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Comparative Analysis & Design of Irregular RCC Building G+10 Working with Floating Columns and Without Floating Columns in Various Seismic Zones using E-Tabs

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ABSTRACT: In the present situation, the multi-storey buildings with floating columns will provide much larger spaces that are required for community halls, shopping malls, and hospitals. The column which is supported on a beam instead of a rigid foundation is known as the floating column. By providing these type of columns, they may satisfy the functional requirements but the structural behavior changes abruptly due to the floating columns and while considering the seismic load with different zones the behavior may cause major accidents of multi storey buildings. In this dissertation, the seismic performance of the building with or without the floating columns is presented in terms of various parameters such as storey drift, wind forces, storey displacement, and axial forces. The building is analyzed by using ETABS software with zones- II, III, IV, and V. In this building the floating columns are placed at various locations at different stories that are considered for the study. The main aim of this dissertation is to evaluate the seismic response of the building under different zones and with floating columns and comparing it with a normal building.

KEYWORDS: floating columns, seismic zones.

I.INTRODUCTION

Many multi-story buildings in India now include a vacant story as an unappealing feature. This is being used as an aggregate halting or gathering hall in the lower level. To analyze the structure's behavior when seismic power (i.e., earthquake power) is applied to the ground. The behavior of a structure under seismic tremor load is primarily determined by its auxiliary shape, size, and geometrical appearance, as well as the reduction of pivotal power created on the structure as a result of earthquake forces. The seismic tremors had an impact on the structure's numerous story levels. Seismic forces are generated at various floor levels in a structure and should be brought down along the stature of the structure's lower ground level via the short way; any diversion or deterioration in this heap move way results in story relocation, story float, and a lackluster showing of the structure. Multistory structures with vertical reinforcements, such as hotel structures, multiplex structures, and shopping malls, are a few stories wider than other buildings. Due to limited space for stopping, people, and additional aesthetic and functional needs, structures in metropolitan regions are obliged to have section free space at lower base stories. This results in enormous misshapenings and disturbing minutes. Structures with gliding segments are exceptionally inconvenient in a structure, for the situation, there are worked in the seismic zones dynamic zones, (for example, Zone-4, Zone-5), which cause the hub powers which are created because of tremor load conveyed along the tallness of the structure need to convey along the most limited way, because of open zone in base (ie skimming columns)causes deviations, or irregularity causes gigantic story relocations, story drift.

Floating column: A column is a vertical member which transfers load caused due to ie(floor, beams) and transfer the load directly to the foundation. In the case of floating columns is a vertical member that rests on a horizontal beam and doesn't have a foundation. The floating columns don't transfer the load directly to the foundation due to discontinuity. Of the column, it transfers the load to below the beam on which it's resting on it. The floating column acts as a point load on the beam and this beam transfers the load to the column below it.

II.LITERATURE REVIEW

Ms.S.BWaykule,Mr.S.Kadam(2016) In this paper present study about analysis of G+5 Building with and without floating column in highly seismic Zone V. four models are created such as floating column at 1st ,2nd,and 3rd floor

buildings and without floating column building. Linear static and time history analysis are carried out of all the four models. Here we observe that the base shear, storey drift, storey displacement is increased 5-10% for floating column floor compare to without floating column.

A.P.Mumdada,S.GAwadakar(2014)In this paper we study behavior for architectural drawing and the framing drawing of the building having floating columns. for the difference in G+7 existing residential structure with and with floating columns the data has been collected and the project is carried out by using STAAD Pro. Here we observe the axial forces and moments on floating columns building is 45% more compared to normal building.

Lakshmi Chandran(2015) In this paper the comparative study of analysis of multi- storied building with and without floating columns at different levels in regular and irregular plans. The equivalent static analysis are carried out on G+14 building of regular and irregular plans using the software SAP2000 and the comparison of these models are done. Here we observe R.C.C regular structure with floating columns is less base shear about 9% than R.C.C irregular structure with floating columns.

Ancy Mathew, Priya Prasannan(2017)In the study, the effect of varying the location of floating columns floor wise and within the floor of multi storied RC building on various structural response quantities of the building using response spectrum analysis is studied in the software ETABS 2015. Here observe by shear walls with floating columns structure the storey drift ,storey displacement base shear as decreased 40% than structure with floating column.

