

Analysis & Design of Multi-storey Residential Building (G+7) by using ETABS Software

Ashish Kumar¹ Kata Neelima² Paila Uday Kumar³
^{1,2,3}Student

^{1,2,3}Department of Civil Engineering

^{1,2,3}Nadimpalli Satyanarayana Raju Institute of Technology, Visakhapatnam, India

Abstract— As per latest predictions more than 20% of the current Indian population is going to shift to town / cities in upcoming years. But due to space constraints in the cities multi storey apartments play a major role in the urban infrastructure development. The main object of this current study is to Analysis and design of a multi-storeyed residential apartment (G+7) which is situated in Visakhapatnam city. 'ETABS' software is used for the analysis & design purpose and 'Auto Cad' is used for detailing and preparation of drawings for this project. Finally optimized structure is obtained and the same is shown in the prepared final drawings. And Foundation loads are obtained from the analysis at the bottom of columns and will be used for the further scope of foundation design.

Keywords: ETABS Software Tool, AutoCAD, Multi-Storied Residential Building

I. INTRODUCTION

Project on structural analysis and design of multi-storey RCC building focuses on the structural analysis of multi-storey building using appropriate methods of structural analysis and software (ETABS). In this project we have taken an architectural plan of the building on the basis of which the analysis will be done for the whole structure. For analyzing a multi-storied building, one has to consider all the possible loading and see that the structure is safe against all possible loading conditions.

Analysis of beams and columns has been done by using ETABS software and slab is designed using "LIMIT STATE METHOD" according to IS: 456-2000. Material used are M-20 & M-30 concrete and Fe-415.

The building is designed as a framed structure with brick infill walls. Keeping in view the requirement & utility of the building the dead load, live load & super imposed loads have been considered for the analysis & design of the structure in accordance with the specification of IS:456-2000 and IS:875-1987(Part 1& Part 2). Subsequently, the beam column layout was prepared with the help of slabs were identified as One Way or Two-Way slabs. The slabs were designed names in a series as S1, S2 & S3. The slabs were designed as per the moments obtained using the Bending Moment Co-efficient as per Annex D of IS :456-2000. The present project deals with the analysis of multi-storied residential building. The dead load and live loads are applied and the design for beams, columns & slabs is obtained.

II. LITERATURE REVIEW

Varalakshmi V et.al (2014) [1] analyzed a G+5 storey residential building and designed the various components like beam, slab, column and foundation. The loads namely dead load and live load were calculated as per IS 875(Part I

& II)-1987 and HYSD bars i.e. Fe 415 are used as per IS 1986- 1985. They concluded that the safety of the reinforced concrete building depends upon the initial architectural and structural configuration of the total building, the quality of the structural analysis, design and reinforcement detailing of the building frame to achieve stability of elements and their ductile performance.

Chandrasekhar et.al (2015) [2] analyzed and designed the multi-storied building by using ETABS software. A G+5 storey building under the lateral loading effect of wind and earthquake was considered for this study and analysis is done by using ETABS. They have also considered the chances of occurrence of spread of fire and the importance of use of fire proof material up to highest possible standards of performance as well as reliability. They suggested that the wide chances of ETABS software which is very innovative and easier for high rise buildings so that time incurred for designing is reduced.

Balaji.U and Selvarasan M.E (2016) [3] worked on analysis and design of multi-storied building under static and dynamic loading conditions using ETABS. In this work a G+13 storey residential building was studied for the earth quake loads using ETABS. They assumed that material property to be linear, static and dynamic analyses were performed. The non-linear analysis was carried out by considering severe seismic zones and the behavior was assessed by considering type II soil condition. Different results like displacements, base shear were plotted and studied.

Geethuet.al (2016) [4] made a comparative study on analysis and design of multi storied building by STAAD. Pro and ETABS software's. They provided the details of both residential and commercial building design. The planning was made in accordance with the national building code and drafted using Auto CAD software. They concluded that while comparing both software results, ETABS software shows higher values of bending moment and axial force.

III. METHODOLOGY

- 1) Assumptions of geometric properties on the basis of preliminary calculation.
- 2) Preparation of plan in AutoCAD.
- 3) Modelling of building and assigning of loads in ETABS.
- 4) Analysis of building.
- 5) Design and design check of building components.
- 6) Detailing

