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Analysis of a Mid Rise Structure Considering Floating Column with Different Arrangements of Beams below using staad.pro

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ABSTRACT

Floating columns are one of the important aspects of multi-storey structures due to their various advantages thus seem to be unavoidable. Floating columns are generally not found reliable in seismic prone areas. This research is followed towards analyzing the performance of floating columns structure considering different beam arrangements prone to seismic load. The research was focused on analyzing the effects of floating columns when supported on various pattern of beams in a G+6 storey structure in considering seismic zones III and soft soil condition using Staad.Pro.v8i. The analysis of floating columns was done considering the parameters namely the base shear, storey displacement, storey drift and storey acceleration concerning subject multi-storey structure with different placement of supporting beam just below the floating columns.

Keywords : Floating columns, STAAD.Pro, Story drift, Base shear, Story displacement.

I. INTRODUCTION

Multi Storey structure were introduced for crating spaces to accommodate larger population in limits spaces and further their need arise to have column free spaces due to shortage of space, population and also for aesthetic and functional requirements. Such floating columns come along with a disadvantage in such structures constructed in seismically active areas. The seismic tremor that is formed at various floor levels in a structure should be conveyed down along the stature to the ground by the most limited way.

Deviation or brokenness in this shift in load brings the poor performance of the structure. The conduct of a structure during seismic forces relies fundamentally upon its general shape, size and geometry, notwithstanding how the forces of the earthquake are conveyed to the ground. Numerous structures with an open ground storey planned for supporting failure or were seriously damaged in Gujarat during the 2001 Bhuj tremor.

In this study we are analyzing a G+6 structure with mixed use of land i.e lower floors for commercial and

rest above are residential. Utilizing Ground and first floor for parking and commercial use respectively. For this we need large span and location of column should be such that it does not obstructed the above floor requirement .but under some circumstance there is a need to terminate the column at certain floor and make new column from beam to support the above structure.

II. LITERATURE REVIEW

Kapil Dev Mishra and Dr A. K. Jain (2018) the research paper considered analysis of a multi storied Plaza building of storey (G+2+3) having different position of floating columns (4 columns of mid ordinate axis or 4 columns of diagonal axis) at different height of building (at the level above second floor) at two different zones (ZONE III and ZONE IV). The plan area of building up to second floor was 30m×30m and above this floor area was reduced to 20m×20m. Height up to second floor of the building was used for parking or commercial shops having floor height of 4m and above this it was used for residential and office purpose. Floating columns was provided at office floor.

The results stated that Maximum Bending Moments as well as Maximum Support Reaction for the structures having floating columns was higher than that of structures without floating columns. Maximum Bending Moments at seismic Zone IV was greater than that of Zone III. Structures having floating column constructed in Zone IV was more affected by earthquake than Zone III.

Waykule .S.B et al (2017) the research paper presented static analysis for a multi-storey building with and without floating columns. Different cases of the building was presented by varying the location of floating columns floor wise. The structural response of the building models with respect to, Base shear, and Storey displacements was investigated. The analysis was carried out using software sap2000v17.

The results stated that base shear decreased on first floor due to introduction of floating column in comparison to structure without floating column. Displacement was maximum at each storey with floating column in comparison to structure with traditional columns.

Objectives of the study

The main objectives of this study is to evaluate the performance of floating column building.

Followings are the specific objectives of this study.

1. To study the behavior of mid rise structure with floating columns.
2. To determine the effect of seismic forces over a mid rise structure with three different floating column conditions.
3. To determine the utilization of analysis tool staad.pro in analysis of tall structures.
4. To determine the cost effectiveness of floating column structure with three different boundary conditions.

III. METHODOLOGY

In this study we are adopting followings steps one by one to complete the study:

Step-1

In this step we reviewed publications and research works available on citations and in google scholar to review them briefly to prepare our study scope and boundary conditions.

