

MICHIGAN DEPARTMENT  
OF  
STATE HIGHWAYS AND TRANSPORTATION

1973 - 1974

PREWETTED SALT REPORT

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HIGHWAYS  
LANSING, MICH.  
P. O. DRAWER "K" 48904

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Maintenance Methods Unit  
Administrative Services Section  
June 1, 1974

## RECOMMENDATIONS

1. Recommend that four additional garages be equipped with 8,000 gallon liquid calcium chloride storage tanks together with transfer pump and application equipment to apply liquid calcium chloride to ice control salt.
2. All spreading equipment so equipped be mechanically restricted so that maximum application of 400 lbs. per mile can be applied.
3. All the equipment in one garage be so equipped.

## OBJECT OF RECOMMENDATIONS

1. To continue and expand the prewet program.
2. Concentrate on volume of salt use and savings resulting from procedure.
3. Develop instructions and training material for future uses.
4. Gather information on the value of adding liquid chloride to ice control sand.

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## SALT COMPARISONS

### Application Facts

<u>Prewet</u>	<u>Dry</u>
Holds in close pattern. No dust.	Some segregation. Large particles spread wide. Dust evident.
Stays in place, little sliding on slick ice.	Stays in place on loose slush. Slides wide on slick ice.
Imbeds in ice cover immediately.	Dormant when applied. Imbeds 3-5 minutes at 30° above; 19 minutes at 25°; much greater below 20°.
Early loss caused by whipping of traffic - minimal.	Loss variable: High temperatures - minimal Low temperatures - considerable

### Melting Action

Starts immediately-----28° - 32°-----Minor delay  
Starts immediately-----25° - 28°-----10 to 20 minute delay  
Minor delay-----Below 20°-----30 minutes or greater

### Wind Effect

Cling together; little effect. No dust noted.	Spreads in loose pattern - must compensate for crosswind. Dust obvious.
Little or no melting noted on surface shoulders.	Melting on shoulders obvious from loss of salt and dust.

## SUMMARY

The prewetting of ice control salt accelerates the action and it increases the volume of salt retained on the pavement surface. These two factors reflect the possibility of reducing the quantity of salt used without affecting our present level of service. The mechanical details are now functional but will undoubtedly improve with more experience. With proper engineering our present hydraulic spreading controls can be greatly simplified if prewetted salt is used consistently.

The emphasis on a calibration program and the knowledge of equipment's spreading abilities has reduced the total volume of salt used. Additional savings which can be attributed to the prewetting technique are estimated 10 to 15% but at this point cannot be verified. The estimated savings by prewetting can be attributed to the reduction in rates of application, the accelerated action of the salt, and the added control of pattern and dust.

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## 1974 - 1975 PROPOSED PROGRAM

The proposed program would require equipping four additional garages, Saginaw East and Kalamazoo which use a high volume of salt, and Kalkaska and St. Ignace which use a medium amount of salt but at lower temperatures and also use a volume of sand. The sand usage would permit gaining some experience and an opportunity to evaluate the effect of liquid calcium chloride on the sanding operation.

The past testing has determined that the addition of calcium chloride does not create any noticeable adverse effect on the pavement surface or any adverse effect on the spreading equipment. The object of this year's program would be as follows:

1. Try to determine the amount of material saved which can be credited to the prewetting operation. Because of a lack of a system to acquire exact measurements this item will require good judgment. Guide rules and a method for recording observations will be established.
2. Determine the value, if any, of adding liquid chloride to ice control sand instead of dry salt or flake chloride.
3. Gather documentation of any advantages of the prewetting and gather training and instructional material for future expansion if process appears desirable.

Upon completion of the proposed program a report would be prepared which would include all findings, data and a recommendation.

## DETAILS OF 1973 PREWET SALT TEST

During the 1973-74 winter season, prewetting of ice control salt was tested at the Webberville Garage. The results of the test were something less than expected because of three reasons:

1. The equipment was ordered in September with delivery promised within 10 days. Due to the truck strike and back-order of certain parts, delivery was not completed until December 1.
2. The original truck-mounted distribution pump failed when exposed to low temperatures. All units had to be replaced; this resulted in a break of our method of operation.
3. During February and March adverse road conditions were limited.

