Dynamic Analysis of RCC BLDG With Floating Column

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Abstract- *In urban India floating column building is a typical feature in the modern multi-storey construction. Floating columns buildings are adopted either for architectural aspect or when more free space is required in the ground floor. Such features are highly undesirable in seismically active area. In the project studies the analysis of G+13 storey building with floating column and without floating is carried out. The analysis is done by using STAAD Pro V8i software by using Response spectrum analysis. The paper deals with the results variation in displacement of structure, base shear, Seismic weight calculation of building from manual calculation and STAAD pro V8i. For building with floating column and building without floating column, finding the variation between the response parameters of earthquake and describe what happens when variation may be high or low. The study is carried out to find whether the floating column structures are safe or unsafe when built in seismically prone areas, and also find out commercial aspects of floating column building either it is economical or uneconomical.*

Keywords- Floating column building, Normal building, Response spectrum analysis, STAAD Pro V8i, earthquake effect.

I. INTRODUCTION

A typical Column is a vertical structural member which support to horizontal structural members by means of their weights, moments, shear force, axial load etc., to keep the structure in safe condition and transfer these loads to the ground. But now a days some columns are designed in such a manner that it does not reach to the ground, because of various architectural aspects. In those cases the columns transfer above loads as a point load on a beam. This type of column is termed as Floating column. This Point load increases too much bending moment on beam so that area of steel required will be more in such cases. While earthquake occurs, the building with floating columns damages more as compared to the building without any floating columns because of discontinuity of structure & load transfer path.

The overall size, shape and geometry of a structure play a very important roll to keep structure safe while earthquake occurs. As theory and practical study on buildings says that, earthquake forces developed at different floor levels in a building needs to be brought down along the height to the ground by the shortest path; any deviation of discontinuity in this load transfer path results in poor performance of the building. In Earthquake analysis the main response parameters are storey displacement, Storey drift, storey shear. These parameters are evaluated in this paper and critical position of floating column building is observed. In this critical position the effect of increasing section of beam and column in irregular building and regular building has been observed.

A. Aim

This study aims to create awareness about these issues in Earthquake resistant design of multistoried buildings with floating column

B. Objective

In this present project, the following aspects are attempted to study.

1) Modeling of the multi-storey building with and without floating Column using STAAD PRO.
2) Comparative study is done between the multi-storey building with and without floating column in different zones, when the floating column are present at the same floor and different location in the building.
3) Comparative study on variations in the structural response in the structure due to seismic excitation is also performed,
4) The building with floating column are tend to fail at seismic excitations, hence the recommendations for the earthquake resistant design of the considered buildings are modelled and analyzed.
5) The main objective of the study is to provide a economical and safe design of a building with floating column at seismic zones with recommending some design recommendations as there is no specified

provision or magnification factor provided in I.S codes for this type of irregularities.

II. LITERATURE REVIEW

Seismic Analysis of Multistory Building with Floating Column Prof. A V Asha [1]In this thesis 2D frames with and without floating column having same material property and dimension were analyzed under same loading by using FEM (finite element method) and software STAAD pro. And compatible time history as per spectra IS 1893 (part 1): 2002 applied on the structures. It concluded that, with increase in ground floor column the maximum displacement, inter story drift values are reducing. The base shear and overturning moment vary with the change in column dimension.

Comparative Study Of Column and Non –floating Columns With and Without Seismic Behaviour Nakul A. Patil[2] In this paper they summarized, comparative study of seismic analysis of building with and without floating column and they also give output results will be expressed in terms of story displacements, inner-story drift and comparison of amount of steel and concrete required in different cases by using ETABS software. Following same graphs of result. It was concluded that, with floating column not preferable in higher earthquake zones because of high value displacements according to code

Seismic Response of Multi-Story building with Vermicular Irregularity as Floating column Joshi Shridhar D [3] In this paper floating column provided different floor where location center of building was analyzed is carried out using FEM and ETABS software. And they study about importance of explicitly recognizing the presence of the floating column in the analysis of building. For the present study response spectrum and time history analysis are carried out to know the various structural parameters like base shear, story shear, story displacement. It was concluded that, Increase in size of beams and columns improve the performance of building with floating column by reducing the values of story displacement. And Fundamental time period and base shear of normal building is maximum compared with all other floating column buildings.