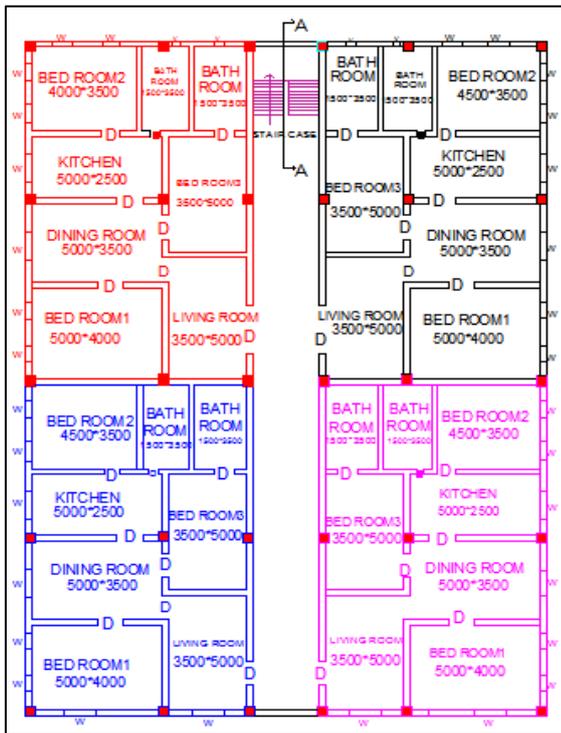


Fig. 1:

IV. RESULTS & DISCUSSION

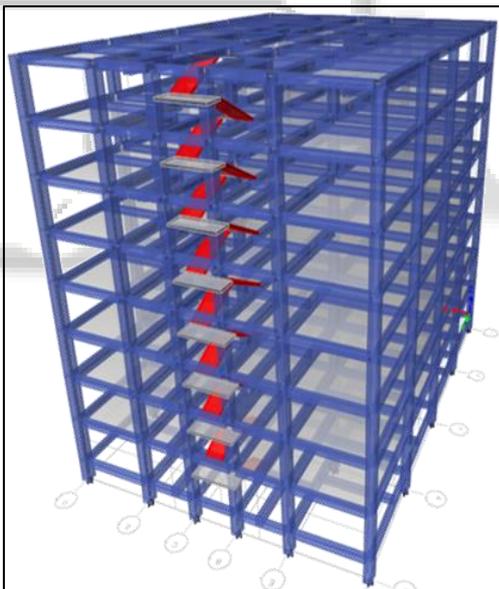


Fig. 2: 3D Structure View of Building

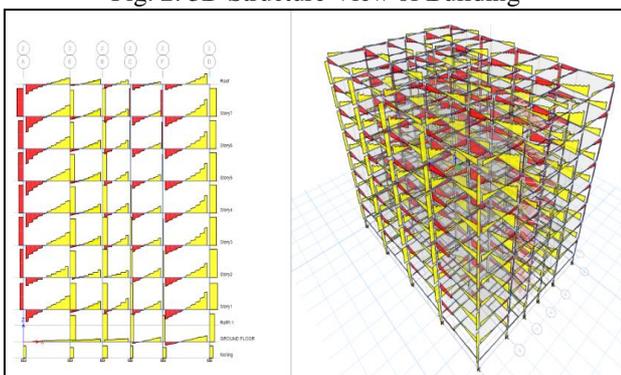


Fig. 3: Shear Force Details

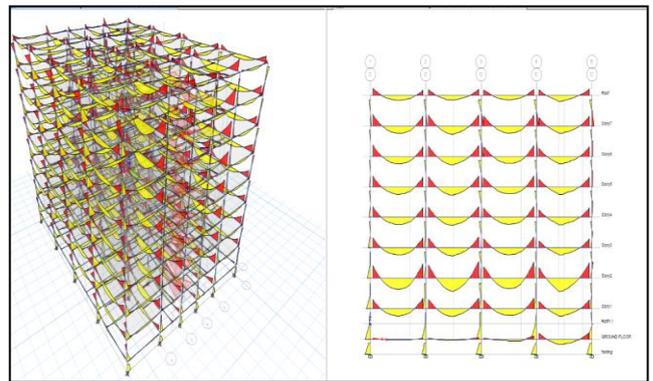


Fig. 4: Bending Moment Details

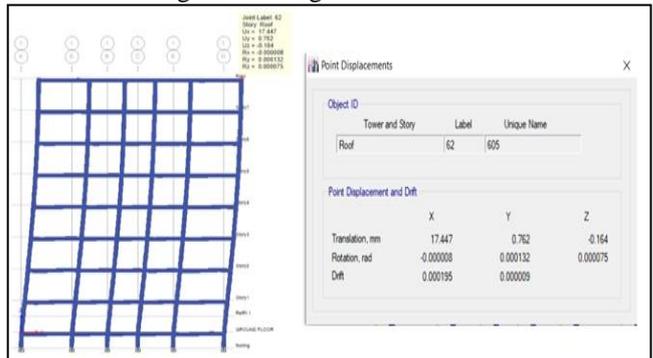


Fig. 5: Drift of the Building

Load Case/Combo	FX kN	FY kN	FZ kN	MX kN-m	MY kN-m	MZ kN-m	X m	Y m	Z m
Dead	0	0	32610.8675	458471.5268	-325819.7783	0	0	0	-1.5
Wall load	0	0	28673.25	402156.0004	-291275.4375	0	0	0	-1.5
Floor finish	0	0	8830.7432	122119.5965	-88307.432	0	0	0	-1.5
Roof live	0	0	0	0	0	0	0	0	-1.5
Live<=3	0	0	10762.3202	151439.6458	-107622.4639	0	0	0	-1.5
Roof live1	0	0	821.055	11269.4192	-8210.55	0	0	0	-1.5
wind load 1	-1445.1023	0	0	0	-22016.2405	20231.4329	0	0	-1.5
wind load 2	0	-1032.216	0	15725.8861	0	-10322.1596	0	0	-1.5
1.5(DL+LL)+9WL Max	0	0	121315.7714	1715433.452	-1219538	18208.2896	0	0	-1.5
1.5(DL+LL)+9WL Min	-1300.5921	-928.9944	121315.7714	1701280.154	-1239352	-9289.9437	0	0	-1.5
1.5(DL)	0	0	105172.2911	1474120.685	-1058104	0	0	0	-1.5
1.5(DL+LL)	0	0	121315.7714	1701280.154	-1219538	0	0	0	-1.5
1.5(DL+LL)-9WL Max	1300.5921	928.9944	121315.7714	1701280.154	-1199723	9289.9437	0	0	-1.5
1.5(DL+LL)-9WL Min	0	0	121315.7714	1687126.857	-1219538	-18208.2896	0	0	-1.5
9(DL+LL)+1.5WL Max	0	0	72789.4629	1044356.922	-731722.6006	30347.1493	0	0	-1.5
9(DL+LL)+1.5WL Min	-2167.6535	-1548.3239	72789.4629	1020768.093	-764746.9614	-15483.2394	0	0	-1.5
Envelope Max	0	0	32610.8675	458471.5268	-325819.7783	0	0	0	-1.5
Envelope Min	0	0	32610.8675	458471.5268	-325819.7783	0	0	0	-1.5
9(DL+LL)-1.5WL Max	2167.6535	1548.3239	72789.4629	1020768.093	-698698.2398	15483.2394	0	0	-1.5
9(DL+LL)-1.5WL Min	0	0	72789.4629	997179.2633	-731722.6006	-30347.1493	0	0	-1.5
DL	0	0	70114.8607	982747.1236	-705402.6479	0	0	0	-1.5
DL+LL	0	0	80877.181	1134186.769	-813025.1118	0	0	0	-1.5
DL+LL-9WL Max	1300.5921	928.9944	80877.181	1134186.769	-793210.4953	9289.9437	0	0	-1.5
DL+LL-9WL Min	0	0	80877.181	1120033.472	-813025.1118	-18208.2896	0	0	-1.5
DL+LL-9WL Max	0	0	80877.181	1148340.067	-813025.1118	18208.2896	0	0	-1.5
DL+LL-9WL Min	-1300.5921	-928.9944	80877.181	1134186.769	-832839.7283	-9289.9437	0	0	-1.5
DL+LL+1.5WL Max	0	0	80877.181	1157775.599	-813025.1118	30347.1493	0	0	-1.5
DL+LL+1.5WL Min	-2167.6535	-1548.3239	80877.181	1134186.769	-846049.4726	-15483.2394	0	0	-1.5
DL+LL-1.5WL Max	2167.6535	1548.3239	80877.181	1134186.769	-780000.751	15483.2394	0	0	-1.5
DL+LL-1.5WL Min	0	0	80877.181	1110597.94	-813025.1118	-30347.1493	0	0	-1.5

Table 1: Base Reactions

Note: In Future, these all Base Reaction Can Be Used for Foundation Design

V. CONCLUSIONS

The preparation of the project has provided an excellent opportunity to emerge ourselves in planning and designing of multistorey residential building. Design was done by using ETABS software and successfully verified as per IS 456-2000. By using ETABS, the analysis and design work can be completed within the stipulated time.

The analysis and design results obtained from software are safe when compared with manual calculations and design.

REFERENCES

- [1] Chandrashekar and Rajasekar (2015), “Analysis and Design of Multi Storied Building by using ETABS software”, International journals of scientific and research vol.4: issue.7: ISSN no. 2277-8179.
- [2] Balaji and Selvarasan (2016), “Design and Analysis of multi-storied building under static and dynamic loading conditions using ETABS”, International Journal of Technical Research and Applications e-ISSN: 2320-8163, www.ijtra.com volume 4, Issue4, PP.15.
- [3] 3.Geethu S N, Deepthi M, Abdul Nasir N A and Izzudeen K M (2016) “Comparative study on design and analysis of multi storied building by STAAD.Pro and ETABS software’s”.
 - IS 456-2000, code of practice for plain and reinforced concrete?
 - IS-875(PART-1): code for dead load.
 - IS-875(PART-2): code for imposed loads.
 - IS-875(PART-3): code wind loads
 - SP 16 Design aid for reinforced concrete to IS-456.

