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ANALYZING IRREGULARITIES IN 10-STORY STRUCTURES: A COMPARATIVE STUDY OF THE IMPACT OF FLOATING COLUMNS WITH ETABS

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ABSTRACT: The purpose of the normal column is to distribute the weight to the base or bottom column and base. However, floating columns do not directly participate in load transfer. Depending on the architectural design needs of a particular project, floating columns can be placed on the ground floor, upper floor, or mezzanine. Beam or slabs are lack of permanent support from the underlying foundation. Note that floating columns are designed to carry gravity loads and have been shown to be better at transferring vertical loads than lateral stresses. The lateral load here refers to the seismic load. The construction of floating columns in seismically active areas is based on the idea that shear walls or columns share the seismic loads of the system without the help of floating columns. Above beams or slabs, floating columns are considered as normal compression members. The beam under the floating column acts as a transfer beam and carries the load of the floating column as a point load. Deep beams and beams with high shear force are used to support floating columns. The Indian Code does not mention these clauses. Due to construction earthquake and wind loads, the stub column is not part of the lateral load resistance mechanism of the system. This software analyses floating columns by inserting pin connections at both ends. In this research work prepares 10 storey models with various irregularities. With the help of ETABS M30 grade of concrete and HYSD 550 grade of steel used as material for modelling work. There are total 4 cases one is 10 floors building with bare frame, second is 10 Floor building with floating column on odd floor at corner, third is 10 floors building with floating column near outer corners on odd floor and last final model is 10 floors building with floating column corridor on odd alternate floor. To compare the story drift and nodal displacement for all models with with and without floating columns collect their data and compare their graphs.

Keywords: Irregularities, Load combination, Response Spectrum etc.

1. INTRODUCTION

As in any building, loads of the upper floors are transferred to the columns. Then all the weight is transferred to the beams that support the floating columns. Floating columns are similar to standard columns. The beam placed on it is considered as a point load to bear the full weight of the column. Also called transfer beams or purlin beams, these beams usually have a large cross-section and are made of heavy steel. This beam is also twisted. The design and details of this beam are very important for the construction of the floating column. A well-defined force transfer path must be used to transfer lateral seismic forces to the foundation. A floating column breaks this power transmission path. In highly seismic areas, these floating columns absorb a lot of seismic force, which is negative. Floating columns work well when only vertical forces are considered. However, they are very unfavourable against lateral forces such as earthquakes.

However, we often see the use of floating posts in the construction of buildings, whether residential, commercial, or industrial. The only good reason is that you can adjust your up or down strategy to suit your client's needs. This is where our structural engineering expertise comes into play. Therefore, in such situations, it is the duty of structural engineers like us to ensure that such structures are properly surveyed and detailed. Steel details are an important factor in the construction of floating columns. Floating columns are becoming increasingly discouraged but still play an important role in the building sector. It is our responsibility to ensure that this structural part is properly analysed and designed. Our task is to carefully complete the details of the beams and structural parts that support this floating column.

1.1 Buildings with Reinforced Concrete

Reinforced concrete is strong in both tension and compression. For this reason, concrete is a popular building material. Concrete components are generally available and affordable worldwide. Concrete, as such, is very cheap to make. Using reinforced concrete has a positive economic impact because it requires less maintenance due to its high durability. Reinforced concrete structures reduce on-going costs associated with operational energy consumption, maintenance, and disaster recovery through durability, flexibility, reduced maintenance needs, and energy efficiency. On a construction site, concrete may be poured into various forms of hatches or moulds to create the desired shape, form, surface, texture, and size. This is because freshly poured concrete is liquid and flow able. So it is more suitable for your architectural needs. Reinforced concrete structures are durable if properly planned and constructed. This material can withstand up to 100 years and is not affected by weather conditions such as snow and rain. Concrete can tolerate water-soluble chemicals such as sulphates, chlorides, and carbon dioxide, and its low permeability can cause concrete corrosion without significant damage. This makes reinforced concrete ideal for applications that require underwater or underwater construction, such as pipelines, dams, channel linings, and structures.

