uses for this product: (1) Ice control, (2) Soil stabilization, and (3) Dust control. This article will give you a first hand account of why these towns are using CaCl₂ and what results they have experienced. Other articles in this newsletter will also discuss using CaCl₂ on local highways. As a rule, using CaCl₂ will increase road performance and reduce maintenance costs.

Ice Control
Keene Expands Calcium Chloride Program

Liquid calcium chloride is playing a much larger role this winter in Keene, New Hampshire’s deicing program. After five years of having only one truck-mounted spray system to pre-wet rock salt and abrasives, the city is taking delivery of four more units.

“We get a lot of ski resort and commercial traffic through the city,” says Bruce Tatro, Keene’s highway superintendent. “Keeping our primary routes clear will be easier with five units. Now we can cover up to 100 miles with the liquid calcium, instead of treating only 15 to 20.”

For the last five years, Tatro reserved his sole liquid calcium truck for hard-to-clear patches of road, such as shady and hilly areas. He observed how well the liquid calcium chloride worked.

“Pre-wetting salt and abrasives with a calcium chloride solution did a faster

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and more thorough job," says Tatro. "We got quicker melting activation with the material than with salt alone. We

"Pre-wetting salt and abrasives with a calcium chloride solution did a faster and more thorough job."

also found that the areas reserved for calcium chloride required a third less salt."

Salt is fairly effective at 32° F, but its ability to melt snow and ice decreases dramatically as the temperature reaches 20° F. Calcium chloride enhances salt's melting ability at below-freezing temperatures by attracting moisture and generating heat, the two factors essential for salt to melt snow and ice.

Tatro likes the control the truck-mounted unit provides. The driver pumps a 32 percent liquid calcium chloride solution, manufactured by General Chemical Corporation, from the tank to the salt/sand mixture as it leaves the truck, using a spray bar mounted over the spinner. This allowed Tatro to selectively treat trouble spots. He found that the calcium chloride also helps sand

Salt is fairly effective at 32° F, but its ability to melt snow and ice decreases dramatically as the temperature reaches 20° F. Calcium chloride enhances salt's melting ability

and salt imbed better into snow and ice, which cuts down on spreader bounce and product waste.

"We should have an easier time clearing roads this winter with more liquid calcium chloride," says Tatro. "The material works so well that we're also looking to apply it on sidewalks in our downtown business area."

Full-depth Reclamation
Fitzwilliam Cuts Costs with Calcium Chloride

Budget cuts often require highway

superintendents to change their plans, sometimes even in mid-project. Road Agent Ed Mattson discovered that an unexpected event can lead to a positive solution.

In 1989, Mattson's department in Fitzwilliam, N.H., appropriated $50,000 to refinish West Lake Road, which makes up one mile of Fitzwilliam's 52 miles of roads. Mattson began preparing the road for a three-inch pugmill mix - an expensive treatment, given the amount of oil needed in making the mix. His crew spent $15,000 preparing the road, replacing culverts and removing rocks. At that point, a mid-year tax cut eliminated the funds Mattson needed to complete the process.

"As an alternative, I decided to try full-depth reclamation with a 35 percent liquid calcium chloride solution," said Mattson, who had heard about the process the year before at a New Hampshire Road Agents Association seminar. "I knew it would be less expensive than the pugmill mix because we'd be reusing the existing base and top instead of buying additional materials."

A liquid calcium chloride distributor and contractor, All States Asphalt, performed the work by first pulverizing the existing base to a depth of six inches using a reclaiming machine. A distributor truck then saturated the exposed base with liquid calcium chloride, manufactured by General Chemical Corporation, at a proportion of a half gallon per square yard. After the reclaiming machine made a second pass over the materials, the road was shaped, graded and rolled, then sealed with another half gallon of liquid calcium chloride.

