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COMPARE THE EFFECT OF FLOATING COLUMN UNDER EARTHQUAKE EXCIATATION IN G+15 L SHAPE BUILDING

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Abstract: This Now a day's multi-storey buildings are constructed for intension to build residential and commercial buildings. Few columns at ground storey is mostly a common feature that is known as open ground storey . Mostly the ground storey is kept free without any constructions for the parking purpose .The multi-storey buildings having floating columns, which situated in seismically active areas (zone IV,V) are very dangerous. This paper contains effect of floating column under earthquake excitation in (G+15) storey for L shape building. At first storey building level (G+1) five different cases of floating columns are used. Dynamic Analysis of multi-storey building is done by using Response Spectrum Method. The analysis is done in ETABS software by using IS 1893(part1)2016.The main aim of this project is to find the best position of floating column in different five cases and improve the structure stability of building for best position of floating column by providing the shear wall

***Index Terms* - Floating column, Earthquake, L shape building, G+15 storey, ETABS software, Response spectrum**

I. INTRODUCTION

The Performance of a multi-storey building during earthquakes depends upon overall shape, size and geometry. The earthquake forces developed at top storey need to comes at ground storey by the shortest path. Any discontinuity in this load transfer path results failure of the building. The Multi-storey buildings with vertical setbacks (like the hotel buildings with a few storeys wider than the rest) forms a sudden jump in earthquake forces at the level of discontinuity. The building contains fewer columns or wall which situated at particular storey level are main reason to failure. In Floating column building, discontinuity of load transfer large occurs, due to this reason seismic analysis of floating column building must be carried out.

Now a day's multi-storey buildings are constructed for intension to build residential and commercial buildings. Few columns at ground storey is mostly a common feature that is known as open ground storey. Mostly the ground storey is kept free without any constructions for the parking purpose. Generally Closely spaced columns are not convenient for parking floor as compare to upper floors. Hence to sidestep from that complication, floating column concept has come into reality.

II. Floating Column

Column is vertical member which start from the foundation level. Floating column is also vertical member which rest on beam. The beam transfers the load to the adjacent column and that column transfer load to the footing. Generally discontinuity in the load path in moment frame arises due to floating column. That is when column coming from the top storey is discontinued by lower storey. Due to this, load from overhanging portion transfer to nearest column and column to foundation and failure of column occurs and number of columns required at ground storey. Due to this reason we need to select the best position of the floating column and in seismically active areas earthquake analysis of the building must be done.

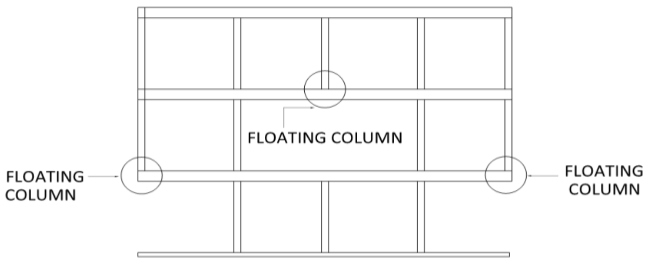

Fig -1 : Floating columns

Grade of	M25

III. OBJECTIVE

The floating columns are eliminated placed at bottom storey to serve parking purpose. In this study G+15 L shape building with and without floating column are considered. 5 different cases are considered for the study. The objectives of this project are as follows

1. To model the G+15 L shape building using ETABS 2017
2. To carry out dynamic analysis by response spectrum method for different 5 cases by varying the position of the floating column in G+15 L shape building (IS1893:2016)
3. To study the best and worst position of the floating column
4. To improve the structure stability of building for best position of floating column by providing the shear wall.

1. MODELLING AND ANALYSIS

A. Modeling

A G+15 storied L shape building with and without floating column located in zone III of India as per code IS 1893 (part 1):2016 were taken for the study. Different five cases of floating columns in first storey are considered for the study. Modeling and analysis of the building is done by using ETABS software. Dynamic analysis is done by response spectrum method. From that maximum storey displacement, storey drift, storey shear are compared and best position of the floating column is carried out.

Particulars	Reinforced concrete Building
Occupancy	Residential building
Number of stories	(G+15)
Total height of building	53 M
Ground floor height	2.5 M
Intermediate floor height	3 M
Nature of soil	Medium soil
Seismic zone	III(Table 3,Is 1893 part1:2016)

Table -1: building description

Column Size	450 x 600 MM
Beam size	230 x 450 MM
Slab Thickness	125 MM
External wall thickness	230 MM
Internal wall thickness	150 MM

Table -2: Member dimension

concrete	
Grade of steel	Fe-500
Density of concrete	25KN/m³(IS-875 part1:1987)
Density of Brick	18.85 KN/m³

Table -3: Material used

Live load on floor	2KN/m (IS 875 part2:1987)
Sunk load	5 KN/m²
Floor finish Load	1 KN/m² (IS875 part2:1987)
Parking Load	5 KN/m²
Lift Machine Room Load	10 KN/m²
Wall load(230mm Thickness)	9.05 KN/m
Wall load(150mm Thickness)	5.21 KN/m
Importance Factor	1 (IS 1893 part1:2016)
Response Reduction Factor	5 (IS-1893 part1:2016)
Supports	Fixed

Table - 4: load considered

There are 5 different cases are considered. These are as follows

1. Regular building (model1)
2. Floating column at outer-periphery (model2)
3. Floating column at corner and inside(model3)
4. Floating column at inside the building (model4)
5. Floating column at one of the edge (model5)

