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Comparative Study of R.C.C & Composite Structure

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ABSTRACT: This paper presents a work done on seismic performance of reinforced concrete structure and composite structure of G+10 buildings in seismic zones III & IV. This paper focus on the R.C.C Structure and Composite Structure with their relative significance. The results are obtained on the basis of Story Drift, Story Displacement. The seismic performance of buildings having reinforced concrete structure and composite structure is comparable but the differences exist.

Composite structure as on today was first used in both a building and bridges. as compared to R.C.C structure Composite structures are more famous due to Both speed and economy can be achieved in case of composite systems. Steel-concrete composite systems for buildings are form a bond with each other and they form a complete composite structure with the help of shear connectors etc.

KEYWORDS: Composite steel-concrete systems, Soft storey, Equivalent static method, Response spectrum method, Base shear. Using ETAB software. Ratio, Displacement, Infill frame, Inter-Storey, drift, Strut.

I. INTRODUCTION

Steel concrete composite systems have become quite popular in recent times because of their advantages against conventional construction. Composite construction combines the better properties of the both i.e. concrete and steel and results in speedy construction. Composite members are made up of two different materials such as steel and concrete which are used for beams and columns. The steel and concrete structures have wide applications in multi-storey commercial buildings and factories as well as in case of bridges. Steel and concrete have almost the same thermal expansion, concrete is efficient in taking compression loads and steel is subjected to tensile loads. Composite structures are becoming

popular and steel or purely concrete structures can be minimized. In composite construction initial construction loads will be carried out by steel frame sections including self-weight during the construction and then concrete is cast around the section or concrete is poured inside the tubular section. In the comparative study includes deflections of the members, size and material consumption of members in composite with respect to R.C.C., seismic forces and behaviour of the building under seismic condition in composite with respect to R.C.C. foundation requirements and type of foundation can be selected for Composite structure with respect to building.

II. COMPONENTS OF COMPOSITE STRUCTURES

Composite slab

A composite slab in which steel sheets are connected to the composite beam with the help of shear connectors, initially steel sheets act as permanent shuttering and also act as bottom reinforcement for steel deck slab and later it is combined with hardened concrete.

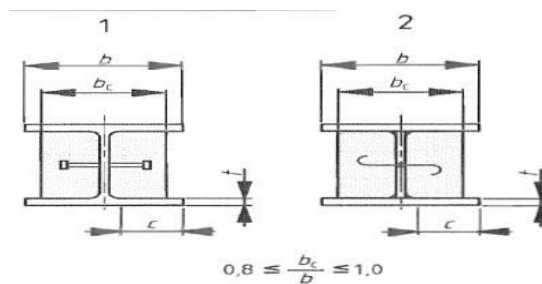
Shear connectors

Shear connectors (studs) are used to connect the concrete and structural steel and they give the sufficient strength and stiffness to the composite member.



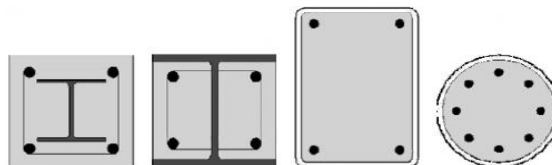
Composite beam

A composite beam is a steel beam or partially encased beam which is mainly subjected to bending and it supports the composite deck slab.



Composite column

Composite columns are a composite compression member or bending and compression members with steel encased sections partially or fully and concrete filled tubes.



Plastic resistance of a composite column of a cross section will be determined by following equation

For concrete encased and partially concrete encased sections

$$PPC = A_a \cdot f_{yd} + 0.85 A_c \cdot f_{cd} + A_s \cdot f_{sd}$$

For concrete filled sections

$$PPC = A_a \cdot f_{yd} + A_c \cdot f_{cd} + A_s \cdot f_{sd}$$

A_a – cross sectional area of structural steel

A_c – cross sectional area of concrete

A_s – cross sectional area of reinforcing steel

f_{yd} – design value of yield strength of structural steel

f_{cd} – design value of yield strength of cylindrical compressive strength of concrete

f_{sd} – design value of yield strength of reinforcing steel

III.LITERATURE REVIEW

Umesh P.Patil , Suryanarayana (june 2015) evaluate and compare the seismic performance of G+ 15 storey's made of RCC and composite structures ETABS 2013 software was used for the purpose. Both steel and concrete composite structures and RCC structures were having soft storey at ground level, structures were located in the region of earthquake zone III on a medium soil. Equivalent static and response spectrum method is used for analysis. Storey drift, self weight, bending moment and shear force, are considered as parameters. When compared composite structures shows better performance than RCC. It was concluded that the

