



Robert Prosser & Associates

AUDIT REPORT
ON
**INFRASTRUCTURE SERVICES
DEPARTMENT (PUBLIC WORKS BRANCH)**
Snow & Ice Management



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Report Highlights

Overall Opinion

Although the program cost per capita is less than three of the four Western Canadian cities surveyed, current staff scheduling practices lead us to conclude that there is still room for improvement in optimizing the mix of resources (i.e. staff, overtime, private contractors).

The City has taken reasonable steps to ensure that sidewalks in high traffic areas are safe for pedestrian traffic.

Based on benchmark data, consistency of current service priorities and timelines with the City's related public policy and service level objectives, and the process that management follows when reviewing the ongoing appropriateness of service levels, we conclude that established service levels are appropriate. Survey results indicate that major enhancements to service levels (e.g. residential sidewalk clearing) would have a substantial impact on the program budget.

The City is taking reasonable and responsible steps to minimize the likelihood and potential impact of damage to the environment due to sanding and salting.

Risk of Idle or Insufficient Resources

Idle and/or insufficient resources are inherent risks of the Snow and Ice Management program due to unpredictable and fluctuating weather conditions. Idle resources translate into increased program costs. Insufficient resources can lead to service levels not being met, placing the public at risk.

Current control strengths include service level compliance reports, use of private contractors, use of overtime, alternative work arrangements, supervision, productivity monitoring reports, operator back-up training, GPS technology, and V&E's equipment management/maintenance program.

Opportunities for improvement include:

- *More consistency in the production of service level compliance monitoring reports;*
- *Exploring strategies for optimizing resource mix (i.e. staff, overtime, private contractors).*

Risk of Low Productivity

Low productivity is an inherent risk of the Snow and Ice Management program. Low productivity translates into increased program costs.

Control strengths include productivity performance reporting, GPS technology, operator training, work activity guidelines and work quality audits.

Although the snow and ice control operating cost per lane km of roadway has increased four-fold since 2001, benchmark data indicates that the per capita cost of Saskatoon's overall snow and ice control program is still less than 3 of the 4 Western Canadian cities surveyed.

Opportunities for improvement include:

- *Completing documentation of Standard Operating Procedures.*

Risk of Unsafe Sidewalks

We examined current systems, practices and controls for minimizing the risk of public injury caused by snow, ice or slush on sidewalks. Public injury can result in associated liability claims being filed against the City. Per management, the City invests very little in sidewalk snow clearing and sanding – i.e. budgets were \$138,835, \$124,474, \$122,436, and \$181,434 in 2003, 2004, 2005 and 2006 respectively.

Control strengths include public disclosure of service levels, bylaws requiring businesses in certain areas to clear snow from sidewalks adjacent to their property, inspections to ensure bylaw compliance, a hotline for the public to report possible hazards or concerns, and a claims review process.

Opportunities for improvement include:

- *Service level compliance monitoring and reporting;*
- *Posting the service level timelines for sidewalk snow clearing on the City's website.*

Risk of Damage to Private Property

Damage to private property is an inherent risk for the Snow and Ice Management Program.

In our opinion, adequate systems, practices and controls are in place to minimize the likelihood and potential impact of this risk. This is reflected in statistical trends which show relatively few incidents.

Control strengths include requiring operators to have commercial drivers licenses, operator training and certification, designated snow routes, technology on equipment, policy on disciplinary action for frequent accidents, accident reporting, accident review committee, equipment pre- and post-use inspections, standard operating procedures & training manuals, and insurance.

Risk of Damage to the Environment

Damage to the environment due to sanding and salting, is an inherent risk for the Snow and Ice Management Program. Road salts can be a major pollutant in both urban and rural areas. Snow runoff (on roads and at snow storage sites) containing salt can produce high sodium and chloride concentrations in the river. This can cause unnecessary fish kills and changes to water chemistry.

Management is taking reasonable and responsible steps to minimize the likelihood and potential impact of this risk. In particular, we note development of a Salt Management Plan appears to be consistent with Environment Canada's Code of Practice for the Environmental Management of Road Salts and the Transportation Association of Canada's Synthesis of Best Practices in Road Salt Management.

Service Level Appropriateness & Performance

We assessed the appropriateness of current service levels relative to the other cities' service levels and the criteria used to establish service priorities. We also assessed the adequacy of systems, practices and controls for ensuring service levels are met.

Based on benchmark data, consistency of current service priorities and timelines with the City's related public policy and service level objectives, and the process that management follows when reviewing the ongoing appropriateness of service levels, we conclude that established service levels are appropriate.

We conclude that existing systems, practices and controls provide reasonable assurance that service levels will be met with the following exceptions:

- *Service level compliance reports are not completed on a consistent basis;*
- *Service level compliance reports are not being prepared for snow removal, sanding/salting and sidewalk clearing.*

Compliance reports are an essential control for demonstrating results and holding responsible parties accountable.

Use of Private Contractors

The City currently uses a mix of in-house resources (regular shifts and overtime) and private contractors for snow and ice control activities. Employees are also assigned to alternative work during periods of low demand (e.g. no snow accumulation).

The current staff scheduling strategy (e.g. 8.57 hour shifts; full staff complement at times when snowfall is often low and when limited alternative work is available) leads us to conclude that there may be room for improvement in optimizing the level and mix of resources required to meet snow and ice control service levels.

We note that other cities make more extensive use of the private sector in their resource mix. Possible constraints to the City of Saskatoon's ability to increase private contractor participation in the program include the collective agreement and the availability of qualified external service providers.

Recognizing these constraints, and the fact that Saskatoon's program cost per capita is lower than three of the four cities surveyed, we are recommending that management explore strategies for optimizing resource mix.

Chapter 1 Introduction

The 2005/06 Corporate Audit Plan included provision to audit the Infrastructure Services Department's Snow and Ice Management Program.

Our work was conducted in accordance with generally accepted internal auditing standards and, accordingly, included such tests as we deemed necessary to adequately address the lines of enquiry set out in the project terms of reference.

Audit Objective

The objective of the audit was to determine the extent to which adequate systems, practices, and controls are in place to mitigate/minimize the likelihood and/or impact of the following potential risk events:

- Idle or insufficient resources (e.g. staff/equipment) to meet service level objectives, resulting from unpredictable snowfall/weather patterns;
- Low productivity;
- Public injury caused by snow, ice or slush on sidewalks or extensions of sidewalks used as street crossings;
- Damage to private property (e.g. grader/sander damaging vehicles);
- Damage to the environment from sanding/salting.

The audit also included an analysis of the appropriateness of current service levels.

Audit Approach

The audit included, but was not necessarily limited to, the following steps:

- Collection and review of relevant information and documents provided by City staff (e.g. compliance reports, work orders, regulations, etc.);
- Documentation and review of the current service levels (i.e. new priority system compared to established objectives);
- Interviews with management and staff involved in the program;
- Identification and documentation of significant risks and evaluation of current control processes;

- Performing necessary audit procedures and tests;
- Examination of relevant claim statistics;
- Conducting internet research and surveying other cities with respect to common practices including benchmark service levels and risk management practices;
- Documentation of the key control activities.

Acknowledgements

Robert Prosser & Associates Inc. wishes to extend special thanks to the General Manager of Infrastructure Services, the Public Works Branch Manager, the Roadways Section Manager, Systems Analysts and other staff involved in the program, for accommodating our requests for interviews, information and documents, and reviewing our audit findings.

Chapter 2 Program Profile

The Snow and Ice Management program falls within the Roadways Section of the Infrastructure Services Department, Public Works Branch.

The Program includes the following key components:

- Snow clearing;
- Snow removal and disposal;
- Sanding/salting;
- Sidewalk plowing;
- Snow fencing.

The strategic objective of the program is the safe, efficient and timely movement of vehicle and pedestrian traffic during the winter months. The related operating objective is timely and effective snow clearing, snow removal and ice control.

The program operates with the following staff and financial resources:

- Snow and Ice has operated with a complement of approximately 30 FTE staff since 2002. This staff can be further segregated into “Snow” and “Sanding” – i.e. in 2005, 16.4 FTE’s were budgeted for Snow operations and 13.1 FTE’s for Sanding operations.
- Snow and Ice Management incurred higher expenses in 2005 (\$4,134,208 due to larger accumulations of snow and more snowfall events than normal). In 2004, snowfall was greater than normal, with expenses totaling \$3,183,840. From 1999-2003, annual expenditures were under \$3 million.

The program operates with the following equipment:

- 12 Motor graders
- 10 Plow-Trucks (some include rear sanding mechanism)
- 9 Sanding Trucks (some include plowing mechanism)
- 4 Sidewalk Plows
- 5 Tandem Trucks
- 2 Snow Blower for loading large Trucks (require loader to operate)
- 4 Front-End Loaders
- 3-6 Contracted Semi-Trucks
- 6 Contracted Graders

The Snow & Ice Management Program maintains an estimated 45-50% of the City’s 1,097 centerline kilometers of roadways and an estimated 20% of the City’s 1,200 kilometers of sidewalks.

The Infrastructure Services Snow and Ice Management Program uses both the Timberline and Maintenance Management System (MMS) to monitor and organize equipment and staff.

- The MMS is used to track “Work Accomplishment” by individual employee, crew, activity, etc. This system has information input on a daily basis from a “Work Capture Form” prepared by

each crew member responsible for a particular activity (i.e. snow clearing). Historical data is used to set a “target” or an expected production figure. System-generated reports are used to analyze productivity (i.e. actual relative to target).

- The Timberline system is used for both payroll and job costing. Timberline allows for the entering of time and other payroll information to jobs, cost codes, categories, days of the week, location and more. This information is input from the “Daily Timesheets” completed by each employee. The Timberline System generates reports for job costing and expenditure monitoring.

Chapter 3 Risk of Idle or Insufficient Resources

Idle and/or insufficient resources are inherent risks of the Snow and Ice Management program due to unpredictable and fluctuating weather conditions. Idle resources translate into increased program costs. Insufficient resources can lead to service levels not being met, placing the public at risk.

Current control strengths include service level compliance reports, use of private contractors, use of overtime, alternative work arrangements, supervision, productivity monitoring reports, operator back-up training, GPS technology, and V&E's equipment management/maintenance program.

Opportunities for improvement include:

- More consistency in the production of service level compliance monitoring reports;
- Exploring strategies for optimizing resource mix (i.e. staff, overtime, private contractors).

Background

The risk of “insufficient resources” relates to both staff and equipment. This risk is evident when large accumulations of snow occur in a short period-of-time. Per management, the City does not have an adequate number of qualified staff and equipment in place to handle a winter storm that substantially exceeds the average accumulations of snow - i.e. 8 year average snow accumulations was 85.8 cm (82.1 cm past 5 years) and the 30 year average was 97.2 cm per “Environment Canada 1971-2001”.

With respect to any winter storm, the department focuses on priority one streets, while attempting to have as many operators in the field as resources (i.e. equipment and staff) allow. Per management, the cause for not meeting service level targets is usually “insufficient resources” to meet the demand created by large accumulations of snow over a short period of time. Management’s objective is to **minimize** the likelihood of “insufficient resources” since it is not necessarily possible or practical to eliminate this risk altogether.

The risk of “idle resources” also relates to both staff and equipment. Contributing factors include equipment breakdowns and low or no snow accumulation. Management’s objective is to **minimize** the likelihood of “idle resources” since it is not necessarily possible or practical to eliminate this risk altogether.

Staff is re-allocated within Roadways from November 1 to April 15th the following year, from summer operating programs to Snow & Ice Management, with all the equipment being assigned from Vehicle and Equipment Services. There is a core staff of approximately 72 during these winter months - i.e. approximately 30 FTE staff. Employees are assigned a job based on their experience and position classification (i.e. Utility C worker).

