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Study on Effect of Deicer on the Durability (Freezing Thawing Resistance) of Concrete

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Summary

Concrete deterioration of scaling, that is, the phenomenon of removal of small flakes or chips of binder apart to the shape of flakes from surface of concrete is becoming remarkable with the increases of spraying the deicing chemicals. In order to clarify the mechanism of concrete scaling by deicing chemicals and to propose the countermeasure against scaling, concrete scaling by three kinds of deicing chemical was reproduced experimentally and the grade of degradation was quantified. The results were discussed for the reference of the previous papers.

In this study, mortar specimens by the water cement ratio 55% and 50% using Portland cement and fly ash cement were prepared. On the mortar specimens, Solution of 3 mass % of deicing chemical was poured out so that it might become a depth of 1cm. Freezing-thawing test of these mortars was carried out by use of freezer. After separating the piece of mortar removed through filter paper, the amount of scaling was dried for one day by a drier, and scaling ratio (g/cm^2) is determined by the amount of scaling / cross-section area of specimens

Reference concrete dipped in water without deicing chemical has lowest scaling ratio and most scaling is not observed to 20 cycles. In case of dipping concrete into deicing chemicals, scaling appears after 5 cycles, and a subsequent change is also large. The scaling ratio in chlorination calcium solution increased proportionally to the number of cycles. The scaling ratio in sodium chloride solution and potassium acetate solution increases rapidly, from 25 cycle.

Although there are various theories about the mechanism of scaling under the salt environment acquired from previous researches, we can divided into six kinds of mechanisms, there are as follows: i) increase of osmotic pressure, ii) increase of the moisture osmosis by freeze point depression, iii) chemical change of deicing chemicals attack, iv) thermal shock, and v) layers by layers freezing, and vi) Glue-Spall mechanism. These mechanisms were verified the conditions of this experiment, and based on the result. Consequently, it turns out that it is hard to think that i) increase of the osmotic pressure, ii) increase of the moisture osmosis by freeze point depression and iv) heat shock mainly causes degradation of concrete scaling.