

CITY OF TORONTO

WORKS & EMERGENCY SERVICES

Transportation Services Division



SALT MANAGEMENT PLAN

SUMMARY

September 2004

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1.0 INTRODUCTION

1.1 Overview

Toronto has about 5100 kilometres of roads within the framework of a classification system, which provide for the safe, efficient and affordable means of surface transportation for all road users. We rely on this roadway network throughout the year for transport to the workplace, to recreation and leisure facilities, for the transport of goods and services, and for emergency and security services.

Snow and ice conditions on the road system have a dramatic impact on public safety, roadway capacity, travel time and economic costs. The City, like other road authorities, must use road salt to maintain safe roads and sidewalks for the people of Toronto during the winter.

In 2001, Environment Canada released an assessment report stating that road salts are entering the environment in large amounts and are posing a risk to plants, animals, birds, fish, lake and stream ecosystems and groundwater. The report recommended that salt be designated toxic under the Canadian Environment Protection Act (CEPA). Fortunately, this recommendation was never implemented. In response to the report, Environment Canada assembled the multistakeholder working group that would go on to develop the *“Code of Practice for the Environmental Management of Road Salts”* released in April 2004.

The main objective of the Code of Practice is to ensure environmental protection while maintaining roadway safety. Under the Code, all public entities that use 500 tonnes of road salts per year or more and/or have any environmentally vulnerable areas must prepare a salt management plan within a year of the official release of the Code. The Transportation Association of Canada has also prepared and released a *“Synthesis of Best Practices”* in conjunction with Environment Canada’s Code of Practice.

In a proactive response to both the growing environmental concerns regarding road salt, and the assessment undertaken by Environment Canada, the City of Toronto’s Transportation Services began the preparation of a Salt Management Plan in 2001. The Plan was completed in April 2002 and was distributed to managers and operations staff for review and implementation. As an ongoing consequence of the Salt Management Plan, Transportation Services has initiated better handling and washing practices at all City facilities while at the same time continuing to ensure road safety by better managing the City’s use of salt. The City is one of the first road authorities in Canada to produce such a comprehensive Salt Management Plan.

While we look for ways to reduce salt use, user safety, both pedestrian and driver, remains the most important priority within winter maintenance operations, practices and strategies contained in the Salt Management Plan.

Although there is ongoing research into the use of alternatives to road salt (sodium chloride) in winter maintenance, salt continues to be the most cost-effective de-icer across Canada. However, because of the adverse effects that salt has on the environment, the Salt Management Plan strives to minimize the amount of salt entering the environment by including best salt handling practices, and using new technologies to ensure its most effective use over the road system.

The review strategy in the Salt Management Plan requires that new technologies be investigated and trials conducted on promising developments and discussed in annual assessments. This Summary Document presents an overview of the Salt Management Plan.

1.2 Purpose of the Plan

The Salt Management Plan sets out a policy and procedural framework for ensuring that the City of Toronto continuously improves the management of road salt used in winter maintenance operations. It was based on a comprehensive comparison of past practices against best management practices. The plan sets out specific goals for improving the City's salt management practices.

Any modifications to the City's winter maintenance activities must be carried out in a way that provides roadway safety and user mobility consistent with the weather conditions experienced during the snow and ice control season.

This Plan is dynamic – allowing the City to phase in new approaches and technologies in a way that is responsive to fiscal demands and the needs to ensure that roadway safety is not compromised.

1.3 Format of the Plan

Chapter 2.0 of the Salt Management Plan presents the Policy Direction approved by the City of Toronto Council. These policies are summarized in Chapter 2 of this Summary.

Chapter 3.0 of the Plan presents the Winter Maintenance Policies that are relevant to salt management. It focuses on Levels of Service, Spreader Settings and Snow Removal and Disposal Policies.

