THE CITY OF
CALGARY
ROADS

SNOW AND ICE CONTROL ANNUAL REPORT (2014 – 2015 SEASON)

2015 August

EXECUTIVE SUMMARY

The City of Calgary Transportation Department is committed to the provision of a safe, customer focused, efficient and sustainable transportation system that supports mobility choices. The Roads Business Unit is committed to a well maintained road system for all travel modes and is responsible for The City's Snow and Ice Control (SNIC) Program Plan. The Roads Maintenance Division delivers The City's SNIC Program Plan based on Council Policy TP004**.** The aim of the SNIC Policy is "... to provide reasonable winter driving conditions for vehicles/cycles that are properly equipped for winter driving; and are operated in a manner consistent with good winter driving habits."

Highlights of the 2014/2015 SNIC Program include:

- The 2014/2015 SNIC expenditures for 16,266 lane kilometres of roadway totalled $36.75 million. This is significantly less than the $51 million spent during the 2013/2014 SNIC season.
- 2015 SNIC operations are presently running a positive variance due to reduced snowfall in February, March and April of 2015.
- In the past year (August 18, 2014 to August 17, 2015) Roads received 80,465 Service Requests, of those requests 6,832 were SNIC related – about 8.5 % of the total.
- Roads met their target to plough and sand 100 per cent of the Priority 1 and 2 routes within 24/48 hours during the 2014/2015 season.
- Citizen satisfaction results indicated that 84 per cent of respondents were either "very satisfied" or "satisfied" with travel conditions due to snow and ice control services when driving or being in a vehicle on Calgary roads. This is an improvement compared to 2013/2014 survey results which indicated 81 per cent of citizens were either "very satisfied" or satisfied with travel conditions due to snow and ice control services.
- The average snow fall for the 2014/2015 SNIC season was 140 cm. The average snow fall from 2010-2015 was 145 cm. This indicates that the 2014/2015 SNIC season experienced an average snow fall amount.

Roads Maintenance was committed to mobility choices by supporting the cycling community and removing snow from the 7 Street cycle track. Innovation included both equipment utilized and materials applied to provide an improved cycling experience in all weather conditions. Maintenance also worked closely with Calgary Transit and Community and Neighbourhood services to improve mobility for citizens with challenges at 100 transit locations. This program will be expanded in the fall of 2015 to provide an increased level of service at ~350 locations.

Report Sections

The Snow and Ice Control Annual Report (2014-2015 Season) is divided into three parts:

PART I: 2014/2015 SNIC Season Summary: A detailed account of the City's experience during the winter season of 2014/2015, including performance metrics, snowfall data, budget impacts and the impact on other Business Units (BUs).

PART II: 2014/2015 SNIC Season Budget and Metrics: A review of the resources, infrastructure, budget and metrics related to SNIC in 2014/2015.

PART III: Additional Work Completed during the 2014/2015 SNIC Season: This includes items identified for review by the Roads business unit:

- Provide benchmarking on SNIC responses compared to other winter cities;
- Research an increased SNIC response for persons with mobility challenges; pedestrians and cyclists;
- Research an increased SNIC response with standby resources
- 2015-2018 SNIC enhancements

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Introduction

The annual Roads SNIC Program Plan (hereinafter referred to as the "Program Plan") provides detailed plans and strategies to meet the expectations set out in Council's Snow and Ice Control (SNIC) Policy **TP004** (hereinafter referred to as the "SNIC Policy") .The SNIC Policy and the Program Plan continue to evolve to stay ahead of changing weather patterns, funding levels, innovation, best practices and lessons learned. The SNIC Policy and Program Plan are established to address normal winter weather conditions. Trained personnel and the required resources are deployed to provide safe mobility on City infrastructures during the SNIC season. While the SNIC Policy and the Program Plan addresses "extreme winter conditions" and "snow emergencies", these sections have undergone significant change based on the weather outcome of past winters. These program changes will allow the City to respond more effectively to a winter like the one experienced in December 2013 and January of 2014.

Background

The aim of the SNIC Policy is "... to provide reasonable winter driving conditions for vehicles/cycles that are properly equipped for winter driving; and are operated in a manner consistent with good winter driving habits." Council and Administration remain committed to the delivery of excellent SNIC services within a policy framework that is efficient, effective and fiscally responsible. Extreme winter conditions and snow emergencies were evident in the 2013/2014 winter season and may likely continue in the future. Council and Administration are aware that response to extreme winter weather conditions requires a systems approach with stakeholder awareness and collective commitment to a safe and well-maintained road system for all travel modes.

7 Day Plan

The SNIC response is broken down into a 7 day plan; this plan allows Roads to quickly address the impact of any snow event on the mobility of our citizens. The plan is a systematic response that addresses high volume and high risk transportation assets first and then moves to lower volume and lower risk assets. If another snow event occurs prior to completing the plan our response resets back to day 1 and we continue with the plan to day 7.

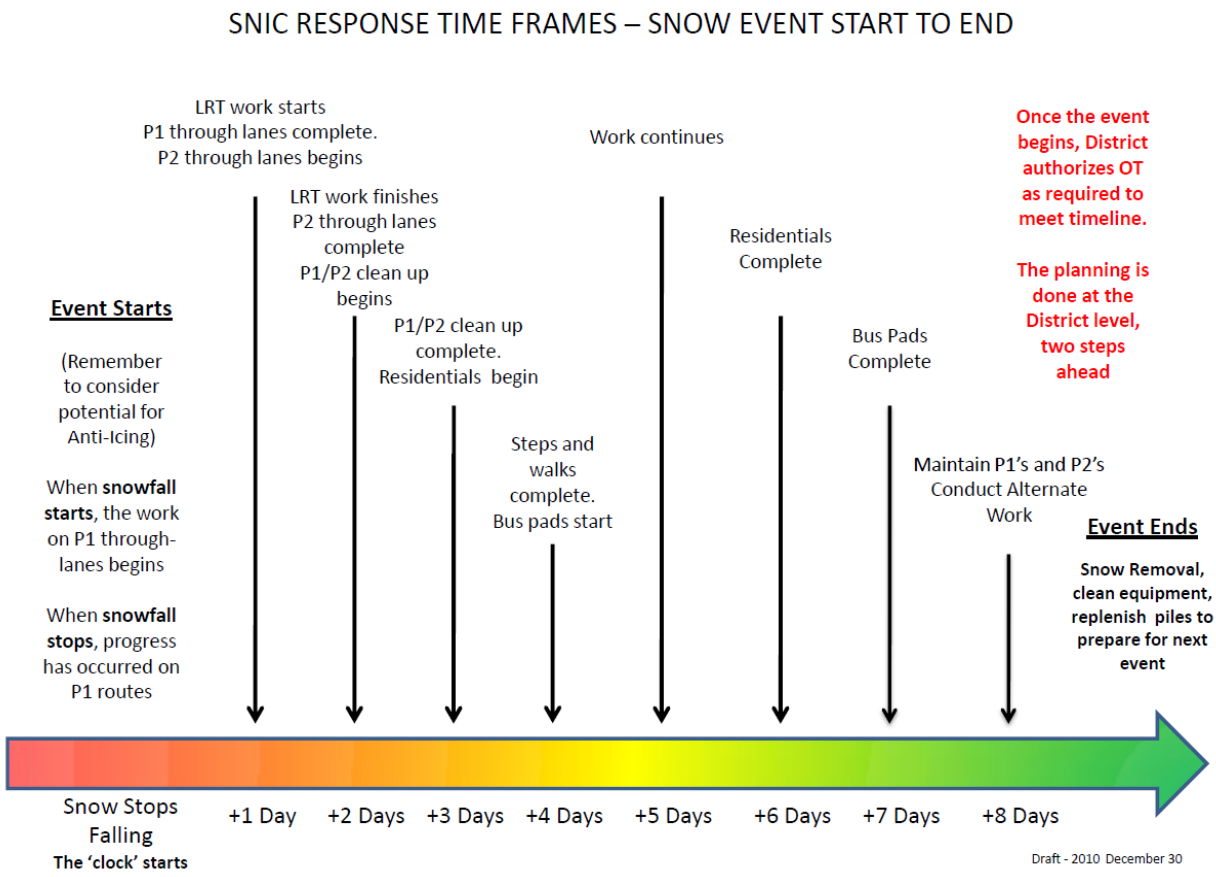


Figure 1: 7 Day Plan

During the 2014/2015 SNIC season it snowed approximately 140 cm, with 46 snow days and 30 day of trace snow. During the SNIC 2014/2015 program, the 7-day plan restarted twice.

Definitions

Extreme Winter Conditions: where the immediate demand for snow and ice control services exceeds the available resources. Normally this induces Council to declare a snow emergency and provide the Roads Maintenance Division with additional funds to increase the response using contracted services.

Ice Control: the application of abrasives and/or chemical de-icers to the surface of roads, sidewalks, steps and pathways to improve traction and to control or eliminate the formation of ice.

Passable road: a road with a total accumulation of fewer than 12 centimetres, or ruts that do not exceed 12 centimetres in depth.

SNIC: Snow and Ice Control

SNIC Season: Mid-October to Mid-April

Snow emergency: In a general sense it refers to a winter storm that overwhelms the base compliment of snow fighting equipment and personnel. Actions can include banning all traffic except emergency personnel, restrictions or prohibitions to on-street parking and closure of public buildings. A snow emergency is normally issued before the storm begins as drivers may not be able to reach their destinations after it has started.

