Comparative Analysis of G+1 Structure With and Without Floating Column

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Abstract--- This paper represents a comparative analysis of G+1 structure with and without floating columns. These days floating columns are used in multi-storey buildings. Some of the advantages floating columns has attracted architects to go for structures with floating column. The maximum bending moment of the structures are compared in this paper. The cost of the structure is mainly dependent on the maximum moments that are found out. Structures are designed for this maximum bending moment. A 2D frame analysis has been done using SAP 2000. The comparative analysis gives us the maximum bending moment that comes on structures with and without floating column. From which we can find out which of the structure will be more economical. SAP2000 is used for the purpose of analysis of 2D frame and analysis has been carried out.

Keywords: FEM, Floating Column, Portal Frame, Static Analysis, SAP, Seismic, 2D Frame.

1 INTRODUCTION

Portal frames are the structures which has beams and columns that are connected by rigid joints. Floating columns are the structures which has columns that rests on beams, beam being the support to the columns on 1st slab and above the structure the bottom ground floor is kept open by using minimum number of columns which would take all the load that will come from beams to the basement columns and transfer it to the earth. Floating column structure are the structure which are of more interest of architects all over the world. Because of the advantage that more open space is available due to the limit use of columns without much obstacles. These are more commonly used in urban areas where space is an issue. All the recent multi-storey buildings are made by the concept of floating columns. These structures are not included in IS code because these structures cannot sustain seismic forces and likely to get damaged. Many buildings in Gujrat Bhuj area where found was constructed with open 1st storey that collapsed in earthquake in 2001.The conventions structures are recommended for areas in seismic zones.

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These structures are not dynamically reliable; the static reliability of structures with floating column is required to be studied. Our aim is to compare the structural and well as economic reliability of the structure. This comparative analysis in SAP 2000 is done just to see and the maximum bending moment. That comes due to the live and dead loads on the structure. There are many studies that show the way to an economic structure is the least value of bending moment. The analysis will give us results of 2D frame G+1 structures with and without floating column.

2 METHODOLOGY

Methodology includes software based analysis of 2D frame G+1 structure with normal columns and with floating column.

SAP 2000 is an ideal software civil engineering for analysis of any type of structure. Sap 2000 can be used for structures with complex and simple geometry problems. A sophisticated FEM analysis is derived in SAP 2000 . It is mainly designed and analytical integrated software which deals with the analysis of all types of structures. Many static, dynamic, linear , and non-linear analysis of structure can be done with the help of this software. Many methods of structural analysis such as FEM, Rayleigh Ritz method for modal analysis etc. gets covered in this software SAP

2000. Our aim is to perform a static analysis on 2D Frame structure.

The structures that have been analysed that is structure with and without floating column is assumed to have same material properties and has same number of bays, storey height for comparative purpose.

The properties of sections and structural configuration is as follows:

- Steel section- I sections was used
- Modulus of elasticity of the structure =1.99 x 10 ^08 KN/m^2.
- Density of material = 7.99 KN/m^3.

G+1 Structure details:

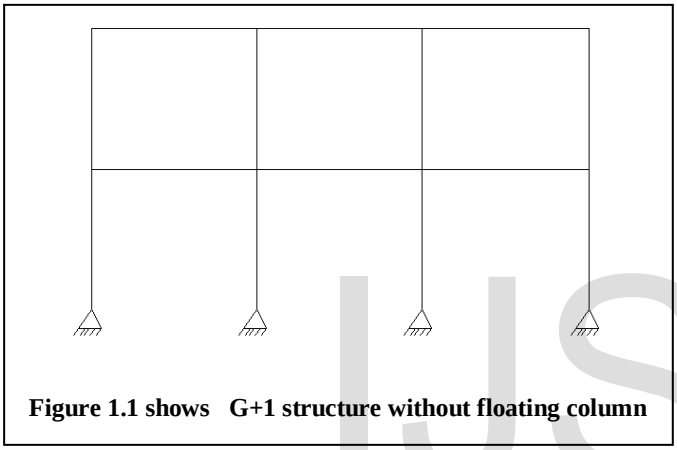


Figure 1.1 shows G+1 structure without floating column

No. of columns at base: 4

- No. of storey = 2
- No. of bay= 3
- Storey height =3m
- Bay width = 6m

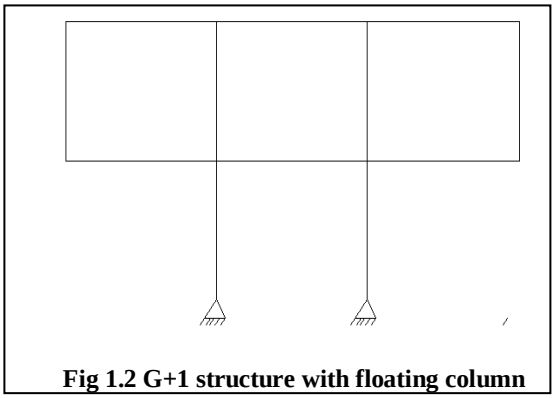


Fig 1.2 G+1 structure with floating column

- No. of column at base for above structure = 2

Load on frame:

- The frame is subjected to
- Live load of 20 kN/m
- Self-weight of section of beams and columns
- The structure is analysed for combination of live load + dead load.

