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DYNAMIC ANALYSIS ON MULTI-STOREYED BUILDING WITH & WITHOUT FLOATING COLUMN

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Abstract: In the present study high rise G+10 building with regular structure and with irregularity are studied and analyzed with and without floating column. The critical position of floating column has been studied for different locations around the periphery columns for both regular and irregular structures for zone V. The study highlights the response of G+10 high rise regular and vertically irregular building with and without presence of floating columns subjected to earthquake forces. The various response parameters such as base shear, storey drift, node displacement, shear forces and bending moments are studied in the various models. The results are compared to determine the effects of presence of floating column in a building.

Keywords: *Floating Column, Base Shear*

I.INTRODUCTION:

Modern architectural trends are increasingly driven by the need for aesthetic appeal and functional versatility. This has led to the incorporation of unconventional structural elements like floating columns in multi-storeyed buildings. A floating column is a vertical member that is not directly connected to the foundation but rests on a beam or a transfer girder. This feature is commonly used in buildings to create open spaces for parking, lobbies, or commercial purposes, offering enhanced usability and visual appeal. However, this architectural flexibility comes at a cost. Floating columns introduce vertical irregularities that disrupt the uniform load transfer mechanism in buildings. During seismic events, such irregularities can lead to a concentration of forces and increased vulnerability in specific structural members. This makes buildings with floating columns more susceptible to damage and collapse compared to regular structures without such features. Additionally, the presence of floating columns can amplify the torsional effects, making the building's response to dynamic loads unpredictable. Understanding the behavior of structures under seismic forces is critical for designing safe and resilient buildings. Dynamic analysis methods, such as response spectrum analysis and time history analysis, are essential tools for evaluating the performance of buildings under earthquake loads.

II. OBJECTIVE OF STUDY

- To evaluate the dynamic response of multi-storeyed buildings with and without floating columns.
- To study the impact of floating columns on base shear, axial force and storey drift.
- To provide design recommendations for improving the seismic performance of buildings with floating columns.

III.MODELLING

3.1General

The model is analyzed for Zone V and situated at medium soil Type II and the response is studied to determine the seismic weight, storey drift, node displacement, base shear, bending moments and shear forces in different directions.

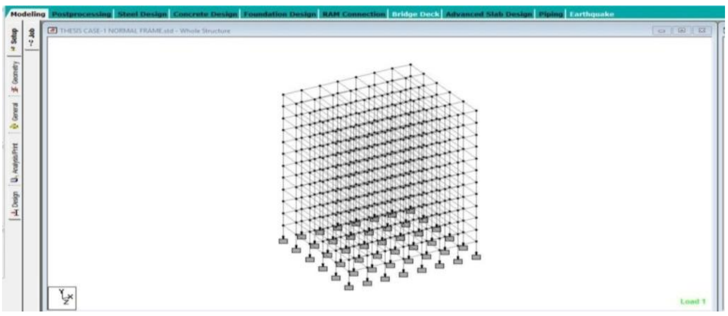


Fig.3.1- Modeling of structure

3.2 Assign Properties

The properties in the model such as the sectional properties which includes the size of the beams and columns will be assigned as per the loading and the span details ,as well as the load coming on to the structure. The properties are assigned to each and every member of the structure and the sectional properties may be varied as per the requirement of the designer and on the results from the analysis.

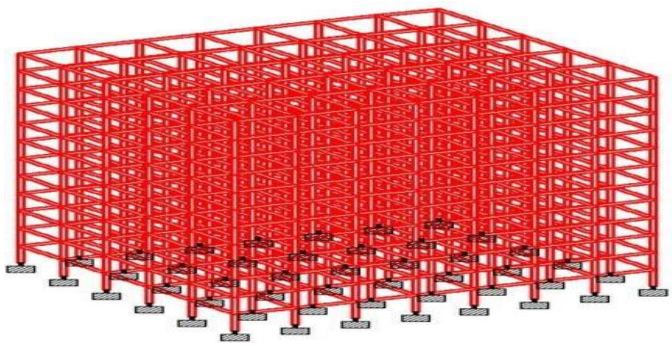


Fig.3.2- Assigning of properties

3.3 Loads and Load combination

In the present work, for the analysis of the structure, the loads such as the dead load (IS-875 PART 1), live load IS-875 (PART 2), and the seismic load are taken for analysis as per IS 1893 (Part 1):2002. The load combinations used in analysis are also applied as per the IS code.

Load Combinations :

The following load combinations are considered for the design and analysis as per code IS 1893 (Part 1) : 2002 clause no.- 6.3.1.2,

Where,

DL= Dead load LL = Live load EL = Earthquake Load

EQX, EQY= Earthquake load in the X and Y directions, Respectively

1) 1.5(DL + IL)
2) 1.2(DL+ IL ± EL)
3) 1.5(DL ± EL)
4) 0.9DL ± 1.5 EL

IV.RESULT AND DISCUSSION

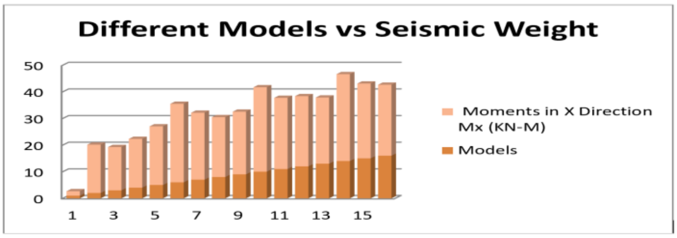
4.1 General: The position of floating column has been varied around the periphery in three different cases and also three different types of irregular structure has been analysed. Results have been compared in tabular way for each model and presented by plotting graphs which are as given.