Snow ploughing: pushing accumulated snow from the roadways surface either to the sides of the roadway or the centre of the roadway to ensure that travel lanes, turn lanes and ramps are passable to traffic.

Snow removal: the removal of ploughed and accumulated snow that is impeding the flow of traffic and pedestrians to a snow dump or nearby green space.

Windrow: a continuous pile of snow along a roadway as a result of snow ploughing by a truck or grader.

Trace Snow: The precipitation amount of less than 0.2 mm often referred to as a dusting of snow.

PART I: 2014/2015 SNIC Season Summary

Background

Planning for the 2014/2015 SNIC season continued along traditional lines and included a preparation and execution phase. Preparation focused on systems readiness (i.e. operational, personnel, material and equipment) which allowed for a smooth transition to the winter operations from the summer service delivery.

311 Service Requests

During the 2014/2015 SNIC season, Roads Maintenance received 6,832 services requests (SR's). The top three SR types were Sand and Salt requests at 3,499, Snow clearing requests at 2,033, and Sidewalk Snow Ploughing at 404.

Road's was able to adhere to its completion service level agreement of 90 per cent of all SR's. In addition, 94 per cent of all SR's were resolved at the first request, without the need to be re-opened. The average response time of a Snow and Ice Control SR open to close was four and a half days.

Table 1: Service Requests from 2010-2015

Historical 311 Data					
	2010/11	**2011/12**	**2012/13**	**2013/14**	**2014/15**
Total SNIC SRs	**12,278**	**4,086**	**8,534**	**35,871**	**6,832**

Season Comparison

This is a comparison of snow fall between 2010 and 2015.

Table 2: Season Comparison 2010-2015

	Season				
Month	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**
September				0	28.2
October	4.4	1	25.5	4.4	1.2
November	22	14.4	19.4	27.8	43.2
December	20.8	16.4	15.6	52.4*	7.5
January	29.7	6.2	24.9	23.3	34.6
February	24.2	16.8	3.4	6.4	13.7
March	24.4	18	21.6	36.2	6.2
April	58	27.1	11.8	13.6	5.4
Totals	**183.5**	**99.9**	**122.2**	**180**	**140**

See APPENDIX E: SNOW DATA, Snow Data for more information on Snow Fall numbers from 2010-2015.

Snow and Ice Control Materials

Roads Maintenance utilizes three main SNIC materials in its operations: road salt (sodium chloride), sanding chips and calcium chloride brine. Sand chips are 6 millimetre rock particles which are mixed with up to 3 per cent salt. Liquid brine helps the material stick to the road surface. Calcium chloride brine is utilized in pre-wetting whereby the liquid brine is sprayed into salt or abrasive materials such as gravel, before it is applied to the roadway.

A five season comparison of SNIC material consumption is shown in Table 3: Five Year Comparison of SNIC Material Consumption, Snow Days and Total Snowfall. This table indicates that the 2014/2015 SNIC season had a below average number of snow days at 45 days. Road salt usage during the 2014/2015 SNIC season was decreased by greater than 10,000 tonnes or approximately 15 per cent when compared to the five season average. Sanding chip consumption during the 2014/2015 SNIC season was greater than the average by approximately 7,000 tonnes or 13 per cent. Calcium chloride brine had the most significant decline in consumption at 424,000 L or 36 per cent. The reduction in calcium chloride consumption can be attributed to the loss of a calcium chloride station in the Roads Northeast District. The average District consumption of calcium chloride brine is 237,600 L. Roads Maintenance uses calcium chloride brine for its effectiveness in extremely cold temperatures, unlike regular salt brine.

Liquid brine helps the material stick to the road surface. Studies have shown that without pre-wetting, only 46 per cent of the material applied to a roadway will actually stay in the middle third of the roadway. However, if the material is pre wet, 78 per cent will stay in the middle third of the roadway. This practice increases the efficiency of the sanders, reduces costs and helps minimize our impact on the environment.

Table 3: Five Year Comparison of SNIC Materials Use, Snow Days and Total Snow Fall

SNIC Season	Road Salt/NaCl (tonnes)	Sanding Chips (tonnes)	Calcium Chloride Brine (litres)	Snow Days	Snowfall (cm)
2010/11	75,296	120,164	1,149,095	59	183
2011/12	55,815	32,729	1,031,440	45	100
2012/13	70,658	28,274	967,741	37	122
2013/14	79,252	40,927	1,793,791	60	180
2014/15	53,680	61,449	764,000	46	140
Average	**66,940**	**56,709**	**1,141,213**	**49**	**145**

Snow Storage Sites

The City retains three snow storage sites to manage snow removed from roadways. These sites are identified below in Table 4:

Table 4: Snow Storage Sites

Site	Address	Capacity (cubic metres)
Highfield	1320-50 Ave SE	672,760
Spring-Gardens	1025-32 Ave NE	494,100
Pumphouse	2140 Pumphouse Ave SW	55,805

Unlike the 2013/2014 winter season, these 3 snow storage sites had limited snow placed in them during the 2014/2015 season. Snow came mainly from snow removal activities in the downtown core in an effort to improve parking, sidewalk and bicycle lane accessibility. In the previous season, these 3 sites had exceeded their capacity by late December which necessitated the establishment of a temporary snow storage site to accommodate residential snow accumulations.

A 2012 condition assessment identified areas for improvement to the Highfield and Spring-Gardens snow storage sites up to and including full reconstruction. The condition assessment, combined with capacity issues, would lead to the recommendation of the Highfield and Spring-Gardens snow storage sites and the development of two additional locations. The new locations would replace the Pumphouse site and accommodate surplus snow during extreme winter conditions. The estimated cost to reconstruct the two old sites is $16 million dollars which includes storm water management upgrades and new pavement. The estimated cost to develop two new sites is $36 million dollars which includes land costs, design, provincial approvals and construction. This project is currently unfunded.

Budget Review 2014/2015

The graph in Figure 2 shows our base costs, budget and actual costs compared to the snow fall and snow days in a particular season. Base costs consist of labour, equipment lease and legislated equipment preventative maintenance. Budget is what was allocated for the season and actual is what was spent throughout the season. Snow fall is how many centimetres of snow fell during SNIC, and snow days explains how many day we received snow.