Step-2

In this step we started preparing geometry of all the three cases considered in this study where we are considering same geometry with different boundary and floating column support conditions using structure wizard tool in staad.pro

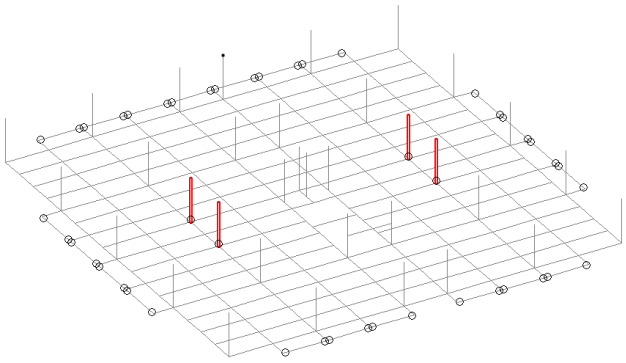


Fig a: Case I (Floating column supported on beam at regular interval)

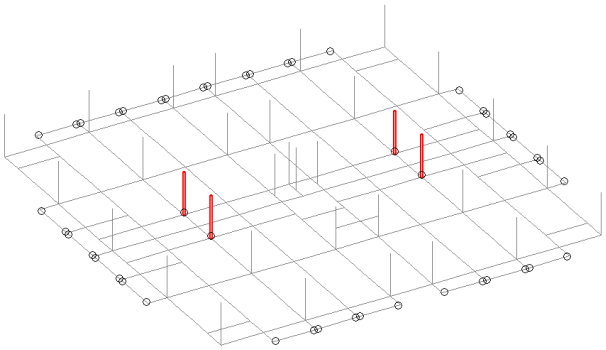


Fig b: Case II (Floating column supported on beam at Perpendicular direction)

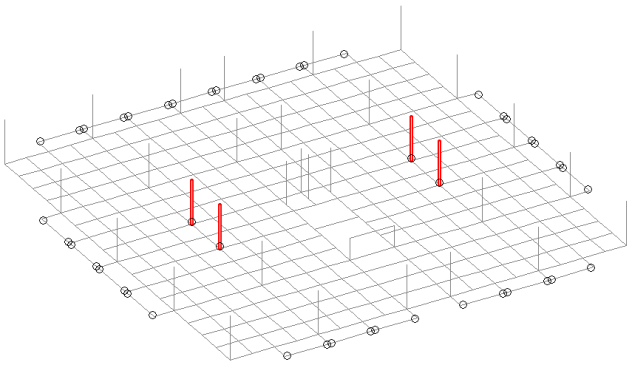


Fig c: Case III (Floating column supported on Closely Supported beams in both directions)

Fig 1: Plan of structures

Step-3: Assigning material descriptions and member sizes to the structure using property wizard in staad.pro

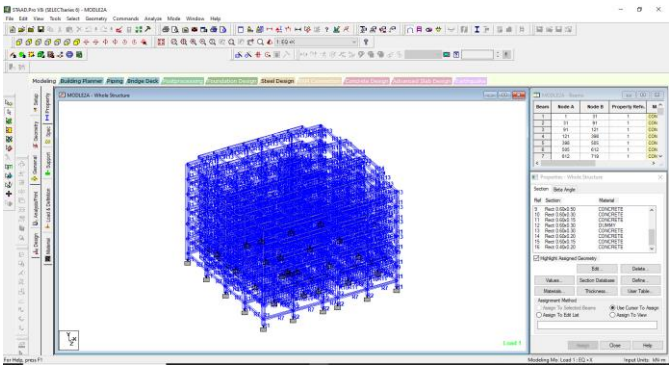


Fig 2: Material and size of structural members

Step-4: Assigning fixed end & moment release support condition to the structure.

