International Journal of Advance Research in Science and Engineering
Volume No.07, Special Issue No.07, April 2018
www.ijarse.com
IJARSE
ISSN: 2319-8354

Comparative study of multistoried building considering reinforced cement concrete and concrete filled steel tube column

S. T. Patil[1], Prof. D. B. Kulkarni[2]

[1]*Department of civil engineering,*
Rajarambapu Institute of Technology, Rajaramnagar. Islampur, India
[2]Professor, *Department of civil engineering,*
Rajarambapu Institute of Technology, Rajaramnagar. Islampur, India

ABSTRACT

In the recent era, the growth of population is tremendous and deficiency of land, especially in the urban areas, so as to overcome these problems, construction of the multistoried buildings are carried out but because of the large axial forces and moments , the buildings are requiring bulky columns which results in decrease in functional area. To overcome such problem, use of concrete filled steel tube column is better option. In this dissertation work, comparative study by selecting various parameters and seismic responses such as storey drift and storey displacement of a G+6 storied RCC building provided with RCC and concrete filled steel tube columns of different grade has been studied by using E-TAB 2016. The results of the seismic responses namely storey drift and storey displacement of the building provided with both type of columns are compared. The results obtained are observed to be well within acceptable limits as specified by codes. Thus from the study it is concluded that the concrete filled steel tube columns provide better stiffness to the building along with decrease in column sizes.

Keywords:Reinforced cement concrete; Concrete filled steel tube column, Response spectrum analysis.

I.INTRODUCTION

In recent era of creativity, two materials most commonly used as building material those are steel and concrete for structures ranging from sky scrapers to pavements, although these materials possess different characteristics and properties, they both liketo complement each other invarious ways.[2]Composite columns are a combination of two traditional structural forms: structural steel and structural concrete. As composite columns were generally developed after steel columns and reinforced concrete columns.[8]

Steel has excellent resistance to tensile loading but has lesser weight ratio so slender sections are used which may be dangerous to buckling phenomenon and on the other hand concrete is good in compression. Steel may

be used to influence ductility which is an important aspect for high rise building, on the other hand corrosion prevention and thermal insulation can be done by concrete. The role of the concrete core in a composite column is not only to resist compressive forces but also to reduce the potential for buckling of the steel member.[4]The steel tube reinforces the concrete to resist any tensile forces, bending moments and shear forces. The interaction between the steel tube and concrete so the local buckling of the steel tube is delayed by the restraint of the concrete, and the strength of concrete is increased by the confining effect of the steel tube.

Fig.1 CFST Column.

IIMETHODOLOGY

This study is concern about comparative study between RCC column and CFST column model. The building used in the study is (G+6) story having same floor plan throughout the height of the building as shown in Fig.3. The story height is 3m. The thickness of brick wall over all primary beams is taken as 0.23 m. The unit weight of masonry is taken as 20 KN/m^3. The above mentioned CFST column building analyses as per requirement of AISC 360-10. The structure has been considered to be located in seismic region III with an importance factor 1.2 and sub soil type 2 (medium). The response spectrum Analysis is carried out on building models using the ETABS software. The load and loadcombinations considered in the analysis is as perIS 1893-2016 (part I)

Table No. 1 Modelling parameters.

Sr. No.	Particulars	Details
1	Type of structure	Multistoried moment resisting frame
2	Typeof Building	Residential Building
3	Seismic Zone	III
4	Number of stories	G + 6
6	Height of story	3m
7	Height of building	48m
8	Materials	Concrete- M20 Steel Reinforcement- fe415 Structural steel- fe250
9	Sizes of beam	230 X 450 , 230 X 600
10	Column	R.C.C. : 230 X 300 , 230 X 450, 230X 550, 230 X 800 CFST : 200 X 200 X 15 thk.
11	Thickness of deck	175mm
12	Dead load	2KN/m^2
13	Live load	3KN/m^2

