|| Volume 8 || Issue 11 || November 2024 || ISSN (Online) 2456-0774
INTERNATIONAL JOURNAL OF ADVANCE SCIENTIFIC RESEARCH
AND ENGINEERING TRENDS

REVIEW-DYNAMIC ANALYSIS ON MULTI-STOREYED BUILDING WITH & WITHOUT FLOATING COLUMN

KAMLESH BAMNIYA[1], MONIKA KOUSHAL[2]
[1]*M.Tech Scholar, Department of Civil Engineering, BM College of Technology, Indore*
[2]*Associate Professor, Department of Civil Engineering, BM College of Technology, Indore*

Abstract: The increasing demand for architectural flexibility in modern multi-storeyed buildings has led to the widespread adoption of floating columns. While these structural elements enable functional and aesthetic enhancements by creating open spaces in lower floors, they also introduce significant challenges to the overall stability and seismic resilience of buildings. This review delves into the dynamic analysis of buildings with and without floating columns, providing a comprehensive assessment of their behavior under dynamic loads such as earthquakes. The paper explores various analytical methods, including modal analysis, response spectrum analysis, and time history analysis, to evaluate the structural implications of floating columns. Key findings from existing studies indicate that buildings with floating columns experience higher inter-storey drifts, increased base shear, and amplified stress concentrations, which compromise their seismic performance. In contrast, structures without floating columns demonstrate superior stability, uniform load distribution, and enhanced dynamic response

Keywords: *Floating Column, Response Spectrum Analysis, Storey Drift, Seismic Performance*

I.INTRODUCTION:

The rapid evolution of architectural design and construction practices has introduced several innovative features in modern multi-storeyed buildings. Among these, floating columns have emerged as a popular solution to meet the demands for aesthetic and functional flexibility. Floating columns are structural elements that terminate at a certain floor level, relying on transfer beams or slabs to redirect their loads to other structural members. This design is often employed to create open spaces for parking, lobbies, or large halls on lower floors, thereby enhancing the usability and visual appeal of buildings.However, the inclusion of floating columns disrupts the continuity of load transfer paths within the structure. Unlike conventional columns that transfer loads directly to the foundation, floating columns induce additional stress on the supporting beams and slabs. This discontinuity in the load path can significantly compromise the building's resistance to lateral forces, especially during seismic events.

Seismic forces pose a considerable challenge to buildings with floating columns, as the abrupt changes in stiffness and mass distribution lead to torsional irregularities and increased inter-storey drifts. Such irregularities make these structures more vulnerable to damage or collapse during earthquakes. Therefore, understanding the dynamic behavior of buildings with floating columns is essential to ensure their safety and performance under seismic conditions.

II. OBJECTIVE OF STUDY

- Analyze how floating columns influence load distribution, stiffness, and stability in buildings.
- Compare the dynamic responses of buildings with and without floating columns to identify vulnerabilities and performance differences.
- Explore and recommend design interventions, such as shear walls and bracing systems, to enhance the seismic resilience of structures with floating columns.

III. LITERATURE REVIEW

3.1 General

Its been observed from the literature survey that various researches have been done on floating column in the structure, but most of them are the comparative studies of building with and without floating column. However very little research is available on the structure which are irregular in shape and have floating column in them and also comparing them with the normal structure. Also the floating column been variated from their positions in the structure. So the brief review of work done by the various researchers in the past has been presented in this chapter.

3.2 Review of Literatures

Neha Pawar et.al (2021) This review shows the responses of various studies done by Researchers. Comparison of result is done with respect to different parameters like bending moment, storey shear, displacement, time period etc. Authors have modelled various structures such as conventional Building, building with Floating Columns, building modelled with different solutions and their solution is compared. This review also focuses on the methodology to be adopted to have better seismic response of Building with Floating Column.

