COMPARITIVE ANALYSIS & DESIGN OF IRREGULAR RCC BUILDING G+10 WORKING WITH FLOATING COLUMNS AND WITHOUT FLOATING COLUMNS IN VARIOUS SEISMIC ZONES USING ETABS

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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 paper, the seismic execution of the structure with or without the skimming sections is introduced as far as different boundaries, for example, story drifts, wind forces, story displacements, and axial forces. The structure is broke down by utilizing ETABS programming with zones- III and IV. In this structure the coasting segments are set at different areas at various stories that are considered for the examination. The fundamental point of this exposition is to assess the seismic reaction of the structure under different zones and with floating columns and comparing it with a normal building.

Key words: **Floating column, seismic analysis, ETabs2015, Story drifts, Story displacements, Axial forces.**

1. INTRODUCTION

In urban regions these days numerous multi story structures in India, today have a vacant story as a disagreeable component. This is being embraced to aggregate stopping or gathering hall in the lower story. To consider the conduct of the structure during seismic power (ie quake powers) are carried on the ground. The conduct of a structure during seismic tremor load relies upon the fundamentally upon its auxiliary shape, size, geometrical appearance notwithstanding decrease the pivotal power created on the structure because of quake powers. The seismic tremor powers did on the structure created at various story levels in the structure. The seismic powers are made at various floor levels in a structure should be brought down along the stature of the lower ground level of the structure by the short way, any diversion or deteriorate in this heap move way results causes story relocation, story float, the lackluster showing of the structure. The multi story structures with vertical reinforcements like ie-Hotel structures, Multiplex structures, Shopping Malls with a couple of stories wide than the rest buildings. Due to unexpected reason in seismic powers at the level where the structure got suspend. Structures that have less sections or dividers in a specific floor story or with un brokenness tall story building which will in general reason harm or breakdown which is started in that story, because of the openings of the structure which may cause a beating impact which is started in that story , In numerous structures with the open ground story is aggregated for leaving of vehicles. Because of the open stories, the firmness of the structure may diminish which may cause a breakdown of the structure. In the seriously harmed in Gujarat during the 2001 Bhuj quake .structures with coasting sections that hanging pillars which comprises of cantilever overhangs at a middle of the road story and don't go right to the base, which have discontinuities in the heap move way of the structure. In such structures causes colossal misshapenings, upsetting minutes, structures in urban areas are required to have section free space at lower base story because of short space for stopping, populace, and furthermore for tasteful and utilitarian purposes. The structures with gliding segments are exceptionally inconvenience 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(i.e. skimming columns)causes deviations, or irregularity causes gigantic story relocations, story drifts, sliding, upsetting, and so on..; which brings about lackluster showing of the structure..

Floating Column: A segment is a vertical part which moves load caused because of i.e. (floor, pillars) and move the heap legitimately to the establishment. On account of floating columns segments is a vertical part that lays on a level shaft and doesn't have an establishment. The skimming sections don't move the heap straightforwardly to the establishment because of intermittence. Of the section, it moves the heap to underneath the shaft on which it's laying on it. The segment goes about as a point load on the pillar and this shaft moves the heap to the segment beneath it.

2. LITERATURE REVIEW

1. Williams, Gardonia&Bracci, In this examination the efficient benefit of a given retrofit method technique utilizing the casing structure work subtleties. A parametric investigation was directed to characterize how certain quake impacts are diminished by a seismic retrofit technique. The aftereffects of examination and study misuse that, for most circumstances, a seismic retrofit working of a current structure is more expense than development of another building.

2. Thermo et al In this undertaking we examined the presentation of composite steel-concrete frames. The insufficiencies of the codes and provisions that cause troubles in the quality showed by the edges. This is because of the structure code that limitations the joints on segment property such second-request impacts prompting developing over-moderate plan and investigation. The inelastic static limits strategy, for example, weakling examination was utilized for acquiring the reaction of the various structures.

