*52ND EASTERN SNOW CONFERENCE*
*Toronto, Ontario, Canada 1995*

# Field Trials Evaluating Prewetting Salt With Liquid Calcium Chloride for Snow and Ice Control on Urban Streets

W. DUNN[1], H. BRINKHOF[1] AND W.M. MINER[1]

## ABSTRACT

Prewetting of salt with salt brine or calcium chloride is not a new concept. Experiments with prewetting salt hve shown that more material stays on the road surface and less material is susceptible to being blown away by passing vehicles. Prewetting salt quickens its melting action and, if prewetted with liquid calcium chloride, enhances its melting effect at lower temperatures.

Unfortunately, salt prewetting has not gained widespread use in the past. The method for prewetting salt was to drive the spreader under a boom and spray the salt in the hopper. An alternative to spraying the salt in the hopper was to prewet the salt while in its stockpile. Typically the result was an unevenly wetted load which caused uneven spreading and produced greater wear and tear on the conveyor and carrier system of the salt spreader.

Recently, however, a small number of companies have introduced an inexpensive add-on saddle tank system which is designed to prewet the salt at, or just before, the spinner. Manufacturer claims describe savings in salt use of up to 40% when prewet with calcium chloride while maintaining an equal or better level-of-service than previously achieved with dry salt.

In order to substantiate manufacturer claims and investigate the potential of utilizing add-on prewetting systems in conjunction with the existing fleet of salt spreaders, the City of Ottawa's Department of Engineering and Works designed an experiment to be conducted in a controlled field trial during the 1994-1995 winter. This paper describes the field trial and the results.

## OBJECTIVES

The objective of the winter long field trial of prewetting salt with calcium chloride was two-fold:

1. To substantiate the reduction in salt use which can be realized through the utilization of an on-board prewetting system.
2. To document any enhancement in de-icing performance of salt prewetted with calcium chloride relative to dry salt at various temperatures.

## FIELD TRIAL DESIGN AND IMPLEMENTATION

The project was structured similar to the 1987-1988 Alternative De-icers Field Trial in that the experiment was run out of the Industrial Maintenance Yard, the Pleasant Park/Smyth Road test loop was utilized, and the de-icer performance during select storm events was monitored with an electronic decelerometer similar to the type utilized for monitoring runway conditions at Canadian airports.

### ON-BOARD LIQUID STORAGE AND DISPENSING SYSTEM

Through the supplier of the Department's salt spreader control equipment (Basic Hydraulics), the Department purchased a pair of on-board saddle tanks complete with a hydraulic power unit/pump for the storage and dispensing of prewetting liquid. Figure 1 shows the location of the saddle tanks and the hydraulic pump on the spreader truck. Each tank had a 150 L capacity and was connected in parallel such that the liquid levels in both tanks were always equal.

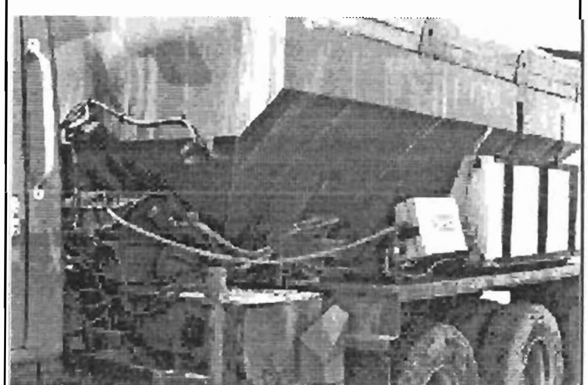

Figure 1. On-board Saddle Tank Configuration

Figure 2 shows the two nozzle spray bar location at the main conveyor, just before the salt stream is split into the two side conveyors which feed each spinner.