Chapter 4.0 of the plan presents the summaries of Operational Practices and Strategies for Snow and Ice Control as they relate to the effective management of road salt. This chapter is presented as a series of sub-section that can be modified as new policies, procedures and practices are introduced and refined. Specifically, the current subsections set out the City's goals with respect to improving the following areas:

- The snow and ice control fleet;
- The use of pre-wetting and anti-icing techniques;
- The approach to vehicle washing;
- The way the City records and tracks its salt use;
- How salt and sand/salt blends are stored and handled;
- The information available for making snow and ice control decisions such as weather forecasts and pavement temperature information;
- Winter patrol procedures;
- Storm response procedures;
- Snow and ice control training;
- Snow removal and disposal procedures; and
- Monitoring of the environmental implications of winter road maintenance.

The key goals are summarized in Chapter 4 of this report.

Chapter 5.0 of the plan presents the approach to monitoring the implementation of the plan and to maintaining and updating the plan in the spirit of continuous improvement.

1.4 Responsibilities

Everyone within the City connected to winter road maintenance has some responsibility for developing, implementing and reviewing the success of the Salt Management Plan. It is through a cooperative effort that the City will reduce the environmental effects of its road salt while maintaining safe roads.

2.0 SALT MANAGEMENT POLICY

2.1 Vision, Mission, Mandate

Vision

The Transportation Services Division will be recognized as a leader in using de-icers in an environmentally sensitive manner while providing for safe road and sidewalk conditions during the winter.

Mission

The Transportation Services Division will optimize the use of de-icers on Toronto's roads and sidewalks while striving to minimize salt impacts to the environment.

Mandate

The Transportation Services Division is to provide safe winter conditions for vehicular and pedestrian movements as required by level of service policies and funding guidelines established by Toronto City Council.

2.2 Policy Statement

The City of Toronto will provide effective winter maintenance to ensure the safety of users of our road network in keeping with Provincial Legislation and accepted standards while striving to minimize the adverse effects that the use of road salt can have on our environment. To meet this commitment the City of Toronto will:

- meet and adhere to the guidelines contained within the Salt Management Plan;
- strive to review and upgrade, as necessary, the standards contained in the Salt Management Plan on an annual basis to take into account new technologies and developments;
- work with Environment Canada, other transportation agencies and environmental groups to upgrade best winter practices; and
- commit to ongoing staff training and education.

2.3 Application

This policy is adopted by the Transportation Services Division and applies to all employees involved in Winter Maintenance Operations.

2.4 Conditions

The following principals will guide the ongoing process to upgrade the Salt Management Plan:

- The plan is activity-based and follows an Environment Management System framework consistent with the principles of continual improvement. It includes the following elements:
 - Periodic Review and Analysis of Industry Practices;
 - Implementation and Documentation of the Plan;
 - Education and Training of Staff;
 - Monitoring and Analysis;
 - Management Review;
 - Environmental Review; and
 - Practices and Policy Revision.

- The plan is reviewed and refined on an on-going basis.

3.0 WINTER MAINTENANCE POLICIES
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3.1 Introduction

The major activities related to winter maintenance are:

- Salt and sand storage;

- Salt/sand spreading;
- Snow ploughing (roads, sidewalks, laneways);
- Snow removal and disposal from City streets; and
- Snow removal at driveway entrances and bus stops.

3.2 Winter Operations – Roads De-Icing and Ploughing

The City's salt application guideline is shown in Table 3.2.1. The City's level of service policy is provided in Table 3.2.2 which is taken from the March 24, 1999, report to the Urban Environment and Development Committee and subsequently adopted by Toronto City Council.

Within this framework, District Road Operations Managers are allowed some latitude regarding frequency and timing of applications. Application rates have been harmonized

across the City. These settings were established through past practices within our urban environment.

