

DESIGN AND ANALYSIS OF COMMERCIAL G+4 BUILDING

B.LATHASRI¹

T. GANESH², K.SOMA SHEKAR³, CH. MUKESH GOUD⁴, B.ESHWAR⁵

¹Assistant Professor, Civil Engineering, Guru Nanak Institute of Technology, Hyderabad.

^{2,3,4,5}UG Scholar, Department of Civil engineering, Guru Nanak Institute of Technology, Hyderabad.

Abstract –Multi storied Industrial/commercial building is selected and is well analysed and designed. The project was undertaken for M/s NKR Group of Constructions Pvt Ltd., It is a Ground+4 storied building, The analysis and designing was done according to the standard specification to the possible extend. The analysis of structure was done using the software package STAAD PRO.V8i. All the structural components were designed manually. The detailing of reinforcement was done in AutoCAD 2013. The use of the software offers saving in time it takes value on safer side than manual work.

Key Words: Staad pro, load combinations ,structural elements, Load Analysis, Displacements

1.INTRODUCTION

Design is not just a computational analysis, creativity should also be included. Art is skill acquired as the result of knowledge and practice. Design of structures as thought course stands to consist of guessing the size of members required in a given Structure and analyzing them in order to check the resulting stressed and deflection against limits set out in codes of practice. Structural Design can be seen as the process of disposing material in three dimensional spaces so as to satisfy some defined purpose in the most efficient possible manner. The Industrial training is an important component in the development of the practical and professional skills required by an engineer. The purpose of industrial training is to achieve exposure on practical engineering fields. Through this exposure, one can achieve better understanding of engineering practice in general and sense of frequent and possible problems.

1.1 General of the project

To get the most benefit from this project it was made as comprehensive as possible on most of the structural design fields. Industrial training consists of two parts. First part consists of Modeling, Analysis, Designing and Detailing of a multistoried reinforced concrete building. Second part is the study of Execution of Project by conducting Site visit. The building chosen for the purpose of Industrial/Commercial building. The project was undertaken for M/s NKR Group of Construction Pvt Ltd. It is a G+3 storied building, located at

Miryalaguada. The base area of the building is about 1180m² and height is 16.0m. Floor to floor height is 4.0 m for all floors. The building consists of two lifts and two main stairs. The terrace floor included overhead water tank and lift room. Underground storey consists of Retaining wall. The structural system consists of RCC conventional beam slab arrangement.

1.2 General Practice Followed in Design

The loading to be considered for design of different parts of the structure including wind loads shall be as per I.S. 875-1987 (Part I to V) and I.S. 1893-2002 (seismic loads)

Unless otherwise specified, the weight of various materials shall be considered as given below.

1. Brick masonry: 19.2kN/m².
2. Reinforced cement concrete: 25kN/m².
3. Floor finish: 1kN/m².
4. Live load for sanitary block shall be 2kN/m²
5. Lift machine room slab shall be designed for a minimum live load of 10kN/m².
6. Loading due to electrical installation e.g. AC ducting, exhaust fan set c. shall be got confirmed from the Engineer of Electrical wing. Any other loads which may be required to be considered in the designs due to special type or nature of structure shall be documented and included.

2. MODELLING AND ANALYSIS OF THE BUILDING

Structural analysis, which is an integral part of any engineering project, is the process of predicting the performance of a given structure under a prescribed loading condition. The performance characteristics usually of interest in structural design are:

1. Stress or stress resultant (axial forces, shears and bending moments)
2. Deflections
3. Support reactions

has been accepted to ensure at least 95 percent of the cases the characteristic loads considered will be higher than the

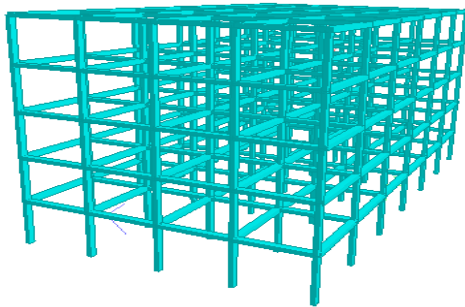


FIG: Rendering view of g+4 commercial building

The dead load and live load on the slabs were specified as floor loads, wall loads were specified as member loads and seismic loads were applied as nodal forces. Wind loads were specified by defining it in the STAAD itself. Various combinations of loads were assigned according to IS456:2000.

Table:2 Factor k_2 for various height

Height(m)	k_2
10	0.98
15	1.02
20	1.05

These loads depend on the velocity of the wind at the location of the structure, permeability of the structure, height of the structure etc. They may be horizontal or inclined forces depending on the angle of inclination of the roof for pitched roof structures. Wind loads are specified in IS87.

2.1. LOAD COMBINATIONS

Design of the structures would have become highly expensive in order to maintain either service ability and safety if all types of forces would have acted on all structures at all times. Accordingly the concept of characteristic loads

actual loads on the structure. However, the characteristic loads are to be calculated on the basis of average/mean load of some logical combinations of all loads mentioned above. IS456:2000 and IS1893 (Part1) 2002 stipulates the combination of the loads to be considered in the design of the structures.