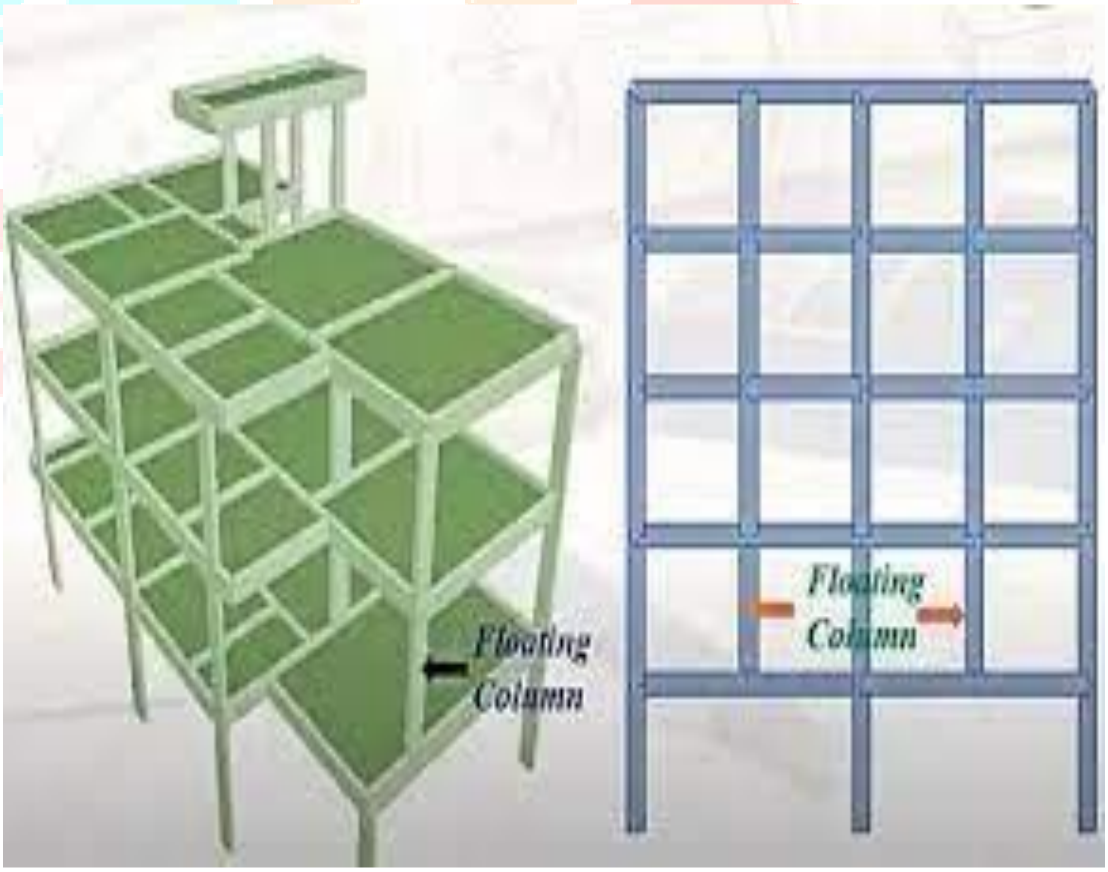


Figure 1 Structure with Floating column

3. METHODOLOGY

In this section, we use the Etabs 2016 programme to analyze a model of a ten-story building with a bare frame, a floating column on the floor in the corner, a floating column near the outer corners on an odd floor, and a floating column corridor on an odd alternate floor.

Table 1 Model Configuration

Cases	Description
Case - 1	10 Floor building with bare frame
Case - 2	10 Floor building with floating column on odd floor at corner
Case - 3	10 Floor building with floating column near outer corners on odd floor
Case - 4	10 Floor building with floating column corridor on odd alternate floor

