

Snow and Ice Control - Pilot Results

Recommendation

That Administration prepare amendments to the Snow and Ice Control Policy to prioritize bare pavement, using a full variety of control methods, as outlined in Attachment 1 of the September 4, 2019, City Operations report CR_6852, and return to City Council.

Executive Summary

Achieving a safe and reliable transportation network is the goal of the City of Edmonton's Snow and Ice Control Policy (C409J). Administration uses a number of control measures to achieve this goal, including anti-icing, de-icing, sanding as well as mechanical means depending on what tool is most effective based on road and weather conditions.

This report is a follow-up to previous information provided to Council about Edmonton's Snow and Ice Control pilot, which was initiated to achieve safer, bare pavement conditions, in alignment with Vision Zero's goals. This report includes a summary of results from laboratory and field testing on the effects of salt and brine on safety, infrastructure and the environment.

Studies commissioned by Administration in 2018-2019 found that salt and brine impacts on asphalt and concrete are minimal. These tools can have a corrosive effect on some types of metal, however effects are highly dependent on the product concentration levels, active inhibitors and amount of exposure. Corrosion can be significantly reduced with inhibitors in the products, washing, paint or other coatings for metal. Salinity levels in soil next to roadways was found to be high both for the sites treated with the traditional salt/sand mix and those treated with brine.

Administration is recommending continued, balanced use of all snow and ice tools depending on conditions for the safety and accessibility of all users. This recommendation is based on a data-driven approach that shows the pilot is demonstrably improving safety. Vehicle collision severity and frequency has notably decreased in pilot corridors when bare pavement was achieved.

Pending direction from Committee, Administration will prepare updates to the Snow and Ice Control Policy for Council's consideration and create procedures to provide more clarity on terminology, priority levels and operational practices. Ultimately Council's decision on the revised Snow and Ice Policy will guide Administration's plans for

monitoring, preventative maintenance and changes to design standards to minimize any potential impacts to infrastructure.

Report

Background

The City of Edmonton's Snow and Ice Control (SNIC) program strives to provide a safe and reliable transportation network for all users throughout the winter season. With a changing climate and winter conditions, Administration requires a variety of tools to address snow and ice and to deliver on Vision Zero's long-term goals of zero traffic fatalities and serious injuries.

To take action on audit recommendations, Administration discontinued the Winter Street Sand Recycling program in 2016. In 2017, Council directed investigation of SNIC options other than sand, including anti-icing agents, to achieve safe conditions and increased mobility. At the same time, Administration conducted extensive public engagement on existing SNIC practices and identified potential service improvements. Based on public input, direction from the audit and a scan of industry best practices, Administration identified bare pavement as the highest standard to promote safety and accessibility for all users of the transportation network.

To deliver on this standard, Administration initiated pilot testing of anti-icing brine prior to snowfall on select arterial and collector roads, sidewalks around seniors' centres, bike lanes, bus stops and multi-use trails. Preliminary results of the pilot shared in the July 4, 2018 report, CR_5033 Alternative Practices to Address Snow and Ice Control, showed improved traction and accessibility of the mobility network through bare pavement, reduced operational costs and significantly reduced sand application.

To further evaluate the effects of using brine, Administration undertook a wide range of research and monitoring studies in 2018-2019. On June 26, 2019, report CR_6851 Snow and Ice Control - Pilot Update presented findings from literature reviews and jurisdictional scans about the benefits, trade-offs and effectiveness of different winter maintenance practices. The report also highlighted findings from public and stakeholder engagement conducted in 2018-2019.

Data-Driven Decision Making

Throughout the 2018-2019 winter season the focus of the SNIC program was to achieve bare pavement by using the right tool for the right conditions. This included a variety of methods such as anti-icing, de-icing, sanding as well as mechanical means such as plowing to make the transportation network safer. Conditions allowed for anti-icing use two times in the 2018-2019 season.

To assess the benefits and trade-offs of each tool and facilitate data-driven decision making, Administration conducted a variety of comprehensive research and monitoring studies. For ease of reference and transparency, Administration has provided a short summary of each study which is included in Attachment 2. The full comprehensive reports for each research area are available on the City website and can be found at edmonton.ca/snowandicepilot.