Findings

The current control framework for minimizing the likelihood and potential impact of idle or insufficient resources includes the following elements:

- Service Level Compliance Reports;
- Service contracts with the private sector;
- Staff schedules with 24/7 coverage;
- Overtime;
- Alternative work arrangements;
- Supervision;
- Reports;
- Backup training;
- Technology and best practices;
- Equipment management and maintenance.

Service Level Compliance Reports

Service Level Compliance Reports are generated by management from the information entered daily by staff/operators. These reports are used, in part, after each major snow event to determine when inadequate resources may have resulted in snow clearing service levels not being met. They list all streets, in the priority category designated, that were not cleared within the timeframes allotted. Although reasons for not meeting service levels are not explicitly stated in the reports, they are implicit in the 'issues to resolve' section of the report. Reasons for not meeting service levels include, but are not necessarily limited to, excessive snow, breakdown of equipment or lack of sufficient equipment and/or qualified staff.

Contracted Services

Using private contractors to provide snow clearing/removal services when demand exceeds available resources increases the likelihood of service levels being met. It also reduces the risk of excess resources associated with staffing to meet peak demand.

The City of Saskatoon has several contracts with local companies, covering industrial sites, school zones and other services such as pushing snow dumps and hauling snow. These contracts do not guarantee any amount of work but do specify response times and completion times that are consistent with the City's service level standards.

Per management, contractors treat the City as a high priority client and, therefore, meet their commitment to provide services within the desired range of time. In addition to specifying response time limits and completion time limits, the contracts also include the statement that "payment adjustments are provided for work not completed in the specified time and for damage to public property." The City attempts to mitigate the risk of liability through its current agreements with contractors.

Risk of Idle or Insufficient Resources, cont'd

The following tables show the proportion and extent of contract work over the past 3 years (in total and by service category):

Table 1: Contracted Service Comparison

Year	2003	2004	2005
Actual Contracted Expenditures (Snow Clearing)	\$5,586	\$33,394	\$62,762
Actual Contracted Expenditures (Snow Removal-Trucks)	\$72,910	\$83,634	\$182,448
Actual Contracted Expenditures (Sidewalk Plowing & Clearing)	N/A	N/A	N/A
Actual Contracted Expenditures (Ice Control-Sanding & Salting)	None	\$27,400	\$65,137
Total Contracted Expenditures (Actual)	\$78,496	\$144,428	\$310,347
Total Contracted Expenditures (% of Total Program Budget)	2.7%	5.2%	10.6%
Total Contracted Expenditures (% of Actual Salaries & Benefits)	5.7%	9.1%	17.9%

With regard to other cities, we note the following:

- Regina relies on both the hiring of casual staff and contracted help to meet demand when major storms occur. They noted that their difficulties are in finding the proper resources on weekends and holidays to meet the demands of storms.
- Winnipeg is an aggressive city with respect to contracting services to meet the demand of winter storms. They noted having approximately 50% of their snow and ice budget allocated to contracting winter services. The City obtains these services through two different types of contracts.
 - 1) Fixed contract based on a given geographical area with 40% of that contract guaranteed to the contractor in any given year regardless of demand.

Risk of Idle or Insufficient Resources, cont'd

- 2) Hourly contracts established on an as needed basis where demand requires more resources to meet service levels.
 - Edmonton has developed a staffing model to balance its internal staff with contracted services. All sanding and truck plowing is completed by City workers, while contracts are established through the Road Builders contract at a fixed hourly rate for help with snow plowing and sidewalk clearing operations.

Staff Schedules

Staffing schedules are prepared at the start of each winter season. Leave – e.g. vacation time – is built into the schedule. The schedules include pre-defined staff levels by activity and shift. Pre-season schedules provide reasonable assurance that adequate staff will be available to handle normal snow and ice control activity, reducing the risk of insufficient or idle resources.

Management negotiated with the Union, a revised staffing schedule for the 2005 winter, designed to improve overall productivity. The revised staffing schedule focused on equal distribution of qualified staff on a 24/7 basis. All staff were designated a 10-hour shift (6:30 a.m. to 4:30 p.m. and 8:30 p.m. to 6:30 a.m.) that results in four days on and four days off with two days off after every third cycle (4 on, 4 off, 4 on, 4 off, 4 on and 2 off). A skeleton crew also operates from 12:00 p.m. to 10:00 p.m. providing the ability for staff to extend their shifts to 12 hours when demand requires.

Table 2: 2005 Staffing (Snow & Ice Management)

Monday – Sunday(7 Days Per Week)	
Time	Staff
06:30 – 16:30	18-22
20:30 – 06:30	17-18
12:00 – 22:00	2

It is our understanding that staff scheduling has changed again in 2006, with three 8.57 hour shifts (tied to EDO's) providing 24/7 coverage. This schedule is far less efficient than the 2005 schedule. It results in unnecessary overlap of hours and increases idle capacity (e.g. operators waiting for equipment to be returned so they can start their shifts; increased lost time due to equipment traveling to work sites and back to the yards three times a day).

Staffing for the 2004 winter included snow plowing/clearing operators and snow removal operators working weekdays from 7:00 a.m. to 3:30 p.m. and weeknights (Sunday through Friday) from 10:30 p.m. to 7:00 a.m. These shifts did not provide 24/7 coverage without incurring overtime.

Ice control operators worked 12-hour shifts (7:00 a.m. to 7:00 p.m. and 7:00 p.m. to 7:00 a.m.) in 2004, providing 24/7 coverage.

Sidewalk plowing operators worked weekday shifts from 7:00 a.m. to 3:30 p.m. in 2004. These shifts did not provide 24/7 coverage without incurring overtime.

Table 3: 2004 Staffing (Snow & Ice Management)

Monday – Friday (Weekdays)		Saturday – Sunday (Weekends)	
Time	Staff	Time	Staff
07:00 – 15:30	46	07:00 – 19:00	8
15:30 – 19:00	6	19:00 – 07:00	6
19:00 – 22:30	6		
22:30 – 07:00	11		

With regard to other cities, we note the following:

- Edmonton’s entire winter maintenance program operates 24/7. They separate the city into five geographical areas. They use three consecutive 8-hour shifts as well as 12-hour day and night shifts throughout the week.
- Regina’s approach to staffing for winter maintenance has varied in past. It was indicated that the City wishes to provide a more standardized approach with consistent coverage throughout the week. The City of Regina hires casual staff during large storms and requires their staff to work overtime when demand warrants.
- Winnipeg’s winter maintenance program operates 24/7 with three, eight-hour shifts. Overtime is expected when the demand is high (i.e. storm). Approximately 40% of staff are allocated to the day, 40% to the evening and 20% to the night shift. Weekends result in a low staff level unless weather dictates otherwise. The City relies heavily on contractors to fill in where the City cannot meet the demand.

Overtime

Overtime is used to top up resources during above-average snow and ice accumulation, in order to meet established service levels.

Overtime is either “requested” of staff or “scheduled” by management when demand warrants additional resources. “Scheduled” overtime involves including some overtime in future shifts when demand is known ahead of time (e.g. snow removal). “Requested” overtime occurs in the event of unanticipated demand (e.g. heavy snowfall). Workers realize that when a storm arises, overtime will be a requirement of their job. Overtime is offered to each qualified employee on an “equal opportunity basis”, with each employee having the opportunity to accept or reject an overtime shift at his/her discretion. Management documents and keeps a schedule of all overtime offerings to ensure that each employee is given equal opportunity to work these extra hours.

Risk of Idle or Insufficient Resources, cont'd

The following table provides comparative data on overtime for fiscal years 2003, 2004 and 2005.

Table 4: Comparison of Regular and Overtime Salaries

Activity	2003			2004			2005		
	Regular	O/T	%	Regular	O/T	%	Regular	O/T	%
Snow Removal	\$590,317	\$57,382	9.7%	\$517,274	\$133,565	25.8%	\$612,564	\$181,200	29.6%
Sanding	\$392,990	\$31,733	8.1%	\$416,915	\$45,103	10.8%	\$388,599	\$50,969	13.1%

The increase in overtime for snow removal in 2004 and 2005 was a result of increased demand – i.e. higher snow accumulation and increased number of major snow events. Snowfall in 2004 and 2005 was 125 cm. and 93.9 cm. respectively vs. 68.2 cm. in 2003.

Alternative Work

When the demand for snow clearing, snow removal and ice control drops, scheduled work hours do not change, presenting the need for alternative work. Alternative work includes washing road signs, back lane cleanup, snow fence repairs, replenishing stockpiles, etc. Per management, there is usually a surplus of alternative work available for staff working the regular day shift. Where the problem of “idle resources” often occurs, is on the night shift when many of the alternative activities are not available for assignment.

Supervision

Four Supervisor VI's are responsible for the management of snow clearing and removal, sidewalk clearing, sanding and salting. At least one Supervisor VI is always on duty to fill this role. Each supervisor is responsible for ensuring that resources are being allocated appropriately and managed effectively.

Supervisor presence in the field to “lead by example” is an effective control for monitoring performance and productivity and for identifying opportunities for improvement. It also provides an effective medium for communication between the employees and management. Each Supervisor being a part of the work team involved in the day-to-day work routines, allows for a good understanding of where deficiencies exist and potentially how to eliminate them.

Reports

Reports on performance and activities are generated by each supervisor on a daily basis, and provided to management. The reports, *discussed in detail in the Productivity chapter*, facilitate analysis of productivity, safety and overall conditions that exist within operations including staffing and equipment. Idle or insufficient resources would be highlighted in the performance reports for management follow-up and corrective action. Per management, weekly workplans include both program activities and value-added alternative work. Staff hours allocated to program activities vs. alternative work are also monitored, and reported to management upon request.

Operator Backup Training

Operators are also trained to handle other pieces of equipment. For example, some snow removal staff are trained to operate graders, sanders and sidewalk snowplows. Some snow clearing operators are trained to operate sanders. Some of the ice control operators are also trained to operate motor graders; however, in most cases, they are not available for plowing/clearing since both plowing/clearing and sanding are required at the same time.

Having staff trained to operate various pieces of equipment provides flexibility to respond to changing demands – e.g. increased need for sanders due to freezing rain.

Technology & Best Practices Research

Developments in technology and best practices focus on efficiencies, the environment and reducing costs associated with snow and ice management. Introduction of modern technology and best practices promotes efficiency through streamlining processes and controls. Research on Best Practices, the industry emphasizes the need to implement strategies on road maintenance in order to “advise” the public of poor weather or road conditions, to “control” and manage the effect that weather has on the roads and to “treat” the conditions that result through prevention or reaction to poor weather.

Examples of technology and practices currently being researched, tested, and applied across Canada include pavement temperature sensors, atmospheric sensors, video surveillance, pre-wetting materials, road surface condition monitoring equipment, road weather information systems (RWIS), anti-icer liquid spray system, salt brine maker, electronic spreader controls on sanding/salting trucks, high-speed spreaders, and automatic bridge de-icing systems.

Per management, the City is always exploring new technology and best practices, in part, through staff attendance at seminars and workshops on sand and salting. Examples of new technology and best practices introduced over the past three years include infrared thermometers and GPS.

The City recently purchased mobile infrared thermometers in 2005 to measure the temperature of the road for application of de-icing materials. This information assists in planning where and when salt application will be most effective. With the use of these thermometers, it is perceived that the appropriate amount of sand/salt will be applied at the right time and in the proper areas to keep roads in good condition for safe and efficient movement of traffic.

The City of Saskatoon is using GPS technology. GPS identifies equipment location while the GPS logger records material spreading rates, spreader operating speeds, snowplow speeds, etc.

The City tested GPS technology through a pilot project in 1999 and subsequently implemented it in 2000. GPS technology is used as a planning tool to more efficiently and effectively allocate equipment on priority routes with the intention of meeting service levels. Additional benefits include:

- Accurate data on location of equipment at all times if rerouting of equipment is required or a potential breakdown occurs.
- Monitoring staff performance (e.g. achievement of service level standards).

