Seismic analysis of building with floating column

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Abstract: **In present scenario buildings with floating column is a typical feature in the modern multistory construction in urban India. Such features are highly undesirable in building built in seismically active areas. This study highlights the importance of explicitly recognizing the presence of the floating column in the analysis of building. Alternate measures, involving stiffness balance of the first storey and the storey above, are proposed to reduce the irregularity introduced by the floating columns. FEM codes are developed for 2D multi storey frames with and without floating column to study the responses of the structure under different earthquake excitation having different frequency content keeping the PGA and time duration factor constant. The time history of floor displacement, inter storey drift, base shear, overturning moment are computed for both the frames with and without floating column.**

I. Introduction

Many urban multi-storey buildings in India today have open first storey as an unavoidable feature. This is primarily being adopted to accommodate parking or reception lobbies in the first storey. Whereas the total seismic base shear as experienced by a building during an earthquake is dependent on its natural period, the seismic force distribution is dependent on the distribution of stiffness and mass along the height. The floating column is a vertical member which rest on a beam and doesn't have a foundation. The floating column act as a point load on the beam and this beam transfers the load to the columns below it. But such column cannot be implemented easily to construct practically since the true columns below the termination level are not constructed with care and hence finally cause to failure [Sukumar Behera et al, 2012]. The floating column is used for the purpose of architectural view and site situations. It can be analyzed by using STAAD Pro, ETABS and SAP2000. . The Provision of floating columns can be stated as most of the buildings in India are covering the maximum possible area on a plot within the available bylaws.

Objective and scope of present work

To analyze RCC frame (G+10) with floating columns in different locations. To investigate the base shear & Drift between floating columns located in outer periphery (4 sides & 2 Sides)

1) Modeling & Analysis of G+10 RCC building with floating columns located outer periphery (4 Sides) **(Case 2a)**
2) Modeling & Analysis of G+10 RCC building with floating columns located outer periphery (2 Longer Sides) **(Case 2b)**
3) Modeling & Analysis of G+10 RCC building with floating columns located outer periphery (2 Shorter Sides) **(Case 2c)**

The G+10 storey RCC building by considering effect of floating column in the modeling. The moment about X and moment about Z are compared by equivalent static analysis method. The above building models are generated using the software STAAD Pro 8Vi and are analyzed using equivalent static method. In this work entitled analysis of multistoried building with floating column analytical study is carried out on floating column. Preliminary study is carried out on a building model comparing three cases.

II. Model Formulation

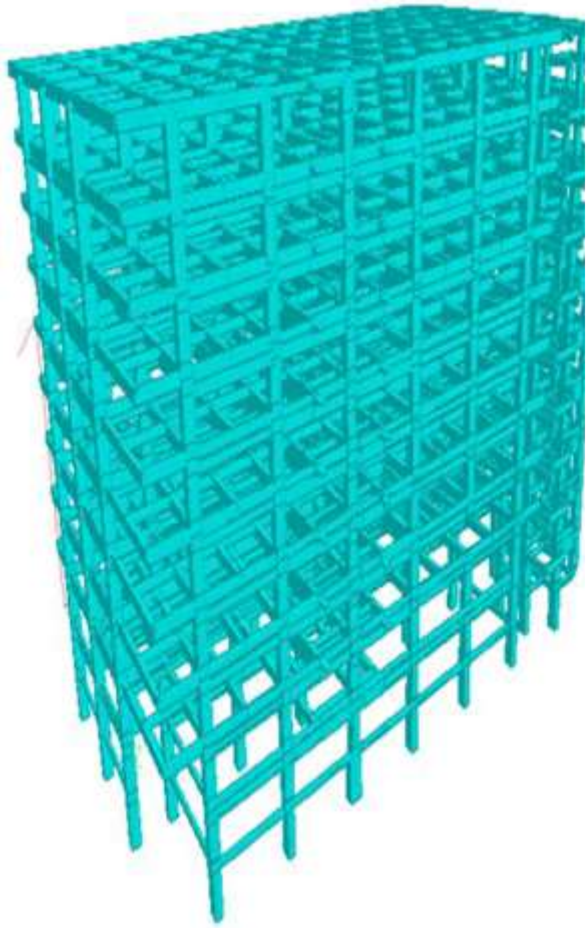
The study is carried out on a building with floating columns. The plan layout of the building is shown in the figure. The building considered is a residential building having G+10. Height of each storey is kept same as other prevalent data.

