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Comparative Study on RCC Beam with & without Carbon Fibre Reinforced Polymer using Ansys Software

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ABSTRACT

- RCC components are mainly beams and columns are sturdy and strong in flexure when they are utilized with Carbon Fibre Reinforced Polymers (CFRP) composites which are epoxy bonded for tensile zones with the direction of fibres parallel to it of high tensile stresses.
- The mechanical behavior of composite concrete structures is difficult to analyze by an analytical model, due to the nonlinear behavior of the composite material. FE analysis is an efficient solution to overcome the problems.
- A load defection response, stress response and strain response were measured when CFRP reinforcement was provided, the stiffer response was observed at a relatively reduction in deflection, stress and strain in (CFRP) sheet.
- Finite Element Method analysis for the investigation of deformation and stresses.
- Ansys 14.5 software is used for finite element modelling. In this study unreinforced beam and beam reinforced with CFRP are compared on the basis of deformation and stresses.

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INRODUCTION

Carbon Fibre Reinforced Polymer and their Properties

In general, the properties of Fibre Reinforced Polymer are controlled by the type of fibres used for strengthening. The following types of fibres are generally adopted for structural applications:

Carbon Fibre

Advantages of FRP

The advantages of composite materials have energized development of new applications in business sectors, for example, transportation, development, consumption obstruction, marine, framework, buyer items, electrical, airplane and aviation and apparatuses and business gear. The advantages of utilizing composite materials include:

High Strength – Composite materials can be intended to meet the particular quality prerequisites of an application. An unmistakable favorable position of composites over different materials is the capacity to utilize numerous mixes of saps and fortifications, and consequently custom tailor the mechanical and physical properties of a structure.

Light Weight – Composites are materials that can be intended for both lightweight and high quality. Truth be told, composites are utilized to create the most elevated solidarity to weight proportion structures known to man.

Corrosion Resistance – Composites items give long haul protection from extreme substance and temperature conditions. Composites are the material of decision for open-air presentation, concoction taking care of uses, and extreme condition administration.

Design Flexibility – Composites have favourable position over different materials since they can be formed into complex shapes at generally ease. The adaptability of making complex shapes offers fashioners an opportunity that trademarks composites. Composites can be uniquely custom fitted to have quality in a particular bearing. In the event that a composite needs to oppose bowing one way, the majority of the strands can be situated at 90o to the twisting power. This makes a solid structure one way. What really happens is that a greater amount of the material can be utilized where it matters most. With metals, if the more noteworthy quality is required one way, the material must be made thicker by and large, which includes weight. Likewise tailor capacity is the additional favourable position in FRP.

Durability – Composite structures have an exceedingly long life expectancy. Combined with low upkeep necessities, the life span of composites is an advantage in basic applications.

OBJECTIVES

To evaluate the effectiveness of the use of CFRP laminates as external reinforcement to reinforced concrete frames Beam section subjected to stress and Deformation.

METHODOLOGY

- In the present thesis, an analytical work has been carried out on the beam section sized 220mm x 300mm with effective length 3.5m, to evaluate the performance of a concrete beam model which is reinforced CFRP materials.
- The CFRP materials using in this study with different thicknesses 3mm and 6mm.
- The analytical concrete beam model was generated using a finite-element software program ANSYS 14.5.
- In ANSYS software concrete beam which is subjected to loading through UDL loading. Vertical load was applied 150 KN/m for better computational accuracy.
- Analysis has been carried out to investigate the response of concrete beam system with respect to deflection, stress and strain.

ANSYS

- ANSYS is a far reaching broadly useful limited component PC program that contains more than 100,000 lines of code. ANSYS is equipped for performing static, dynamic, heat exchange, liquid stream and electromagnetism examination. ANSYS has been a main FEA program for well more than 20 years. The present form of ANSYS has a totally new look, with different window consolidating Graphical User Interface (GUI). Draw down menus, discourse boxes and apparatus bar. Today we will discover ANSYS being used in many designing fields, including aviation, car gadgets and atomic. ANSYS is exceptionally ground-breaking and amazing building apparatus that might be utilized to tackle an assortment of issues. Be that as it may, A client without an essential comprehension of the limited component techniques will get oneself in indistinguishable pickle from a PC instructing with access to numerous noteworthy instruments and devices, however who can't fix a PC since he and she doesn't comprehend the inward working of a PC.

