

## Retrofitting for Reinforced Cement Concrete Beam using Carbon Fiber Reinforced Polymer(CFRP)

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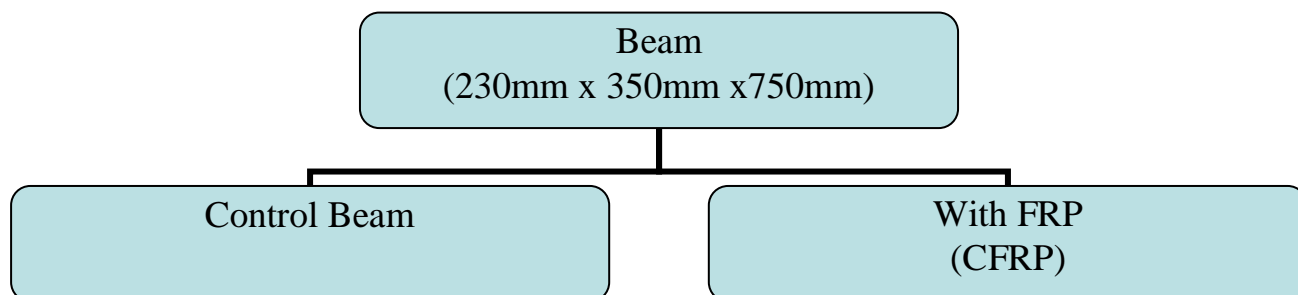
**Abstract** — The present paper study is to experimentally of RC structural Member beam strengthened with CFRP. Beam having a dimension 230mm x 350mm x750mm. Fe 500 used for steel Reinforcement & grade of concrete is M20. For beam CFRP wrapping at the bottom layer. One control beam and other CFRP beam in that one is for one layer of CFRP, second is for two layer & third is for three layer of CFRP in bottom. Result obtained in terms of Load v/s deflection.

**Keywords**-RC beam, CFRP, experiment etc.

### I. INTRODUCTION

The structural retrofit has two ways of solution one is repair/retrofit or second is demolition/reconstruction it means complete replacement of an existing structure. Reconstruction is a cost-effective solution therefore retrofitting is the best way to give a strengthening of existing structure. Different types of FRP like glass, Carbon, Basalt etc. FRP is easily and effectively strengthened of a concrete members. Its high strength, very light weight, corrosion resistance, easy installation.

### II. EXPERIMENTALWORK



- Beam specimen divided B1,B2 ,B3 &B4.
- B1 is a control beam
- B2 is One layer of CFRP at bottom.
- B3 for two layer of CFRP at bottom of beam.
- B4 is three layer at bottom of beam.
- **Casting and curing of beams:-**
  - Casting of four beams conducted by M20 grade of concrete and Fe 500 grade of Reinforcement.
  - Concrete mix proportion as below

Grade of concrete	Water	Cement	Sand	Coarse Aggregate
M20	0.5	1	2	3.23

- Proportion of ingredients used for 1m<sup>3</sup> Concrete mix are as below:-
  - Cement = Cement = 372 kg/ m<sup>3</sup>
  - Sand = 737.76 kg/ m<sup>3</sup>
  - 10 mm aggregate = 447.667kg/ m<sup>3</sup>
  - 20 mm aggregate = 671.5008 kg/ m<sup>3</sup>
  - Free water = 186 kg/ m<sup>3</sup>
  - W/C = 0.5

- Average cube strength of 3cubes after 7day and 28 days is  $17.21 \text{ N/mm}^2$  and  $25.70 \text{ N/mm}^2$  respectively.

Total no.4no. Of beam casting size of  $230\text{mm} \times 350\text{mm} \times 750\text{mm}$   
Reinforcement Details for Beam:-



Casting of beam work:-



Curing of beam:-



### III. MATERIAL CFRP

A material Carbon Fiber Reinforced Polymer used as a strengthening material especially in resins and ceramics. It's also called as a Fabric (Carbon sheet or C-sheet). This strengthening method is easy and fast to put in place because carbon is very light material and application is very simple.

- **Material properties of Carbon Fiber:-**

Technical data (unidirectional)	400 g/m <sup>2</sup>
Weight per unit area of sheet (g/m <sup>2</sup> )	430
Tensile strength (MPa)	4000
Fibre weight (g/m <sup>2</sup> ) (main direction)	400

<b>Density (g/cm<sup>2</sup>)</b>	1.80
<b>Ultimate Elongation (%)</b>	1.7
<b>Design thickness (Fiber weight/density) (mm)</b>	0.42
<b>Filament diameter (mm)</b>	7

Apply CFRP sheet at the bottom layer.

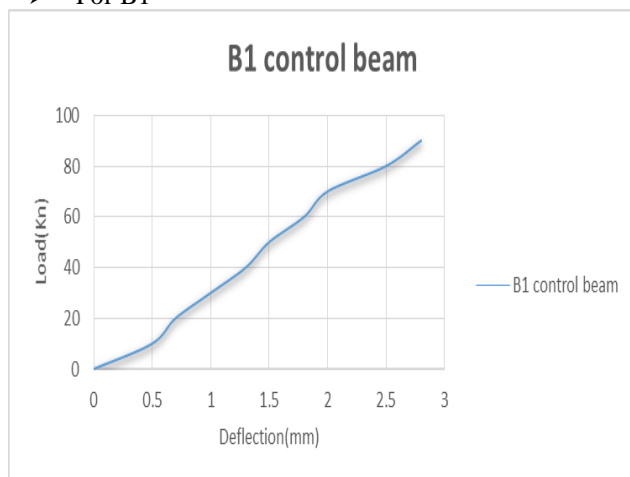


Specimen type B1, B2, B3 and B4 is control beam, one layer at bottom, two layer and three layer at bottom of CFRP sheet. And after 28 days flexural strength measure.