- Having real time information on roads and sidewalks to help management more efficiently schedule and route resources.
- Having access to accurate and timely information on the status of roadways in terms of service levels, that can be communicated to Branch Managers, General Managers and the public.
- Data for monitoring and evaluating the effectiveness and efficiency of the priority routing system.

Equipment Management and Maintenance

Effective management and maintenance of equipment helps to reduce or eliminate the potential for idle or insufficient resources, and ensures that suitable and sufficient equipment, in proper working order, is available, when required.

Vehicle and Equipment Services is responsible for obtaining, providing and maintaining the equipment used by the Snow and Ice Management Program. Equipment is used throughout the year by several areas in the department (i.e. a truck can be used to haul snow to disposal sites and material for pavement repairs). An example of managing idle resources includes providing equipment to other agencies in exchange for training staff discounts. When graders are not being fully utilized in the summer months, training is provided to staff through a partnership with a local “practical training agency”. This agency discounts its training rates to the City in exchange for having access to City graders to provide the training.

The Vehicle and Equipment Services Department maintains all of the equipment used by the Snow & Ice Management program. Effective maintenance reduces the risk of breakdowns. Breakdowns can result in service levels not being met. The financial and social cost of not meeting service levels due to equipment breakdown in a storm can be extensive as it not only results in economic losses, but also places the safety of the public at risk when priority routes are not cleared as expected. Per the January 21, 2005 “Service Level Compliance Report” the cost of having a snow blower broken down is approximately \$1,000 to \$1,200 per hour (includes the cost of labour for any employees idle on the job).

The Vehicle & Equipment Services Department maintains a fleet of spares for backup during equipment breakdown and for backup when equipment is in the shop for routine maintenance. Per management, breakdowns have not been a problem for the program, since V&E Services has an adequate inventory of spares.

Table 5: Snow & Ice Control Equipment

Equipment	Active	Spare	Total
Motor graders	12	1	13
Plow-Trucks (underbody & front body plows)	10	1	11
Sanding Trucks (2 with underbody plows; 2 with front plows)	9	0	9
Sidewalk Plows	4	1	5
Tandem Trucks (Hauling)	5	0	5
Snow Blower for loading large Trucks	2	1	3
Front-End Loaders	4	2	6
Contracted Semi-Trucks	As required	N/A	N/A

Conclusion

Service Level Compliance Reports are not produced on a consistent basis and are not produced for snow removal, sanding/salting and sidewalk clearing. These reports are seen as crucial in assessing the performance and management of resources for the department. Failure to consistently measure and monitor compliance with service levels can lead to inefficient and ineffective allocation and use of resources, resulting in increased program costs and reduced public safety.

The City of Saskatoon has established contracts with private organizations to perform snow and ice activities on an as-needed basis within particular areas of the City. Information is not currently available to evaluate whether the current mix of resources (i.e. staff, overtime, private contractors) is the most optimal situation from both a cost and a service perspective. While contracted services have expanded in recent years (e.g. \$310,347 in 2005 vs. \$78,496 in 2003) due to higher than normal snowfall, the contracts are limited to school zones and industrial areas. Survey results indicate that other municipalities rely heavily on contractors to assist in clearing priority streets to meet their 'service levels'. For example, Winnipeg also relies on contractors for a portion of their normal workload (i.e. this is reflected in the fact that they guarantee contractors 40% of the total contract value). The City of Saskatoon should consider the possibility of expanding the involvement of private contractors in clearing priority streets during above average snowfalls. We note, however, that there are possible constraints to the City of Saskatoon's ability to increase private contractor participation in the program – e.g. the collective agreement and the availability of qualified external service providers.

Staff scheduling is a major challenge for Snow and Ice departments across Canada since workload fluctuates due to unpredictable weather. Ideally, staff levels would, to the extent possible, fluctuate in relation to workload. However, we note that the 2004 shifting arrangements did not facilitate optimum use of staff and equipment. We note, for example, that:

- Snow plowing/clearing in non-residential areas is most efficient at night when there is less traffic. Yet, more resources were assigned to snow plowing/clearing during the day shift.
- 2004 shifting did not provide 24/7 coverage for snow plowing/clearing.

- In 2004 and prior years, approximately 40% of snow removal took place during the Sunday to Friday day shift; yet, with the exception of residential areas, snow removal is most efficient at night when there is less traffic.
- Sidewalk plowing is most efficient at night; yet, most of the work is undertaken during the day shift.

The 2006 staff scheduling of 8.57 hour shifts provides 24/7 coverage. However, it does not provide the same level of efficiency as the 2005 schedule (i.e. two 10-hour shifts, 7 days a week).

Per management, in 2005, 70% of snow removal took place during the night with the majority of that snow removal being in the Central Business District. Productivity trends in Chapter 4 indicate the need to continue strengthening controls around staff utilization. Strategies should be explored that would more closely align available resources with workload, increase the ability to achieve service level objectives, increase flexibility, reduce overtime costs, and improve productivity.

Recommendations

- 1. That “Service Level Compliance Reports” be generated (i.e. for all major snow events greater than 5 cm’s) on a consistent basis and for all snow and ice activities including snow clearing and removal, sanding and salting, and sidewalk clearing.**
- 2. That the “Service Level Compliance Reports”, and related analysis, include an explanation for non-compliance, stating the reason for missing each service level and noting details such as the actual time priority routes were completed.**
- 3. That management explore strategies for optimizing resource mix (e.g. staff, overtime, private contractors).**

Management Response

- 1. Agree**
- 2. Agree**
- 3. Agree**

Chapter 4 Risk of Low Productivity

Low productivity is an inherent risk of the Snow and Ice Management program. Low productivity translates into increased program costs.

Control strengths include productivity performance reporting, GPS technology, operator training, work activity guidelines and work quality audits.

Although the snow and ice control operating cost per lane km of roadway has increased four-fold since 2001, benchmark data indicates that the per capita cost of Saskatoon's overall snow and ice control program is still less than 3 of the 4 Western Canadian cities surveyed.

Opportunities for improvement include:

- Completing documentation of Standard Operating Procedures.

Background

Productivity is a measure of the relationship between service output (e.g. kilometers of snow cleared; tonnes of snow removed) and resource input (e.g. staff hours, staff cost, equipment hour).

Productivity can be increased by reducing the resources required to produce a unit of service or by increasing the units of service produced with existing resources.

Findings

There has been a steady transition within the snow and ice program, from operations that rely solely on prior experience of management and operators to operations that rely on historical data and performance information. This is reflected, in part, in the current control framework which includes the following elements:

- Performance management reporting;
- Technology;
- Training;
- Work Activity Guidelines;
- Work Management Task Group;
- Work Quality Audits.

Performance Reporting

Management uses several reports to assess productivity of crews and equipment. These reports help to identify significant variances between actual and expected performance.

Crew Size Analysis Reports

Crew size analysis reports provide productivity data on an individual employee basis. This report lists the employee's name and their work completed for the year, compares Average Daily Production (ADP) to a targeted daily production, and compares actual per unit cost to targeted per unit cost. This report is designed to show large variations in work completed by an

individual versus what the department has considered acceptable. When there is a large variance, it is up to the Supervisor to take corrective action and/or provide a reasonable explanation. A response to a variation may include disciplinary action where there is concern over the productivity of an employee.

Activity Reports

Work activity “variance reports” are generated by each Supervisor on a bi-weekly basis, listing all of the winter activities. The report lists productivity figures such as “planned versus actual units of work”, “planned versus actual per unit costs”, etc. Comments are provided for any large variation (+/- 10%) and are followed up by management.

Activity Costing Reports are generated for management that provide detail on “Unit Costs”, “Cumulative Expenditures”, “Standard Hours” and “Overtime as % of Regular Hours”. Actual results are compared to targets/standards and displayed on graphs to better visualize productivity trends.

The following table shows productivity trends over the past five years:

Table 6: Productivity Trends

Productivity Measure	2001	2002	2003	2004	2005
Roads – Operating cost per lane km maintained	\$293	\$671	\$749	\$859	\$1,104
Roads – Lane kms maintained per FTE	117	119	118	116	111
Roads – Tonnes of sand/salt applied per km maintained	4.0	4.4	4.3	10.4	10.2
Sidewalks – Operating cost per km maintained	n/a	n/a	n/a	\$46	n/a
Sidewalks – kms maintained per FTE	n/a	n/a	n/a	55.5	n/a
Sidewalks - % of sidewalk kms maintained	n/a	n/a	n/a	n/a	n/a
Road winter maintenance cost per capita	\$4.84	\$11.16	\$12.07	\$13.65	\$17.46
Sidewalk winter maintenance cost per capita	\$0.40	\$0.44	\$0.32	\$0.35	\$0.55
Snowfall per year (in centimeters)	42.4	78.1	68.2	125.6	93.9
Number of major snow events (5cm or greater)	2	3	4	10	5

Per management, significant factors contributing to the increased tonnes of sand/salt applied per km maintained pertain to the increase in snowfall and number of snow events in 2004 and 2005.

Per management, significant factors contributing to the increased operating cost per lane km include a substantial increase in contractor rates, increased use of contractors, substantial increase in V&E rental rates, substantial increase in cost of sand/salt mix, increased snow accumulation, and more overtime due to higher snow accumulation.

New Technology (i.e. GPS, Underbody Plow)

Advancements in technology can also impact productivity. Equipment is becoming more sophisticated and precise, alleviating problems that arise due to human error. The City of

Saskatoon has been very progressive with regards to technology focused around productivity. For example, GPS systems installed in most of the equipment (i.e. sanders and graders), provide more timely information for productivity monitoring.

Global Positioning System (GPS)

The City tested GPS technology through a pilot project in 1999 and subsequently implemented it in 2000. GPS technology is used as a planning tool to more efficiently and effectively allocate equipment on priority routes with the intention of meeting service levels. Additional benefits include:

- Accurate data on location of equipment at all times if rerouting of equipment is required or a potential breakdown occurs.
- Monitoring staff performance (e.g. achievement of service level standards).
- Having real time information on roads and sidewalks to help management more efficiently schedule and route resources.
- Having access to accurate and timely information on the status of roadways that can be communicated to Branch Managers, General Managers and the public.
- Data for monitoring and evaluating the effectiveness and efficiency of the priority routing system.

Other Technology and Best Practices

Spreaders have been placed on the back of plough trucks to accomplish the clearing and sand/salting function all at once. They have been automated to establish a specified rate of application that is controlled electronically. More precise equipment results in better outcomes from applications, reducing the number of trips required over the same roadway.

Infrared thermometers on the sanding & salting trucks, one of the program's recent proposals to improve services, will allow the operator to know the temperature of the road surface when passing over it. This information provides operators the opportunity to target potential problem areas before the formation of ice occurs, and can lead to potential savings in product consumption and costs and increased public safety. Without this technology, operators must rely solely on visual cues and their experience to determine where problems may exist.

Alternative practices for sanding & salting, which include pre-wetting of roads and the use of materials such as IceBan, have proven to be proactive in managing road conditions. Reducing the quantity of salt required while also reducing the number of applications required to maintain safe road conditions supports being productive.

Operator Training

In order for new operators to receive their Utility Classification, they are required to ride along with an experienced operator for their first 20 hours on each piece of equipment. This provides them with the opportunity to learn more about the equipment and the actual process and the opportunity to ask questions. Once the appropriate time has been logged and the operator feels confident, they can operate the equipment on their own.

Regular training is provided to both experienced and inexperienced operators on an annual basis. This serves as an update or refresher for experienced operators and as initial training for those who are new to a process or piece of equipment. Three general realms for training to occur include the classroom, the field or in the shop through mechanical training.

An “Operator Certification Program” has been developed that provides training on each piece of equipment. This training program focuses on specific aspects of equipment for all operators. Certification through the proper programs and the proper training determines what equipment each employee can operate. Without the proper certification and training, employees are not allowed to operate the equipment.

