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FEA OF COLUMNS UNDER PARAMETRIC STUDY OF VARIOUS STEEL-CORRUGATED TUBES

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Abstract: This project discus about the strength of steel columns with thin walls. The typical stress-strain curves have a large strain hardening region, a gradual yielding, and a nonlinear course. Corrugated concrete filled steel tube columns are widely used in long-span and substantially laden buildings because to the benefits of its flexible joint types, larger moment of inertia, and ease of meeting construction regulations. To Corrugated concrete filled steel tube columns can use a variety of channel column shapes, but it is necessary to assess the dimensions of each shape's section. A parametric study of corrugated sections is necessary to assess the impact of variables on section behavior. the effectiveness of poured concrete and corrugated steel tube as load-bearing materials should be compared. Different corrugated steel tube types, including trapezoidal and rectangular shapes, were used to understand the behavior of bucking load capacity.to find out how various loading and boundary conditions behave. To determine which concrete ratios work best in steel tubes filled with corrugated concrete. We discover that the rectangle forms of the corrugate section have the highest bucking load-carrying capacity in the scenario of CFST column axil loading condition with bucking load analysis

Index Terms **- Component, formatting, style, styling, insert.**

I. INTRODUCTION

The strength of thin-walled stainless steel columns has been investigated extensively over the last few years. Typical stress-strain curves follow a nonlinear path with gradual yielding and a large strain hardening domain. Four solid elements were introduced to simulate the guiding plates placed along the outside and inside cross-section perimeters during the experiment. Contact conditions between the guiding plates and the endplates of the testing machine were defined through tie constraints on the joining surfaces Due to the advantages of its flexible joint types, greater moment of inertia, and ease of meeting construction standards, corrugated tube column columns are frequently employed in long-span and heavily loaded constructions.

OBJECTIVE

- To investigate the performance of corrugated steel tube and filled concrete with load carrying capacity's effectiveness.
- To determine how well various corrugated forms, operate and comprehend load capacity.
- To comprehend the behavior of bucking load capacity various corrugated steel tube kinds, including trapezoidal and rectangular shapes.
- To investigate how various boundary conditions and loading conditions perform.
- To assess the effectiveness of various concrete ratios in steel tubes filled with corrugated concrete

SCOPE

- The work is limited to modelling and analysis of Lipped channel using ANSYS.
- The work is focused only on Lipped channels made of steel.
- Geometric changes will happen in the existing model.
- Confinement provided for corrugated tube columns are to improve the strength characteristics and ductility.

RESULTS AND DISCUSSIONS

Using ANSYS, sinusoidal and trapezoidal shaped columns with steel plate connections were created to explore the structural behaviour of non-prismatic corrugated steel tubes with various column arrangements. Columns with sinusoidal and trapezoidal shapes were modelled using solid 180 models. A higher order 3D 8-node surface element named SHELL 181 demonstrates quadratic displacement behaviour. The element has eight nodes, each with six degrees of freedom, and may move and rotate in the x, y, and z dimensions.

GEOMETRY

The specimen's geometry is maintained to be identical to that of the specimens in the base journal. Non-prismatic columns of the L and T form were taken into consideration for the analysis. The figures below explain how to measure the steel tube thickness for columns. Steel tubes are 3 mm thick with a yield strength of 337 MPa, while stiffeners are 3 mm thick with a yield strength of 306 MPa. The specimen length is 900 mm.