III. METHODOLOGY

A building should possess four main attributes namely simple and regular configuration and adequate lateral Strength, stiffness and ductility for well performance in an earth quake. Buildings having simple regular geometry and uniformly distributed mass and stiffness in plan as well as elevation, suffer much less damage than buildings with irregular configuration. A building shall be considered as irregular for the purposes of this standard, if at least one of the Conditions are applicable as per IS 1893(part1):2002

A. The Procedures For The Earthquake Analysis Of The Structures:

- Linear Static Procedure
- Linear dynamic Procedure
- Response Spectrum method
- Time history method
- Nonlinear Static Procedure (Pushover analysis)
- Nonlinear dynamic procedure
- As per IS-1893:2002, Methods Adopted are
- Equivalent Static Lateral Force (or) Seismic Coefficient Method
- Response Spectrum Method
- Time history method

Response Spectrum Method:

- Response-spectrum analysis (RSA) is a linear-dynamic statistical analysis method which measures the contribution from each natural mode of vibration to indicate the likely maximum seismic response of an essentially elastic structure.
- Response-spectrum analysis provides insight into dynamic behavior by measuring pseudo-spectral acceleration, velocity, or displacement as a function of structural period for a given time history and level of damping.
- It is practical to envelope response spectra such that a smooth curve represents the peak response for each realization of structural period. Response-spectrum analysis is useful for design decision-making because it relates structural type-selection to dynamic performance.
- Structures of shorter period experience greater acceleration, whereas those of longer period experience greater displacement. Structural performance objectives should be taken into account during preliminary design and response-spectrum analysis. Response spectra helps to obtain the peak structural response under linear range, which can use to obtain lateral forces developed due to earthquake, thus facilitates in seismic resistant design of structure.

B. Problem statement

The structure must be modeled and analyzed so that the values of the response parameters of earthquake are calculated with sufficient accuracy for design purpose. The acceptance criteria of result of response parameter may vary on whether static or dynamic non-linear analysis is used. G+11 RCC frame structures are modeled by using Staad Pro V8i software. The Building Frames are special moment-resisting frame (SMRF). All details of size, properties are tabulated above

Model Details G+11

The space frame building is modeled in STAAD-Pro. The beams and columns are modeled as beam elements and the slab is modeled as a plate element.

Beam Size: 230 X 500 mm
Column Size: 230 X 600 mm
Slab Thickness :150 mm
Storey Height:3m
Grade of concrete:M25

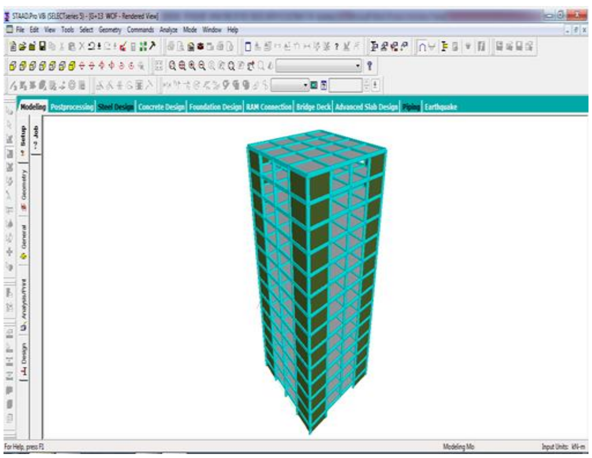
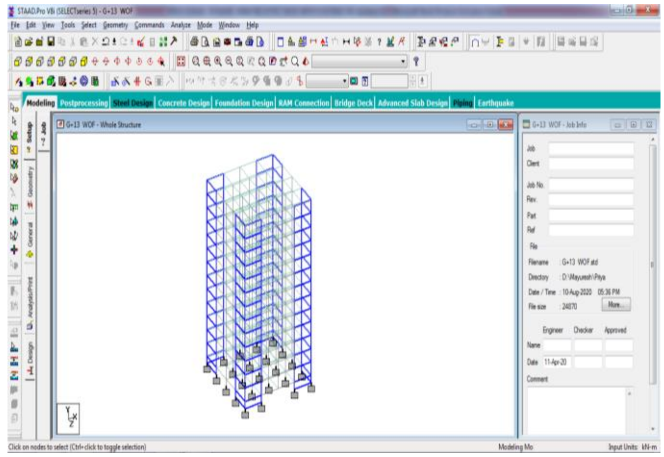