Only static analysis has been done. SAP 2000 is a software in which FEM is used for analysis of structures with static loading.

Both the structures that are analysed with keeping all the properties also have same loading conditions.

Firstly analysis of 2D Portal frame for normal column that is continuous span with 4 column is done.

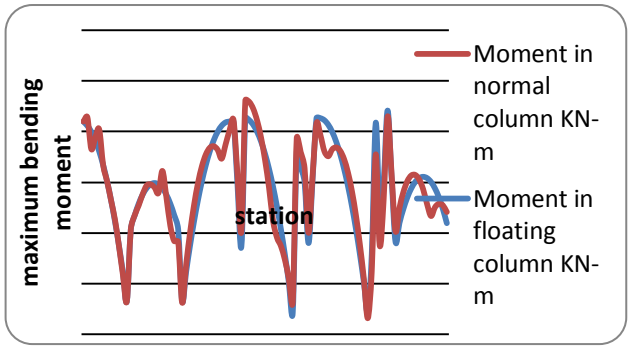
Then analysis was conducted on 2D portal frame with 2 columns at base and 4 column just above the column supporting by beams is done. And the results are investigated.

3 RESULT

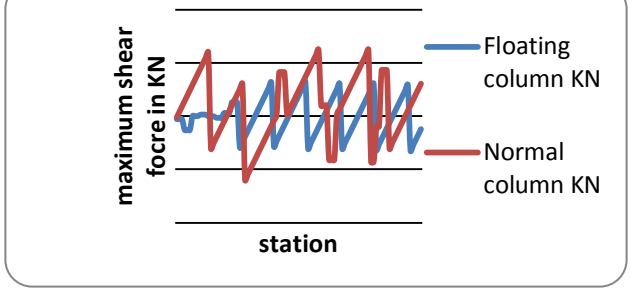
The results are based on the analysis that was conducted on G+1 2D portal frames.

The analytical study gives different results of each one of the cases with and without floating column so that it will give us the comparable results for both type of structures.

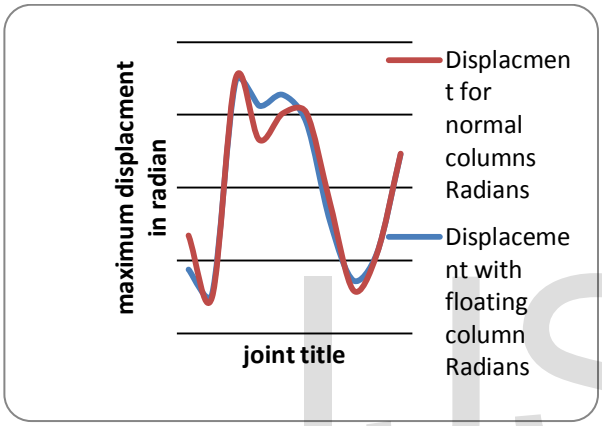
A comparative study is done with respective of maximum displacement of structure, bending moment, shear forces etc, based on which following graphs are worked out.



Graph 1: Comparison of max bending moments in z direction



Graph 2: Comparison of max shear forces in normal and floating column



Graph:3 Comparisons of maximum displacement between floating column and normal column structure.

4 CONCLUSION

Following conclusions are drawn based on the investigations that was carried out within the scope of the study:

1. The maximum moment that is obtained is more in case of structure with floating column and lesser in case of structure with normal column.
2. As the bending moment is maximum in case of structure with floating column we can conclude that the structure will required more material so nomal column structure is more economical.
3. The sections required by the structure with floating column is more.
4. The floating column is subjected to maximum shear force as compared to the structure with normal column.
5. The stress pattern is more critical in case of floating column than in structure with normal column.
6. The structure with floating column in subjected to maximum displacement comparatively in than in normal column structure.
7. As the effect of statical load is more on floating column is more the dynamic analysis will give much more critical results that are in case of floating columns.

Though floating columns are of more interest to architects for construction of multi-storey buildings in urban areas these are not as reliable as the conventional structures. The conventional structure does not provide open space that much as compared to the structure with floating column but these columns are economical. And are more strong and safe to be constructed also in seismic zone areas.

5 REFERENCES

[1] Comparitive study of effect of floating columns on the cost analysis of a structure designed on stadd pro v8i. Pratyush Malaviya[1], Saurav

[2] Very large floating structures: applications, analysis and design e. Watanabe1, c.m. wang2, t. Utsunomiya1 and t. Moan3.

[3] Seismic response of multi-storey irregular building with floating column isha rohilla1 , s.m. Gupta2 , babita saini3.

[4] Seismic Response Evaluation of RC frame building with Floating Column considering different Soil Conditions Prerna NautiyalA, Saleem AkhtarA and Geeta BathamA

[5] Seismic analysis of multi-storey building with floating column -By Sukumar Beher