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DIGITAL

A new season for winter road maintenance:

6 trends and technologies that
matter most today



With the arrival of new technologies and practices, winter road maintenance is evolving. This evolution promises improved efficiency and maintenance outcomes — but only if agencies can prioritize correctly.

This ebook discusses 6 important trends and technologies that are changing how winter maintenance is done across the globe.

The human factors matter

Changes in winter road maintenance are also driven by environmental and workforce issues that many agencies overlook.



Environmental: In the last few years, many authoritative studies have pointed to the fact that material waste and chemical use create unforeseen costs to our living spaces and the natural environments. This, in turn, has driven innovations that allow for better controlled salt or liquid use. In some cases, this creates new efficiencies; in other cases, better environmental stewardship requires effort and resources on the part of the agency.



Workforce: Additionally, the arrival of a younger workforce is creating important organizational changes. Younger professionals are less likely to be driven by money and more likely to value flexibility and a good working environment. This has prompted agencies to adopt new workplace practices at the same time that they are making technological and procedural changes.



1

Moving from reactive to proactive operations

Any organization seeks to behave proactively, but “proactive operations” has a specific meaning in winter maintenance.

While past practices reacted to weather events by necessity (you can’t abate snow that you can’t effectively predict), today’s technologies allow for much better forecasting and highly effective, pre-emptive mitigations that cut down on workload, material use, and traffic disruption.

The times are changing

	Then	Now
Plow/de-icing deployment	Deployed during/after snow event	Remediation starts before the weather
Forecasting	Only atmospheric conditions	Atmospheric and pavement conditions from many data sources
Road condition data	Broad and nonspecific	Granular and detailed
Timescales	Long; data frequently outdated	Short, often real-time
Sensing and observation	Unsophisticated, manual and prone to error	Automated, objective, and instant
Material waste	Excessive and costly	Minimal and continually optimized

Improvement cheat sheet:

- Evaluate your agency’s observation and remote sensing practices (if you have any). If you can deploy a new technology or two, this can be a quick win and big efficiency boost.
- Identify your biggest current pain points or frustrations. Can a new technology or process help you deal with them proactively, before they spiral into bigger challenges?

2

The rise of thermal mapping

Thermal mapping got its start in the UK and Europe, where freeze events are less likely to include substantial snowfall and more likely to include icy roads, wet and humid conditions, and hard-to-assess roadways.

Agencies learned that thermal mapping allowed them to better plan their Road Weather Information System (RWIS) networks. It is common to see variations

of up to 15°F across short stretches of road, and thermal mapping provides an objective, granular understanding of them.

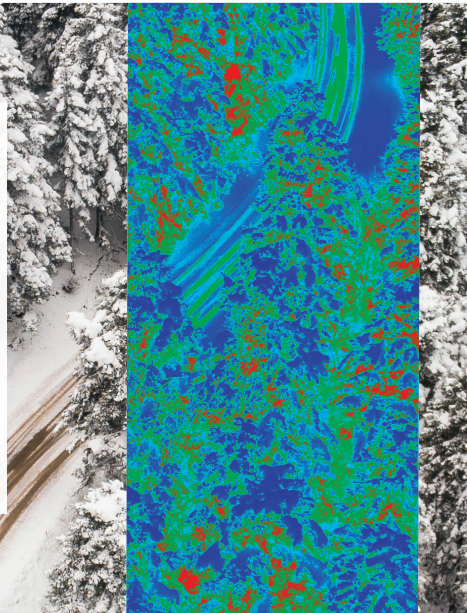
Most obviously, thermal mapping enables agencies to observe and predict which roads need mitigation. Air temperature data is often not a good indicator of roadway temperature, so direct surface measurement creates notable improvements in accuracy. Many agencies have anecdotal or informal

understandings of which sections of road need the most work, but these are usually inadequate.