**TABLE 3.2.1
ROAD CLASSIFICATION – SALTING CHART**

ROAD CLASSIFICATION	TYPICAL	WINTER* SERVICE	DEICER	APPLICATION RATE KG/LANE-KM	TIME FRAME TO COMPLETE DE-ICER OPERATIONS
Expressways	DVP / FGGE	Bare Pavement	100% Rock Salt	70 / 140 / 180	2-3 cm snow & continuing 1-2 hrs
Arterials (minor / major)	Yonge St. / Sheppard Ave.	Bare Pavement	100% Rock Salt	70 / 140 / 180	5 cm snow 2-3 hrs
Collectors	Main Streets through sub-division	Centre Bare Pavement	100% Rock Salt	70 / 90	8 cm of snow & stopped 4-6 hrs
Locals	Residential (including dead end streets and industrial roads <2500 AADT**)	Safe and Passable Pavement	100% Rock Salt	70 / 90	8 cm of snow + stopped 8-12 hrs
Laneways		Safe and Passable Pavement	100% Rock Salt	180	24 hrs

* This is the desired condition of the pavement surface. However, it is necessary to have sufficient traffic volumes to activate and improve the characteristics or the de-icer, the time to achieve this condition will vary with the time, duration and intensity of each storm event.

** Local roads > 2500 AADT under review.

ANOMALIES

- If any link has one or more of the following anomalies present, the winter service level is bumped-up according to the next highest road classification:
 - Ball bank reading >12 at posted speed
 - Slope >4%
 - Presence of emergency services (i.e. police, fire or ambulance station, hospital)
 - TTC bus route including turnaround loops

**TABLE 3.2.2
CONDITIONS FOR WINTER MAINTENANCE OPERATIONS**

ROAD CATEGORY	PAVEMENT CONDITION AFTER SANDING /SALTING	START OF Ploughing AFTER ACCUMULATION OF (cm)	TIME TO COMPLETION Ploughing (HOURS) AFTER THE END OF SNOWFALL			
			STORM TYPE 1 30-40 per year (5cm)	STORM TYPE 2 3-6 per year (5-15 cm)	STORM TYPE 3 Once/2-3 years (15-25 cm)	STORM TYPE 4 Once 10/years (over 25cm)
Expressways	Bare pavement	2.5 to 5.0 and still snowing	2-3 ⁽¹⁾	2-3 ⁽¹⁾	2-3 ⁽¹⁾	2-3 ⁽¹⁾
Red (arterial roads, streetcar routes)	Bare pavement	5.0 and still snowing	-	6-8	8-10	12-14+ ⁽²⁾
Blue (bus routes, collector roads, local streets with hills)	Centre Bare	5.0-8.0 ⁽³⁾	-	8-10	10-12	14-16+ ⁽²⁾
Green (local streets)	Safe and Passable	8.0 ⁽³⁾	-	14-16	18-20	24-36+ ⁽²⁾
Yellow (local streets without boulevards and with long term on-street parking)	Safe and Passable	8.0 ⁽³⁾	-	14-16	18-20	24-36+ ⁽²⁾
Dead Ends (or cul-de-sacs) with limited or no snow storage	Safe and Passable	8.0 ⁽³⁾	-	14-16	18-20	24-36+ ⁽²⁾
Laneways	De-ice as necessary to maintain passable conditions	Ploughing and/or removal, subject to localized laneway conditions	-	-	-	50

Notes:

- (1) Ploughing on Expressways is continuous for bare pavement conditions
- (2) Completion of ploughing under Type 4 Storm conditions, is dependent upon total snow accumulation
- (3) Snowfall to be substantially completed prior to ploughing operations commencing (except for heavy snowfalls)

There are road authorities that are beginning to use liquid de-icing chemicals in addition to solid salt. Literature and practice shows that salt performance can be improved with liquids. However one must be cautious when introducing such techniques. Prior to 2001, established city practices did not include straight liquid chemical techniques.