Hardik Bhensdadia and Siddarth Shah(2016) In this project, we look at an effort to reveal the examination behavior of gliding sections and sensitive stories in diverse seismic zones using seismic investigation. For this situation, we are utilizing Push over-examination because of the produce execution degree of working for investigation and the plan limit of dislodging done up to disappointment, which supports guarantee of breakdown stress and assists with expanding the structure's pliability. To achieve this goal, three R.C.C structures with G+4, G+9, and G+15 structures in different seismic zones were analyzed using SAP2000.

III.METHODOLOGY

- To analysis the G+10 irregular shape R.C.C building with same similar section data with floating columns&without floating columns at various seismic zones.
- By using response spectrum analysis for the both buildings, We observe the behavior of the building with floating columns and building without floating columns
- To compare base shear, Storey drift, Storey displacement for the both G+10 irregular R.C.C building with and without floating columns.

RESPONSE SPECTRUM METHOD:

- The representation of the maximum response of idealized single degree freedom system having certain period and damping, during earthquake ground motion. The maximum response plotted against un-damped natural period and for various damping values and can be expressed in terms of maximum absolute acceleration, maximum relative velocity or maximum relative displacement.
- For this purpose response spectrum analysis have been performed according IS 1893:2002.

IV .DESIGN PROGRAMMING

We are discussing the basic procedure involved in the studybehavior of RCC multi storey building with floating columns and without floating columns. It is carried out in the Computer Laboratory of Civil engineering department of AMRITASAI INSTITUTE OF SCIENCE & TECHNOLOGY. ETABS is the software used in comparison base shear, axial forces, storey displacement, Storey drift are analyzed here.

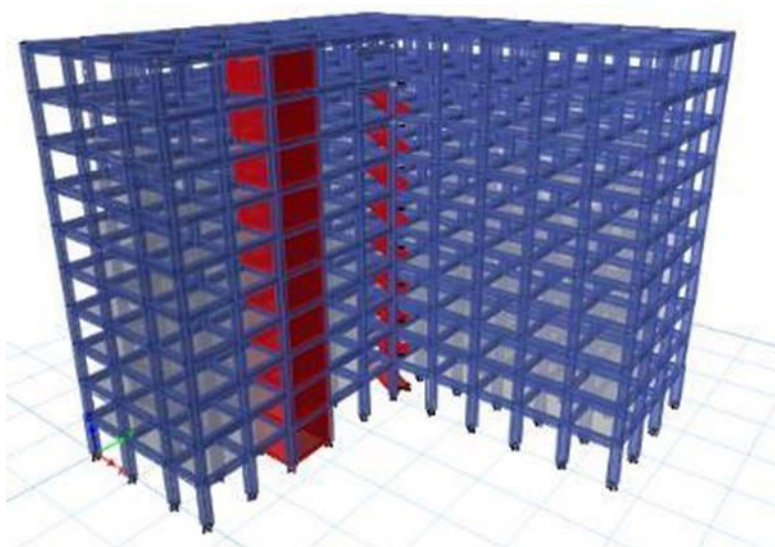
Investigation of R.C.C multi story building without floating columns & floating columns:

The ETABS 2016 program is used to examine R.C.C multi-story operating without drifting parts and with coasting segments. When comparing the two structures, it is possible to determine which is more effective for seismic zoning conditions. The R.C.C structure uses Indian standard codes.

Particulars	Dimensions and values for an RCC structure without floating columns.
Plan Dimension	33mx34m
No. of stories	G+10
The structure's entire height	33.5m
The depth of each story	3m
Depth of parapet	1.3m
Size of beams	
Base to 3rd floor dimensions	300mmx600mm
3rd to 10th floors	300mmx530mm
Size of columns	
Base to 3 rd floor	500mmx700mm
From 4 th floor to Top floor	400mmx600mm
Thickness of walls	Two brick, Onebrick thickness
Interior wall loads	6kN/m ²
Exterior wall loads	12kN/m ²
Seismic zones	2,3,4,5
Floor finish	1.5kN/m ²
Live load at all stories	3kN/m, 1.5kN/m(10 th floor)
The Unit weight of concrete	25kN/m ³
The Unit weight of brick	20kN/m ³
The Density of steel	7850kg/m ³
Strength of concrete	Slabs M30, Columns M40, Beams M35
Strengthening of reinforcing steel	Fe415
Soil conditions	Medium
Response reduction factor	5
Importance factor	1.5

