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A Review Study on Seismic Behavior of Tall Structure by using Floating Columns with Shear Wall

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INRODUCTION

- Floating column rest on the beam, means the beam which support the column is act as a foundation. That beam is called as transfer beam. This is widely used in high storied buildings which are used for both commercial and residential purpose. This helps to alter the plan of the top floors to our convenience. The transfer beam that support floating column will be designed with more reinforcement.
- Many urban multistory 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.
- 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 behavior of a building during earthquakes depends critically on its overall shape, size and geometry, in addition to how the earthquake forces are carried to the ground.
- Buildings with columns that hang or float on beams at an intermediate storey and do not go all the way to the foundation, have discontinuities in the load transfer path.
- In structural engineering, a shear wall is a structural system composed of braced panels (also known as shear panels) to counter the effects of lateral load acting on a structure

Literature Survey

General

- **Borad et al. (2018)** Open ground story and Floating columns are typical features in the modern multi-storey constructions in urban India. Open ground storey and Floating columns are primarily being adopted to accommodate parking or reception lobbies in the ground storey. Floating columns also provided for the purpose to increase the floor space index. An investigation has been performed to study the behavior of the multi-storey buildings with soft storey and floating columns subjected to earthquake loading. The structural action of masonry infill panels of upper floors has also been taken into account by modelling them as diagonal struts. Shear wall is one of the most commonly used lateral load resisting system in high rise buildings. In this study, building is modelled with shear wall at different locations considering soft storey and floating columns. Linear and Non-linear dynamic analysis is carried out by using ETABS. The comparison of these models for different parameters like Storey drift, Storey stiffness, Max storey displacement, Modal time period, Base shear is carried.
- **Sasidhar T 2018** In the modern era of construction multi-storied building with floating column plays a major role in Urban India. These floating columns are used mainly for satisfying the space requirement in the structure and to get good architectural view of the building. In the present study, the analysis and design of multistoried building with and without floating columns was done using static analysis. A residential multistoried building consisting of G+5 has been chosen for carrying out project work.

Objectives

The objectives of the research are outlined below:
Present work is comparative study of the behavior of multistory buildings with and without floating columns with Conner shear panels under same loading condition for both buildings. Both buildings are analysis for wind load and seismic loading condition.

Methodology

In this study the behavior of building frame with and without floating column is studied under static load, Dynamic load and seismic loading condition. The Response Spectrum method is adopted for dynamic analysis in the STAAD. Pro.

Two 11 story two bay 3D building frame with and without floating columns are analyzed for static loading using the present FEM code and for dynamic loading using Response Spectrum method. For analysis of the commercial software *STAAD Pro*. For this study we design a 9- story building tower with all columns supporting to the ground and another same building is design with floating columns.
These columns are supported by a shear wall provided in place of brick

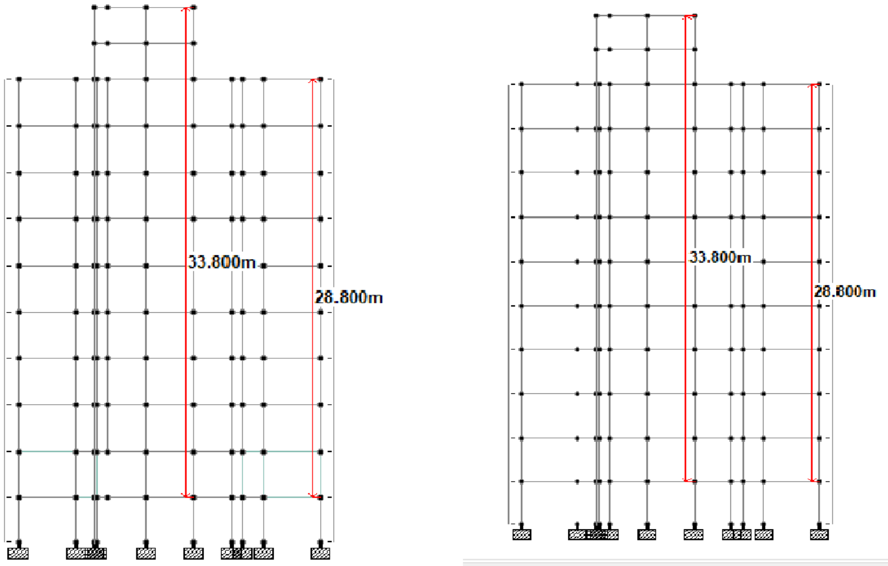


Fig.4.1 Geometry of the 2-dimensional framework Dimensions are in meter

Analysis

In this example two concrete frames with and without floating column having same material property and dimension are analyzed under same loading condition.