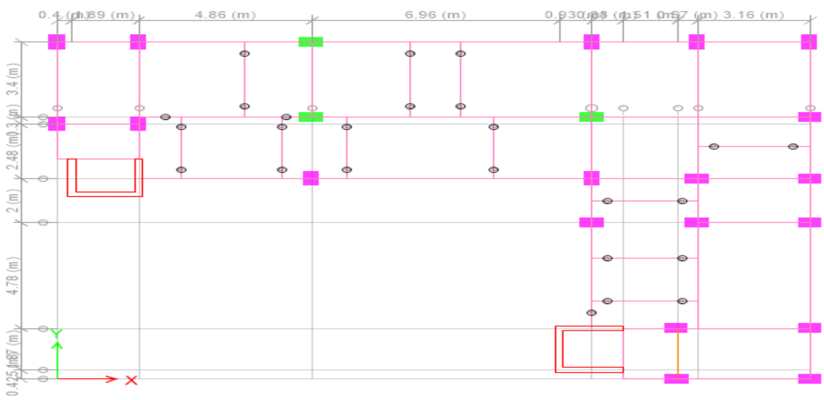

Fig - 2: Model 1

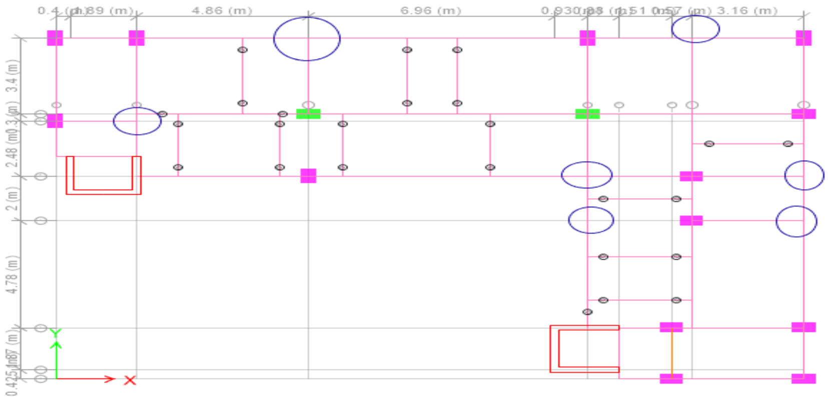

Fig - 3: Model 2

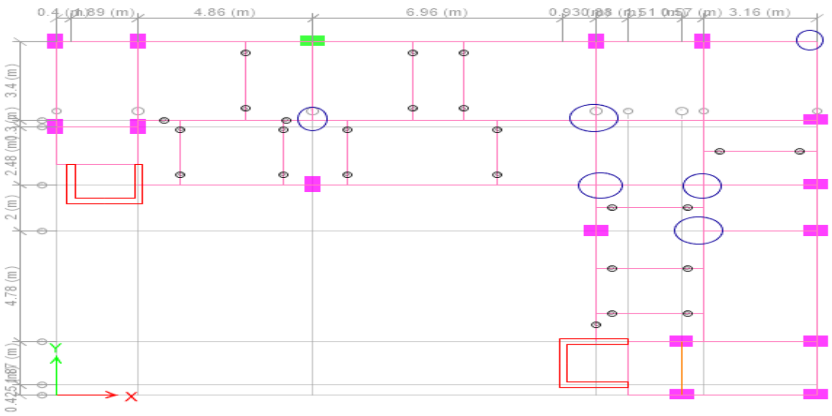

Fig - 4: Model 3

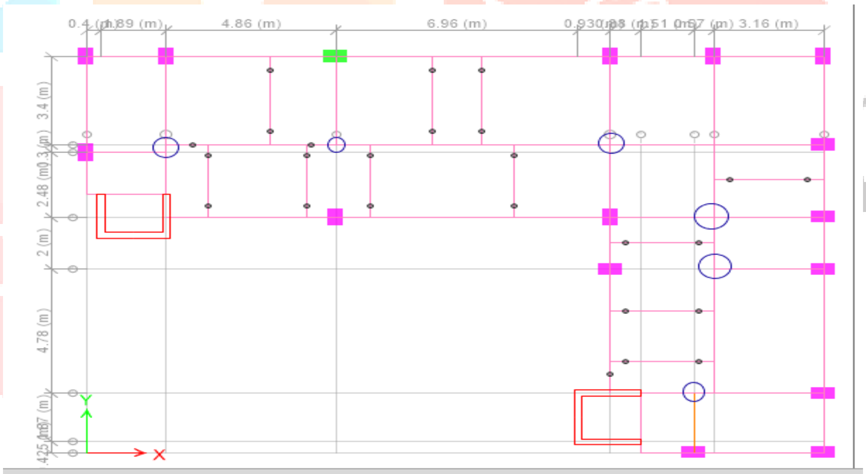

Fig - 5: Model 4

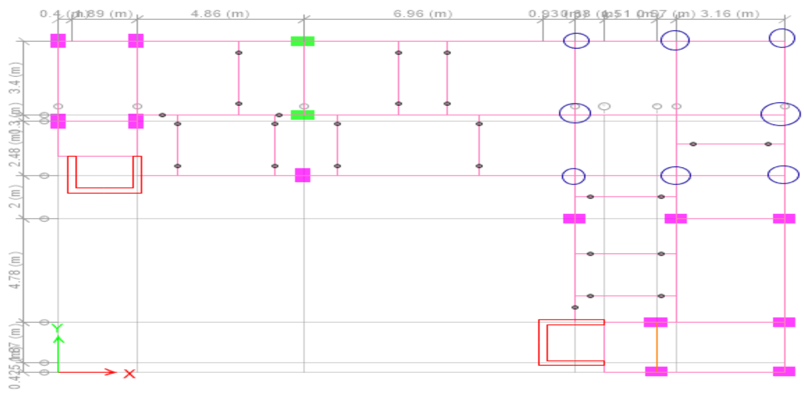

Fig - 6: Model 5

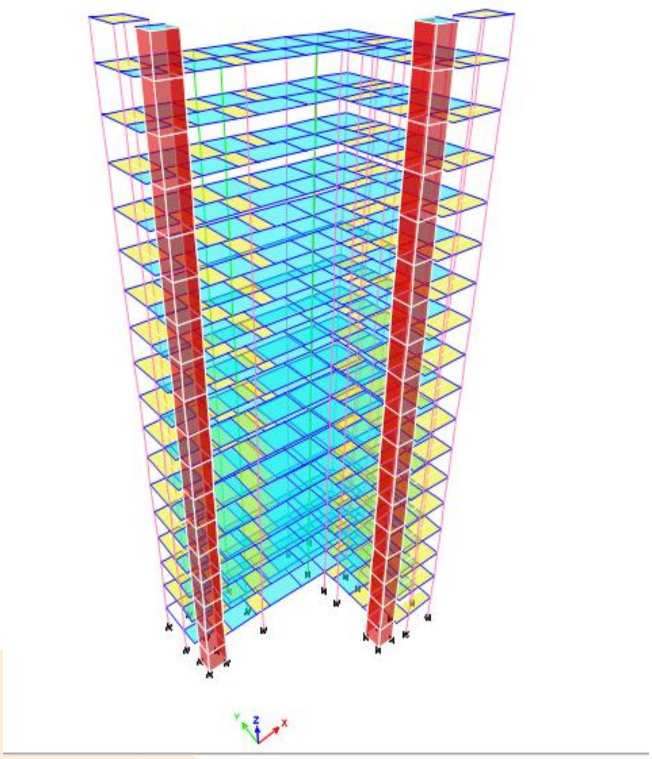

Fig - 7: 3D view of model using ETABS

2. ANALYSIS

5 models are completed using ETABS software. Seismic analysis is done by response spectrum method. The values of storey drift, storey displacement and storey shear obtained from Response spectrum analysis is listed below.

