Structure Behavior of Beams Combining Ultra High Strength Concrete and Normal Strength Concrete

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Abstract:
The concept of "Composite structures or partial elements" was mainly carried out from an economical point view. The basic idea for using the composite elements is combining the Normal strength concrete and Ultra High Strength concrete (UHSC) or any recent advanced cementitious material in composite structures in order to exploit the advantages of the two materials in an optimal way. Ultra-high Strength concrete (UHSC) which was used in this research have exceptional material properties, however, their material costs are significantly higher than those of normal strength concretes. It is defined as a concrete which is meeting special combinations of performance and uniformity requirements that cannot always be achieved routinely using conventional constituent materials and normal mixing, placing, and curing practices,(ACI Committee 116). UHSC is characterized by extraordinary mechanical properties and durability properties. The UHSC-Matrix is very brittle material behavior. In this research an experimental program is being carried out to study the behavior of UHSC beams and composite beams using UHSC (141MPa) and Normal strength concrete with studying the effect of different parameters tested under static loads. This program mainly aims to reach to the optimum thickness of ultra-high strength concrete layer in the composite beams, it also aims to make a validation for using the Egyptian code equation for the maximum reinforcement ratio of longitudinal steel in UHSC and composite beams. This paper presents the results of this experimental program, which consists of ten reinforced concrete beams. The main parameters of this program were: longitudinal reinforcement ratio, the type of used concrete and the thickness of UHSC layer. Particular attention is paid to the effect of each variable on the strength enhancement, stiffness degradation, toughness and ductility of the tested beams. Valuable conclusions were obtained from the research results which stated that; in case of high reinforcement steel ratios the optimum thickness of UHSC in the concrete beams cross section should be not less than the third of the cross section depth only in order to achieve the economic point of view.

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