The different combinations used were:

- 1.1.5(DL+LL)
- 2.1.2(DL+LL+EQX)
- 3.1.2(DL+LL+EQY)
- 4.1.2(DL+LL-EQX)
- 5.1.2(DL+LL-EQY)
- 6.1.5(DL+EQX)
- 7.1.5(DL-EQX)
- 8.1.5(DL+EQY)
- 9.1.5(DL-EQY)
- 10.0.9DL+1.5EQX
- 11.0.9DL-1.5EQX
- 12.0.9DL+1.5EQY
- 13.0.9DL-1.5EQY
- 14.1.5(DL+W LX)
- 15.1.5(DL-W LX)
- 16.1.5(DL+W LY)
- 17.1.5(DL-W LY)
- 18.1.2(DL+LL+W LX)
- 19.1.2(DL+LL-W LX)
- 20.1.2(DL+LL+W LY)
- 21.1.2(DL+LL-W LY)
- 22.0.9DL+1.5W LX
- 23.0.9DL-1.5W LX
- 24.0.9DL+1.5W LY
- 25.0.9DL-1.5W LY

All these combinations are built in the STAAD Pro. Analysis results from the critical load combinations are used for the design of the structural member's. Where,

DL – Dead load

LL – Live load

EQX–Earth quake loading X-direction

EQY–Earthquake loading Y-direction

W LX– Wind load in X-direction

W LY–Wind load in Y-direction

3. STAAD ANALYSIS

The structure was analyzed as Special moment resisting space frames in the versatile software STAAD Pro.V8i. Joint co-ordinate command allows specifying and generating the co-ordinates of the joints of the structure, initiating the specifications of the structure.

Member incidence command is used to specify the members by defining connectivity between joints. The columns and Beams are modeled using beam elements. Member properties be specified for each member. STAAD pro carries out the analysis of the structure by executing "PERFORMANALYSIS" command followed by "RUN ANALYSIS" have to command. After the analysis the post processing mode of the program helps to get bending moment ,shear force, axial load values which are needed for the design of the structure. The values corresponding to load combination was compared and higher values were taken for design.

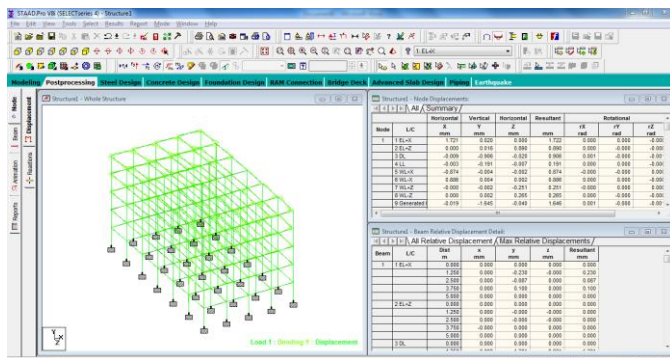


Fig. :Bending Moment Diagram

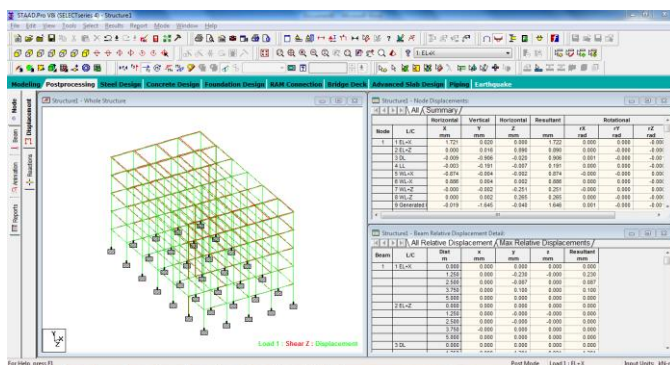


Fig. 7: Shear Force Diagram

On the basis of most critical state and then checked for other limit states .As per IS456:2000 the value of partial safety factor for dead and live load combination which is the maximum is adopted for design of beam sand columns. The following are design examples of slab ,beam, column etc.

4.CONCLUSION

The industrial/Commercial building taken through a period of one month allowed having ample exposure to various field practices in the analysis and design of multistoried buildings and also in various construction techniques used in the industry. The analysis was done using the software package STAAD Pro V8i, which proved to be premium software of great potential in analysis and design sections of construction industry. All the structural components were designed manually and detailed using AutoCAD 2013. The analysis and design was done according to standard specifications to the possible extend.

Used Indian Standard Codes:

1. SP: 07 – (2005) Hand Book of Industrial Buildings.
2. Plain Cement concrete IS: 456:2000
3. For Steel Code IS: 800:2008
4. SP: 32-2005 Detailing for the Reinforcement.
5. Structural safety: STAAD Pro can help ensure that the Structural components of a building are safe in share Force and flexible.
6. Economic: STAAD Pro can be economical.
7. Error identification: STAAD Pro can help identify all types of error
8. Time-saving: STAAD Pro can help save time compared to manual calculations.
9. Material design: STAAD Pro can design and analyze, Structures made from variety of materials, including Concrete, steel ,and timber.
10. Load application: STAAD Pro can apply static and Dynamic loads and their combinations.
11. Visualization: STAAD Pro has tools for visualizing results.
12. International design codes: STAAD Pro includes international design codes.
13. Automation: STAAD Pro can help automate tasks and remove the need for manual calculations.

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