"Reconstruction took place on a rainy day, which was really the worst of conditions," recalled Mattson. "The road took a bit longer than usual to firm up," said Mattson. "But when the excess water evaporated or drained off, the surface was as hard as asphalt. It was unbelievable.'"

Mattson left the road without any additional surface until the following summer. To keep it in shape, he regraded it several times. The calcium chloride improved the cohesion of the aggregates and fines, so the road stayed together during grading.

"Each time we regraded, I could tell the calcium chloride was working," said Mattson. "The road was much easier to work with than our other untreated roads, and showed far less rutting and potholes. Between gradings, the road stood up to months of rain, snow, and traffic without any real structural damage," Mattson recalled.

To date, Mattson has reclaimed four miles of Fitzwilliam's roads using liquid calcium chloride, and plans to do another 6,000 square yards in 1993.

"Calcium chloride has become a key element of my road maintenance program," said Mattson. "I've come to see that conducting reclamation without liquid calcium is like throwing money away. It cuts down on time, labor and materials, which all add up to money saved."

Dust-Free or Deteriorated
New Boston and Dublin Take Control With Liquid Calcium Chloride

Billing dust clouds, potholes, and

"I didn't create a dust control program until I realized how much aggregate was lost each season."

expensive maintenance can await municipalities that don't have a reliable way to stabilize unpaved roadways.

To avoid such conditions, road supervisors from thousands of communities know that liquid calcium chloride is highly effective in keeping dirt roads compact and dust-free. The towns of New Boston and Dublin, N.H., are typical examples. Officials there say that the material suppresses dust and makes their roads harder and more durable,
resulting in less grading and less potholes.

The town’s prepare their unpaved surfaces by grading and raking. Then a 35 percent calcium chloride solution, supplied by All States Asphalt and manufactured by General Chemical Corporation, is applied at a rate of 0.3 gallons per yard. As the calcium chloride solution penetrates the road, it coats tiny particles of fines and gravel, binding them together. This binding action stabilizes the road, keeping it dense and compacted.

Brian Barden, road agent for Dublin, began using liquid calcium chloride three years ago after learning about it at local road seminars. “I didn’t create a dust control program,” he says, “until I realized how much aggregate was lost each season.” One study estimates that a single car travelling an untreated road once a day for a year would throw off a ton of gravel per mile. Road stabilization projects and engineering studies have shown that using calcium chloride reduces the replacement cost of gravel and other materials up to 80 percent, as well as cut grading costs as much as 50 percent.

Barden applies 6,000 gallons of liquid calcium chloride annually on eight of his 18 miles of dirt roads. He says the investment has paid off. “The roads require less preparation and maintenance compared to when I used nothing at all,” he reports. "They harden up so well that I only grade them one or twice a year compared to four times without the calcium chloride.”

In New Boston, Road Agent Lee Murray first used liquid calcium chloride last year and reports the same results. “The roads tightened up real well once we applied the calcium,” says Murray.

“The roads tightened up real well once we applied the calcium,” says Murray.

Dust Control: Why? & How?

Calcium Chloride for dust control is a “fines” choice

When you see dust coming up from your roads you are really seeing dollars thrown to the wind. Road dust is made up of fine particles that are important to the stability of your road. On a surfaced road we usually use asphalt to “glue” the aggregate in our wearing surface together. On a gravel road the fines act as the “glue.” These fines are small enough to pass through a #200 size sieve and they feel like powder when rubbed between your fingers.

When fines blow away the gravel road begins to break down. Traffic scatters the coarser aggregates causing potholes, ruts, washboards, loss of profile, loss of ditch lines, and other problems. One study estimates that a single car traveling an untreated road once a day for a year would throw off a ton of gravel per mile.

Wetting the road surface helps to keep dust and dust related problems in check. Moisture helps fines adhere to each other and to aggregates allowing for optimum compaction. The trick is to keep the road moist. Treating your gravel road with calcium chloride (CaCl₂) is one way to do this.

