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Title: **Improvement of Flexural and Shear Capacity of Beams Using (FRP)**

Abstract

Most fibre reinforced polymer (FRP) structural applications have been in two areas. The first involves replacing steel reinforcing bars or pre-stressing steel strands with carbon fibre reinforced polymer (CFRP), glass fibre reinforced polymer (GFRP), or aramid fibre reinforced polymer (AFRP). The second application is to strengthen structurally deficient beams with FRP fabric, sheets or plates,

Recently, the concept of using a hybrid composite by combining two or more different reinforcing bars to produce bilinear stress–strain behaviour has become a subject of interest. An improvement of the structural performance of concrete beams can be obtained by utilizing a combination of FRP and steel reinforcements or, alternatively, FRP re-bars manufactured combining two or more different materials

In this research, experimental study was conducted on new composite material consisting of CFRP, epoxy, steel strips in two phases. The first phase is concerned to study the mechanical characterization of steel-CFRP composite specimens under direct tension. Eighteen specimens were fabricated in the concrete laboratory of Jamia Millia Islamia. The CFRP was sandwiched between two steel strips to have five groups of steel-CFRP composite specimens with different numbers of layers, each group consisting of three specimens. The sixth group has been left without any layer of CFRP. Thus, three specimens each of one layer, two layers, three layers, four layers and five layers were prepared. All these specimens were tested under tension load.

The second phase consisted of two parts as follows:

Part one:

1- Two types of steel-CFRP composite stirrups, U-shaped and D-shaped, were fabricated with same materials used to fabricate tension specimens in first phase.

2- To study the behaviour of steel-CFRP composite stirrups in beams, six beams were cast, reinforced with these stirrups and tested under a four-point loading system. The behaviour of these beams was compared with beam reinforced with traditional steel stirrups.

The tests revealed that steel-CFRP stirrups reached to their ultimate tensile strength unlike FRP stirrups which ruptured at much lower level than their ultimate strength as reported in various researches and the steel-CFRP composite stirrups could be used in lieu of steel stirrups.

Part two:

1- Two types of longitudinal steel-CFRP reinforcement were fabricated manually.

   a- 16mm wide steel-CFRP composite reinforcement with two layers of CFRP and gross cross sectional area of 80 mm^2

   b- 20mm wide steel-CFRP composite reinforcement with five layers of CFRP and gross cross sectional area of 120 mm^2

2- Four beams were cast, reinforced with the longitudinal steel-CFRP reinforcement and tested under a four-point loading system.

The flexural test results of the beams reinforced with these composite reinforcement showed that the beams with steel-CFRP composite reinforcement have comparable flexural strength and flexural ductility with beam reinforced with traditional steel bars.