International Research Journal of Education and Technology
Peer Reviewed Journal
ISSN 2581-7795

Analysis of Multistory Building With and Without Column Floating Column Under Seismic Loading

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ABSTRACT

Floating column is a vertical member, which at its lower level rests on a beam which is a horizontal member. The beam in turn transfers load to the column below it, thus load transfer path in the discontinuous frame changes from vertical to horizontal. Floating columns are a representative feature in the recent multi-story construction in metropolitan India and are highly unwanted in buildings constructed in seismically active areasnumerous structures in current times have designed and constructed for architectural complexities such as structure with floating columns at various levels and places. These floating columns are extremely harmful in structure which is constructed in seismically prone areas. The lateral forces which are developed at different levels in structure require to be carried down along the height to ground by through path, but due to floating column there is discontinuity in the load transfer passageway which results in unfortunate performance of structure. In this study the analysis of 13 story floating column structure is considered and analysis is done using STAAD Pro. This study is also to find whether the structure is safe or unsafe with floating column is built in seismically active areas with various cases where the floating column is provided on different floors.

Keywords: Floating column, High rise Structure, Residential Building, Stress.

INTRODUCTION-In more recent times, high-rise buildings in urban areas are required to have a column-free space due to lack of space, population and aesthetic and operational requirements. For this building floating columns are provided on one or more floors. These floating columns are the worst of the building ever built in earthquake zones. Seismic forces developed at different levels in a building need to be lowered to the ground by a very short road. Deviation or discontinuation of this load transfer method results in poor performance of the structure. The behavior of a building during an earthquake depends largely on the overall shape, size and geometry, in addition to the way the earthquake forces are carried down. Many of the open-air parking buildings collapsed or severely damaged in Gujarat during the 2001 earthquake in Bhuj. The performance of a building throughout the earthquake depends heavily on all shapes, sizes and geometry, in addition to how the forces of earthquakes are carried on the ground. Seismic forces developed at abnormal levels in a building need to be lowered all the way to the ground in a short way; any deviation or termination in this effect of the transfer mechanism for the efficient operation of the structure. Buildings with continuous disruption (such as hotel buildings with fewer floors than the general ones) create an unexpected escalation in the seismic power of the stop phase. Buildings with columns or walls below a certain floor or with an unusually high floor are often damaged or collapsed on that floor. Many of the open-air parking buildings collapsed or severely damaged in Gujarat during the 2001 earthquake in Bhuj. Buildings with columns hanging or floating on the beams on the middle floor and do not move to the base, have elements that do not work in the way of the load

Floating Column:

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.

There are many buildings in which floating columns are adopted, especially above the ground floor, where transfer girders are employed, so that more open space is available in the ground floor. This open space may be utilized as party hall, assembly hall and for parking purpose. The transfer girder has to be designed and detailed properly, especially in the earthquake zones. The column acts as concentrated load on beam. As far as analysis is concerned, the column is often assumed pinned and therefore taken as point load on the transfer beam.

