

SELF-HEALING WATERTIGHT CONCRETES MANUFACTURED WITH A CARBOXYLIC ACID WATERPROOFING ADMIXTURE

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Abstract

The present paper deals with an experimental research program carried out to evaluate performances of an innovative polycarboxylate acid based waterproofing admixture added in the mixer together concrete traditional ingredients in order to improve concrete watertightness. Reduction of water penetration under pressure in concrete can be ascribed to the precipitation of insoluble salt crystals capable both filling capillary pores and sealing cracks generated by shrinkage in the plastic phase.

Rheological (in the fresh state) properties, compressive strength and water penetration under pressure (EN 12390-8) were measured on concretes manufactured with the carboxylic waterproofing admixture and a similar product already available on the market and compared to reference concretes produced by using only the traditional ingredients. Two reference concretes were manufactured with w/c ratio equal to 0.50 and 0.60. Dosage of waterproofing admixture was 1 and 2% by cement mass. The influence of wet curing period (1, 7 and 28 days) on concrete performances was also evaluated. In order to test the sealing ability of the waterproofing admixture, concrete slabs were exposed in a windy chamber (wind velocity 40 km/h and 30% R.H.) to favour crack formation due to plastic shrinkage. Self-healing ability was evaluated by means of water absorption test carried out with Karsten Tubes. Finally, observation with optical microscopy and Scanning Electron Microscope were carried out to assess the crack sealing ability of the waterproofing admixture.

Addition of waterproofing products does not affect negatively rheological and mechanical performances of concrete. A significant reduction of water penetration under pressure was recorded for concretes produced with the waterproofing products with respect the reference mixture manufactured with the traditional ingredients only. Reduction of water penetration was detected independently of the wet curing period. In cracked slabs produced with the waterproofing admixtures reduction in water absorption was recorded as a consequence of the ability of the carboxylic based products to seal cracks formed in the plastic stage. Observation with the optical and scanning electron microscope confirmed the presence of insoluble salts crystals precipitated in cracks responsible for the reduction of the water absorption.

Carboxylic acid waterproofing admixtures improve concrete watertightness. 1% by mass of the carboxylic polymer reduces the water penetration under pressure by 50% with respect the reference concrete with the same w/c provide that the wet curing time is 7 days. Lower reduction (about 20%) were recorded in concrete wet cured for 1 and 28 days. Waterproofing admixture is capable to fill cracks formed in the plastic stage. After seven days water absorption in the sound areas of a concrete slab is equal to that of areas where cracks are present.