ANALYSIS OF FLOATING COLUMN WITH LATERAL LOAD RESISTING SYSTEM BY USING STAAD PRO

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Abstract -: Many urban multistorey buildings in India today have open first storey as an unavoidable feature. This is primarily being adopted to accommodate parking or reception lobbies in the first storey. Whereas the total seismic base shear as experienced by a building during an earthquake is dependent on its natural period, the seismic force distribution is dependent on the distribution of stiffness and mass along the height.The term floating column is a vertical member which ends at its lower-level rests on a beam which is a horizontal member. The beams in turns transfer the load to other column below it. In present scenario buildings with floating column is a typical feature in the modern multistory construction in India. In present paper effort has been taken to decide proper position of floating column. G+4, G+10 and G+20 buildings were analyzed and it is found that the building with floating column at central position behaves well.

Keywords- Multistorey, seismic, floating column.

1.INTRODUCTION

A column is supposed to be a vertical member starting from foundation level and transferring the load to the ground. The term floating column is also a vertical element which (due to architectural design/ site situation) at its lower level (termination Level) rests on a beam which is a horizontal member. The beams in turn transfer the load to other columns below it.

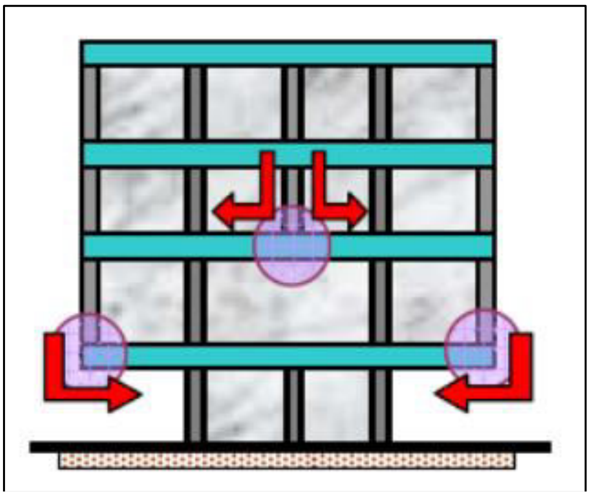

***Figure 1** : Floating Column*

There are many projects in which floating columns are adopted, especially above the ground floor, where transfer girders are employed, so that more open space is available in the ground floor. These open spaces may be required for assembly hall or parking purpose. The transfer girders have to be designed and detailed properly, especially in earth quake zones. The column is a concentrated load on the beam which supports it. As far as analysis is concerned, the column is often assumed pinned at the base and is therefore taken as a point load on the transfer beam. STAAD Pro, ETABS and SAP2000 can be used to do the analysis of this type of structure. Floating columns are competent enough to carry gravity loading but transfer girder must be of adequate dimensions (Stiffness) with very minimal deflection.

Looking ahead, of course, one will continue to make buildings interesting rather than monotonous. However, this need not be done at the cost of poor behavior and earthquake safety of buildings. Architectural features that are detrimental to earthquake response of buildings should be avoided. If not, they must be minimized. When irregular features are included in buildings, a considerably higher level of engineering effort is required in the structural design and yet the building may not be as good as one with simple architectural features. Hence, the structures already made with these kinds of discontinuous members are endangered in seismic regions. But those structures cannot be demolished, rather study can be done to strengthen the structure or some remedial features can be suggested. The columns of the first storey can be made stronger, the stiffness of these columns can be increased by retrofitting or these may be provided with bracing to decrease the lateral deformation.

Literature Review

Sreadha A R, Dr.C Pany study the nature of G+5 multistorey building analyse with and without floating column under earthquake forces and discuss the performance of structure with floating column in seismically active areas also establish the correlation without floating column by using designing software ETABS. Seismic analysis and response spectrum method is done based on IS Code 1893(Part 1) 2002(10). For analysis 3 models considered for Zone 4. In model 1 structure without floating column is consider, In model 2 floating column is introduced at 1st floor and In model 3 floating column introduced at 5th floor. So it conclude that model 1 showing minimum Drift and Displacement and model 2 and 3 showing maximum Drift and Dispalcement.

Miss Priyanka S. Gunjal, Prof. M.N. Shirsath study G+5, G+7, G+9, G+11, G+13 RCC frame structure with floating column and without floating column isanalysed. The response spectrum method is carried out by using Stad Pro software. In earthquake analysis the response spectrum parameters such as storey displacement, storey drift, storey shear is evaluate and critical position of floating column building is studied. In regular or irregular building the effect of increasing section of beam and column has been studied in this critical position. To find whether the stuctures with floating columns are safe or unsafe in seismically prone areas also find out structures are economical or uneconomical as per commercial aspect.In the above study author conclude that building with floating column having more displacements and will make soft storey effect which is very worse than normal building. The torsional effect in earthquake excitation is more so as a result overturning effect cause in floating column building and structure become unsafe. In floating column the quantity of steel and concrete have to increase so as to keep it safe in earthquake excitation so floating column becomes uneconomical as compared to normal building.

