



# Snow and Ice Control Program Review

April 2011



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## Acknowledgments

The City of Medicine Hat would like to thank all participants who attended the open houses and provided feedback towards the snow and ice control program. The feedback and recommendations were essential for establishing expectations of the program.

The City of Medicine Hat's Municipal Works Department would like to thank the following cities for their assistance in providing information and responses for the program review:

- Edmonton, AB
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## Executive Summary

A comprehensive review of the City's current snow and ice control program was approved by City Council on March 1, 2010. The total approved budget for the snow and ice control review project was \$75,000. Of this total, \$50,000 was associated with carrying out an internal review and report by the Municipal Works Department with assistance from a contract employee. The report was reviewed by a subject matter expert. The remaining \$25,000 was allocated for the implementation of GPS tracking on the snow and ice control fleet. A vendor was selected and implementation took place.

The overall objective of the snow and ice control program review was to:

- Review best practices in the industry and other municipalities
- Establish design basis and develop typical approaches with costs
- Public consultation to assess community expectations
- Develop approach for each road and street
- Develop monitoring, evaluation and reporting approaches
- Present recommendations for consideration by Council

The City's snow and ice control program was last fully reviewed in 1999. Since that time the City has experienced:

- An increase in population by 22%
- An increase of roadways by 25%
- An increase in winter operations personnel by 3%
- An increase in winter road maintenance equipment by 17%

The review researched many aspects of the program and has determined that the residents of Medicine Hat are receiving good value for snow and ice control services. Actual funds spent on the snow and ice control program over the last several years have exceeded budgets; however this is consistent among all municipalities researched. For Medicine Hat, exceeding the budget has generally been a result of recent years of heavy snowfall, growth of the city and the current priority (category) requirements.

The City currently has 43% of the City's roadways placed within Category 1. This is high compared to other municipalities researched which have 4%-26% in category 1. At this time the category 1 roadways cannot consistently be maintained within the 16 hour timeframe with current resources. This has created significant challenges on expectations placed on the program. Additional complexities including heavy snowfall years, increases in the number of roadways constructed throughout the city and public expectations for roadway treatment quality further contributed challenges to the program. Further, a policy has never been

established for the snow and ice control program which conveys program expectations to the public.

Staff increased plowing and snow removal efforts throughout the city which started in November 2010. The increased efforts increased costs as significantly more snow had to be removed and hauled to snow dump sites than what had been performed in the past. The 2010/2011 winter season brought significant snowfall amounts and minimal melting which created conditions which challenged City crews. In addition to snow, pot holes and catch basin thawing further increased complexity of the program. Overall the increased efforts throughout the City provided better service to the public by:

- Reducing safety hazards as a result of a heavy 2010/2011 snowfall season
- Additional snow removed increased snow storage capacity along roadways for subsequent snowfalls
- Additional snow removed helped reduce drainage issues during melting
- Positive feedback was received from the public.

As a result of the increased levels of service in the 2010/2011 winter season and multiple heavy snowfall events, timeframes were not met within the current category system. However, the public didn't appear to be concerned with timeframes as the quality of service was increased on the roadways. This was originally identified in the initial public open houses and supported by feedback throughout the winter season.

Responses from the public indicated that the public would like greater levels of service than what has been provided in the past. Generally the feedback indicated that collector roadways should receive a better level of service to improve driving conditions for the majority of road users. These service levels would include additional plowing and snow removal when necessary and be similar to what was displayed in the 2010/2011 winter season. The public indicated that residential roadways should retain the same levels of service experienced in the past as the high cost of removal was not favoured and the method of flat blading is a cost effective and appropriate means to provide safe passage for vehicles in residential areas. In addition, the public indicated support for sidewalks adjacent to City land be cleared as per Bylaw 1556 the same as is expected of residents in the City.

In an effort to reduce costs for snow removal, seasonal parking bans may be an option to consider. Snow would be windrowed in the parking lanes all year round and would remain until melted. Vehicles would not be able to park on the street between designated months. Problems associated with introducing parking bans throughout the winter may include:

- limited off-street parking space for multiple vehicle households

- unpredictable weather (no snow may be present while parking ban in place)
- residents and visitors may be ticketed without knowledge of the seasonal parking bans

The review determined this would not be favoured by the residents that would be affected by this change. The option of snow removal and temporary parking bans was selected in the recommendations which is similar to what was implemented during the 2010 to 2011 winter season.

**Key conclusions are as follows:**

- The general public would like greater levels of snow and ice control service than what has been provided in the past years.
- To utilize equipment more often, additional staff need to be hired. The additional staff would complement increased levels of service.
- Snow plowing and removal would need to be increased in order to provide enhanced levels of service which improves safety and efficiency throughout the network. These increases are aligned with public expectations.
- We currently do not have the resources to meet the service levels in the current category system.
- Additional resources would be required to allow the City to maintain sidewalks within the 24 hour bylaw (1556) requirement without reducing service levels to the roadway network.
- The increased use of contracted services should be considered for roadway maintenance. Contracted services balanced with City forces offers the appropriate resource mix to overall achieve levels of service requested by the general public.
- When new roadways are developed or existing infrastructure is upgraded, the designs of these roadways should consider greater room for snow storage.
- Continuing the use of parking lanes to store snow provides a cost effective means of meeting increased levels of service by reducing the need of hauling costs for snow removal.
- Increased use of de-icing and anti-icing materials is an effective method to address icy conditions which exist on plowed roadways (hills and arterial roadways). A balanced approach should be taken which favours safety and environmentally friendly products, within reason over cost.

**Key recommendations are as follows:**

- Both arterial and collector roadways receive plowing as part of maintenance procedures for a snowfall event.
- That snow removal operations increase on arterial and collector roads when necessary, in addition to current snow removal practices.
- Adjusting the category system by moving collector roadways, school zones and the central business district (downtown) to Category 2.
- Adjusting timeframes to the following (Based on a typical 5-10cm snowfall event):
  - Category 1 – Within 24 hours of the end of snowfall
  - Category 2 – Within 24 hours of Category 1 completion
  - Category 3 – No timeframe
- The creation of a Snow and Ice Control Policy founded on the proposed “Snow and Ice Control Program” as per Appendix A.
- Sidewalks adjacent to City land should be consistently cleared as per Bylaw 1556.
- That the airport be removed from the category system and treated as a separate priority.
- The purchase of:
  - Self-Propelled Snow Blower
  - Pressurized Liquid Chemical Applicator
  - Salt Storage Facility
  - Chemical Storage Tank Structure
- That an additional three full time equipment operators be added to the Municipal Works Department.

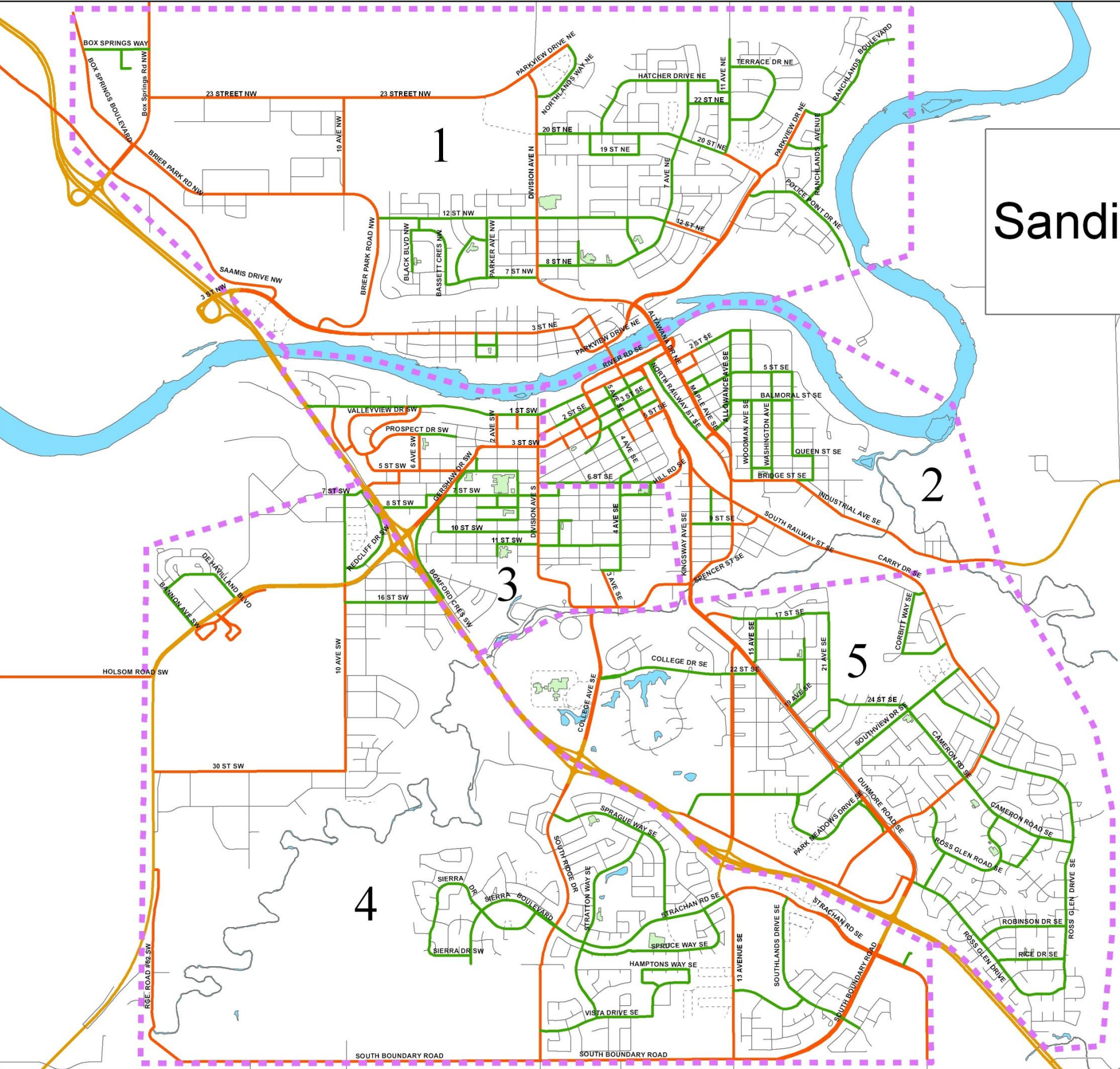
All considerations and recommendations in the review are based on practical solutions to current issues and obstacles identified throughout the process. The solutions represent sound technical and public considerations which are representative and appropriate for the City of Medicine Hat. The snow and ice control program will continue to evolve as does technology, expectations, growth, weather patterns, environmental considerations and resources permit.

The snow and ice control program is an essential service for the City of Medicine Hat. This document highlights snow and ice control challenges including snow storage limitations on existing roadways and involvement required to successfully complete the annual program. The document also emphasises the need for future snow storage planning and many other important considerations as the City continues to grow.





# Proposed Sanding and Plowing Routes for 2011 - 2012



**Legend**

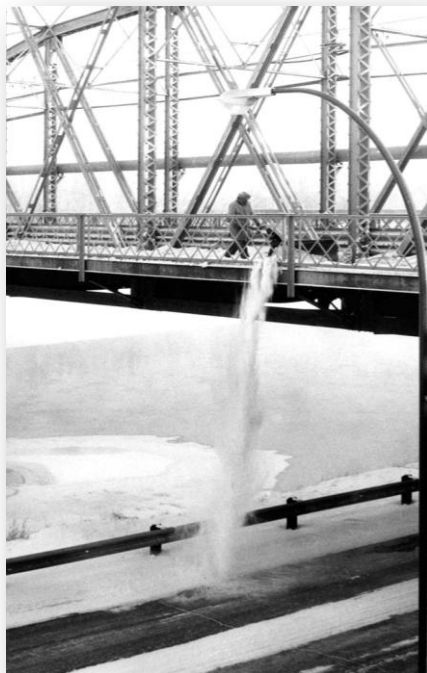
- Zones
- Maintained by Alberta Transportation
- Category 1 - 24 hours of snowfall ending
- Category 2 - 24 hours after Category 1
- Category 3 - No Timeframe
- Private Road
- School Buildings
- River Lake

## 1 Introduction

The City of Medicine Hat has a current population of 61,097 (2009 City Census) residents as it has experienced significant growth in recent years. This growth has led to a 21.8% increase in population from 1999 to 2009. To support this increase, roadways throughout the city have also increased by a total of 24.8% since 1999.

The City of Medicine Hat experiences an average of 95cm of snow fall each year. Over the past 28 years, Medicine Hat has experienced annual snow falls ranging from 40cm to 150cm which has placed challenges on the City's snow and ice control services. The City's Municipal Works Department is responsible for the management of snow and ice within the city. Within these years, City resources have experienced challenges not only with high accumulation but also with multiple day storm events, freezing rain and drifting snow. Medicine Hat is built around the South Saskatchewan River which attributes many snow clearing obstacles including hills, bridges and overpasses which are maintained to a high level of service to ensure safety.

The snow and ice control service is tax supported and is important to the City for safety and economic reasons. The program was last reviewed in 1999. In recent years, there have been concerns brought forth by the citizens of Medicine Hat regarding the snow and ice control program. To address these concerns and understand current expectations, a comprehensive review of the City's current snow and ice control program was proposed to City Council and approved by City Council on March 1, 2010.



City Employee Cleans Snow from Finlay Bridge  
(Photo supplied by Medicine Hat Esplanade archives)



2<sup>nd</sup> Street SE – March 1938 Blizzard  
(Photo supplied by Medicine Hat Esplanade archives)



## **2 Objective, Scope and Methodology of the Review**

### **2.1 Objective**

The overall objective of the snow and ice control program review is to:

- Review best practices in the industry and other municipalities
- Establish design basis and develop typical approaches with costs
- Public consultation to assess community expectations
- Develop approach for each road and street
- Develop monitoring, evaluation and reporting approaches
- Present recommendations for consideration by Council

### **2.2 Scope**

The scope of this project includes all snow-related activities of the snow and ice control program for a typical winter season which runs from October 15th to December 31st, and January 1st to March 15th every year. The scope does not include detailed analysis of clean-up activities which include the removal and disposal of street sand, the clean-up of the snow dump sites nor does it include equipment maintenance and repair.

The Council approved project cost was \$75,000 and was to include hired services (\$50,000) to work with internal staff along with the implementation of GPS in the City's snow and ice control fleet (\$25,000).

### **2.3 Methodology**

The methodology followed included:

- Review of the current snow and ice control practices and costs
- Comparing winter maintenance programs with those provided by other municipalities
- Research snow and ice control publications for design and compliance
- Discuss program deliverables with operations staff
- Gain consensus of community expectations by engaging stakeholders and general public
- Observing winter maintenance activities
- Review process by internal departments and external subject matter expert
- Update program and present to City Council for consideration

### 3 Population and Growth

The City of Medicine Hat has seen an increase of population of 21.8% since 1999 (1999 – 50,152 people; 2009 – 61,097). As part of this increase, the city has seen growth in housing developments and businesses. To meet growing demands, new roadways have been created to connect these elements. Since 1999, various roadways have been created or upgraded to meet demands. Examples of higher volume roadways include Box Springs Boulevard, a portion of Parkview Drive, South Boundary Road, and sections of Strachan Road.

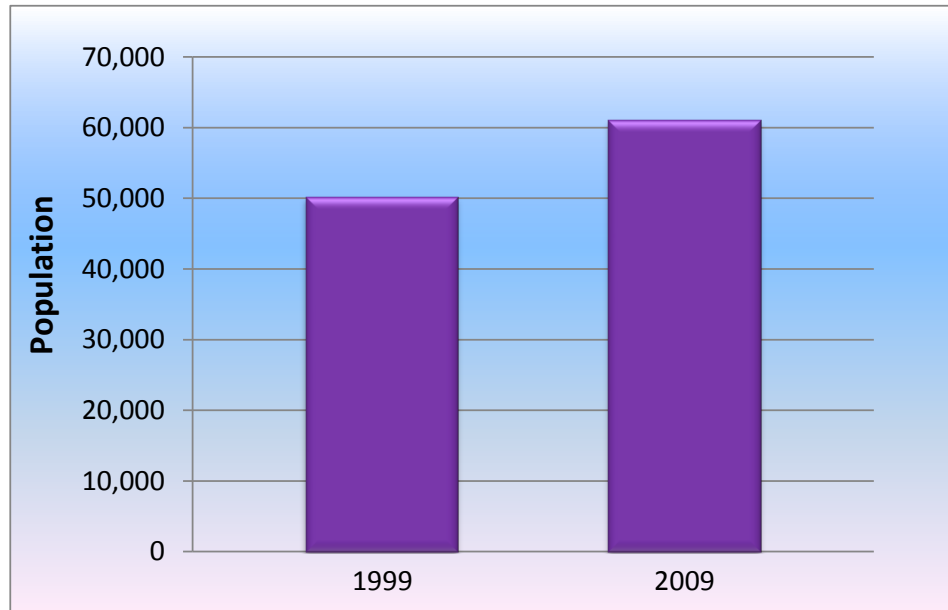


Figure 1: Medicine Hat Population Growth from 1999 to 2009



## 4 Infrastructure

The City currently has approximately 890 lane kilometers of roadway in its inventory which is an increase of 24.8% since 1999. In this inventory, the City has 52 signalized intersections, nine vehicle bridges (two major over South Saskatchewan River), three culvert roadways and two overpass structures.

Since the last review in 1999, the City's infrastructure has changed in various ways. In the year 2002, Highway #1 and Highway #3 were transferred to the ownership of Alberta Transportation. New construction in the city increased arterial, collector and residential roadways. Currently the City of Medicine Hat 890 lane km of roadways maintained during the winter.

Type	Highways & Arterials	Collectors	Residential	Sidewalks	Leisure Trails	Bike Lanes	Vehicle Bridges	Culvert Bridges	Vehicle Overpasses	Ped. Over/Underpasses	Stair Cases
Driving Lane km	214	126	550								
Kilometers				39	92	5					
Quantity						9	3	2	4	14	

Figure 2: Current Infrastructure

## 5 Program Background

The Municipal Works Department manages roadway maintenance year round within the City of Medicine Hat. The department manages all public roadways within road-right-of-ways with the exception of the Trans-Canada Highway #1 and Highway #3 which are under the ownership of Alberta Transportation.

The City's 2010 budget was \$1,082,797. The budget includes funding for wages, equipment, materials and contracted services used for snow and ice control operations. Wages for personnel and equipment performing duties outside of snow and ice control throughout the winter season are not supported by this budget.

Roadway maintenance crews maintain approximately 890 lane kilometers of arterial, collector and local/residential roadways. The department is also responsible for clearing 39 kilometers of sidewalk adjacent to City owned lands as well as the City's regional airport.

The objective of the snow and ice control program is *“to permit safe and efficient travel for vehicles within the City of Medicine Hat during winter months, assuming a reasonable degree of caution”*.

The Municipal Works Department adheres to federal, provincial and municipal operations safety policies, codes and regulations. Guidelines established by Alberta Environment and Environment Canada regarding winter roadway materials such as salt and de-icing chemical, for storage and use, are also adhered to. The snow dump site facilities maintained by the City of Medicine Hat are monitored and adhere to Alberta Environment guidelines.

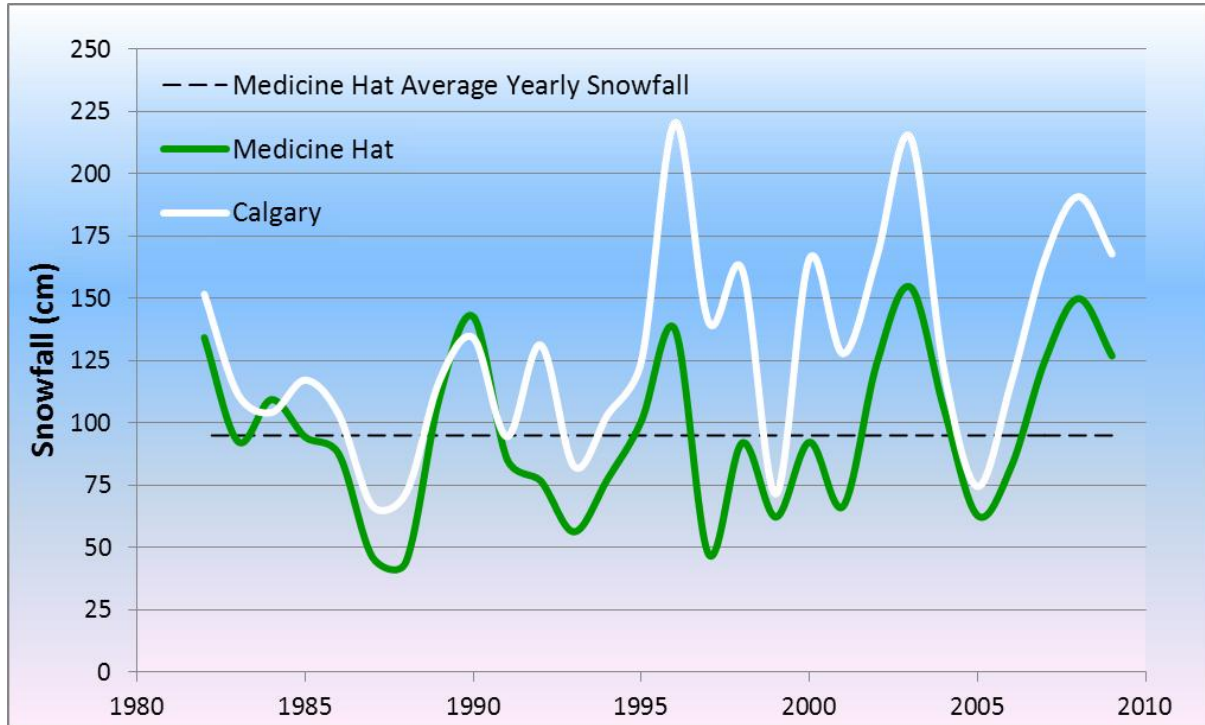
Within the snow and ice control program many attributes shape how the program is executed. The following figure illustrates those attributes:



**Figure 3: Snow and Ice Control Program Attributes**

## 6 Winter Weather

Medicine Hat on average receives 95cm of snow fall each year (Environment Canada). The following figure summarizes the annual snowfall accumulations since 1982 in Medicine Hat.



