Alberta Municipal Benchmarking Initiative – Snow & Ice Control

April 2018

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1 Introduction and Background

1.1 Introduction

Today's municipalities are challenged by an ever-increasing demand to deliver a greater variety and a higher level of public services while maintaining low taxes and user fees.

To meet this challenge, municipal governments are continually looking for new ways to improve performance, operationally and fiscally.

In the spring of 2012, a number of municipalities in Alberta expressed an interest in benchmarking their service delivery against leading practices as a way to improve service. At a workshop hosted by the Town of Banff in May 2012, participating municipalities discussed the benefits of benchmarking; developed a preliminary list of guiding principles; and identified considerations related to governance, scope, data collection, resources, and risks.

Subsequent to this workshop, the Town of Banff, on behalf of a group of 13 municipalities, successfully applied to the provincial government for a Regional Collaboration Grant to fund the development of a municipal service delivery benchmarking framework. With the support of the provincial government, the Alberta Municipal Benchmarking Initiative (ABMI) was launched in 2013.

1.2 Background

The Alberta Municipal Benchmarking Initiative is a collaboration of small and large municipalities. Their objective is to develop and implement a framework that will enable a continuous, multi-year benchmarking process for participating municipalities. The initiative includes identifying and gathering comparable metrics and preparing benchmarking reports to prompt questions, start discussions, identify and share leading practices, and ultimately improve the municipal services provided to Albertans.

The ten service areas to be considered as part of this initiative are:

1. Drinking Water Supply (complete)
2. Wastewater Collection, Treatment and Disposal (complete)
3. Fire Protection (complete)
4. Residential Solid Waste Management (complete)
5. Police Protection, RCMP (complete), and Self-Run (complete)
6. Roadway Operations and Maintenance (complete)
7. Snow and Ice Control
8. Transit
9. Parks Provision and Maintenance
10. Recreation, Facility Booking and Maintenance

A method for collecting data to ensure it is comparable between communities and a database to hold the data and produce performance measure has been developed. The foundation of this method is a "User Manual" for each service area, containing:

- Definitions for cost and service data, and
- Definitions for the calculations of performance measures, for both efficiency and effectiveness.

To ensure an "apples to apples" comparison, participating municipalities are involved in the creation of the user manual.

1.3 Participating Municipalities

The municipalities currently participating in the Snow & Ice Control (SNIC) section of the Project are the cities of Lethbridge, Medicine Hat and Red Deer, and the towns of Banff and Canmore.

1.4 Governance Structure

To guide and drive the project, a model has been developed consisting of:

- A governance committee consisting of six municipal leaders
- A working group with representatives from each of the participating municipalities
- A finance subject matter expert (SME) group with representatives from each of the participating municipalities
- An operations SME group for each service area with representatives from each of the participating municipalities

Governance Committee - The governance committee was created to provide overall guidance and oversight, and to ensure that the work conducted is in the best interest of the group of municipalities as a whole as opposed to an individual municipality. The committee is: Robert Earl (Chair), Town of Banff, Lisa de Soto, Town of Canmore, Corey Wight, City of Lethbridge, Brian Mastel, City of Medicine Hat and two vacant positions.

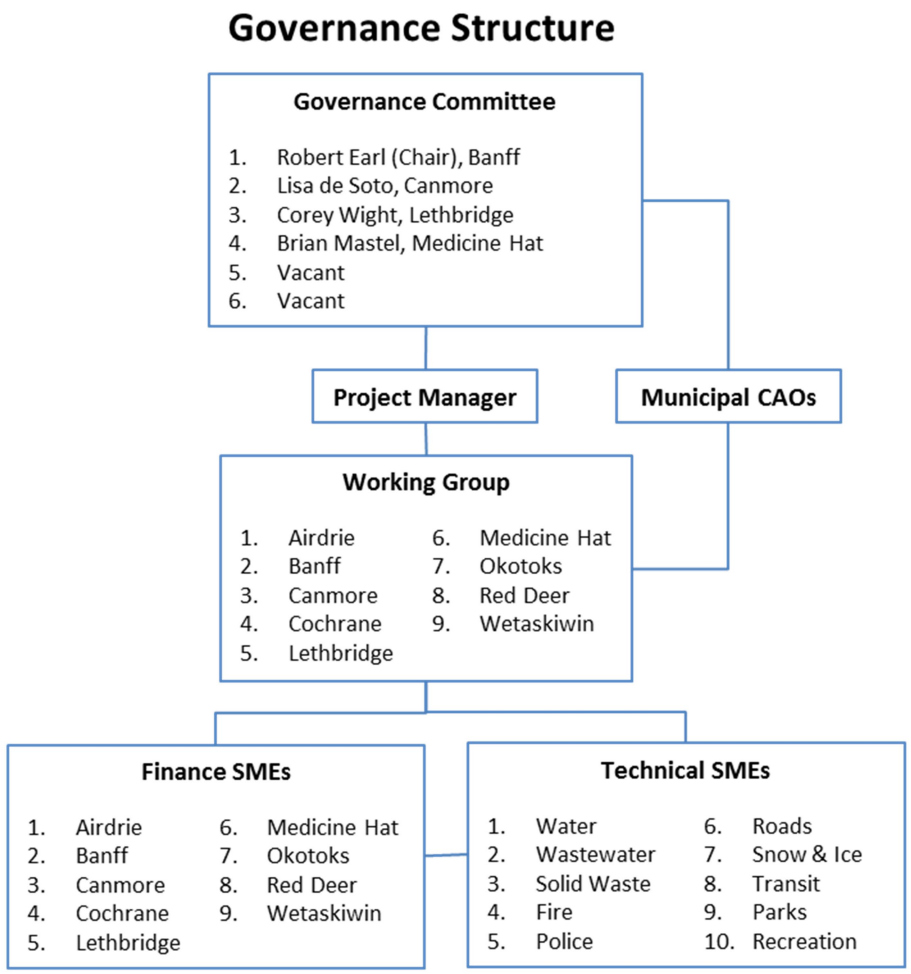
Working Group - Each of the participating municipalities is represented on the working group. Its members' primary role is liaising between the project manager and the respective municipality. They oversee the completion of activities within the municipality, support the identification of SMEs needed for the development of the Database User Manual, and assist with the gathering of relevant data.

Finance Group – The primary role and responsibility of the finance SME group is to collect and enter data for a calculation to allocate overhead to each service area, collect and enter data for amortization of assets in each service area, and assist service area SMEs on collection of cost data for

each service area. The Finance Group also ensures all data is accurate by confirming the financial data to each municipality's non-consolidated financial statements.

Subject Matter Expert Group (SME) – The primary role and responsibility of the SME groups is to provide subject matter expertise in the development of the service definitions, performance measures, and collection of data for the benchmarking project.

The CAOs' Role – In addition to the governance committee, the CAOs from each of the participating municipalities were asked to confirm their commitment to this pilot project, to be the executive sponsor for their respective municipality, to champion this pilot project within their municipality, and ensure that all participating municipalities are informed of the activities and outcomes.



1.5 Benefits of Benchmarking

The anticipated benefits from this benchmarking project are:

- Helps tell the municipal "performance story"
- A sound business practice used in the government and private sectors
- Sets the stage for sharing knowledge and best practices among the municipal sector
- Understanding of trends within each municipality
- Identification of opportunities for change to improve efficiency or effectiveness of municipal services
- Formation of objective evidence that shows the differentiation between municipalities and provides information for municipal CAOs to address questions from Council, staff, and the community on service efficiency and effectiveness
- Encouragement of continuous improvement initiatives and a better understanding of the drivers that impact performance results
- Encourages continuous improvement, and
- Awareness of the value of collaboration between municipalities.
- Supports results-based accountability

1.6 Definitions

Efficiency – Efficiency is a measure of productivity based on dividing the quantity of output (measured in units of deliverables) by the quantity of resources input (usually measured in person hours or dollars).

Effectiveness – Effectiveness is a measure of the value or performance of a service relative to a goal, expressed as the actual change in the service. An effectiveness measure compares the output of a service to its intended contribution to a higher level goal.

Snow and Ice Control

Alberta Municipal Benchmarking Initiative

2 Snow and Ice Control (SNIC)

2.1 System Description

2.1.1 Municipal SNIC Services

Municipal roads departments are usually responsible for the SNIC program. A SNIC program helps make the municipality safe for pedestrians and vehicles according to a priority system along the developed roadways right-of-way (ROW).

An effective and efficient SNIC program is necessary to allow the municipality to function under normal winter weather conditions, to reduce snow and ice hazards, and to provide reasonable winter mobility on municipality roadways, in parking lots, and on sidewalks and pathways.

The intent of the SNIC program is to minimize economic loss to the community, reduce the inconvenience and hazards of winter conditions for motorists, cyclists and pedestrians, and facilitate the operation of public transit and emergency services vehicles. SNIC activities provide reasonable winter driving conditions for vehicles that are properly equipped for winter driving and are operated in a manner consistent with good winter driving habits.

When there are extreme winter conditions, the immediate demand for snow and ice control services may exceed the available municipal resources. At these times, public service announcements may be issued to provide information and to encourage safe driving practices. As well, municipalities may contract additional services locally to supplement municipal SNIC activities.

2.1.2 Factors Influencing SNIC Services

Size of System: Number, size and complexity (hills) of the roadways system for SNIC activities.

Urban Density: Roadways types needing SNIC to serve the population.

Urban Growth: High growth municipalities may have newer SNIC equipment/infrastructure with higher amortization (depreciation) costs.

Weather Conditions: Local weather conditions may require more or less SNIC activities.

2.1.3 SNIC Narrative Data (See Section 3 for definitions of each column heading)

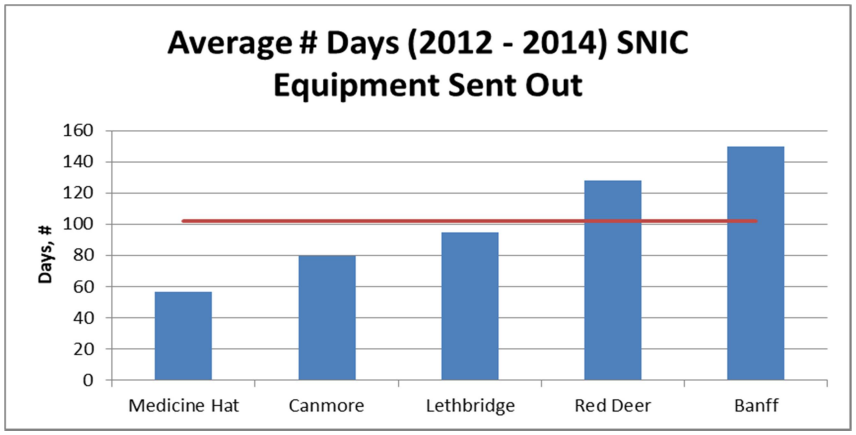
Municipality	Year	Vehicles > $10000 (#)	Days Snow & Ice equipment sent out (# days)	Contracted Snow Removal, Standby full service (Y/N)
Banff	2012	8	150	
	2013	9	150	
	2014	10	150	
Canmore	2012	2	86	Y
	2013	2	84	Y
	2014	2	69	Y
Lethbridge	2012	11	87	
	2013	13	105	
	2014	13	92	
Medicine Hat	2012	13	47	
	2013	13	58	
	2014	15	67	
Red Deer	2012	21	115	
	2013	22	135	
	2014	24	135	

2.1.4 Lessons Learned

1. The overall average number of days SNIC equipment was sent out is 102 days. The three year average 2012 – 2014, ranges from 57 days (Medicine Hat) to 150 days (Banff). See chart below, on the next page.

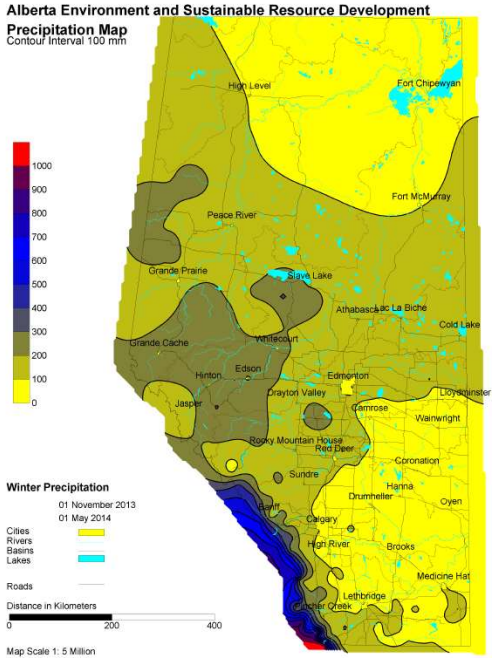
2. All municipalities use contractors for SNIC to some extent. Only Canmore uses a contractor for "Contracted Snow Removal, Standby Full Service", for all roads. This means Canmore does not have equipment or staff involved in municipal roads clearing.

3. Banff chooses not to use salt and liquids for environmental reasons. Banff's high "Number of days SNIC equipment was sent out" is explained by having to continually spread abrasives to keep roads passable.

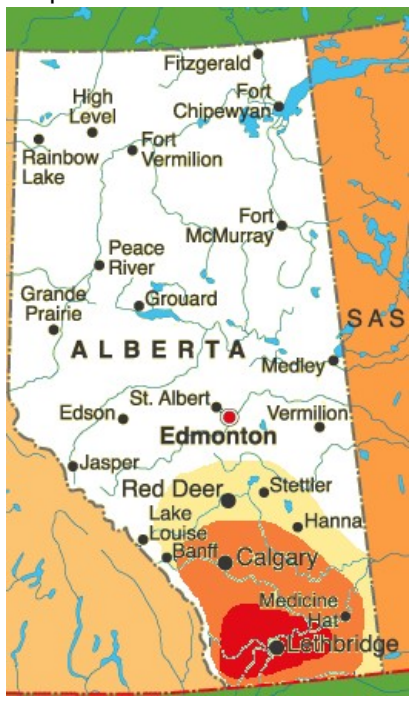


4. Further explanation of "number of days SNIC equipment was sent out" is shown in two weather maps below;
    - Map 1 shows winter precipitation levels with the red, purple and dark blue having the highest accumulations.
    - Map 2 shows what areas are affected by Chinook weather which tends to melt accumulated snow. The red area gets the highest Chinook effect.

