YORK REGION DE-ICING STRATEGIES

SECTOR	DEPARTMENT	ADAPTATION TYPE	DRIVER	FUNDING SOURCE
○ Food ○ Health ● Infrastructure ○ Natural Systems ○ Planning ○ Water Conservation	○ Communications ● Environment ○ Finance/Purchasing ● Infrastructure ○ Parks & Rec ● Planning ○ Public Health ○ Water/Stormwater	○ Decision Support Tools ● Delivery of Adaptation Options ○ Plans + Policies ○ Programs + Initiatives	○ Anticipatory ● Reactive	○ Federal ● Municipal ○ Other ○ Private ○ Provincial

PROFILE *Adapting to Ontario's increasing winter variability requires more complex and dynamic municipal road maintenance strategies. Black ice, freeze thaw damage, and other impacts can occur with very little notice and create a safety hazard for residents, businesses and municipal staff. Addressing these conditions requires real-time information on weather and road conditions, appropriate equipment and the ability to reach affected areas.*

In an effort to maintain safe road conditions during inclement weather, York Region has adapted its tools and strategies to enable a more rapid road maintenance response. In particular, the Transportation and Community Planning Department has developed a Salt Management Plan, introduced new strategies for de-icing and anti-icing, and has adopted new tools that optimize the Region's response and resources.

GEOGRAPHIC CONTEXT York Region is located directly north of the City of Toronto, encompassing an area of 1776km^2 that includes the municipalities of Richmond Hill, Vaughan, Markham, Newmarket, Georgina, King, East Gwillimbury, Aurora and Whitchurch-Stouffville. The Region is home to approximately 1 million residents. By 2030, York Region is projected to grow to approximately 1.5 million residents.

Sitting squarely in Ontario's snowbelt region, York Region endures lake effect snow from three different sources: Lake Simcoe, Georgian Bay and Lake Ontario. Over the past 30 years the Region received significant average snowfall of 120-160cm each winter.

The presence of the Oak Ridges Moraine and the topographic features of the Region complicate municipal response to winter precipitation as they contribute to weather variability within York's boundaries. In any one precipitation event, some areas of York Region might receive freezing rain while others are experiencing driving snow. Under these conditions, managing the Region's 1,028km of paved arterial roads is difficult as teams need to address a variety of weather conditions simultaneously.

Finally, as a rapidly growing municipality, increasing urbanization has added to the challenge of maintaining safe roadways in winter months. As roads have grown steadily wider to accommodate an increasing number of vehicles, there is less space to store snow and higher usage of roadways which exacerbates hazardous driving conditions. These changes have changed the standard of maintenance and care required to achieve safe roads. For example, in some cases, snow removal is now necessary, where plowing was sufficient in the past.

CLIMATE CHANGE CONTEXT Like many Ontario communities, York Region is experiencing a long-term trend of warmer winters and more variable weather. Snow is increasingly replaced with more frequent episodes of freezing rain.

In addition, the Region is experiencing increasing incidents of extreme weather which includes impacts such as freeze/thaw, extreme cold and extreme heat.

Moreover, this variability is projected to continue and in some cases, increase in intensity. Under a rapid growth emissions scenario that reflects current trends (A1B),[1] York's annual average temperature is expected to increase by about 2.7°C by the 2050's. Under the same scenario, annual average precipitation is expected to rise by about 50mm by the 2050's with the majority of this change occurring in the winter and spring seasons. These projections reflect the weather trends that York Region has been experiencing lately, and imply that future weather will be equally variable, demanding dynamic road maintenance strategies.

ISSUE As York Region's winter weather becomes more variable, the municipality has worked to build resilience to climate change by developing new strategies and introducing new equipment and techniques to their maintenance routines.

In 2004, the Region developed a Salt Management Plan aiming to reduce the amount of salt introduced to the environment and watershed. The Plan delegates responsibility for program implementation to the Transportation and Works departments, and introduces new technologies and tools that may be used to create a dynamic and highly efficient road maintenance program. As a strategic document, the Plan also highlights future action areas.

Acting on the recommendations found in the Plan, York Region has implemented three noteworthy new techniques: the use of pre-treated rock salt; the installation of Road Weather Information Systems; and vehicle global positioning systems.

Pre- treated Rock Salt

De-icing is the common practice of applying rock salt to melt the snow and ice that have bonded to it. Though highly effective above -12°C, below that temperature, salt begins to lose its potency, melting ice and snow at a much slower rate. To combat this inefficiency and prepare for future extreme cold events York Region has been testing pre-treated salt in Georgina and East Gwillimbury (areas that are vulnerable to lake effect snow from Lake Simcoe). Starting in 2008, the Region began using rock salt that had been coated with a solution made primarily from beet juice. This treatment enables the salt to emit a higher temperature, meaning that it is effective at melting ice in colder temperatures. In 2011, the Region began to manufacture the treated salt using beet juice from a nearby refinery, and has initiated trials to test the salt's efficiency. Though the atypical warmth of this past winter (2011/2012) prevented the Region from testing the treated salt in temperatures below -12°C, York has noted that the use of their pre-treated salt has reduced the total amount of salt used by approximately 10%. Factoring in the added cost of the beet juice solution, the Region estimates savings of 8% on their road salt budget with this technique. York is currently considering the use of this tool within other District Maintenance Areas within the Region.