Sreadha A R, C. Pany (2020) This article provides an overview of the nature of the construction of buildings under the influence of earthquake forces with and without floating columns. This analysis focuses on the importance of specifying the presence of a floating column in a structural study, determining its correlation with a building without a floating column using Advanced Three-Dimensional Analysis of Building Systems (ETABS) design software. This article also discusses the characteristics of a floating column structure in seismically active areas. In addition to the effects of these various parameters such as maximum displacement, number of floors in sediment, soil displacement, are also investigated. It can be concluded that the seismic zone, a building with a floating support, has a higher floor settlement and larger displacements

compared to a building without a floating support. A floating column structure shows the maximum offset relative to a non-floating column structure.

Mo Farhan (2019) these articles presented the behavior of a floating column in a building, its load distribution, and structural continuity. It was observed that the floating columns do not carry as much load as those columns that are connected to the foundation. The conclusions of the bases analysis and the result conclude that if the structure has a smaller number of floating columns, it does not have a significant impact on the building if the building is no more than three storey's high. If the building is earthquake resistant, the floating column should be disregarded. In open spaces and car parks, a sloping roof should be preferred to floating columns, as they transfer loads directly to the columns and only compressive forces occur. Floating columns are suitable if the columns are closer to each other so that they can distribute loads normally and will not have a significant effect on adjacent beams.

Gulchaman Khan et.al (2019) The articles examine the effect of shear wall along with provide the FC in the multi-storey building. The work consists of with three different storey multi-storey buildings. The storey is 8, 12 & 16-storey. Under all 3 cases suspended columns are equipped with and without shear partitions and analyze the use of ETABS 2016 software for zone V. The analysis shows that the supply of suspended columns is good in the increasing FSI of the building. The lateral displacement of the construction and the storey wave will swing from decrease to better zones, as the significance of the depth may be greater for higher zones. With use of shear wall, lateral forces will be reduced in all cases models. This analytical work is a beneficial aid in conjunction with lateral displacement and the stem inside the floor and multi-storey buildings. The final finding is that the building is safe in the IV and zone V.

Ullas, Gopal. et.al (2019) This study attempts to investigate the behavior of a high-rise frame with floating columns. For this 2 and 3- storey building considered. The work consist a frame with a floating column with and without filler on csi-etabs software. Different types of frames are considered such as bare frame with floating column (BFFL), filled frame with partial soft floor under floating column (SIFFL) and filled frames with floating column (IFFL). The results show that, the lateral and vertical deformation is reduced compared to the bare frame when the filler is applied to the bare frame. When a floating column is introduced at various locations, the lateral and vertical deformation increases in most cases compared to frames without a floating column. In all types of filled frames (SIFFL and IFFL), the compressive stress in the filler is higher compared to the tensile stress. The introduction of a floating column in both cases increases both the compressive and tensile stresses. The paper concluded that the compressive and tensile stresses increase in the filled frame, whose partial soft height is below the floating columns compared to the filled frames.

Radha Krishna Amritraj, Mohit Sheode & et.al. (2018) In this study, an equivalent static analysis (ESA) was performed on the 3D building frames. A 7-story G + building with floating columns and soft ground effects. A total of 73 cases were considered in which 8 cases have central floating columns on a floor, while another 64 have floating columns on a given floor, and the soft floor extends from the floor to the floor (G) and up to G + 7 floors. The cases also consist of a simple case arises where both floor is not soft and no column is floating. Nine load combinations wer e considered. Soft floors were created by changing the height of the floor. Staad.Pro software was used for analytical purposes. The conclusion was that the presence of floating columns on the upper floor increases the maximum node displacement that occurs in a non-soft two-story building. The maximum bending moment increases 2.54 times as the floating columns reach the ground level relative to a normal building under the same load but without floating columns.

Israa H.Nayel et al. (2018) had studied the effect of shear wall locations in the G+10 storey building with floating column subjected to seismic load considering seismic zone IV. Four models had taken for the analysis. The first model was without shear wall, while the other three models include a shear wall at each corner, centre and side of the building to study the best location of shear wall. The effect of shear wall locations on some important parameters like displacement in the two directions, time periods and also the base shear in the two directions were discussed. The present analysis was done by using the software ETABS-2015. Components of loads were presented according to UBC97 CODE. The response spectrum analysis had been used in this paper. The response of these structures were analyzed, discussed and the best location of the shear wall was stated. It was concluded that the maximum storey drift values and shifts were becoming larger for the floating columns. Building with shear wall system worked well in case of corner than in other models of building.