Map 1: Winter 2013-2014 Precipitation



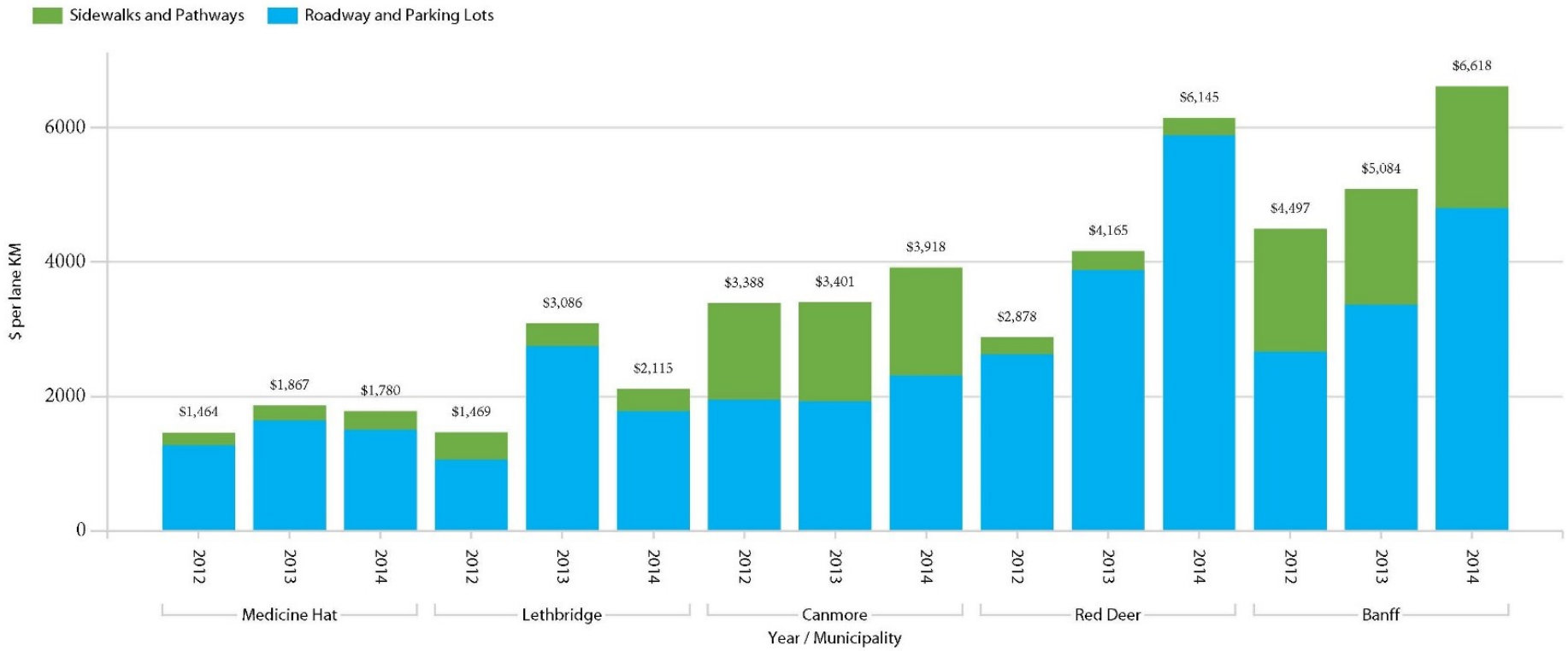
Map 2: Alberta Chinook Effect



- Map 1 Reference; http://environment.alberta.ca/forecasting/data/precipmaps/may2014/wintacc.pdf
- Map 2 Reference; https://commons.wikimedia.org/wiki/File:Alberta-chinook.png

2.2 SNIC Total Cost 1 ($/lane KM) – Efficiency

This chart shows the total SNIC cost per lane KM for two components; roadways/public parking lots (owned by the municipality), and sidewalks/pathways, see note 2 below. Municipalities are in order from lowest to highest cost based on the average of 2012, 2013, 2014 results.



2.2.1 SNIC Total Cost Data (See Section 3 for definitions of each column heading)

Municipality	Year	Roadways & Parking Lots Costs ($)	Sidewalks & Pathways Costs ($)	Total Costs ($)	Roadway Length (traffic lane KM)	Parking Lots Equivalent Length (lane KM)	Total Length (lane KM)	Cost per Lane KM ($)
Banff	2012	$250,445	$172,025	$422,470	84	10	94	$4,497
	2013	$316,376	$161,237	$477,613	84	10	94	$5,084
	2014	$450,889	$170,816	$621,706	84	10	94	$6,618
Canmore	2012	$386,592	$285,470	$672,062	192	6	198	$3,388
	2013	$382,439	$292,267	$674,706	192	6	198	$3,401
	2014	$459,336	$317,910	$777,246	192	6	198	$3,918
Lethbridge	2012	$1,572,757	$601,392	$2,174,149	1,478	2	1,480	$1,469
	2013	$4,199,926	$509,719	$4,709,645	1,524	2	1,526	$3,086
	2014	$2,806,429	$521,246	$3,327,675	1,571	2	1,573	$2,115
Medicine Hat	2012	$1,419,718	$206,809	$1,626,527	1,108	4	1,111	$1,464
	2013	$1,837,410	$247,760	$2,085,169	1,113	4	1,117	$1,867
	2014	$1,704,461	$305,023	$2,009,484	1,125	4	1,129	$1,780
Red Deer	2012	$3,681,445	$352,698	$4,034,143	1,394	8	1,402	$2,878
	2013	$5,533,647	$408,902	$5,942,549	1,419	8	1,427	$4,165
	2014	$8,482,514	$375,983	$8,858,497	1,434	8	1,442	$6,145

NOTES:

1. A traffic lane KM is the centreline length of a road multiplied by the number of traffic lanes in that road, e.g. a 1 KM road with 4 traffic lanes equals 4 lane KM. The definition of lane KMs of roadways excludes roadways parking lanes.

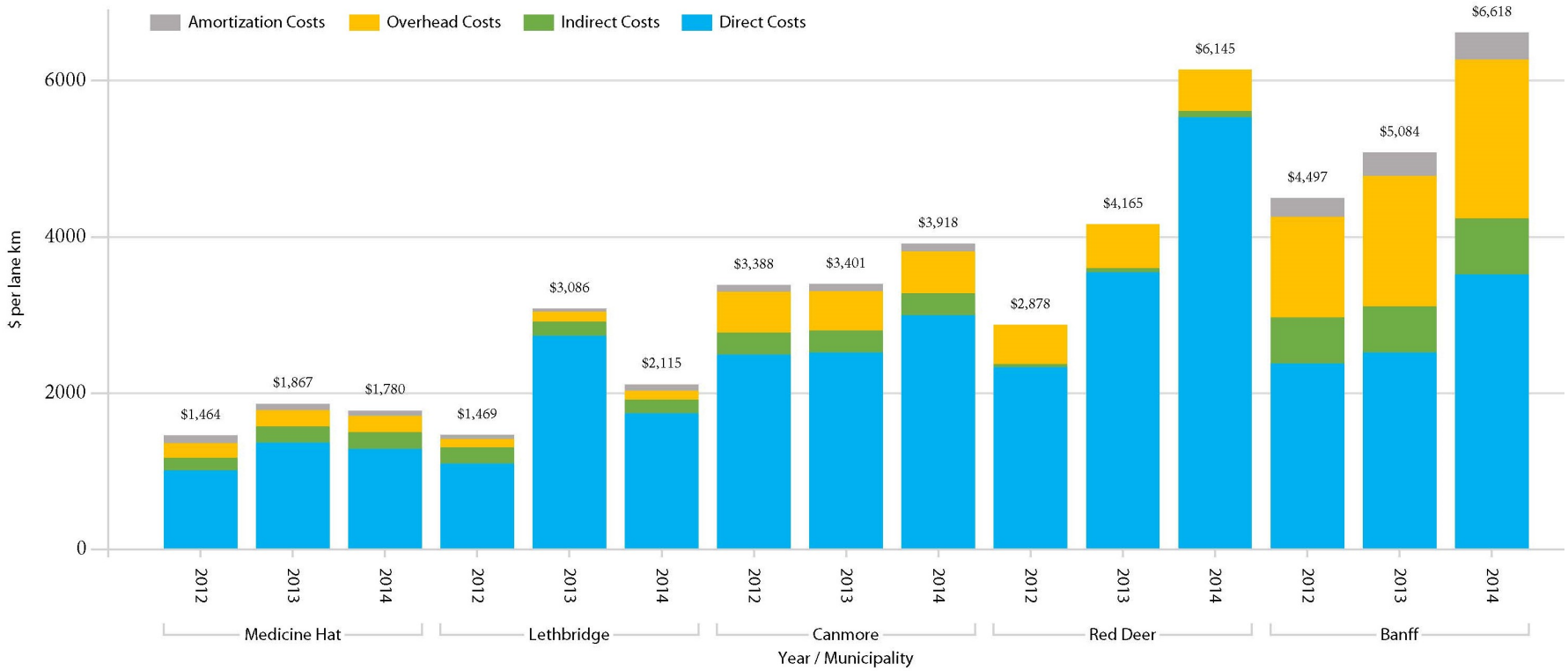
2. For parking lots, the area is converted to the equivalent length in lane KM by dividing the area in square metres by 4 meters (one lane width) x 1,000 m. (to convert to KM), e.g. for Banff 2012, the total area of parking is 39,795 sq. m. ÷ (4 x 1,000) = 10 equivalent lane KM.

2.2.2 Lessons Learned

1. The average SNIC cost per total lane KM is $3,459. The range is from $1,464 per total lane KM (Medicine Hat 2012) to $6,618 (Banff 2014).

2.3 SNIC Total Cost 2 ($/total lane KM) – Efficiency

This chart shows the total SNIC cost per lane KM by cost type; direct costs are for day-to-day operation of the service, indirect costs are for management/support of the service, overhead cost is a calculated allocation of total overhead to this service, and amortization cost is the depreciation cost of assets used to provide the service. Municipalities are in order from lowest to highest cost based on the average of 2012, 2013, 2014 results.

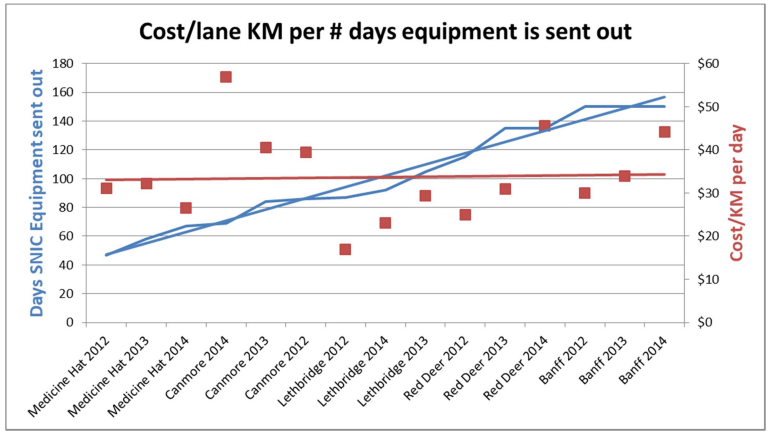


2.3.1 SNIC Total Cost Data (See Section 3 for definitions of each column heading)

Municipality	Year	SNIC Direct Costs ($)	Indirect Costs ($)	Overhead Costs ($)	Amortization Costs ($)	Total Costs ($)	Roadway Length (lane KM)	Parking Lots Equivalent Length (lane KM)	Total Length (lane KM)	Cost per lane KM ($)
Banff	2012	$223,734	$55,341	$120,833	$22,562	$422,470	84	10	94	$4,497
	2013	$236,831	$55,481	$156,781	$28,520	$477,613	84	10	94	$5,084
	2014	$330,993	$67,095	$191,196	$32,422	$621,706	84	10	94	$6,618
Canmore	2012	$495,098	$55,080	$104,722	$17,162	$672,062	192	6	198	$3,388
	2013	$500,550	$55,080	$100,826	$18,250	$674,706	192	6	198	$3,401
	2014	$594,320	$56,000	$106,500	$20,426	$777,246	192	6	198	$3,918
Lethbridge	2012	$1,630,400	$303,449	$160,082	$80,218	$2,174,149	1,478	2	1,480	$1,469
	2013	$4,174,939	$274,772	$198,998	$60,936	$4,709,645	1,524	2	1,526	$3,086
	2014	$2,745,086	$269,423	$178,852	$134,314	$3,327,675	1,571	2	1,573	$2,115
Medicine Hat	2012	$1,125,128	$180,660	$207,612	$113,127	$1,626,527	1,108	4	1,111	$1,464
	2013	$1,527,612	$232,556	$228,483	$96,518	$2,085,169	1,113	4	1,117	$1,867
	2014	$1,450,666	$242,178	$234,245	$82,395	$2,009,484	1,125	4	1,129	$1,780
Red Deer	2012	$3,275,067	$55,681	$703,395	$0	$4,034,143	1,394	8	1,402	$2,878
	2013	$5,063,964	$73,920	$804,702	$0	$5,942,586	1,419	8	1,427	$4,165
	2014	$7,980,431	$116,823	$761,142	$0	$8,858,396	1,434	8	1,442	$6,145

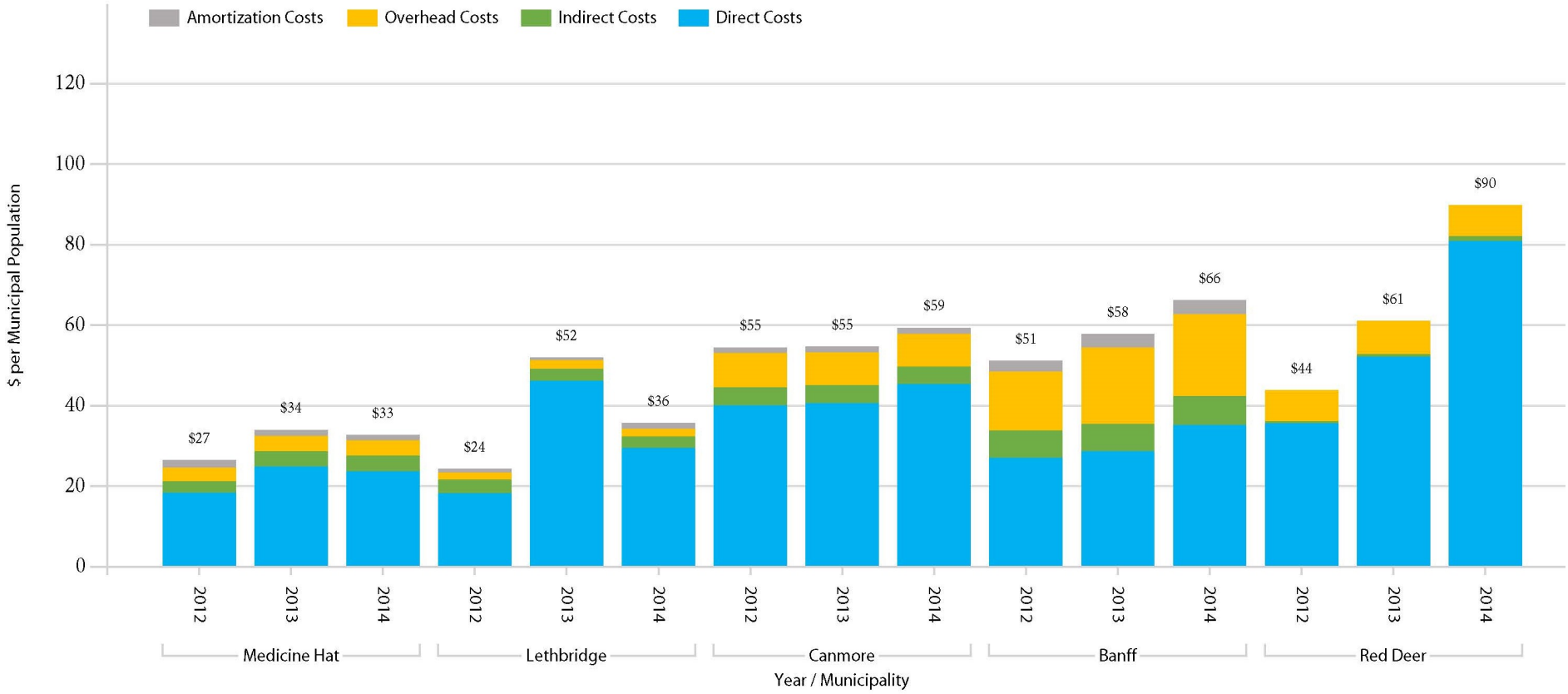
2.3.2 Lessons Learned

1. All municipalities are about equal in their cost/lane KM per day SNIC equipment is sent out, i.e. the cost to send equipment out per day remains constant at "about" $34 (see chart, red trend line) regardless of how many days that equipment is sent out. Days SNIC equipment is sent out by municipalities is most likely a combination of service level decisions and weather events.