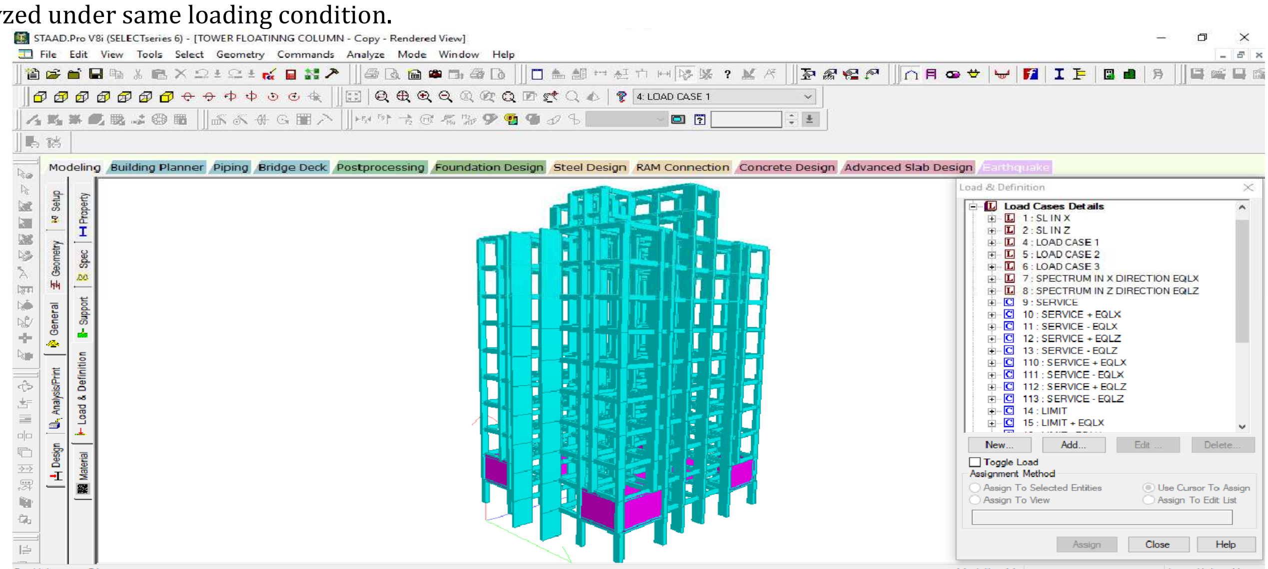


Fig.4.7 –STAAD Generated 3D Rendered model of building having shear wall and floating columns

