THE CORPORATION
OF THE
TOWN OF CALEDON

Submission to 2003
TAC Environmental Achievement Award
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Title : 67% Reduction in Road Chlorides on Caledon Roads achieved in 8 years !

Introduction :

This submission documents dramatic progress in reducing the use of chlorides as Caledon manages dust and ice on it's roads and streets. Caledon is a large rural municipality in Peel Region, within the Greater Toronto Area of Ontario. Our landscape sees the convergence of the Oak Ridge Moraine, the Niagara Escarpment and the Peel Plain – each with remarkable environmental sensitivities. The headwaters of the historic Humber and Credit River watersheds also form largely in Caledon. Bolton is the largest of several urban settlements within Caledon.

1991 to 2001 was a time of rapid change for our road system. A zero tax increase for this period set the pace for restraint. Provincial road subsidies dried up. Population grew from 35,000 to 50,000! Today its population is passing 55,000.

The Road System:

600 km of the local, lower tier, municipal road system is rural in nature. (another 168km is residential/commercial in nature). Today these rural roads carry an average of over 500 vehicle trips per day; tripled since 1991! In 2001, as the hard surfacing program kicked in over half of these rural roads were still gravel surfaced - and fully one third of these carried over 500 aadt ! In total dollars Caledon had the largest dust control program for a southern Ontario municipality – before amalgamations kicked in. Road safety on Caledon's roads has dropped dramatically from a high of 6 reported crashes per million vehicle km traveled in 1991, down to 2 today! Winter road

operations currently deploy 20 combination plow spreaders and 4 graders out of two yards.

Reducing Road Chlorides:

Beginning in 1996, a series of practices were introduced, primarily to reduce program costs, but also to reduce chlorides introduced to the roadside environment. The performance measure of **kilograms of chlorides per capita (kg/cap/yr)** is considered a fair measure : recognizing the influence of traffic, population, service expectations, and inflation. The following table and charts illustrate a trend of 11% compounding reduction annually over a 10 year period. This means we now annually **avoid spillage into the environment** of 160 kg of salt or calcium chloride for every man, woman and child living in Caledon – or almost 8,000 tonnes per year!

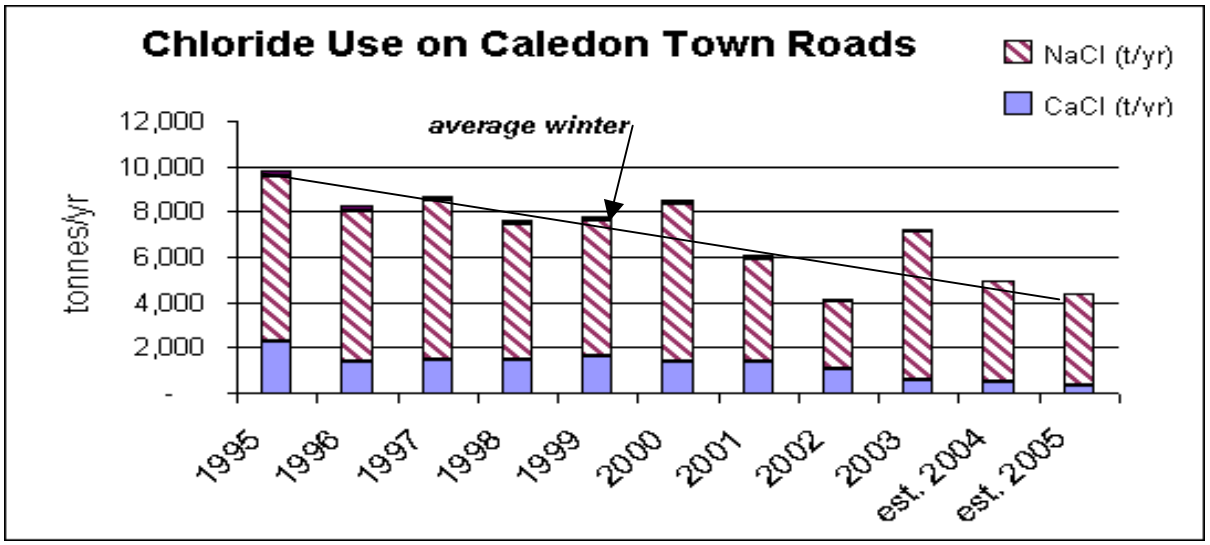
By 2002 a 67% overall reduction in road chlorides from the 1995 benchmark was achieved, down from 239 kg/capita/yr to 79.