14	Zone factor (Z)	0.16
15	Response reduction factor	5
16	Soil type	II
17	Importance factor (I)	1.2

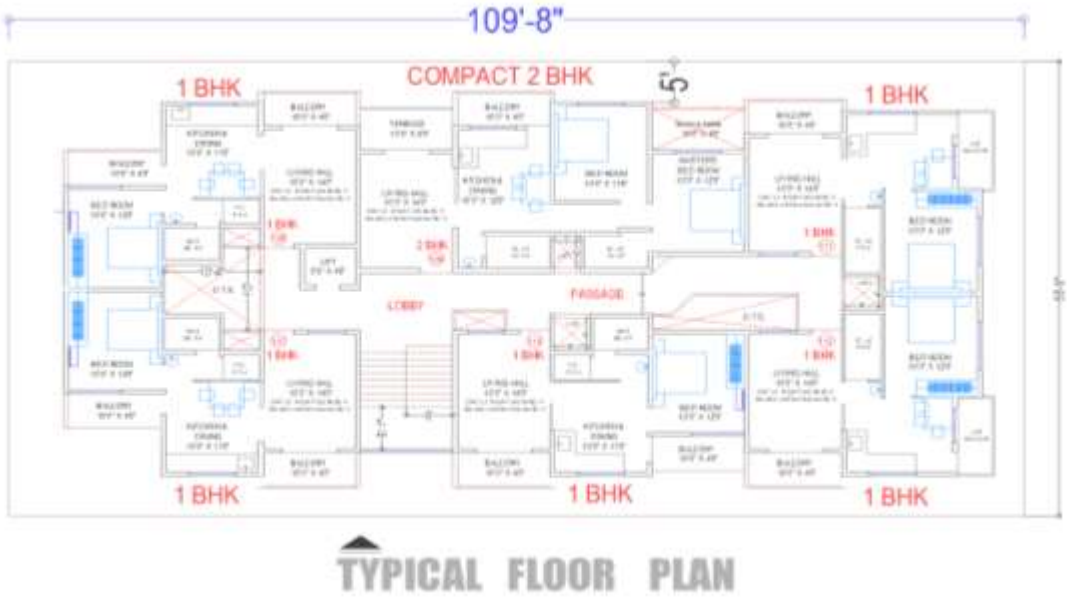


Fig.2 Plan of buidling

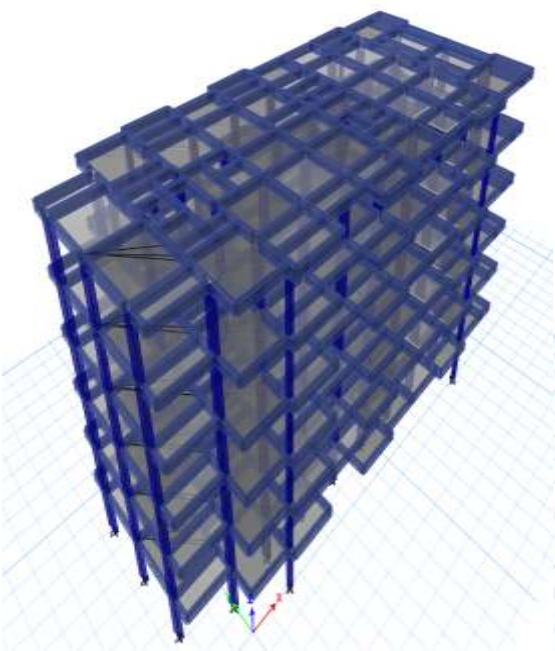


