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Analysis of RCC Frame Structure with Change in Location of Floating Columns

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Abstract: ***The objective of present study is to analyze and compare the change in location of floating column in R.C.C frame structure. The comparison of both structures is studied by calculating, finding and tabulating comparative values of displacement. The study reflects that with change in structure i.e. the behavior of structure towards earthquake changes, nodal displacement, moment, and base shear values shows drastic changes towards resistivity against seismic forces. The soft computing tool and commercial software STAAD-Pro is used for modeling and analysis also the study done over here thus helps to understand effect of earthquake on structures for achieving stable and safe structure.***
Keywords: Floating column, multistory building, seismic response, staad pro, Nodal displacement, Support Reactions, optimum case.

I. INTRODUCTION

In RCC framed structure, the load is transferred from a slab to the beam then to the columns, further to the lower columns, and finally to the foundation which transfers the load to the soil, the walls are constructed after the frame is prepared, most tall buildings use RCC technology. A column is a vertical member which transfers the loads from beam to foundation whereas a floating column is a vertical member which transfers the load from beam to another beam. The load transfer in any building is usually from slab to beams to columns and then foundation. But a floating column, instead of transferring the load to foundation transfers the load on to the beam. The beam on which the floating column rests transfers the load to the columns below. The load is transferred in the form of a point load.

In recent times, multi-storey buildings in urban cities are required to have column free space due to shortage of space, population and also for aesthetic and functional requirements. For these buildings are provided with floating columns at one or more storey. These floating columns are highly disadvantageous in a building built in seismically active areas. The earthquake forces that are developed at different floor levels in a building need to be carried down along the height to the ground by the shortest path. 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.In modern times the buildings are becoming complex particularly the mix use ones. There are different uses on different floors and hence to follow it structural grid becomes difficult as columns on any floor would become a hindrance. Even in residential buildings when there is a parking on ground floor or lower stories or huge cantilevers are taken to exploit ambiguities in local bylaws for gaining more free spaces, the lower floors need column-free spaces for easy movement of vehicles; while on upper floors which are more in number of the columns have been designed based on room layout. They are also frequently used when there are shops on ground floor and residence on upper floors. Rather than finding an architectural solution one easily take recourse to floating columns and remove columns on lower stories, which is a dangerous proposal.

II. LITERATURE REVIEW

A.P. MundadaȦ et. al. (1), Vol.4, No.5 (Oct 2014), In this the study of architectural drawing and the framing drawing of the building having floating columns. Existing residential building comprising of G+ 7 structures has been selected for carrying out the project work. The load distribution on the floating columns and the various effects due to it is also been studied in the paper. The importance and effects due to line of action of force is also studied. In this paper we are dealing with the comparative study of seismic analysis of multi-storied building with and without floating columns. The equivalent static analysis is carried out on the entire project mathematical 3D model using the software STAAD Pro V8i and the comparison of these models are been presented.

Deepak Jain et, al (4) This paper studies that floating column building are vulnerable to the high seismic zones. The risk of damage also depends on the shape and size of the buildings. The ductile detailing of the joints is the promising solution for immediate failure of such buildings.

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MsWaykule(2017)(5)-Software approach is applied for comparative study of the Floating column and brought that base shear in first floor decreases with use of floating column in place of without Floating column.

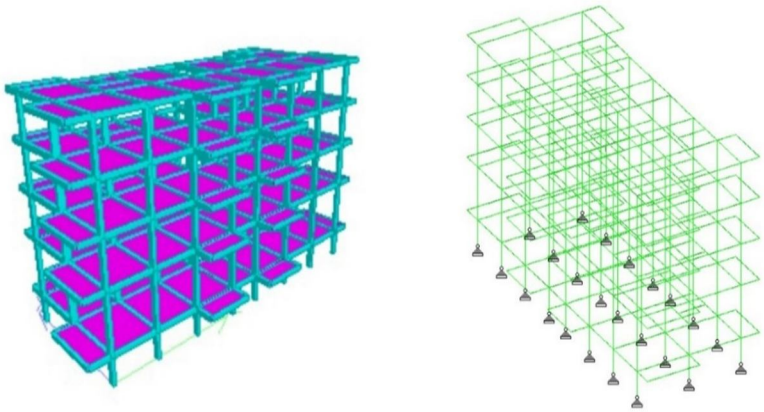
Snehal Ashok Bhoyar (2017) (6)- Different locations of Floating column in the structures changes the behaviour of the especially its performance.

