

Comparative Analysis of Displacement and Deflection in RCC Building for Different Seismic Zones

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Abstract— The main aim of the project is to compare the earthquake resistance structure in different seismic zones by adopting parameters like displacement of column and deflection in beam by using STAAD-PRO. The structure is analysis for worst load cases. The objective of the project is to obtaining the correlation between parameters like displacement of column and deflection of beam and results of different parameters are plotted in the form of graph. The behavior of the structure according to different seismic zone was analyzed. Analysis of G+3 building by referring IS codes i.e IS : 456 : 2000, IS : 1893 (part I) : 2016, IS : 875 (part II) : 1987 and comparison between the normal load cases i.e DL, LL, EQX, EQZ. Live load are taken from IS codes.

Keywords: STAAD-Pro, RCC Building, Seismic Zones

I. INTRODUCTION

Comparison of G+3 RC frame building on different seismic zones by adopting earthquake loads and comparing that structure in terms of different parameters such as Displacement of selected columns and Deflection on beam by using software STAAD PRO.

Due to different zones, zone factor, Importance factor and Response reduction factor are changes. The structure is analysis for maximum load from different load cases.

According to different zones of India, have to design the structure and compare in different parameters so that the structure will be safe and sustain the earthquake load. Selecting columns and beams from the whole RC frame building and that selected column and beam are compare in different parameters.

The structure were modelled and compare for earthquake forces in different seismic zones. STAAD PRO software was used for the analysis of the models. According to research, it can be inferred that support reactions tended to increase as the zone varied from II to V, which in turn increased volume of concrete and weight of steel reinforcement in footings and in case of beams, percentage of steel reinforcement increased through zones II to V.

The results which we are getting of different parameters in different zones, which are plotted in the form of graph and obtaining the co-relationship between them.

The parameters are:-

- Displacement on column
- Deflection on beam

II. METHODOLOGY

- Seismic analysis of RC frame G+3 building in different zones.
- Review of literature.
- Study of IS code provisions.
- Comparison of results and correlating them in graphs.

- Result discussion and interpretation.

1	No. of storey	G+3
2	Location	Zone II, Zone III, Zone IV, Zone V
3	Floor to floor height	3 m
4	Type of support	Fixed support
5	Size of column	450 * 230 mm
6	Size of beam	450 * 300 mm For staircase : 600 * 230 mm For cantilever : 450 * 150 mm
7	Earthquake load	As per IS: 1893: 2016
8	Slab thickness	150 mm
9	Wall thickness	External wall : 230 mm Internal wall : 150 mm
10	Dead load including floor finish	4.75 KN/m ²
11	Floor finish	As per IS: 875 (part II): 1987
12	Sesmic zone	All four seismic zones
13	Type of soil taken	Hardy rocky
14	SBC of soil taken	KN/m ²

