

FIELD TEST OF SELF-HEALING CONCRETE ON THE RECOVERY OF WATER TIGHTNESS TO LEAKAGE THROUGH CRACKS

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ABSTRACT

In this research, the recovery of water tightness to leakage through penetrating cracks in concrete cast in box shape water-retaining container was investigated in order to develop autogenous healing concrete for field application. For field test all concretes were produced in an actual ready-mixed concrete plant in consideration of the practical applicability. It was confirmed through casting that the fresh properties of self-healing concrete satisfied the actual construction field requirements. After several months later from casting penetrating cracks were induced to specimens and the water leakage through cracks were monitored. It was found that the sealing effects of water leakage could be improved by cementitious composite materials with self-healing capability. This field test seems very meaningful, both from the scientific and practical viewpoints, since there are few field applications of such a material in Japan so far.

INTRODUCTION

In this study, in order to apply materials with self-healing capability to the field application, the essential fresh properties of ready-mixed concrete with self-healing capability are examined and the recovery of water tightness to the leakage through penetrating cracks are examined the laboratory and under the actual field condition. In the field test several self-healing concretes developed by the authors were mixed at a ready-mixed concrete plant and cast for the box shape water-retaining specimens. Cementitious composite materials with self-healing capability were prepared in order to develop autogenous healing concrete based on the basic design concept as reported in the previous paper [1].

EXPERIMENTAL PROGRAM

The experiments were divided into two stages. In the first stage, basic properties such as concrete slump and flow, compressive strength, and self-healing capability were investigated in the laboratory. In the second stage, a field test was conducted, in which box shape water-retaining containers were cast using self-healing concrete.

(a) Property of self-healing concrete

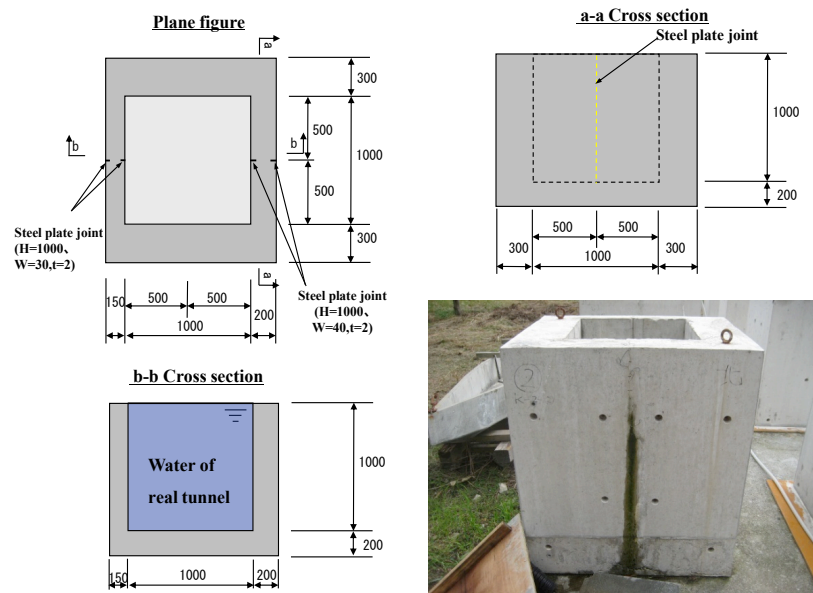
In this research all cementitious composite materials with self-healing capability [called pre-mixed products] based on previous research [1] were manufactured in the laboratory. Table 1 shows the mix proportions of concretes; a W/B ratio of 47.3% and an S/A ratio of 46.6% were applied to all concretes. Slump value of concrete was measured at the just after mixing, after 30 and 60 minutes. The compressive strength of concrete was also measured by JIS A 1108 at 1, 3, 7, and 28 days.

Table 1 Mix proportion of concrete

Binder (370)		Water/Binder W/B	Sand	Gravel	SP
OPC	Pre-mixed Products				Binder x 1.15%~1.35%
93%	7%	47.3%	809	920	4.26~4.99
344.1	25.9	175			

(b) Water leakage test of box shape water-retaining container

Box shape water-retaining containers made by self-healing concrete with various chemical compositions were fabricated as shown in Figure 1. Concrete was produced at a ready-mixed concrete plant and delivered to the site by an agitator truck. After several months curing, cracks were induced at the almost center of two target side walls by the hydraulic jack. Crack width was controlled to be set at 0.2 mm though the actual crack widths were not perfectly controlled. Just after inducing cracks water was supplied in containers and the amount of water leakage with time was being measured at several time steps to estimate the sealing effect by cementitious re-crystallization.

**Figure 1:** Outline of box shape water-retaining container**CONCLUSIONS**

In this research, in order to develop autogenous healing concrete with self-healing capability for application in the field, upgraded self-healing materials and self-healing concrete cast in cylinders and in box shape water-retaining container were investigated.

It was confirmed that the fresh properties of self-healing concrete produced at a ready-mixed concrete plant satisfied the actual construction field requirements, and the sealing effects of water leakage through the penetrating cracks could be improved by cementitious composite materials with self-healing capability.

REFERENCES

- [1] T.H. Ahn and T. Kishi, Crack self-healing behavior of cementitious composites incorporating various mineral admixtures, *Journal of Advanced Concrete Technology*, Vol. 8, No. 2, June 2010, pp.171-186