INTRODUCTION

The increasing demand placed on highway authorities to maintain safe winter driving conditions has resulted in the use of large quantities of sodium chloride to keep roads free of ice and snow. Sodium chloride is an extremely effective deicing chemical but its use does have serious undesirable consequences. It causes corrosion of vehicles and of reinforcing steel in structures and there is increasing concern about its effect on the environment. These drawbacks coupled with the need to use the financial resources for road and traffic management as economically as possible, has led to intensive efforts to reduce the amount of salt used for deicing roads.

Research has therefore been directed towards identifying a less damaging deicing chemical. BP Chemicals Limited are investigating two acetate salt deicing chemicals, namely Clearway CMA (a solid calcium magnesium acetate) and Clearway 1 which is an acetate based liquid deicer. Clearway CMA is intended for use on highways and structures where the use of salt cannot be tolerated, whilst Clearway 1 is being developed specifically for use on airport runways as an alternative to urea and glycol. The deicing ability of these products has been assessed and reported by Parmenter (1987).

This report gives details of a laboratory investigation to compare the relative scaling damage caused by different deicing chemicals in freeze/thaw tests on an air-entrained concrete used by the British Airports Authority (BAA) for airfield pavements. A second paper will report on tests carried out on concrete mixes without entrained air.

RILEM RECOMMENDATIONS FOR FREEZE/THAW TESTING

Methods of testing concrete for freeze/thaw resistance are not new and have been used in various forms for a number of years. The test procedures used previously have included frequent visual inspections of concrete specimens subjected to a freeze/thaw testing programme which has continued for a specified number of cycles or to the point of complete disintegration of the specimens. In some tests these inspections have been supplemented by a more quantitative assessment of damage, in which cubes have been tested for crushing strength after different numbers of freezing and thawing cycles. A further method described by Jones (1949) consists of measuring the variation in speed of an ultrasonic pulse transmitted through the concrete after different numbers of freeze/thaw cycles.

In addition to the overall freeze/thaw attack, the action of deicing salts has a deleterious effect on concrete exposed to low temperatures. Many workers have examined these effects but probems have arisen in assessing the damage quantitatively.

In 1977 the Technical Committee of RILEM* published a standardised procedure for carrying out freeze/thaw testing in the presence of deicing salts, based upon four conditions:

(a) the description of the test method should be easy to understand and not subject to anomalous interpretation;

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* RILEM = International Union of Testing and Research Laboratories for Materials and Structures.