



The Experimental Investigation of Flexural Behavior of Reinforced Concrete Beams Strengthened With Prestressed CFRP Plates

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Abstract

The strengthening of structures by using Fiber Reinforced Polymer (FRP) is a conventional and effective method throughout the world. The reason for this acceptance is to obtain good results from these materials in compare with old materials. In time of strengthening of structures by using FRP materials in traditional and non prestressed methods, often the full usage of FRP materials' capacity is not possible; also it is not possible to balance between the percentages of strengthened obtained and cost of project.

Therefore in this research the effect of prestressing as a new method for the flexural strengthening of reinforced concrete beam have been investigated. In this research program, flexural strengthening by using CFRP plates as a non prestressed and prestressed have been carried out on 8 reinforced concrete beams. Different level of prestressing ranging from 20 to 35% ultimate tensile strength of CFRP laminate were induced into the bonded plate by using external prestressing system as developed by researchers of this study. The results show the desirable effect of prestressing on the increased loading and desirable usage of CFRP plates.

Keywords: Flexural Strengthening, Reinforced Concrete Beam, CFRP Plate, Prestressing

1- Introduction:

Throughout the world there are reinforced concrete structures which will be used for many years. These structures due to aging, increased loading, the change in the usage of structures, change in the design codes or the damages due to earthquake and war are in need of rehabilitation or repair. By selecting the terms of "repair" it would be the turns for different strengthening method to be selected with their advantages and draw backs.

By using modified Fiber Reinforced Polymer (FRP) regarding its advantages such as light weight, easy erection, durability and high tensile strength, resisting against corrosion and unlimited access in size and dimension made it a favorable choice for the engineers. Usage of these materials regarding its widespread among the different options of strengthening technique will say the importance of this material and also the need for more investigation for its application for strengthening projects. By the way for more advantages of these materials, studying and presenting the new method are needed in order to improve better use of this type of strengthening and developing its application in strengthening structures. Here the prestressing technique can be treated as new choice for the strengthening by using CFRP plates.

FRP plates are occasionally used on the tension surface of reinforced beams which are due to be strengthened.

The research shows in this method due to separation of plate before the target load, its is not practible to use the whole strength of FRP (ACI Committee 440, 2002). That is why to increase the efficiency of EBR method different strengthening method has been presented (Khalifa 1999).

Prestressing technique of FRP plates are applied in different methods. In the first method, the prestress force was induced in the FRP plates by cambering of the beam. Prestressing force induced by this method was small (Saadatmanesh 1991). The second method was external tensioning of FRP plate and then their gluing on the tensile surface of beam. This method which was most general method of applying of prestressing force