



Effect of 12-hour fire on Flexural Behavior of Recyclable Aggregate Reinforced Concrete Beams

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Abstract

Fire being one of the hazards causes external and internal adverse effects on concrete. On the other hand, demolishing waste causes numerous environmental issues due to lack of proper disposal management. Therefore, this research work presents experimental evaluation of effect of 12-hour fire on flexural behavior of reinforced concrete beams made with partial replacement of natural coarse aggregates with coarse aggregates from demolished concrete. The model beams are prepared using both normal and rich mix. Natural coarse aggregates are replaced in 50% dosage. Also, the beams without recyclable aggregates are prepared to check the results of proposed beams. After 28-day curing all the beams are exposed to fire for 12-hour at 1000°C in purpose made oven, followed by testing in universal load testing machine under central point load. During the testing deflection, load, and cracks are monitored. Analysis of flexural behavior and cracking reveals that after 12-hour fire residual strength of the beams is 52%. This shows loss of the strength of reinforced concrete beams thus requires appropriate retrofitting decision before putting again the structure in service after fire. Observation of cracks shows that most of the beams failed in shear with minor flexural cracks. In comparison to the results of control specimen the proposed beams show good fire resistance. The outcome of the research will prove landmark for future scholars and help the industry personals in understanding the behavior of the material in fire.

Keywords: Cube Size; Fire; Flexural Behavior; Recyclable Aggregates; Demolished Waste; Recyclable Aggregate Concrete.

1. Introduction

Green concrete prepared by using alternatives of ingredients of conventional concrete has remained active area of research since couple of decades. Indeed, it is because green concrete is not only environment friendly but also allows preservation of natural deposits of the aggregates. Among several components of demolishing waste, large volumes are of the concrete. This concrete may be used as full or partial replacement of natural coarse aggregates. Several attempts have been made by different scholars around the globe to study the possibilities of using old concrete as coarse aggregates. Memon (2016) presented recent developments on the use of demolished concrete as coarse aggregates in new concrete [1]. Li et al. (2015) also published literature review regarding re-use of demolished concrete as coarse aggregates but they addressed the issue from 2005 to 2014. The authors reviewed possibility of using the old concrete in steel composite sections, reinforced concrete sections and long-term performance of concrete. From the review authors concludes that RC composite members have similar or slightly lower behavior for certain replacements of natural coarse aggregates with recycled coarse aggregates. Hence use of recycled old concrete as aggregates in steel composite

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