



Starting Date: 03/25/2005

Evaluation of two Chemical De-Icers used in Nebraska

Nebraska Department of Roads

Research Project Title:

Evaluation of two chemical De-Icers used in Nebraska

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PURPOSE OF THE RESEARCH PROJECT:

This study was initiated due to the growing concern that new liquid chemicals are being used as deicers, without knowing potential effects on the service life of Nebraska's concrete pavements. Currently, NDOR is using magnesium chloride and potassium acetate as liquid deicers in their winter maintenance program, as do many other states across the country. Each concrete sample will be taken from a NDOR construction project to ensure that the concrete samples are representative of the concrete pavement being placed in the field.

DESCRIPTION OF THE PROJECT:

1. Investigate the long-term effects of using 100 % magnesium sodium chloride and 50 % potassium acetate solutions on bridge decks and concrete pavement.
2. Evaluate accordance with ASTM C672 in order to quantify Scaling Resistance.
3. Evaluate the performance of three different cement types: IPF Inter-ground, IPF Blended and IPF with 10% Class C fly ash from two different sources.

OBJECTIVES

The primary objective of this study is to evaluate the performance of concrete pavements with two deicers used in Nebraska: potassium acetate and magnesium chloride.

SCOPE OF THE PROJECT

The research project consists of the following tasks:

- Task 1: Evaluate the condition of concrete surfaces exposed to the two deicers magnesium chloride and potassium acetate.
- Task 2: Calculate the removal percentage from an average of two blocks and compare the results from the two deicers.
- Task 3: Evaluate the condition of the ponding blocks by a visual rating according to the ASTM C672 specification.

LABORATORY INVESTIGATION:

The ponding blocks are tested in accordance with ASTM C672, which evaluates the condition of concrete surfaces exposed to deicing chemicals. A visual examination of specimens is required as well as weekly measurements of the amounts of material that is lost from the specimen after several freeze and thaw cycles. The ponding blocks observed are shown in Figure 1 as follows:



Figure1: Ponding block sets

NDOR added test procedures into the ASTM C672 test to obtain the weight of the residue from the ponding blocks. The steps are described as follow:

- a) After the completion of freeze-thaw cycles, the solution coming from the ponding blocks is poured into a beaker through a Whatman #42 filter paper using the Büchner funnel vacuum.
- b) At the end of the filtration, the filter paper with residue is weighed in a porcelain crucible.
- c) The filter paper is heated slowly until the paper is charred and then ignited to constant weight.
- d) The residue is cooled to room temperature in a desiccator and the weight of the residue is obtained.

Figure 2 describes the modified steps that are conducted to obtain residue material from the ponding blocks.

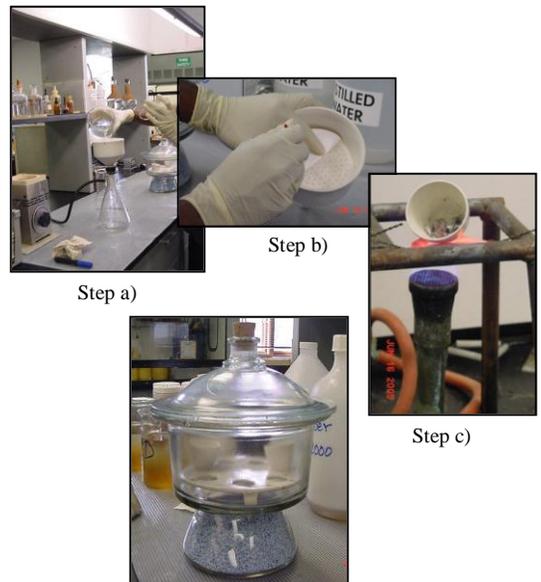


Figure 2: Steps to obtain the weight of residue

Laboratory Test Results:

Conclusions:

After four months conducting the NDOR modified ASTM C672 .The first of six mix designs evaluated was 47B IPF blended from Holcim. While the results are very preliminary, they show low to minimum scaling resistance from the average material removed from the specimens as well as in accordance with the visual rating. After the preliminary results NDOR started with the evaluation of ASTM C 1567 with potassium acetate instead 1N NaOH and to observe what the potassium acetate's effects are on Nebraska's aggregate and pavement service life.