Because of the delays and interruptions in the testing, a true evaluation of materials saved was not possible. The test did, however, verify earlier observations and permit development of applying equipment. The test also permitted experimenting with and developing locking systems to regulate the maximum application rate per mile. The test last winter also confirmed that by prewetting the salt the rate of application can be reasonably reduced without affecting the level of service. Observations verify that salt applied in identical quantities with the same equipment, under the same conditions, and in a continuous spread the prewet will out perform dry salt in melting abilities. This was noted and commented on by operators, the Maintenance Foremen, and the Area Superintendent.

## PATTERN CONTROL

The pattern of the salt applied by field forces during adverse conditions is improved by the prewetting technique. The observations of the application indicate that the moist material will hold together when discharged from the spreader and result in a greater per cent of the salt spread laying in the center one-third of the pavement. The presence of the moisture prevents the granules from sliding off the slab and being lost on the shoulders.

The fact that prewet salt is retained on the slab is evident by the lack of melting action on surfaced shoulder. On numerous occasions it was noted that on the section where wet salt had been applied the bituminous shoulder remained covered with snow. On sections where dry salt was applied one or both shoulders were slushy or wet. There was evidence that the melting action was caused by widespread salt particles and possibly by drifting salt dust.

During the period of the tests in which a reduced rate was used there was no noticeable reduction in level of service. This fact was noted on repeated occasions by the Maintenance Foreman, Area Superintendent, and all observers from the Methods Unit. Reports have been received stating that under some conditions the pavement surface remains wet for a longer period of time with prewet salt than dry. The wet pavement could be a problem under certain circumstances. This condition has not been reported frequently or consistently with any specific reasoning. It has not been noted by the Methods Unit or area supervision.

## CONTROL OF FINES

One other point of prewetting is the control of the salt dust. It's obvious from our tests that the spray of the liquid chloride does control the salt lost by dusting. We cannot measure the volume of the dissipating dust, but by wetting it apparently adheres to the particles of salt or it is dissolved by the chloride and utilized on the road surface. During the application of dry salt the dust can be seen in varying amounts. This dust is always blown to the outside edge of the pavement or completely clear of the slab. Our present specifications require that the dust content be 7% or less.

Gradation tests are taken at the vendor's stockpile prior to the original loading. It is then loaded for delivery and dumped at the garage site, run over by the front-end loaders and manipulated into the storage shed; re-loaded into spreading trucks, worked over the flite chain, and through the spreading auger. After all the various handlings the dust content has increased and is evident when spreading dry.

To determine the amount of increase of fines, six samples were taken from salt storage sheds and at the spreading augers for testing. The results of the salt gradation tests taken by the Testing & Research Division show that the percentage of fines subject to loss by wind action increases from less than 7% to a maximum recorded of 10.3% in the salt storage shed. This percentage will again increase with the additional handling required before it is in place on the road surface.

## EQUIPMENT EVALUATION

The winter tests were beneficial in disproving the value of the original distribution pumps. The original pumps had been tested for constant operation and for repeated starting and stopping. All of the equipment testing was conducted by the vendor during the summer months and at summer temperatures. When field tested under actual conditions at low temperatures the retainer seal shrank permitting liquid chloride to leak, shorting out and destroying the electrical motor. All the original pump units were replaced on warranty with an improved design which proved satisfactory.

The stainless steel tanks on the truck have been used for the past two seasons and have proven to be adequate. An inconvenience when filling the truck-mounted tank has been eliminated by the truck operators. They have designed and installed a tank gauge. A simple piece of clear plastic tubing and two brass petcocks has permitted filling the tank without spilling on the spreader or wasting the liquid chloride.

The 8,000 gallon storage tank and the transfer equipment has performed very efficiently without any maintenance. A small 3 sided shelter to protect the operator from the weather when filling the truck tank would be beneficial.

The experimenting at the Webberville Garage developed a spray arrangement which together with the new distribution pump is capable of saturating the salt in the chute just before application to the road surface. The spraying arrangement was developed

by reducing the orifice on the spray head and experimenting with various locations in the chute. This arrangement eliminated a hard crust which previously had built up within the chute and created several problems. It is our opinion that this spray arrangement can also be used to add calcium chloride to ice control sand at the time of application.

