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ANALYTICAL STUDY OF CFST COLUMN- IBEAM CONNECTION BY DOUBLE HEADEDANCHORED BLIND BOLTS

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Abstract: This study has been undertaken to investigate the better bolt arrangement in three different bolt configurations. CFST column- I beam connection with Double headed anchored blind bolts (DHABBs) analyzed using ANSYS 16.0.Extensive research has been carried out on CFST column- beam connection. The present study dedicates to find the better configuration among circular, X type and C type bolt arrangement. In this order, three full-scale specimens of the bolted connection were tested under the cyclic loading to evaluate the performance of connections, and then a parametric study was carried out using the verified finite element models.

***Index Terms*–Concrete filled steel tube,I- beam,connection,double headed anchored blind bolt,load.**

1. INTRODUCTION

A column or pillar in architecture and structural engineering is a structural element that transmits, through compression, the weight of the structure above to other structural elements below. In the last few decades, high-rise, large-span, and large-scale building structures have become more common. Concrete-filled steel tubular (CFST) members are well recognized for their excellent performance owing to the combined merits of steel and concrete materials. Therefore, concrete-filled steel tubes are being increasingly used in high-rise buildings and in large-span structures. CFST columns have been used in earthquake-resistant structures and bridge piers subject to impact from traffic and used to support storage tanks, decks of railways, and high-rise buildings as well as being used as piles. Concrete-filled steel tubes require additional fire-resistant insulation if the fire protection of the structure is necessary. Owing to easy connection and working reliably together with other structural members such as beam, wall, and slab when compared with circular-sectional CFST column, rectangular-sectional and square-sectional CFST columns have attracted more and more interests around the world. Compared with square-sectional or circular-sectional CFST columns, rectangular-sectional CFST column has the unequal bending stiffness along different axes. Blind bolts have been used for manufacturing and repair for decades. Because they come in all sizes and designs, it can be a challenge selecting the right fastener for the job. Choosing the right blind bolt is a matter of assessing the parameters of the application and selecting the right blind bolt to deliver maximum strength. We want to ensure that the blind bolt is easy to install, yet will be strong enough to create a lasting join. Here in this paper, present the CFST circular column- I beam connected with double headed anchored blind bolt, and finds the better bolt configuration among three configurations such as circular bolt configuration, X- type and C- type.

2. Objective of Project

- To find the load carrying capacity
- Comparison of three different configuration

3. CFST column – I beam connection

CFST column – I beam connected with twelve numbers of double headed anchored blind bolts. Number of bolts are found out by IS 800-2007. Types of configurations used are:

- Circular configuration
- X -type
- C-type

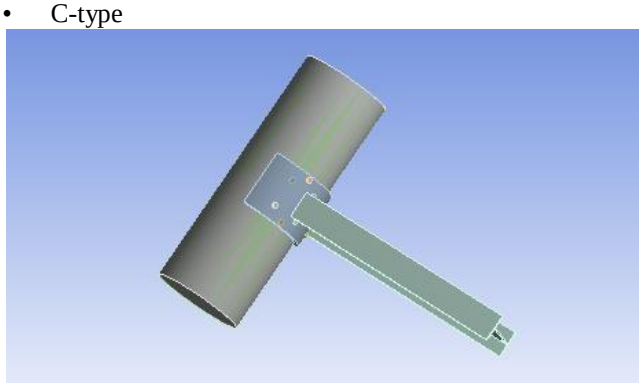

Fig 1: geometry of circular bolt configuration

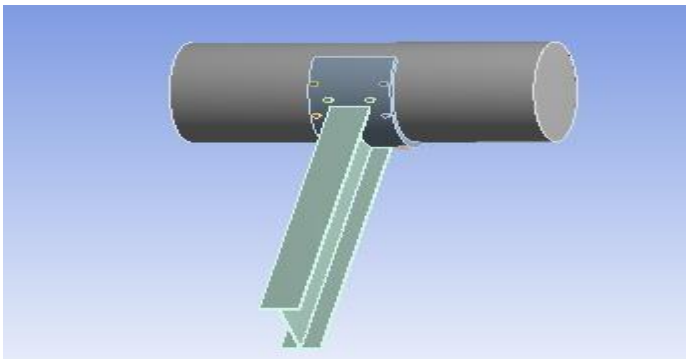

Fig 2: geometry of x- type bolt configuration

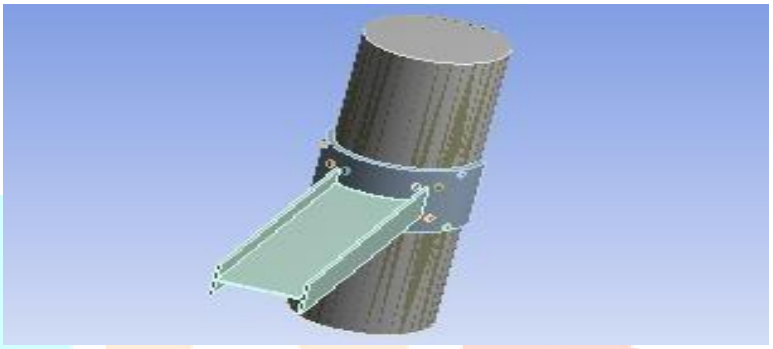

Fig 3: geometry of c- type bolt configuration

4. MODELING AND ANALYSIS

Details of Models

Table1: Components of model

Components	Specifications
CFST circular column	457mmdiameter
I beam	ISMB300
Double headed anchored blind blot (DHABB)	4.6 grade

The CFST circular column of 457mm diameter was used and it has length of 1290mm. The thickness of tube wall used is 9.5mm. Here, use I beam section ISMB300. The length of I beam is 1200mm, depth of section is 300mm, width of flange would be 140mm, thickness of flange 12.4mm and thickness of web 7.5mm. The double headed anchored blind bolt of 18mm diameter was used. Pitch and end distance are 50mm and 30mm respectively. Non linear analysis is done in the ANSYS 16.0. ANSYS is an American public company based in Canonsburg, Pennsylvania. It develops and markets engineering simulation software.

Material properties

Table1: Material properties

Properties	Steel	Bolt
Young's modulus (KPa)	2×10^{11}	2×10^{11}
Yield strength (MPa)	599	490
Poisson's ratio	0.3	0.3

5. Details of comparison study

From the analysis, which configuration had better load carrying capacity among three different bolt arrangements. The bolt configurations used are circular, x- type and c- type.

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Analytical models

Fig. 4 shows the total deformation of CFST circular column –I beam connections with twelve numbers of double headed anchored blind bolts in circular bolt configuration. The deformation which is minimum in column surface and maximum in a small portion of web of I beam. Fig. 5 shows the equivalent stress. Which also minimum in column and maximum in web of beam section. Fig. 6 shows the total deformation of CFST circular column –I beam connections with twelve numbers of double headed anchored blind bolts in X –type bolt configuration. The deformation which is minimum in column surface and maximum in a small portion of web of I beam. Fig. 7 shows the equivalent stress. It also minimum in column and maximum in web of beam section. Fig. 8 shows the total deformation of CFST circular column –I beam connections with twelve numbers of double headed anchored blind bolts in C–type bolt configuration. The deformation which is minimum in column surface and maximum in a small portion of web of I beam. Fig. 9 shows the equivalent stress. It also minimum in column and maximum in web of beam section.