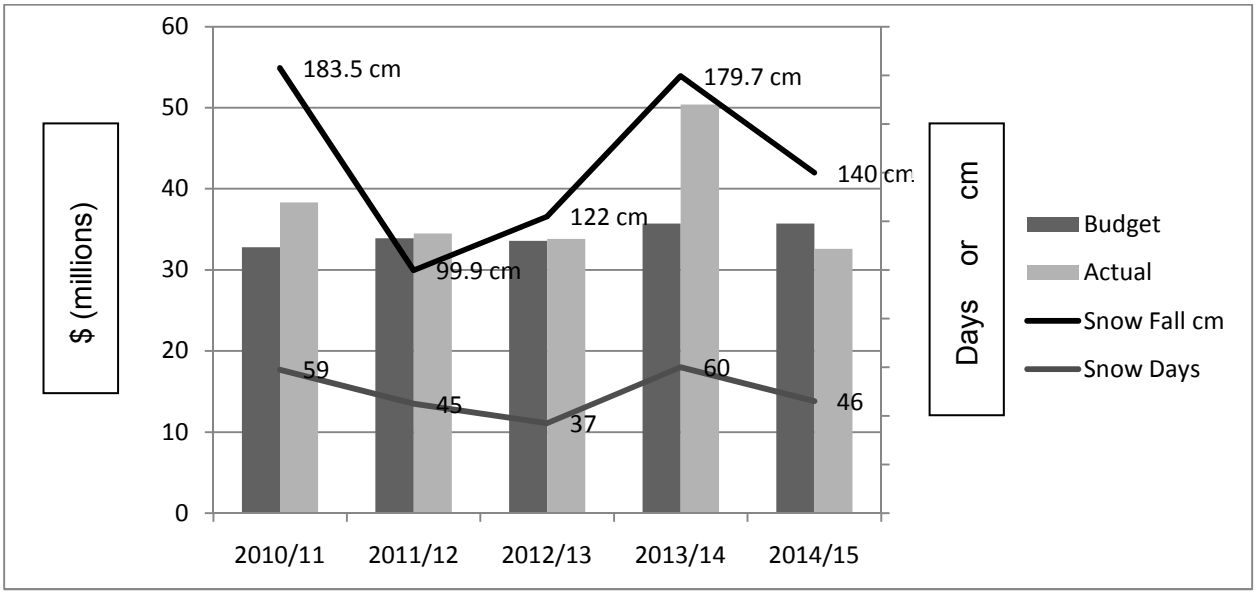


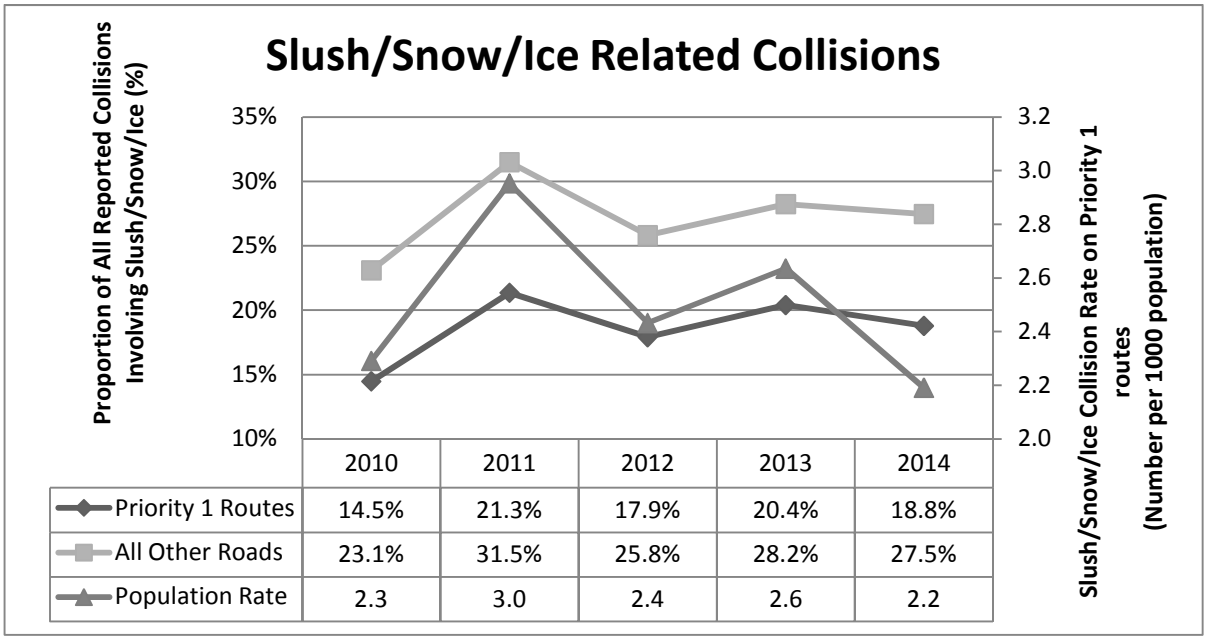
Figure 2: Expenditures and Snow Days 2010-2015

During the 2014/2015 SNIC season, 140 cm of snow was reported to have fallen in the City of Calgary with 46 snow days and 30 days of trace snow. Roads observed that the amount of snow fall in 2014/2015 was average to above average snow fall compared to the past five years. This season's temperatures were above average and as such much of the accumulated snow melted and was all but gone by mid-March.

The SNIC reserve has served its intended purpose. Roads Maintenance recommends that the reserve be replenished in the 2015 and 2016 fiscal years amounting to $5 million each year. These funds could be augmented by a positive variance from Roads, should that be possible at fiscal year end, up to the Council prescribed maximum of $15 million.

Collision Data for P1 Routes

One of the goals of SNIC activities is to provide the opportunity for safe movement of citizens. Explicit review of the relationship between SNIC activities and collisions has not been reported previously. Comparison of collisions during the latest five calendar years of complete collision data (Figure 3) shows that Priority 1 SNIC routes generally have 9 per cent fewer collisions attributed to 'Slush/Snow/Ice' road surface conditions than other routes. Furthermore, the number of 'Slush/Snow/Ice' related collisions on priority routes, per 1,000 population, has been decreasing since 2011.



	2010	2011	2012	2013	2014
Priority 1 Routes	14.5%	21.3%	17.9%	20.4%	18.8%
All Other Roads	23.1%	31.5%	25.8%	28.2%	27.5%
Population Rate	2.3	3.0	2.4	2.6	2.2

Figure 3: Snow Related Collisions

When considering the average number of 'Slush/Snow/Ice' related collisions on Priority 1 SNIC routes (Figure 4), we see that there has been a general decrease from 61 collisions per day in 2011 to 47 collisions per day in 2014. The exception to the previous statement is the average of 84 collisions per day in 2013, attributable in part to the extreme weather events of that calendar year.

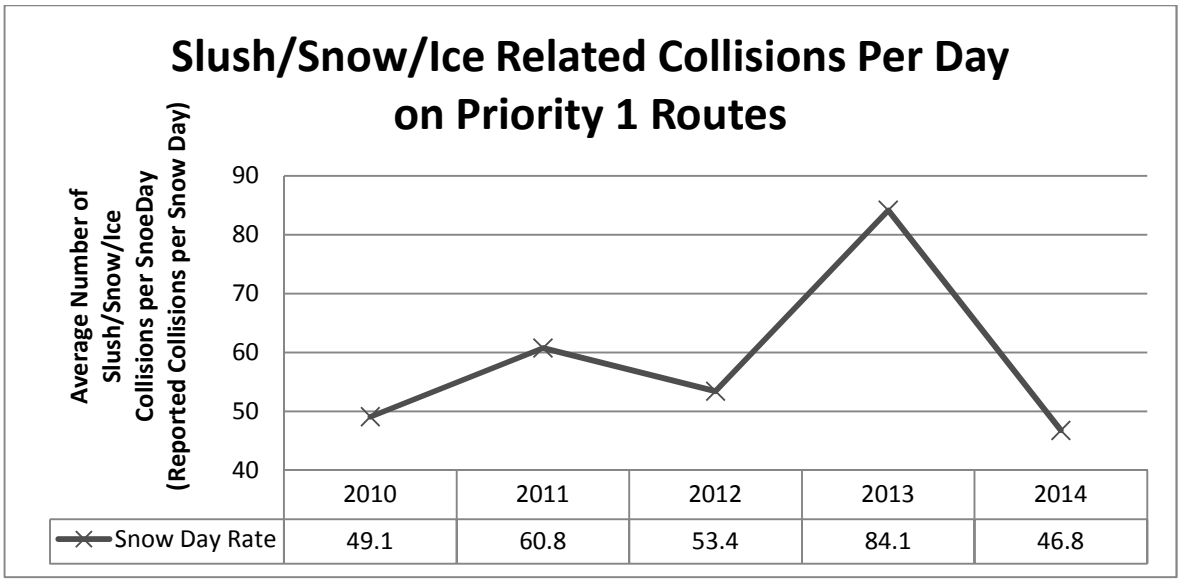


Figure 4: Snow Related Collisions on Priority 1 Routes

SNIC Policy Metrics

The Roads Maintenance SNIC program service levels are based on the Council-approved Snow and Ice Control Policy (TP004). The purpose of the policy is to:

- Maintain reasonable conditions on roadways and sidewalks so as to minimize hazards and economic loss to the community;
- Ensure safe access for emergency vehicles providing Fire, Police and Emergency Medical Services;
- Provide guidelines for management and operating personnel in the handling of winter maintenance operations; and
- Outline citizens' responsibilities regarding sidewalk snow and ice control on private property.

To align with the approved SNIC service levels (Figure 5: SNIC Service Levels) outlined in the Council Approved Snow and Ice Control Policy, Roads has identified three key performance indicators (KPI's) (Figure 6: Roads Maintenance KPI's and Performance Achieved).

Road Designation	Response Time
Priority 1 Routes	Through lanes ploughed and sanded completed within 24 hours of the end of snowfall (100% sanded/salted and 90% ploughed)
Priority 2 Routes	Through lanes ploughed and sanded completed within 48 hours of the end of snowfall (100% sanded/salted and 90% ploughed)
Priority 3 Routes	Within 4 days after Priority 2 routes complete (sanded and ploughed when temperature conditions allow)
Priority 4 Routes	Within 4 days after Priority 2 routes complete (sanded and ploughed when temperature conditions allow)

Figure 5: SNIC Service Levels

Performance Indicators	Target	2014-15 Achieved
Percent of time Roads completes SNIC on Priority 1 through lanes within 24 hours.	100% Sanded 90 % Ploughed	100% 100%
Percent of time that Roads completes SNIC on Priority 2 through lanes within 48 hours.	100% Sanded 90 % Ploughed	100% 100%
Satisfaction with road travel conditions due to Snow and Ice Control.	81%	84%*

Figure 6: Roads Maintenance KPI's and Performance Achieved

*The May 2015 Snow and Ice Control Program Citizens' Survey conducted by HarGroup Management Consultants Inc. indicated that 84 per cent of respondents were either satisfied or very satisfied with travel conditions due to snow and ice control services when driving or being in a vehicle on Calgary roads.

The first two KPI's indicate that Roads met the Council Approved Snow and Ice Control Policy.

2015 Snow Route Parking Bans

A Snow Route Parking Ban is considered when a snow accumulation of 5 centimetres or greater is forecast. Snow routes include major roadways and most bus routes. A major advisory is issued when a snow event is expected in the forecast. This advisory is meant to serve as a warning that parking bans may soon be in effect on Snow Routes. Vehicles should be moved as quickly as possible following the notice.

A parking ban is declared when crews finish ploughing priority one routes, but before they start on priority two routes. Parking bans are in effect for up to 72 hours or until the City declares that they have been lifted. The parking ban is announced on local radio and TV stations and is publicized via the web and social media. Snow clearing operations are ongoing. Vehicles that remain parked on these roads during the ban are subject to enforcement, up to and including a parking tag and tow. Business Revitalization Zone (BRZ) and the downtown core have overnight bans (9pm-6am).

Parking Ban Route Changes 2014/2015

A review of the parking ban routes was undertaken, and 70 km of Snow Routes were removed to accommodate citizens and operations. The routes that were removed were not-Calgary transit routes. The parking ban routes now total 2,050 km. Snow Route Parking bans are displayed for citizens on calgary.ca as indicated in Figure 7 below.