[1] City of Ottawa, Department of Engineering and Works, Operations Branch, 111 Sussex Drive, Ottawa, Ontario K1N 5A1, Canada

## SALT SPREADER CONTROL CONSOLE

The V-hopper tandem spreader dedicated to the field trial for the winter was supplied with the CS 220 salt spreader control manufactured by Basic Hydraulics (Figure 3). This spreader console contains data acquisition capabilities which enable staff to monitor salt usage by actual console setting. With respect to this particular trial, the device ensured that, for the test and control streets, the spreader delivered the requested dry salt and prewetted salt application rates

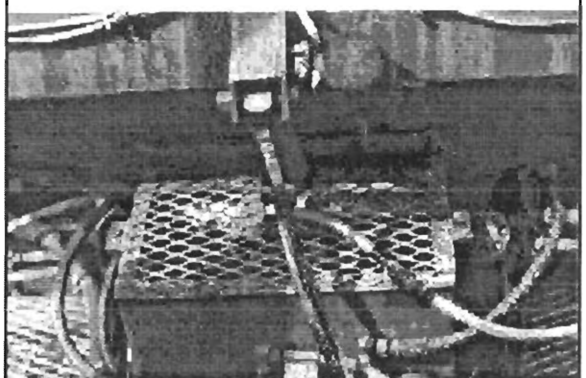

Figure 2. Spray Bar location over main conveyor

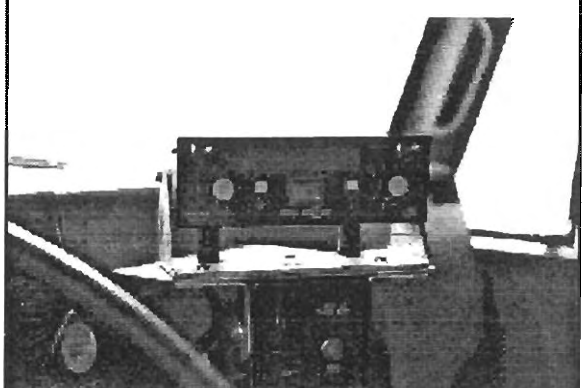

Figure 3. On-Board Data Acquisition System

Basic Technologies CompuSpread 220 — Spread List of Truck #6518

Logging Date: 11/06
Logging Time: 19:55

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Material Number : | 1 | | | | | | | | | |
| Spreadrate Selected: | 0 | 100 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900 |
| Distance Travelled : | 1.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 1.7 | 1.2 | 2.2 | 0.0 |
| Time Travelled : | 00:06 | 00:00 | 00:00 | 00:00 | 00:00 | 00:00 | 00:04 | 00:02 | 00:06 | 00:00 |
| Distance at Blast : | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Average Truck Speed: | 16 | 0 | 0 | 11 | 0 | 15 | 24 | 24 | 20 | 0 |
| Maximum Truck Speed: | 34 | 0 | 6 | 17 | 6 | 18 | 32 | 30 | 29 | 0 |
| Season's Quantity : | 3672 | | | | | | | | | |
| Season's Distance : | 6.8 | | | | | | | | | |
| Material Number : | 2 | | | | | | | | | |
| Spreadrate Selected: | 0 | 0 | 0 | 240 | 320 | 400 | 480 | 560 | 640 | 0 |
| Distance Travelled : | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.8 | 0.0 |
| Time Travelled : | 00:00 | 00:00 | 00:00 | 00:00 | 00:00 | 00:00 | 00:00 | 00:00 | 00:07 | 00:00 |
| Distance at Blast : | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Average Truck Speed: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 0 |
| Maximum Truck Speed: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 0 |
| Season's Quantity : | 1799 | | | | | | | | | |
| Season's Distance : | 2.8 | | | | | | | | | |
| Material Number : | 3 | | | | | | | | | |
| Spreadrate Selected: | 0 | 100 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900 |
| Distance Travelled : | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Time Travelled : | 00:00 | 00:00 | 00:00 | 00:00 | 00:00 | 00:00 | 00:00 | 00:00 | 00:00 | 00:00 |
| Distance at Blast : | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Average Truck Speed: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Maximum Truck Speed: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Season's Quantity : | 0 | | | | | | | | | |
| Season's Distance : | 0 | | | | | | | | | |
| Material Number : | 4 | | | | | | | | | |
| Spreadrate Selected: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Distance Travelled : | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Time Travelled : | 00:00 | 00:00 | 00:00 | 00:00 | 00:00 | 00:00 | 00:00 | 00:00 | 00:00 | 00:00 |
| Distance at Blast : | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Average Truck Speed: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Maximum Truck Speed: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Season's Quantity : | 0 | | | | | | | | | |
| Season's Distance : | 0 | | | | | | | | | |

Figure 4. Salt Use Data

Figure 4 is an example of a hard copy print out of data captured by the unit after a single application along the test and control street sections. The figure indicates that, at material 1 (dry salt), the spreader travelled 2.7 km at 170 kg/2-lane km (1.7 mi at 600 lbs/2-lane mi); 1.9 km at 198 kg/2-lane km (1.2 mi at 700 lbs/2-lane mi); and 3.5 km at 227 kg/2-lane km (2.2 mi at 800 lbs/2-lane mi). Similarly, at material 2 (prewetted salt), the spreader travelled 4.5 km at 181 kg/2-lane km (2.8 mi at 640 lbs/2-lane mi). The spreader also recorded 2.7 km (1.7 mi) at the 0 setting dead-heading between the test and control street sections.