Most of an operator’s training will come from “on the job” experience. Training during the summer months and “dry runs” before the snow falls familiarize operators with potential issues that may arise. Regular training, updates on new technology, and being aware of the surroundings all contribute to improved operator productivity.

Work Activity Guidelines (WAG)

Work Activity Guidelines are used to promote safe and efficient work methods for each activity assigned to employees. These guidelines provide employees with an understanding of their roles and responsibilities and management with the knowledge of how employees are assigned to various duties (activities). The guidelines are updated as required due to changes in operational processes.

These guidelines contribute to improved operator productivity, by ensuring continuity and consistency in processes, practices and use of equipment.

Work Management Task Group

A Work Management Task Group was recently established, comprised of managers from all areas within Infrastructure Services (e.g. snow & ice management, sidewalk repair and maintenance, hydrant inspection and water and sewer). The mandate of this Group includes reporting on work quality and identifying productivity improvement opportunities (e.g. improvements in technology, best practices, etc.). Per management, this Group has taken steps to encourage front line staff (e.g. equipment operators) to identify and bring forward opportunities for improvement.

This open communication between management and front line staff also promotes the sharing of information between those dealing with setting the standards and controls (management) and those having to follow and adhere to them (staff). Productivity concerns often stem from the lack of communication between the different levels of an organization. Opening communication through an organized group of individuals promotes a healthy work environment, leading to improved productivity.

Work Quality Audits

“Work Quality Audits” were recently introduced. These audits of randomly selected crews, include assessment of all aspects of an activity being performed (i.e. proper clearing of lanes; lights clear and in working order; safety equipment in place; etc.). The audits are completed by Supervisors, Superintendents and Managers to provide management with practical information on the work being completed by staff. They are meant to serve as a preventative control, to identify issues before they become serious problems.

Issues that surface through the audits are to be discussed with the applicable operators to obtain their feedback and input. A summary of the observations and issues is then made available through a presentation to the entire staff. Sharing of this information helps to reduce the potential for accidents or inefficiencies.

The Work Quality Audits are not intended to be intrusive or judgmental to any of the operators; they are meant to identify opportunities for improvement in work practices, technology, etc. that would lead to improved employee safety, public safety and productivity.

Manuals

An example is the “Sander Manual” for the City of Saskatoon. This manual states the objectives of sanding and salting and outlines the checks and measures that each operator needs to follow when operating each type of equipment involved in the process. The Manual includes discussion on all of the basic operational areas such as safety, application procedures, maintenance and equipment use.

Standard Operating Procedures (SOP)

Standard operating procedures provide guidance for all winter maintenance activities. SOP’s include detail procedures for each activity that staff are to carry out. Snow and Ice Management are currently in the process of completing SOP’s for all of the Department’s activities.

Conclusion

With the exception of shift scheduling (which we discuss in the preceding chapter) and resource mix optimization, we believe adequate controls are in place to minimize the likelihood of low productivity. In the preceding chapter, we raise the issues of resource mix (e.g. staff resources, overtime, private contractors) and recommend that management explore strategies for optimizing resource mix and bring forward appropriate recommendations to the Planning & Operations Committee for consideration and recommendation to Council. Further discussion on resource mix and optimization can be found in Chapter 9.

Recommendations

4. That Standard Operating Procedures be developed for all Snow & Ice Management activities.

Management Response

4. Agree

Chapter 5 Risk of Unsafe Sidewalks

We examined current systems, practices and controls for minimizing the risk of public injury caused by snow, ice or slush on sidewalks. Public injury can result in associated liability claims being filed against the City. Per management, the City invests very little in sidewalk snow clearing and sanding – i.e. budgets were \$138,835, \$124,474, \$122,436, and \$181,434 in 2003, 2004, 2005 and 2006 respectively.

Control strengths include public disclosure of service levels, bylaws requiring businesses in certain areas to clear snow from sidewalks adjacent to their property, inspections to ensure bylaw compliance, a hotline for the public to report possible hazards or concerns, and a claims review process.

Opportunities for improvement include:

- Service level compliance monitoring and reporting;
- Posting the service level timelines for sidewalk snow clearing on the City's website.

Background

Sidewalk plowing and sanding is carried out in areas of high pedestrian traffic using industrial sidewalk plows and hand tools.

The City plows and sands designated sidewalks including:

- Sidewalks adjacent to major Arterial and Collector streets, bus routes, elementary and secondary schools, University and SIAST campuses, hospitals, and senior citizen multi-housing units;
- Meewasin trail system, walkways on structures (such as bridges and pedestrian overpasses), and sidewalks adjacent to the downtown bus mall;
- Paraplegic ramps, crosswalks, lane crossings and bus stops in business areas where property owners/occupants are required by bylaw to clear snow and ice from City sidewalks adjacent to their property.

Property owners in the Central Business District and the Broadway, 20th Street, 33rd Street and Central Avenue Business areas are required, by bylaw, to clear snow and ice from adjacent City sidewalks.

There is no snow clearing or sanding on residential sidewalks or walkways except where conditions are expected to cause spring drainage problems. Snow and ice initiatives in residential areas are left up to residents in these areas.

Findings

The current control framework for minimizing the likelihood and potential impact of public injury due to snow or ice accumulation on sidewalks and sidewalk extensions, includes the following elements:

- Service level objectives;
- Bylaw;

- Public disclosure and communications;
- Inspections;
- Hotline;
- Claims review;
- Insurance.

Service Level Objectives

Service levels typically provide timelines for clearing snow and sanding in order to ensure safe movement of pedestrian traffic. If appropriate and followed consistently, they minimize the likelihood and potential impact of public injury and related lawsuits

A service level objective is currently in place and priority routes drafted for sidewalks that are cleared and sanded by the City – i.e. clearing all priority sidewalks within 5 days following a winter storm. The current service level for sidewalks (i.e.) is based on what management feels can be accomplished given existing staffing levels. Where weather conditions are extreme, equipment breaks down or other unknown factors play a role, service levels can become difficult, if not impossible, to meet.

A service level objective is in place for property owners who are responsible, under Bylaw No. 8463, for clearing and removal of snow and ice on City sidewalks adjacent to their properties in certain business areas of the city - i.e. removal of snow on or before 0900 hours after the snowfall ceases, or in case of a heavy snowfall, on or before 1200 hours each day.

With regard to other cities, we note that the City of Edmonton has established service levels for all activities including sidewalks. The City assumes responsibility for clearing snow from 950 kilometers of the 4,400 kilometers of sidewalks in Edmonton. If there is a property owner adjacent to the sidewalk, the responsibility for clearing the snow from that sidewalk is placed on that owner by bylaw, the City generally assuming responsibility for all other sidewalks within City limits. Priority levels are documented, with School Zones, Senior's lodges and Hospitals being Priority 1 and arterial sidewalks with high traffic volume being Priority 2. The City has 15 sidewalk plows. Per management, this is not sufficient to meet demand; therefore, they contract approximately 55% of their sidewalk plowing to meet service levels. Per the City's Bylaw, all sidewalks must be cleared within 48 hours to a bare surface. This includes both residential and commercial areas. The City holds itself to the same 48 hour timeline.

We note that in the City of Regina, sidewalks are cleared based on the priority of street they are parallel to (i.e. a sidewalk running alongside a Priority 1 street is classified as a Priority 1 sidewalk). Sidewalks are cleared prior to roadways of the same priority to allow the plowing of snow from the sidewalk onto the roadway. Refer to Chapter 8 for roadway clearing service level standards. Similar to Saskatoon, sidewalks in non-residential areas are only cleared where responsibility has not been assigned to a business owner through Civic bylaw.

The City of Winnipeg clears the entire network of sidewalks throughout the City including residential areas. The City has established three priority levels that range from clearing snow with 36 hours to 5 days following the end of an average storm. As stated by management, residential sidewalk clearing requires a great deal of resources, keeping staff busy throughout the winter season simply to maintain the priority levels established.

Bylaw

Responsibility for clearing and de-icing sidewalks is shared by the City, property owners in business districts, and residents.

Bylaw No.8463, replacing Bylaw No.2780 on January 23, 2006, places responsibility on property owners in specified business districts, to keep sidewalks adjacent to their properties, clear of snow and ice. The Bylaw specifies service level expectations and provides the City with the authority to undertake this work and charge the related cost to the applicable property owners, if they fail to comply with the Bylaw. The Bylaw also provides opportunity to impose fines on those who fail to comply with it.

Having a Bylaw in place legally transfers some degree of accountability to adjacent property owners, increasing the probability of service levels being met and reducing maintenance costs that the City and local taxpayers would otherwise have to fund.

Public Disclosure and Communications

Public disclosure of service levels increases accountability. Accountability, in turn, increases the likelihood of service levels being achieved.

The City has used a variety of strategies for disclosing and communicating expectations regarding sidewalk snow clearing including brochures, placement of ads in newspapers, television commercials (i.e. Global-2006) and the City website. Two years ago, the City distributed brochures to households outlining responsibilities for clearing sidewalks. The brochure also included service level timelines for the City and business owners to clear sidewalks in high pedestrian traffic areas and business districts respectively, and stressed that property owners were responsible for clearing and de-icing sidewalks in front of their property in residential areas. The City currently posts information on its website encouraging residents to clear snow from sidewalks adjacent to their property.

Inspections

Supervisors conduct inspections of sidewalks in areas designated in Bylaw No. 8463, in conjunction with complaints that are issued by the public. There are no routine inspections in place to ensure that property owners are complying with service levels prescribed in the Bylaw.

Supervisors conduct routine inspections of sidewalks that fall within the City's area of responsibility, in order to confirm that the City's service level objectives are being met. If there is concern with respect to a particular sidewalk that has already been cleared, the supervisor communicates the concern and the crew returns to correct the situation. Supervisors provide an

objective analysis of the work being completed by City staff. Legitimate complaints from the public are also forwarded to the supervisor in charge for inspection and corrective action.

Supervisors inspect sidewalks to identify “extreme areas of hazard”. An example includes a water main break causing a sidewalk to become completely iced-over. Where such hazards are identified, the priority of sidewalks would change to address the concern, reducing the risk of public injury.

Hotline

A Hotline was established that allows for the reporting of any possible hazards or concerns with regards to the roadways or sidewalks. This information is screened for repeated or insubstantial requests and is then dispatched or forwarded on to a supervisor as a “Work Request Registry”. Supervisors receive “work request registry” reports daily, and undertake the necessary inspections to reduce or eliminate any potential hazard (risk). In cases where an immediate response is required (i.e. icy section of sidewalk), dispatch has the ability and will send out the proper equipment immediately to address the issue.

Claims Review

The City Solicitor’s Office Risk Management section receives and processes claims, monitors claims history, and takes corrective action, when required. Infrastructure Services also receives details from the City Solicitor’s Office on all ‘slip and fall’ claims pertaining to sidewalk snow clearing and de-icing. Claims information can assist in monitoring the appropriateness of, and compliance with, service level objectives established for sidewalk snow clearing and ice control.

The number of ‘slip and fall’ claims against the City has been declining over the past three years – i.e. 8, 7 and 1¹ in 2003, 2004 and 2005 respectively. The total cost associated with these claims was not available.

Insurance

The City of Saskatoon holds a Commercial General Liability Policy to help minimize the effect of possible lawsuits that can occur against the City.

Conclusion

There are differences in how each City addresses sidewalk snow clearing, particularly with regards to residential areas. Saskatoon and Regina do not clear residential sidewalks. Edmonton has a bylaw requiring residents to clear snow from adjacent sidewalks. The City of Winnipeg clears the entire network of sidewalks, including those in residential areas.

With the exception of service level compliance monitoring and report, we conclude that adequate controls are in place to minimize risk to the City attributable to snow and ice on city sidewalks.

¹ The 2005 figure covers the first two months of 2005.

Recommendations

5. That the City's website be updated to include sidewalk snow clearing service level timelines.
6. That a system be put into place for measuring, monitoring and reporting on the extent of compliance with sidewalk snow clearing service levels.