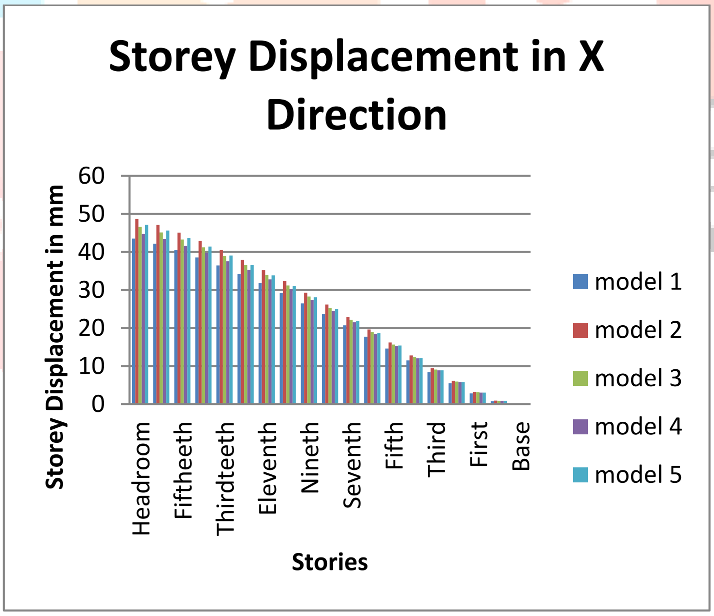

Chart - 1: Displacement in X direction

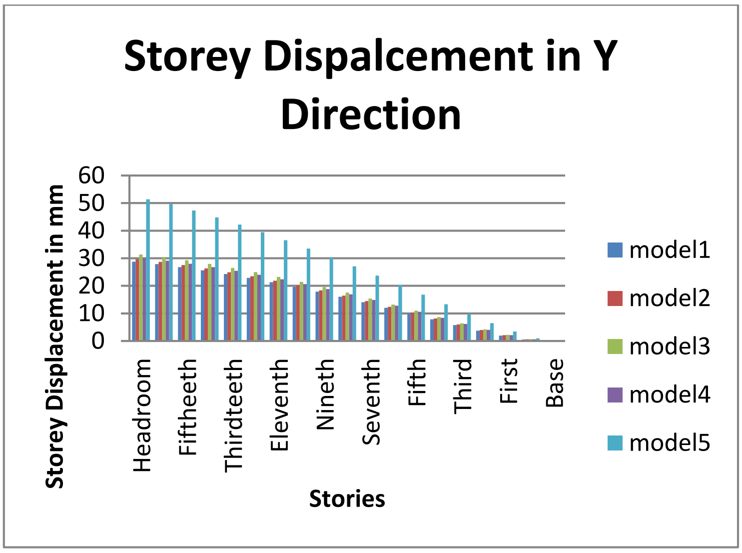

Chart - 2: Displacement in Y direction

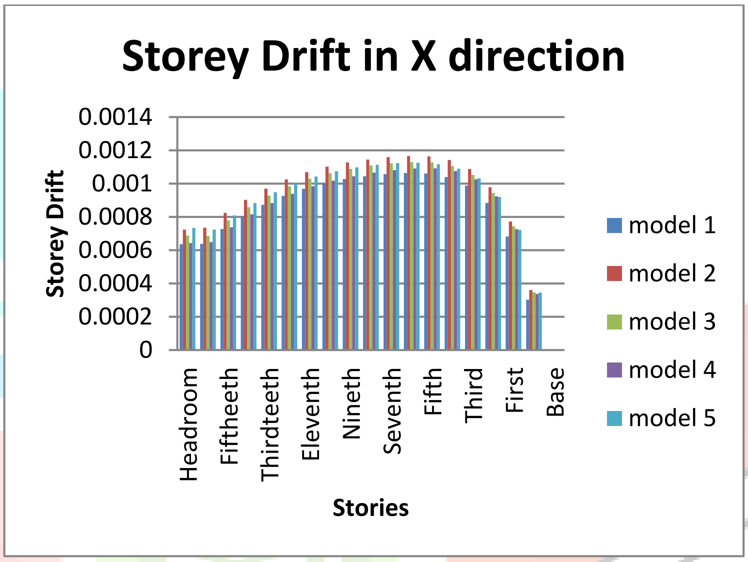

Chart - 3: Drift in X direction

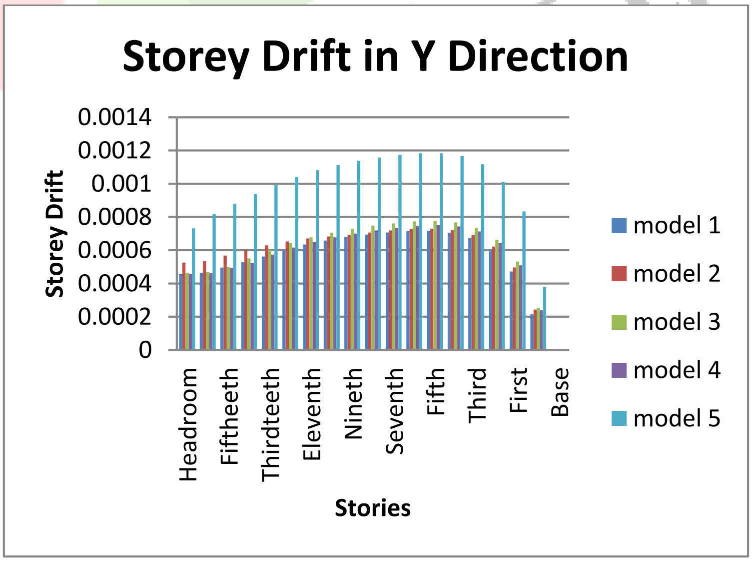

Chart - 4: Drift in Y direction

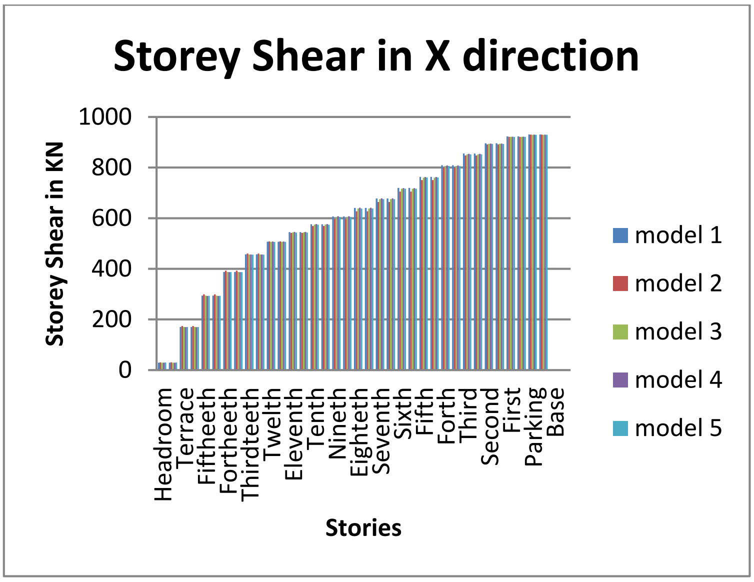

Chart - 5: Shear in X direction

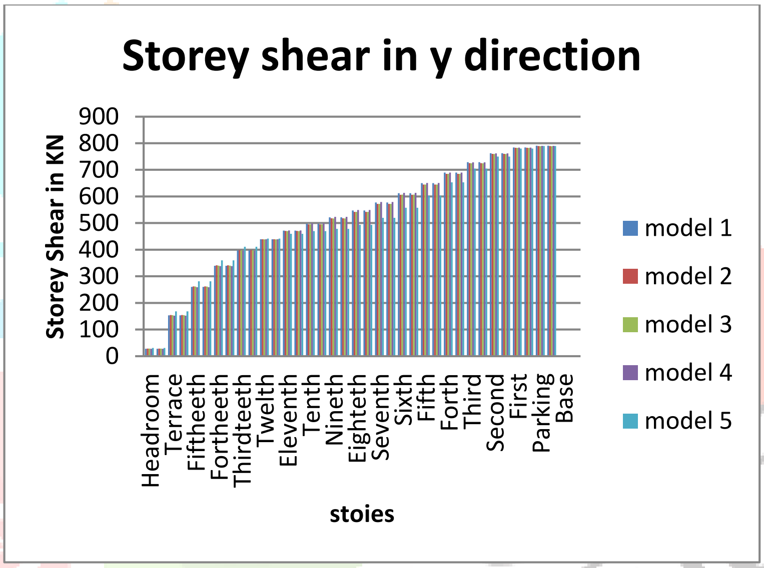

Chart - 6: Shear in Y direction

storey	model 1	model 2	model 3	model 4	model 5
Headroom	43.523	48.668	46.595	44.747	47.134
Terrace	42.184	47.117	45.143	43.381	45.632
Fiftheeth	40.469	45.097	43.281	41.635	43.629
Fortheeth	38.556	42.88	41.213	39.689	41.435
Thirdteeth	36.461	40.482	38.959	37.56	39.067
Twelth	34.193	37.913	36.526	35.254	36.534
Eleventh	31.763	35.182	33.927	32.784	33.848
Tenth	29.186	32.306	31.176	30.162	31.023
Nineth	26.477	29.298	28.288	27.402	28.076
Eighteth	23.65	26.17	25.277	24.517	25.022
Seventh	20.717	22.935	22.157	21.519	21.874
Sixth	17.694	19.608	18.944	18.422	18.651
Fifth	14.604	16.212	15.661	15.249	15.376
Forth	11.484	12.786	12.348	12.036	12.09
Third	8.398	9.394	9.067	8.846	8.855
Second	5.448	6.144	5.926	5.783	5.776
First	2.8	3.216	3.099	3.019	3.021
Parking	0.754	0.902	0.869	0.842	0.862
Base	0	0	0	0	0

