Seismic Analysis of Unsymmetrical Building in Plan

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Abstract : A structure can be classified as irregular if it contains irregular distributions of mass, stiffness and strength or due to irregular geometrical configurations. The behavior of any building depends on the arrangement of structural elements present in it. The important aspects on which the structural configuration depends are geometry, shape and size of the building. In reality, many existing structures contain irregularity due to functional and aesthetic requirements. In this proposed work, the structural analysis and design of G + 20 storey reinforced concrete symmetrical and asymmetrical structures is done with the help of Staad-Pro software. Irregular plan of the structure (E, L, T, and Y shape) and regular plan (Rectangular shape) of the structures are considered. These buildings have approximately area of about 620m2. The building is assumed to be sited in seismic zone III on a site with medium soil and Special Moment Resisting Frame are evaluated and compare Basic parameters such as shape factor, modal analysis, deflection, storey drift. Response spectrum analysis method is used for analysis.

Index Terms **- Irregularity, Geometry, shape factor, modal analysis, deflection, storey drift etc.**

I. INTRODUCTION

Structures are the complex system and multiple items have to be considered at the moment of designing them. Hence at the planning phase itself, architects and structural engineers must work together to confirm that the critical features are avoided and good building shape is chosen. The approach to seismic analysis by conventional methods make use of many random assumed values like time period, intensity of earthquake and direction of earthquake etc. Sometime the plot area is having irregular shape. In that situation there is need of construct building according to shape of plot area. Now a day there is craze of built buildings with initial letter of names Like I, L, W, V, T, O, E. This shape is challenging for earthquake study. It would be ideal if all buildings have their lateral-load resisting elements symmetrically arranged and earthquake ground motions would strike in known directions. Due to scarcity of land in big cities, architects often propose irregular buildings in order to utilize maximum available land area and to provide adequate ventilation and light in various building components. However, it is quite often that structural irregularity is the result of a combination of both types.

II. BUILDING PLAN AND DETAILS

Five models of G + 20 storey structures with one rectangular shape plan and remaining irregular plan have been taken. The plan area for every structure is same only there is difference of geometry. Each plan consists of the approximately area of 620 sq. m. structures sited in earthquake zone (III) of India.

1. Rectangular Shape Plan
2. E shaped Plan
3. L Shape Plan
4. T shaped Plan
5. Y Shape Plan

Table 1 BUILDING PLAN DETAILS

Storey Height	3m
Number of storey	G + 20
Steel Grade	Fe 415
Concrete Grade	M40
Size of Beam	0.3m x 0.5m
Size of Column	0.8m x 0.3m 0.7m x 0.3m 0.6m x 0.3m 0.5m x 0.3m
Slab Thickness	0.150m
Important Factor (I)	1.0
Response Reduction Factor (R)	5
Damping Factor	0.05