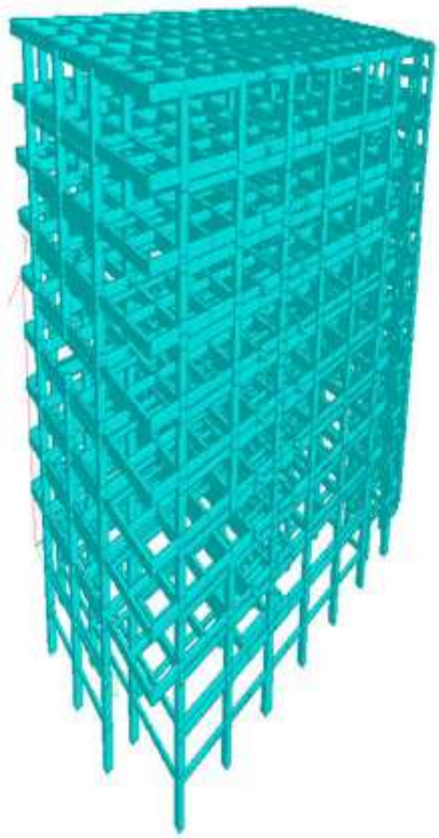
Research Significance:

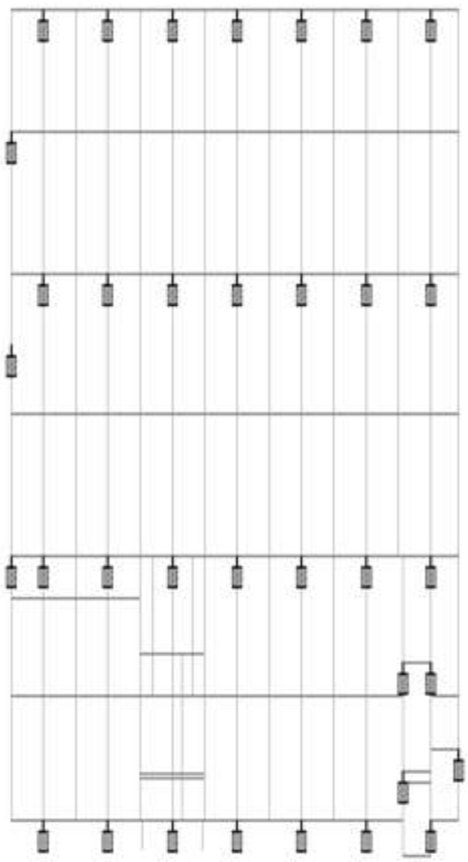
In urban areas, multi storey buildings are constructed by providing floating columns at the ground floor for the various purposes which are stated above. These floating column buildings are designed for gravity loads and safe under gravity loads but these buildings are not designed for earthquake loads. So these buildings are unsafe in seismic prone areas. The project aims to create awareness about these issues in earthquake resistant design of multi-storeyed buildings.

III Modeling of Building

The (G+10) with a floating column building, with specially moment resisting frames in two orthogonal directions were selected for the study. The building is considered to be located in Zone III as per IS 1893:2002. The building is modeled using the software STAD Pro. V8i. The analytical models of the building include all the component that influence the mass, strength, stiffness and deformability of structure. The building structural system consists of beam, column, slab, wall, foundation retaining wall, elevator, and staircase.







IV Plan of Building

Building with Floating Column

Total building consists of 3 phases. 1st phase consists of lower two storey provided for parking purpose.2nd phase is of residential flats from 1st floor to 5th floor.3rd phase is of duplex.

Phase1: upper and lower ground floor

This phase is also for parking as in building without floating column but placements of columns are changed.

Phase 2: 1st floor to 5th floor

Each floor includes residential area consisting of a flat system. The flat system consist of 2 BHK and 3 BHK at alternate floors. The built up area is 3733.2 sq. m and the terrace area is 1863.47 sq. m .the floor consist of all the columns coming from the ground level. Certain overhang is provided on either side of the floor. Staircase of dog legged type is provided and elevator of 1.4 X 1.72 m. Terrace of 3 X 7.35 m at each floor is provided. In this building 6 numbers of columns are floated from 2nd slab.

Phase 3: 6th floor plan

On 6th floor duplex is provided. Some more columns are floated here.

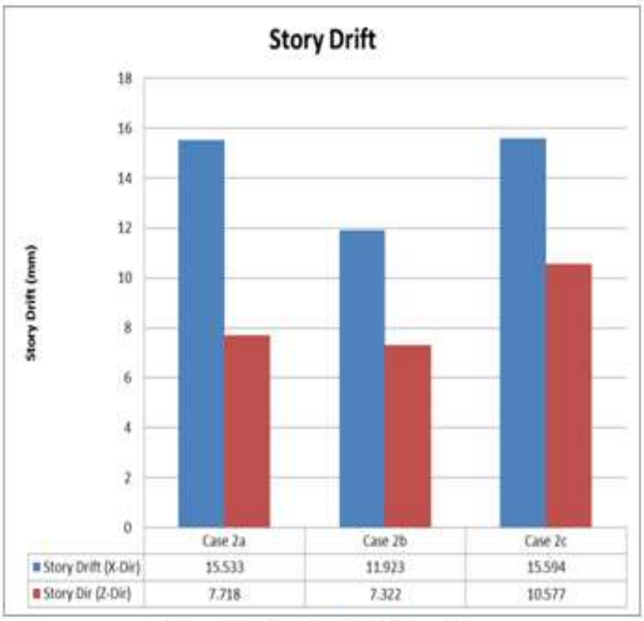
Analysis of Building

Seismic codes are different for a particular region or a country. In India, Indian standard criterion for earthquake resistant design of structures IS 1893(part 1): 2002 is the main code that provides outline for calculating seismic design forces. This force depends on the mass and seismic coefficient of the structures and the latter in turn depends on properties like seismic zone in which the structures lies, importance of the structure the soil strata, its stiffness and its ductility.

