FREEZE THAW RESISTANCE OF SELF-COMPACTING CONCRETES BASED ON LOCAL BY-PRODUCTS

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ABSTRACT

The evaluation of freeze-thaw resistance of self-compacting concrete containing by-products is a major issue for the construction of durable concrete structures and raises many questions among researchers.

The works dealing with the frost resistance of SCC are few. The few results in the literature are contradictory, especially when different types of SCC are compared to each other or SCC is compared to its corresponding vibrated. In its conclusions, Makishima et al (Makishima et al, 2001) concluded that the SCC has excellent resistance to freeze-thaw, but to achieve frost resistance in the long term, entrained air is necessary. Persson (Persson, 2003) studied the frost resistance of SCC. He noted that internal damage is much less in the SCC compared to normal concrete, but the scaling is similar between them. Unlike Makishima (Makishima et al, 2001) no relationship between air voids content and frost resistance (Gísli, 2004).

The use of mineral admixtures may provide a way of improving the durability of SCC depending on the type and amount of mineral admixtures used (Selvamony et al, 2010). For SCC containing fly-ash, an equivalent or even higher freeze-thaw resistance has been observed. However, concretes containing limestone powder have shown increased alteration in the freeze thaw test (Mňahončáková et al, 2008). The poor resistance of the latter was attributed to the presence of a family of capillary pores absent in the first case. Therefore, it is the complex physical parameters of the material that governs the strength of SCC in the frost action. Further, it should be considered that the SCC has higher paste content, which in general has an adverse effect on the freeze-thaw behavior. Persson (Persson, 2003) concluded that the SCC with limestone filler exhibited much larger changes in length and mass than SCC with silica fume, fly ash, slag, or glass filler, which indicated a lower resistance to internal frost of SCC with limestone powder.

This relatively small summary of the work done with regard to SCC sustainability pointed out that there are many types of SCC. Each variable affects the properties of concrete, including sustainability; therefore, each case must be examined separately.

Keywords: Self-compacting concrete, by-products, freeze/thaw resistance, limestone powder, marble powder.

RESULTS AND DISCUSSION

This work aims to study the behavior of self-compacting concrete under freeze and thaw cycles, mainly the effect of the total replacement of limestone powder (LP) by marble powder (MP) on the performance of SCC.
The mixtures were subjected to freeze/thaw test according to ASTM C 666 Procedure B, air freezing and water thawing by adapting the freeze-thaw test to the Algerian context using a small number of cycles and without salt deicer. The test methods used to evaluate durability were weight change, length change, compressive and tensile strength loss.

The results show that the total replacement of limestone powder by marble powder has a positive effect on the freeze and thaw resistance of self-compacting concrete.

REFERENCES


