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IMPACT OF ELEVATED TEMPERATURE ON THE BEHAVIOR OF RC BEAMS STRENGTHENED WITH FRP

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ABSTRACT

Concrete structure are subjected to severe harms, or collapse, when they encounter extremely high temperatures. That is because the extremely high heat causes: the emergence and the rise of vapor pressure, the cement decomposition; and-at temperature above 500°C- the concrete components suffer an inhomogeneous variation in volume. To regain the strength of the heat-damaged structures, many techniques have been introduced such as the carbon fiber-reinforced polymer (CFRP). This technique was the focus of this study, aiming to study the flexural behavior of externally-reinforced-with-CFRP RC beams when exposed to extremely high temperatures. To achieve the objective of this study, thirty-two RC beams had been casted, and were sorted to: 8 of them were set as control beams without anchoring; while the remaining 24 samples were reinforced, externally, with CFRP composites. The specimens experimented under four-point bending to evaluate the specimens' modes of failure, in addition to the relation between the exerted load and the resultant displacement. The obtained results indicated that the strengthened-with-CFRP specimens had encountered a safer mode of failure than the control beams. Further, the reinforced specimens showed a remarkable enhancement- with respect to the control ones- in each of: the ultimate capacity of load-carrying, and in the deflections at the mid-span; whereas, the enhancements were not with the same amount. The material of the CFRP laminates is featured as it is able to bridge the emerging crack; where this ability is directly proportional to the length of the laminates. That is because the longer the CFRP laminates, the more capable they of connecting together the both ends of the prime flexural crack. Upon inspecting the load vs. deflection graph, in the light of the study parameters, it is observed that the curve is split to two sections: 1) the-almost- straight line, and 2) witnessed a slope rise, where the load has slightly risen, while the deflection greatly increased. The reason of the increase of the slope, in the second part of the curve, was the CFRP sheets; as those laminates conveyed the exerted load, due to the steel yielding. Finally, high temperatures decreased, to a big extent, the specimens': ductility, energy absorption, and ultimate load; as this effect was more and more obvious when the temperatures were higher.