

# Seismic Analysis of Multi-Storey Building With And Without Floating Column And Shear Wall: A Review

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**Abstract-** In recent years, many multi-storey and commercial buildings are constructed with architectural complications. Floating column building is a typical feature in the modern multi-story construction. This type of buildings are adopted either for architectural aspect or when more free space is required in the ground floor for the purpose of parking, conference halls, showrooms & functional requirement. Shear wall are used for lateral force- resistance system in style and retrofit building. it's huge lateral stiffness and strength, and may give serviceable management of horizontal displacement and story drifts of buildings beneath earthquakes masses. Such features are highly undesirable in seismically active area .The purpose of the current study is to analyse the behaviour of structure obtaining both floating columns and shear walls structure with comparing the normal structure. also comparing the parameters like storey displacements, storey drift, time period, storey shear. The seismic analysis of structure is analysed with equivalent static and response spectrum method.

**Keywords-** Floating column, Shear wall, Earthquake, Storey displacements, Storey drift, Storey shear, Equivalent static method, Response spectrum method, High rise building.

## I. INTRODUCTION

India is a developing country, where urbanization is at the faster rate in the country including adopting the methods and type of constructing buildings which is under huge development in the past few decades. As a part of urbanization multi-story buildings with architectural provisions are constructed. These requirements are nothing but soft story, floating column, hefty load, the reduction in stiffness, etc. Now a day's many urban multi-storeybuildings have open first storey as an unavoidable feature. This is mostly being adopted to accommodate parking or reception lobbies in the first storey. Whereas the total seismic base shear as practiced by a building during an earthquake is reliant on its natural period. The seismic force distribution is depending the distribution of stiffness and mass along the height. The behaviour of a building during earthquakes depends critically on its overall shape, size and geometry, along with how the

storey shear are transferred to the ground. The storey shears at different storeys in a building necessity to be transferred down to the ground by the shortest path; any discontinuity in the structural members results in the change in the load path. Buildings having vertical setbacks basis a sudden variation in earthquake forces at the levels of discontinuity. The discontinuities in the load path is formed in the buildings with floating columns at an middle storeys or ground storey and do not continue up to foundation.

Hence, there is need of understanding the behaviour of earthquake, also constructing and developing earthquake resistant structures. Thus, shear walls are introduced to resist the lateral forces formed during earthquake. They are known as the vertical elements of the horizontal force resisting structure. Shear walls in the construction counters the effect of lateral loads acting on structure. Specifically, significant for high rise buildings, shear walls thus act against lateral forces produced by wind, earthquake and unequal settlement loads. Urbanization and Growing of high rise buildings is the need of current population and earthquakes have the potential for causing the greatest damages to those tall structures. Hence, it is needed to take in to account the seismic load for the design of high-rise structure. Commonly the shear wall building will be strong. But the floating column structure, how behaviour with the shear wall will be studied in this study.

## II. LITERATURE REVIEW

The following research work in the field of the application of the floating column, shear wall and dynamic analysis of structure has been surveyed at the global level. The brief discussion is as follows:

### Floating Column

In the past, there are a large number of published works on floating column, shear wall and dynamic analysis of structure. Maneesh Ahirwar, Er. Rahul Satbhaiya (2020) [1] This paper presents a Reliability Analysis of Multi-Storey Building with Floating Column by Staad.pro-V8i. This study contracts with the stiffness stability of all the storey and is

proposed to reduce the irregularity presented by the columns which are floating in the building. Modeling was executed through detailed analysis using a commercially available FEM tool, StaadPro v8i.0. Sreadha A R, C. Pany (2020) [2] This paper reports on the Seismic Study of Multistorey Building using Floating Column. This analysis focus the status of particularly classifying the presence of the floating column within the study of the building, establish its correlation with the structure without a floating column using wily software ETABS. This paper also confers the presentation of structure having floating column in seismically active parts. Besides these various parameter such as extreme displacement, effect on number of storey on drift, base shear are also studied. Abdul Azeed, Beebijahira H Talageri, Nidith Kumar Shetty, Sankarshan M. (2019) [3] In this study work residential multistoried building consisting of G+6 has been chosen for carrying out plan work. The work was carried out considering dissimilar cases of removal of columns in different positions and in different floors of the structure. The above building models are created using the software E-TABs 2015 and are analyzed and designed by using IS 456-2000 guidelines. Akshay Gujar, H.S. Jadhav (2019) [4] This paper presents a building construction with floating column are analyzed in single step by using linear static analysis with statement that the structures are having total load once the whole structure built completely. But in real condition construction of building is completed story by story. Therefore that effect due to sequential loading is dissimilar than actual analysis. Objectives of this study is evaluate result of vertical irregularity such as floating column in the buildings. In this paper result of construction order analysis and regular analysis are compared. For analysis the G+10 story structure is considered for zone IV. The results such as displacement story shear, story drift are obtained by ETAB software. K Sai Krishna, P Siva Sankar (2019) [5] This research studied the Seismic Analysis of Multi Storied Buildings with Floating Columns. analyzed for seismic loads before its building. In design work, the floating columns are analyzed for seismic zone – II by ETABS Software and is associated with the structure with and without floating column for Base Shear, Time Periods, Storey Displacements, Storey drifts of each floor, as per IS Codal Recommendations.