Analysis of R.C.C structure without floating columns:

The first L-shape sporadic R.C.C structure is broken down for seismic stacking in Zone-II, Zone-III, Zone-IV, and Zone-V using a bit-by-bit strategy, as shown below. The selected plan analysis is done for the L-shape irregular R.C.C structure with and without drifting segments



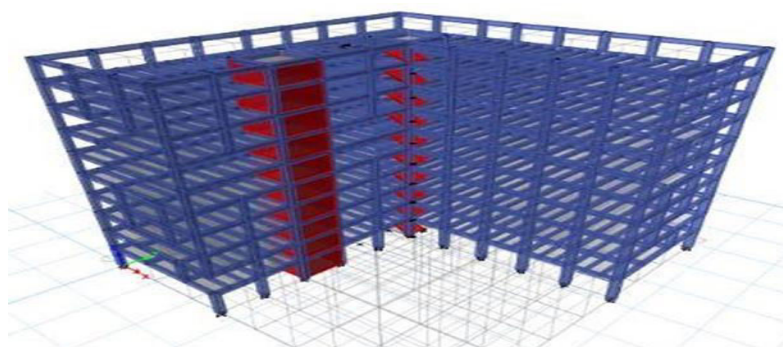
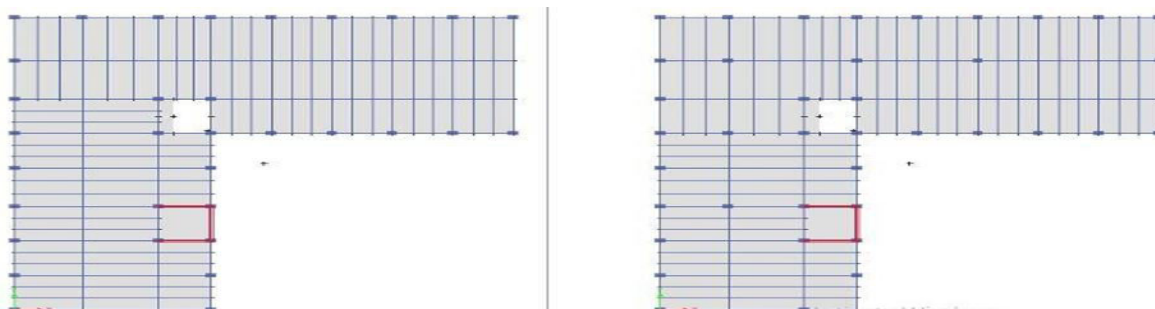
Showing full L-shape R.C.C Structure without floating columns

Analysis of R.C.C structure with floating columns:

For the selected plan, analysis is performed for both reinforced cement concrete structures with and without floating

columns. The R.C.C structure with floating columns is assessed for various seismic loading zones (II, III, IV, and V) and stacking conditions using the step-by-step methods shown below.

Particulars	Dimensions and values for RCC structure with floating columns.
Plan Dimensions	33mx34m
No. of stories	G+10
The building's total height	33.5metres
The depth of each story	3m
Height of parapet	1.3m
Size of beams	
Base to 3rd floor dimensions	300mmx600mm
From 3 rd floor to Top floor	300mmx530mm
Secondary beams	230mmx450mm
Size of columns	
Ground to 3 rd floors	500mmx700mm
4 th floor to 10 th floors	400mmx600mm
Thickness of walls	Twobricks, Onebrick thickness
Interior wall loads	6kN/m ²
Exterior wall loads	12kN/m ²
Seismic zone	2,3,4,5
Floor finish	1.5kN/m ²
Live load at all floors	3kN/m, 1.5kN/m(10 th floor)
The Density of concrete	25kN/m ³
The Density of brick	20kN/m ³
The Unit weight of steel	7850kg/m ³
Compression strength of concrete	Slabs M30 and Columns M40 and Beams M35
Strengthening of reinforcing steel	Fe415
Soil conditions	Medium
Response reduction factor	5
Importance factor	1.5



Showing R.C.C structure with floating columns



V.RESULTS AND DISCUSSION

This section compares the consequences of Reinforced Cement Concrete structures without floating columns to Reinforced Cement Concrete structures with floating columns in terms of deflections, storey drift, seismic stress, and movement around them. Graphs and tables are used to determine the difference.