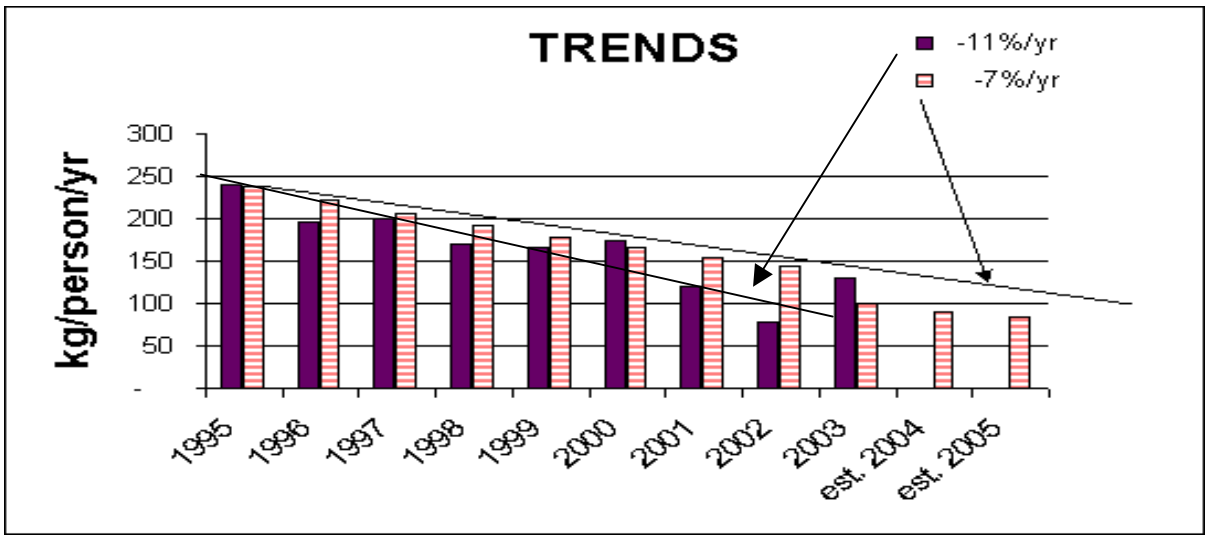
Reduced chloride quantities not only mitigate environmental damage but save tax dollars. A conservative estimate puts annual operating savings in the order of $1 million per year. This does not credit the clear benefit to the environment or personal vehicles of these reduced applications.

Use of Chlorides on Caledon Town Roads to 2003

Quantities are actual product bought in fiscal year regardless of when applied

	Summer Dust Control CaCl (t/yr)	Winter Salt in Sand NaCl (t/yr)	Total Tonnes	population	actual -11%/yr kg/p/yr	planned -7%/yr kg/p/yr
1995	2,298	7,274	9,572	40000	239	239
1996	1,382	6,663	8,045	41000	196	222
1997	1,423	7,061	8,484	42500	200	207
1998	1,459	6,022	7,481	44000	170	192
1999	1,628	6,000	7,628	46000	166	179
2000	1,388	6,970	8,358	48000	174	166
2001	1,380	4,572	5,952	50000	119	155
2002	1,085	3,003	4,088	52000	79	144
2003	590	6,517	7,107	55000	129	100
est. 2004	450	4,500	4,950	57000	-	90
est. 2005	350	4,000	4,350	59000	-	84





Here is how we did it!

Four specific practices were changed to achieve this remarkable reduction to date. Two practices reduce calcium chloride in summer (A and B), and two reduce salt in winter (C and D).

A. Spring Gravel Road Stabilization

In 1996, the application rate for dust control on gravel roads was reduced 60%, from 7 t/km to 4, on average along with a new practice for spring stabilization. By 1999 the spread rate for calcium chloride was averaging out to 4.5t / km. – and doing the job!

By 2005 the average Calcium Chloride spread rate is projected to be down to 2.8 t/km on our remaining gravel roads !

Objectives of the Practice: The new practice has three primary objectives: minimized dust (basically zero tolerance), maximize a safe smooth riding surface, and reduce the need for re shaping down to 2 or 3 times per season .

Describing the Practice: Our spring gravel road stabilization practice is a multi step process conducted after the road is dry enough and frost free.

Step 1. Deep grade (100 mm) to produce a granular mix with uniform characteristics. This maximizes and restores overall structural strength.

Step 2. Apply 33% liquid Calcium Chloride (with rust inhibitor) stabilizer and palliative on the loose gravel.

Step 3. Reshape the gravel with 6% cross fall!

Step 4. Roll with 2-3 passes of an 8t vibratory steel drum roller.

B. Hard Surfacing of Gravel Roads

By 2005 our calcium chloride needs will have dropped from over 2000 t / yr, to 400*!*

2002 was the first year of a planned 4 year aggressive gravel to hard surface conversion program. Full cost accounting demonstrated that, for most of our gravel roads, the operating cost of gravel approached the lifecycle cost of a low cost hard surfacing. Funds have now been prioritized for year 3 of this 4 year plan. In 2003 we surfaced over 50km of gravel road, having switched from "double high float treatment" to a thin lift HL3. By the end of 2003, 30% of our gravel roads were now hard surfaced.

Objective of Program: The hard surfacing program has the objective of converting our emphasis from grading, dust control, and graveling, to hard surface management. Overall chloride use on these converted roads should go from 6t/km/yr for dust control to 3t/km/yr for ice control. The public perception is that a hard surfaced road is a superior service to even a well maintained gravel road.

