# How hyperlocal data helps reduce salt use in road maintenance

Data-driven strategies for making smarter winter maintenance decisions.

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# Road salt: Why we still use it and what the future holds

Road salt, or rock salt, comes from the same deposits as your regular table salt, but it's coarser and less refined. In the US, rock salt was first found in Detroit in 1885, and it has been used to de-ice roads since the 1940s. Salt is often more effective in ensuring road safety than sand, and it remains a cornerstone of winter road maintenance. However, environmental concerns and tightening budgets have prompted a shift towards more targeted, sustainable salting practices.

Innovations in winter maintenance, from more efficient equipment to better weather monitoring, empower road crews to minimize salt use while still achieving reliable results.

This eBook will guide you through these changes, offering practical insights to help you lower costs and improve operational outcomes while balancing safety, service, and sustainability.

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# Why are we using salt?

Despite being around for decades, salt is still the superior way to keep our roads safe in challenging winter weather conditions. It works by lowering the freezing point of water and preventing ice from forming. While salt is not the only chemical to do this, it is the cheapest and most established option.

**Compared to sand, salt has many benefits:**

Salt lowers the freezing point of water, so it can be applied in advance to prevent ice from forming in the first place. This is often the optimal method since it requires significantly less salt and may keep the roads completely clear of snow or ice.

Salt works excellently in sub-freezing temperatures and can rapidly melt large areas of compacted ice, improving road safety.

Salting also provides better grip and longer-term protection than sand due to its betterstaying power on the road surface.

To combat the negative environmental impacts of excessive salt use, smarter and more data-informed ways of salting the roads are needed.

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# Best practices for reducing salt use

Integrating industry best practices and innovations is important for reducing the use of road salt without compromising road safety. Some solutions are faster to implement, whereas others will require more investments.

### Equipment calibration

Regularly calibrating salt spreaders ensures that the correct material is applied to the roads. Over-application wastes resources, while under-application may lead to unsafe conditions, and both can be mitigated through consistent calibration. Every storm is different, and so every treatment should be different.

### Training

Comprehensive training programs for road maintenance crews ensure they understand the importance of minimizing salt use, calibrating equipment, and using advanced tools like liquid de-icers.

### Level of service

Defining specific service levels (such as plowing after a certain snow depth or salting only critical areas) helps prioritize resources. This approach ensures that materials like salt are applied where they are most needed rather than across an entire network.

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**Equipment upgrades**
Simple upgrades, like adding
sensors or automated spreader
controls, can lead to more efficient
salt application. These upgrades
are often quick to implement and
can yield immediate savings in
both material and labor costs.

**Measurement**
Tracking the amount of salt and
other materials used during each
snow event helps with future
planning and reduces overuse.
Implementing measurement
systems can help managers
compare usage against expected
targets and adjust accordingly.

**Accountability**
Developing clear accountability
protocols ensures that operators
follow best practices for resource
use, including how and when
to apply salt. This could involve
detailed recordkeeping or
performance reviews.



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# Advanced solutions —these may require more time or investments.



**Variable application rates**
Adjusting the amount of salt or brine applied based on road conditions, traffic levels, and microclimates ensures more precise use of materials. Tailoring the application to real-time needs can significantly reduce waste.

**Sensors and hyper-local forecasts**
Using detailed, localized weather forecasts and road weather sensors helps maintenance teams apply salt or brine only when and where it's necessary. This allows for proactive, rather than reactive, treatments and reduces the need for repeated applications.

### Grip forecasts
When treating roads, the aim is to maintain grip. Incorporating grip forecasts can therefore enhance decision-making by predicting how slippery the roads will become. By understanding the precise mix of frozen elements, maintenance teams can better predict grip and take more targeted actions.

### Exploring alternatives
In extremely cold temperatures, traditional salt is less effective. Switching to alternative materials, such as calcium chloride or magnesium chloride, which work at lower temperatures, can maintain safety while minimizing environmental impact. Using liquid de-icers like brine also improves adherence to road surfaces and allows for more efficient applications.

### Pre-wetting
Pre-wetting solid salt with brine before it is spread increases its effectiveness by helping it stick to the pavement and activate more quickly. This reduces the overall amount of salt needed and minimizes waste.

### Anti-icing
Anti-icing is a proactive strategy that involves applying liquid deicer to roads before snow or ice accumulates. This prevents the bond between snow/ice and pavement from forming, reducing the need for large quantities of salt after the fact.

### Technology
Investing in innovative technologies like road weather sensors and computerized salt dispensing systems allows for more precise control over salt application. These systems can help you optimize routes, track material usage, and provide data for future improvements.

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# Science and policy support smart choices

In the Salt Belt of the US, salt has been estimated to cause $5 billion in damage each year to roads and cars. Despite this, huge amounts of salt continue to be poured onto the roads: in the US in 2023, highway deicing accounted for about 41% of total salt consumed. However, states are taking action to curb the monetary and environmental costs of salting the roads. For example, Wisconsin is using leftover cheese brine for deicing and Minnesota offers Smart Salting training to help organizations reduce their salt use by up to 70%.

