Study on the Analysis of Multi Storey Regular and Irregular (Horizontal and Vertical) Structure By ETABS

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Abstract- *The behaviour of G+12 multi story building of regular and irregular configuration under earth quake is complex and it varies of wind loads are assumed to act simultaneously with earth quake loads. In this paper a residential of G+12 multi story building is studied for earth quake and wind load using ETABS. The behaviour of building during Earthquake depends critically on its overall shape, size and geometry. The Seismic performance of building is available and new design methods should account for the building ability to dissipate energy and the effect of the lateral deformation.*

Keywords- Symmetric and Asymmetric structures; building analysis, Storey Deflection, Storey Shear, Base Shear, Overturning moment.

I. INTRODUCTION

Many buildings in the present scenario have irregular configurations both in plan and elevation, which in future may subject to devastating earthquakes. In case, it is necessary to identify the performance of the structures to withstand against disaster primarily due to earthquake and wind. Irregularities are not avoidable in construction of buildings. However the behaviour of structures with these irregularities during earthquake needs to be studied. Adequate precautions can be taken. A detailed study of structural behaviour of the buildings with irregularities is essential for design and behaviour in earthquake. Several related studies have focused on evaluating the response of "regular" structures. However there is a lack of understanding of the seismic response of structure with irregularities. Therefore a comprehensive evaluation of the effect of vertical and horizontal irregularities on the seismic demand of building structures is greatly needed.

Concept of regular and irregular configuration: To perform well in an earth quake a building should possess four main attributes namely simple and regular configuration and adequate lateral Strength, stiffness and ductility. Current earthquake codes define structural configuration as either regular or irregular in terms of size and shape of the building, arrangement of the structural and non-structural elements within the structure, distribution of mass in the building etc. A building shall be considered as irregular for the purposes of this standard, if at least one of the conditions is applicable as per IS 1893(part1):2002

A. PLAN IRREGULARITY:

Asymmetric or plan irregular structures are those in which seismic response is not only translational but also torsional, and is a result of stiffness and/or mass eccentricity in the structure. Asymmetry may in fact exist in a nominally symmetric structure because of uncertainty in the evaluation of centre of mass and stiffness, inaccuracy in the measurement of the dimensions of structural elements.

B. VERTICAL IRREGULARITY:

Vertical irregularity results from the uneven distribution of mass, strength or stiffness along the elevation of a building structure. Mass and Stiffness irregularity results from a sudden change in mass and stiffness between adjacent floors respectively.

II. OBJECTIVES

1. To study irregularities in structures analyze and design of G+12 storied structure as per code provision.
2. Analyze the buildings in ETABS software to carry out the storey deflection, storey drift, storey shear force, overturning moment and base shear of regular and irregular structures using response spectrum analysis and compare the results of different structures.

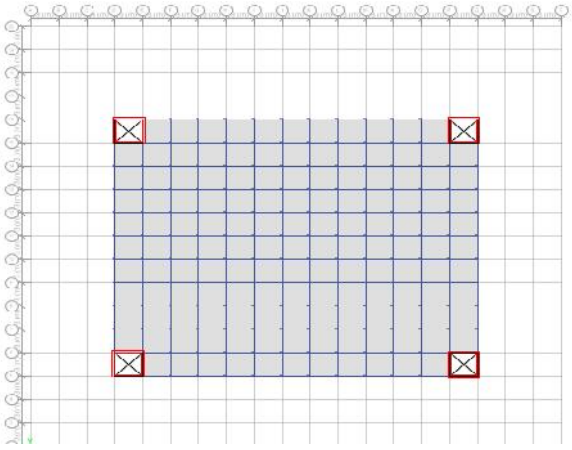
III. PROBLEM FORMULATON

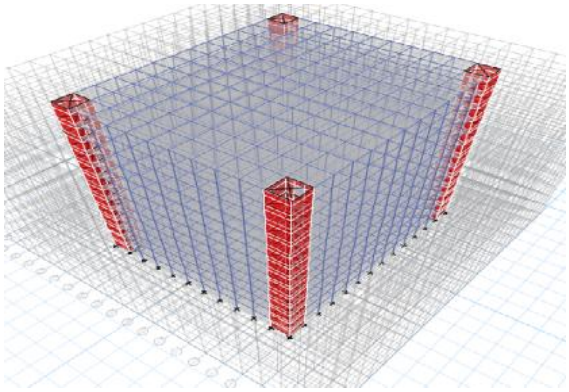
The structural analysis and design of G+12 storey reinforced concrete symmetrical and asymmetrical buildings is done with the help of Etabs software. The building is assumed as commercial building. Regular plan of the structure and irregular plan of the structures are shown in fig. The structure is assumed to be located in seismic zone V on a site with medium soil. These buildings have approximately the same plan area.