Management Response

5. Agree
6. Agree

Chapter 6 Risk of Damage to Private Property

Damage to private property is an inherent risk for the Snow and Ice Management Program.

In our opinion, adequate systems, practices and controls are in place to minimize the likelihood and potential impact of this risk. This is reflected in statistical trends which show relatively few incidents.

Control strengths include requiring operators to have commercial drivers licenses, operator training and certification, designated snow routes, technology on equipment, policy on disciplinary action for frequent accidents, accident reporting, accident review committee, equipment pre- and post-use inspections, standard operating procedures & training manuals, and insurance.

Background

Factors that can affect the likelihood of accidents and related damage to private property include, but are not necessarily limited to, equipment condition, equipment size and type (e.g. graders, sanding trucks), operator qualifications and experience, operating procedures, parked vehicles, traffic levels, weather conditions, etc.

Findings

The current control framework for minimizing the likelihood of accidents resulting in damage to private property includes the following elements:

- Drivers License
- Operator training and certification;
- Designated snow routes;
- Technology on equipment;
- Policy on disciplinary action;
- Accident reporting;
- Accident Review Committee;
- Equipment inspection;
- Standard Operating Procedures and Training Manuals;
- Insurance.

Commercial Drivers License

The ability to operate each piece of equipment for snow and ice operations requires a specific Utility rating. Each Utility rating requires a special license (i.e. Utility A – 1A license; Utility C – 3A license). A specialized license requirement along with the associated training requirements promotes a safe work environment where the operators understand the equipment they are operating, in turn lowering the risk of damage to property.

Operator Training and Certification

When an operator is involved in an accident it is often due to lack of experience. This “lack of experience” can usually be attributed to low hours of operation with a particular piece of equipment or a new route being traveled without the proper preparation and planning. Management for snow and ice operations ensures that each operator is properly trained before they are expected or allowed to operate equipment.

Training is offered several ways including:

- “Dry runs” are conducted before the winter season begins, noting any obstructions and getting a feel for the route.
- New operators travel with an “experienced operator” for a minimum number of hours or until the experienced operator feels comfortable with their progress.
- “Training seminars” are held to educate operators on new technology. Refresher courses are also held, on regular operational practices.
- “Training and Operating Manuals” are provided to all operators. Regular revisions to these manuals are also provided to and reviewed with staff.

Effective training reduces the likelihood of damage to private property.

Designated Snow Routes

In 1999, the City of Saskatoon implemented a Snow Route System to improve snow clearing services, and to increase the efficiency of the overall snow and ice control program. When conditions warrant the need for Snow Routes, residents would be informed through the media when Snow Route parking restrictions will commence, and be enforced. Residents would receive at least 8 hours advance notice, and would be expected to have their cars relocated once parking restrictions take effect.

The plan was to have snow routes remain in effect until snow has been cleared from the site, to a maximum of 72 hours. Residents could then resume parking on snow routes as soon as city crews have completed their work at that location.

While the intention of the City was to implement Snow Routes in 1999 on a trial basis, the lack of snow that winter resulted in a delay for implementing these Snow Routes. Currently, Snow Route signs are in place and the routes are designated for a test trial, while enforcement of these routes has never been in practice. Implementation of these routes would require notification to the public. Notification would generally include a letter to residents and public meetings to discuss how this practice will affect the applicable areas being cleared.

The following snow routes were designated in 1999:

- 33rd Street to Confederation Drive
- 12th Street, Broadway to Cumberland

The matter of designated Snow Routes is under review and is not currently covered under any civic Bylaw (e.g. Traffic Bylaw). Management is in the process of collecting information from other cities where designated snow routes have been in place for some time. The intent is move forward with implementation of the designated snow route program, benefiting from the experiences of other cities. Amendments to the Traffic Bylaw will be required to designate show routes and provide for enforcement.

Technology

All equipment used to manage snow and ice conditions for the City is stored and maintained by Vehicle Equipment Services. Each piece of equipment is designed with safety in mind and, therefore, comes standard with features such as backup sirens, flashers, etc. Other methods for ensuring the safety of both the public and staff include advanced warning systems and barricades. Snow and Ice Management places an emphasis on advising the public of possible hazards as well as ensuring its equipment is well marked to reduce the potential for accidents.

Policy on Disciplinary Action

The City currently has a stringent policy to react to operators who are involved in an excessive number of accidents. This action usually results in reassignment, while demotion or potential termination can result given the right circumstances. Disciplinary action is directed at providing a solution for the problem, recognizing that not all staff will function at the same level and efficiency.

Accident Reporting

All staff are required to report accidents that occur while working in the field, documenting all circumstances applicable to each incident.

Accidents are monitored for each employee, in terms of severity and cost to the City. Monitoring facilitates timely identification of any undue risk that an individual employee may be placing on the City that could be dealt with through additional training, additional supervision, possible reassignment, or disciplinary action.

Annual preventable accidents averaged just under 8 from 2000-2005. Total accidents averaged 20 per year from 2000-2005.

Accident Review Committee

All accidents involving City employees are reviewed by the Accident Review Committee. This Committee is within Infrastructure Services. Its role is to determine whether the accidents were preventable or non-preventable. The Committee is comprised of management and supervisors. If the employee feels that the decision made by the Accident Review Committee is inappropriate, the case would then be passed on to the Appeals Committee within Infrastructure Services, comprised of both management and a representative from the union.

The committees promote an atmosphere of independence and objectivity where both management and employees are able to voice their opinions before an impartial group of individuals - i.e. individuals on the committees have no direct accountability for area in which the employee works.

Equipment Inspection

Operators conduct pre-trip and post-trip inspections on equipment. Inspection procedures are described in detail in the operator training manuals for each piece of equipment. Pre- and post-inspections ensure that the equipment is safe to operate, reducing the potential for equipment malfunction or failure that could result in damage to private property. Inspections also facilitate disclosure of damage to the equipment that may have been the result of an unreported accident involving private property (e.g. private vehicle). Each piece of equipment has a "log book" that is used to record a number of details including the operator name, hours of operation, maintenance and repairs, etc. The "log book" acts as a record of the life of the equipment and allows management to link accidents to specific operators for accountability purposes.

Standard Operating Procedures and Training Manuals

Each piece of equipment has a training manual that describes how to safely operate and maintain it. The training manuals are made available to staff, are updated annually and are very detailed in their description of equipment and potential operating hazards.

"Standard Operating Procedures" have also been documented and are available to staff. The Standard Operating Procedures detail out each activity involved with winter maintenance (e.g. plowing techniques).

Having each employee familiar with the equipment they operate and standard operating procedures, promotes safe work practices that, in turn, reduces the likelihood of accidents causing damage to private property.

Insurance

The City of Saskatoon holds a Commercial General Liability Policy to help minimize the effect of possible lawsuits that can occur against the City.

Conclusion

Adequate systems, practices and controls are in place to minimize the likelihood and potential impact of damage to private property. This is reflected in the low frequency of accidents that the City has experienced over the past few years.

Recommendations

That the information be received.

Chapter 7 Risk of Damage to the Environment

Damage to the environment due to sanding and salting, is an inherent risk for the Snow and Ice Management Program. Road salts can be a major pollutant in both urban and rural areas. Snow runoff (on roads and at snow storage sites) containing salt can produce high sodium and chloride concentrations in the river. This can cause unnecessary fish kills and changes to water chemistry.

Management is taking reasonable and responsible steps to minimize the likelihood and potential impact of this risk. In particular, we note development of a Salt Management Plan appears to be consistent with Environment Canada's Code of Practice for the Environmental Management of Road Salts and the Transportation Association of Canada's Synthesis of Best Practices in Road Salt Management.

Background

Road salts enter the environment through losses at salt storage and snow disposal sites and through runoff and splash from roadways. High releases of road salts can have an adverse effect on freshwater ecosystems, soil, vegetation and wildlife. Road salts include sodium chloride, calcium chloride, potassium chloride and magnesium chloride. The mixture that the City of Saskatoon uses typically contains 95% sand and 5% salt, the salt used to keep stockpiles manageable under extremely cold temperatures. Alternatives to using a standard salt mixture include the use of Iceban targeted at reducing the percentage of salt required to a 2-3% blend. Iceban reduces the amount of salt placed on the roads and, therefore, entering into environment through runoff and clearing. A product called Caliber was used in the 2005/06 winter in order to reduce the amount of sand and salt spread on the roads. While this product is very effective, its use is limited to mild temperatures, therefore requiring an alternative when its application is not considered effective.

The City of Saskatoon's current policy with regard to road salting is to respond as quickly as possible where icy conditions may exist. While there are no formal policies with respect to the environment, the City's intention is to reduce the amount of salt released to the Environment through effective salt management practices. A Salt Management Plan was implemented in order to lead this practice and to make road safety a top priority.

The City applies, on average, 22,041 tonnes of salt and sand on city streets and roadways during the winter months.

Findings

Environment Canada Code of Practice for the Environmental Management of Road Salts

In 2004, Environment Canada introduced the Code of Practice for the Environmental Management of Road Salts. This Code is designed to help municipalities and other road authorities better manage their use of road salts in a way that reduces any harm they cause to the environment while maintaining road safety. Per the City of Calgary website:

- Health Canada released a report in 2001 that indicates road salts are not harmful to humans. However, a 2001 assessment report by Environment Canada indicates that road salts are

entering the environment in amounts large enough to pose a risk to plants, animals, birds, fish, lake and stream ecosystems and groundwater.

- As a result of the scientific assessment, Environment Canada recommended adding road salts to Schedule 1 (Priority Substances List) of the Canadian Environment Protection Act (CEPA). This recommendation led Environment Canada to release the *Code of Practice for the Environmental Management of Road Salts* in 2004.

The Code of Practice advocates the following:

- Development of salt management plans, based on a review of existing road maintenance operations, identification of means and goal-setting to achieve reductions of the negative impacts of salt releases;
- Implementation of best management practices in the areas of salt application, salt storage and snow disposal, as outlined in the Transportation Association of Canada's *Syntheses of Best Practices*;
- Monitoring and reporting information to Environment Canada within prescribed timelines.

Five years after publication of the Code, organizations will be invited to participate with Environment Canada in an evaluation of progress achieved towards prevention and reduction of the negative impacts of road salts on the environment through implementation of the Code. The review will help determine if other steps or programs are needed.

The final Code of Practice issued under Section 54(1) of the Canadian Environmental Protection Act, 1999, applies to organizations which are defined to include public entities that use or are responsible for the use of road salts on public roads in Canada and companies that hold a concession or lease to manage a public road. Organizations that use more than 500 tonnes of road salts per year and organizations that have vulnerable areas in their territory that could potentially be impacted by road salts have one year to prepare a salt management plan containing best management practices to protect the environment from the negative impacts of road salts.

The City of Saskatoon uses approximately 2,500 to 3,000 tonnes of road salts per year, while also having vulnerable areas that could be potentially impacted by road salts – i.e. the Saskatchewan River. Environment Canada advocates the use of more environmentally benign alternatives in these more sensitive areas. The City of Saskatoon does not currently use environmentally benign materials in sensitive areas.

Pursuant to the Code, the City has developed a Salt Management Plan and is implementing TAC best practices. The City of Saskatoon began filing reports with Environment Canada in 2004/05. The report includes figures on the use of road salts each year.

Transportation Association of Canada – Synthesis of Best Practices: Road Salt Management

The Transportation Association of Canada has issued a series of Synthesis of Best Practices related to the management of road salt use in winter maintenance operations, including the following:

- Salt Management Plans;

- Training;
- Road and Bridge Design;
- Drainage and Storm Water Management;
- Pavements and Salt Management;
- Vegetation Management;
- Design and Operation of Road Maintenance Yards;
- Snow Storage and Disposal;
- Winter Maintenance Equipment and Technologies.