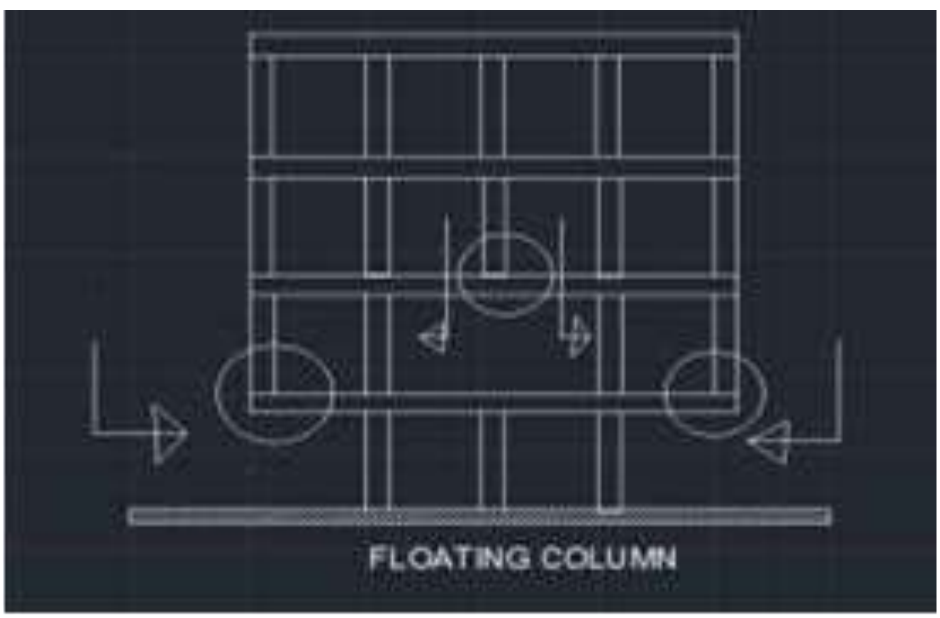

Fig 1- Floating column in building

Table 1Types Of Cases Used For Analysis Of Structure

Building configuration	G+12
No. of bays in X direction	5
No. of bays in Z direction	5
Height of building	45 M
Dimensions of building	25 X 25 M^2
Size of beam	0.6 X 0.55,
Size of column	0.6 X 0.55
Concrete and Steel Grade	M 30& FE415

Table2Detailsofbuilding

Earthquake parameters	Zone III with RF 4 & 5% damping ratio
Period in X & Z direction	0.72&0.72 for both direction
Dead load for floor with waterproofing	2KN/m^2& 1KN/M^2
Live load for floor and roof	3KN/M^2&1.2 KN/M^2