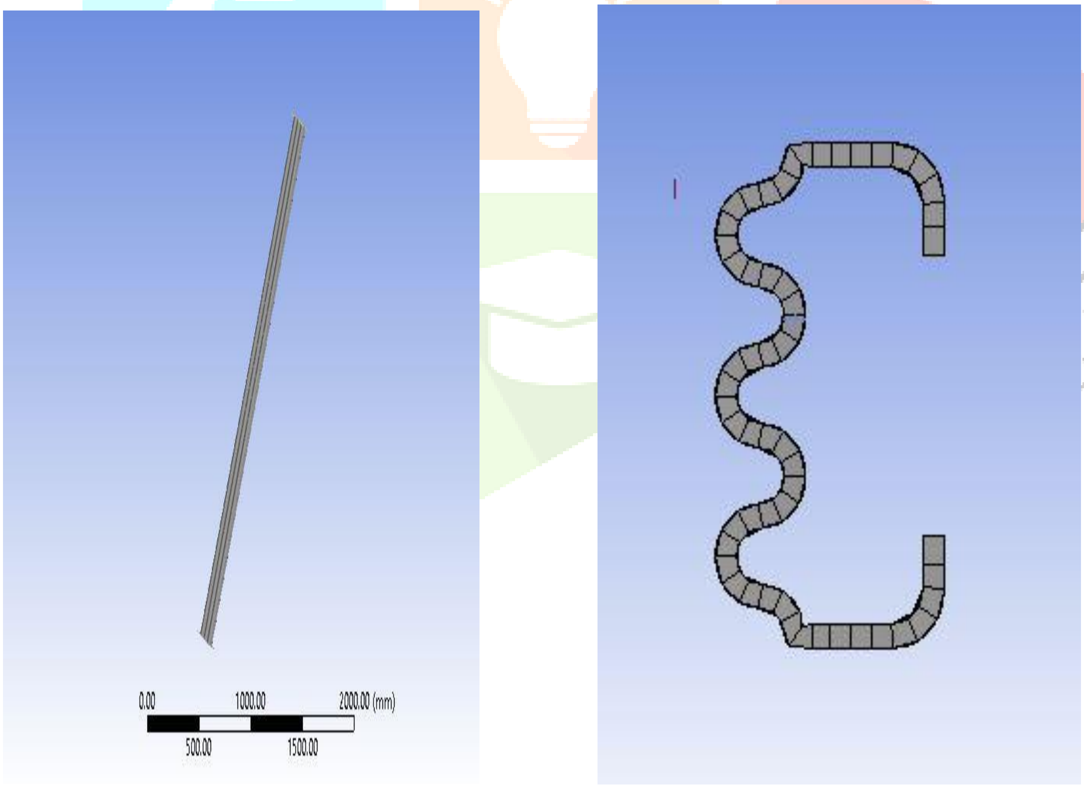


Fig 4.22 Geometry sinusoidal

MESHING

Meshing separates the entire component into a predetermined number of tiny parts. To achieve precision, the element's size must be as small as possible. To attain the highest level of precision in the results, a fine mesh was used in this research. After meshing, SHELL models are transformed into a finite element model.

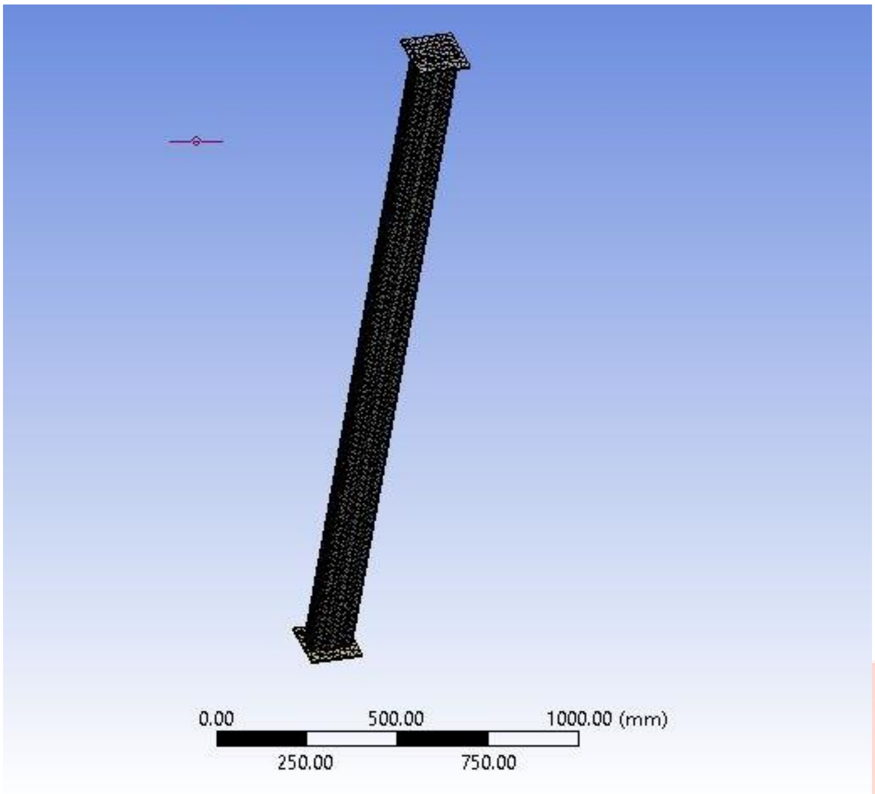


Fig 4.23 Mesh sinusoidal shaped column

LOADING AND BOUNDARY CONDITIONS

Columns were modelled with one end fixed and the other end loose to replicate real situations. Only one direction saw load application. Utilising ANSYS, the behaviour of the specimen under axial load was investigated.