### Shear Wall

Hossam El-Sokkary, Khaled Galal (2020) [6] In this work explained shear wall system is a common seismic force resisting system that is used for both reinforced masonry (RM) and reinforced concrete (RC) buildings. This paper aims to estimation the quantities of building materials required for RM shear walls compared to those of RC walls. Three multistorey RM shear wall buildings with dissimilar heights located in

three dissimilar cities in Canada were selected. The analysis and design measures were repeated for each case when RC material was used. The amount of building materials used for the shear walls of each building was estimated for both RM and RC cases and they were compared. Moreover, the rate of labour and temporary works for RM and RC shear walls was estimated and compared. . M.A. Cando, M.A. Hube, P.F. Parra, C.A. Arteta (2020) [7] In this paper studied the effect of the stiffness on the seismic performance of residential shear wall buildings calculated according to current Chilean regulations, including DS60 and DS61. Specifically, the paper efforts on the effect of stiffness on the building overstrength, displacement ductility, fragility for Life Safety (LS) and collapse limit states, as well as the possibility of achieving these two limits states in 50 years. The seismic performance is evaluated for a group of four 20-story residential shear wall buildings archetypes situated in Santiago. Walls were modeled by the multiple vertical line element model (MVLEM) with inelastic hysteretic materials for the vertical elements, and a linear-elastic shear behavior. it is concluded that the performance of reinforced concrete shear wall buildings is enhanced by increasing the stiffness. T.L. Chang, C.-L. Lee, A.J. Carr, R.P. Dhakal (2020) [8] In this work described about novel membrane element named as GCMQ (Generalised Conforming Mixed Quadrilateral) has recently been future for modelling reinforced concrete shear walls, as well as other types of planar difficulties. In this work, a basic version, abbreviated to SGCMQ (Simplified GCMQ), is built by omitting the enhanced strain field for the determination of an improved balance between cost and performance. The numerical imitations show that SGCMQ and GCMQ are able to predict accurate natural periods with very insufficient elements defined. Zhen Wang, Wei Pan, Zhiqian Zhang (2020) [9] This paper work explained about modular construction widely adopted for low-to-medium-rise buildings, but equally limited for highrises. This paper aims to develop a new lateral force resisting system using formed shear walls as part of the modules for high-rises. A 40- story public housing building in Hong Kong was used for case study. Using the FE model nonlinear static and dynamic analyses were conducted to observe the feasibility of the proposed system under the wind and seismic loadings in relevant codes. Results show that the developed FE model is effective to reproduce the structural performance of the precast concrete shear walls, and the future system is strong sufficient to resist wind and seismic loadings. Hassan Bedeir, Marwan Shedid, Hussein Okail, Osama Hamdy (2019) [10] They studied the arithmetic modeling of a two-story third-scale reinforced concrete masonry building composed of walls in orthogonal directions and subjected to quasi-static cyclic lateral loading up to disappointment. Open Sees and Response-2000 were used to imprisonment the behavior at the

section level as well as that at the element and system levels. The results of ten empirically tested individual walls were used to verify the modeling approach that was used to make the building model. Numerical outcomes showed that overall ductility of the building was higher than that of its constituent walls especially under eccentric load which was consistent with experimental results. The torsional response of flanged walls was found to be vital for the accurate representation of the building behavior under eccentric lateral loading.

