DESIGN AND ANALYSIS OF G+3 RESIDENTIAL BUILDINGUSING E-TABS

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Abstract : A multi-storey building is a building that has multiple stories and typically contains vertical circulation in the form of ramps, stairs and lifts .Multi story building range from 2 stories to more than 150 stories. In this project we analysed the 5-storey building using ETABS and ETABS. The multi-storey building is designed using software ETABS & manually as per IS 456. The load used in the analysis are dead load (IS875-1987 part1), live load (IS875-1987 part2), wind load (IS875-1987 part3), seismic load (IS18931984 part1) and 25 load combinations are considered as per the IS875 (part5)-1987 code book The beams, columns and slabs are designed using software and by manual procedure, reinforcement details are compared. The foundation is designed by using ETABS software.

IndexTerms **– G+3 Residendial Building, Design, Analysis, E-Tabs, Seismic**

1. INTRODUCTION

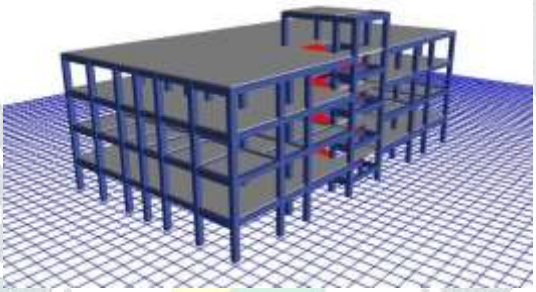

Fig No. 1

1.1 GENERAL

Building construction is the engineering deals with the construction of building such as residential houses. In a simple building can be define as an enclose space by walls with roof, food, cloth and the basic needs of human beings. In the early ancient times humans lived in caves, over trees or under trees, to protect themselves from wild animals, rain, sun, etc. As the times passed as humans being started living in huts made of timber branches. The shelters of those old have been developed nowadays into beautiful houses. Rich people live in sophisticated condition houses. Buildings are the important indicator of social progress of the county. Every human has desire to own comfortable homes on an average generally one spends his two-third life times in the houses. The security civic sense of the responsibility, these are the few reasons which are responsible that the person do utmost effort and spend hard earned saving in owning houses. Nowadays the house building is major work of the social progress of the country. Daily new techniques are being developed for the construction of houses economically, quickly and fulfilling the requirements of the community engineers and architects do the design work, planning and layout, etc., of the buildings.
Draughtsman is responsible for doing the drawing works of building as for the direction of engineers and architects. The draughtsman must know his job and should be able to follow the instruction of the engineer and should be able to draw the required drawing of the building, site plans and layout plans etc., as for the requirements.

1.2 STRUCTURAL PLANNING

This involves determination of the form of the structure, the material for the same, the structural system, the layout of its components, the method of analysis and the philosophy of structural designs.
The principle element of a R.C. building frame are as follows.

1. Slabs to cover large area
2. Beams to support slabs and walls
3. Columns to support beams
4. Footing to distribute concentrated column loads over large area of the supporting soil.

After getting an architectural plan of the building, the structural planning of the building frame is done. This involves determination of the following.

A) Column position
B) Beam location
C) Spanning of slabs
D) Layout and planning of stairs
E) Types of Footing
F)

1.3 STAGES IN STRUCTURE DESIGNS

The process of structure design involves the following stages

1. Structural planning.
2. Estimation of Loads
3. Analysis of Structure
4. Member design
5. Drawing, Detailing and preparation of schedule

2. RESEARCH METHODOLOGY

2.1 DETAILS OF THE PROJECT

The plot size for the project was 35 X 25m. accordingly the building has been laid in the centre of the plot leaving sample space on all the sides for landscaping and pathways for cars and for visitors parking.

