Effectiveness of Combined Confinement with Metal Meshes and Ties for Preloaded and Post-Heated RC Short Columns

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Recently, innovative materials are used as lateral confinement reinforcement to increase concrete core contribution to load carrying capacity of reinforced concrete (RC) columns. This paper presents experimental assessment for the effectiveness of practical lateral confinement that utilizes metal meshes combined with typical steel ties for RC columns. The experimental plan comprises thirty square short column specimens, and investigates two metal meshes types; expanded metal mesh (EMM) and welded wire mesh (WWM). Preloading and post-heating were considered in the experimental study to provide realistic assessment for proposed confinement in real and fire conditions. Prior to testing under monotonic axial compression, all column specimens were subjected to preloading with 65% (of reference column capacity) in addition to post-heating for only fourteen specimens. The lateral reinforcement consisted of metal mesh layers (either EMM or WWM) wrapped above steel ties of various volumetric ratios (ρ=0.333%, 0.167%, and zero). Results showed that column load capacity was increased (49.15%-2.72%) for all specimens enclosing proposed lateral reinforcement with respect to reference specimens whose lateral reinforcement comprising only ties (ρ=0.333%). Also, the ductility was noticeably improved. Results revealed that metal mesh strength had the upper hand in magnifying ultimate load and ductility. Moreover, optimum lateral reinforcement (that develops significant improvement in load capacity and ductility without degradation of stiffness) was determined. Metal meshes enhanced fire resistance by dropping concrete core temperature and mitigating ultimate load reduction of post-heated RC columns compared to reference specimens