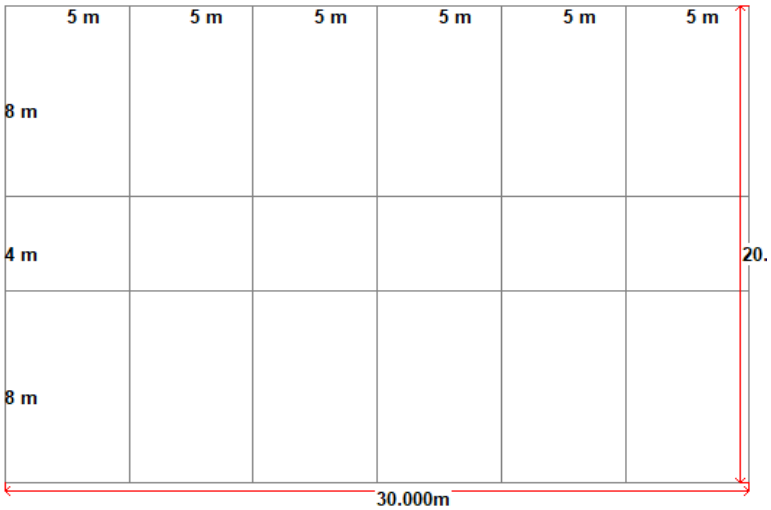


Fig. 1 modeling line plan for Rectangular shape

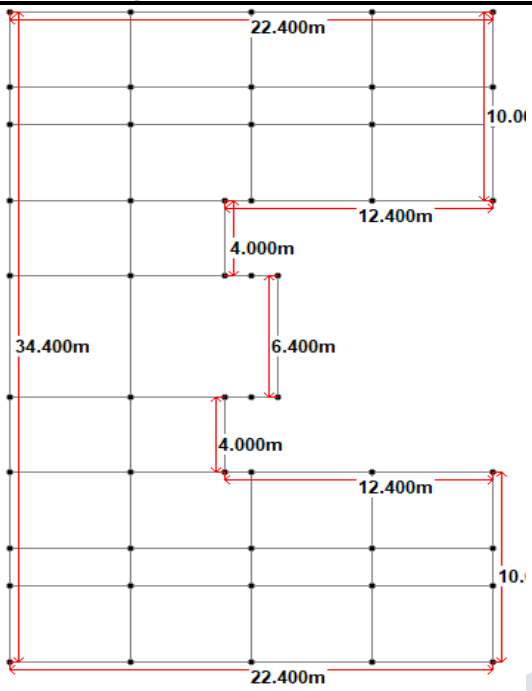


Fig. 2 modeling line plan for E shape

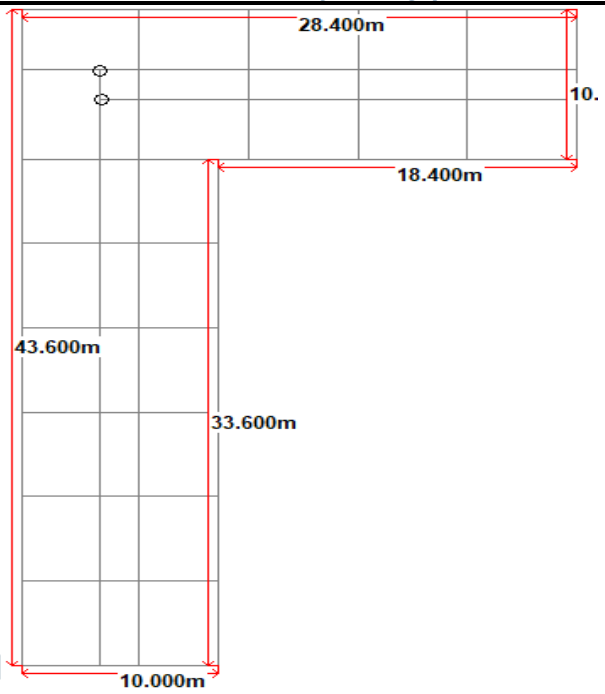


Fig. 3 modeling line plan for L shape

