International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 05 | May-2018 www.irjet.net p-ISSN: 2395-0072

# SEISMIC ANALYSIS OF MULTISTOREY BUILDING WITH FLOATING COLUMN

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**Abstract -** *Structural planning and design is an art and science of designing with economy and elegance and durable structures. In present scenario buildings with floating column is a typical feature in the modern multistory construction in urban India. Such features are highly undesirable in building built in seismically active areas. Tremendous increase in the use floating column can be seen these days cause of spacious and aesthetic appearance but that could not be achieved on the risk of failure of building. This study highlights the importance of explicitly recognizing the presence of the floating column in the analysis of building. The study is carried out to analyze the building with floating columns and to find out its comparison with the building without floating column in terms of storey drift, base shear and time period frequency using designing software.*

***Key Words***: **Floating column, seismic effects, storey drift, base shear, storey displacement.**

## 1. INTRODUCTION

SAP2000 stands for STRUCTURAL ANALYSIS PROGRAMMING. SAP2000 is commonly used to analyze concrete structures, steel structures, parking garages, designing of multi-storey RCC building etc. The structural members are designed by thoroughly following IS Code and the selection of the type of construction depends on various factors including type of loading, type of structure and circumstances. Aesthetic appearance of building is also becoming a major design factor these days.

Due to tremendously growing increase in demand for land and decrease in its availability, residential buildings are provided with open space generally on the ground or first floor. Now here comes the role of the structural engineer is to design the building as per its requirement and economical as much as possible. The primary function of providing the open space is to accommodate parking or reception lobbies in the first or ground storey which can be sustained by providing the floating column.

## 2. LITERATURE REVIEW

1. **[1]Maison and [2]Ventura, (1991)**, Members of ASCE computed dynamic properties and response behaviour of thirteen-storey building and this result are compared to the true values as determined from the recorded motions in the building during two actual earthquakes and shown that state-of-practice design type analytical models can predict the actual dynamic properties.
2. **Sukumar Behera (2012)** studied the behavior of multistory buildings with floating columns under earthquake excitations. Finite element method is used to solve the dynamic governing equation. Linear time history analysis is carried out for the multistory buildings under different earthquake loading of varying frequency content. The base of the building frame is assumed to be fixed. Newmark's direct integration scheme is used to advance the solution in time

## 2. OBJECTIVES OF STUDY

1. Analysis of a high rise storey building with and without use of floating column.
2. Design of building with floating column using SAP 2000 V20.0.0
3. Finding out the effect on different design parameters under seismic effects due to the presence of floating column
4. To compare the benefits of providing floating column
5. To compare the results of all the models as obtained

## 3. METHODOLOGY

Eight Model are considered among which 4 are being analyzed as rectangular building and 4 are analyzed as square buildings

## 4. MODEL CONFIGURATIONS

**Four building models are created and analysed for following data**

Plan Area = 600 $m^2$

Exterior Beam = M20 230*550 mm

Interior Beam = M20 230*500 mm

Transfer Beam = M45 1.2m * 1 m

Column 1 = M35 1.1m*1.1m

Column 2 = M35 500*500mm

Slab = M20 125mm

Live Load = 3KN/$m^2$

Roof live = 1.5 KN/$m^2$

Floor Height = 3 m

RCC structures are designed basically on the according to the IS 456:2000 and for seismic analysis IS 1893 2016 is being used. Sap2000 V20.0.0 is used for modelling and analyzing multi-storey building with and without floating column at various storey.

| Seismic Parameters Details | | |
|---|---|---|
| Frame Type | Special Moment Resisting Frame | |
| Response Reduction Factor (R ) | | |
| Seismic Zone Factor (Z) | Zone IV | 5 |
| Importance Factor (I) | Residential Building | 1 |
| Time Period | User Defined | 1 |

### 4.1 OVERVIEW OF SOFTWARE

- This program is primarily used for gravity analysis and design
- This tool is often utilized for smaller structures or portions of a larger structure
- It is great at handling complex geometry as it offers users a lot of different element types and a lot of customization with regards to meshing options

## 5. STRUCTURE MODELS

**MODEL 1 -** Rectangular Building without any floating column

**MODEL 2 -** Rectangular Building with floating column at ground floor

**MODEL 3 -** Rectangular Building with floating column at first floor

**MODEL 4 -** Rectangular Building with floating column at second flood

**MODEL 5 -** Square Building without floating Column

**MODEL 6 -** Square Building with Floating Column at Ground Floor

**MODEL 7 -** Square Building with floating column at first floor

**MODEL 8 -** Square Building with floating column at second floor

This research is to analyze the behaviour of a multi-storey building with respect to providing or not providing floating column and change in the position of the floating column.

