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Structural Performance of Special Shaped Non Prismatic Column Under Eccentric Load

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Abstract - *Implementation of special shaped non-prismatic engineered cementious composite filled steel tube is increased wide.Six type of non-prismatic columns are taken. Non symmetry shape such as Land Z shapes, second type one side symmetry shape such as T and C,and finally thired type both side symmetry shape such as I and X shapes, and comparative study of prismatic and non-prismatic column to apply eccentric load. Using ANSYS software to find structural performance of each model and comparison study about prismatic column and non-prismatic column.*

Key Words: Non-prismatic column, axial load, eccentric load, conventional column, prismatic column.

1.INTRODUCTION

The non-prismatic engineered cementious composite filled steel tube columns have predominantly used in diverse type of structure due to their majestic structural performance and modest prominence. And also effective area of room will increases due to the non-prismatic column can avoid the additional use of column. Use of non-prismatic column to improve architectural appearance in building and bridges. Therefor take non-prismatic column can resist the eccentric load than conventional column

1.1 Eccentric Load of Prismatic Columns

Eccentric load on column is the load will not act on the middle of the of cross-section of the column, that means load does not pass through the axis of the column. Also the line of action of load passess some distance from the axis of the column either towards right or left corners of the column.

1.2 Eccentric Load of Non-Prismatic Columns

Non prismatic column can resist eccentric loading than conventional column. Therefore column exhibit excellent structural and construction advantages.

2. ANALYSIS OF PRISMATIC AND NON-PRISMATIC COLUMN UNDER ECCENTRIC LOAD

Material properties of the prismatic and non-prismatic columns are taken same values. The properties used for analysis using ANSYS software shown fig below.

Properties of Outline Row 4: Structural Steel

	A	B	C	D	E
1	Property	Value	Unit		
2	Material Field Variables	Table			
3	Density	7850	kg m^-3		
4	Isotropic Secant Coefficient of Thermal Expansion				
6	Isotropic Elasticity				
7	Derive from	Young's Modulus a...			
8	Young's Modulus	2E+11	Pa		
9	Poisson's Ratio	0.3			
10	Bulk Modulus	1.6667E+11	Pa		
11	Shear Modulus	7.6923E+10	Pa		
12	Bilinear Isotropic Hardening			☑	
13	Yield Strength	328	MPa		
14	Tangent Modulus	0	Pa		
15	Multilinear Isotropic Hardening	Tabular			

2.1 ANALYSIS OF PRISMATIC COLUMNS UNDER ECCENTRIC LOAD

Model specification of eccentric load on prismatic columns include 6 shapes are T,L,Z,C,I and X.The all shapes are considered the same dimensions that is overall dimension is 300X300mm,web size is 100mm and flange size is 100mm and also volume of concrete maintain constant.Example figure of one model is shown below.