- 1) Storey drift is reduced by 10% in composite models compared to RCC in soft storey level. In other storey's using equivalent static case, storey drift is reducing by 70% and the same reduces by 50% using response spectrum case.
- 2) Self weight is reduced by 10% in composites compared to RCC.
- 3) Bending moment in X direction in composites is reduced by 11% compared to RCC, but in Y direction it is increased by 70%.
- 4) Shear force in X direction in composites is reduced by 16% compared with RCC, but in Y direction increases by 65%.

Shweta A. Wagh*, Dr. U. P. Waghe (April 2014) they study Four various multi-storeyed commercial buildings i.e. G+12, G+16, G+20, G+24 are analysed by using ETABS 2013 software. Where design and cost estimation is carried out using MS-Excel programming and from obtained result comparison made between R.C.C and composite structure. It was concluded that

- 1) composite structure is nearly double than that of R.C.C structure but within permissible limit.
- 2) the Shear force and Axial force in R.C.C structure is on higher side than that of composite structure.

D. R. Panchal and P. M. Marathe (December 2011) they analyse steel concrete composite, steel and R.C.C. options are considered for comparative study of G+30 storey commercial building which is situated in earthquake zone IV. Equivalent Static Method of Analysis is used. For modelling of Composite, Steel and R.C.C. structures, ETABS software is used and the results are compared

It was concluded that

- 1) The reduction in the dead weight of the Steel framed structure is 32 % with respect to R.C.C. frame Structure and Composite framed structure is 30 % with respect to R.C.C. framed structure.
- 2) Shear forces in secondary beams are increased by average 83.3% in steel structure and reduced by average 10 % in composite structure as compared to R.C.C. framed structure while in main beams shear forces are increased by average 131% in steel structure and reduced by average 100 % in composite structure as compared to R.C.C. framed structure.
- 3) Bending moments in secondary beams are increased by average 83.3% in steel structure and reduced by average 48 % in composite structure as compared to R.C.C. framed structure while in main beams bending moments are increased 131% in steel structure and increased by average 117 % in composite structure as compared to R.C.C. framed structure.
- 4) Total saving in the composite option as compared to the R.C.C. results in 10 % so as with Steel it will be 6-7%.

IV.OBJECTIVES

The salient objectives of the present study have been identified as follows:

- 1) To perform Dynamic analysis of multi Story buildings having composite column for different seismic zone in India.
- 2) To observe the behaviour of composite column under seismic conditions.
- 3) To compare the behaviour of multi-Story buildings with using R.C.C columns and Composite columns.
- 4) To validate which type of column give best result.

V.MODELING CONFIGURATION

- 1) Plan dimensions: - 12m X 12m
- 2) Length in X-direction: - 12m
- 3) Length in Y-direction: - 12m
- 4) Floor to floor height: - 3.0m
- 5) No. of Story: - 11Story
- 6) Total height of building: - 33 m
- 7) Slab thickness: - 135mm

- 8) Outer wall thickness: - 230mm
- 9) Inner wall thickness: - 115mm
- 10) Grade of Concrete: - M25
- 11) Grade of Steel: -Fe415
- 12) Importance factor: - 1
- 13) Response Reduction factor: - 3
- 14) Zone Factor

Zone	Factor
III	0.16
IV	0.24

In the present work building of G+10, are referred as modal. Seismic analysis was performed for Zone III and Zone IV.

Table.1 List of Modal

Story	Modal	Beam	Column	Slab
G+10	Modal 1	RCC	RCC	RC slab
	Modal 2	RCC	COMPOSITE	RC slab
	Modal 3	STEEL	STEEL	RC slab

Respective modals of G+10, are analysed and compared considering parameter such as story drift, joint displacement, story shear, self-weight, Bending moment.

Method adopted for analysis of structure was response spectrum method. IS 1893-2002 was used for seismic analysis of modal.

