

# Alternative Practices to Address Snow and Ice Control

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**Recommendation:**

That the July 4, 2018 City Operations report CR\_5033, be received for information.

**Previous Council/Committee Action**

At the July 6, 2017, Community and Public Services Committee meeting, the following motion was passed.

That Administration investigate alternative practices to addressing snow and ice control. The approaches should include:

1. Use of anti-icing agents.
2. Use of mechanical means to remove as much snow as possible.
3. Application of the most appropriate product (salt, sand, chloride) in the least amount possible to achieve the safest conditions and best levels of mobility and return to Committee in summer 2018 with the results including river quality monitoring data and possible policy amendments if applicable.

Related information report to be presented to Community and Public Services Committee:

- CR\_4147 - Options to Manage the Used Winter Street Sand.

**Executive Summary**

The City of Edmonton's Snow and Ice Control Policy (C409I) outlines Administration's operational practices to provide safe and reliable transportation networks for all users throughout winter. The policy requires review and updates regularly to ensure it provides the right level of service based on changing weather patterns and advancements in snow removal technologies.

After extensive engagement in 2016 to determine public opinion on snow removal practices, Administration returned to City Council in July 2017 with a summary of potential service improvements (CR\_3805). The improvements included four proposed service levels to achieve safe conditions and best levels of mobility. Administration piloted the new practices for the 2017-2018 winter season.

Overall, the pilot was considered to be a positive step toward improving the safety and accessibility of the mobility network during the winter. By increasing the tools to manage snow and ice control (SNIC) proactively, the overall cost of the SNIC program reduced by \$4.3 million, and sand application decreased by 68 percent.

This report provides the results of the SNIC pilot for winter 2017-2018, and outlines policy amendments and next steps.

### **Report**

#### **Background**

Edmonton has had a Snow and Ice Control Policy in place since 1978. The policy has been updated a number of times to reflect changing practices, technologies, fluctuating weather patterns and service level changes in conjunction with citizen feedback.

In 2016, Administration conducted extensive public engagement to gauge opinion on current snow removal practices. This feedback, along with an analysis of industry best practices and a jurisdictional scan (see Attachment 1), informed Administration's vision, which was presented to City Council in July, 2017 (CR\_3805). The vision focuses on delivering a service that responds to core transportation needs, improves safety and encourages active modes of transportation year-round (walking, cycling and public transit).

The report focused on safety and aligned with the long-term goals of zero fatalities and serious injuries, as outlined in Vision Zero. Increasing safety and mobility are the primary proposed service measures. The recommended policy changes are guided not only by environment and infrastructure impacts, but also financial costs and feedback collected from diverse user groups.

During the winter of 2016-2017, Administration piloted an anti-icing (calcium chloride) product in three areas: Yellowhead Trail, St. Albert Trail from 156 Street to the Yellowhead, and Calgary Trail and Gateway Boulevard from 19 Avenue to Whitemud Drive. Initial results suggested the City may be able to reduce the amount of street sand and improve plowing efficiency to provide a safer driving surface. Based on these results, at the July 6, 2017 Community and Public Services Committee, Administration was directed to expand its pilot.

#### **Piloted Service Level Changes**

During the 2017-2018 winter season, Administration conducted an anti-icing pilot on a variety of the City's transportation networks including:

- 2,839 km of roadway (75 percent were arterial roads);
- 13 km of protected on-street bike lanes;
- 8 km of shared-use paths in four city parks;

- 167 bus stops; and
- sidewalks at Northgate and Central Lions Senior Centres.

The pilot assessed the following opportunities for potential inclusion in an update to the policy:

1. Maintain arterials and freeways to bare pavement within 12 hours from end of snowfall (no residual snow or ice on road surface).
2. Maintain bus stops adjacent to City property to a bare pavement within 24 hours from end of snowfall.
3. Maintain prioritized sidewalks, trails and bike routes to bare pavement within 24 hours from end of snowfall.
4. Apply anti-icers and/or plow residential neighbourhoods so that limited residual snow remains on roadways.

### Learnings: Calcium Chloride Application

Administration learned that calcium chloride as an anti-icing agent is best used under the following conditions:

- Between -7° and -20° Celsius
- Humidity less than 70-80 percent
- Dew point is not close to the pavement temperature
- No freezing rain forecasted, as it dilutes the material's concentration and reduces effectiveness
- No blowing snow forecasted, as calcium chloride makes roads wet, and blowing snow will stick to them
- Application rates of anti-icers and de-icers should be based on pavement temperature as opposed to air temperature

### Learnings: Overall Pilot

The pilot demonstrated advantages and challenges to changing the City's SNIC practices.