**Figure 4: Annual Snowfall Accumulations**

\* 2007-2009 data not available for Medicine Hat. Years were estimated based on Calgary's yearly snowfall 2007-2009.

The information indicates that Medicine Hat has received greater amounts of snow in recent years compared to the average. Fluctuating accumulations reoccur every five to eight years. These fluctuations have direct impacts on resources as they vary significantly from 40cm to 150cm per year.

## 6.1 Snow Fall Events

Over the last 28 years the amount of snowfall per day has been collected by Environment Canada. The information was summarized to create the understanding of “events”. Events represent an accumulation of snow received over several days.

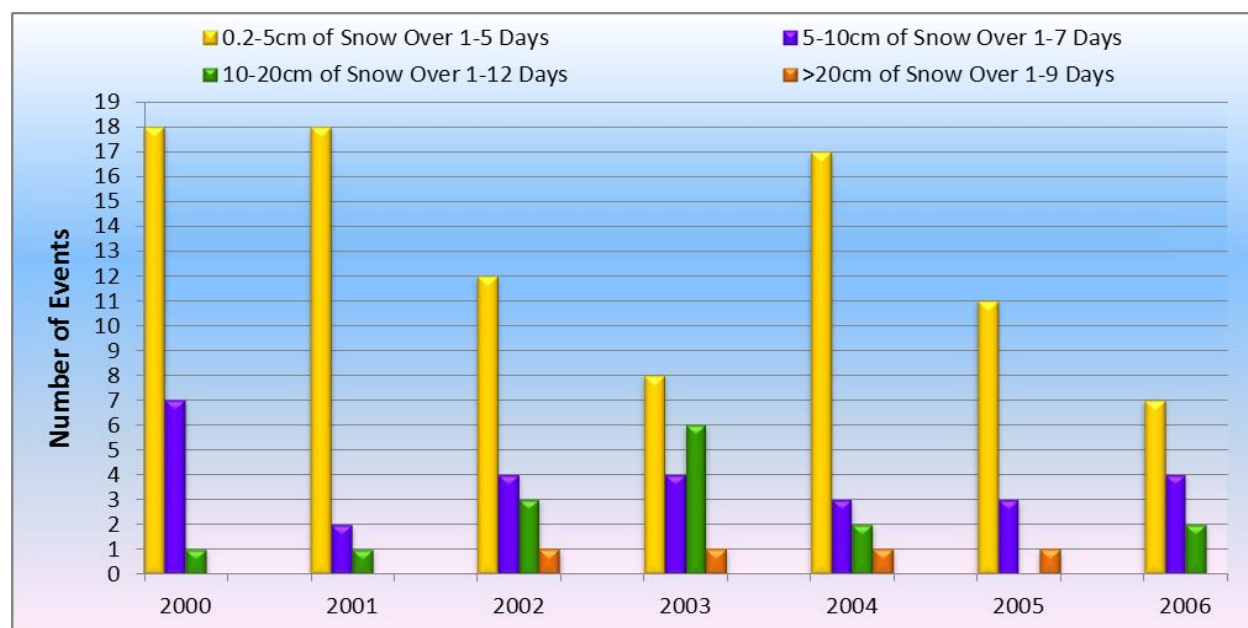


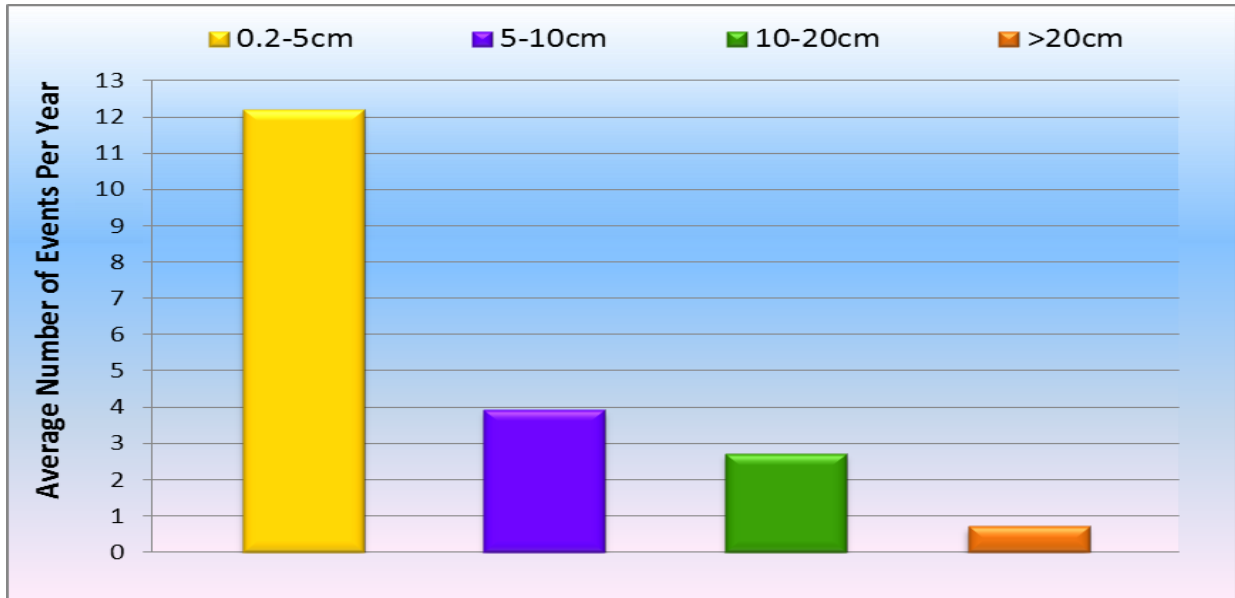
Figure 5: Multiple Day Snow Events vs. Snow Accumulation per Event in Medicine Hat

Variation of amount of snow received over several days has a direct effect on how crews strategize to allow safe passage for traffic. As not every snowfall/storm is the same, crews have to be heavily involved and aware of current roadway conditions and forecasted weather.

For each event the crews maintain roadways following the same category system which is discussed in section 7.2.

Table 1: Types of Snowfall Events

Event Type	Snowfall	Duration of Event	Snow & Ice Control
Minor	0.2-5 cm	1-5 Days	<ul style="list-style-type: none"> <li>As accumulations are minimal crews apply sand, salt and chemical where required</li> <li>Ice buildup, drifting and localized accumulation may occur; plow trucks and graders are then deployed to address issues</li> </ul>
Moderate	5-10 cm	1-7 Days	<ul style="list-style-type: none"> <li>Above 5cm will initiate the category system of clearing roadways</li> <li>Depending on snowfall amounts, blowing snow and temperature, crews may have to re-clear higher priority roads which delays other roadway clearing</li> </ul>
Heavy	10-20 cm	1-12 Days	<ul style="list-style-type: none"> <li>Above 10cm crews continue to follow category system</li> <li>Additional resources are hired to help clear roads</li> <li>Crews are typically working around the clock</li> <li>Snow drifts and slippery intersections challenge crews to keep up with sanding and removal of snow for safe passage</li> </ul>
Extreme	>20cm	1-9 Days	<ul style="list-style-type: none"> <li>20cm and above challenge crews with constant clearing of high priority roadways, sanding major intersections and clearing snow drifts from select roads</li> <li>All crews and available contracted services are deployed for clearing roadways</li> <li>During these events crews may have to return to higher priority roadways before continuing on with lower priority roadways</li> </ul>



**Figure 6: Average Number of Events per Year**

\* Environment Canada's data was incomplete for Medicine Hat 2007-2009; therefore, snow fall accumulation for Medicine Hat 2007-2009 was estimated based on Calgary snow fall for 2007-2009.

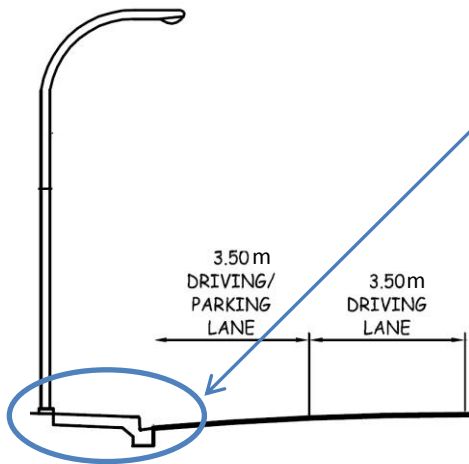
*In a typical year, Medicine Hat can expect to experience about 12 minor "events" (0.2cm-5cm), four moderate "events" (5cm-10cm), three heavy "events" (10cm-20cm) and one extreme "event" (>20cm) per year. For budget purposes in the past, the program was designed on five – five cm events per year. With this updated information, staff can better budget, track and forecast annual snow and ice control budgets.*

## 7 Snow and Ice Control Program for Medicine Hat

The snow and ice control criteria was initially established in 1999. Since that time the program has evolved into what it is today. The City's snow and ice control program encompasses the maintenance of roads in road-right-of-ways and sidewalks adjacent to City owned lands.

### 7.1 Medicine Hat Roadways

Medicine Hat has a network of arterial, collector and local (residential) network of roadways which serve businesses and residents in our community. Placement of snow can be challenging as many roadways do not have places to store snow.



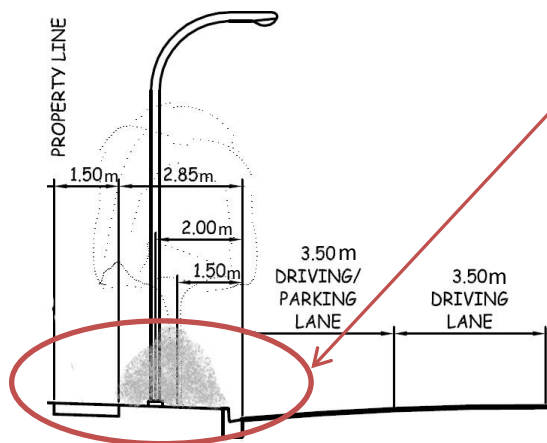
#### Monolithic Sidewalks

Sidewalks adjacent to the roadway limit where snow can be placed. The lane closest to the sidewalk is narrowed when snow is cleared. This becomes compounded with driveways and multiple snowfalls.

#### Options:

- Do not plow – Let snow pack/melt
- Leave snow in parking lane and create parking ban.
- Removal of snow - high cost.

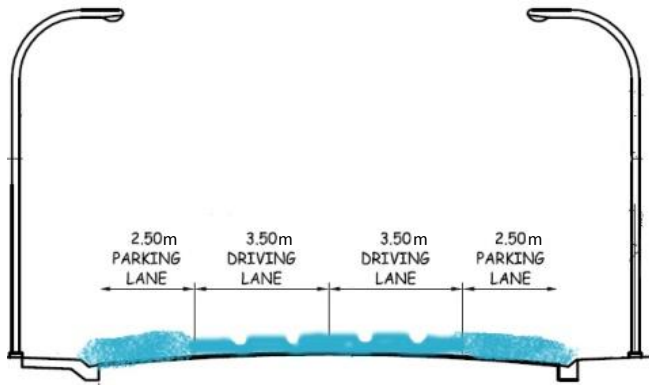
Many collector roadways have monolithic sidewalks, parked cars and driveways which limit where snow can be placed. In this instance, plowing to asphalt is typically not practiced as there is no place to put snow and snow removal is too expensive for the current budget. Flat blading and sanding usually takes place in this situation (Example: Ross Glen Drive prior to 2010).



#### Separate Sidewalks

Separate sidewalks along a roadway are ideal for snow removal as there is space on boulevards to store snow, however space is limited if boulevards are narrow. Obstacles that exist include parked cars and driveways. Residents may experience temporary parking bans and accumulation of sand/aggregate to be cleaned in the spring. Caution must be given to avoid damaging trees and medians along boulevards.

## On-Street Snow Storage Options



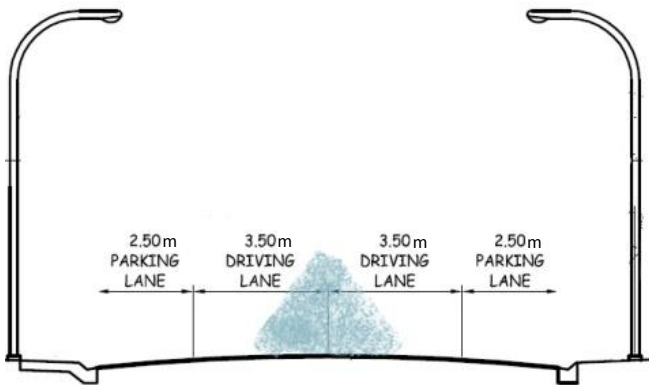
*Typical Collector Roadway*

*\*Residential roadways are typically 2m narrower*

### Snow Storage Option – Snow Pack

Currently Medicine Hat uses this option for the majority of collector and residential roadways. Snow in driving lanes becomes compacted (4:1) by vehicles. This option is the most economical as minimal maintenance is performed. Rutting eventually occurs due to traffic volumes and flat blading takes place to level out the ruts in the driving lanes. Small windrows are formed as a result.

\*(4:1) 4cm of fallen snow will typically compact down to 1cm of snow.

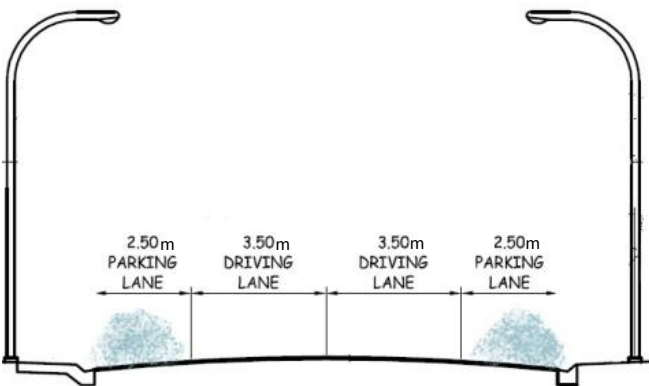


*Typical Collector Roadway*

*\*Residential roadways are typically 2m narrower*

### Snow Storage Option – Center of Road

In this scenario, snow is piled in the center of the roadway. Due to narrow road widths on many of Medicine Hats' collector roads; on-street parking would need to be banned for the winter season. When melting occurs, ice can form in the driving lanes.



*Typical Collector Roadway*

*\*Residential roadways are typically 2m narrower*

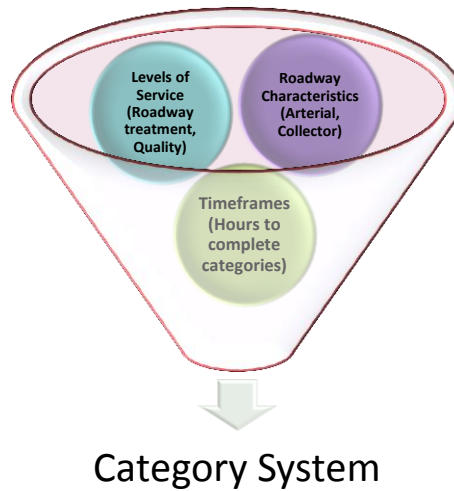
### Snow Storage Option – Parking Lanes

With monolithic sidewalks and narrow road width, storing snow in parking lanes can be cost effective at providing a good roadway condition. The majority of parking lanes would be consumed by snow. If homes have driveways, on street parking is less of a need. This option can cause drainage issues during melt. Catch basins must be clear to accept melt water.



## 7.2 Category Systems

The category systems are a collaboration of roadway characteristics, levels of service and timeframes.



### Medicine Hat's 1999-2005 Snow & Ice Control Program Category System

In 1999 a snow and ice category system was established which included roadway characteristics and levels of service. Timeframes were established and added to the program as a result of the approved 2001-2003 City business plan. In 2002, Highways #1 and #3 were taken over by Alberta Transportation. The snow and ice control program remained as per below from 1999-2005.

**Table 2: Medicine Hat's 1999-2005 Snow and Ice Control Program Category System**

Category 1	Category 2	Category 3
Airport Emergency Routes Highways - (Holsom Road & HWY #41A) Arterials Hills & Bridges Central Business District (Downtown)	<b>Collectors</b> <b>School Zones</b> Transit Routes	Residential Roads City Owned Parking Facilities Sidewalks Lanes/Alleys

Roadway Type	Target Time Frame
Airport, hills, highways	6 Hours
Arterials, intersections	24 Hours
Downtown and city sidewalks	5 Days
Collectors	5 Days
Locals	7 Days

*Based on "10cm Snow" – 2001-2003 Business Plan*

### Level of Service (1999-2005)

- All roadways within the snow and ice control categories maintained as passable.
- The City incorporated the use of fine road salt on Dunmore Road Hill, Brier Park Hill, major highways and other roadways within the city.
- In 2005 the Municipal Works Department implemented the use of liquid de-icing chemical into their operations for snow and ice control.

### Medicine Hat's 2006-2010 Snow & Ice Control Program Category System

The snow and ice control category system along with the corresponding target time were revisited in 2005. As result of a Council meeting held in January of 2005, Council directed staff to add collector roadways and school zones to Category 1 which was applied in 2006. This system has remained in place since 2006 and currently is what the City uses for its program.

**Table 3: Medicine Hat's 2006-2010 Snow and Ice Control Program Category System**

Category 1	Category 2	Category 3
Airport Emergency Routes Highways (Holsom Road & HWY #41A) Arterials Hills & Bridges Central Business District (Downtown) <b>Collectors</b> <b>School Zones</b>	Transit Routes	Residential Roads City Owned Parking Facilities Sidewalks Lanes/Alleys
Target Time Frames		
Category 1	Category 2	Category 3
16 Hours After End of Snow Fall	Within 24 Hours After Category 1	No Time Frame Established

*Based on a "Less Than 5cm Event"*

### Levels of Service (2006-2010)

Table 3 below outlines the roadway treatments that the Municipal Works Department applies to different roadways. These levels of service have not been formally established through City Council. To date, levels of service have been documented as maintaining roadways as passable.

**Table 4: Medicine Hat's Current Roadway Treatments**

Possible Treatment	Highways	Emergency Routes	Arterials	Hills	Bridges	Downtown & Hospital	Collectors	School Zone	Transit Routes	Residential Roads
Plowing to Near Bare Pavement	■	■	■	■	■	■				
Sand or Sand/Salt for Slippery Intersections & Roadway	■	■	■	■	■	■	■	■		
Application of De-Icing Chemical			■							
Snow Removal		■	■		■		■			
Plowing to a Compact Road Surface						■	■	■		
Maintaining a Passable Road Surface										■

■ Identifies Treatments Currently Performed

### Summary of Category Changes

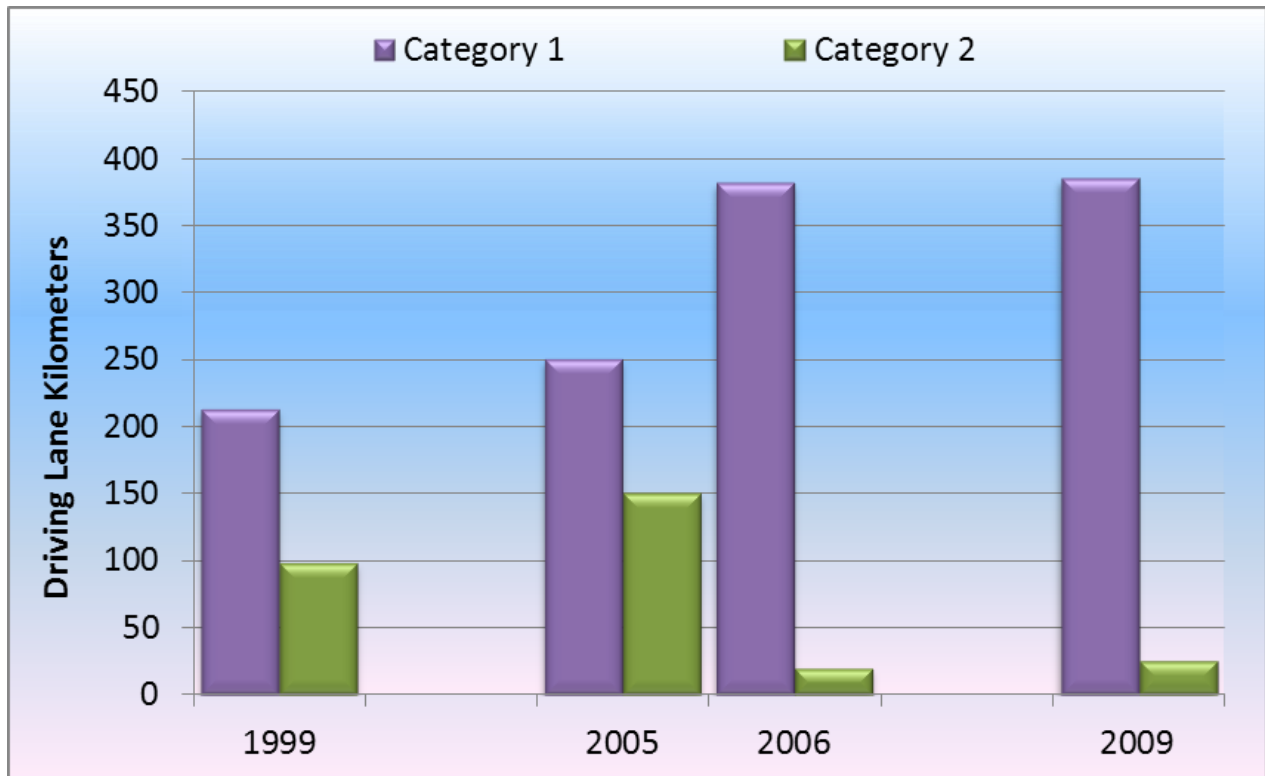


Figure 7: Category 1 and 2 Lane Kilometers in Medicine Hat

- Changes to the category system in 2005-2006 increased Category 1 roadways by 53% (250 lane km in 2005 vs. 382 lane km in 2006).
- In 2005-2006 category 1 target times were changed significantly:

#### 1999-2005

Roadway Type	Target Times
Airport, hills, highways	6 Hours
Arterials, intersections	24 Hours
Downtown and city sidewalks	5 Days
Collectors	5 Days

Based on "10cm Snow" – 2001-2003 Business Plan



#### 2006-2010

Roadway Type	Target Times
Airport	16 Hours
Emergency Routes	
Highways	
Arterials	
Hills and Bridges	
Downtown	
Collectors	
School Zones	

Based on a "Less Than 5cm Event"

- Combined category 1 and 2 roadways have increased by 32% (311 lane km to 410 lane km) since 1999.