P. Rama Jitendra, et.al (2018) had considered the building models with the one having floating column in the odd floors and the other building had no floating column. They analyzed by using Response spectrum analysis by assuming that the structure shall be exposed to all the loading combinations when the whole structure was completely constructed. The analysis was finished using ETABS 2015 software. The present work was to verify the safety of the structure with the existence of floating column after being built in areas where seismic action was very high. The succeeding conclusions had been taken that displacement for the building possessing floating columns was more when compared to the building without floating column. The storey drift for the building having floating columns was more because the columns being removed and the mass increases and hence there was increase in drift. The base shear for the buildings possessing floating columns was less when compared to the buildings without floating columns.

S. D. Sagare, S. S. Patil (2018) In this paper, a building with open ground storey brings out the importance of the presence of soft ground storey in the analysis. Usually the most economical way to eliminate the failure of soft storey was by adding shear walls. The shear walls were one of the most efficient lateral force resisting element in high rise buildings. This paper deals with occurring of soft storey at lower level in high rise building subjected to earthquake. Also it had been tried to investigate on adding of shear wall to structures in order to reduce soft storey on seismic response of building. They considered the non-linear dynamic analysis i.e. Time history analysis using SAP2000v14 software. Variation of natural time periods, natural frequency and lateral displacements had been taken into observations.

YS Reddy, Y. Sunny babu (2017) these articles presented the seismic performance of a building with floating columns. The building is examined under various parameters such as displacement, storey drift, maximum column forces, and vibration time. The building is modeled using ETABS finite element software. The seismic method is adopted in it is Equivalent static analysis and response spectrum-dynamic analysis for different buildings and their seismic performance is evaluated. The final conclusion is that it is only worthwhile to

build a floating column in buildings if there is a proper purpose and functional requirement for them. If they are to be secured, due care must be taken in the design of the structure.

Rupali Goud (2017) This researchers analyzed the RC Building having with and without floating columns. The articles consist of comparative study of both modes. Two buildings with floating columns and buildings without floating columns were analyzed for seismic loading. The building chosen was a 16 m high building with 4 model cases. The seismic response is performed by response spectrum analysis. The result shows that short natural period structures suffer greater acceleration. Thus, increasing the duration of the insulated-based structure ensures that the structure is completely safe from the earthquake resonance range. The building with floating columns sheared at a higher level than the normal building. This increases the size of the structural members. So a floating column building is as uneconomical as a normal building. Lateral displacements are in time history analysis rather than the other two methods of analysis. The maximum displacement increases in the floating column model compared to the floating column model.

Pradeep D., Chethan V R, & et. al. (2017) These articles are based on comparative study of a building without a floating column and a building with a floating column on different floor levels. Seismic analysis is performed by linear static and linear dynamic methods using ET ABS. As per the results obtained, the floor shear force proved to be maximum on the first floor and decreased to a minimum on the upper floor. The results obtained showed that buildings located in medium soils experience 25% more base shear than buildings located in hard soils. A building with a column floating on the lower floor experiences the same base shear, but drift between floors is greater compared to a building with a column floating on the edge of the building. Buildings in hard soil show less displacement and drift than buildings in medium soil. A building without floating columns shows 35% less displacement compared to buildings with floating columns.

IV. CONCLUSIONS

Based on literature survey following conclusions are made.

1.Structures with short natural period will suffer higher accelerations. Thus the increase in period of the structure with isolated has makes sure that the structure is completely safe from the resonance range of the earthquake.

2.The building with floating columns experienced more storey shear than that of the normal building. This will increase the structural member sizes. So the floating column building is uneconomical to that of a normal building.

