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Multi storey Building with and Without Floating Column

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Abstract*: The current study find out the effects of the structural irregularity which is produced by the discontinuity of a column in a building overcome to seismic loads in Zone III. In this paper analysis is done by equivalent static method for a multistory Rcc frame of G+4, G+10, G+20 buildings with and without floating columns(FC) in seismic Zone-III. Different cases of the building are considered for the study by varying the location of floating columns on 1st floor. The analysis is carried with the help of software ETABS ver.13.

Keywords: – Floating column (FC), equivalent static analysis, displacement, ETABS ver.13.

I. INTRODUCTION

Now a day's many multi-storied buildings in India constructed for various purposes. The buildings are used mainly for residential, industrial, commercial etc purpose. Floating columns an common and inescapable feature. This is being adopt-

- **i)** To give more amount of space in ground floor for habitation of parking or ground lobbies.
- **ii)** For architectural luster.
- **iii)** To boost floor space index.

The floating column (FC) is a vertical member which situated on a beam and doesn't have a rigid foundation. The FL act as a pin load on the beam and this beam distribute loads to the columns which are connected with this beam. The flexure and shear demand of the beams which supports floating columns are higher compare to surrounding beams. The building with FC can be analyzed with help of different analysis software such as STAADpro, SAPv2000, etabs , Ansys etc. FC in a building give end results in a concentration of forces or in an adverse load path pattern or deflection in the vertical lateral force resisting system. This paper represents the results of study of structural response quantities of a multi-storied building along FC

II. OBJECTIVE

The objective undertaken in this study is to analyze the G+4(15m.), G+10(33m.) and G+20(63m.) storey building with floating columns at zone III and also to check the storey displacement in different case for floating columns at various locations.

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Case-1 Normal Rcc frame.

Case-2 RCC frame along floating columns(FC) located outer circumference (1 Sides)

Case-3 RCC frame along floating columns(FC) located outer circumference (2 adjacent Sides)

Case-4 RCC frame along floating columns(FC) located outer circumference (3 adjacent Sides)

Case-5 RCC frame along floating columns(FC) located outer circumference (All Sides)

Case-6 Rcc frame along floting columns(FC) located outer circumference (All sides) accept corner columns.

III. MODELING AND ANALYSIS

The buildings considered to analysis regular G+4, G+10, G+20 normal Rcc frames of plan dimension 22.5m×25m shown in fig 1, considered the buildings are situated in Zone- III as per IS 1893-2002. The buildings are modeled using the software ETABS ver.13.

Table 1: STRUCTURAL AND MATERIAL DATA

SN.	I	ii	Iii	iv			v
1	STRUCTURE	Beam	Slab	Column			Wall
2	STORY	-	-	G+4	G+10	G+20	-
3	SIZE	350× 730 mm^2	150 mm	350× 350 mm^2	500×500 mm^2	660× 660 mm^2	300 mm
4	MATERIAL	M20	M25	M25	M30	M35	Brick

Table 2: ARCHITECTURAL DATA

S.N.	I	Ii
1.	No. of stories	G+4, G+10, G+20
2.	Floor height	3m
3.	Dimension of plan	25m×22.5m

Table3: SEISMIC DATA

S.N.	I	ii
1.	Seismic zone	III
2.	Importance factor(I)	1
3.	Response reduction factor(R)	3
4.	Zone factor	0.16

Table 4: LOAD

S.N.	I	Ii
1	LL (Live load)	3KN/M^2
2	WL (Wall load)	13KN/M

Model:

- Model 1: G+4 Rcc building.
- Model 2: G+10 Rcc building.
- Model 3: G +20 Rcc building.

These 3 models analyzed for following different cases

Case:

- **Case I**: Rcc frame without floating column.
- **Case II** : Rcc frame with floating column (eliminate all GF circumference column of frame A)
- **Case III** : Rcc frame with floating column (eliminate all GF circumference column of frame A, 1)
- **Case IV** : Rcc frame with floating column (eliminate all GF circumference column of frame A, 1, 6)
- **Case V** : Rcc frame with floating column (eliminate all GF circumference column)
- **Case VI** Rcc frame with floating column (eliminate all GF circumference column accept corner columns)