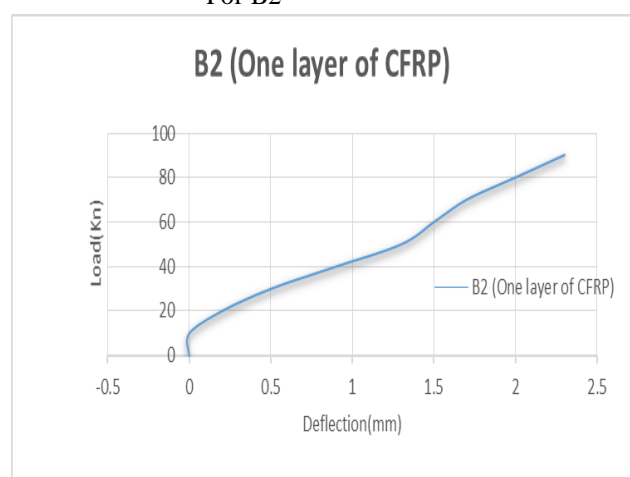
## V. RESULT

For R.C.C beams with and without carbon fiber wrapping result in terms of load (KN) v/s deflection (mm). When the plain R.C.C beam is wrapped by bottom with one layer, two layer & three layer the strength is increased as compare to control R.C.C beam of concrete M20 grade.

➤ For B1

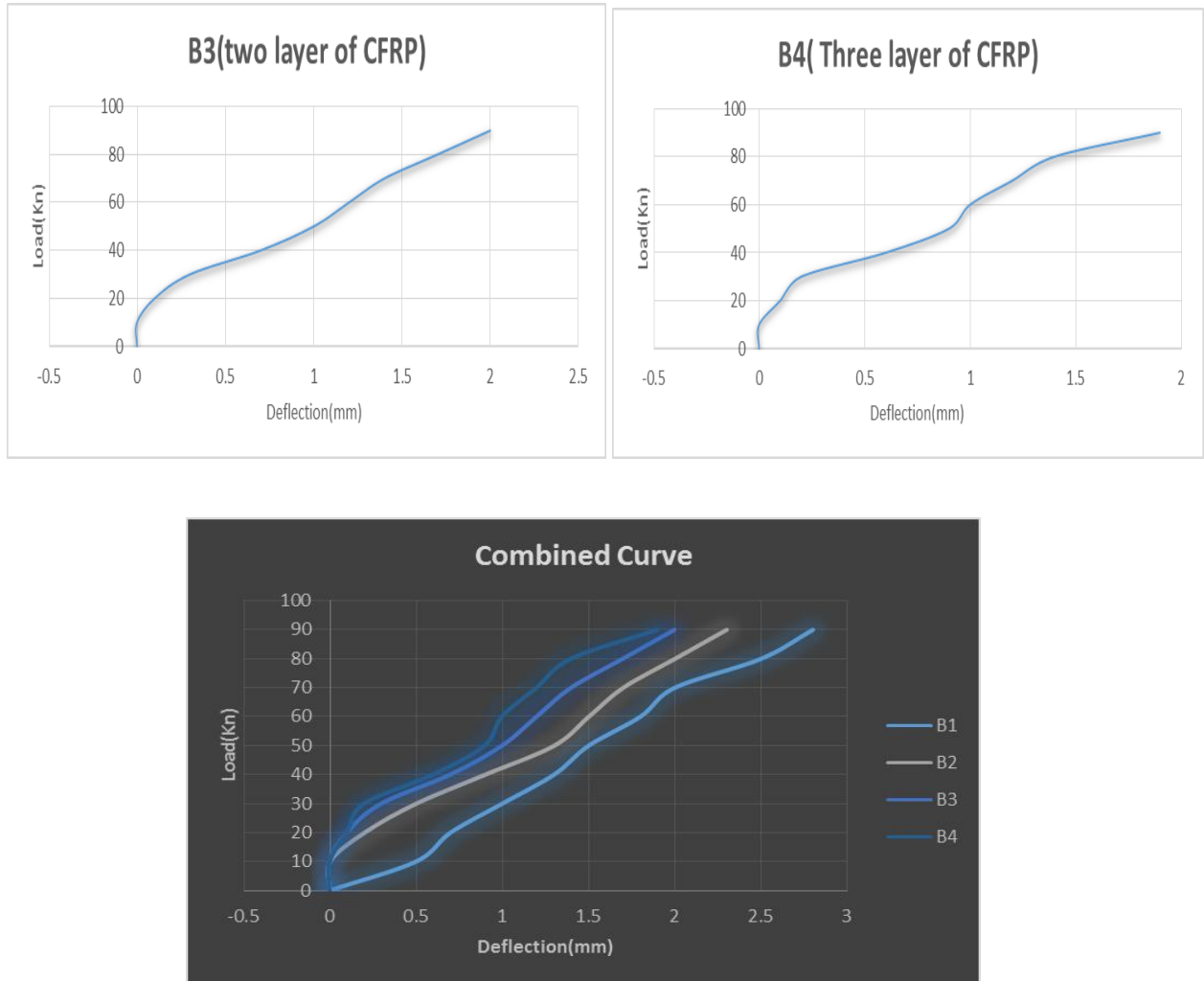


For B2



➤ For B3

For B4



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Link:-

➤ <http://www.byggmek.lth.se/fileadmin/byggnadsmekanik/publications/tvsm3000/web3070.pdf>