International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 10 | Oct 2019 www.irjet.net p-ISSN: 2395-0072

EXPERIMENTAL STUDY OF FLOATING COLUMN FOR SEISMIC ANALYSIS OF MULTISTOREY BUILDING

Prof. Tejas N. Kothari[1], Prof. Pranay P. Deogade[2], Prof. Vishwajit R. Jaiswal[3]

[1,2,3]Assistant Professor, Dept. of Civil Engineering, Jagadambha College of Engineering & Technology, Yavatmal, Maharashtra, India

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Abstract - *Now a day's many multistory buildings are constructed with floating column for aesthetic point of view and for getting more space at parking areas for movement in the building. But such structure are highly get damaged during earthquake in highly seismic zone as compared to normal structure. Floating columns in the building are a typical feature in the modern multi-storey construction in world and are highly undesirable in structure built in seismically active areas. In this paper present study about analysis of G+5 Building with and without floating column in highly earthquake zone v. four models are created such as floating column at 1st ,2nd and 3rd floor buildings and without floating column building. Different cases of the building are studied by varying the location of floating columns floor wise.* Finally, Parameter such as storey displacement and base shear compared and obtained results were presented in both graphically and tabular format*. The analysis is carried out using software sap2000v17.*

Key Words*: *Floating column, base shear, storey displacement, linear static analysis, sap2000v17.

1. INTRODUCTION

In recent times, multi-storey buildings in urban cities are required to have column free space due to shortage of space, population and also for aesthetic and functional requirements. For this buildings are provided with floating columns at one or more storey. These floating columns are highly disadvantageous in a building built in seismically active areas. The earthquake forces that are developed at different floor levels in a building need to be carried down along the height to the ground by the shortest path. Deviation or discontinuity in this load transfer path results in poor performance of the building. The behavior of a building during earthquakes depends critically on its overall shape, size and geometry, in addition to how the earthquake forces are carried to the ground. Many buildings with an open ground storey intended for parking collapsed or were severely damaged in Gujarat during the 2001 Bhuj earthquake.

Floating Column: The floating column is a vertical member which rest on a beam and doesn't have a foundation. The floating column act as a point load on the beam and this beam transfers the load to the columns below it.

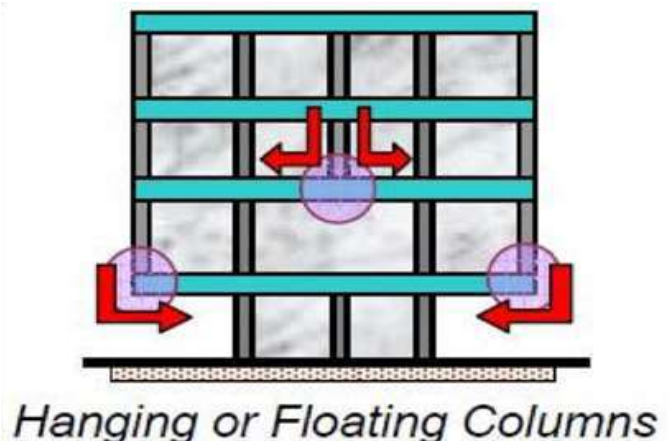

Fig no.1 Floating column in building.

II. REVIEW PAPERS

1. Shrikanth M.K, Yogendra.R.Holebagilu In this paper study is all about to compare the behavior of a building having only floating column and having floating column with complexities. High rise building is analyzed for earthquake force. For this purpose created four models in ETABs and analyzed for lower and higher earthquake zones for medium soil condition. Analysis was carried out by using extended 3 dimensional analysis of building system ETAB version 9.7.4 software. The results are presented in terms of Displacement, soft storey, storey drift for these four models and tabulated on basis of linear seismic analysis. [1]

2. Sabari, in this paper the time history analysis of RCC frame structure of different stiffness. In this they considering the building frame base fixed, the author has created artificial stimulation of earthquake similar to bhuj earthquake ground motion with the help of FEM Package SAP 2000. In this various parameters where taken like base shear, roof displacement, axial force, storey drift were considered. By changing the column size dynamic analysis is carried out and concluded that with increase in column size, the maximum deflection and inter storey drift are reduced. [2]