These included:

- *Collisions Study Results*
Administration investigated the safety effects of achieving bare pavement through the pilot by comparing the number and nature of collisions on pilot routes before (2012 to 2017) and after the pilot was implemented (2017 to 2019). Results showed that reaching bare pavement on these routes reduced all collision types (i.e. injury and property damage collisions) on mid blocks (i.e. on roads between intersections) in the range of 13.7 to 19.7 percent, and reduced injury collisions at intersections by 12.5 percent. This reduction in collisions has significant societal safety benefits.
- *Concrete Study Results*
Administration commissioned a laboratory and field research program to assess the impact of salt and brine on concrete infrastructure. The field investigations on roadway concrete demonstrated little to no sign of actual or potential damage caused by freeze/thaw distress exacerbated by anti-icing and de-icing agents. Some areas showed physical damage by snow removal equipment. Findings from residential concrete test sections also showed similar results.
- *Asphalt Study Results*
The results of the asphalt investigation did not indicate that anti-icing or de-icing agents had any impact on durability or the potential for rutting from vehicle wheels. Long-term exposure may result in some decrease in asphalt strength but it was deemed not significant enough to have a negative impact on performance. Exposure to liquid increased asphalt stiffness (which can lead to deterioration), but the effects were similar regardless of anti-icing, de-icing or water exposure. There were no discernible differences in the test roadway maintenance conditions or performance due to application of anti-icing or de-icing chemicals.
- *Metal Corrosion Study Results*
Administration commissioned a study on the corrosion conditions and effects of chlorides on various metals, as well as what mitigation strategies work best. The laboratory program exposed four different metals to ten different solutions. The long-term lab test using repeated exposure produced complex and variable results. Different solutions and concentrations produced more or less corrosion depending on the type of metal. Overall, dilute chloride-based solutions were

more corrosive than concentrated brines, however the addition of an inhibitor significantly reduced corrosivity in the diluted solutions. These findings help Administration determine the right concentration levels and dilution rates for using chlorides in the field so that any potential corrosion effects can be minimized.

The field program was inconclusive due to the limited use of anti-icing last season and insufficient field duration to generate measurable impacts. The limited findings however are consistent with research in other jurisdictions.

For both the laboratory and field conditions, impacts were highly dependent on the amount of exposure to corrosive environments. The report also noted that protection of exposed metal from moisture and chlorides, such as paint, coatings and washing, is important in limiting corrosion.

- *Soil Study Results*

Administration commissioned a study evaluating soil salinity at various depths and distances along roadways that were treated with salt and brine. The City chose 12 sites and the Urban Development Institute (UDI) chose an additional six sites. The report assessed the soil as per provincial standards. Salinity levels were high for all 12 City sites, but the report found higher salinity (“unsuitable” rating) for the soil next to roadways treated with the traditional salt/sand mix and relatively lower salinity (“poor” rating) for the sites treated additionally with the anti-icing brine. Soil salinity is generally higher in winter cities along roads that are treated for snow and ice, so landscape design standards and effective operating standards for “on-street” snow storage must consider those conditions. For all six UDI suggested sites, the soil salinity rating was found to be “good” regardless of the material used on the adjacent roads. These findings are likely due to samples being collected when the ground was starting to freeze. All of the samples taken were on City-owned right of way.

A separate report initially commissioned using the same data did not meet provincial regulatory standards and established best practices for soil salt assessment in an urban setting. It is also available on the website.

- *Comparison of SNIC Material Usage by the Province and Other Municipalities*

A review of similar jurisdictions found that most municipalities use some form of liquid brine and varying combinations of sand and salt for their winter maintenance practices. Detailed results from the jurisdictional scan were shared in June in CR_6851, Snow and Ice Control - Pilot Update. Further information about the application rates and material quantities of these municipalities and Alberta Transportation is summarized in Attachment 3.