CaCl₂ absorbs water vapor from the air and liquid water from the roadbed. At 77°F and 75% humidity, for example, it absorbs more than twice its weight in water. In addition, the low vapor pressure and high surface tension on CaCl₂ solutions means that they attract more moisture to the road that they give up in evaporation. The road remains dense and compact under almost any level of traffic because CaCl₂ keeps materials on the road by keeping moisture in the road, even under a burning sun on a sweltering day.

A six step procedure is recommended to stabilize a gravel road with CaCl₂:

1. Scarify the existing granular surface.
Quebec gives calcium chloride \((\text{CaCl}_2)\) a confident “ok.”

This article first deals the Quebec decision and then presents answers to specific questions that may concern you.

In 1989 Quebec’s Ministry of Transportation and Highways called for a toxicity study. In 1990 the Ministry of Environment completed the requested toxicity study and reported that calcium chloride and calcium lignosulfonate are two dust control agents which have been found satisfactory when used according to good sprayed application practices.

Mr. L.T. Hubbard, P.E., Director of Municipal Liquid and Environmental Waste Branch, Environmental Protection Division, stated in a letter to the Ministry of Transportation:

*We have assessed the results of these tests and our assessment has not indicated any definite areas of environmental problems. In this regard we have no objection to the continued use of these products, subject to the use of good application practices which minimize potential impacts on the receiving environment.*

Mr. Hubbard went on to say that training programs are recommended “for all individuals working with these materials, to familiarize them with guidelines for application…” The Technology Transfer Center also believes training is important. We were particularly pleased to see New Hampshire towns using the application rates and procedures set up by General Chemical. These are the same recommendations set forth by the Quebec Ministry of Environment and Ministry of Transportation.

**Questions & Answers**

**Question:** What happens if \(\text{CaCl}_2\) gets into the drinking water? Is it harmful?

**Answer:** The maximum tolerance of chloride concentration in water for domestic purposes has been set at 250 mg/1 by the U.S. Public Health Service. The restriction on drinking water, however, is based primarily on aesthetics of taste and palatability rather than health. The taste threshold values of \(\text{CaCl}_2\) have been reported to range from 150-350 mg/1. Water containing chloride concentrations as high as 2000 mg/1 has been reportedly consumed by humans without adverse effects. In fact, St. Charles County in the state of Maryland actually uses \(\text{CaCl}_2\) to mineralize their soft water wells (when using \(\text{CaCl}_2\) to treat drinking water all specifications included under AWWA B550-90, Standard for \(\text{CaCl}_2\), must be adhered to).

**Question:** Does \(\text{CaCl}_2\) migrate and end up in a water table?

**Answer:** Chloride contamination of ground water tables and aquifers is due more to surf ace runoff of deicing applications than to road stabilization or dust control. Water pollution from deicers is primarily limited to shallow wells near roads and small ponds and streams that get direct runoff from roadways. A study conducted in Maine found chloride concentration related directly to distance from a road. \(\text{CaCl}_2\) migrates slower than the typical road salt used on New Hampshire roads. When properly used for soil stabilization, \(\text{CaCl}_2\) tends to stay where it is placed. In dust control applications there is no indication that negative environmental effects have occurred from the use of calcium chloride. At this time studies pertinent to full-depth reclamation indicate that the migration of \(\text{CaCl}_2\) in silty clay soils under paved surfaces is very slow. The migration occurs vertically through the soil depending on rainfall and evaporation. Samples, taken from Route 108 in West Peru, ME, showed that 4/10 of a pound of \(\text{CaCl}_2\) per square yard remained in the road base material after 24 years.

One study showed that higher water tables carried \(\text{CaCl}_2\) from soils with an extreme amount of silts. \(\text{CaCl}_2\) should not be placed in areas which often contain high, receding ground water tables. As a precaution, do not use \(\text{CaCl}_2\) in roads where the drainage is particularly poor.

