

NEAR-SURFACE MOUNTED FRP REINFORCEMENTS FOR FLEXURAL STRENGTHENING OF CONCRETE STRUCTURES

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ABSTRACT

The use of Fibre-Reinforced-Polymer (FRP) materials for strengthening of bridges and buildings has been used extensively in the last decade. FRP has been used in different configurations and techniques to utilize the material effectively and to ensure long service life of the selected system. One of these innovative strengthening techniques is the near-surface mounted (NSM) that consists of placing FRP rebars or strips into grooves pre-cut into the concrete cover in the tension region of the strengthened concrete member. This method is relatively simple and considerably enhances the bond of the mounted FRP reinforcements, therefore utilizing the material more effectively. This paper presents test results of reinforced concrete T-beams strengthened in flexure with different strengthening systems using FRP rebars and strips as NSM reinforcement and externally bonded FRP strips. The FRP reinforcements used in this investigation include carbon-fiber-reinforced-polymer (CFRP) rebars and strips, and glass fiber-reinforced-polymer (GFRP) thermoplastic strips. The behavior and effectiveness of the materials used for the various strengthening systems are compared. The structural performance and modes of failure of the tested beams are presented and discussed. Test results indicated that using NSM-FRP rebars and strips is practical, significantly improves the stiffness and increases the flexural capacity of reinforced concrete beams. Limitation of using NSM-FRP rebars and strips is controlled by serviceability requirements in terms of overall deflections and crack widths rather than delamination, observed by many researchers, of externally bonded FRP reinforcement. Strengthening of reinforced concrete beams using NSM FRP strips provided higher strength capacity than externally bonded FRP strips using the same material with the same axial stiffness.

Keywords: Strengthening, near-surface mounted, externally bonded, carbon, glass, fiber-reinforced polymer, thermoplastic, concrete beams.