Table 3 Detail of loading

RESULT AND DISCUSSION-

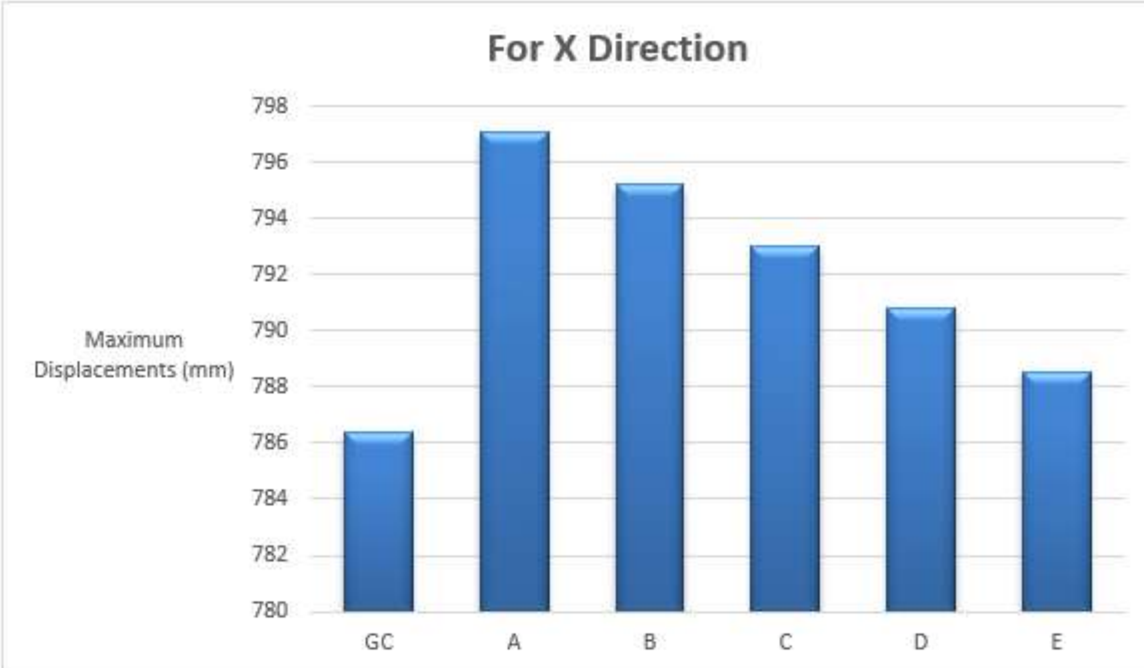

Fig.1: Maximum Displacement in X direction for all cases in Zone III

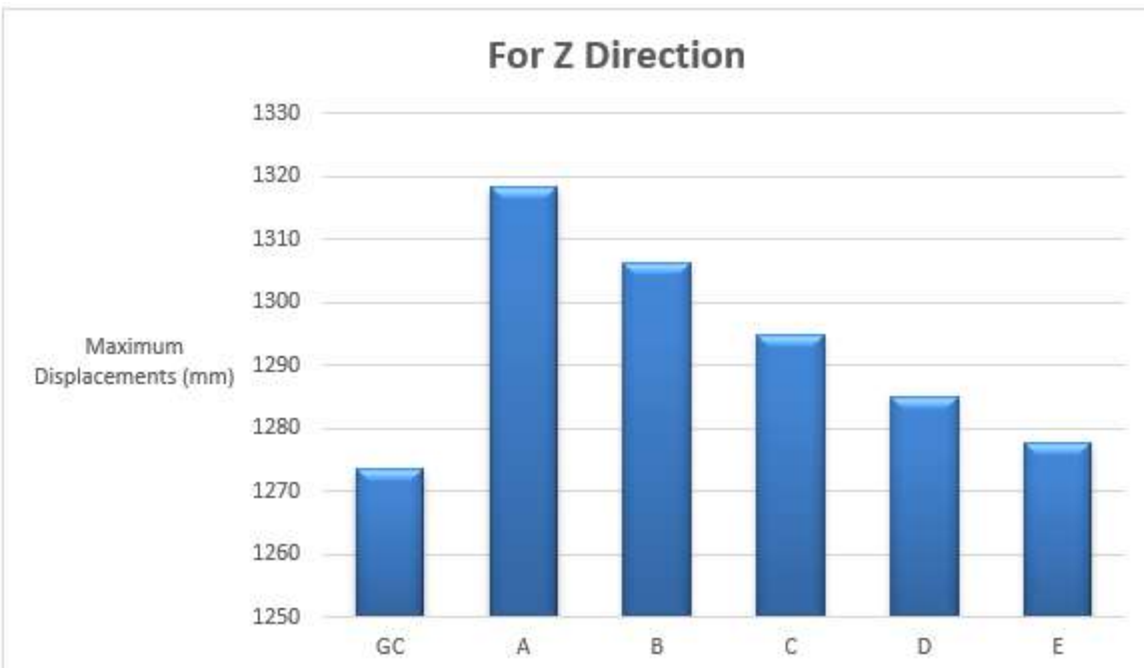

Fig.2: Maximum Displacement in Z direction for all cases in Zone III

