# Effect of Floating Column Position (Center, Edge, Corner) on Seismic Response of A Multi-Storey Rc Building

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**Abstract -** *The present study investigates the effect of floating column position (centre, edge, and corner) on the seismic response of G+15, G+25 and G+40 storey RCC building located in Seismic Zone III on medium soil conditions. A detailed three-dimensional analytical model is developed using ETABS 2021, and seismic analysis is performed using the Response Spectrum Method in accordance with IS 1893 (Part 1):2016. Four building configurations are considered: a regular building without floating columns and three buildings with floating columns placed at centre, edge, and corner locations with varying building height (15 floor, 25 floor and 40 floor), while maintaining identical geometry, material properties, loading, and boundary conditions for each storey height.*

**Key Words: Displacement; Response Spectrum Method; Floating Column; Seismic Analysis; ETABS**

## 1. INTRODUCTION

The rapid growth of urban areas and increasing architectural requirements have resulted in the adoption of unconventional structural configurations in multi-storey reinforced concrete buildings. One such configuration is the floating column, which is commonly introduced to provide column-free spaces at lower floors for parking, commercial activities and other functional requirements.

A floating column is a vertical structural member that does not extend continuously to the foundation. Instead, its load is transferred through a transfer beam or transfer girder to the supporting columns below. This discontinuity in the vertical load path results in redistribution of forces and stiffness within the structure. Consequently, the building may experience increased lateral displacement and storey drift.

## 2. LITERATURE REVIEW

The behaviour of multistorey reinforced concrete (RC) buildings with floating columns under seismic loading has been a subject of extensive research in the last two decades. A detailed review of previous research on floating columns, vertical irregularity, seismic behaviour, transfer girders, torsional effects and different floating column positions was carried out.

### 2.1 Summary of Literature Review

1. Floating columns create vertical discontinuity and induce stiffness irregularity.
2. Transfer beams experience high combined forces and require careful detailing.
3. Corner floating columns consistently produce the worst seismic performance.
4. Torsional irregularity is strongly correlated with floating-column placement.
5. Storey drifts and displacements consistently increase in floating-column models.
6. Transfer beams influence the global response, not just local behaviour.
7. Mitigation strategies such as bracing and shear walls are widely validated.
8. SSI further amplifies drift and torsion; fixed-base assumptions may underestimate seismic demands.

## 3. OBJECTIVE AND SCOPE OF WORK

### 3.1 Objective of Work

The objectives of the present study are:

1. To develop analytical models of G+15, G+25 and G+40 reinforced concrete buildings with and without floating columns.
2. To model floating columns at centre, edge and corner locations under identical structural conditions for each building height.
3. To perform dynamic seismic analysis using the Response Spectrum Method in ETABS in accordance with IS 1893 (Part 1): 2016.
4. To evaluate and compare the seismic response of the different building models.
5. To investigate the influence of building height on the seismic response of floating-column buildings.
6. To identify the comparatively critical floating column location based on seismic response.

### 3.2 Scope of Work

1. Comparative study of Structure with and without floating column with varying building height.
2. To understand the behavior of Floating column structure with various location of floating column (Edge, Center,

Corner).
3. Performance of Response Spectrum Analysis in both principal directions (X and Y) using ETABS.
4. To calculate the comparison of various structural parameters like Modal mass participation, Time period, Storey displacement, Storey drift, transfer girder Bending Moments, Shear Force.
5. A comparative assessment is made to determine the effect of floating column location and building height.