Advantages of Diverse Tools

The results from different research and monitoring studies shared in this report and in June (CR_6851) indicate that every SNIC tool has benefits and trade-offs. The key consideration is to use the right tool for the right condition to achieve the safest possible condition for all transportation network users, while minimizing potential impacts of that tool. There are many advantages of using diverse winter maintenance methods:

- Using SNIC tools in varying combinations based on weather helps achieve safer, bare pavement conditions
- Impacts of climate change require a winter maintenance approach that can adapt to conditions more frequently and quickly
- Improved service levels for residents and businesses by allowing faster and more efficient snow and ice clearing
- Improved operational efficiency by using the most appropriate amount of material, labour and equipment based on the conditions
- Less reliance on any single tool reduces negative impacts from excessive use of just one (e.g., transport, clean up and other impacts of increased sand use)
- Allows Administration to continuously look for innovative products that might be more efficient or have fewer trade-offs

Implications of Limited Tools

In years prior to the SNIC pilot, Administration primarily used sand mixed with three percent salt, pre-wetted with liquid brine (calcium chloride), on roadways for winter maintenance. Plows physically cleared snow. Sand was used as a traction agent on snow pack conditions prior to plowing. Salt was used to prevent the sand from freezing and brine was used to ensure the sand adhered to the roads. Administration used all these tools during the SNIC pilot as well, however, their purpose and quantities were adjusted to better suit the conditions and facilitate bare pavement. Limiting options for winter maintenance would have significant implications, including:

- Safety of the transportation network could decrease as achieving bare pavement would be difficult, requiring more resources with limited tools
- Service standards would decline given limitations of fewer SNIC tools
- Significantly increased sand use, which has a large environmental footprint and safety and health concerns
- Restricted ability to adapt to more freeze-thaw cycles and freezing rain expected with climate change

Impacts to Infrastructure

Impacts to infrastructure from winter maintenance tools are dependent on several factors including weather conditions and material usage. With a changing climate, material usage fluctuates every winter, so impacts to infrastructure also vary. Although

impacts may be limited in the short-term, it is difficult to estimate the long-term impacts of using chlorides based on monitoring from one season.

Ongoing monitoring and preventative maintenance is important to minimize potential impacts from any tool. Administration monitors all of its assets for changing conditions as part of routine maintenance, trying to identify any patterns over the long term within historical data. Administration is planning to work with stakeholders to consider operational and design changes for hard and soft infrastructure, and establish chloride-specific monitoring processes for bridges, turf, trees and low-impact development sites.

Recommendation

Bare pavement is the safest condition for vehicle users and pedestrians, and was adopted as the standard of performance in the SNIC policy in October 2018 (CR_6320) in support of Vision Zero goals. Bare pavement requires the use of a variety of control methods and the results from the SNIC pilot showed that bare pavement can be achieved faster and more efficiently with the right tool. The results indicating fewer collisions show that the pilot has had positive impacts on traffic safety. The other research indicates varied effects to infrastructure, confirming that ongoing monitoring, mitigation efforts and preventative maintenance is necessary.

Based on the established bare pavement standard for safety, the monitoring study results and assessment of all the benefits and trade-offs, Administration proposes development of SNIC policy changes and procedures to allow the use of all winter maintenance methods as outlined in Attachment 1. Administration is recommending this policy decision to use all the SNIC tools, even with the potential impacts to infrastructure, due to the societal benefits of improved public safety. The goal of SNIC should be to provide a safe transportation network for all users by using the right tool for the right condition through proper application to minimize potential impacts.

Next Steps

Pending Committee's decision and the feedback received from different stakeholders, Administration will undertake the following next steps as part of the SNIC program:

- *SNIC Policy and Procedures Update*
Feedback received from the public and the Accessibility Advisory Committee showed a need to prepare adjustments to the SNIC Policy and create procedures to provide more clarity on terminology, priority levels and operational practices, especially for active pathways. Administration will also make operational adjustments on the tools and will prepare updates to the SNIC Policy in fall 2019 and return for Council approval.

- *Ongoing Monitoring and Preventative Maintenance*
Council's decision will also guide Administration's future plans for monitoring and preventative maintenance. Administration will work with different stakeholders to implement operational and design changes to minimize the impacts of winter maintenance tools on infrastructure and the landscape.
- *Residential Trials*
Administration is exploring different practices based on public input about residential winter maintenance and plans to trial two different strategies. One will be minimizing windrows through enhanced levels of service to allow more accessibility. The second will be an odd/even parking ban during residential blading cycles so that snow can be cleared from curb to curb, providing wider driving lanes. Administration will conduct further engagement with potential neighbourhoods before beginning these trials.
- *Snow and Ice Control on Walkways*
Attendees provided various ideas for better winter maintenance on walkways during the Winter Walkways Symposium. Based on the feedback, Administration will redefine and restructure active pathways in the SNIC policy to include everything other than roadways (i.e., sidewalks, bike lanes, multi-use trails, shared-use paths, bus stops, transit facilities and stairs). This will help improve service levels and identify separate priority levels for all walkways.