Fig.3: Storey Drift in X direction for cases in Zone III

Fig. 4: Storey Drift in Z direction for all cases in Zone III

ISSN 2581-7795

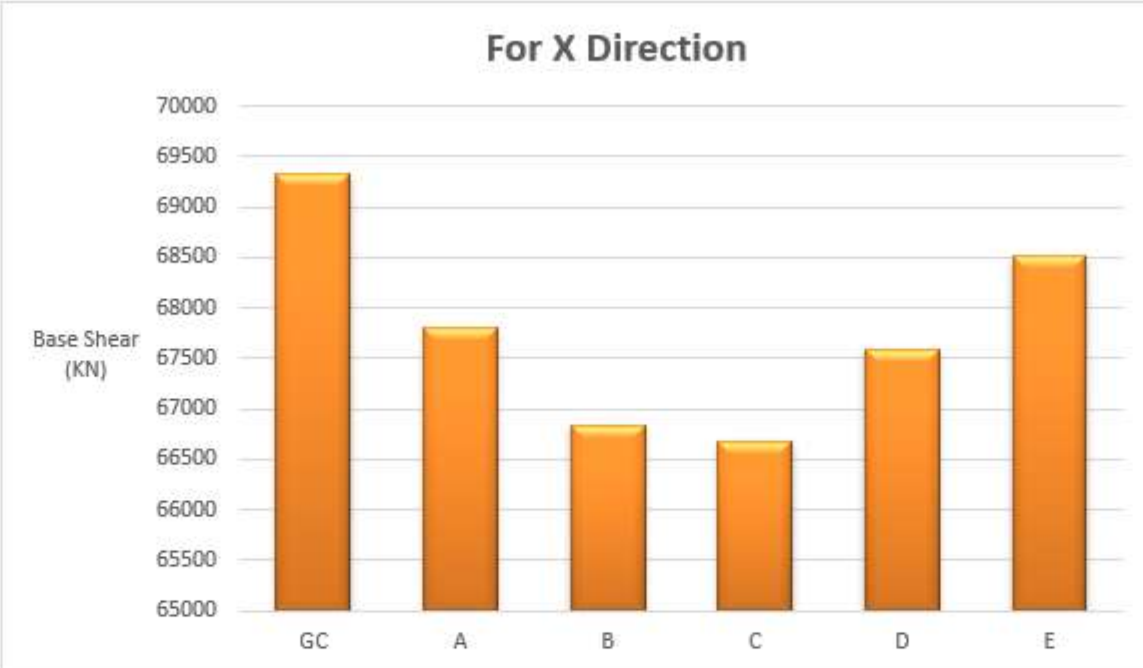

Fig. 5: Base Shear in X direction for all Building cases

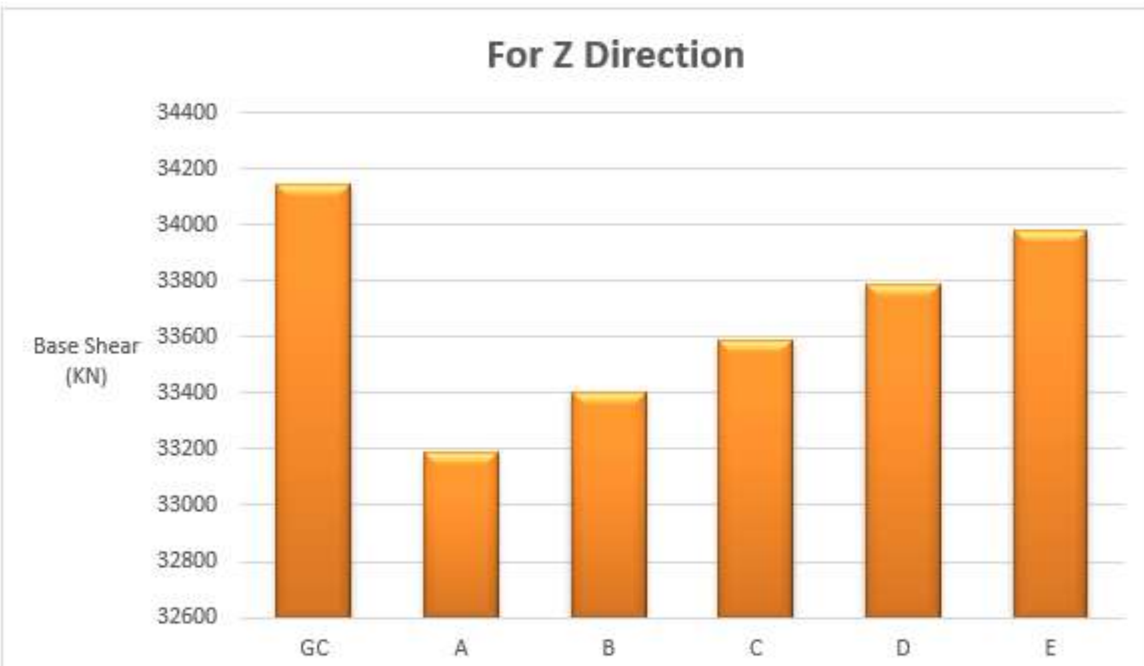