Model 1 is a simple G+11 residential building having rectangular geometry (plan area = 600m$^2$) without any floating column.

Model 2 is a G+10 residential building having rectangular geometry (plan area =600m$^2$) with floating column at ground floor provided at y=10m

Model 3 is a G+10 residential building having rectangular geometry (plan area =600m$^2$) with floating column at first floor provided

Model 4 is a G+10 residential building having rectangular geometry (plan area =600m$^2$) with floating column at second floor provided

Model 5 is a G+10 residential building having square geometry (plan area = 625m$^2$) without floating column

Model 6 is a G+10 residential building having square geometry (plan area = 625m$^2$) with floating column at ground floor

Model 7 is a G+10 residential building having square geometry (plan area = 625m$^2$) with floating column at first floor.

Model 8 is a G+10 residential building having square geometry (plan area = 625m$^2$) with floating column at second floor.

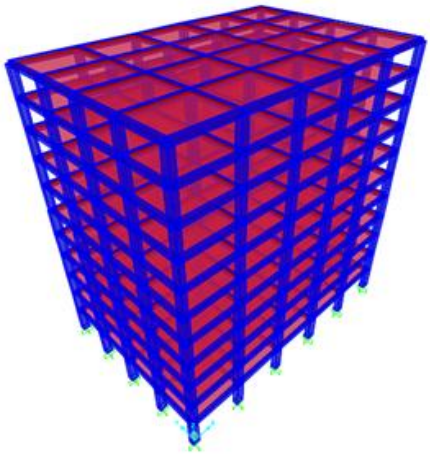


**Fig-1. 3D view of Model 1**

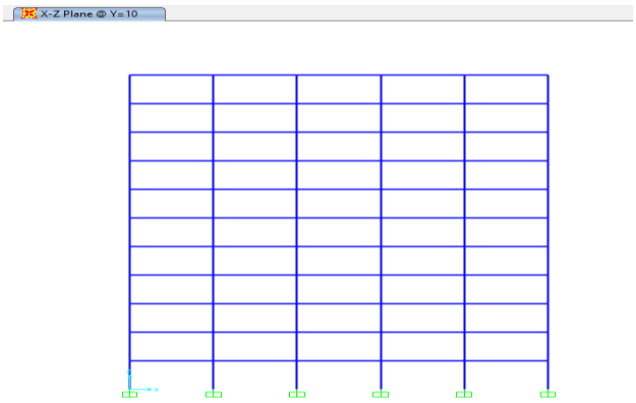



**Fig-2. Model1 - Building without floating column**

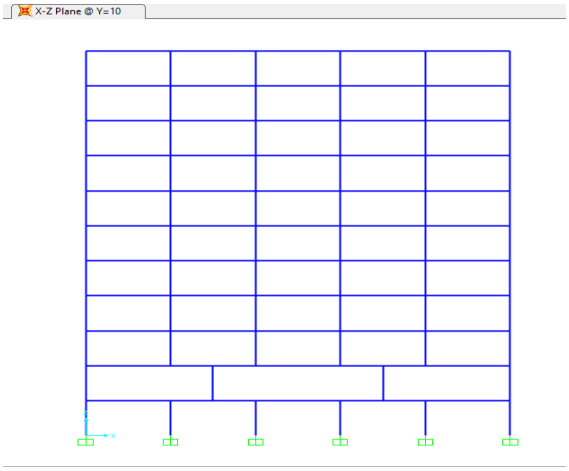