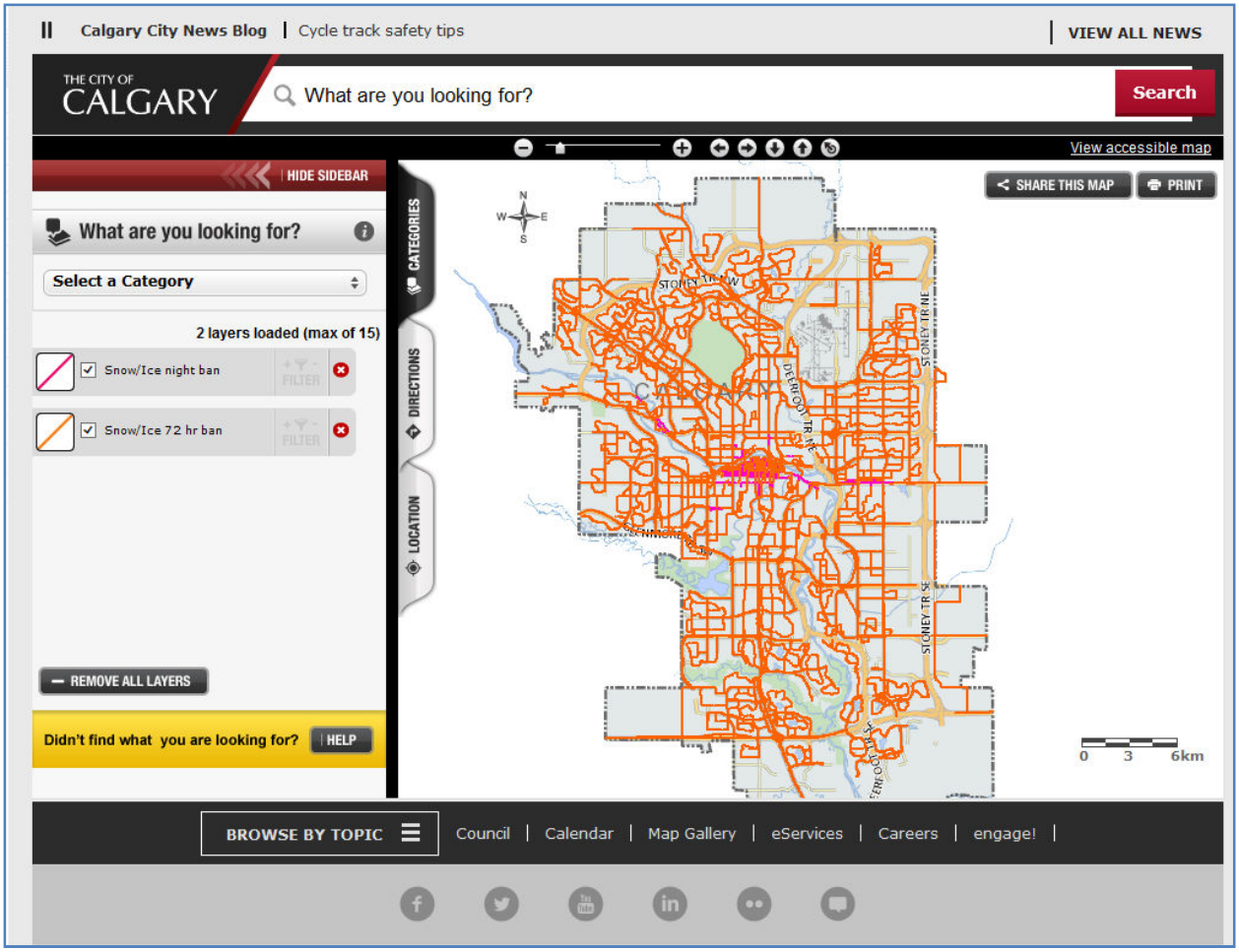


Figure 7: Parking Bans on Calgary.ca

Snow Route Parking bans 2014/2015

The City did not call any Snow Route Parking Bans in 2014/2015 SNIC season. Parking Bans were not issued because the majority of the major snow falls occurred on weekends, and crews were able to respond effectively to clear the snow before the work week began.

Roads BU Lessons Learned

A summary of the Roads BU's lesson learned can be found below and, where applicable, have been incorporated into the recommendations component of this report:

- The Roads BU requires upgrades and expansion of its snow storage capacity.
- Review staff utilization to provide a more effective and efficient operations, including coverage on statutory holidays.
- Better lead-time communication between trouble spot contractors and Roads Maintenance.
- The Roads BU requires upgrades to SNIC Material Storage facilities.

PART II: 2014/2015 SNIC Season Budget and Metrics

Background

The Roads Business Unit commits personnel, material, equipment, infrastructure, capital and operational funds to SNIC operations as follows:

- 460 personnel working rotating shifts, available 24/7 throughout the season.
- Material, including equipment consumables (i.e. plough blades), and snow remediation substances including salt, de-icing liquids, and abrasives.

The various machinery and equipment includes:

- 92 tandem trucks equipped to plough and apply materials;
- 27 graders;
- 11 snow blowers;
- 9 front end loaders; and
- A variety of smaller equipment to service bus stops, Light Rail Transit (LRT) stations, pedestrian bridges, and city owned sidewalks and pathways.

Roads Infrastructure includes 9 District depots and 3 snow storage sites as well as the following right-of-way infrastructure contained in Table 5 below. The 2014/2015 SNIC season budget supported the maintenance operations for the following right-of-way infrastructure contained in Table 5: Infrastructure Right-of-Way.

Table 5: Infrastructure Right-of-Way

Description	Lane-kms	Linear-kms	SNIC Service	Quantity
Expressways	1,603	528	Yes	-
Arterial Roadways	2,533	922	Yes	-
Collector Roadways	3,309	1,123	Yes	-
Residential Streets	8,525	3,180	Yes	-
Gravel Roadways	296	140	Yes	-
TOTAL	**16,266**	**5,893**	**-**	**-**
Back Lanes Paved	987	461	As required – WRS*	10,040
Back Lanes Gravel	2,050	1,216	As required – WRS	
Marked, On-Street Bike Lanes	-	42	Yes – 26	-
Sidewalks (Roads)	-	5,520	Yes – 287	-
Sidewalks (Parks)	-	265	Yes – 265	-
Pathways (Parks)	-	806	Yes – 300	-
Engineered Walkways	-	-	No	2,078
Vehicle Bridges	-	-	Yes	227
Pedestrian Bridges	-	-	Yes	142
Parks Bridges	-	-	Yes	209
LRT Bridges	-	-	Yes – select locations	32
LRT Stations	-	-	Yes – select sidewalks	46
Bus Zones	-	-	Yes	6,138
Stairs/Steps	-	-	Yes	2,884

Data obtained from The City's ArcGIS. *WRS – Waste and Recycling Services Business Unit

Budget

The annual 2014 SNIC budget is the calendar year budget for snow activities. Although the past winter season of 2014-2015 was a typical winter, the 2014 SNIC budget activities were impacted by the response to the extreme weather conditions that occurred in December of 2013 and January of 2014.

Table 6: 2014 SNIC Expenditures and Budget

		For the period October 2014 to Dec 31 2014	
Line #	Activity	Budget	Actual
1	Snow Removal P1 & P2	179,494	420,458
2	Snow Removal Residential	949,947	2,046,090
3	Ploughing P1 & P2	507,963	673,664
4	Sanding and Salting P1 & P2	7,919,063	8,807,141
5	Residential Sanding and Ploughing	766,953	1,069,948
6	Transit SNIC LRT Stations*	0	
7	Transit SNIC Bus Zones*	0	
8	Snow Dump Site Maintenance	46,000	8,371
9	Separate Bikeways	124,959	41,411
10	Snow Fencing	60,158	125,810
11	Anti Icing	152,000	61,817
12	Material Handling and Storage	82,628	179,479
13	Sidewalk SNIC Clearing	766,953	1,068,948
14	Winter Supplementary Work**	1,453,923	3,189,720
15	Winter Operation	12,893,019	16,706,273
16	SNIC Reserve Fund Transfer 2013/2014***		(4,141,033)
17	2014 TOTAL		12,565,240

**Includes environmental control, sweeping, depot maintenance, pothole repairs.

***This transfer was for SNIC 2013/2014

Table 7: Calgary Transit-2014 SNIC Activity Expenditures versus Recovery

		For the Period October 2014 to Dec 31 2014	
Line #	Activity	Actual	Recovery
6	Transit SNIC LRT Stations*	550,600	551,553
7	Transit SNIC Bus Zones*	298,208	313,569

Table 8: 2015 YTD Expenditures and Budget

		Year to Date – For the Period January 2015 to April 30 2015		Variance	Fiscal Year 2015
Line	Activity	Budget	Actual	%	Budget
1	Snow Removal P1 & P2	376,666	684,760	(181)	535,547
2	Snow Removal Residential	212,067	141,071	67	2,035,000
3	Ploughing P1 & P2	845,303	633,442	75	1,411,643
4	Sanding and Salting P1 & P2	11,464,713	8,494,414	74	21,571,805
5	Residential Sanding and Ploughing	1,962,049	2,200,300	(112)	3,148,000
6	Transit SNIC LRT Stations*	0	5,637		
7	Transit SNIC Bus Zones*	0	6,434		
8	Snow Dump Site Maintenance	69,000	52,708	76	115,000
9	Separate Bikeways	185,600	31,441	17	319,018
10	Snow Fencing	84,000	76,015	90	152,104
11	Anti Icing	228,000	78,570	34	380,000
12	Material Handling and Storage	120,000	171,175	(143)	207,730
13	Sidewalk SNIC Clearing	1,330,246	1,373,420	(103)	2,216,856
14	Winter Supplementary Work**	2,148,000	6,125,034	(285)	3,688,303
15	Winter Operation	20,163,646	20,046,140	99	35,781,007
16	SNIC Reserve Fund Transfer			0	
17	2015 Total	20,163,646	20,046,140	99	

**Includes environmental control, sweeping, depot maintenance, pothole repairs. Brackets indicate that Roads went above budget in spending costs.