Our present guideline is to apply a solid or solid/pre-wetted de-icer once snow starts to accumulate or “stick” on arterial roads and expressways. This proactive strategy reduces the amount of material that would be lost if solid de-icer was applied onto dry pavement prior to a storm. This also ensures timely applications on major expressways and arterials (i.e. within the first hour of any significant snow or ice accumulation). Timely application of chemicals is critical to preventing snow from sticking to roads. Further, the City introduced limited direct liquid application during the winter season of 2003-2004. Without the timely application of chemicals, snow could easily bond to roads and, in turn, become difficult to plough, potentially causing road hazards. With this technique, liquid chemicals are applied prior to a storm and they are allowed to work on roads before snow accumulates on the road and ploughing is required. As snow accumulates, it is ploughed to maintain safe driving conditions.

Currently, the City of Toronto application rates for the salting of arterial roads are; 70kg/lane-km, 140kg/lane-km, and 180kg/lane-km. Pre-wetting was introduced to the Winter Maintenance Depots in 2003-2004 when 1/3 of the arterial road salt trucks were equipped with pre-wetting. A further 1/3 of the arterial road salt trucks will be outfitted with pre-wetting equipment for the winter of 2004-2005 and the final 1/3 for the winter of 2005-2006. The introduction of pre-wetting on arterial road salt trucks will see a phased-in reduction of the straight granular application rates of up to 20%. To allow staff time to adjust to pre-wetting, there was no official reduction in application rates for the 2003-2004 season except in limited trials in the South District. A reduction of 10% in the granular application rate will be discussed for the 2004-2005 season. The current rate of pre-wetting on conventional side discharge spreaders is 6% by volume.

The City of Toronto first introduced Direct Liquid De-Icer Applications(DLA) during the winter of 2002-2003 as part of a small pilot project in South and East Districts. In this first season, approximately 60,000 litres of salt brine were used. This technique was then adapted for limited use in the winter of 2003-2004 using approximately 500,000 litres of salt brine for both DLA and pre-wetting. The lessons learned over the course of this pilot project were used to develop guidelines for the expanded program that was introduced as part of the 2003-2008 Winter Maintenance Depot Contracts.

3.3 Snow Removal and Disposal

As a result of snow ploughing operations, snow accumulates at the side of roads as windrows or mounds. The City starts snow removal operations when these windrows reach volumes that create a nuisance or hazard to pedestrians and motorists, to maintain capacity for subsequent snowfalls, or after a Type 4 storm.

Experience over the years has shown that the City must have the capability and capacity to remove and dispose of 150,000 loads of snow in a two-week period.

Snow removal involves the use of in-house mobile and stationary melters, snow blowers, belt loaders, front-end loaders and trucks in conjunction with contracted truck fleets and the City Hired Equipment Registry.

Over the years the City has used 30 different land disposal locations, 2 portable stationary melters, 3 mobile melters and one sewer snow disposal site to disposal of snow. Many of the snow disposal sites had environmental and operational constraints. Concerns over the potential environmental impacts of these sites led to the development of a Snow Disposal Study in year 2002. As part of this process the disposal sites were evaluated on the basis of environmental and technical criteria. As a result, the City is closing several sites and improving the environmental protection measures at those that will continue to operate, through upgrading the existing city-wide Snow Disposal Plan.

Snow Removal Policy

Table 3.3.1 presents the City's Snow Removal Policy. Snow removal follows the timetable and details outlined in the City's Snow Removal Plan. Snow will be removed from roadways once the net snow accumulation has reached the trigger levels presented in Table 3.3.1. Snow that is removed must only be disposed of at designated Snow Disposal Sites.