**Question:** Does \(\text{CaCl}_2\) affect trees and other vegetation?

**Answer:** \(\text{CaCl}_2\) is less toxic than sodium chloride (typical New Hampshire road salt) to roadside vegetation. Sodium salts may indirectly affect plant growth by altering the soil structure, its permeability, and aeration. Sodium is also deemed toxic to certain species of plants and trees, with excess amounts causing leaf burning and browning. Calcium, on the other hand, is frequently found in soils and it appears essential for plant growth. \(\text{CaCl}_2\) has even been added to soils in order to replace undesirable sodium ions and restore soil fertility. Chloride ions do not enter the water moisture bound to soil particles.

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...cium and sodium, however, do enter soil moisture layers. Thus chloride ions pass through the soil more rapidly than calcium or sodium.

Additionally, it should be kept in mind that salt may be falsely blamed for plant injury from gasoline and diesel engine emissions. The Environmental Health Service reports that gases such as ozone, nitrogen dioxide, ethylene, and chloride account for the most widespread injury to plant life, destroying plant chlorophyll, disrupting photosynthesis, and reducing the plant's food production. 8

Question: What can I do?

Answer: According to Better Roads, June 1991, many factors determine how road salt affects plants. These include amount of salt applied, how soon plowing occurs after application, soil quality and drainage, slope, how much snow melt runs off before the ground thaws, and the type of trees present. The type of salt also is important. Experiments show that sodium chloride is at least five to ten times more toxic to elm and white pine than calcium chloride.

One thing you can do is design plantings to minimize the effects of deicing salts. Place the most salt-tolerant and persistent turf species adjacent to the road. Plant deciduous and evergreen trees as far from the roadway as possible. Plant trees sensitive to salt, such as maples, hemlock, birch, and some pines, 30 or more feet from a highway.

Where snowplow and vehicular splash is present, select the most spray-tolerant species. Also, do not plant salt sensitive trees and plants on slopes below the roadway. And, finally, place shallow diversion ditches between the road and woody plantings.

There are some ways to limit salt caused pollution or vegetation damage. One is to use deicers that cause less environmental damage than road salt, or materials that reduce the amount of road salt used. For example, CaCl₂ melts more ice in less time than sodium chloride, especially at lower temperatures. Also, CaCl₂ goes into solution more rapidly than sodium chloride, so less is wasted during plowing. Both of these benefits mean that less salt is needed to maintain bare pavement. The result is a reduction of salt-caused pollution and damage to plants.

Another strategy is to pre-wet sodium chloride with liquid CaCl₂. Liquid CaCl₂ increases salt efficiency, improves the application pattern, reduces salt loss, and decreases the frequency of salt application.

References:
4. Ibid

For more information on the use of Calcium Chloride in road applications and its environmental effects contact the T² Center at 800-423-0060 (NH only) or 603-862-2826.

Full Depth Reclamation

Using calcium chloride (CaCl₂) for base stabilization

When used in new construction or during full depth reclamation, CaCl₂ can increase compaction of road materials, reduce frost heaving, increase load bearing capacity, and double the life of the road after paving. Numerous studies are available to back up the claims of CaCl₂ (see the end of this article for a listing of these studies).

New Construction

During new construction, using liquid CaCl₂ will help in the compaction process. The CaCl₂ helps to properly maintain moisture levels. The maintenance of optimum moisture during construction is the most important factor in obtaining maximum density and uniformity, both of which are necessary for good performance. Moisture limits for maximum compaction are strict. A variation of only 1% from optimum may reduce density by over two pounds per cubic foot and increase the voids by as much as 8%.

During the hot summer months, maintaining the proper moisture level is particularly difficult due to the rapid evaporation occurring at the time of construction. In these situations a higher rate of liquid CaCl₂ is prescribed (check with your distributor for details concerning application rates).

Three properties of liquid CaCl₂ contribute to compaction of materials:

1. Liquid CaCl₂ lubricates the fines so they will compact faster. Due to the high surface tension of the solution, the aggregates tend to stick together better. That means the road will require less compaction for it to reach maximum density.

