

Analysis and Design of ‘G+8’ RCC Building using Etabs

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Abstract:

Planning and designing a structure is an art to achieve safety, serviceability, durability and economy. The entire process of structural planning and designing requires not only imagination and conceptual thinking but also sound knowledge of science of structural engineering besides knowledge of practical aspects, such as relevant design codes and building by-laws. For this purpose, a site is selected in which a building of eight-storey (G+8) is constructed. Each floor has four apartments consisting of all facilities required for a residential house like bedroom, toilet, living, dining, and kitchen and store room. The present project deals with the analysis and design of the apartment building. For the purpose of analysis and design, only the dead load and live load are considered. Effect of wind load is not considered as it is not significant for an eight-storey building. Here, AutoCAD is used to prepare a plan and elevation. It involves outer appearance of the plan and elevation. E-Tabs software tool is used for the Analysis purpose.

Keywords —Moment analysis by using Moment Distribution Method, Slope deflection method, ETABS for analysis purpose, IS 456:2000.

I. INTRODUCTION

An apartment building is actually a single storey house and it's a part of a multi storey building. Due to growing population and less availability of land this multi storey buildings are constructed which serve many people in a limited area, more over the deforestation is avoided and its sense of development is an important indicator of social progress of the country. Nowadays the house building is a major work of the social progress of the country, daily new technique is developed for the construction of house economically, quickly and fulfilling the requirements of the community. Engineers do the planning, designing, planning layout etc. The building is designed by considering

only vertical loads. Because here we are designing only G+8 where there is no necessity of considering the wind load. The vertical load consists of dead load of structural components such as beam, column, slabs etc. and live load by using the code IS – 875 (Part 1 and Part 2). The building is designed as two dimensional vertical frame and analysed for the maximum bending moments and shear force as per IS 456-2000. The E Tabs software is used for analysis.

II. RELATED WORK

OBJECTIVES OF PROJECT:

The main Objectives of this Project are:

1. To Complete analyse and design for a G+8 Structure.
2. Analyse of a structure is done for both gravity loads & lateral loads.
3. Analysis for gravity loads is done using substitute frame method and that of lateral loads can be done using two methods namely Static and Dynamic Analysis.
4. For the analysis of lateral loads, portal frame method is adopted. Coming to the Dynamic analysis Seismic Analysis are done.

SCOPE OF STUDY:

- Design using Software Can be useful if any additional modification has to be done in the structure during its future life .
- To study how analysis and design is to be carried out in E-tab And Staad RCDC software

LOADS AND COMBINATION:

As per the limit state design of reinforced concrete structures, the following load combination has been taken:

1.5(DL+LL)	1.5(DL - ELX)
1.2(DL+LL+ELX)	1.5(DL+ELY)
1.2(DL+LL-ELX)	1.5(DL+ELX)
1.2(DL+LL+ELY)	0.9DL+1.5ELX
1.2(DL+LL-ELY)	0.9DL-1.5ELX
1.5(DL+ELX)	0.9DL+1.5ELY
0.9DL-1.5ELY	

METHODOLOGY/ PROPERTIES

I.PLANNING OF THE BUILDING

The plan was taken from the architecture in Nashik and been analysed and designed by the software package E-TABS.

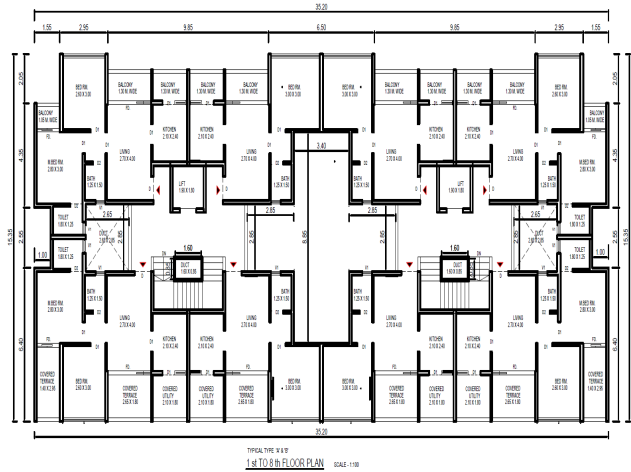


Figure 1 Plan of the Building

II.ETABS MODELLING

Step - 1: Initial Setup of Indian Standard Codes.

Step - 2: Creation of Grid Points and Generation of Structure

After getting opened with ETABS we select a new model and a window appears where the grid dimensions and story dimensions of the our building are entered.

