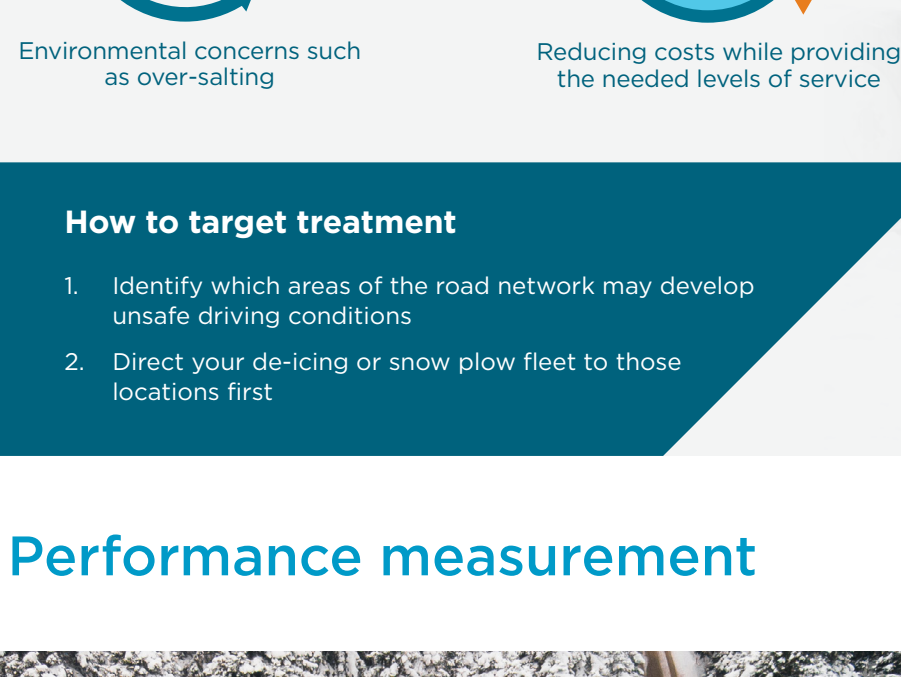# VAISALA

The road ahead:
Driving improvement in winter maintenance

1
Targeted treatments

By applying salt before ice formation at locations only where it is needed you are delivering targeted treatment

Why target?

High expectations from roadway users

Environmental concerns such as over-salting

Reducing costs while providing the needed levels of service

How to target treatment

1. Identify which areas of the road network may develop unsafe driving conditions
2. Direct your de-icing or snow plow fleet to those locations first

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Performance measurement
2

Performance measurement answers the question: Are we doing a good job? Are we meeting our service level agreement?

First define the service level, then measure what you want to improve.

What is your level of service?

Is it internal or external? For example, developed by road authority or determined by a community water service policy

Is it specific or objective? For example, covering roads within a number of hours after snowfall, preventing ice formation, or ensuring highway friction is not endangered by ice and snow

Get a grip on measurement

Once measurement is in place, you see the bigger picture. One common measurement is level grip. By installing sensors with the capability to measure grip, you can quantify if — and for how long — grip levels will decrease during winter conditions.

3
Environmental concerns

Material waste and chemical use are impacting living spaces and the environment. This drives innovation that enables better controlled salt or liquid use.

By developing and following best practices such as targeted treatment methods, you can continue to meet service levels and minimize environmental impact.

Salt is the most popular and effective material to keep road networks moving during the winter (UK Salt Association). Too much can harm the natural ecosystem. A smaller amount will disperse through natural processes.

Lessen the load

- Rising chloride levels are a primary concern, but all materials and chemicals impact the environment
- Use best practices to reduce material usage and achieve level-of-service goals

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Measurements that improve forecasts
4

Measurements enable forecast fine-tuning. There are two primary sources for measurements: Fixed and mobile stations.

Fixed road weather station
- Reference grade, continuous data
- Can be used to calibrate other data sources

Vaisala Mobile Detector MD30
- Professional grade mobile measurements
- Provides broad network coverage and ease of deployment
- Requires a driver on the road to collect data

5
Data driven decision-making

Why?
- Data collection is becoming easier and more automated
- With the right analysis, situational awareness and efficiency can improve greatly
- Funding and efficiency pressures demand more intelligent decision-making

Just what is Big Data?
- **Big in quantity:** combines many data points from many devices
- **Big in scope:** analyzes many weather and performance factors
- **Big in power:** sources data for powerful insights, better decisions

What Big Data does for agencies:
- Helps improves an agency's resiliency and efficiency
- Enables road condition data to offer awareness and problems
- Allows experts to work together for better insights and decisions

It's about the Big Picture
Advanced algorithms can fuse data from multiple sources to deliver a more comprehensive view of:
- Road segment forecasts
- Roadway assessments
- Current conditions/snow location visualizations

A changing workforce
6

The arrival of a younger workforce is leading to important organizational changes. The call for more flexibility and decision-supporting technology is prompting road authorities to adopt new workplace practices as well as new technology and procedures.

The younger workforce
- Is less interested in money and overtime
- Seeks more flexibility and work-life balance
- Has less experience in weather-critical operations
- Embraces new technology

To retain them
- Incorporate new, useful technology
- Learn how best to engage and employ them
- Deliver the predicted impact of weather

How a forecast is created

Accurate and precise forecasting is the first step in determining the correct action in winter maintenance. Accumulate information about the two decision-making.

