

# Design and Structural Analysis of Multi Storey Building (both Commercial and Residential) by using “Staad Pro V8i” Software

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**ABSTRACT** - Structural design is the primary aspect of civil engineering. The foremost basic in structural engineering is the design of simple basic components and members of a building viz., Slabs, Beams, Columns and Footings. In order to design them, it is important to first obtain the plan of the particular building. Thereby depending on the suitability; plan layout of beams and the position of columns are fixed. Thereafter, the vertical loads are calculated namely the dead load and live load. Once the loads are obtained, the component takes the load first i.e the slabs can be designed. Designing of slabs depends upon whether it is a one-way or a two-way slab, the end conditions and the loading. From the slabs, the loads are transferred to the beam. The loads coming from the slabs onto the beam may be trapezoidal or triangular. Depending on this, the beam may be designed. Thereafter, the loads (mainly shear) from the beams are taken by the columns. For designing columns, it is necessary to know the moments they are subjected to. For this purpose, frame analysis is done by Moment Distribution Method. After this, the designing of columns is taken up depending on end conditions, moments, eccentricity and if it is a short or slender column. Most of the columns designed in this mini project were considered to be axially loaded with uniaxial bending. Finally, the footings are designed based on the loading from the column and also the soil bearing capacity value for that particular area. Most importantly, the sections must be checked for all the four components with regard to strength and serviceability.

**KEY WORDS** : staad pro, footing , column, beams, slab, staircase, shear stress, bending moment, dead load, live load

## INTRODUCTION:

Our project involves analysis and design of multi storey building (G+5) both residential and commercial using a very popular designing software “STAAD Pro v8i”. We have chosen STAAD Pro because of its following advantages:

- easy to use interface,
- conformation with the Indian Standard Codes,
- versatile nature of solving any type of problem,

- Accuracy of the solution.

STAAD Pro features a state-of-the-art user interface, visualization tools, powerful analysis and design engines with advanced finite element and dynamic analysis capabilities. From model generation, analysis and design to visualization and result verification, STAAD Pro is the professional's choice for steel, concrete, timber, aluminium and cold-formed steel design of low and high-rise buildings, culverts, petrochemical plants, tunnels, bridges, piles and much more.

STAAD Pro consists of the following:

The STAAD analysis and design engine: It is a general-purpose calculation engine for structural analysis and integrated Steel, Concrete, Timber and Aluminium design. In the initial phase of our project we have done calculations regarding loadings on buildings. Structural analysis comprises the set of physical laws and mathematics required to study and predicts the behaviour of structures. Structural analysis can be viewed more abstractly as a method to drive the engineering design process or prove the soundness of a design without a dependence on directly testing it.

To perform an accurate analysis a structural engineer must determine such information as structural loads, geometry, support conditions, and materials properties. The results of such an analysis typically include support reactions, stresses and displacements. This information is then compared to criteria that indicate the conditions of failure. Advanced structural analysis may examine dynamic response, stability and non-linear behaviour. The aim of design is the achievement of an acceptable probability that structures being designed will perform satisfactorily during their intended life.

## LITERATURE REVIEW:

A.D.Bhosale, Archit Pradip Hatkhambkar, Rupesh Vinayak Katkar, Shubham Balasaheb Babar, Sunny Pramod Gorivale, “Analysis and Design of Multi-Storey Building by using STAAD-Pro V8i”, International Journal of Innovative Science and Research Technology (IJISRT) Volume:03, Issue:04, April 2018.

Unique structures need more time for its time consuming calculations, if we use manual methods. STAAD Pro provides us a quick results. It is easy to use for analyze and design any structure for more accuracy. In the STAAD Pro limit state method is use as per Indian Standard Code and Practices. We can conclude that this software can save much time and very accurate in designs. In this project G+3 structure is consider and dead, live, combination, wind are applied. Then results are studied and compared by manual calculations. For this purpose this project has been selected. In the STAAD Pro the designing is done by Better technique for creating Geometry, Defining the cross sections for column and beam etc, Creating specification and supports, then the Loads are defined. After that the model is analyzed by 'run analysis'. Then reviewing (whether beam column passed in loads or failed) results.

Pabba Mounika, Maroju Navya, Syed Viqar Malik, "Design of Residential Building and Analysis with STAAD Pro", International Journal for Scientific Research & Development (IJSRD), Volume:03, Issue:11, February 2016.

The construction these days have been far than the reach due to developing status that our country India holds. With development of country, development of residential buildings takes place. In this paper the design of residential building is done with limit state analysis. Limit state method is a good way to attain strength of structure with low cost when compare to other design synopsis. The plan, section and elevation are generated in AUTOCAD software as per required area of 200 sq m. Then the design follows with different types of loading conditions with different cases of rooms and position of rooms. After plotting the design, analysis is made with the help of STAAD Pro software and the results found out to be same.

#### **Dead Load:**

Dead loads consist of the permanent construction material loads compressing the roof, floor, wall.

In staad pro assignment of dead load is automatically done by giving the property of the member.