Advantages:

- Additional plowing, anti-icing and de-icing reduced the cost of the SNIC program by approximately \$4.3 million, a seven percent savings compared with the five-year average from 2013 to 2017 of \$62.2 million (the number of snowfall days and the total snowfall amount in 2017-2018 was comparable to the five-year average). See Attachment 2 for a financial summary of the 2017-2018 snow and ice control program.
- 68 percent less sand was used because of the pilot anti-icing applications, resulting in less sand to sweep, transport and find uses for (see Attachment 3). By extension, there was also less sand obstructing and settling into catch

basins and carried into associated waterways.

- Administration completed the spring sweep six days faster than the five-year historical average.
- Associated equipment maintenance cost were reduced due to lower sand volumes.
- Improved safety for workers and pedestrians from reduced exposure to silica as a result of using significantly less sand.
- Traffic mobility improved in the pilot areas, as Administration was able to achieve bare pavement conditions within 48 hours of the snow event. Given the short length of the pilot, there was not enough data to draw a correlation between the work of the pilot and traffic safety or improved road friction. Research provided from the Salt Institute conducted by the University of Waterloo, took an in-depth analysis of calcium chloride application and plowing which demonstrated a 30-66 percent decrease in collisions (see Attachment 4).

### Challenges:

- Salt usage increased to get to bare pavement because current equipment and application methods are not designed to minimize application rates.
- Pre-wetting dry salt with calcium chloride will reduce the amount used by 30-50 percent.
- Engineering Services researched the effects of salt and calcium chloride on concrete and asphalt.
  - The study showed that the calcium chloride and sodium chloride creates moisture, increasing the number of freeze-thaw cycles. There is a higher risk of damage to improperly cured concrete during freeze-thaw cycles. There are similar risks as snow or ice melts under natural conditions.
  - For optimal anti-icing performance, roads should be plowed every two to four hours during a snow event. Administration is evaluating contracting and staffing requirements during these timeframes.
- The methods of snow and ice removal have not changed significantly over the last 25 years. As a result, Administration will invest in training and change management for City staff as well as citizen-focused campaigns to increase awareness and understanding.

### Pilot Results

Attachment 5 outlines each of the proposed changes; the current practice; addresses whether the service outcomes met the goal; identifies the challenges and/or actions required to meet the goal; and proposes potential policy amendments.

Administration evaluated success according to four criteria: safety, environmental impact, financial costs, and feedback from diverse groups.

Administration recommends the collection of additional data to evaluate how the increased chloride usage and reduced sand usage may influence the local ecosystem. The City will continue to monitor the five snow storage sites for melt in addition to working with EPCOR to monitor several storm water outfalls. The findings will be available in October 2018. So far, the chloride concentration at the snow site outfall exceeds the standard, which is common at the beginning of the melting season.

Overall, the pilot was considered to be a positive step forward in improving the safety and accessibility of the mobility network during the winter. By increasing the tools to manage SNIC proactively, the overall cost of the program reduced by \$4.3 million and decreased sand application by 68 percent. By refining the SNIC program and adding anti-icing and de-icing as part of the toolkit, Administration is continually improving the program to meet the goals and objectives of the revised SNIC policy.

### **Budget Implications**

Additional capital is required to upgrade equipment to meet the proposed SNIC policy amendments, and a corresponding service package will be proposed as part of the 2019-2022 capital and operating budget.

### **Public Engagement**

Administration contracted Leger Market Research to better understand the perceived effectiveness of implementing alternative practices to address snow and ice control. The initial study included two methods: a survey with 1,054 Edmontonians using Leger's online panel, and five focus groups with four types of road users and one stakeholder group.

#### Summary of Engagement Findings

Edmontonians were categorized into the following groups: drivers, cyclists, pedestrians/dog owners and professional drivers.

Key measurements focused on:

- Awareness (whether citizens noticed the pilot, aided and/or unaided)
- Attitude (whether citizens like the pilot)
- Support (whether citizens support the change, after detailed benefits are provided)

Based on the initial study, the findings were as followed:

- 67 percent of Edmontonians who responded to the survey knew the City was using anti-icer this past winter.
- Before they knew detailed benefits and downsides, 37 percent of Edmontonians who responded to the survey had a positive opinion about the anti-icing pilot, 38

percent had a neutral opinion, and 15 percent had a negative opinion.