Table 9: Calgary transit-2015 YTD Expenditures and Recoveries

		Year to Date – For the Period January 2015 to April 30 2015	
Line	Activity	Actual	Recoveries
6	Transit SNIC LRT Stations*	567,703	567,703
7	Transit SNIC Bus Zones*	360,618	360,618

Table 10: Residential SNIC clearing and Removal Expense

(A) Line #	(B) Description	(C) 2010-11 Season	(D) 2011-12 Season	(E) 2012-13 Season	(F) 2013-14 Season	(G) Five Year Average	(H) 2014-15 Season
1	SNIC Clearing (Plough/Sand)	3,043,527	3,894,058	4,224,380	6,777,794	4,484,940	4,243,699
2	Snow Removal	778,242	265,561	171,862	12,194,096	3,352,440	216,217
3	**Total**	**3,821,769**	**4,159,619**	**4,396,242**	**18,971,890**	**7,837,380**	**4,459,916**

PART III: Additional Work Completed during the 2014/2015 SNIC Season

Background

The Roads BU has provided some comparative information with a peer city and has continues to look for innovative ways to improve our delivery of services during the winter.

Peer City Edmonton

Edmonton has some similar winter weather conditions when compared to The City of Calgary. Due to high costs, Edmonton has become very efficient in recycling their sanding chips and pickle mixture. Edmonton uses approximately 150,000-180,000 tonnes of street sand and sanding chips each winter. Edmonton picks up approximately 70 per cent of the sand and chips placed during the winter and approximately 80 per cent of the sand and chips that are picked up are re-used. Calgary is not able to adapt the program at this time, as our price for sanding chips is substantially lower than $5 dollars per tonne vs Edmonton's $110 dollars per tonne. The cost difference is mainly due to the transportation costs of the material to Edmonton, whereas the material we use in Calgary is a by product of a locally produced aggregate product. For additional information regarding Edmonton's program and a comparative table Appendix B including Table 11: SNIC Comparison -Edmonton and Calgary.

Pothole Repairs

It is estimated that from January 1 to April 12, Road's received 881 pothole service requests (SRs) from 311 and repaired an estimated 10,181 potholes. The number of potholes repaired is calculated by obtaining the amount asphalt used from January 1 to April 12 which was approximately 848.42 tonnes. Roads estimated that one tonne of asphalt can repair approximately 12 potholes.

Program to Improve Mobility Challenged Access During SNIC

In the 2015 to 2018 budget cycle, 2 million dollars was allocated to improve accessibility for citizens with mobility challenges during the SNIC season. This funding was jointly given to Calgary Transit, Community Neighbourhood Services (CNS) and Roads. During the spring of 2015, the mobility-friendly program focused on bus pads and bare pavement bus stops with large windrow accumulation. These locations included bus stops with high numbers of ramp deployment (to assist citizens with mobility challenges), including hospitals, senior homes, and locations where mobility-challenged individuals frequently visit. Snow clearing would begin

during the storm and continue until all the identified locations were clear following the storm. Calgary Transit and CNS worked together to provide a list of priority locations. Calgary Transit controlled funding for this program. Roads had a contract in place that would allow this work to be completed as on-demand SNIC work.

By identifying challenges and working closely with the contractors and Calgary Transit, Roads was able to trial the service at 100 locations during two separate storms in the spring of 2015. Both snow storms were lighter than the seasonal average; with 2-4 centimetres of snow fall for each storm. From the two trials, the contractors were able to provide the service and clear all bus pads within six to eight hours for the predetermined locations. Data was collected during and after the service to project future costs. A new reporting system was also trialed, where before and after photos were taken. Photos informed Roads staff of the contractor's last known location and provided a record of the work and condition of the stop. This information was also included as back up for invoice verification. Below is a sample communication from the contractor.

Figure 8: Contractor Communication

Calgary Transit and CNS was able to provide SNIC work to an additional 250 transit locations, totalling 350 locations completed at the end of SNIC. These locations are expected to increase once the 2015-2016 SNIC season starts. CNS and Calgary Transit meet with Roads on a monthly basis to determine if additional locations are required, these monthly meetings will continue through the SNIC season. Initially, the budget was $2 million dollars and now due to spending and operational savings it is $1.18 million dollars. Even though the trial was successful during the 2014/2015 season, Roads does not have an accurate estimate for the 2015/2016 seasonal costs, as there was not a severe enough snowstorm.

One of the challenges identified during the trial is that most of these locations have very limited snow storage capacity. Snow removal is extremely costly, so Roads Maintenance has to allow

snow from the bus stops and any windrow to be stored on boulevards. The contractors have instructions on how to place the material to ensure snow is stored correctly. Contractors are directed to clear snow storage locations after a snow storm in preparation for the next storm.

Bike Lanes

The City's cycle track and cycle track trial, bike lanes, multi-use pathways, neighbourhood greenways (bicycle boulevards), shared lanes, and signed bicycle routes all contribute to mobility choices. The City's 6.8 km's of new cycle track will be cleared within 24 hours of the end of a snow event. All 42 km's of marked, on-street bike lanes are swept within 48 hours of the end of a snow event. This level of response is on-par with other winter cities, including The City of Edmonton..

Contingency Plan

A SNIC Contingency Plan was added to the SNIC Program Plan. The SNIC Contingency Plan outline includes:

- The emergency declaration- including who, what, when, where, why and how.
- The engagement of the emergency operations centre- including 24/7 staffing.
- The layered, targeted and timely engagement of City and contracted resources.
- The return to routine operations.
- The after action review and report.

City resources includes all business unit SNIC assets. Contracted resources includes individual and/or formed SNIC assets from the Fleet Services hired truck contract and the annual Roads SNIC contract. The Fleet Services hired truck contract can react within a short time frame and can offer various SNIC assets at hourly rates. The Roads SNIC contract retains an "on demand" component that can react within a short timeframe to augment City resources with trouble spot snow clearance/removal operations. An on-call "surge" and "reserve" capability consisting of an increase of 10 per cent and 20 per cent of the Roads SNIC assets could be contracted to react within a prescribed timeframe. This increase would provide further improvements to SNIC service delivery during adverse weather/snow emergencies.

Standby Resources

The City of Calgary retains contracted stand-by resources to augment City personnel and equipment for SNIC operations. The Roads Maintenance Division, in conjunction with the Supply Management Division, has a contract to provide the following SNIC services:

Schedule A - Transit Trouble Spots: 173.23 lane-km
Schedule B - District Trouble Spots: 420.33 lane-km
Schedule E - City Parking Lots: x5
Schedule F - District Northwest Steps: 2,325 x steps and 7.1 km of abutting sidewalk
Schedule G - On Demand Service: limited service to augment City forces.

Schedules A, B and G had been contracted since 2010. Schedule G could be used to create a "surge" capability to assist with a snow emergency of limited duration. This "surge" would act as a targeted force while awaiting the call-out of a larger "reserve" force should such an extreme winter condition require. While a simple 10 per cent surge and 20 per cent reserve may address a majority of emergencies, the necessary funding for retention fees would require further study. Edmonton has spent $3.4M per annum on a retainer program for hired graders. While beneficial during times when snowfall warranted the added service, it proved equally costly when the call-out was not required. Edmonton ended their retainer program in 2008/2009.

The Roads Maintenance Division also engages the Fleet Services business unit. Fleet Services keeps construction equipment and contractors through a rental equipment tender and hired truck contract that is reviewed every two and six years respectively. Also, a limited number of all-inclusive snow removal units (i.e. personnel, graders, loaders, bobcats and dump trucks) can be formed to assist with snow removal operations.

Industry could deliver a "surge" force to address extended SNIC service delivery in support of extreme winter conditions. The make-up, and priority assignment, of such a force would need to be included within the proposed Contingency Plan. Union and contractor issues such as resource readiness, reaction, deployment and engagement are all factors that must be considered when reviewing a Contingency Plan.

APPENDIX A: COMMUNICATIONS SUMMARY AND STRATEGY

Introduction

Annually, the Roads Communications team creates a comprehensive communication strategy for the Snow and Ice Control (SNIC) season. The strategy includes proactive communications to both internal and external stakeholders, regarding SNIC policies and plans, specific to the Roads BU.

In a typical season, regular SNIC communications begins when the snow falls (normally October to April) and includes updates through City communications channels (Calgary.ca updates, blogs, news releases, social media posts) based on road conditions.

Communications Goals

During the 2014-2015 SNIC season, the primary goal of the Communications team was to educate Calgarians on how The City clears streets of snow and ice using the seven day snow event plan. This strategy was implemented to manage The City's reputation through consistent, accurate, transparent communication with citizens around its snow clearing efforts.