Both the Environment Canada Code of Practice discussed above, and the TAC Synthesis of Best Practices include frameworks for Salt Management Plans. The Infrastructure Services Department has drawn from both sources in developing a Salt Management Plan for the City of Saskatoon.

Salt Management Plan

As noted above, the City has developed a Salt Management Plan. We reviewed the Plan for consistency with the frameworks set out in the Code of Practice and the TAC Synthesis of Best Practices.

The Code of Practice Framework includes the following criteria:

- Provide a statement recognizing the role of a salt management plan in achieving improved environmental protection without compromising road safety
- Provide a commitment or endorsement of the plan at the highest level in the organization
- Identify activities or operations through which road salts may be released to the environment and goals to achieve reduction of the negative environmental impacts of these releases
- Assess current practices against recommended best management practices, including those contained in the TAC Syntheses of Best Practices
- Contain documentation of all policies and procedures applicable to the salt management plan
- Include communication activities necessary to inform the organization and the public of the salt management plan and related policies and procedures
- Contain a training program for all personnel when managing or performing winter maintenance activities involving the use of road salts
- Provide response procedures to react to uncontrolled releases of road salts that could result in environmental impacts
- Ensure monitoring of actions to measure the plan's effectiveness
- Include record-keeping as described in section 15 of this Code
- Include a procedure for yearly review of the plan by the organization with continual improvement of salt management practices and the salt management plan as better management practices become known and progress is achieved
- Establish and implement corrective actions to address deficiencies identified in the operations of the organization to which the plan applies

The TAC Synthesis of Best Practices includes the following criteria:

- Salt management policy and objectives
- Situational analysis (i.e. inventory of current practices that encompasses the following elements: on road use, salt vulnerable areas, sand and salt storage sites, snow disposal sites, and training)
- Documentation and communication of policies, procedures and guidelines in specified areas (e.g. level of service for each roadway type, salt and sand application rates, etc.)
- Identification of gaps in best practices and proposed approaches for addressing the gaps (i.e. clear tasks, schedules with milestones, budget considerations, and assigned responsibilities for implementing best salt management practices)
- A comprehensive education/training program that demonstrates the value of new procedures and ensures that personnel have the necessary knowledge and skills to implement the plan effectively
- Provision and assigned responsibility for monitoring, analyzing and reporting to senior management, City Council, staff and the public on the implementation status and results of the Salt Management Plan
- Provision for annual review by senior management to confirm that progress is being made, and that corrective action is taken when necessary

Based on discussion with management and review of the plan, we conclude that the foregoing criteria appear to have been met.

Conclusion

The City is taking reasonable and responsible steps to minimize risk to the environment associated with road salts. The Salt Management Plan appears to meet the content criteria set out in the Code of Practice and the TAC Synthesis of Best Practices.

Recommendations

That the information be received.

Chapter 8 Service Level Appropriateness & Performance

We assessed the appropriateness of current service levels relative to the other cities' service levels and the criteria used to establish service priorities. We also assessed the adequacy of systems, practices and controls for ensuring service levels are met.

Based on benchmark data, consistency of current service priorities and timelines with the City's related public policy and service level objectives, and the process that management follows when reviewing the ongoing appropriateness of service levels, we conclude that established service levels are appropriate.

We conclude that existing systems, practices and controls provide reasonable assurance that service levels will be met with the following exceptions:

- Service level compliance reports are not completed on a consistent basis;
- Service level compliance reports are not being prepared for snow removal, sanding/salting and sidewalk clearing.

Compliance reports are an essential control for demonstrating results and holding responsible parties accountable.

Background

Service levels were formally established by the City of Saskatoon in 1985-86 and have been revised from time-to-time as the City expands, technology advances and priorities change. A revised priority map was presented to Council on February 20, 2006, focusing on traffic volumes and emergency services.

The city's streets were previously assigned to five priority classifications, including industrial areas, for the purpose of snow clearing, snow removal and ice control. The revised priority map has reduced these levels down to three primary classifications with a fourth noted as Industrial. Each priority classification, in turn, is assigned a service level objective. The following are the four revised priority classifications and applicable service levels:

- Priority 1: Within twelve hours of snowfall or within six hours of the development of icy conditions. Includes all roadways with average daily traffic volumes greater than 15,000.
- Priority 2: Within thirty-six hours of snowfall, or within twelve hours of the development of icy conditions. Includes all roadways with average daily traffic volumes between 7,501 and 15,000, including all emergency roads or streets adjacent to emergency roads if not already declared a priority 1 or 2 street.
- Priority 3: Within seventy-two hours of snowfall, or within twenty-four hours from the development of icy conditions. Includes Central Business District, priority bus routes, and remainder of major arterials.

- **Industrial:** This priority relates to industrial streets which are contracted out and prioritized under the same structure as Priority 1 to 3 streets listed above, to be cleared and sanded in the same manner as non-industrial roads.

Roads are cleared based on priority once accumulations warrant. During their shifts, operators will return to Priority 1 and Priority 2 streets where necessary – i.e. these streets take priority over all other lower priority streets. This process keeps high traffic roadways that are often higher speed roadways, clear of snow and ice. Lower priority streets are serviced once Priority 1 and Priority 2 streets are clear of accumulations and considered safe.

Residential streets are graded only ‘when required’ and as resources permit – i.e. to reduce ruts or when lanes are impassable. Residential snow removal is only carried out in particular cases to improve spring run-off conditions or in areas of high parking (e.g. University, Kelsey).

Snow Removal from road right-of-ways is typically limited to the Central Business District and Priority 1 & 2 streets. There are no prescribed timelines for removal. Criteria for determining when snow should be removed include:

- Limited availability of snow storage in right-of-ways
- Windrows reach specified height
- Traffic sight lines are restricted
- Safety concerns exist
- Spring drainage concerns exist

Sidewalk plowing and clearing is carried out in areas of high pedestrian traffic as well as sidewalks adjacent to major arterial and collector streets, bus routes, schools, universities and colleges, hospitals and senior citizen multi-unit housing complexes. Other responsibilities of the City include the Meewasin trail system, walkways on bridges and overpasses, and sidewalks adjacent to the downtown bus mall. The intention of the City is to clear all applicable sidewalks within 5 days.

Property owners in designated business areas are responsible for clearing snow from sidewalks adjacent to their property. This requirement is enforced through Bylaw No. 8463. The service level expectations are spelled out in the Bylaw – i.e. removal of snow within 5 hours after the snowfall ceases, or if the snowfall ceases during the night, before twelve o’clock noon the following day

Findings – Appropriateness of Service Levels

Consistency with Policy Objectives

The priority classifications and service level timelines are consistent with the following public policy objectives:

- Safe, efficient and affordable movement of vehicle and pedestrian traffic.
- Minimize economic loss to the community resulting from unsatisfactory road conditions.

The new priority classifications and new service level timelines are also consistent with the following service level objectives that have been posted on the City's website:

- To ensure that key emergency transportation routes are passable, and to enable the safe and normal movement of vehicles and goods along designated emergency and "hazardous goods routes".
- To enable the safe and normal movement of high priority public transportation by ensuring that a majority of residents are within two kilometers walking distance of public transportation.
- To ensure safe and normal traffic movement for the majority of residents, and "high ridership" public transportation routes.
- To ensure that public transportation is able to move on all routes, and access to nursing homes is clear.
- To enable the safe and normal continuation of industrial/commercial activity along designated streets.

Traffic volumes are the primary factor in designating the order of revised priority routes, with emergency routes including fire halls, ambulance sites, and hospitals being placed as a Priority 1 regardless of traffic volume. Other considerations were given to transit routes and streets adjacent to schools.

Review Process

In determining the above revised priority routes, management noted the following steps that were carried out to establish a relevant and applicable priority map that could be used and relied on:

1. Create priority map based on traffic
2. Revise priority map based on factors that affect the safe and economical transportation of the public. Factors include access to emergency facilities, clearing of bus routes, continuous routing and consideration of areas that will be cleared by contractors (i.e. industrial and school zones).
3. Discuss revised priority map with specific City departments including Transit, Roadways, etc. for input to ensure objectives are met for all facets of transportation. Revisions made where acceptable.
4. Discuss revised priority map with operators to obtain feedback on whether these changes can be implemented and to determine how these changes will affect the priority service levels.
5. Revisions made to the Service Level documents provided to the public. As priority levels and routes have been revised, there will be a required alteration in the time it will take to meet service levels for each priority.
6. Complete compliance reports with respect to the revised service levels in order to assess whether they are appropriate.
7. Annual review of priority routes considering new expansion/infrastructure, bus routes changes, etc.

Other Cities

Survey results indicate that other cities in Western Canada take the same approach in defining service levels – i.e. establish 'priority classifications' and 'timelines' for servicing the priorities.

A report completed in 2003 by the City of Winnipeg compared the plowing of residential streets of eight different cities. The results showed that the three Western cities do not provide residential plowing (Edmonton, Calgary and Regina) while the four Eastern cities (Toronto, Hamilton, Ottawa, Montreal, and Winnipeg do provide residential plowing). In that same report, Winnipeg noted that residential plowing, not removal of snow, had a budgetary impact of \$1.9 million.

In February 2005, the Administration filed a report with the Executive Committee of Council that included, among other things, benchmark information on service levels. The report indicated that each city uses a priority system as the basis for how work gets carried out although differences existed in the time allowed for each priority. We also researched other Cities' service levels with regard to roads, and their approach to meeting those levels, benchmarking these service levels to that of Saskatoon. Our survey results showed the following significant differences:

Table 7: Service Level Comparison

City	Priority 1 Street Clearing (hrs)	All Priority Street Clearing (hrs)	Accumulation Requirements (cm)
City of Saskatoon	12	72	No policy**
City of Regina	24	60	No policy*
City of Edmonton	24	48	3
City of Winnipeg	36	48	3-5

* Regina officials stated that this measure is discretionary, with drifting snow and accumulations dictating when operations commence.

** Saskatoon does not state a guideline clearly in their service levels, although guidelines are in place and implemented as follows:

1-3 cm (Sanding)

3-5 cm (Priority 1 Plowing)

Greater than 5 cm (Snow Clearing – All equipment)

Claims Analysis

The Infrastructure Services Department receives details from the City Solicitor's Office on all roadways claims filed against the City. With regard to winter claims, the report shows the number of incidents by category – e.g. slip and fall, ice conditions, grader accident, sanding truck, etc.

SGI maintains statistical trends relating to accidents attributable to snow and ice conditions. This information is not passed on to the Snow & Ice section. However, it would assist in monitoring the appropriateness of Service Levels.

In 2004, the City engaged Earth Tech (Canada) Inc. to conduct a Roadways Infrastructure Services Needs Assessment. A collision review was conducted as part of the Needs Assessment. Earth Tech used collection statistics provided by SGI, to conduct the review. They identified two areas in particular, that had a disproportionately high number of collisions during the winter months – i.e. Idylwyld Bridge and Circle Drive Bridge. The report noted that, per data provided by SGI, the average collision cost based on severity was as follows:

- Property damage only collision \$4,800

- Collision with a personal injury \$180,000
- Collision involving a fatality \$1,400,000

Knowledge and understanding of incident trends can help in establishing and assessing the ongoing appropriateness of service level objectives.

The following Table shows winter roadways claims history over the past three years.

Table 8: Roadway Claims

Year	Plow Truck	Sanding Truck	Slip & Fall	Ice Conditions	Grader Accident
2003	1	5	8	9	2
2004	4	5	7	8	3
2005 ²	-	5	1	11	3

Findings – Controls for Ensuring Service Levels are Met

The current control framework for ensuring service level priorities and timelines are met includes the following elements:

- Service Level Compliance Reports;
- Public disclosure of service level objectives;
- GPS technology;
- Service level appropriateness review process;
- Alternative resourcing strategies;
- Employee training and communication;
- Operator assignments;
- Supervision;
- Designated snow routes.

