

STUDY & ANALYSIS OF FLOATING COLUMN WITH LATERAL LOAD RESISTING SYSTEM BY USING STAAD PRO SOFTWARE

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ABSTRACT

In India nowadays, open first level is a common and inescapable element of urban multistory structures. The main reason for adopting this is to provide room for parking or reception lobbies in the first storey. In contrast to the seismic force distribution, which depends on the distribution of stiffness and mass along the height, the total seismic base shear that a structure experiences during an earthquake is influenced by the earthquake's natural period. A vertical member that terminates at its lower level and rests on a beam, which is a horizontal member, is referred to as a floating column. The beams then shift the weight to a different column below it. Buildings with floating columns are a common design element in India's new multistory construction at the moment. In the current paper, an attempt has been made to choose the ideal location for the floating column. Buildings of the G+4, G+10, and G+20 types were examined, and it was discovered that the building with the floating column in the centre behaved properly.

Keywords: Multistorey, seismic, floating column, Self-weight Loading, 3D Analysis Software Staad Pro

1. INTRODUCTION

A column is means to be a vertical part that carries the weight from the foundation level to the ground. The phrase "floating column" refers to a vertical element that at its lower level (termination level) rests on a beam, which is a horizontal part, because of the architectural design or site circumstance. The weight is then transferred from the beams to the columns underneath them. Floating columns are often used in construction projects, particularly above the bottom level when transfer girders are used to provide more open space on the ground floor. These open areas could be necessary for a parking lot or an assembly hall. Particularly in earthquake zones, the transfer girders must be adequately specified and planned. The beam that supports the column is under a concentrated load from the column. The column is often considered to be pinned at the base during analysis, in which case it is treated as a point load on the transfer beam. This sort of structure may be analysed using STAAD Pro.

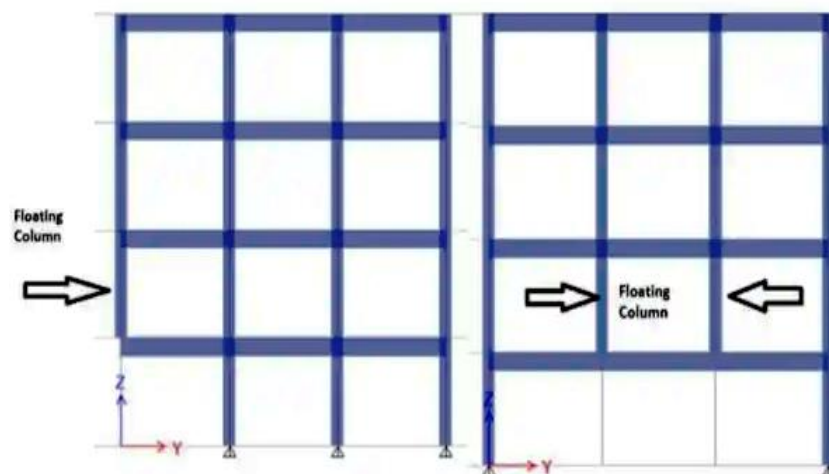


Fig.1: Floating Column in Building

2. OBJECTIVE OF STUDY

The current work's goal is to investigate how multistory structures with floating columns respond to both normal loads and seismic excitations. The following are the goals of the current work:

- To investigate the behaviour of a multi-story structure with a floating column under typical loading conditions.
- Studying how a multi-story skyscraper with a floating column responds to seismic excitation
- Research potential collapse patterns for floating column multistory buildings.
- Propose strategies for bracing a floating column and analyse their effects.
- Compare and discover the most efficient way to reinforce floating columns.

3. PROBLEM IDENTIFICATION

In the current work, reaction spectrum analysis was used to examine the seismic response of conventional multi-story structures with and without floating columns. Using STAAD Pro V8i, storey frame models with G+4, G+10, and G+20 floors have been examined. The crucial point of the floating column has been determined after varying its position. To assess the impact of floating columns on the seismic response of RC-framed structures, a variety of input parameters were employed. Table 1 provides thorough information on the input parameters.