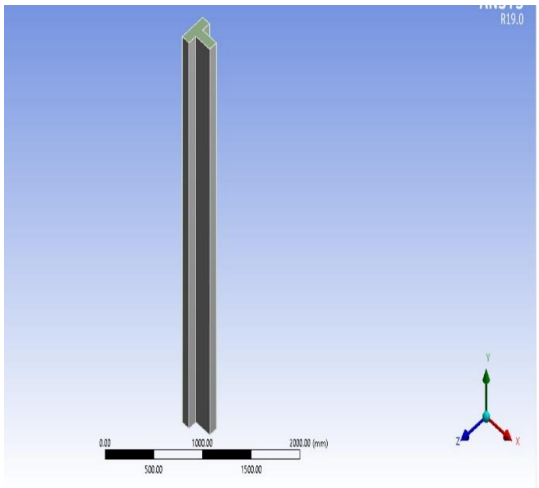

Fig -1: Prismatic T shaped geometry

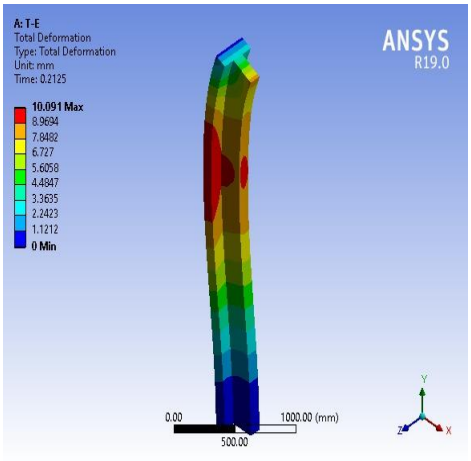

Fig -2: Total deformation at ultimate load of prismatic T shape

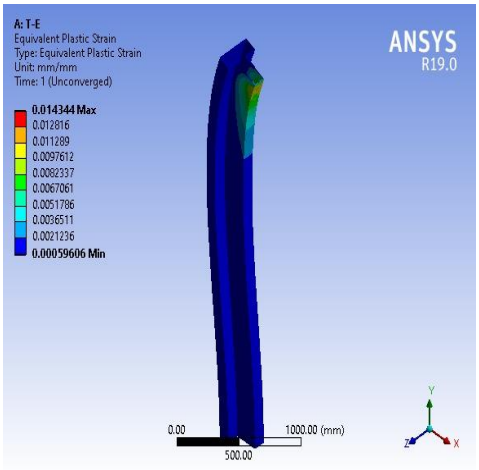

Fig -3: Plastic strain distribution on column of prismatic T shape

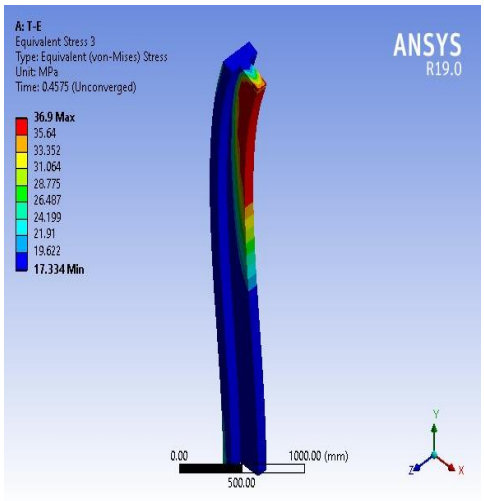

Fig -4: Equivalent stress on column of prismatic T shape

2.2 ANALYSIS OF NON-PRISMATIC COLUMN UNDER ECCENTRIC LOAD

Model specification of eccentric load on non-prismatic column include six shapes are T, L, Z, I and X. The all shapes are considered the identical dimension the bottom size of the column is 300x300mm, top size 200x200mm and also the web size is not constant is varying with reference to the shape and also volume of concrete maintained constant. Figure of eccentric load of non-prismatic T shape is given below.

