Analysis of A Structure Considering Floating Columns: A Review

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Abstract- *Floating columns are one of the important aspects of multi-storey structures due to their various advantages thus seem to be unavoidable. Floating columns are generally not found reliable in seismic prone areas. This research is followed towards analyzing the performance of floating columns structure and traditional structure prone to seismic load. The primary advantage of using floating columns is that using such provides maximum parking when using in-ground floors or wide-open areas when used at upper storey due as the rest of beams without having a foundation. These columns have discontinuities in the load move way and are intended for gravity load however these structures are not intended for tremor loads. So these structures are dangerous in seismic inclined regions.*

Keywords- Floating columns, STAAD.Pro, Story drift, Base shear, Story displacement, Story acceleration

I. INTRODUCTION

Multi Storey structure were introduced for crating spaces to accommodate larger population in limits spaces and further their need arise to have column free spaces due to shortage of space, population and also for aesthetic and functional requirements. Such floating columns come along with a disadvantage in such structures constructed in seismically active areas. The seismic tremor that is formed at various floor levels in a structure should be conveyed down along the stature to the ground by the most limited way. Deviation or brokenness in this shift in load brings the poor performance of the structure. The conduct of a structure during seismic forces relies fundamentally upon its general shape, size and geometry, notwithstanding how the forces of the earthquake are conveyed to the ground. Numerous structures with an open ground story planned for stopping fallen or were seriously damaged in Gujarat during the 2001 Bhuj tremor.

Fig 1: Floating column used on Structure in construction

II. FLOATING COLUMN

A column should be a vertical part beginning from establishment level and moving the heap to the ground.

Looking forward, obviously, one will keep on making structures fascinating as opposed to dreary. In any case, this need not be done at the expense of helpless conduct and the quake security of structures. Compositional highlights that are adverse to the tremor reaction of structures ought to be kept away from. If not, they should be limited. At the point when sporadic highlights are remembered for structures, an impressively more elevated level of designing exertion is required in the basic plan but then the structure may not be comparable to one with straightforward building highlights.
Henceforth, the structures previously made with these sorts of spasmodic individuals are jeopardized in seismic locales. Yet, those structures can't be obliterated, rather study should be possible to reinforce the structure or some healing highlights can be recommended. The segments of the principal story can be made more grounded, the firmness of these sections can be expanded by retrofitting or these might be furnished with supporting to diminish the lateral deformation.

III. LITERATURE REVIEW

Kandukuri Sunitha and Kiran Kumar Reddy (2017) the research paper presented the analysis of a 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 analysis was done by the use of ETABS. The intensities of the past earthquakes i.e., applying the ground motions to the structures, from that displacement time history values was compared with the primary aim to identify whether the structure was safe or unsafe with floating column when built in seismically active areas and also to find floating column building was economical or not.

The results concluded that by the maximum displacement and storey drift values was increasing for floating columns. The drift ratios stated that by increasing the height of the building the deflection and storey drift drastically changed. The axial forces increased in the columns other than floating columns due to transfer of loads of the floating columns to the conventional columns. Shear walls building prove to present safe behavior in every parameter of building safety but shear walls cannot be considered economical for building with lesser height. The building with bracing system worked well in case of smaller height than in high rise building; difference was stated in higher stories of the building. The bending moment in columns was greater in the top stories and lesser in the bottom stories.

Kapil Dev Mishra and Dr A. K. Jain (2018) the research paper considered analysis of a multi storied Plaza building of storey (G+2+3) having different position of floating columns (4 columns of mid ordinate axis or 4 columns of diagonal axis) at different height of building (at the level above second floor) at two different zones (ZONE III and ZONE IV). The plan area of building up to second floor was 30m×30m and above this floor area was reduced to 20m×20m.Height up to second floor of the building was used for parking or commercial shops having floor height of 4m and above this it was used for residential and office purpose. Floating columns was provided at office floor.