3.A.p.Mumdada, S.g awadakar, In this paper we study conduct for engineering drawing and the encircling drawing of the structure having gliding segments .for the distinction in G+7 existing private structure with and with drifting sections the information has been gathered and the venture is completed by utilizing STAAD Pro three models are made. For utilizing proportionate static examination for each model is analyzed by using STAAD Pro. Various boundaries, for example, pivotal power, second circulation, the significance of the line of activity of power, and seismic tremor zone factors are read for models. This will assist with finding the different logical properties of the model structure and furthermore have an exceptionally orderly and efficient plan for the buildings.

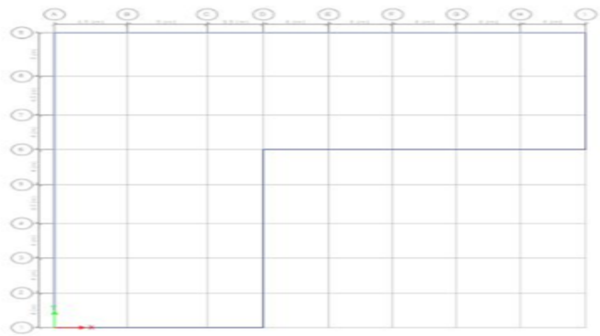
4.DRC.Pise, S.S Kadam, In this project we study the behavior of floating columns for Multi storey building various seismic zones analysis is done by using tabs, for soil type rock type at seismic zone G+5.Using time history analysis and equivalent static analysis for building with floating columns by using SAP2000 software we get storey drifts, time period

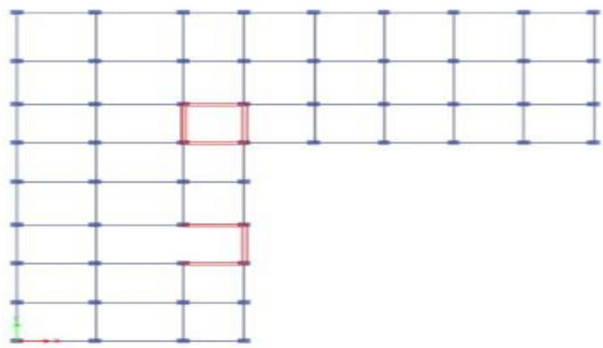
3. METHODOLOGY

The main objectives of proposed work are:

1. Response spectrum analysis on G+10 irregular buildings having floating columns and without floating columns at different storeys levels.
2. To compare the Base shear, storey drift, story displacement, axial forces.

Examination of R.C.C multi story working without drifting sections and with coasting segments is carried out by using ETABS 2015 software. Comparing both structures which will be the effective one for seismic zoning conditions can be suggested based on Indian standard codes.





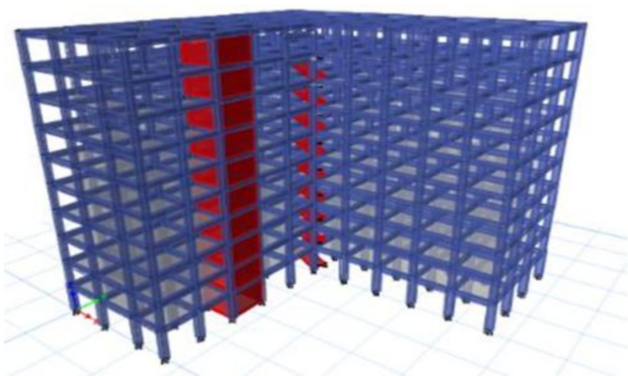


Figure. 1&2 Plan and 3d Section view Structure model.

Particulars	Dimension/Value for RCC structure without floating columns
Plan Dimension	33mx34m
No. of stories	G+10
The total height of the structure	33.5m
Depth of each story	3m
Depth of parapet	1.3m
Size of beams	
Base to 3rd floor	300mmx600mm
3rd floor to 10th floor	300mmx530mm
Size of columns	
Base to 3rd floor	500mmx700mm
4th floor to Top floor	400mmx600mm
Thickness of walls	2brick, 1brick 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 stories	3kN/m, 1.5kN/m(10th floor)
Unit weight of concrete	25kN/m^3
Unit weight of brick	20kN/m^3
Density of steel	7850kg/m^3
Strength of concrete	Slabs M30, Columns M40, Beams M35
Strengthening of reinforcing steel	Fe415
Soil condition	Medium
Response reduction factor	5
Importance factor	1.5

Table 1: Particulars of structural model

Table 2: Unit weight of structural materials.

