Analysis and Design of G+6 Storied Residential Building using Staad Pro

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Abstract - *The main objective of using the tools of modern age is to design the complex and huge structure efficiently, precisely, accurately and economically.*

As of today, due to increasing population and migration and scarcity of land there is an increase in the construction of the tall buildings. In order to utilize the time efficiently these softwares are used to design these complex structures.

Taking all these factors into consideration we have decided to design and analyse our structure using AutoCAD and Staad Pro softwares by Limit State Method.

***Key Words*: STAAD Pro, Residential Building (G+6), AUTOCAD, Analysis, Design, Residential Building**

1. INTRODUCTION

Nowadays there is rise in population which gives rise to increase in migration for different purposes, which leads to increase in construction of the building structures. Now to construct these huge, tall structures manually, is a time consuming and tedious process considering the accuracy and precision. So to compete with the time factor and to fulfill the sustainability requirements along with economy factor, various softwares comes into picture to design these complex structures. Also there are calamities caused by nature such as earthquake, floods, etc. in order to withstand these disasters the factor safety is the most important factor to be taken into account during designing process.

Considering the above constraints, there are modern age tools coming into picture such as Staad Pro, AutoCAD, E-Tabs etc. of which we have chosen Staad Pro as designing tool. Staad Pro features the state of art of visualization tools, design and analysis engines with advance finite elements as well dynamic analysis capabilities. The software is capable analyzing each and evry force that acts on the structure and is also capable of representing the wa the forces act on the structure by creating a miniature model of the structure. This particular analysis is also carried out for various materials such as Steel, Aluminium, Timber etc.

The aim of this project is to design and analyse a 6-storeyed hostel building for various load combinations using STAAD Pro software. The structure is designed and analysed by using the Indian Standard codal specifications which includes IS 456-2000 and IS 875 (I,II & III).

1.1 Stages in structural design:

The process of structural design involves the following stages, planning of structure, loads computation, method of analysis, design and detailing of framework members, drawing and preparation of schedules.

2. LITERATURE REVIEW

- Kumar: An effort is made within the project and a designing of a tall rise structure a G+8 framed structure with the seismic load and wind loads. The analysis is done by static methods and the design is completed following guidelines of IS: 456:2000. Research designed to withstand these two moments and hogging and critical moments and beams include the provided shear and flexural reinforcement along the length of the beam.
- Sudheer: Vertical loads contain permanent load and Horizontal load contains wind forces, so this building is designed under IS875 for dead loads, direct loads and wind loads. The structure is analyzed for extreme and smallest bending moment and shears force by experimental methods according to IS 456:2000. It is noted that in terms of software development, the percentage of steel is higher.
- P. Jayachandran: The design and analysis of multistoreyed building G+4 building at Salem, Tamil Nadu, India. The study includes design and analysis of footings, columns, beams and slabs by using two softwares named as Staad Pro and RCC design suit.

3. METHODOLOGY

- MODELLING
  - G+6 RESIDENTIAL BUILDING
- LOADS
  - Live Load, Dead Load, Wind Load
- PROPERTIES
  - Section Properties
- ANALYSIS
  - Analysis of RCC framed structure
  - Shear force and Bending

moment calculation and Diagrams

- DESIGN
  - Design of beam, column, slab, footing, staircase

4. OBJECTIVES

- Structural Planning
- Model Generation in Staad Pro
- Application of Load on Members
- Analysis
- Report Generation

5. INTRODUCTION OF STAAD PRO

Staad Pro is used worldwide because of its efficiency, accuracy and ease in use. Our project aims to design and analyze the structure by using Staad Pro.

5.1 Features

- Input/Output file
- GUI based modelling
- Analysis and Design tool
- Results as per IS
- Report Generation