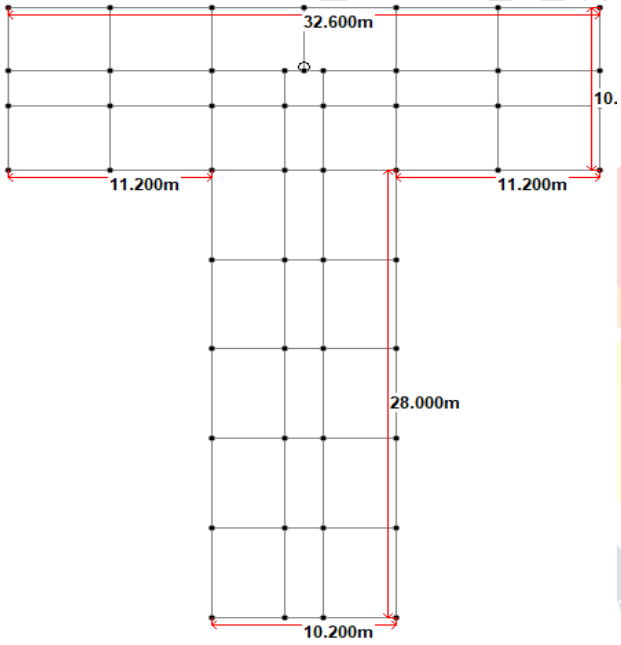


Fig. 4 modeling line plan for T shape

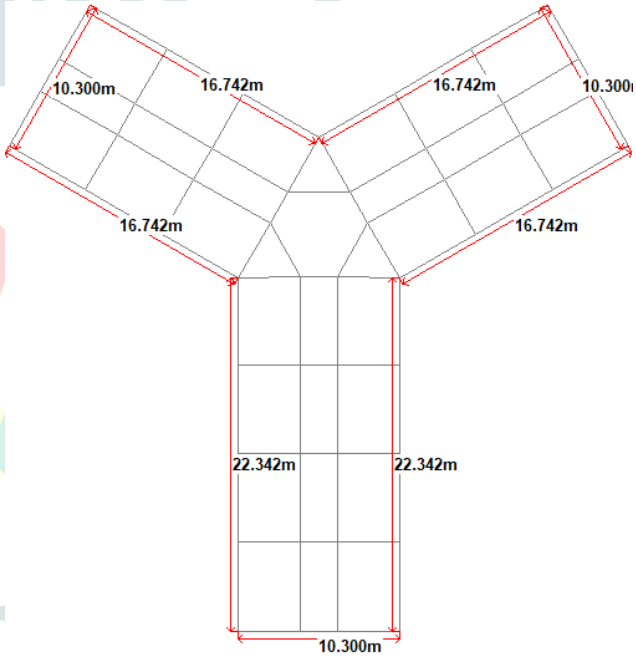


Fig. 5 modeling line plan for Y shape

III. RESULTS

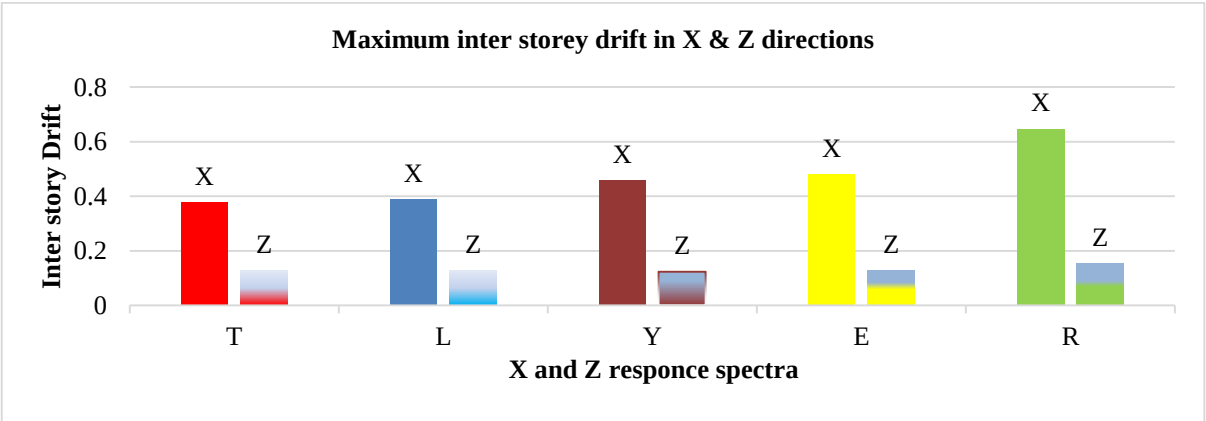
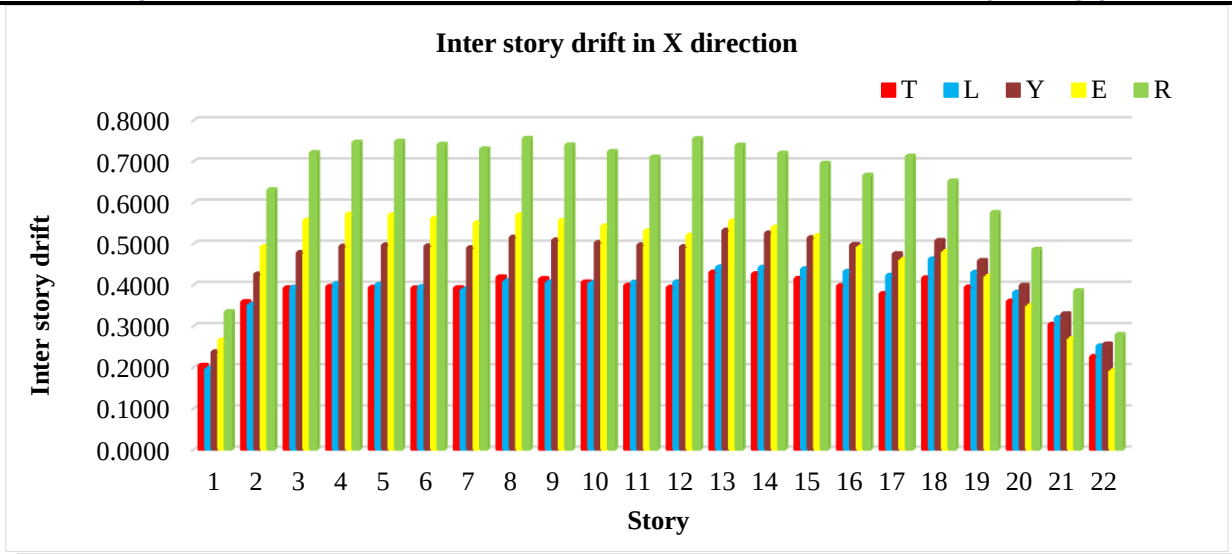