4. MATERIALS AND METHODOLOGY

Table 1: Material and Structural Information

Sr. No.	I	II	III	IV			V
1	Structure	Beam	Slab	Column			Wall
2	Storey	---	---	G+4	G+10	G+20	---
3	Size	350x730mm ²	150mm	350x350mm ²	500x500mm ²	660x660mm ²	300mm
4	Material	M20	M25	M25	M30	M35	Brick

Table 2: Building Information

Sr. No.	I	II
1	No. of stories	G+4, G+10, G+20
2	Floor Height	3m
2	Dimension of plan	25m x 22.5 m

Table 3: Earthquake Data

Sr. No.	I	II
1	Seismic zone	III
2	Importance factor(I)	1
3	Response reduction factor(R)	3
4	Zone factor	0.16

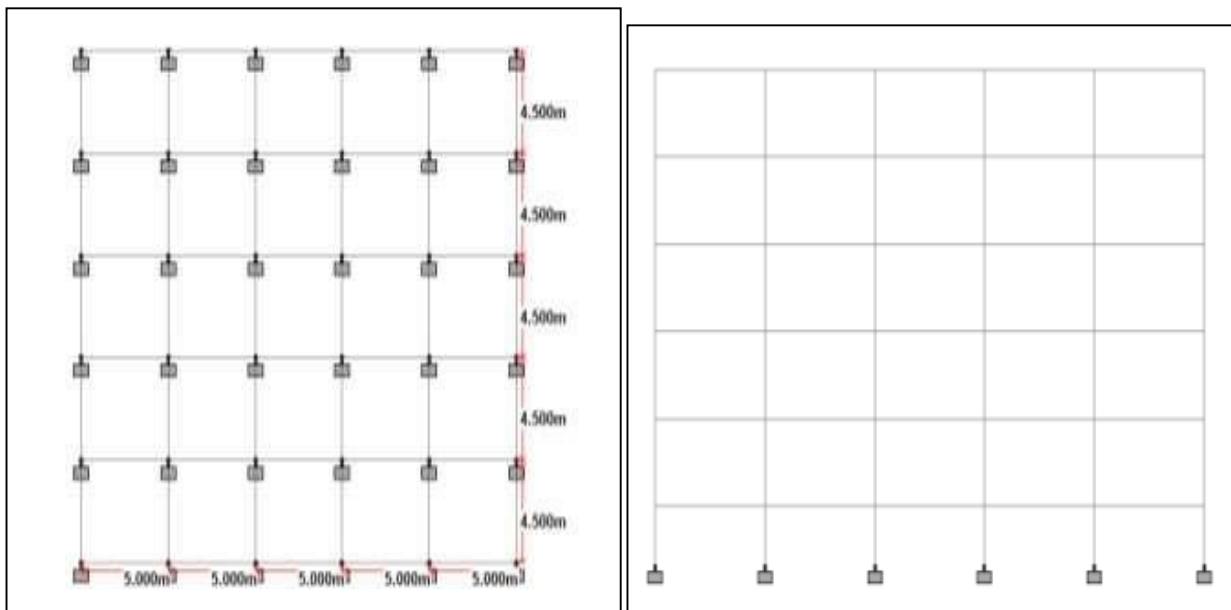


Fig 2: Models have been created in STAAD Pro V8i using the given information

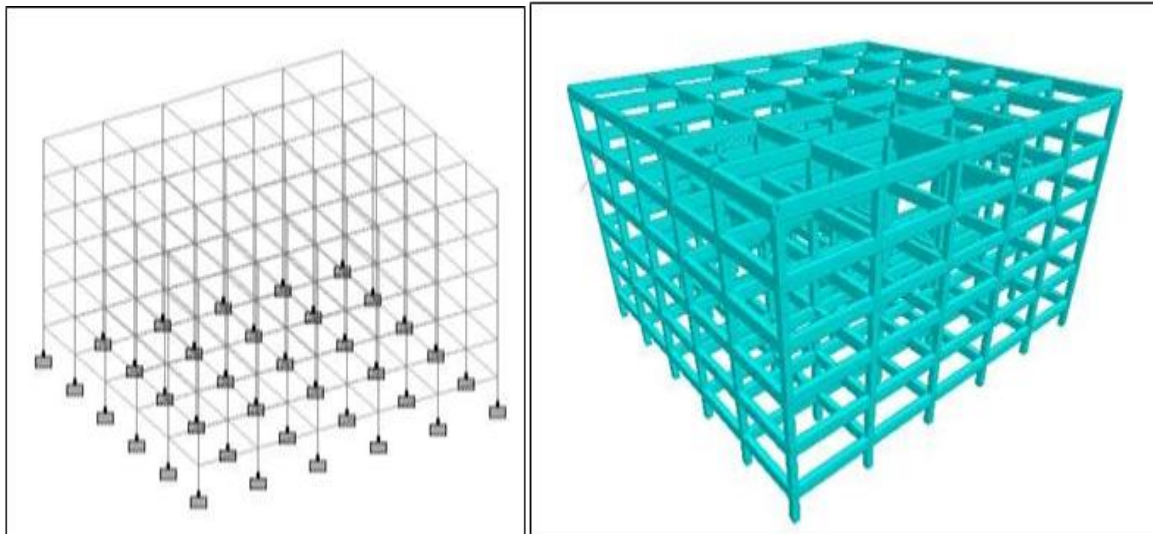


Fig.3: 3D perspective of G+4 Building and 3D perspective of G+4 Building (Rendering view)

