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SEISMIC ANALYSIS FOR VERTICALLY GEOMETRIC IRREGULARITY USING E-TABS

K. Vamsi Krishna [1], k. Naga Poojitha [2], L. Mohan Kumar [3], K. Krishna Mohan [4], R. Leela krishna sai [5] ,P. Girish sai kumar[6]

[1]*Assistant professor in Civil Engineering, Dhanekula institute of engineering& Technology, Ganguru, Andhra Pradesh.*

[2, 3,4,5,6] *students in civil engineering, D.I.E.T, Ganguru, Andhra Pradesh.*

Abstract - *During an earthquake, failure of structure starts from the points of weakness. This type of weakness arises due to discontinuity in mass, stiffness and geometry of structure. Vertically irregular structure is nothing but the discontinuities in the vertical plane of the structures. To construct any structure safety plays a very important role, in that a building must resist for earthquake. For a regular or for a simple structure damage due to earthquake will be minimum but irregularity makes structures vulnerable under seismic loading. In this present study G+5 building located in zone II, III, IV are analyzed using ETABS software for vertical geometric irregularity. In order to find out the seismic response of the structure for in three different zones, it is important to obtain the plan of the structure and to analyze various elements of a building such as beam, column, slab, foundation and stair case under the seismic load acting on the structure. The structure was analyzed with various combination as per code IS1893:2002 part-1. We also used the AUTOCAD for our designs of the structures. The main advantage of displacing the drawing in AutoCAD is user has more flexibility to modify the drawings in AutoCAD.*

KEYWORDS*:* **seismic load, G+5, Zones, Auto CAD, E-TABS.**

1.INTRODUCTION

Earthquakes are natural hazards, Generally earthquakes are mainly caused by the collision of tectonic plates, some other natural disasters like volcanic eruptions and other man-made structures. For new constructions, establishing earthquake resistant regulations and their implementation experience is the critical safeguard against earthquake induced damage. when constructing an vertically irregular structures the structural engineers role becomes more difficult than others. Before we going to construct a structure evaluation is important. The analysis and design is must and should for every irregular structures, that gives the result whether the structure is safe or not.

In the shape point of view, The buildings can are broadly categorized as regular and irregular buildings. The irregularity of a building can be depends on the stiffness, discontinuity in plane or geometry, mass or load resisting elements. The structural irregularities can be broadly categorized as horizontal and vertical irregularity.

The different factor that causes damage to the structure throughout the earthquake are mass irregularity, vertical irregularities, torsional irregularity, irregularity in strength and stiffness, etc. Generally in multi-storied RC framed buildings, The destruction stats from the point of weakness. In some of the cases, these weaknesses are also developed by discontinuities in stiffness, strength or mass between adjacent stories.

1.1 Necessity of the study

Seismic analysis of a building has now become an important part in present senario of modern structural designs, it is because earthquake causes lots of damages and loss of life. Multi-storey structures constructed by reinforced cement concrete are subjected to severe actions of seismic waves during earthquake. The main reason for the failure of RC building is irregularity in geometry. The irregularities may be in its plan dimension, lateral force distribution.

2. METHODOLOGY

Following steps of methods are adopted in this project:
Step-1: Selection of the structure and three different seismic zones like II, III, IV.
Step-2: Collection and study of literatures
Step-3: Plan representation in CAD software
Step-4: Export to ETABS
Step-5: Assigning of loads and load combinations
Step-6: Seismic analysis and design for the data model
Step-7: Interpretation of results.