4.2 Comparison of Result & Discussion

The results of the seismic weight, base shear, node displacement, beam forces and moments, are presented through tables and graphs for all the models. As the regular structures are compared with the irregular ones with different positions of floating column, their performance is observed in the high seismic Zone V.

Table 4.1- Seismic weight for all models

S.No	Model	Seismic Weight (KN)
Case 1	1	73067.95
	2	71445.22
	3	70669.80
	4	70683.38
Case 2	5	62157.35
	6	60546.63
	7	59750.21
	8	58953.78
Case 3	9	57654.10
	10	56843.42
	11	56147.05
	12	55340.68
Case 4	13	54850.86
	14	54340.14
	15	53843.11
	16	53347.28

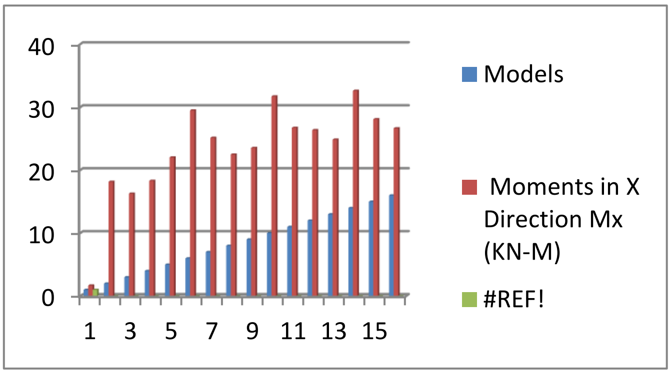


Graph 4.1: Seismic weight of different models

From the data acquired, it is seen that the seismic weight of the models without any vertical irregularity are higher as compared to the ones which have irregularity. The seismic weight goes on decreasing for the models with irregularity and is least for models with higher irregularity (i.e Case-4)

Table 4.2- Base Shear for all models

S.No	Model	Base Shear	
		X (KN)	Z (KN)
Case 1	1	5624.17	5326.49
	2	5598.27	5283.15
	3	5623.61	5297.60
	4	5638.94	5312.05
Case 2	5	4832.53	4552.38
	6	4786.53	4509.05
	7	4801.86	4523.49
	8	4817.20	4537.94
Case 3	9	4561.13	4296.71
	10	4515.12	4253.38
	11	4530.46	4267.82
	12	4545.79	4262.27
Case 4	13	4289.72	4041.04
	14	4243.72	3997.71
	15	4259.05	4012.15
	16	4274.39	4026.60

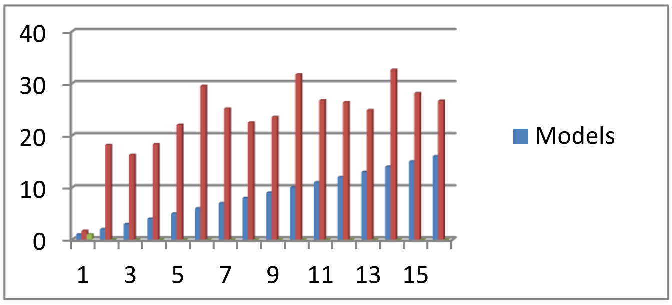


Graph 4.2: Base Shear of different models

The Base Shear values are higher for the models without vertical irregularity (i.e Case-1) which is 5624.17 kN and are almost same for all the models in that case. The base shear goes on decreasing for the models with irregularity and is least for the most irregular models (i.e Case-4). Also the base shear values are higher for all the models in X direction as compared to models in Z direction.

Table 4.3- Node Displacement for all models

S.No	Model	Node Displacement	
		X (mm)	Z (mm)
Case 1	1	182.76	162.60
	2	294.31	293.66
	3	187.65	166.54
	4	185.40	164.77
Case 2	5	173.80	184.65
	6	233.99	320.22
	7	191.84	191.30
	8	206.87	188.96
Case 3	9	175.89	193.37
	10	232.86	326.15
	11	198.83	196.83
	12	218.08	194.55
Case 4	13	184.02	196.61
	14	239.36	328.61
	15	217.32	199.77
	16	227.21	197.60



Graph 4.3: Node Displacement of different models

The node displacement is maximum for models with outer periphery floating column for both regular and irregular structures. The node displacement is still higher in Z direction for these models otherwise in all other models it is more in X direction. So It is seen that due to the seismic forces the displacement is more in the structure with larger number floating column and irregularity in structure.

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V. CONCLUSIONS

1.It is conclude that the seismic weight of the models without any vertical irregularity are higher as compared to the ones which have irregularity. The seismic weight goes on decreasing for the models with irregularity and is least for models with higher irregularity (i.e Case-4).

2.The Base Shear values are higher for the models without vertical irregularity (i.e Case-1) which is 5624.17 kN and are almost same for all the models in that case. The base shear goes on decreasing for the models with irregularity and is least for the most irregular models (i.e Case-4). Also the base shear values are higher for all the models in X direction as compared to models in Z direction.

3.The node displacement is maximum for models with outer periphery floating column for both regular and irregular structures. The node displacement is still higher in Z direction for these models otherwise in all other models it is more in X direction. So It is seen that due to the seismic forces the displacement is more in the structure with larger number floating column and irregularity in structure.

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