

TRANSPORTATION ASSOCIATION OF CANADA

**BEYOND ROAD WEATHER INFORMATION
AS A DECISION-MAKING TOOL
IN WINTER MAINTENANCE OPERATIONS,
WHAT ELSE IS NEEDED?**

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ABSTRACT

The last few years have witnessed a leap forward by road maintenance agencies, with the adoption of new equipment, materials, and new application techniques, such as liquid anti-icing and pre-wetting. The development and proliferation of Road Weather Information Systems (RWIS) are positive steps into the direction of more advanced winter maintenance operations. While Road Weather Information Systems are gaining acceptance and popularity, they are only tools in a tool box and they do not become useful unless they are part of an interconnected system for the operation and management of the road winter maintenance operation.

Other technologies have been developing as well; they are being adopted by the various levels of road authorities. Emerging technologies such as Electronic Spreader Controllers, Automatic Vehicle Location (AVL) technologies, and various types of Data Collection Systems have provided more hope for improved decision-making practices and improved tracking and control of winter operations, when used along with information from RWIS.

Data collection is becoming more and more crucial to the winter maintenance operations. Operations managers should be able to access valuable information, not raw data, in order to enhance the decision-making process and make it more efficient.

This paper will discuss how RWIS does not work independently, and must be integrated with other systems and tools to provide proper methodologies of decision-making. The paper will also touch on what requirements that must be met before adopting a road weather information system in a decision making process.

INTRODUCTION

The last few years have witnessed a leap forward by road maintenance agencies, with the adoption of new equipment, materials, and new application techniques, such as liquid anti-icing and pre-wetting. The development and proliferation of Road Weather Information Systems (RWIS) are positive steps into the direction of more advanced winter maintenance operations. While Road Weather Information Systems are gaining acceptance and popularity, they are only tools in a tool box and they do not become useful unless they are part of an interconnected system for the operation and management of the road winter maintenance operation.

Although RWIS can be an added value to the operation, the questions must be frequently invoked are why would an agency need road weather information and how would such information be utilized? More importantly, what else would a winter maintenance operation require?

New technologies have emerged in this field. They are being adopted by various levels of road authorities. Emerging technologies such as Electronic Spreader Controllers, Automatic Vehicle Location (AVL) technologies, and various means of Data Collection Systems have provided more hope for improved decision-making practices and improved tracking and control of winter operations, when used along with information from road weather information systems.

EMERGING TECHNOLOGIES

Many other technologies have come to play a role in the field of road winter maintenance; some of these emerging technologies are developing somewhat in isolation, or derived by other needs. Just for illustration purposes, few are discussed to evaluate their impact on the decision-making process.

Electronic Spreader Controllers

Spreader controllers have evolved from a simple on/off switch to very sophisticated computerised electronic controllers, complete with Global Positioning System (GPS) readers, symmetry control, width spreading and precision material application rates. Some controllers even have made room for sensors to measure a variety of other activities and variables of winter maintenance operations. Such controllers are just important for their function to control the application of material on the road, but are now equally important for the information is generated by those controllers and the ability to capture such data and use it in the general scheme of operational decision-making.

Some spreader controllers' manufacturers have accommodated various sensors within their information display and data collection systems. The type of sensors deployed

provides accurate measurements. For example, sensors have been developed to detect the usage of snow plows and wings (down or up), to measure pavement and air temperatures, road friction, and road salt residue.

Mobile Temperature Measurement

The popularity of mobile temperature sensors - designed to measure road surface temperatures - has led to the fact that pavement temperature is the one that must be monitored in order to predict surface conditions, which directly should be reflected in the type of treatment selected to control snow and ice. This can be seen clearly in the installation of road temperature sensors on supervisory vehicles to help in real time assessing road conditions by patrol supervisors. Some authorities even went further and started to transmit such measurement live with GPS location to create a network-wide road temperature map.

That also has led to further interest in road temperature, aside for the RWIS factor. The interest in having a thermal signature for the road network is making thermal mapping an option that is worth considering. Thermal mapping is a measurement of the road temperature along the road length at specific times. The temperature is then plotted on a map showing “cold” and “hot” spots on the road. Such information can be useful in making a decision on when and how to apply snow and ice control actions. Also, it may help in automating material spreading operations.