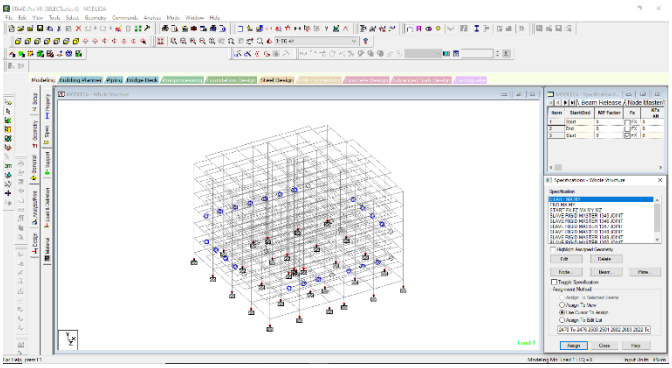


Fig a: Moment Release at supported beams

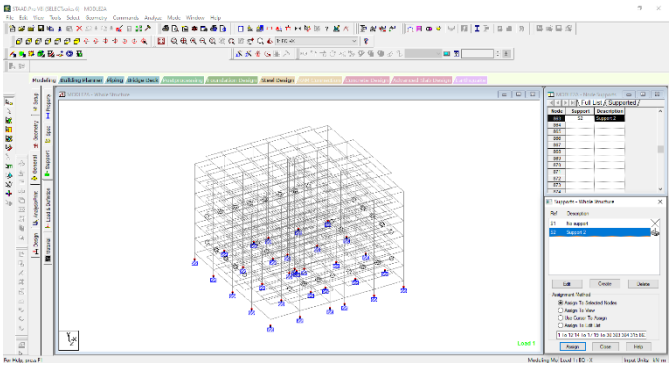


Fig b: End Conditions

Fig 3: Support Condition

Step-5: Defining Load conditions as per Indian Standards

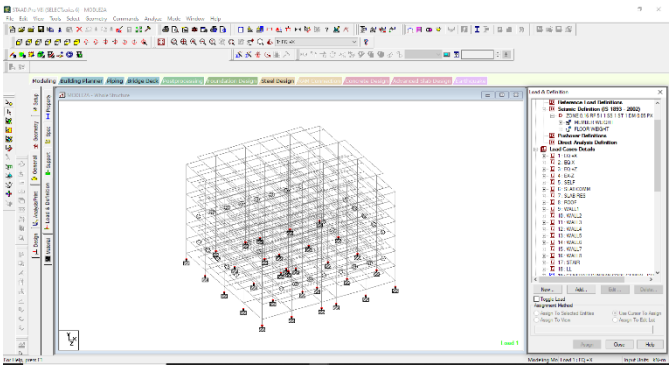


Fig 4: Defining Load conditions

Step-6: Performing Analysis

In this comparative analysis we have performed seismic analysis of structures considering seismic zones III and soft type of soil. In this study we are performing finite element analysis.

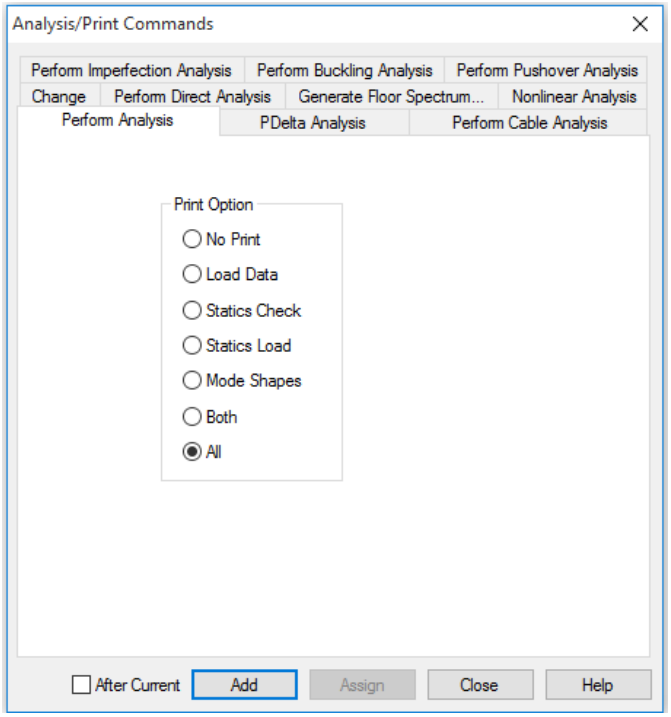


Fig 5: Analysis of the structure

Step-7: Analyzing results in terms of forces, moment and displacement.

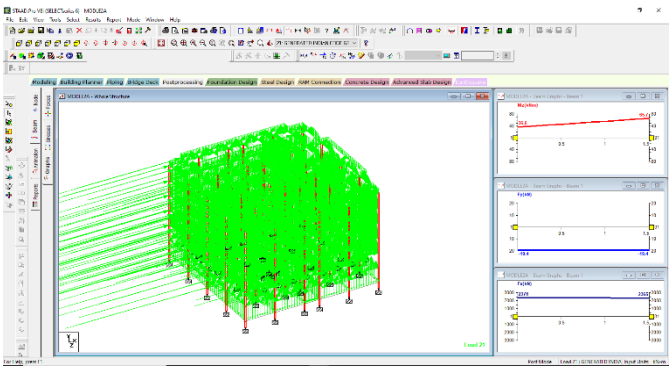


Fig 6: Analysis output

Cases considered in this study are

Case I: Floating column supported on beam at regular interval.

