International Journal of Research in Engineering, Science and Management
Volume 4, Issue 4, April 2021
https://www.ijresm.com | ISSN (Online): 2581-5792


# Study of Behaviour of Multistorey Building with Floating Column: A Review

Prajakta Agawane[1*], Girish Joshi[2]
[1,2]*Department of Civil Engineering, G. H. Raisoni College of Engineering and Management, Wagholi, India*

***Abstract*: In the modern multi-storey construction in urban India, Floating columns is a classical feature and is highly undesired in buildings built in seismically active areas. Buildings built in seismically active areas do not desire to have buildings built with floating column. From the past events that took place in seismically active areas it can be inferred that the structures constructed without proper design and without proper quality can cause great destruction and can be highly harmful. Thus, the tall structures build in seismically active areas should be built with proper safety against earthquake forces therefore, there is need to determine seismic responses of such building for designing earthquake resistant structures by carrying seismic analysis of the structure.**

***Keywords*: Multistorey building, Floating column.**

## 1. Introduction

In today's scenario, due to limited space, increasing population and also for aesthetic and functional requirements multi-storey buildings in urban areas are required to have column free space. For this, buildings are provided with floating columns at one or more storey. To reduce the no. of columns in a building to make the maximum space available floating columns are used where in the columns are made to rest upon the beams. In case of the first floor and the consecutive floors above, the beam is being used to support the columns and the bottom ground floor with the minimum no. of columns which would take the entire load that will come from beams to the basement columns and then transfer it to the earth. Floating column structures has got the attention of the architects from all over the world due to its ability to provide aesthetical view for the building. The benefit of floating column is more open space is available due to the limited use of columns without many obstacles. These are more advantageous in urban areas where space is an issue.

In the seismically active areas these floating columns are highly destructive. The earthquake forces that are established 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. Buildings overall shape, size and geometry, in addition to how the earthquake forces are carried to the ground tells us about its behaviour during earthquakes. During the 2001 Bhuj earthquake in Gujarat many buildings with an open ground storey intended for parking collapsed or were severely damaged.

### *A. Floating Column*

The floating column is a vertical member which doesn't have a foundation and is made to rest upon a beam and. The floating column acts as a point load on the beam and this beam then transfers the load to the columns below it. But such column cannot be implemented easily and is hard to construct practically since the true columns below the termination level are not constructed with care and hence finally cause to failure. Hence, in seismic regions, the structures already made with these kinds of discontinuous members are endangered. But those structures cannot be destroyed, rather they can be studied and they can be strengthened or some remedial features can be suggested to increase its strength.

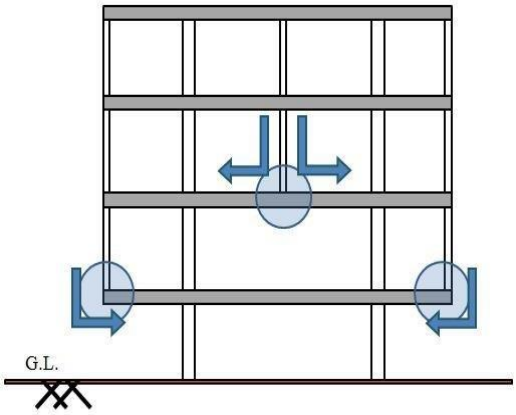


Fig. 1. Floating column

The stiffness of these columns can be increased by retrofitting or these may be provided with bracing to decrease the lateral deformation and in this way the columns of the first storey can be made stronger. The column is a concentrated load on the beam which supports it. As in the regard of the study, the column is often supposed pinned at the base and hence it is taken as a point load on the transfer beam.

## 2. Literature Review

Literature review related to the seismic analysis of multistorey building was carried out. The main aim of the study

*Corresponding author: prajaktaagawane97@gmail.com

was to find out the stability of different multistorey buildings in the different seismic zones and study its behaviour. It was noticeable about the study on the seismic zone by numerous researchers, academicians and consultants.

Gaurav Pandey, Sagar Jamle [2018] studied on, "Optimum Location of Floating Column in Multistorey Building with Seismic Loading". In this paper Response spectrum analysis was performed against various load with multiple load combinations on all the model comprises of normal structure and all the cases of structure with floating column at various locations. Nodal displacement, story drift, maximum shear force, maximum bending moment and maximum axial forces was analysed and compared for various cases.

Shivam Tyagi, B. S. Tyagi [2018] worked upon, "Seismic Analysis of Multistorey Building with Floating Column". In this paper he compared Behavior of models on the basis of the storey displacement and storey drift. He concluded that, 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.