Road Weather Information System

In addition to pre-treated rock salt, York Region has also incorporated a Road Weather Information System (RWIS) into their road maintenance efforts since 2000. The RWIS technology consists of a puck-shaped device that monitors sub-surface temperature, ground temperature, salt concentration on roads, wind speed and precipitation levels in real-time. York Region implanted 4 RWIS pucks in the ground at strategic locations including:

- The highest point in York Region to get an indication of how elevation affects weather. This point is in the west end of the Region and monitors weather patterns for this area.
- Within the hills to get an idea of the Oak Ridges Moraine effect.
- At the base of the Oak Ridges Moraine to get a point of comparison that better reflects non-hilly areas of York Region.
- Near Lake Simcoe to monitor lake effect snow.

The RWIS system also accesses data from a local weather network, to provide real-time weather data for the puck location. Using this data, the pucks are able to produce 'do-nothing' scenarios which advise municipal staff of likely road conditions if they do not act. This function allows staff to better understand weather-related threats with regard to the current state of the roads. This real-time information enables York Region to monitor risky situations and to adapt its road care strategy easily in the face of new weather challenges.

York Region is currently in the process of obtaining approval to acquire additional RWIS pucks to be introduced in areas where the Region is concerned about ground water quality.

[1] The A1B scenario assume rapid population growth and reliance on a variety of energy sources thus producing a medium level of greenhouse gas emissions.

Pre-treated roadway

This effort will help the Region monitor salt use in these areas and prevent contamination of water supplies.

Geographic Positioning Systems (GPS)

Finally, to ensure that the real-time data informs an efficient response to climate conditions, the Region has linked the RWIS technology directly to patrol vehicles in each of the four districts. In addition to facilitating a real-time location monitoring and application rates of salt, this linkage speeds the Region's response in the face of a looming weather event.

These new technologies and tools have contributed to York Region's ability to address weather variability and improve safety on winter roads. To maintain this level of safety, the Region has begun using pre-wetting techniques[2] and has outfitted all snowplows with GPS.

PARTNERS York Region has relied on key partnerships to identify and implement this new technology because of the heavy research and development associated with this process. The Ontario Road Salt Management Group (ORSMG) housed within the Ontario Good Roads Association has been integral in identifying new technologies and opportunities. The use of pre-treated rock salt was the result of findings presented to this group by a local manufacturer. Additionally, the ORSMG offers members the opportunity to pool money to finance the testing of new technology that may prove beneficial for all.

The Ontario Ministry of Transportation (MTO) piloted and recommended the RWIS technology. Relying on findings from European studies, where the system has been used for over 20 years, the MTO adopted the system and released the findings of their studies to the ORSMG. Additionally, the MTO has vetted the use of pre-treated rock salt and a number of other tools and technologies.

Finally, through a competitive bidding process, the Region maintains an ongoing partnership with weather forecasting providers to access local, up-to-date weather which informs their road maintenance response.

FINANCING Each of the new tools and technologies are funded by the Roads Branch housed within York Regions Transportation and Community Planning Department. In cases where new technology or tools are under consideration, a business case is developed by staff and approved by Council. The funding for the new tools is then incorporated into the Roads Branch annual budget.

The tools and technologies highlighted in this case study represent a significant investment by the Region to ensure safer

[2] Pre-wetting refers to the practice of spraying roadways with a brine solution before a weather event to prevent ice formation during and after the event.

York Region Vehicle GPS and RWIS

winter transportation. As discussed, the addition of the beet juice solution to the rock salt has increased the cost of use by about 2%. However, this increase is more than offset by the 10% reduction in salt that it creates. The RWIS pucks cost between $50,000 -$80,000 to install depending on the location and potential connectivity of the site. In addition to this cost, York Region incurs an ongoing monthly fee to retain a weather provider. Finally, the Region must pay between $20-$40/month/vehicle to outfit them with GPS.

CHALLENGES York Region has encountered a number of challenges in the implementation of new de-icing tools and technology. Some examples include:

Financing New technologies and tools require an initial and sometimes ongoing monetary commitment from the Region to implement and integrate them into current strategies. New equipment, staff training and ongoing monitoring must be budgeted for. While safety is a key priority, finding additional funds to commit to new, and potentially untested technologies, is an ongoing struggle for the Roads Department.

Public Perception Public opinions on winter road care and maintenance are often split between road users that are primarily concerned with safety and those that demand environmentally sustainable practices. York Region has worked to find win-win situations that simultaneously reduce environmental impact and improve safety.

Research and Development Like many municipalities with limited resources, York has relied on partners like MTO and the ORSMG to conduct the research and development needed to vet new technologies. Recently, MTO has moved away from this role. This change puts more responsibility on the Region to conduct research before implementing new technologies. Moving forward, this will prove to be a challenge for York as they continue to evolve and adapt to climate change with the use of new tools and technology.

LESSONS LEARNED *York Region has learned several key lessons throughout the process of implementing new road maintenance tools and technologies including:*

- **Identifying and implementing new tools and technologies can help municipalities to protect their residents and businesses from weather related damage.**
- **Partnerships between municipalities can provide the opportunity to share research and development costs.** These partnerships will allow cost effective uptake of new technologies in a responsible way.
- **Communication to public and staff is important when showcasing new technology** as it can help to explain why the change is occurring and provides a forum for feedback if needed.

IMAGES

All images courtesy of York Region

FURTHER INFORMATION

Environment Canada. National Climate Data and Information Archive.

York Region. 2004. Salt Management Plan.

York Region. 2012. Chapter 5 – An Urbanizing Region: Building Cities and Complete Communities.

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