Fig. 6 Maximum inter storey drift in X & Z directions



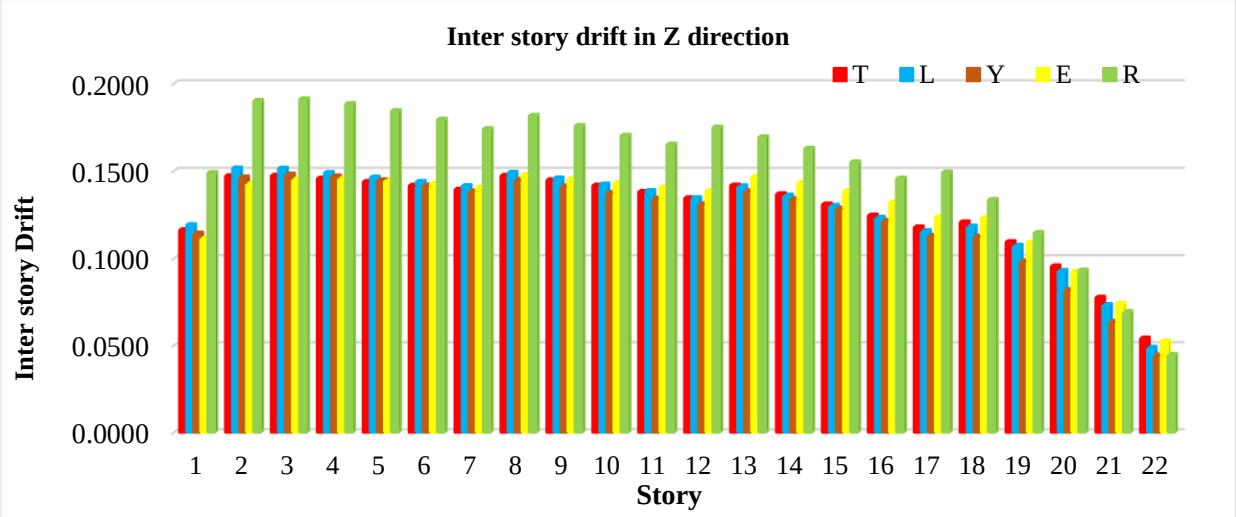
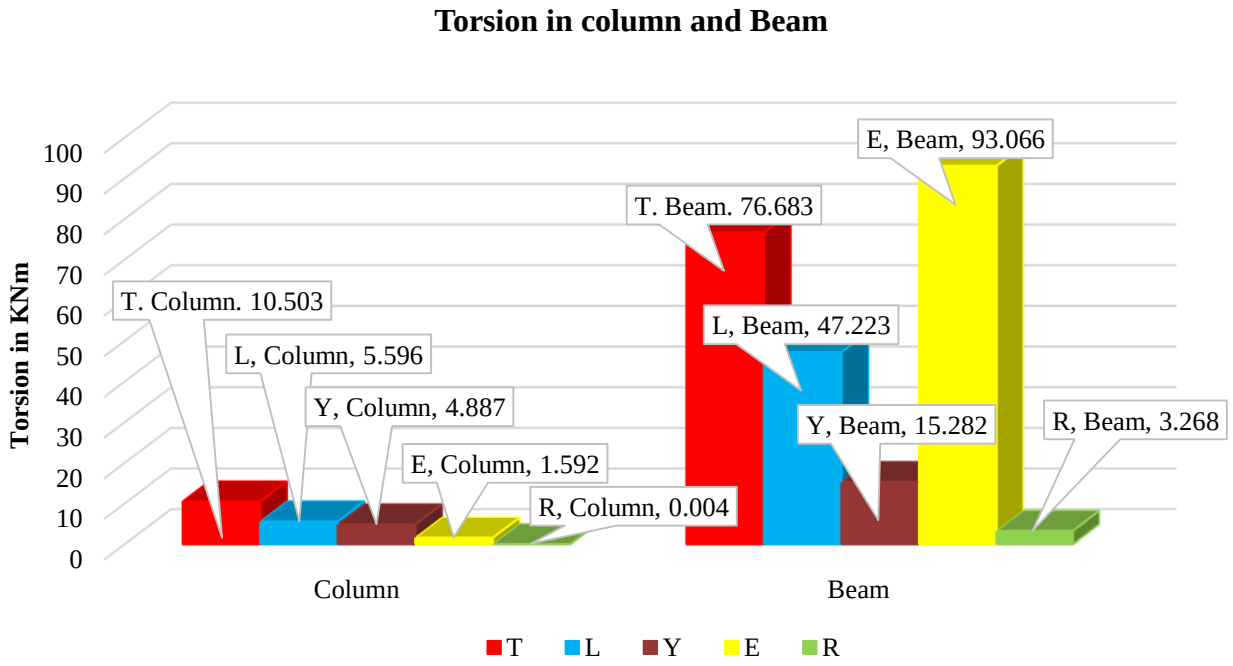