2.4 SNIC Total Cost 3 ($/capita) – Efficiency

This chart shows the SNIC total cost per capita, based on municipal population, by cost type; direct costs, indirect costs, overhead cost allocation, and amortization cost. Municipalities are in order from lowest to highest cost based on the average of 2012, 2013, 2014 results.



2.4.1 SNIC Total Cost Data (See Section 3 for definitions of each column heading)

Municipality	Year	Direct Costs ($)	Indirect Costs ($)	Overhead Costs ($)	Amortization Costs ($)	Total Costs ($)	Municipal Population (#)	Cost per Capita ($)
Banff	2012	$223,734	$55,341	$120,833	$22,562	$422,470	8,244	$51
	2013	$236,831	$55,481	$156,781	$28,520	$477,613	8,244	$58
	2014	$330,993	$67,095	$191,196	$32,422	$621,706	9,386	$66
Canmore	2012	$495,098	$55,080	$104,722	$17,162	$672,062	12,317	$55
	2013	$500,550	$55,080	$100,826	$18,250	$674,706	12,317	$55
	2014	$594,320	$56,000	$106,500	$20,426	$777,246	13,077	$59
Lethbridge	2012	$1,630,400	$303,449	$160,082	$80,218	$2,174,149	89,074	$24
	2013	$4,174,939	$274,772	$198,998	$60,936	$4,709,645	90,417	$52
	2014	$2,745,086	$269,423	$178,852	$134,314	$3,327,675	93,004	$36
Medicine Hat	2012	$1,125,128	$180,660	$207,612	$113,127	$1,626,527	61,180	$27
	2013	$1,527,612	$232,556	$228,483	$96,518	$2,085,169	61,180	$34
	2014	$1,450,666	$242,178	$234,245	$82,395	$2,009,484	61,180	$33
Red Deer	2012	$3,275,067	$55,681	$703,395	$0	$4,034,143	91,877	$44
	2013	$5,063,964	$73,920	$804,665	$0	$5,942,549	97,109	$61
	2014	$7,980,431	$116,823	$761,243	$0	$8,858,497	98,585	$90

NOTES:

1. Canmore indirect costs include the cost to administer SNIC contract with a 3rd party SNIC contractor for roadways.

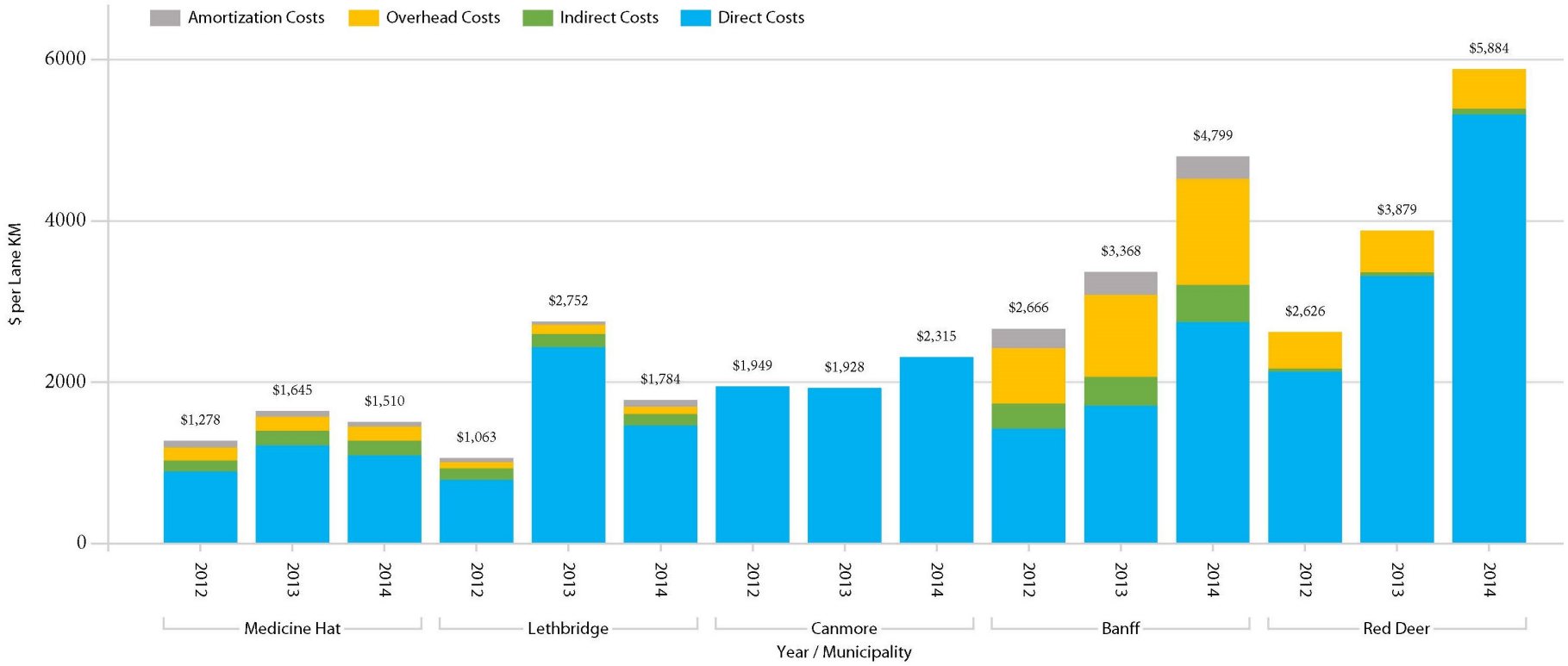
2. Amortization of Red Deer SNIC equipment and vehicles is included in direct costs.

2.4.2 Lessons Learned

1. The average SNIC cost per capita is $50. The range is from $24 (Lethbridge 2012) to $90 (Red Deer 2014).

2.5 SNIC Costs for Roadways and Parking Lots 1 ($/lane KM) - Efficiency

This chart shows the SNIC costs per lane KM for roadways/parking lots including snow removal/disposal. Municipalities are in order from lowest to highest cost based on the average of 2012, 2013, 2014 results.



2.5.1 SNIC Cost Data for Roadways/Parking Lots (See Section 3 for definitions of each column heading)

Municipality	Year	Direct Costs ($)	Indirect Costs ($)	Overhead Costs ($)	Amortization Costs ($)	Total Costs ($)	Roads Length (lane KM)	Parking Lots Equivalent Length (lane KM)	Total Length (lane KM)	Cost per lane KM ($)
Banff	2012	$133,878	$29,529	$64,475	$22,562	$250,445	84	10	94	$2,666
	2013	$160,529	$33,854	$95,666	$26,327	$316,376	84	10	94	$3,368
	2014	$258,217	$43,336	$123,492	$25,845	$450,889	84	10	94	$4,799
Canmore	2012	$386,592	$0	$0	$0	$386,592	192	6	198	$1,949
	2013	$382,439	$0	$0	$0	$382,439	192	6	198	$1,928
	2014	$459,336	$0	$0	$0	$459,336	192	6	198	$2,315
Lethbridge	2012	$1,169,217	$211,661	$111,661	$80,218	$1,572,757	1,478	2	1480	$1,063
	2013	$3,719,649	$243,205	$176,136	$60,936	$4,199,926	1,524	2	1526	$2,752
	2014	$2,305,353	$220,432	$146,330	$134,314	$2,806,429	1,571	2	1573	$1,784
Medicine Hat	2012	$990,360	$155,680	$178,906	$94,772	$1,419,718	1,108	4	1111	$1,278
	2013	$1,357,698	$201,797	$198,263	$79,651	$1,837,410	1,113	4	1117	$1,645
	2014	$1,238,214	$202,243	$195,618	$68,386	$1,704,461	1,125	4	1129	$1,510
Red Deer	2012	$2,991,539	$50,607	$639,299	$0	$3,681,445	1,394	8	1402	$2,626
	2013	$4,735,254	$67,173	$731,254	$0	$5,533,681	1,419	8	1427	$3,879
	2014	$7,667,859	$108,386	$706,175	$0	$8,482,420	1,434	8	1442	$5,884

NOTES:

1. Canmore contracts all SNIC activities for roads. As a result, there are no indirect (only contract administration), overhead or amortization costs.

2. Red Deer fleet department charges all fleet costs, including amortization, as a direct cost to each service area. Amortization is not recorded separately.

2.5.2 Lessons Learned

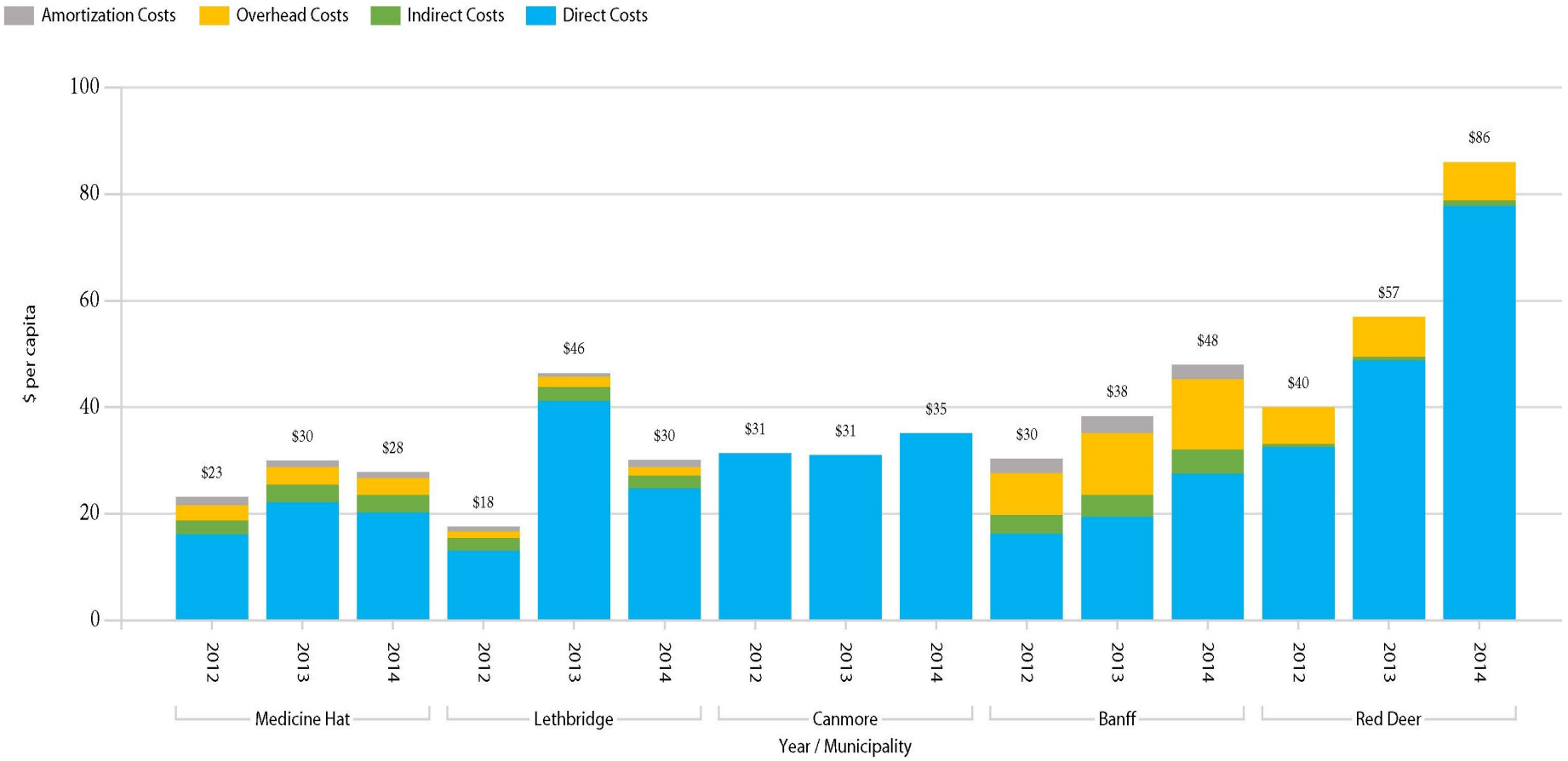
1. The average SNIC cost per total lane KM for roadways and parking lots is $2,630.The range of cost is from $1,063 per lane KM (Lethbridge 2012) to $5,884 (Red Deer 2014).

2. The more days SNIC equipment is sent out, the higher the total cost per lane KM for roadways and parking lots. Banff and Red Deer send equipment out an average of 134 days vs. 77 days for Lethbridge, Medicine Hat and Canmore. Banff and

Red Deer, on average, have SNIC cost per lane KM at $3,870, more than twice that of Lethbridge, Medicine Hat and Canmore combined at $1,803.

2.6 SNIC Costs for Roadways and Parking Lots 2 ($/capita) - Efficiency

This chart shows the SNIC costs per capita for roadways/parking lots including the costs of snow removal/disposal. Municipalities are in order from lowest to highest cost based on the average of 2012, 2013, 2014 results.