### 7.3 Sidewalks, Bike Lanes and Leisure Trails

The City currently has Bylaw 1556 in place which dictates expectations the clearing of sidewalks within the city.

**Bylaw 1556** - *The owner or occupant of any premises adjoining a sidewalk shall clear away any snow, ice, dirt or other obstruction from a sidewalk within twenty-four hours after the time such snow, ice, dirt or other obstruction was deposited or formed on the sidewalk.*

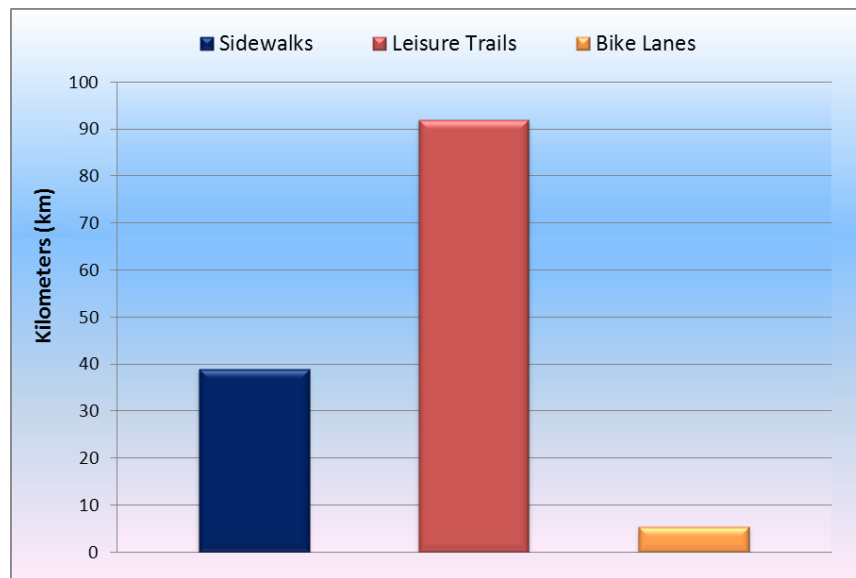


Figure 8: Distances of Sidewalks, Trails and Bicycle Lanes in Medicine Hat

The City's Municipal Works Department maintains 39 kilometers of sidewalks in front of City owned lands. The current program places sidewalks in Category 3. Public concerns stated that the City should be held accountable to the same bylaw (1556) for sidewalk clearing as the public.

The City's Parks and Outdoor Recreation Department maintains approximately 92 kilometers of leisure trails throughout the city, approximately 40% receives snow and ice control maintenance.

To maximize City resources, the Municipal Works Department maintains sidewalks and select trails in the north half of the city while the Parks and Outdoor Recreation Department maintains sidewalks and select trails in the south half of the city. Through past experience the Municipal Works Department and the Parks and Outdoor Recreation Department has determined that dividing the city into such a manner improves dispatching resources and overall efficiency for the maintenance of sidewalks and trails.

Bike lanes are new to the City of Medicine Hat and currently are not maintained during the winter. The network is currently small and ridership during the winter is minimal. This aspect may need to be reviewed at a later date as the size of the cycling network increases.

#### **7.4 Bridges, Overpasses, and Stairs**

Of all the bridges and other structures that Medicine Hat has in its inventory, there are five bridges, one overpass, two pedestrian underpasses and three pedestrian overpasses that contain walkways which pose distinct challenges for snow and ice control maintenance. Maintaining these walkways varies as some are remote and can only be accessed using labour intensive manual shovelling. Others can be cleared with snow blowers or bobcats. Snow removed from these structures takes extended periods of time since the snow cannot be pushed off to the side due to traffic below or water bodies so they must move the snow to the ends of the structures.

Medicine Hat also has a total of 14 stair cases. These structures are also labour intensive for snow and ice control as they are maintained through manual shovelling.

#### **7.5 Equipment and Personnel**

The Municipal Works Department's equipment and personnel tend to a multitude of activities within the snow and ice control program as well as various other city maintenance activities outside of snow and ice control program.

Operating heavy equipment such as graders and plow trucks is a skill that requires training. A key element for any municipality is to have trained City staff and contracted staff as many obstacles exist when maintaining urban roadways including traffic, intersections, pedestrians, manhole covers, catch basins, parked vehicles, road conditions, buried objects and reduced visibility. When working within an urban environment operators must be alert and aware of their constantly changing surroundings.

**During snow and ice control activities equipment and personnel maintain:**

- Airport Clearing
- Roadway Clearing
- Lane Grading (Snow)
- Bridge Clearing
- Overpasses Clearing
- Snow Removal
- Catch Basin Clearing
- Hauling of Sand/Aggregate
- Spot Sanding
- Salting Applications
- Chemical Applications
- Snow Dump Site Maintenance

In addition to snow and ice activities, crews continue to maintain infrastructure in need of repair, clean up and general maintenance throughout the winter season.

**Winter activities outside of snow and ice control include:**

- Traffic Sign Maintenance
- Parking Meter Collection
- Stairs, Pedestrian Overpasses, Bridge Walkway Maintenance
- Surface Drainage Control
- Storm Pond Maintenance
- Interdepartmental Work (parking lots sanding, road clearing, i.e. Power Plant)
- Dead Animal Pickup (within road right-of-way)
- Litter Control (within road right-of-way)
- Downtown Garbage Collection
- Downtown Gas Lamp Maintenance
- Guide Rail Repair
- Temporary Pot Hole Repair
- Street Sweeping (Sustained Chinooks)
- Catch Basin Thawing
- Airport Maintenance (parking lot clearing, sidewalk clearing, light fixture repair)
- Perimeter checks and wildlife control at airport
- Downtown Pedestrian Underpass Maintenance



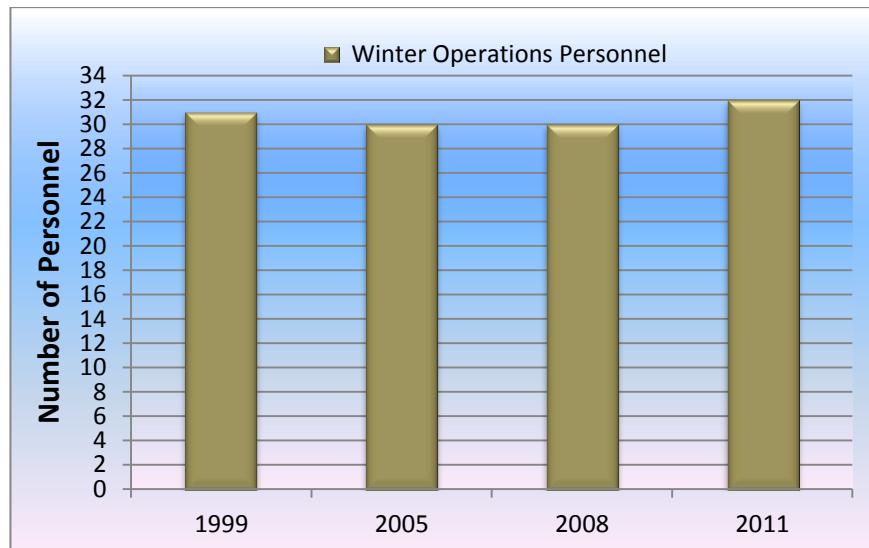
Catch Basin Thawing  
(Photo supplied by Medicine Hat News)



Pot Holes  
(Photo supplied by Medicine Hat News)

During summer months, the same equipment and personnel maintain infrastructure including:

- Paving Operations
- Street Sweeping
- Pothole Repair
- Sidewalk Replacement
- Storm Sewer Maintenance
- Bridge Cleaning
- Guide Rail Repair
- Special Event Setup (Parades)
- Downtown Gas Lamp Maintenance
- Sign Installations, Traffic Sign Maintenance
- Lane Grading (Gravel)
- Line Painting
- Gas Lamp Maintenance
- Downtown Garbage Collection
- Storm Pond Maintenance
- Sidewalk Construction
- Parking Meter Collection
- Airport Maintenance
- Perimeter checks and wildlife control at airport
- Downtown Pedestrian Underpass Maintenance



**Figure 9: Number of Full Time Winter Operations Personnel**

*All operations staff is required to adhere to regulations which dictate the maximum allowable number of working hours per day. Emergency situations allow for extended times.*

- **Overall, the number of operations personnel has increased by 1 person since 1999.**

#### **Winter Operations Personnel (2011 – 32 Full Time Employees)**

- 3 Field Supervisors
- 18 Equipment Operators
- 3 Sign Shop Personnel
- 8 Labourers

*From May-October, the Municipal Works department hire 7.5 FTE's of temporary casual labourers. The temporary FTE's, 32 FTE's (above) as well as a superintendent (1) and a manager (1) total 41.5 FTE's for business plan purposes.*

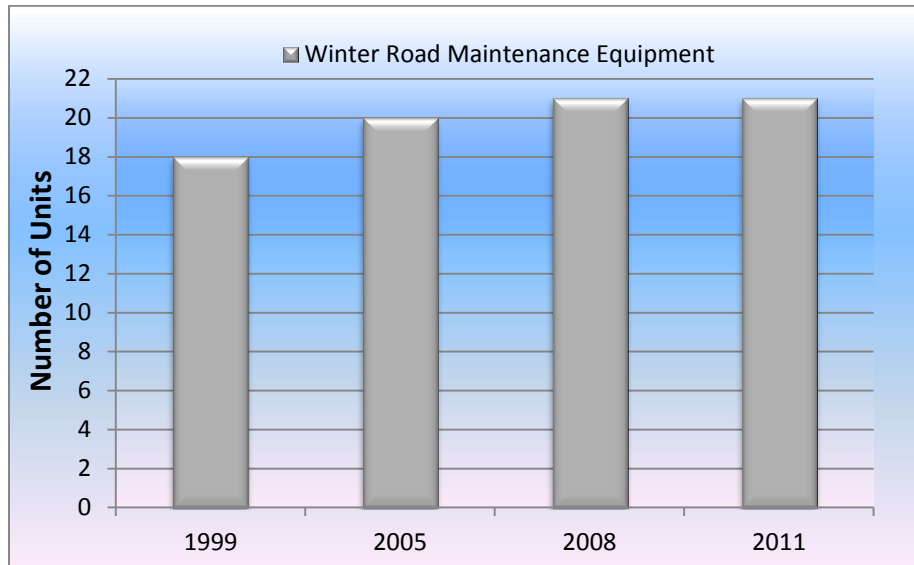


Figure 10: Number of Winter Road Maintenance Units

During winter months, the Municipal Works Department assigns one to three personnel to maintain the runways, roads and parking lots on the airport property. After needs have been met at the airport; the staff members proceed onto winter maintenance on city roadways (Section 7.9).

- **Municipal Works has received an increase of three pieces (17% increase) of winter road maintenance equipment since 1999**

#### Winter Roadway Maintenance Equipment (2011)

- 4 Motor Graders (three used regularly, one Training Grader)  
*Training grader scheduled to be replaced with new grader in 2012.*
- 5 Sanding Trucks
- 6 Plow/Sanding Trucks
- 2 Front End loaders
- 2 Tandem Snow Hauling Trucks
- 1 Water Hauling Truck (Chemical Application)
- 1 Snow Loader

A total of 21 units are available for maintaining city roadways during the winter season.



Municipal Works Department's Snow & Ice Control Equipment



### **Winter Sidewalk and Trail Maintenance Equipment – Municipal Works Department**

- 1 Holder (blade, sweeper and snow blower attachments)
- 1 Trackless (blade and sweeper attachments)
- 3 Bobcats

A total of five units are available for maintaining city sidewalks during the winter season.

### **Winter Sidewalk and Trail System Maintenance - Parks and Outdoor Recreation Department**

The Parks and Outdoor Recreation Department's personnel and equipment as well as contractors carry on with a diversity of tasks throughout the winter months, including sidewalk and trail snow removal.

This is in addition to the Parks and Outdoor Recreation Department's personnel focus on urban forest maintenance, i.e. tree pruning; park furniture repair; equipment repair, etc. During winters with heavy snow fall tasks such as tree pruning are either deferred or not carried out that year.

During summer months, the same equipment and personnel maintain infrastructure and deliver public service including: leisure trail maintenance, grounds maintenance, horticultural and arboriculture operations, sports field maintenance and irrigation operation and maintenance.

### **Winter Sidewalk and Trail Maintenance Equipment – Parks and Outdoor Recreation Department**

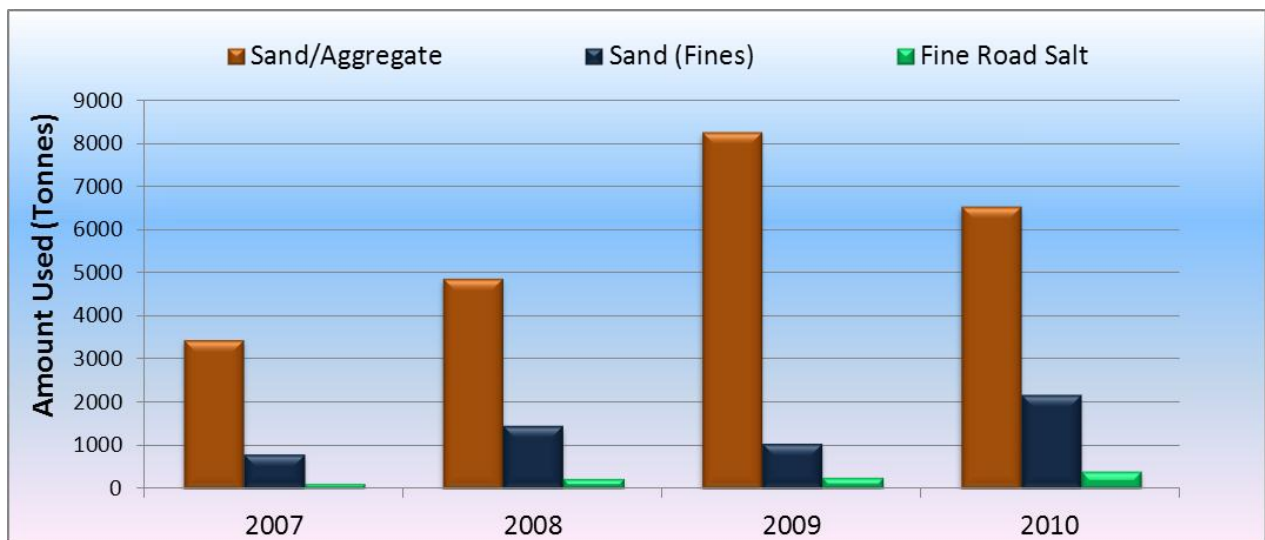
- 1 Trackless Articulated Tractor (blade, snow blower and rotary broom attachments)
- 1 Skid Steer Tractor
- 1 Mower Power Unit (blade, snow blower and rotary broom attachments)
- 2 Tractor/Loaders (blade and rotary broom attachments)



Work crew removing snow on 3<sup>rd</sup> Street SE – 1938  
(Photo supplied by Medicine Hat Esplanade archives)

## 7.6 Materials and Storage

The City of Medicine Hat's Municipal Works Department manages all aspects of environmental concern regarding any foreign material applied to city roadways for snow and ice control purposes. The department follows Alberta Environment guidelines set out for the proper use and monitoring of snow and ice control products and guidelines set out for snow disposal sites. Monitoring wells located on City snow dump sites are tested and submitted to Alberta Environment for record annually.



**Figure 11: Traction Control Material, Fine Road Salt and De-Icing/Anti-Icing Chemical Usage**

*\*All annual quantities purchased depend on severity of snowfall events, temperature, roadway type and geographic attributes (hills and bridges).*

### Sand/Aggregate

Sand/aggregate is an effective method for traction control and is typically used for very slight snow fall events when plowing measures are less effective. This results in an increased quantity of sand/aggregate on city roadways when there are frequent light snowfall events. To improve the effectiveness of sand/aggregate a liquid de-icing chemical is sprayed on the material, this is called pre-wetting. Pre-wetting sand/aggregate increases the amount of material that remains on the roadway after application. During plowing operations the sand/aggregate may end up on boulevards and grasslands. In this case, the adjacent manicured grasslands typically have sand brushed off in the spring.



Sand/Aggregate Storage



Sanding Truck

Amounts of materials used are dependent on the severity and nature of the winter weather events. A balanced approach is taken which considers public safety, cost of materials and the environment. In 2010 additional plowing and the increased use of sand/salt mix and chemical was an attempt to reduce ice accumulation on busy roadways while reducing the amount of sand/aggregate used. Plowing reduces the amount used and accumulation of aggregate on roadways.

A few of the factors that play a role in the use of traction and ice control materials in Medicine Hat are:

- The large number of hills in Medicine Hat require enhanced traction control
- Medicine Hat receives numerous minor snow events each year, during these events applying materials to the roadway is the most effective method of traction control

### Fine Road Salt

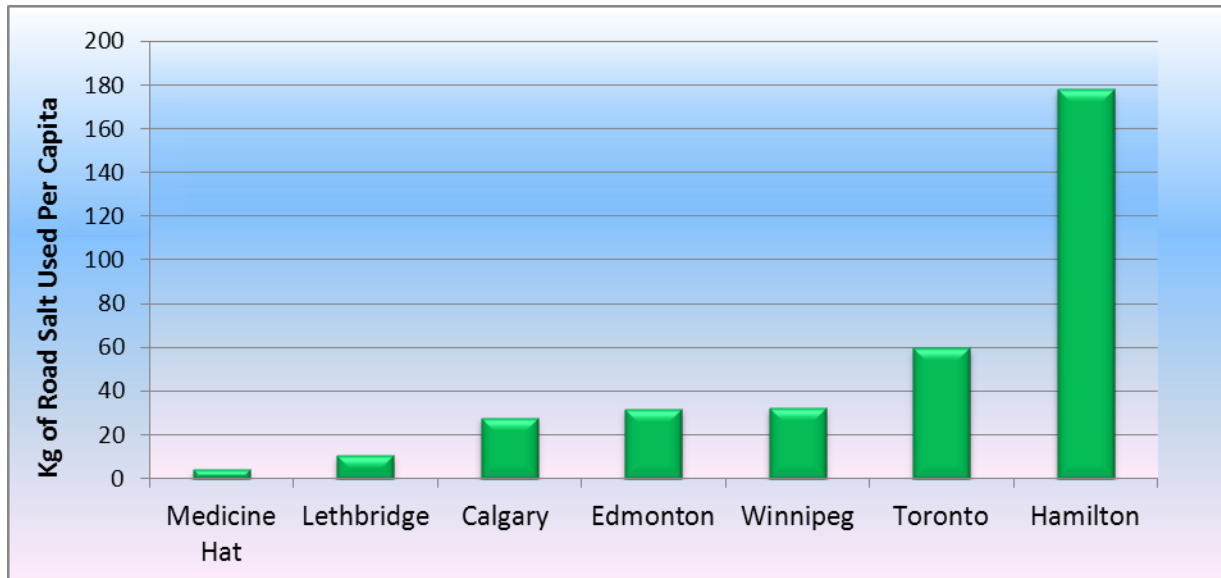
Currently the City of Medicine Hat uses less than 500 tonnes of fine road salt each year on its roadways. Fine road salt is an economical method for melting snow and ice that may accumulate on the roadway. Fine road salt is very effective at providing an enhanced driving surface (dry pavement) when used within its working temperatures, but is corrosive to vehicles and metal structures. Currently fine road salt use remains at a minimum as it is only used on designated highways and hills, as these roads pose an increased safety risk and therefore require an increased snow and ice control treatment. The use of this product is typically in locations where ice build-up is difficult to remove through mechanical means (graders or plows) and would therefore require an ice melting product. Fine road salts capabilities are enhanced when used in conjunction with liquid chemical (pre-wetting). Pre-wetting salt significantly increases the quantity of salt that adheres



City of Medicine Hat's current fine road salt storage facility

to the snow and ice on the road surface resulting in more salt remaining on the road surface. This method of pre-wetting also increases the rate at which the salt and liquid chemical melts snow and ice.