Fig. 6: Base Shear in Z direction for all Building cases

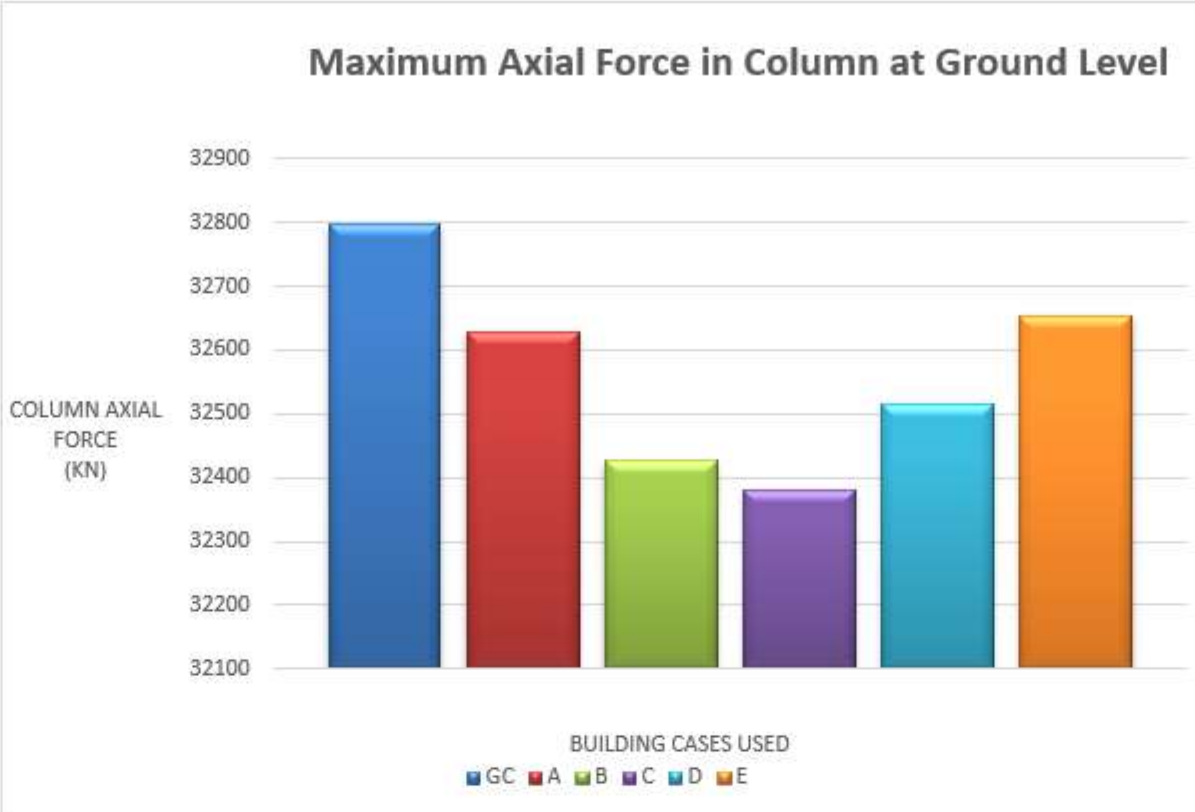

Fig. 7: Maximum Axial Forces in Column at ground level for all Building cases

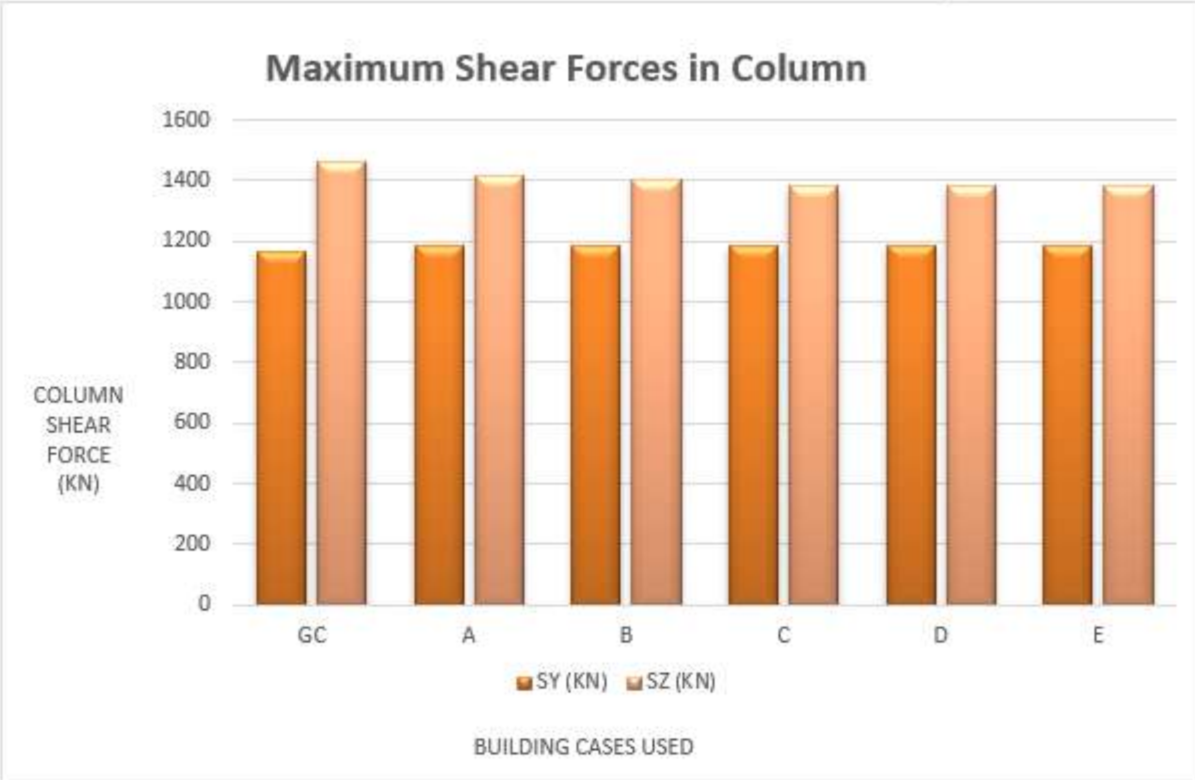

Fig.8: Maximum Shear Forces in Columns for all Building cases