Fig.1Modelling of G+13 with Shear Wall

IV. RESULTSAND DISCUSSION

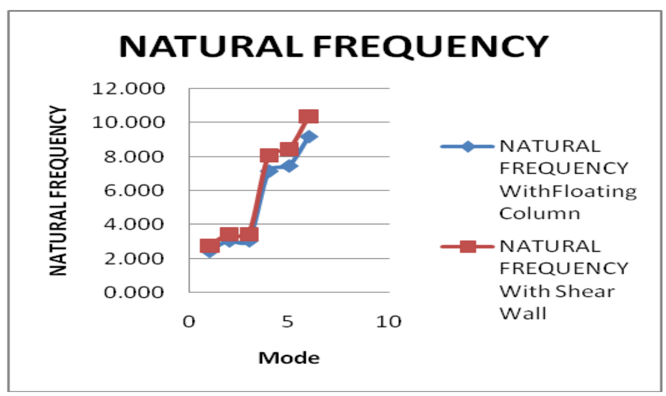
COMPARISON OF G+13 BUILDING HAVING FLOATING COLUMN WITH AND WITHOUT SHEAR WALL



Modelling of G+13 with Shear Wall

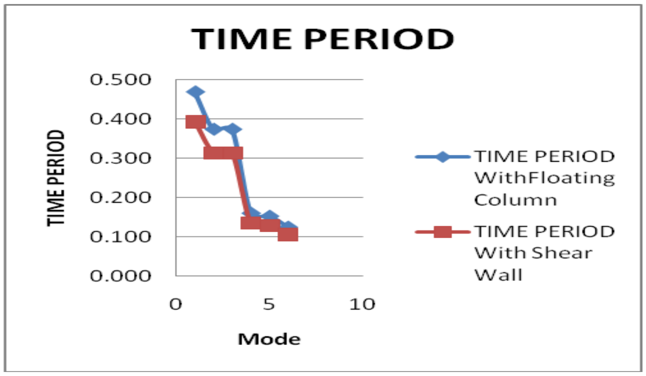
NATURAL FREQUENCY

NATURAL FREQUENCY		
Mode	With Floating Column	With Shear Wall
1	2.438	2.755
2	3.051	3.448
3	3.058	3.456
4	7.149	8.079
5	7.454	8.423
6	9.175	10.368



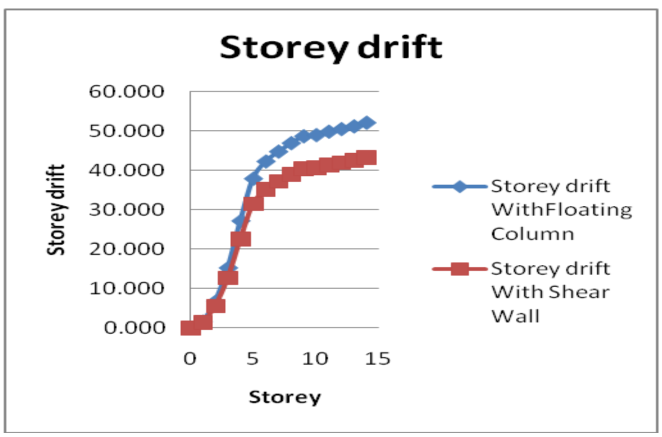
IME PERIOD

TIME PERIOD		
Mode	With Floating Column	With Shear Wall
1	0.469	0.394
2	0.374	0.314
3	0.374	0.314
4	0.160	0.135
5	0.153	0.128
6	0.125	0.105