It is shown in Figure 12 that compared to other cities Medicine Hat uses significantly less salt per capita. Salt does have limitations since it loses its effectiveness at temperature below -9°C which affects how much salt can be used in colder climates.



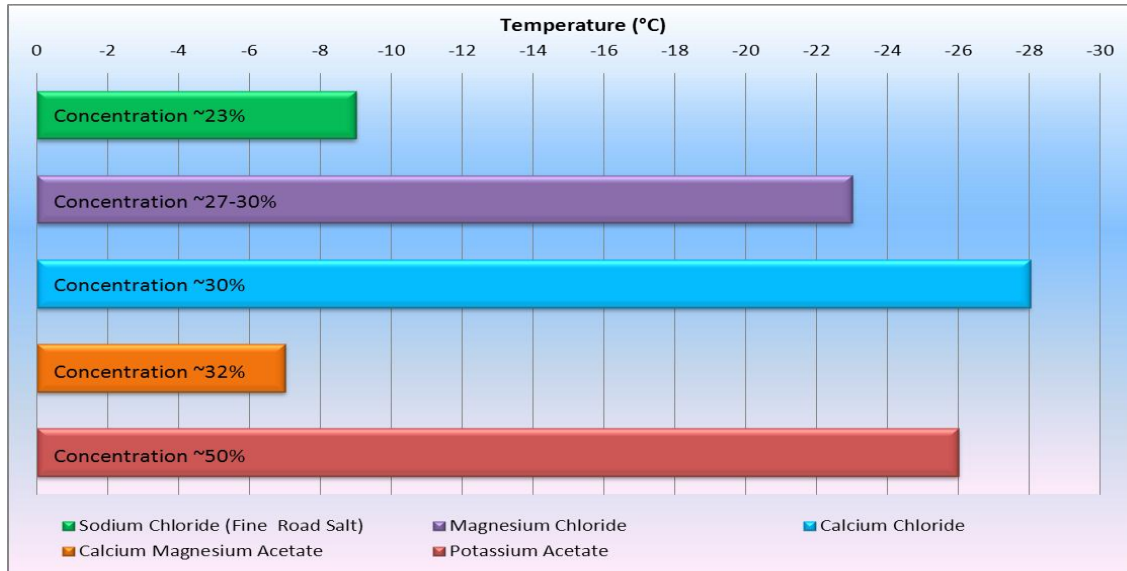
**Figure 12: Comparison of Average Annual Road Salt Used**

Figure 12 depicts kg of road salt used per capita instead of kg per lane km because the exact length of roadway each city applies salt to is unknown. Salt usage varies significantly as a result of total annual snow fall, temperature, regulations, roadway types and city geography.

### Liquid Anti-Icing/De-Icing Chemical

Approximately 4000 to 5000 gallons of anti-icing/de-icing chemical are used each year. The majority of the chemical is applied to high risk areas such as hills and high traffic roadways prior to a snowfall event. Liquid chemical is applied to roadways prior to events such as freezing rain or events which forecast icy road conditions to prevent snow or ice from adhering to the road surface. Liquid chemical is also used to reduce the amount of abrasive materials such as sand/aggregate that is needed to provide traction for vehicles. Using liquid chemical significantly reduces the frequency in which abrasive materials must be applied as well as reduces the amount of abrasive's that must be cleaned off the road in the spring.

The City uses magnesium chloride with a corrosion inhibitor as their anti-icing/de-icing chemical because it is less corrosive to vehicles and infrastructure. This product is more expensive but works at temperatures well below the capabilities of regular fine road salt and is effective at a greater rate of speed. The City follows guidelines for chemical use for snow and ice control set out by Alberta Environment. Anti-icing/de-icing chemicals are used responsibly as to limit the effect on ground water and roadside vegetation.



**Figure 13: Anti-Icing and De-Icing Chemical Effectiveness Temperatures**

Figure 13 outlines a few of the major de-icing compounds used for winter road maintenance. Potassium acetate is the most favourable as it is non-corrosive and the least harmful to the environment, but it is the most expensive compound. This compound is commonly used at airports, including the Medicine Hat Regional Airport, as airports require non-corrosive materials for the runways to prevent any damage to aircraft.

### Snow Dump Sites

The City has four approved snow dump sites located throughout the city. The sites are located on 30th Street SW, 10th Avenue SW, 23rd Street NW and at the bottom of Scholten Hill. Each site has been reviewed by the Alberta Environment and has monitoring wells that test for any abnormal effects to its surroundings such as increased levels of chemicals.

The Scholten Hill snow dump site has a clay foundation to prevent runoff from directly entering into the nearby creek. Typical summer weather allows for the evaporation of water remaining on site, due to high precipitation in 2010 this site would require the remaining water to be pumped out at an addition cost at the end of the 2010/2011 winter season. The Municipal Works Department chose to exclude the Scholten Hill snow dump site for the 2010/2011 winter season because of limited water dissipation from the previous year. See Appendix E for snow dump site locations map.



**30<sup>th</sup> Street Snow Dump Site**



## 7.7 Resource Mix

The Municipal Works Department is a year round operations department which provides a variety of services to the city. For cost efficiency, the department strives to balance equipment, personnel and contracted services to avoid having an overabundance of equipment that would not be used during a particular season. Currently the department has a balance of equipment that limits equipment being idle for extended periods however; the department is challenged with having sufficient operators to keep the current equipment operational 24 hours a day seven days a week.



Grader

The department's strategy is to have enough equipment to provide services for average winter weather events. Rather than having an excess of equipment to combat extreme weather the department hires contracted services to assist when needed. In addition to standard equipment (graders, plows, and sanding trucks) the department is required to have some specialized equipment which only serves its purpose during a specific season (e.g. snow loader during winter for snow removal). New specialized equipment will enhance the department's capability to meet the increasing snow removal needs.

When a snowfall event occurs in Medicine Hat a combination of City and contracted services perform winter maintenance operations throughout the city. Contracted services provide qualified operators however, training or guidance is still required for the operators to become aware of challenges when working on city roadways.

A wide range of equipment is used to maintain the City's airport, roadways, lanes/alleys, sidewalks, bridges, overpasses, stairs and various other structural entities during and after a winter weather event. The City provides winter maintenance through the use of graders, plows, sanding trucks, a chemical application truck, sidewalk clearing units, a snow loader, snow hauling trucks, front end loaders, and personnel manually shovelling snow. In past years contracted services have provided assistance to City crews through the use of graders, snow hauling trucks and a snow blower.

During heavy and extreme weather events contracted services may be unavailable to provide the large number of pieces of equipment required to meet target times in which case the City must extend the times in which winter maintenance is completed. At times contractors may have prior obligations before they are able to commit resources to assisting with city roadways.

During long duration snow events, contractors and City employees are subject to labour laws which can limit the number of consecutive hours or days a person can work. Labour law resources Include:

- Canada Labour Code (for the Medicine Hat Regional Airport)
- Government of Alberta Employment Standards Code
- Government of Alberta Employment Standards Regulation
- Union Collective Agreements

Post event clean up incorporates a combination of City equipment, personnel and contracted services. Typical post event clean up requires the addition of contracted graders, snow hauling trucks in combination with City resources. At times when City crews are at full force, contracted services are used to haul in materials such as sand/aggregate to ensure that materials remain available for roadway maintenance.

Many roadways in Medicine Hat have sidewalks on both sides of the street without boulevards which limits where snow can be placed. Graders are more versatile and have specialized equipment such as snow gates that allow them to manoeuvre snow better than a plow; therefore the City utilizes these graders within the city. The City uses plows on roadways that do not pose limitations of where snow can be placed. Outlying roadways that do not pose snow placement limitations allow for the higher speed plows to operate to their full capacity since they are able to travel at greater rates of speed.



Front Plow/Sanding Truck



Snow Blower and Haul Truck

## 7.8 Budgets

The City's snow and ice control program's base budget is tax supported. The 2010 annual snow and ice control budget allocation was \$1,082,797. In 2010, the average household paid approximately \$28 for the snow and ice control service (based on the average assessed house value of \$256,890). As weather is variable by nature, the program is considered an uncontrollable variance which allows for acceptable spending to maintain roadways as needed to ensure established levels of service are met.

The budgets for the snow and ice control program from 1999 to 2010 are outlined in Figure 14. Typical annual increases are a result of industry inflation costs for personnel, equipment, contracted services and materials. Levels of service regarding what treatment the roadways receive remained the same.

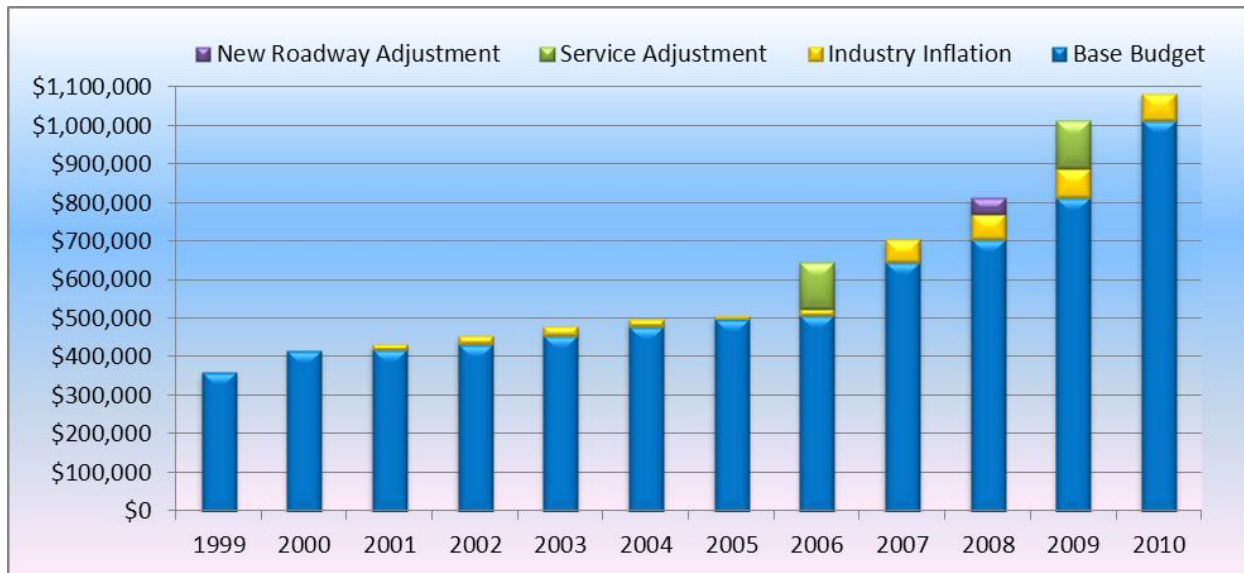


Figure 14: Medicine Hat's Snow & Ice Control Budget Increase from 1999 to 2009

### Summary of Budget Increases

2006 - The snow and ice control budget was increased when City Council approved an additional \$120,000 for moving schools and collector roadways into the Category 1 group.

2008 – Newly constructed roadways contributed funds to the program which included the Parkview Drive extension (\$15,000) and Black and White Trail upgrade (\$30,000).

2009 – Service adjustment increases as part of the 2009-2011 business plan included \$75,000 for the snow and ice control program and \$50,000 for Environmental Management Compliance and Snow Dump Site Monitoring.



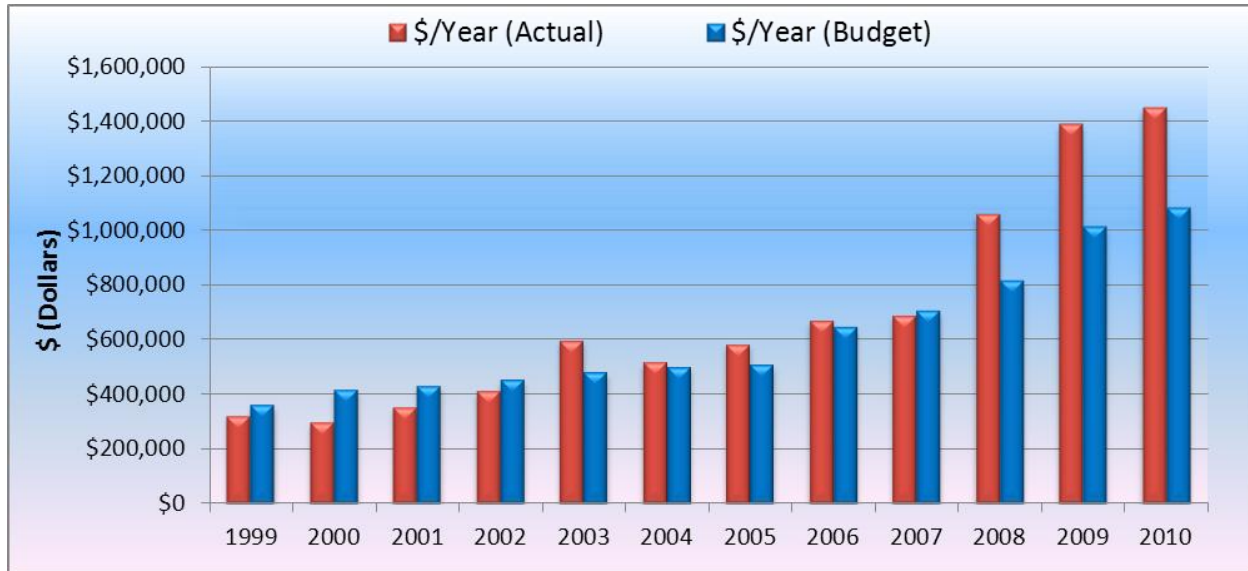


Figure 15: Medicine Hat's Snow and Ice Control Budget vs. Actual Overall Costs

The above costs reflect actual costs vs. budgeted costs from 1999 to 2010 winter seasons. The snow and ice annual budget starts January 1<sup>st</sup> and ends December 31<sup>st</sup> of each year. This means that one budget year is split between two winter seasons, example: 2008 Snow and Ice Control Budget begins Jan 1, 2008 and ends Dec 31, 2008.

## 7.9 Regional Airport

The City of Medicine Hat owns and operates the Medicine Hat Regional Airport. The Airport is under the responsibility of the Municipal Works Department and is funded separately from the City's snow and ice control program. However, certain elements overlap:



City of Medicine Hat Airport

- During a storm event, the airport is the highest priority, one to three municipal works staff members (depending on snow storm severity) are assigned to ensure that the runways and access for potential emergency needs is met. After these needs have been met at the airport, the staff members proceed to winter maintenance activities on city roadways and sidewalks.
- During a snowfall event, the runways have the highest treatment possible in order for aircraft to land safely (Regional Airport status obligations). The maintenance standard for the runways is “bare and dry”. This means that minimal to no snow or ice can be on the runways. In order to keep it to this level of service, City crews use several pieces of equipment including a runway broom (large rotating wire brush) to ensure the runways are clear of all snow. To prevent ice from forming, chemical potassium acetate is applied to ensure traction for aircrafts.
- The airport runways must remain at the highest treatment level of service at all times. Aircraft may need to land in case of emergency or scheduled flight; operations staff must be immediately available to maintain the runway 24 hours per day, 365 days per year.

It is a requirement that the airport runways meet standards dictated by Transport Canada. Municipal Works personnel monitor runways 24 hours a day to ensure accurate data and runway conditions are available to aircraft operators.

The airport has its own snow and ice equipment which is to remain on the airport property at all times (federal funding stipulations). This means that the City's Municipal Works Department is not allowed to use them for clearing roadways. The list of equipment includes:

- 1 Front Plow/Sander
- 1 Wing Plow
- 1 Runway Broom (Large Rotating Wire Brush)
- 1 Front End Loader
- 2 Snow Blowers

## 8 Comparison to Other Municipalities

Staff researched a variety of cities including Calgary, Edmonton, Winnipeg, Saskatoon, Regina, Lethbridge and Red Deer which are in close proximity or are good references for program development. Staff compared time lines, roadway classifications and type of treatments for different roadways of these programs. Municipalities researched commonly experience the same challenges for snow and ice control as Medicine Hat.

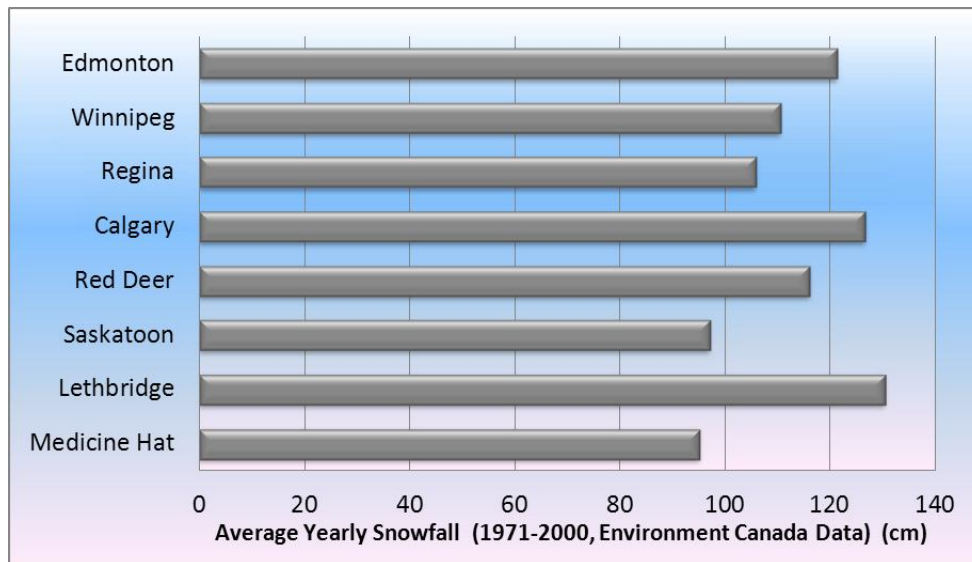


Figure 16: Average Yearly Snowfall Comparison (1971-2000)

### 8.1 Snow and Ice Control Programs of Neighbouring Cities

Through researching each program from other cities, key differences in program configurations are summarized as follows:

1. In all cases, Category 1 roadways were reserved for high importance routes which typically include highways, arterials and emergency routes. Medicine Hat is the only municipality to have school zones and collector roadways in Category 1 (Table 4).
2. Medicine Hat is the only municipality to maintain its airport in conjunction with city roadway maintenance; all other municipalities treat their airports as a completely separate entity.
3. The time frame to complete Category 1 roadways compared to the percentage of roadways in Category 1 is significantly lower for Medicine Hat than compared to all other municipalities researched (Figure 17).
4. Medicine Hat has the highest amount of total city roadways in Category 1 (43%), followed by Winnipeg which has 26% (Figure 17).
5. Many cities maintain Category 1 roadways to bare pavement (Table 5). Medicine Hat does this on select roads as many roadways have limited places to store snow.

6. Collector roadway maintenance varies from compacted snow to clearing. Many municipalities reference traffic volumes as an indicator for clearing snow from the roadways. Many Medicine Hat collector streets have limited places to store snow.
7. Most Cities including Medicine Hat maintain residential roads to a compacted snow surface if they are impassable to traffic flat blading occurs (Table 5).
8. Most cities including Medicine Hat typically don't clear or remove snow from local roads/residential areas (Table 5).

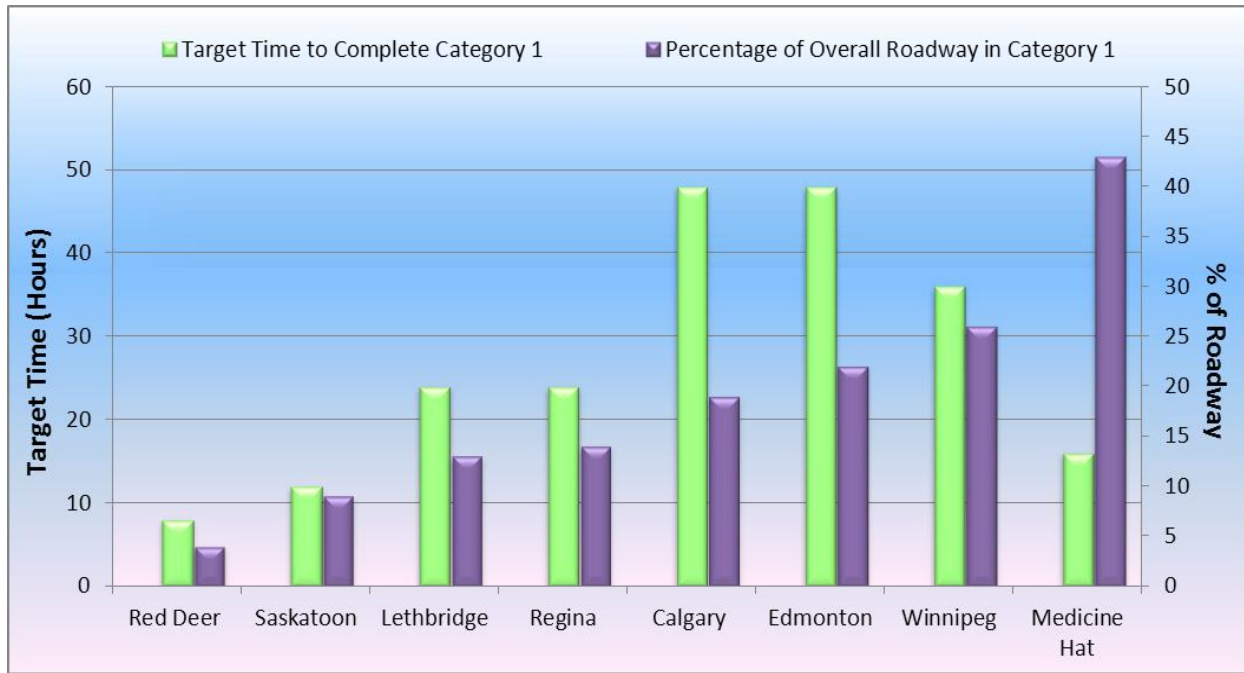


Figure 17: Comparison of Category 1 Roadways and Target Times

- The time frame to complete Category 1 roadways compared to the percentage of roadways in Category 1 is significantly lower for Medicine Hat than compared to all other municipalities researched.