S.No	Materials	Unit Weight
1	Concrete-RCC	25kn/m^3
2	Plain Cement Concrete	24kN/m^3
3	Brick	20kN/m^3
4	Plaster	21kN/m^3
5	Soil -16	18kN/m^3
6	Water	10kN/m^3
7	Steel	78.5 kN/m^3

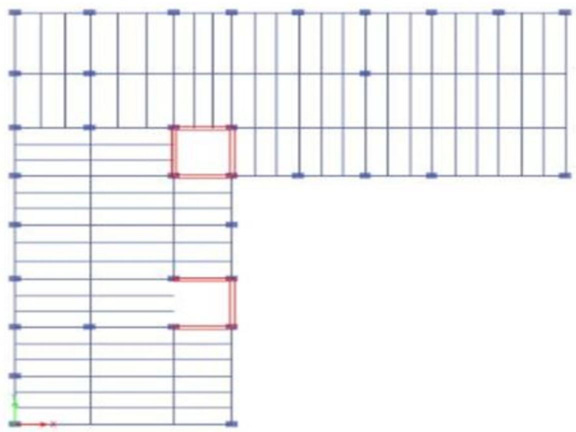
Table 3: Different Seismic zones Definition

Zone-II	Zone-III	Zone-IV	Zone-V
0.1	0.16	0.24	0.36

- R – Response Reduction factor = 3 or 5(for moment resistant structure)
- Importance factor = 1(for general building.) or 1.5(for important building)
- Soil factor = 2 = for general soil.
- Damping ratio = 0.05(for concrete).
- Seismic Loading
  Self-weight (with factor=1)
- External Wall Load = 0.23 x 3 x 20 = 11.6 kN/m^2
- Internal Wall Load = 0.12 x 20 = 3kN/m^2
  Load of floor finish = 0.06 x 24 = 1.4kN/m^2 or 1.5kN/m^2
- Load of slab=0.15 x 25 = 2.875 kN/m^2
- Live load=Generally for Commercial Building = 3kN/m^2

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

For selected plan analysis is done for both Reinforced Cement Concrete structure with floating columns & without floating columns. Here R.C.C structure with floating columns is analyzed for various seismic loading Zone-II, Zone-III, Zone-IV, and Zone-V with various stacking conditions step by step methodology demonstrated below. Similar data has been taken as per above table similar beam sections are taken but floating columns are assigned as per usage for the building. And analysis is carried out my using the response spectrum analysis for the building, here we study the behavior of the both structures as per Indian standard code. Hence we take similar data comparative analysis is done by using E-Tabs software various seismic zone.



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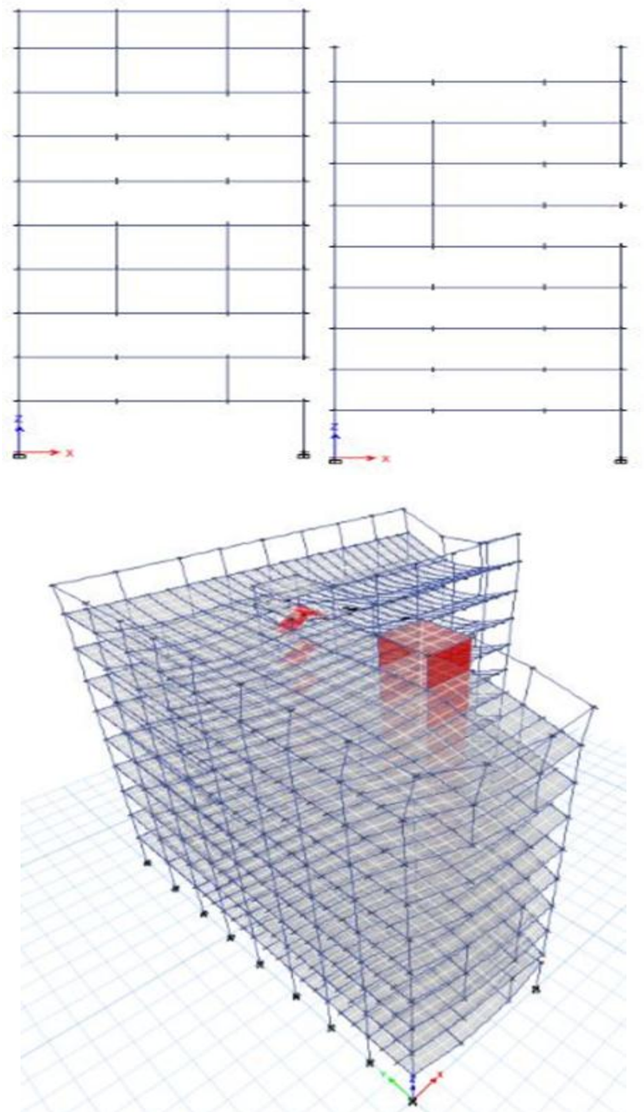