Sukumar Behera (2012) (7) has proposed that in seismically area the features are highly undesirable. He has analyzed the structure by using ETAB software with and without floating column. The alternate measures are also including by including stiffness balance of first storey and storey above. Pratyush Malaviya1 publish paper on International Journal of Scientific and Engineering Research, Volume 5, Issue 5, May 2014, on Comparative study of effect of floating column on the cost analysis of a structure designed on Etabs. They have compared the cost of normal column structure and floating column structure.

Mr. MaheshaM, et. al.(8) This publish paper in Research Journal of Engineering and Technology International on Comparative study on 3D RC frame structure with and without floating columns for stiffness irregularities subjected to seismic loading. They study the significance of expressly perceiving the vicinity of the floating columns and significance of explicitly recognizing the presence of with and without floating column in the investigation of building furthermore alongside floating column with a few complexities were considered for G+16 story building at different alternative location.

III. DETAIL STUDY

A. Phase I: Design Residential building , Assume M20 concrete and Fe415 grade steel.



B. Phase II: Analysis of Normal RCC frame structure with change in location of floating columns.

Case consideration staad-pro modeling and analysis

1) Case 1. Rcc Structure Without Removing Floating Column

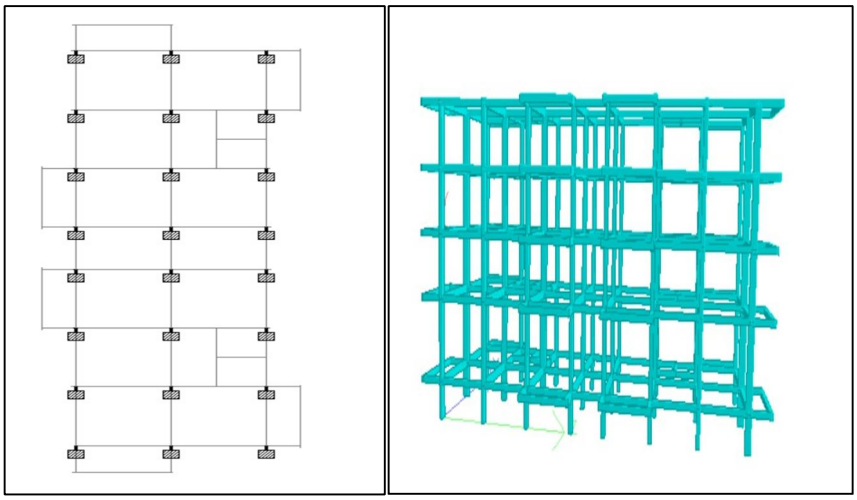
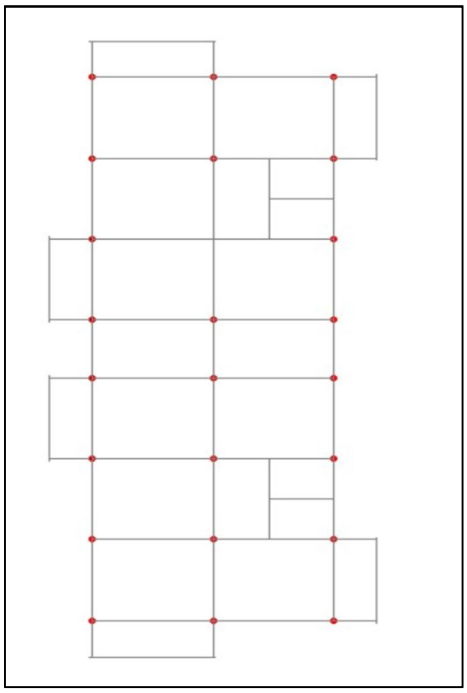