Table 5: Category Comparison of Other Municipalities

Category 1							
Calgary	Edmonton	Saskatoon	Winnipeg	Regina	Lethbridge	Red Deer	Medicine Hat
High Volume Arterials Designated Emergency Routes Central Business Districts	Freeways River Valley Hills & Bridges Grade Separations Business Areas	Freeways Major Arterials	All Regional Streets & Some Streets to Facilitate Ambulance Access to Hospital	Freeways - Expressways, Major Arterial Roads & Designated Emergency Routes	Designated Arterials	Hospital Access Hills Bridges & Overpasses High Collision Intersections High Hazard Locations	Arterials Emergency Routes Highways (Holsom Road & HWY #41A) Hills & Bridges Central Business District (Downtown)  <b>**Airport School Zones Collectors**</b>
48 Hours	48 Hours	12 Hours	36 Hours	24 Hours	24 Hours	8 Hours	16 Hours
19%	22%	9%	26%	14%	13%	4%	43%
% values represent the percent of total roadway within each category							

Category 2							
Calgary	Edmonton	Saskatoon	Winnipeg	Regina	Lethbridge	Red Deer	Medicine Hat
Designated Mid Volume Streets Traffic Lights & Controlled Crosswalks Designated Emergency Routes	Arterial Roadways	Access to Emergency Locations (Fire Halls, Ambulance Sites & Hospitals) Bus Routes	Non-Regional Bus Routes & Collector Streets Based on Traffic Counts	Minor Arterials Major Collector Roads (High Volume) All Roads in the Areas Referred to as Regina	Remaining Arterials & Designated Collectors	Arterials	Transit Routes (City Bus)
96 Hours	48 Hours	36 Hours	36 Hours	36 Hours	24 Hours After Completing Category 1	16 Hours After Commencement of Category 2	24 Hours After Category 1
11%	5%	19%	23%	10%	N/A	18%	3%
% values represent the percent of total roadway within each category							

Category 3							
Calgary	Edmonton	Saskatoon	Winnipeg	Regina	Lethbridge	Red Deer	Medicine Hat
Designated Feeders Collectors Bus Routes	Collector 1 Roadways -Carries Vehicles Between Arterial & Residential Roadways	Remainder of the Arterials & Collectors Local Bus Routes Access to Schools	Residential: Maintained to Snow Pack Conditions After 10 cm of Snow	Major Collectors (Mid Volume) Minor Collectors Industrial Roads Transit Routes & Truck Routes	Remaining Collectors Controlled Intersections (stops & yields) Bus Routes	(After 10 cm of Snow Pack) Downtown Bus Routes & Other Collectors Residential Streets Immediately Adjacent to School Property Lines	Sidewalks Lanes/Alley City Owned Parking Facilities Residential Roads as Required
Within 8 Days	48 Hours	72 Hours	Within 5 Days of Commencement	48 Hours	72 Hours	Downtown - Within 4 Days Others - Within 8 Days	No Established Time Frame
5%	15%	10%	51%	18%	N/A	27%	54%
% values represent the percent of total roadway within each category							

Category 4							
Calgary	Edmonton	Saskatoon	Winnipeg	Regina	Lethbridge	Red Deer	Medicine Hat
Residential spot sanding at playgrounds, and designated hills. Plowing impassible sections	Collector 2 - Roadways - Designated bus routes through residential areas	No Category 4	No Category 4	Minor Collector Roads & Major Residential Local Roads Which Lead Into School Bus Unloading Zones	All other city controlled roadways and laneways	Industrial - Commercial	No Category 4
No Time Frame	48 Hours			60 Hours	After Category 1 through 3	Within 3 Days of Commencement	
N/A	4%			5%	N/A	6%	
% values represent the percent of total roadway within each category							

Category 5							
Calgary	Edmonton	Saskatoon	Winnipeg	Regina	Lethbridge	Red Deer	Medicine Hat
Alleys only sanded or plowed if required for garbage pickup	Rural Roadways  (Bladed to Maintain Snow Pack)	No Category 5	No Category 5	Residential Local Roads  (Maintained Compacted Snow Surface ~10cm)	No Category 5	Residential Roads  (When Access for Emergency Vehicles, Garbage Trucks, and/or Recycling Trucks is Restricted)	No Category 5
No Time Frame	No Time Frame			No Time Frame		Within 25 Day of Commencement	
N/A	54%			54%		45%	
% values represent the percent of total roadway within each category							

**Table 6: Levels of Service Comparison of Other Municipalities**

<b>Calgary</b>
<ul style="list-style-type: none"> <li>*Snow plowing of category 1 routes will commence after the accumulation of 5 cm of snow</li> <li>*Plowing of residential streets commences after snow accumulation of 12 cm</li> <li>*Snow plowing may result in windrows on one or both sides of the street</li> <li>*Windrows left in front of driveways are the responsibility of the abutting property owner</li> <li>*Snow ruts greater than 12 cm will be plowed down to 12 cm or leveled to eliminate ruts</li> <li>*Snow removal commences for central business district and major arterials when snow impedes traffic</li> </ul>
<b>Edmonton</b>
<ul style="list-style-type: none"> <li>*Snow plowing on all arterial and bus routes to maintain bare pavement</li> <li>*Blading of residential streets to maintain a compact snow surface of no greater than 10 cm</li> <li>*Windrows left in front of driveways will be the responsibility of the abutting property owner</li> <li>*Snow removal from the central business area as required</li> <li>*Snow removal from arterial and bus routes when driving width or parking areas restricts safe vehicular movement</li> </ul>
<b>Saskatoon</b>
<ul style="list-style-type: none"> <li>*Plowing on residential roads only when roadways become unsafe or impassable</li> <li>*Grading streets to reduce snow ruts as required</li> <li>*Snow is plowed into windrows along curbs while trying to prevent snow from accumulating in driveways</li> <li>*Residential snow removal will only be completed in particular cases to improve spring run-off conditions, or in areas with a high concentration of parked vehicles such as the University or Kelsey campus.</li> </ul>
<b>Winnipeg</b>
<ul style="list-style-type: none"> <li>*Category 1 streets are normally maintained to bare pavement, commencement after 3 cm of snow fall</li> <li>*Category 2 streets are normally maintained to bare pavement, commencement after 5 cm of snow fall</li> <li>*Category 3 streets are normally maintained to a compact snow surface, commencement after 10 cm snowfall</li> </ul>
<b>Regina</b>
<ul style="list-style-type: none"> <li>*Category 1&amp;2 commencement after 5 cm of snow accumulation and maintained to bare pavement</li> <li>*Category 3&amp;4 commencement after 10 cm of snow accumulation and maintained to a compacted snow surface of approximately 8 cm or less</li> <li>*Category 5 commencement after 25 cm of snow accumulation and maintained to a compacted snow surface of approximately 10 cm or less</li> </ul>
<b>Lethbridge</b>
<ul style="list-style-type: none"> <li>*Category 1, 2&amp;3 roadways complete ice control and snow plowing</li> <li>*Category 4 roadways are maintained as passable to emergency vehicles and general public</li> </ul>
<b>Red Deer</b>
<ul style="list-style-type: none"> <li>*Category 1&amp;2 roadways are plowed and snow removal will commence for those areas with limited storage space</li> <li>*Snow removal will commence for the following: <ul style="list-style-type: none"> <li>Downtown - within 4 days</li> <li>Bus routes &amp; other collectors - within 8 days</li> <li>Residential street immediately adjacent to school property lines - within 8 days</li> </ul> </li> <li>*Category 4 roadways are plowed and windrowed within 3 days</li> <li>*Category 5 roadways are plowed and windrowed within 25 days</li> </ul>

*Bare Pavement (Edmonton): "Conditions refer to a snow free condition in the driving lanes of roadways. Bare pavement shall be no more than 2cm of snow cover on the road surface." (2007 Edmonton City Policy)*

*Bare Pavement (Regina): "Refers to a road surface condition where the wheel paths in driving lanes are generally visible. Ice, frost and snow may remain in wheel paths which results in slippery conditions. Loose snow between or outside of the wheel paths is normally plowed. Generally 3 cm of compacted snow between or outside of the wheel path is not plowed." (2006 Regina Winter Maintenance Policy)*

## 8.2 Other Municipality's Resource Mix

Similar to Medicine Hat, cities use a combination of City fleet and contracted services. Contracted vs. City owned will vary from city to city because it depends on what operations occur in the summer to justify full time City staffing levels all year round. Upon review of other municipalities it was observed that similar challenges are faced when determining the proper balance of contracted services and City owned equipment. It is common that cities review the balance of equipment periodically.

## 8.3 Other Municipality's Budgets

Staff compared winter maintenance budgets to Calgary, Edmonton, Winnipeg, Saskatoon, Regina, Lethbridge and Red Deer which are in close proximity or are good references for program development.

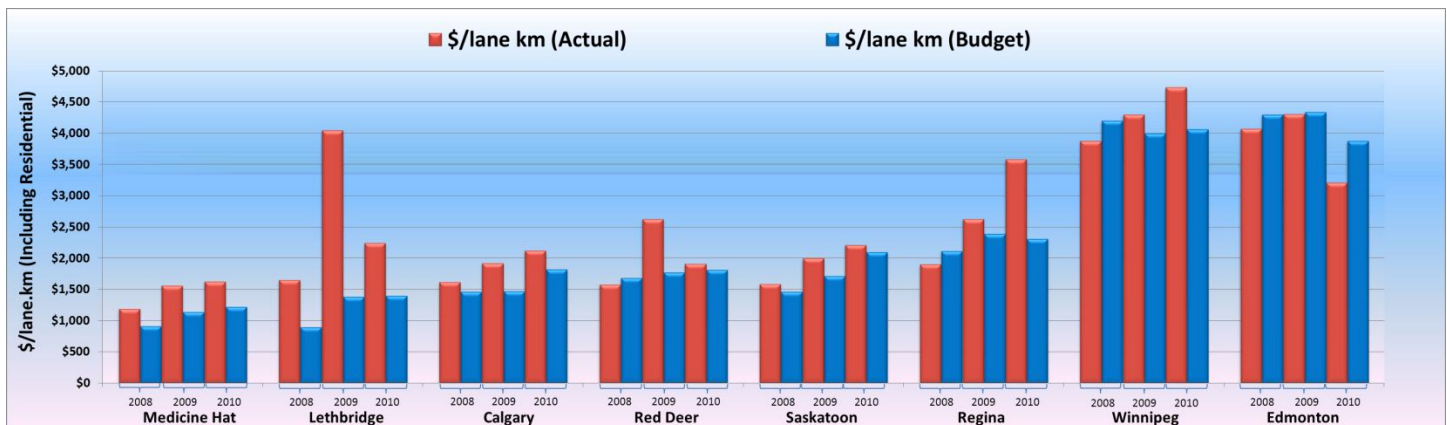


Figure 18: Cost Comparison \$/lane km to Other Municipalities (2008-2010)

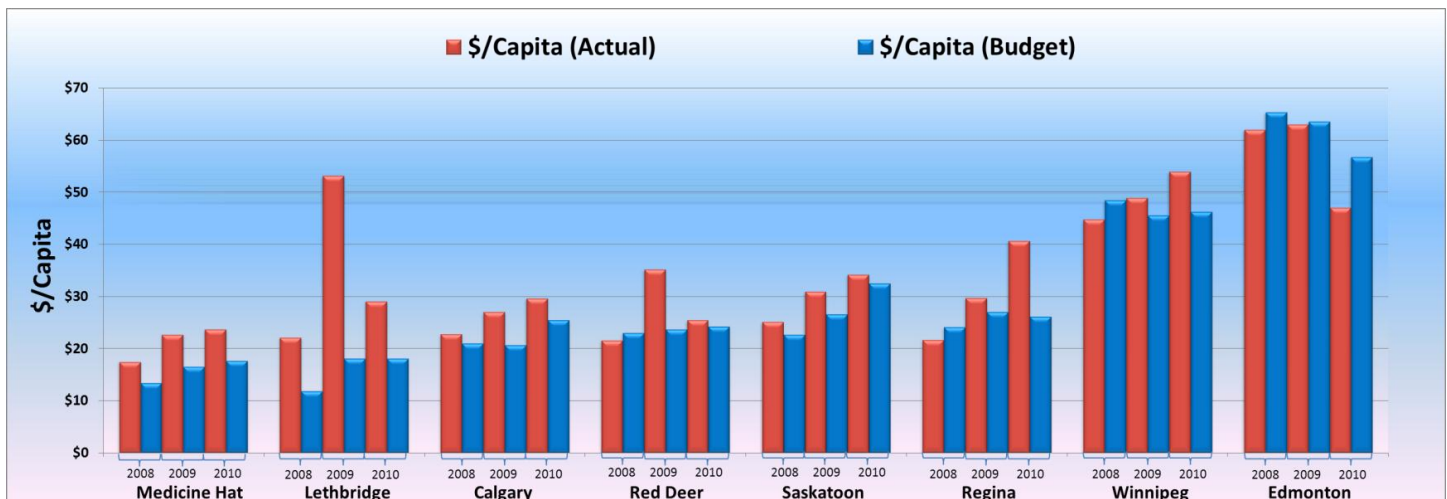
\* In 2009, Lethbridge spent 3.2 million dollars on snow removal which significantly increased their dollars per lane kilometer for that year. In 2009 Lethbridge experienced significant winds causing drifting of snow which required complete snow removal to reopen roads that became impassable.

- **Medicine Hat is among the lowest for funds budgeted and invested per lane kilometer into a winter roadway maintenance program compared to other cities in 2008-2010.**



There are many factors that affect the costs of winter road maintenance in the different cities including:

- Weather (temperature, amount of snow, frequency of snow, Chinooks)
- City road structure (room to store snow beside streets or not)
- Amount of lane-kilometers serviced
- Snow removal and storage costs
- Labour rates (internal and external)
- Snow and ice control policy/program requirements
- Sidewalk policy or bylaw requirements



**Figure 19: Cost Comparison Per Capita to Other Municipalities (2008-2010)**

\* In 2009, Lethbridge spent 3.2 million dollars on snow removal which significantly increased their dollars per lane kilometer for that year. In 2009 Lethbridge experienced significant winds causing drifting of snow which required complete snow removal to reopen roads that became impassable.

- **Medicine Hat is among the lowest for \$/Capita budgeted and invested for snow and ice control compared to other cities in 2008-2010.**

## 9 Performance Measures

Performance measures are appropriate to understand details for current and future review and audit purposes. Throughout the review of the snow and ice control program, staff were able to compare several elements which are consistent among other municipalities. Other performance measures identified through the review will be implemented as a result of the research.

**Total funds (budget and actual) spent per lane kilometer** – This tracking is consistent among all municipalities and is a high level comparison with many subjective variables.

**Total funds (budget and actual) spent per capita** – Census information is available and comparison further allows staff to compare how funds are spent on a per person basis. This again is a high level comparison with many subjective variables.

**Sub Category Budget Tracking** – Within the snow and ice control program many communities have embraced tracking snow removal (post storm), snow plowing/grading, snow dump sites, sidewalk clearing and sanding costs individually to better understand program effectiveness. This method of tracking is not currently performed by the City but is being considered as an adjustment to the current snow and ice program and may be implemented internally to track progress.

**GPS Tracking** – Staff can better track efficiency and equipment more effectively by using GPS (Global Positioning System). Supervisors can monitor efficiency in various areas of the city and obtain information pertaining to time and area maintained more accurately than before. GPS is being installed as part of this review (refer to section 11).

## 10 Consultations

Consultations were a key element of the snow and ice control review process. Throughout the process various members were consulted including internal staff, external stakeholders and the general public. The process included meetings, open houses, online information, questionnaires, phone and e-mail correspondence.

### 10.1 Researching Industry Best Practices

Throughout the snow and ice control review process the Municipal Works Department reviewed a variety of materials to determine what industry leaders on snow and ice control set as standards and best practice. Resources that were reviewed include:

- American Public Works Association
- Pacific Northwest Snow Fighters
- Transportation Association of Canada
- Ontario Ministry of Transportation

Additional resources can be found in Appendix G.

### 10.2 Internal Municipal Works Staff

Constant consultations with internal staff members were crucial to understanding the current program. Years of experience from grader operators, supervisors and other staff provided excellent insight and understanding of current obstacles and challenges the department faces.

Internal staff indicated several specific items which were reviewed:

- Budget constraints
- The number of operators in relation to the number of current equipment we have
- Amount of equipment currently owned is adequate for year round use (summer and winter)
- Addition of a snow blower may improve snow removal operations
- Contracted services are needed for winter operations
- Training and succession planning are important to operations staff
- The number of roadways within Category 1 that have to be completed within a short timeframe which is often not achieved.
- Felt that we weren't being responsive enough to community needs.

### 10.3 Open Houses

Public consultation was a main aspect of the snow and ice control review. Several forums were arranged for the public to provide input into how the program is perceived and direction it should take in the future. Open houses were held at various locations throughout the city which resulted in attendance of approximately 150 people. Accompanying the open houses were two separate questionnaires, receiving 235 responses for the initial questionnaire and 76 responses for the final questionnaire. Throughout the public consultation process the Municipal Works Department received a multitude of suggestions and concerns which has assisted in the progression and development of the future snow and ice control program.

#### 10.3.1 Initial Public Open Houses

To understand public expectations, staff hosted six initial public open houses throughout September 27 – Oct 2, 2010.

Initial open house locations included:

- South Ridge YMCA
- Connaught School
- Elm Street School
- McCoy High School
- Ross Glen Elementary School
- The Medicine Hat Mall



South Ridge YMCA Open House

The open houses were a forum for the public to provide the Municipal Works Department with their concerns and suggestions for the future program. The information available at the open houses included Medicine Hat's current snow and ice control practices and practices currently performed by other municipalities.

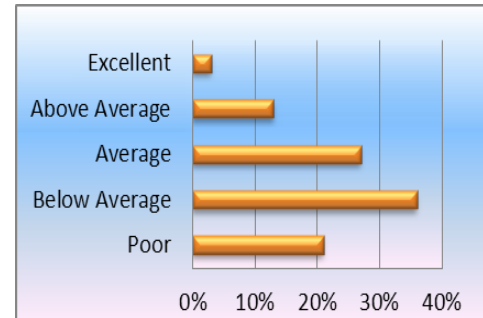
A total of 110 people attended the open houses. Staff also set up a booth at the Great West Home Expo & Leisure Show at the Medicine Hat Exhibition and Stampede Grounds on October 29-31, 2010 to try to garner maximum public input.

As part of the open houses a questionnaire was developed as a medium for the public to provide their input. The questionnaire was accessible at all the open houses as well as available on the City of Medicine Hat's website where residents could fill it out online, print and mail in, or drop off at any one of the open houses. In addition, the questionnaires gave residents the option to be contacted directly by staff to discuss their concerns. The Municipal Works Department attempted to provide every citizen a means to give their thoughts and ideas on the snow and ice control program.

## Summary of the 235 initial public questionnaire responses

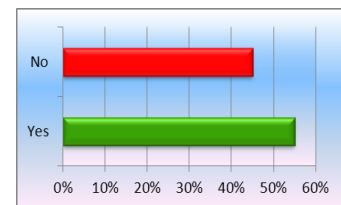
### Public's grade of the City's current snow and ice control services:

Many residents commented that snow and ice control was generally good on main roads and hills, while residential roads do not seem to receive any type of snow or ice treatment. Concerns were focused on mid-volume roadways (collectors), such as Ross Glen Drive, 20th Street NE, and 12th Street NE/NW. Reduced lane widths on roads such as Strachan Road and Carry Drive were also mentioned.



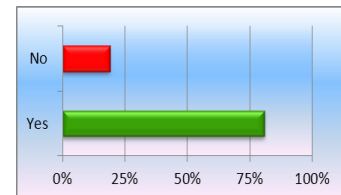
### Public's response to increase of taxes for improving the program:

For those residents who checked yes to an increase in taxes, they were willing to pay for more personnel and equipment to receive a better level of service, such as complete snow removal. For residents who checked no to an increase in taxes stated that their taxes were already high enough and encouraged a more efficient use of resources. Many residents stated that the current snow and ice control services were sufficient.



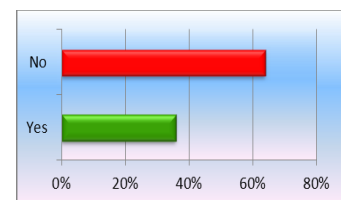
### Public's response to whether the City should change its winter maintenance practices:

Concerns varied significantly on this topic. General consensus was that service levels should be improved.