Comparison of R.C.C without floating columns & with floating columns for Zone-II:

Base Shear

Comparison Property(Base Reactions)	RCC structure with floating columns	RCC structure without columns sections
Max.Shear Force(kN)	1943.47	1498.54

Storey Drifts Comparison of R.C.C without floating columns & R.C.C with floating columns:

Storey no	RCC structure with floating columns	RCC structure without floating columns
10(x-axis)	8.74×10^{-4}	1202×10^{-6}
(y-axis)	6.64×10^{-4}	707×10^{-6}
9(x-axis)	8.61×10^{-4}	1.096×10^{-5}
(y-axis)	5.84×10^{-4}	6.22×10^{-4}
8(x-axis)	8.55×10^{-4}	966×10^{-6}
(y-axis)	5.77×10^{-4}	619×10^{-6}
7(x-axis)	8.25×10^{-4}	944×10^{-6}
(y-axis)	4.95×10^{-4}	602×10^{-6}
6(x-axis)	8.21×10^{-4}	824×10^{-6}
(y-axis)	3.93×10^{-4}	0.000569
5(x-axis)	7.48×10^{-4}	0.000745
(y-axis)	0.384×10^{-3}	5.64×10^{-4}
4(x-axis)	0.621×10^{-3}	0.000738
(y-axis)	3.56×10^{-4}	5.38×10^{-4}
3(x-axis)	4.88×10^{-4}	6.36×10^{-4}
(y-axis)	2.8×10^{-4}	4.46×10^{-4}
2(x-axis)	3.0×10^{-4}	529×10^{-6}
(y-axis)	0.000146	0.000419
1(x-axis)	0.000238	0.000484

Axial forces at each storey for R.C.C without floating columns & R.C.C with floating columns:

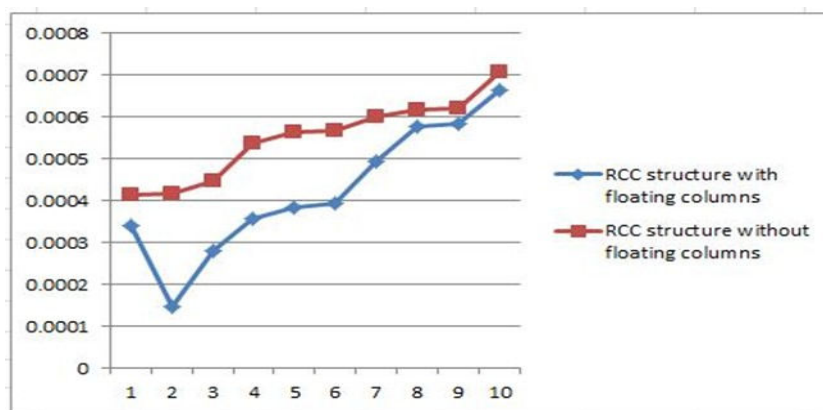
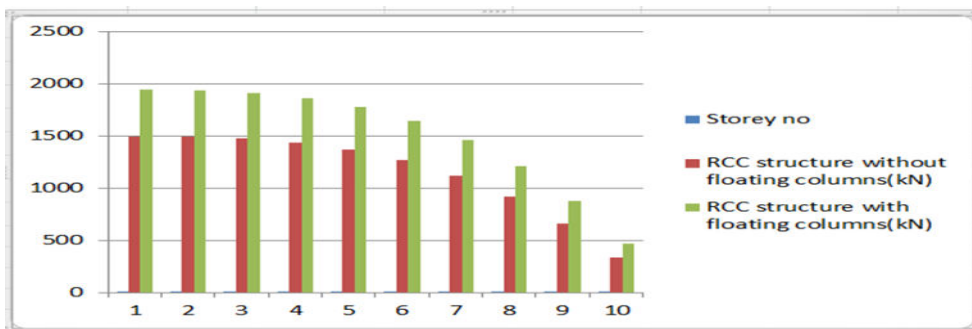
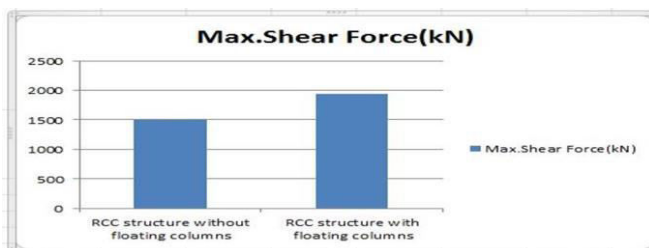
Storey no	RCC structure with floating columns(kN)	RCC structure without floating columns(kN)
10	340.873	196.921
9	643.161	206.821
8	883.259	363.210
7	1068.158	483.567
6	1205.057	572.680
5	1301.156	635.234
4	1363.650	675.918
3	1399.749	699.416
2	1417.013	710.424
1	1422.21	714.18