Results

Deflection, Stress & Strain Contour Plots for CFRP

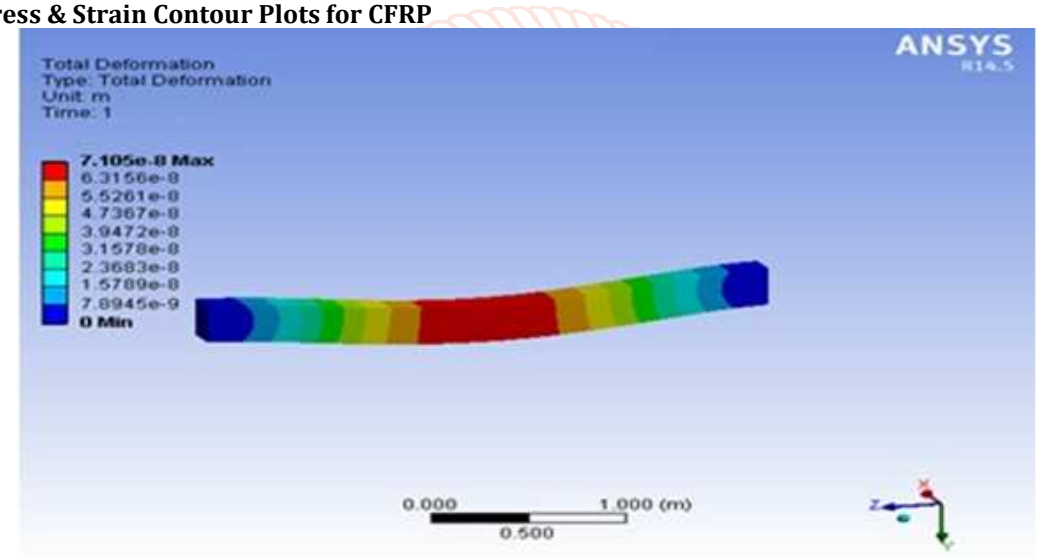


Fig.5.1 CFRP 3mm Deflection Results

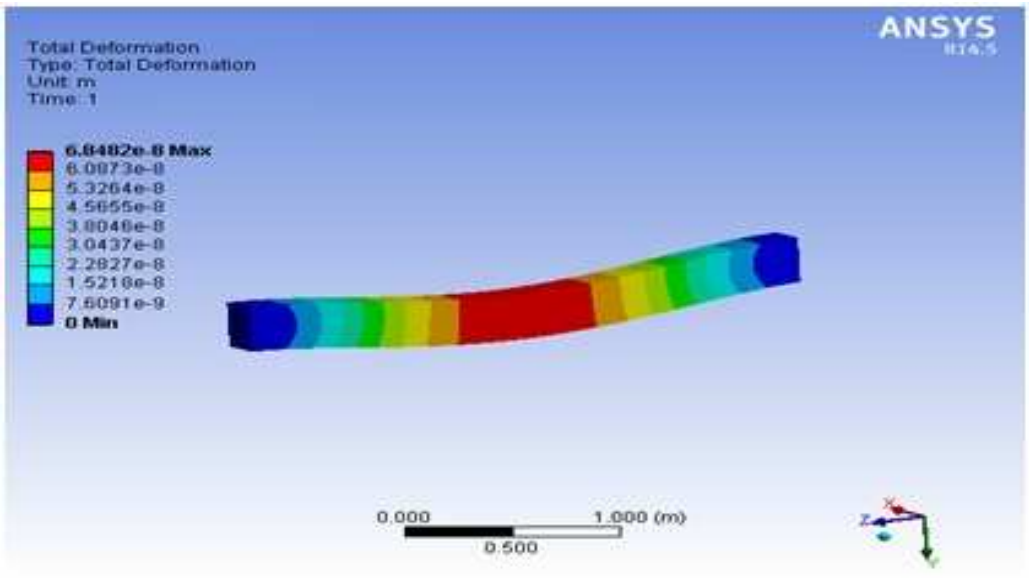


Fig. 5.2 CFRP 6mm Deflection Results

