

Shear Behavior of Reinforced Concrete Beams Casted with Recycled Coarse Aggregate

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Abstract : The amount of construction and demolition (C&D) waste has increased considerably over the last few decades. From the viewpoint of environmental preservation and effective utilization of resources, crushing C&D concrete waste to produce coarse aggregate (CA) with different replacement percentage for the production of new concrete is one common means for achieving a more environment-friendly concrete. In the study presented herein, the investigation was conducted in two phases. In the first phase, the selection of the materials was carried out and the physical, mechanical and chemical characteristics of these materials were evaluated. Different concrete mixes were designed. The investigation parameter was Recycled Concrete Aggregate (RCA) ratios. The mechanical properties of all mixes were evaluated based on compressive strength and workability results. Accordingly, two mixes have been chosen to be used in the next phase. In the second phase, the study of the structural behavior of the concrete beams was developed. Sixteen beams were casted to investigate the effect of RCA ratios, the shear span to depth ratios and the effect of different locations and reinforcement of openings on the shear behavior of the tested specimens. All these beams were designed to fail in shear. Test results of the compressive strength of concrete indicated that, replacement of natural aggregate by up to 50% recycled concrete aggregates in mixtures with 350 Kg/m³ cement content led to increase of concrete compressive strength. Moreover, the tensile strength and the modulus of elasticity of the specimens with RCA have very close values to those with natural aggregates. The ultimate shear strength of beams with RCA is very close to those with natural aggregates indicating the possibility of using RCA as partial replacement to produce structural concrete elements. The validity of both the Egyptian Code for the design and implementation of Concrete Structures (ECCS) 203-2007 and American Concrete Institute (ACI) 318-2011 Codes for estimating the shear strength of the tested RCA beams was investigated. It was found that the codes procedures gives conservative estimates for shear strength.

Keywords : construction and demolition (C&D) waste, coarse aggregate (CA), recycled coarse aggregates (RCA), opening

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