A SEISMIC ANAYSIS AND DESIGN OF RCC LOW RISE AND HIGH RISE BUILDINGS

Dipshi Gajbhiye[1],Jayesh Gaikwad[1],Rushabh Jain[1],Sharayu Dhawane[1],Amey Hate[1],Dr. Shailesh Angalekar[2], Rohit Mangalekar[2]
[1]UG Students, Department of Civil Engineering Sinhgad college of engineering, Pune, Maharastra,India
[2]Associate professors, Sinhgad college of engineering, Pune, Maharastra, India

***Abstract*—Earthquake resistant design of structure is anenduring field of exploration since the earthquake engineering has started. In order to successfully overcome the effects of earthquake we are required to analyze the seismic behaviour of the structures by using different analytical procedures. A thorough study of seismic performance of low rise and high rise structures, both regular and irregular, is necessary for its design, which ensure the structures to withstand during earthquakes. The behavior of a building during an earthquake depends on several factors, stiffness, adequate lateral strength and ductility, simple and regular configurations. This study may help to analyse the various parameters such as storey drift in different mode shapes, vertical displacement and base shear for G+4 and G+24 storey regular and irregular RCC buildings for same seismic zone of India by using Response spectrum analysis in ETABS.**

Index Terms*— Structure *Design, ETABS, Low & High Rise Buildings, Plan Irregularity, seismic Performance.

1) INTRODUCTION

Earthquakes are one of the nature's greatest hazards on our planet which have taken heavy toll on human life and property since ancient times. Since earthquakes are so far unpreventable and unpredictable, the only option with us is to design and build the structures which are earthquake resistant. This paper mainly deals with the study of seismic analysis of low rise and high rise buildings using ETABS.In this study there are basic four models which can be used for analysis of both the type of structures, regular and irregular, analysed for G+4 and G+24 storeys located in same Seismic zone of India, by using Response Spectrum Method of analysis in ETABS. After analysing models in ETABS the results for storey displacement, base shear and storey drift are then obtained and comparison of same is graphically represented. After observing these results and its graphical representation some conclusions are made.

2) MODELLING OF RCC FRAMES

Seismic performance of building depends upon various parameters viz. element sizes, location, height of building, soil properties, etc. the plan dimensions considered for analysis are as shown in figure 1.1 for regular (low and high rise) and fig 1.2 for irregular (low rise and high rise).

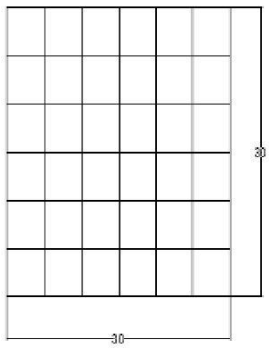

fig.1 plan for regular building

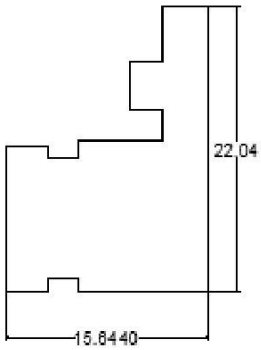

fig.2 plan for irregular building

All details of four models which are used in this study are as follows

TABLE 1

Model ID for Response Spectrum Analysis	Model label
R3L	G+4 regular RCC building in zone III
R3H	G+24 regular RCC building in zone III
I3L	G+4 irregular RCC building in zone III
I3H	G+24 irregular RCC building in zone III

TABLE 2

ELEMENT	**DIMENSIONS (mm)**	
	Regular	**Irregular**
Beam	300 x 600	300 x 600
Column (upto 3 storey)	400 x 1050	400 x 1200
Column(4 to 25th storey)	400 x 800	400 x 800
Slab	150	150
Shear Wall	200	200

TABLE 3

Parameters	Model details	
No. of storey	5	25
Height of the building	16 m	76 m
Height of bottom storey	4 m	4 m
Each storey height	3 m	3 m
Soil type	MEDIUM	MEDIUM
Structure type	SMRF	SMRF
Response reduction factor R	5	5
Importance factor I	1	1
Zone Z	III	
Grade of Concrete	30 kN/m^2	
Gradeof Steel	500 kN/m^2	

III. LOADING

Loads acting on the structure are dead load (DL), Live load and Earthquake load (EL).

1. Self weight comprises of the weight of beams, columns and slab of the building.

2. Dead load: Wall load, Parapet load and floor load (IS 875(Part1))

a) Wall load= (unit weight of brick masonry X wall thickness X wall height)
= 7.65 kN/m (acting on the beam)

3. Live load: 2kN/m_2 (IS 875 (Part 2)

4. Floor load: 1kN/m_2 (IS 875 (Part 1)

5. Seismic Load: Seismic load is considered along two directions EQx and EQy (IS 1893 Part 1)

IV. LOADING COMIBINATION

The structure has been analyzed for load combinations considering all the previous loads in proper ratio. Combination of self-weight, dead load, live load and seismic load was taken into consideration according to IS-code 875(Part 5).

