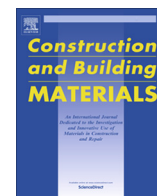


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Durability of self-compacting concrete made with Recycled Concrete Aggregates and mineral admixtures



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HIGHLIGHTS

- The durability properties of SCC made with RCA have been investigated.
- The use of RCA deteriorates the properties of SCC mixes.
- The use of MK and SF compensate the loss due to swap of coarse NA with RCA.

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ABSTRACT

Durability performance of Self-Compacting Concrete (SCC) made with Recycled Concrete Aggregates (RCA) as partial or full replacement of Natural Coarse Aggregates (NCA) and with selected mineral admixtures as partial replacement of Portland Cement (PC) is reported. The replacement levels of NCA with RCA were kept at 0%, 50% and 100%. The workability properties of various SCC mixes were assessed using slump flow test, V-funnel test, L-box test and J-ring test. Durability performance of the SCC mixes was investigated using rapid chloride penetrability test, initial surface absorption test, water penetration test, and capillary suction test. Addition of Silica Fume (SF) or Metakaolin (MK) at 10% by weight of PC was able to compensate for the loss of durability properties when 50% of the NCA were substituted with RCA, with MK being more effective than SF. For 100% replacement of NCA with RCA, the aforesaid pozzolans were not effective in fully compensating for the loss of durability properties on account of substitution of NCA with RCA.

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1. Introduction

According to ACI [1], Self-Compacting Concrete (SCC) is highly flowable, non-segregating concrete that can spread into place, fill the formwork and encapsulate the reinforcement without any mechanical consolidation. In many ways, SCC has been the most significant development in concrete technology in the recent past and it has had a profound impact on concrete placement in particular and on construction processes in general. Although the relative proportion of aggregates in SCC is lower than that in Normally Vibrated Concrete (NVC), this material is still the major constituent of SCC and has a significant influence on fresh and hardened properties. The use of coarse Recycled Concrete

Aggregates (RCA) obtained from processing of construction and demolition waste as a substitute for Natural Coarse Aggregates (NCA) is being encouraged to reduce the environmental impact of concrete construction. However, due to presence of the relatively soft and porous residual mortar on a typical RCA particle, the physical and mechanical properties of these aggregates may be inferior to those of NCA. This may raise concerns about the strength and durability properties of concrete made with RCA. This situation is likely to get compounded in the case of SCCs since the use of RCA will impact the fresh properties also which in turn are fundamental to the performance of such concretes.

Although the mechanical and durability properties of NVC made with RCA have been extensively studied, relatively few investigations have concentrated on the durability properties of SCC made with RCA. In the literature, reported trends in the durability properties like water permeability [2,3], air permeability [2,4], resistance to chloride penetration [5,6], carbonation [7,8], sulphate

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