## LIQUID CALCIUM CHLORIDE

The liquid calcium chloride used to prewet the road salt was purchased from General Chemical and stored in the Industrial maintenance yard in a 20,000 L capacity tanker. The tanker came equipped with a pump so that the spreader operators could simply pull up beside the tanker, start the tanker motor, couple the tanker hose to the on-board saddle tanks, and fill the tanks with calcium chloride liquid.

The optimum percent calcium chloride in solution for de-icing purposes is 32%. This mixture results in a eutectic temperature of approximately -55 °C. However, other factors come into play when the mixture is applied in the outdoors on a road surface, resulting in somewhat smaller effective temperature range for in-field use.

Based upon prewetting trials performed at the Minnesota DOT and technical articles found in publications such as Civic Public Works and Better Roads, the reduction in dry salt which could be attributed to prewetting the salt ranged from 10% to 40%. These salt reductions were achieved by prewetting the salt with 32% liquid calcium chloride at a rate of 4 to 8% by weight.

For the purposes of this trial, the initial reduction in salt use was set conservatively at 20% when prewet and the liquid dispensing system was also set conservatively to prewet at 8% by weight.

## TEST VEHICLE AND ELECTRONIC DECELEROMETER

The performance of the prewetted salt test section and the dry salt control section was monitored using a test vehicle instrumented with an electronic decelerometer (Figure 5). The test vehicle was followed by a warning vehicle instrumented with warning flashers to provide a safe buffer distance between the test vehicle as it was applying its brakes and any unsuspecting motorists.

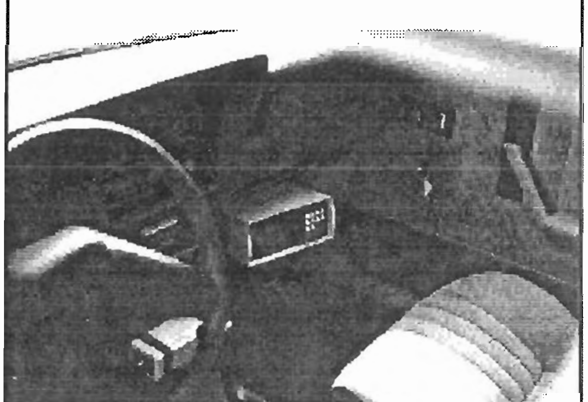

Figure 5. TES Ltd., Electronic Decelerometer

When the test vehicle brakes were applied and the wheels fully locked, the decelerometer would measure the skid friction in percent g (gravitational force) between the road surface and the tires of the test vehicle. Measuring the actual braking friction from the time de-icing chemical was applied throughout a storm event has proven to be a very effective and quantitative method for assessing de-icer effectiveness.

Figure 6 displays the relationship between an electronic decelerometer reading in percent g's and the stopping distance of a vehicle. The vehicle was travelling at a constant 40 kph before each skid test. A 15% braking force reading, for example, would be a reading taken on wet hard pack snow or ice and would translate into a stopping distance of approximately 42 m, whereas a 65% braking force reading would be a reading taken on a street that was bare but wet and would translate into a stopping distance of approximately 10 metres.

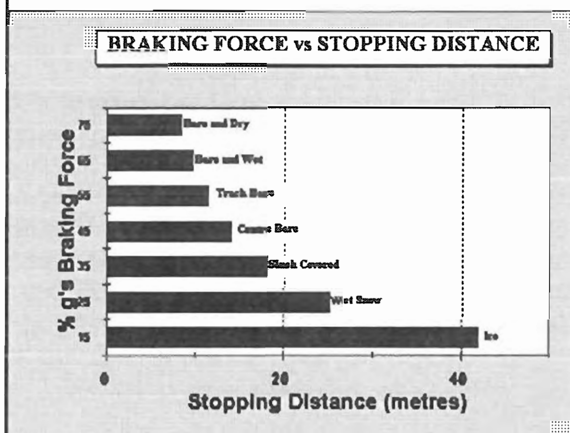


Figure 6. Braking Force vs. Stopping Distance

## TEST AND CONTROL ROUTES

As the Department maintains salt routes on both arterial and collector roads, the field trial was designed initially to include an arterial road (Smyth Road) and a collector (Pleasant Park). Figure 7 indicates the extent of the dry salt control section (between St. Laurent and Lynda Lane on both Pleasant Park and Smyth) and the extent of the prewetted salt test section (between Lynda Lane and Alta Vista on both Pleasant Park and Smyth).