TABLE 4

Sr.no.	Load Combo	Loads	Factors
1	1.5DL+1.5LL	SELF WT	1.5
		FF	1.5
		LL	1.5
2	1.5DL+1.5EQx	SELF WT	1.5
		FF	1.5
		EQx	1.5
3	1.5DL-1.5EQX	SELF WT	1.5
		FF	1.5
		EQx	1.5
4	1.5DL+1.5EQy	SELF WT	1.5
		FF	1.5
		EQy	1.5
5	1.5DL-1.5EQy	SELF WT	1.5
		FF	1.5
		EQy	1.5
6	1.2DL+0.3LL+1.2EQx	SELF WT	1.2
		FF	1.2
		LL	0.3
		EQx	1.2
7	1.2DL+0.3LL+1.2EQy	SELF WT	1.2
		FF	1.2
		LL	0.3
		EQy	1.2

V. MODELLING IN ETABS

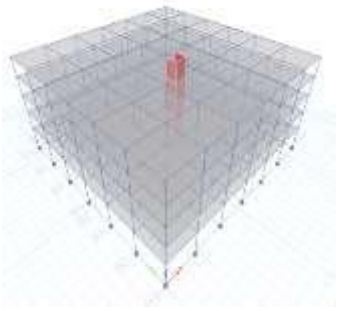

Fig 3-3D View of the 5-storeys Regular building

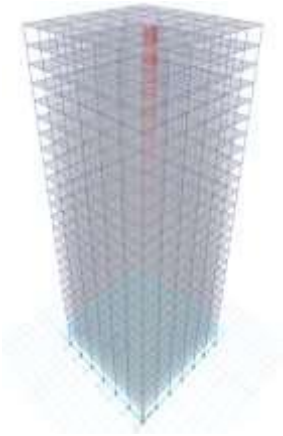

Fig 4-3D View of the 25-storeys Regular building

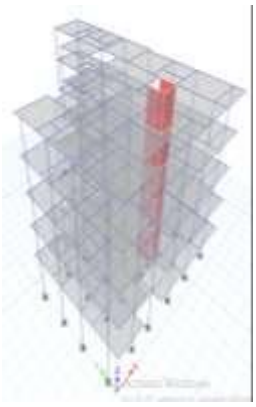

Fig 5-3D View of the 5-storeys Irregular building

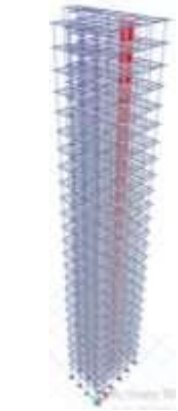

Fig 6-3D View of the 25-storeys Irregular building

VI. RESULTS AND DISCUSSIONS

Story	High rise		Low rise	
	Regular	Irregular	regular	irregular
Story displacement	44.9	260.77	9.4	12.291
Storey drift	0.000759	0.000851	0.00071	0.000883
Storey shear	2343.616	2322.253	1333.81	499.5291