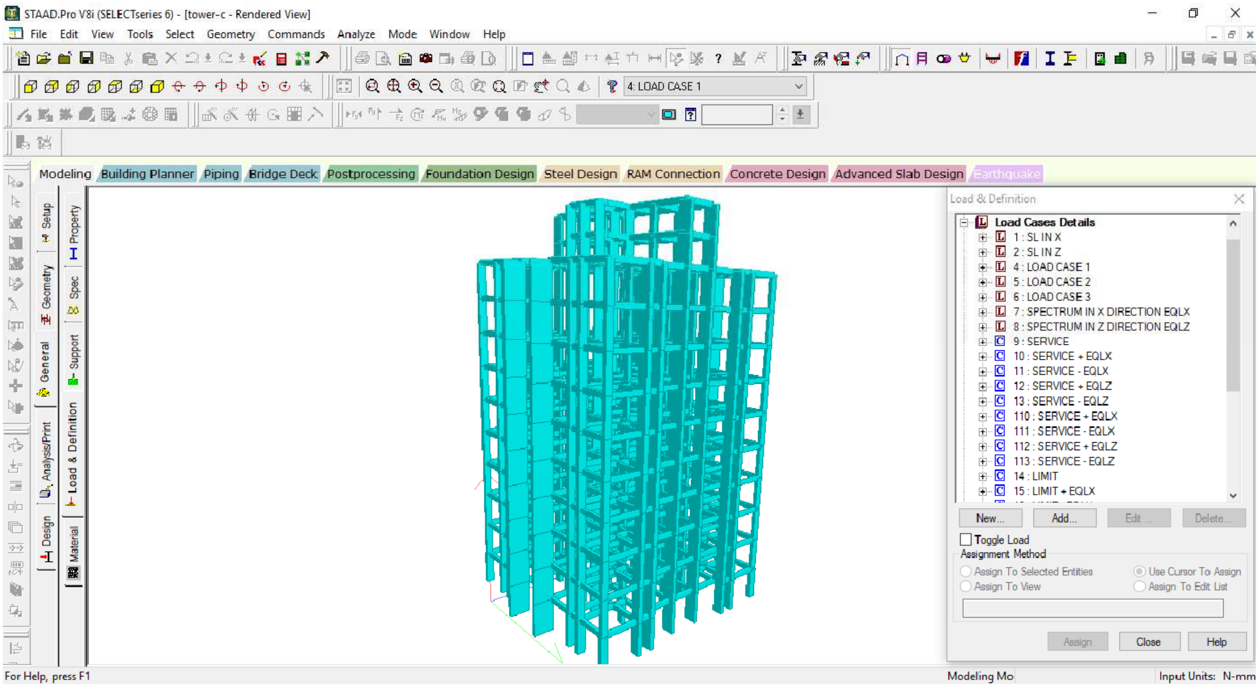


Fig.4.8 –STAAD Generated 3D Rendered model of building without shear wall and floating columns

Results

COMAPRISION BETWEEN BUILDING TOWERS WITH AND WITHOUT FLOATING COLUMNS

After finishing comparative study of the building's towers with and without floating columns a comparison is made on the basis of following points given bellow Then final result is obtained by reading these tables.

1. MAXIMUM BENDING MOMENT
2. MAXIMUM SHARE FORCE
3. AXIAL LOAD ON COLUMNS FOOTING
4. NODAL DISPLACEMENT OF BEAMS
5. VOLUME OF STEEL AND VOLUME OF CONCRETE

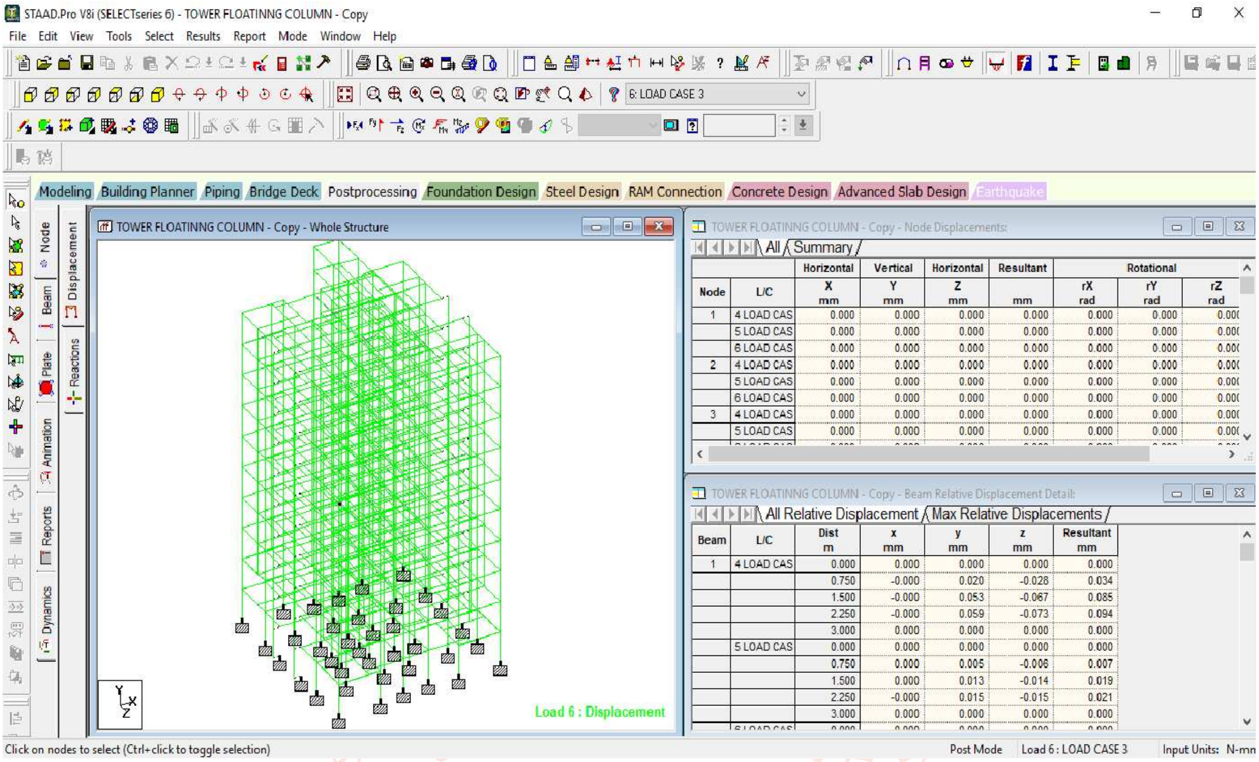


Fig.5.6 – STAAD Pro Model showingNodal displacement in Building without floating columns