BUILDING DETAILS

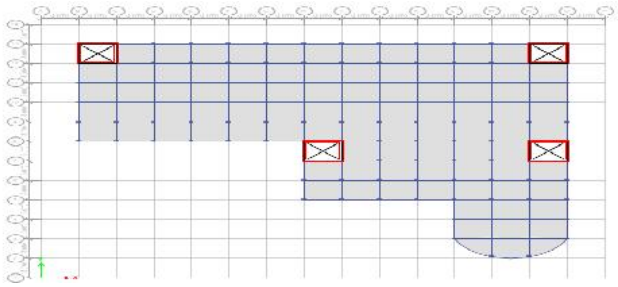
Dimension of beams Beam 1 Beam 2 Beam 3	 450*300 mm 300*250 mm 250*250 mm
Dimension of column	400*300 mm
Thickness of slab	125 mm
Load of wall	13.11 kN/m
Height of each storey	3 m
Live load On floor On roof	 4kN/m^2 1.5kN/m^2
Grade of reinforcing steel	Fe 415
Grade of concrete	M 30
Seismic Intensity	Very sever
Importance factor	1
Zone factor	0.36
Damping ratio	5%
Wind speed	50 m/s
Terrain category	2
Structure class	B

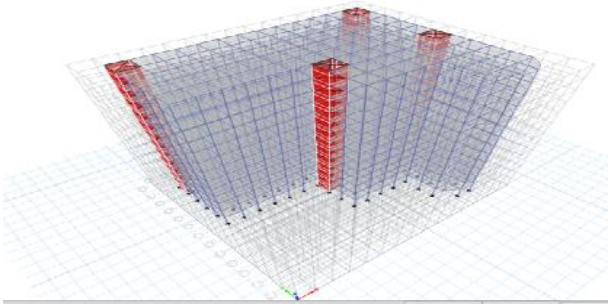
PLAN IRREGULAR STRUCTURES



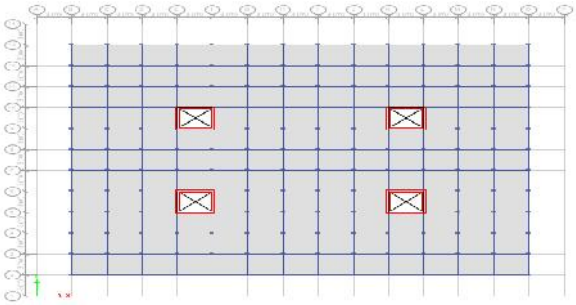


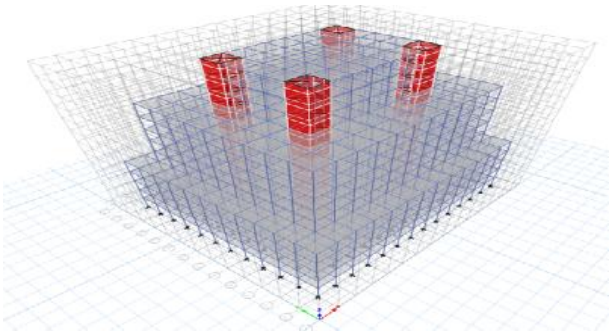
REGULAR BUILDING





HORIZONTAL IRREGULAR BUILDING





VERTICAL IRREGULAR BUILDING

LOAD COMBINATIONS

The gravity loads and earthquake loads will be taken for analysis. As per IS 1893 (Part I): 2002 Clause no. 6.3.1.2, the following Earthquake load cases have to be considered for analysis.

IV. RESULTS AND DISCUSSION

Response Structure analysis was performed on regular and various irregular buildings using Etabs. The storey

shear forces, storey drift, displacement and base shear were calculated for each floor and graph was plotted for each structure.