FIG.1.1 Whole Structure Plan FIG.1.2 Whole Structure 3D

2) Case 2. RCC Structure with Removing Ground Floor Floating Column



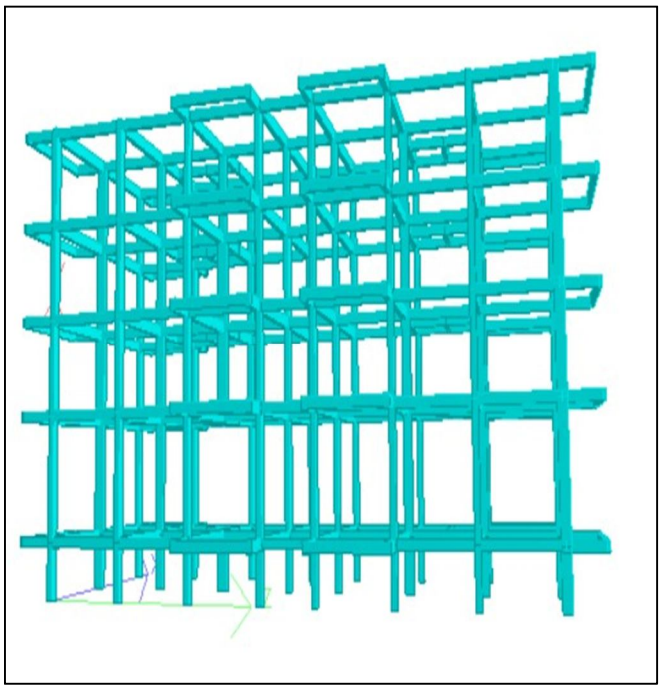
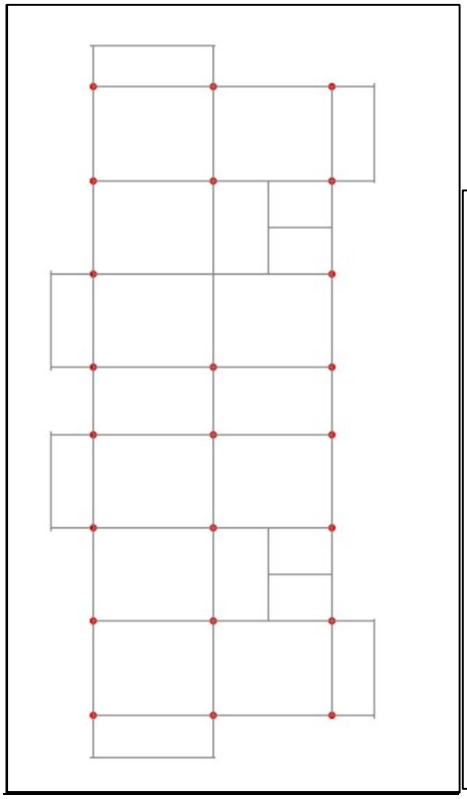


FIG. 2.1ground Floor Plan FIG.2.2 Ground Floor 3D

3) Case 3.RCC Structure with Removing 1st Floor Floating Column



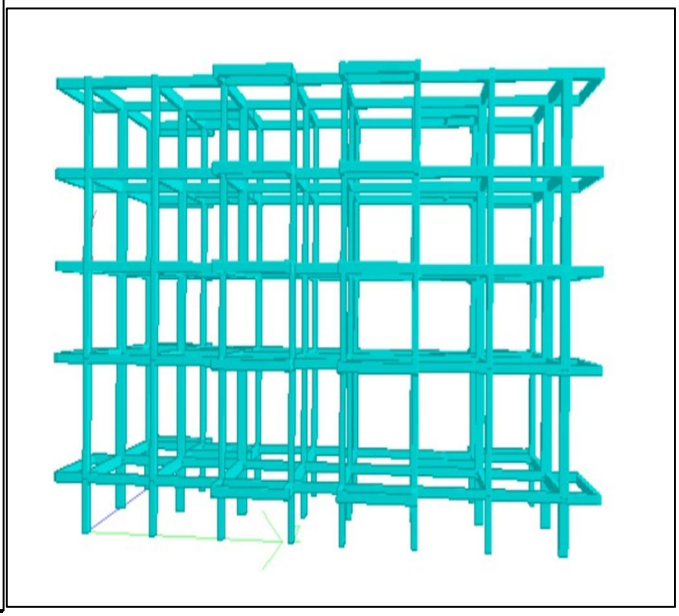


FIG. 3.1 First Floor Plan FIG.3.2 First Floor 3D

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IV. OBSERVATION

With the aim of Comparative analysis of R.C.C frame structure with change in location of floating columns., Various cases are modeled analyzed in the previous . Each case represents change in location of floating column for same RCC structure and comparison is made over here.