Fig.3 3D view of story building with considered for analysis

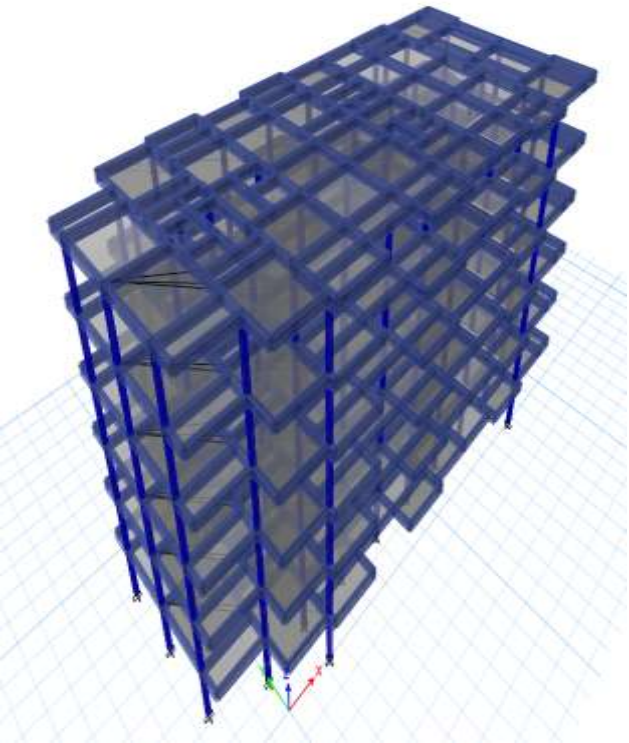
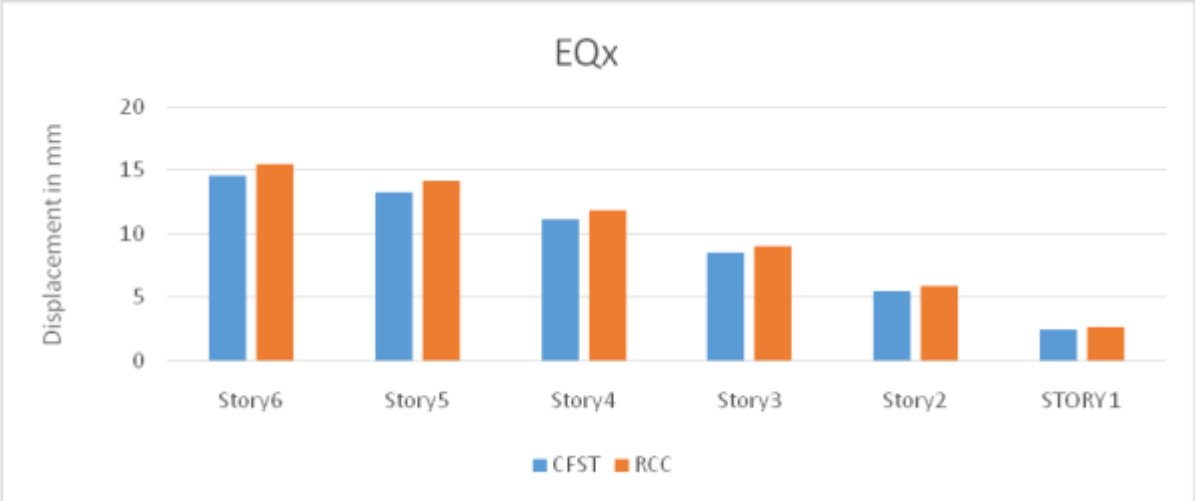


Fig.4 3D view of story building RCC Columns with CFSTColumns considered for analysis.