Comparison of Regular and Plan Irregular and Vertical irregular structure

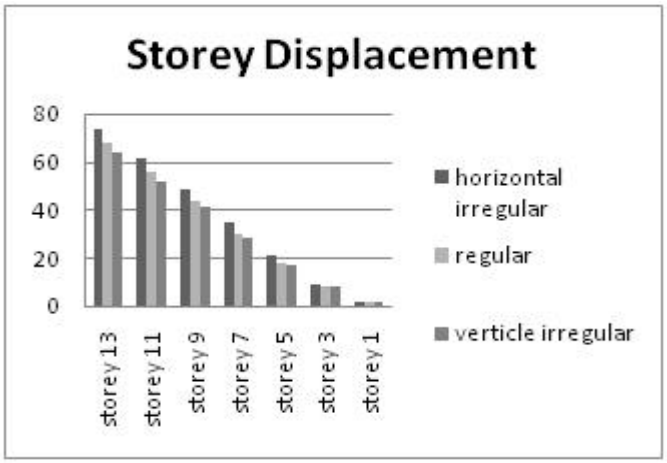


CHART 1: STOREY DISPLACEMENT

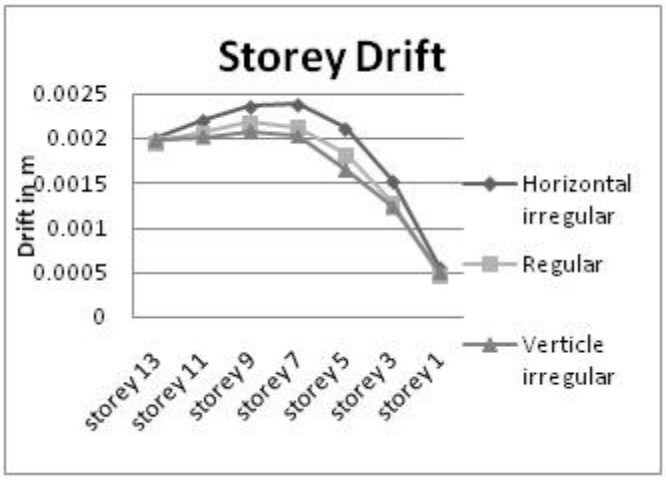


CHART 2: STOREY DRIFT

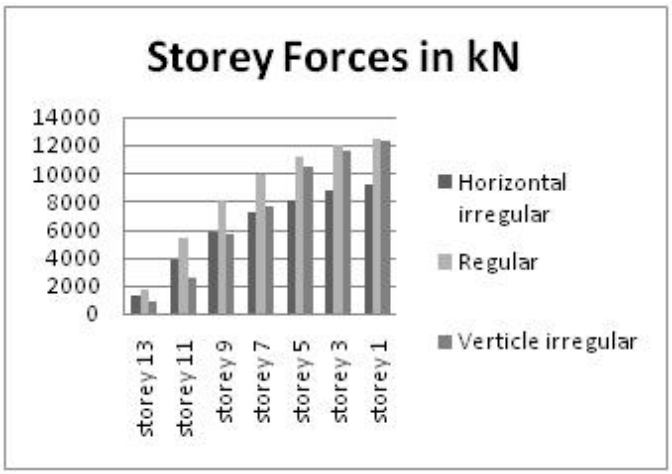


CHART 3: STOREY FORCES

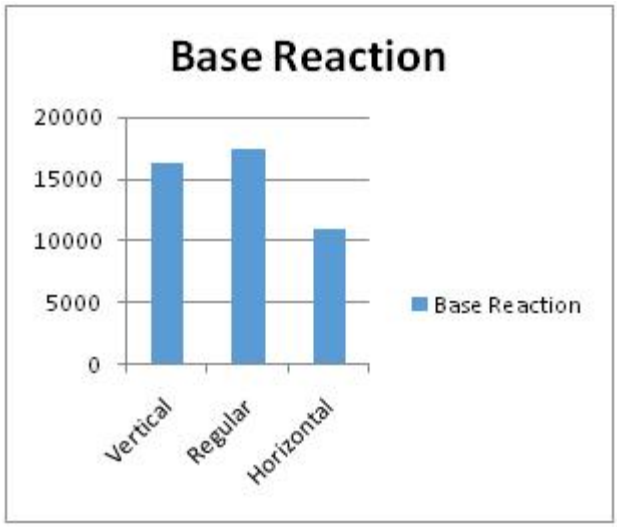
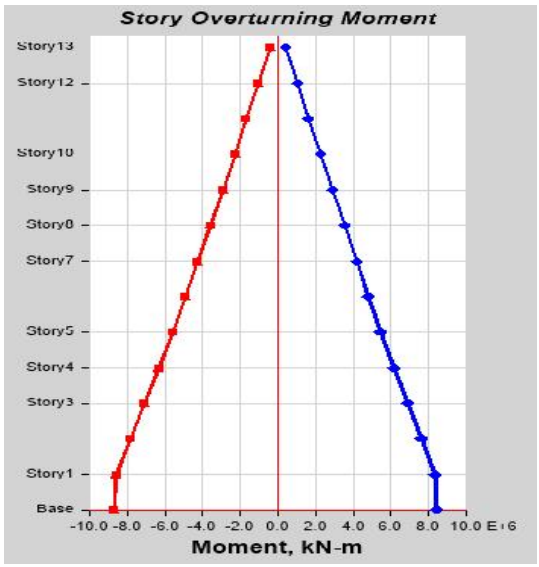
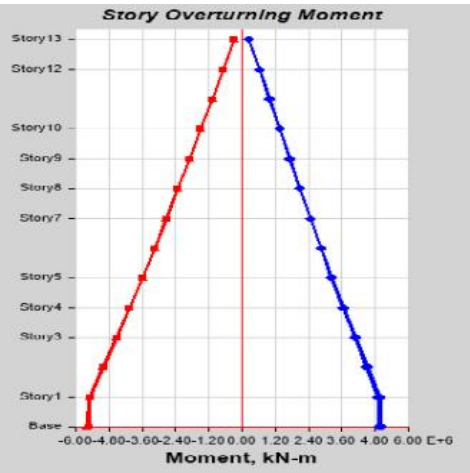


CHART 4: BASE REACTION

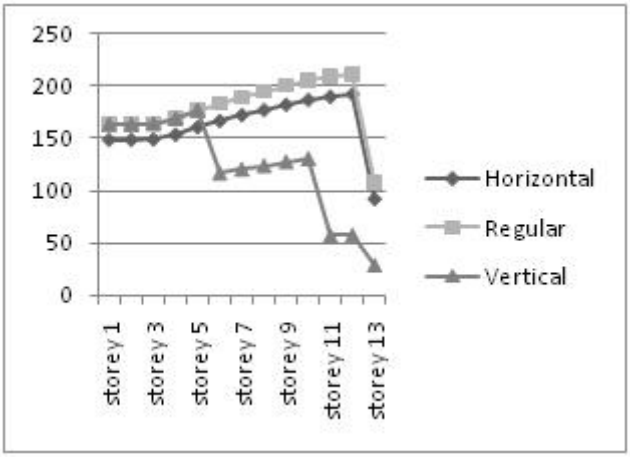
VERTICAL IRREGUER



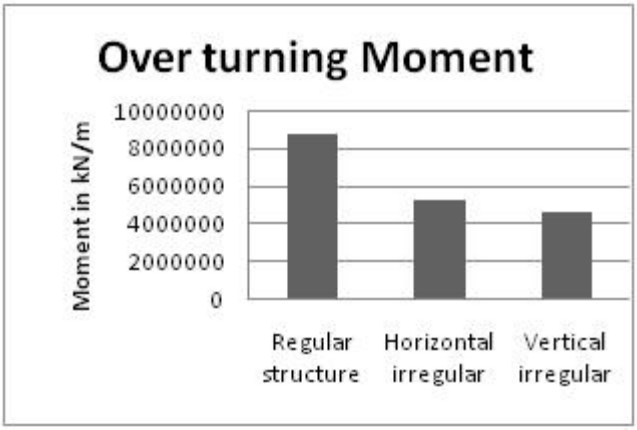
Regular



HORIZONTAL IRREGULAR



WIND FORCES



OVER TURNING MOMENT

V. CONCLUSIONS

1. The plan configurations of structure has significant impact on the seismic response of structure in terms of displacement, story drift, story shear.
2. According to results of RSA, the storey shear force was found to be maximum for the first storey and it decreased to a minimum in the top storey in all cases.
3. Large displacement was observed in the Horizontal irregular building. It indicates that building with severe irregularity shows maximum displacement and storey drift.
4. According to results of RSA, it was found that horizontal irregular building frames experience larger base shear than similar regular building frames.
5. According to results of RSA, the stiffness irregular building experienced lesser base shear and has larger inter storey drifts.
6. It is observed that the storey drift for all the stories are found to be within the permissible limits.

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