MS Waykule S.B., Mr. kadam S.S., Mslale S.V. study G+5 storied building with and without floating column is studied for highly seismically active zone 5 as per IS Code (1893 Part 1):2002. Four models are studied as floating column at 1st, 2nd, 3rd floor and without floating column. By using SAP 2000V17 software modelling and analysis is done. For all the four models Linear static and Time history Analysis are carried out. From this analysis models result obtained are compared in the form of seismic parameters such as storey drift, storey displacement, time period and base shear by varying the location of floating column floor wise.In the above study author conclude that building with floating column has more time period, less base shear, more displacement, more storey drift as compared to building without floating column. It was also conclude that shifting of floating column from 1st storey towards top storey of the building results in increasing time period, base shear, storey displacement storey drift because of lateral stiffness of building.

Srikanth M.K., Yogendra R. Holebagilu carried out the comparison between having only floating column and having a floating column with complexities were considered for Ten Storey RC building for lower II and higher V seismic zones for medium soil condition at different alternative locations to find the optimum position and this analysis is carried out by using ETABS Version 9.7.4 software. The entire work consists of four models i.e. Model FC, FC+4, FC+HL, FC+4+HL. Where FC= floating column, HL= Heavy load. This four models is studied by changing the location of floating column firstly in the middle, outer and in edge of the frame of the building. In the above study author conclude that four models are not preffered in higher zone because of more displacement values. Because of magnitude of intensity will be more for higher zones the displacement of building increases from lower to higher zones. The value of displacement and drift is more for model FC+HL and FC+4+HL than FC and FC+4 due to the increament in weight. Displacement values increases when floating column is provided with middle and edge than the outer face of the frame. In model FC+HL, FC+4+HL there is sudden change in storey shear due to the heavy load on slab. In model FC+4+HL the drifts are deviated more compared to other models.

Arpit Shrivastav, Aditi Patidar work on the three cases of multistorey building along with 8 storey, 12 storey and 16 storey having floating column under seismic forces to observe the effect of shear wall. By using STAD-Pro software all the three cases consider having floating column provided with and without shear wall and analysed for zone III, zone IV and zone V. Due to the more magnitude of intensity for higher zones, the parameters lateral displacement, and storey drift of the building increases from lower to higher zones.

In the above study author conclude that the storey drift and lateral displacement is more for the building having floating column because columns are removed , the mass gets increased. For all the zones Displacement and drift values reduced by providing shear wall as compared to without shear wall models. Displacement value crosses the maximum permissible limit in case of without shear wall in zone IV 16 storey and zone V 8storey and 12 storey but it become safe incase of building with shear wall. In zone V 16 storey building is not safe for both with and without shear wall. To reduce the displacement values it is suggested to increase the size of column.

2.Problem Definition

The buildings considered to analysis regular G+4, G+10, G+20 of special moment resisting frames of plan dimension 22.5m×25m shown in fig 1, considered the buildings are situated in Zone- II as per IS 1893-2002. The buildings are modelled using the software STAAD Pro V8i.

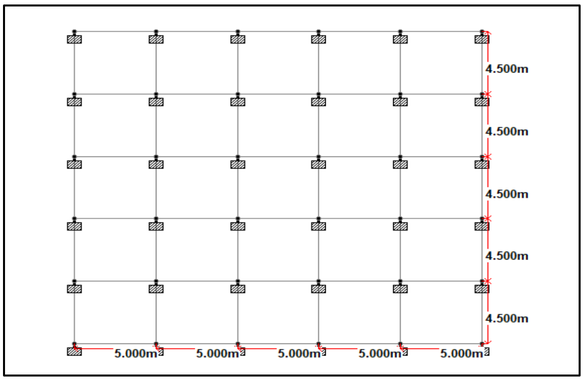

Figure 2: Plan of G+4, G+10 and G+20 Building

Various input parameters have been used to evaluate the effect of floating column on seismic response of RC framed structure. A detailed information of input parameters has been shown in table 1.

Table 1. Structural and Material Data

Sr. No.	I	II	III	IV			V
1	Structure	Beam	Slab	Column			Wall
2	Storey	---	---	G+4	G+10	G+20	---
3	Size	350x730 mm2	150 mm	350x350 mm2	500x500 mm2	660x660 mm2	300 mm
4	Material	M20	M25	M25	M30	M35	Brick

Table 2. Architectural Data

Sr. No.	I	II
1	No. of stories	G+4, G+10, G+20
2	Floor Height	3m
2	Dimension of plan	25m x 22.5 m

Table 3. Seismic Data

Sr. No.	I	II
1	Seismic zone	II
2	Importance factor(I)	1
3	Response reduction factor(R)	5
4	Zone factor	0.10

Modelling and Analysis of Structures

Procedure of Analysis of Structure Using STAAD Pro V8i consist of following steps:

- Modelling.
- Assigning member properties.
- Assigning supports.
- Applying loads.
- Analysis and design of structure.