Kirankumar Gaddad, Vinayak Vijapur [2018] examined about "Comparative Study of Multi Storey Building with and without Floating Columns and Shear Walls". he did Seismic analysis of G+20 storey structure is done by both equivalent static and response spectrum method to obtained the parameters storey displacements, storey shear, storey drift, time period for seismic zone V. from equivalent static method and response spectrum method, He concluded that, storey drift was increased by 9% in building with floating columns as compared to buildings without floating columns. Also, storey shear was obtained as decreased by 4.5% in buildings with floating columns as compared to building without floating columns.

Shiwli Roy, Gargi Danda De [2015] analysed the, "Behavioural Studies of Floating Column on Framed Structure". In this paper, G+3, G+5, and G+10 buildings with floating columns and RCC columns was analysed by using STAAD PRO V8i. The G+3, G+5 and G+ 10 structures are compared with tables and graphs of shear force and bending moment. From graph conclusion was given as, shear force is maximum for floating column but is minimum for normal column. If the shear force in floating column increases the normal column also increases. This means that if the height of structures increases the shear force also increases. It also concluded that in G+3 structures the moment is maximum for normal column and the moment is constant in normal column and the moment suddenly increases from G+3 to G+10 structures. This means that the moment for floating column increases with increase in its structure increases.

Waykule S. B. et al. [2016] studied on, "Study of Behaviour of Floating Column for Seismic Analysis of Multistorey Building". Here in this paper G+5 Building with and without floating column in highly seismic zone v was analysed. For these four models are created such as floating column at 1st, 2nd, and 3rd floor buildings and without floating column building. Linear static and time history analysis were carried out of all the four models from linear static analysis compare all the of models result obtained in the form of seismic parameter such as time period, base shear, storey displacement, storey drift. this paper concluded that building with floating column has more time period as compared to building without floating columns. It was also observed that in building with floating column has less base shear as compared to building without floating column

C. P. Pise et al. [2017] researched on, "Comparative Study of floating column of multi storey building by using software". In this paper static analysis was done for a multi-storey building with and without floating columns. Different cases of the building are studied by varying the location of floating columns floor wise. The structural response of the building models with respect to, Base shear, and Storey displacements is investigated. This paper concluded that in building as we introduce floating column at 1st floor base shear of such building decreases as compared to building without floating column and also observed that displacement of each storey of floating column building is more as compared to without floating column building.

Badgire Udhav S. et al. [2015] worked on, "Analysis of Multistorey Building with Floating Column". Existing residential building comprising of G+10 structures was selected for carrying out the project work. The building models were generated using the software STAAD Pro 8Vi and were analysed using equivalent static method. This paper concluded that the difference in the probabilities of failure with floating column of case 1, [Modeling & Analysis of G+10 RCC building with floating columns located outer periphery (2 Longer Sides)] is more than floating column of Case 2 [Modeling & Analysis of G+10 RCC building with floating columns located outer periphery (2 Shorter Sides)]. In Case 1 and Case 2, column shears values are increasing or decreasing significantly depending upon position and orientation of column.

Kandukuri Sunitha, Kiran Kumar Reddy [2017] studied on, "Seismic Analysis of Multistorey Building with Floating Column by using Tabs". They analysed G+4, G+9, G+14 storey normal building and a G+4, G+9, G+14 storey floating column building for external lateral forces. The values of storey drift that is the inter storey displacement for two consecutive floors were correspondingly compared with the help of graphs. They concluded that, as the zone intensity increases, storey drift increases. In this paper the behaviour of multi storey building with and without floating column were studied under different earthquake excitation. This paper concluded that the maximum displacement and storey drift values were increasing for floating columns. It is also concluded that bending moment in columns are greater in the top stories and lesser in the bottom stories. Bending moment varies in each model for every corner column, internal column and peripheral column.

Fahimi M., Sreejith R. [2015] studied about, "Seismic Analysis of Multi-Storey Building with and without Floating Column". In this paper dynamic analysis of G+14 multistoried RCC building considering for Sumatra earthquake is carried out by time history analysis and response spectrum analysis and

seismic responses of such building are comparatively studied and modeled with the help of ETABS software. The floor displacement, inter storey drift, base shear is computed for both the building with and without floating column. This paper concluded that the storey displacement for the building with floating column on the corner of the first storey is less when compared with the building with floating column provided on the 14th and15th storey. With increase in size of beams and columns, storey displacement decreases. Due to increase in size of beams and columns the mass increases and therefore storey shear increases.

