

The Influence of Freezing and Thawing Cycles on Recycled Concrete Incorporating Mineral Slag

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Abstract

This paper aims to study the freeze-thaw resistance of various proportions of the recycled aggregate concrete (RAC) prepared using local recycled aggregates supplied by a Kuwaiti Recycled Aggregates factory. The recycled concrete was prepared with partial replacement of Portland cement by mineral slag (GGBS) of 25%. Six different mixtures were used to cast the concrete specimens. The water-binder ratio (w/b) was kept constant at 0.35 in all mixtures. Three different ratios of recycled aggregates (0%, 50% and 100%) were utilized, with or without 25% slag as cement replacement. Mixes were tested for workability, compressive strength and freeze and thaw resistance, which is considered a good indication for concrete durability.

For the freeze and thaw test, specimens were inserted in the Freeze-Thaw machine. The duration of each freeze-thaw cycle was 4 hours. Specimens were tested after every completed 30 freeze-thaw cycles. The compressive strength, mass loss, length change, transverse frequency and relative dynamic modulus of concrete mixtures were determined. In general, the incorporation of 25% slag improved the compressive strength of the RAC and had a positive effect on them when subjected to freeze-thaw cycles. Mass, ultrasonic pulse velocity (UPV) and freeze-thaw resistance of concrete decreased in recycled aggregate concrete and enhanced by the introduction of 25% GGBS as partial cement replacement. The durability factor for concrete mixes that contain slag was decreased as the amount of recycled aggregates increased. A lower frost resistance and deterioration due to freeze-thaw cycles when using 25% GGBS combined with 100% RA was noticed compared to other recycled aggregates ratios.

Biography:

Moetaz El-Hawary is an Associate Professor at Kuwait University. He is an Associate member in ACI Committees 130, 201 and 555. He is a board director and past president of ACI-Kuwait Chapter. He is the winner of ACI Chapter Activities Award, 2009. He received his BS from King Saud University and MS and PhD from the University of California at Davis. He published more than 170 publications mainly in the field of concrete technology.

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