Table 1: Preliminary data of the structure considered for analysis and design

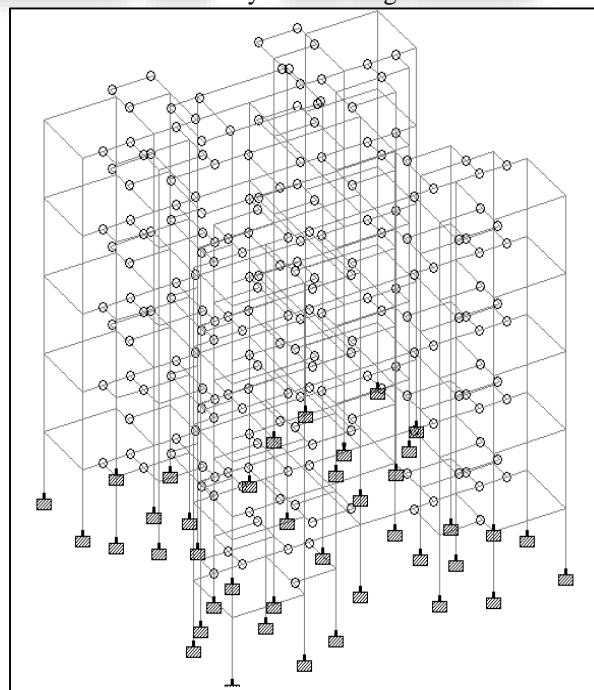


Fig. 3.1: Typical 3D view

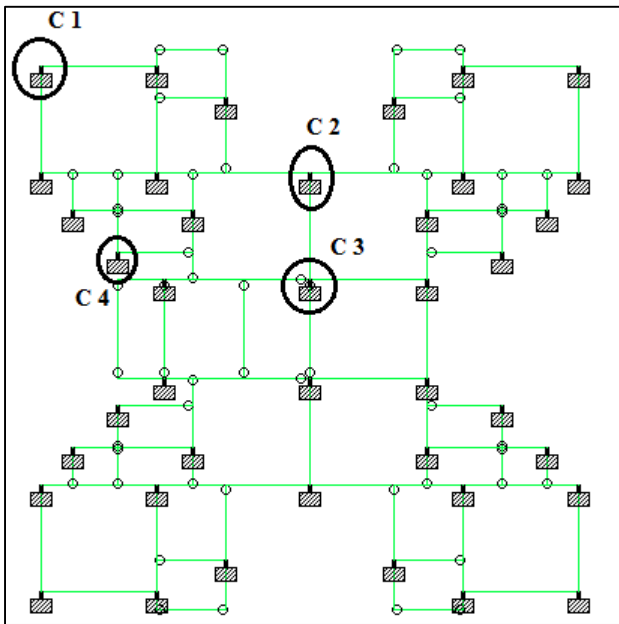


Fig. 3.2: Selected Column For Analysis

The selected columns for analysis are:-
C1 & C4-Corner column
C2-Middle column
C3-Interior column

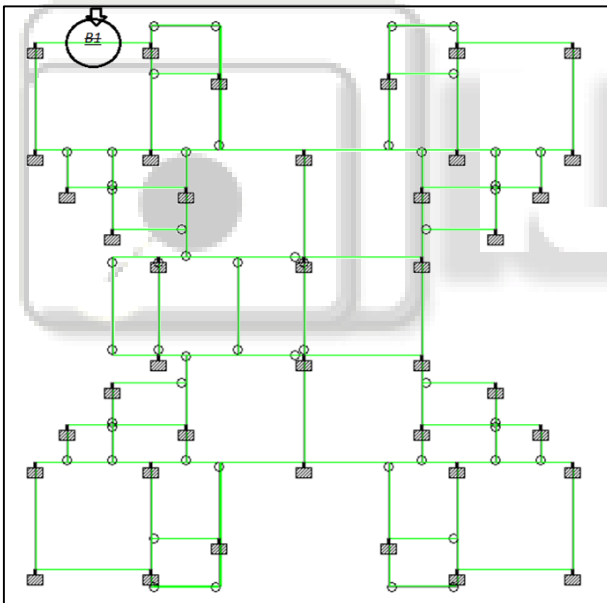


Fig. 3.3: Selected Beam For Analysis

The selected beams for analysis are:-
B1-The selected beam are external beam.

III. RESULT AND DISCUSSION

A. Results of absolute displacement in column:

	0	1	2	COLUMN-01 3	4	5
ZONE-2	0	3.01	9.642	15.694	20.451	22.892
ZONE-3	0	5.108	16.344	26.781	35.042	39.574
ZONE-4	0	6.852	22.418	35.527	47.877	53.973
ZONE-5	0	10.279	33.383	54.581	71.405	80.637

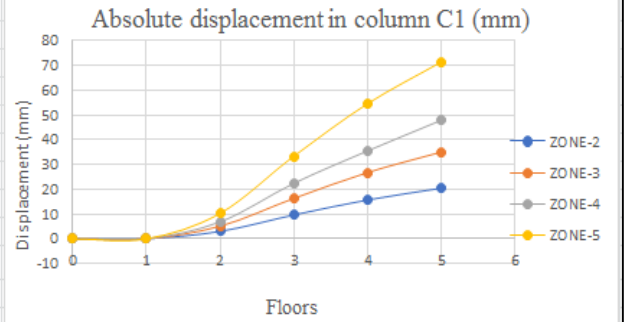


Fig. 4.1: Absolute displacement in column C1

	0	1	2	3	4	5
ZONE-2	0	2.862	9.406	16.004	21.219	24.351
ZONE-3	0	4.925	16.093	26.621	35.244	40.376
ZONE-4	0	6.789	22.372	36.889	48.704	55.636
ZONE-5	0	10.105	33.225	54.832	72.303	82.493

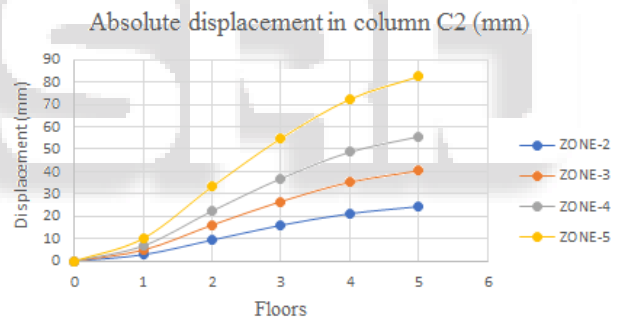


Fig. 4.2: Absolute displacement in column C2

	0	1	2	3	4	5
ZONE-2	0	3.102	9.685	15.708	20.998	25.057
ZONE-3	0	4.996	15.94	26.775	35.835	42.8
ZONE-4	0	6.825	22.129	37.104	49.477	58.672
ZONE-5	0	10.072	33.043	55.022	73.216	86.386