Area of Plot	35X25m
Number of Floor	G+3
Number of Units	12 (Ground Floor to be used as car Parking)
Type Apartment	2BHK
Area of Each Apartment	93.6 m^2
Number of stairs case	4

Table 2.1

Structural details:

Length of building	27.6m
Width of building	16m
Height	14.2m
Floor to Floor height	3m
Live load on Floor	2-3.0KN/m2

Grade of Concrete	M20-M30
Steel	Fe415-Fe500
Total No Columns	230
Total No Beam	397
No of footing	56

Table 2.2

3 DESIGN

3.1 DESIGN OF SLAB

Slab No	Size	Depth		AST X	AST Y
01	4000 X 3000 MM	125	MID	10MM@260MM	10MM@120MM
			SUPPORT	10MM@240MM	10MM@70MM
			TORSION	245.25MM^2 (600MM)	834.72MM^2 (800MM)
			EDGE STIRRUPS	10MM@380MM	10MM@380MM
02	4000 X 3000 MM	125	MID	10MM@260MM	10MM@120MM
			SUPPORT	10MM@280MM	10MM@300MM
			TORSION	197.88MM^2 (600MM)	196.34MM^2 (800MM)
			EDGE STIRRUPS	10MM@380MM	10MM@380MM
03	4000 X 2000 MM	125	MID	10MM@90MM	8MM@400MM
			SUPPORT	10MM@80MM	10MM@400MM
			TORSION	-	-
			EDGE STIRRUPS	-	-
04	2700 X 1500 MM	125	MID	10MM@300MM	10MM@100MM
			SUPPORT	10MM@300MM	10MM@80MM
			TORSION	196.34MM^2 (300)	659.91MM^2 (540)
			EDGE STIRRUPS	10MM@380MM	10MM@380MM
05	2700 X 4500 MM	150	MID	10MM@100MM	10MM@300MM
			SUPPORT	10MM@300MM	10MM@90MM
			TORSION	548.83MM^2 (540MM)	196.34MM^2 (900MM
			EDGE STIRRUPS	10MM@300MM	10MM@300MM
06	2700 X 2000 MM	125	MID	10MM@110MM	10MM@210MM
			SUPPORT	10MM@140MM	10MM@300MM
			TORSION	396.89MM^2 (400MM)	196.34MM^2 (540MM)
			EDGE STIRRUPS	10MM@300MM	10MM@300MM
07	4000 X 1500 MM	135	MID	10MM@300MM	8MM@380MM
			SUPPORT	10MM@75MM	10MM@380MM
			TORSION	-	-
			EDGE STIRRUPS	-	-
08	5000 X 4500 MM	175	MID	10MM@300MM	10MM@250MM
			SUPPORT	10MM@300MM	10MM@250MM
			TORSION	230MM^2 (900MM)	230MM^2 (1000MM)
			EDGE STIRRUPS	10MM@250MM	10MM@250MM
09	5000 X 2000 MM	135	MID	10MM@300MM	8MM@380MM
			SUPPORT	10MM@80MM	10MM@380MM
			TORSION	-	-
			EDGE STIRRUPS	-	-
			MID	10MM@300MM	8MM@380MM
			SUPPORT	10MM@80MM	10MM@250MM

10	4000 X 1500 MM	135	TORSION	-	-
			EDGE STIRRUPS	-	-
11	4500 X 4000 MM	175	MID	10MM@250MM	10MM@250MM
			SUPPORT	10MM@200MM	10MM@60MM
			TORSION	292.93MM^2 (800MM)	927.61MM^2 (900MM)
			EDGE STIRRUPS	10MM@250MM	10MM@250MM
12	4000 X 2000 MM	135	MID	10MM@300MM	8MM@380MM
			SUPPORT	10MM@90MM	10MM@380MM
			TORSION	-	-
			EDGE STIRRUPS	-	-