TABLE 3.3.1

GUIDELINES FOR INITIATION AND COMPLETION OF SNOW REMOVAL

ROAD CATEGORY	NET SNOW ACCUMULATION FOR REMOVAL START	TYPE OF OPERATION	TIME TO COMPLETE REMOVAL
EXPRESSWAYS	20 to 30 cm	Full operation (Overtime if required)	3 Days
RED [Selected sections] *Without or small Boulevard *Commercial on-street Parking	20 to 30 cm 30+ cm	Partial Operation (8 hr shifts) Full Operation (Overtime if required)	2 Weeks
BLUE Bus Routes Collector Roads Local Streets with hills	20 to 30 cm 30+ cm	Partial Operation (8 hr shifts) Full Operation (Overtime if required)	2 Weeks
GREEN Local Streets	-	(Only required for sight lines, etc.)	-
YELLOW Local Streets without Boulevards and with long term on-street parking	30+ cm	Full Operation (Overtime if required)	2 Weeks
DEAD ENDS (or cul-de-sacs) - with limited or no storage space for snow	20 to 30 cm	Full Operation (Overtime if required)	1 Week
LANEWAYS	30+ cm	Full Operation (Overtime if required)	3 Weeks

3.4 Sidewalk Snow Clearing

Mechanical sidewalk snow clearing is required along selected eligible sidewalks in the City as adopted by the Council meeting of July 24 to 26, and as reported to Works Committee on September 4, 2001 (see Appendix C). Current guidelines adopted within the City requires that snow clearing begins when snow accumulations reach 7.5 cm, but District Mangers are allowed latitude in case of freezing rain. Salt/Sand mixtures are used as required after ploughing to provide grit and traction on eligible sidewalks. Within District 1, most sidewalks adjacent local roads do not meet established guidelines and, as such, adjacent residents are required under existing By-Laws to clear the snow from sidewalks. The current standard is 50/50 salt to sand blend. At a few locations a higher percentage of salt is being used since sand clogged the spreader units. In light of the new salt initiatives, sidewalk snow clearing practices will be reviewed.

4.0 OPERATIONAL PRACTICES AND STRATEGIES

4.1 Overview

Chapter 4.0 of the Salt Management Plan presents a discussion of each of the key operational practices and strategies related to the effective management of road salt during winter maintenance activities.

Each subsection has a summary that presents a discussion of the objective, environmental considerations, current situation, plan goal, responsibilities, performance measures and references (documents or tables). It is important to recognize that the plan is dynamic and will take time to implement.

4.2 Key Goals

Table 4.1.1 summarizes the key goals of the Salt Management Plan.

TABLE 4.1.1

SALT MANAGEMENT PLAN GOALS

ACTIVITY	GOALS
LEVEL OF SERVICE	<ul style="list-style-type: none"> The Level of Service Policy will be reviewed and updated as needed.
ELECTRONIC SPREADER CONTROLS	<ul style="list-style-type: none"> By 2005 all equipment used to spread salt shall have ground speed regulated electronic spreader controls.
PRE-WETTING AND ANTI-ICING EQUIPMENT	<ul style="list-style-type: none"> 9 anti-icing trucks equipped for winter 2003/2004. 2/3 of all arterial road salt trucks equipped with pre-wetting for winter 2004/2005.
SPREADER CALIBRATION	<ul style="list-style-type: none"> Standardized Salter Calibration Procedures have been developed. All beats have been benchmarked against the spreader settings. All spreaders will be properly calibrated each fall. Calibration will be checked regularly and recalibrate as needed.
EQUIPMENT WASHING	<ul style="list-style-type: none"> By Fall 2002, all City vehicle washing shall be carried out indoors and washwater shall pass through oil/water separators before being discharged.
DE-ICER ORDERING AND DELIVERY	<ul style="list-style-type: none"> Measures are being taken to reduce the loss of salt during delivery operations.
DE-ICER RECORD KEEPING	<ul style="list-style-type: none"> The City will record salt use by each vehicle, beat and storm and periodically compare the usage to benchmarked rates to confirm the spreader calibration.
SAND/SALT BLENDS	<ul style="list-style-type: none"> The City will investigate how it can reduce the amount of salt in sand/salt blends while maintaining the effectiveness.
SALT AND BLENDED SAND STORAGE	<ul style="list-style-type: none"> By 2004, all salt and sand/salt blends shall be stored inside buildings on impermeable floors. All new maintenance facilities will be designed in accordance with the principles set out in TAC's Code of Practice for Design of Maintenance Yards.
GOOD HOUSEKEEPING PRACTICES	<ul style="list-style-type: none"> The City has developed a Good Housekeeping Code of Practice that improves salt management practices at storage facilities.
WEATHER FORECASTING	<ul style="list-style-type: none"> The City will improve its access to weather information and provide training to all staff on interpreting weather information when making snow and ice control decisions.
ADVANCED ROAD WEATHER INFORMATION SYSTEMS	<ul style="list-style-type: none"> The City has installed 4 RWIS stations. It will now contract with a forecaster to provide pavement temperature forecasts. Staff will be trained in using RWIS information.
STORM RESPONSE	<ul style="list-style-type: none"> Storm response data keeping will be improved to help in fighting future storms and analyzing how storms were attacked.
WINTER PATROL	<ul style="list-style-type: none"> Patrol guideline will be amended to ensure that the City's level of service policy is met and demonstrated.

