Seismic Behaviour of Structure in Zone 2 and 3 with Floating Column in Different Floors

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ABSTRACT

A floating column is supposed to be a vertical member starting from foundation level and transferring the load to the ground. In India many of the buildings are constructed with floating column. Floating columns are adopted in order to provide spacious hall and other amenities. The seismic forces generated at different floor level of the building need to be carried out to the foundation by shortest possible way which may not be the case when floating columns are provided. Providing floating columns may satisfy some of the functional requirements but structural behaviour changes abruptly due to provisions of floating columns. In this study analysis of RC structures with floating column in different seismic zones using ETABS is studied. The building is modelled using ETABS software. The models are G+10 RC buildings whereas, one is regular structure and others are structures with floating columns provided in different stories. In this thesis parameters such as storey displacement, storey shear and storey drift are computed using ETABS and the values extracted are compared with each other.

Keywords: Floating column, Seismic forces, Etabs, Storey displacement, Storey drift, Storey shear.

INTRODUCTION:

Modern multi-storey buildings are constructed with Irregularities such as mass irregularity, plan irregularity and vertical irregularity. And it is observed that most of RC structures with these kind of irregularities are undesirable for seismic activity. In this study we have chosen floating column irregularity which is stiffness irregularity comes under vertical irregularity. Stiffness irregularity is nothing but, a storey in which lateral stiffness is less than 60-70 percent of that of above or less than 70-80 percent of the average lateral stiffness of the three storeys above. In this study 4 models i.e, regular structure, structure with floating column in 1st floor, structure with floating column in 4th floor and structure with floating column in 9th floor are considered analysed for zone 2 and 3 using ETAB's. Results such as storey displacement, storey shear, storey drift for zone 2 and zone 3 are extracted from ETABS and compared the respective results with different models.

Floating Columns:

The floating column is a vertical member which rests on beam and transfers loads from beam to the column below it. Now a days multi-storey buildings constructed for the purpose of residential, commercial, industrial etc., with

an open ground storey has become a common feature. For a hotel or commercial building, where the lower floors contain banquet halls, conference rooms, and large uninterrupted space is required for the movement of people or vehicles.

OBJECTIVES:

To study the seismic behaviour of structure in zone 2 and 3 with floating columns in 2nd and 5th floors to tabulate the parameters such as:

- To study the storey displacement of the structure with floating column in 2nd and 5th floors for seismic zones 2 and 3.
- To study the storey drift of the structure with floating column in 2nd and 5th floors for seismic zones 2 and 3.
- To study the storey shear of the structure with floating column in 2nd and 5th floors for seismic zones 2 and 3.

STRUCTURAL DATA AND MODELLING:

STRUCTURAL DATA:

PARTICULARS	MODEL-01	MODEL-02	MODEL-03
Number of storey	G+10	G+10	G+10
Size of column(mm)	300*450	300*450	300*450
Size of beam(mm)	230*450	230*450	230*450
Zone	2 and 3	2 and 3	2 and 3
Soil type	2	2	2
Height of building	33.5	33.5	33.5
Position of floating column	-	2st floor	5th floor
Type of structure	Moment resisting frame	Moment resisting frame	Moment resisting frame

MATERIALS PROPERTIES:

Name	E MPa	v	Unit Weight Kn/m^3	Design Strengths
HYSD500	200000	0	76.9729	Fy=500MPa, Fu=545MPa
M25	25000	0.2	24.9926	Fc=25MPa

MODELS:

MODEL:-01(Regular structure):

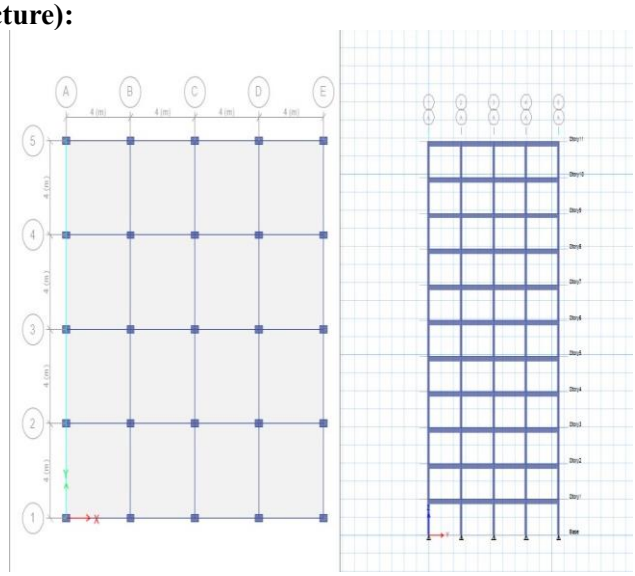

Fig-01: Regular structure

MODEL:-02 (Structure with floating column in 2nd floor):

