**Study and Analysis behaviour of reinforced concrete composite columns use the ANSYS software**

**Rohit Kumar1, Dr. Jyoti Yadav2**

1M.Tech Scholar, Dept. Of Civil Engineering, Sarvepalli Radhakrishnan University, Bhopal, M.P, India

2Assistant Professor, Dept. Of Civil Engineering, Sarvepalli Radhakrishnan University, Bhopal, M.P, India

**Abstract-**According to the requirements of advanced infrastructure, high-quality construction materials and innovative technologies are necessary. In recent years, the use of composite materials to reinforce concrete structures has increased. In this paper, numerous techniques for enhancing the performance of reinforced concrete columns using FRP composite material are examined. Using ANSYS, a linear analysis of a column specimen was conducted. The performed analysis will aid in determining the deformation of concrete columns reinforced with FRP bars.

**Keywords:- Fiber Reinforced Polymer (FRP), Linear Analysis, ANSYS**

**Introduction**

For many years, traditional reinforcing techniques in reinforced concrete columns have been used as a common practise among designers and builders. There has been much study, and designers can forecast how the columns will operate in the future. Fibre reinforced polymer (FRP) is used for structural reinforcement and rehabilitation. Because of their low weight, non-corrosiveness, high specific strength, specific stiffness, and ease of construction, FRP composites in the form of sheets, cables, rods, and plates have shown to be a future alternative to steel reinforcements [1,2]. AFRP, GFRP, and CFRP are typical forms of FRP employed in different research and real-world applications[3-5]. The goal of this study is to simulate and examine the behaviour of reinforced concrete columns strengthened with CFRP. The findings and observations reported in this research may help engineers anticipate the compressive strength of concrete columns made of CFRP.

**2. Objectives of the Study**

1. To examine the responses of steel-bar reinforced concrete columns to axial loads alone.

2. To investigate the behaviour of carbon fibre reinforced polymer-reinforced reinforced concrete columns under longitudinal and transverse compression under a pure axial load.

3. The structural behaviour of RCC and GFRP columns should be compared.

1. **Methodology**

In Fig. 1, the specifics of the testing columns were shown. Analysis was done on column specimens, each of which had a square cross-section with a length of 3000mm and a side of 400mm. Main steel and CFRP reinforcement for the examined columns was 8#16mm. The typical compressive strength of concrete columns is 30 N/mm2, and the transverse reinforcement (steel, GFRP) was about 6 mm stirrups spaced 250 mm apart.

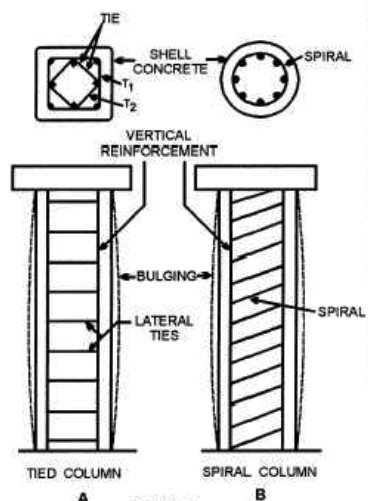
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Fig. 1:RCC columns

|  |  |  |  |
| --- | --- | --- | --- |
|  | Concrete | Steel  reinforcement | CFRP |
| Unit Weight  (N/mm3) | 2.40e-5 | 7.90e-5 | 1.60e-  5 |
| Ultimate Compressive Strength(N/mm2) | 30 | NA | NA |
| Tensile  Strength(N/mm2) | 2.2 | 490 | 2070 |
| Elastic  Modulus(N/mm2) | 2.40e4 | 2e5 | 1.52e5 |
| Poisson ratio | 0.2 | 0.3 | 0.2 |

Table 1.Material Properties

The reinforcing ratios and kinds, concrete's typical compressive strength, ultimate load bearing capability, and other parametric studies are all considered in this inquiry.

|  |  |  |  |
| --- | --- | --- | --- |
| ColumnNo. | Reinforcement ratio  (%) | Ultimate load on column  (KN) | Remark |
| 1 | 0.8 | 2477 | Steel used as  reinforcement |
| 2 | 0.8 | 4148 | CFRP used as  reinforcemnt |

Table 2: Ultimate Load on column (KN)

1. **Results**

Table 3 compares deformations in columns reinforced with steel and CFRP and displays the analytical findings of deformations using ANSYS.

|  |  |  |  |
| --- | --- | --- | --- |
| Column  No | Reinforcement  ratio(%) | Deformation  (mm) | Remark |
| 1 | 0.8 | 1.875 | Steel used as  reinforcement |
| 2 | 0.8 | 2.785 | CFRP used as  reinforcement |

Table 3: ANSYS Results for Deformation (Linear Analysis)

Equation of Elasticity for Composite Material is used to verify the values of deformations derived by ANSYS (In Linear Analysis). Table 4 show the verification of deformation in concrete columns reinforced with steel and CFRP.

|  |  |  |  |
| --- | --- | --- | --- |
| Column  No. | Reinforcement  ratio(%) | Deformation  (mm) | Remark |
| 1 | 0.8 | 1.919 | Steel used as  reinforcement |
| 2 | 0.8 | 3.220 | CFRP used as  reinforcemnt |

Table 4: Validation for Deformation

|  |  |  |  |
| --- | --- | --- | --- |
| Column No. | Reinf ratio(%) | Cost  of Steel | Cost  of CFRP |
| 1 | 0.8 | 795 | 2835 |

Table 5: cost analysis & comparison

1. **Conclusions**
2. The values of deformation derived from the equation of elasticity for composite materials and the deformation findings from finite element analysis are in excellent agreement.
3. The ultimate load bearing capability of the column is greatly improved when made with CFRP.
4. Although CFRP is more expensive than steel reinforcement, it is ultimately more affordable because:

4. The CFRP has a stronger tensile strength, weighs 1/4 the amount of steel, is corrosion-free, and significantly lowers maintenance costs.

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