Figure. 3&4 Plan and 3d Section view of Structure model with deflection

4. RESULTS AND DISCUSSIONS

Consequence of Reinforced Cement Concrete structure without floating columns & Reinforced Cement Concrete structure with floating columns are compared for deflections, storey drift, seismic loading, and movement about it. Graphs and tables are plotted to get the difference.

Story Drift: It is characterized as the distinction in horizontal diversions caused between two nearby stories (or) floors of the structure. During a tremor, huge horizontal burden powers can be forced on the structures; Lateral redirection and drift, removal has three essential consequences for a structure; the development can influence the basic elements (such as pillars and sections, chunks); the developments can influence neighboring structures. Without appropriate thought boundaries during the plan procedure of the structure, sidelong avoidances and floats, removals can effectively affect building components, nonstructural components, and close to structures during the breakdown cover on one another structure.

Base shear: It is an estimation of the most extreme sidelong power that will happen because of seismic level ground movement at the base of a structure. It relies on the dirt condition at the site and because of the seismic burdens.

Story displacement: It can be characterized as that dislodging of a story concerning the base of a structure.

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

Table 4: Base Reactions of structure model

Comparison Property(Base Reactions)	RCC structure without columns sections	RCC structure with columns sections
Max.Shear Force (kN)	1422.21	714.18

Table 5: Story Drifts of structure model

Storey no	RCC structure Without floating columns	RCC structure with 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)	8.55x10-4	966×10^{-6}
(y-axis)	5.77x10-4	619×10^{-6}
7(x-axis)	8.25x10-4	944×10^{-6}
(y-axis)	4.95x10-4	602×10^{-6}
6(x-axis)	8.21x10-4	824×10^{-6}
(y-axis)	3.93x10-4	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)	$3.0x10^{-4}$	$529x10^{-6}$
(y-axis)	0.000146	0.000419
1(x-axis)	0.000238	0.000484
(y-axis)	$8.4x10^{-4}$	$4.15x10^{-4}$

Table 6: Story Displacement of structural model

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

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

Table 7: Base Reactions of structural model

Comparison Property(Base Reactions)	RCC structure without columns sections	RCC structure with columns sections
Max.Shear Force(kN)	2275.54	1532.18