Table- 5 : Displacement in X direction

storey	model 1	model 2	model 3	model 4	model 5
Headroom	0.000636	0.000723	0.000688	0.000643	0.000734
Terrace	0.000638	0.000735	0.000686	0.000648	0.000723
Fiftheeth	0.000727	0.000824	0.000779	0.000738	0.000809
Fortheeth	0.000805	0.000902	0.000858	0.000816	0.000883
Thirdteeth	0.000872	0.00097	0.000928	0.000883	0.000948
Twelth	0.000926	0.001025	0.000984	0.000939	0.001001
Eleventh	0.000969	0.001069	0.001029	0.000984	0.001043
Tenth	0.001002	0.001102	0.001063	0.001018	0.001074
Nineth	0.001027	0.001127	0.001089	0.001045	0.001097
Eighteth	0.001045	0.001145	0.001109	0.001066	0.001113
Seventh	0.001057	0.001159	0.001122	0.001081	0.001123
Sixth	0.001064	0.001166	0.001129	0.001091	0.001125
Fifth	0.001061	0.001164	0.001127	0.001092	0.001117
Forth	0.00104	0.001142	0.001105	0.001075	0.00109
Third	0.000988	0.001088	0.001052	0.001026	0.001032
Second	0.000884	0.000978	0.000944	0.000923	0.00092
First	0.000682	0.000772	0.000744	0.000726	0.000721
Parking	0.000302	0.000361	0.000347	0.000337	0.000345
Base	0	0	0	0	0

Table- 6: Drift in X direction

IV. Shear wall

5 models are analyzed using ETABS software. Response spectrum analysis is used to find displacement, drift and shear. From the result obtained, best and worst position of floating column determined. For the better performance of best model using floating column shear wall provided. In this project shear wall is provided on slide of the building and corner of the building in Model 4.

