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Fire protection of fiber-reinforced polymers strengthened concrete members: A real need

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The retrofitting of damaged structures or the rehabilitation of old construction in an efficient and cost-effective way has always been a challenge for the civil engineering community. A state-of-the-art technology that has seen an increasing number of field applications during the past two decades involves the use of fiber-reinforced polymers (FRPs) in the retrofit of reinforced concrete (RC) members. However, their low resistance to elevated temperature effects has limited their application to structures vulnerable to fire. The use of insulation has proven to be an effective measure against temperature rise in the FRP material, thus allowing for this strengthening technique to become applicable in construction where fire poses a serious threat. An issue is that the fire insulation of FRPs is very expensive as it must keep the FRPs temperature lower than 70oC-80oC which is the Tg of epoxy resins. Furthermore, it is most likely that FRPs will be reconstructed after a fire event, even if they are fire protected. Against a number of guidelines and provisions, the paper presents an analysis of fire design codes and typical retrofitting cases where the fire protection of FRP systems is not necessary as the seismic loads, the increased live loads and applied high safety factors are not considered for fire design and so the structure is safe-according to the fire design codes-without considering the FRPs in fire.

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