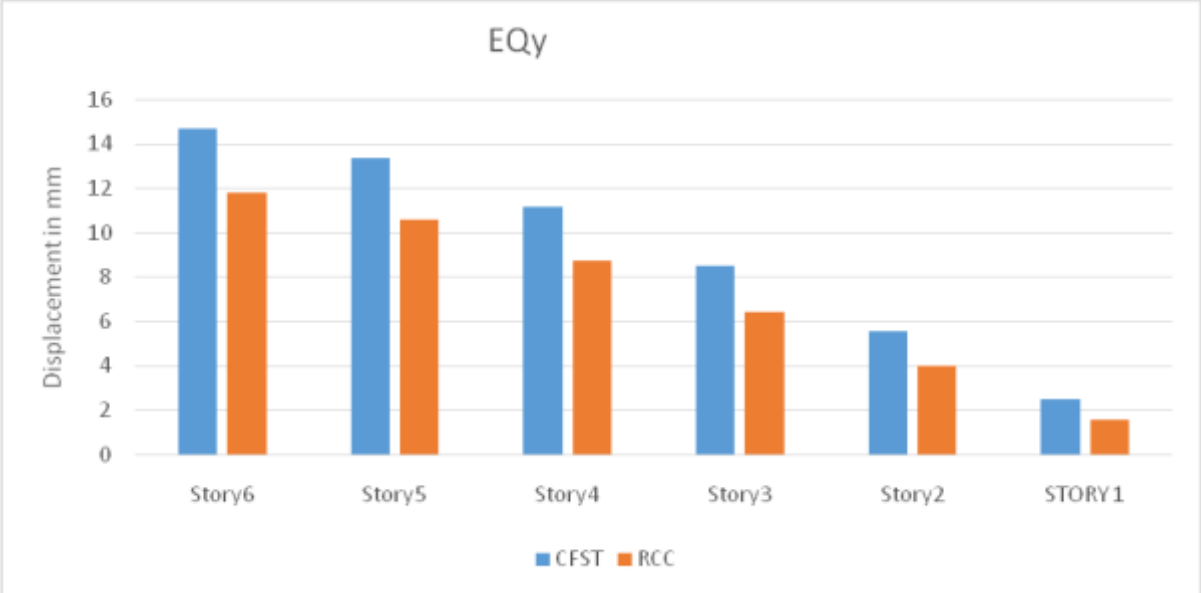
International Journal of Advance Research in Science and Engineering
Volume No.07, Special Issue No.07, April 2018
www.ijarse.com
IJARSE
ISSN: 2319-8354

III.RESULT AND DISCUSSION

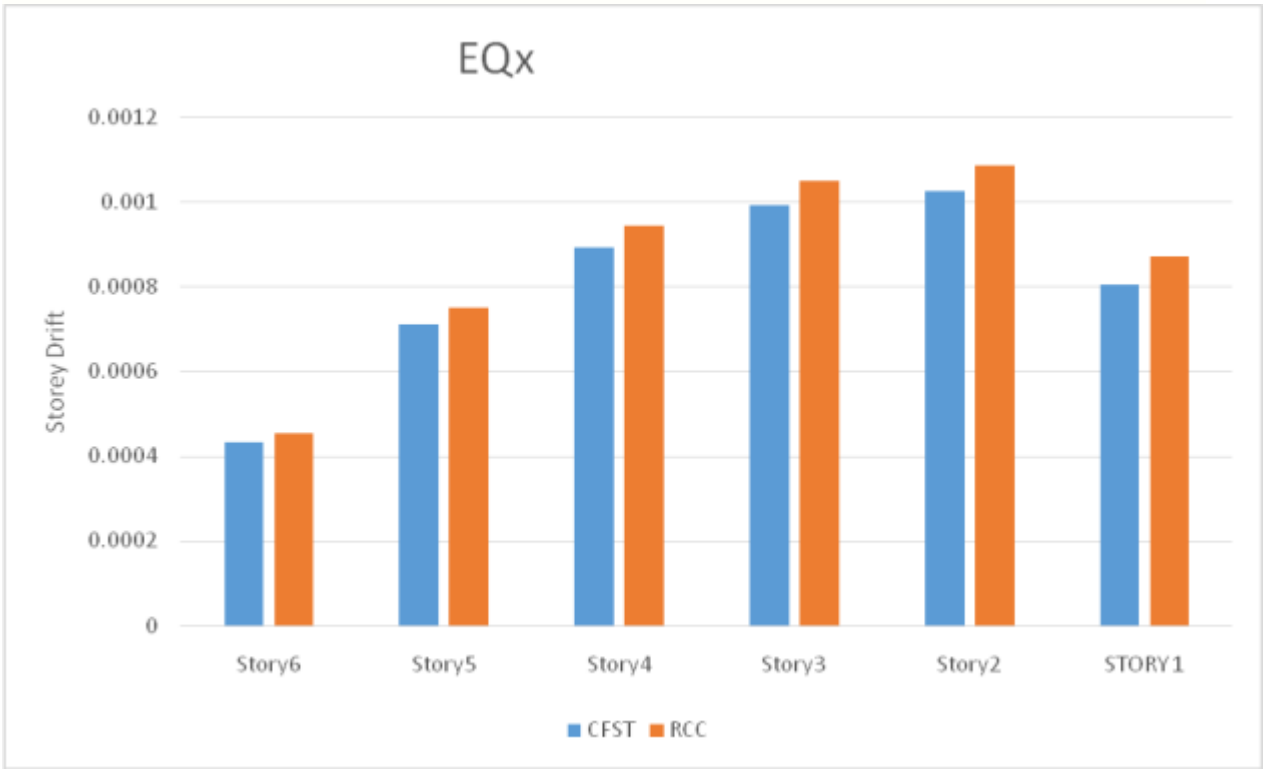
From the response spectrum analysis which is performed over all four building models, following results are obtained for story displacement and story drift.