Early in the program it was determined that the skid friction readings taken on Smyth Road throughout a storm event, for all intents and purposes, mirrored those skid friction readings taken on Pleasant Park. Therefore, in an effort to minimize traffic disruption, the Department limited skid testing to Pleasant Park. The Department did, however, continue to apply prewetted salt at a reduced rate to Smyth Road in order to obtain visual observations of salt behavior and ensure comparable performance.

Figure 7. Test and Control Streets

**TEST PROCEDURE**

There were two distinct teams engaged in the field tests: the spreader team and the skid testing team. The spreader team consisted of the three operators of spreader truck 6518 which operated out of the Industrial Maintenance Yard. The skid testing team involved a driver of the test vehicle and a driver of the warning vehicle which also operated out of Industrial Maintenance Yard.

The step-by-step procedures followed for each storm by the two teams were as follows.

**SPREADER TEAM TEST PROCEDURE**

(1) Snow accumulations dictated the need for a City-wide salt application (application rate determined by the Road Superintendent).
(2) Spreaders were dispatched on their routes to apply salt at the pre-determined application rate.
(3) When the spreader equipped with the on-board prewetting tanks would reach the test sections, the spreader would stop, change from material setting 1 to material setting 2, and turn on the hydraulics for the prewetting system. The operator did not have to change the actual application rate setting as the console was programmed to reduce the dry salt application rate by a pre-determined amount.
(4) At the end of the test sections, the spreader operator would return the material setting to a value of 1 for dry salt application and continue along the regular route.
(5) The spreader operator would radio the test vehicle informing the test driver of the time that salt was applied to the test and control sections for inclusion on the skid friction data sheet.

**SKID TEST TEAM PROCEDURE**

(1) One of the field staff from Industrial Yard would call the test driver with the estimated time of the initial salt application.
(2) The test driver would team up with the warning vehicle at the beginning of the test loop.
(3) If the test and control sections have not been salted, the test vehicle would perform skid patches along the test loop for a pre-salted skid friction reading. A test loop consisted of 6 skid tests along each leg of the test loop (i.e. collector/pre-wetted salt, collector/dry salt, arterial/pre-wetted salt, arterial/dry salt) for a total of 24 tests.
(4) Once the test driver either witnessed the completion of the salt application or was informed over the radio that salting was complete on the test and control sections, continuous monitoring of the test loop would begin. Skid patches were positioned far enough away from the transition point between dry salt and prewetted salt in order to eliminate any possible effects of vehicle tracking.
(5) Monitoring of the road conditions would continue until road conditions stabilized.
(6) The skid friction data sheet would be filed for future analysis.

## ANALYSIS OF DE-ICER PERFORMANCE

The 1994/1995 winter season experienced only 154 cm of snow, with the first storm taking place November 27, 1994. Twenty storm events were successfully monitored with the electronic decelerometer. The storms ranged in temperatures from -22 °C (not including a wind chill) to +1 C and ranged in snow accumulations from 5 to 24 cm. Temperature and snow accumulation data for each storm were obtained from the Atmospheric Environment Service.

The monitored storms were placed into three temperature ranges: mild storm events (0 to -4 °C), moderate storm events (-5 to -14 °C), and cold storm events (-15 to -24 °C). During the winter long trial 6 storm events fell into the 0 to -4 °C temperature range, 12 storm events fell into the -5 to -14 °C temperature range, and 2 storms fell into the -15 °C and colder temperature range.

As previously described in the test procedure, the Roads Superintendent would determine the application rate of dry salt which the City-wide spreader fleet would apply to the arterial and collector streets. All application rates called by the Roads Superintendent fell between 85 and 283 kg/2-

lane km (300 and 1,000 lbs/2-lane mi) with the most common application rates being 170 and 227 kg/2-lane km (600 and 800 lbs/2-lane mi). Therefore, if 227 kg/2-lane km of dry salt was called for by the Roads Superintendent, the corresponding application rate for the prewetted salt test section was 20% less or 181 kg/2-lane km.