3. T.raja sekhar*, Mr.P.V. Prasad, The behavior of building frame with and without floating column is studied under static load, free vibration and forced vibration condition. The results are plotted for the frames with and without floating column by comparing both by time history of displacement and base shear. The equivalent static analysis is carried out

on the entire project using the STAAD Pro V8i software and the comparison of these al models was been presented. This help us to find the various analytical properties of the structure and we may also have a very systematic design and economical design for the structure. [3]

4. Nikhil Bandwal, This studied the architectural complexities and various irregularities like floating columns at various level and location are analysed. The main focus of this paper is on the behaviour of such buildings during earthquake. Earthquake load for this building is considered according to IS 1893(Part 1):2002. The critical position of internal floating columns and external floating columns of G+6 building is analysed. With the help of significant graph the various parameters like storey displacement, moments and forces on columns and beams at various floor levels are compared and correlated to each other. Staad pro software is used for the design and analysis of the building. The author concluded that the torsional effect was experienced at the ground level. [4]

5. A.p. mundada, S.G. Sawadakar In this paper study is done for architectural drawing and the framing drawing of the building having floating columns. For comparison of G+7 existing residential building with and without floating column are taken for carry out entire project work. by using STAAD ProV8i 3D 3 model are created .equivalent static analysis of these model are done by using STAAD Pro V8i .Different parameters such as axial load ,moment distribution, importance of line of action of force and seismic factors are studied for all this models. This will help them to find the various analytical properties of the structure and also have a very systematic design and economical design for the structure.[5]

6. Hardik Bhensdadia, Siddarth shah in this study an attempt is made to reveal the effects of floating column & soft story in different earthquake zones by seismic analysis. For this purpose Push over analysis is adopted because this analysis will yield performance level of building for design capacity (displacement) carried out up to failure, it helps to determine of collapse load and ductility capacity of the structure. To achieve this objective, three RCC frame structures with G+4, G+9, G+15 stories respectively will be analysed in SAP 2000 software and compared the base force and displacement of RCC frame structure with G+4, G+9, G+15 stories in different earthquake zones like Rajkot, Jamnagar and Bhuj using SAP 2000 software.[6]

7. Srikanth, has performed the whole work consist of four models i.e., models, FC (floating column is provided in particular floor, location),FC+4(floating column is provided by rising height by 4m), FC+HL(floating column is provided by applying heavy load), FC+4+HL(floating column is provided by rising the storey height by 4m). The design methodology in this paper employs the fully combined process that allow modelling, analysing, designing. The author of this paper concluded that complex building will undergo whiplash effect under earthquake shaking. The models experience less displacement value for lower zone and goes on increase for higher zone. [7]

III. METHODOLOGY

The main objectives of the proposed work are:

1. Static linear analysis of all building having floating column at different floors.

2. To compare the Base shear.

3. To Compare the Storey displacement.

IV. PROBLEM STATEMENT

A G+5 storied building with floating column and building without floating column located in zone v of India as per code IS 1893(Part1):2002 were taken for the investigation. The linear static analysis of buildings were done under gravity loads and seismic loads. In this paper they study first a normal building without floating column is modeled as model 1. In model 2 floating column is located in the building at 1st floor, in model 3 floating column located in the building at 2nd floor and in model 4 floating column is located in the building at 3rd floor. Then compare the base shear and storey displacement of each building. The Modeling and analysis was carried out in sap 2000v17.

Building details

For the analysis purpose of four model considered as:

MODEL 1- Building without floating column

MODEL 2-Building in which floating column located in the building at 1st floor.

MODEL 3-Building in which floating column located in the building at 2nd floor

MODEL 4- Building in which floating column located in the building at 3rd floor.