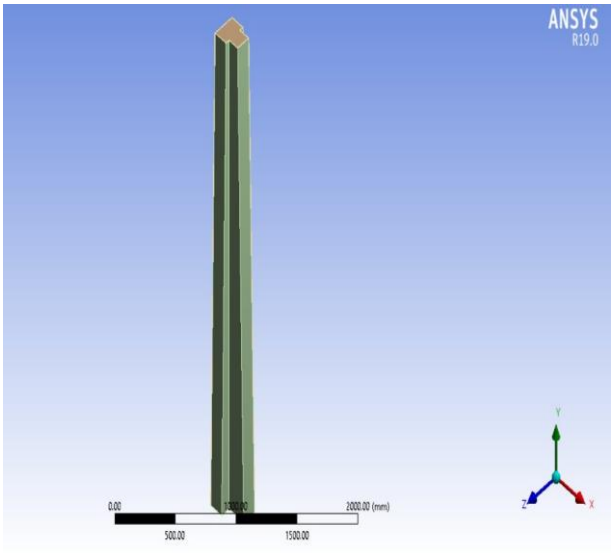

Fig -5: Non-prismatic T shape geometry

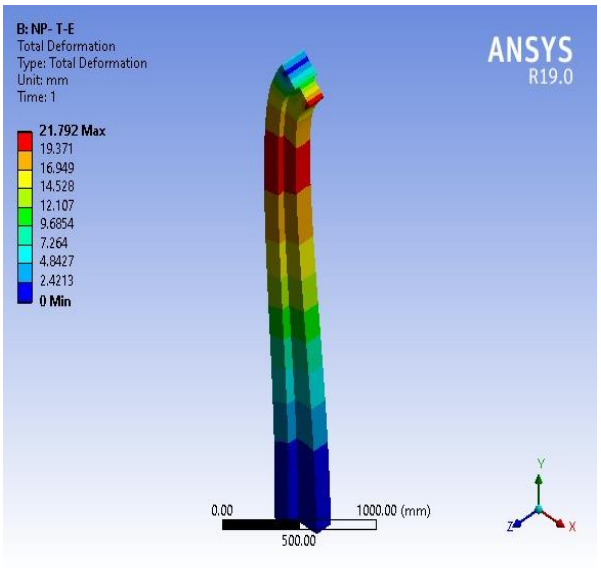

Fig -6: Total deformation at ultimate load of non-prismatic T shape

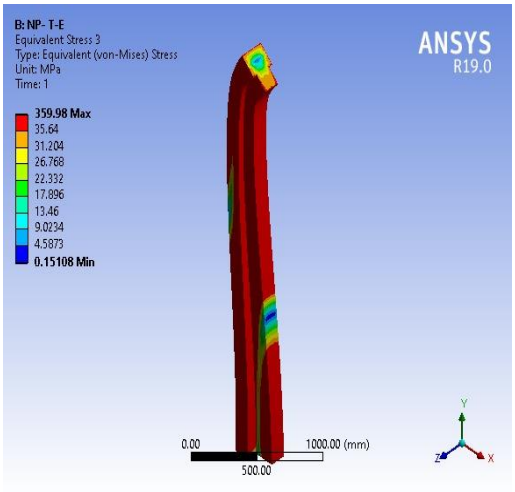

Fig -7: Equivalent stress on column of non-prismatic T shape

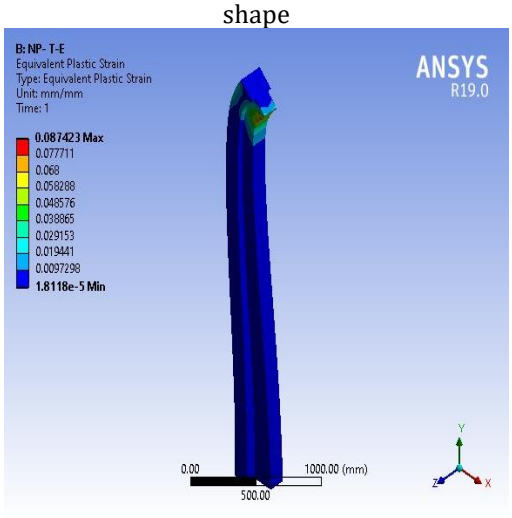

Fig -8: Equivalent stress on column of non-prismatic T shape

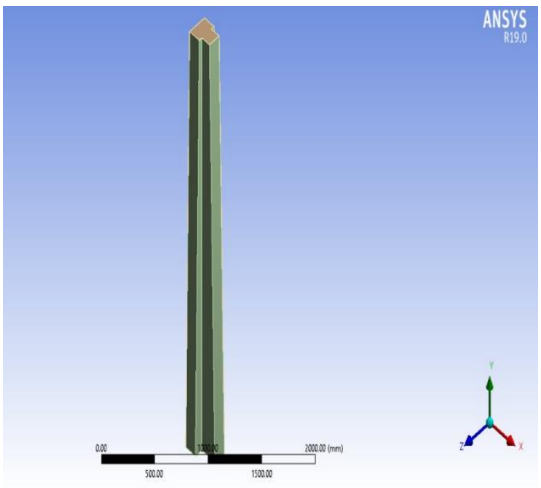

Fig -9: Non-prismatic T shape geometry

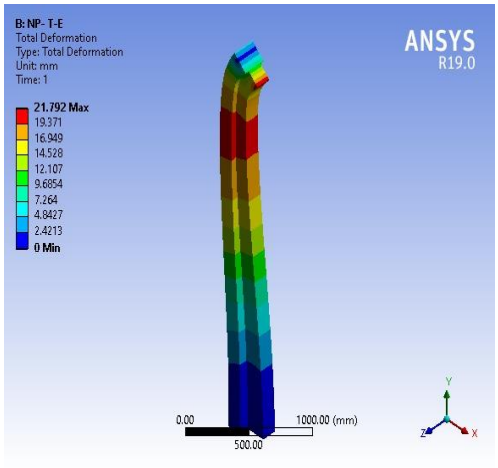

Fig -10: Total deformation at ultimate load of non-prismatic T shape

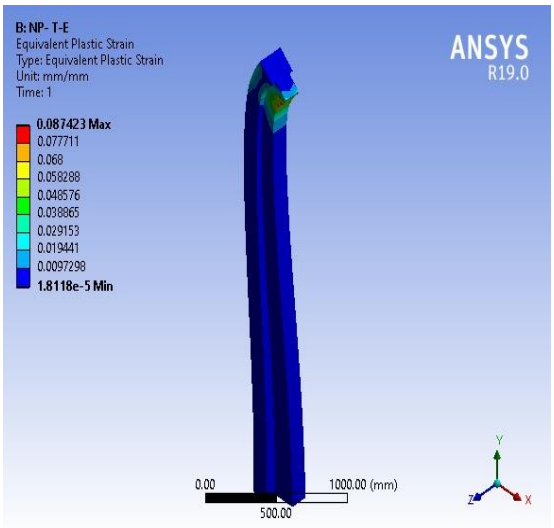

Fig -11: Equivalent stress on column of non-prismatic T shape

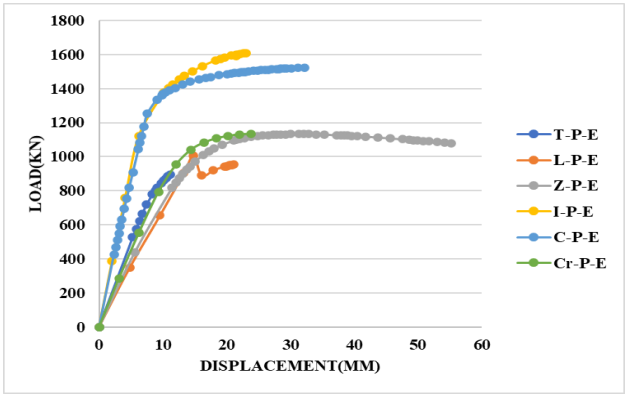