While winter maintenance organizations have a key role in mitigating the impacts of salinization, they cannot do it alone. Evidence-based solutions and policy recommendations must promote the reduction of salt runoff and establish effective monitoring programs.

In the United Kingdom, the National Winter Service Research Group (NWSRG) provides recommendations and treatment matrices for plowing and de-icer application to minimize material use and maximize effectiveness.

A similar case study looks at how countries are striving to manage excessive nutrient pollution through research and regulations and by offering financing for nutrient reduction activities. These lessons should be used to build salt management strategies that work hand in hand with water quality and climate change solutions.



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# Tools for targeted treatments

One of the best ways to improve the effectiveness of your salt use is to apply treatments more precisely. Let's discuss tools and technologies that can help you target your winter maintenance efforts more effectively.

# IoT road sensors

IoT road sensors are a cost-efficient way to get observations from your road network.

**Components:** Typical IoT sensors include sensors for road surface temperature. Depending on the type, they can also report the amount of residual salt or other chemical, surface state, air temperature, humidity, and dew point.

**Benefits:**

· Cost effective

· Easy to install and maintain

· The latest technology

· Real-time data for full situational awareness

· Improve the quality of road weather forecasts

**How GroundCast measures salt:**

· Vaisala GroundCast sensors measure conductivity: different chemicals create different conductivity levels, allowing us to track e.g. salt levels hyperlocally

· The sensors measure salt by default, but they can also be configured to recognize other types of deicing chemicals

· Xweather's Wx Horizon service pulls data from GroundCast sensors to give you a comprehensive view of the status of your roads

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# Road weather information systems (RWIS)

RWIS stations provide real-time data about road and weather conditions across many parameters.

**Components:** Typical RWIS stations include sensors for air temperature, humidity, wind speed/direction, precipitation, and pavement temperature.

**Benefits:**
- Extensive range of reference-level readings
- Resilient and reliable
- A large number of communication options
- Improve the quality of road weather forecasts



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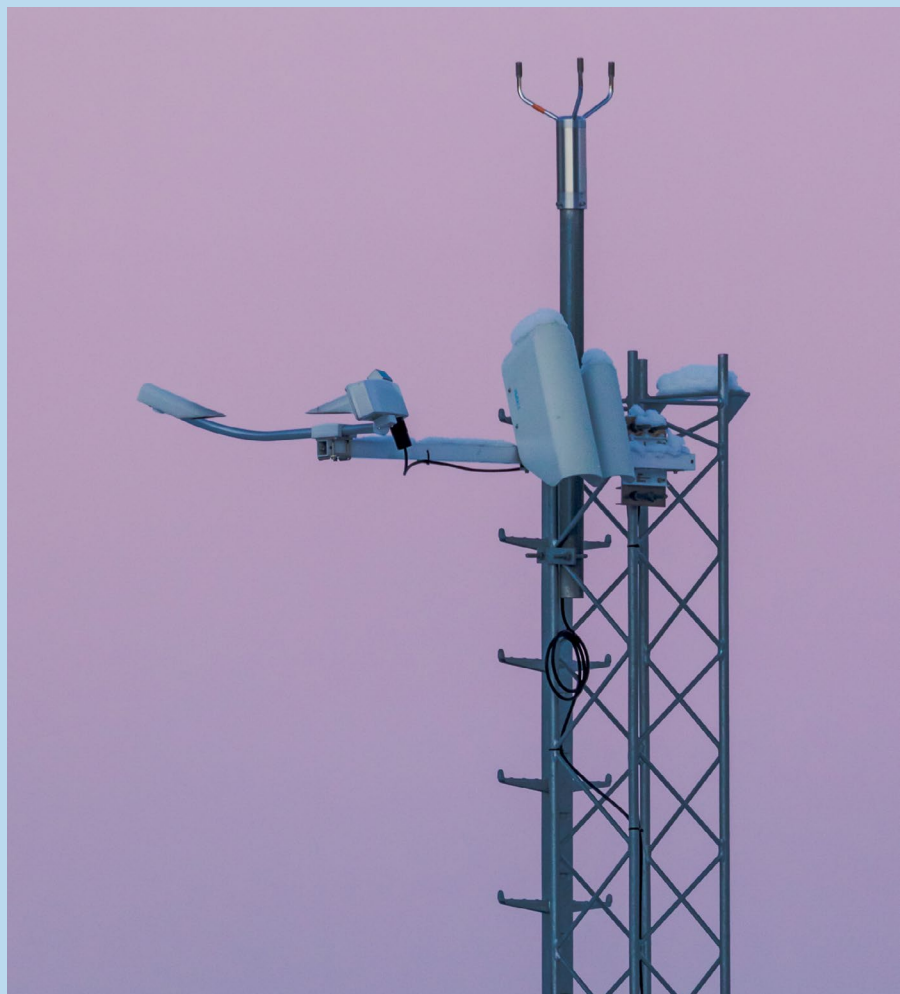
# Mobile sensing technologies

Vehicle-mounted sensors can provide a more comprehensive view of your road network.