2.6.1 SNIC Cost Data for Roadways/Parking Lots (See Section 3 for definitions of each column heading

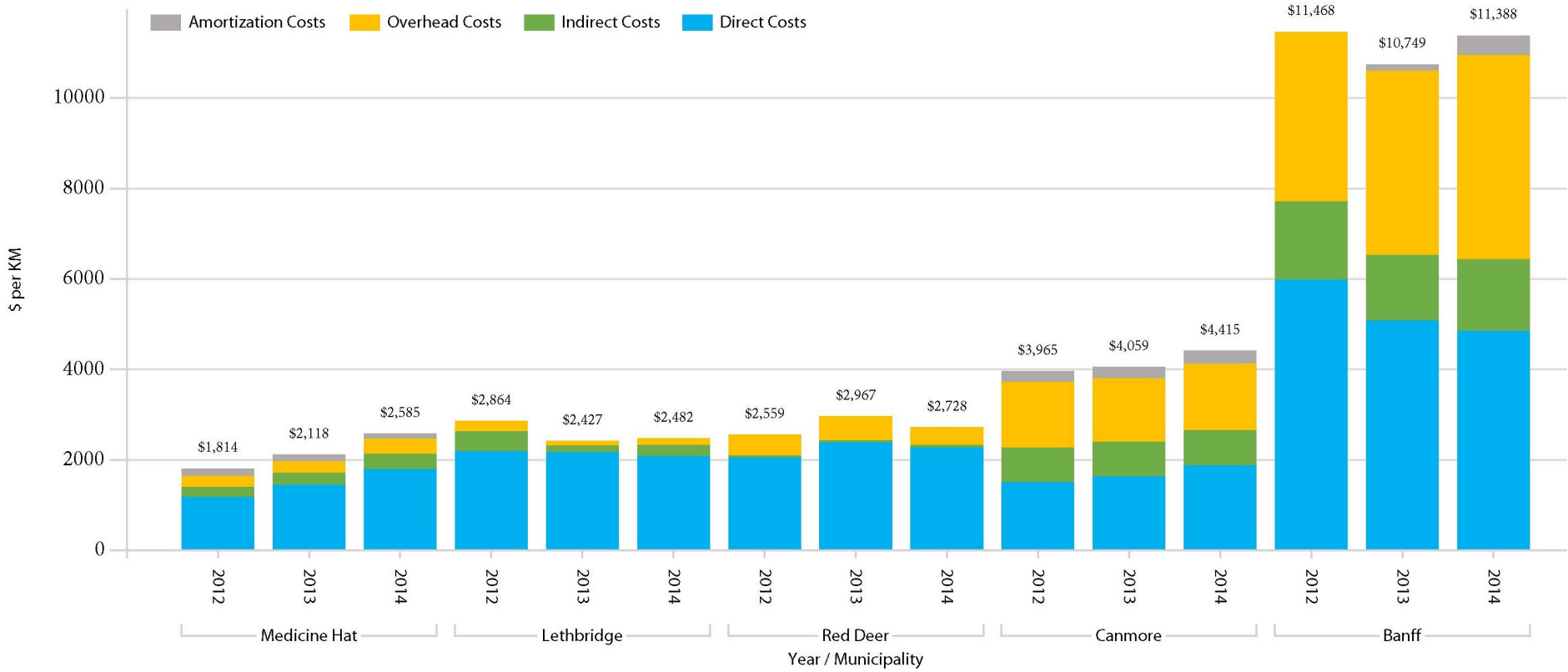
Municipality	Year	SNIC Direct Costs ($)	Indirect Costs ($)	Overhead Costs ($)	Amortization Costs ($)	Total Costs ($)	Municipal Population (#)	Cost per Capita ($)
Banff	2012	$133,878	$29,529	$64,475	$22,562	$250,445	8,244	$30
	2013	$160,529	$33,854	$95,666	$26,327	$316,376	8,244	$38
	2014	$258,217	$43,336	$123,492	$25,845	$450,889	9,386	$48
Canmore	2012	$386,592	$0	$0	$0	$386,592	12,317	$31
	2013	$382,439	$0	$0	$0	$382,439	12,317	$31
	2014	$459,336	$0	$0	$0	$459,336	13,077	$35
Lethbridge	2012	$1,169,217	$211,661	$111,661	$80,218	$1,572,757	89,074	$18
	2013	$3,719,649	$243,205	$176,136	$60,936	$4,199,926	90,417	$46
	2014	$2,305,353	$220,432	$146,330	$134,314	$2,806,429	93,004	$30
Medicine Hat	2012	$990,360	$155,680	$178,906	$94,772	$1,419,718	61,180	$23
	2013	$1,357,698	$201,797	$198,263	$79,651	$1,837,410	61,180	$30
	2014	$1,238,214	$202,243	$195,618	$68,386	$1,704,461	61,180	$28
Red Deer	2012	$2,991,539	$50,607	$639,299	$0	$3,681,445	91,877	$40
	2013	$4,735,254	$67,173	$731,254	$0	$5,533,681	97,109	$57
	2014	$7,667,859	$108,386	$706,175	$0	$8,482,420	98,585	$86

2.6.2 Lessons Learned

1. The average SNIC cost per capita for roadways and parking lots is $38.The range of cost is from $18 per capita (Lethbridge 2012) to $86 (Red Deer 2014).

2.7 SNIC Costs for Sidewalks and Pathways ($/KM) - Efficiency

This chart shows the SNIC cost per KM for sidewalks/pathways by cost type. Municipalities are in order from lowest to highest cost based on the average of 2012, 2013, 2014 results.



2.7.1 SNIC Cost Data for Sidewalks and Pathways (See Section 3 for definitions of each column heading)

Municipality	Year	Direct Costs ($)	Indirect Costs ($)	Overhead Costs ($)	Amortization Costs ($)	Total Costs ($)	Sidewalks & Pathways Length (KM)	Cost per KM ($)
Banff	2012	$89,856	$25,812	$56,358	$0	$172,025	15	$11,468
	2013	$76,302	$21,627	$61,115	$2,193	$161,237	15	$10,749
	2014	$72,776	$23,759	$67,704	$6,577	$170,816	15	$11,388
Canmore	2012	$108,506	$55,080	$104,722	$17,162	$285,470	72	$3,965
	2013	$118,111	$55,080	$100,826	$18,250	$292,267	72	$4,059
	2014	$134,984	$56,000	$106,500	$20,426	$317,910	72	$4,415
Lethbridge	2012	$461,183	$91,788	$48,422	$0	$601,392	210	$2,864
	2013	$455,290	$31,567	$22,862	$0	$509,719	210	$2,427
	2014	$439,733	$48,991	$32,522	$0	$521,246	210	$2,482
Medicine Hat	2012	$134,768	$24,980	$28,707	$18,355	$206,809	114	$1,814
	2013	$169,914	$30,759	$30,220	$16,867	$247,760	117	$2,118
	2014	$212,452	$39,935	$38,627	$14,009	$305,023	118	$2,585
Red Deer	2012	$283,528	$5,074	$64,096	$0	$352,698	138	$2,559
	2013	$328,710	$6,747	$73,448	$0	$408,905	138	$2,967
	2014	$312,572	$8,437	$54,967	$0	$375,976	138	$2,728

NOTES:

1. The length of sidewalks and pathways receiving SNIC includes those in the roads ROW plus those outside the ROW that are cleared by Parks departments.

2. The sidewalks length in the roads ROW excludes the length of sidewalks cleared by residents.

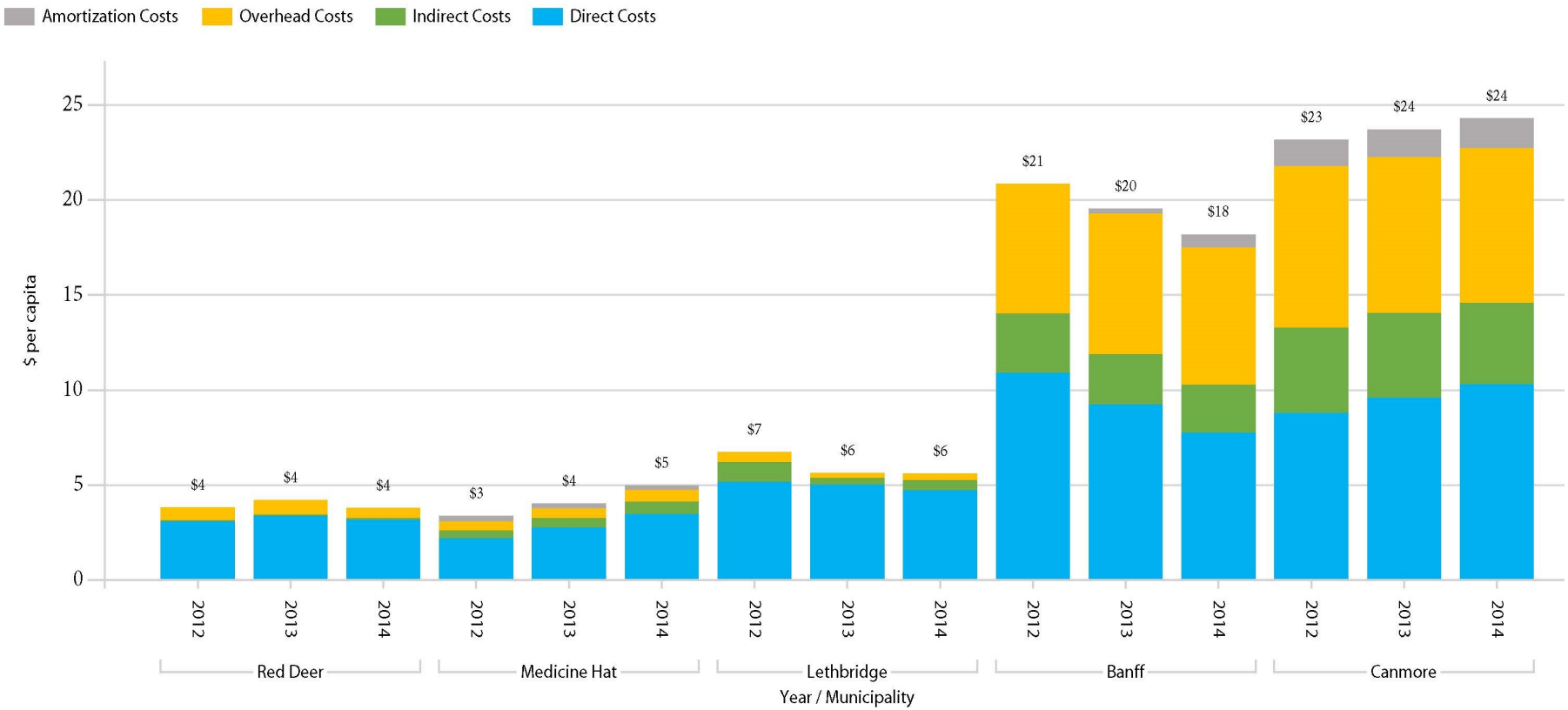
2.7.2 Lessons Learned

1. The average SNIC cost per KM for sidewalks and pathways is $4,573 with a range from $1,814 (Medicine Hat 2012) to $11,388 (Banff 2012).

2. Banff sidewalks/pathways average costs per KM are more than three times higher at $11,202 for than Canmore, Lethbridge, Medicine Hat and Red Deer combined at $2,917. This is attributed to the frequency of inspections/clearing (daily) activities.

2.8 SNIC Costs for Sidewalks and Pathways ($/capita) - Efficiency

This chart shows the SNIC cost per capita for clearing sidewalks/pathways. Municipalities are in order from lowest to highest cost based on the average of 2012, 2013, 2014 results.



2.8.1 SNIC Cost Data for Sidewalks/Pathways (See Section 3 for definitions of each column heading)

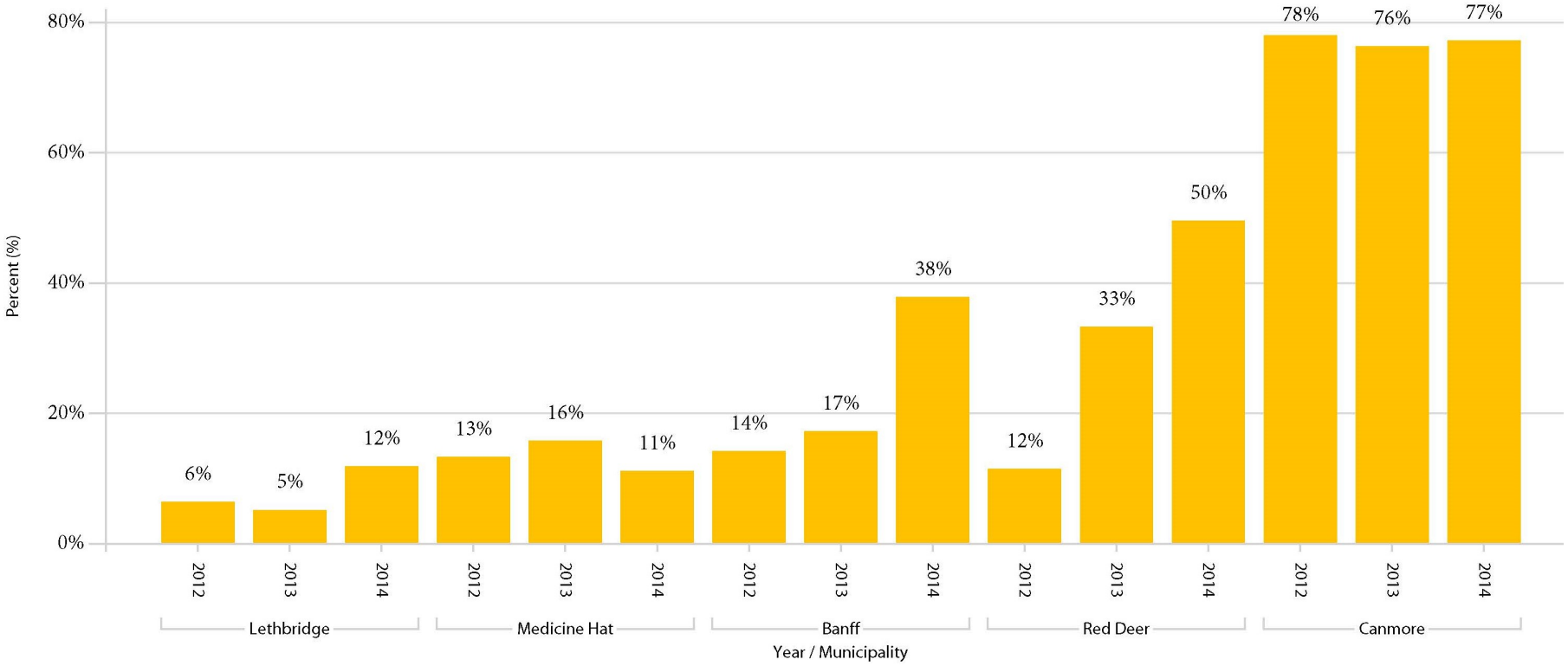
Municipality	Year	Direct Costs ($)	Indirect Costs ($)	Overhead Costs ($)	Amortization Costs ($)	Total Costs ($)	Municipal Population (#)	Cost per Capita ($)
Banff	2012	$89,856	$25,812	$56,358	$0	$172,025	8,244	$21
	2013	$76,302	$21,627	$61,115	$2,193	$161,237	8,244	$20
	2014	$72,776	$23,759	$67,704	$6,577	$170,816	9,386	$18
Canmore	2012	$108,506	$55,080	$104,722	$17,162	$285,470	12,317	$23
	2013	$118,111	$55,080	$100,826	$18,250	$292,267	12,317	$24
	2014	$134,984	$56,000	$106,500	$20,426	$317,910	13,077	$24
Lethbridge	2012	$461,183	$91,788	$48,422	$0	$601,392	89,074	$7
	2013	$455,290	$31,567	$22,862	$0	$509,719	90,417	$6
	2014	$439,733	$48,991	$32,522	$0	$521,246	93,004	$6
Medicine Hat	2012	$134,768	$24,980	$28,707	$18,355	$206,809	61,180	$3
	2013	$169,914	$30,759	$30,220	$16,867	$247,760	61,180	$4
	2014	$212,452	$39,935	$38,627	$14,009	$305,023	61,180	$5
Red Deer	2012	$283,528	$5,074	$64,096	$0	$352,698	91,877	$4
	2013	$328,710	$6,747	$73,448	$0	$408,905	97,109	$4
	2014	$312,572	$8,437	$54,967	$0	$375,976	98,585	$4

2.8.2 Lessons Learned

1. The average SNIC cost per capita for sidewalks and pathways is $11 with a range from $3 per capita (Medicine Hat 2012) to $24 (Canmore 2013, 2014).

