OPERATIONS WORK SESSION
Monday, July 25, 1994

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Kentucky Department of Highways

CHEMICALS--WHAT'S NEW, TRIED AND TRUE APPLICATIONS

Before getting into my topic of deicing chemicals, let me give you some information on the Kentucky Department of Highways as it relates to our size, our responsibilities, and our background in snow and ice removal.

The Department has 27,338 centerline miles on roads to maintain throughout the Commonwealth. We have an annual maintenance budget of $130,851,000 to maintain this system of roads. In regard to snow and ice removal, we have an annual budget of $8,304,000 designated for this activity.

When addressing snow and ice removal, we measure our responsibilities by two-lane miles, which is the basis of our treatment plan for applying deicing materials. Our two-lane miles of responsibility total 30,146 miles.

Currently, we have 870 trucks equipped with plows and spreaders assigned to the snow and ice removal program. In addition, we have 162 graders and three snowblowers available for use, when needed.

The last winter's snow and ice removal program proved to be an historical event for the Department. We set a record for both salt usage (166,471 tons) and total expenditures ($17,868,000). Numerous snow and ice storms hit Kentucky during the past winter, including the record setting snowfall of January 16, 1994.
An overview of our past expenditures and salt usage is as follows:

### Annual Expenditure for Snow and Ice Removal

<table>
<thead>
<tr>
<th>Year</th>
<th>Expenditure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988-89</td>
<td>$4,890,000</td>
</tr>
<tr>
<td>1989-90</td>
<td>$7,892,000</td>
</tr>
<tr>
<td>1990-91</td>
<td>$6,617,000</td>
</tr>
<tr>
<td>1991-92</td>
<td>$3,701,000</td>
</tr>
<tr>
<td>1992-93</td>
<td>$9,463,000</td>
</tr>
<tr>
<td>1993-94</td>
<td>$17,868,000</td>
</tr>
</tbody>
</table>

### Historical Salt Usage

<table>
<thead>
<tr>
<th>Year</th>
<th>Tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988-89</td>
<td>69,711</td>
</tr>
<tr>
<td>1989-90</td>
<td>104,412</td>
</tr>
<tr>
<td>1990-91</td>
<td>80,288</td>
</tr>
<tr>
<td>1991-92</td>
<td>40,804</td>
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<tr>
<td>1992-93</td>
<td>100,013</td>
</tr>
<tr>
<td>1993-94</td>
<td>166,471</td>
</tr>
</tbody>
</table>

Technology has provided many improvements over the past years in snow and ice removal. We have evolved from a plow-only program to one where we look at precise application of deicing chemicals to melt snow and ice. We have more sophisticated equipment to use in our program, along with deicing chemicals that, in combination, work to extremely low temperatures.

Why this need for such a program when, in the 1950s, it was nearly unheard of to miss a day of school because of a slick road? The public demands it! Businesses demand it! So, we do it!

### Deicing materials

There are several deicing materials on the market today. Among these are such products as calcium magnesium acetate, ethylene glycol, calcium chloride, magnesium chloride, and sodium chloride.

Some brief advantages and disadvantages of these products are as follows:

#### Calcium Magnesium Acetate (CMA) **ADVANTAGES:**
- Non-corrosive
- Melts snow above 25 degrees F
- Commercially available

#### Calcium Magnesium Acetate (CMA) **DISADVANTAGES:**
- Cost - $600-$700 per ton
- Ineffective below 25 degrees F
- Requires more material per two-lane mile than salt
- Light, fluffy material—requires truck cover
- Windshield coverage problem

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Calcium Magnesium Acetate
(CMA) ADVANTAGES:

Ethylene Glycol
Advantages:
Non-corrosive
Effective at temperatures below 25 degrees F
Biodegradable

Calcium Chloride/Magnesium Chloride Advantages:
Effective at temperatures to -0 degrees F
Effective in combination with salt

Sodium Chloride Advantages:
Effective above 20 degrees F
Most economical deicing chemical at $35-$40 per ton

Calcium Magnesium Acetate
(CMA) DISADVANTAGES:

Ethylene Glycol
Disadvantages:
Toxic to humans if ingested
Expensive - $3.50 per gallon
Requires equipment for liquid applications
Requires airtight storage

Calcium Chloride/Magnesium Chloride Disadvantages:
Corrosive
Requires specialized equipment for liquid applications

Sodium Chloride Disadvantages:
Corrosive
Ineffective below 20 degrees F
Potential environmental contaminant

What is the Kentucky Department of Highway’s choice of deicing material? The answer is salt. Salt is the most economical and effective deicing chemical we have found. Our primary mission in snow and ice removal is to achieve bare pavement on our highways, except in those extreme weather conditions where all deicing chemicals are ineffective. At that time we rely on abrasive materials such as sand, cinders or #11 limestone. The only other time abrasive are used is when salt supplies are low and a need exists to extend salt.