2. CaCl₂ continually attracts water to the road base, and its lower vapor

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2. Select and add aggregate as needed.
3. Add 1% CaCl$_2$ by weight of aggregate as needed.
4. Mix all materials.
5. Create a 4% slope on either side of the crown.
6. Compact the surface uniformly.

CaCl$_2$ is generally sprayed as a 35% solution using a tank truck with a rear-mounted distribution bar that spreads the liquid evenly over the road. One pass will cover an 8- to 12-foot-wide road. Two passes are needed on roads 16 feet to 18 feet wide.

The New Hampshire town road agents we spoke to said that they first shape up their roads, shoot them with a 35% solution of liquid CaCl$_2$, and then role them to get good compaction. The rolling is highly recommended by Brian Barden, road agent for Dublin. Lee Murray, road agent in New Boston cautions not to use the CaCl$_2$ flake. The liquid does a much better job. "It worked so well for New Boston that the selectmen want to do more this year," he told us. "It held my road together and kept my grading to a minimum."

As soon as CaCl$_2$ enters a road it is attracted to negatively charged soil particles, such as clays, which help resist leaching. CaCl$_2$ may move deeper into the base during wet weather, but will rise toward the surface through capillary action during dry spells.

An unpaved road stabilized with CaCl$_2$ retains a smooth dustless surface. The moisture retained by the calcium chloride keeps the surface plastic enough so fines can migrate into gaps formed between aggregates under the varying pressure of car and truck traffic.

In summary, calcium chloride...

- reduces the amount of gravel needed in construction and maintenance
- extends the service life of the gravel wearing course decreasing blading and shaping
- is a viable cost effective alternative to an asphalt surface treatment
- controls dust, and reinforces stabilization
- helps to improve roads when used over time

Information for the above article came from Constructioneer, August 20, 1990, from Better Roads, June 1991, the Cornell Local Roads Program publication, Nuggets and Nibbles, April 1989, and from conversations with New Hampshire road agents.

Dust...

An Old Problem...

A Modern Solution...

Apply Liquid CaCl$_2$
Pre-Mixing & Pre-Wetting Salt

Deicing properties, benefits, and application of calcium chloride (CaCl₂)

To be effective at lower temperatures, salt requires heat and moisture—two things often lacking on cold, dry winter days. Typical New Hampshire road salt begins to lose its effectiveness as the temperature drops. Between 30°F and 25°F road salt can lose 61% of its effectiveness. At 20°F salt can become 81% ineffective. Calcium chloride (CaCl₂) melts up to eight times as much ice as does salt alone within the first 30 minutes at 20°F following application. Premixed with salt and abrasives, CaCl₂ becomes a cost-effective edge for winter road safety.

Properties of CaCl₂

- **Exothermic**: CaCl₂ releases heat as it melts to speed salt’s melting ability.
- **Hygroscopic**: CaCl₂ attracts moisture and dissolves quickly to activate rock salt’s melting action.
- **Fast Acting**: CaCl₂ begins to dissolve immediately upon application to break the bond between pavement and ice.
- **Powerful**: CaCl₂ brine remains active for prolonged periods of time to prevent ice from bonding to the highway.
- **Low eutectic point**: CaCl₂ melts to much lower temperatures than salt; controlled studies prove its effectiveness down to -59°F.

Benefits of CaCl₂

- **Highway Safety**: studies show that, in 85% of applications, CaCl₂ salt mixtures achieve bare pavement faster than salt alone at temperatures near 30°F, to ease traffic and reduce accidents.
- **Savings**: CaCl₂ increases salt’s effectiveness, therefore reducing the number of applications necessary during storms-saving manpower, equipment and material costs. Plus, it freeze-proofs abrasives to help them embed in ice and snow, so you lose less material to spreader bounce and traffic scattering.
- **Results**: calcium chloride’s superior melting action helps highway officials achieve maximum results from other maintenance materials.