2.9 Contracted Costs vs. Direct SNIC Costs (%)

This chart shows what portion of SNIC total direct costs is contracted out to third parties. Municipalities are in order from lowest to highest based on the average of 2012, 2013, 2014 results.



2.9.1 Contracted vs. Total SNIC Direct Costs (%) (See Section 3 for definitions of each column heading)

Municipality	Year	Contracted Costs ($)	Total Direct Costs ($)	Ratio (%)
Banff	2012	$31,851	$223,734	14%
	2013	$41,090	$236,831	17%
	2014	$125,475	$330,993	38%
Canmore	2012	$386,592	$495,098	78%
	2013	$382,439	$500,550	76%
	2014	$459,336	$594,320	77%
Lethbridge	2012	$105,736	$1,630,400	6%
	2013	$219,094	$4,174,939	5%
	2014	$327,214	$2,745,086	12%
Medicine Hat	2012	$150,454	$1,125,128	13%
	2013	$242,951	$1,527,612	16%
	2014	$162,293	$1,450,666	11%
Red Deer	2012	$378,203	$3,275,067	12%
	2013	$1,687,949	$5,063,964	33%
	2014	$3,957,961	$7,980,431	50%

NOTES:

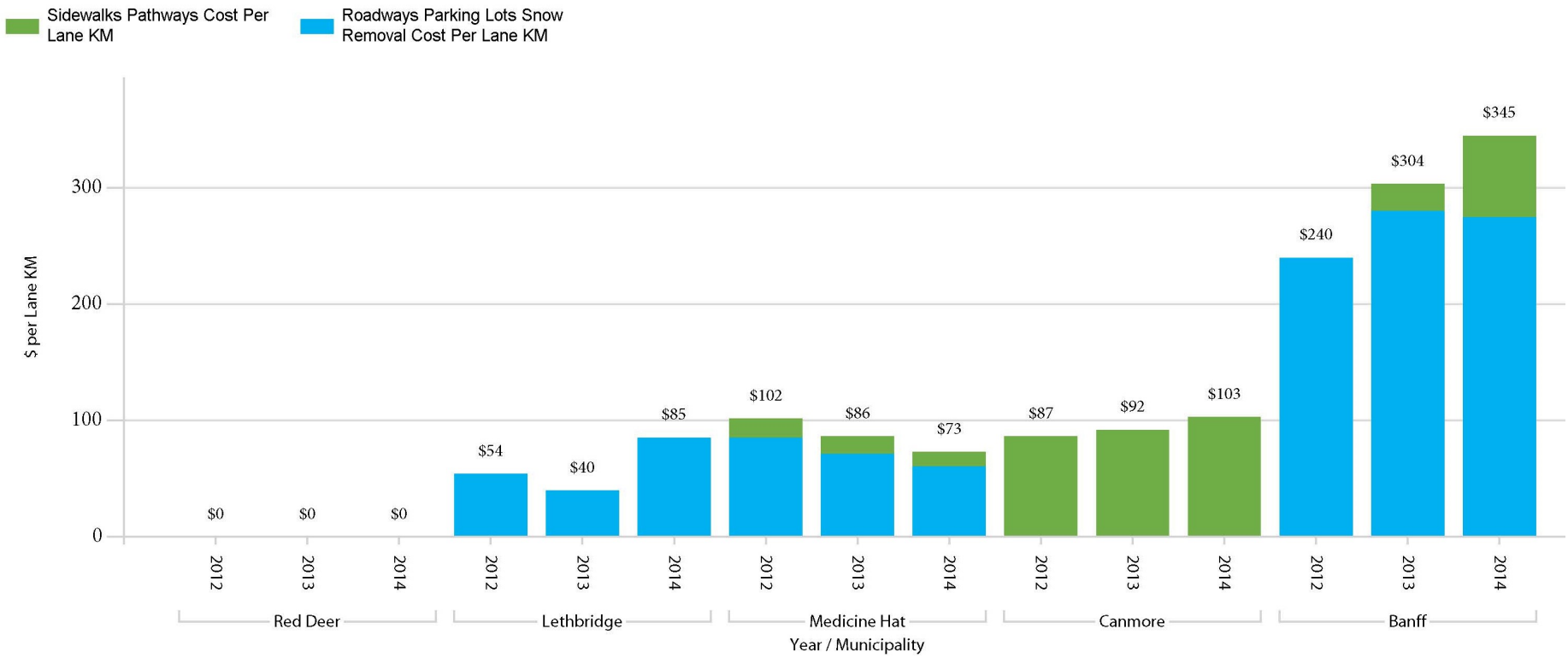
1. In 2014, both Banff and Red Deer had an increase in costs due to unexpected heavy snow events, resulting in use of private contractors for clearing. Private contractors are used to supplement the municipal capacity for SNIC.

2.9.2 Lessons Learned

1. The average percentage use of contractors for SNIC is 31% with a range from 5% (Lethbridge 2013) to 78% (Canmore 2012). Excluding Canmore, the average is 19%.

2.10 SNIC Assets Amortization Costs ($/lane KM) - Efficiency

This chart shows the amortization cost (depreciation) of SNIC assets per lane KM. Municipalities are in order from lowest to highest cost based on the average of 2012, 2013, 2014 results.



2.10.1 SNIC Amortization Cost Data (See Section 3 for definitions of each column heading)

Municipality	Year	Roads, Parking Lots & Snow Disposal ($)	Sidewalks & Pathways ($)	Total Amortization ($)	Roadways Length (Lane KM)	Parking Lots Equivalent Length (lane KM)	Total Length (lane KM)	Cost per lane KM ($)
Banff	2012	$22,562	$0	$22,562	84	10	94	$240
	2013	$26,327	$2,193	$28,520	84	10	94	$304
	2014	$25,845	$6,577	$32,422	84	10	94	$345
Canmore	2012	$0	$17,162	$17,162	192	6	198	$87
	2013	$0	$18,250	$18,250	192	6	198	$92
	2014	$0	$20,426	$20,426	192	6	198	$103
Lethbridge	2012	$80,218	$0	$80,218	1,478	2	1,480	$54
	2013	$60,936	$0	$60,936	1,524	2	1,526	$40
	2014	$134,314	$0	$134,314	1,571	2	1,573	$85
Medicine Hat	2012	$94,772	$18,355	$113,127	1,108	4	1,111	$102
	2013	$79,651	$16,867	$96,518	1,113	4	1,117	$86
	2014	$68,386	$14,009	$82,395	1,125	4	1,129	$73
Red Deer	2012	$0	$0	$0	1,394	8	1,402	$0
	2013	$0	$0	$0	1,419	8	1,427	$0
	2014	$0	$0	$0	1,434	8	1,442	$0

NOTES:

1. Canmore uses a SNIC contractor for roadways and has no equipment/amortization for roadways.

2. Lethbridge had a unique situation for amortization costs in 2012 – 2014, as did Banff in 2012. Vehicles/equipment for sidewalks/pathways SNIC were either fully depreciated (replaced in subsequent years) or below the tangible capital assets (TCA) capitalization/amortization threshold.

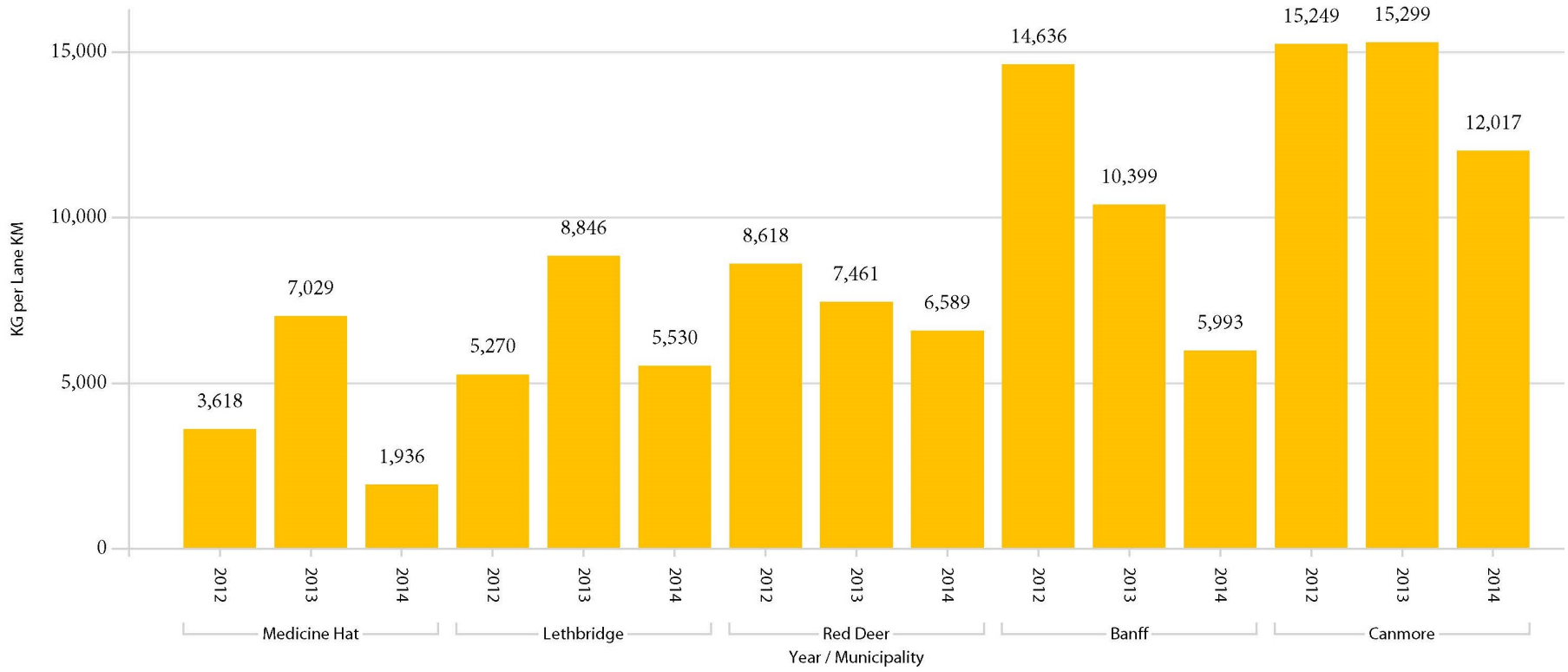
3. Amortization of Red Deer SNIC equipment and vehicles is included in direct costs to the service area.

2.10.2 Lessons Learned

1. The average SNIC amortization cost per lane KM is $107. The range is from $40 (Lethbridge 2013) to $345 (Banff 2014).

2.11 SNIC Materials Used, Abrasives (kg/lane KM) – Effectiveness

This chart shows the weight in kilograms (kg) of SNIC abrasives (stone) used per lane KM. Municipalities are in order from lowest to highest based on the average of 2012, 2013, 2014 results.



2.11.1 SNIC Materials Used Data, Abrasives (See Section 3 for definitions of each column heading)

Municipality	Year	Abrasives Used (kg)	Roadways Length (Lane KM)	Parking Lots Equivalent Length (lane KM)	Total Length (lane KM)	Kilograms per lane KM (#)
Banff	2012	1,375,000	84	10	94	14,636
	2013	977,000	84	10	94	10,399
	2014	563,000	84	10	94	5,993
Canmore	2012	3,025,000	192	6	198	15,249
	2013	3,035,000	192	6	198	15,299
	2014	2,384,000	192	6	198	12,017
Lethbridge	2012	7,800,000	1,478	2	1,480	5,270
	2013	13,500,000	1,524	2	1,526	8,846
	2014	8,700,000	1,571	2	1,573	5,530
Medicine Hat	2012	4,020,000	1,108	4	1,111	3,618
	2013	7,850,000	1,113	4	1,117	7,029
	2014	2,186,000	1,125	4	1,129	1,936
Red Deer	2012	12,079,000	1,394	8	1,402	8,618
	2013	10,644,000	1,419	8	1,427	7,461
	2014	9,499,000	1,434	8	1,442	6,589

NOTES:

1. Lethbridge is actively reducing the use of abrasives and increasing use of salt and liquids to get roads to bare pavement. Lethbridge found abrasives are pushed off the road too quickly by vehicles to be effective. Lethbridge reports this trend is happening in Edmonton as well.