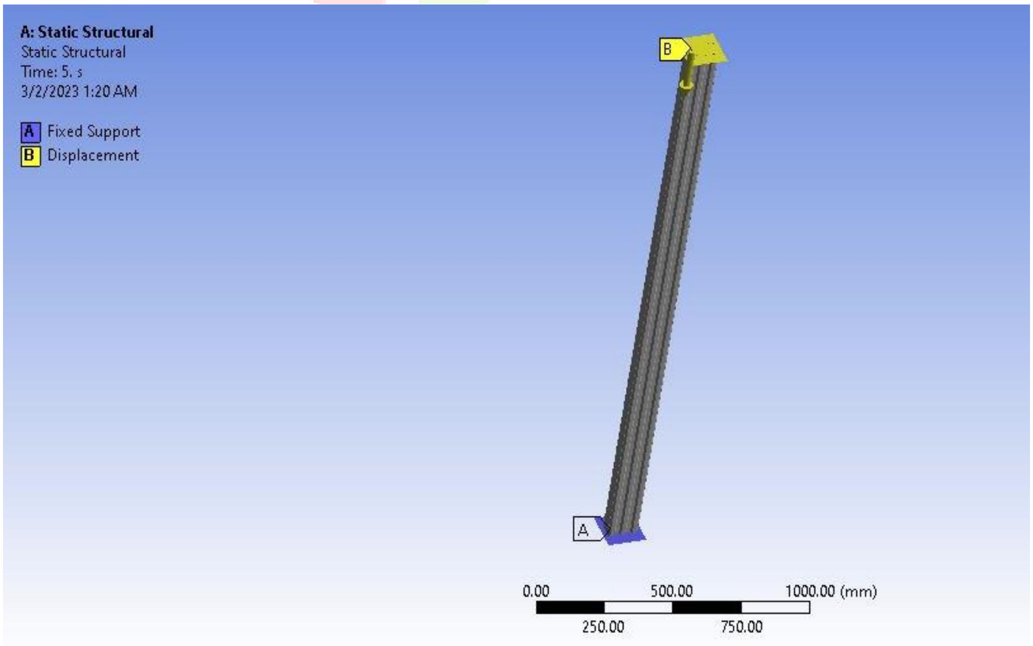


Figure: Application of loads in sinusoidal shaped column

RESULT OBTAINED

Non-linear analysis was carried out in the loaded lipped channel, and results for the force-deflection relationship were obtained.
Comparison is made between the total deformation and equivalent stress diagrams.