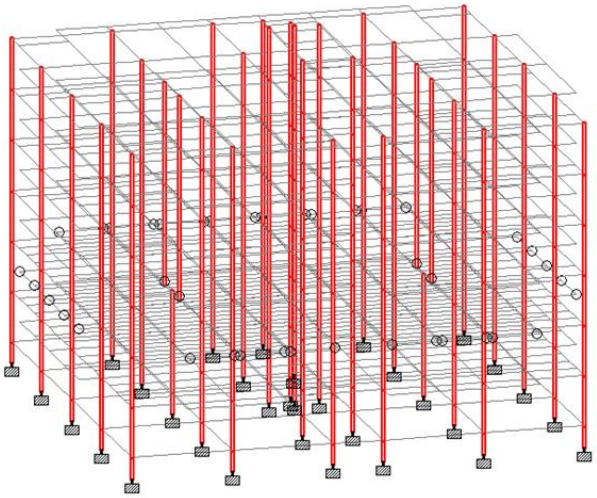


Fig a : Case I

Case II: Floating column supported on beam at Perpendicular direction

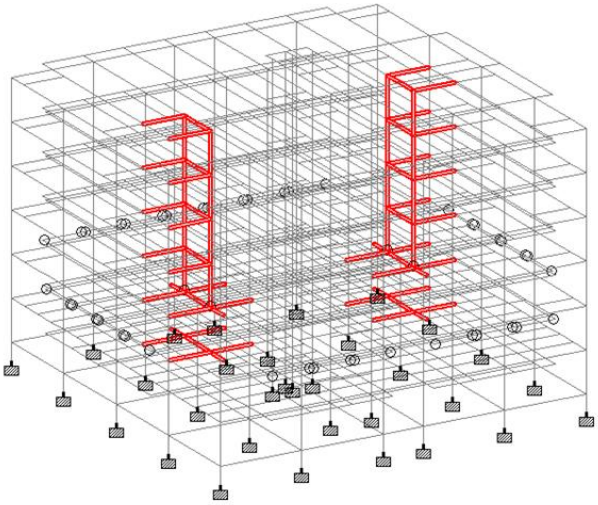


Fig b : Case II

Case III: Floating column supported on Closely Supported beams in both directions