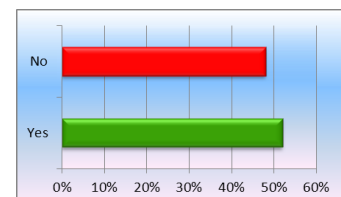
### Public's response to whether the City should windrow snow in front of driveways for efficiency:

The majority of residents would not approve of plowing snow in front of driveways. Concerns for the elderly and people with disabilities to clear snow were discussed.



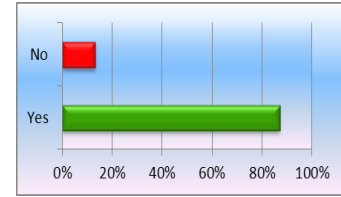
### Public's response to if placing a seasonal parking restriction on one side of the street is acceptable:

The residents of Medicine Hat are split on whether parking bans would be acceptable. Concerns that there isn't enough parking already. Concerns that large windrows would limit access to homes.



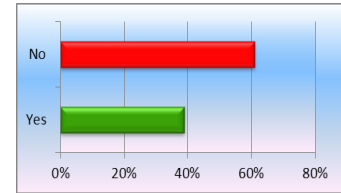
**Public's response to if implementation of a "snow angels" program would be good for the city (Volunteers who help clear snow for peoples with disabilities and the elderly):**

*The majority of residents were in favour of implementing a snow angels program. Many respondents noted they could help or benefit from the program.*



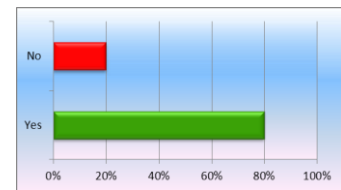
**When presented with how the City currently uses materials (sand and salt), the public was asked if the City should change its practices.**

*Many residents are satisfied with the current use of materials, stating that the use of sand and chemical can improve road safety with some residents concerned with potential environmental impacts and stressed appropriate use of products.*



**The public was asked if they think the bylaw for sidewalk clearing (24 hours) is appropriate.**

*The majority of residents agreed with the current bylaw. Residents expressed concern regarding the enforcement of the bylaw.*



**Public's response of the City's ability to clear their own sidewalks along City owned parks, stairways, parking facilities and other property.**

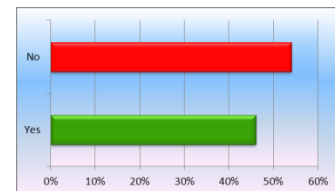
*The majority of the residents were satisfied with this service. Some residents were not satisfied with the quality of service nor the time frames as per the sidewalk snow clearing bylaw.*

**Public's general response when asked which considerations for the program are most important.**

*The majority of the respondents ranked quality of service as the greatest concern followed by target times and budget.*

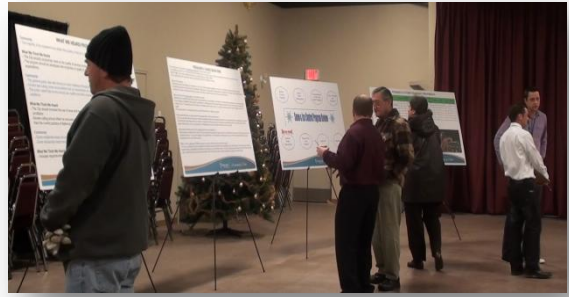
**Public's response when asked if they feel safe driving in Medicine Hat during the winter season.**

*Many residents are concerned with icy intersections and rutting on various, more frequently used roads. Comments were also noted for drivers to use caution and drive according to road conditions.*



### 10.3.2 Final Open House

Approximately 40 people were in attendance at the final open house held on November 24<sup>th</sup>, 2010 in Higdon Hall located at the Medicine Hat Exhibition and Stampede grounds. Intent of the open house was to confirm expectations from the public which were crucial to the program's development.



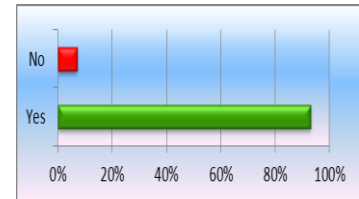
Higdon Hall Final Open House

Questionnaires were created to capture critical information from the public pertaining to costs and expectations. A total of 76 questionnaires were received from the public. The following summarizations were created.

#### Summary of the 76 final public questionnaire responses

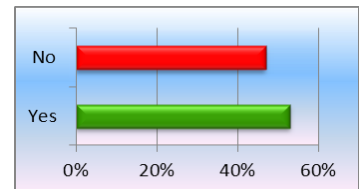
**Public's response when asked if higher volume roadways (example: Ross Glen Drive, 12 Street NE/NW and 20 Street NE) should receive a better level of service to reduce rutting and snow accumulation.**

*The majority of the respondents agreed that roadways such as Ross Glen Drive, 12th Street NW/NE and 20th Street NE should be receiving a better level of service that provided in the past but this better level of service should not just be limited to these select roadways.*



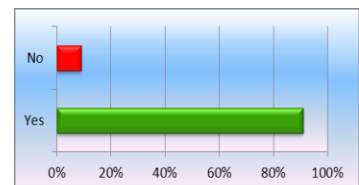
**Public's response when asked if snow should be left in one of the parking lanes along higher volume roadways (where off-street parking is available) is acceptable as a cost saving measure.**

*Respondents were split on acceptance of this concept.*

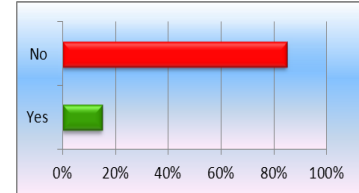


**Public's response when asked if snow should be removed from multiple lane roads (example: Strachan Road, Carry Drive) so lane widths are not reduced.**

*The majority of the respondents agreed that multiple lane roadways should see complete snow removal upon sufficient accumulation of snow to prevent any reduction in safe passage due to reduced lane widths.*

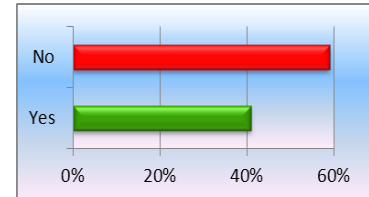


**Snow removal in all residential areas** could cost taxpayers approximately \$10,000,000 per year (10 times current budget) plus additional costs to acquire land for more snow dumps. The public were asked if this option should be pursued.



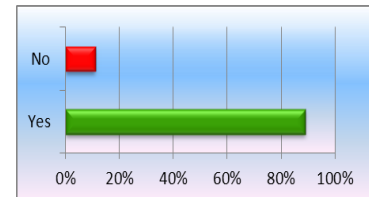
*The majority of respondents do not think that complete snow removal on residential roads is necessary but state that removal is required on higher volume roadways.*

**Snow plowing/grading in all residential areas** could cost taxpayers approximately \$3,000,000 per year (three times current budget). Snow would be windrowed in parking lanes in front of driveways and homes. Property owners would be responsible for clearing snow from in front of driveways. The public were asked if this option should be pursued.



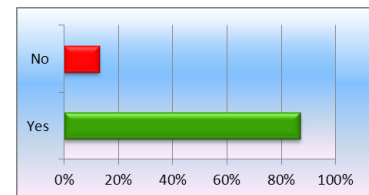
*Most of the respondents did not think that snow plowing/grading would be appropriate on all residential roads. Many residents did not favour clearing the windrows left from the clearing. Many indicated that flat blading and sanding would be sufficient for maintaining these roadways.*

**Public response when asked if the City should concentrate snow and ice control funds on busier roads which benefit the majority of the public.**



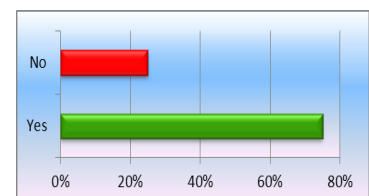
*Support was shown for maintaining the main roads that are used by the majority of the public but it was also stated that some attention still needs to be given to lower volume roadways after completion of busier roads.*

**Public response when asked if they agree that “quality of service” is the most important consideration for the snow and ice control program followed by target times and budget.**



*Many respondents agreed that quality of service is very important but they also feel that snow and ice control service should be completed in a timely manner.*

**Public response when asked if that the City should re-align categories, levels of service and target times to be comparable to other cities.**





## 10.4 Stakeholders

Several stakeholders were contacted which included special needs groups, seniors groups, business groups and safety groups. In addition, the review was submitted and circulated throughout the City's Technical Coordination Committee (TCC). The TCC group is composed of many departments including: Emergency Services, Planning Building and Development, Gas Utility, Electric Utility, Municipal Works, Environmental Utilities, Community Inclusion and City Transit.

It was commented that for the most part, Municipal works has maintained more than adequate emergency access throughout the city. Emergency services indicated that at times concerns exist with regards to residential roadways as they commonly respond to these areas. Icy intersections and rutting in residential areas could hinder response times when these conditions exist. The concerns did not necessarily focus on removing snow but ensuring that rutting is controlled appropriately.

Safety groups expressed that reducing accidents is important. Reducing icy locations would make situations safer. Reminding drivers to drive for the weather conditions is appropriate as some may forget from time to time.

Community Inclusions have indicated that generally snow, ice, windrows, and melt water at corners all pose barriers for people with mobility disabilities, senior worried about slipping, those pushing strollers or carts, and those using guide dogs. As the majority of sidewalks are adjacent to homes and businesses, it is significant for all to understand how important efforts to clear sidewalks in accordance with bylaw 1556 are to ensure the sidewalks are accessible to all. Further, ensuring the accessibility of bus stops is also important. Community inclusions further supported moving towards separate sidewalks as it would provide a place to pile snow and increase pedestrian safety by separating pedestrians from the traffic and the potential to drop off into traffic. Separate sidewalks also provide for larger landing areas at intersections so people with mobility disabilities can change directions with less difficulty.



Photo supplied by Community Inclusions

Businesses rely on clear passable roadways to ensure business continues as usual. Transportation of employees, customers and deliveries are all crucial elements to the economic success of the business.

City Transit expressed concerns on a few roadways where the driving lanes are narrowed due to windrows as the busses are wider than average vehicles. In addition, transit also stresses the importance of ensuring that sidewalks are clear and accessible for their customers.



Photo supplied by City Transit

### 10.5 Subject Matter Expert Review

Quotation from Jay Wells – Washington DOT – Member of the Pacific Northwest Snowfighters:  
*“Let me first off congratulate you on a very well done document. I am very impressed with the level of detail and the quality information you have included.”*

As part of the snow and ice control review process a subject matter expert review of this document was to be completed. The Municipal Works Department contacted an organization called the Pacific Northwest Snowfighters to complete the review. The Pacific Northwest Snowfighters are a collaboration of transportation agencies within the states of Washington, Oregon, Montana and Idaho and the province of British Columbia. Each agency provides expertise on a variety of aspects that contribute to snow and ice control. This organization is well recognized by the industry and are considered industry leaders in development and research.

In addition to the providing a subject matter expert review, the Pacific Northwest Snowfighters provided reference documentation which assisted in the planning and development of the program.

## 11 GPS and Route Optimization

As part of the snow and ice control review, staff was allotted \$25,000 to outfit the City fleet with a Global Positioning System (GPS). Staff evaluated several GPS manufacturers to determine which provider would be suitable for meeting current program needs. The Municipal Works Department was looking to find a GPS system that was functional for both winter and summer operations. Many GPS systems are hard mounted into a piece of equipment; the department was looking for a system that is mobile and could be transferred from one piece of equipment to another with limited challenges.

Municipal Works is anticipating that a GPS system will improve efficiency over time. The new GPS data will provide time and location stamps of when and where equipment has been throughout the day to better understand daily practices. This will assist supervisors in knowing where the equipment is and coordinate resources in real-time more effectively. The system should also help the department determine if a combination of other GPS tools may further enhance snow and ice control operations.

The GPS system that was selected uses BlackBerry® technology which transmits GPS locations every 15-30 seconds to a server within the city. This system has been installed in the 21 Municipal Works winter operations equipment. During spring and summer months this technology will be transferred into the street sweeping, paving, roadway repair and other units to better track those operations.



GPS Mapping

To complement the GPS tracking system the BlackBerry® users will be able to access the City's Geographic Information System (GIS) data base out in the field. This will allow the user to locate items such as catch basins, signs and other infrastructure through their mobile phone. For example, when operations staff is thawing catch basins throughout the city, staff members will be able to locate exactly where catch basins are buried, whether under snow, ice, water or debris quickly and efficiently. Once the staff member has completely thawed out a catch basin they can update the GIS data base through their mobile phone allowing all other staff members a real time update of what work has been completed. Future intended use of this technology includes:

- Work Order Management System
- Online Mapping for Public Viewing
- Enhanced Cost Analysis

Another aspect of GPS data collection is using this information for route optimization. Route optimization software is available today which can be designed to pick the routes to take based on a various number of factors. Staff reviewed the software and due to its initial expense to purchase and time devotion to setup has minimal effectiveness for the current size of Medicine Hat. Certain aspects of route optimization have already been established internally through years of experience. Municipal Works staff has established routes inside of the category system which are efficient and best serve the public. As we use GPS we will continue to see trends in routes taken and will progressively continue with route optimization.

## 12 Snow and Ice Control Practice Review 2010/2011

The Municipal Works Department was challenged to review all aspects of its snow and ice control program from how practices are established to what happens during daily operations. This section describes what actions the department took to combat the 2010/2011 winter weather events while taking into consideration what the department heard from the public consultations.

At the beginning of the 2010/2011 winter starting on November 16, crews were challenged with seven mm of rain which created severe icing on roadways. The city then received approximately 34cm of snow over a sixteen day period. Municipal Works staff commenced shift work hours to provide day and night snow and ice control maintenance. City crews with assistance from contracted services began winter road maintenance following the category system. The initiative included capturing real costs and time frames associated with clearing and removal.

The Municipal Works Department received a variety of recommendations, concerns and comments from the public regarding snow and ice control practices. This feedback along with technical research and a review of our practices led to a variety of increased levels of service along many roadways. Some of the levels of service that were being provided included:

- Snow removal operations were significantly increased (refer to Appendix F for November to December snow removal/blowing). Snow removal was performed at the hospital, downtown, various arterial and collector roads and on select local roads where snow accumulation problems occurred.
- A snow blower was contracted to remove snow from many roadways throughout the city. The snow blower was also used on outlying roads to deal with drifting snow issues.
- Additional arterial and collector roads were receiving plowing which created windrows on the side of the road. Many of the windrows were removed to allow for future storage of snow which was required in early 2011.
- Crews were taking a pro-active approach in dealing with snow accumulation issues on residential roads. Efforts included uncovering catch basins, flat blading residential areas and preparation of potential flood areas. Best efforts were made to address all public concerns.

During the 2010/2011 winter season crews were dealing with an increase in post event clean up challenges. Post event clean up challenges included additional snow removal, additional flatblading, drifting accumulations, maintenance of lanes, and general access issues throughout the City. The additional post event clean up resulted in:

- The snow and ice control budget was surpassed to accommodate the increased levels of service requested by the public compounded by the very heavy snowfall amounts experienced throughout the City for the 2010/2011 winter season.
- Staff was required to work in shifts for extended periods which eventually required staff to have time off due to fatigue and labour laws, such as;
  - Canada Labour Code (for the Medicine Hat Regional Airport)
  - Government of Alberta Employment Standards Code
  - Government of Alberta Employment Standards Regulation
  - Union Collective Agreements
- Staff were challenged to make full use of all the equipment because the department had to split crews into 24 coverage (day and night shifts).
- During the warm weather in early 2011 crews were challenged with clearing catch basins in a timely manner to improve runoff drainage throughout the city.
- Contracted services provided great service support in response to requests however at times they had other clients and contractual obligations which somewhat limited availability. During winter weather events contracted services were also subject to the same labour laws and fatigue management requirements as City crews.
- Crews were challenged in providing 24 hours per day, 7 days per week service all winter due to limited number of staff and available contracted services as a result of continued winter snowfall events throughout the 2010/2011 winter season.

Part of the review process was to look at methods of improving the snow and ice control program. As a result of the public consultation process the Municipal Works Department anticipated a significant increase to snow removal operations. The department researched cost effective methods of snow removal that would allow crews to have more versatility in their operations. Therefore, the department chose to hire a snow blower which had periodically been used in the past, however not to the extent of use seen during the 2010/2011 winter season.

It was observed that the use of a snow blower can cost effectively assist in removing snow from roadways by placing it on a boulevard area rather than hauling to a snow dump site. The contracted cost for snow blowing is lower than snow hauling however, a clean-up cost may be required when the snow melts and debris (gravel, garbage) is accumulated on the side of road or boulevards.



Snow Blowing

As a result of all snow removal efforts it was estimated that staff removed 27,000m<sup>3</sup> of snow from November to December 2010. During that time the snow dump sites reached approximately 70% capacity. After further snow removal during the month of January 2011 the snow dump sites were slightly expanded to accommodate the large volumes of snow being removed throughout the city.

- Challenges during snow removal and snow blowing operations include:
  - Width of the roadway
  - Presence of parking lanes on the roadway
  - Distance from the closest snow dump site
  - Traffic - day vs. night
  - Parked vehicles
  - Available locations to blow snow rather than haul away
  - Total accumulation of snow on roadway and type of snow
  - Appropriate placement of snow during snow blowing operations in efforts to avoid tree damage



Snow Loader



Snow Removal Process

The Municipal Works Department increased snow removal as well as a variety of winter maintenance operations throughout the city. Operations were enhanced as a outcome of technical research and feedback obtained from the public consultations. The department received many calls during this time which conveyed positive feedback on the enhanced snow and ice control services seen throughout the city.

Benefits observed as a result of all increased efforts included:

- Enhanced public safety on busier roadways – Better surface conditions
- Reduced rutting on select roads - More driving lanes were plowed
- Removed snow gave crews ability to store snow for next snowfall events
- During thaws the removed snow reduced icing and flooding issues



## 13 Key Challenges and Discussion

Review of the current program, comparison to other cities and determination of current public expectations has allowed staff to identify differences in the current snow and ice control program compared to current practices and expectations.

All aspects of the snow and ice control program contribute to how the program functions as a whole, but need to be outlined separately to fully understand the programs challenges. The areas that will be looked at include population and growth, infrastructure, weather, geography, overall program challenges, comparison with other municipalities, public expectations and the review of current practices.

The program has consistently exceeded budgets and been challenged with resources in order to achieve service levels, meet community expectations, growth and respond to heavy snowfall years.

### 13.1 Population and Growth Challenges

As Medicine Hat has grown in population, so has the development of subdivisions and essential roadways. As a result several obstacles exist:

- **Funding has not been consistently increased to support new roadways.**
  - As we have built new roadway throughout the city we haven't consistently seen increases to accompany the growth which has challenged department resources.
  - A Policy or practice does not currently exist which allocates funding for winter roadway maintenance when new subdivisions or roadways are completed and become open for general use.

### 13.2 Infrastructure Challenges

Roadways in Medicine Hat vary greatly in design. This is typically driven by changing design practice over time. The City currently has several obstacles relating to snow and ice control which exist in the current network:

- **In consideration of plowing roadways, older arterial and collector roadways have monolithic sidewalks which limit where snow can be placed.**
  - Collector roadways with a parking lane (e.g. Ross Glen Drive) pose challenges for snow storage. Since there are no boulevards, snow must be placed either in the parking lanes or in the center of the street, both options resulting in parking limitations. Complete snow removal is required when snow accumulation exceeds the storage space available along these roadways which increases the cost for snow control. Parking lanes can act as good snow storage locations



preventing costly snow removal. The snow plowed off the roads make driving conditions better by reducing the amount of snow which could create icing.

- Collector roadways with multiple lanes (e.g. Strachan Road) that does not have parking lanes pose challenges since the snow cannot be stored along the roadways for an extended period of time without resulting in a reduction in lane widths. When graders move snow across the sidewalk this can potentially damage the sidewalk, turf, grader blade or other infrastructure. Upon sufficient snow accumulation complete removal is required which increases the cost for snow control. Equipment such as a snow blower can move the snow to an available boulevard area without the costly need to haul the snow away to a dump site.
- Many arterial roadways within the city present distinct challenges (e.g. Kingsway, 13<sup>th</sup> Avenue SE) since they contain neither boulevards nor parking lanes and have an added challenge because there are multiple access points and driveways along them. These roadways require complete snow removal which increases the cost for snow control.
- Snow removal occurs at the hospital due to pedestrian volumes and limited storage space for snow. These roadways must be kept open to allow safe passage for emergency vehicles.
- The downtown area also experiences high pedestrian volumes and receives snow removal due to limited storage space for snow.
- Seasonal parking bans on select roadways may be an option to consider. Snow would be windrowed in the parking lanes all year round and would remain until melted. Vehicles would not be able to park on the street between designated months. Parking issues could include limited off-street space, unpredictable weather (no snow while parking ban in place) and general community expectations of accessible free parking.
- **City Standards – MSSM (Municipal Servicing Standards Manual) for roadway design**
  - Current drawings in the MSSM allow for the option to use monolithic sidewalk or separate sidewalk when constructing roadways. Monolithic sidewalks limit where snow can be stored. Separate sidewalks offer boulevard storage for snow clearing activities while minimally affecting on street parking.
  - Monolithic sidewalks have a lower cost to construct than separate sidewalks and have minimal maintenance since there is no boulevard. Snow removal however is costly if required. Future review of the MSSM should evaluate importance of snow storage on streets versus initial costs for the installation of separate

sidewalk or monolithic sidewalk. In addition, these considerations should be reviewed to consider costs which may impact developers.