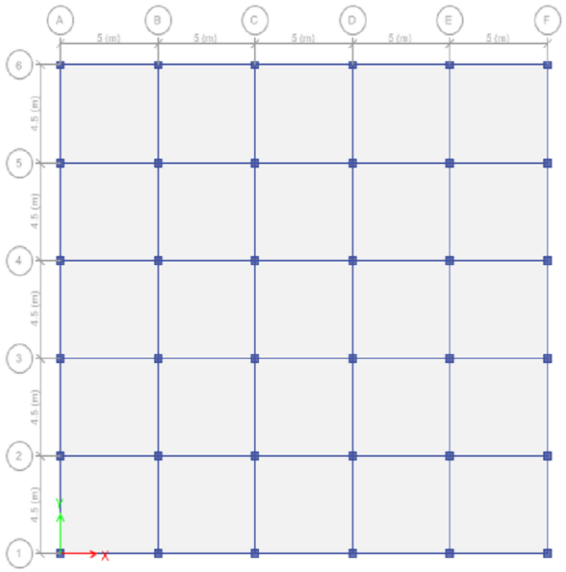

Fig 1: Plan of Rcc Building

Different seismic codes are used for different regions or a country. For the seismic design of building in India the seismic code used is IS 1893 (Part1): 2002. The dependable properties for this force are mass of building (m), stiffness (k) and seismic coefficient of the structures. Other than these properties it is also depends on similar to seismic properties of seismic zone in which the structure is situated, significance of the structure, the soil strata, and its ductility.

IV. RESULTS

As a result of the appliance of lateral loads in direction of X the structure will be analyzed for different combinations of load given in clause of 6.3.1.2 of IS1893-2002. For the specified load combinations maximum displacement at each floor is noted in X direction by equivalent static analysis and shown below in the form of graph.

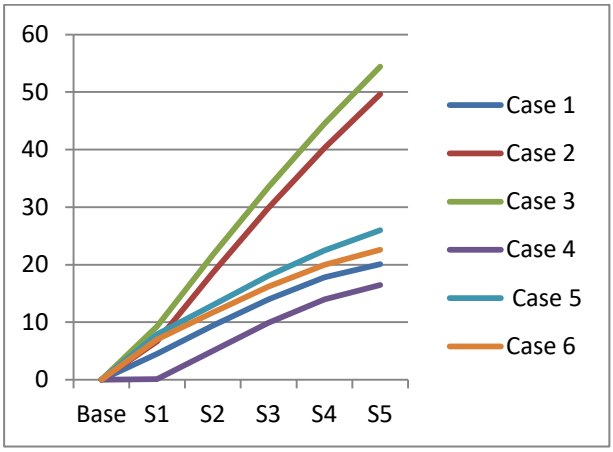

Fig 2: Displacement (mm) of G+4 building

Table 5: Displacement values (mm) of G+4 building

Story	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Base	0	0	0	0	0	0
S1	4.5	6.7	9.3	0.1	7.9	7
S2	9.4	18.6	21.7	5	13	11.7
S3	14	29.9	33.5	9.9	18.1	16.2
S4	17.8	40.3	44.5	14	22.5	20
S5	20.1	49.6	54.4	16.5	26	22.6

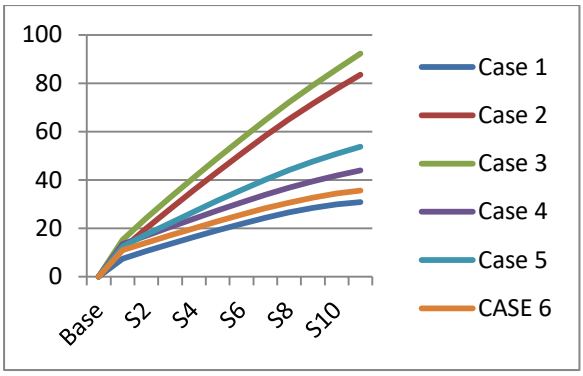

Fig 3: Displcement (mm) of G+10 building

Table 6: Displacement (mm) values of G+10 building

Story	Case 1	Case 2	Case 3	Case 4	Case 5	CASE 6
Base	0	0	0	0	0	0
S1	7.4	11.5	15.3	13.6	12.5	11
S2	10.6	20	24.2	17	17.5	14.1
S3	13.5	28	32.7	20.5	22.2	17.1
S4	16.4	35.9	41	24	26.9	20
S5	19.2	43.5	49.2	27.4	31.5	22.9
S6	21.9	51	57.1	30.7	35.9	25.7
S7	24.4	58.2	64.8	33.9	40.1	28.3
S8	26.7	65.1	72.2	36.8	44.1	30.6
S9	28.5	71.6	79.2	39.5	47.7	32.7
S10	30	77.7	85.8	41.8	50.9	34.4
S11	30.9	83.5	92.2	44	53.7	35.7