The various cases analyzed are

1) Case I: - Whole Structure
2) Case II: - Change in Location of Floating Columns at Gr. Floor.
3) Case III: - Change in Location of Floating Columns At 1st Floor.

On the basis of this case analysis, the observation related to nodal displacement value are depicted in the tables.

a) Nodal Displacement of Column Location {Interior}

NODE NO.	CASE1	CASE2	CASE3
231	59	65.01	63.37
187	53.13	59.18	58.29
143	42.28	49.02	48.43
99	28.28	36.35	26.72
55	3.7	3.2	3.6

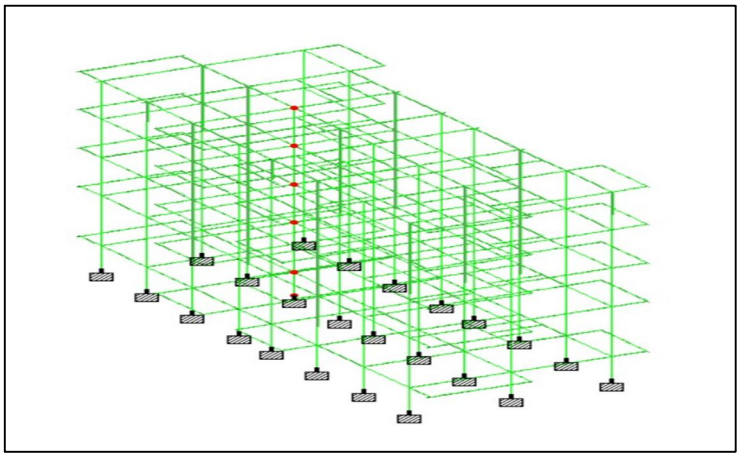


FIG. 6.1 Nodal Displacement Of Interior Columns

b) Nodal Displacement of Column Location {Exterior}

NODE NO.	CASE1	CASE2	CASE3
224	61.94	61.137	60.04
180	56.156	55.39	54.48
136	44.189	44.21	43.3
92	29.72	28.9	28.6
48	3.65	3.54	3.57

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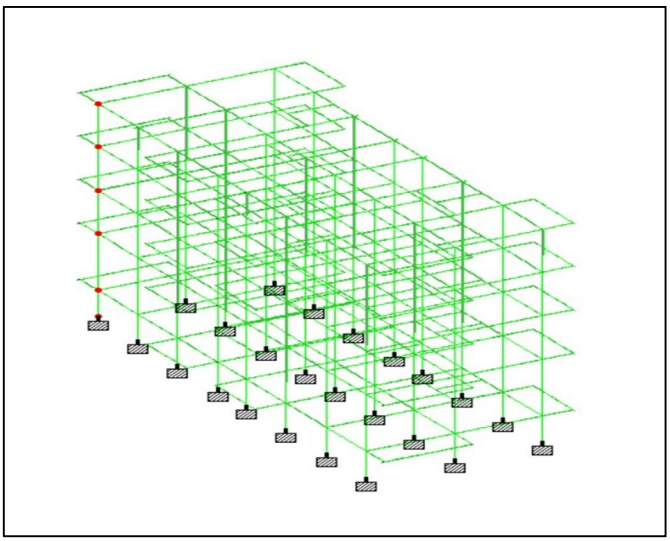


