ANALYSIS OF AXIAL LOAD BEHAVIOUR OF NONPRISMATIC SPECIAL SHAPED CFST COLUMNS

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Abstract – *Concrete filled steel tube (CFST) columns was popular these days. In this study was mainly used to examine the presentation of non-prismatic CFST by different column arrangement of T and L shaped columns with steel plate joining, to examine influence of stiffness plates with and without holes in non-prismatic special shaped columns and investigation with different hole orientations, to examine the presentation of no prismatic CFST with non-prismatic end column elements. To examine the presentation of non-prismatic CFST column with different shapes. Result obtained that load carrying capacity was improved a lot by introduction of steel plate stiffeners. Non-prismatic LCFST can perform well than non-prismatic TCFST which can absorb more energy before fracture. The influence of stiffness plate with and without holes in non-prismatic column and with different hole orientation, here LCFST with zigzag holes have ultimate load. The performance of non-prismatic CFST with non-prismatic end column elements here LCFST have ultimate load. By comparing different shapes in CFST columns, here circular column has high deformation.*

***Keywords**: Special-shaped column, CFST column, bearing capacity, Stability Stiffener.*

1. INTRODUCTION

1.1 General Background

The traditional rectangular column has column corners which protrude toward the inside of the rooms. The special shaped column denotes a structural column with L shaped, T shaped or cross shaped segments. Columns-limbs was as thick as wall. Special shaped column -structures have CFST gets advantage that has great bearing capacity and ductility of CFST structures. Compared to traditional CFST columns and special shaped column has smaller column limb dimension and has smooth connection with together infilled walls. Utilizes the indoor space more efficiently. Good architectural performance.

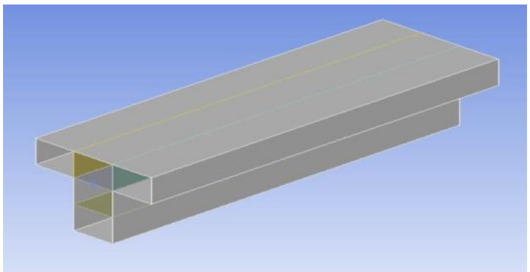

Fig -1: Model of T CFST

2. OBJECTIVES

The main objectives are,

1. To examine, the non-prismatic CFST by different column arrangement of T and L shaped column by steel plate connection.
2. To examine, effect of stiffness plate with and without holes in non-prismatic column and with different hole orientations.
3. To study, performance of non-prismatic CFST with non-prismatic end column elements.

2.1 To examine the performance of non-prismatic CFST with different column arrangement of T and L shaped column with steel plate connection.

To investigate the mechanical behavior of non-prismatic CFST by different column arrangement of T and L shaped column with steel plate connections were developed using ANSYS. Solid 180 Models were used to model T and L shaped non-prismatic CFST.

Geometry of specimen was L- shaped and T- shaped non-prismatic columns was considers for the analysis. The columns steel tube thickness was took as demonstrated in the figures shown below. The thinness of steel tube was equal to 3mm with yield strength 306 MPa and stiffeners having thickness 3mm with yield strength 306 MPa and specimen length is taken as 900 mm.

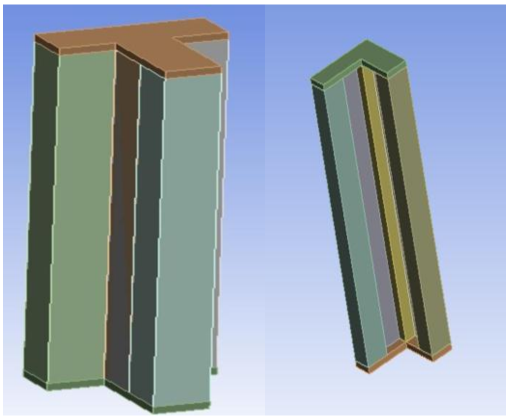

Fig -2: Model of T CFST and LCFST

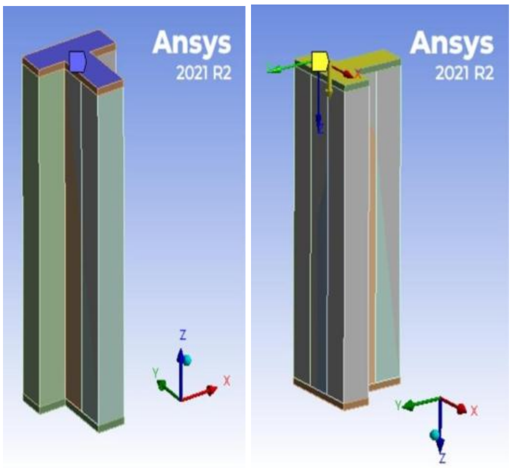

Fig -3 : Application of boundary conditions

The support condition is fixed. A remote-displacement is also provided. Figure 3 shows the loading pattern LCFST and TCFST column.