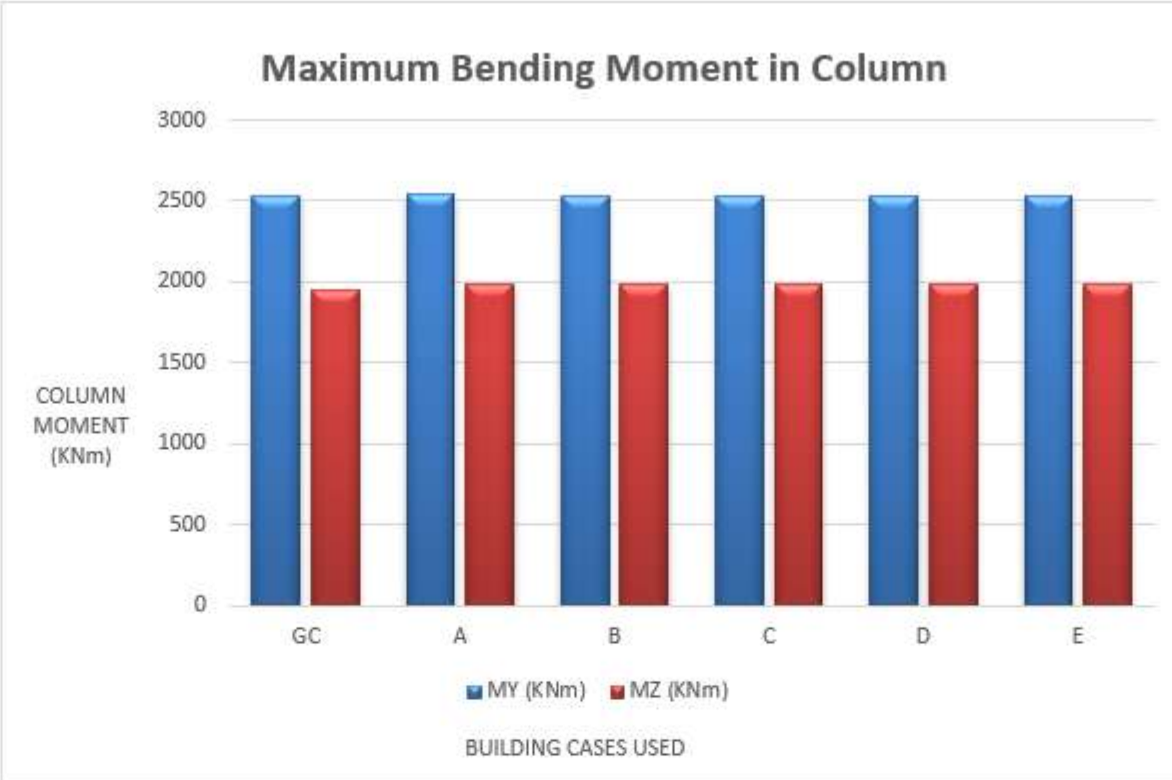

Fig. 9: Maximum Bending Moment in Columns for all Building cases

Fig. 10: Maximum Shear Forces in beams parallel to X direction for all Building cases

Fig. 11: Maximum Shear Forces in beams parallel to Z direction for all Building cases