## 4. PROBLEM FORMULATION

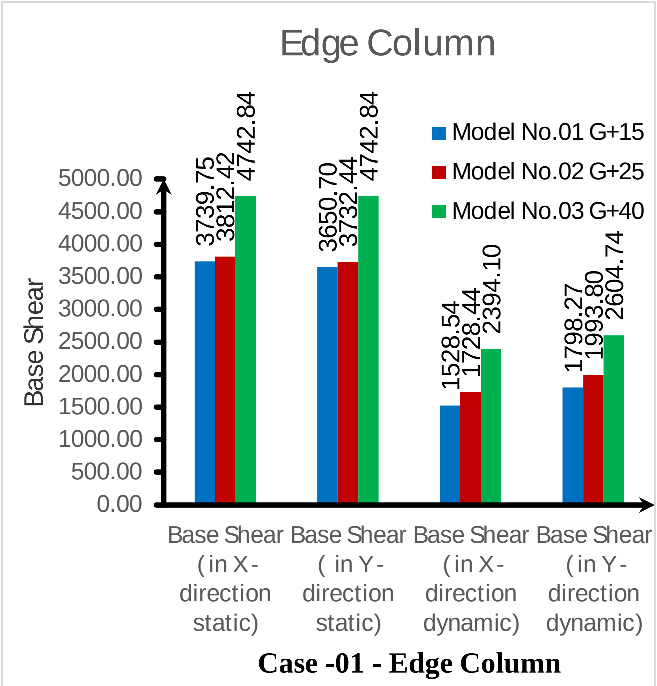
The present study considers RCC framed buildings of G+15, G+25 and G+40 storeys, having a plan size of 26.60 m × 17.60 m and floor-to-floor height of 3.0 m, with building heights of approximately 50 m, 80 m and 125 m, respectively. Floating columns are considered at centre, edge and corner locations, with a regular building without floating column as the base model. The aim of the study is to investigate the effect of floating column location on the seismic response of multi-storey RCC buildings. ETABS software is used for the analytical study, and Response Spectrum Analysis is carried out considering seismic forces as lateral loads. The analysis will include Key seismic parameters, including modal mass participation, base shear, storey drift, storey displacement, time period, Transfer girders bending moment and shear forces will be evaluated. The basic parameter for analysis of floating column building with varying location are considered as shown in Table 5.1.

**Table -5.1:** CONFIGURATION OF MODELS

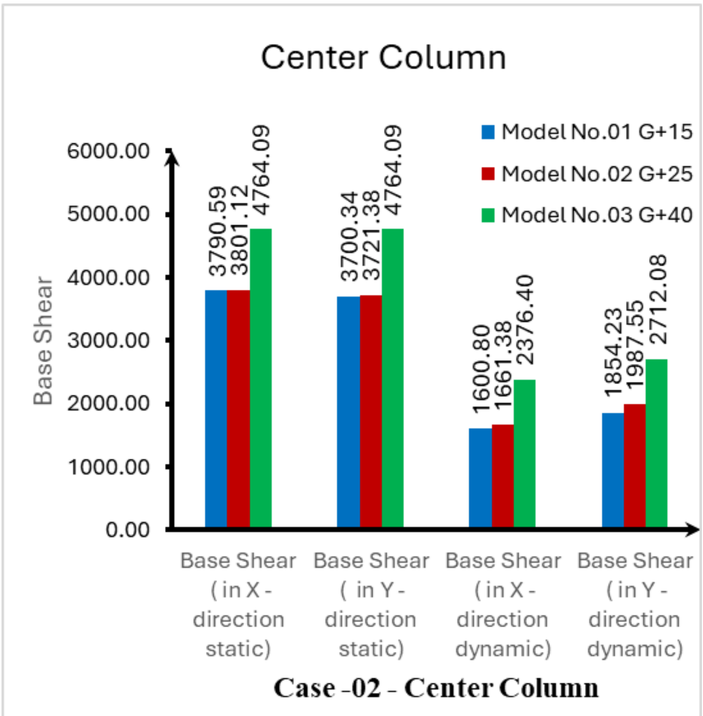
| **Material Properties** | |
|---|---|
| **Grade of Concrete** | M35, M40, M50 (as per structural requirement) |
| **Grade of Steel** | Fe550 |
| **Density of RCC** | 25 kN/m3 |
| **Density of Steel** | 78.5 kN/m3 |
| **Density of L.W.Block Work** | 10 kN/m3 |