Chart -1: Eccentric load on prismatic columns

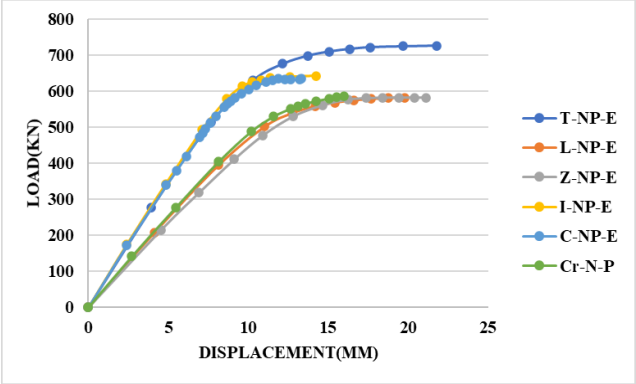

Chart -2: Eccentric load on non-prismatic columns

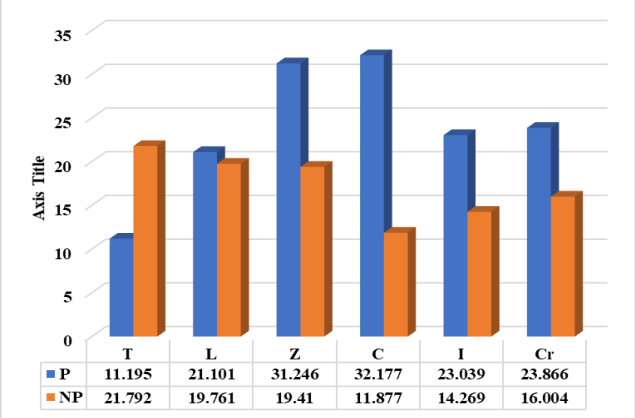

Chart -3: Comparison chart of ultimate deflection

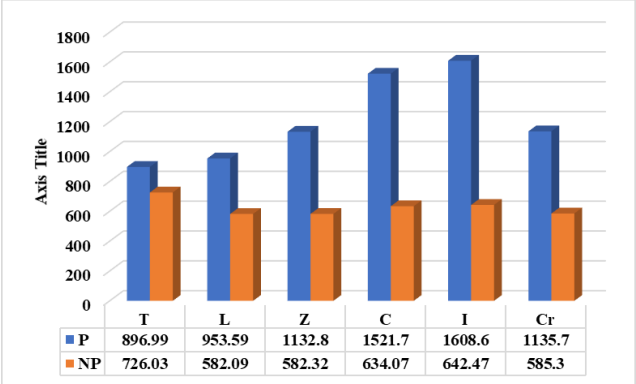

Chart -4: Comparison chart of ultimate load

These charts are show eccentric load on prismatic and non prismatic columns and it is appear the comparison of ultimate deflection,ultimate load and stiffness.

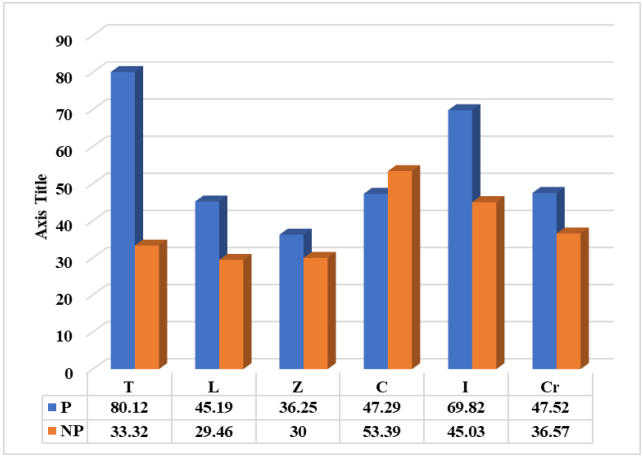

Chart -5: Comparison chart of stiffness

Eccentric		Ultimate Deflection(mm)	Ultimate Load(KN)	Stiffness (Kn\mm)
NP	T	21.792	726.01	33.32
	L	19.761	582.09	29.46
	Z	19.41	582.32	30.00
	C	11.877	634.07	53.39
	I	14.269	642.47	45.03
	Cr	16.004	585.3	36.57
P	T	11.195	896.99	80.12
	L	21.101	953.59	45.19
	Z	31.246	1132.8	36.25
	C	32.177	1521.7	47.29
	I	23.039	1608.6	69.82
	Cr	23.866	1135.7	47.59

Table -1

Comparison of prismatic and non-prismatic column on eccentric load

3. CONCLUSION

Apply eccentric load on prismatic and non prismatic columns.Consider non-symmetrical shape include L and Z,one side symmetrical shape include T and C both side symmetrical shape include Iand X shapes. Prismatic and non-prismatic columns case the mass of concrete taken as constant i.e, 336 kg.The non prismatic column can resist the eccentric load than prismatic column to think about the identical volume of steel and concrete in two case.

4. REFERENCES

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