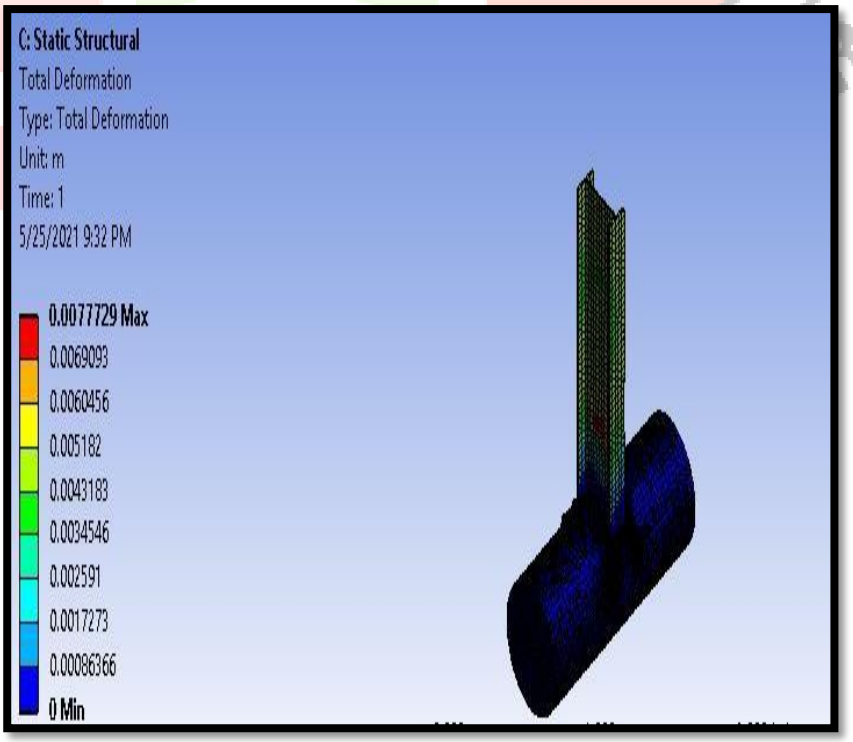

Fig 4: Total deformation of circular bolt configuration

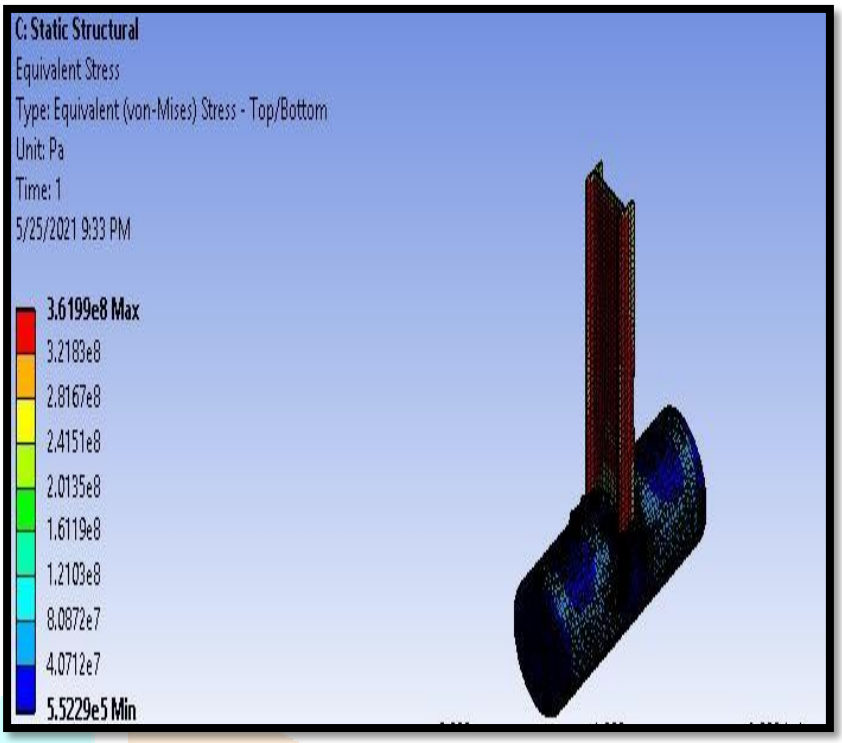

Fig 5: Equivalent stress of circular bolt configuration

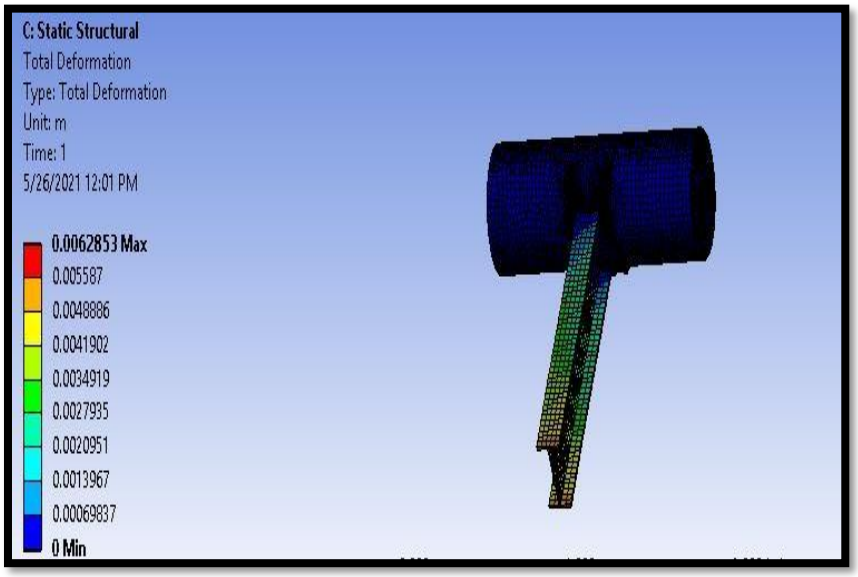

Fig 6: Total deformation of x-type bolt configuration

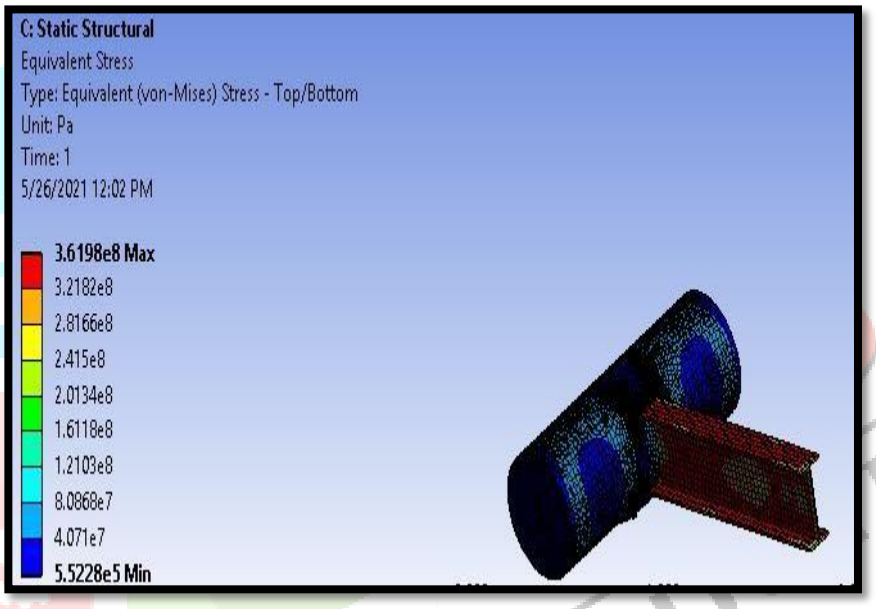

Fig 7: Equivalent stress of x-type bolt configuration