Models have been prepared using above data in STAAD Pro V8i.

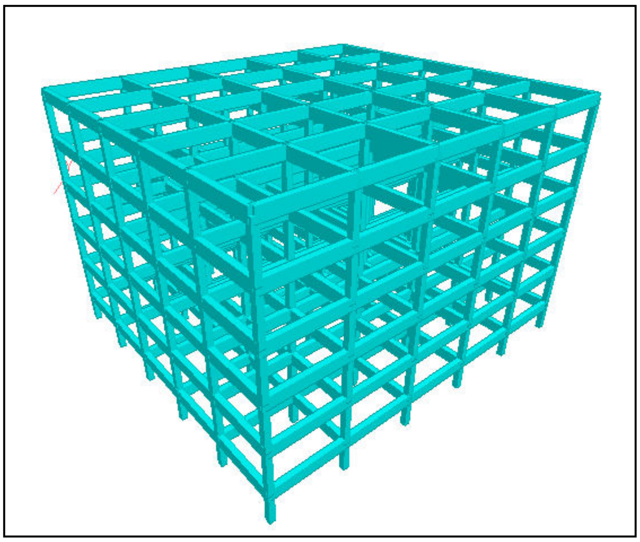

Figure 3: 3D view of G+4 Building (Rendering view)

Observations

In order to decide position of floating column in building, analysis of G+4, G+10 and G+20 models were carried out and displacements at extreme corner columns were observed and presented below.

Table 4. G+4 Without floating column, Corner Column and Central Column

Structure	Columns	Nodes	Displacement			Resultant
			X	Y	Z	
G+4 Without floating column	1	1	-0.004	-0.928	-0.004	0.928
		37	-0.011	-2.099	-0.01	2.099
		73	-0.008	-3.034	-0.007	3.034
		109	-0.006	-3.722	-0.005	3.722
		145	-0.003	-4.156	-0.003	4.156
		181	0.071	-4.332	0.058	4.333
G+4 Corner column	1	1	-0.016	-1.707	-0.004	1.707
		37	-0.016	-3.857	-0.014	3.857
		73	0.016	-5.532	-0.009	5.532
		109	0.01	-6.743	-0.006	6.743
		145	-0.009	-7.503	-0.005	7.503
		181	0.255	-7.819	0.076	7.824
G+4 central column	1	1	-0.032	-0.44	-0.003	0.441
		37	-0.159	-1.037	-0.009	1.05
		73	-0.032	-1.557	-0.007	1.557
		109	-0.023	-1.959	-0.005	1.959
		145	-0.013	-2.205	-0.003	2.205
		181	0.455	-2.275	0.055	2.321