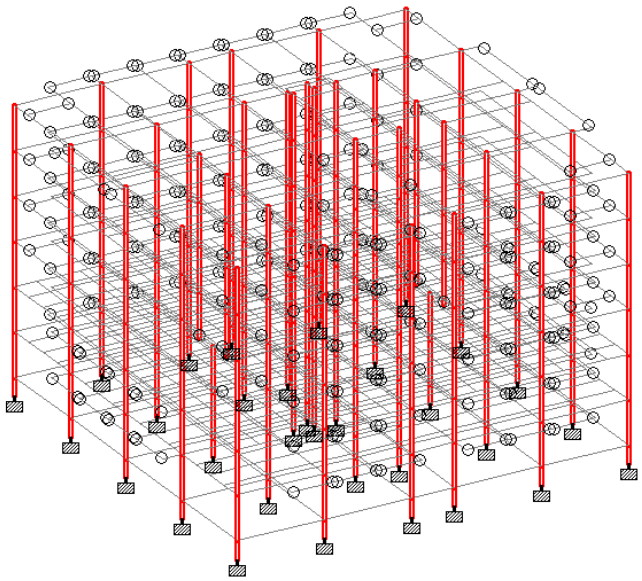


Fig C : Case III

Fig 7: Cases considered for analysis

Geometrical description

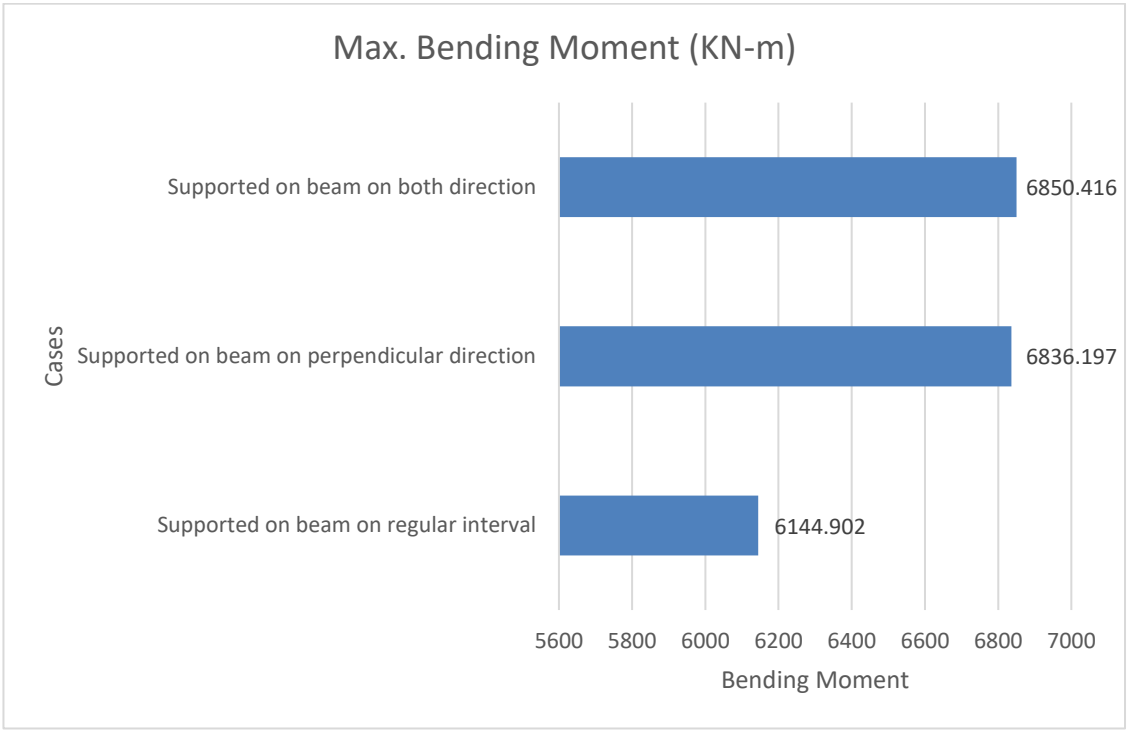
The geometric parameters of structure are shown in Table 1.

Table 1 Geometric parameters of case study

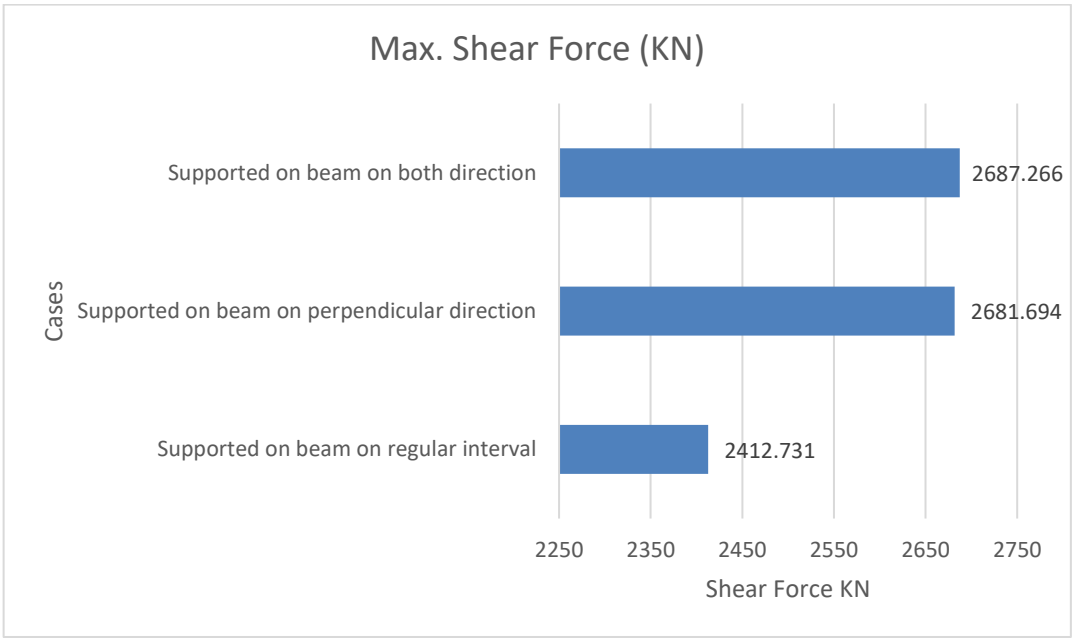
S. No.	Description	Value
1	Area of building	1036.80 m^2
2	Length	32.4 m
3	Breadth	32 m
4	Storey height	3.6 m
5	Height of the column below plinth level	1.5 m
6	Size of the outer column	600 mm x 400 mm
7	Size of the 2 column at exterior	600 mm x 600 mm
8	Size of the 4 interior column	300 mm x 600 mm
9	Size of the 3 columns located at same plane	300 mm x 220 mm
10	Size of the 1 column located at interior centre	380 mm x 300 mm
11	Size of beam for Plinth level	500 mm x 300 mm
12	Size of beam for first & second level	600 mm x 500 mm
13	Size of beam for Closely supported	600 mm x 300 mm
14	Size of beam for perpendicular supported	600 mm x 150 mm
15	Size of beam for center C shape	600 mm x 300 mm
16	Size of beam for 3 level above level	600 mm x 300 mm
17	Size of beam for perpendicular beam	400 mm x 200 mm
18	Support condition	Fixed End