Thermal mapping shows long-term patterns that are valuable for preemptive mitigations, and the data can even be merged with traffic and accident data to create a richer understanding of dangerous stretches and roads that might need re-engineering or safety enhancements.

Familiar roads seen with fresh eyes

Thermal mapping data is easily visualized and exported to various devices, giving agencies and operators immediate, actionable data. Removing the guesswork in winter operations saves resources, improves driving conditions for drivers, and makes all travelers safer.



Improvement cheat sheet:

- Map temperatures over a short stretch of road to see for yourself how much variation there is.
- Educate your drivers on the principles of thermal mapping and discuss together what on-the-road value it may provide.

3 The rise of liquids

Liquid use is becoming the preferred mitigation method, and it carries many benefits. Liquids — usually salt brine, magnesium chloride, or calcium chloride — are widely available, work instantly, and have large working temperature ranges. They also expand the useful window of treatment time because they work before, during, or after a weather event.

Agencies incorporate liquids to improve their performance while reducing the amount of chemical needed. Salt brine, the most commonly used liquid, allows agencies to do more with less, since a smaller amount of solid salt is required when it is put into a solution. This alleviates environmental concerns, since solid salts can end up scattering into waterways, where they can affect water quality and ecosystems.

Liquids also offer clear advantages over sanding. Sanding is a notable environmental problem because the sand often ends up as silt in waterways, or as unhealthy particulate matter in the air. It is also highly abrasive to cars and equipment.

Choose your liquid

Agencies often stock liquids for both anti-icing and de-icing along with solids that produce similar effects. Their goals are usually the same:

- Lower the freezing point of water on the road
- Prevent snow and ice from bonding to the pavement
- Allow for easier removal of accumulated slush, snow, and ice

Good weather data is crucial when choosing between these options. It is impractical, for example, to apply liquids ahead of a storm that will begin as heavy rain.

Improvement cheat sheet:

- As you deploy more liquids, track your decrease in granular material use (if applicable). This can provide your stakeholders with a helpful metric for your innovation and progress as an organization.
- Consider your biggest causes of waste. Are they equipment-related (i.e., subpar application equipment) or information-related (i.e., you apply liquids to roads that don't need it because you lack objective road data or operator training)? Can you make some changes?

4 Higher-performance equipment

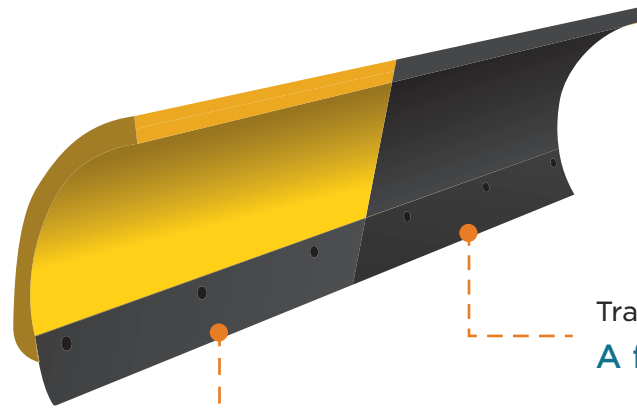
Agencies and equipment producers are constantly improving winter maintenance equipment, but adopting new tools isn't always an easy process — especially in environments of budget scarcity.

Any improvement has to be a smart investment. Almost inevitably, newer, high-performance products will be more costly, so in order to justify them, a return on investment needs to be provided as well. This generally starts with some sort of pilot program or a study done to prove the superiority of the new product over time.

With informed investments, however, agencies can control their replacement costs over time, keep plows and other vehicles on the road and out of the shop, and achieve much greater performance and results. Technology advances like ground-speed computerized dispensing systems and remote sensors add new ways for agencies to optimize their operations.

Plowing into the future

Plow blades have been improved drastically in recent years. Newer plow blades can cost as much as 10 times more than traditional blades, but they can last for many seasons, creating a cost savings in the medium- or long-term. They also are much better-performing — your roads will be safer and your jobs will be easier.