Table -1:

S. No	Content	Description
1	Type of structure	Vertical geometric irregularity
2	Shape of the building	Asymmetrical
3	Number of storey	G+5
4	Height of the floor	3.0m
5	Materials	Concrete (M25), Steel(Fe415)
6	Wall thickness	300mm
7	Beam size	230*450mm
8	Column size	300*550mm
9	Depth of slab	150mm
10	unit weight of RCC	25kN/m3
11	Live load	3.0kN/m2

Model considered in the project

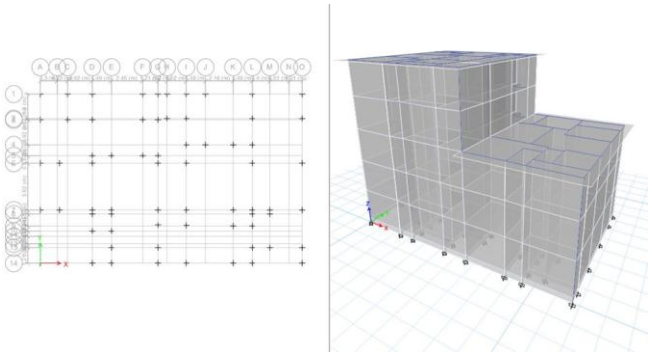

Fig -1: G+5 Vertical Geometric Irregularity

3. RESULTS

Results for base shear, displacement and drift on both X and Y directions are represented graphically for three different zones

Table-1 Base shear along x-direction in three different zones:

No of	Zone 2	Zone 3	Zone 4
5	344.342	550.9472	826.4209
4	298.7901	478.0642	717.0962
3	266.728	426.7648	640.1471
2	139.494	223.1904	334.7856
1	39.8936	63.8298	95.7447
Ground	0.4885	0.7816	1.1724
Base	0	0	0

Table-2 Base shear along y-direction in three different zones:

No of stories	Zone 2	Zone 3	Zone 4
5	344.342	550.9472	826.4209
4	298.7901	478.0642	717.0962
3	266.728	426.7648	640.1471
2	139.494	223.1904	334.7856
1	39.8936	63.8298	95.7447
Ground	0.4885	0.7816	1.1724
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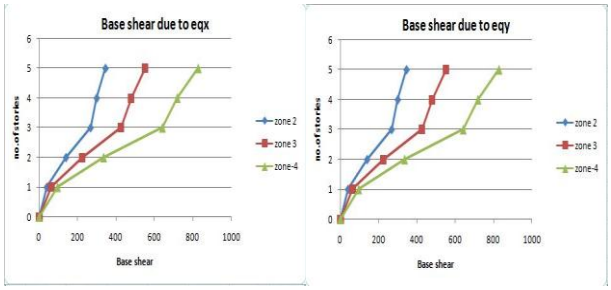


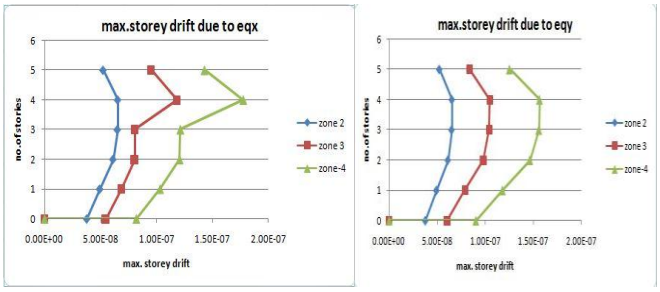
GRAPH-1,2 BASE SHEAR IN BOTH X & Y DIRECTIONS FOR THREE ZONES

Table-3 Displacement along x-direction for three different zones:

No of Stories	Zone 2	Zone 3	Zone 4
5	0.001	0.001	0.002
4	0.001	0.001	0.002
3	0.000449	0.001	0.001
2	0.000296	0.000474	0.001
1	0.000144	0.000231	0.0003459
Ground	1.54E-05	2.46E-05	3.69E-05
Base	0	0	0

Table-4 Displacement along y-direction for three different zones:

No Of Stories	Zone 2	Zone 3	Zone 4
5	0.001	0.001	0.002
4	0.001	0.001	0.002
3	0.001	0.001	0.001
2	0.000348	0.001	0.001
1	0.000165	0.000263	0.000395
Ground	1.69E-05	2.71E-05	4.07E-05
Base	0	0	0