Service Level Compliance Reports

Service Level Compliance reports were implemented by management in January 2004 with the intention of providing a detailed analysis of compliance with service levels for snow clearing. Management meets after each major storm to review compliance issues and to determine steps that need to be taken in order to create a more efficient snow clearing processes. Reports have generated results that include revisions to the priority routes, requests for new equipment, discussion around new shifting arrangements to better meet service level objectives, etc.

² Information provided to February 18 for the 2005 winter season, therefore not representing the calendar year of 2005.

Public Disclosure of Service Levels

The City's service levels for the snow and ice management program are posted on the City's web site. Brochures have also been prepared and distributed in the past to households, describing certain aspects of the snow and ice management program – in particular, service levels relating to snow clearing, sanding and salting, and sidewalk clearing. Ads have been placed in local newspapers in the past and advertisements on television are something new the City is using for 2006.

Public disclosure helps to promote clarity and understanding of service level expectations, elicits cooperation and understanding from the public, and provides a basis for public accountability. Public knowledge of service level priorities and timelines also serves as a catalyst to encourage management and staff to focus on performance – i.e. achieving service level expectations.

GPS Technology

The Infrastructure Services Department has introduced GPS technology to assist in developing routes and monitoring compliance with service levels. Management stated that technology will be implemented in late 2006 or early 2007 to allow the tracking of equipment that is in operation versus traveling. This technology could then document work completed and the information be used to complete compliance reports on a regular basis.

Service Level Review Process

The current process for evaluating the appropriateness of established service levels begins with identifying the priority order of all stakeholders and includes consultation with operators and other civic departments. Consultation builds commitment and ensures service level priorities and timelines are achievable.

Alternative Resourcing Strategies

The City uses overtime and outside service providers to top-up resources during periods of heavy demand. Using overtime and private contractors when demand exceeds available resources increases the likelihood of service levels being met. As noted elsewhere in this report, the City has several contracts with local companies, covering industrial sites, school zones and other services such as pushing snow dumps and hauling snow. These contracts do not guarantee any amount of work but do specify response times and completion times that are consistent with the City's service level standards.

Employee Training & Communication

Employees are made aware of service level expectations during training sessions and through ongoing communication with their supervisors. Employee knowledge increases the likelihood of service level compliance.

Operator assignments

Operators are provided time frames and priority routes at the start of their shifts. Knowledge of performance expectations increases the likelihood of service level objectives being met.

Supervision

Supervisors conduct field trips to monitor and assess road conditions and effectiveness of operations and provide feedback to management and operators on inefficiencies or problems that exist. Field trips and proper communication of findings increase the likelihood of service levels being achieved.

Snow Routes

The City of Saskatoon implemented a Snow Route System in 1999 to improve snow clearing services, and to improve the efficiency of the overall snow and ice control program. Improved efficiency increases the likelihood of service levels being met. Under the program, parking restrictions are only in effect with snow routes have been publicly declared.

When snow route restrictions are publicly declared, residents will be informed. Residents will receive at least 8 hours advance notice, and will be expected to have their cars relocated once parking restrictions take effect. Snow routes will remain in effect until snow has been cleared from the site, to a maximum of 72 hours. Residents can resume parking on snow routes as soon as city crews have completed their work.

Conclusion

The current service levels are appropriate relative to the City's policy objectives and other cities' service levels. Our conclusion was also based on the review process that was followed by management.

With the exception of improvements required in service level compliance reporting, we believe that adequate systems, practices and controls are in place for ensuring service levels are met.

- Service level compliance reports for roadway snow clearing have not been prepared on a consistent basis. One report was generated for January 2004 and one in January 2005, with no compliance report completed for all of the other snow events. Per Environment Canada's "Daily Historical Weather Reports" there were 6 storms of significance from October 2004 until April 2005 where snow fall was greater than 5 centimeters. Only one compliance report was generated for this time period.
- Service level compliance reports are not generated for other activities – i.e. snow removal; sanding/salting; sidewalk snow clearing. Consequently, there is no accountability for achieving results in these areas.

Elsewhere in this report we recommend that service level compliance reports be prepared consistently and for all major snow and ice control activities.

Recommendations

That information be received.

Chapter 9 Use of Private Contractors

The City currently uses a mix of in-house resources (regular shifts and overtime) and private contractors for snow and ice control activities. Employees are also assigned to alternative work during periods of low demand (e.g. no snow accumulation).

The current staff scheduling strategy (e.g. 8.57 hour shifts; full staff complement at times when snowfall is often low and when limited alternative work is available) leads us to conclude that there may be room for improvement in optimizing the level and mix of resources required to meet snow and ice control service levels.

We note that other cities make more extensive use of the private sector in their resource mix. Possible constraints to the City of Saskatoon's ability to increase private contractor participation in the program include the collective agreement and the availability of qualified external service providers.

Despite these constraints and the fact that Saskatoon's program cost per capita is lower than three of the four cities surveyed, we are recommending that management explore strategies for optimizing resource mix (i.e. staff, overtime, private contractors).

Findings

Activities that account for most of the resources allocated to snow and ice management include the following:

- Snow clearing, snow removal and sidewalk plowing and clearing;
- Ice control (sanding and salting).

The following table shows actual staff year equivalents and operating funds allocated to each of the program activities in 2005.

Table 9: 2005 Budget Allocation

Program Component	2005 Budget	% of Budget	Per capita cost
Snow Clearing, Removal & Sidewalk Clearing & Removal	\$1,774,423	60%	\$8.35
Ice Control (sanding & salting)	\$1,159,379	40%	\$5.45
Total	\$2,933,802		\$13.80

Snow Clearing

2004 resources and practices for Snow clearing included:

- 15 operators available to operate motor graders, speed plows and underbody plows (sanders if required) on the weekday shift (7:00 – 15:30).
- 7-9 operators available to operate motor graders for snow removal (snow clearing if required) on the weeknight shift (22:30 – 7:00). Some operators on the 12 hour (24/7) shifts are trained to operate motor graders for clearing although demand usually keeps these individuals on ice control, sanding and salting roads.
- 20 plowing units that include motor graders, single axle speed plows, tandem speed plows and tandem underbody plows.
- Plowing at night is significantly more efficient than plowing during the day due to the limited traffic at night.
- Almost all weekend snow clearing must be performed by operators on overtime.

Table 10: 2004 Regular Staffing (Snow Clearing)³

	Monday-Friday 7:00-15:30	Saturday-Sunday 7:00-15:30	Monday-Friday 15:30-22:30	Saturday-Sunday 15:30-22:30	Monday-Friday 22:30-7:00	Saturday-Sunday 22:30-7:00
Permanent Staff	15-20 mixed⁴	2 mixed	None	2 mixed	7-9 mixed	None
Available Staff	6 sanders	6 sanders	6 sanders	6 sanders	6 sanders	6 sanders

Snow plowing and clearing priority routes focused on traffic volumes and the speed of traffic. Equipment such as front body plows are used on high speed roads such as Circle Drive while graders are used to clear snow on Priority 1 streets such as 8th Street.

During a typical snow storm cleanup, all equipment and operators would be scheduled on a 24/7 basis until high priority streets are cleared. Large accumulations require 12 hour shifting, creating a demand for over-time from regular staff until priority routes are cleared. Large accumulations occur, on average, 3 to 4 times per year. Each cleanup takes approximately one week to clear, depending on nature of the storm and previous accumulations of snow.

Snow Removal

Snow removal requires a large amount of resources for an extended period. Management has found the need to contract services out when having to remove snow due to large accumulations. City of Regina officials noted that the cost to remove snow is approximately ten times greater than the cost to clear it.

³ Permanent Staff are defined as staff working their regular shift; Available Staff are defined as staff working their regular shift that can be transferred between snow and ice activities. There is no consideration given to overtime in this table.

⁴ Mixed staff refers to a variety of staff that could include sander, grader or sidewalk plough operators.

Resources and practices for snow removal include:

- In 2004, approximately 60% of snow was removed during the Sunday to Thursday night shift (22:30 – 7:00). The remainder of snow was removed during the day shift.
- Per management, 90% of snow should be removed during the night shift Sunday-Thursday as a best practice. The final 10% should be removed during the day in residential areas, where parking is less of a problem than at night.
- Staffing suggested as above with 12 hour shifts (4on-4off) having 10-12 staff during the day and 12-16 at night.
- Semi-trailers are contracted for snow removal when required.

Table 11: 2004 Regular Staffing (Snow Removal)⁵

	Monday-Friday 7:00-15:30	Saturday-Sunday 7:00-15:30	Monday-Friday 15:30-22:30	Saturday-Sunday 15:30-22:30	Monday-Friday 22:30-7:00	Saturday-Sunday 22:30-7:00
Permanent Staff	15-20 mixed	2 mixed	None	2 mixed	7-9 mixed	None
Available Staff	6 sanders	6 sanders	6 sanders	6 sanders	6 sanders	6 sanders

Sidewalk Plowing and Clearing

Two to three operators are currently assigned to operate the sidewalk plows. These individuals are often pulled from sidewalk duty for sanding or snow clearing operations, as required. Sidewalk maintenance is given a low priority in overall snow and ice management in order to meet other service levels associated with snow clearing, snow removal and ice control.

- The resources available, along with common practices, for sidewalk clearing consist of the following:
- Approximately 3 operators available to operate sidewalk plows (other equipment if required) on the weekday shift.
 - 2 operators available to operate sidewalk plows (typically working on snow removal) on the weeknight shift
 - All weekend sidewalk plowing, which is not common practice, requires operators on overtime.
 - Currently 4 sidewalk plows available although the priority with respect to sidewalk clearing is low compared with all other operations (i.e. snow and ice clearing, sanding and salting).
 - Night sidewalk plowing more efficient due to low number of pedestrians, staff suggested same as above.
 - Plowing starts immediately when accumulations start to occur, if there is a shortage of operators, they will shift over to cover snow clearing before fulfilling their role in sidewalk clearing.

⁵ Contracts are in place to have semi-trucks haul snow in conjunction with the City providing the snow blowers.

Table 12: 2004 Regular Staffing (Sidewalk Clearing)

	Monday-Friday 7:00-15:30	Saturday-Sunday 7:00-15:30	Monday-Friday 15:30-22:30	Saturday-Sunday 15:30-22:30	Monday-Friday 22:30-7:00	Saturday-Sunday 22:30-7:00
Permanent Staff ⁶	None	None	None	None	None	None
Available Staff ⁷	3 mixed	None	None	None	2 mixed	None

Ice Control (Sanding & Salting)

Resources for sanding and salting are in place to react immediately to adverse weather creating unsafe road conditions. These resources included:

- There are approximately 6 staff on a 12 hour shift (4on-4off) available to operate sanders on a 24/7 basis. Some of these operators are trained on other equipment such as motor graders and can, therefore, help with snow clearing if required.
- 7-9 staff assigned to snow removal on the weeknight shift that can operate a sander if needed.
- 15-20 operators who operate snow clearing and removal equipment are trained on sanders if conditions create the need
- There are 6-8 permanent sanders with approximately 5 more available in the fleet.

Table 13: 2004 Regular Staffing (Sanding & Salting)

	7 days per week 7:00-19:00	7 days per week 19:00-7:00
Permanent staff	6 sanders	6 sanders
Available staff	15-20 weekdays	7-9 weeknights

Overtime is not as prevalent for sanding and salting activities due to 12-hour shifts operating 24/7. Over-time is primarily required when staff are sick or on vacation.

Staff Scheduling Changes (Winter 2005)

A scheduling system to provide better coverage throughout the week and around the clock was implemented by snow and ice management in 2005. Discussions between snow and ice management

⁶ Permanent staff refers to staff assigned to a specific operation. Sidewalk clearing has staff available if not required for a higher priority service such as snow clearing or sanding.