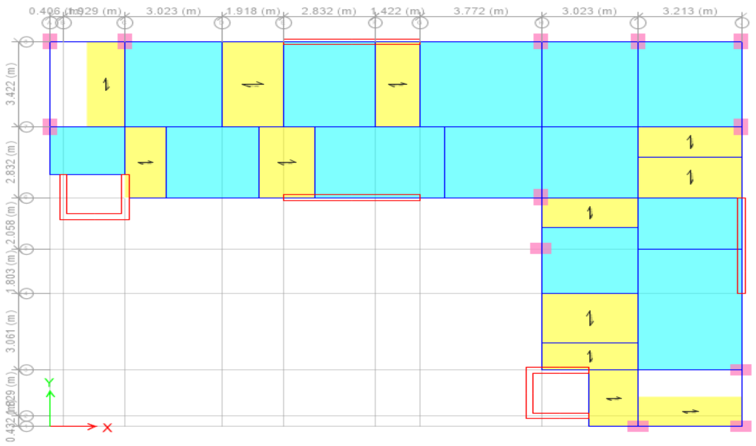

Fig -8: shear wall provided on sides

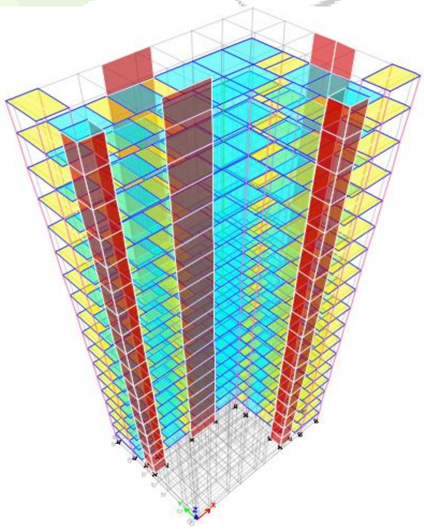

Fig -9: 3D view of shear wall provided on sides

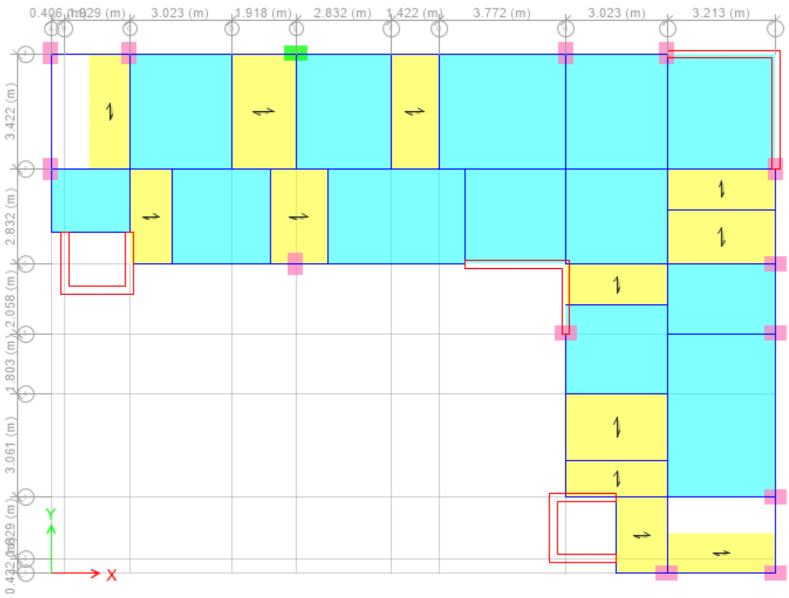

Fig -10: shear wall provided at corner of the building

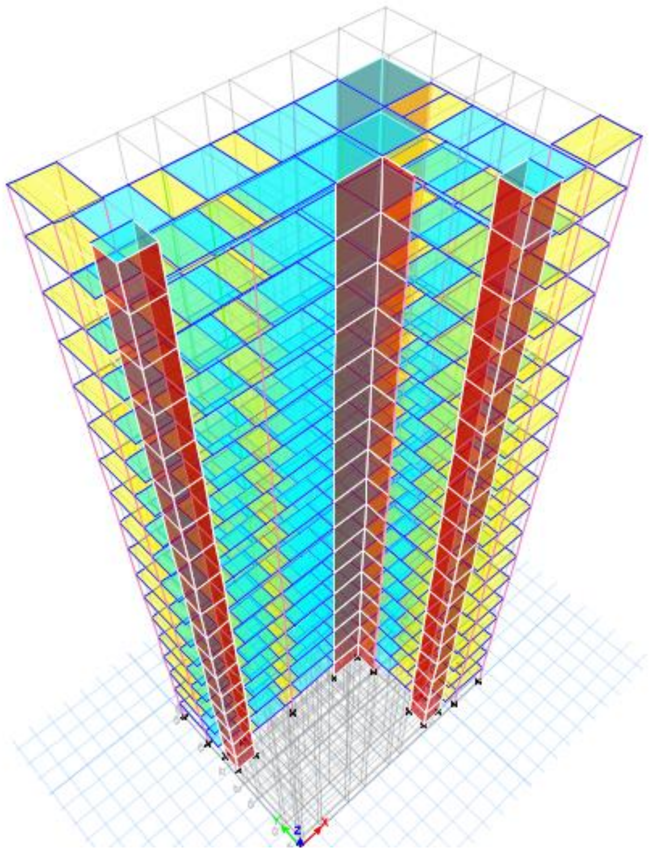

Fig -11: 3D view of shear wall provided at corner of the building

Shear wall is provided on slide of the building of Model 4. The values of storey displacement, storey drift, storey shear is obtained by response spectrum method. The values of storey drift and displacement are tabulated below.