## 5. RESULTS AND DISCUSSIONS

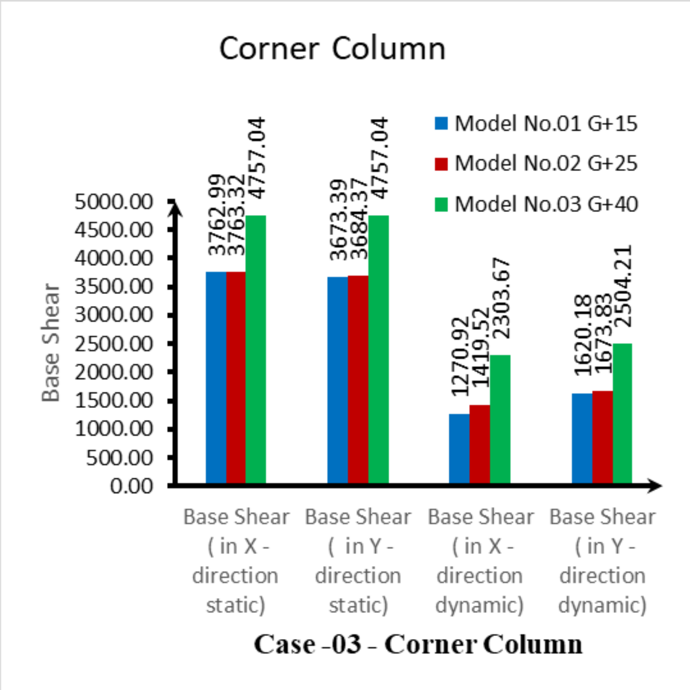
### 5.1 BASE SHEAR




**Graph -1** Base Shear in X & Y Directions for Edge Column

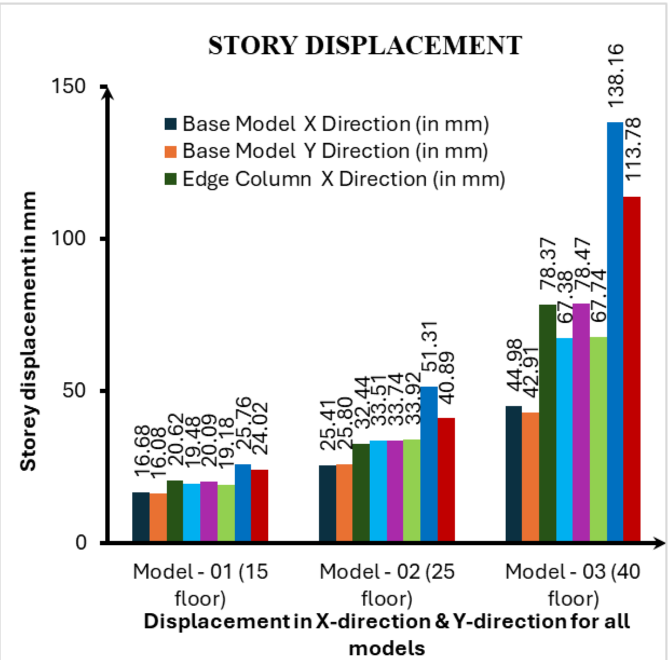



**Graph -2** Base Shear in X & Y Directions for Center Column

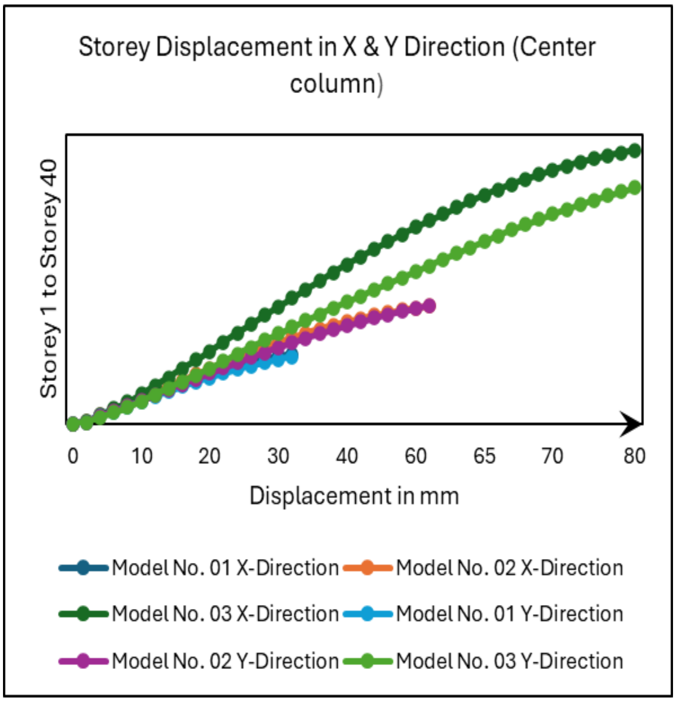



**Graph -3** Base Shear in X & Y Directions for Corner Column

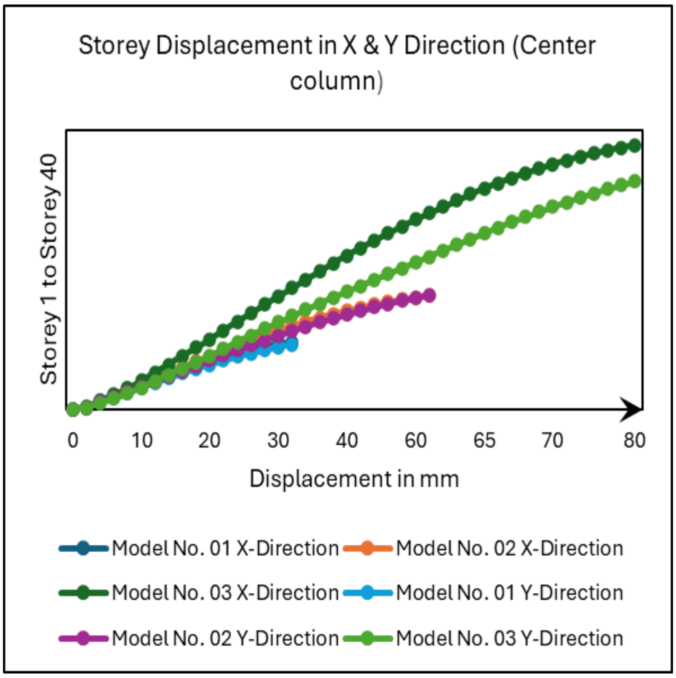
## 5.2 STOREY DISPLACEMENT



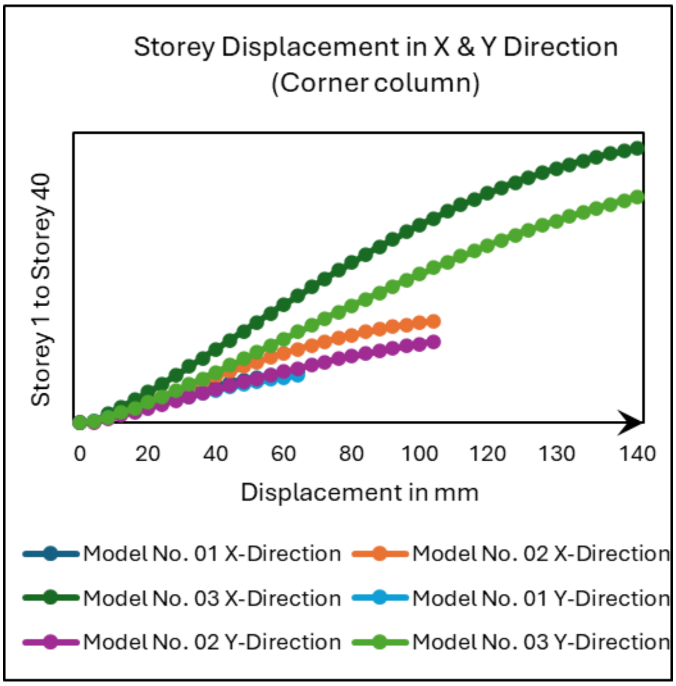

**Graph- 4** Storey Displacement in X & Y Directions for all floating column (for 15floor, 25floor, 40 floor)




**Graph 5** Storey Displacement in X & Y Directions for Edge column (for 15floor, 25floor, 40 floor)

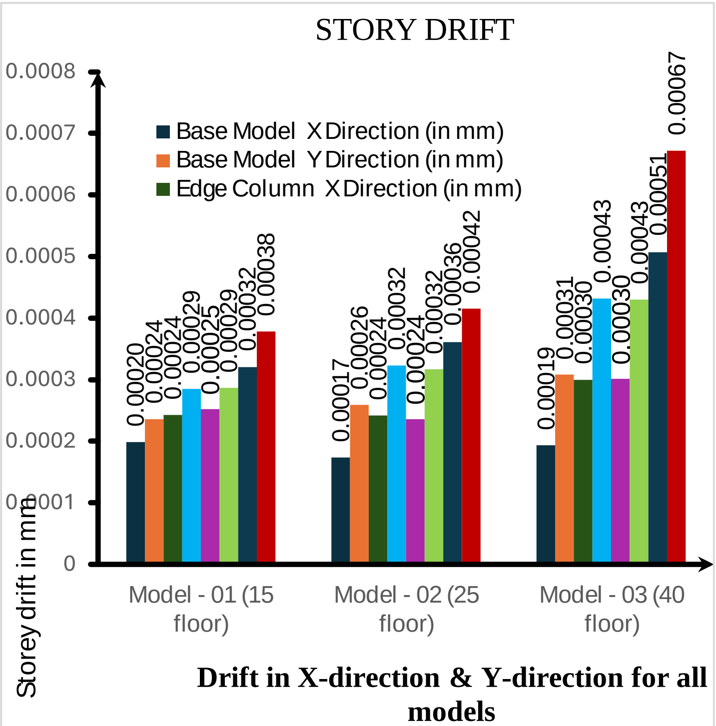



**Graph- 6** Storey Displacement in X & Y Directions for Center column (for 15floor, 25floor, 40 floor)

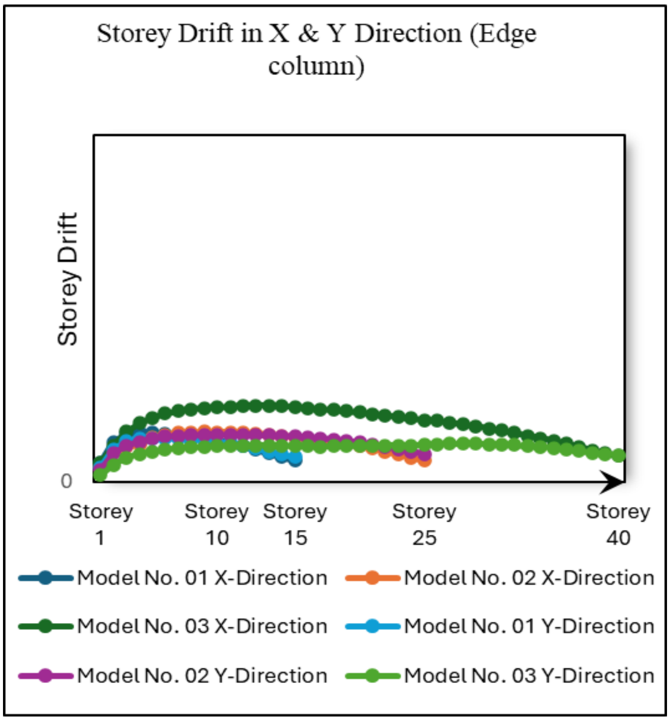