A method of mechanically locking the spreading controls was devised so that a maximum rate of 400 lbs. per mile could be obtained, and also an arrangement which would permit reduction in rates of application to 200 lbs. per mile. In addition to the spreading restrictions it was necessary to make arrangements so that unloading the unused salt could be accomplished in minimum time. Unloading time at the stockpile has been reduced from the original 45 minutes down to 12 minutes.

In addition to the control adjustment, provisions were made so that the tailgate could always be returned to the identical opening. This was accomplished with a lock stop and also by visual markings which would identify the setting as correct from any place in the rear of the truck. To assure that our locks and our tailgate adjustments were constant, each truck was calibrated monthly during the test. Equipment designed to apply prewettered salt or treated sand could be simplified by reducing the hydraulic controls we now require. The hydraulic controls could be preset and the volume of material spread could be adjusted at the tailgate.

## OPINION OF OTHER MICHIGAN USERS

In interviews with other users\* of liquid chloride there are a few expressions which are always noted. There is always enthusiasm expressed and there is confidence that prewetting will improve the efficiency and economics of the salting operation. There is a general belief that through the use of liquid chloride the level of service can be upgraded or the volume of salt reduced.

Without exception the prewetting concept has been accepted by supervision who are directly involved with the salting operation. At the same time, no one has factual information which would establish a definite amount of savings. One variation in opinions is the method of applying the liquid chloride. The two methods of application are the spray bath over the entire load, versus the spraying of the salt at the time of application.

### List of those interviewed:

\*Herbert O. Larkin, Engineer - Manager  
Kalamazoo County Road Commission

\*Paul S. Pyles, Superintendent  
Kalamazoo County Road Commission

\*Gerald Streichert, Superintendent - Engineer  
Genesee County Road Commission

\*James Henson, Street Superintendent  
City of Kalamazoo

## PROPOSED PROGRAM COST ESTIMATE

### KALKASKA GARAGE

1973-74 Salt usage 1,213 tons  
Cost per ton \$12.86 Total \$15,600  
8,000 gallon tank, pump and accessories \$4,000.00  
Equip 5 spreader units @ \$300 each 1,500.00

Total estimated cost \$ 5,500.00

### ST. IGNACE GARAGE

1973-74 Salt usage 1,730 tons  
Cost per ton \$15.85 Total \$28,200  
8,000 gallon tank, pump and accessories \$4,000.00  
Equip 7 spreader units @ \$300 each 2,100.00

Total estimated cost \$ 6,100.00

### SAGINAW GARAGE EAST

1973-74 Salt usage 3,079 tons  
Cost per ton \$10.90 Total \$33,560  
8,000 gallon tank, pump and accessories \$4,000.00  
Equip 11 spreader units @ \$300 each 3,300.00

Total estimated cost \$ 7,300.00

### KALAMAZOO GARAGE

1973-74 Salt usage 4,343 tons  
Cost per ton \$12.65 Total \$54,940  
8,000 tank, pump and accessories \$4,000.00  
Equip 15 spreader units @ \$300 each 4,500.00

Total estimated cost \$ 8,500.00

TOTAL ESTIMATED COST OF EQUIPPING 4 GARAGES FOR  
PROPOSED PROGRAM \$27,400.00

The installation of all the equipment can be made by the local forces with the assistance of the garage mechanic.

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## EQUIPMENT COST ESTIMATE

ESTIMATED COST TO EQUIP EACH INSTALLATION \$ 4,000.00

8,000 gallon fiberglass tank, filters, switches,  
stainless steel transfer pump, hoses, fitting,  
fill nozzles, and weatherproof switch

ESTIMATED COST TO EQUIP EACH TRUCK \$ 300.00

70 gallon tank for truck mounting \$ 70.00

Distribution package - pump, hydraulic  
pressure switches, hoses, fitting and  
controls \$230.00

## CALCIUM CHLORIDE COST

32% Calcium Chloride F.O.B. \$ 0.049 per gallon

Calcium Chloride cost per mile  
of application - 2 gallons per  
mile \$ 0.098 per mile