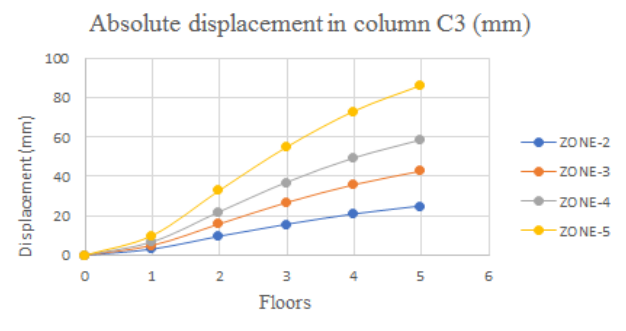


Fig. 4.3: Absolute displacement in column C3

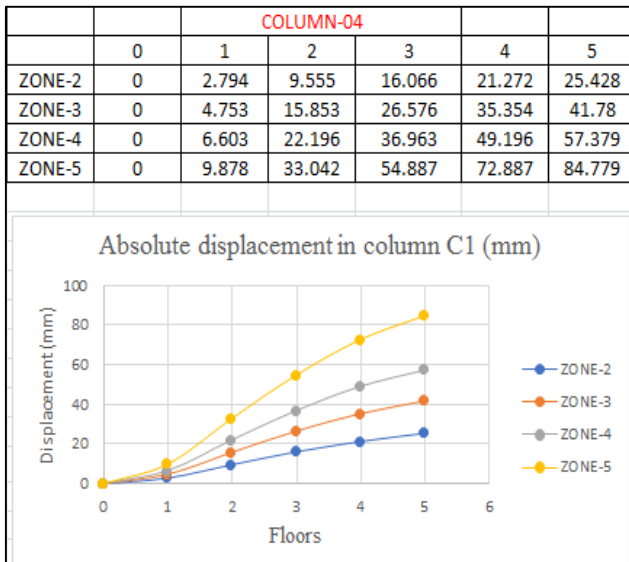


Fig. 4.4: Absolute displacement in column C4

- The displacement which likely to occur due to seismic force is calculated and tabulated.
- The displacement which is maximum at each floor level corresponding to ground is shown in fig 4.1, 4.2, 4.3 and 4.4 for equivalent static method.
- The displacement values are taken and compare in different seismic zone.

B. Results of maximum deflection in beam:

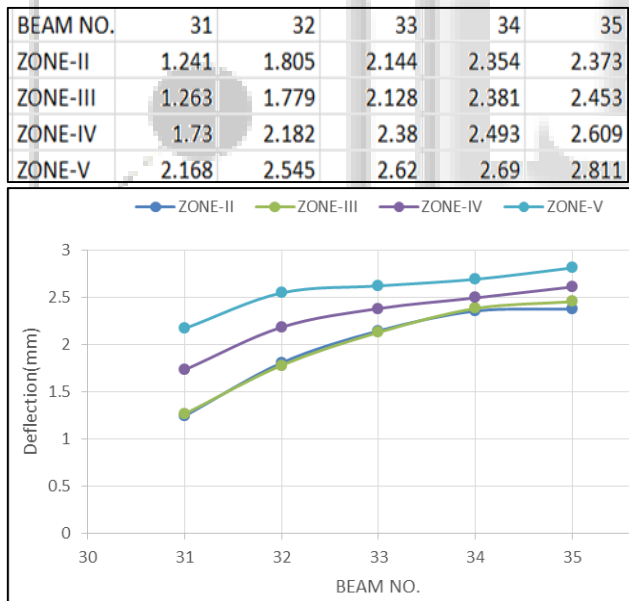


Fig. 4.5: deflection in selected beam

- The deflection which likely to occur due to seismic force is calculated and tabulated.
- The deflection which is maximum at each floor level corresponding to ground is shown in fig 4.5 for equivalent static method.
- The deflection values are taken and compare in different seismic zone.

IV. CONCLUSION

- 1) The displacement of all selected column i.e. C1, C2, C3 and C4 are symmetrical.

- 2) Displacement increases from floor to floor.
- 3) Displacement increases from Zone II to Zone V.
- 4) The displacement in exterior column is more than interior column.
- 5) The deflection of the structure is increased from zone II to ZoneV.
- 6) Deflection of the beam in Zone II and Zone III is approximately same.

REFERENCES

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