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STUDY AND ANALYSIS BEHAVIOUR OF REINFORCED CONCRETE COMPOSITE COLUMNS USE THE ANSYS SOFTWARE

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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

1. 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.

3. 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.

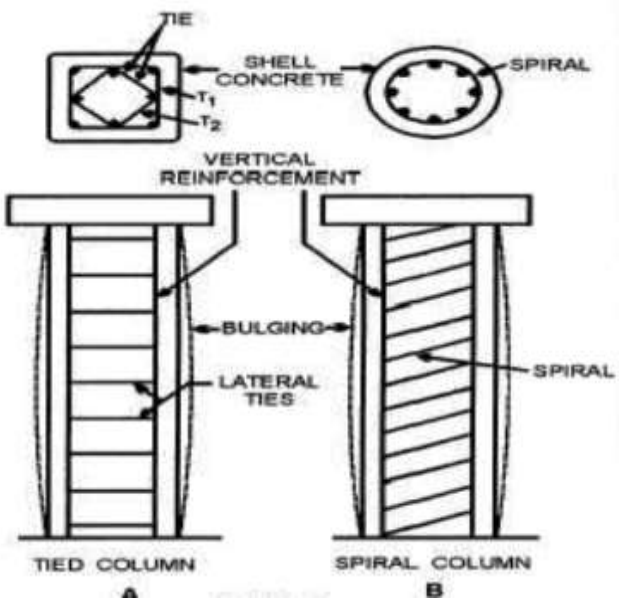

Fig. 1: RCC columns

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Table 1. Material Properties

	Concrete	Steel reinforcement	CFRP
Unit Weight (N/mm^3)	2.40e-5	7.90e-5	1.60e- 5
Ultimate, Compressive Strength(N/mm^2)	30	NA	NA
Tensile Strength(N/mm^2)	2.2	490	2070
Elastic Modulus(N/mm^2)	2.40e4	2e5	1.52e5
Poisson ratio	0.2	0.3	0.2

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

Table 2: Ultimate Load on column (KN)

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

4. RESULTS

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

Table 3: ANSYS Results for Deformation (Linear Analysis)

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

quation 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.

Table 4: Validation for Deformation

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 5: cost analysis & comparison

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

5. CONCLUSIONS

1. 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.

2. The ultimate load bearing capability of the column is greatly improved when made with CFRP.

3. 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.

6. REFERENCES

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