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Experimental and Numerical Investigation of Concrete-Filled Steel Tube (CFST) Columns Under Axial Loading

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Abstract: *Concrete-Filled Steel Tube (CFST) columns are widely used in modern structural applications due to their superior axial load carrying capacity, ductility, stiffness, and confinement characteristics. This paper presents an experimental and numerical investigation of CFST columns subjected to axial loading. Experimental testing and finite element analysis using ANSYS were carried out for M20, M25, and M30 concrete grades. Load-deflection and stress-strain responses were studied to evaluate structural behavior. The results indicate that CFST columns exhibit enhanced axial resistance and reduced deformation compared to conventional reinforced concrete columns.*

Keywords: CFST Columns, Axial Loading, ANSYS, Composite Structures, Load-Deflection, Stress-Strain

I. INTRODUCTION

Concrete-Filled Steel Tube (CFST) columns are composite structural members consisting of steel tubes filled with concrete. The steel tube provides confinement to the concrete core while the concrete prevents inward buckling of the steel tube. This interaction improves structural efficiency, stiffness, ductility, and energy absorption capacity.

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II. OBJECTIVES

The objective of this study is to investigate the behavior of CFST columns under axial loading through experimental and numerical analysis. The study also evaluates load carrying capacity, stress-strain behavior, and deformation characteristics.

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III. LITERATURE REVIEW

Previous research studies indicate that CFST columns provide improved structural behavior under axial compression. Researchers observed enhanced load carrying capacity and confinement effects due to composite interaction between steel and concrete.

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IV. EXPERIMENTAL PROGRAM

Circular CFST specimens were prepared using steel tubes filled with M20, M25, and M30 concrete grades. The specimens were tested under axial compression loading using a Universal Testing Machine.

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V. NUMERICAL MODELING USING ANSYS

Finite element analysis was performed using ANSYS software to simulate the axial loading behavior of CFST columns. Material properties and loading conditions were assigned according to standard assumptions.

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VI. RESULTS AND DISCUSSION

Experimental and numerical investigations showed that CFST columns exhibit superior axial performance. Higher concrete grades demonstrated increased stiffness and reduced deformation.

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VII. CONCLUSION

CFST columns provide enhanced structural efficiency under axial loading conditions. The confinement effect generated by the steel tube improves strength and ductility. ANSYS results showed good agreement with experimental observations.

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VIII. FUTURE SCOPE

Future studies may include seismic analysis, cyclic loading, fire resistance investigation, and optimization of composite sections.

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IX. GRAPHICAL RESULTS

Fig. 1: Load vs Deflection Curve

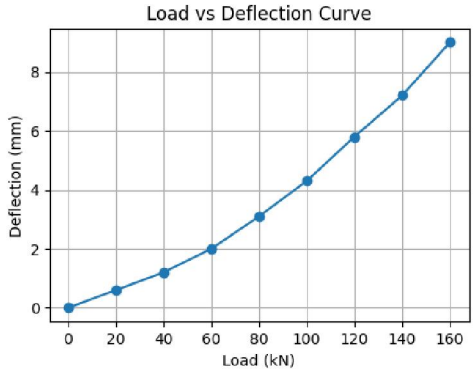

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Fig. 2: Stress vs Strain Curve

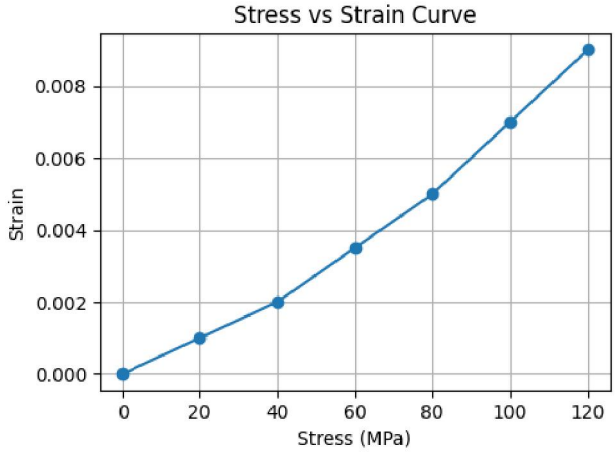
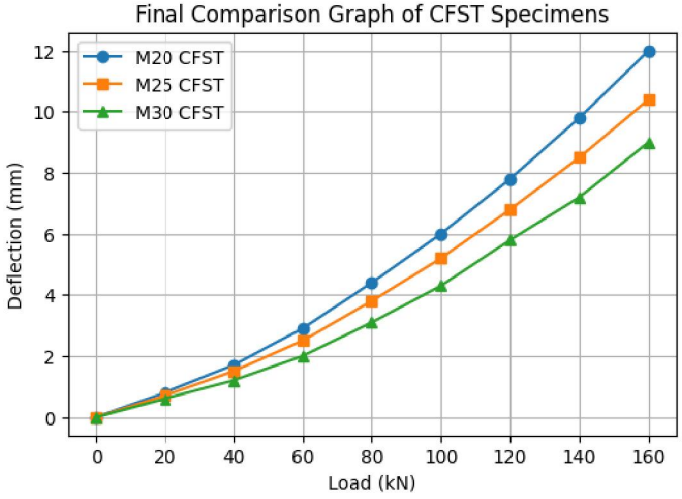


Fig. 3: Final Comparison Graph of CFST Specimens



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