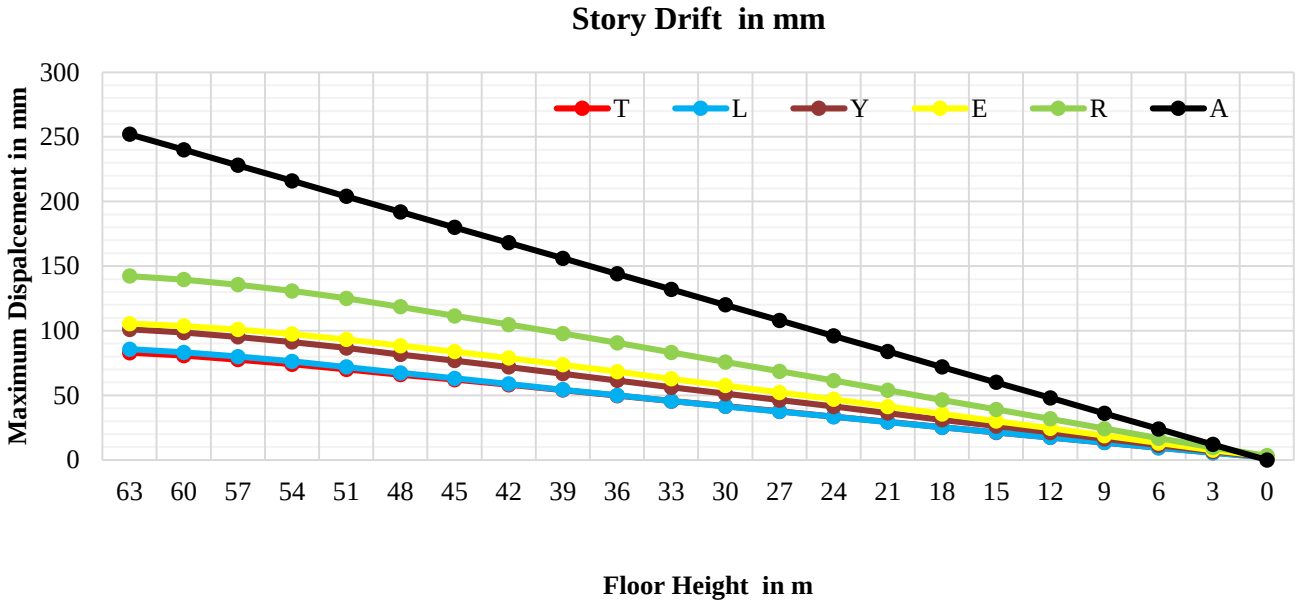
Table 2 Modes of shapes

Building	MODE	Frequency (cycles/sec)	Period (sec)	Along axis	Period as is code (sec)
E shape	1	0.285	3.5026	Z	1.1980
	2	0.381	2.6272	X	0.9667
L shape	1	0.291	3.4323	Z	1.0640
	3	0.387	2.5854	X	0.8587
R shape	1	0.233	4.2977	Z	1.2679
	3	0.281	3.5551	X	1.0352
T shape	1	0.295	3.3914	Z	0.9931
	3	0.413	2.4191	X	0.9174
Y shape	1	0.293	3.4181	Z	0.9045
	3	0.390	2.5653	X	0.9016

Table 3 Maximum Torsion

Maximum Torsion in KN m					
Building	**T**	**L**	**Y**	**E**	**R**
Column	10.503	5.596	4.887	1.592	0.004
Beam	76.683	47.223	15.282	93.066	3.268





IV. CONCLUSIONS

1. Performance of Symmetrical building is better than Asymmetrical building.
2. Maximum displacement for regular shapes rectangle building then other buildings. This has occurred because of the column stiffness is almost half in rectangle building than T building.
3. In comparison of torsional moment in beam the result shows that for asymmetrical building the torsional moment are more than symmetrical therefore it is necessary to design the beam and column for torsional moment.
4. Structural parameters such as lateral displacement, time period for Asymmetrical structure is higher as compared to rectangle building.
5. Total reinforcement cost of Asymmetrical building will be more as compare to rectangle building
6. We can build any shape building but number of columns required for that should have good quantity.

V. REFERENCES

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