The Seniors Home Supports and the Community League Snow and Ice grants are current City-led programs that help organizations provide walkway clearing to those who need assistance. Administration is also developing a grant program for individuals with disabilities in collaboration with the Accessibility Advisory Committee.

Budget Implications

Amending the Snow and Ice Control Policy and developing associated procedures is not anticipated to have a financial impact at this time as minor program changes can be made within the existing budget. Given the high variability of weather and snow and ice control demand, Administration is able to operate within existing constraints for efficient and effective service delivery.

Budget requirements for potential residential service level changes, walkway grants, ongoing monitoring or preventative maintenance, noted above, will be presented for Council's consideration as needed.

Public Engagement

Administration has conducted public engagement since the pilot was initiated and has also gathered feedback from the industry stakeholders. The results from different engagement initiatives are included in previous reports, including Summary of Potential Service Improvements to Snow and Ice Control Policy C409I (CR_3805), Alternative Practices to Address Snow and Ice Control (both CR_5033 and CR_6320) and Snow and Ice Control - Pilot Update (CR_6851). The engagement shaped upcoming changes to walkways and residential service levels as outlined in 'Next Steps.'

Corporate Outcomes and Performance Management

Corporate Outcome: Edmonton is a safe city.			
Outcome(s)	Measure(s)	Result(s)	Target(s)
The City promotes improved mobility and traffic safety through the Snow and Ice Control pilot.	Reduction in collisions (between October to March) during pilot years on applicable routes compared to previous years.	13.7 - 19.7 % (midblock collision reductions, pre-2017 to 2019) 12.5% (Injury collisions for intersections only, pre-2017 to 2019))	TBD
Corporate Outcome: Effective and efficient service delivery.			
The City promotes increased accessibility by adhering to established directives, policies and guidelines (Snow and Ice Control Policy C409J).	Average time from the end of a snowfall to when priority 1 arterials and freeways are cleared to bare pavement.	12-24 hours (2018-2019)	36 hours (annual target)
	Average time from the end of a snowfall to when priority 1 bus stops adjacent to City property are cleared to bare pavement.	48 - 72 hours (2018-2019)	48 hours (annual target)
	Average time from the end of a snowfall to when priority 1 sidewalks, trails and bike routes are cleared to bare pavement.	24 hours (2018-2019)	24 hours (annual target)

Risk Assessment

Risks if recommendation is approved						
Risk Element	Risk Description	Likelihood	Impact	Risk Score (with current mitigations)	Current Mitigations	Potential Future Mitigations
Public Perception	Negative public feedback due to concerns about impacts to infrastructure	4 - likely	2 - moderate	8 - medium	Communication and public information through web and other channels	Larger education campaign on benefits and trade-offs of all tools

Environmental	Long-term impacts to environment if tools are used in large quantities	2 - unlikely	2 - moderate	4 - low	Decision matrix to ensure the right tool is used in the right conditions and in as low quantities as possible	Ongoing monitoring for material usage and potential impacts, and continuous calibration of equipment
Risks if recommendation is not approved						
Customer/ Citizens	Reduced service standards with limited tools	4 - likely	3 - major	12 - medium	Change the service level set in the SNIC policy to guide citizen expectations	Increased budget for staff and equipment to meet desired service levels
Public Safety	Less safe road conditions without bare pavement standard	4 - likely	3 - major	12 - medium	Use whatever tools are available in quantities that are necessary to achieve safe roads	Education campaigns or road design changes to influence driver behaviour

Attachments

1. Recommended Use of Winter Maintenance Tools
2. Summary of SNIC Pilot Research and Monitoring Studies
3. Review of SNIC Material Usage by Province and Other Municipalities

Others Reviewing this Report

- A. Laughlin, Acting Deputy City Manager, Financial and Corporate Services
- C. Owen, Deputy City Manager, Communications and Engagement
- J. Meliefste, Acting Deputy City Manager, Integrated Infrastructure Services
- K. Armstrong, Deputy City Manager, Employee Services
- R. Smyth, Deputy City Manager, Citizen Services
- S. McCabe, Deputy City Manager, Urban Form and Corporate Strategic Development
- B. Andriachuk, City Solicitor