Sreekanth Gandla Nanabala et al. [2014] studied on, "Seismic Analysis of a Normal Building and Floating Column Building". In this paper the variation of the both structures were studied by applying the intensities of the past earthquakes i.e., applying the ground motions to the both structures, from that displacement time history values are compared. Also find whether the structure is safe or unsafe with floating column when built in seismically active areas and also find floating column building is economical or uneconomical. From the studies they conclude that After the analysis of buildings, comparison of quantity of steel and concrete are calculated from which floating column building has 40% more rebar steel and 42% more concrete quantity than a normal building. So, the floating column building is uneconomical to that of a normal building. From the time history analysis, it is noticed that the floating column building is having more displacements than a normal building. So floating column building is unsafe than a normal building.

Deekshitha R. [2017] researched on, "Analysis of Multi-Storey Building with and without Floating Column". This paper examined the effect of floating columns in building. Models were developed for multistorey (G+5) buildings with and without floating columns to carry out comparative study of structural parameters such as natural drift values, base shear and horizontal displacement under seismic excitation. From this study they conclude that Storey drift increases as storey displacement increases. Storey shear will be more for lower floors, than the higher floors due to reduction in weight from bottom to top floors. The base shear value decreases due to introduction of floating column.

Rashi Chaurasia et al. [2019] reviewed on, "Comparative Analysis of Multi-Storey RC Frame Building with and without Floating Column using Base-Isolation in Seismic Zone V". In this paper software method is used for dynamically analysed a multi-storey modal structure as per Indian standards to know how much effective a base isolation method is when used in high seismic zone V. This paper concluded that the Storey drift and displacement increases due to vertical irregularity. Also base- isolation are the control method which confine a building against lateral forces which does not allow a building to undergo through vibration effects as the base isolation minimize them. Use of base isolation to reduce the base shear values at the bottom of the structure.

Hardik B., Siddharth S. [2015] worked on, "Pushover Analysis of RC Frame Structure with Floating Column and Soft Story in Different Earthquake Zones". In this paper three RC bare frame structures with G+4, G+9, G+15 stories respectively were analysed and compared the base force and displacement of RC bare frame structure with G+4, G+9, G+15 stories in different earthquake zones. From the studies they concluded that the base shear increases with the increase of mass and number of story of the building, also base shear obtained from pushover analysis is much more than the base shear obtained from the equivalent static analysis. The displacement of building increases from lower zones to higher zones, because the magnitude of intensity will be more for higher zones, similarly for drift, because it is correlated with the displacement.

Meghana B. S. T. H. Sadashiva Murthy [2016] analysed "Effect of Floating Column on the Behaviour of Composite Multistoried Building Subjected to Seismic Load". In this paper study is done by using ETABS. For study of various effects, the steel concrete composite structure with floating column in different positions in plan, in buildings of various heights such as G+3, G+10 and G+15 in lower and higher earthquake prone zones was considered. They concluded that the floating column provided in edges of outer face of building is more critical and base shear value decreased due to introduction of floating column.

Sabari S., Praveen J. V [2015] studied on "Seismic Analysis of Multistorey Building with Floating Column". This paper gives idea about the behaviour of multistorey buildings with and without floating columns under earthquake excitations. RC Frames of different stiffness on floor wise and height of building are considered. They assumed the base of the building frame is to be fixed. In this paper time history analysis of these RC Frames has been done by subjecting the whole system to BHUJ earthquake ground motion, using FEM Package SAP2000.

Sarika Yadav, Raksha Parolkar [2016] worked on "Seismic Behaviour of Multistorey Buildings Having Floating Columns". This paper gives idea about the behaviour of multistorey buildings having floating columns under seismic forces and the effect of shear wall in the same building. For the study purpose they considered three cases of multi-storey buildings having 8 storey, 12 storey and 16 storey. All the three cases are considered having floating columns provided with and without shear wall, and also analysed for zone III, zone IV and zone V by using software Staad Pro. From the analysis of the building, they concluded that the lateral displacement and storey drift of the building increases from lower to higher zones because the magnitude of intensity will be more for higher zones.

Sreadha A. R., C. Pany [2020] researched on "Seismic Study of Multistorey Building using Floating Column". This paper discusses the performance of structure having floating column in seismically active areas. Also the effect on various parameter such as maximum displacement, effect on number of storey on drift, base shear was analysed by considering different building models. They considered three different models of building for the analysis purpose. In model 1 structure without floating column is considered and floating column is introduced at 1st and 5th floor at the outer section of the plan in model 2 and

model 3 respectively.