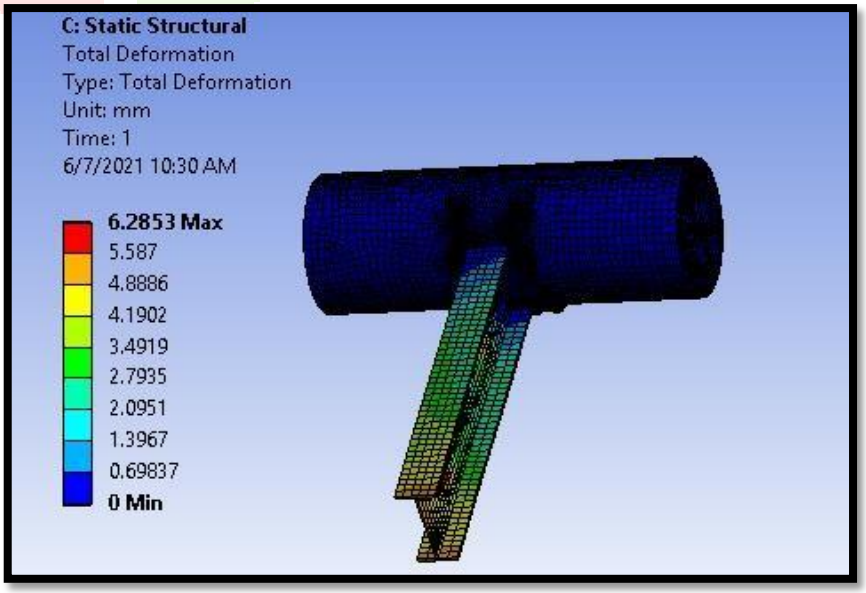

Fig 8: Total deformation of c-type bolt configuration

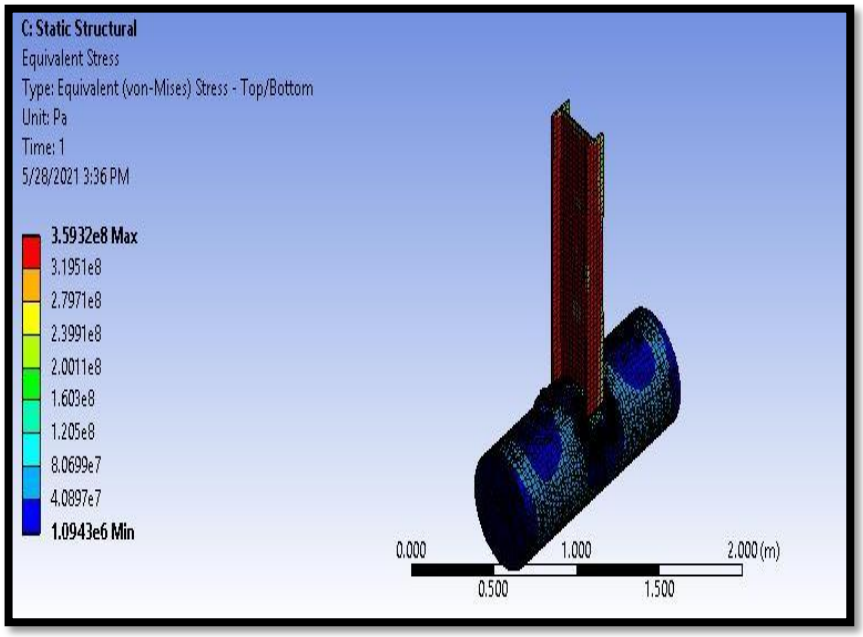

Fig 9: Equivalent stress of c-type bolt configuration

RESULT AND DISCUSSION

The maximum load 1980kN carried at a displacement of 0.55 was shown in fig.10. The result obtained from analysis using ANSYS 16.0 is shown below. The load carrying capacity is better in circular bolted configuration, which was 1980kN. In X- type, the load carrying capacity was 1950kN. This is shown in Fig. 11. In C- type bolt configuration, it would be 1900kN. There will be small variation of result. But better load carrying capacity is more in CFST circular column- I beam connected with double headed anchored blind bolts in circular bolt configuration.