GRAPH-3,4 STOREY DRIFT IN BOTH X&Y DIRECTIONS FOR THREE ZONES

Table-5 Storey Shear in zone II:

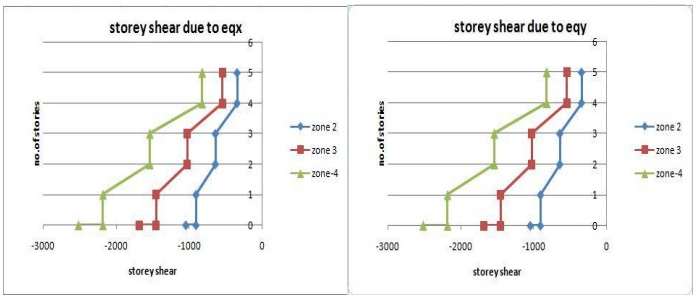
No. of stories	Elevation	Location	x-direction (mm)	y-direction (mm)
Storey 5	15.45	Top	-344.342	-344.342
	15.45	Bottom	-344.342	-344.342
Storey 4	12.45	Top	-643.132	-643.132
	12.45	Bottom	-643.132	-643.132
Storey 3	9.45	Top	-909.86	-909.86
	9.45	Bottom	-909.86	-909.86
Storey 2	6.45	Top	-1049.35	-1049.35
	6.45	Bottom	-1049.35	-1049.35
Storey 1	3.45	Top	-1089.25	-1089.25
	3.45	Bottom	-1089.25	-1089.25
Ground	0.45	Top	-1089.74	-1089.74
	0.45	Bottom	-1089.74	-1089.74
Base	0	Top	0	0
	0	Bottom	0	0

Table-6 Storey Shear in zone III:

No. of stories	Elevation	Location	x-direction (mm)	y-direction (mm)
Storey 5	15.45	Top	-550.947	-550.947
	15.45	Bottom	-550.947	-550.947
Storey 4	12.45	Top	-1029.01	-1029.01
	12.45	Bottom	-1029.01	-1029.01
Storey 3	9.45	Top	-1455.78	-1455.78
	9.45	Bottom	-1455.78	-1455.78
Storey 2	6.45	Top	-1678.97	-1678.97
	6.45	Bottom	-1678.97	-1678.97
Storey 1	3.45	Top	-1742.8	-1742.8
	3.45	Bottom	-1742.8	-1742.8
Ground	0.45	Top	-1743.58	-1743.58
	0.45	Bottom	-1743.58	-1743.58
Base	0	Top	0	0
	0	Bottom	0	0

Table-7 Storey Shear in zone IV:

No. of stories	Elevation	Location	x-direction (mm)	y-direction (mm)
Storey 5	15.45	Top	-826.421	-826.421
	15.45	Bottom	-826.421	-826.421
Storey 4	12.45	Top	-1543.52	-1543.52
	12.45	Bottom	-1543.52	-1543.52
Storey 3	9.45	Top	-2183.66	-2183.66
	9.45	Bottom	-2183.66	-2183.66
Storey 2	6.45	Top	-2518.45	-2518.45
	6.45	Bottom	-2518.45	-2518.45
Storey 1	3.45	Top	-2614.19	-2614.19
	3.45	Bottom	-2614.19	-2614.19
Ground	0.45	Top	-2615.37	-2615.37
	0.45	Bottom	-2615.37	-2615.37
Base	0	Top	0	0
	0	Bottom	0	0



GRAPH-5,6 FOR STOREY SHEAR AT THREE DIFFERENT ZONES ALONG X-DIRECTION AND Y-DIRECTION

4. CONCLUSIONS

• In this study, we have mainly considered storey displacement, storey drift, Axial lateral load and Storey shear for the building and analysed by using E-tabs as per the specification IS 1893:2002(part1).

• It can be concluded that, Base shear, storey displacement, storey shear and storey drift will increases as the earthquake intensity increases from zone II, zone III, zone IV.

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