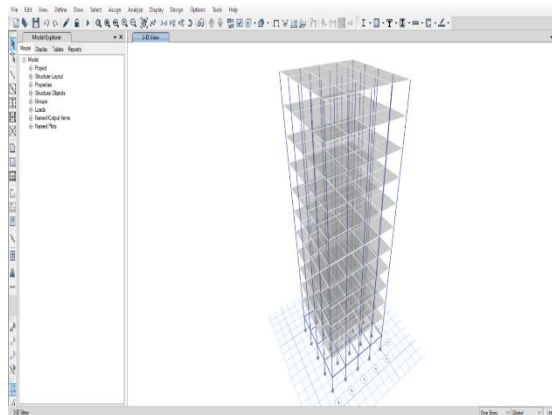


Fig:1 Isometric View of Building (G+10).

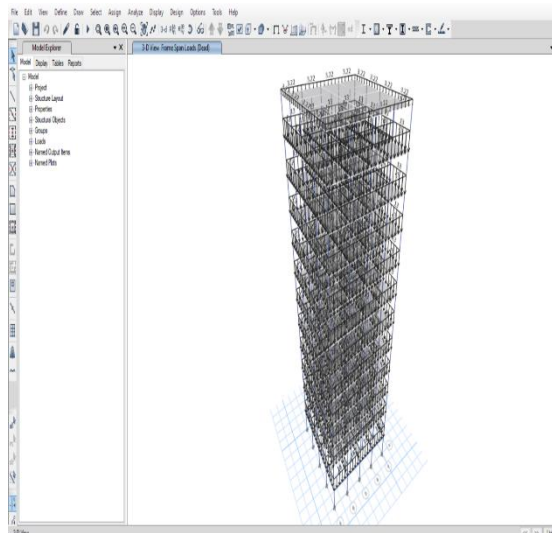


Fig:2 Isometric View of Building (G+10) with loading.

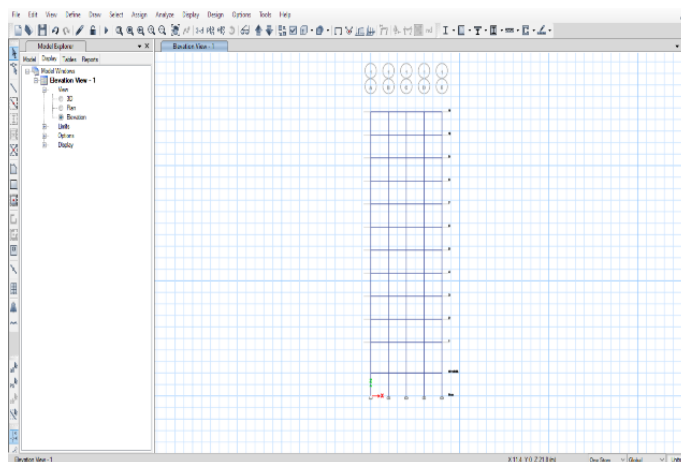


Fig:3 Elevation of G+10 Building.