Step - 3: Defining of Property

Here, first, the material property was defined by selecting define menu material properties. New materials were added for structural components (beams, columns, slabs) by giving the specified details in defining. After that section size was

defined by selecting frame sections as shown below and add the required section for beams, columns etc.

Step - 4: Assigning of Property

After defining the property the structural components were drawn using command menu. Draw line for beam for beams and create columns in region for columns by which property assigning is completed for beams and columns.

Step - 5: Assigning of Supports

By keeping the selection at the base of the structure and selecting all the columns were assigned supports by going to assign menu joint/frame Restraints (supports) fixed.

Step - 6: Defining of Loads

In ETABS all the load considerations are first defined and then assigned. The loads in ETABS are defined as using static load cases command in define menu.

Step-7: Assigning of Dead Loads

After defining all the loads, Dead loads are assigned for external walls, internal walls in STADD but in ETABS automatically taken care by the software i.e., inbuilt

Step-8: Assigning the Live loads

Live loads are assigning for the entire structure including Floor finishing.

Step-9: Assigning of Load Combinations

Using load combinations command in define menu 1.5 times of dead load and live load will be taken as mentioned in above.

Step-11: Analysis

After the completion of all the above steps were have performed the analysis and checked for errors.

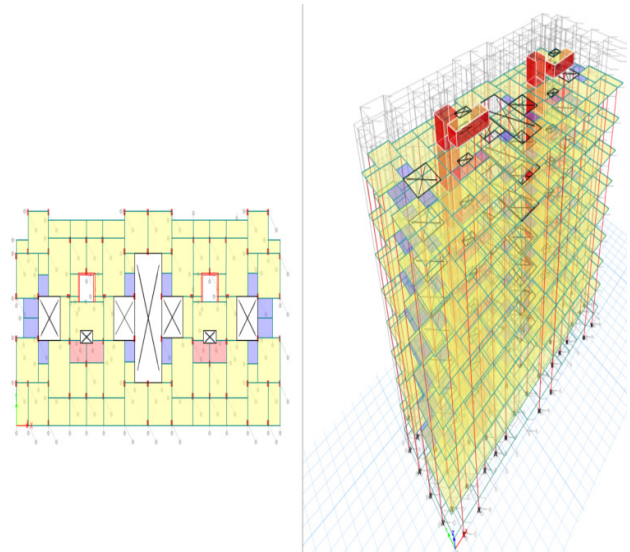


Figure 2 Model in ETABS

III.LOAD CALCULATION

Loads acting on the structure are dead load (DL), Live load and Earthquake load(EL).

1. Self Weight comprises of the weight of beams, columns and slab of the Building.

2. Dead Load: wall load, parapet load and floor load (IS 875(part1)).

a) Wall Load

➤ External wall load

Thickness of wall = 230 mm

Wall load = unit weight of brick x thickness of wall x (floor height – beam depth)

$$= 15 \times 0.23 \times 3$$

$$= 10.35 \text{ kN/m}$$

➤ Internal wall load

Thickness of wall = 150mm

Wall load = $15 \times 0.15 \times 3$
= 6.75 kN/m

b) Floor Load

Thickness of slab = 125 mm

Slab load (s1) = $0.075 \times 20 = 1.5$ kN/m²

Floor finish = 1 kN/m² (as per IS 875 part 1)

Total floor load = 2.5 kN

Slunk Slab

Thickness of Slab =150

Slab load = $0.23 \times 20 = 4.6$ kN/M²

Staircase Slab

= $0.15 \times 20 = 3.75$ kN/m

c) Beam Load

Beam Load = $25 \times b \times D$

= $25 \times 0.23 \times 0.45$

= 2.587 kN/m

RESULTS

This project is done with the intention of gaining holistic knowledge of analysis and design. The analysis and design was done based on IS 875–1987 and IS 456-2000 recommendations.

The analysis was done by considering the structure as a whole, and the design was done components-wise like column, beam, slab etc. The designed components were integrated to make a structure.

Even though the structure consisted of many columns, every column was not designed. Instead, a group of similar columns, depending on the location of those in the plan were identified and

only one column for each group was designed and the same dimensions and reinforcements were provided for the rest of the columns of that group. The same kind of approach was adopted for footings, beams and slabs.

CONCLUSIONS

Planning, analysis and design of G+8 multi-storey Apartment building was done. The analysis was done according to standard specifications using ETABS for different loads. The dimensions of structural members were specified and dead load and live load were applied. All the structural components were designed manually and detailed using AutoCAD 2018. Beams, columns and slabs were designed for bending moment, axial loads, shear and checked for deflection. The design was safe and economical design was achieved. Through this project enough analysis and design knowledge was gained.

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