Building dimensions: 16.70m×7.55m

TABLE 1. BUILDING DATA

Parameter	Without floating column building Model 1	Floating column at 1st floor building Model 2	Floating column at 2nd floor building Model 3	Floating column at 3nd floor building Model 4
Soil type	Hard soil	Hard soil	Hard soil	Hard soil
Seismic zone	V	v	v	v
Response reduction factor	5	5	5	5

Importance factor	1	1	1	1
Height of building	16.70m	16.70m	16.70m	16.70m
Floor to floor height	3.1m	3.1m	3.1m	3.1m
Thickness of slab	125mm	125mm	125mm	125mm
Beam sizes	230×450mm	230×450mm	230×450mm	230×450mm
Ground to 2nd floor	230×450mm	230×450mm	230×450mm	230×450mm
3rd floor to 5th floor	230×380mm	230×380mm	230×380mm	230×380mm
Grade of concrete	M20	M20	M20	M20
Grade of steel	Fe415	Fe415	Fe415	Fe415

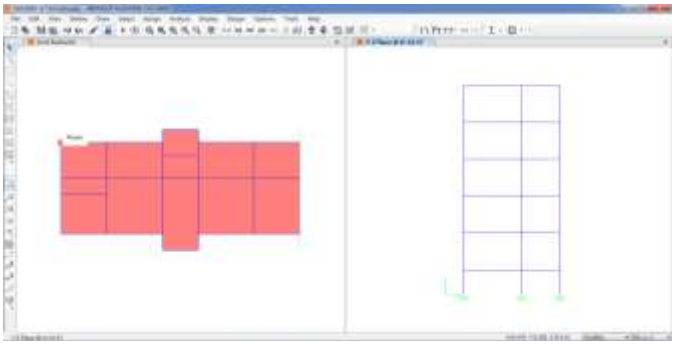

Fig no.2 Model 1

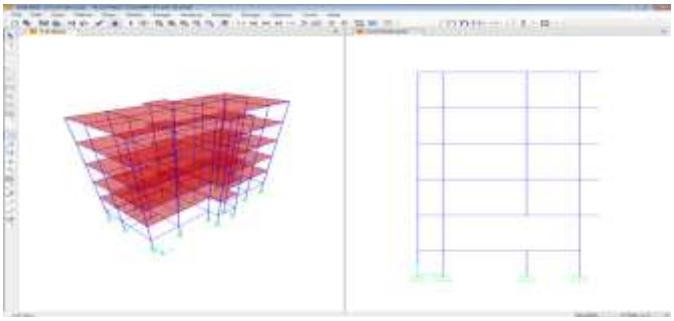

Fig no.3 Model 2

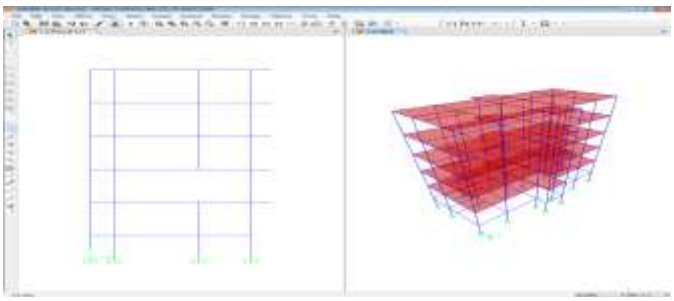

Fig no.4 Model 3

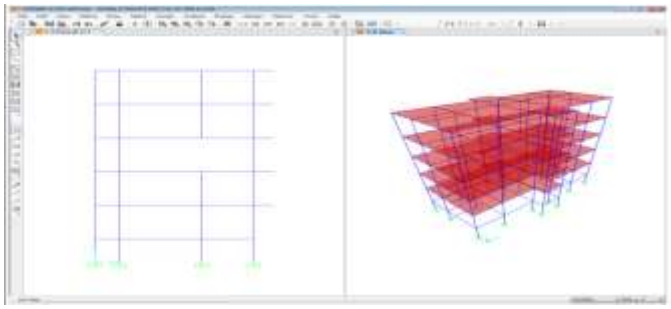

Fig no.5 Model 4

V. RESULT

In the present study, the effect of varying the location of floating columns floor wise of multi storey RC building on various structural response quantities of the building using static analysis . The results are compared in tabular form and graphically for the analysis of the building without floating columns and with floating columns of all four model.