5.2 Analysis and Design of Structural Members:

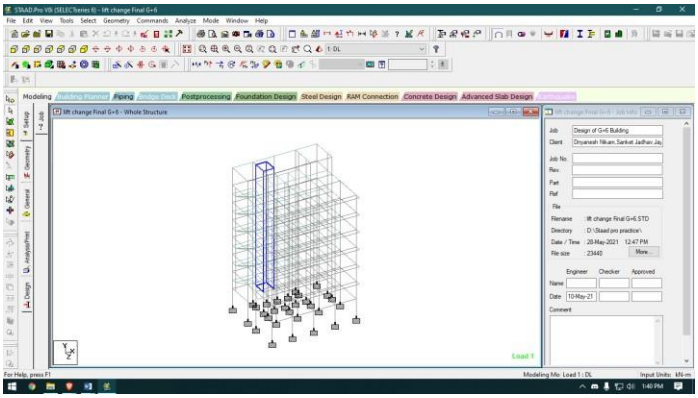

Fig 1 3D modelling in STAAD PRO

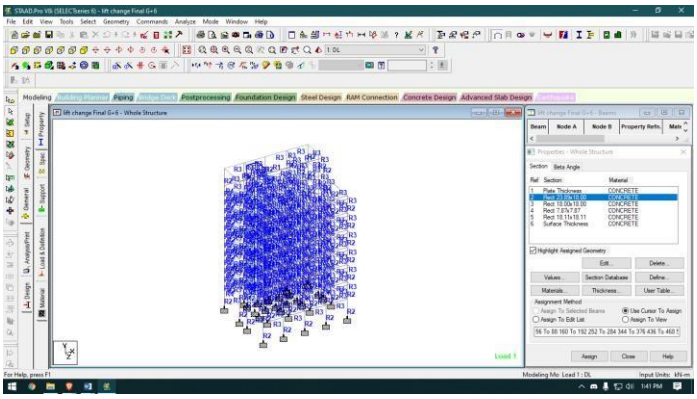

Fig 2 Beam and Column Number

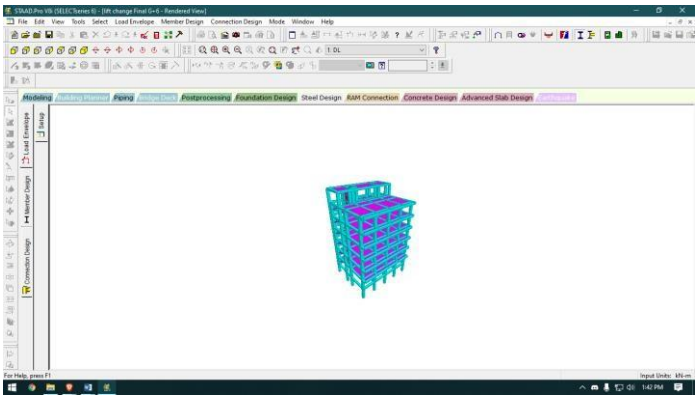

Fig 3 3D Rendered View

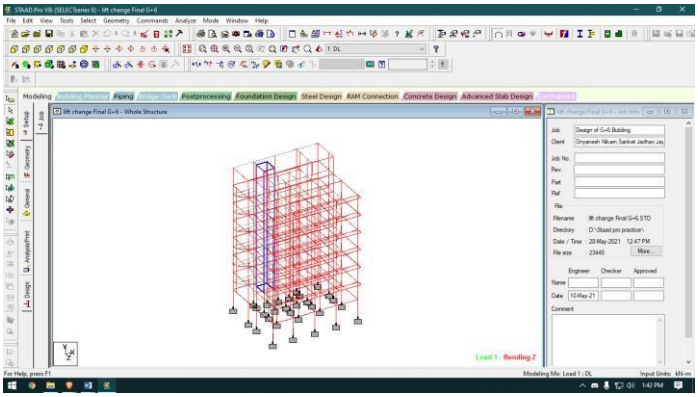

Fig 4 Bending Moment Diagram

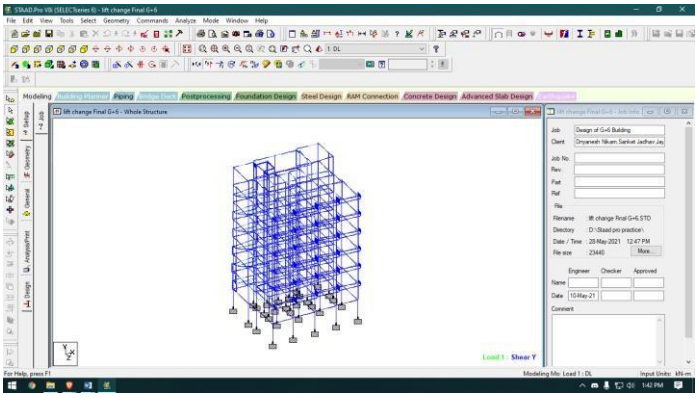

Fig 5 Shear Force Diagram

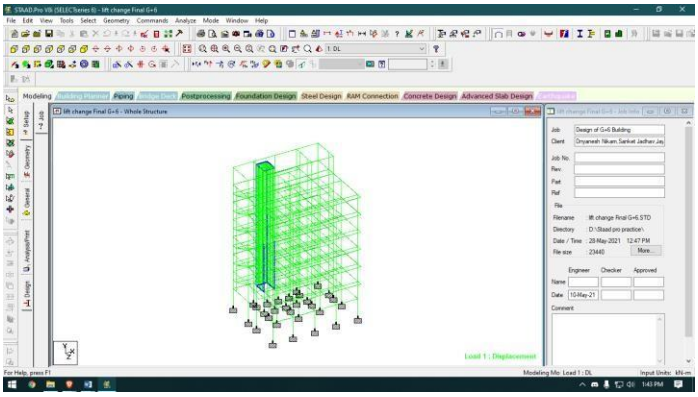

Fig 6 Deflection

5.2.1 Design of Elements of RCC

The elements of RCC structure consists of beams, columns, slabs etc.

5.2.2 Design of Beams

There are three types of reinforced concrete beams:

- Single reinforced beams
- Double reinforced beams
- Flanged beams

5.2.2.1 Single reinforced beams

In singly reinforced simply supported beams steel reinforcement is provided only on tension in a beam in the direction of bending.

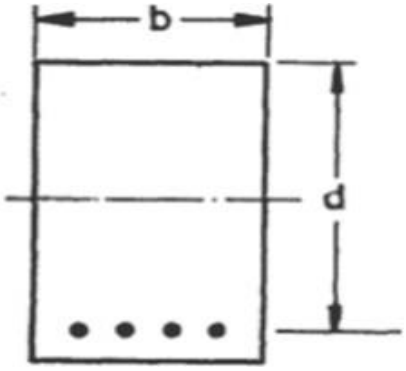

Fig 7 Single Reinforced Beam

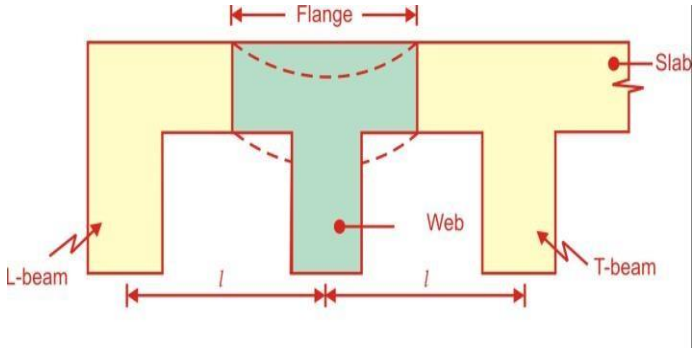

Fig 9 Flanged Beam

5.2.3 Column

A column is defined as a compression member which carries axial compression at both of its ends. Its effective length is greater than 3 times the least dimension of the member. They can be classified into three types as pedestal, short columns and long columns.

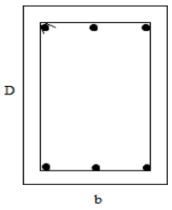

Fig 10 Column Reinforcement

5.2.4 Slabs

Slabs are commonly used as floor and roofs of building. It is subjected to transverse loads which are transfer to the walls or beams to support the slabs. On the basis of spanning direction: It is two types one way slabs and two way slab.

5.2.2.2 Double reinforced beams

The beam in which reinforcements are provided on both tension and compression sides is called doubly reinforced beam. It is provided when the strength of singly reinforced beam is inadequate.

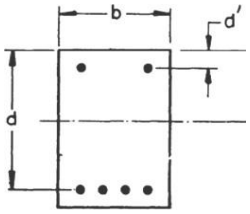

Fig 8 Double Reinforced Beam

5.2.2.3 Flanged beams

There are two types of flanged beams:

1. T – beam
2. L – beam

5.2.4.1 One way slab: The slab which is supported on two opposite support is called as one way slab. Its aspect ratio is greater than two. It bends in one direction only, so the main reinforcement is provided along the shorter span and distribution steel is provided in transverse direction to hold the main steel in position.