**Types of mobile sensors:**

- Infrared sensors for pavement temperature

- Cameras for real-time road condition assessment

**Benefits:**

- Dynamic data collection across your entire network

- Real-time adjustment of treatment strategies

- Improved efficiency in resource allocation



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# Road weather forecasts

Forecasts for individual locations or individual routes, domains, or complete networks.

**Road weather forecast parameters:**
- Surface temperature
- Surface state
- Grip
- Amount of snow, ice, and water on the pavement surface

**Benefits:**
- Essential information about the behavior of the pavement surface
- More accurate prediction of ice formation
- Improved timing of anti-icing treatments
- Better resource allocation
- Enhanced decision-making for variable treatments



**0.21** Low grip

**0.0** Residual salt

Ice

**−1.6** Surface temp

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# Precision application equipment

Modern spreaders and sprayers allow for more precise control of material application.

**Reduced overall salt usage**
- More consistent treatment across the road network

- Improved accountability and data for performance analysis

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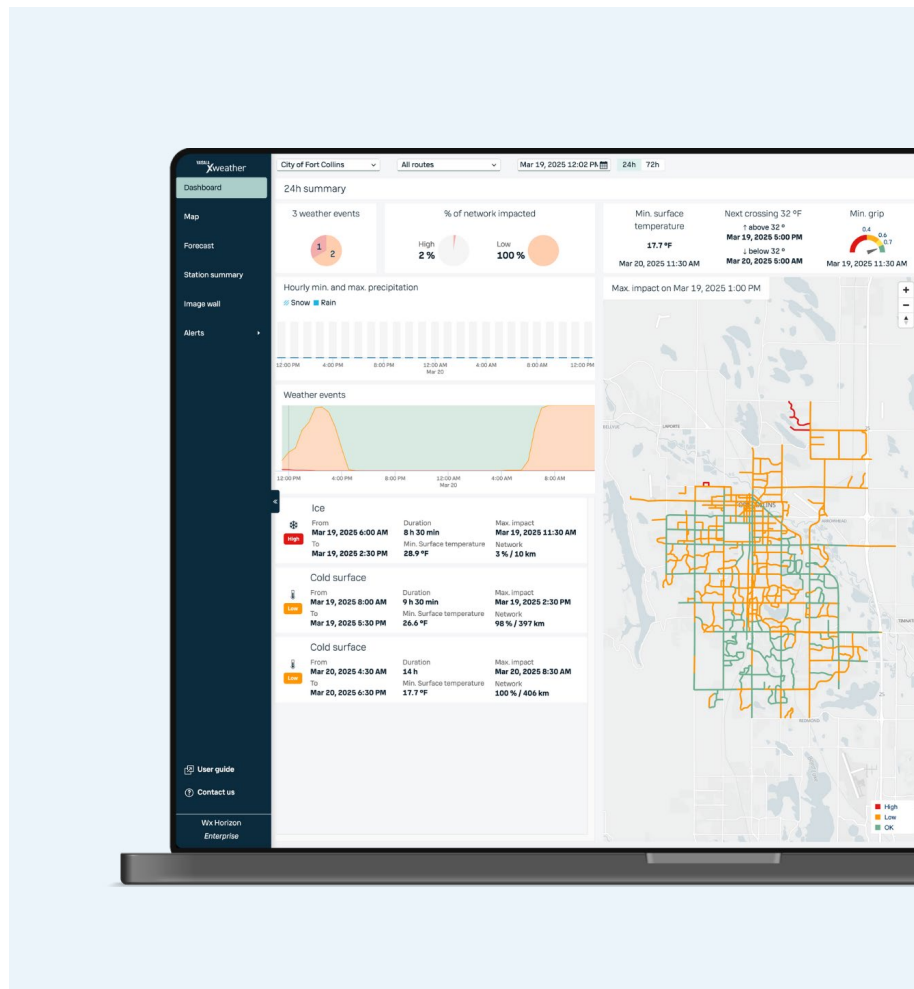


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# Wx Horizon: Smarter winter maintenance

Wx Horizon is a winter maintenance subscription service for complete awareness of current and future road weather conditions across your network.

It uses advanced forecasting models powered by hyperlocal sensor data. The solution has helped municipalities across the US and Europe save tens of thousands of dollars and dozens of tons of salt, improving road safety and community satisfaction and fostering a good work-life balance for public works teams.

Observations from highly accurate IoT sensors improve forecasts of road surface temperature and grip conditions by providing real-time data on road and weather conditions and reducing forecast errors.

# Less salt, more savings – let's get started

Vaisala Xweather is the weather intelligence partner for the world's leading organizations and governments. Let us help you turn weather from a challenge into an advantage.

**"In one day, Wx Horizon saved us, at a minimum, 80 tons of salt. Five to six thousand dollars worth of salt. Which equals out to about a year's subscription on Wx Horizon."**

**Tyler Buerger,** Assistant Director of Public Works, Oak Creek

READ THE STORY

## Book a demo

Are you ready to put theory into practice? Book a call with our experts and explore the benefits of Wx Horizon road weather forecasts live.

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## Download the guide to data-driven winter maintenance.

Get your essential guide to data-driven winter maintenance: everything you need to know to get started with data-driven winter maintenance.

GET THE GUIDE

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