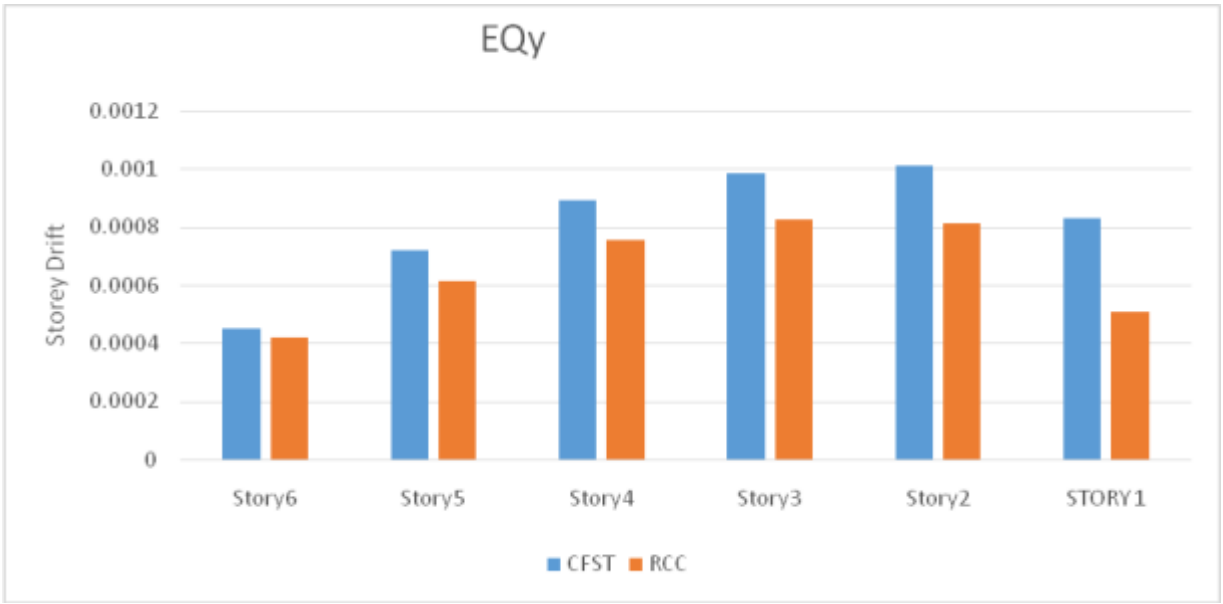
Graph 01. Story displacement (Eqx) Vs. Story number



