JETRM International Journal of Engineering Technology Research & Management (IJETRM) https://ijetrm.com/

ANALYSIS AND DESIGN OF MULTISTOREY (G+5) RESIDENTIAL BUILDING USING STAAD.PRO

Mohammed Ibrahim

Assistant Professor, Deccan college of Engineering and Technology, Osmania University <u>mohdibrahim1018@gmail.com</u>

Mohammed Abdul Azeem Saif¹, Mohammad Zaidullah²,

Mohammed Taquiuddin Siddiqui³, Mohammed Abdul Rahman⁴

UG Students, Deccan college of Engineering and Technology, Osmania University Zaidu995@gmail.com , ma.rahman603@gmail.com taquisiddiqui9@gmail.com , azeemsaif2004@gmail.com

ABSTRACT

In order to compete in the ever-growing competent market, it is very important for a structural engineer to save time. As a sequel to this an attempt is made to analyze and design a multistoried building by using a software package STAAD pro.

For analyzing a multi storied building one has to consider all the possible loadings and see that the structure is safe against all possible loading conditions.

There are several methods for analysis of different frames like kani's method, cantilever method, portal method, and Matrix method.

The present project deals with the analysis of a multi storied residential building of G+5 consisting of 5 apartments in each floor. The dead load & live loads are applied and the design for beams, Columns, footing is obtained.

STAAD Pro with its new features surpassed its predecessors, and compotators with its data sharing capabilities with other major software like AutoCAD and MS Excel

We conclude that STAAD pro is a very powerful tool which can save much time and is very accurate in Designs.

This it is concluded that STAAD pro package is suitable for the design of a multistoried building.

Advanced structural analysis may examine dynamic response, stability and non-linear behavior.

Few standard problems also have been solved to show how "STAAD. Pro" can be used in different cases. These typical problems have been solved using basic concept of loading, analysis, condition as per IS code 456:2000.

INTRODUCTION

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 earl 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. Even 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 arc 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 county. 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 are 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.

A building frame consists of number of bays and story. A multi-story, multi-paneled frame is a complicated statically intermediate structure. A design of R.C building of G+5 story frame work is taken up. The building in plan

JETRM International Journal of Engineering Technology Research & Management (JETRM)

https://ijetrm.com/

(40*28) consists of columns built monolithically forming a network. The size of building is 40x28m. The number of columns are 85 it is residential complex.

The design is made using software on structural analysis design (STAAD-pro). The building subjected to both the vertical loads as well as horizontal loads. The vertical load consists of dead load of structural components such as beams, columns, slabs etc. and live loads.

The horizontal load consists of the wind forces thus building is designed for dead load, live load and wind load as per IS 875. The building is designed as two-dimensional vertical frame and analyzed for the maximum and minimum bending moments and shear forces by trial-and-error methods as per IS 456-2000. The help is taken by software available in institute and the computations of loads, moments and shear forces and obtained from this software.

LITERATURE REVIEW

Methods of Analyzing Statistically Indeterminate Portal Frames

Various methods are employed to analyze indeterminate portal frames, each with unique characteristics, advantages, and limitations. The following are notable techniques:

1. Method of Flexibility Coefficients

This method transforms a hyperstatic structure into a determinate one by removing redundant supports or introducing cuts/hinges.

Limitation: Not suitable for structures with a degree of redundancy greater than 3.

2. Slope Displacement Method

Effective when kinematic indeterminacy is less than static indeterminacy. It uses slope and

displacement relations to derive equations.

Limitation: Tedious for larger frames (more than two bays and two storeys).

Iterative Variation: Involves distribution of known values across joints, relying on compatibility.

3. Kanis Method

Improves on the Hardy Cross method by distributing only the total joint moment at each step. It features a self-corrective iteration process.

Advantage: Suitable for analyzing side sway in frames.

Limitation: Accuracy depends on correct iteration; skipping steps may affect convergence.