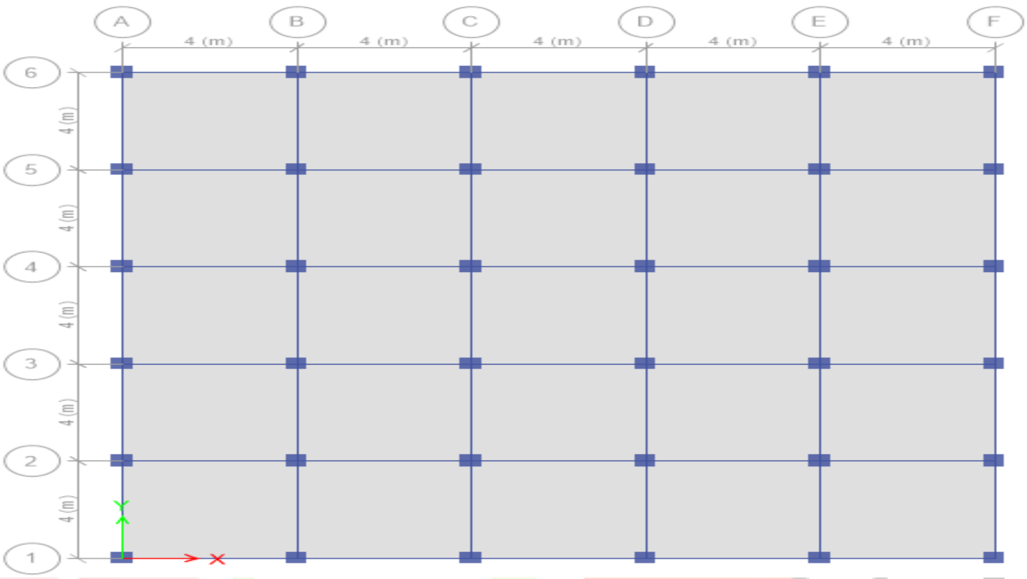
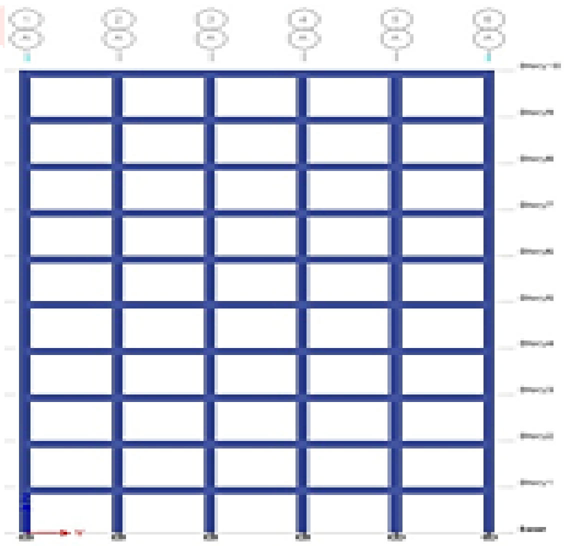
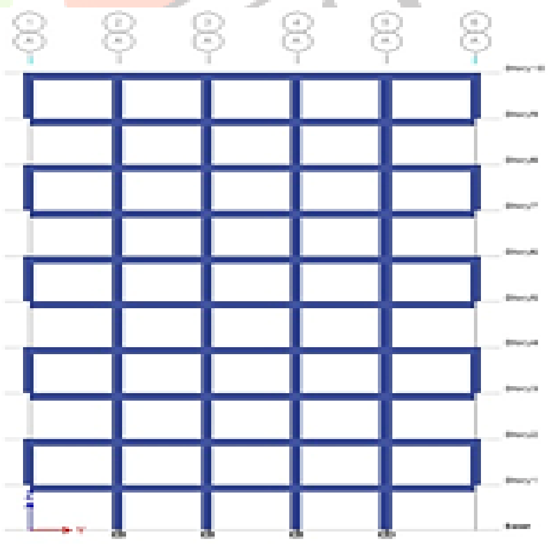


