

HR-271 Effects of Deicing Salt Compounds on Deterioration of PCC

Key Words: Halite, Rock salt, Calcium sulfate, Deicing, PCC Deterioration

ABSTRACT

Naturally occurring rock salt is vital to ice removal procedures in the northern states. In 1980, 6.4 million tons of rock salt were used by federal, state, and local agencies for ice and snow control. This is approximately 40 percent of the rock salt mined.

There are many sources for deicing salts. Rock salt purchased by the Iowa Department of Transportation comes from mines in Michigan, Louisiana, and Kansas. Figure 1 is a compilation of Iowa DOT contract data for deicing salt origins. Contours represent percentages of Kansas deicing salt delivered to storage sites during the period 1961 to 1984. Halites having origins other than Kansas were from Louisiana and Michigan. Salt purchases are made using a low-bid process explaining the high percentage of Kansas halite in the western half of the state.

The current specification for deicing salts (ASTM. D632) addresses only particle size gradation and sodium chloride content, which is limited to a minimum of 95 percent by weight. This allows up to 5 percent impurities, the most significant of which is calcium sulfate; see Table 1.

This document reports research on the effects of calcium sulfate in halite on PCC durability. Much has been published about sulfate ions causing expansive reactions in PCC, on scaling caused by sodium chloride, and the participation of magnesium sulfate in seawater attack. However, little work has been done on the influence of sodium chloride and calcium sulfate solutions as they are found combined in natural rock salt. Durability studies were conducted using brines containing different amounts of gypsum as an impurity. Damage mechanisms, reaction products and pore structure changes were evaluated.