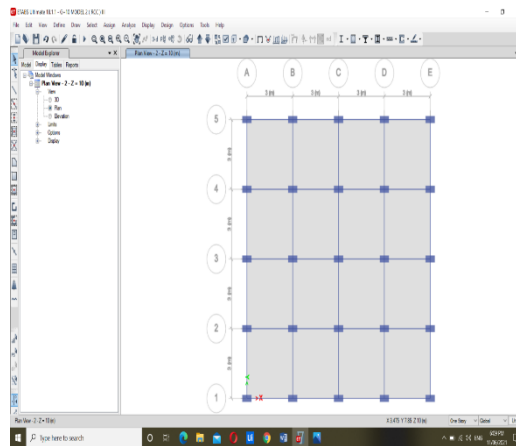


Fig:4 Plan of Building with Rectangular RCC Column

Table 2. List of Beam for G+10

Story	Zone III			Zone IV		
	Composite	RCC	Steel	Composite	RCC	Steel
1	ISMB 250-1	300X600	ISHB 300-1	ISMB 250-1	300X600	ISHB 300-1
2	ISMB 250-1	300X600	ISHB 300-1	ISMB 250-1	300X600	ISHB 300-1
3	ISMB 250-1	300X600	ISHB 300-1	ISMB 250-1	300X600	ISHB 300-1
4	ISMB 250-1	300X600	ISHB 300-1	ISMB 250-1	300X600	ISHB 300-1
5	ISMB 250-1	300X600	ISHB 300-1	ISMB 250-1	300X600	ISHB 300-1
6	ISMB 250-1	300X600	ISHB 300-1	ISMB 250-1	300X600	ISHB 300-1
7	ISMB 250-1	300X600	ISHB 300-1	ISMB 250-1	300X600	ISHB 300-1
8	ISMB 250-1	300X600	ISHB 300-1	ISMB 250-1	300X600	ISHB 300-1
9	ISMB 250-1	300X600	ISHB 300-1	ISMB 250-1	300X600	ISHB 300-1
10	ISMB 250-1	300X600	ISHB 300-1	ISMB 250-1	300X600	ISHB 300-1
11	ISMB 250-1	300X600	ISHB 300-1	ISMB 250-1	300X600	ISHB 300-1

Table.3 Frame configuration for G+10

ZONE	Composite	RCC	Steel
	RECTANGULAR	RECTANGULAR	I SECTION
III	300X600 + ISMB 250-1	300X600	ISHB 300-1
IV	300X600 + ISMB 250-1	300X600	ISHB 300-1

VI. PERFORMANCE ANALYSIS

Result of G+10
For Zone III
For Drift in X-Y Direction
For Rectangular Column Structure

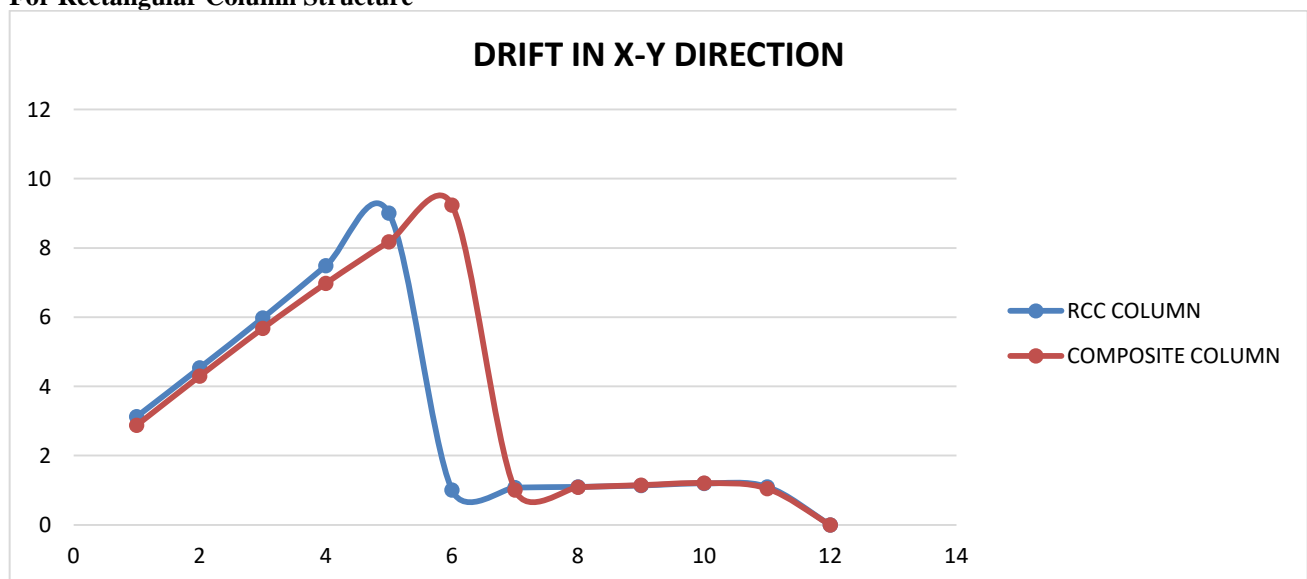


Fig. 7 Story Drift in x-y direction

From result it is observed that maximum storey drift in x-y direction for RCC Rectangular column structure is more than the drift for Composite Rectangular column structure.