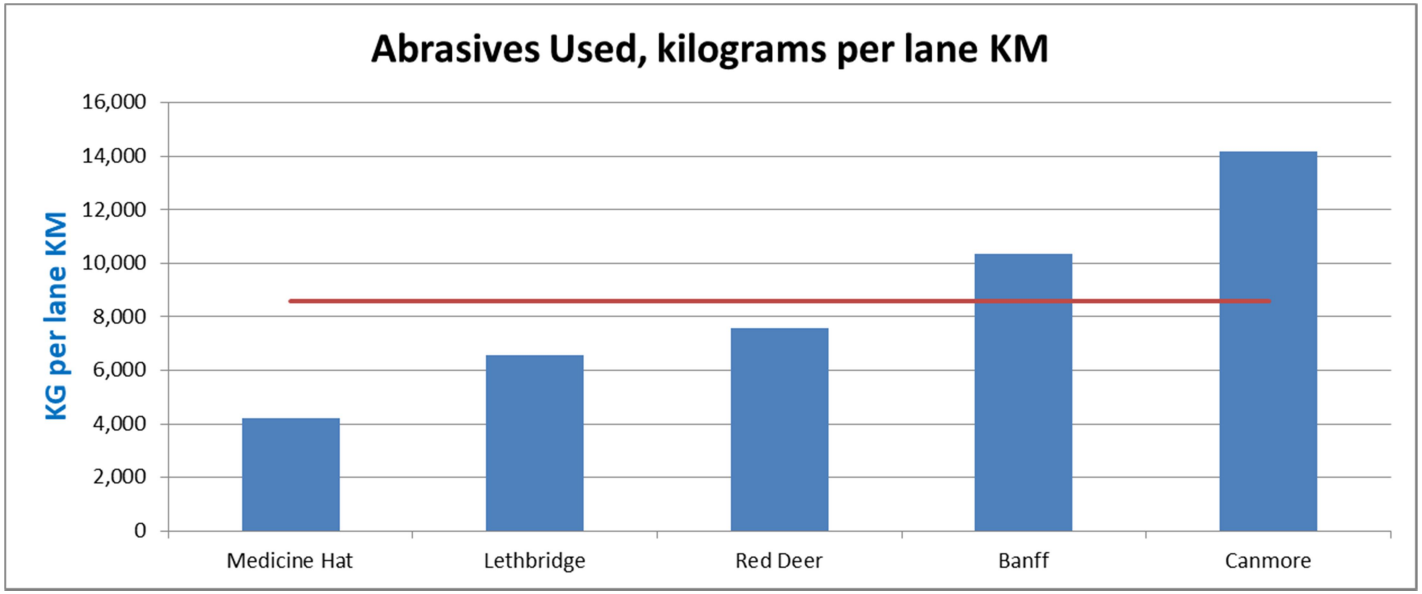
2.11.2 Lessons Learned

1. The overall average abrasives used is 8,566 kg per total lane KM (red line on chart below). The range is 1,936 kg per lane KM (Medicine Hat 2014) to 15,299 (Canmore 2013).

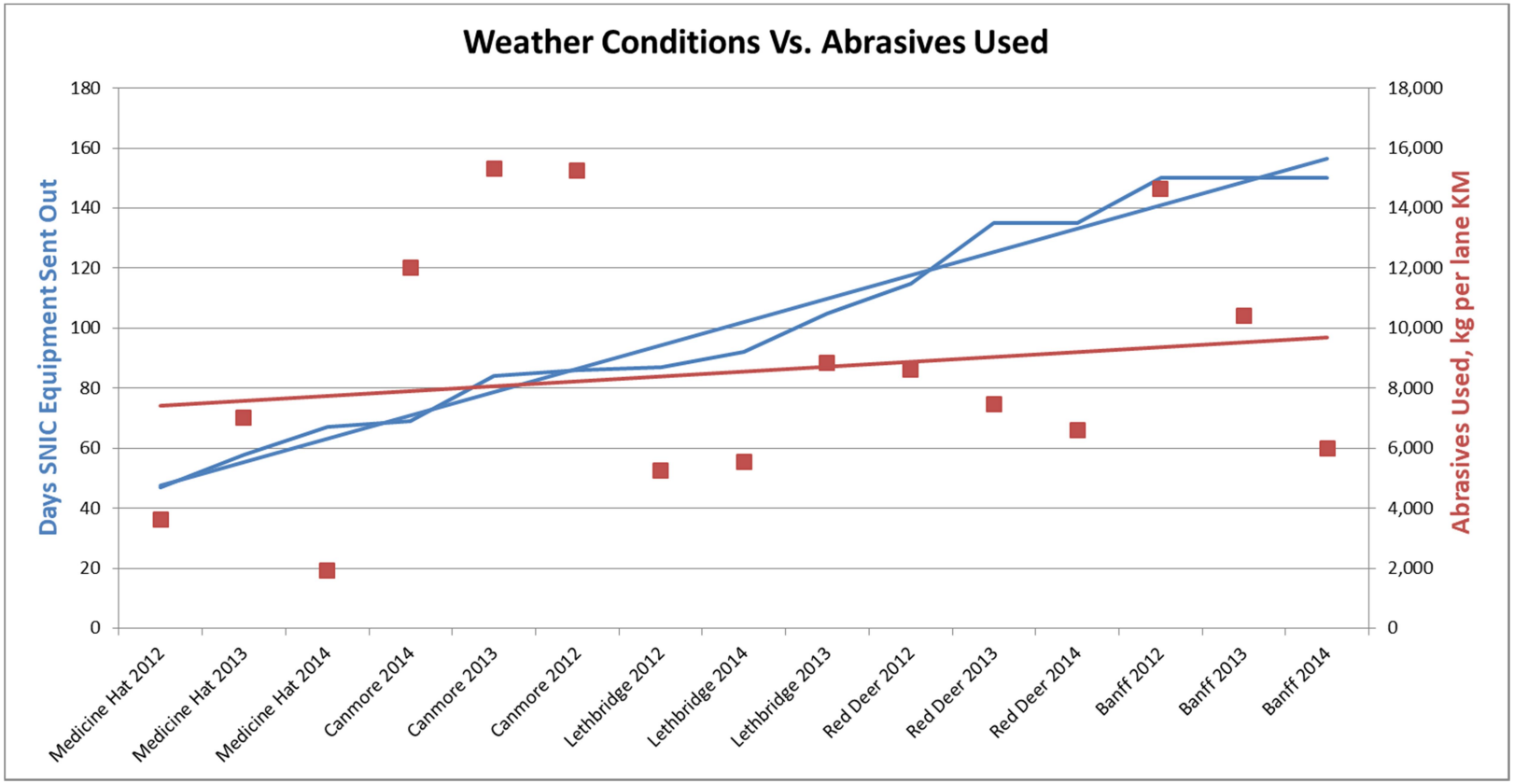
2. The more days SNIC equipment is sent out the more abrasives are used per lane KM. Banff and Canmore use on average 50% more abrasives per lane KM than Lethbridge, Medicine Hat and Red Deer combined.

The number of days SNIC equipment was sent out for Banff and Canmore at 115 days is on average 23% more vs. the 93 days for Lethbridge, Medicine Hat and Red Deer.

3. The three year average (2012 – 2014) for kilograms of abrasives per lane KM for each municipality ranges from 4,194 (Medicine Hat) to 14,188 (Canmore). See chart below.

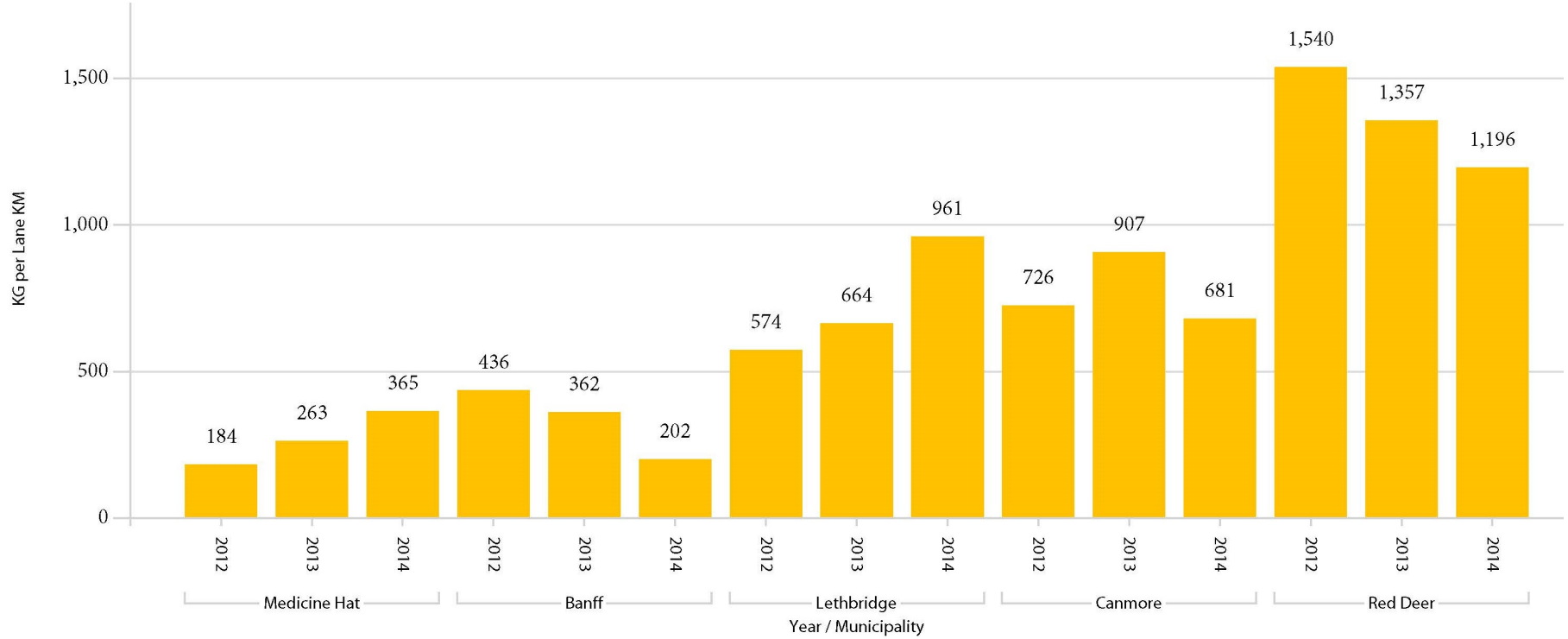


4. Weather conditions are the main driver of materials usage. As the "days SNIC equipment is sent out" increases from 47 to 150 (blue trend line) the weight per lane KM of abrasives used increases from about 7,000 kg to about 10,000 kg (red trend line). See chart below.



2.12 SNIC Materials Used, Salt (kg/lane KM) – Effectiveness

This chart shows the weight of SNIC salt used in kg per lane KM. Municipalities are in order from lowest to highest based on the average of 2012, 2013, 2014 results.



2.12.1 Materials – Salt Data (See Section 3 for definitions of each column heading)

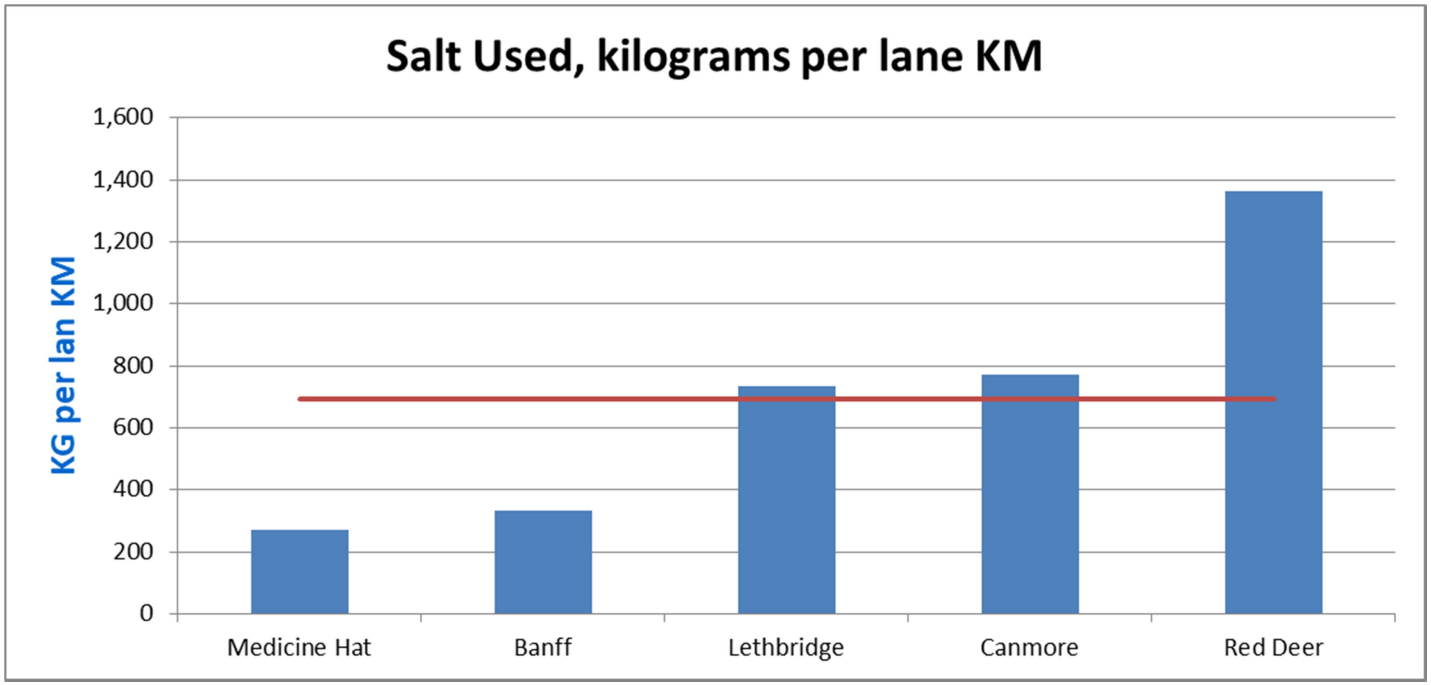
Municipality	Year	Salt Used (kg)	Roadways Length (lane KM)	Parking Lots Equivalent Length (lane KM)	Total Length (lane KM)	Kilograms per lane KM (#)
Banff	2012	41,000	84	10	94	436
	2013	34,000	84	10	94	362
	2014	19,000	84	10	94	202
Canmore	2012	144,000	192	6	198	726
	2013	180,000	192	6	198	907
	2014	135,000	192	6	198	681
Lethbridge	2012	849,000	1,478	2	1,480	574
	2013	1,014,000	1,524	2	1,526	664
	2014	1,512,000	1,571	2	1,573	961
Medicine Hat	2012	204,000	1,108	4	1111	184
	2013	294,000	1,113	4	1117	263
	2014	412,000	1,125	4	1129	365
Red Deer	2012	2,158,000	1,394	8	1,402	1,540
	2013	1,936,000	1,419	8	1,427	1,357
	2014	1,724,000	1,434	8	1,442	1,196

2.12.2 Lessons Learned

1. The overall average kg of salt used is 695 per total lane KM (red line on chart below). The range is from 184 kg per total lane KM (Medicine Hat 2012) to 1,540 (Red Deer 2012).