Did anyone run out of salt last winter? If you did not, I am sure you were critically low at times. Salt is in great demand by most public agencies for snow and ice removal. The days are gone when salt was readily available upon demand from the vendor during the winter months.

Groundwater regulations are having the same effects on salt companies as on us. Vendors are not stockpiling large inventories of salt outside on terminal lots for long durations of time. Therefore, the burden of stockpiling salt rests upon the user.
For the past several years, the Department has maintained a pre­season stockpile of salt that was equal to one-half of the average amount of salt used the previous two winters. Beyond this required amount of salt, we have reserve salt stockpiled in 15 large domes, strategically located across the state. Each of these domes hold between 4,000 and 5,000 tons of salt. Since 1985, we have gone into each winter with approximately 130,000 tons of salt on hand. This worked well for us until last winter, when we depleted all reserves and were forced to ration salt across the state.

**Salt storage**

Salt must be protected when stockpiled on maintenance lots. Uncov­ered salt exposed to the elements will become unusable. In addition, unprotected stockpiles can cause movement of salt off site and create potential pollution problems. The Federal Clean Water Act contains limits on the amount of chlorides that can be released into the environ­ment. We are currently developing compliance procedures for storm water runoff on our maintenance lots. This entails storing as much salt as possible in storage buildings designed to contain and protect salt. When additional salt is stockpiled outside, we are to select sites on maintenance lots that are out of drainage patterns, construct pads to place the salt on, and cover piles of salt tightly with plastic tarps. We want a *usable product* when winter arrives.

**Salt applications**

Once winter does arrive and salt applications begin, proper use of salt is important. Our applications techniques must provide desired results while not creating wasteful situations or releasing excessive amounts of chlorides into the surrounding environment. The term “sensible salting” has been around for many years. It simply means use what it takes, but no more.

A typical Kentucky snowfall of 1-inch accumulation at 28 degrees F is easily removed with 500 lb per two-lane mile application, providing the salt application is placed in the right location on the road surface. A 6-8 ft. spread pattern is correct. A 15-24 ft. pattern is incorrect. Put the salt where it is effective, on the crown of the road, not in the ditchline.

Salt rates need to be varied, according to the type of storm. There­fore, judgements must be made on the job to gain the desired results. Spreaders should not only be calibrated to allow for change in rates, but also to control maximum output that prevents waste. Currently, our spreaders are calibrated to put out 400, 500, and 800 pounds of salt per two-lane mile.

In addition, when temperatures during a snowfall or ice storm fall below 25 degrees F, calcium chloride is used in our operation. We have the capabilities to prewet salt in our trucks at many of our maintenance
locations. This application allows for the melting of snow and ice for a continued period of time, at least to 10-15 degrees F. The liquid calcium chloride added to salt allows for better adherence of the salt to the roadway surface. Also, calcium chloride begins working immediately.

**Program enhancements**

We are currently adding some new capabilities and features to our snow and ice removal program. Fifteen new calcium chloride storage units are now being constructed on our maintenance lots. This brings our total to 87 units statewide. We also are planning to purchase some truck-mounted, liquid calcium chloride dispensing units where the material can be applied at the spinner. This will increase the effectiveness of liquid calcium chloride and reduce corrosion to our equipment.

We also are expanding our use of liquid magnesium chloride by making this material available for an entire district. This deicing material is used as a prewetting agent to salt in the same manner as calcium chloride is currently used. Magnesium chloride contains an anticorrosion additive that is desirable in our operation. This move will allow us to get a better handle on the total effectiveness of magnesium chloride.

We have upgraded our new plow specifications to buy a taller plow (40 inches minimum height) with a solid curved moldboard. In addition, all future plows bought for tandems assigned to interstate and parkway routes will be 12-feet wide, reversible plows.

We also are planning to equip a tandem truck with a wingplow unit for the upcoming winter to experiment with attaining a wider plow swath. This should greatly increase the effectiveness of a truck plowing on the Interstate System.

Additionally, we plan to equip three road tractors for snow and ice removal. This will include installing a plow, vee-box spreader, and other attachments on these trucks.

In summary, the Kentucky Department of Highways will continue to rely on sodium chloride as the primary deicing chemical in our snow and ice removal program. We will continue to emphasize the correct storage of salt, and the proper application of salt to the roadway.