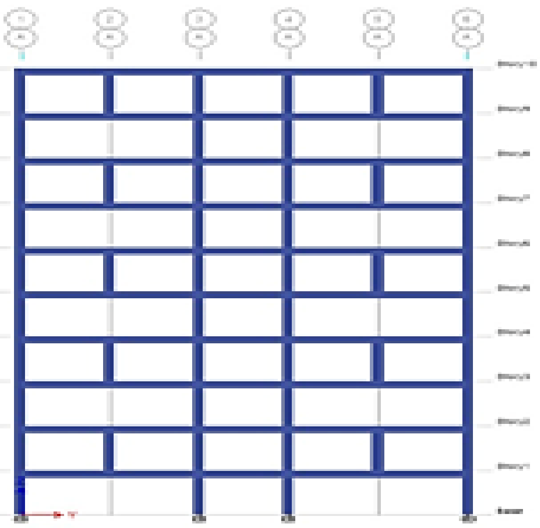
Figure 2 Plan view of 10 floor building



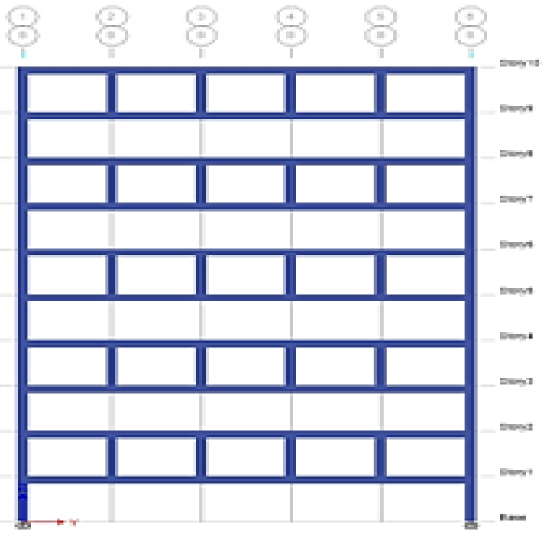
Case 1 - Bare frame



Case 2 - floating column on odd floor at corner



Case 3 - floating column on odd floor at corner



Case 4 - floating column corridor on odd alternate floor

Figure 3 Elevation view of 10 floor building in 4 different cases

4. RESULTS AND MODELLING

In this section we make 10 storey building models with 4 different cases like Floor building with bare frame, 10 Floor building with floating column on odd floor at corner, Floor building with floating column near outer corners on odd floor, and Floor building with floating column corridor on odd alternate floor. And variable results of joint displacement, storey drift, shear force, stiffness and base reaction with various load combinations.