Graph 02. Story displacement (Eqy) Vs. Story number



Graph 03. Story Drift (Eqx) Vs. Story number



Graph 04. Story Drift (Eqy) Vs. Story number

For the above graphs, on X-axis there is no. of story and on Y-axis there are story displacement and story drift. All loads and load combinations are considered for the comparison but results are presented for maximum load case. The maximum storey displacement of building due to EQx with CFST column is decreased by 5.77 % than that of building provided with RCC column.The maximum storey displacement of building due to EQy with

CFST column is 24.38 % more than that of building provided with RCC column. Still it is within the permissible limit. The maximum storey drift of building due to EQx with CFST column is decreased by 5.61 % than that of building provided with RCC column.The maximum storey displacement of building due to EQy with CFST column is 22.424 % more than that of building provided with RCC column. Still it is within the permissible limit.

IV.CONCLUSION

From the analysis of building with Reinforced cement concrete column and concrete filled steel tube columns, it is conclude that in the seismic event the building provided with both types of column shows better performance over medim rise building i.e story displacement and story drift in the building with bothReinforced cement concrete column and concrete filled steel tube columns are within the permissible limits.

V.ACKNOWLEDGMENT

This research was supported by Prof.D.B.Kulkarni, Dr. P. S. Patil, Dr.P.D.Kumbhar, Dr.Mrs.S.S.Kulkarni and RIT College,Islampur. I am thankful to my colleagues from Civil Department, who provided expertise that greatly assisted the research. I have to express out -appreciation to the Dr. Mr.S.S.Kulkarni for shearing their pearls of wisdom with us during the course of research.

REFERENCES

[1]. Ahmed Elremaily, AtorodAzizinamini (2013), " Behavior of circular concrete filled steel tube columns", Journal of composite construction in steel and concrete, Volume IV, ASCE pp.573-583

[2]. Myoungsu Shin a, Yoon Young Choi a, Chang-Ho Sun (2013), "Shear strength model for reinforced concrete rectangular hollow columns", Elsevier, Engineering Structures Volume-56 (2013) pp. 958–969.

[3]. Qing-Jun Che, Jian Cai , Mark A. Bradford c, Xinpei Liu , Zhi-Liang Zuo (2014) "Seismic behavior of a through-beam connection between concrete-filled steel tubular columns and reinforced concrete beams" Elsevier, Engineering Structures, Volume- 80 24–39

[4]. D. Lam and K. K. Y. Wong (2015)," Axial Capacity of Concrete Filled Stainless Steel Columns", Structures congress ASCE library.

[5]. Russell Q. Bridge (2015), "Design of composite column- Steel , concrete or composite approach", International Conference on Composite Construction in Steel and Concrete. ASCE library. Pp.276-290

[6]. Kenji sakino, Hiroyuki nakahara , et. al (2016), "Behavior of centrally loaded concrete filled steel tube short column " , Journal of Structural Engineering , ASCE library. p.p 180-188

[7]. A.L. Krishan, E.A. Troshkina, E.P. Chernyshova, (2016), "Efficient Design of Concrete Filled Steel Tube Columns", Elsevier, Procedia Engineering Volume 150 ,pp. 1709 – 1714

[8]. Qing-Xin Ren, Lin-Hai Han, Chao HouZhong Tao, Shuai Li (2017) , "Concrete-encased CFST columns under combined compression and torsion: Experimental investigation", Elsevier, Journal of Constructional

Steel Research 138 pp.729–741

[9]. Zhi-bin Wang, Zhong Tao, Lin-hai-Han et.at (2017),"Strength, stiffness and ductility of concrete filled steel columns under axial compression''. Elsevier, engineering structures., pp. 209-221.

[10]. AnkurTailoraSejal P. DalalbAtulK.Desai (2017), " Comparative Performance Evaluation of Steel Column Building &Concrete Filled Tube Column Building under Static and Dynamic Loading", Elsevier, Procedia Engineering Volume-173, pp.1847 – 1853