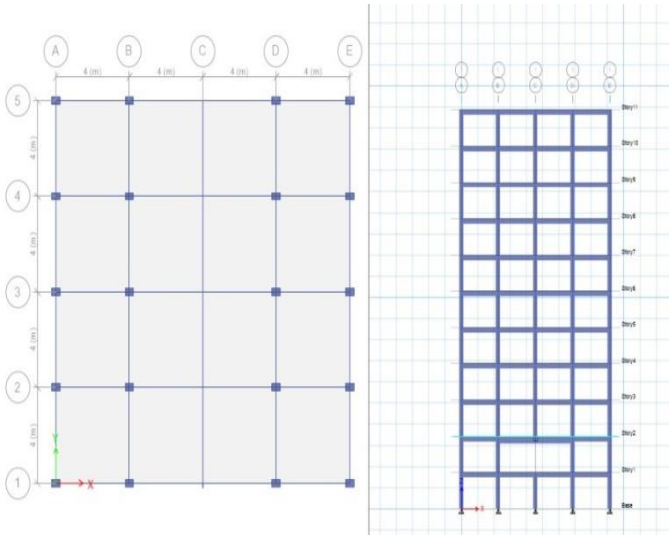

Fig-02: Structure with floating column in 2nd floor

MODEL:-03 (Structure with floating column in 5th floor):

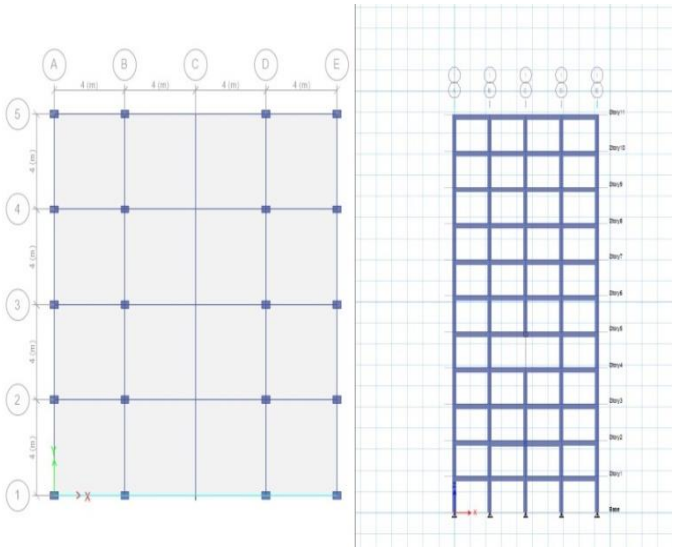

Fig-03: Structure with floating column in 5th floor

RESULT AND DISCUSSION:

STOREY DISPLACEMENT:

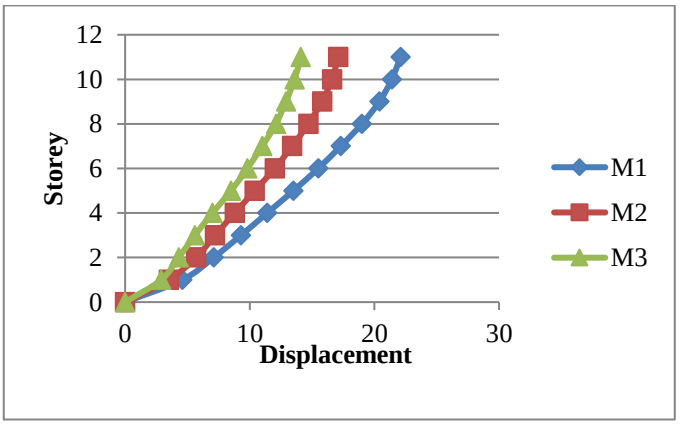

Fig. 05: Storey vs storey displacement in X direction in zone 2

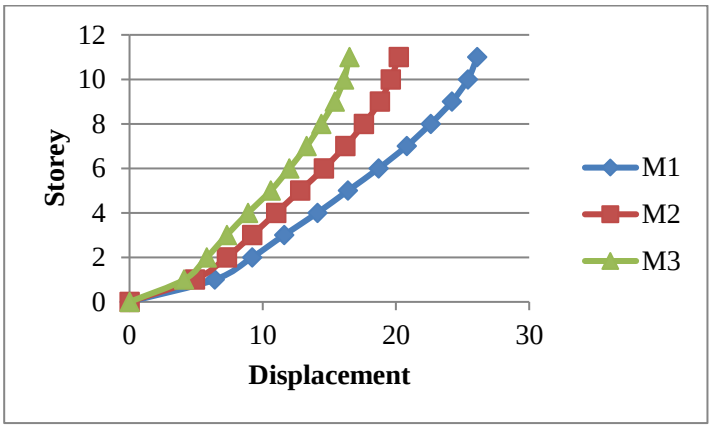

Fig. 06: Storey vs storey displacement in Y direction in zone 2

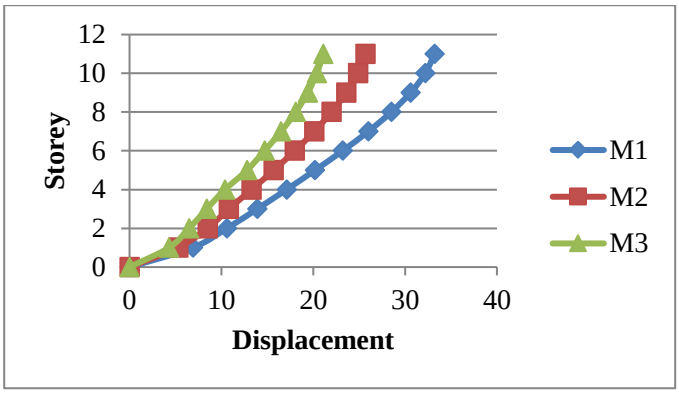

Fig. 07: storey vs storey displacement in X direction in zone 3

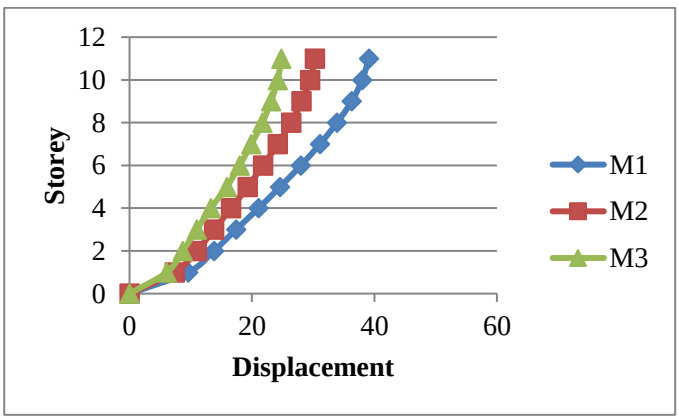

Fig. 08: Storey vs storey displacement in Y direction in zone 3

STOREY DRIFT:

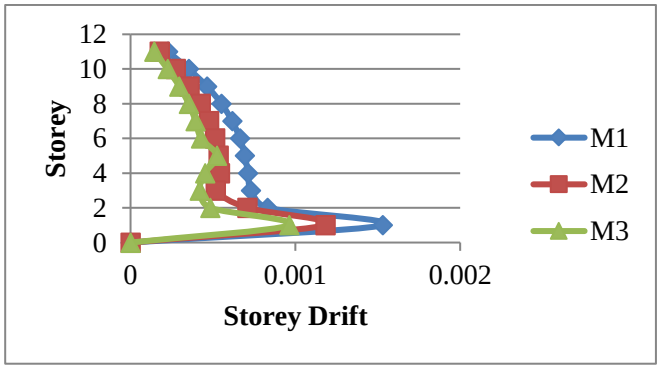

Fig. 09: storey vs storey drift in X direction in zone 2

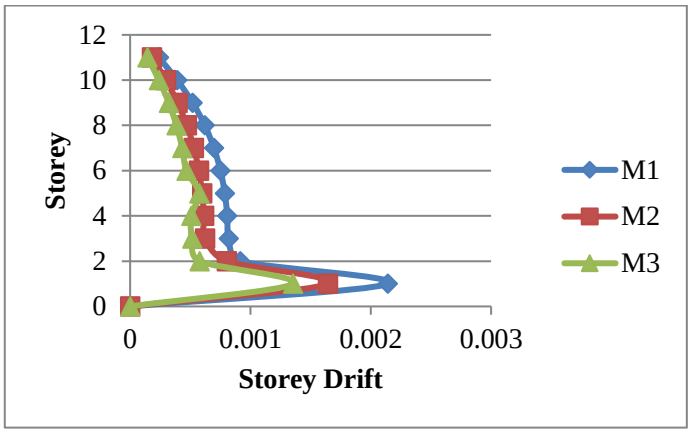

Fig. 10: storey vs storey drift in Y direction in zone 2

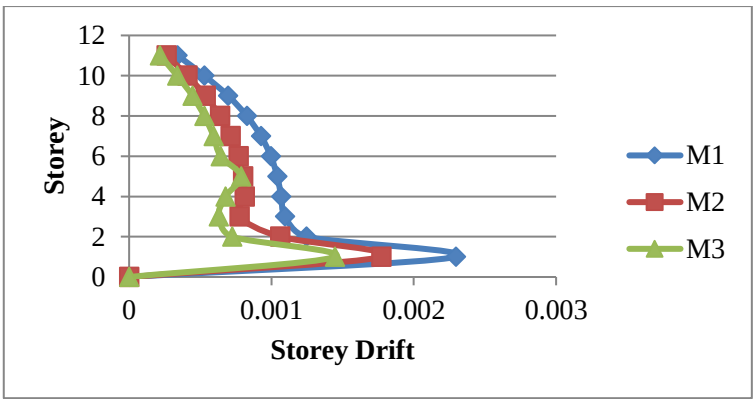

Fig. 11: storey vs storey drift in X direction in zone 3

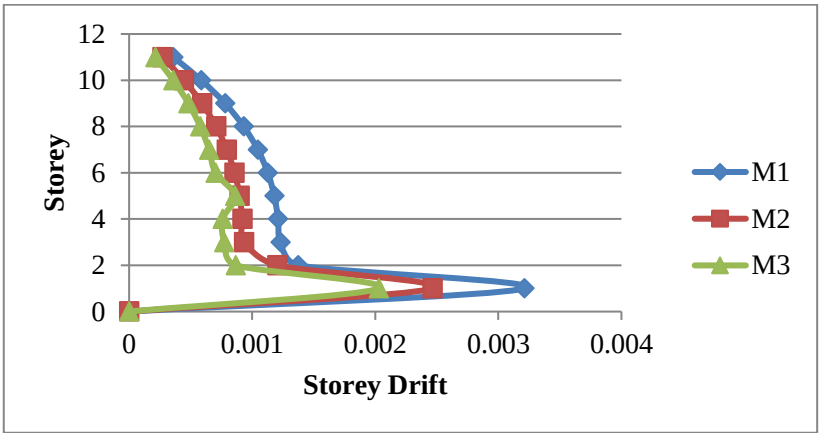

Fig. 12: storey vs storey drift in Y direction in zone 3

STOREY SHEAR:

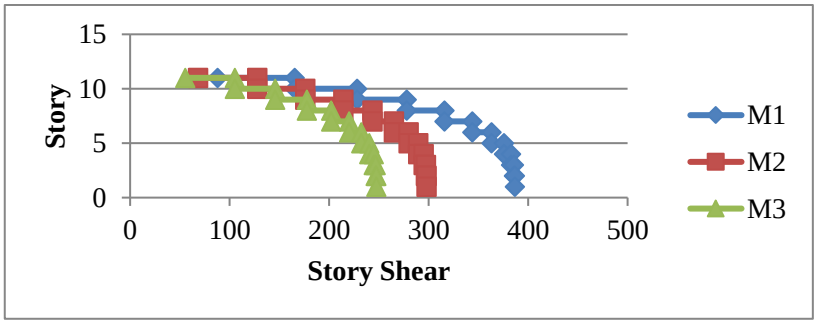

Fig. 13: storey vs storey shear in X direction in zone 2

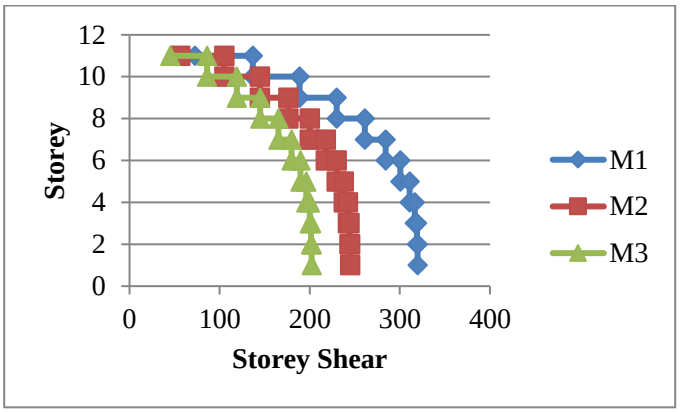

Fig. 14: storey vs storey shear in Y direction in zone 2

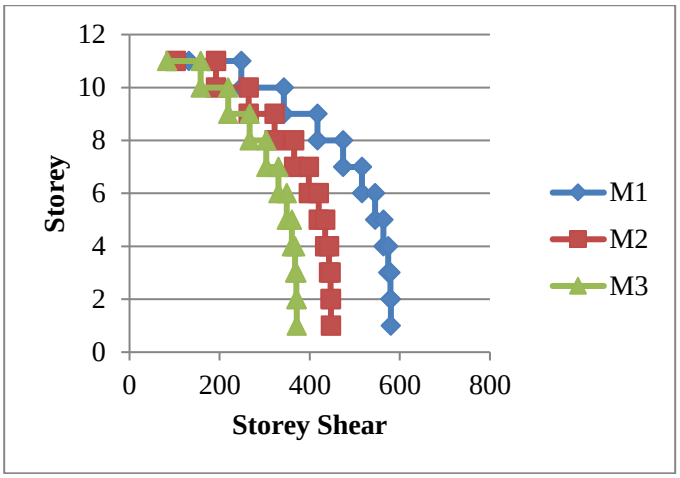

Fig. 15: storey vs storey shear in X direction in zone 3

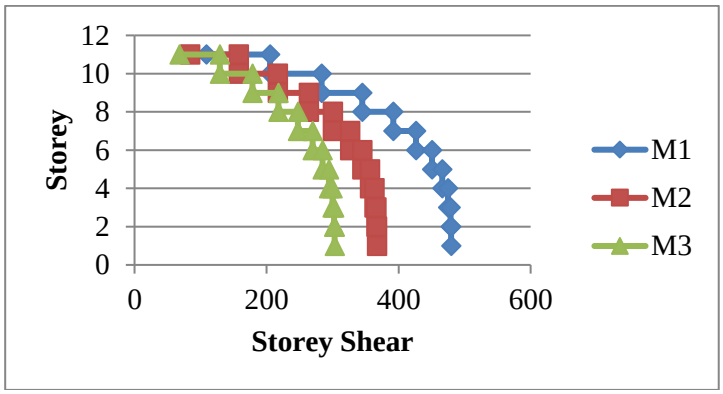

Fig-16: storey vs storey shear in Y direction in zone 3

CONCLUSION:

Comparative analysis of G+10 storey building with 3 different models and two different zones (zone 2 and zone 3). ETABS software is used for modelling and analysis of the structures. Analysis results like storey displacement, storey drift and storey shear are presented here. Following are the conclusions drawn from the study.

- The storey displacement is more in zone 3 compared to zone 2 and model 3 in both zone shows less displacement compared to all other models.
- The storey drift is more in zone 3 compared to zone 2 and model 3 in both zone shows less drift compared to all other models.
- The storey shear is more in zone 3 compared to zone 2 and model 3 in both zone shows less shear compared to all other models.

- Model shows more results as the zone increases and model 3 in both zone shows less results compared to other models.

From the above study we can conclude that as the seismic zone increases the values for storey displacement, drift and shear also increases. Building with floating columns can be provided in lower zones.

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