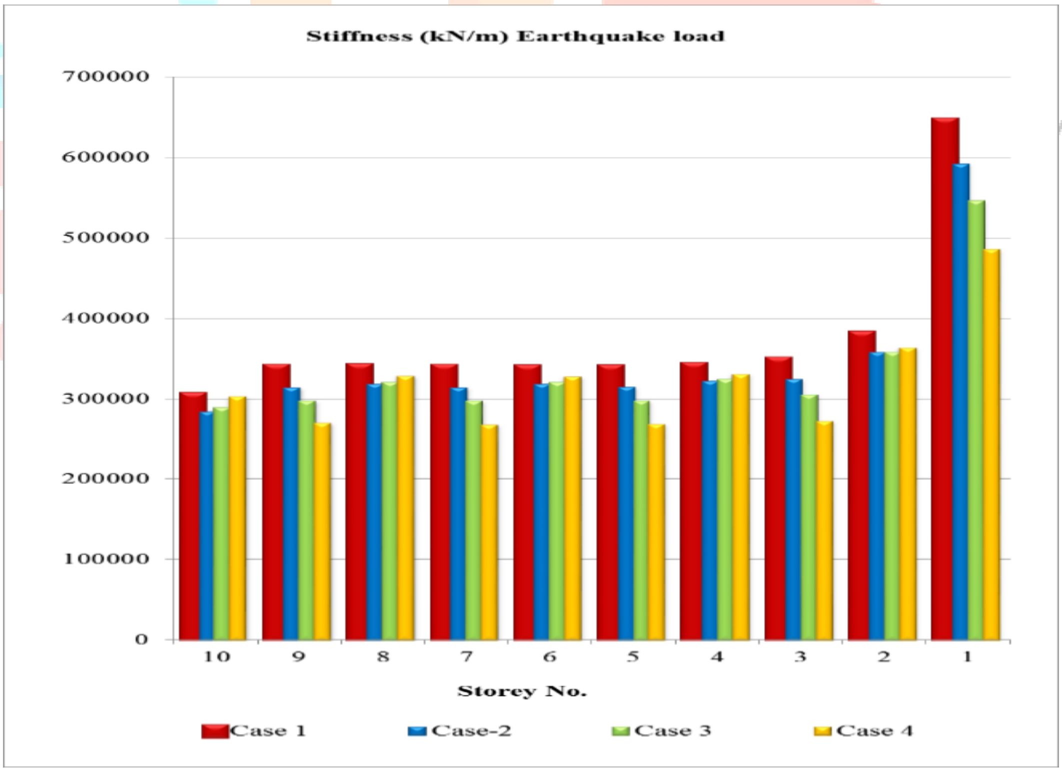


Figure .4 Stiffness on different cases due to earthquake load

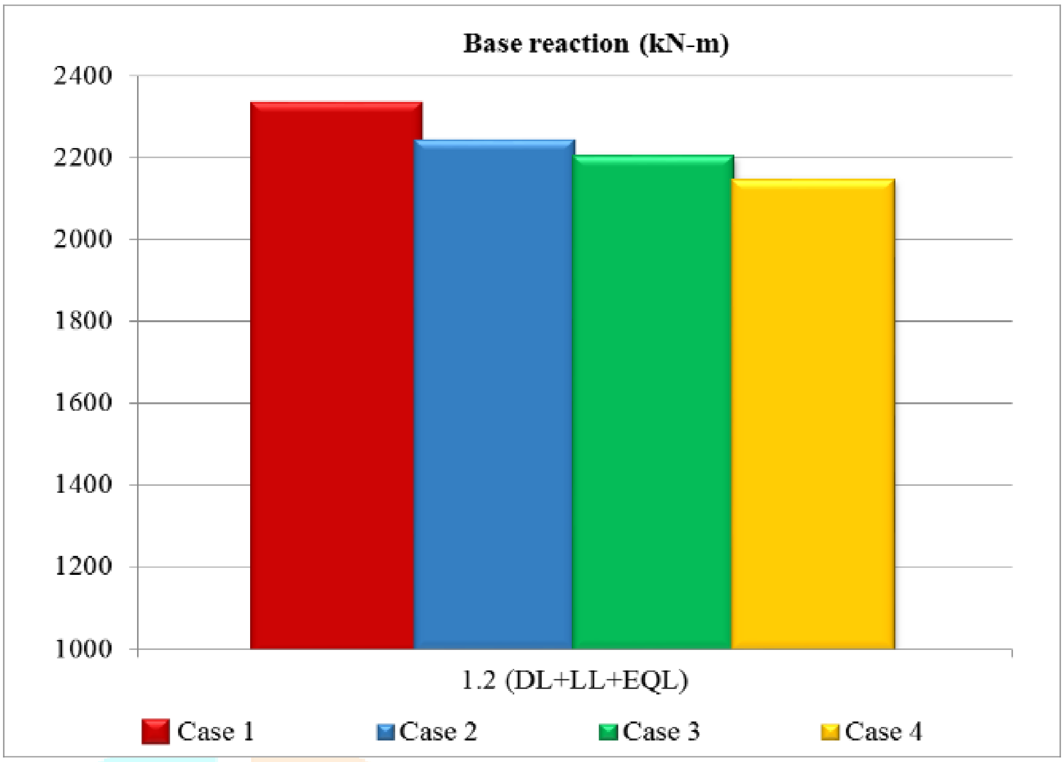


Figure .5 Base reaction in different cases due to load combination 1.2 (DL+LL+EQL)