ACTIVITY	GOALS
TRAINING	<ul style="list-style-type: none"> • Training modules will be presented in the following areas: <ul style="list-style-type: none"> • Interpretation of weather and pavement conditions and use to make snow and ice control decisions • Proper use of infra-red thermometers • When and how to apply chemicals • Concepts and merits of use of liquid chemicals for pre-wetting and anti-icing • Proper record keeping and review
SNOW REMOVAL AND DISPOSAL GUIDELINE	<ul style="list-style-type: none"> • A Snow Disposal Site Management Program will be established by the Summer 2002. • Surplus sites will be cleaned up and closed. • Snow Disposal Site Upgrade Plan will be established by July 2002. • The initial phase of mitigation and enhancement measures will be installed at all primary land disposal sites by October 2002. • A program for monitoring the quality of runoff from 2 snow disposal sites will be developed.
TECHNOLOGY REVIEW	<ul style="list-style-type: none"> • Pilot studies are planned for prewetting, anti-icing, and AVL for 2002.
COMMUNICATIONS	<ul style="list-style-type: none"> • Information on the City's approach to winter maintenance and salt management will be distributed to the public.
ENVIRONMENTALLY SENSITIVE AREAS	<ul style="list-style-type: none"> • The City will work with the TRCA to identify any other environmentally sensitive areas that need to be addressed in future upgrades of this plan.
MONITORING PROGRAMME	<ul style="list-style-type: none"> • The City is installing 10 water-sampling stations to track the improvements that the measures set out in the Salt Management Plan have over time. • The City will also institute an ongoing winter monitoring program to track the successful implementation of all elements of the Salt Management Plan.
LIQUID TRIALS	<ul style="list-style-type: none"> • To develop a program for the use of liquids in anti-icing and pre-wetting that contributes to a reduction in salt usage.
TORONTO ROAD SALT MANAGEMENT GROUP	<ul style="list-style-type: none"> • Promote the City of Toronto as a champion of salt management • Create, within the City of Toronto, a group dedicated to the discussion and resolution of issues related to salt management.
COMMUNICATIONS	<ul style="list-style-type: none"> • To produce an information brochure for the public explaining the City's winter maintenance program and the highlights of the Salt Management Plan annually. • To produce a summary of the Salt Management Plan that can be reviewed annually.

5.0 CLOSING

The City of Toronto is committed to ensuring that the City's roads are properly maintained in accordance with its level of service policy. While doing so, the City is committed to reducing the impacts that de-icing chemicals, such as salt, have on the environment.

The City has developed a comprehensive Salt Management Plan that it is committed to implementing over the next few years. The City will also continue to improve the plan as more salt management techniques become available.