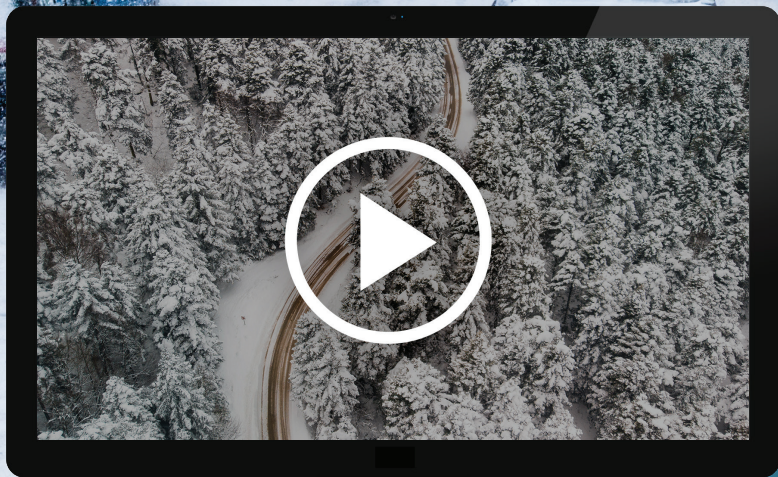


Traditional mild steel plow blades:
A few hours of use

Today's blades with rubber-encased carbide or ceramic:
A few years of use

Improvement cheat sheet:

- Use your connections. If you're a public agency, check with other agencies about new tools they've deployed and the value those tools have created (or not). This can help you avoid ineffective investments and seize smarter ones.
- Hit the road. Go out with driver(s) during plowing and other work. Their most desired technology improvements might not be the same as what's advertised most to you.



WEBINAR
“A new season for winter
road maintenance:
Trends and technologies
that matter most today”

Download our recent webinar presentation to hear these and several other key topics discussed by the experts.

Mobile sensors solve one of the most critical problems of winter maintenance: getting real-time, objective data and insights about road conditions and using that data for better decision-making. When implemented correctly, they can create significant savings in money and materials, as well as drastic improvements to situational awareness and efficiency.

From the operator's perspective, mobile sensing immediately informs decisions about whether to treat pavement and how much material to apply. For example, today's vehicle-mounted sensors can determine road temperature, road state, friction levels, and the thickness of the snow or ice layer before and after a plow's cutting edge has passed. This immediately confirms whether or not the blade is getting the pavement to the desired state.

Often, this data can be sent back to the agency, which can then integrate multiple data streams for a richer, contextual understanding of mitigations and