Early in the testing it was found that the prewetted salt section (at the reduced application rate) did not perform all that differently than the dry salt section. Therefore, in order to ensure that it was the liquid calcium chloride that was responsible for the enhanced performance of the reduced salt application and not simply the fact that too much salt was being spread for that particular storm condition, the test section was split to include an additional test section of dry salt at the same application rate as the prewetted salt. Thus, if 227 kg/2-lane km of dry salt was called for by the Roads Superintendent, the corresponding application rates for the test sections were 20% less or 181 kg/2-lane km for the prewetted salt section and 181 kg/2-lane km for the dry test section.

## Mild Storm Events

Figure 8 reflects the condition of the prewetted salt test section, the dry salt test section, and the dry salt control section as a function of time from the initial application for a typical mild storm event. The weather for the December 11th storm, relative to the time of de-icer application, is shown in Figure 9.

Figure 8 depicts the original City-wide salt application rate call at 227 kg/2-lane km (800 lbs/2-lane mi) at 1:00 a.m. The corresponding test sections were salted at 181 kg/2-lane km (640 lbs/2-lane mi) prewetted with liquid calcium chloride and 181 kg/2-lane km (640 lbs/2-lane mi) of dry salt. A second application was called for 7:00 a.m., after a plow run.

From the Figure it can be seen that although the initial salt application was applied early in the storm, the rate of snow fall was greater than the melting capabilities of the salt. As a result, the brine covered over and slippery road conditions persisted. Even though the test vehicle did not record many skid patches between 2:00 a.m. and 7:00 a.m., it was assumed that all sections would be recording braking force readings in and around the 25% to 30% g range.

The storm subsided just hours before the morning rush hour at which time a plow run was called followed by a final salt application. The final salt application rates were the same as the original rates. Referring to the legend of Figure 8 one can see that the 227 kg/2-lane km dry salt control section performed similar to the 181 kg/2-lane km prewetted salt test section. However, the 181 kg/2-lane km dry salt test section lagged in de-icing performance by approximately 60 minutes.

Figure 9 shows that the total snow accumulation for the events was 7.4 cm and the temperatures hovered around the -4 °C mark.

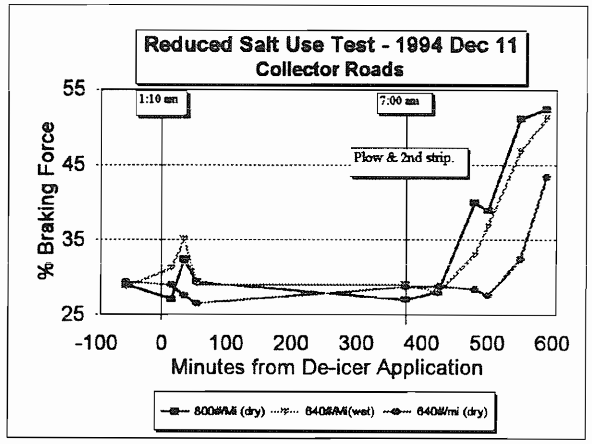


Figure 8. Mild Storm Event - Braking Force Readings

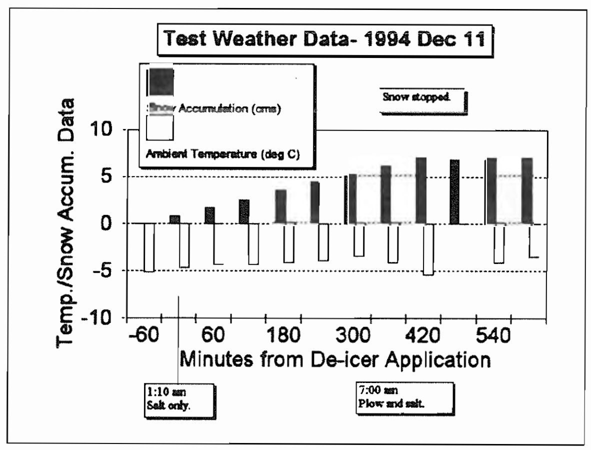


Figure 9. Mild Storm Event - Weather Data

## Moderate Storm Events

Figure 10 reflects the condition of the prewetted salt test section, the dry salt test section, and the dry salt control section as a function of time from the initial application for a typical moderate storm event (i.e. ambient air temperatures between -5 and -14 °C). The weather for this February 9th storm, relative to the time of de-icer application, is shown in Figure 11.