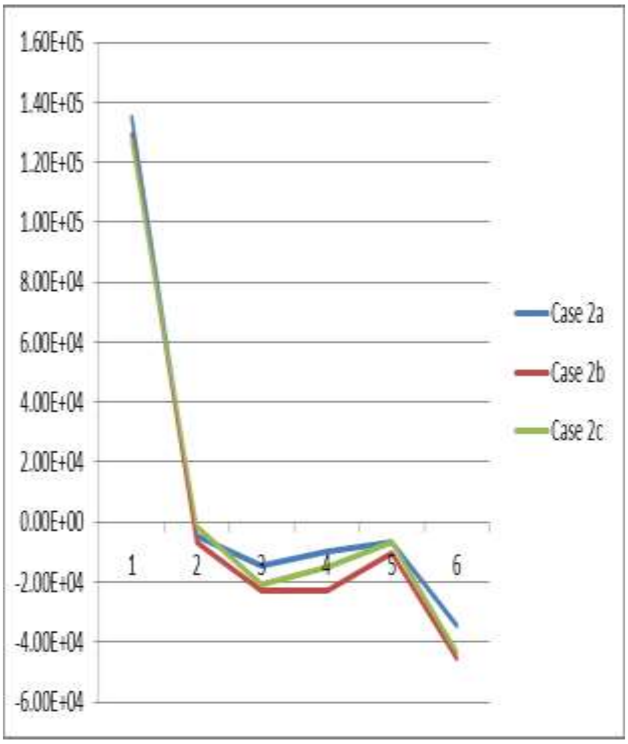
V. Results and Discussion

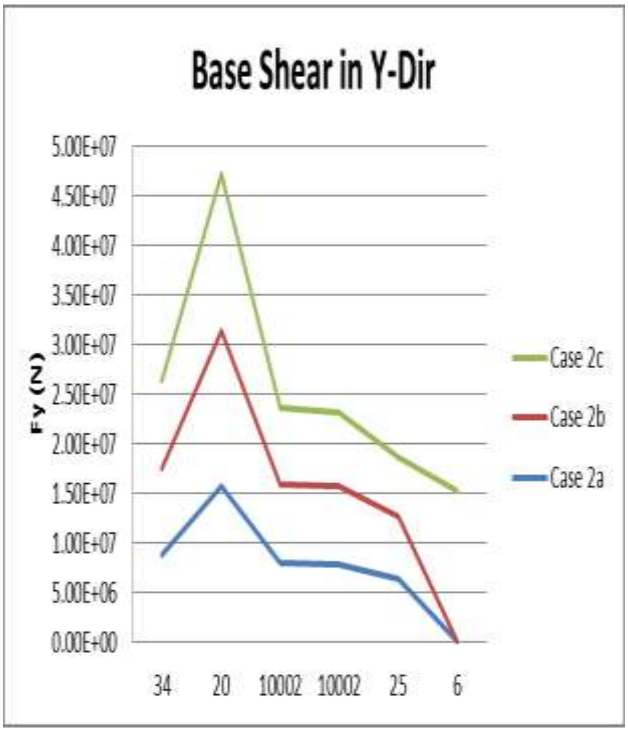
Phase I

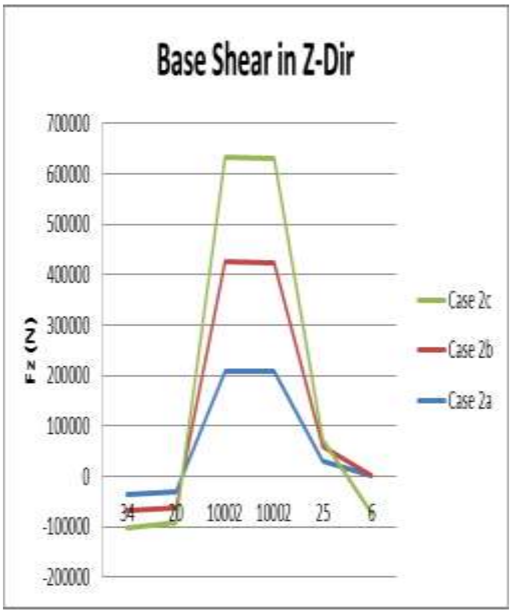
By the application of lateral loads in X and Z directions the structure can be analysed for various load combinations given by clause 6.3.1.2 of IS 1893:2002. For the given load combinations maximum displacement at each floor is noted in X and Z direction and are shown below in the form of a graph



Story Drift in X & Z Direction







VI. Conclusion

Preliminary study is carried out on a building model comparing three cases. The difference in the probabilities of failure with floating column (Case 2b) is more than floating column (Case
2c). In Case2b and Case2c, column shears values are increasing or decreasing significantly depending upon position and orientation of column.

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