Decision-making practices

Traditionally, mobilization of winter equipment decisions were made based on air temperature, however the more appropriate temperature that should tracked and used is the road surface temperature. The availability of handheld and vehicle mounted surface temperature measuring devices have allowed for a shift in decision-making practices. Along with this shift, road maintainers started to note weather patterns as they relate to road surface temperature in their operations. For example, some road maintainers have started to incorporate more than just road temperature into their decision making process. Speaking from experiences at the former Regional Municipality of Ottawa-Carleton, some road supervisors found it beneficial for them to monitor weather radar images and wind conditions to better help them define attention-spots during the maintenance operations.

Automatic Vehicle Location

Automatic Vehicle Location (AVL) technologies has been steadily gaining acceptance with road maintainers. AVL tracking technologies have added yet another tool to help better track, manage and analyse the actions within winter road maintenance operation. AVL is basically a device the record location information received from the Global

Positioning System (GPS) and relaying this information to determine a history of vehicle travel. The basic information that can be collected from the GPS is location coordinates, speed, and direction. Other data can be collected at the same time as the GPS and plotted on a map to show operational activities as they relate to time and location of such activities.

The information from GPS is more consistent than certain reading off the vehicle controllers because the system operated continually around the globe providing accurate and unified time stamping. Decision making can, and would, be enhanced by having actual information from the whereabouts of winter maintenance vehicles. The same can be said for year-round road maintenance activities.

The concept of AVL is evolving to include more than just simple GPS location of mobile equipment, existing and prospective users of AVL systems are demanding automated operational data be collected and be matched to its time and GPS location. The operational data required as the same data being produced by electronic and computerized spreader controllers, which produce information relating to material application rate, pre-wetting percentages and material type and quantities being expended within the operation.

Data Collection

Data from the operation has been collected in its basic format as far as the operation existed. Manual methods and paper records have been used for a long time. However, the demand for more data to be collected, more often, is driven in part by requirements increased efficiencies for tracking and control, legal issues and environmental issues

Advancements of electronic spreader controllers have given the chance to produce data in an automated and systematic fashion, as well as the possibility and the capabilities to capture and record such data. The operational data collected

Data collection is becoming more and more a crucial requirement for the winter maintenance operation. An increasing number of road authorities are making data collection a core requirement of their contracts and outsourced winter services. The data collection requirement is being heightened by possible environmental impact of excessive usage of road salt within winter maintenance operation.

Within the context of decision-making, data collection requires a delicate balance. Not collecting data from operations is sometimes as damaging to the decision-making process as having a flood of raw data that do not make good operational sense. An operations manager should be able to access valuable information, not raw data, in order to enhance the decision-making process and make it more efficient.

WINTER MAINTENANCE MANAGEMENT SYSTEM

When considering the winter maintenance operation in its entirety, one may easily conclude that RWIS should be part of an integrated winter maintenance management system that deals with the whole operation rather than with the cause of it, that is the local weather and area climates. A well-integrated winter maintenance operation includes several components that evolve collaboratively in order to achieve the desired integration.

First, road maintainers need access to quality road weather forecasts in order to mobilize their forces more precisely and more effectively. Road weather forecasts are also used to determine the type of road maintenance to be used in a particular situation. Thus, a reliable Road Weather Information System (RWIS) is one of the first components needed at a maintenance command center or snow desk.

Second, information about resource utilization and scheduling must be in a manageable format at the maintenance command center. This means having information about the staff, supervisors, equipment, contractors, and service providers.

Finally, data collected from vehicles during operations, such as salt and sand quantities used, material application rates, plow coverage areas, route coverage (using GPS) is crucial. Whether this information is available in real-time, delayed real-time or after-the-fact depends on the requirements, resources, and policies of the particular road authority. Nevertheless, the information needs to be available eventually, if not sooner. By storing all the information in a central location, managers can perform essential data analysis to assess and modify operational decisions.