TOTAL DEFORMATION

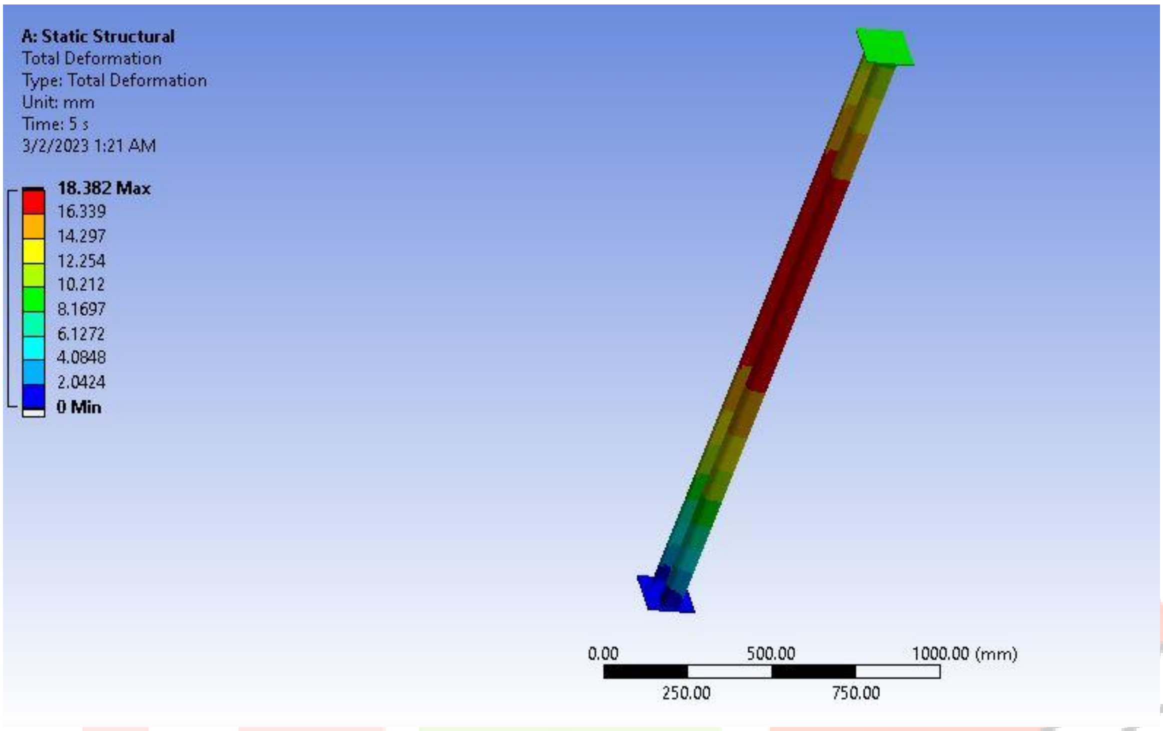
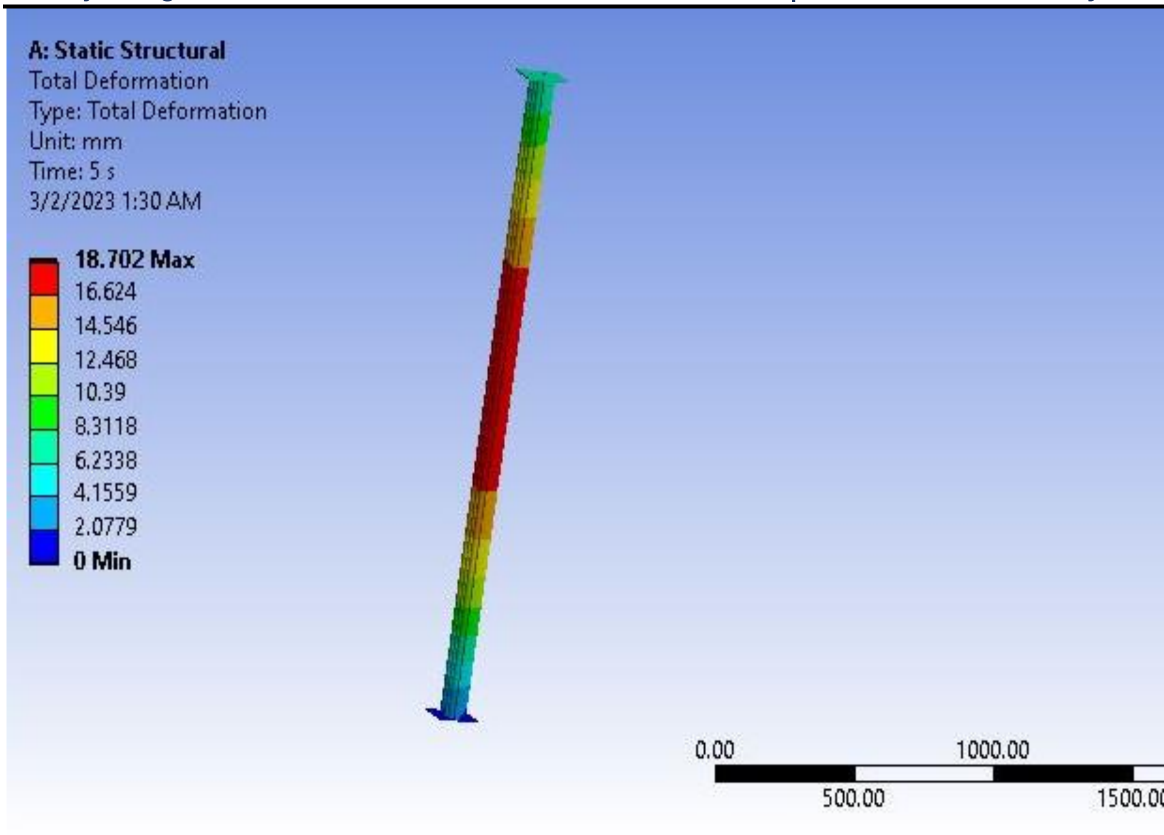


