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SEISMIC ANALYSIS OF MULTISTOREY BUILDING WITH FLOATING COLUMN: A REVIEW

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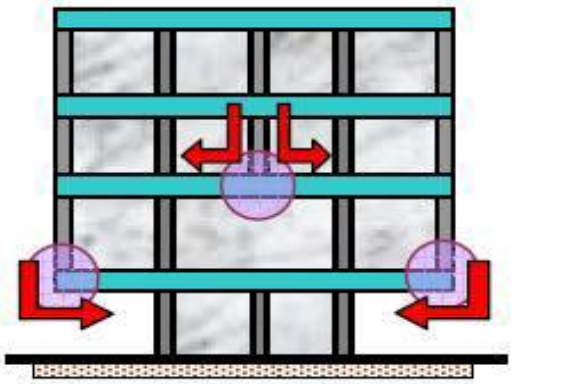
Abstract - *This review paper is based on some of the previous studies relating to the "Seismic Analysis of Multi-storey Buildings with Floating Column". Conclusions are drawn based upon the respective results of all the mentioned research papers. For a hotel or commercial building, where the lower floors contain banquet halls, conference rooms, lobbies, show rooms or parking areas, large interrupted space required for the movement of people or vehicles. Closely spaced columns based on the layout of upper floors are not desirable in the lower floors. So to avoid that problem floating column concept has come into existence.*

Key Words: Floating columns, STAAD analysis, Multi-storey

1. INTRODUCTION

Many urban multi-storey buildings in India today have open first storey as an unavoidable feature. This is primarily being adopted to accommodate parking or reception lobbies in the first storey. Whereas the total seismic base shear as experienced by a building during an earthquake is dependent on its natural period, the seismic force distribution is dependent on the distribution of stiffness and mass along the height.

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. The earthquake forces developed at different floor levels in a building need to be brought down along the height to the ground by the shortest path; any deviation or discontinuity in this load transfer path results in poor performance of the building. Buildings with vertical setbacks (like the hotel buildings with a few storeys wider than the rest) cause a sudden jump in earthquake forces at the level of discontinuity. Buildings that have fewer columns or walls in a particular storey or with unusually tall storey tend to damage or collapse which is initiated in that storey. Many buildings with an open ground storey intended for parking collapsed or were severely damaged in Gujarat during the 2001 Bhuj earthquake. Buildings with columns that hang or float on beams at an intermediate storey and do not go all the way to the foundation, have discontinuities in the load transfer path.



Hanging or Floating Columns

2. LITERATURE REVIEW

Srikanth M.K [1] in 2014 observed that, the displacement of the 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. Storey shear will be more for lower floors, then the higher floors due to the reduction in weight when we go from bottom to top floors. And with this if we reduce the stiffness of upper floors automatically there will be a reduction in weight on those floors so in the top floors the storey shear will be less compared to bottom stories. Whether the floating columns on ground floor or in eight floors the displacement values increases when a floating column is provided in edge and middle than the outer face of the frame. The multi-storey building with complexities will undergo large displacement then the model having only floating column. In all models the displacement values are less for lower zones and it goes on increases for higher zone.

T.Raja Sekhar [2], studied the behaviour of multi-storey building with and without floating column is studied under different earthquake excitation. The compatible time history and Elcentro earthquake data has been considered. The PGA of both the earthquake has been scaled to 0.2g and duration of excitation is kept same. A finite element model has been developed to study the dynamic behaviour of multi story

frame. The static and free vibration results obtained using present finite element codes are validated. The dynamic analysis of frame is studied by varying the column dimension. It is concluded that with increase in ground floor column the maximum displacement is reducing and base shear varies with the column dimensions.

Kavya N [3], concluded that the natural time period depends on the building configuration. Lateral displacement increases along the height of the building. There is more increase in the displacement for the floating column buildings compared with the regular building. The inter storey drift also increases as the increase in the number of storey's. The storey drift is more for the floating column buildings because as the columns are removed the mass gets increased hence the drift. As the mass and stiffness increases the base shear also increases. Therefore, the base shear is more for the floating column buildings compared to the conventional buildings. Hence, from the study it was concluded that as far as possible, the floating columns are to be avoided especially, in the seismic prone areas.

Comprehensive information of the building models considered are given below:-

Structure	SMRF
No. of storeys	G+3
Type of building	Commercial
Type of Foundation	Isolated footing
Seismic zone	IV
MATERIAL PROPERTIES9	
Grade of concrete	M20 and M30[for cantilever beam]
Grade of steel	Fe415
Youngs modulus of concrete6	ForM20, 22.32X10^{68}KN/m^2
Density of concrete	25 KN/m^2
Young's modulus of brick masonary	2100X10^3 KN/m^3
Densityof brick masonary	20 KN/m^3

MEMBER PROPERTIES

Thickness of slab	0.150 m
For four storey building:	0.25*0.5m (beam) 0.45*0.95m(overhanging beam) 0.25* 0.4m (small beam) 0.3* 0.5 (floating column) 0.6*0.6(peripheral column) 0.4* 0.5(core column)
Thickness of wall	0.25m
Roof finishes	2.0KN/m^2
Floor finishes	1.0 KN/m^2
Live load intensities	
Roof	1.55 KN/m^2
Earthquake Live load on slab as per clause 7.3.1 and 7.3.2 of IS 1893(part I)-2002	
floor	0.25* 3.0= 0.75 KN/m^2
Roof	5 KN/m^2

D. Annapurna and Sriram Nadipelli [4] studied the analysis of G+5 story normal building and a G+5 story floating column building for external lateral forces. The analysis was done by the use of E-Tabs software by using equivalent static analysis they also studied the variation of the both structures 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 .The present paper deals with the variation of time period, displacement of structure, base shear, seismic weight of building from manual calculations and E-Tabs. It was found that floating column building is unsafe than a Normal building.

3. CONCLUSIONS

1. The analysis outputs were noted in terms of lateral displacements, storey drifts, and storey shear and were tabulated on the basis of linear seismic analysis.

2. The inter storey drift also increases as the increase in the number of storey's. The storey drift is more for the floating column buildings because as the columns are removed the mass gets increased.

3. Hence, from the study it can be concluded that as far as possible, the floating columns are to be avoided especially, in the seismic prone areas.

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