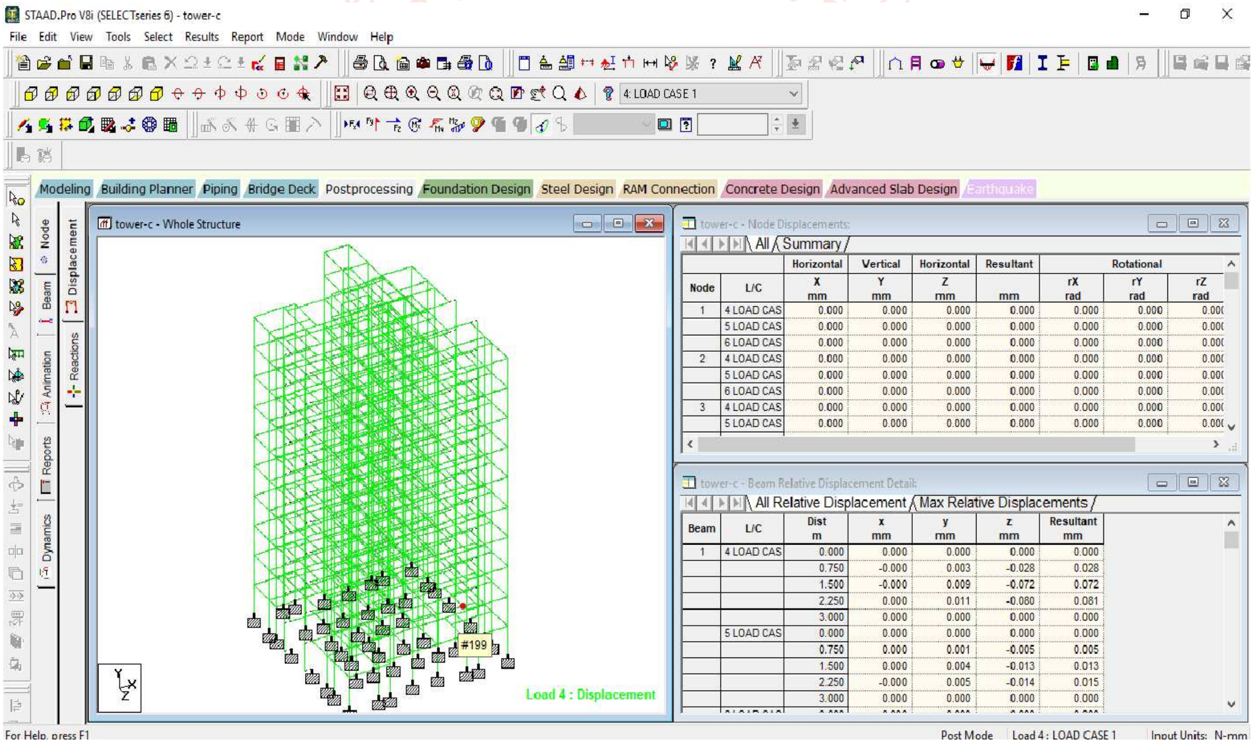


Fig.5.6 – STAAD Pro Model showingNodal displacement in Building without floating columns

1. VOLUME OF STEEL AND VOLUME OF CONCRETE

A. TOTAL VOLUME OF CONCRETE FOR BUILDING HAVING FLOATING COLUMN = 654.6 CUM

B. VOLUME OF STEEL

BAR DIA (in mm)	WEIGHT (in New)
8	125821
10	76746
12	183721
16	126834
20	75764
25	24383
32	39396