FIG. 6.2 NODAL DISPLACEMENT OF EXTERIOR COLUMN

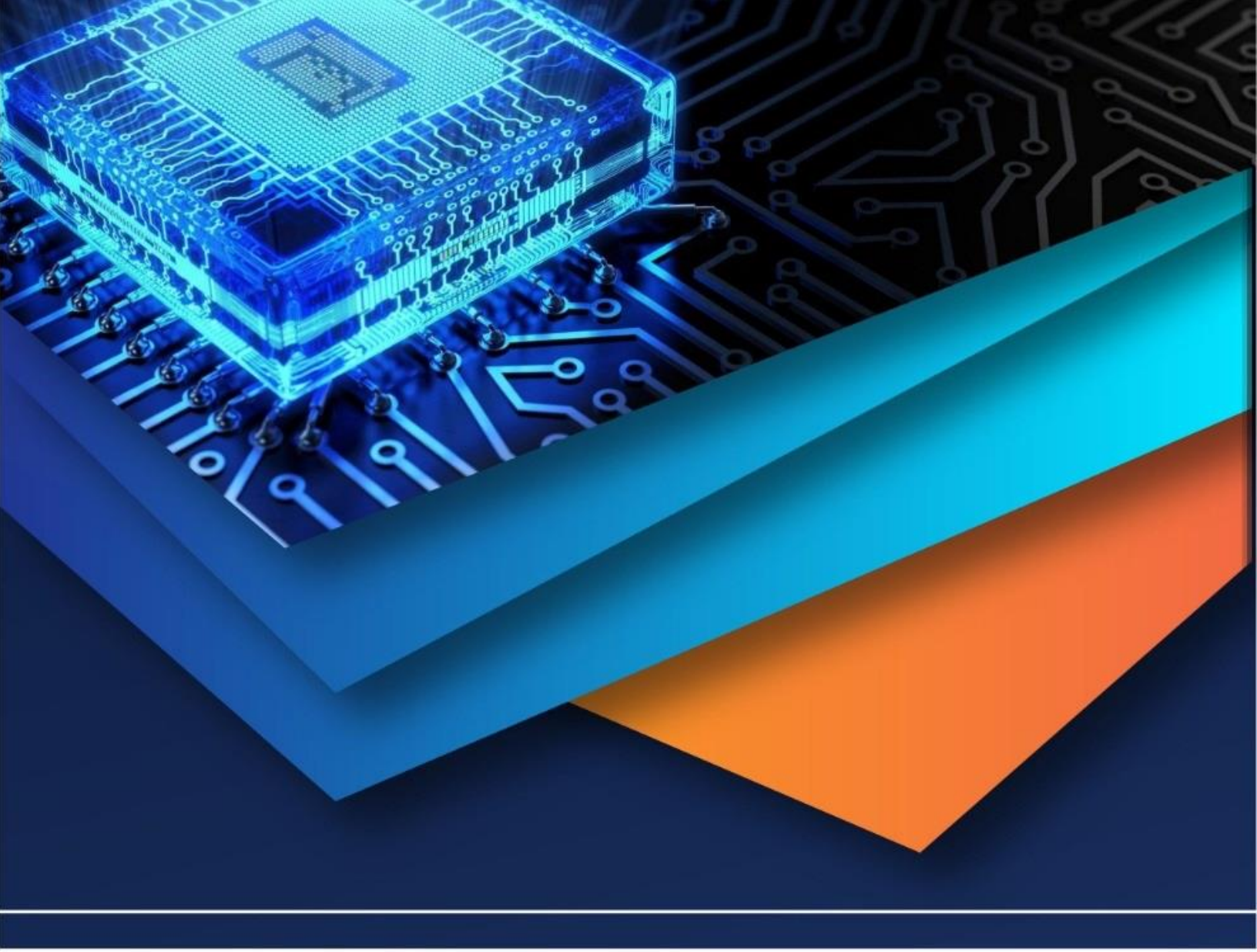
V. CONCLUSION

The Geometrical Continuity of Structure Plays the Vital Role in The Structure Stability When We Considered Earthquake Forces, The Impact of The Forces Are from The All-Possible Direction and Thus It Becomes Necessary to Study Behaviour of Structure with Change in Geometrical Continuity.

For Studying The Floating Column Effect That Is The Vertical Irregularity The Five Cases Are Modelled And Analysed With The Same Parameter But Only With The Change In Location Of Floating Column ,It Can Be Concluded From The Various Observed Table 5 That Not Only Beam And Forces But Nodal Displacement And Reaction Drastically Change With The Insertion Of Floating Column At Respective Location ,The Column In Continuity Of Location Design Attention From The Study It Is Concluded That To Reduce Impact Of Sudden Load Floating Column Should Not Be Provided.

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