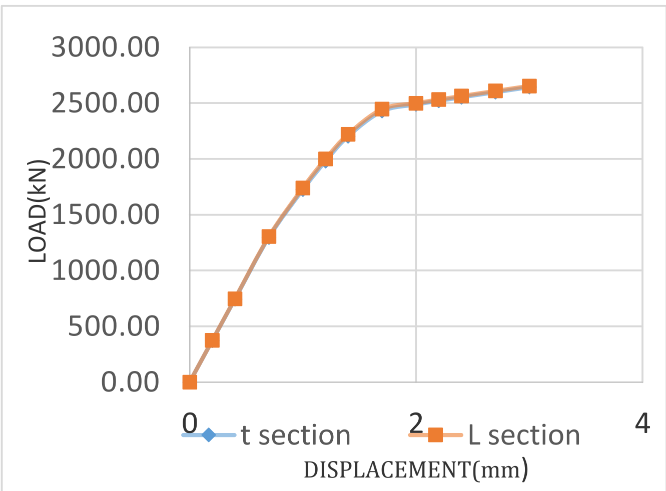

Chart-1 : Load vs displacement diagram

Table-1 : Result obtained from analysis of TCFST and LCFST

COLUMN TYPE	LATERAL DEFORMATION (mm)	ULTIMATE LOAD (kN)
TCFST	3.0028	2644.1
LCFST	3.0032	2654.1

2.2 To examine the influence of stiffness plate with and without holes in non-prismatic column and with different hole orientation.

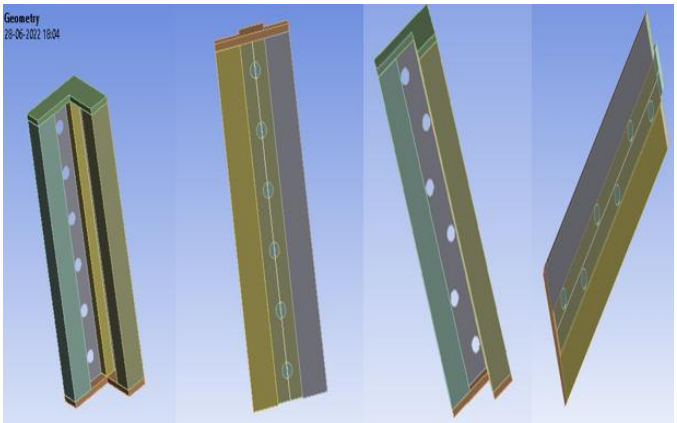

Fig -4 : Different hole arrangements

In case of the first arrangement of holes through the center portion of the steel plate and the second case of the arrangement is in a zig zag manner as shown.

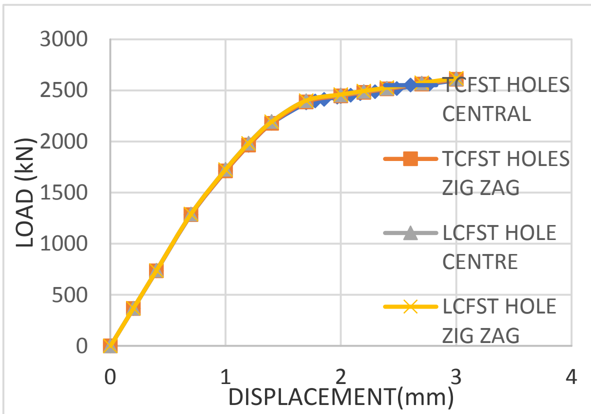

Chart-2 : Load vs displacement diagram of different holes arrangements

Table-2: Result obtained from analysis of different holes arrangements

COLUMN TYPE	DEFORMATION(mm)	ULTIMATE LOAD(kN)
TCFST(Holes central)	3.0035	2598.5
TCFST(Holes zigzag)	3.0026	2607.7
LCFST(Holes central)	3.003	2616.3
LCFST(zigzag)	3.0031	2619.6

2.3 To examine the performance of non-prismatic CFST with non-prismatic end column elements.

Here the end plate connections are provided in the L and T shaped non-prismatic columns. Geometry of specimen was L- shaped and T- shaped non-prismatic columns was considers for the analysis. The columns steel tube thickness was took as demonstrated in the figures shown below.