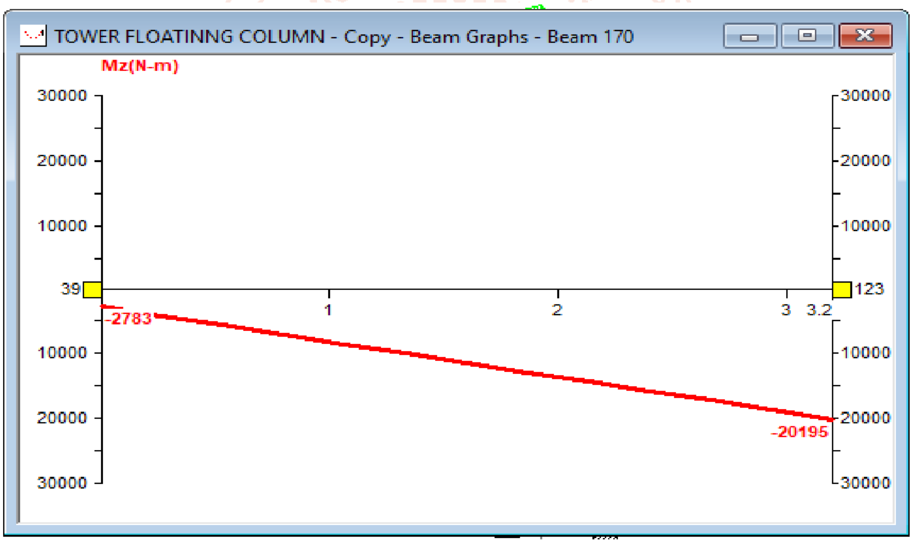
*** TOTAL= 652665 = 65266.5 KG

C. TOTAL VOLUME OF CONCRETE FOR BUILDING WITHOUT FLOATING COLUMN = 666.4 CUM

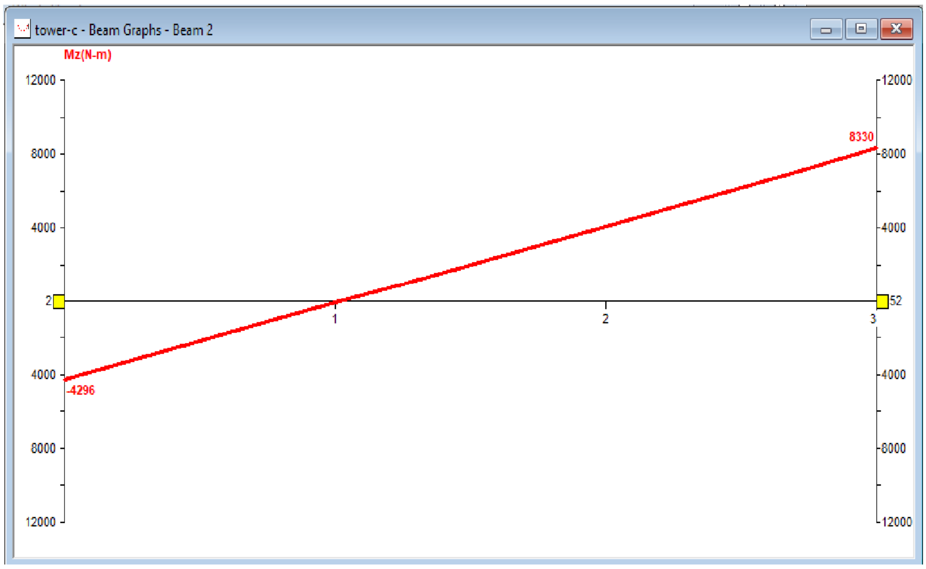
D. VOLUME OF STEEL

BAR DIA (in mm)	WEIGHT (in New)
8	130674
10	84173
12	203828
16	122924
20	78177
25	22385
32	62389