The results stated that Maximum Bending Moments as well as Maximum Support Reaction for the structures having floating columns was higher than that of structures without floating columns. Maximum Bending Moments at seismic Zone IV was greater than that of Zone III. Structures having floating column constructed in Zone IV was more affected by earthquake than Zone III.

Waykule .S.B et al (2017)the research paper presented static analysis for a multi-storey building with and without floating columns. Different cases of the building was presented by varying the location of floating columns floor wise. The structural response of the building models with respect to, Base shear, and Storey displacements was investigated. The analysis was carried out using software sap2000v17.

Trupanshu Patel et al (2017) the research paper presented the behaviour of G+3 buildings having floating columns. The research constituted of 29 models and these models were modelled and analysed by SAP 2000. It was analysed for local zone III (surat), medium soil condition, and results are tabulated for horizontal and vertical displacements.

The results stated that buildings with provisions of floating columns at corners, on any floor presented poor performance compare to other considered cases. Hence corner provisions of floating columns should be considered as critical case. As the position of floating columns changes from corner to the centre of stiffness of typical floor, there was decrement in value of displacements, higher decrement was visible in vertical displacements, comparison to the horizontal one. As the position of floating columns changes from 1st – 2nd – 3rd – 4th floor there was higher vertical displacements in floors, above the floor provided with floating columns. i.e provisions of floating columns at 1st floor shows higher vertical displacements at 2nd, 3rd and 4th floor. The incremental load considered in the model on one side amounts to about 5% increases in eccentricity. Infill walls provided seismic strengthening of the floating column building. It also assisted in reduction of seismic response of the building. Horizontal displacement reduced by 182.26% (max) and vertical displacement reduced by 140.03% (max) after infill provisions. Revising the design of structural members after provision of infill walls presented that revision tends to reduce the quantity of steel and concrete. Hence it proved not only in reduction of the seismic response but also made the structure economical. Provision of infill walls tends to reduce the size and cost of structural members in comparison of the buildings without infill walls.

Shiwli Roy and Gargi Danda de (2015) the research paper presented analysis of various types of structures G+3, G+5 and G+10 for RCC column and floating column. The difference between G+3, G+5 and G+ 10 structures are shown by graphs and charts. Comparison will be done on bending moment and shear force between these structures. This paper presents the analysis of floating column and RCC column by using STAAD PRO V8i. The analysis on floating column for G+3, G+5 and G+ 10 structures stated that if the height of the structure increases, the shear force and bending moment also increases. The column shear varies according to the situation and the orientation of columns. The moment at every floor increases and shear force increases but it was same for each floor column. The variation in shear force presented that the shear force is maximum for G+10 structure and the difference between normal and floating column for shear force was 4.368KN for G+3 structure, 7.133 KN for G+5 structure and 13.793KN for G+10 structure. The variation in shear force presented that the Bending moment is maximum for G+10 structure and the difference between normal and floating column for bending moment is 0.004KN for G+3 structure, 0.004 KN for G+5 structure and 0.003KN for G+10 structure.

Avinash Pardhi et al (2016) the research paper presented the seismic performance of building with and without floating columns in terms of various parameters such as displacement, storey drift, maximum column forces, time period of vibration etc. The building having various locations of floating columns i.e. floating columns starting from different stories were considered for the study. The building was modeled using finite element software ETABS. The beams and columns were modeled as two nodded element with six degrees of freedom at each node. The slab was modeled as membrane element with three degrees of freedom at each node. Equivalent static analysis and response spectra dynamic analysis was performed on the various buildings and their seismic performance is evaluated. The primary motive was to evaluate the seismic response of building with floating columns and compare it with the normal building.

IV. CONCLUSION

Many solutions have been developed in the past few decades following the introduction of new seismic necessities and the availability of advanced materials in the field of civil engineering. Specific evaluation methods and strategies and performance targets have also been developed and adopted by many advanced countries. Floating column technology is based on increasing the size or space requirement through the use of this technique where we remove the column located to have proper space.

This technology is used to develop a innovative method wherever architectural requirement is important with structure safety.

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