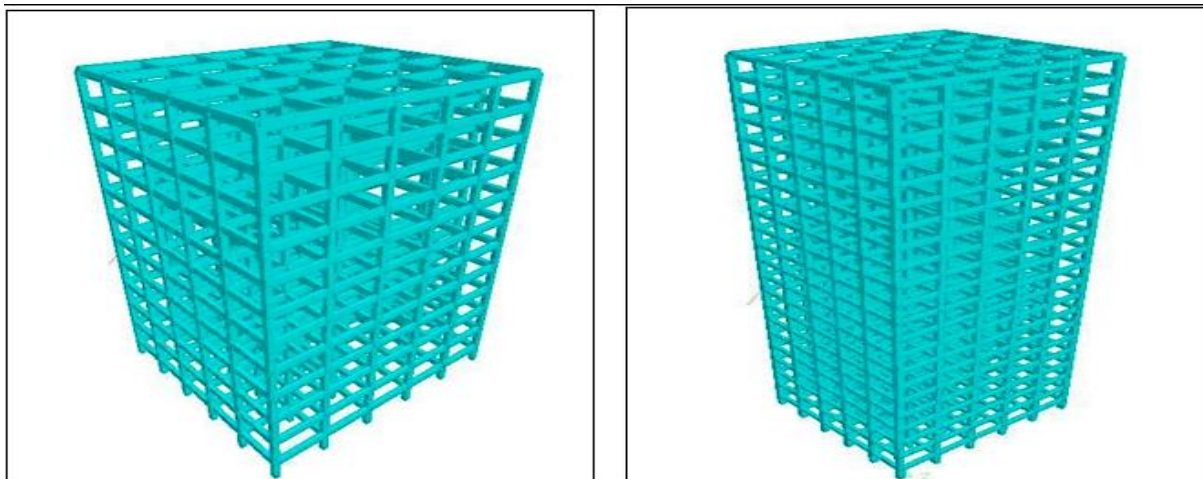


Fig. 4: 3D image of the G+20 Building and 3D picture of the G+10 Building (Rendering view)

Table 4: Static Analysis Loading Calculations

Type Load	Particulars	Calculations
Dead Load	Weight of slab	$= 25 * D$ $= 25 * 0.15$ $= 3.75 \text{ KN/m}^2$
	Weight of partition wall	$= 20 * t * h$ $= 20 * 0.3 * (3.0 - 0.73)$ $= 13.62 \text{ KN/m}$
	Weight of parapet wall	$= 20 * t * h$ $= 20 * 0.3 * 0.9$ $= 5.4 \text{ KN/m}$
	Floor Finish	$= 1 \text{ KN/m}^2$
Live Load	Live load	$= 3.00 \text{ KN/m}^2$ (As per IS 875 part II)

5. RESULT

At first, G+4. In order to determine the most effective place for the floating column, static and dynamic analyses of the G+10 and G+20 structures were performed. Column displacement is used as a baseline for comparison of the findings.

