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Design of Multistorey Building Using Etabs Software.

Tanvi Mahesh Jangam [a], Prof. Priyanka Patil [b]

[a] *Student of MBA Project and Construction Management, MIT-ADT, Loni-Kalbhor, Pune,412201, India.*
[b] *Assistant Professor at MIT-ADT, Loni-Kalbhor, Pune, 412201, India.*

A B S T R A C T

Design of earthquake resistant buildings in India should be of prime importance while design of buildings. Shear wall systems are one of the most commonly used lateral load resisting systems in high- rise buildings. Earthquake resistant buildings can be designed in various ways by achieving economy and sustainability, Earthquake resistant building design for ductile (IS 13920-2016) and non-ductile detailing as per costing. Shear wall systems are one of the most commonly used lateral load resisting systems in high-rise buildings, as per our literature review it founds that location of L shape shear wall at corner is preferable. For our project we have selected G+14 storey commercial building for zone III and V (SMRF, OMRF) with shear wall and we applied loads as per IS 875 Part I, II & IS 1893: 2016.After analysis in ETABS we provided appropriate sizes of column and beam, we finalize model by having two checks for column

i) Providing Ast of column in range of 0.8- 4% of gross area

ii) Minimum size of column is greater than 20 times of max. Diameter of bar in beam.

After the finalized designed model, we ended up with a Bar Bending Schedule of beam, column and shear wall and concrete quantity. After analysis of all four models, we concluded that size of column and area of steel is more in OMRF as compared to SMRF and also sizes are greater in zone V as compared to zone III and hence SMRF design is preferable for earthquake resistant building

Keywords: *Seismic Zone, Shear wall, SMRF, OMRF.*

Introduction

While designing a building main five types of loads are considered on buildings namely live load, dead load, wind load, snow load (in heavy snowfall region) and other load combinations. Earthquakes are a major factor affecting the stability of multistoried buildings. We have to construct the building by considering all above loads; and then we have to check the position of the shear wall and buyer's affordability. Along with loads there are four seismic zones in India namely zone II, zone III, zone IV and zone V. In this project we consider the seismic zone III and for construction. Shear walls are one of the excellent means of providing earthquake resistance to multistoried reinforced concrete buildings. Along with the shear walls we have to consider the ductile and non-ductile nature of multistorey building.

Methodology

ARCHITECTURAL PLAN:

Based on the client requirements and site conditions, we develop architectural drawing. In this project, I have planned for stilt+14 floors which is an residential building as per the norms and basic requirements which includes municipal rules, Vaastu, site conditions.

ANALYSIS AND DESIGN:

Basic height of floor is 3.2 m, loads patterns are DEAD load with self-weight 1, live load, wall as dead load.

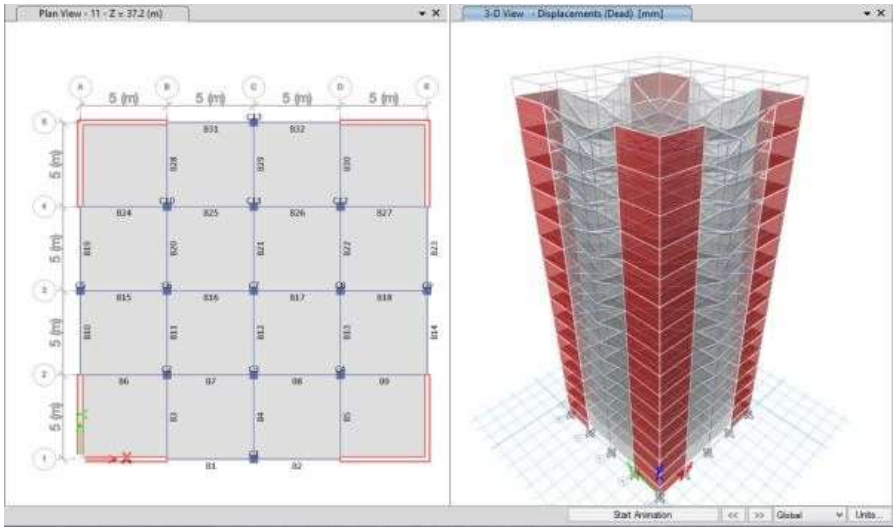

Figure 1 Plan and Section for analysis

Base reaction:

Base Reactions

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Base Reactions

Output Case	Case Type	Step Type	Step Number	FX kN	FY kN	FZ kN	MX kN-m	MY kN-m	MZ kN-m
EQY	LinStatic			0	-1543.3916	0	56787.6852	0	-15433.9163
EQX	LinStatic	Step By Step	1	-1543.3916	0	0	0	-56787.6852	15433.9163
EQX	LinStatic	Step By Step	2	0	-1543.3916	0	56787.6852	0	-15433.9163
SPACEX	LinRespSpec	Max		1543.3916	0.0002	0	0.0002	49242.7073	15433.9147
SPACEY	LinRespSpec	Max		0.0002	1543.3916	0	49452.3296	0.0002	15433.9157
UDCon1	Combination			0	0	140562.8442	1405628.4419	-1405628	0
UDCon2	Combination			0	0	172362.8442	1723628.4419	-1723628	0
UDCon15	Combination	Max		1852.0699	0.0002	137890.2754	1378902.7538	-1319812	18520.6977
UDCon15	Combination	Min		-1852.0699	-0.0002	137890.2754	1378902.7533	-1437994	-18520.6977
UDCon16	Combination	Max		0.0002	1852.0699	137890.2754	1438245.5491	-1378903	18520.6989
UDCon16	Combination	Min		-0.0002	-1852.0699	137890.2754	1319559.958	-1378903	-18520.6989
UDCon17	Combination	Max		2315.0874	0.0003	140562.8442	1405628.4422	-1331764	23150.8721
UDCon17	Combination	Min		-2315.0874	-0.0003	140562.8442	1405628.4416	-1479493	-23150.8721
UDCon18	Combination	Max		0.0002	2315.0874	140562.8442	1479806.9364	-1405628	23150.8736
UDCon18	Combination	Min		-0.0002	-2315.0874	140562.8442	1331449.9474	-1405628	-23150.8736

