

# FLEXURAL BEHAVIOUR OF REINFORCED CEMENT CONCRETE BEAM WRAPPED WITH GFRP SHEET

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## Abstract

Existing concrete structures may, for a variety of reasons, be found to perform unsatisfactorily. This could manifest itself by poor performance under service loading, in the form of excessive deflections and cracking, or there could be inadequate ultimate strength. Additionally, revisions in structural design and loading codes may render many structures previously thought to be satisfactory, noncompliant with current provisions. In the present economic climate, rehabilitation of damaged concrete structures to meet the more stringent limits on serviceability and ultimate strength of the current codes, and strengthening of existing concrete structures to carry higher permissible loads, seem to be a more attractive alternative to demolishing and rebuilding. This paper investigates the flexural behavior of R.C.C. beam wrapped with GFRP (Glass Fiber Reinforced Polymer) sheet. A total 8 beams, with (150×150) mm rectangular cross section and of span 700 mm were casted and tested. Three main variables namely, strength, ductility and damage level of R.C.C. under reinforced beam and R.C.C. beam weak in flexure were investigated. In first set of four R.C.C. under reinforced beams two were strengthened with GFRP sheet in single layer from tension face which is parallel to beam axis subjected to static loading tested until failure; the remaining two beams were used as a control specimen. In second set of four beams weak in flexure two were strengthened with GFRP sheet tested until failure; the remaining two were used as a control specimen. Comparison has been made between results of two sets.

**Keywords:** Beam, Glass fiber reinforced polymer sheet, Reinforced Cement concrete Beam

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## 1. INTRODUCTION

All over the world there are structures intended for living and transportation. The structures are of varying quality and function, but they are all ageing and deteriorating over time. Some of these structures are in such a bad condition that they need to be replaced. There is also a need for upgrading existing structures. Errors can have been made during the design or construction phase so that structures need to be strengthened before it can be fully utilized. New and increased demands from the transportation sector or change of use can also be reasons for upgrading existing structures. A strengthening method that has been increasingly used during the last decade Civil engineering structures are an important element of infrastructure and provide good service to the user they experience distresses on account of reasons and need strengthening to bring them back to their originally intended service mode. If effective methods are used for strengthening it is possible to bring structures back to their originally intended service usages many modern techniques are involved to proper effective strengthening methods.

FRP can be applied to strengthen the beams, columns, and slabs of buildings and bridges. It is possible to increase the strength of structural members even after they have been

severely damaged due to loading conditions. In the case of damaged reinforced concrete members, this would first require the repair of the member by removing loose debris and filling in cavities and cracks with mortar or epoxy resin. Once the member is repaired, strengthening can be achieved through the wet hand lay-up process of impregnating the fiber sheets with epoxy resin then applying them to the cleaned and prepared surfaces of the member. [8]

Two techniques are typically adopted for the strengthening of beams, relating to the strength enhancement desired: flexural strengthening or shear strengthening. In many cases it may be necessary to provide both strength enhancements. For the flexural strengthening of a beam, FRP sheets or plates are applied to the tension face of the member (the bottom face for a simply supported member with applied top loading or gravity loading). Principal tensile fibers are oriented in the beam longitudinal axis, similar to its internal flexural steel reinforcement. This increases the beam strength and its stiffness (load required to cause unit deflection), however decreases the deflection capacity and ductility.

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