OFFICE MEMORANDUM

MICHIGAN
STATE HIGHWAY DEPARTMENT
JOHN C. MACKIE, COMMISSIONER

March 10, 1959

To: W. W. McLaughlin
Testing and Research Engineer

From: E. A. Finney

Subject: Rock Salt Anti-Caking Agent Investigation. Research Report No. 309. Research Project 59 G-97. Report by Wayne Frederick.

Rock salt for highway de-icing is purchased by the Department with an anti-caking agent added to facilitate handling and application. Recently, complaints from the field indicated that rock salt presumably treated with the anti-caking agent was caking badly in storage. Other complaints indicated that the treated salt was slower acting on ice than untreated salt. These complaints resulted in a request for an investigation of the treated rock salt, and Research Project 59 G-97 was initiated.

A salt sample from a badly caked stockpile at Roscommon was received with a request to test for the anti-caking agent. Preliminary testing indicated the presence of the agent. To aid in developing test methods for the anti-caking agent, field investigations of salt stored at Jackson and Williamston were conducted in early January. Samples of salt received in the fall of 1958 and samples of subsequent shipments were taken for laboratory investigation. Table 1 lists the laboratory sample numbers, sampling locations, suppliers, and approximate ages of stockpiles on the sampling dates.

Jackson and Williamston stockpiles containing early fall shipments were badly caked and did not show the blue color normally associated with treated salt. However, a light blue surface color was noted on later shipments at Jackson, and stockpiles of these shipments maintained a free-flowing characteristic beneath an easily broken 1- to 2-in. crust. A later shipment at Williamston had a 10- to 12-in. crust.

After the field observations, it was learned from a representative of the International Salt Company that shipments in early fall, 1958 came from exposed storage piles. It was assumed that the anti-caking agent might have leached out of the supplier's stockpiles and thus caking would not have been effectively inhibited. Exposed laboratory samples of treated salt demonstrated leaching-out of the anti-caking agent.

Since most Departmental purchases are received from either the Morton Salt Company or the International Salt Company, anti-caking agents used by these companies were investigated. Morton uses a dark blue ferrocyanide compound (Prussian blue) at the rate of o. 1 lb per ton of salt, which imparts a blue color to treated rock salt. A sample of Prussian blue was obtained from the Morton Salt Company. International uses "Storite," a mixture of an extender (identified as calcium carbonate) and a ferrocyanide compound, at the rate of 2 lb Storite per ton of salt. This mixture is white when applied to the salt, but after mechanical handling and weathering, a blue or sometimes a green color develops. A sample of Storite was received from International.

Anti-caking agent content of the samples listed in Table 1 was estimated quantitatively. No treating agent could be detected in the three Morton samples - 59 MR 2, 3, and 4. It should be noted that two of these samples represent badly caked shipments in fall, 1958. Two of the three International samples - 59 MR 1 and 8 - were found to contain less than one-fourth the claimed Storite treatment, and the third sample (59 MR-9) contained between one-fourth and one-half the claimed treatment of 2 lb of Storite per ton of rock salt.

An infrared and a chemical procedure for detection of the agents have been developed. A quantitative method for field use is under investigation, with further work necessary under field conditions.

Visual comparison of rock salt action on ice, between salt treated in the laboratory with an excess of Prussian blue and untreated salt, showed no noticeable differences in action or time of action. A similar comparison with similar results was obtained when salt was treated with an excess of Storite.

Two rock salt samples were treated with Storite in the laboratory and exposed to weather to study the leaching-out of the anti-caking agent. One sample was treated at the recommended rate of 2 lb per ton of salt, and the other with half this amount. Very severe weather conditions - snow, sleet, and considerable rain - were encountered during the weathering period. Table 2 shows the loss of Storite during weathering.

No information on the effectiveness of the Storite anti-caking agent was obtained during the weathering period.

OFFICE OF TESTING AND RESEARCH

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TABLE 1
ROCK SALT SAMPLE IDENTIFICATION

Laboratory Sample No.	Stockpile Location	Supplier	Stockpile Age	Anti-Caking Agent Total Claimed	Anti-Caking Agent % Present
59 MR 1	Roscommon	International	Unknown	2 lb/ton	less than 25
59 MR 2	Williamston	Morton	Approx. 3 mo.	0.1 lb/ton	0
59 MR 3	Williamston	Morton	3 weeks	0.1 lb/ton	0
59 MR 4	Jackson	Morton	Approx. 3 mo.	0.1 lb/ton	0
59 MR 8	Jackson	International	1 day	2 lb/ton	less than 25
59 MR 9	Jackson	International	2 days	2 lb/ton	25-50

TABLE 2
CHANGE OF "STORITE" CONCENTRATION DURING WEATHERING

Initial Treatment	After 7 days	After 11 Days
2 lb/ton	1-1-1/2 lb/ton	Less than 1/2 lb/ton
1 lb/ton	Less than 1/2 lb/ton	Less than 1/2 lb/ton