Figure 10 depicts the original City-wide salt application rate call at 170 kg/2-lane km (600 lbs/2-lane mi) at 1:00 p.m. The corresponding tests section were salted at 136 kg/2-lane km (480 lbs/2-lane km) prewetted with liquid calcium chloride and 136 kg/2-lane km (480 lbs/2-lane km) dry salt.

From Figure 10 it can be seen that after the salt had been applied the actual braking force readings reduced slightly from roughly 35% to 30% g's for all de-icers. However, within 60 minutes the skid friction readings were above their pre-application values. The graph also shows that the prewetted salt test section (136 kg/2-lane km) was performing slightly better than the dry salt control section (170 kg/2-lane km) 2 hours after the original applications, even at the reduced salt application rate. The dry salt test section (136 kg/2-lane km) lagged in performance by roughly 30 to 40 minutes.

Figure 11 shows that the total snow accumulation for the events was 4.4 cm and the temperatures hovered around the -8 °C mark.

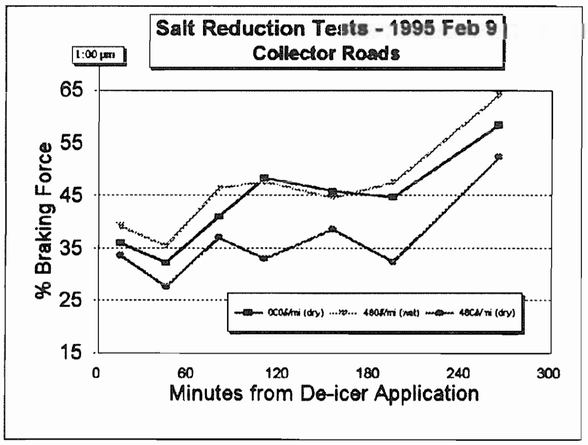


Figure 10. Moderate Storm Events - Braking Force Readings

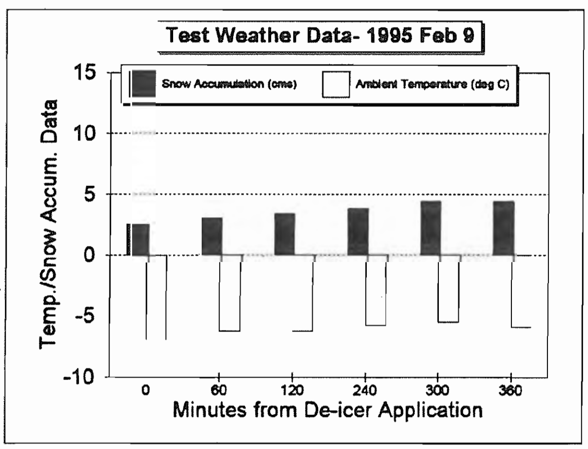


Figure 11. Moderate Storm Event - Weather Data

## Cold Storm Events

Figure 12 reflects the condition of the prewetted salt test section, the dry salt test section, and the dry salt control section as a function of time from the initial application for a cold storm event (i.e. ambient air temperatures colder than -15 °C). The weather for this February 6th storm, relative to the time of application, is shown in Figure 13.