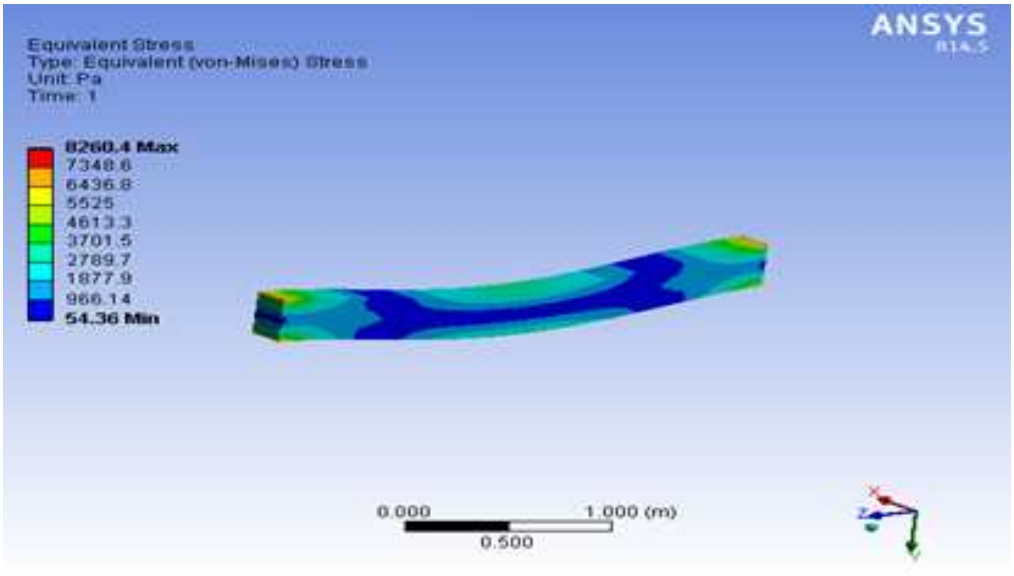


Fig. 5.3 CFRP 3mm Stress Results

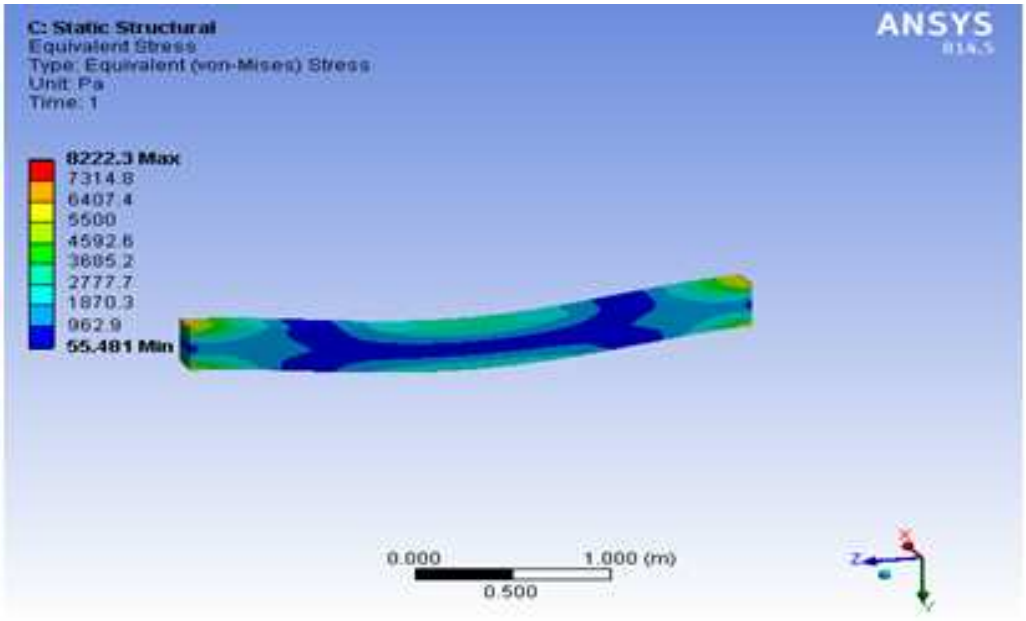


Fig. 5.4 CFRP 6mm Stress Results

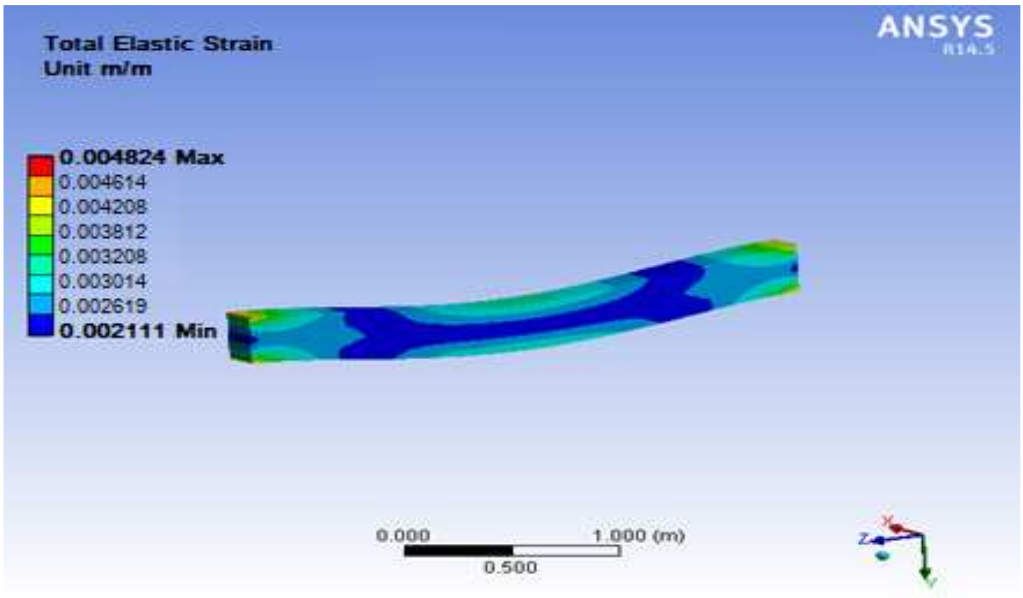