**Graph-7** Storey Displacement in X & Y Directions for Corner column (for 15floor, 25floor, 40 floor)

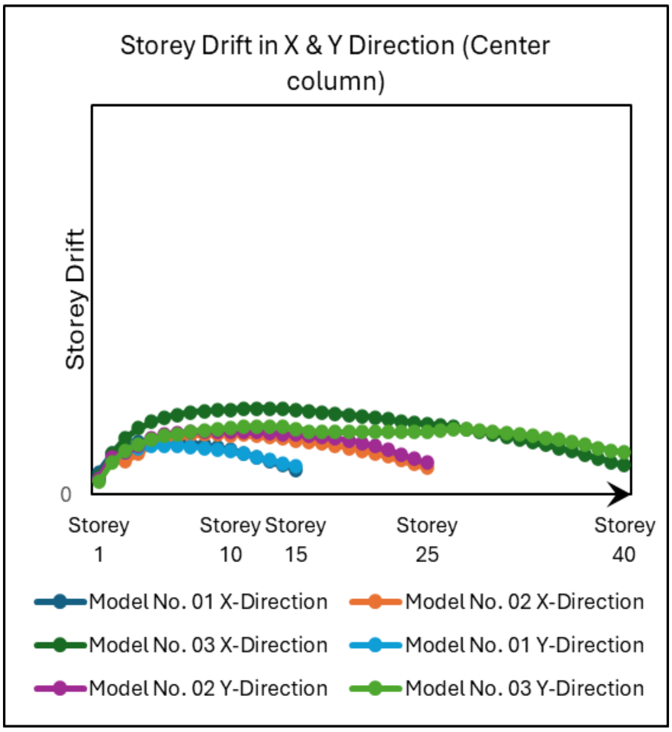
### 5.3 STOREY DRIFT



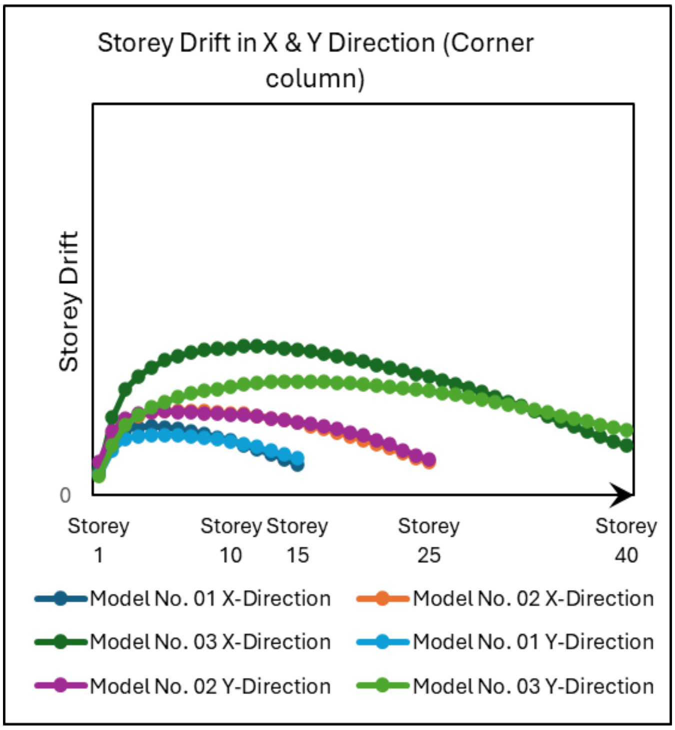

**Graph -8** Storey Displacement in X & Y Directions for all floating column (for 15floor, 25floor, 40 floor)




**Graph- 9** Storey Displacement in X & Y Directions for Edge column (for 15floor, 25floor, 40 floor)




**Graph -10** Storey Displacement in X & Y Directions for Center column (for 15floor, 25floor, 40 floor)




**Graph -11** Storey Displacement in X & Y Directions for Corner column (for 15floor, 25floor, 40 floor)

## 6. CONCLUSIONS

Based on the results it can be concluded that

1. Buildings with floating columns exhibited higher lateral displacement and storey drift compared to regular buildings without floating columns. The increase in displacement and drift became more significant with increase in building height.