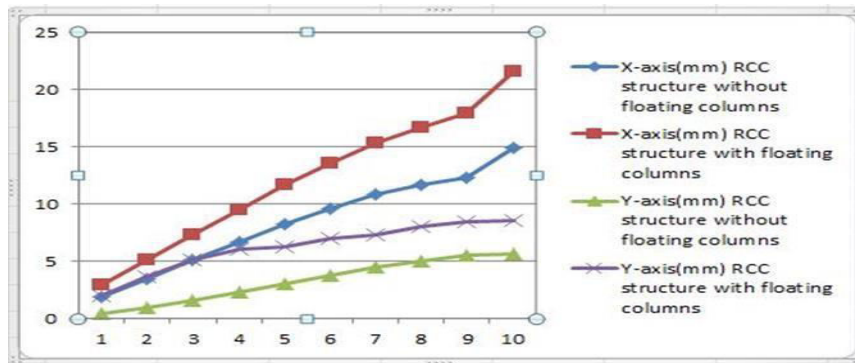


Storey displacement at each storey for R.C.C without floating columns & R.C.C with floating columns:

Storey no	X-axis(mm)		Y-axis(mm)	
	RCC structure without floating columns	RCC structure with floating columns	RCC structure without floating Columns	RCC structure with floating columns
10	14.9	21.55	5.62	8.54
9	12.30	17.94	5.53	8.42
8	11.72	16.74	5.04	8
7	10.81	15.32	4.45	7.3
6	9.61	13.61	3.78	7
5	8.21	11.66	3.06	6.3
4	6.67	9.54	2.32	6.1
3	5.07	7.32	1.61	5.1
2	3.45	5.09	0.94	3.7
1	1.91	2.90	0.38	2

GRAPHS:





GRAPHS FOR ZONE-II STOREY DRIFT, STOREY DISPLACEMENT ,BASE SHEAR,SIMILIARLY GRAPHS ARE OBTAINED FOR OTHER ZONES ALSO

VI.CONCLUSIONS

The analysis of R.C.C structures with floating columns reveals that the structure's axial force, base shear, storey displacements, and storey drifts are significantly higher than in R.C.C buildings without floating columns.

As a result, we may conclude that the R.C.C structure without floating columns is more cost effective than the typical R.C.C structure with floating columns, as secondary beams are used when building with floating columns.

Because of its inherent ductility, a R.C.C structure without floating columns outperforms a R.C.C structure with floating columns during an earthquake. As a result, energy dissipation through a structure with floating columns does not work effectively.

The optimal site for floating columns is on the first floor, which minimizes storey displacements and drifts throughout the building.

The base shear of the R.C.C structure with floating columns rose for Zones II, III, IV, and V by 62%, 73%, 77%, and 80%, respectively, as compared to the R.C.C structure without floating columns in those zones.

Hence Storey-drift values for R.C.C structures with floating columns rise by 50%, 60%, 70%, and 80%, respectively, as compared to R.C.C structures without floating columns in Zones II, III, IV, and V.

Hence Storey displacement values for R.C.C structures with floating columns rise by 60%, 70%, 80%, and 90%, respectively, as compared to R.C.C structures without floating columns in Zones II, III, IV, and V.

Hence, we have discovered that storey displacement for R.C.C structure with floating columns in Zone-V has exceeded storeydisplacement constraints per IS 1893:2002.

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