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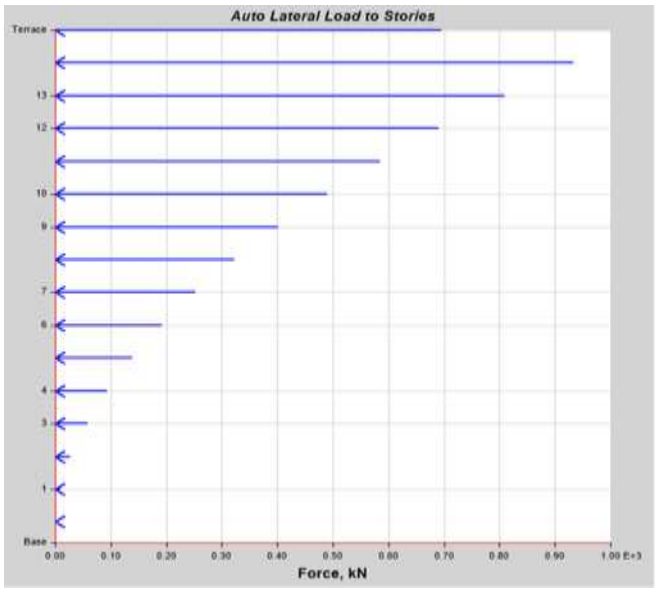
❖ **Zone III-Non ductile Building**

- Story Response - Auto Lateral Load to Stories
- Summary Description
- This is story response output for a specified range of stories and a selected load case or load combination



❖ **Zone III- Ductile Building**

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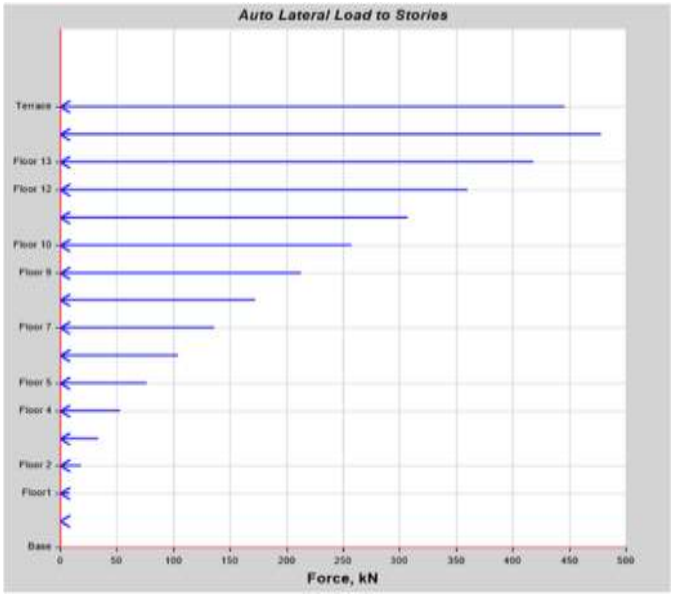

Name	**Story Resp1**		
Display Type	Auto lateral loads to stories	Story Range	All Stories
Load Pattern	EQX	Top Story	Terrace
Load Set	1	Bottom Story	Base

5. Future Scope

This report is clear with the structural analysis and design of multi-storeyed building which was designed by ETABS. This software is very innovative and easier which is better than Staad pro. It is better for designing the high rise buildings under the applied live load, dead load, wind load, earthquake load, and seismic load. Construction of apartments were become a needy in urban areas, mainly construction of g+5 residential buildings for living were taking place. So I suggest my project will apt for above specified buildings with measurements, so that it reduces time period for designing.

6. Observation

1. The most preferable location for shear wall is at corners with 'L' Shape.
2. Time period of SMRF building for zone III is more than OMRF building & Base Shear for OMRF building for zone III is more than SMRF building.
3. Steel quantity required for zone III Ductile building is 104% of zone III nonductile
4. Concrete quantity required for zone III Ductile building is approximately equal to zone III non-ductile building.
5. Cost for ductile building **is comparatively more than non-ductile building for both III.**

7. Conclusion

Based on the analysis and design of multi- storied building, the following conclusions are made: Building layout and design has to follow the nature especially for sunlight and wind directions. These types of principles were explained in Vaastu were followed at the beginning of project only. Geotechnical engineering cannot be neglected while building the tall buildings. The geotechnical engineer needs to be consulted to do soil sampling, analysis, ground water depth and mainly for estimation of soil bearing capacity. The proposed building should be in area where all the types of amenities are available.

8. References

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