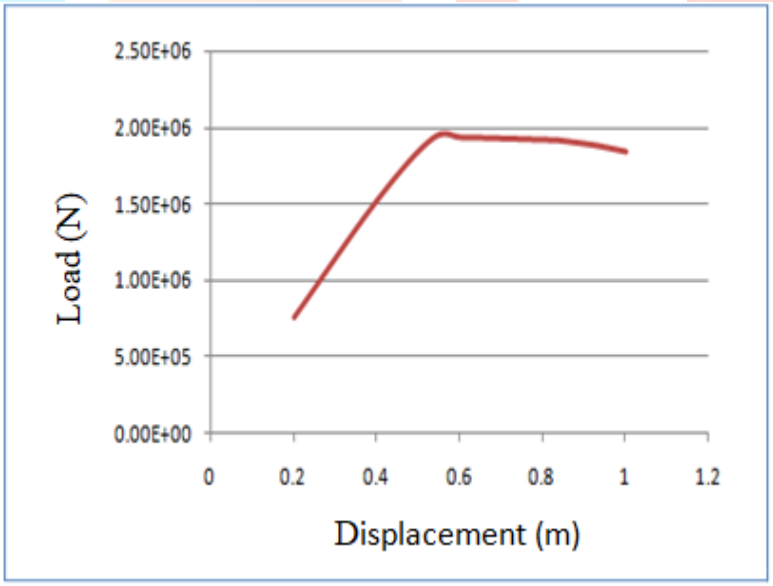

Fig 10: Load-displacement graph of CFST column- I beam connections with circular bolt configuration

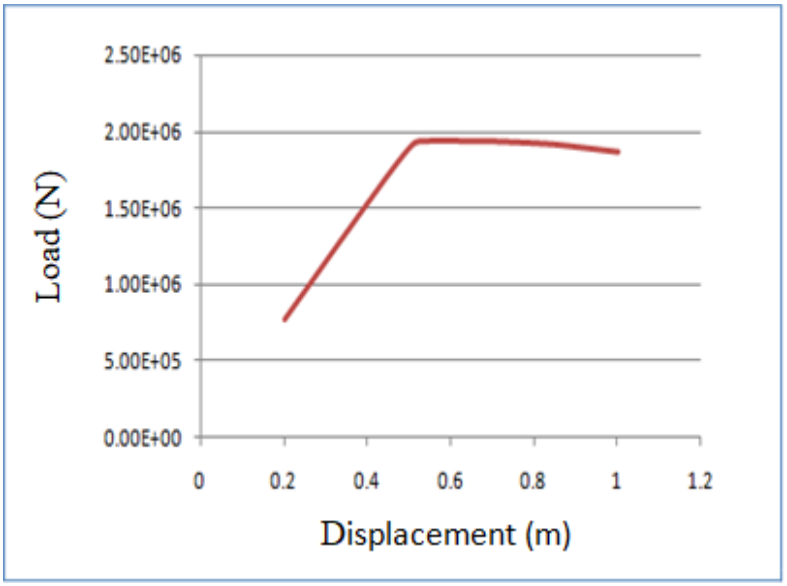

Fig 11: Load-displacement graph of CFST column- I beam connections with x- type bolt configuration

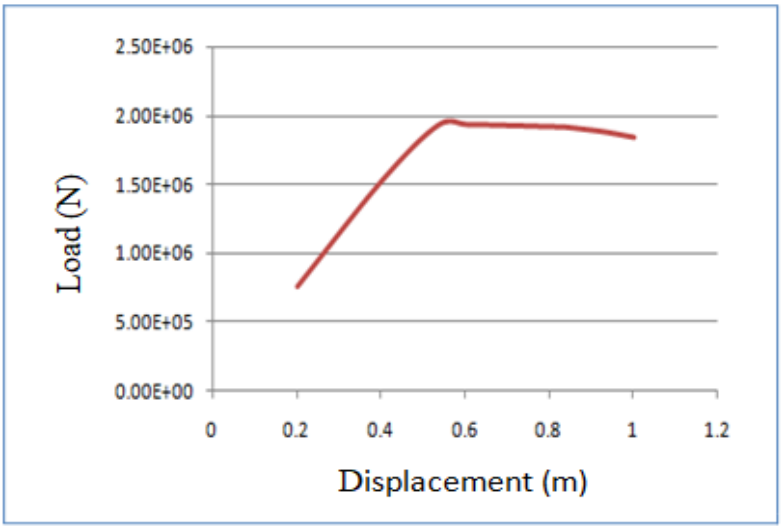

Fig 12: Load-displacement graph of CFST column- I beam connections with c- type bolt configuration

Table 2: Analytical results of models

Type of bolt configuration	Load
Circular	1980
X- Type	1950
C- Type	1900

CONCLUSIONS

From the analysis of CFST circular column – I beam connected with double headed anchored blind bolts, the better load carrying capacity was found out in circular bolt configuration among x-type and c-type bolted configurations. There should be small variation of result.

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