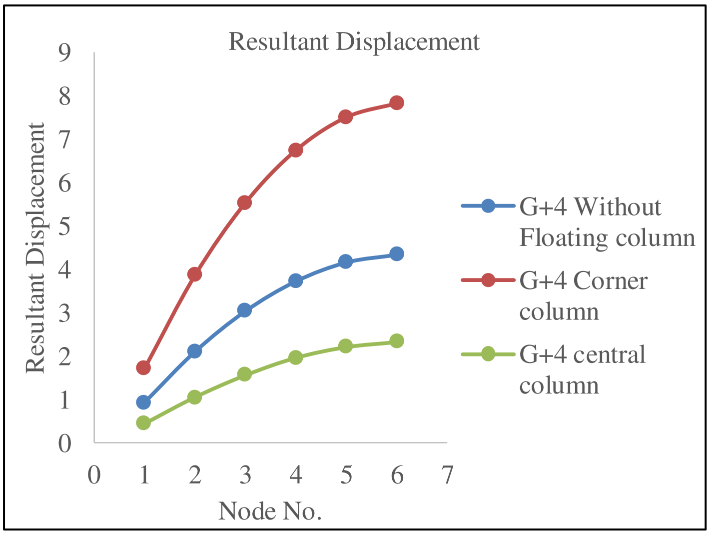

Figure 4: Resultant displacement for G+4 Building

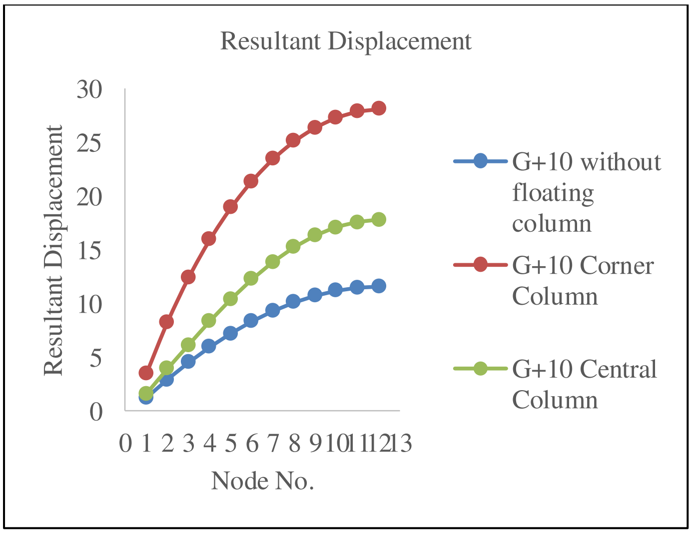

Figure 5: Resultant displacement for G+10 Building

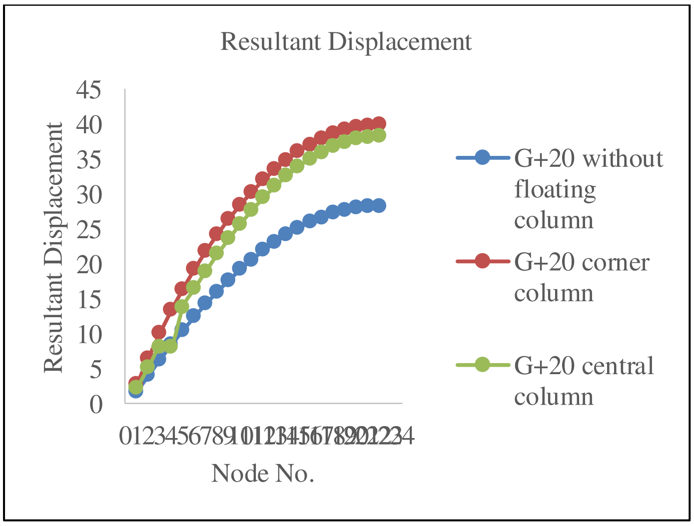

Figure 6: Resultant displacement for G+20 Building

3. CONCLUSIONS

Based on observations presented following conclusion have been drawn.

- As height of building increases resultant displacement also increases.
- An introduction of floating column in symmetrically loaded structure increases its displacements for static loading.
- Structure with floating column provided at central portion behaves well as compare to floating column provided at corner.

REFERENCES

[1] **SukumarBehera**(may2012)- Seismicanalysisofmultistorybuildingwithfloatingcolumn, Department of Civil Engineering, National Institute of Technology Rourkela769008 MAY 2012.

[2] **Shrikanth .M.K**(2014) –Seismic response of complex building with floating column and without floating column, International journal of Engineering Research-Online. A Peer Reviewed International Journal .Vol. 2., Issue.4, 2014 .ISSN:2321-7758

[3] **T.Raja.Sekhar**(2014)– Studyofbehaviorofseismicanalysisofmultistorybuildingwith and without floating column. T. Raja Sekhar et al, Carib .j. SciTech, 2014, Vol2,697-710.

[4] **A. P. Mundada**(2014) – Comparative seismic analysis of multi storey building with and withoutfloatingcolumn,InternationalJournalofCurrentEngineeringandTechnology,Vol.4, No.5 (Oct2014)

[5] **Hardik Bhensdadia**(2015)- Pushover analysis of Rc structure with floating column and soft storey in different earthquake zones , frame International Journal of Research in Engineering and Technology . Volume: 04 Issue: 04 Apr-2015.

[6] **Awkar J. C. and Lui E.M,** "Seismic analysis and response of multistory semirigid frames", Journal of Engineering Structures, Volume 21, Issue 5, Page no: 425-442,1997.

[7]**BalsamoaA,ColomboA,Manfredi G,NegroP&ProtaP**(2005),"Seismicbehaviorof afull-scaleRCframerepairedusingCFRPlaminates".EngineeringStructures27(2005)769– 780.

[8]**Bardakis V.G., Dritsos S.E.** (2007), "Evaluating assumptions for seismic assessment of existing buildings ".Soil Dynamics and Earthquake Engineering 27 (2007)223–233.

[9] **Garcia Reyes, Hajirasouliha Iman, PilakoutasKypros,** (2010),"Seismicbehaviour of deficient RC frames strengthened with CFRP composites". Engineering Structures 32 (2010) 3075-3085

[10] **Mortezaei A., Ronagh H.R., Kheyroddin A.,**(2009), "Seismic evaluation of FRP strengthened RC buildings subjected to near-fault ground motions having fling step". Composite Structures 92 (2010)1200–1211.