### Floating Column and Shear Wall

Vyom Goel, Mr. Ajit Kumar Jain (2020) [11] "Seismic Analysis of Multi-storey Building with and without Floating Column and Shear Wall using STADD Pro Software" In this paper studied Seismic Analysis of Multi-storey Structure with and without Floating Column and Shear Wall using STADD Pro Software analyse the behaviour of floating column with flat slab & shear wall on the high-rise building. For this determination, current commercial building comprising of G+10 under seismic forces has been particular for carrying out the project work & also the building analysed for moments and Stresses by STADD Pro Software. The models of normal RCC multistorey flat plate buildings with and without floating column were analysed and the models with flat plate multistorey rcc structures with and without shear wall and floating column were analysed by STADD Pro. Software and the results were calculated above in tables and graphs and the relative study between these models were made between the different stresses and shear forces and moments possessed in these models with same proposal area and load applied. Israa H. Nayel, Shereen Q. Abdulridha, Zahraa M. Kadhum (2018) [12] "The Effect of Shear Wall Location in RC Multistorey Building With Floating Column Subjected to Seismic Load" this paper concerns with analysing the consequence of different locations of the shear wall on a multistorey specific structure (contains 10 stories) with floating columns which is subjected to earthquake force region. The first model taken without shear wall, while the others three models include a shear wall in the centre, core and at the centre of the structure to study the best location. The effect of shear wall locations on some significant parameters like displacement in the two directions, time periods and also the base shear in the two directions are conferred. The present analysis was completed by using the software ETABS-2015, because of there is large difficulties to do that experimentally. The responses of these structures are analysed, discussed and the best location of the shear wall is stated. Kirankumar Gaddad, Vinayak Vijapur (2018) [13] "Comparative Study Multi-Storey Building With And Without Floating Columns And Shear Walls" This paper Considering G+20 storey building, four models. First model will consider the normal structure, second model will consider

floating columns structure, third model will consider shear wall structure, fourth model will consider both shear walls and floating columns structure. The seismic analysis of G+20 storey structure is analysed by both equivalent static and response spectrum method. Obtained storey displacements, storey shear, storey drift, time period for seismic zone V. Comparing all four models the time period of floating column building model II is greater than all three building. Model III is better performances lesser displacements, more strength comparing all models. Kandukuri Sunitha, Mr. Kirankumar Reddy. (2017) [14] "Seismic Analysis of Multi-storey Building with Floating Column by using Tabs" In this research work calculated on the analysis of normal building with five storey, ten storey, and fifteen storey. And different positions and different conditions like floating columns, shear wall, bracings are to taken as same models. Two methods to be considered for the analysis of structure as linear static method and time history method. Analysis done for by ETAB software compare the displacements, storey drift and the time history values of the different models. In static analysis concluded that the maximum displacements and storey drift values are increasing for floating column. by observing the drift ratio the deflection and storey drift will be drastically changed when the height of the building will be enlarged. Vignesh Kini K, Dr. Rajeeva S V. (2017) [15] "Seismic Behaviour Of RC and STEEL-CONCRETE Composite Multi-Storey Building With Floating Columns With and Without Shear Walls" This research work studied The structure models are analysed using response spectrum analysis with the assumption that the structure will be subjected to all the loads or full load in a only stretch when the whole structure is constructed completely. The analysis of the building models is done by CSI ETABS 2016 software. The present study involves response spectrum analysis of RC structure and steel-concrete composite structure with floating columns at the middle of penultimate bay, with and without shear walls and the parameters like storey displacement, storey drift and storey shear of RC structure and steel-concrete composite structure with floating columns at the middle of penultimate bay, with and without shear walls are compared. the storey shear and base shear values obtained for both RC and steel concrete composite structure with floating columns and shear walls is more compared to RC and steel-concrete composite structure with floating columns and without shear walls because of growth of seismic weight of the structure.

### III. CONCLUSION

- The present literature investigation reviews that works have been done on the response and behavior of structures with and without floating columns, with and without shear walls to seismic forces.

- From the literature examination it is seen that work has been done on linear static analysis of buildings and not dynamic analysis which includes response spectrum analysis and time history analysis. So, it is essential to study the behavior of buildings subjected to seismic forces by analyzing the structure using response spectrum analysis.
- The Seismic behavior of the combination of floating column structure and shear wall structure with Normal building.
- Obtaining the parameters storey displacements, storey shear, storey drift, time period for modeled structures.
- Comparing the results of normal building with combination of floating column building and shear wall building.
- shear wall structure is better performances lesser displacements, more strength comparing all models.
- Study of structure with floating column and shear wall.

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