⁷ Available staff refers to operators available without the requirement of overtime.

and union representatives resulted in a memorandum to revise the staffing schedules to provide the 24/7 coverage required to manage the inconsistency of the weather and the demand for resources that result. The revised scheduling system combined all staff including field staff and supervisors into crews that operated on a 10-hour schedule with the ability to work a 12-hour day if demand required it. Shifts were classified as the “Day Shift” (6:30 a.m. to 4:30 p.m.), the “Night Shift” (8:30 p.m. to 6:30 a.m.) and the skeleton or “Evening Shift” (12:00 p.m. to 12:00 a.m.). There were two crews scheduled for each shift which operated on a four day on and four day off cycle, with every third cycle being followed by only two days off.

Table 14: 2005 Regular Staffing (All Activities)

	Day Shift 1	Day Shift 2	Night Shift 1	Night Shift 2	Evening Shift 1	Evening Shift 2
Permanent Staff Level	22	18	18	17	2	2

The 2005 staff schedule provided an appropriate number of staff to meet regular winter maintenance demands. 4:30 p.m. to 8:30 p.m. each day was the only period of time where staffing resources were below management’s desired complement. To address this issue, staff working the day shift were able to extend their hours to 6:30 p.m. working a 12 hour shift and the night shift workers could be called in early to work at 6:30 p.m. to extend their shift to 12 hours.

As noted in Chapter 3, it is our understanding that staff scheduling changed again in 2006, with three 8.57 hour shifts (tied to EDO’s) providing 24/7 coverage. This schedule is far less efficient than the 2005 schedule. It results in unnecessary overlap of hours and increases idle capacity (e.g. operators waiting for equipment to be returned so they can start their shifts; increased lost time due to equipment traveling to work sites and back to the yards three times a day).

Contracted Services

Industrial areas and school zones are contracted out to ease the burden on the City’s resources. Contract services are provided on a “call in” basis where the City communicates the need for such services before they are provided. Having an agreement in place to access resources only when required, helps to minimize snow clearing/removal costs. Other contracted services include snow hauling, snow dump plowing and hand shoveling. Each of these services is also provided by contractors “on demand” – i.e. when situations warrant such as snow accumulations greater than the average. There are four snow dump sites throughout the City of Saskatoon. The “snow pushing” at the two major sites is currently contracted out.

Other Cities

Other cities contract a large percentage of their winter maintenance out each year. Winnipeg is known for contracting several activities out to the private sector. Contract dollars account for approximately 46% of their total program budget. 40-50% of snow and ice services workload before the winter

season begins, is contracted to the private sector. After the winter season begins, contractors may be engaged for as much as 85% of the workload during a major storm.

The City of Edmonton states that all of their sanding and truck plowing is completed in-house, while much of its grader plowing of roadways and sidewalk plowing is outsourced through pre-arranged contracts. Activities that are contracted out, such as sidewalk plowing, are charged to the City based on volume of snow moved. The City of Edmonton takes the approach of contracting out all winter maintenance where equipment used for that maintenance could not be utilized throughout the entire year. An example of this strategy is the fact that all sanding and plow trucks are owned and operated by the City as they are later used for summer operations. The majority of contracts occur with graders and sidewalk plows which have limited use in the quantities required for winter maintenance.

The City of Regina uses private contractors on a regular basis during major storms (i.e. 8 graders or more). These contractors are hired on an hourly basis to clear snow from roadways.

Table 15: City Workload Comparisons (2004)

	Budget (\$million)	Budget Per Capita (\$)	Roadway Kilometers	Sidewalk Kilometers	Fulltime Equivalents	Average Snowfall (cm) ⁸
City of Saskatoon	\$2.9	\$13.77	1,012	1,266	80	97.2
City of Edmonton ⁹	\$19.2	\$28.82	4,600	6,100	360	123.5
City of Winnipeg	\$13.5	\$20.87	3,500	3,100	205	110.6
City of Regina	\$2.3	\$12.31	920	1,205	68	105.9
City of Calgary	\$13.7	\$14.68	4,300	4,690	360	126.7

Table 16: Contracting Services

City	2005 Budgeted Expenditures	2005 Budgeted Contracted Services	2005 Salaries & Benefits	Contracted Services as % of Total Budget	Contracted Services as % of Salaries & Benefits
Saskatoon	\$2,933,802	\$210,000 ¹⁰	\$1,735,255	7.2%	12.1%
Regina	\$2,740,600	\$890,000	Information not available.	32%	Information not available
Edmonton	\$27,000,000 ¹¹	\$5,270,162	8,158,337	26%	41%
Winnipeg ¹²	\$14,000,000	\$6,500,000		46%	

Strategy Optimization

⁸ Average snowfall per Environment Canada 1971-2001

⁹ Edmonton budget of \$22.6 million includes spring cleanup costs of \$3.4 million.

¹⁰ Actual for 2005 was \$337,229.

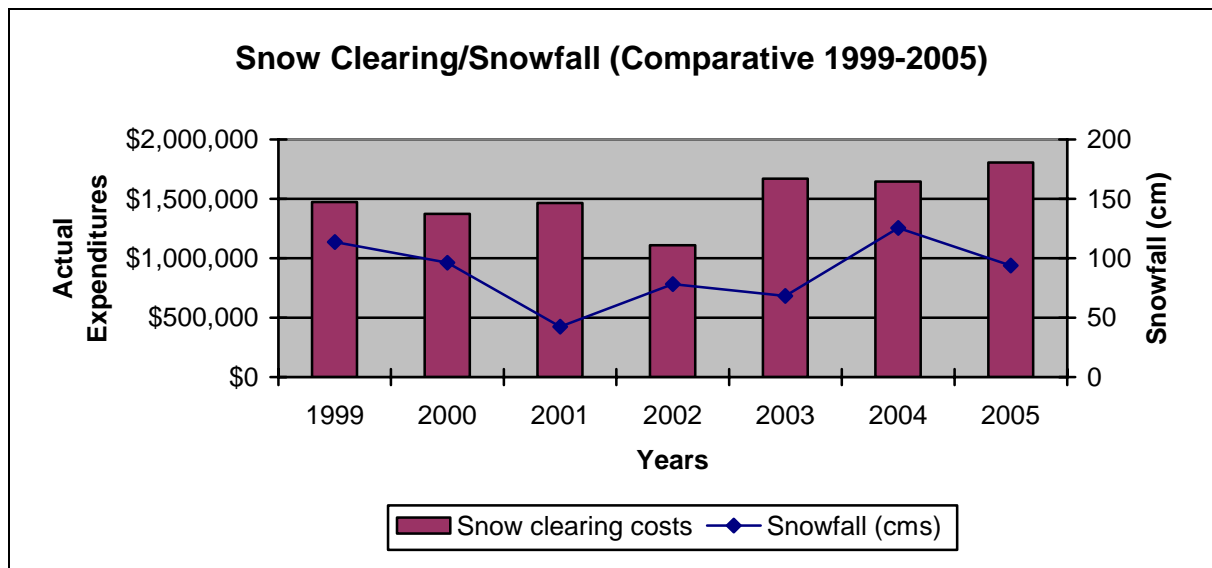
¹¹ Edmonton budget of \$27.0 million includes spring cleanup costs of \$7.1 million.

¹² Winnipeg's information provided as an estimate.

It is not possible to draw definitive conclusions from the benchmark data, on which city(ies) employs the most cost-effective resourcing strategy(ies) for snow and ice control. Weather is unpredictable and, therefore, budgets do not always show the true picture. For example, the City of Edmonton stated that while their budget in 2004 was \$22.6 million, actual expenditures were in the neighborhood of \$30.0 million. An increase of snowfall to 170 cm's versus the average 124 cm's was the primary reason for this over expenditure. The nature of the snowfall played a part as well. The City of Saskatoon has already incurred over \$3 million in expenditures for 2006, making it almost a certainty that the budget will once again be exceeded in 2006.

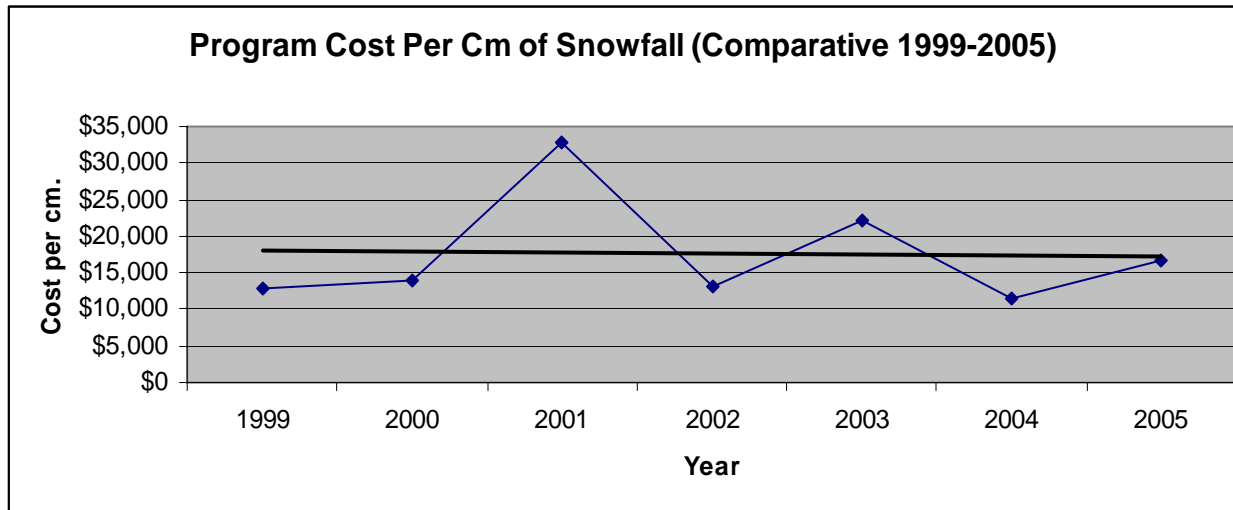
When resource levels and mix are optimized (i.e. appropriate mix of scheduled in-house resources, overtime, and outside resources), one would expect a fairly close correlation between annual snowfall and annual snow and ice control expenditures – i.e. annual expenditures would, for the most part, increase or decrease in response to increases and decreases annual snowfall. The following table shows trends in both program expenditures and annual snowfall from 1999 to 2005. While the chart appears to show little to no correlation between program expenditures and annual snowfall (e.g. in 2005 program expenditures increased while annual snowfall decreased), we caution that this may not, in fact, be the case. For example, expenditures may have been incurred in January of one fiscal year that pertained to heavy snowfall at the end of the prior year. Therefore, we were unable to definitively conclude from this data, the extent to which resource levels and mix are being optimized.

Graph 17: Snow Clearing Expenditures/Snowfall Comparative



We also used the data in the table above, to trend the program cost per centimeter of snowfall over the seven-year period, after adjusting program expenditures by the Saskatoon All Items Consumer Price Index. The following table shows that the program cost per centimeter has declined slightly between 1999 and 2005. Although it is not possible to conclude on resource optimization from this chart it does show that over time, program costs have remained consistent with the amount of snowfall.

Graph 18: Program Cost per Cm of Snowfall Trend



Results from a limited number of “Service Level Compliance Reports” indicate that resource levels and mix are not being optimized. We note, for example, that November and December are the two months where staff is at a full complement; yet, the demand for snow and ice control services is often low with limited alternative work available. When staff is not required to carry out snow & ice management, they are instructed to do ‘alternative work’. This type of work includes activities such as washing signs, back lane cleanup, etc. (also refer to discussion in Chapter 3 on alternative work).

Conclusion

The current staff scheduling strategy (e.g. 8.57 hour shifts; full staff complement at times when snowfall is often low and when limited alternative work is available) leads us to conclude that there may be room for improvement in optimizing the level and mix of resources required to meet snow and ice control service levels. In Chapter 3 we recommended that management explore strategies for optimizing resource mix (e.g. staff, overtime, private contractors).

Recommendation

That the information be received.

