Seismic Analysis of Residential Building for Different Zones Using E-tab

Shilpa S[1] | Sainath Naik[2]

[1]Assistant Professor, Srinivas University College of Engineering and Technology, Mangalore, Karnataka, India
[2] PG Scholar, Srinivas University College of Engineering and Technology, Mangalore, Karnataka, India

Abstract: High prices and land scarcity in India may increase the unit area of skyscrapers. Earthquakes may be the phenomena that can generate the most powerful forces that can damage structures. The safe building must be constructed with the right technology and the right component assignments to ensure that the brakes have a certain amount of resilience. The main goal is to use ETABS to analyse G+6 buildings in all seismic zones and soil type. This project considers a variety of zone surfaces and soils. Advanced 3D Analysis System (ETABS) is software that can be integrated into all prime static, dynamic, linear and non-linear analysis engines. The program is especially used for the building analysis and planning. In this study, the behavior of the G+6 building under the seismic load condition is studied using the response spectrum analysis. G+6 buildings were analyzed for all achievable combinations (Dead loads, live loads, masonry loads, and seismic loads). As expected, we examine ourselves as a residential building. The height from the 1st to 6th floors is 3.0m. The structure was exposed to dead load, self-loading, live loading, wall loading, and seismic loading according to the specifications of the ETABS specification conditions Seismic calculations were performed according to following. The Some common materials with beam and column section elements are allocated and foundation of support is defined as fixed.

KEYWORDS: Soils, Zones, Analysis, Base shear, Storey drift, Storey displacement, Storey shear.

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INTRODUCTION

The successful design and development of seismic structures is becoming more and more prominent around the world. In this approach, designers primarily try to maximize their potential by using a variety of the use of the materials, taking into account the superior properties of the each strong and delicate materials. Long length, construction load, soil conditions, timing, adaptability and high economic requirements are the optimal arrangements. Buildings that are not damaged by such severe but rare earthquakes are called earthquake-resistant buildings. Before the structural analysis and modelling, it is very necessary to obtain the every necessary information about the holding soils through the soil survey. Land geotechnical engineering is also a method of gathering information and assessing site conditions for foundation construction and construction purposes. Civil engineers are challenged to closely monitor multiple projects that are both efficient and cost-effective in their solutions. On the other hand, ensure that the final building and building designs are sufficient to provide the expected performance over the life of the project. There are many program packages available on the market today for analyze and design for all type of construction structures. RISA software, STAAD PRO software, ETABS software, GT STRUDL,MIDAS Civil, SAP ERP, RAM , programs.

II. OBJECTIVE OF WORK

- A study on the action of building structure under the influence of seismic loads.
- Similarities on various structure analysis results of building under zones 2, 3, 4, and 5 using ETABS program.
- To learn how to evaluate of the earthquake in building.
- For evaluating the type of loads applied on these types of building structure.
- Behaviours values in the zone areas are retrieved and their relevant impact is displayed in the result.
- To gain the knowledge of earthquake analysis methods such as response spectrum analysis, and how to apply them to programs.
- The aim of the work is to analyse a G+6 buildings with the ETABS program.

III. SCOPE OF WORK

- The number of building structure will grow significantly. The impacts of lateral loads, like seismic forces, are becoming progressively major, and nearly all structural designers are faced with the challenge of give sufficient power and durability against all lateral forces.
- RC building structures are designed first for gravitational load and then for earthquake loads.
- Observations are studied to determine difference in action of RC design structures during earthquakes.

IV. METHODOLOGY

In the previous chapter, it is necessary to analyze the structure of the building and design it to withstand lateral seismic forces. This chapter defines the analysis of G+6 residential structure using E-TABS program according with response spectrum method. Storey. From seismic analysis to predicting displacement and forces in structural system members, using spectrum response methods has the computational advantages. This method calculates the highest displacement process and element forces using uniform design spectrum averaged over various seismic motions. Those all Seismic zones and Soil types have been adopted for derive reactions and how they interact with different regions and soil types.

V. BUILDING CONFIGURATION

The G+6 floor residential structure is designed with RCC frame structures using reinforced concrete slabs. Buildings are analyzed with E-TABS program and the analysis is performed for all seismic region of India and all soils type. The building models consist of 7 storey with 3 meter height. The different merits apply for each zones type and soils and the effect is included in the results. 12 models were created for individual zone and soil types.

Table -1: Showing detailing of the building structures

SI. NO	Particular	Input value
1	Length of building	36 meter
2	Width of building	31 meter
3	Height of building	21 meter
4	Height of each floor	3 meter
5	Total number of floor	7

Table-2: Other loads

Parameters	Value
Dead load (KN/m2)	3.75
Live load (KN/m2)	3.0
Floor finish (KN/m2)	1.0
Main Wall Load(KN/m)	12
Parapet Wall Load(KN/m)	2.7

Table-3: Factors in seismic analysis

SL. NO	Factors	Zone-2	Zone-3	Zone- 4	Zone-5
1	Seismic Zone factors	0.10	0.16	0.24	0.36
2	Response Reduction factors	5.0	5.0	5.0	5.0
3	Importance factors	1.0	1.0	1.0	1.0
4	Type of soils	1 : Soil- 1(Hard soil) 2 : Soil- 2(Medium soil) 3 : Soil- 3(Soft soil)			

SL. No	Description	Value
1	Grade of the concrete used in structure	M 30
2	Grade of the steel used in structure	HYSD 500
3	Density of the concrete for structure	25 KN/m3
4	Thickness of slab	150 mm thick