- **Shear wall at corner**

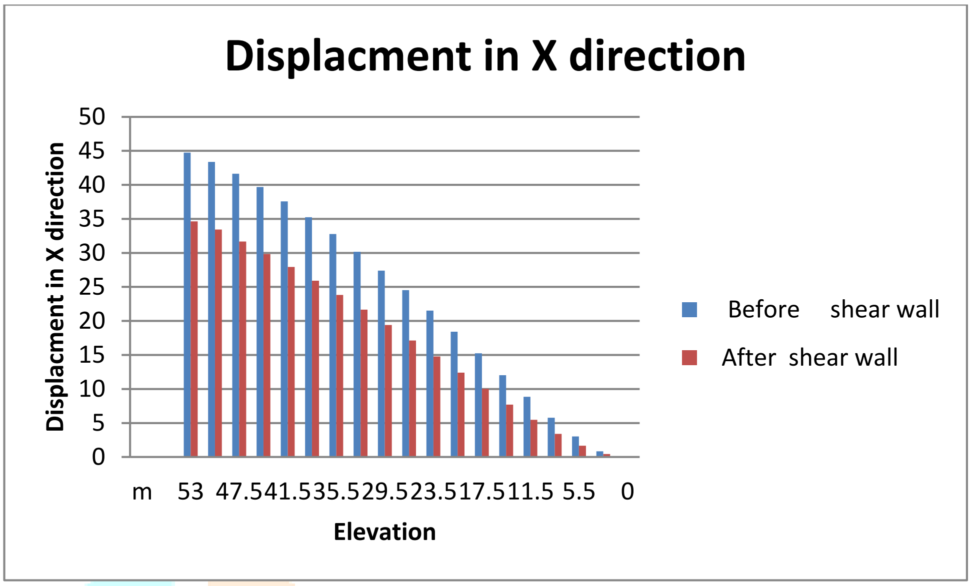

Chart - 6: Displacement in X direction

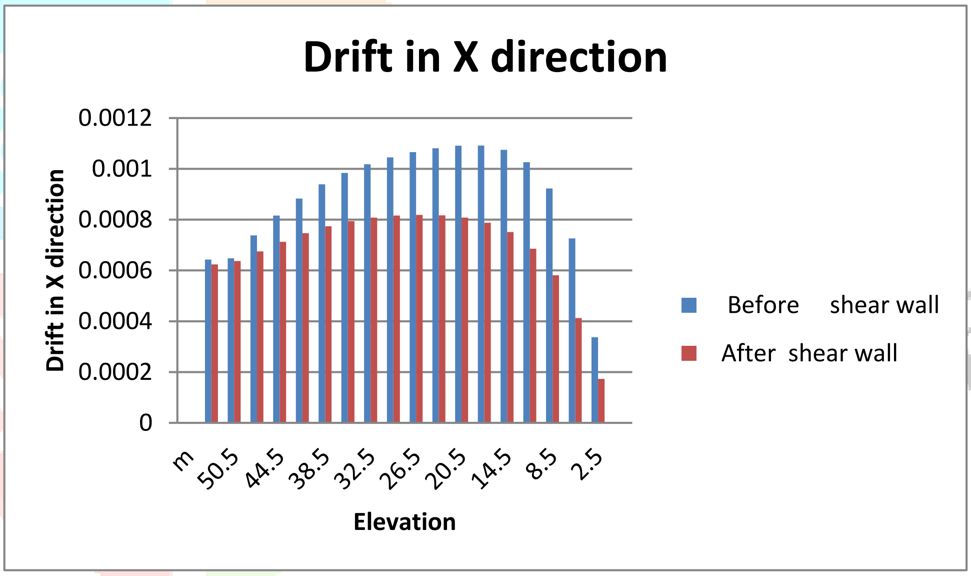

Chart 8: Displacement in X direction

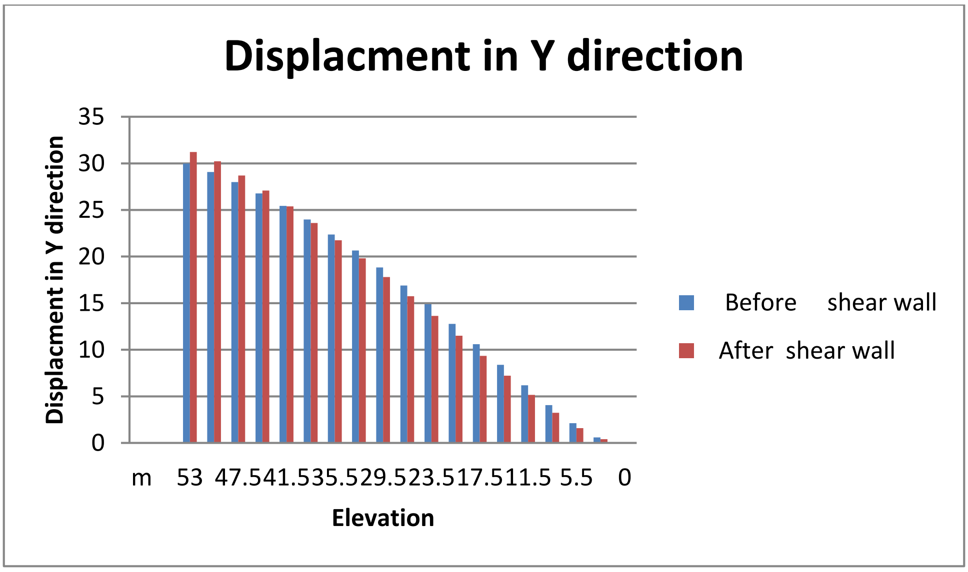

Chart - 9: Displacement in X direction

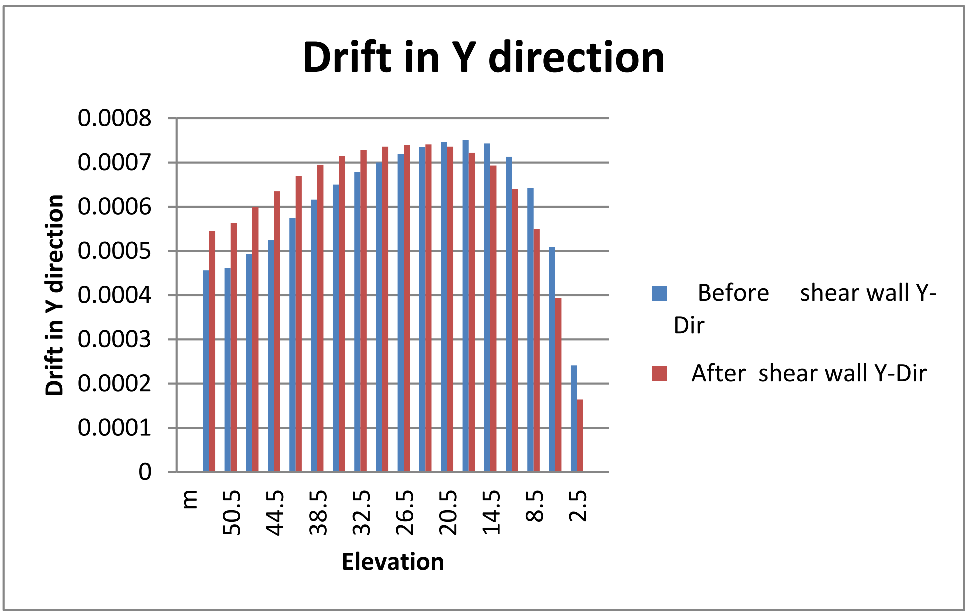

Chart - 10: Displacement in X direction

➢ **Shear wall on side**

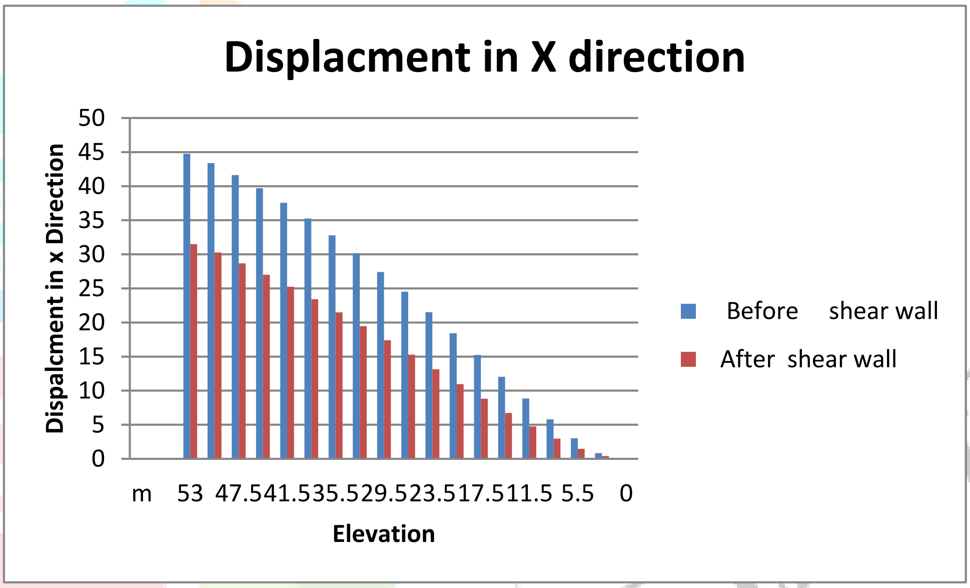

Chart - 11: Displacement in X direction

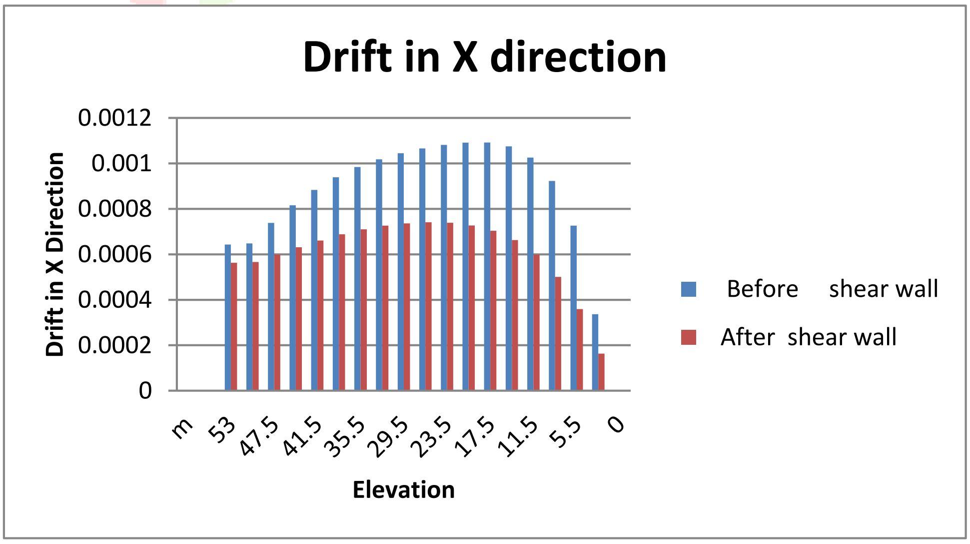

Chart - 12: Displacement in X direction

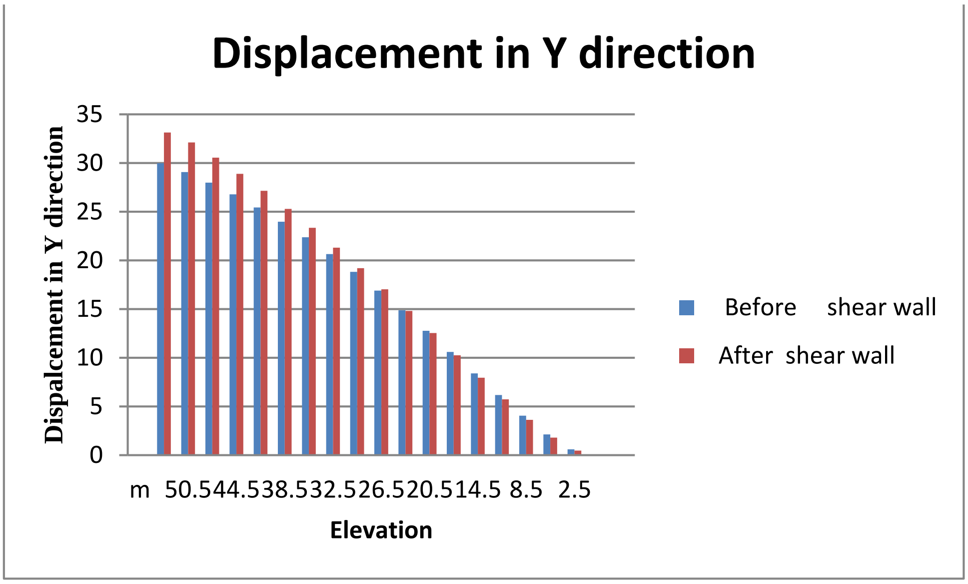

Chart - 13: Displacement in X direction

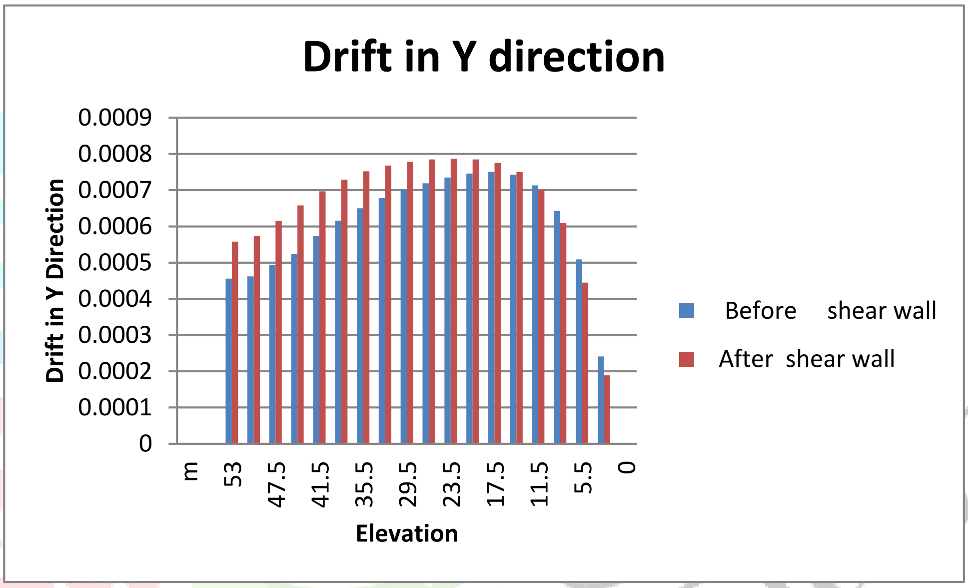

Chart - 14: Displacement in X direction

5. CONCLUSIONS

1. The building with floating column shows maximum displacement than the normal building column.
2. The displacement value of floating column provided at outer periphery(model2) is 3.921mm greater to floating column provided at inside the building (model 4).
3. The displacement value of floating column provided at one of the edge of the building (model5) is 2.387 mm greater to floating column at inside the building (model4).