2. The centre floating-column model performed comparatively better due to more symmetrical load distribution and reduced torsional effects.
3. Storey drift values increased considerably near the transfer level due to sudden stiffness discontinuity and concentration of lateral deformation. However, the obtained drift values were found to be within permissible codal limits specified in IS 1893 (Part 1): 2016.
4. Base shear values varied with building height and floating column configuration. Buildings with floating columns generally showed reduced stiffness, which altered the dynamic characteristics and seismic force distribution of the structure.
5. Modal mass participation results indicated that sufficient modal participation mass was achieved within the required number of modes, satisfying codal recommendations for dynamic analysis.
6. Transfer girders supporting floating columns experienced significantly higher bending moments and shear forces due to concentrated load transfer from upper storeys.
7. floating columns introduce structural irregularity and affect seismic performance, particularly when located at corner positions. Therefore, the use of floating columns should be minimized wherever possible.
8. If floating columns are unavoidable due to architectural requirements, centre-positioned floating columns with properly designed transfer girders, ductile detailing, and adequate lateral load-resisting systems should be preferred.
9. Proper seismic analysis, codal compliance, and structural detailing are essential to ensure the safety and serviceability of floating column buildings in earthquake-prone regions.

**Future Scope:** Further studies may investigate the effectiveness of shear walls, bracing systems, outrigger systems, dampers, and diagrid structures in improving the seismic resistance of floating column buildings.

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