## 3. Conclusion

From the study of all literature review it was observed that floating columns in seismic areas can be destructive and if needed to implant should be done with proper studies. Different models of multistorey building were analysed for the study. From this comparative seismic analysis of multistorey building with and without floating column analytical study was carried out on floating column and other columns affected due to floating column. From this study effect of floating column on various parameters of building such as time period, base shear, storey displacement, storey drift for different models was analysed. After analysation of various models, it can be concluded that Storey displacement increases as the height of the building increases and storey drift increases as storey displacement increases. The base shear value decreases due to introduction of floating column.

## References


[1] Shivam Tyagi, B. S. Tyagi, "Seismic Analysis of Multistorey Building with Floating Column", *International Research Journal of Engineering and Technology (IRJET)*, Volume 5, Issue 5, May 2018.

[2] Gaurav Pandey, Sagar Jamle, "Optimum Location of Floating Column in Multistorey Building with Seismic Loading", *International Research Journal of Engineering and Technology (IRJET)*, Volume 5, Issue 10, October 2018.

[3] Kirankumar Gaddad, Vinayak Vijapur, "Comparative Study of Multi Storey Building with and Without Floating Columns and Shear Walls", *International Research Journal of Engineering and Technology (IRJET)*, Volume 5, Issue 7, July 2018.

[4] Shiwli Roy, Gargi Danda de, "Behavioural Studies of Floating Column on Framed Structure", *International Journal of Research in Engineering and Technology*, volume 9, Issue 9, September 2015.

[5] Waykule. S. B, C. P. Pise, C.M. Deshmukh, Y. P. Pawar, S. S Kadam, D. D. Mohite, and S. V. Lale, "Comparative Study of floating column of multi storey building by using software", *Int. Journal of Engineering Research and Application*, Vol. 7, Issue 1, January 2017.

[6] Badgire Udhav S, Shaikh A.N., Maske Ravi G, "Analysis of Multistorey Building with Floating Column", *International Journal of Engineering Research*, Volume 4, Issue 9, pp. 475-478, September 2015.

[7] Kandukuri Sunitha, Mr. Kiran Kumar Reddy, "Seismic Analysis of Multistorey Building with Floating Column by using Tabs", *International Journal of Engineering Technology Science and Research*, Volume 4, Issue 8, August 2017.

[8] Waykule S. B, Kadam S. S, Lale. S. V, "Study of Behaviour of Floating Column for Seismic Analysis of Multistorey Building", *International Research Journal of Engineering and Technology (IRJET)*, Vol. 3, Issue 8, August 2016.

[9] Fahimi M, Sreejith R, "Seismic Analysis of Multi-Storey Building with and without Floating Column", *International Journal of Engineering Research & Technology (IJERT)*, Volume 3, Issue 29, 2015.

[10] Sreekanth Gandla Nanabala, Pradeep Kumar Ramancharla, Arunakanthi E., "Seismic Analysis of a Normal Building and Floating Column Building", *International Journal of Engineering Research & Technology (IJERT)*, Vol. 3, Issue 9, September 2014.

[11] Hardik Bhensdadia, Siddharth Shah, "Pushover Analysis of RC Frame Structure with Floating Column and Soft Story in Different Earthquake Zones", *International Journal of Research in Engineering and Technology*, Volume 4, Issue 4, April 2015.

[12] Y. R. Deshmukh, S. P. Jadhav, S. M. Shirsat, A. S. Bankar, D. G. Rupanawar, "A Review on Seismic Analysis of Multistorey Building with Floating Column using STAAD.PRO V8 i", *International Journal of Engineering Research & Technology (IJERT)*, Vol. 7, Issue 4, April 2018.

[13] Deekshitha R, H. S. Sureshchandra, "Analysis of Multi-Storey Building with and without Floating Column", *International Journal of Engineering Research & Technology (IJERT)*, Vol. 6, Issue 6, June 2017.

[14] Meghana B. S., T. H. Sadashiva Murthy, "Effect of Floating Column on the Behaviour of Composite Multistoried Building Subjected to Seismic Load", *International Research Journal of Engineering and Technology (IRJET)*, Vol. 3, Issue 6, June 2016.

[15] Sabari S, and Praveen J. V, "Seismic Analysis of Multistorey Building with Floating Column", *International Journal of Civil and Structural Engineering Research*, Vol. 2, Issue 2, pp. 12-23, October 2014-March 2015.

[16] Sarika Yadav, Raksha Parolkar, "Seismic Behaviour of Multistorey Buildings Having Floating Columns", *International Journal of Civil and Structural Engineering Research*, Vol. 4, Issue 1, pp. 87-94, September 2016.

[17] Sreadha A R, C. Pany, "Seismic Study of Multistorey Building using Floating Column", *International Journal of Emerging Science and Engineering (IJESE)*, Vol. 6, Issue 9, April 2020.