Fig. 5.5 CFRP 3mm Strain Results

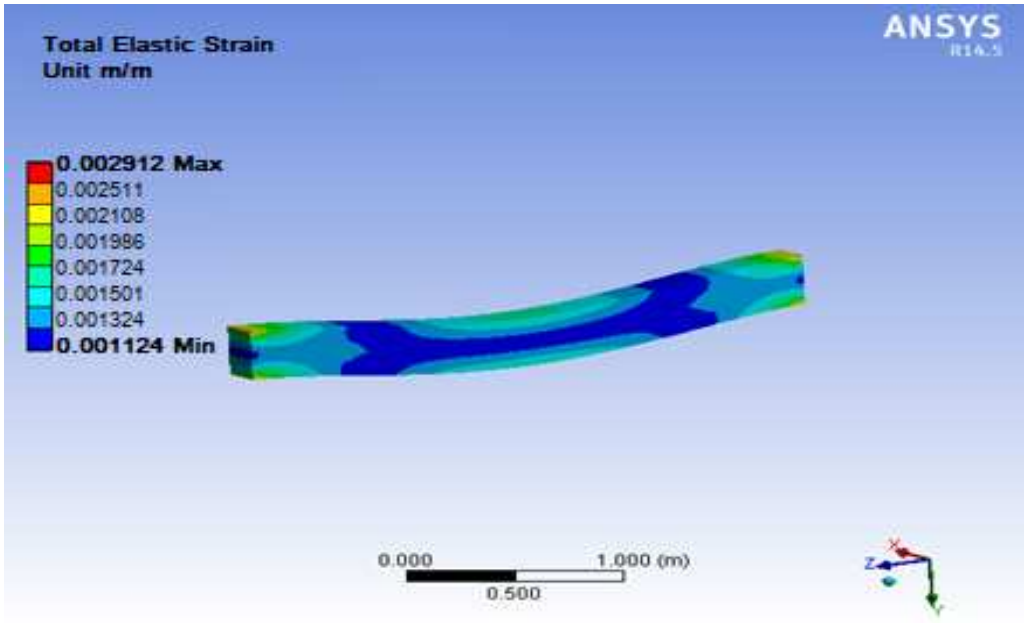
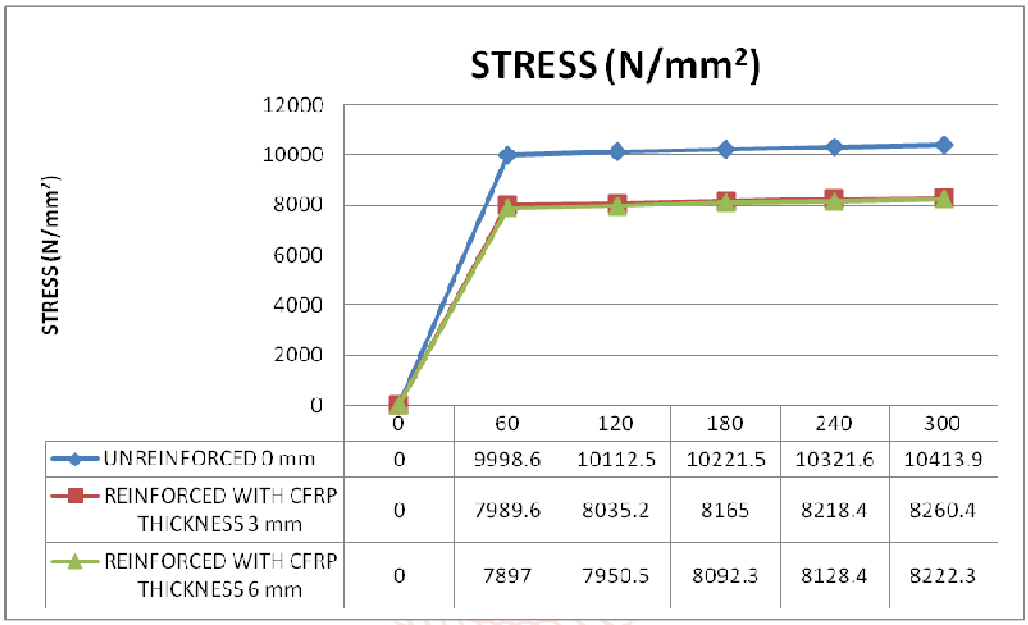
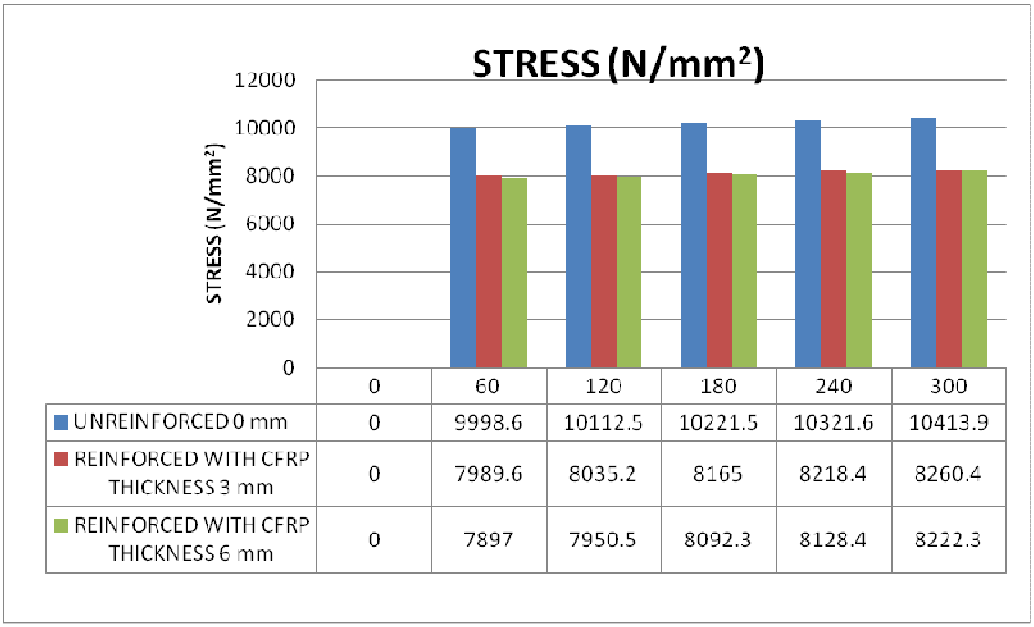


Fig. 5.6 CFRP 6mm Strain Results



	0	60	120	180	240	300
UNREINFORCED 0 mm	0	9998.6	10112.5	10221.5	10321.6	10413.9
REINFORCED WITH CFRP THICKNESS 3 mm	0	7989.6	8035.2	8165	8218.4	8260.4
REINFORCED WITH CFRP THICKNESS 6 mm	0	7897	7950.5	8092.3	8128.4	8222.3