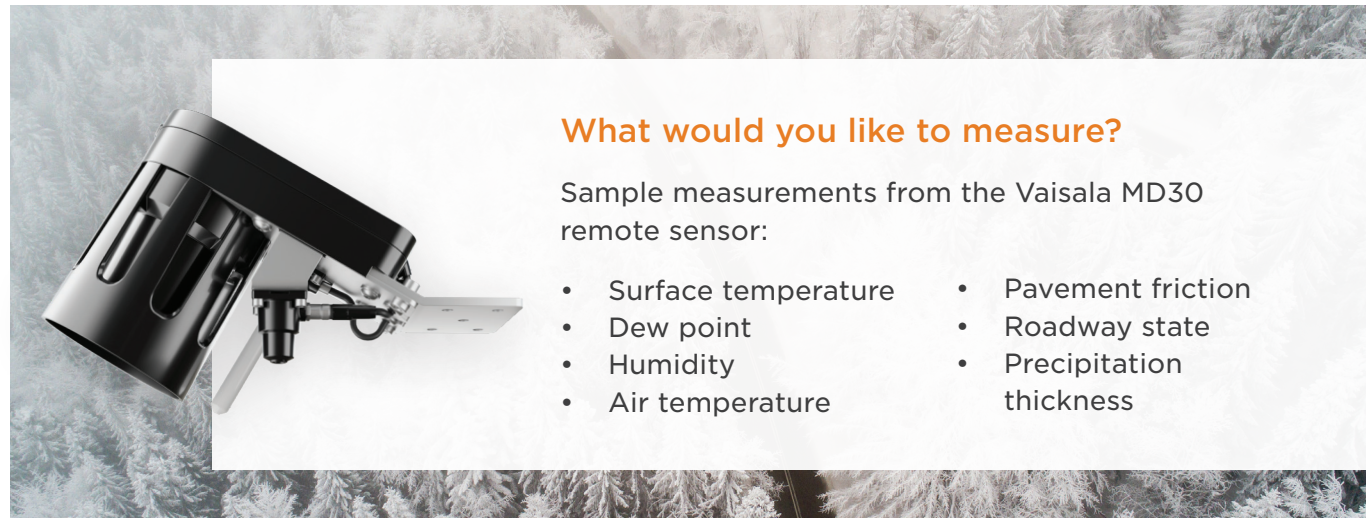
materials used. They can also compare this mobile data with their fixed-site RWIS data to see how the roadway temperatures vary between their weather stations.

Mobile observations can also be incorporated into the forecast model to improve the overall understanding of current conditions and what the pavement is likely to look like in the near future.

Mobile sensors such as Vaisala's MD30 are also rugged enough to withstand virtually any weather, and they can be installed on almost any vehicle, including snow plows.

Improvement cheat sheet:

- Conduct a trial of mobile sensing using your most mission-critical roadways. The cost of entry for mobile sensing is often quite reasonable.
- Learn and use your mobile sensors' data analytics capabilities. Mobile sensing is a game-changer in part because of what it allows you to do with data after it is collected.



What would you like to measure?

Sample measurements from the Vaisala MD30 remote sensor:

- Surface temperature
- Dew point
- Humidity
- Air temperature
- Pavement friction
- Roadway state
- Precipitation thickness

6

Incorporating big data

Data collection everywhere is becoming easier and more automated. In the context of winter maintenance, leveraging big data delivers on the promise of remote sensing and other forms of collection.

Most agencies feel funding and efficiency pressures that demand more intelligent decision-making. This is where big data

can be a life saver: With the right analysis, situational awareness and efficiency can improve enormously without any new investments in manpower, trucks, or materials.

With the right software and system integrations, road segment forecasts, roadway assessments, and plow location visualizations can all be auto-generated, adding great value for operators and planners.

Additionally, advanced algorithms can be deployed to fuse data from multiple sources to deliver a more comprehensive and robust pavement forecast.

These and other applications of big data can increase an agency's resiliency, efficiency, and ability to deliver on its core mission of maintaining safe, passable roadways.

Just what is Big Data?

Big in quantity: combines many data points from many devices

Big in scope: measures many weather and performance factors

Big in power: Assimilates data for powerful insights, better decision-making

Big in results: Transforms observations into actionable information



Improvement cheat sheet:

- Consider inter-agency partnerships or other collaborations that can enlarge your available pool of data, making everyone's road analyses richer and more valuable. Previously unheard-of data integrations are now possible — and affordable.
- Inventory your existing data repositories and collection practices. It's likely that you are underutilizing data you already have, and many vendors and partners can help you leverage it more fully.

Winter road maintenance is changing. Know your priorities.

The six factors we've discussed here are changing how agencies approach their jobs. They are disruptions, certainly, but innovation is almost always disruptive. The opportunities and efficiencies they unlock will continue to shape our field for years to come.

To learn more, connect with Vaisala about our industry-leading ground transportation solutions. Vaisala provides the technology, partnership, and decades of experience that agencies need to make their winter maintenance operations more efficient, cost-effective, and effective for those they serve.

www.vaisala.com/winter-maintenance

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