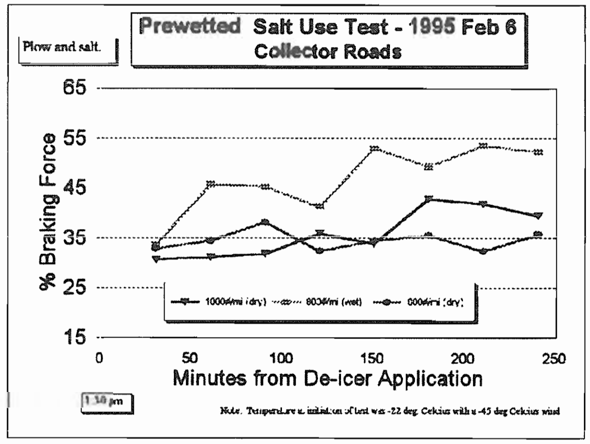


Figure 12. Cold Storm Events - Braking Force Readings

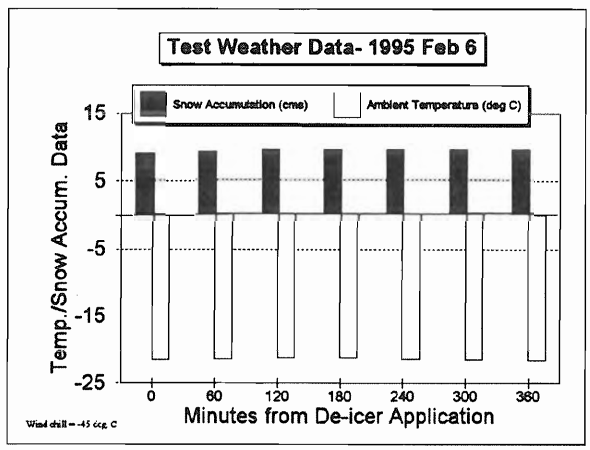


Figure 13. Cold Storm Events - Weather Data

Due to the extremely cold temperatures, the City-wide salt application rate call was 283 kg/2-lane km (1000 lbs/2-lane mi) at 1:30 p.m. The corresponding tests section were salted at 227 kg/2-lane km (800 lbs/2-lane mi) prewetted with liquid calcium chloride and 227 kg/2-lane km (800 lbs/2-lane mi) dry salt. The snow accumulation for this event ceased the previous morning. Even though salt's effectiveness is greatly suppressed at these temperatures, bright sunshine prevailed during the following day (February 6th), and as a result the Roads Superintendent called a City-wide salt application of 283 kg/2-lane km (1000 lbs/2-lane mi).

Figure 12, unfortunately, confirmed what our Roads staff already knew. Even with bright sunshine, dry salt at any application rate is ineffective at such extremely cold temperatures as were experienced on February 6th. However, Figure 12 also illustrated the enhanced performance of salt when prewet with liquid calcium chloride. Both dry salt sections remained dormant at a braking force of approximately 25% to 30% g throughout the test, whereas the wet salt section produced a braking force of 55% g in slightly over 2 hours and then stabilized.

# DISCUSSION

## PREWETTING EQUIPMENT

The on-board saddle tanks and the hydraulic pump designed to deliver the prewetting liquid was purchased for $3,500. Installation of the on-board prewetting kit took upwards of two days. The reason for the excessive installation time stemmed from, what shop staff determined was, inadequate anchoring of the saddle tanks to the frame of the V-hopper spreader. The manufacturer recommended that simply placing the tanks snug to the hopper and filling them with liquid would wedge them and keep them in place. However, as the tanks emptied, they tended to move. As a result, shop staff fabricated two braces to secure the tanks to the spreader frame.

The kit was installed on a tandem spreader with dual spinners. For simplicity, only one spray bar was installed over the main conveyor. If both spinners were required, the flow of prewetted salt would simply be split into two as it dropped onto the two side conveyors. Should continued testing identify that the liquid application would be more effective closer to the spinner, the liquid delivery line would have to be split into two; one line leading to each spinner. Each line would require some form of valve to enable one or two spinner operations.

## COST-EFFECTIVENESS

For mild and moderate temperatures the trial illustrated that prewetting salt with 8% liquid calcium chloride by weight resulted in a 20% reduction in the use of road salt while maintaining the same de-icing effectiveness. The trial also illustrated the enhanced performance of prewetted salt, ***even at a reduced application rate***, over that provided by dry salt in very cold temperatures.

The cost of salt delivered and stockpiled in the salt domes was $58.00 per tonne. The cost of the liquid CaCl for the trial was $0.11 per litre. At a dry salt application rate of 227 kgs/2-lane km, this strategy results in a savings of $1.42 per 2-lane km. The Department currently supports 1295 lane kms of salt routes, not including turning lanes (895 lane-kms are Regional and 400 lane-kms are City).

During the past five winters the Department has experienced mild winter seasons which produced only 155 cm of snowfall where the fleet used 20,000 tonnes of salt. The Department has also experienced severe seasons which produced 344 cm of snowfall where the fleet has used 40,000 tonnes of salt.