4. Moment Distribution Method (Hardy Cross)

Useful for frames with fixed joints; redistributes moments iteratively to achieve balance.

Limitation: Ineffective for rigid frames with intermediate hinges or side sway.

5. Approximate Method

Useful for preliminary design by assuming locations of inflection points (zero moment) and simplifying structure as determinate.

Application: Effective for multi-storey frames with separate horizontal and vertical load analyses.

Note: Beams should not rotate when columns translate; not suitable for frames with intermediate

hinges.

Visual Criteria

- Applicable Frames: Regular, vertically aligned frames without intermediate hinges.

- Not Applicable: Frames with complex geometry or intermediate hinges.

SOFTWARES USED

1. STAAD.PRO v8I

2. STAAD foundations 5 (v81)

3. Auto CAD

Basics:

1.STADDPRO v8I:

STAAD is powerful design software licensed by Bentley. STADD stands for structural analysis and design Any object which is stable under a given loading can be considered as structure. So first find the outline of the structure, whereas analysis is the estimation of what are the type of loads that acts on the beam and calculation of

JETRM International Journal of Engineering Technology Research & Management (IJETRM)

https://ijetrm.com/

shear force and bending moment comes under analysis stage. Design phase is designing the type of materials and its dimensions to resist the load but that we do after the analysis.

To calculate S.F.D and B.M.D of a complex loading beam it takes about an hour. So when it comes into the building with several members it will take a week. STAAD pro is a very powerful tool which does this job in just an hour's STAAD is a best alternative for high rise buildings.

Now-a-days most of the high rise buildings are designed by STAAD which makes a compulsion for a civil engineer to know about this software.

These software can be used to cam RCC Steel, bridge truss etc., according to various country codes.

2.STAAD Foundation:

STAAD foundation is a powerful tool used to calculate different types of foundations. It is also licensed by Bentley software's. All Bentley software's cost about 10 lakhs and so all engineers can't use it due to heavy cost.

Analysis and design carried in STAAD and post processing in STAAD gives the load at various supports. These supports are to be imported into these software to calculate the footing details i.e., regarding the geometry and reinforcement details. This software can deal different types of foundations

SHALLOW (D<B)

1. Isolated (Spread) Footing

2. Combined (Strip) Footing

3. Mat (Raft) Foundation

DEEP (D>B)

1. Pile Cap

2. Driller Pier

1. Isolated footing is spread footing which is common type of footing.

3. Auto CAD

AutoCAD can be defined as the use of computer systems to assist in the creation, modification, optimization of a design.

• In this, we can create both 2D and 3D drawings used in construction and manufacturing.

• It was developed by John Walker in the year 1982 with the help of AUTODESK and maintain it successfully.

DESIGN CODES:-

THESE TYPICAL PROBLEMS HAVE BEEN SOLVE USING BASIC CONCEPT OF LOADING, ANALYSIS , CONDITION AS PER IS CODE 456:2000

ASSUMPTIONS AND NOTATIONS USED:-

THE NOTATIONS ADOPTED THROUGHOUT THE WORK IS SAME IS456:2000

ASSUMPTIONS IN DESIGN:-

1. USING PARTIAL SAFETY FACTORS FOR LOAD IN ACCORDANCE WITH CLAUSE 36.4 2 OF IS456:2000 AS T=1.5

2. PARTIAL SAFETY FACTOR FOR MATERIAL IN ACCORDANCE WITH CLAUSE 36.4 2 IS IS456:2000 IS TAKEN AS 1.5 FOR CONCRETE AND 1.15 FOR STEEL

3. USING PARTIAL SAFETY FACTORS IN ACCORDANCE WITH CLAUSE 36.4 IS456:2000 COMBINATION OF LOAD

BUILDING DETAILES:-

Salient features:

Utility of building:-residential complex No of stories :-G+5

Shape of the building:- 5 APARTMENTS

No of staircases:- 4

No. of flats:- 25

No of lifts:- 2

Type of construction:- RCC framed structure

Types of walls:- brick wall

Geometric details.