4. Displacement increases from lower storey to higher storey for all cases.
5. The displacement value of floating column provided at inside the building (model4) 3.921mm is less than floating column provided at outer periphery of the building (model4).
6. The Storey drift value for floating column provided at one of the edge(model5) 0.001125 is maximum and 0.001091 is minimum for floating column provided at inside the building (model4).
7. The Storey shear value is maximum at first storey and minimum for top storey.
8. Therefore best position of the floating column is model 4 i.e floating column inside the building and worst position of floating column is model 5 i.e floating column provided at one of the edge
9. The displacement value in X direction for shear wall provided at corner is 10.117mm less than the without shear wall building (Model4)
10. The displacement value in Y direction for shear wall provided at corner is 1.248 mm greater than the without shear wall building (Model4)
11. The displacement value in X direction for shear wall provided on side is 13.237mm less than the without shear wall building (Model4)
12. The displacement value in Y direction for shear wall provided at corner 3.159mm greater than the without shear wall building (Model4)

13. The storey drift value in X direction for shear wall provided at corner is 0.00002 less than the without shear all building (Model4)
14. The drift value in X direction for shear wall provided on side is 0.000028 less than the without shear wall building (Model4)
15. The storey drift value in Y direction for shear wall provided at corner is 0.000095 greater than the without shear wall building (Model4)
16. The storey drift value in Y direction for shear wall provided on side is 0.000102 greater than the without shear wall building (Model4)
17. From that it is concluded that we cannot give the best position of shear wall which increase the stability of the building. The result mainly depend upon the position of shear wall and size of shear wall provided it will be studied in future

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