TABLE 4

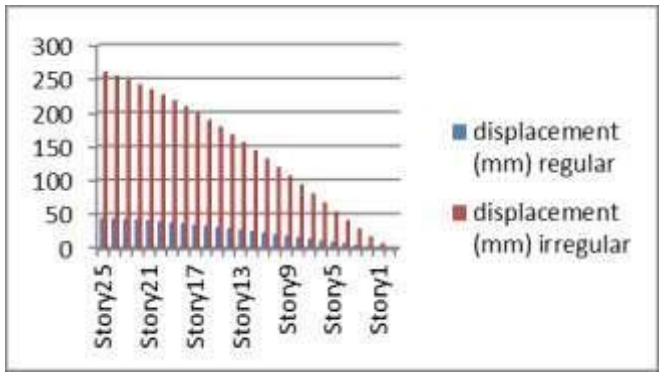

Fig 7- Graphical representation of story displacement for High rise

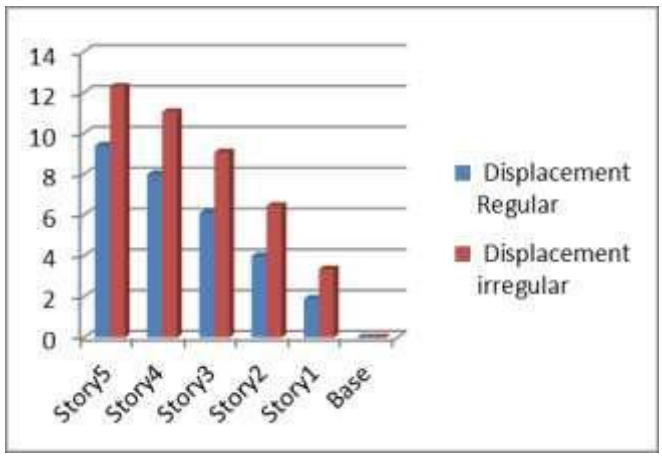

Fig 8- Graphical representation of story displacement for Low rise

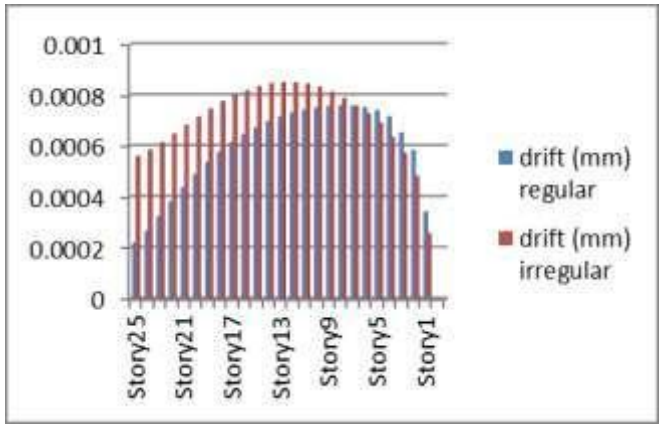

Fig 9- Graphical representation of story drift for High rise

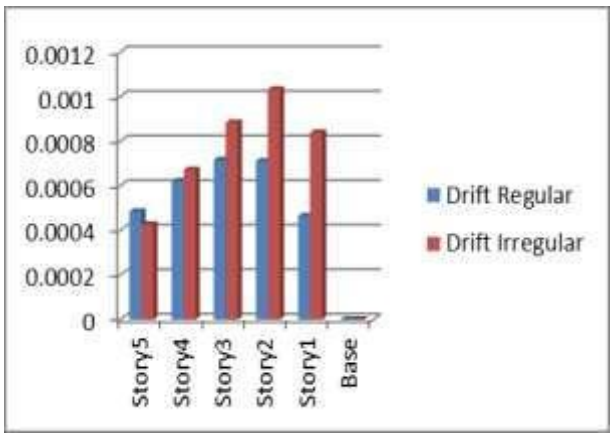

Fig 10- Graphical representation of story drift for Low rise

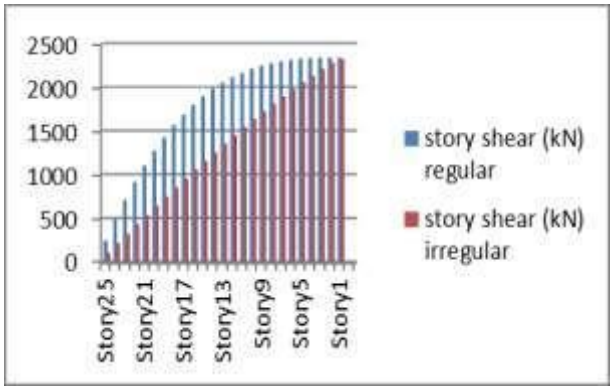

Fig 11- Graphical representation of story shear for High rise

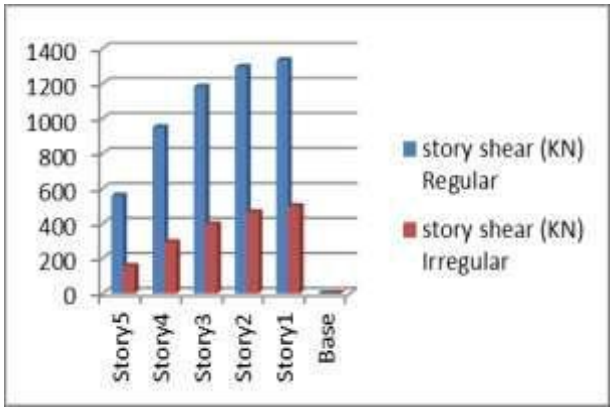

Fig 12- Graphical representation of story shear for Low rise

VII. CONCLUSIONS

1) Storey Displacement-

- As base of the structure is fixed, lateral displacement at base is almost equal to zero. Lateral displacement will increase with increase in number of storey.
- Height of the structure is another factor which affects the displacement. Lateral displacement of g+4 storey structure is lesser than that of g+24 storey structures.
- Lateral displacement of irregular structure is more as compared with regular structure.

2) Storey Drift-

- From results it can be concluded that story drifts are increased with the increase the height of the structure.
- Results proved that the story drift for Irregular structure is greater as compared with regular structure.

3) Base Shear-

- Base shear of G+24 storey structure is greater than all other structures, so that the results are suggesting that the base shear varies with the height of the structure, it goes on increasing as the height of the structure increases.
- Base shear of regular buildings is greater than base shear of irregular buildings.

VIII. REFERENCES

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