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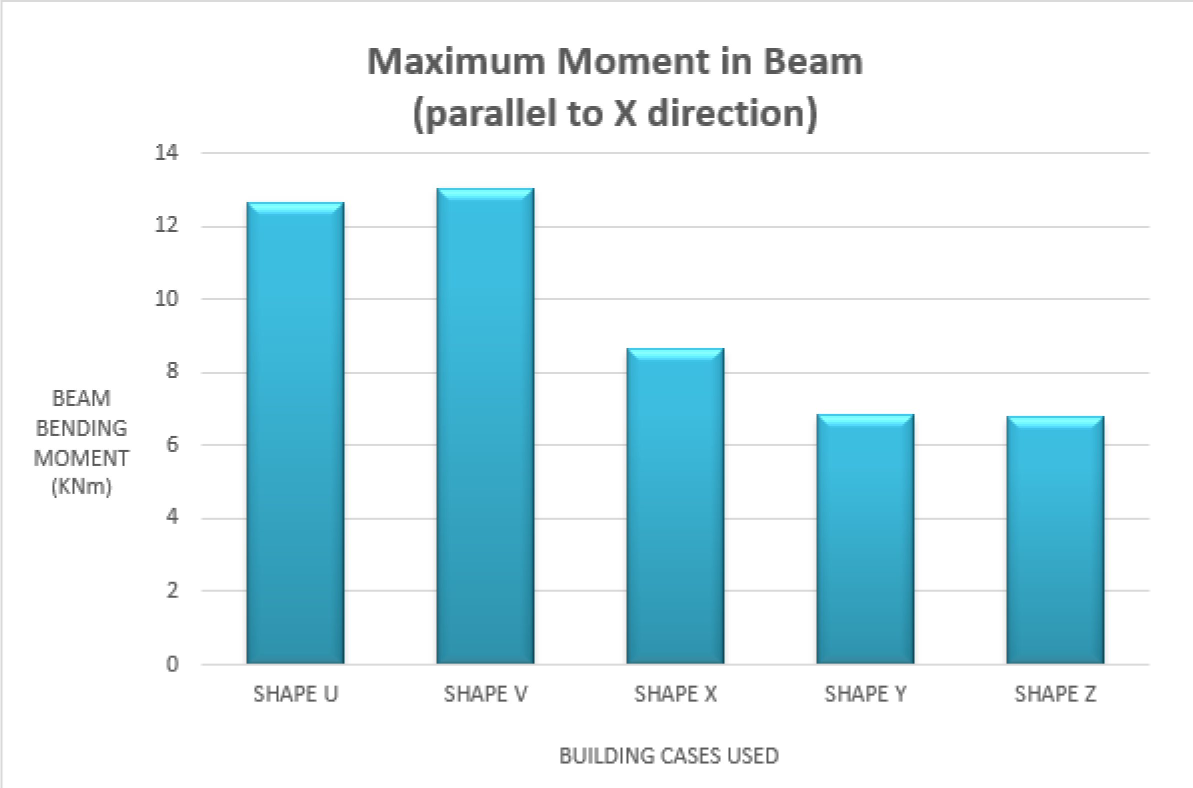

Fig. 12: Maximum Bending Moment in beams parallel to X direction for all Building cases

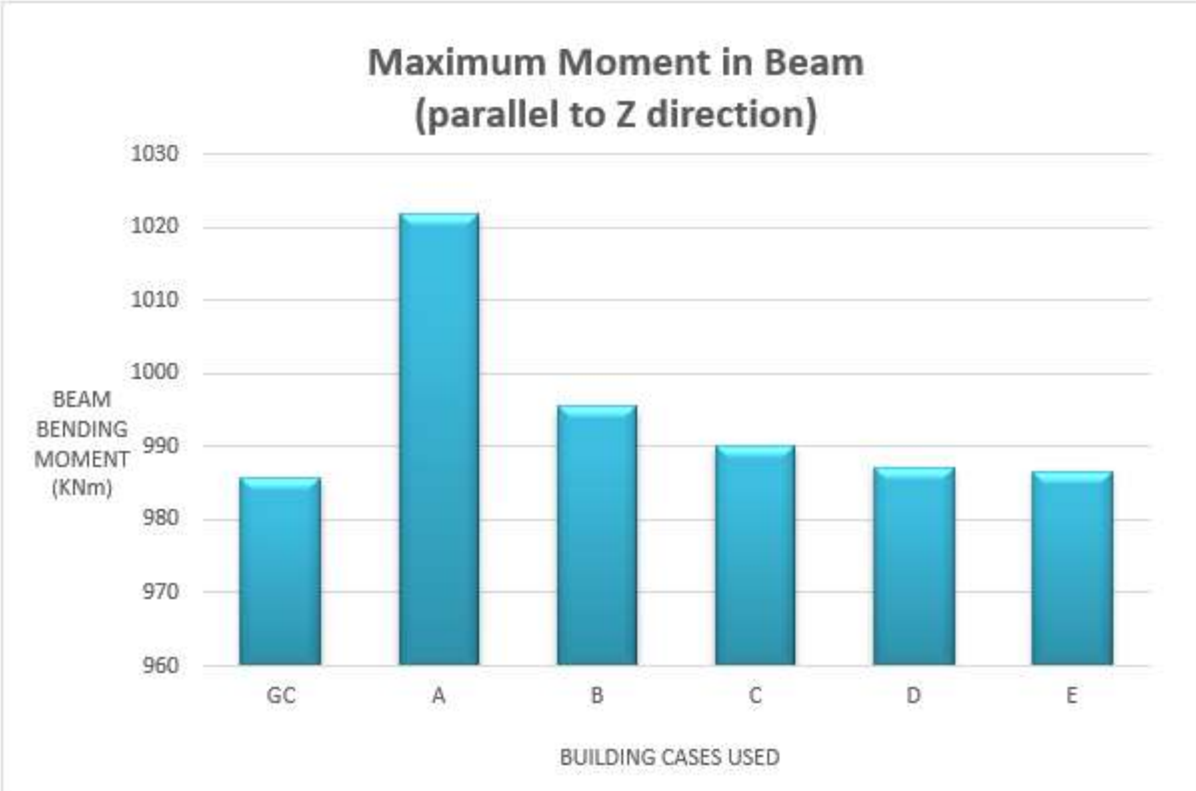

Fig. 13: Maximum Bending Moment in beams parallel to Z direction for all Building cases