SNIC 2014-2015 Communications

Last year, the Communications team identified key issues and challenges which occurred due to the extreme snow events in December 2013 and January 2014. At the time, recommendations for the 2014-15 SNIC season were made including more robust internal and external public awareness campaigns.

In response, a corporate "Snow" communications group was formed which included communicators from Roads, Customer Services & Communications, Parks, Animal & Bylaw Services, Transit, Community and Neighbourhood Services and the Office of the Councillors as well as representatives from 311 to coordinate external and internal communications.

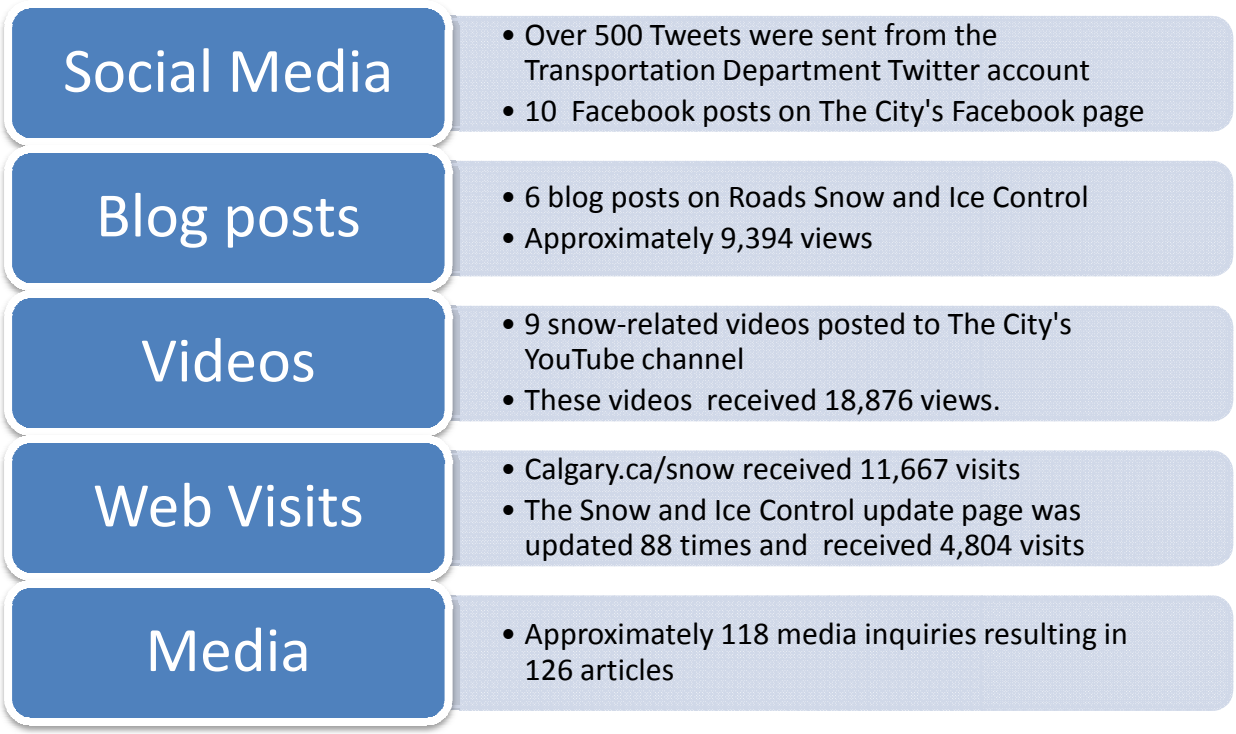
This team was established early in the fall of 2014 to develop a coordinated SNIC communications plan and response. A variety of Corporate and Roads-specific communication tactics came out of this partnership including:

1. A Corporate SNIC kick-off media event with spokespeople from Roads, Parks, Animal & Bylaw Services and Calgary Parking Authority. This media briefing was meant to provide the media with general information on how The City's different departments handle winter operations prior to any major snowfall. It also provided the media with information on Roads' new extreme snow event plan (up to an including EOC activation) and contractors who would now be retained by Roads to help with serious snow events. All major Calgary media outlets from TV, radio and newspaper attended.
2. The webpage Calgary.ca/snow was developed as a central hub where citizens could find all of The City's snow related information in one place as well as a list of snow – related online 311 service requests (SRs). This page's popularity was weather dependent with visits spiking during snow events.
3. A SNIC Report to Calgarians, featuring Mayor Naheed Nenshi, that encouraged citizens to visit Calgary.ca/snow for city-wide winter information was produced and aired in December.
4. Representatives from Corporate Employee Communications used information provided to them at the group meetings to educate employees on our SNIC program through myCity and printed pay inserts.
5. Roads promoted continued use of The City's Road Conditions map (Calgary.ca/roadcondtions) and mobile app which allows citizens to see crews' progress on Priority 1 and 2 routes and the locations of City snow clearing equipment, including sanders and graders.
6. Roads continued using the Snow and Ice Control Update page on Calgary.ca that was developed during the 2013-2014 SNIC season. This page was updated twice daily for the duration of the seven day snow event plan each time a snow event was called. This page included information on what crews were doing to clear roads, road conditions, the Transportation Department's Twitter feed, a countdown clock indicating when citizens could expect crews to begin snow clearing in residential areas as well as links to The City's Road Conditions Map.
7. Roads executed an education social media campaign that lasted the duration of the 2014-2015 SNIC season. The campaign used the Transportation Department and Corporate Twitter accounts, as well as The City's Facebook page, blog and YouTube

channel to disseminate information on the seven day snow event plan to citizens. Social media was also used to provide information on road conditions by encouraging citizens to visit the SNIC Update page and Road Conditions Map. Additionally, social media was used to provide citizens with information on issues that would arise throughout the season. This included blog posts on street clearing, windrows, what a completed street looked like (according to the seven day snow event plan), what residents could do during a snow event and what crews were doing during periods of unusually warm weather.

SNIC Communications Outcomes and Results

A review of all The City's communication channels between November 2014 and April 2015 resulted in the following:



Survey Results - Communications

In March 2015, Roads conducted the biannual Winter Driving Survey. During the survey period, 803 Calgarians were surveyed by phone and over 600 citizens participated in the online version.

The survey overwhelmingly demonstrated that Calgarians felt they were receiving an appropriate amount of information from Roads on Snow and Ice Control related information.

A significant majority of respondents (89 per cent) stated they were satisfied with The City's efforts to inform them about travel conditions. As well, the vast majority of respondents (95%+ in all categories) who use sources offered by The City of Calgary stated the information was very or somewhat helpful.

7 Day Plan

Recent additions to our assets have been incorporated into the 7-day plan, specifically on-street cycle tracks and are aligned with priority 1 work. Marked on street bike lanes (pavement marked) are cleared within 48 hours after the end of snowfall and are aligned with priority 2 work.

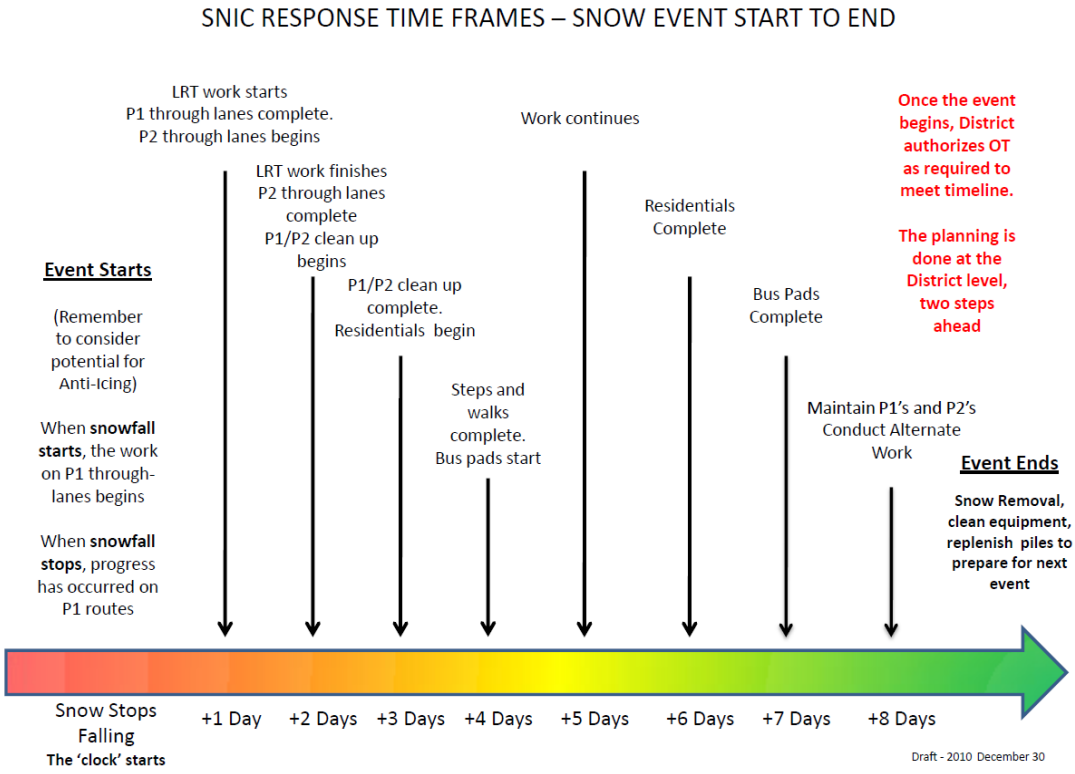


Figure 1: 7 Day Plan

Common Fleet Operating System (CFOS)

The City retains 132 Common Fleet Operating Systems (CFOS) with GPS and has successfully conducted a proof of concept trial during the 2015 Spring Clean-Up Operations. The success of the trial has resulted in the implementation of 35 portable units for use in City or contracted equipment. An additional 20 portable units will be purchased for use during the 2015/2016 Snow and Ice Control season.