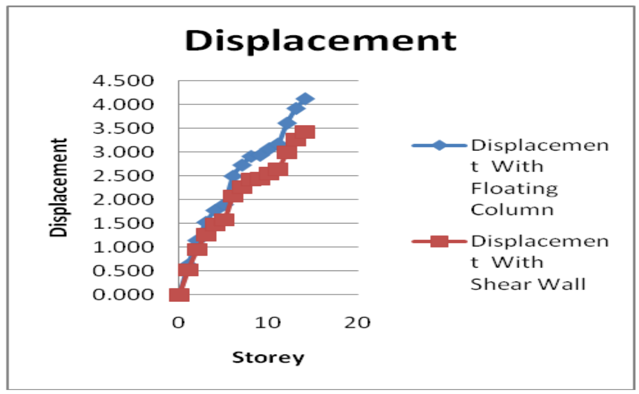
Storey drift

Storey	Storey drift	
	With Floating Column	With Shear Wall
0	0.000	0.000
1	1.702	1.413
2	6.808	5.650
3	15.329	12.723
4	27.253	22.620
5	37.962	31.509
6	42.341	35.143
7	44.840	37.217
8	46.986	38.998
9	48.738	40.452
10	49.036	40.700
11	49.901	41.418
12	50.558	41.963
13	51.246	42.534
14	52.165	43.297



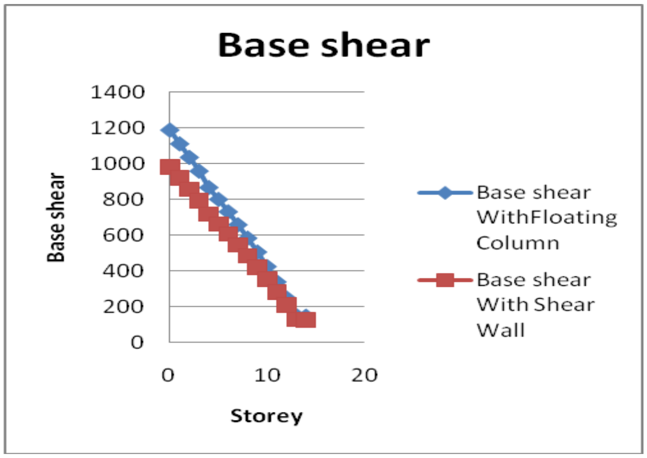
Displacement

Storey no.	Displacement	
	With Floating Column	With Shear Wall
0	0.000	0.000
1	0.637	0.529
2	1.148	0.953
3	1.530	1.270
4	1.781	1.478
5	1.902	1.579
6	2.499	2.074
7	2.732	2.268
8	2.913	2.418
9	2.939	2.440
10	3.076	2.553
11	3.175	2.636
12	3.612	2.998
13	3.921	3.254
14	4.124	3.423



Base shear

Storey no.	Base shear	
	With Floating Column	With Shear Wall
0	1186.718	984.976
1	1110.132	921.410
2	1034.773	858.862
3	957.853	795.018
4	866.473	719.173
5	800.503	664.417
6	731.37	607.037
7	659.366	547.274
8	584.606	485.223
9	507.008	420.817
10	426.055	353.626
11	340.695	282.777
12	250.544	207.952
13	153.669	127.545
14	149.522	124.103



V. CONCLUSION

The Study presented in the paper compares the difference between building with and without floating column. The following conclusions were drawn based on the investigation.

1) From the response spectrum analysis it is noticed that the floating column building is having more displacements than a building without any floating column. So Floating column building is unsafe than a normal building.
2) After the analysis of building, it is found that quantity of steel and concrete have to increase in floating column building to keep it safe in earthquake excitation. So floating column building becomes uneconomical as compare to normal building.
3) By the lateral stiffness calculation at each floor for the structure it is observed that the building with floating column will make the soft storey effect very worse while the normal building without any floating columns have less soft storey effect. So the floating column building is unsafe.
4) The Torsional effect in earthquake excitation is more in floating column building as compare to normal building, as a result overturning effect occurs in floating column building and structure becomes unsafe.
5) Generally, a building becomes expensive if it is designed to sustain any damage during an strong earthquake shaking.
6) In the present study, it is observed that the normal column building is more efficient when compared with other models i.e. floating column buildings.
7) Hence the recommendations such as shear walls, infill walls, bracings are considered in the modeling and analysis and observed that they can also be designed as an earthquake resistant up to an extent, such that on introduction of floating columns in the RC frames increases the time period of bare frames due to decrease in the stiffness.
8) On comparison of the results obtained for each model, it is observed that the building with normal column building have lesser displacements and story drifts when compared with the floating column models.
9) After Analyzing floating column with and without shear wall building it conclude that shear wall is effective to reduce deflection, story drift and other parameters , so use shear wall while designing of building with floating column.

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