IV. ANALYSIS RESULTS & DISCUSSION

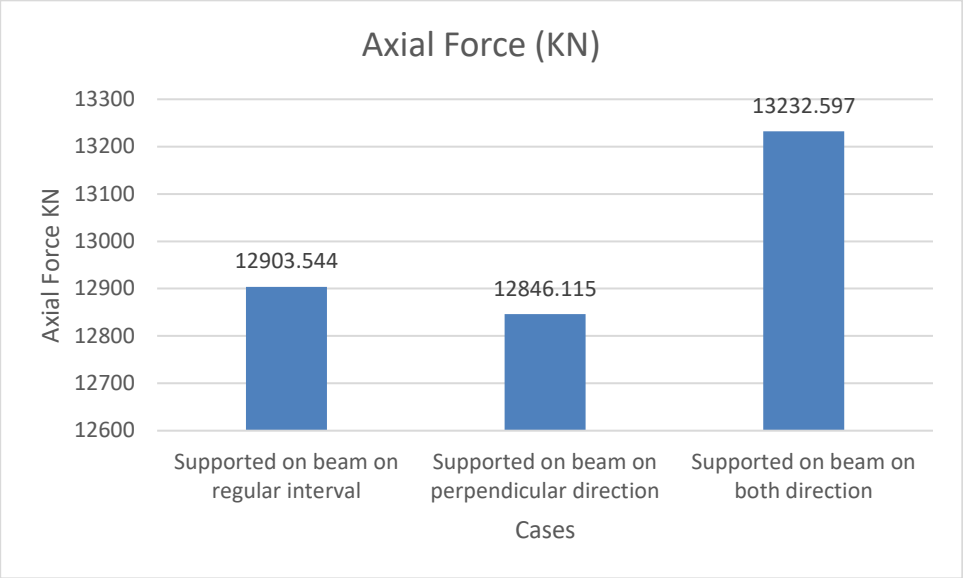
Bending Moment (KN-m)