Table 3.1

3.2 DESIGN OF BEAM

BEAM	B	D	BOTTOM	TOP	ZONE B	ZONE A
1	300	450	20mm-2bars	20mm-2bars	10mm@300mm	10mm@300mm
2	300	450	20mm-2bars	20mm-3bars	10mm@300mm	10mm@300mm
3	300	450	20mm-2bars	20mm-2bars	10mm@300mm	10mm@300mm
4	300	450	20mm-1bar	20mm-2bars	10mm@300mm	10mm@300mm
5	300	450	20mm-2bars	20mm-2bars	10mm@300mm	10mm@300mm
6	300	450	20mm-1bar	20mm-2bars	10mm@300mm	10mm@300mm
7	300	450	20mm-1bar	20mm-2bars	10mm@300mm	10mm@300mm
8	300	450	20mm-2bars	20mm-2bars	10mm@300mm	10mm@300mm
9	300	450	20mm-2bars	20mm-3bars	10mm@300mm	10mm@300mm
10	300	450	20mm-2bars	20mm-4bars	10mm@300mm	10mm@300mm
11	300	450	20mm-2bars	20mm-3bars	10mm@300mm	10mm@300mm
12	300	450	20mm-2bars	20mm-3bars	10mm@300mm	10mm@300mm
13	300	450	20mm-1bar	20mm-2bars	10mm@300mm	10mm@300mm
14	300	450	20mm-1bar	20mm-3bars	10mm@300mm	10mm@300mm
15	300	450	20mm-1bars	20mm-3bars	10mm@300mm	10mm@300mm
16	300	450	20mm-1bar	20mm=3bars	10mm@300mm	10mm@300mm
17	300	450	20mm-5bars	20mm-4bars	10mm@300mm	10mm@115mm
18	300	450	20mm-9bars	20mm-4bars	10mm@300mm	10mm@115mm
19	450	750	28mm-10bar	28mm-9bar	10mm@40mm	10mm@40mm
20	300	450	20mm-1bar	20mm-4bars	10mm@300mm	10mm@115mm
21	350	600	20mm-6bars	20mm-6bars	10mm@190mm	10mm@130mm
22	300	575	20mm-6bars	20mm-6bars	10mm@300mm	10mm@195mm
23	350	600	20mm-6bars	20mm-7bars	10mm@125mm	10mm@105mm
24	350	600	25mm-4bar	28mm-4bar	10mm@300mm	10mm@190mm
25	350	600	20mm-5bars	20mm-7bars	10mm@300mm	10mm@105mm
26	350	600	20mm-6bars	20mm-7bars	10mm@135mm	10mm@105mm
27	350	600	28mm-3bar	28mm-4bar	10mm@80mm	10mm@190mm
28	350	600	28mm-3bar	28mm-4bar	10mm@300mm	10mm@280mm
29	350	600	20mm-6bars	20mm-7bars	10mm@135mm	10mm@105mm

30	350	600	25mm-6bar	25mm-6bar	10mm@80mm	10mm@280mm
31	350	600	28mm-4bar	28mm-4bar	10mm@300mm	10mm@270mm
32	350	600	20mm-6bar	20mm-7bar	10mm@130mm	10mm@100mm
33	500	750	28mm-11bar	28mm-11bar	12mm@50mm	12mm@50mm
34	500	750	28mm-9bar	28mm-9bar	12mm@50mm	12mm@50mm

Table 3.2

3.3 DESIGN OF COLUMN

Column No	B	D	Longitudinal Bar	Stirrups
C1	350MM	425 MM	25MM-4	8MM@300MM
C2	350MM	500 MM	25MM-15	8MM@300MM
C3	350MM	425 MM	25MM-4	8MM@300MM
C4	350MM	425 MM	25MM-4	8MM@300MM
C5	350MM	425 MM	25MM-4	8MM@300MM
C6	350MM	425 MM	25MM-3	8MM@300MM
C7	350MM	425 MM	25MM-3	8MM@300MM
C8	350MM	425 MM	25MM-3	8MM@300MM
C9	350MM	425 MM	25MM-3	8MM@300MM
C10	350MM	500 MM	25MM17	8MM@300MM
C11	350MM	425 MM	25MM-4	8MM@300MM
C12	350MM	425 MM	25MM-4	8MM@300MM
C13	350MM	450 MM	25MM-7	8MM@300MM
C14	350MM	450 MM	25MM-9	8MM@300MM
C15	500MM	650 MM	25MM-27	8MM@300MM
C16	350MM	550 MM	25MM-16	8MM@300MM

Table 3.3

3.4 DESIGN OF FOOTING

3.4.1 ISOLATED FOOTING

FOOTING	B	D	BOTTOM AST	TOP AST
F1	2.1	2.1	20MM@180MM	20MM@180MM
F2	2.1	2.1	20MM@180MM	20MM@180MM
F3	2.1	2.1	20MM@180MM	20MM@180MM
F4	2.1	2.1	20MM@180MM	20MM@180MM
F5	2.1	2.1	20MM@180MM	20MM@180MM
F6	2.1	2.1	20MM@180MM	20MM@180MM