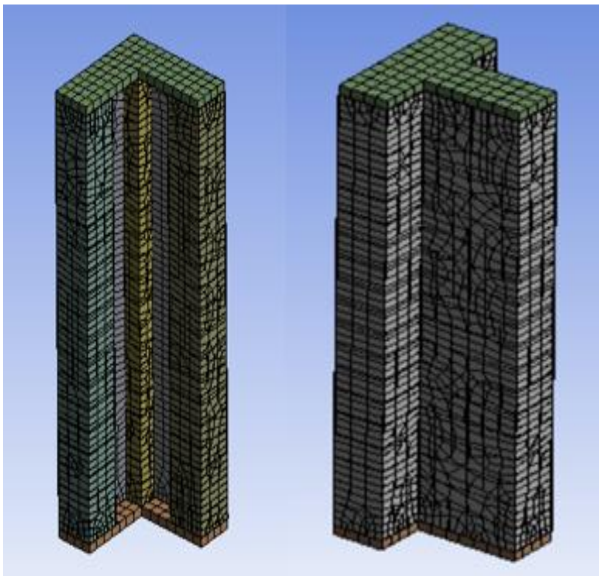

Fig -5 : Mesh developed in non-prismatic end column elements.

Table-3: Result obtained from analysis of non-prismatic end column elements.

COLUMN TYPE	DEFORMATION (mm)	ULTIMATE LOAD(kN)	Equivalent Stress(MPa
TCFST	3.0142	5222.3	3161.8
LCFST	3.0025	7314.1	3121.3

2.4 To examine the performance of non-prismatic CFST column with different shapes of column elements

This study using the software ANSYS helps us to find out which shape of the CFST column gives better performance as compared with other sections. Here end plate connections are provided in the L shaped non-prismatic columns. The diameter of circular column was about 112.86mm. Also length and width of rectangular section is 120 and 83.35mm.

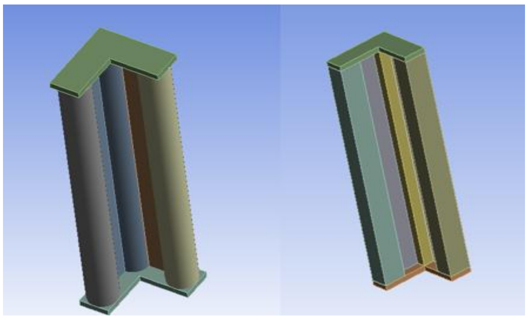

Fig -6 : CFST analysis using different shapes

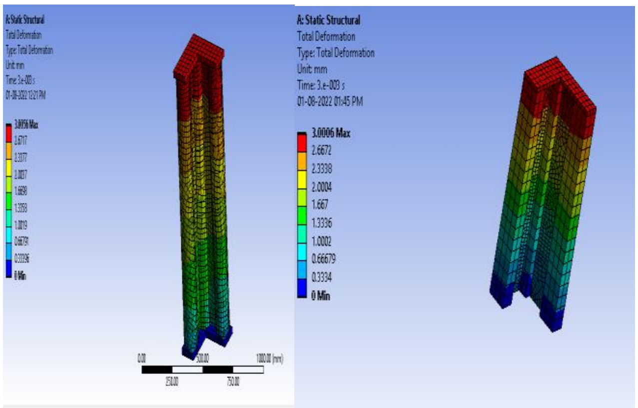

Fig-7: Total deformation in circular and rectangular element

3. CONCLUSIONS

Load carrying capacity was improved a lot by introduction of steel plate stiffeners. Ductility and stiffness of the material was also improved, so that material gain it's ability to absorbs more energy before its fracture. Non-prismatic LCFST can perform well than non-prismatic TCFST which can absorb more energy before fracture. The influence of stiffness plate with and without holes in non-prismatic column and with different hole orientation, here LCFST with zigzag holes have ultimate load. The performance of non-prismatic CFST with non-prismatic end column elements here LCFST have ultimate load. By comparing different shapes in CFST columns, here the circular column have high deformation.

ACKNOWLEDGEMENT

I wish to thank the Management, Principal and Head of Civil Engineering Department of Universal Engineering College,Thrissur, affiliated by Kerala Technological University for their support. This paper is based on the work carried out by me (Aleena Binth K H), as part of my PG course, under the guidance of Amritha E K (Associate professor, Civil Department, Universal Engineering College, Thrissur, Kerala). I express my gratitude towards her for valuable guidance.

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