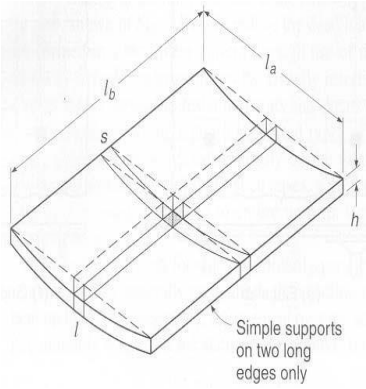

Fig 10 One Way Slab

5.2.4.2 Two Way Slab : The slab which is supported along its all four edges and bends in two orthogonal direction, main reinforcement is provided in such slabs in two direction, where the bending moment and deflection are small is called as two way slab.

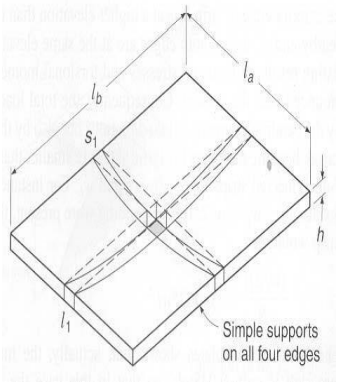

Fig 11 Two Way Slab

5.2.5 Foundations

Part of the structure below the ground level is called as foundation. Foundation supports the weight of the structure and load carried by it. The type of foundation also depends on the bearing capacity of the soil. Its main purpose is to spread the load over a large area, ensure safety of the super structure against soil movements and erosion, to provide the base platform for masonry and concreting. Its thickness is generally based on the shear and flexure which are critical near the column location. -*/

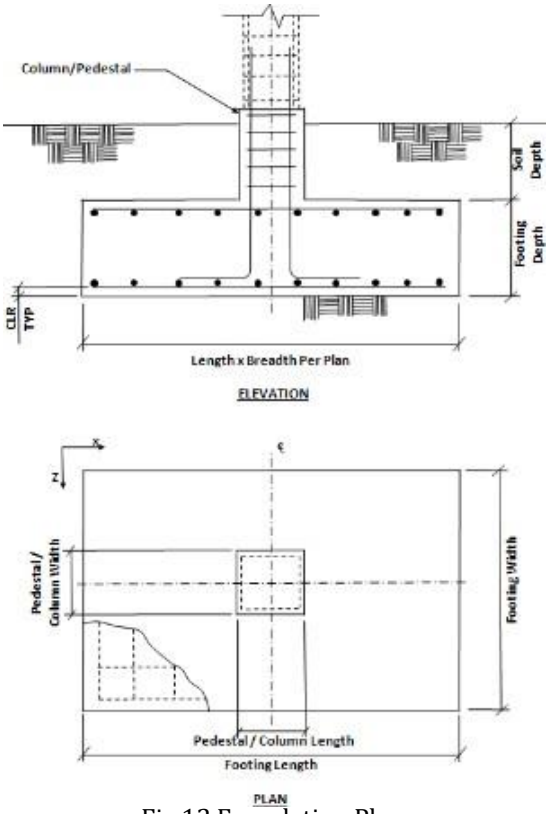

Fig 12 Foundation Plan

5.2.6 Staircase

Stair is an inclined structural system for movement from one

level to another. It is used for ascending and descending from floor-to-floor movement in vertical direction in a building. In our building we have provided dog-legged staircase.

6. CONCLUSION

1. The structural members of the building are safe in shear, flexure and deflection of horizontal members are within 20mm.

2. The steel provided for the structure is economic.

3. The sizes of the members proposed by software can be used in construction.

7. REFERENCES

[1] S. Sudheer (2017): Analysis and design of G+5 residential building using STAAD Pro, Global Journal for Research Analysis: 2277-8160, Vol.6 Issue 5

[2] V. Varalakshmi, G. Shiva Kumar, R. Sunil Sarma (2014): Analysis and Design of G+5 Residential Building, IOSR Journal of Mechanical and Civil Engineering: 2278-1684, 2014, pp: 73-77

[3] P. Jayachandran and S. Rajasekaran, Structural Design of Multi-Storey Residential Building for Salem, Tamil Nadu, India, mini project report, PSG College of Technology, Coimbatore, Tamil Nadu, India-2006

IS codes:

- Indian Standard 456-2000 - Plain and Reinforced Concrete - Code of Practice (Fourth Revision)
- Indian Standard 875 (Part 1) - 1987: Dead Load
- Indian Standard 875 (Part 2) - 1987: Imposed Load
- Indian Standard 875 (Part 3) - 1987: Wind Load