- After they knew detailed benefits and downsides, 47 percent of Edmontonians who responded to the survey had a positive opinion about the anti-icing pilot, 34 percent had a neutral opinion, and nine percent had a negative opinion.
- After they knew detailed benefits and downsides, 74 percent of Edmontonians who responded to the survey felt the anti-icing pilot should continue, and 71 percent felt it should be expanded (see Attachment 6 for the full survey).

In addition to the initial Leger study, an online survey asked the same questions to the Edmonton Insight Community, an open link online survey with the general public, an online survey with interested City of Edmonton employees, and a number of focus group discussions with Parks and Roads Services Branch staff; Edmonton Transit Service and Edmonton emergency response staff are currently ongoing.

Additional engagement data from these surveys will be ready by the end of July. Administration will share this data with Council once it is available.

### Next Steps

Preliminary pilot data supports the proposed changes to address snow and ice control in Edmonton. Administration recommends taking the following action:

- Pursue a request for proposal for snow clearing on high speed arterials.
- Purchase specialized anti-icing equipment to optimize anti-icing and de-icing operations.
- Align shift scheduling to improve operational efficiency.
- Continue piloting proposed service level changes for the 2018-2019 winter season, and continue to collect data that will inform changes to the SNIC Policy and service levels.
- Validate whether the 12-hour target to bare pavement on arterials and freeways can be met and at what cost. Determine the optimal target based on costs and time to bare pavement.
- Update the SNIC Policy to:
  - remove recycled sand from the policy;
  - include use of anti-icing and de-icing agents;
  - reclassify the roadway priority hierarchy to include the entire mobility network;
  - update operational guidelines for when and where plowing and sanding occurs; and
  - update policy language to include entire mobility network.
- Update Bylaw 5590 for SNIC and spring sweep.
- Begin to evaluate use of anti-icers and/or residential plowing to a standard where limited residual snow remains on roadways.

In assessing the pilot results, Administration will develop, implement and track the following performance management system. The measures will include:

- volume of street sand used per event;
- volume of calcium chloride (wet) and sodium chloride (dry) used per event;
- number of snow events per year (major and minor);
- total SNIC program costs per event by snow control method (anti-icing, de-icing, plowing and sanding);
- volume of snow hauled to snow storage facilities per event and by whom;
- cost of snow hauling per tonne per event; and
- time to bare pavement after end of snowfall by event and type of road.

This work will be integrated with the Enterprise Performance Management System described in the May 8, 2018 Urban Form and Corporate Strategic Development report CR\_5839rev.

### Corporate Outcomes and Performance Management

Corporate Outcome(s): Edmonton is a safe city			
Outcome(s)	Measure(s)	Result(s)	Target(s)
The City adheres to established directives, policies and guidelines, Snow and Ice Control Policy C409I	Average time from the end of a snowfall to maintain arterials and freeways to a standard of bare pavement.	48 hours (to bare pavement in 2017-2018)	12 hours  Note: Target will be analyzed in the 2018-2019 winter season to determine the optimum service level, including financial and safety impacts.
	Average time from the end of a snowfall event to clear bus stops adjacent to City property to bare pavement.	24 hours (2017-2018)	24 hours
	Average time from the end of a snowfall event to clear prioritized sidewalks, trails and bike routes to bare pavement.	24 hours (2017-2018)	24 hours

### Attachments

1. Jurisdictional Review of Residential Winter Maintenance Policies
2. Financial Summary of the 2017-2018 Snow and Ice Control Program
3. Sand Usage Summary
4. Table 6-2: Collision Rates Before and After Maintenance Operations and Percent Reduction (Fu and Usman, 2012).
5. Proposed Improvements, Outcomes and Challenges

6. Anti Icing Pilot Evaluation - Draft Report

**Others Viewing this Report**

- R. Kits / S. Padbury, Acting Deputy City Managers, Financial and Corporate Services
- M. Sturgeon, Acting Deputy City Manager, Communications and Engagement
- R. G. Klassen, Deputy City Manager, Regional and Economic Development
- A. Laughlin, Deputy City Manager, Integrated Infrastructure Services
- L. McCarthy, Deputy City Manager, Urban Form and Corporate Strategic Development
- K. Block, Acting Deputy City Manager, Citizen Services