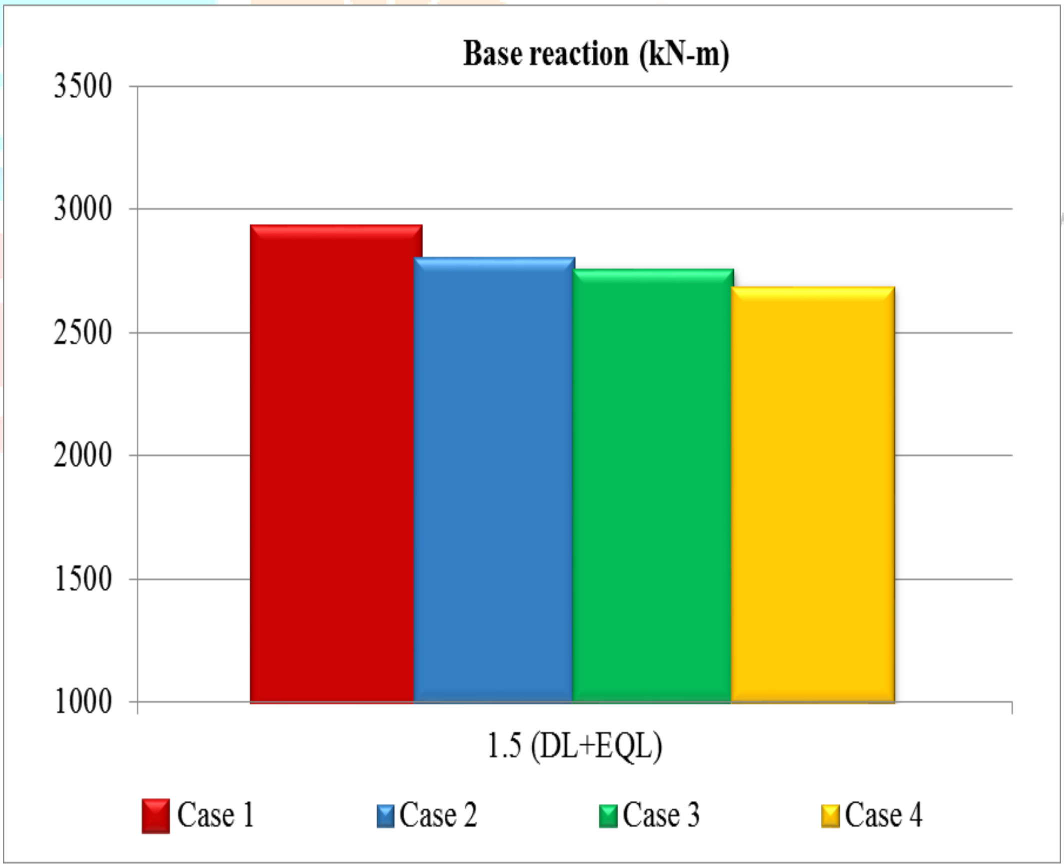


Figure .6 Base reaction in different cases due to load combination 1.5 (DL+EQL)