IJETRA International Journal of Engineering Technology Research & Management

(IJETRM) https://ijetrm.com/

Ground floor:3m Floor to floor height:3m. Height of plinth:0.6m Depth of foundation:500mm Materials: Concrete grade:-M30 All steel grades:-Fe415 grade Bearing capacity of soil:-300KN/m2

LOADS ACTING:-

Loads can usually be deliberated to be primary or secondary. Accessory loads are those loads due to temperature changes, construction eccentricities, curling of structural materials ,Disposal of foundations, or other such loads **Dead Loads**



Wind Loads

Wind is the correlative motion of air to the surface of the earth. Wind speed in atmospherically boundary layer increments with height form zero at ground level to maximum at gradient height, the slight change in wind direction, within this height is disregarded. Typically, buildings are planned to resist a potent wind with a very long return period, such as 50 years or more. The design wind speed is destined from historical records using ultimate value theory to forecast future absolute windspeeds.





Figure 8 Wind loads in X 1-direction

Figure 9 Wind loads in X 1-direction





Figure 11. Wind loads in Z- direction (1)



Figure 10. Wind loads in Z-direction (-1)

JETRM International Journal of Engineering Technology Research & Management (IJETRM) https://ijetrm.com/



ASSIGNING OF THE COLUMN :-



ASSIGNING OF THE BEAM :-

JETRM International Journal of Engineering Technology Research & Management (IJETRM) https://ijetrm.com/



CONCLUSION:

1. STAAD PRO has the capability to calculate the reinforcement needed for any concrete section.

2. The program contains a number of parameters which are designed as per IS: 456(2000).

3. Beams are designed for flexure, shear and torsion.

REFERENCES:

[1]. Mahesh Ram Patel, R.C. Singh," Analysis of a Tall Structure using Staad Pro providing different Wind Intensities as per 875 Part-III", International Journal of Engineering Sciences & Research Technology, Pg. 2018-2025, May, 2017.

[2]. Anoop. A FousiyaHussian, Neeraja.R, Rahul Chandran, Shabina.S, Varsha.S, "Planning

Analysis and Design of Multi Storied Building by Staad.Pro.v8i", International Journal of Scientific & Engineering Research, Volume 7, Issue 4, April-2016.

[3]. D.R. Deshmukh, A.K. Yadav, S. N Supekar, A. B. Thakur, H. P Sonawane, I. M. Jain, "Analysis and Design of G+19 Storied Building Using Staad-Pro", Pg. 17-19, ISSN: 2248-9622, Vol. 6, Issue 7, (Part-1) July 2016.

[4]. Borugadda Raju, Mr. R. Rattaiah, Analysis AND Design of High-Rise Building (G+30) UsingSTAAD.PRO', International Journal of Research Sciences and Advanced Engineering, Volume 2, Issue 12,PP: 50 54, OCT DEC' 2015.

[5]. Anoop.A, FousiyaHussian, Neeraja. R, Rahul

Chandran, Shabina.S, Varsha.S, 'Planning Analysis andDesign of Multi Storied Building by STAAD.PRO.V8i', International Journal of Scientific & EngineeringResearch, Volume 7, Issue 4, ISSN 2229-5518, April-2016.
[6]. Nasreen. M. Khan, 'Analysis and Design of Apartment Building', International Journal of InnovativeScience, Engineering and Technology, Volume 03, Issue: 03, ISSN 2348-7698, March-2016.R.D. Deshpande, Manoj. N. Pai, N. Pawan, Aashish.P. Pednekar, 'Analysis, Design and Estimation of Basement+G+2 Residential Building', International Research Journal of Engineering and Technology (IRJET), Volume: 04, Issue: 06, e-ISSN: 2395 -

0056, p- ISSN: 2395-0072, June -2017.