

Developing Performance Evaluation Technology for Concrete in Cold Districts

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Research Topics

- Development of scaling resistance evaluation technique for concrete
- Evaluation of frost damage resistance using a rapid permeability test
- Development of a technology for improving concrete surface layer quality

Research Seeds

In cold regions, concrete structures are adversely affected by frost damage caused by freeze-thaw action during extremely cold winters. In recent years, architects and civil engineers have observed that concrete structures often show scaling (Fig. 1): a phenomenon by which concrete surface layers delaminate. This phenomenon increases concomitantly with the spraying of antifreeze agents, composed mainly of sodium chloride (NaCl), onto road surfaces. In Japan, strict limitations on the use of studded tires from 1991 have engendered a rapid increase in the use of antifreeze agents to prevent road surface freezing. Consequently, concrete surfaces in cold regions are exposed to a severer chloride environment than ever. As a result, concrete scaling has become common because it is promoted synergistically by the compound action of chloride deterioration and freeze-thaw action. Currently, Japan has no established technique for evaluating concrete scaling resistance in a chloride environment.



Fig. 1 Scaling damage to concrete products.

Given this background, we conducted a study to develop a technique to evaluate scaling resistance in a chloride environment. We investigated the ASTM C672 and RILEM CDF scaling tests, which are widely used outside of Japan. We evaluated these tests from the ease of use and testing utility, and decided to endorse the application of RILEM CDF as a general-purpose testing method in Japan. To perform these scaling tests rapidly without the use of large facilities, we adopted a test method using a home freezer. As a scaling resistance evaluation technique for actual structures, we adopted a method using the air permeability of concrete as an index (Fig. 2).

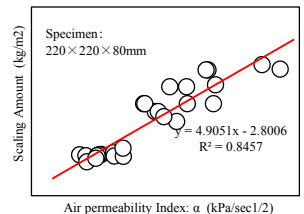


Fig. 2 Relation between scaling amount and air permeability index: α .

Related Technology

- Quality evaluation and degradation diagnosis for concrete
- Technology for improving concrete frost resistance