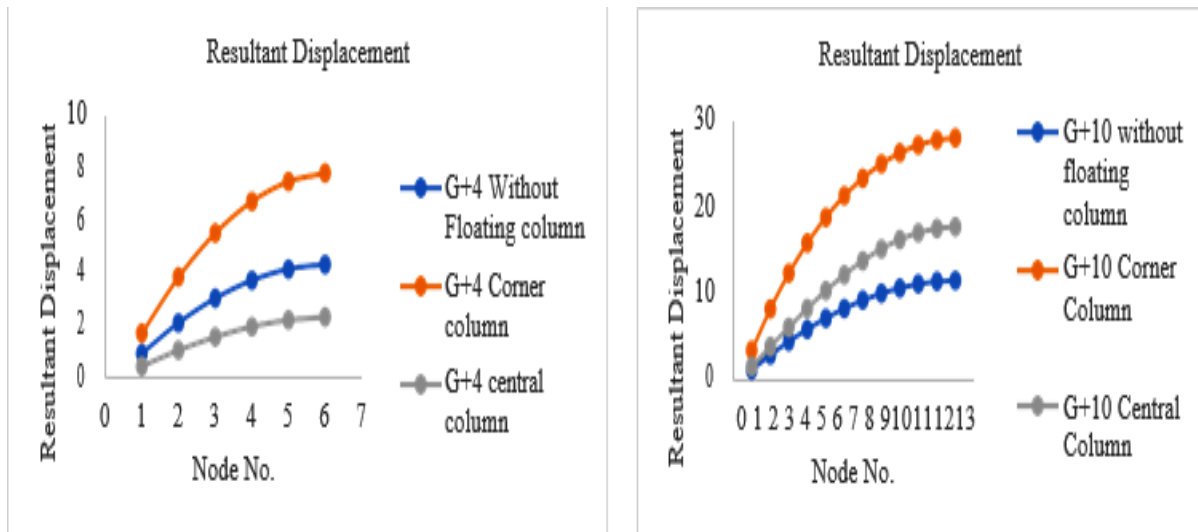


Fig.5: Resultant displacement for G+4 Building (Static) and displacement for G+10 Building (Static)

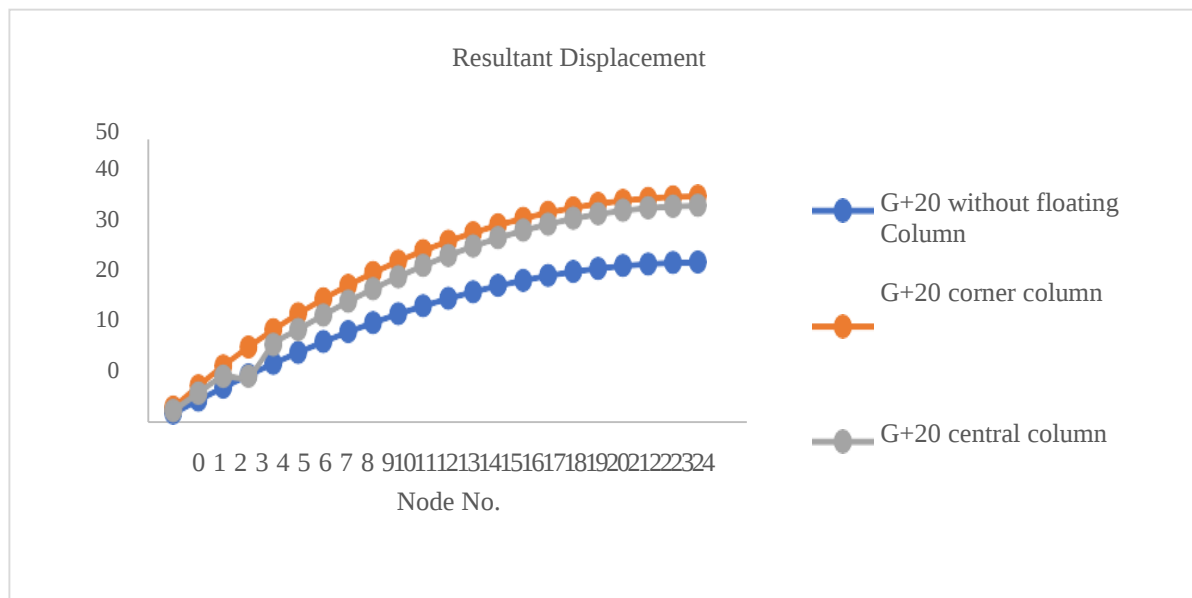


Fig 6: Resultant displacement for G+20 Building (Static)

In order to examine structures for the combinations of dead load and live load, graphs were produced between nodes based on the heights and displacements of the loads. The data collected shows that the displacements in the constructions without floating columns are at their lowest. When a floating column is added to a structure, the displacements grow, reaching their peak when the floating column is positioned at a corner.