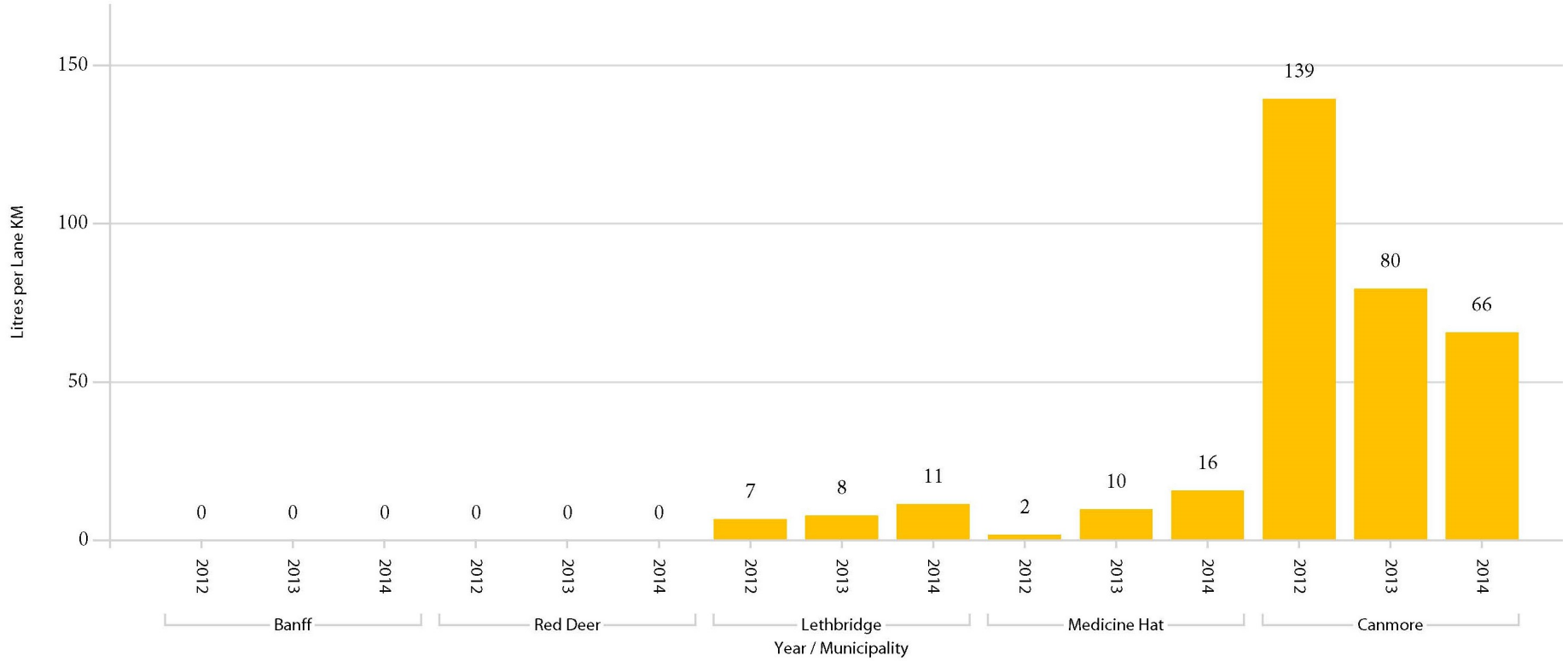
2. The three year average (2012 – 2014) kg of salt used per lane KM for each municipality ranges from 271 (Medicine Hat) to 1,364 (Red Deer). See chart below.

3. Canmore and Red Deer use on average 58% more salt per lane KM than Banff, Lethbridge and Medicine Hat.
    - In 2012 – 2014, Red Deer used only sand and salt (no liquids) for SNIC, leading to higher reported usage.
    - Banff only uses enough salt mixed into the abrasives to prevent freezing while in storage.


Salt Used, kilograms per lane KM
KG per lan KM
1,600
1,400
1,200
1,000
800
600
400
200
0
Medicine Hat
Banff
Lethbridge
Canmore
Red Deer

2.13 SNIC Materials Used, Liquids (litres/lane KM) – Effectiveness

This chart shows the volume of SNIC liquids used per lane KM. Liquids are used for pre-wetting, anti-icing and de-icing. Municipalities are in order from lowest to highest based on the average of 2012, 2013, 2014 results.



2.13.1 Materials Used - Liquids Data (See Section 3 for definitions of each column heading)

Municipality	Year	Liquids Used (Litres)	Roadways Length (Lane KM)	Parking Lots Equivalent Length (lane KM)	Total Length (lane KM)	Litres per Lane KM (#)
Banff	2012	0	84	10	94	0
	2013	0	84	10	94	0
	2014	0	84	10	94	0
Canmore	2012	27,656	192	6	198	139
	2013	15,778	192	6	198	80
	2014	13,040	192	6	198	66
Lethbridge	2012	10,000	1,478	2	1,480	7
	2013	12,000	1,524	2	1,526	8
	2014	18,000	1,571	2	1,573	11
Medicine Hat	2012	2,077	1,108	4	1,111	2
	2013	11,077	1,113	4	1,117	10
	2014	17,769	1,125	4	1,129	16
Red Deer	2012	0	1,394	8	1,402	0
	2013	0	1,419	8	1,427	0
	2014	0	1,434	8	1,442	0

NOTES:

1. Banff chooses not to use liquids for SNIC for environmental reasons.

2. Red Deer started using liquids in 2015, e.g. used 86,132 liters in 2015/2016 season and 293,248 in 2016/2017.

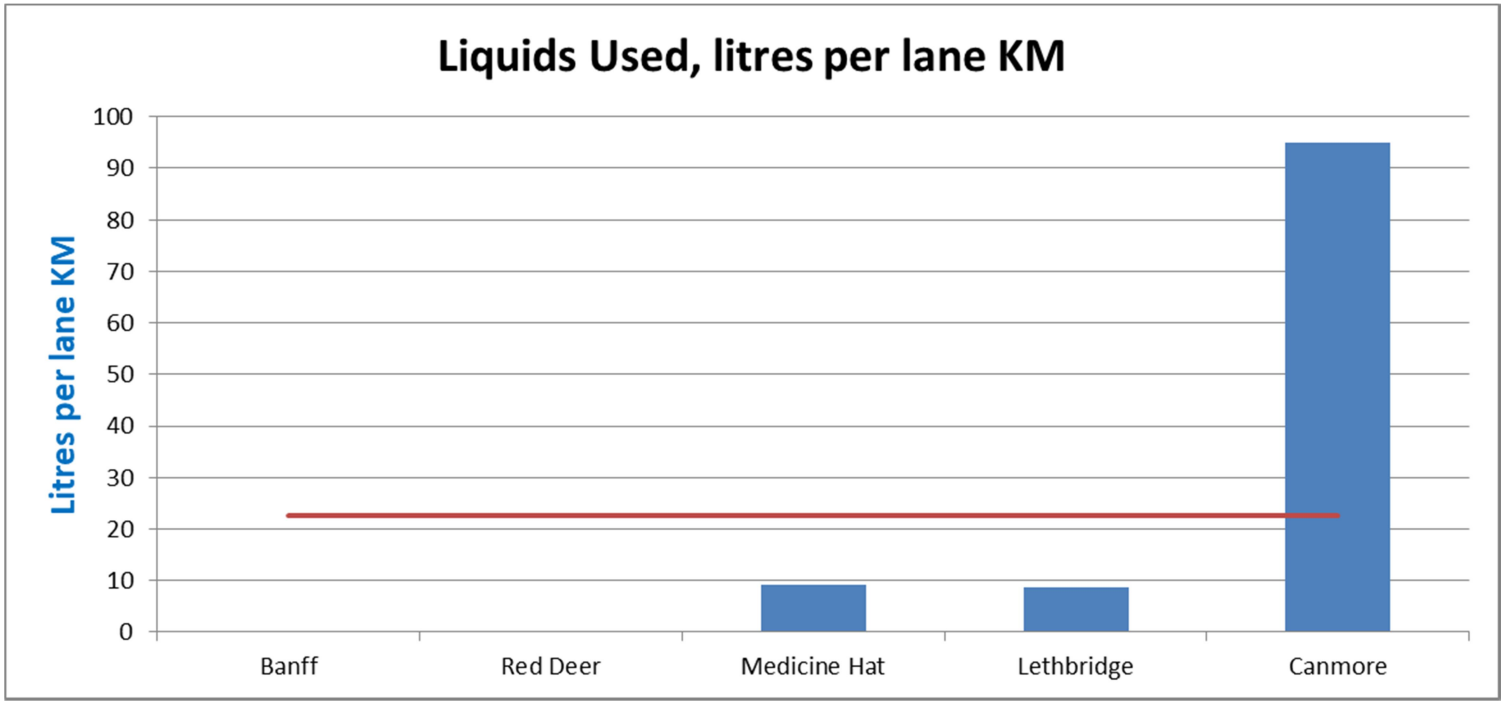
3. Liquids use is temperature sensitive; too cold and liquids can lead to black ice (about -18C), too warm and the liquids become run-off to the storm water system.

4. Canmore has the highest usage of liquids per lane KM in 2012 – 2014. This is because the private contractor for roads clearing had trucks outfitted to deliver liquids. Other municipalities have since added the capability to use liquids for SNIC.

2.13.2 Lessons Learned

1. The average use of liquids is 23 litres per total lane KM with a range from 0 litres per total lane KM (Banff, Red Deer 2012 - 2014) to 139 litres (Canmore 2012).

2. The three year average (2012 – 2014) litres of liquids used per total lane KM for each municipality, ranges from 0 (Banff, Red Deer) to 95 (Canmore). See chart below.



2.14 SNIC Service Data **(See Section 3 for definitions of each column heading)**

This data consolidates the information about the SNIC system for each municipality.

Part 1 – Roadway Types

Municipality	Year	Arterial Length (lane KM)	Collector Length (lane KM)	Local Length (lane KM)	Private Length (lane KM)	Lane Length (lane KM)	Emergency Length (lane KM)	Total Length (lane KM)
Banff	2012	11	21	40	7	5	0	84
	2013	11	21	40	7	5	0	84
	2014	11	21	40	7	5	0	84
Canmore	2012	33	28	100	0	22	9	192
	2013	33	28	100	0	22	9	192
	2014	33	28	100	0	22	9	192
Lethbridge	2012	375	373	594	0	136	0	1,478
	2013	375	377	602	0	170	0	1,524
	2014	377	381	609	0	204	0	1,571
Medicine Hat	2012	219	139	572	0	178	0	1,108
	2013	219	139	576	0	179	0	1,113
	2014	230	139	577	0	179	0	1,125
Red Deer	2012	333	256	574	0	231	0	1,394
	2013	335	263	587	0	234	0	1,419
	2014	335	269	595	0	235	0	1,434

Part 2

Municipality	Year	Sidewalks Cleared Length (KM)	Pathways Cleared Length (KM)	Sidewalks and Pathways Cleared Length (KM)	Parking Lots Area (square m)	Parking Lots Equivalent Length (lane KM)	Abrasives Usage (tonnes)	Salt Usage (tonnes)	Liquids Usage (litres)
Banff	2012	8	7	15	39,795	10	1,375	41	0
	2013	8	7	15	39,795	10	977	34	0
	2014	8	7	15	39,795	10	563	19	0
Canmore	2012	41	31	72	25,510	6	3,025	144	27,656
	2013	41	31	72	25,510	6	3,035	180	15,778
	2014	41	31	72	25,510	6	2,384	135	13,040
Lethbridge	2012	10	200	210	8,739	2	7,800	849	10,000
	2013	10	200	210	8,739	2	13,500	1,014	12,000
	2014	10	200	210	8,739	2	8,700	1,512	18,000
Medicine Hat	2012	38	76	114	14,372	4	4,020	204	2,077
	2013	38	79	117	14,372	4	7,850	294	11,077
	2014	39	79	118	14,372	4	2,186	412	17,769
Red Deer	2012	110	28	138	30,689	8	12,274	2,203	0
	2013	110	28	138	30,689	8	11,484	1,969	0
	2014	110	28	138	30,689	8	9,388	1,761	0

NOTES:

1. For parking lots, the area is converted to the equivalent length in lane KM by dividing the area in square metres by 4 meters (one lane width) x 1,000 m. (to convert the lane to KM), e.g. Banff 2012, parking lots area is 39,795 sq. m. ÷ (4 x 1,000) = 10 equivalent lane KM.

2.15 Lessons Learned, General

1. When there is more data, determine the relationship between weather patterns and days SNIC equipment is sent out, the amount of materials used and the type of materials used.

Database Manual, Snow & Ice Control

Alberta Municipal Benchmarking Initiative

3 Database Manual, Snow & Ice Control (SNIC)

3.1 Municipal Roadways Systems

Municipal roads departments are usually responsible for the SNIC program. A SNIC program helps make the municipality safe for pedestrians and vehicles according to a priority system along the developed roadways right-of-way (ROW).

An effective and efficient SNIC program is necessary to allow the municipality to function under normal winter weather conditions, to reduce snow and ice hazards, and to provide reasonable winter mobility on municipality roadways, sidewalks and pathways and in parking lots.

The intent of the SNIC program is to minimize the economic loss to the community, reduce the inconvenience and hazards of winter conditions for motorists, cyclists and pedestrians, and facilitate the operation of public transit and emergency services vehicles. SNIC activities provide reasonable winter driving conditions for vehicles that are properly equipped for winter driving and are operated in a manner consistent with good winter driving habits.

When there are extreme winter conditions, the immediate demand for snow and ice control services may exceed the available municipal resources. At these times, public service announcements may be issued to provide information and to encourage safe driving practices. As well, municipalities may contract additional services locally to supplement municipal SNIC activities.

3.2 Benchmark Data Definitions - Costs

All costs for Benchmarking are OPERATING COSTS ONLY. Capital costs are not to be included.

3.2.1 Roadways SNIC Direct Costs ($/year)

All operating direct costs involved in SNIC activities to keep the total traffic lane KM of roadways in a condition travelable by vehicles.

Includes costs for;

1. Plowing
2. Pre-wetting
3. Spreading salt
4. Spreading abrasives
5. Anti-icing
6. De-icing
7. Sweeping abrasives on fair weather winter season days
8. Removal of snow accumulated from plowing

9. Disposal of removed snow and operation of a dedicated snow dump site
10. Repair and Maintenance, e.g. snow dumps, storage facilities for abrasives and salt, equipment
11. Notifications, e.g. temporary signage for road closures

Excludes

1. Clearing, e.g. sidewalks, pathways, parking lots

Examples of direct operating costs;

1. Labour wages and benefits, and compulsory training for certified staff, including first-aid
2. Materials used, e.g. liquids for pre-wetting, anti-icing, de-icing, and salt, abrasives
3. Disposal; e.g. waste materials, snow
4. Standby charges, captured separately from other activity costs
5. Contract costs for 3rd party services, e.g. roadways clearing, specialized repairs, inspections

3.2.2 Sidewalks/Pathways SNIC Direct Costs ($/year)

All direct costs involved in activities to keep sidewalks/pathways maintained by the municipality, in a condition travelable by pedestrians. Sidewalks/pathways include all those in the roadways ROW plus any other location in the municipality, e.g. parks.