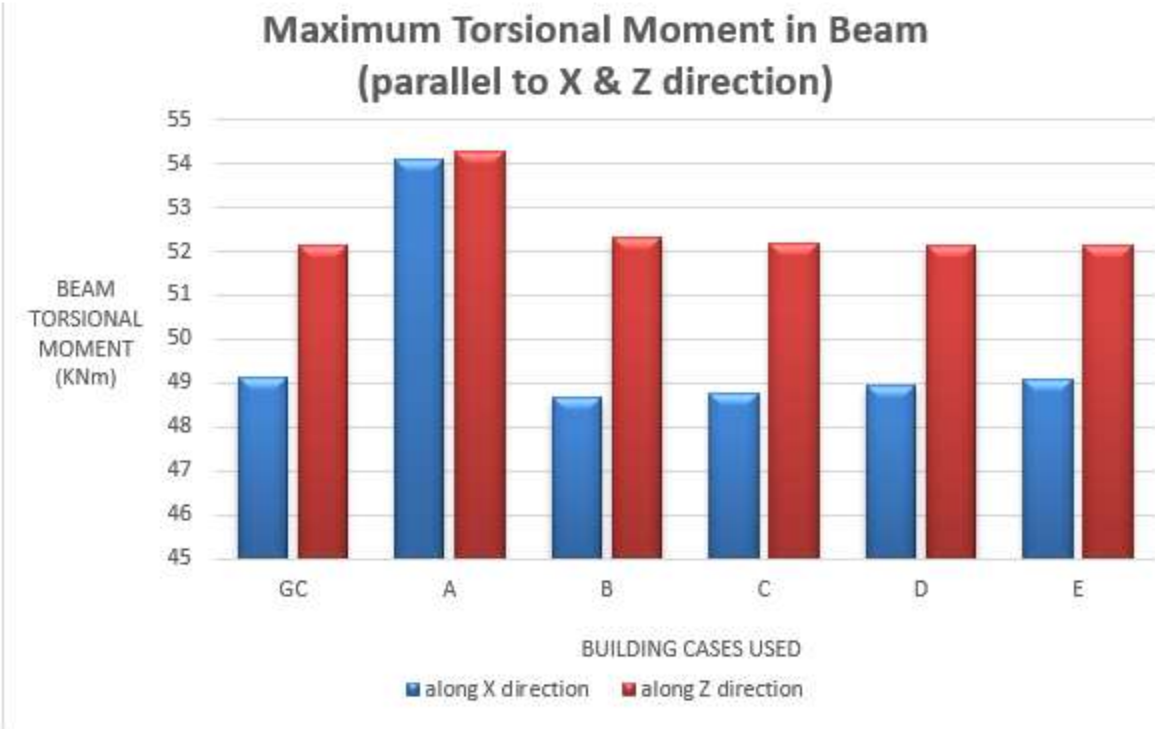

Fig. 14: Maximum Torsional Moment in beams parallel to X &Z direction for all Building cases

Conclusion

On the basis of above parameters following results are obtained from this comparative study. On comparing it has been concluded that the maximum displacement obtained for Cases E with a minimum value respectively both X and Z directionas per comparative results, Case C for axial forces values are found best among all the cases. On analyzing column shear force values, Case C is effective for both directions. On analyzing column bending moment values, Case C is effective for X and Z direction as per comparative results, Case C for X direction and Case A for Z direction for base shear values are found best among all the cases. On analyzing beam shear force values, Case E is effective for X direction and case A is effective for Z direction. On analyzing beam bending moment values, Case A is effective for X and Case E is effective for Z direction On analyzing Torsional force values, Case B is effective for X direction On analyzing Torsional force values, Case D is effective for Z direction As the analysis of all parameters Case E is the best case for using floating column.

As per the above result shown that there are 6 different cases we study and we find the various result of these cases including with or without floating column condition and we concluded that the floating column we should provide on case E building where all the results are satisfactory or we can say structure is safe and efficient among all the other cases.

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