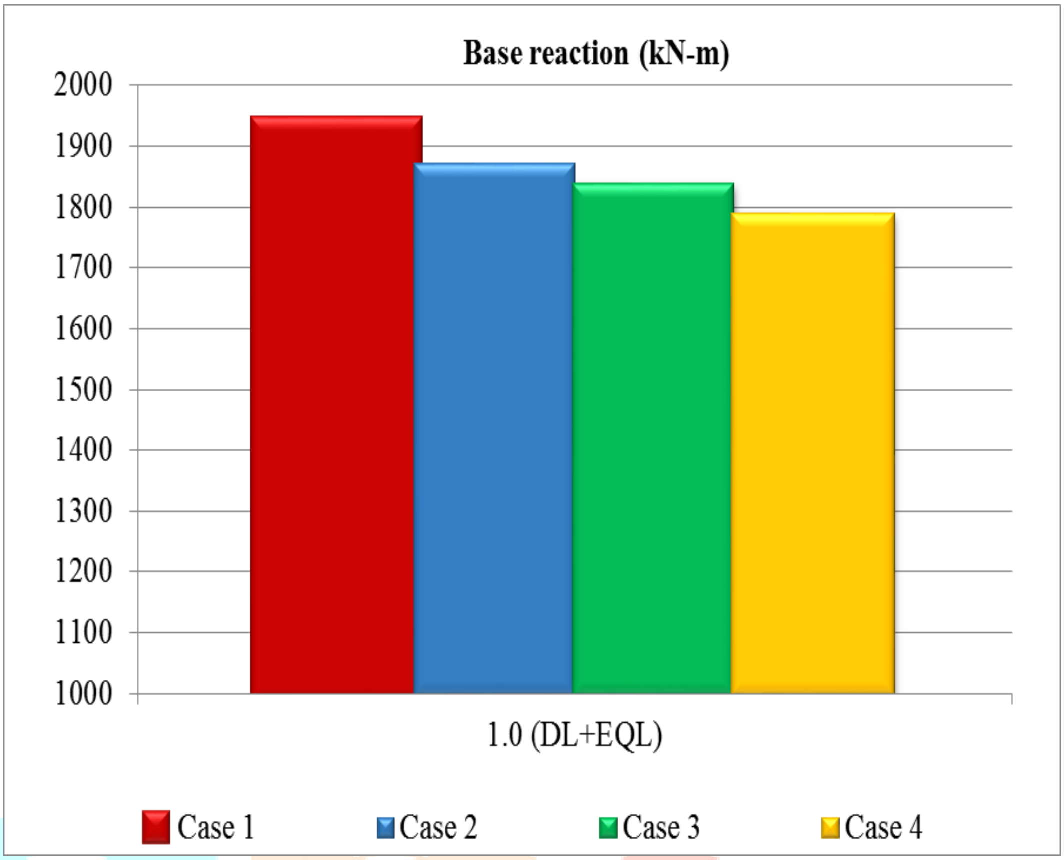


Figure .7 Base reaction in different cases due to load combination 1.0 (DL+EQL)

5. CONCLUSION

Maximum value of Stiffness occurs on 1st floor due to load combination 1.2 (DL+LL+EQL) and minimum value at top floor. A comparative analysis concluded that maximum value of Stiffness in Multistory building with bare frame (case-1).minimum value of Stiffness occurs in Multistory building with floating column corridor on odd alternate floor (case-4). This is also noticed that due to load combination 1.2 (DL+LL+EQL) maximum value of Stiffness is 645821.5kN/m.

A comparative analysis concluded that maximum value of Base reaction 1.2 (DL+LL+EQL) of Multistory building with bare frame (case-1).minimum value of Stiffness occurs in Multistory building with floating column corridor on odd alternate floor (case-4). This is also noticed that due to load combination 1.2 (DL+LL+EQL) maximum value of Base reaction is 2324.69kN-m.

A comparative analysis concluded that maximum value of Base reaction 1.5 (DL+LL+EQL) of Multistory building with bare frame (case-1).minimum value of Base reaction occurs in Multistory building with floating column corridor on odd alternate floor (case-4). This is also noticed that due to load combination 1.5 (DL+LL+EQL) maximum value of Base reaction is 2905.86kN-m.

A comparative analysis concluded that maximum value of Base reaction 1.0 (DL+LL+EQL) of Multistory building with bare frame (case-1).minimum value of Base reaction occurs in Multistory building with floating column corridor on odd alternate floor (case-4). This is also noticed that due to load combination 1.0 (DL+LL+EQL) maximum value of Base reaction is 1937.24kN-m.

REFERENCES

Sruthi, Sudeepthi B. Ms. "Seismic Analysis of RCC Building with Mass Irregularity." (2016).

Kapse, D., and R. Shinde. "Survey Paper on Behaviour of Multi-Storied RCC Frame Structure." IJRET Int. J. Res. Eng. Technol (2015): 2319-2322.

Akberuddin, Mohommed Anwaruddin Md, and M. Z. Saleemuddin. "Pushover analysis of medium rise multi-story RCC frame with and without vertical irregularity." International Journal of Engineering Research and Application 3.5 (2013): 540-546.

Reddy, K. P., Lakshmi, M. S., Ramesh, R., Anitha, I., Vamsi, K. V. S. K., & Urmila, P. Seismic Analysis of a Multistorey Building with and without Floating Columns.

Singh, T., Goyal, A., & Sharma, S. Analysis of Irregular High Rise Steel Building with and without Floating Column under Seismic Forces.

Jain, D., & Maru, S. Comparative Study of Unbraced, Crossed and Diagonally Braced Frame of Building with Floating Column.

Pham, T. A. (2022). Design and analysis of geosynthetic-reinforced and floating column-supported embankments. International Journal of Geotechnical Engineering, 16(10), 1276-1292.

Eldar, B., & Singh, G. (2022). Analysis of irregular multistorey buildings with and without floating columns under seismic loading. Materials Today: Proceedings.

Bosh, P., Awall, M. R., & Hasan, M. (2023, April). Comparative study on seismic analysis of a multi-storied building with and without floating column. In AIP Conference Proceedings (Vol. 2713, No. 1). AIP Publishing.