Includes costs for;

1. Plowing
2. Shoveling
3. Spreading salt
4. Spreading abrasives
5. Anti-icing
6. De-icing
7. Removal of snow accumulated from plowing
8. Disposal of removed snow at a dedicated snow dump site
9. Notifications, e.g. temporary signage for sidewalks/pathways closures

Excludes

1. Sidewalks adjacent residences; these are kept cleared by residents
2. Clearing roadways
3. Clearing parking lots

Examples of direct operating costs;

1. Materials used, e.g. liquids for pre-wetting, anti-icing, de-icing, and salt, abrasives
2. Labour wages and benefits, and compulsory training for certified staff, including first-aid
3. Disposal; e.g. waste materials, snow
4. Standby charges, captured separately from other activity costs
5. Contract costs for 3rd party services, e.g. clearing sidewalks/pathways, specialized repairs, inspections

3.2.3 Parking Lots SNIC Direct Costs ($/year)

All direct costs involved in activities to keep parking lots, owned and operated by the municipality for general use by vehicles, in a condition useable by vehicles and pedestrians.

Includes costs for;

1. Plowing
2. Shoveling
3. Spreading salt
4. Spreading abrasives
5. Anti-icing
6. De-icing
7. Removal of snow accumulated from plowing
8. Disposal of removed snow at a dedicated snow dump sites
9. Notifications, e.g. temporary signage for parking lot closures

Excludes

1. Clearing roadways
2. Clearing sidewalks/pathways
3. Clearing parking lots adjacent to municipal facilities, e.g. parking lot at a municipal recreation centre (costs for snow control are part of the operating costs for the building)

Examples of direct operating costs;

1. Materials used, e.g. liquids, abrasives, salt
2. Labour, wages and benefits
3. Compulsory training for certified staff, including first-aid
4. Disposal; e.g. waste materials, snow
5. Contract costs for 3rd party services, e.g. clearing parking lots, specialized repairs, inspections

3.2.4 Snow Removal and Disposal Cost ($/year)

All direct costs involved in activities for snow removal;

1. Removal of snow accumulated from plowing
2. Plowing and removal at the same time, e.g. a truck plows snow and a blower removes the snow by blowing it into the truck
3. Disposal of removed snow at a dedicated snow dump site

Includes

1. Removal costs for snow accumulated from plowing
2. Disposal costs
3. Operating costs for snow dumping sites, e.g. cleaning, grading

3.2.5 Contracted Costs ($/year)

Contract costs are all costs of contracted services used for SNIC of roadways, sidewalks/pathways and parking lots.

Includes

1. Full service contract costs
2. Occasional use contract costs

3.2.6 Indirect Costs ($/year)

Indirect are all costs for the activities to manage/support the activities of the SNIC department.

Includes costs to;

1. Manage the operations for snow and ice control, e.g. salaries/office costs for managers (may be a portion of the total cost, e.g. a public works manager who is also responsible for roadways, water and wastewater)
2. Training; soft-skills (if not covered by HR budget) and other related training not separable between maintenance, operations and traffic control, and sidewalks/pathways and parking lots
3. Conferences
4. Planning, e.g. for the snow and ice control activities
5. Internal Engineering: engineering staff time/costs for roads operations activities and capital projects;
   - When engineering is a corporate-wide department (smaller municipalities), all time/costs of engineering staff working on roads operations and capital projects are captured in Overhead Cost
   - When engineering staff are within/dedicated to the roads/SNIC department, the time/costs are divided (% or otherwise) into two categories;
     1. Time/costs on operational projects that are added to Indirect Costs (supporting roads operations)
     2. Time/costs on capital projects that are captured as Out of Scope, consistent with TCA reporting
6. External engineering for operational projects of the roadways department
7. Insurance

Total indirect costs are prorated (allocated) separately to SNIC for Roadways/Parking Lots and Sidewalks/Pathways separately in the database based on the percentage the direct costs of each represents of total direct costs to operate the SNIC program.

3.2.7 Amortization Costs – SNIC Assets ($/year)

Amortization costs for SNIC capital assets. This includes "dedicated" assets and a portion of "seasonal" use assets. Seasonal assets amortization will be total amortization multiplied by % usage for SNIC during the year.

Includes

1. Assets dedicated to snow and ice control, e.g. plows, snow blowers

2. Seasonal assets as per TCA policy, e.g. dump truck used for snow plowing in the winter months and a dump truck in the summer months.

3.2.8 Overhead Costs ($/year)

Overhead costs are all operating costs of municipal activities necessary for the continued functioning of the municipality but not directly associated with the services being offered.

Includes

1. Costs, e.g. human resources, IT, security, engineering, planning, financial services, Council, Administration, tax funded debt interest.

NOTE:

1. Total overhead costs are allocated to each service area using a calculation in the database. The calculation includes these factors; for fleet – number and value of vehicles, for facilities – area, sq. ft., and for all other overhead – service area total cost and number of FTEs.

2. Overhead allocation for the SNIC service area will then be prorated (allocated) in the database separately to the roadways/parking lots and sidewalks/pathways systems based on the percentage the direct cost each represents of total direct costs of the SNIC program.

3.2.9 Out of Scope Costs ($/year)

Out of scope costs are all operating costs for activities not captured in the direct costs for SNIC for roadways, sidewalks/pathways and parking lots, e.g. special studies unique to a municipality.

The total of these costs will be used by Finance to ensure all operating costs for the SNIC service area are accounted for as recorded in the municipality's annual Non-Consolidated Financial Statements.

3.3 Benchmark Data Definitions - Service

3.3.1 Roadway, Right-of-Way (ROW)

A roadway ROW is the total area between the public/private property lines. A right-of-way can be any width, depending on the type of road to be constructed and, utilities and other features to be included in the right-of-way.

Includes

1. Paved surfaced vehicle travel/parking lanes
2. Gravel surfaced vehicle travel/parking lanes
3. Medians
4. Boulevard areas, which includes sidewalks, paths and landscaped areas.

3.3.2 Roadways, Types

1. **Arterial**: Arterial roads are high-capacity urban roads between urban centres. The primary function of an arterial road is unimpeded high-speed movement between city centres and primary highways. Speed limits are typically between 50 and 80 km/h. The width of arterial roads can range from four lanes to ten or more. Some are divided at the center, while others share a common center lane, such as a central turning lane.
2. **Collector**: A collector road is a low-to-moderate-capacity road which serves to move traffic from local streets to arterial roads. Unlike arterials, collector roads are designed to provide access to residential properties. Speed limits are typically 30 60 km/hr. in built-up areas, depending on the degree of development.
3. **Local Streets**: Streets are quieter, often residential in use and character, and may be used for vehicular parking. Can be one-way or two-way
4. **Private**: Streets or lanes not in a ROW but maintained by a municipality
5. **Lane**: A narrow lane or back alley, a passage way that runs between or behind buildings in towns and cities
6. **Emergency Lane**: Lanes with locked gates to be accessed by emergency vehicles only

3.3.3 Roadways Length (traffic lane KM)

A roadway lane is defined as a lane in the roadway right-of-way, travelable by a vehicle and maintained by the municipality. For SNIC in most municipalities, roadways are assigned a priority (1, 2, 3 and 4), e.g. Priority 1, roadways are cleared first and kept clear; Priority 4 roadways get cleared "when possible" or not at all, e.g. local roads (residential).

Includes

1. Total centreline length of all roadways types multiplied by the number of traffic lanes in the roadways;
    - Arterial
    - Collector
    - Local

- Private

2. Lanes
   - Back alleys, paved or gravel, considered to be one lane regardless of width
   - Emergency

3. Bridges road surfaces, if not included in other roadways

Excludes

1. Roadway parking lanes
2. Railway crossings, if not included in other roadway
3. Sidewalks
4. Pathways
5. Medians
6. Boulevards

3.3.4 Sidewalks/Pathways (KM)

Length of sidewalks/pathways in KM includes all sidewalks and pathways, both in the roadways ROW and in any other locations, e.g. pathways in parks maintained by the municipality.

Includes

Total centreline length of;

1. Sidewalks and pathways in roadway ROW
2. Sidewalks/pathways maintained by Parks service area

3.3.5 Parking Lots (m^2)

Area of parking lots, in square metres, cleared by the municipality;

Includes

Total area of;

1. Parkades
2. Surface lots

Excludes

1. Roadway parking lanes
2. Parking lots adjacent to and serving municipal services, e.g. recreation centre

For parking lots, the area is converted to the equivalent length in lane KM by dividing the area in square metres by 4 meters (one lane width) x 1,000 m. (to convert the equivalent road lane to KM), e.g. Banff 2012, parking lots area is 39,795 sq. m. ÷ (4 x 1,000) = 10 equivalent lane KM.

3.3.6 Equipment and Vehicles Usage (hours)

The SME group decided to not collect this data for 2012 – 2014 and defer collection to sometime in the future.

3.3.7 Materials Usage – Abrasives (tonnes/kg)

This is the weight of abrasives materials, in tonnes and kg, used annually for SNIC.

3.3.8 Materials Usage – Salt (tonnes/kg)

This is the weight of salt, in tonnes and kg, used annually for SNIC.

3.3.9 Materials Usage – Liquids (litres)

This is the volume of liquids materials, in litres, used annually for SNIC. The liquids used for SNIC include calcium chloride, magnesium chloride (both about 30% concentration, which may be diluted to a lower concentration by some municipalities, and sodium chloride salt brine. These liquids all have different application rates, cost and appropriate application times.

Includes liquids for;

1. Pre-wetting, litres
2. Anti-icing, litres
3. De-icing, litres

3.3.10 Climate Effect (days)

For benchmarking, climate effect is be measured by the number of days snow and ice control equipment is sent into operation.

Includes

1. The number of days equipment is sent out during a weather event for snow and/or ice control
2. The number of days equipment is sent out prior to a weather event for preventative action, e.g. anti-icing

Excludes

1. Number of days a snow event occurred
2. Snow accumulation in centimetres
3. Days with temperature below zero Centigrade

3.4 Benchmark Performance Measures (PM) Calculations

All calculations are made in the database system based on finalized data input from municipalities.

Efficiency

1. SNIC Total Cost 1 ($/lane KM)

$$\frac{Roadways - Parking\ lots\ \ and\ Sidewalks -\ \ Pathways,\ \ Total\ Clearing\ Costs}{Traffic\ lane\ KM\ of\ \ Roadways + Parking\ Lots\ Equivalent\ lane\ KM}$$

2. SNIC Total Cost 2 ($/lane KM)

$$\frac{Roadways, Parking\ lots,\ \ Sidewalks\ and\ Pathways\ Direct\ Clearing\ Cost +\ \ Prorated\ Indirect\ Costs\ \ +\ \ Prorated\ Overhead\ Costs + Prorated\ Amortization\ of\ Snow\ \ Ice\ Assets}{Traffic\ lane\ KM\ of\ \ Roadways + Parking\ Lots\ Equivalent\ lane\ KM}$$

3. SNIC Total Cost 3 ($/capita)

$$\frac{Roadways, Parking\ lots,\ \ Sidewalks\ and\ Pathways\ Direct\ Clearing\ Cost +\ \ Prorated\ Indirect\ Costs\ \ +\ \ Prorated\ Overhead\ Costs + Prorated\ Amortization\ of\ Snow\ \ Ice\ Assets}{Municipal\ Popupation}$$

4. SNIC Roadways and Parking Lots Costs 1 ($/lane KM)

$$\frac{Roadways\ and\ Parking\ Lots\ Direct\ Clearing\ Costs +\ \ Prorated\ Indirect\ Costs\ \ +\ \ Prorated\ Overhead\ Costs + Prorated\ Amortization\ of\ \ Roadways\ Snow\ Ice\ Assets}{Traffic\ lane\ KM\ of\ \ Roadways\ \ + Parking\ Lots\ Equivalent\ lane\ KM}$$

5. Roadways and Parking Lots SNIC Costs 2 ($/capita)

$$\frac{Roadways\ and\ Parking\ Lots\ Direct\ Clearing\ Costs + \ Prorated\ Indirect\ Costs\ + \ Prorated\ Overhead\ Costs + Prorated\ Amortization\ of\ Roadways\ Snow\ Ice\ Assets}{Municipal\ Population}$$

6. Sidewalks/Pathways SNIC Costs 1 ($/KM)

$$\frac{Sidewalks, Pathways\ Direct\ Clearing\ Costs + \ Prorated\ Indirect\ Costs\ + \ Prorated\ Overhead\ Costs + \ Prorated\ Amortization\ of\ Sidewalks, Pathways\ Snow\ and\ Ice\ Assets}{KM\ Sidewalks, Pathways}$$

7. Sidewalks/Pathways SNIC Costs 2 ($/capita)

$$\frac{Sidewalks, Pathways\ Direct\ Clearing\ Costs + \ Prorated\ Indirect\ Costs\ + \ Prorated\ Overhead\ Costs + \ Prorated\ Amortization\ of\ Sidewalks, Pathways\ Snow\ and\ Ice\ Assets}{Municipal\ Population}$$

8. Contracted vs. Total SNIC Direct Costs (%)

$$\frac{All\ Contracted\ Costs\ for\ SNIC}{Total\ SNIC\ Direct\ Costs}\ X\ 100$$

9. Amortization – SNIC Assets ($/total lane KM)

$$\frac{Amortization\ Dedicated\ SNIC\ Assets + Amortization\ Seasonal\ SNIC\ Assets}{Traffic\ lane\ KM\ of Roadways + Parking\ Lots\ Equivalent\ lane\ KM}$$

Effectiveness

10. Materials Usage – Abrasives (kg/lane KM)

$$\frac{Abrasives\ usage\ in\ kg}{Traffic\ lane\ KM\ of Roadways + Parking\ Lots\ Equivalent\ lane\ KM}$$

11. Materials Usage –Salt (kg/lane KM)

$$\frac{Salt\ usage\ in\ kg}{Traffic\ lane\ KM\ of Roadways + Parking\ Lots\ Equivalent\ lane\ KM}$$

12. Materials Usage – Liquids (litres/lane KM)

$$\frac{Liquids\ usage\ in\ litres}{Traffic\ lane\ KM\ of\ Roadways + Parking\ Lots\ Equivalent\ lane\ KM}$$