EFFECT OF FIRE EXTINGUISHING METHOD AND SURFACE AREA TO VOLUME RATIO ON ULTIMATE STRENGTH OF RC COLUMNS SUBJECTED TO FIRE

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Abstract

Concrete is more durable against fire than other construction materials. However, high temperature has deteriorating effects on concrete mechanical properties. Decrease of strength at higher temperaâture can be associated with various reasons, such as micro-and macro-cracks in concrete, volume expansion of coarse aggregates and the deterioration of calcium silicate hydrate (C-S-H) gel in the cement paste. Behavior of concrete subjected to fire depends on its mix properties, fire temperature and duration, dimensions of the structural elements, thickness of the concrete cover, fire extinguishing method (which control the rate of cooling) and the surface area to volume ratio of different structural elements. The main objective of this research is to study the effect of four different extinguishing methods on the ultimate strength of 30 reinforced concrete columns subjected to fire. The tested columns are of different surface area to volume ratios. Non-destructive tests (Core & Ultrasonic pulse velocity tests) were used to estimate the deterioration extent of concrete subjected to fire. Results of the experimental study had shown that by increasing the surface area to volume ratio or by increasing the cooling rate, the ultimate strength of RC columns decreased considerably. A mathematical model was developed to estimate the ultimate strength of RC columns subjected to fire in order to decide whether these columns deserved repair and strengthening or not. Results of the mathematical model and the obtained experimental results were compared together to evaluate the accuracy of the proposed model

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