Pre-Mixing with Flake CaCl₂

Pre-mixing refers to using flake CaCl₂ mixed with salt and/or abrasives prior to deicing application. Pre-mixing provides both initial melting action and long-lasting protection.

Mix flake CaCl₂ with rock salt by placing the desired amount of each in two piles on a bituminous pad, and combine them with a front end loader.

When the salt is damp, the best mixing method is to load the chemicals into the hopper spreaders in layers, and allow them to mix as they are spread.

Pre-Mix Application

Optimal premix application rates fall in the range of approximately 200 lbs to 300 lbs per two-lane mile. The exact amount depends on snow and ice accumulation and temperatures. Hills and intersections should be treated first. On all roads, it is recommended that materials be spread in a winrow down the center line. Traffic will work it out to the edges without pushing it off the shoulder.

- **Business districts & residential areas**: High traffic volume and mild temperature ranges in downtown areas allow good road-clearing results with light premix applications. Where traffic is heavy and fast, spread a fairly wide winrow 4' down the center of the road.

In residential areas, where traffic is slower, spread premix in a narrow winrow 2' down the center of the pavement, and flare out coverage at stop lights.

- **Rural areas**: To reveal the center line as quickly as possible on country roads, spread premix down the center in a narrow winrow 2' wide. This enables drivers to see the lines and stay in the correct lane.

- **Expressways**: A 6' spread is required with heavier applications on ramps and passing lanes.

Preparing & Applying Wetted Salt

At 25°F, rock salt takes a full 19 minutes to embed in ice and hard-packed snow. But wetted with a 32% CaCl₂ solution, rock salt immediately digs-in and holds a close pattern on winter roads as temperatures drop down to 0°F. Wetted salt reduces the need for frequently repeated applications, decreasing material use by as much as 40%.

Storing a solution of 32% CaCl₂ in bulk tanks provides an efficient means of spraying rock salt as needed. Except for the equipment and adaptation methods described below, wetted salt application techniques vary only slightly from those for conventional rock salt.

- **Spraying in the spreader truck**: Load rock salt into the spreader truck and drive it beneath a spray bar and spray the amount of liquid CaCl₂ needed onto the salt. Usually a 32% solution of CaCl₂ is applied at an average of 12 gallons per ton.

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pressure resists evaporation even during periods of low humidity and high temperature.

3. In addition, a co-valent bond is established between the positive calcium cation (Ca++) and negatively charged soil particles. This bond yields a tighter compaction and tends to anchor CaCl₂ in the soil.

Full Depth Reclamation

In situations where the road is not strong enough to carry the traffic, merely doing a shim and overlay will prove unsatisfactory. Base failures will often reflect through a new overlay. One solution to this problem is to use full depth asphalt reclamation.

During the reclamation process, liquid CaCl₂ can be added to assist in obtaining the required strength in the base.

Step 1: Pulverize the existing bituminous surface with the underlying gravel base to a design depth of approximately 6" creating a uniform aggregate composition.

Step 2: Apply a 35% solution of liquid CaCl₂ to the reclaimed base using a distributor truck via a rear mounted spray bar. Spray about 0.75 gallons per square yard.

Step 3: Grind the road again to ensure thorough mixing of the materials with the liquid CaCl₂.

Step 4: Shape the road, fine grade it, and roll it to achieve good compaction.

Step 5: Apply an additional 0.25 gallons of liquid CaCl₂ to seal the new surface.

Step 6: Allow the base course to cure for several weeks before an asphalt overlay or other wearing surface is placed.

Protection Against Frost Heaves

In 1983 Alaska was researching the possibility of converting portions of the Alaska Highway into a high speed gravel road. They knew the Yukon government was already treating its part of the highway with CaCl₂ and achieving good results. The Alaska study indicated that not only would treating the highway with calcium chloride result in better roads at less cost, but that it would significantly reduce frost heaving.