**Fig-3. Model 3 - Building with floating column at 1st floor**

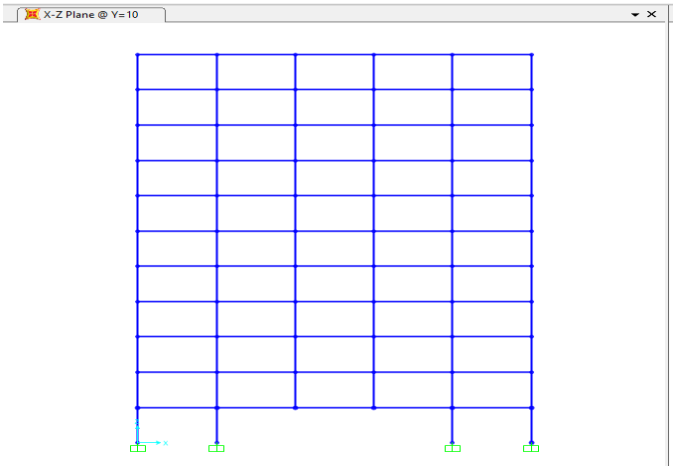



**Fig-6. Model 5 - Building with floating column at ground floor**

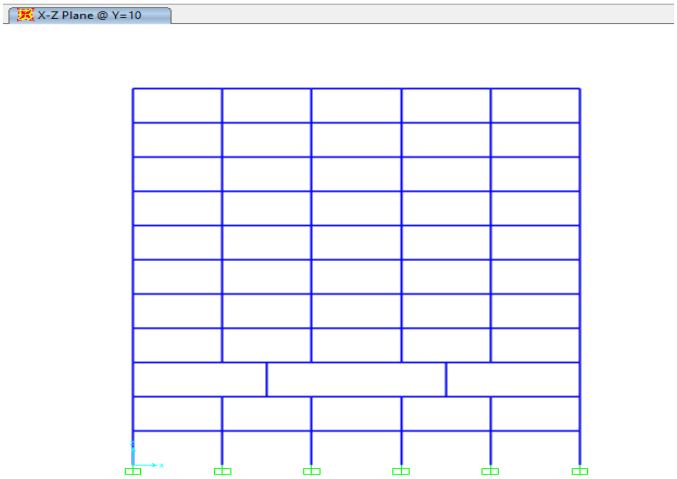



**Fig-3. Model 4 - Building with floating column at 2nd floor**

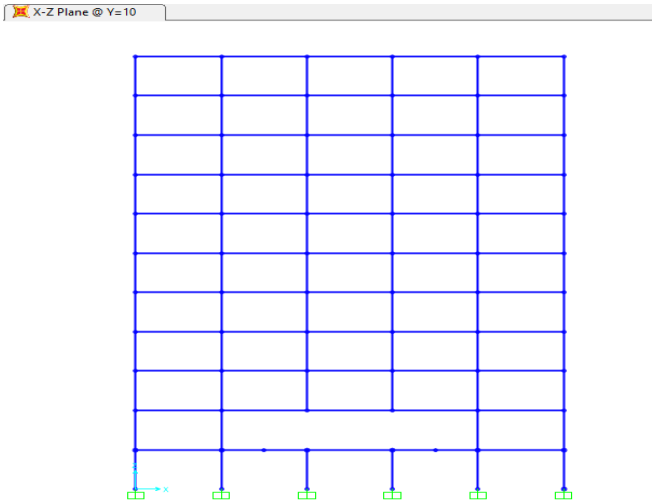



**Fig-7. Model 7 - Building with floating column at first floor**

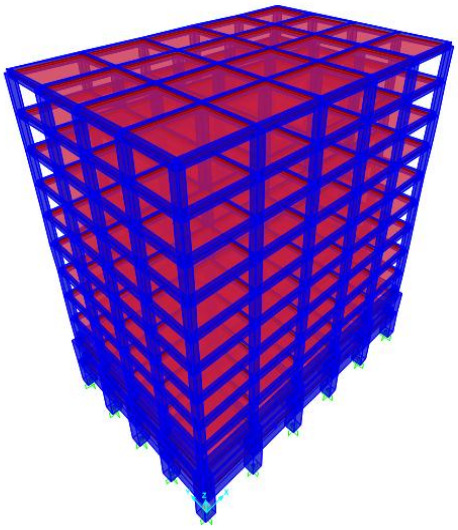


**Fig-4. 3D View of Model 5**

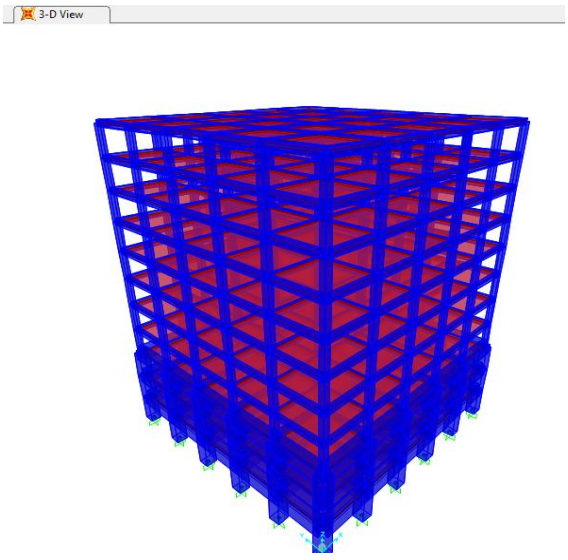


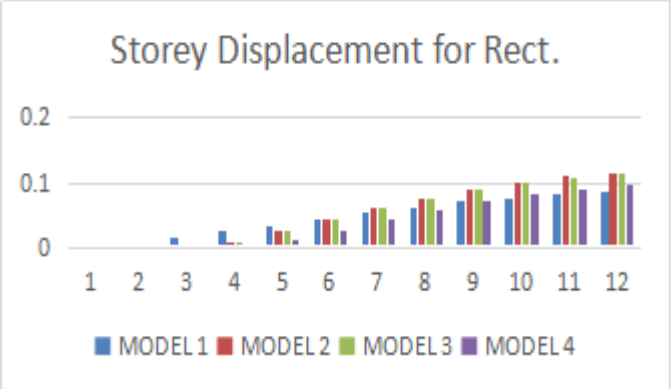

**Fig-8. Model 8 - Building with floating column at second floor (3D View)**

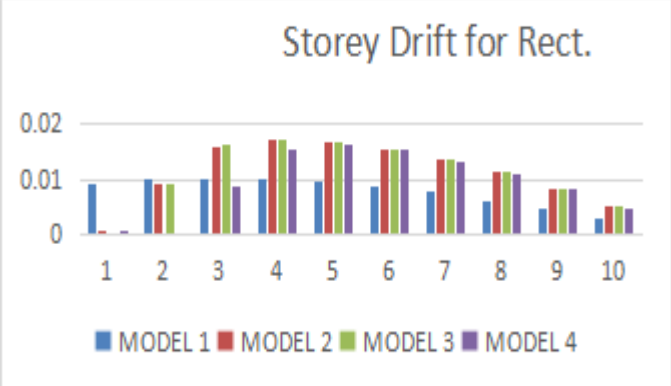
## 6 RESULTS

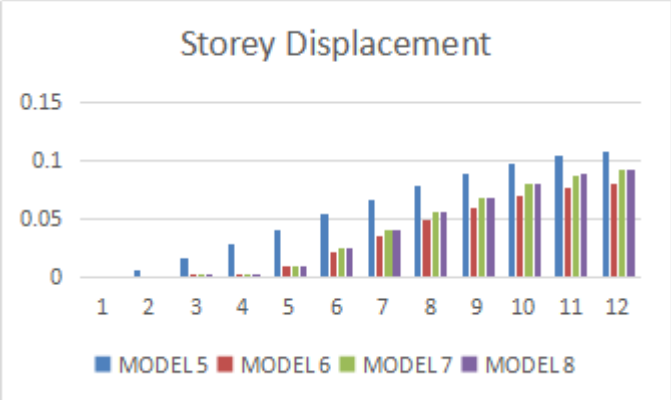
Behavior of these models is compared on the basis of the storey displacement and storey drift.

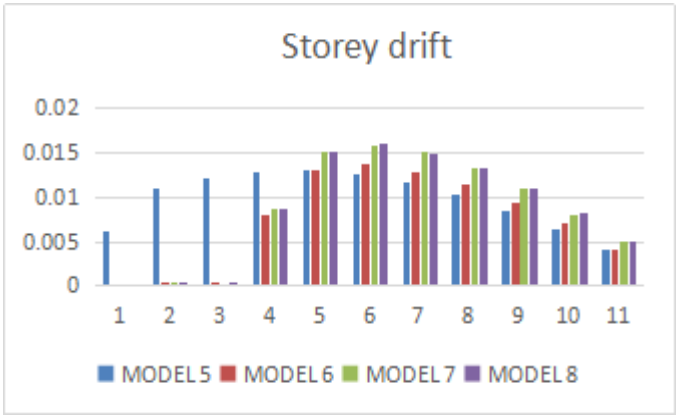
Storey displacement is the lateral movement of the structure caused by lateral force The deflected shape of a structure is most important and most clearly visible point of comparison for any structure. No other parameter of comparison can give a better idea of behavior of the structure than comparison of storey displacement.

Storey drift is the relative displacement of the floor and calculated as the difference of deflections of the floors at the top and bottom of the story under a difference of deflections of the floors at the top and bottom of the story under consideration




## 7 CONCLUSION

The studies of various research and analyzing the studies mentioned above, it can be concluded that the use of floating column in the modern buildings are increasing vastly. The unavoidable requirements of space at the time of its shortage can be fulfilled by floating column leading to increase in their demand within residential building as well as commercial building.

Building provided with floating column shows more storey drift and storey displacement as compared to building without floating column in seismic prone area.

## 8 ACKNOWLEDGEMENT

My thanks is for God and my parents for being supportive at every point of my life.I would like to thanks my HOD Prof. B.S.Tyagi sir who helped me in selecting the topic that was not a easy task for me. I would also like to thanks those mentioned in reference section and also the best source of knowledge of recent scenario i.e., internet

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