### 13.3 Weather Challenges

Specific to Medicine Hat, variable weather can create many challenges for snow maintenance crews. Challenges experienced during winter maintenance operations include:

- **High Snowfall Accumulations**
  - Variations in the total amount of snowfall received each year has created compelling challenges on the snow and ice control program as high accumulations require more roadways to be maintained more often to ensure they are passable. In residential areas, snow storage space is very limited and accumulations can cause deep ruts. Snow removal may be necessary however is very expensive. It is appropriate that the snow and ice control program be based on average snowfall events and accumulations as annual accumulations can vary significantly from year to year.
- **Snowfall Events**
  - Medicine Hat can receive significant variations in the amount of snowfall accumulating over multiple days (Figure 4). This situation consumes resources as crews have to re-sand or re-clear roadways in the category system which often leaves lower category roads to be addressed at a later date. These multiple day events pose challenges to provide staff coverage on day and night shifts in order to provide 24 hour coverage. A consideration may be to provide additional staff and contracted services to help bridge these challenges and improve the department's coverage and effectiveness.
- **Temperature and Freezing Rain**
  - Medicine Hat can experience several warm days causing melting as well as freezing rain events throughout the winter season. Melting reduces snow amounts on city streets but may leave ice when temperature returns to below freezing. Freezing rain adds complexity to winter operations as immediate salt/sand treatment resources are needed on the majority of city roadways. These challenges are significantly enhanced when freezing rain occurs accompanied by sudden drops in temperature as ice control products lose effectiveness at these decreased temperatures. Using de-icing and traction control materials in a responsible manner can help ensure driving surfaces are safe for the motoring public.

- Cold weather can result in reduced levels of service on roadways as equipment may break down reducing effectiveness of overall service.
- **Drifting Snow**
  - Medicine Hat can experience high winds during and after winter snowfall events. As a result, snow drifts can accumulate and cause blocking of roadways or lanes (alleys) which require crews to immediately clear to make passable. Clearing these blockages is important for access in case of emergency.

### 13.4 Geographical Challenges

Medicine Hat is built on a river valley which poses distinct challenges for snow and ice control.

- **Bridges**
  - These structures are susceptible to freezing in mild conditions. This requires crews to continuously revisit bridges throughout the day. These structures also pose problems when dealing with snow accumulation as the snow must be completely removed when it can no longer be pushed to the side.
- **Hills**
  - Medicine Hat contains numerous hills that require a higher level of service. To limit slippery conditions hills must be maintained more frequently than other roadways. This requires crews to continuously revisit hills throughout each shift. Appropriate uses of de-icing and traction control materials help reduce the number of times crews have to revisit these locations.

### 13.5 Current Snow & Ice Control Program Challenges

Over the years, the snow and ice control program has evolved. Challenges identified within the current snow and ice control program include.

- **Resources are not in place with expectations placed on meeting the current snow and ice category system.**
  - Currently 43% of our roadway network is in Category 1. Roadways include Arterial, collector, school zones and the downtown which have current expectations of being maintained within 16 hours.
  - The 16 hour target time for completing Category 1 roadways is only being achieved 50% of the time. It may be appropriate to realign our category system in consideration with what other communities do and with our own community expectations.

- The regional airport requires different levels of service than roadways so placing it within the snow and ice control program for roadways may not be appropriate.
  - Servicing the airport should be treated as a completely separate priority for snow and ice control practices.
  - We need to consider either adding additional resources or change our category and service levels.
- **Resources**
    - Since 1999, the budgets have increased by 200% and the actual costs have typically been at or exceeding the budgets. Major contributors to the increase in costs include:
      - The City's population has increased by 21.8% (Figure 1)
      - The City's roadway infrastructure has increased by 24.8% (Section 4)
      - Alberta's economic boom contributed significantly to inflation (Figure 14)
      - Changes in service levels in 2006 (Figure 7)
      - Heavy winter snowfalls in recent years (Figure 4)
    - The number of operations staff has increased by 1 person (3%) since 1999 (Figure 9) while the city roadway network has grown by approximately 25%.
    - During shift work, day and night crews do not have enough staff to operate all equipment. Additional personnel would help improve coverage, more frequently achieve the category target times and make more use of City owned equipment.
    - Labour laws restrict the number of hours and days that people can work which impacts our 24/7 coverage during extended winter weather events.
    - The Municipal Works Fleet is composed of equipment that can provide functionality for both summer and winter operations, with the exception of some specialized equipment. Achieving the correct balance of City resources and contracted services to accommodate extreme weather is always a challenge. Hiring contracted services to work alongside City services is cost effective for snow maintenance activities as the City doesn't have to own and maintain as many pieces of equipment which would otherwise not get used in other seasons.
    - Equipment can break down unexpectedly this poses challenges if crews require specific pieces of equipment to complete tasks (e.g. The snow loader breaking down during removal can impede snow removal operations). The use of a differently purposed machine such as a snow blower can be used to backup the snow loader if it unexpectedly breaks down.
    - Contracted services provide great service support in response to requests however at times they may have other clients and contractual obligations which somewhat limit availability. Further contracted services are also subject to

similar labour laws and fatigue management as City crews which effect operations during extended winter weather events.

- During a snow event the airport requires City roadway personnel to tend airport snow clearing needs. This reduces operators available to tend roadways. To free up City resources for roadway maintenance, some aspects of the airport may be contracted or personnel hired to serve the airport's needs. Future alternative service delivery such as contracted services needs to be considered.
- Timing of winter weather events can affect when roadways will be cleared. Depending on the time of day crews may be unable to clear roads before peak traffic times or if time is required to mobilize crews there may be a delay in snow clearing.
- To be able to respond to all weather events without requiring any mobilization time crews would have to be on standby throughout the duration of the winter season in order to provide an "immediate response 24 hour a day" system. This system would have cost implications and/or require significantly more staff. This level of responsiveness is likely not cost effective for the level of service we're trying to achieve. This is why the department has a call out system which requires time for mobilization.

- **Sidewalk clearing**

- Currently City sidewalk clearing operations are conflicting with the 24 hour bylaw as the bylaw is not being met 100% of the time.
- Crews are challenged during extended, multiple day events as they must deal with other infrastructure such as stairs, pedestrian overpasses, bridge walkways and other duties while attempting to maintain sidewalks. These challenges are compounded when personnel are reduced due to shift work.
- Sidewalks are an area where consideration could be given to the use of contracted services as the equipment is not specialized and there may be an interest in doing the work there by creating competitive process. The benefit of this alternate delivery is that City personnel can then concentrate their efforts on stairs, pedestrian overpasses, bridge walkways and roadway levels of service and possibly achieve some efficiencies through the process.

- **Snow and ice control program documentation.**

- Improved communication between the City and the public is required to better understand public expectations and for the public to better understand how the Municipal Works Department conducts snow and ice control activities. Making documentation available for public viewing such as this review, a policy and other material may aid in clearly communicating expectations.

### 13.6 Other Municipalities

There are some minor differences that exist between the municipalities researched, however several prominent differences exist between Medicine Hat and all researched municipalities:

- **Category systems**
  - All other municipalities researched have similarities in the order which they complete roadways. Most other municipalities categorize their roadways in a similar format with the exception of Medicine Hat. Medicine Hat's Category 1 and 2 roadways system is not aligned with the other municipalities researched as Medicine Hat has the highest percentage of roadways within Category 1 (Section 8.1). With 43% of Medicine Hat's roadways in Category 1 and only 16 hours to clear them, we can't meet these expectations on a regular basis. An option for consideration may be to change the snow and ice control service levels and categories to align with resources, infrastructure and other cities.
- **Budgets**
  - Over the past several years, the actuals are either at or exceeding our budgets. Medicine Hat remains among the lowest for \$/lane km (budget) and actual \$/lane km (Figure 18) among the seven municipalities researched.
  - Medicine Hat was also among the lowest for \$/capita (budget) and \$/capita (actual) when compared to the other municipalities (Figure 19).
  - It is unknown if recent weather patterns will continue. If they do, then we may want to consider increasing our budget to reflect heavier winter snowfall events, providing for increased levels of service and addressing public expectations.

### 13.7 Public Expectations

Through public consultations, the public have identified consistent areas of improvement desired in the snow and ice control program. These improvements include:

- **The public would like to see collector roadways receive more snow control maintenance.**
  - The public has identified specific roadways that are prone to icing, rutting and accumulation issues. The majority of the roadways of concern are higher volume roads (e.g. Ross Glen Dr., Strachan Rd, 12<sup>th</sup> St NW/NE and 20<sup>th</sup> St NE). Additional funds for this increased level of service for these roads and others would be required as it has a direct and high cost to the department due to the need to remove snow rather than store it.
- **The public have expressed that plowing and removal on local/residential streets is desired however, were not in favour due to the anticipated cost to taxpayers.**

- The questionnaire results showed that 15% of respondents were in favour of paying for residential snow removal while 85% were opposed. The questionnaire results also showed that 41% were in favour of paying for residential snow plowing while 59% were opposed.
- A major issue with clearing residential streets is that there is no place to put snow. Residential clearing would require that snow be piled in parking lanes and in front of driveways for this process to be cost effective. The other option is removal which is the most expensive due to hauling the snow to a snow dump site.
- Similar to other cities, the conventional method of flat blading and sanding (typically request driven) is performed on residential roads.
- **Quality of Service**
  - Quality of service was considered the most important aspect for the snow and ice control program conveyed by public response. The public requested that the City provide greater service to the city as a whole specifically to roadways which benefit the majority of the public. This should be considered when reviewing the category system as quality of service has been conveyed as being more important than target times and budget.
- **Windrows and Parking on City Streets**
  - Residents were split between accepting seasonal parking restrictions to save cost of snow removal on city streets. The public were concerned with parking competition due to windrowed snow. Others agreed that parking bans could be used in certain situations.
  - The results of the questionnaire showed that on higher volume roadways where off street parking is available 53% of respondents were in favour of implementing parking restrictions while 47% were opposed. Cost saving approaches should consider using parking lanes for snow storage.
- **Snow Angels Program**
  - The majority of the respondents were in favour of the implementation of a snow angels program in Medicine Hat. Resources are not currently available for the implementation of such a program, however the program does warrant further consideration for future development.

## 13.8 Snow and Ice Control Practice Review

- **Levels of Service**

- There is a direct cost increase associated with providing enhanced levels of service on additional roadways.
- Contracted service availability was limited at times creating operations challenges during extended winter snowfall events.
- Personnel were working for extended periods of time to provide expected service levels. Overtime costs were higher as a result of extended storms as well as shift challenges occurred when labour laws and fatigue were present.
- Due to shift work all equipment was not fully used 24 hours a day 7 days a week.
- During the warm weather crews were challenged with clearing catch basins to allow for drainage while still addressing other problems throughout the city.
- The department cannot clear the roadways within the timeframes of the current category system.
- To meet expected levels of service the 2010 snow and ice control budget was exceeded. Increased personnel, budget and adjustment to the category system should all be considered when establishing new levels of service.

- **Snow Removal**

- Cost for snow removal significantly varies as many factors exist including:
  - Distance from the closest snow dump site
  - Traffic – Day vs. Night
  - Parked Vehicles
  - Available location to blow snow rather than hauling away
  - Accumulation of snow on the road surface
  - Width of the roadway
  - Parking lanes on the roadway (included as part of a lane km)
- Currently there is insufficient snow dump site capacity to handle significant removal as the snow removal completed at the end of the 2010 year put the City's snow dump sites at 70% capacity. The City snow dump sites had to be slightly expanded in January 2011 due to the high volumes of snow that was removed from city streets.
- As part of the 2010 program we moved snow onto boulevards with the use of a snow blower. At this time it is unknown the cost for debris clean-up (sand and litter) on the boulevards. It is anticipated that costs will be significantly less than removing and hauling the snow away to a snow dump site.
- Funding increases should be considered for the snow and ice control program if snow removal activities are to be continued into the future.



## 14 Conclusions

1. The general public would like greater levels of snow and ice control service than what has been provided in the past years.
2. As weather varies it is appropriate that the snow and ice control budget remain as an uncontrollable variance. Budget and resources should be aligned to compensate for an average winter season.
3. To utilize equipment more often, additional staff need to be hired. The additional staff would complement increased levels of service.
4. Snow plowing and removal would need to be increased in order to provide enhanced levels of service which improves safety and efficiency throughout the network.
5. We currently do not have the resources to meet the service levels in the current category system.
6. Additional resources would be required to allow the City to maintain sidewalks within the 24 hour bylaw (1556) requirement without reducing service levels to the roadway network.
7. The airport runways should not be included in the snow and ice control category system as it must adhere to different standards than roadways as dictated by Transport Canada.
8. The increased use of contracted services should be considered for roadway maintenance. Contracted services balanced with City forces offers the appropriate resource mix to overall achieve levels of service requested by the general public.
9. When new roadways are developed or existing infrastructure is upgraded, the designs of these roadways should consider greater room for snow storage.
10. When new roadways (including subdivisions) become operational, consideration for additional funds towards snow and ice control should be made to sustain our service levels.
11. Continuing the use of parking lanes to store snow provides a cost effective means of meeting increased levels of service by reducing the need of hauling costs for snow removal.
12. Increased use of de-icing and anti-icing materials is an effective method to address icy conditions which exist on plowed roadways (hills and arterial roadways). A balanced approach should be taken which favours safety and environmentally friendly products, within reason over cost.
13. Material storage facilities and other equipment should be updated or implemented to compliment increased levels of service by improving efficiency and effectiveness throughout the network.
14. To improve public knowledge and expectations of the program, consideration should be made to place updated snow and ice control program documentation on the City's website for public viewing.

## 15 Summary

The review researched many aspects of the program and has determined that the residents of Medicine Hat are receiving good value for snow and ice control services. Actual funds spent on the snow and ice control program over the last several years have exceeded budgets; however this is consistent among all municipalities researched. For Medicine Hat, exceeding the budget is a result of recent years of heavy snowfall, inflation, and growth of the city.

Staff increased plowing and snow removal efforts throughout the city which started in November 2010. The increased efforts increased costs as significantly more snow had to be removed and hauled to snow dump sites than what had been performed in the past. The 2010/2011 winter season brought significant snowfall amounts and minimal melting which created conditions which challenged City crews. In addition to snow, pot holes and catch basin thawing further increased complexity of the program. As a result of all the above, the snow and ice control review staff was fortunate to experience the complexities to place perspective of real world challenges which affect the snow and ice control program.

The increased efforts throughout the City provided better service to the public by minimizing safety hazards, capacity issues for subsequent snowfalls and drainage issues when warmer temperatures followed. Coincidentally these increased efforts aligned with public expectations noted from public feedback further supporting the changes of practice for the City of Medicine Hat.

Review of the category system determined that too many roadways may be placed into Category 1 to be able to achieve target times with current resources. When compared to other municipalities, Medicine Hat's category system is not aligned well when comparing time to maintain roads vs. amount of roadways to complete. Obtaining resources necessary to complete all roadways within current timeframes would not be cost effective or practical. Public feedback further supported that the public is mostly concerned with the quality of service followed by target times and budget. For these reasons it is appropriate to realign the category system to better align with other municipalities and address the public feedback.

- **Hills, Bridges and Arterial Roadways (example: Dunmore Road, Kingsway Avenue)**

The public generally felt that the City was doing a good job on arterial roadways. The public felt safe and thought the level of service on these roadways is appropriate. City forces dedicate a significant amount of resources towards these roadways as they are more susceptible to potential accidents due to higher speeds and traffic volumes. Crews regularly apply sand, salt and chemical where appropriate to minimize slippery surfaces. The majority of these roadways have storage space for snow which minimizes costs for hauling snow away (Dunmore Road). Other roadways do not have appropriate storage space which significantly increases costs

because snow has to be loaded and hauled to a snow dump site (Kingsway Avenue, Section of 13<sup>th</sup> Avenue).

- **Collector Roadways (example: Ross Glen Drive, 12<sup>th</sup> Street NE/NW, 20<sup>th</sup> Street NE)**

The public felt that the service to these roadways need improvement. Prior to November 2010, most collector roadways received a level of service of “snow pack” and flat blading (Section 7.1). In November 2010, City crews significantly increased plowing and snow removal efforts on collector roadway. Other municipalities also treat collector roadways similar to the service which was provided by staff this winter season. Positive feedback from the public indicated that this level of service for collector roads was seen as a good level of service in accordance with community expectations.

- **Local roadways (Residential Roads)**

The public desired improvement of service to residential roadways however the additional costs to taxpayers for snow removal or snow plowing service was not supported. Residential streets are currently held to a level of service of “snow pack” with flat balding. Snow pack eventually develops rutting due to traffic and then can be flat bladed with a grader to level the surface. This is an economical approach as the majority of the snow becomes compacted and used as a driving surface. Issues can sometimes arise when melting snow turns into slush. Crews respond to concerns from the public as they arise based on severity. Many municipalities follow the same approach. In recent years, large cities such as Calgary have attempted plowing residential roadways. Feedback has been mixed and concerns with parking, driving lane widths and others have been raised. Feedback from the Medicine Hat public indicated that on-street parking is important to them and having to manually remove windrows from in front of their own driveways was not appealing to the respondents. Services for flat blading are typically request driven and are performed as necessary.

### **Cost Saving Considerations**

In an effort to reduce costs for snow removal, seasonal parking bans may be an option to consider. Snow would be windrowed in the parking lanes all year round and would remain until melted. Vehicles would not be able to park on the street between designated months. Problems associated with introducing parking bans throughout the winter may include:

- limited off-street parking space for multiple vehicle households
- unpredictable weather (no snow may be present while parking ban in place)
- residents and visitors may be ticketed without knowledge of the seasonal parking bans

The review determined this would not be favoured by the residents that would be affected by this change. The option of snow removal and temporary parking bans was selected in the

following recommendations which is similar to what was implemented during the 2010 to 2011 winter season.

## 16 Recommendations

The following recommendations should be considered as a result of an in depth analysis of the current snow and ice control program, review of best practices, staff and technical considerations, comparison to other cities and understanding of public expectations:

**1. Both arterial and collector roadways receive plowing as part of maintenance procedures for a snowfall event.**

The public did identify that plowing was an important aspect for roadway maintenance. Collector roadways would receive a better level of service improving driving conditions for the majority of road users. Service levels would be similar to what was displayed in the 2010/2011 winter season.

**2. Using parking lanes to store snow along arterial and collector roadways. Implementation and use of temporary parking bans will be at the discretion of the General Manager of the Municipal Works Department.**

**3. That snow removal operations increase on arterial and collector roads when necessary, in addition to current snow removal practices.**

This form of snow and ice control will assist in providing a higher level of service to the public by minimizing safety hazards, capacity issues for subsequent snowfalls and drainage issues when warmer temperatures occur. This is further supported by public open house responses and questionnaires.

**4. That residential/local roads are still maintained as passable.**

Due to limited space to store snow along residential roadways and the high cost for plowing/removal on all residential roads, flat blading would be a cost effective and appropriate means to provide safe passage for the public along residential/local roadways.

**5. Adjusting the category system by moving collector roadways, school zones and the central business district (downtown) to Category 2.**

Adjusting roadways within the category system will better align the City's roadway network with available resources and other municipalities. Adjusting the categories will create practical and achievable goals for the City in addition to better conveying intentions to the public

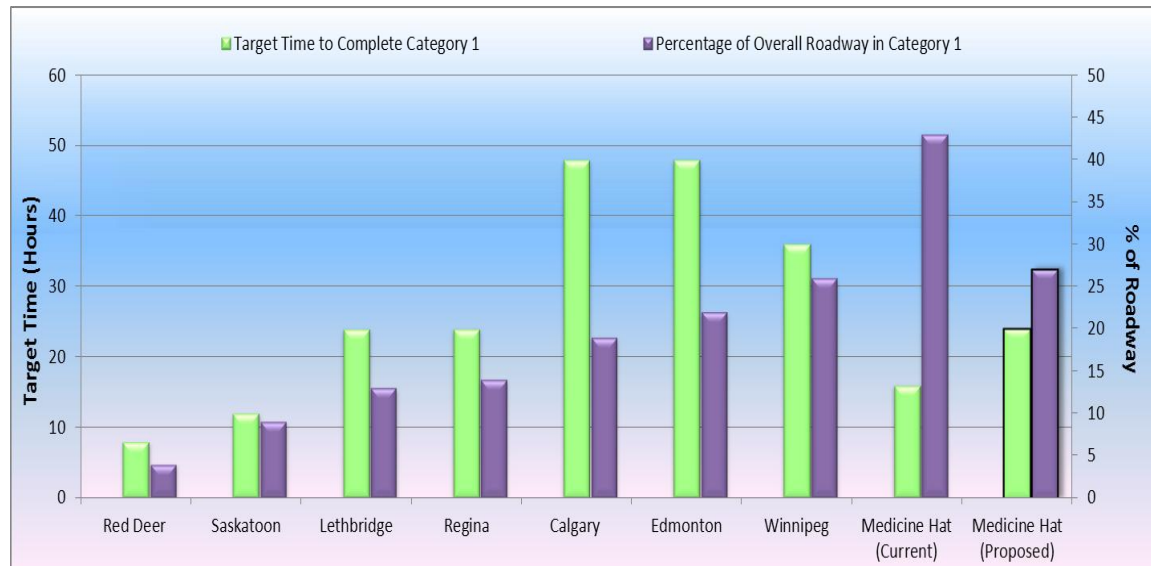
**6. Adjusting timeframes to the following (Based on a typical 5-10cm snowfall event):**

**Category 1 – Within 24 hours of the end of snowfall**

**Category 2 – Within 24 hours of Category 1 completion**

**Category 3 – No timeframe**

Adjusting timeframes within the category system will better align the City's roadway network with available resources and other municipalities. As supported by the public, residents are mostly concerned with the quality of service followed by target times and budget.