For Displacement in X-Y Direction
For Rectangular Column Structure

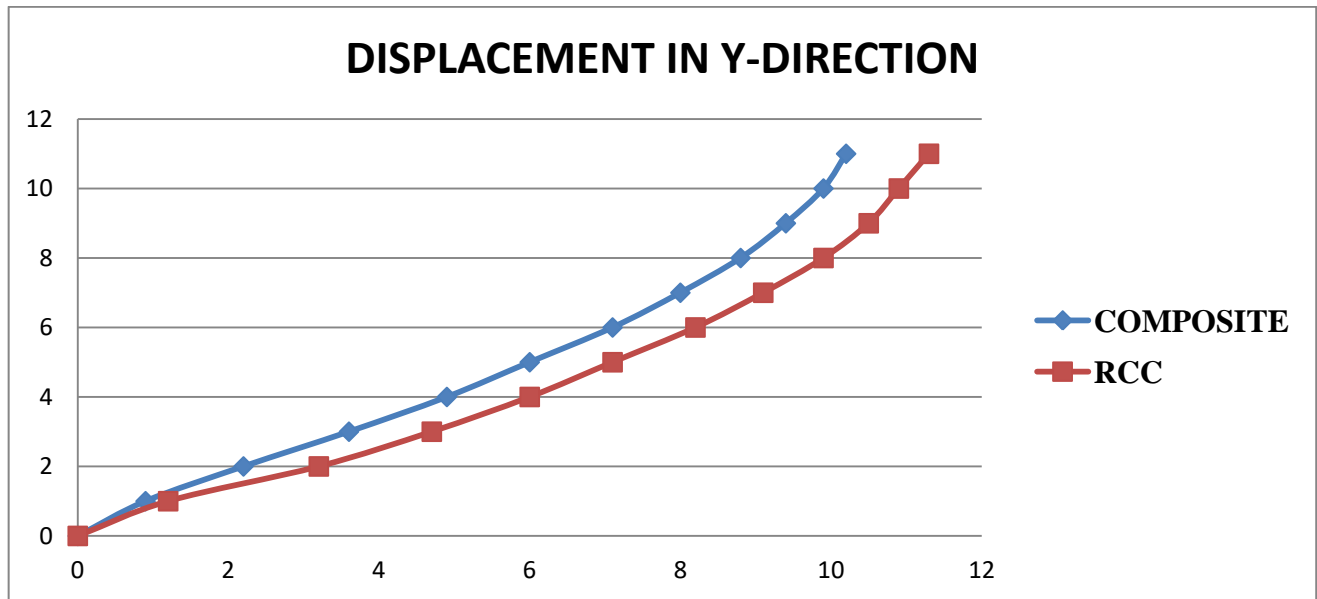


Fig. 10. Story Displacement in x-y direction

From result it is observed that maximum storey displacement in x-y direction for RCC Rectangular column structure is more than the displacement for Composite Rectangular column structure.

VII.CONCLUSION

From the analysis done on G+10 structure in zone III & zone IV. the following conclusions are made:

- 1) In zone III & zone IV story drift is coming out to be less for composite column structure as compared to RCC column structure for G+10 modal
- 2) In zone III & zone IV story displacement is coming out to be less for composite column structure as compared to RCC column structure for G+10 modal.
- 3) In zone III & zone IV self weight is coming out to be less for composite column structure as compared to RCC column structure for G+10 modal.
- 4) Composite and Steel structure show to be economical.
- 5) Composite structures are being more ductile, resist lateral load better than RCC structures.
- 6) From the result it can be concluded that for low rise building and high rise building composite structure gives best result than RCC frame under seismic analysis.

REFERENCES

1. IS: 800, "Code of practice for general construction in steel, Bureau of Indian Standards, New Delhi, 2007.
2. IS: 11384, "Code of practice for composite construction in structural steel and concrete", Bureau of Indian Standards, New Delhi, 1985.
3. D.R Panchal and P.M. Marthe, "Comparative Study of RCC, Steel and Composite (G+30) Storey Building" International Conference 2 On Current Trends In Technology, Institute Of Technology, Nirma University, Ahmedabad – 382 481, pp 1-6, December, 2011.
4. Umesh P. Patil, Suryanarayana, "analysis of g+15 RCC and composite structure having a soft storey at ground level by response spectrum and equivalent static methods using etabs 2013", International Research Journal of Engineering and Technology (IRJET), Volume: 02 Issue: 03, June-2015.
5. Shweta A. Wagh, Dr. U. P. Waghe Comparative Study of R.C.C and Steel Concrete Composite Structures G+12, G+16, G+20, G+24 Int. Journal of Engineering Research and Applications Vol. 4, Issue 4, April 2014
6. IS 13920: 1993. "Indian Standard Code of the practice for the detailing of Reinforced Concrete Structures Subjected to Seismic Forces" Bureau of Indian Standards, New Delhi.



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