours—this means running your winter operations at sub-optimal levels and consuming more of your city's budget than necessary. Here are just a few examples of how not incorporating the appropriate data into your operations could be leading to undue costs.

Lack of
real-time data



Lack of
route optimization



Lack of
reporting





Lack of real-time data can lead to over- (or under-) salting the roads

An optimal de-icing operation needs real-time data flowing both to and from your team's plow trucks. For example, giving your truck operators highly localized weather details can help them determine the right amounts of salt to dispense in a given area based on weather conditions.

And the ability for your winter operations management team to monitor the amount of salt being dispensed from each vehicle in real time can also help you correct for over- or under-use.

One study reviewing winter operations practices in Nevada concluded that prior to providing detailed weather information to their truck operators, municipal agencies in the state had been collectively overspending by hundreds of thousands of dollars every season.⁷

Lack of route optimization can lead to increased fuel and labor costs

When your region suffers a snowstorm, it's critical that your drivers are able to plow and de-ice the affected areas as quickly and efficiently as possible. You already know that speed in these situations impacts your municipality's bottom line. The American Highway Users Alliance estimates, for example, that one day of impassable roads can cost a city between \$300 million and \$700 million, depending on the affected area.⁸

But what you might not have considered is how inefficiencies in your fleet's routes can cost your municipality directly. When drivers don't have help optimizing their routes in real-time, including turn-by-turn directions, the result can be inefficient route choices, more fuel consumption, and unnecessary overtime pay.

Lack of reporting and analysis can lead to over- (or under-) purchasing salt

With municipalities often forced to purchase their road salt upfront, ahead of snow season, one best practice is to learn as much as possible about your city's average road salt usage to 1) determine if you can lower your usage without compromising de-icing effectiveness and road safety and 2) determine if you are needlessly paying for and storing more salt than necessary.

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A decade-long study of winter operations in the State of Ohio found that municipalities and counties throughout the state had repeatedly under- or overestimated their locales' needs for road salt. The authors noted that "The state nearly ran out of salt in two places," and that "Several salt storage locations... had excessive salt inventory at the end of the season."⁹



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Now that we've established the challenges road salting poses to your winter operations and the environment, let's review a few best practices to help you address both issues — to run your operations more efficiently, lower your costs, and improve your environmental stewardship.



Tip 1:

Improve your operations through calibration

With uncalibrated salt spreaders across your fleet, neither your drivers nor your management team will have visibility into how much material you're putting down in any given area and at what rate.

Calibrating your fleet's spreaders will have a direct and positive impact on both your operation's bottom line and the degree to which your de-icing salt can affect the local environment.

Case in point:

Employees of Norwood Young America, a small town in Minnesota, attended a winter operations training workshop and learned about the importance of calibrating equipment—which they had not previously been doing.

As a Minnesota State report later described, these employees implemented this best practice as well as another, applying pre-wet salt, to their operations. Doing so enabled the city to reduce its road salt usage by almost half—from 600 tons to 350 tons a year. And this led to an annual savings of more than \$17,500.¹⁰

The City of Pittsburgh experienced similarly positive results from salt-spreader calibration—although on a much larger scale. When the winter operations team equipped their entire fleet with the SkyHawk telematics system from TELUS, and calibrated all vehicles' spreaders, the management team discovered the drivers had been overusing the blast button—which they were able to quickly rectify.

The result? By calibrating the fleet's equipment, among other operational benefits the winter operations team received by deploying the SkyHawk telematics solution, The City was able to lower its salt usage by 59%—and save \$1.03 million—in its first winter season after rolling out the new telematics system.¹¹



Tip 2:

Implement road-temperature monitoring

Another key set of data points that should guide your truck operators' decisions are the air and road temperatures along their routes.

As the Department of Transportation's Manual for Highway Winter Maintenance Personnel explains, pavement temperature directly influences the formation, development, and breaking of bonds between fallen or compacted precipitation and the road surface. It also influences the effectiveness of chemical treatments, such as road salt.¹²

One best practice in winter maintenance, for example, is to avoid applying rock salt when pavement temperatures are below 15° F, because the de-icing effect will be too slow. (Under these circumstances, you will want to add a liquid de-icer to speed the melting process.)

But without a mechanism to measure the surface temperature in real-time, your operators won't know when the conditions call for adjusting their de-icing processes. This can reduce your operation's overall effectiveness and lead to an excess use of materials—which can both increase your impact on the environment and needlessly increase your costs.