**Figure 20: Proposed Adjustments to Category 1**

**7. The creation of a Snow and Ice Control Policy founded on the proposed “Snow and Ice Control Program” as per Appendix A.**

A snow and ice control policy would provide guidelines which better communicates program intentions to the public.

**8. Sidewalks adjacent to City land should be consistently cleared as per Bylaw 1556.**

This will be achieved with additional funding to hire contracted services to work with City resources to meet the bylaw. The sidewalks, sidewalks on bridges and stairs budget would be separated from the snow and ice control program and tendered for competition.

**9. That the airport be removed from the category system and treated as a separate priority.**

It is a requirement that the airport runways meet standards dictated by Transport Canada which differ from roadways. Snow clearing operations should be addressed separately from the roadway category system.

**10. The development of a mechanism which dedicates funds for roadway maintenance when a new roadway or subdivision becomes operational.**

**11. Revisiting the Municipal Servicing Standards Manual (MSSM) to allow for snow storage accommodation, sidewalk placement and parking on future roadways.**

**12. The increased use of anti-icing and de-icing materials on plowed roadways to combat icy conditions (within Alberta Environment Guidelines).**

The City currently uses salt as well as magnesium chloride to reduce ice on City roadways. The use of these materials on the majority of plowed roadways during the winter season will help by reducing the amount of sand currently applied. A balanced approach will be taken by using the materials conservatively to minimize adverse effects to the environment and cost while maintaining safety. The assessment of more environmentally friendly products will continue to be explored.

**13. That a new on-site salt storage/containment unit and the installation of a liquid chemical storage tank to be constructed on Municipal Works property (Meeting Alberta Environment Guidelines).**

With the proposed increased usage of anti-icing and de-icing materials, the current salt storage facility is not adequately sized and a chemical storage tank would be appropriate for winter maintenance activities.

**14. That future snow storage sites be reviewed and identified.**

Additional snow storage site(s) will increase the overall snow storage capacity and improve snow removal operations within the city. The review may consider locations such as storm ponds, other lands, and/or expanding current sites which are appropriate for snow storage.

**15. The purchase of:**

**Self-Propelled Snow Blower  
Pressurized Liquid Chemical Applicator  
Salt Storage Facility  
Chemical Storage Tank Structure**

These items will further make processes more efficient, effective and flexible during the winter season.

**16. That an additional three full time equipment operators be added to the Municipal Works Department.**

A City operator cost analysis versus contracted services was completed which deemed that three additional City operators is the appropriate balance with contracted services for winter operations in order to provide recommended levels of service changes to the program. Shifts would experience optimized equipment usage. The additional personnel will help reduce productivity loss on city roadways caused by winter maintenance needs at the airport during a snowfall event.



## **Appendix A: Snow and Ice Control Program**

## **SNOW AND ICE CONTROL PROGRAM**

The Snow and Ice Control Program's general guideline is to maintain snow and ice control in city right-of-way roadways. All city roads are categorized based on use and potential hazards to public safety.

There are three categories for the snow and ice control program, Category 1 being the first roadways to respond to, and Category 3 being the last.

Below five cm of snowfall the City will maintain roadways through the use of sanding, salt, chemical and plowing as required.

Commencement of the category system will begin at five cm of accumulation. For snowfall events five cm to ten cm, the categories have an estimated time of completion.

For snowfall events greater than ten cm (blizzard, winter snow storm) timeframes may be extended. The category sequence remains the same in these heavy snowfall events.

The Medicine Hat Regional Airport is maintained outside of this policy as snow and ice control practices for the airport runways are regulated by Transport Canada.

Category 1:           Emergency Routes (Example: Hospital, Ambulance, Police, Fire)  
                          Arterial Roadways  
                          Hills & Bridges  
                          Highways (Holsom Road and Hwy 41A)

**Service Level:** Complete ice control and snow plowing within 24 hours of snowfall ending.

**\*It is important to note that removal of snow will not take place during a snow fall event. Snow removal takes place between snow fall events when services are available. During the snow event, plowed snow will be windrowed on the side of the roadway.**

Category 2: Collector Roadways  
School Zones  
Transit Routes (City Bus Routes)  
Central Business District (Downtown)

**Service Level:** Completed ice control and/or snow plowing within 24 hours of Category 1 completion. Category 2 roadways are subject to review (after event) of excessive accumulation of snow and ruts to determine the need for plowing or snow removal. Complete snow removal may occur at a later date if determined necessary by the General Manager of Municipal Works.

Category 3: Residential Roads  
Lanes/Alleys

**Service Level:** Passable to emergency service vehicles and general public. Maintained as required upon completion of Category 1 and 2.

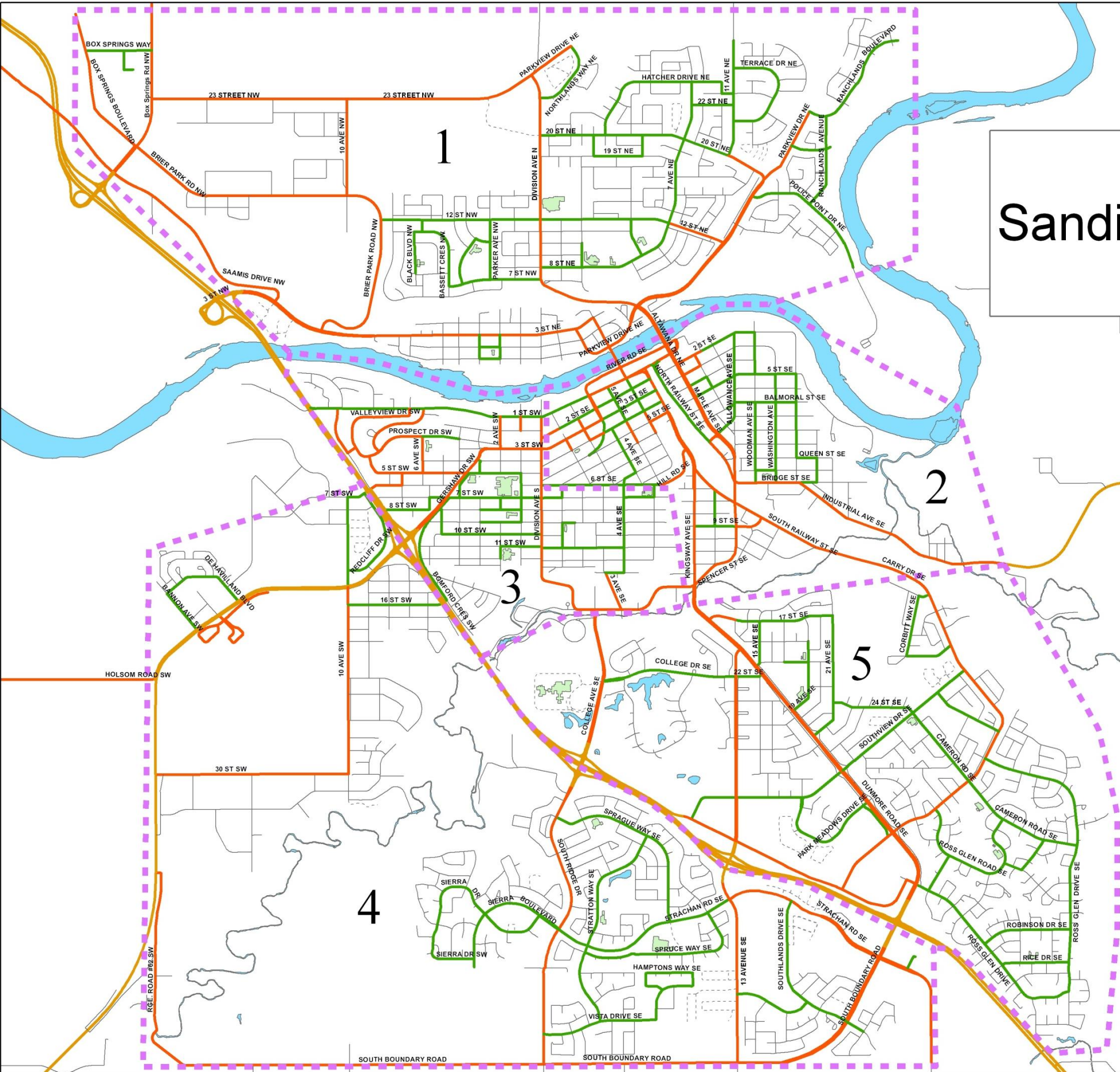
### Extenuating Circumstances

When extenuating circumstances exist, the Chief Administrative Officer may authorize the General Manager (or delegate) of Municipal Works to work outside of this policy to address situations as it relates to snow and ice control for the transportation system, in whole or in part.

## **Appendix B: Proposed Category System Map**



# Proposed Sanding and Plowing Routes for 2011 - 2012



## Legend

- Zones
- Maintained by Alberta Transportation
- Category 1 - 24 hours of snowfall ending
- Category 2 - 24 hours after Category 1
- Category 3 - No Timeframe
- Private Road
- School Buildings
- River Lake

## **Appendix C: Current Snow Category System Map**



### Legend

- ■ ■ ■ Zones
- Maintained by Alberta Transportation
- Category 1 - 16 hours of snowfall ending
- Category 2 - 24 hours after Category 1
- Category 3 - No Timeframe
- - - Private Road
- School Buildings
- River Lake



## **Appendix D: Definitions**

Arterial Roads

Major roadways throughout the city which carry high volumes of traffic.

Collector Roads

Roadways that connect local roadways to arterial roadways and carry moderate volumes of traffic.

Fine Road Salt

A solid material (sodium chloride, NaCl) which is applied to the roadway to assist in melting snow and ice.

Ice Control

Combating ice buildup through traction control materials such as sand, or de-icing/anti-icing materials such as fine road salt or chemical. The use of mechanical equipment to break up ice may be required.

Lanes/Alleys

Lanes and alleys typically provide access to the rear of properties.

Lane Kilometers (lane km):

One kilometer of roadway this allows passage for a single vehicle (one lane of traffic).  
e.g. One kilometer of roadway with two lanes of traffic would equate to 2 lane km.

Liquid De-Icing/Anti-Icing

A liquid chemical that is applied to the roadway to assist preventing and/or melting snow and ice.

Maintained as Passable

Maintaining a driving lane to provide safe passage for emergency response vehicles such as police, fire, ambulance and the general public.

Near Bare Pavement

Maintaining the wheel paths to less than 2-3cm of snow cover. Slippery conditions may still exist.

Residential Roads

Roadways that typically serve residential neighbourhoods. These roads carry low volumes of traffic.

Snow Plowing

Pushing accumulated snow away from a driving lane to improve driving surface conditions.

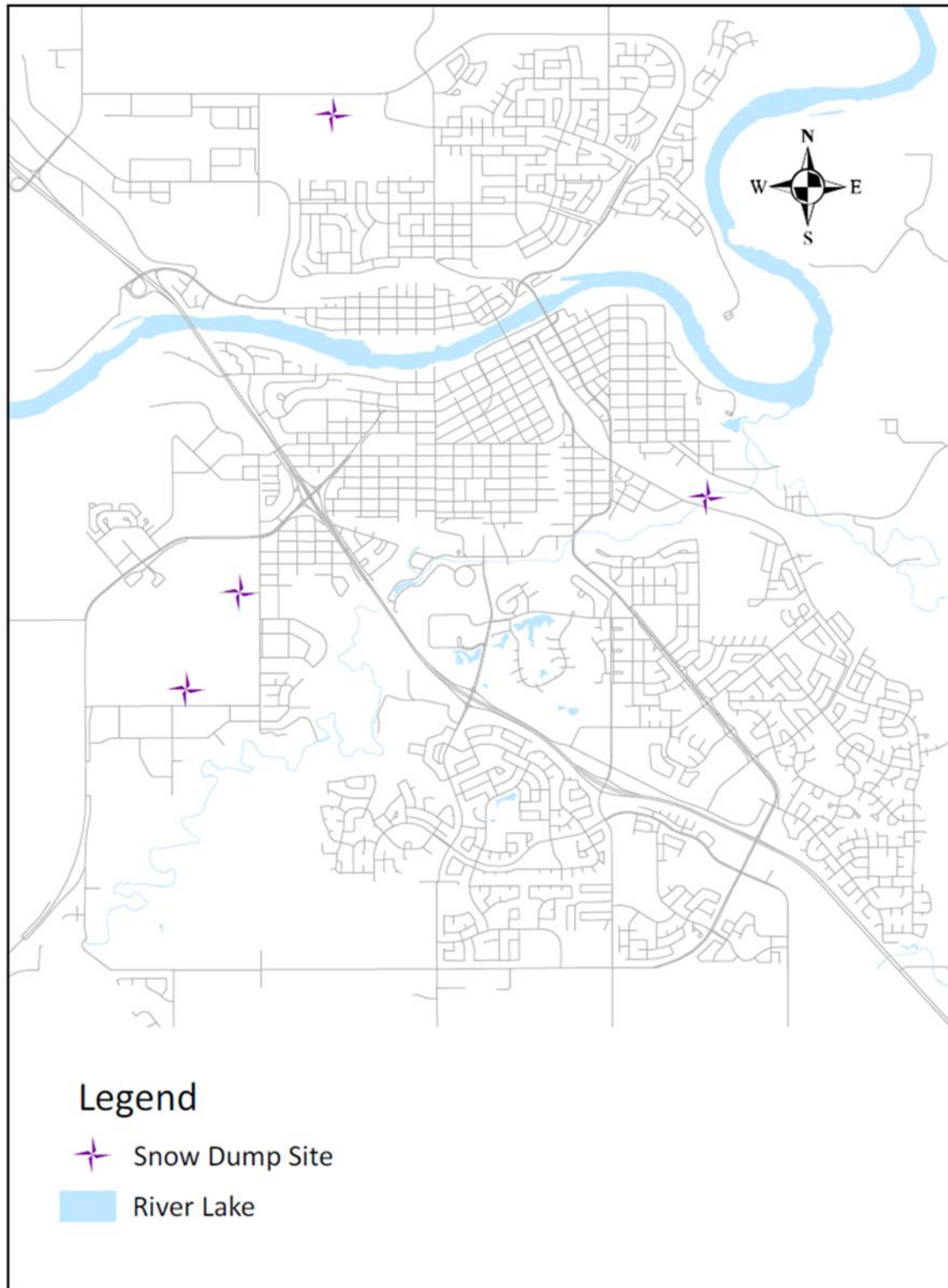
Snow Removal

Completely removing plowed snow from a road surface which is either hauled away or blown away from the road surface.

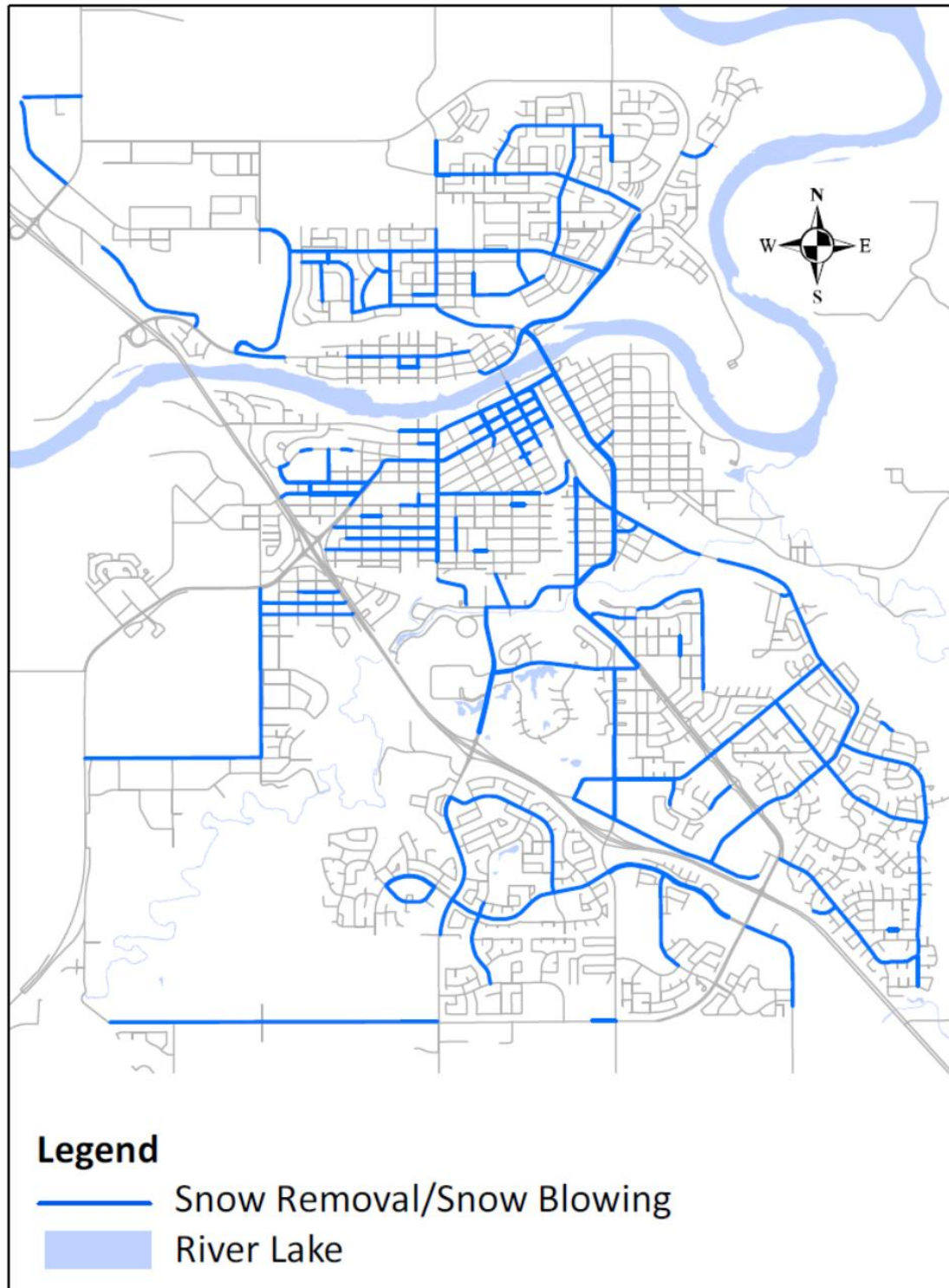
Target Times

Time frames that are assigned to categories as a measure of when winter road maintenance shall be completed.

## **Appendix E: Snow Dump Site Locations Map**



## **Appendix F: Snow Removal/Blowing November-December 2010**



## **Appendix G: Research Resources**



Transportation Association of Canada (TAC)  
<http://www.tac-atc.ca/>

Environment Canada  
[http://www.weatheroffice.gc.ca/canada\\_e.html](http://www.weatheroffice.gc.ca/canada_e.html)

Alberta Transportation  
<http://transportation.alberta.ca/>

Alberta Environment  
<http://www.environment.alberta.ca/>

Ontario Ministry of Transportation  
<http://www.mto.gov.on.ca/>

Pacific Northwest Snowfighter  
<http://www.wsdot.wa.gov/partners/pns/>

American Association of State Highway and Transportation Officials  
[www.aashto.org](http://www.aashto.org)

American Public Works Association (APWA)  
<http://www.apwa.net/>

National Cooperative Highway Research Program  
[www.TRB.org](http://www.TRB.org)

Salt Institute  
<http://www.saltinstitute.org/>

Minnesota Department of Transportation  
<http://www.dot.state.mn.us/>

Iowa Department of Transportation  
<http://www.iowadot.gov/>

Montana Department of Transportation  
<http://www.mdt.mt.gov/>

Washington State Department of Transportation  
<http://www.wsdot.wa.gov/>

Idaho Transportation Department  
<http://www.itd.idaho.gov/>

US Department of Transportation  
<http://www.dot.gov/>

City of Calgary (Snow and Ice Control)  
[www.calgary.ca](http://www.calgary.ca)

City of Edmonton (Snow and Ice Control)  
[www.edmonton.ca](http://www.edmonton.ca)

City of Winnipeg (Snow and Ice Control)  
[www.winnipeg.ca](http://www.winnipeg.ca)

City of Regina (Snow and Ice Control)  
[www.regina.ca](http://www.regina.ca)

City of Saskatoon (Snow and Ice Control)  
[www.saskatoon.ca](http://www.saskatoon.ca)

City of Red Deer (Snow and Ice Control)

[www.reddeer.ca](http://www.reddeer.ca)

City of Lethbridge (Snow and Ice Control)

[www.lethbridge.ca](http://www.lethbridge.ca)

City of Hamilton (Snow and Ice Control)

[www.hamilton.ca](http://www.hamilton.ca)

City of Toronto (Snow and Ice Control)

[www.toronto.ca](http://www.toronto.ca)

City of Grande Prairie

[www.cityofgp.com](http://www.cityofgp.com)

Various other Cities throughout Canada and the United States (Snow and Ice Control)

National Cooperative Highway Research Program

*"Snow and Ice Control: Guidelines for Materials Methods"*

Transport Canada

<http://www.tc.gc.ca/eng/innovation/tdc-projects-air-f-crfi-95.htm>

NAV Canada

*"Canadian NOTAM Procedures Manual"*

## **Appendix H: Sidewalk & Trail Snow Clearance Maps**