3.Maximum displacement is increased in floating column model when compared with without floating column model. The decrease in the base shear in base isolated model compared to fixed base models is due to the decrease in spectral acceleration values due to the period shift.

V.REFERENCES

1. Neha Pawar, Kuldeep Dabhekar, P.B. Patil, Isha Khedikar Review on “Effect of Floating Columns on Building subjected to seismic Forces” International Conference on Contemporary and Sustainable Infrastructure IOP Conf. Series: Earth and Environmental Science 822 (2021) 012045 IOP Publishing doi:10.1088/1755-1315/822/1/012045.
2. Sreadha A R, C.Pany (2020) Seismic Study of Multistorey Building using Floating Column, International Journal of Emerging Science and Engineering (IJESE) ISSN: 2319–6378, Volume-6 Issue-9, Retrieval Number: G2334026720/2020©LSP, DOI: 10.35940/ijese. G2334.046920 Published By:Lattice Science Publication, pp 6-11
3. Mo Farhan (2019) Behaviour of a Floating Column in a Building, International Journal for Scientific Research & Development (IJSRD),Vol. 7, Issue 04, ISSN (online): 2321-061, pp 895 -899.
4. Ullas, Gopal. D. J, B. P. Annapurna (2019) Analysis of Multistoreyed Infilled Frame with Floating Columnm International Journal of Research and Analytical Reviews (IJRAR), Volume 06, Issue 1, E-ISSN 2348-1269, P- ISSN 2349-5138, IJRAR19J1506 ,pp-269-276.
5. Gulchaman Khan, Mayur Singi (2019) Seismic Analysis of Multistorey Building Having Floating Column, International Journal of Engineering Sciences & Research Technology (IJESRT) ISSN: 2277-9655, Impact Factor: 5.164, IC™ Value: 3.00 CODEN: IJESS7, pp-256-262, DOI: 10.5281/zenodo.2553032
6. Radha Krishna Amritraj , Mohit Sheode and K. K. Pathak (2018) Analysis of Building Frames with Floating Columns and Soft Storeys under Wind Loads International Journal of Latest Trends in Engineering and Technology, Vol.(7)Issue(4), pp.113-129 e-ISSN:2278-621X, PP 113-129. DOI: http://dx.doi.org/10.21172/1.74.016
7. Yeruvakota Sanjeeva Reddy, Y.Sunnybabu (2017) Earthquake Resistance of Multistoried Building with Floating Columns Using E Tabs International Journal of Research in Engineering and Applied Sciences , Aijreas Volume 2, Issue 1 (Issn-2455-6300) Online Anveshana’s,pp 50-58.
8. Lalit Balhar, Dr. J.N. Vyas ,“Comparative analysis of flat slabs & Conventional Rc slabs with and without Shear wall”, International Research Journal of Engineering and Technology (IRJET) Issue 01,Vol 6 (January 2019).
9. Lalit Balhar, Dr. J.N. Vyas, “Review Paper on Comparative analysis of Flat slabs & Conventional Rc slabs with and without Shear wall”, International Research Journal of Engineering and Technology (IRJET) Issue 02,Vol 6 (February 2019).
10. Pradeep D., Chethan V R, Ashwini B T. (2017) Seismic Analysis of Multi-Storey Building with Floating Columns Using Etabs, International Journal of Scientific Development and Research (IJSDR), ISSN: 2455-2631, Volume 2, Issue 9 IJSDR1709019, pp 110-116.

11. Rupali Goud (2017) Study of Floating and Non-Floating Columns with and Without Earthquake International Journal of Science Technology & Engineering (IJSTE), Volume 4, Issue 1, ISSN (online): 2349-784X, pp 152-157.
12. Waykule.S.B, Kadam.S.S, Lale S.V (2016) Study of behaviour of floating column for seismic analysis of multistorey building, International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056, Volume: 03 Issue: 08, p-ISSN: 2395-0072 IRJET ,Impact Factor value: 4.45, ISO 9001:2008 ,PP-70 -83.