Case in point:

The City of Minnetonka, in Minnesota, leveraged this data to improve the effectiveness of its de-icing operations and reduce its salt usage. The City subscribed to a weather service that provides frequently updated air and road-temperature data. As the Minnesota State report explains, this information helps the crew identify when the conditions are appropriate for dispensing rock salt directly, and when the circumstances call instead for applying the correct amount of liquid to pre-wet the salt.

Leveraging this temperature monitoring practice (among the use of other relevant data) has helped the City of Minnetonka reduce its salt usage by 180%.¹³



Tip 3:

Deploy a route optimization solution

When you deploy your winter maintenance fleet to clear and salt snowy or icy roads, your team will likely be prioritizing several key objectives simultaneously: ensuring your local streets and highways are safe for travel, attaining that level of road safety as quickly as possible, and maintaining responsible stewardship over your operation's budget.

One strategy to help you with all these goals is implementing a route optimization solution. The right solution will enable your team to gather, analyze, and apply a wide range of relevant data for your fleet—including weather conditions as well as updates on which roads need service, the conditions of those roads (which might affect which types of vehicles should be deployed there), and which roads have already been cleared by other drivers.

Case in point:

In Ontario, The City of Brampton deployed the FOCUS by TELUS telematics platform to collect and analyze this information and optimize winter maintenance routes for all drivers across its fleet.

By leveraging this real-time data to enable more efficient route planning and guidance, The City was able to reduce fuel usage and overtime, while also achieving 97% precision in its applicator rate of salt (another data point that the FOCUS system measures).¹⁴

In another real-world example, research into the Ohio Department of Transportation's winter operations found that applying route optimization decreased the time it took to treat each road by 17 hours.¹⁵



Tip 4:

Leverage data to right-size salt purchase levels

You can choose from many frameworks for forecasting the amount and timing of your winter maintenance program's salt purchases. The inventory control model, weather regression model, and simulation model are among the most common.

But you'll improve the accuracy of these and other forecasting models—and, as a result, control your operation's expenditures—to the extent that your team has relevant data. For example, being able to review the rate at which your fleet dispensed salt in recent years under various weather conditions can help improve the accuracy of your estimated needs for future salt purchase and storage.

And again, rolling out the right telematics solution will give your operation visibility into all this invaluable data—vehicle usage, weather conditions, road temperatures, salt application rates, etc.—which you can review both in real-time and over longer time periods.

Case in point:

A Texas A&M study on best practices for winter maintenance found that The State of Utah realized dollar cost savings of millions of dollars per year on its de-icing operations—including savings on material costs—by leveraging weather forecasting to more accurately predict materials needed.¹⁶

Conclusion:

Improving your winter operations comes down to data sharing

If there has been one theme uniting all points in this paper, it's that your winter maintenance operation can benefit tremendously from deploying, analyzing, and sharing the right data across your entire operation—from leadership to the plow truck driver.

During a heavy rain or a snowstorm, your drivers working heroically to keep your city's streets safe are often doing so with very limited visibility. You can help improve that visibility—metaphorically, at least—by giving them real-time updates on local weather conditions, pavement temperatures, and route optimization to help them clear impassable streets more quickly and efficiently.

At the same time, your management team back at the office often faces low-visibility conditions during these times—unable to monitor salt-rate application, determine whether drivers are taking the most efficient routes to clear the highest-priority roads, and gather insights about the current conditions to help more accurately plan for de-icing strategies and expenditures next season.

You can improve your management team's visibility, too, by deploying the right telematics solution to help them monitor these key data points fleetwide—and apply their learnings to continually improve your winter operations.

About TELUS

Over the past 15 years, TELUS has emerged as a leader in transportation solutions. With our own national fleet of over 4000 vehicles, we know how to uncover your unique fleet needs and how to drive it to new horizons. Powered by TELUS' award-winning¹ network and support excellence, TELUS will accelerate your fleet to a new plateau of efficiencies—streamlining your operations further, faster.

Let's make transportation smarter, safer, and more sustainable:



A smarter way

Advanced telematics offers powerful insights, helping public works teams optimize operations. With 5G and system automation on the rise, fleet solutions are only growing smarter.



A safer tomorrow

Make sure your team arrives safe. Monitoring driver behavior encourages safer driving practices; helping to protect your drivers, vehicles, reputation and community.



A sustainable future

Efficient journey planning, timely vehicle maintenance and minimized materials usage all play critical roles in empowering your agency's sustainability initiatives.

¹ Opensignal Awards – Global Mobile Network Experience Awards 2020 based on independent analysis of mobile measurements recorded during the period January 1 – June 28, 2019 & 2020.

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