3 steps to build an atmospheric weather forecast

1. **Know the current atmospheric conditions around the world.**
   Every nation in the world participates in global cooperation for measurements.

2. **Collect measurements into global weather prediction centers.**
   Global weather models are only computed by a few organizations around the world with exceptional computer processing power.

3. **Use high-resolution models to refine the global weather models.**
   Most governments run a local model for their own regions. Vaisala also runs local models where more data is needed.

4. **Refine raw data.**
   Machine-learning techniques improve forecasts by learning from past forecast errors, past measurements, and past forecasts.

   5. **Run a nowcast model to improve the initial forecast.**
   Nowcasting models use the latest weather station, radar, and satellite data to improve short-range forecasts.

The road weather model

Weather forecast — indicates what is happening in the atmosphere

Road weather forecast — indicates what is happening on the road surface

The modelling
The road weather model is a physical model of the main processes affecting the road surface.

3 parts to the road weather model

Energy balance model
Predicts the surface temperature.
Example: When black asphalt gets warmer under sunlight, the model calculates the rise in temperature.

Material balance model
Tracks and categorizes the amount and state of water/moisture on the road surface.
Example: When the weather forecast says it is raining, the model adds water to the water category. If the surface temperature then drops below freezing, the model moves material from the water category to the ice-ice category.

Forecast site information
Processes environmental site factors.
Example: Identifying bridges, capturing traffic profiles, determining the impact of shading on the forecast location.

The processes

The road weather model predicts surface temperature and surface condition by taking multiple factors into account, including the following.
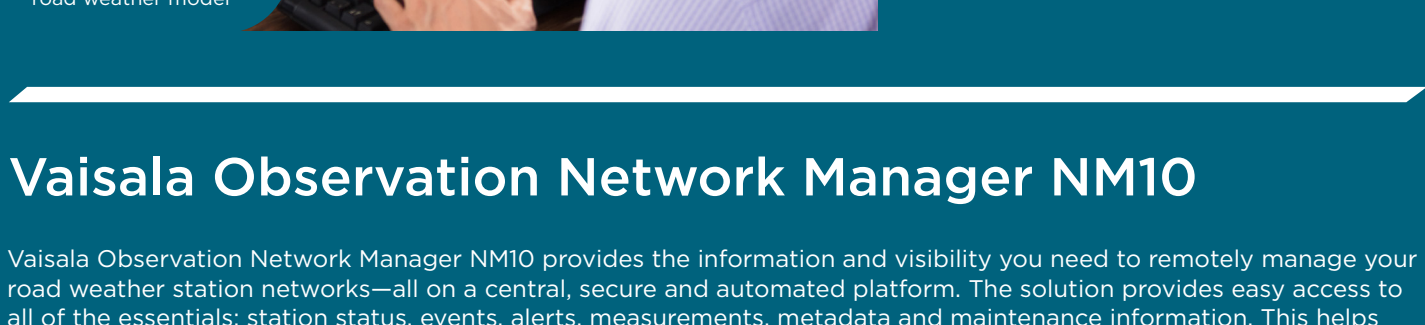
Road surface temperature — impacted by heating and cooling
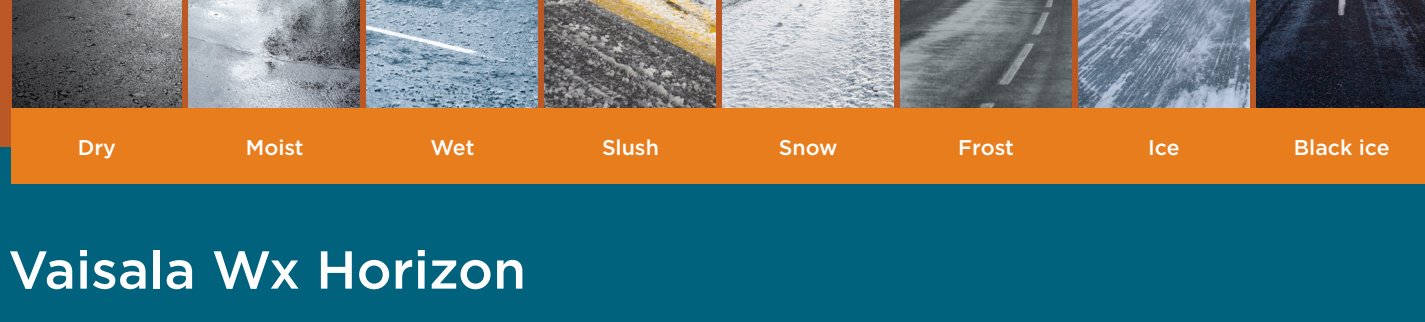
Adding and removing material: water, snow, ice, and chemicals

Road weather condition — interpreted based on road surface temperature and the amount of water, snow, and ice

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Vaisala Wx Horizon

Key benefits
- Maintain safer roads
- Simplify and save time
- Improve sustainable operations
- Drive efficient treatment practices
- Improve your mobile integration
- Provide consistent level of service

Vaisala Observation Network Manager NM10

Vaisala Observation Network Manager (NM10) provides the information and visibility you need to remotely manage your road weather station networks — all in a central, secure and automated platform. The solution provides easy access to critical information: station status, events, alerts, measurements, and maintenance information. This helps you identify and solve problems quickly, ensuring continuous high-quality data.

Key benefits
- Manage your network efficiently and securely
- Save time and costs
- Solve problems faster
- Gain efficient deployment with extensive support

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Visit www.vaisala.com/winter-maintenance for more information.