- Four soil samples (containing 0%, 0.1%, 0.24% and 0.49% CaCl₂ by weight of soil) were kept at 20°F for nearly a week. Only the sample without CaCl₂ froze.

- All samples were subject to three freeze-thaw cycles of 48 to 72 hours at 0°F followed by 24 hours at 40°F.

- There was a dramatic inverse relation between heave and CaCl₂ content of the samples. With only 0.5% CaCl₂ by weight, there was a heave reduction of over 85%.

In another study, Floyd Slate, Purdue University, was able to demonstrate a number of important properties of CaCl₂ in a roadway.

- The horizontal migration of CaCl₂ in soil is minimal. Thus, CaCl₂ stays where it is put. It does not run off to the sides of the road to harm the environment (see the article in this issue on the environmental effects of CaCl₂).

- CaCl₂ in solution is carried down into the sub grade by rain, and will rise toward the surface of a road as the water evaporates during dry weather. But, because of its low vapor pressure and high surface tension, calcium chloride itself will resist evaporation. Instead, its hygroscopicity will draw additional

Pre-Mixing & Pre-Wetting...
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- Spraying during application: Spreaders trucks equipped with CaCl₂ tank-feeding systems provides an effective means of pre-wetting salt. A measured amount of CaCl₂ is sprayed directly onto the salt/sand mix and spread simultaneously. A cab-mounted on/off switch lets the driver control when and where it’s applied. This allows the operator to accommodate varying temperatures and snow and ice conditions, resulting in maximum effectiveness with minimal waste.

Cost Savings

Because CaCl₂ increases the efficiency of sand and salt, materials go further. Road superintendents report reductions of 10 to 20% on materials and 20% on labor.

By increasing the efficiency of salting operations, especially at temperatures below 25°F, second and third plowing runs can be eliminated. With less runs, there is a decrease in labor and less equipment wear.

The first assault on a storm is the most important. A combination of salt mixed with either liquid or flake CaCl₂ can help municipal road crews’ fight winter storms.

Sample Economic Evaluation of Calcium Chloride

You can use this evaluation sheet supplied by the City of Keene, NH to evaluate the use of calcium chloride as a deicing agent.

Data Collection

1. Estimate the number of tons of road salt being used each year. 375 (1)

2. Estimate the percentage reduction of the total amount that is used when temperatures range from 0° to 25°F. 60% (2)

3. Estimate the percentage reduction in salt usage that is expected (Suggestion: if rates are now high use 40%; if low, use 30%). 30% (3)

4. Record the cost of road salt, per ton. 35.00 (4)

5. Record the cost of liquid calcium chloride, per gallon (about $0.75 per gallon). 0.75 (5)

6. Select the number of gallons of calcium chloride to be applied to each ton of road salt (Suggested rate: 8 to 10 gallons per ton). 10 (6)

7. Estimate the average capacity of salting trucks in tons. 6.5 (7)

8. Estimate the average time it takes to return from a route, reload and drive to the next starting point. 1 (8)

9. Estimate the average hourly cost of labor used on each truck. This should include whatever local burdens are appropriate (e.g., fringes, overtime, supervision, support, etc.). 18.00 (9)

Evaluation Usage in The Temperature Range of 0° to 25°F

10. Calculate the amount of salt currently used: $375 \times \frac{60}{100} = 225$ (10)

11. Calculate the amount of salt to be saved: $225 \times \frac{30}{100} = 68$ (11)

12. Calculate the amount of salt that will continue to be used: $225 - 68 = 157$ (12)
Material Cost Savings

13. Calculate the annual savings in salt costs:
\[
\frac{68}{(11)} \times \frac{35}{(4)} = \frac{2380}{(13)}
\]

14. Calculate the annual cost of liquid calcium chloride:
\[
\frac{157}{(12)} \times \frac{10}{(6)} \times \frac{0.75}{(5)} = \frac{1177.5}{(14)}
\]