#### **Live Loads :**

Live loads are produced by the use and occupancy of a building. Loads include those from human occupants, furnishings, no fixed equipment, storage, and construction and maintenance activities. As required to adequately define the loading condition, loads are presented in terms of uniform area loads, concentrated loads, and uniform line loads. The uniform and concentrated live loads should not be applied simultaneously in a structural evaluation. Concentrated loads should be applied to a small area or surface

consistent with the application and should be located or directed to give the maximum load effect possible in endues conditions.

In staad we assign live load in terms of U.D.L .we has to create a load case for live load and select all the beams to carry such load. After the assignment of the live load the structure appears as shown below.

For our structure live load is taken as 2 KN/m<sup>2</sup> for residential and 3KN/m<sup>2</sup> for commercial

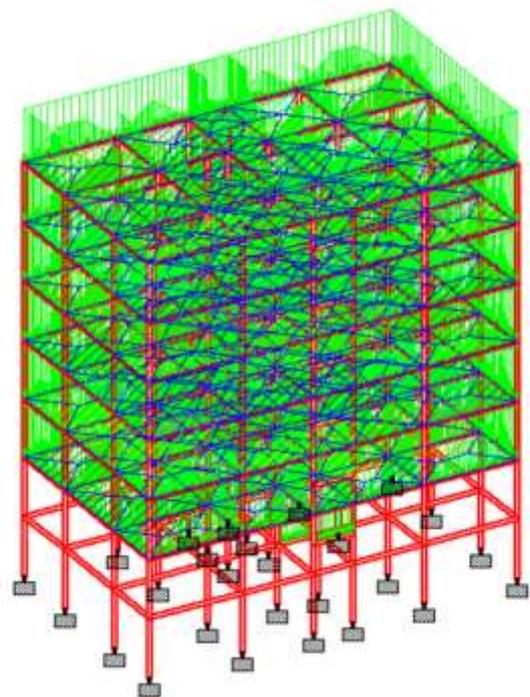
Live loads are calculated as per IS 875 part 2

#### **Load combinations:**

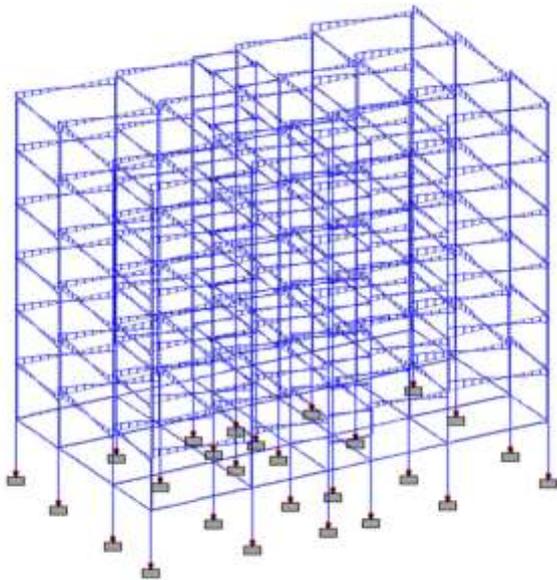
All the load cases are tested by taking load factors as 1.5 and analyzing the building in different load combination as per IS456 and analyzed the building for all the load combinations and results are taken and maximum load combination is selected for the design.

Load factors as per IS 456-2000

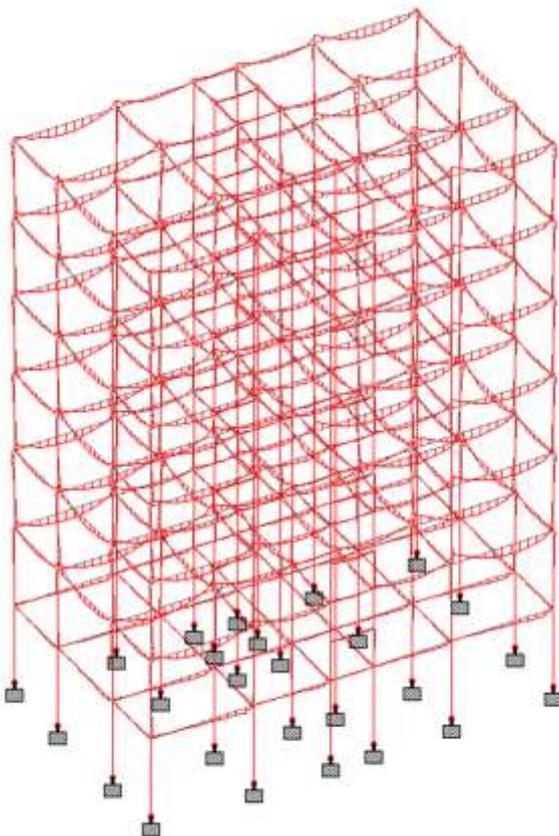
#### **Self-weight of the structure:**



### Shear Force of the Structure:



### Bending Moment of the Structure :



### CONCLUSION:

The analysis has been done with the help of STAAD Pro and the drawings have been made with the help of AutoCAD. Our structure (G+5) building both residential and commercial is safe against all possible loadings and deflection. Designing using Software's like Staad reduces lot of time in design work. All other specifications like section properties, material constants, support load, analysis and design requirements, printing, plotting facilities are available . We can conclude that the results from Staad Pro V8i is much accurate and the structure is safe in analysing and designing.

### REFERENCES

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