Table -4: Building data

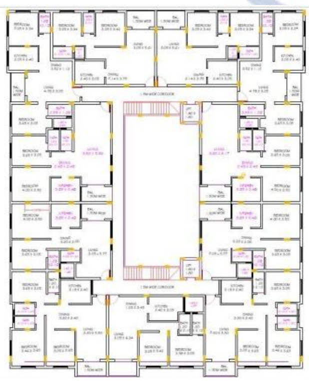

Fig -1: Typical floor plans (1st to 6th floors)

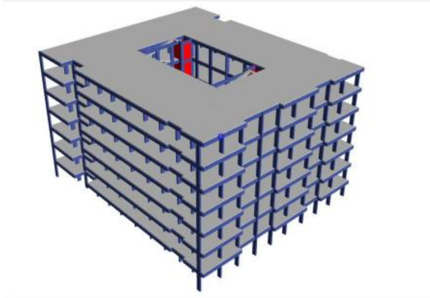

Fig -2: 3D rendered view of structure

VI. RESULT AND DISCUSSION

BASE SHEAR

The structural based estimate of maximal expected lateral force due to the ground seismic motion at bottom of the structure is called Base shear.

Table -5: The Base response in the X -direction

SL. NO	SOIL TYPES	Soil -1	Soil -2	Soil -3
	ZONES	Base Shear (KN)	Base Shear (KN)	Base Shear (KN)
1	ZONE -2	18179.28	18470.80	18721.84
2	ZONE -3	18665.15	19131.60	19533.25
3	ZONE -4	19312.99	20012.65	20615.14
4	ZONE -5	20284.74	21334.24	22237.97

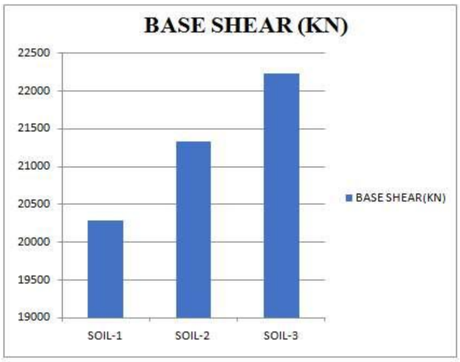

Fig -3: Base shear (KN) in Zone -5

STOREY DRIFT

The variation of displacement in between two successive stories divided by a height of that storey is called storey drift.

Table-6: Storey Drift in X direction for soil -1 in the different seismic zones

Storey No.	ZONE			
	ZONE -2	ZONE -3	ZONE -4	ZONE -5
1.	0.002917	0.003002	0.003115	0.003286
2.	0.005053	0.005218	0.005438	0.005768
3.	0.005680	0.005885	0.006159	0.006570
4.	0.005654	0.005877	0.006174	0.006619
5.	0.005243	0.005465	0.005760	0.006203
6.	0.004651	0.004859	0.005134	0.005547
7.	0.003983	0.004165	0.004406	0.004768

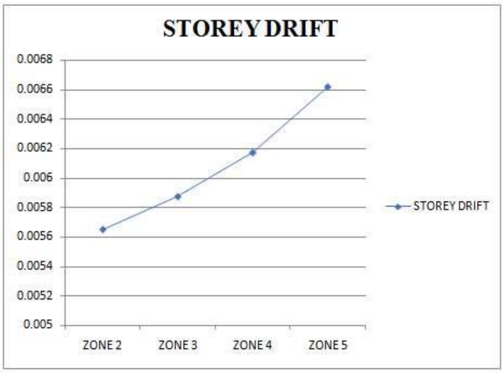

Fig -4: Storey drift for soil -1 in X direction

STOREY DISPLACEMENT

Storey displacement is the highest displacement of any storey with relative to the ground in the building structure along both X and Y directions as a result of combining seismic loads.

TABLE -7: Analysis Storey displacement (mm) at different seismic zones in soil -1

Zones	2		3		4		5	
Storey	X	Y	X	Y	X	Y	X	Y
7	99.540	133.270	103.411	138.128	108.559	144.58	116.286	154.260
6	83.574	117.590	90.916	121.795	91.321	127.39	101.981	135.784
5	73.638	99.178	76.340	102.630	79.939	107.227	81.914	108.990
4	57.909	78.066	59.946	80.690	62.659	84.184	66.729	89.426
3	40.947	54.955	42.315	56.726	44.138	59.085	46.872	62.623
2	22.737	31.535	24.660	32.503	25.661	33.793	27.162	34.254
1	8.751	10.939	9.006	11.257	9.346	11.680	9.857	12.315

Fig -5: Displacement graph along X direction

STOREY SHEAR

Story shear is the chart where present the how most horizontal loads, be it wind or earthquakes, is proceed each story in the structure. The storey shear in the structure with both directions X & Y is achieve for the total seismic combination of load.

Fig -6: Storey shear graph along X direction

VII. CONCLUSIONS

- From the base shear tables it is clear that, Base shear of the building increases as we increases of the seismic Zones from 2 to 5 and soil types 1 to 3.
- Therefore, because of this factors structural reacts differently in different zone and soils. Base reactions are less in the zone 2 because zone 2 has a low earthquake zone and base reactions are higher in zone 5 because zone 5 has a high earthquake zone.
- From the storey drift table displayed that, the storey drift increases as a seismic zone increases from zone to Zone. In the zone 5 highest storey drift is available. That means if the seismic zone changes

from 2 to 5 respectively then storey drift is increases.

- From the storey drift table it is clear that, storey drift of building also increased with soil types.
- If the seismic zones changes from zone to zone respectively then displacement of building structure also increases. The displacement is high at peak storey and low at bottom storey.
- The storey shear is reduces when building structure increases from 1st to 7th floor. The highest storey shear is in bottom storey.

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