15. Calculate the annual net material savings:
\[
\frac{2380}{(13)} - \frac{1177.5}{(14)} = \frac{1202.5}{(15)}
\]

Labor Cost Savings

16. Calculate the number of truck loads of salt corresponding to #10 above:
\[
\frac{225}{(10)} + \frac{6.5}{(7)} = \frac{35}{(16)}
\]

17. Calculate the number of hours spent between:
\[
\frac{35}{(16)} \times \frac{1}{(8)} = \frac{35}{(17)}
\]

18. Calculate the hours saved with reduced salt usage:
\[
\frac{35}{(7)} \times \frac{30\%}{(3)} = \frac{10.5}{(18)}
\]

19. Calculate labor cost savings:
\[
\frac{10.5}{(18)} \times \frac{18}{(9)} = \frac{189}{(19)}
\]

Total Estimated Savings

\[
\frac{1202.5}{(15)} + \frac{189}{(19)} = \frac{1391.5}{(20)}
\]

Economic Payback Period

21. Calculate the number of years (or seasons) needed to payback the $???? equipment costs (for this sample we used $3,500).
\[
\frac{3500}{(20)} + \frac{1391.5}{(20)} = \underline{2.51}
\]

*The numbers in the above sample may not work for your municipality.*

*Try plugging in your own numbers and doing your own analysis.*
Corrosion

Plastic Flamecoating, a new corrosive resistant product, is now being tested in New England

Road agents and public works directors have expressed concern about the use of calcium chloride because of its corrosive properties. Corrosion, however, is not a problem unique to calcium chloride. Sodium chloride, common New Hampshire road salt, is also a major source of corrosion.

Metal corrosion occurs when negatively charged chloride ions meet with metal in the presence of oxygen. Oxidation takes place and the metal gradually breaks down. Negatively charged chloride ions are formed when salt comes in contact with water. It is suspected that calcium chloride tends to cause more corrosion than sodium chloride because of its hygroscopic property. This means that calcium chloride will attract moisture from the air even at fairly low levels of humidity. Furthermore, liquid calcium chloride is, by definition, already in solution. Thus calcium chloride is often in contact with water, oxygen, and your equipment all at the same time. A prime combination for corrosion.

The corrosion problem in your hoppers and on your trucks is similar to the corrosion you've run across in an old flashlight. But flashlights are easier and less expensive to replace. In the U.S. alone, $7 billion is spent annually to fight the inevitable corrosion of metals. Public agencies, whose equipment is subjected to an extremely corrosive environment, are often forced to scrap otherwise mechanically sound pieces of equipment.

As equipment budgets shrink, it has become necessary to extend equipment life to the limit. One solution to the corrosion problem is to put a protective coating on the metal.

A new coating technology, Plastic Flamecoat, is now being used by public agencies nationwide to address this issue. In New England, Dan Bennett, Director of Equipment Maintenance, City of Burlington, VT, has Plastic Flamecoated one of his newly ordered road salt auger-boxes. Dan is testing this coating system on the auger-box, as it is traditionally the most corrosion prone piece of equipment in his fleet. If successful, Plastic Flamecoat will be specified on critical areas of his new equipment (e.g. snow plows, dump beds, sweepers, vac trucks, lawn equipment, salt-hoppers, etc.). We understand that the NHDOT is also testing this new coating. These test applications will be tracked throughout the winter. The results will be published in a future Road Business for your benefit.

The Plastic Flamecoating being tested and discussed above is manufactured by DuPont. It is a thermoplastic powder-coating system. It is designed to be corrosion, chemical, and abrasion resistant. For more information contact Dan Bennett, City of Burlington, VT, (802)264-0166 or Patrick McDonnell, Righter Corporation, Woburn, MA, (617)838-7124.
Mark Your Calendar
June 8, 1993

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