Table 8: Story drift of structural model

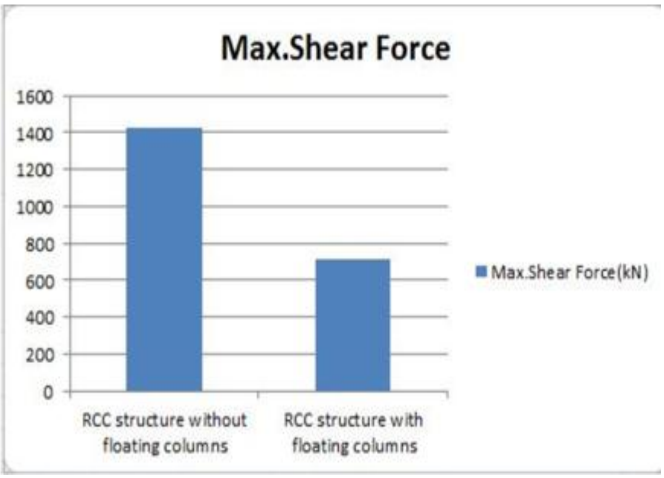
Storey no	RCC structure without floating columns	RCC structure with floating columns
10(x-axis)	$1081x10^{-6}$	$1923x10^{-6}$
(y-axis)	$6.46x10^{-3}$	0.001029
9(x-axis)	$906x10^{-6}$	$1319x10^{-6}$
(y-axis)	$584x10^{-6}$	$9.96x10^{-4}$
8(x-axis)	$8.74x10^{-4}$	$1176x10^{-4}$
(y-axis)	$5.19x10^{-4}$	0.000991
7(x-axis)	$8.28x10^{-4}$	0.0001040
(y-axis)	$4.96x10^{-4}$	$9.63x10^{-4}$
6(x-axis)	$782x10^{-6}$	$915x10^{-6}$
(y-axis)	$4.4x10^{-4}$	$910x10^{-6}$
5(x-axis)	$806x10^{-6}$	$846x10^{-6}$
(y-axis)	$424x10^{-6}$	$902x10^{-6}$
4(x-axis)	0.000723	$8.92x10^{-4}$
(y-axis)	$3.94x10^{-4}$	0.000861
3(x-axis)	$6.46x10^{-4}$	0.000854
(y-axis)	0.000386	0.000775
2(x-axis)	$5.89x10^{-4}$	$757x10^{-6}$
(y-axis)	$3.57x10^{-4}$	0.000692
1(x-axis)	$4.18x10^{-4}$	0.000646
(y-axis)	$2.98x10^{-4}$	0.000615

Table 9: Story Displacements of structural model

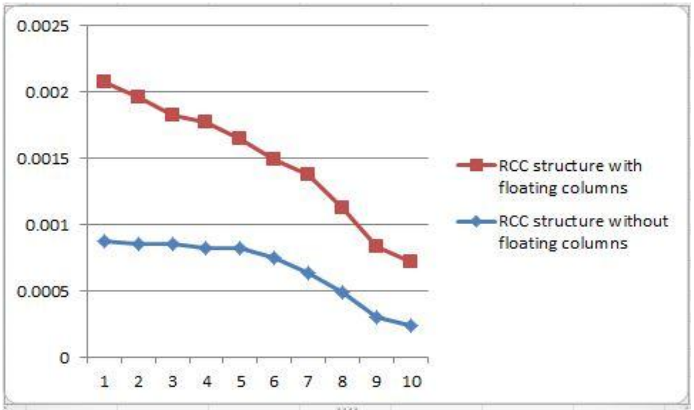
Storey no	X-axis(mm)		Y-axis(mm)	
	RCC structure without floating columns	RCC structure with floating columns	RCC structure without floating columns	RCC structure with floating columns
10	19.6	29.48	8.99	18.6
9	18.3	28.71	8.8	16.2
8	16.9	25.3	8.0	13.5
7	15.3	22.7	7.12	10.8
6	14.9	19.5	6.05	8.5
5	13.14	15.9	4.90	8.03
4	10.68	12.2	3.72	6.3
3	8.18	9.6	2.57	5.1
2	5.5	7.5	1.51	3.7
1	2.3	3.1	0.62	2

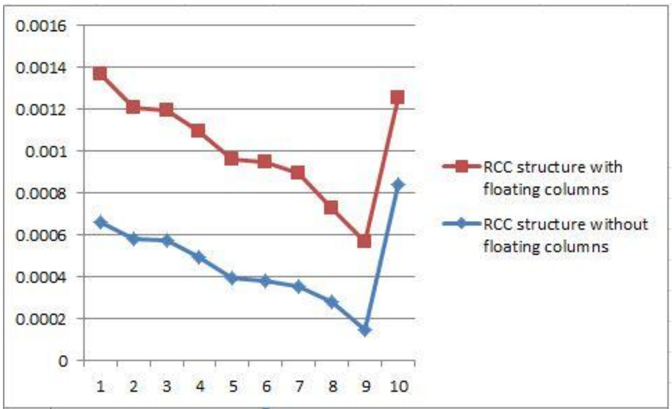
4.2 Comparative results zonal wise

For Zone-II seismic zone:

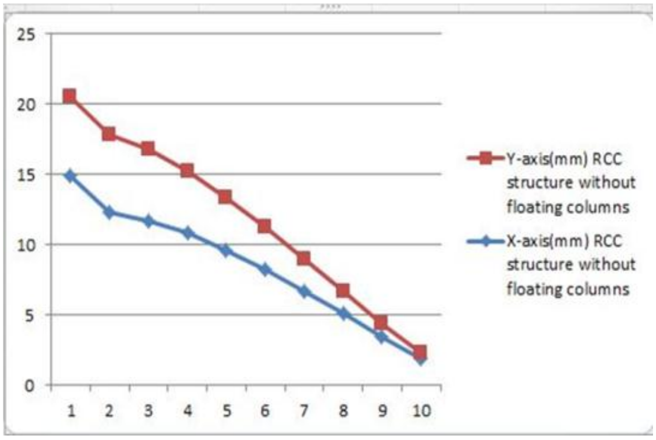


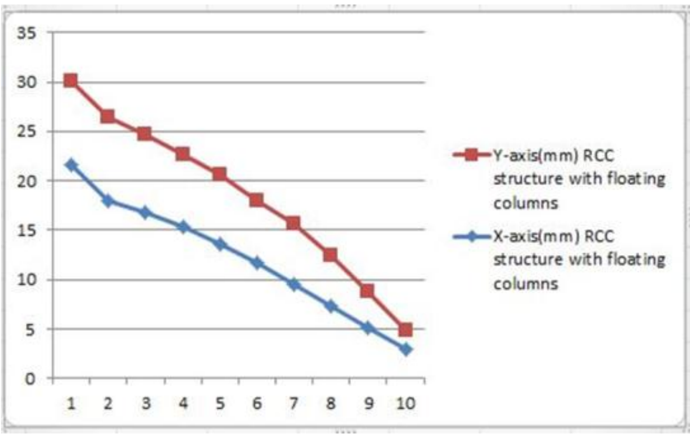
Storey drifts on X-axis & Y-axis



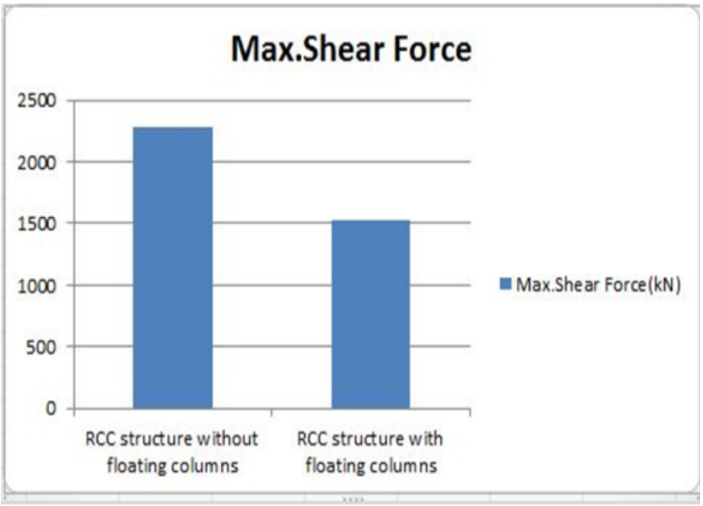


Story Displacements along X-axis & Y-axis

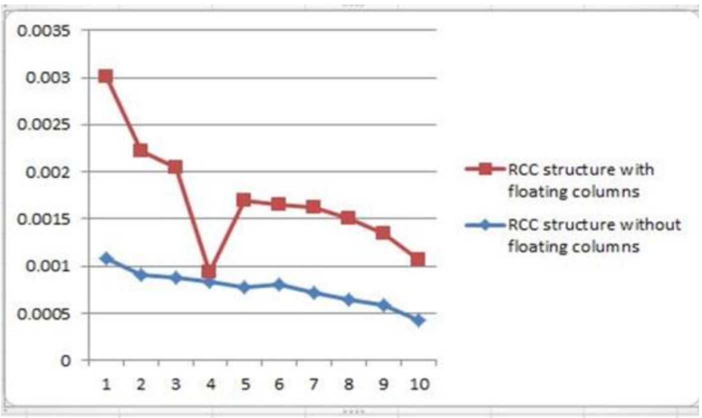


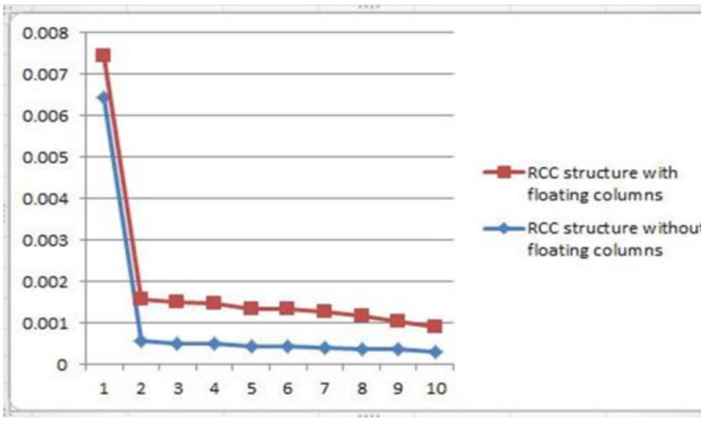


For Zone-III Seismic Zone

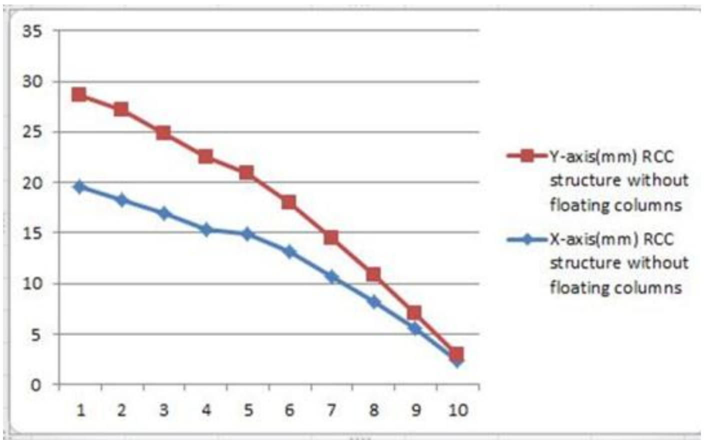


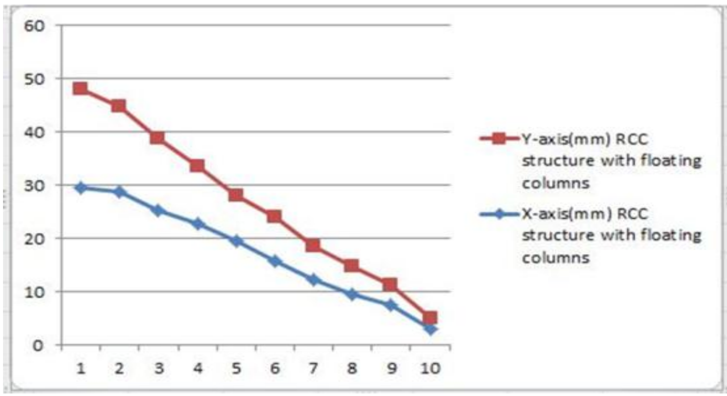
Story drifts along X-axis & Y-axis





Story Displacements along X-axis & Y-axis:





5. CONCLUSIONS

- The analysis of R.C.C structures with floating columns shows that the horizontal forces, moments, and shear forces of the structure are very less for the same loading as compared to R.C.C structure without floating columns.
- The moments and axial forces result in dimensions of columns and beams. Hence here we can conclude that R.C.C structure with floating columns is more economical than conventional R.C.C structure without floating columns.
- The storey drift, storey displacements values increase ZoneII to ZoneIII.
- Hence storey drift, storey displacement for R.C.C structure with floating columns values increases to 5-10% difference to R.C.C structure without floating columns.
- Horizontal forces, Base reactions almost remain the same for all the zones.
- The stiffness of the R.C.C structure without floating columns is found greater than the R.C.C structure with floating columns.
- The axial forces in R.C.C building with floating columns are less than axial forces in R.C.C building without floating columns.
- Earthquake consideration because of inherent ductility characteristics, R.C.C structure without floating columns performs better than an R.C.C structure with floating columns.

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