The CFOS collects detailed unit information including unit number, location, direction of travel, speed, date, time and, in sanding units, when the unit is ploughing the road. The interface is an internal website (Figure 9: Common Fleet Operating System (CFOS) Internal Website) which displays real-time data which is stored in a database for future reference. The data collected has been key in providing unit information for third party claims, 3-1-1 Service Requests (SR's), SNIC situation reports (Sitreps) and, snow event after action reporting.

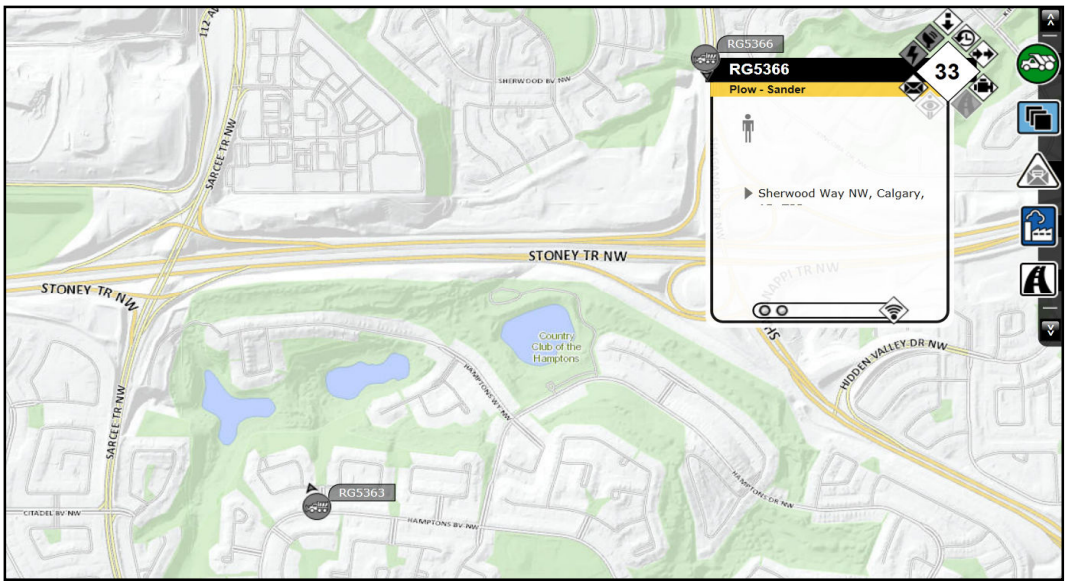


Figure 9: Common Fleet Operating System (CFOS) Internal Website

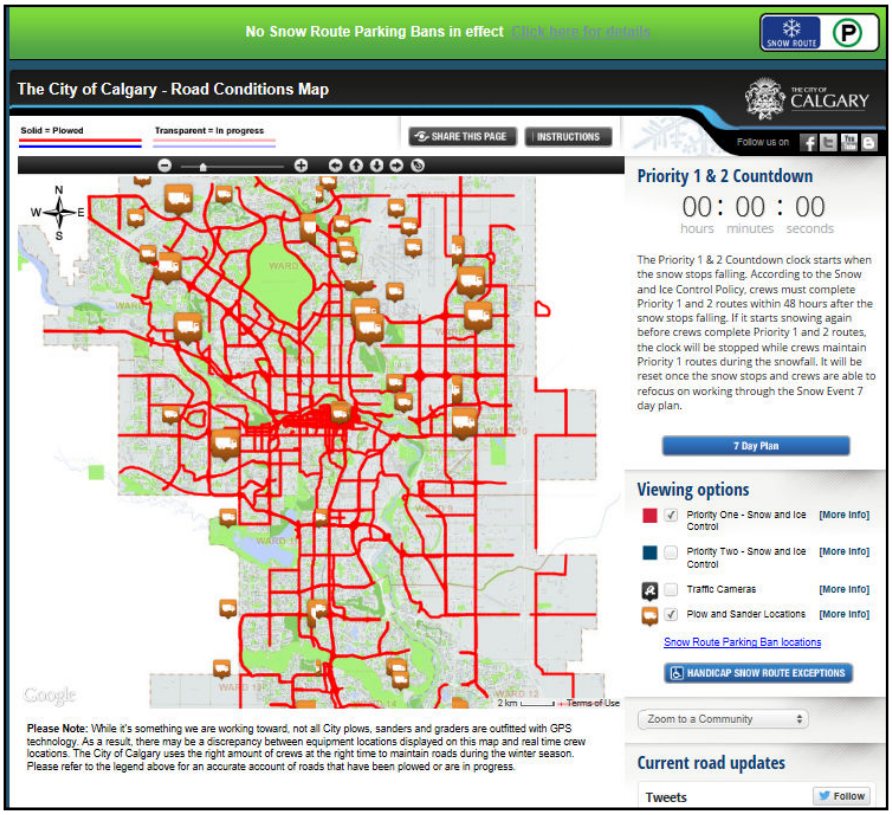


Figure 10: Calgary.ca Road Conditions Map

Sanding unit locations are displayed to the public on The City of Calgary – Road Conditions Map. Figure 10: Calgary.ca Road Conditions Map. Calgary Transit, Roads and external contracts share responsibility for transit property.

Snow and icy conditions on streets

Calgary Transit has identified 173 lane kilometres that are trouble spots for buses. Trouble spot locations are identified based on past winter experience. This includes streets and bus stops that have grades and streets that may not be a high priority for general SNIC, such as some low volume industrial streets. In some cases, entire areas are unable to be serviced by Calgary Transit. By managing trouble spots, Roads Maintenance can improve Calgary Transit's reliability and better keep on schedule. The Roads Maintenance Division has issued an RFP for standby resources for these trouble spots.

APPENDIX B: EDMONTON WINTER MAINTENANCE PROGRAM

The City of Edmonton Snow and Ice Control Policy

Policy Statement: “Ensure that roadways are maintained in such a manner as to minimize economic loss to the community, prevent or reduce accident and injury, and facilitate the handling of emergencies by the emergency responders and police services.”

Fleet

The City of Edmonton has 130 sanding trucks and 20 sidewalk ploughs in their fleet. Sidewalk ploughs operate 24 hours a day 7 days a week from mid-October until April. The first response during snow fall conditions is to apply abrasive street sand and de-icer to provide traction.

Salt Usage

Edmonton uses a combination of course sand, limestone, liquid calcium chloride and salt during the Snow and Ice Program. Sand is preferred to salt because of the low environmental impact and sustainability. In the 2013/2014 season Edmonton used:

- 97,691 tonnes of street sand;
- 18,806 tonnes of salt;
- 34,354 tonnes of rock chips; and
- 143,981 litres of calcium chloride

Edmonton uses approximately 150,000 to 180,000 tonnes of street sand each winter. Approximately 70 per cent of the salt used is picked up and recycled at the end of the snow season. Of that 70 per cent, more than half is re-used.

Snow Removal

Snow is removed from collector roadways and bus routes when the driving routes or parking area restricts safe vehicular movement. Roadways are swept as needed, or when roadway capacity per day reaches 1500 vehicles.

Sidewalks adjacent to city-owned land are swept within 48 hours of a snowfall where there is an accumulation of 2 cm or more. Snow is not hauled away. The property owner is required to remove snow 48 hours after the event of a snow fall, as required in Community Standards Bylaw #146000. Snow is swept from bicycle lanes with the same service plan designed for that of the roadway.

Table 11: SNIC Comparison -Edmonton and Calgary

	Edmonton	Calgary
Sanding Units	130	92
Graders	23	27
Sidewalk ploughs	20	38
Loaders	5	9
Snow Blowers	11	9
Sand (tons)	97,691	5,480
Salt (tons)	18,806	66,940
Rock Chips (tons)	34,354	56,709
Calcium Chloride (L)	143,981	1,141,213
SNIC Employees	480	460
Lane (km)	12,690	16,266
Budget	$58,000,000	$35,780,000

APPENDIX C: SEPTEMBER SNOW EVENT

Calgary experienced two unprecedented snow events between September 8 and September 10, 2014. Although this snow event occurred outside of the regular SNIC season, Roads was able to respond with sanders and ploughs to clear snow on P1 and some P2 routes. As the temperatures were warm following the storms, the snow melted quickly. Roads shifted the focus by responding to the extensive debris from the damaged trees. Priority 1 and 2 roads were cleared of tree debris, as well as communities hardest hit by the damage. Initially members of Roads that were qualified to operate chainsaws were allocated out to Parks to assist with the cleanup. As the cleanup progressed, Roads was tasked by Calgary Emergency Management Agency (CEMA) to assist Parks by providing tree removal teams. Roads Maintenance monitored tree drop-off sites, utilizing our Snow storage yards for debris storage and chipping. The table below shows the costs incurred by Roads for this event. The Roads specific category, RW478740, includes costs incurred while conducting the initial response to make our roads safe for passage. The Parks specific category, RW479085, includes costs incurred assisting Parks in the cleanup of communities, verges of major roadways and monitoring tree drop-off sites. Roads ceased assisting Parks with this operation when we moved to SNIC operations on October 20 2014.