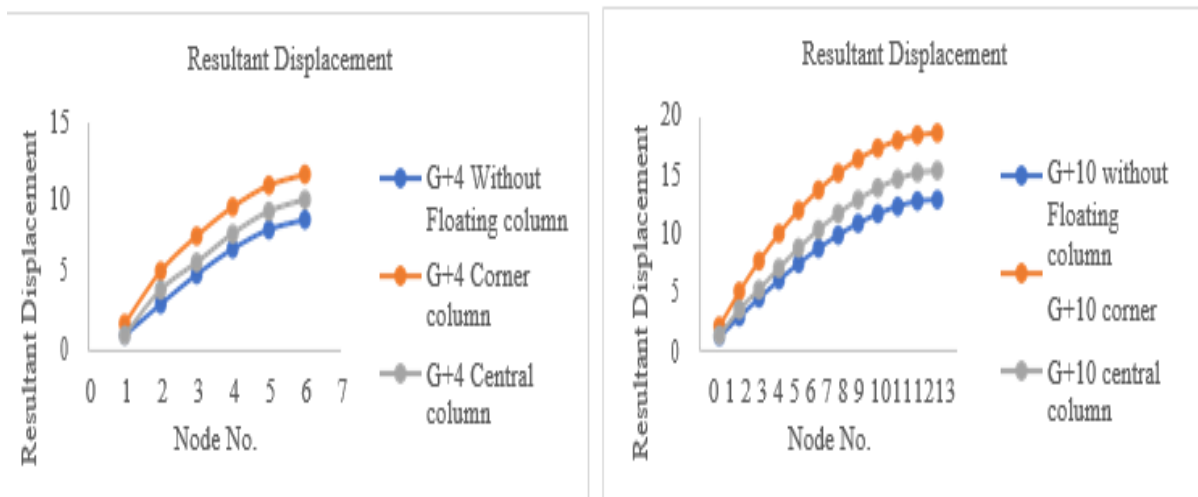


Fig.7: Resultant displacement for G+4 Building (Static) and displacement for G+10 Building (Dynamic)

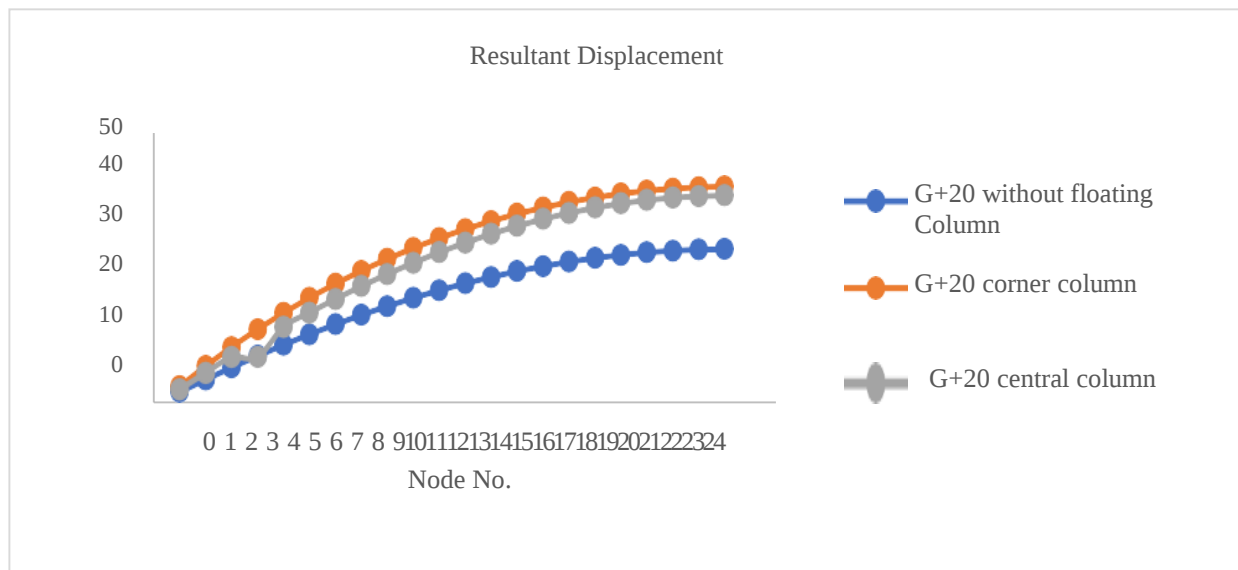


Fig 8: Resultant displacement for G+20 Building (Dynamic)

6. CONCLUSIONS

- Building height grows along with the displacement it causes.
- When a floating column is added to a symmetrically loaded structure, its displacements under static loading rise.
- Floating columns placed in the centre of a structure react better for static analysis than floating columns placed in the corners.
- According to a dynamic study, a building with a central floating column acts better than one with a corner floating column.
- Base shear values calculated manually and using STAAD Pro V8i are quite similar.
- The building's geometric centre is directly above where the centre of mass is positioned.
- Depending on the kind of bracing system used, the building's displacement reduces.
- The G+4 structure has the least displacement when using the inverted V system.
- For the G+10 and G+20 structure, K-type bracing techniques seem to be effective.
- Further research is also conducted for the structures from (G+5) to (G+9), and it is discovered that the Inverted V system is effective up to (G+4), after which the K system is effective.
- Implementing a bracing system enhances how the structure responds to lateral loads.

7. REFERENCES

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