Table 3.4

3.4.2 COMBINED FOOTING

FOOTING	B	D	BOTTOM AST	TOP AST	T. STEEL UNDER C1	T. STEEL UNDER C2
F7	5.6	5.6	20MM@90MM	28MM@60MM	20MM@120 MM	20 MM @ 190 MM
F8	7	7	20MM@100MM	28MM@80MM	20MM@ 90MM	20 MM @ 130MM

Table 3.5

4 CONCLUSION

The aim of this project is to design different structural members of a 3 storey building. This is made up of reinforced concrete. This was made by using manual and software methods. The analysis and design of a multi-storeyed building was done as a part of our project. The study helped us to gain ample exposure to various field practices in the analysis and design of multi-storied buidnigs, and also in various construction techniques used in the industry. The analysis was done in ETABS 2015 and detailing was done in Auto CAD 2010. The structural components beam, column, slabs, stair were designed manually. The designing ant detailing was done according to standard specifications of serious codes to the possible extend. The various difficulties encountered the design process and various constraints faced by the structural engineer in designing were well understood. This study helped to understand and analyse the structural problem faced by the construction industry

REFERENCES

1. IS 456:2000 “Plain and reinforced Concrete”
2. IS 875:1987 PART 1 “Code of Practice for Design Loads (Other Than Earthquake) For Buildings and Structures. **Part 1**: Dead Loads--Unit Weights of Building Materials and Stored Materials (Second Revision)”
3. IS 875:1987 PART 2 “Code of Practice for Design Loads (Other Than Earthquake) For Buildings and Structures. **Part 2**:Imposed Loads)”
4. SP-16:2016 “Design Aids for reinforced Concrete”
5. IS 3370 Part 2(2009) “Code of Practice Concrete structures for the storage of liquids, Part 2: Reinforced concrete structures” 6. IS 3370 Part 4(2009) “Code of Practice Concrete structures for the storage of liquids, Part 4: Design Tables”
7. Faria Aseem, Waseem Sohail, Abdul Quadir, "Analysis and Comparison of R.C.C Conventional Slab& Flat Slab Under Seismic & Temperature Load", International Research Journal of Engineering and Technology, eISSN: 2395-0056, Volume: 04, Issue: 10, Oct -2017
8. Jyothi D N,"Comparative analysis of RCC and steel structure", International Research Journal of Engineering and Technology, e-ISSN: 2395-0056, Volume: 05, Issue: 02, Feb-2018
9. Shaikh Ibrahim, Md Arifuzzaman, Jisan Ali Mondal, Md Taukir Alam, Sanuwar Biswas, Sagar Biswas, "Design and Analysis of Residential Building", International Research Journal of Engineering and Technology, e-ISSN: 2395-0056, Volume: 06, Issue: 04, Apr 2019
10. M. Siva Naga Kanya, A. Meghana Reddy, A. Pujitha, M. Dheeraj, "Design and Analysis of RCC Framed Structure(G+5) by using
11. Etabs and STAAD.etc", International Research Journal of Engineering and Technology, e-ISSN: 2395-0056, Volume: 06, Issue: 03, Mar 2019
12. V. Nagaraju1, N. Vedakala 2, Y. Purnima3, Ajay Kumar4, Y Sudheer Babu5 in their study of analysis and design of multi - storey building under load combination, Volume: 05 Issue: 03 | Mar-2018
13. K. Naga Sai Gopal, N. Lingeshwaran in their study of analysis and design of g+5 residential building by using e-tabs. International Journal of Civil Engineering and Technology (IJCIET) Volume 8, Issue 4, April 2017
14. Imran BK, Syed Shamoon, meraz ahmed, Mohammad umar and Bilal Shaikh in their study of analysis & design of g+5 residential building with conventional and flat slab using staad-pro, Volume : 6 | Issue : 05 | May 2019 • ISSN No 2395 - 0056
15. Bhargav jyoti borah1, amit kalita2, manikuntala sutradhar3, indranuj pathak4 in the study of a comparative study on analysis and design of multistoreyed (g+6) building by staad.pro and sap200, Volume: 05 Issue: 07 | July 2018.
16. Limit state design of reinforced concrete by P.C. Barghtse.
17. Design of RCC structures by Ramamruthan.