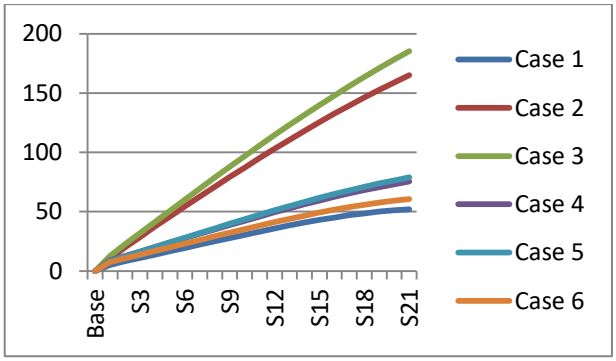

Fig 4: Displacement (mm) of G+20 building

Table 7: Displacement values of G+20 building

Story	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Base	0	0	0	0	0	0
S1	5.1	10.4	12.6	9.1	8.4	7.5
S2	8.2	19.8	22.5	12.6	12.3	10.7
S3	11	28.6	31.9	16.4	16.2	13.8
S4	13.8	37.3	41.3	20.2	20.2	16.9
S5	16.6	45.9	50.6	23.9	24.2	20
S6	19.4	54.4	60	27.7	28.1	23.1
S7	22.2	62.8	69.4	31.4	32	26.2
S8	25	71	78.7	35.1	35.9	29.3
S9	27.8	79.2	87.8	38.8	39.8	32.3
S10	30.5	87.2	96.8	42.4	43.6	35.3
S11	33.2	95.2	105.7	45.9	47.4	38.3
S12	35.8	103	114.5	49.5	51.1	41.2
S13	38.4	110.6	123.1	52.9	54.7	44
S14	40.8	118.1	131.5	56.2	58.2	46.7
S15	43	125.4	139.8	59.4	61.6	49.2
S16	45.1	132.6	147.9	62.5	64.9	51.6
S17	47	139.5	155.8	65.4	68	53.9
S18	48.6	146.2	163.5	68.2	71	55.9
S19	50	152.7	171	70.7	73.8	57.7
S20	51.2	158.9	178.2	73.1	76.4	59.3
S21	52.1	165.1	185.3	75.5	79	60.7

Table 8: Maximum displacement (mm) value

Model	Case 1	Case 2	Case ,3	Case 4	Case 5	Case 6
G+ 4	20.1	49.6	54.4	16.5	26	22.6
G+10	30.9	83.5	92.2	44	53.7	35.7
G+20	52.1	165.1	185.3	75.5	79	60.7

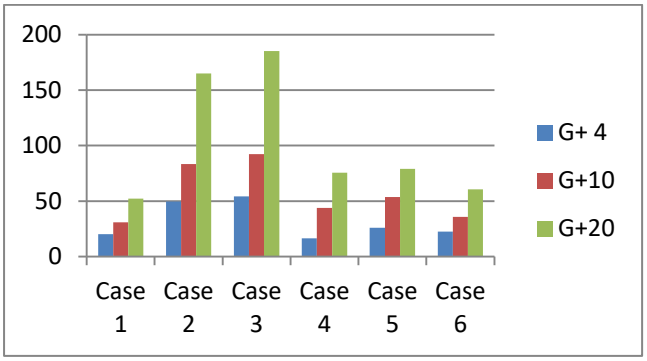

Fig 5: Maximum displacement (mm)

V. CONCLUSION WITH FUTURE SCOPE

Preliminary outcomes are carried out on building models comparing six cases. If we comparison displacement difference in case 1 and case 6 in the X direction then we achieved less value of displacement as comparison to difference of case 1 to all the remaining cases like cases 2, case3, case 4, and case 6 in all prescribed models.

In case 4 of G+4 the value is lesser then case 1 but there is also more displacement in the Y direction compare to another cases . Percentage increase in displacement w.r.o. case 1in X direction given in table 6.

Table 9: Percentage increase in displacement with respect to Case-1 in X direction

Case	G+4	G+10	G+20
Case 2	146.77	170.23	216.9
Case 3	170.65	198.38	255.7
Case 4	-17.91	42.4	44.9
Case 5	29.35	42.39	44.8
Case 6	12.44	15.53	16.5

From above results we conclude that if it is necessary to provide floating column then Case 5 and case6 is the best option to achieve less displacement as comparison to remaining Cases.

so As from result displacement on floating column(FC) high in order to get better its performance at the time of earthquake it is necessary for certain remedial measuring adopted like Shear Wall, Braced frame structures and also on check displacement difference in different seismic zone.

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