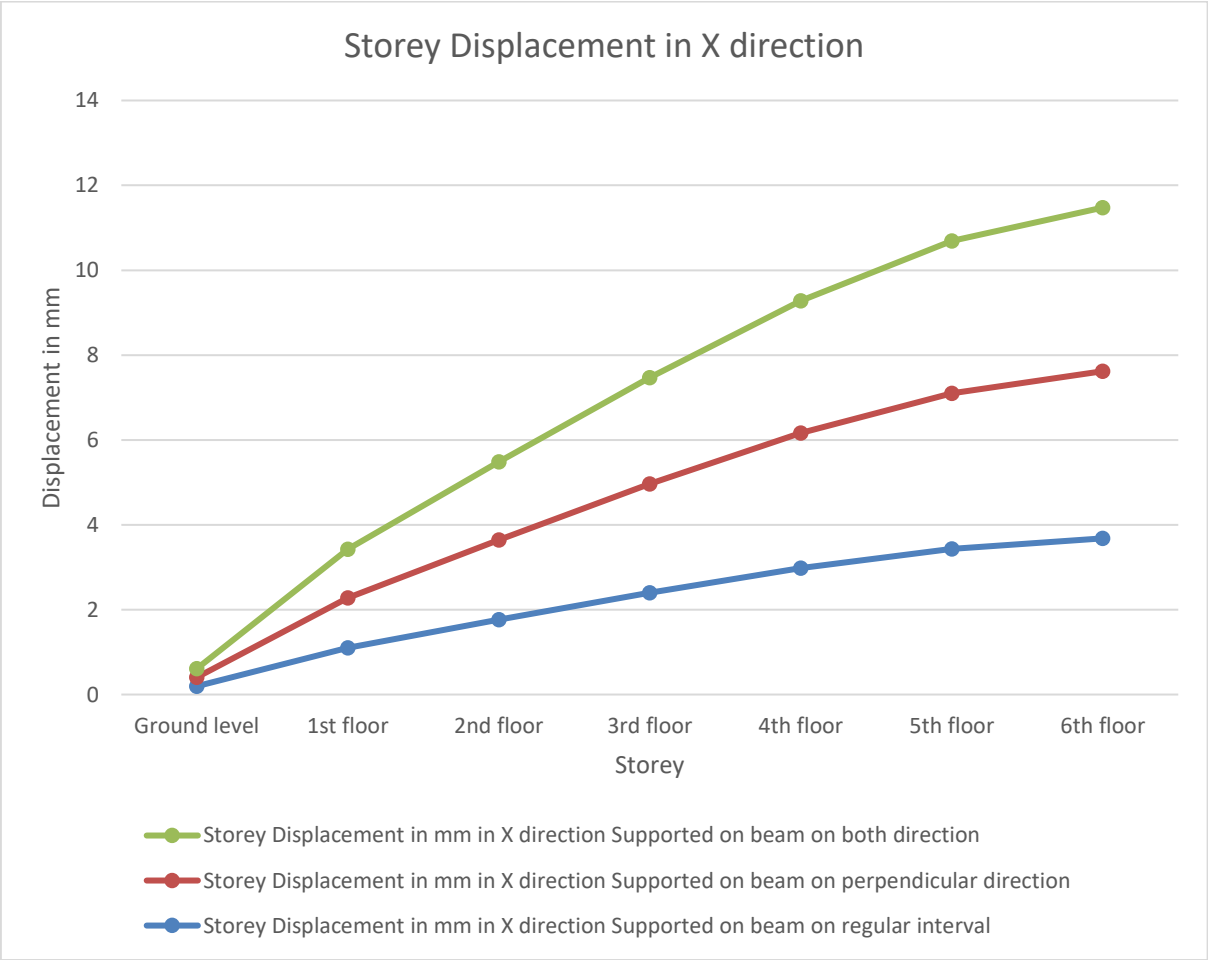
Graph 1: Bending moment



Graph 2: Shear force KN



Graph 3: Axial force



Graph 4 : Displacement in mm

V. CONCLUSION

In present work we are looking at three changed states of coasting section where it is upheld on various game plans of pillars.

In this investigation we presumed that solidness of construction with gliding sections upheld on normal stretch pillars are generally appropriate in correlation while instance of drifting segment upheld on radiates on opposite course second most reasonable sort though case skimming segment upheld on both bearing shafts are showing most noticeably terrible outcomes.

In terms of economy we can presume that case I is similarly most efficient one in examination as twisting second saw for this situation is relatively less which brings about less prerequisite of space of steel.

Here it is seen that all cases are under allowable constraint of relocation according to I.S. 1893-I:2016 henceforth giving security under seismic stacking.

Unbalanced powers are noticed 11.3% more on the off chance that III when contrasted with case I, accordingly coming about greater solidness to case I in examination.

In terms of vertical pressing factor case III is showing minimal more worth in comparion to different cases however variety is practically neglible.

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