Describe the Practice: The practice of successful low cost hard surfacing of gravel roads requires attention to subsurface hydrology. By strategic use of fresh gravel, expanded asphalt base stabilization, geotextiles, and strategic ditching, we are able to deliver the program for about $60,000 per km. A planned failure rate of 10% in the first couple of years identifies where further base work is needed – allowing the balance to do the job at the reduced rehabilitation cost.

C Winter Product Specifications

March 2000 ended the biggest winter in 10 years. 2003 seems to have done it again! Until 2000 we had used a sand premixed with 5% salt, supplemented with up to a "bucket of salt" for every 3 of sand. We used as much salt that winter as back in 1995! There was no shame in that, given the winter, but we knew we could do better. We introduced a new mix design for our winter sand/salt product that November.

Caledon now averages about 4t of road salt / km / yr, down from over 9 in 1995!

Objectives of the Practice: The new practice of using primarily a premixed winter product has several objectives for the road surface : minimize the potential for icy conditions after winter storms, and produce a lump free premixed and easy to load product. Our service levels are geared to road class, but generally speaking for rural hard surfaced roads we seek to have centre bare conditions within 4 hours of the end of the storm, counted in daylight hours.

Describe the Practice: The practice is to blend and stockpile a three product mix of 73% sand, 25% salt, and 2% Calcium Chloride by dry weight. The products are blended by calibrated conveyors and a spray bar, fed through a pug mill prior to stacking. The goal is to avoid leaching in the pile, while maximizing the pre-wet nature of the mix. Currently only 25% of our spreaders have on board pre-wetting. We intend to manufacture our own salt brine, and eliminate pre-wetting of the stockpile, when more than 60% of our fleet is capable of on board pre-wetting. No spreader screens are required. No sweetening with added salt is permitted. Where authorized, besides the premix, operators may choose to draw from our 5% sand mix, (for gravel and very cold times) or pure salt.

We recharged the domes with only 75% salt of what we normally used. It was quickly noticed that the product was giving better results than before, and required less applications. It was working! The liquid, while less than recommended optimum for pre wetting, was keeping almost all the product on the road. And as the salt did its work toward centre bare conditions the sand provided skid resistance. The sand also had a way of mitigating the snow from packing into icy conditions. The combination was a good match for our service level in almost every storm. The search was on for reduced spread rates.

Gravel roads, on the other hand, continue to be sanded if necessary only after grader scarifying. While this practice saved on sand it costs in gravel – we estimate over 100t/km/yr is lost to winter scarifying. We need to rethink the scarifying solution – would we rather loose 80 t (1 cm deep) of gravel to the roadside or 20 tonnes of winter sand?

D. Winter Spread Rates

By 2005 our sodium chloride needs will have dropped from over 7000 t / yr, to 4000 despite service increase*!*

Having a new “hot” winter sand/salt product in the barn required spread rate management. In 2000 our first patrol vehicles had infrared pavement temperature gauges on board. By 2002 every spreader had one as well. All aspects of winter operations come into play when a change is made in product selection and availability, including regular hours of work, spreader capacities and controls, routing, and road weather information. It's easy to publish a rate sheet but at 3 a.m. going downhill and in blinding snow, not pushing the blast button is a different story.

Objective of Practice: winter spread rates need to relate to the primary influences on salt ice fighting effectiveness. Sufficient salt product needs to be spread to deliver centre bare condition with a single application, for known conditions. By 2005 every spreader should be capable of spreading a known (recorded by weight, location and time) quantity of salt and sand.

Description of Practice : A spread rate sheet was developed based on several primary criteria; product used (sand, premix, salt) pavement temperature (0 - -5, -5 to –10, >-10) service level (centre bare, bare), snow ice accumulation (partly covered, covered, built up) and active precipitation (none, light, heavy). For example the rate of 144 kg/km premix is based on the salt required to melt 2 cm of packed snow, 3m wide (centre bare), at –3 C (0 - -5). Actually it only takes 36 kg of salt to do that, but when mixed with 75% sand the spread rate is 144 kg/km. Pre-wetting the product assures it stays on the road to do the job. Six distinct spread rates, calibrated into the control system of the spreaders, reflect the choices anticipated. In residential neighbourhoods preventative spreading occurs only on hills, curves and intersections, preserving the efficiency of single axle combination plow/spreader units.

This past winter we adjusted the mix design again – going to a 50/50 sand salt mix with no on pile liquid – and reduced the spread rates again! Over half the spreading fleet now has on board liquid application systems. Spread rates now are variable depending on capability to pre-wetting on board under certain conditions.

Concluding Remarks:

The reduced dependency on chlorides appears to be sustainable into the future. The Caledon Official Plan of 1997, and subsequent efforts at defining corporate priorities, specifically highlights the natural environment as a high priority for preservation. In 2003 Caledon was awarded a “Greenest Town in Ontario “ recognition by TVO (shared with Orillia). The environment comes first in Caledon.

We are well prepared to meet the intent of the new salt management legislation. The Caledon Public Works Department is committed to excellence in its practices and investment recommendations. Change in operational practices are not without risk or effort. It takes the steady commitment of leadership to investigate and “attempt” all reasonable alternatives. Innovation must be the standard of practice. The results speak for themselves. In Caledon, the public works leadership team is on the job!

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