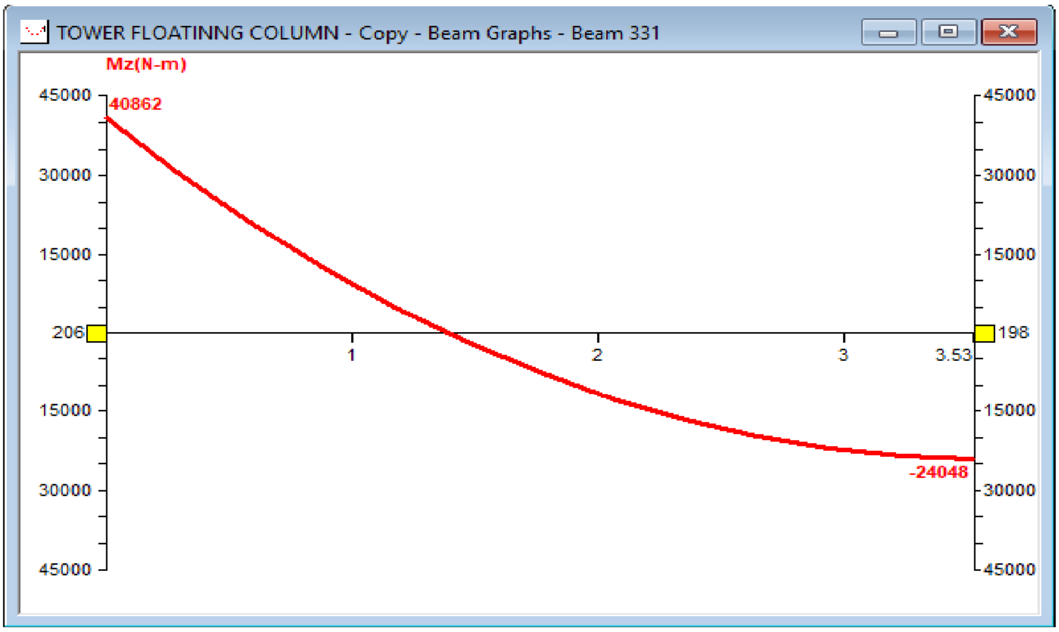
*** TOTAL= 704550 = 70455.0 KG



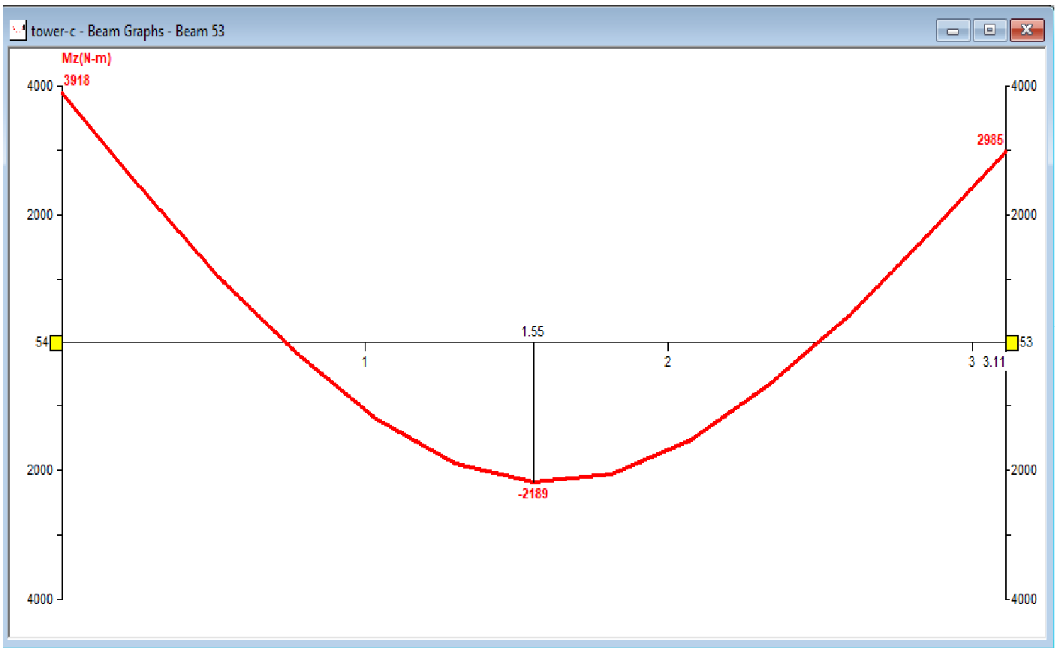
GRAPH: - 5.1 MAXIMUM MOMENT IN COLUMN FOR BUILDING HAVING FLOATING COLUMNS



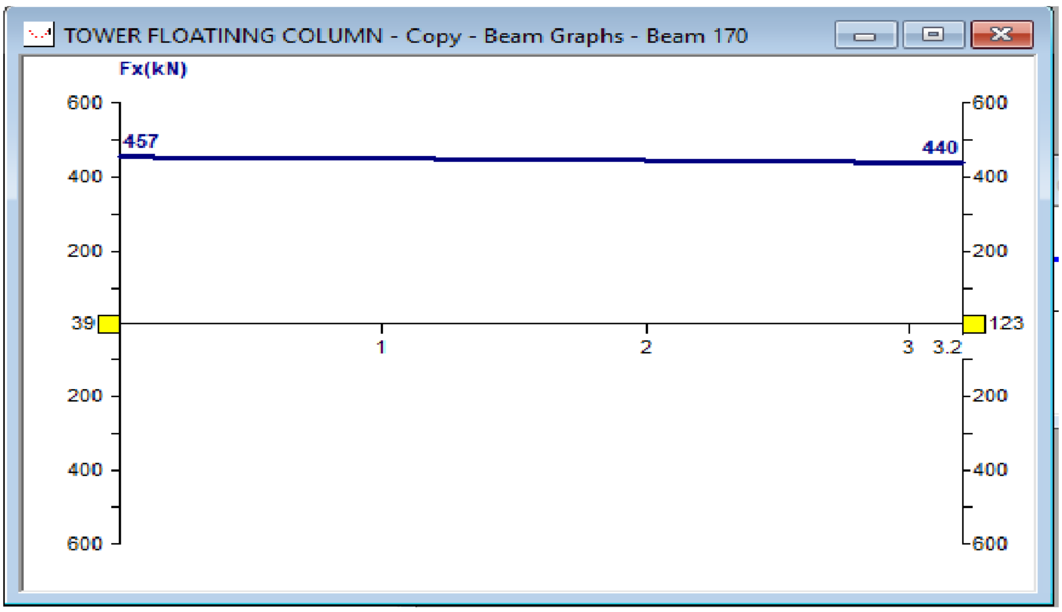
GRAPH: - 5.2 MAXIMUM MOMENT IN COLUMN FOR BUILDING WITHOUT FLOATING COLUMNS



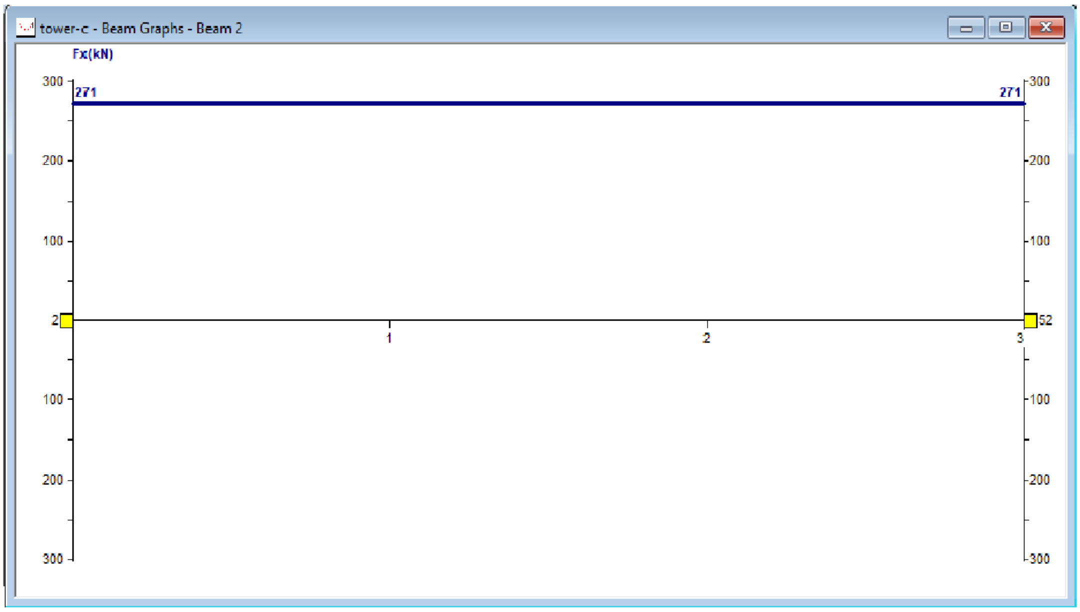
GRAPH: - 5.3 MAXIMUM MOMENT IN BEAM FOR BUILDING HAVING FLOATING COLUMNS



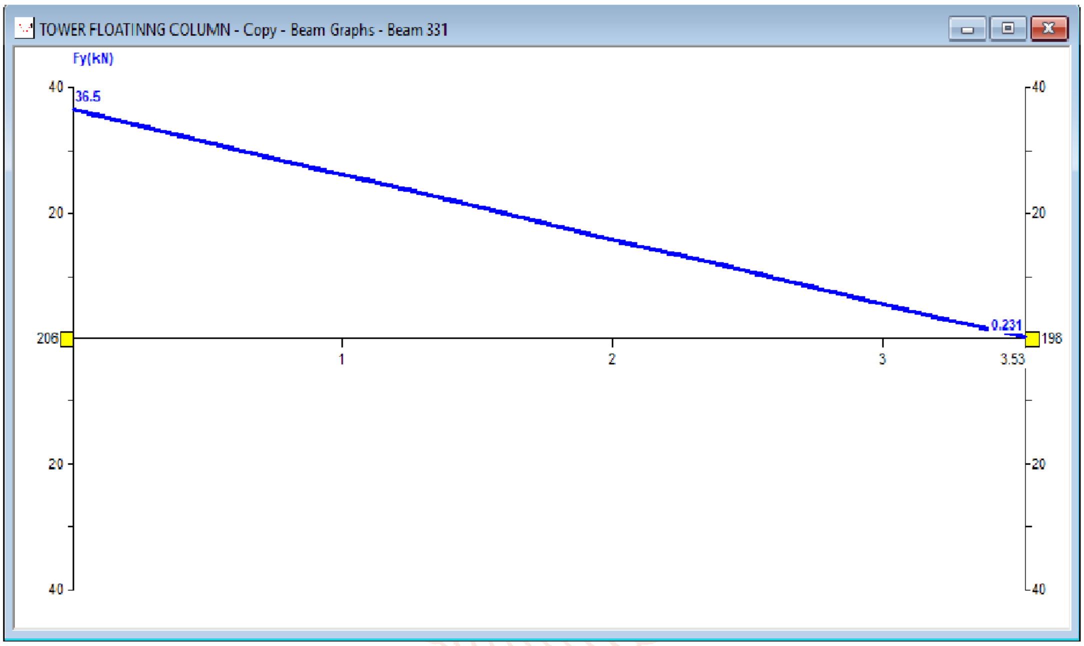
GRAPH: - 5.4 MAXIMUM MOMENT IN BEAM FOR BUILDING WITHOUT FLOATING COLUMNS



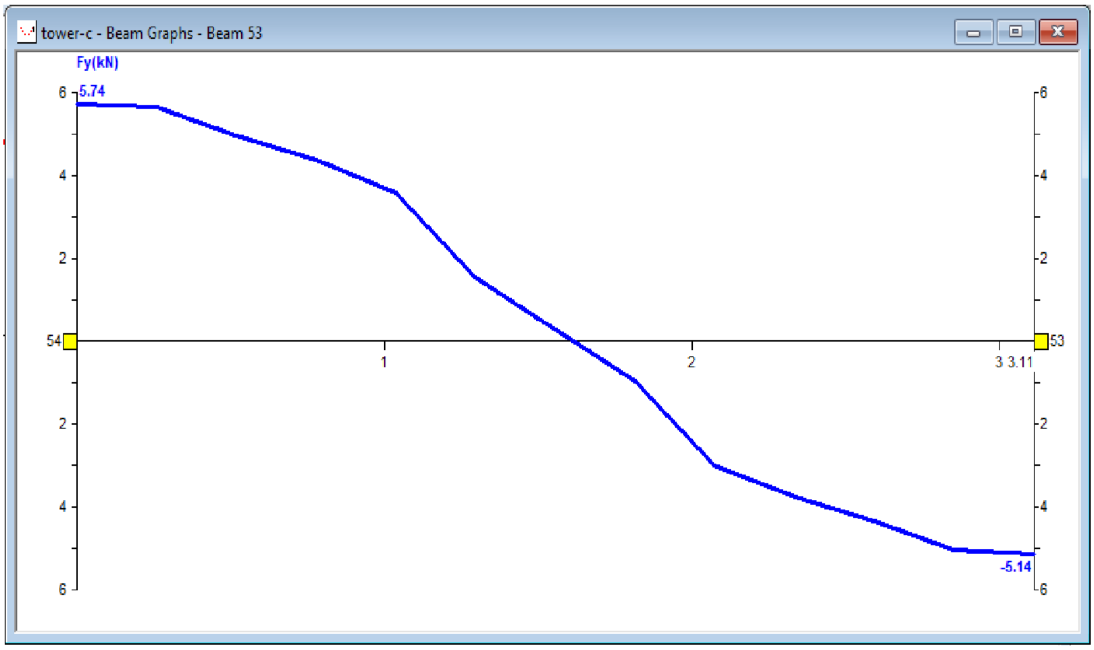
GRAPH: - 5.5 MAXIMUM SHEAR FORCE IN COLUMN FOR BUILDING HAVING FLOATING COLUMNS



GRAPH: - 5.6 MAXIMUM SHEAR FORCE IN COLUMN FOR BUILDING WITHOUT FLOATING COLUMNS



GRAPH: - 5.7 MAXIMUM SHEAR FORCE IN BEAM FOR BUILDING HAVING FLOATING COLUMNS



GRAPH: - 5.8 MAXIMUM SHEAR FORCE IN BEAM FOR BUILDING WITHOUT FLOATING COLUMNS

CONCLUSION

According to model analysis and results obtained from the design perform by STAAD. Pro V8i the following deductions are made

- There is small difference in quantity of concrete in building having floating columns and building without floating columns. The Quantity of concrete for building having floating columns is 654.6 CUM and for Building without floating columns is 666.4 CUM.
- There is major difference in steel used. Steel for building having floating columns is 65266.5 KG and for Building without floating columns is 70455.0 KG. Hence it is clear that cost of the building having floating columnsis less as comparison of same size building having all columns support in ground.
- The maximum +Vemoment in the building having floating columns is 4552.079 N-m and for the building without floating columns is 5940.73 N-m. and maximum -Ve moment in the building having floating columns is -9650.54 N-m and for the building without floating columns is -5940.73 N-m.

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