A. Base shear

Base shear is the horizontal reaction at the base of the structure against horizontal seismic load. This base shear is acting upon the structure at the base or supports of the structure or wherever structure is fixed. The variation in base shear due to different location of floating column floor wise are tabulated in table 2.also variation in base shear are shown through graph in fig no.6 The base shear of the structure is decreases by 5-10% for floating column building as compared to without floating column building.

Table no. 2. Comparison of Base Shear in KN

Model	Base shear (KN)
Model 1	631.704
Model 2	617.074
Model 3	619.687
Model 4	623.201

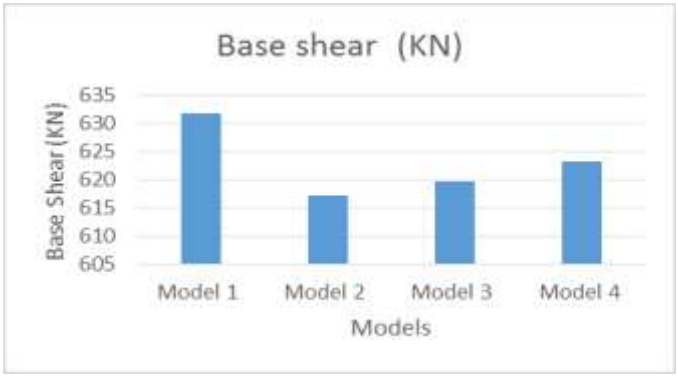

Fig no.6 Base shear in KN

B. Storey Displacement.

Storey displacement is the lateral movement of the structure caused by lateral force. The deflected shape of a structure is most important and most clearly visible point for comparison for any structure. The comparison of storey displacement can give a better idea of behavior of the structure than any other parameter.

The results variation of storey displacement of the structure due to different location of floating column storey wise are tabulated in table no 3.also variation of storey displacement are shown through graph in fig no.7 .

The storey displacement of the structure increases 5-10% for floating column building as compared to building without floating column.

Table no. 3. Storey Displacement in mm

Storeys	Model 1	Model 2	Model 3	Model 4
Storey 6	18.088	18.232	18.291	18.358
Storey 5	16.162	16.342	16.389	16.443
Storey 4	13.103	13.345	13.374	13.398
Storey 3	9.353	9.571	9.671	9.735
Storey 2	5.287	5.374	5.487	5.514
Storey 1	1.224	1.431	1.506	1.607
Base	0	0	0	0

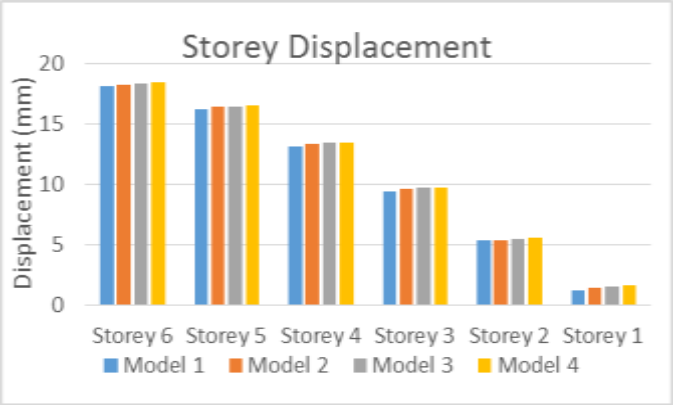

Fig no.7 Comparison of storey displacement

VI. CONCLUSIONS

Following are some of the conclusions which are drawn on the basis of this study.

1. It was observed that in building with floating column has less base shear as compared to building without floating column

2. It was also observed that shifting of floating column from 1st storey towards top storey of the building results in increasing base shear.

3. It was observed that displacement with floating column building is more as compared to without floating column building.

4. It was also observed that shifting of floating column from 1st storey towards top storey of the building results in increasing storey displacement.

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