Fig. 5.7 Stress Response for CFRP



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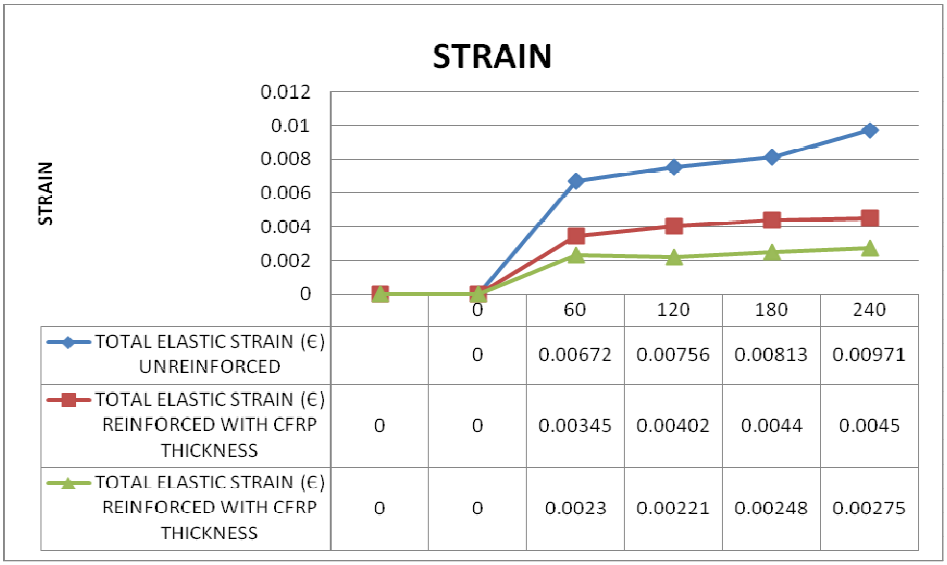
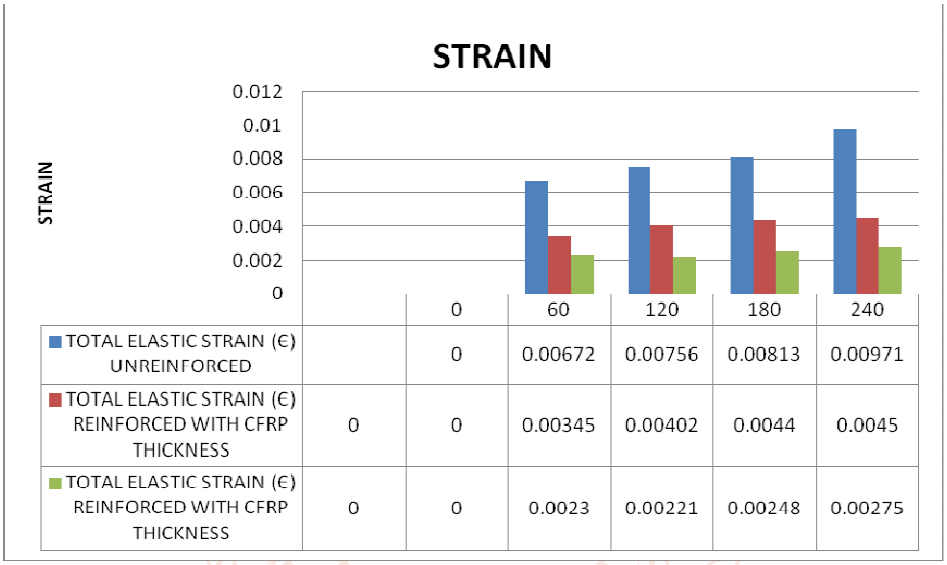
REINFORCED WITH CFRP THICKNESS 6 mm	0	7897	7950.5	8092.3	8128.4	8222.3

Fig. 5.8 Stress Response for CFRP using Bar Chart



TOTAL ELASTIC STRAIN (Є) UNREINFORCED		0	0.00672	0.00756	0.00813	0.00971
TOTAL ELASTIC STRAIN (Є) REINFORCED WITH CFRP THICKNESS	0	0	0.00345	0.00402	0.0044	0.0045
TOTAL ELASTIC STRAIN (Є) REINFORCED WITH CFRP THICKNESS	0	0	0.0023	0.00221	0.00248	0.00275

Fig. 5.9 Strain Response for CFRP



TOTAL ELASTIC STRAIN (Є) UNREINFORCED		0	0.00672	0.00756	0.00813	0.00971
TOTAL ELASTIC STRAIN (Є) REINFORCED WITH CFRP THICKNESS	0	0	0.00345	0.00402	0.0044	0.0045
TOTAL ELASTIC STRAIN (Є) REINFORCED WITH CFRP THICKNESS	0	0	0.0023	0.00221	0.00248	0.00275

Fig. 5.10 Strain Response for CFRP using Bar Chart

Conclusions

Investigate the response of concrete beam system with respect to deflection, stress and strain.

- CFRP provided more strength to the structure Beam and effective than Without CFRP concrete material in reduction of deformation and stresses**.**

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