Table 12: Expenditures for September 2014 Snow Storm

Category	RW478740 - Roads	RW479085 - Parks	Grand Total
Materials, Equipment &Supplies	$104,721.22	$ 628,459.05	$ 733,180.27
Salary	$294,765.73	$1,410,399.48	$1,705,165.21
Grand Total	$399,486.95	$2,038,858.53	**$2,438,345.48**

Impact of Snow storm on scheduled operations

Due to the timing of the storm, Roads postponed scheduled layoffs for 37 seasonal employees and retained those employees for the duration of our involvement of the cleanup. By postponing these layoffs, Roads did not realize any savings for the period of the cleanup. Roads also suspended the gravel lane program and cut back the pothole crews substantially. As a result, we did not have enough time to grade a significant number of lanes until the summer of 2015. Thanks to the average winter, Roads Maintenance was able to catch up on fixing many of the potholes that were missed in the 6 week period that was spent helping in with tree cleanup. This cleanup increased SNIC costs, as the increased asphalt work occurred during our SNIC season.

APPENDIX D: SNOW AND ICE FLEET

Details of the various machinery and equipment utilized by Roads Maintenance.:

Tandems and Sanders

92 tandem trucks equipped to plough and apply materials. The tandems and sanders are a combination of underbody and front ploughs, see Figure 11: Sander Trucks. Our tandems range in age from 1-6 years in age. Each of these trucks mounts a sander to apply materials. They are also used for snow removal and general hauling when the sander is removed.

92 Sanders that are a mix of City of Calgary Fleet services manufactured sanders, shown in Figure 12: Sander Trucks. Roads Maintenance has forty-one high-efficiency commercial off the shelf sanders, thirty-six and leased high-efficiency sanders (15); We will be life cycling 17 units in 2015 and replacing them with a rebuilt/repurposed Fleet services manufactured unit that performs much the same as the high-efficiency commercial off the shelf units. Our sander fleet ranges in age from twenty-nine to one-year-old.

These units together form the spearhead of our response to any and all snow events.

Figure 11: Sander Trucks

Figure 12: Sander Trucks

Graders

27 graders: Fleet range in age from 1-35 years in age. Graders, shown in Figure 13: Grader, are very important in our response to any snow event in that they have the capability to move large amounts of snow, loose snow, compacted snow and ice off the roads and they also are a core component in Roads snow removal operations.

Figure 13: Grader

Snow Blowers

11 snow blowers. We have replaced 4 of our 20-30 years old, self-propelled snow blowers, shown in

Figure 14: Snow Blower and Figure 15: Snow Blower, with 9 new loader-mounted snow blowers at a lower capital cost. We have received all 9 new units as of May 2014. The new units will be in service for the 2015/2016 SNIC season. We have retained 2 of the old units until training and transition to the new units is complete by mid-Jan 2016. The new units will increase the ability to conduct snow removal operations.

Figure 14: Snow Blower

Figure 15: Snow Blower

Loaders

These units are primarily used for loading material into the sanders but they are also used for snow removal by loading snow with the bucket, or mounting one of the loader mounted snow blowers, as shown in Figure 16: Loader.

Figure 16: Loader

Tractors

Roads Maintenance has 38 tractors that range from Skid steers to Tractors, service bus stops, designated sidewalks, pathways and Light Rail Transit (LRT). This equipment ranges in age from fifteen old to less than a year old and are used to provide SNIC for Pedestrians and Cyclists.

APPENDIX E: SNOW DATA

Table 13: Snow Fall Data 2010/2011

2010-2011

SNIC 2010/2011	Total Snow Fall (cm)	Highest amount of snow 24 hrs (cm)	Snow Days	Trace Days or "light-dusting" days	Snow Weekends	Partial Weekends	Precip on Weekends (cm)
October -10	4.4	2.2	4.0	1.0	0.0	0.0	0
November-10	22.0	6.6	9.0	2.0	1.0	1.0	3.6
December-10	20.8	6.4	9.0	5.0	1.0	0.0	2.4
January-11	29.7	14.5	9.0	11.0	2.0	0.0	20.1
February-11	24.2	10.0	8.0	5.0	0.0	2.0	3.4
March-11	24.4	7.4	14.0	9.0	3.0	0.0	10.2
April-11	58.0	21.0	6.0	2.0	1.0	1.0	25
May-11	0.0	0.0	0.0	0.0	0.0	0.0	0
TOTAL	183.5		59.0	35.0	8.0	4.0	64.70
TOTAL MONTHLY AVERAGES		9.7	8.4	5.0	1.1	0.6	35.26%

Table 14: Snow Fall Data 2011/2012

2011-2012

SNIC 2011/12	Total Snow Fall (cm)	Highest amount of snow 24 hrs (cm)	Snow Days	Trace Days or "light-dusting" days	Snow Weekends	Partial Weekends	Precip on Weekends (cm)
October-11	1.0	1.0	1.0	0.0	0.0	0.0	1.0
November-11	14.4	6.4	8.0	2.0	0.0	1.0	0.6
December-11	16.4	5.6	7.0	3.0	1.0	2.0	13.4
January-12	6.2	2.6	7.0	2.0	1.0	1.0	2
February-12	16.8	5.6	7.0	3.0	1.0	0.0	4
March-12	18.0	7.4	8.0	5.0	1.0	0.0	2.4
April-12	27.1	17.7	7.0	3.0	0.0	1.0	2.1
May-12	12.6	12.6	1.0	1.0	0.0	1.0	12.6
TOTAL	112.5		45.0	18.0	4.0	5.0	38.1
TOTAL MONTHLY AVERAGES	7.4	5.8	2.4	0.5	0.8		33.87%

Table 15: 2012/2013

2012-2013

SNIC 2012/2013	Total Snow Fall (cm)	Highest amount of snow 24 hrs (cm)	Snow Days	Trace Days or "light-dusting" days	Snow Weekends	Partial Weekends	Precip on Weekends (cm)
October-12	25.5	11.0	11.0	1.0	1.0	0.0	12.4
November-12	19.4	8.0	6.0	0.0	0.0	0.0	0
December-12	15.6	6.2	5.0	3.0	2.0	0.0	14.8
January-13	24.9	21.0	4.0	2.0	0.0	0.0	0
February-13	3.4	3.0	2.0	0.0	0.0	1.0	0.4
March-13	21.6	11.6	6.0	2.0	0.0	2.0	13.2
April-13	11.8	5.6	3.0	4.0	0.0	1.0	5.6
May-13	0.0	00	0.0	0.0	0.0	0.0	0.0
TOTAL	122.2		37.0	12.0	3.0	4.0	46.4
TOTAL MONTHLY AVERAGES		8.3	4.6	1.5	0.4	0.5	37.97%

Table 16: 2013/2014

2013-2014

SNIC 2013/2014	Total Snow Fall (cm)	Highest amount of snow 24 hrs (cm)	Snow Days	Trace Days or "light-dusting" days	Snow Weekends	Partial Weekends	Precip on Weekends (cm)
October-13	4.4	4.4	1.0	1.0	0.0	1.0	4.4
November-13	27.8	15.5	7.0	5.0	2.0	1.0	26.6
December-13	52.4	14.0	13.0	13.0	1.0	3.0	10
January-14	23.3	7.8	8.0	5.0	0.0	2.0	3.9
February-14	6.4	3.0	5.0	10.0	1.0	1.0	3.2
March-14	36.2	7.6	17.0	4.0	2.0	2.0	13
April-14	13.6	4.8	6.0	5.0	0.0	1.0	3.5
May-14	15.6	11.2	3.0	3.0	1.0	0.0	14.6
TOTAL	179.7		60.0	46.0	7.0	11.0	79.2
TOTAL MONTHLY AVERAGES		8.5	7.5	5.8	0.9	1.4	44.07%

Table 17: Snow Fall Data 2014/2015

	2014-2015						
SNIC 2014/2015	**Total Snow Fall (cm)**	**Highest amount of snow 24 hrs (cm)**	**Snow Days**	**Trace Days or "light-dusting" days**	**Snow Weekends**	**Partial Weekends**	**Precip on Weekends (cm)**
September-14	28.2	15.1	3.0	0.0	0.0	0.0	0
October-14	1.2	1.2	1.0	0.0	0.0	0.0	0
November-14	43.2	11.4	9.0	9.0	1.0	2.0	29.6
December-14	7.5	5.2	4.0	5.0	0.0	2.0	6
January-15	34.6	11.2	10.0	3.0	2.0	2.0	11.6
February-15	13.7	3.8	11.0	7.0	0.0	2.0	4.6
March-15	6.2	2.7	4.0	2.0	0.0	1.0	2.4
April-15	5.4	1.8	4.0	4.0	0.0	1.0	1.8
TOTAL	140.0		46.0	30.0	3.0	10.0	56
TOTAL MONTHLY AVERAGES		6.6	5.8	3.8	0.4	1.3	40.00%

Table 18: Average Snow Fall from 2010-2015

Snowfall	**Snow in 24 hrs (cm)**	**Snow Days**	**Trace Days**	**Snow Weekends**	**Partial Weekends**	**Precip on Weekends**
147.6	7.9	49.4	28.2	5.0	6.8	56.88