Fig 4.26 Trapezoidal Total deformation
In Fig. 4.5, the overall deformation of is seen. Maximum distortion is indicated in the centre (yellow to orange hues), while least deformation is exhibited at the edge (blue tones). A total deformation of 18.382 mm is the highest.



Sinusoidal -Total Deformation

In Fig. 4.5, the overall deformation of is seen. Maximum distortion is indicated in the centre (yellow to orange hues), while least deformation is exhibited at the edge (blue tones). A total deformation of 18.702 mm is the highest.

LOAD - DISPLACEMENT GRAPH

LOAD - DISPLACEMENT GRAPH-COMPARISON

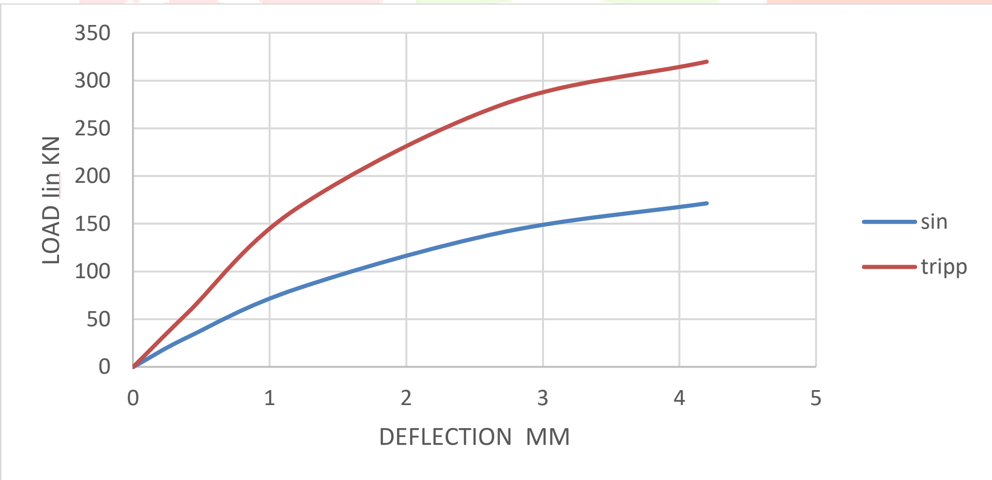


Fig 4.28 Combinations of load displacement graph of L and T sections

• There is a large difference between the sinusoidal and trapezoidal load estimates.

• Sinusoidal curves are smaller in size than trapezoidal curves and have a 170 KN load carrying capacity. The largest area of the curve and the maximum load that a trapezium can support is 332 KN.

ANALYTICAL RESULTS AND COMPARISON

Axial forces are applied to columns, and the table below compares the values of the load displacement curves for columns with non-prismatic sinusoidal and trapezoidal shapes. The ultimate load value of a trapezoidal-shaped column is higher than that of a sinusoidal-shaped column when they are compared, indicating this. When the ultimate load is attained, the column will initially be elastic, but it will then fail. When comparing column shapes, trapezoidal yields come before sinusoidal yields.

RESULT

- The use of steel plate stiffeners greatly increases the material's ability to carry loads, as well as its toughness and ductility, which allow it to take more energy before breaking.
- • Non-prismatic LCFST is superior to non-prismatic TCFST in terms of performance because it can absorb more energy before fracturing.
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Conclusion

Efficacious concrete and corrugated steel tubes with a load-bearing capacity The comprehension and carrying capacities of several corrugated shape kinds were evaluated. It is done to track how different corrugated steel tube forms, such trapezoidal and rectangular ones, behave under bucking loads. Different boundary conditions and loading scenarios are evaluated to gauge how well various concrete ratios work in steel tubes filled with corrugated concrete.

• We learn from the corrugate part of the column axil loading study that trapezoidal geometries have the highest load-carrying capacity.

• According to our examination of the CFST column axil loading, the corrugate section's rectangle forms have the highest load-carrying capacity.

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