If prewetting with calcium chloride had been in place for the 20,000 tonne winter season, the Department would have saved $232,000 in salt; however, the Department would have also had to spend an additional $106,000 in liquid calcium chloride costs. The overall savings for a mild winter would be in the order of $126,000. Similarly, if prewetting with calcium chloride had been in place for the 40,000 tonne winter season, the Department would have saved $464,000 in salt and spent an additional $212,000 in liquid calcium chloride for an overall savings in the order of $252,000 for a heavy winter season. Capital and installation costs of the on-board equipment have not been included.

The actual savings per km would ultimately depend on three factors:

(1) The actual salt application rate called. This ranges between 85 and 283 kg/2-lane km with the majority of calls averaging around the 227 kg/2-lane km rate.

(2) The selected salt reduction rate. The current trial set this salt reduction rate at 20%. Based upon technical literature, this can vary from 10 to 40%. These trials, if continued, will converge upon a salt reduction rate with which management and staff are confident will not jeopardize the current level of service in the Ottawa climate.

(3) The selected amount of liquid for purposes of prewetting. The current trial set the percent liquid calcium chloride by weight at 8%. Based upon technical literature, this rate is at the high range. Other agencies have reported benefits of prewetting salt with 4% liquid calcium chloride by weight. Again, these trials, if continued, will converge upon a percent liquid calcium chloride by weight with which management and staff are confident will not jeopardize the current level of service in the Ottawa climate.

Figure 14 illustrates the relationship between the selected salt reduction, the selected percentage liquid calcium chloride by weight, and the material savings that can be expected when spreading salt at 227 kg/2-lane km.

The large rectangle in the figure signifies the savings per km that is expected from the salt reduction setting and the percentage liquid calcium chloride by weight settings selected for this past winter-long field trial ($1.42). Based upon findings to-date, staff could safely reduce the percentage liquid calcium chloride (at least in the mild to moderate temperature ranges) to increase the material savings. Reducing the percentage liquid calcium chloride while maintaining the 20% salt reduction goal would move the dollars saved per km by prewetting salt along the arrow marked "A". Similarly, increasing the percentage salt reduction while maintaining the 8% liquid by weight prewetting setting would move the dollars saved per km by prewetting in the direction marked by the arrow marked "B".

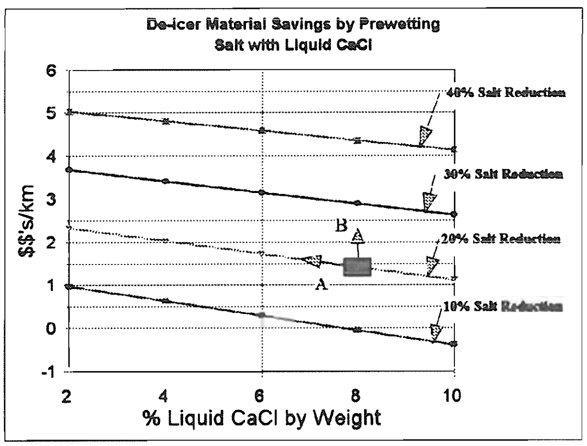


Figure 14. Prewetting Material Savings Relative to Dry Salt

## CONCLUSIONS

Prewetting salt with 32% calcium chloride in solution at a rate of 8% by weight reduced salt use by 20% while maintaining the same de-icing effectiveness for storm events which take place during mild and moderately cold ambient temperatures. However, in very cold temperatures prewetting salt with liquid calcium chloride resulted in an enhanced de-icing performance, even at the reduced salt application rate relative to dry salt. Based upon these factors and historical salt use data, the Department would realize a material savings of $126,000 to $252,000 per winter.

## RECOMMENDATIONS

Prewetting field trials should be continued into 1995/1996 and expanded to encompass an entire maintenance district. This would enable staff to confirm the reduced material costs of prewetting salt relative to the use of dry salt in the other maintenance districts through the MMS tracking system that is already in place. This recommendation would require that all the spreaders in one maintenance district be outfitted with saddle tanks and that procedures be put in place to ensure prewetting takes place and that accurate salt consumption figures are recorded.

The 1994/1995 trials illustrated conclusively that prewetting salt with 8% by weight liquid calcium chloride resulted in a similar or enhanced de-icing performance, even at a reduced salt rate. However, as can be seen, additional savings can be attained through a reduced liquid ratio or an increased salt reduction. It is recommended that decelerometer testing continue, especially during the storms that take place in the mild and moderate temperatures, to increase the material savings per km through reduced liquid ratio or an increased salt reduction.