

A Review on Design of G+11 Storied Building Using Staad-Pro

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Abstract- The structural analysis and design of a multi story building is a complex and challenging task, requiring careful consideration of various factors such as load-bearing capacity, strength, stability, and durability. In this project, STAAD Pro software was used to analyze and design a multi story building. The project involved the creation of a 3D model of the building using STAAD Pro, followed by the application of various loads such as dead loads, live loads, wind loads, and earthquake loads. The software then analyzed the building frame, calculating the stresses, strains, and deformations in the various structural elements. Based on the analysis results, modifications were made to the design to increase its strength and stability. This involved adjusting the size and shape of the columns, beams, and other structural elements to ensure that they could safely withstand the applied loads. Finally, the project involved the selection of appropriate materials, such as concrete and steel, to ensure the durability and longevity of the building. The design was optimized to minimize the amount of material used while still meeting all relevant safety codes and standards.

Index Terms- Structural Analysis, Design, Multi storey Buildings, Building Codes, Structural Systems, Advanced Analysis Methods, Case Studies.

I. INTRODUCTION

Today's world, the population is growing fast and the people need space to live. The structure should be built in an efficient manner so that it can serve people and save money. In other words, the building means an empty space surrounded by walls and roofs, in order to give shelter to human beings. In early days people used to live in caves to protect themselves from wild animals, rain, etc. As people were developing and the type of the structures were developed as well. Now a days, the buildings vary into different types such as low-rise and high-rise buildings. Buildings are the necessary indicators of social progress of the country. At current situations, many types of technologies have been developed for constructions, so that buildings are built economically and fast in order to fulfil the needs of the people. A building structure consists of columns, beams and slabs. Also, buildings are constructed in different sizes, shapes and functions [1]. The buildings should be constructed for the people's requirements and not for earning money. As the world is transforming, the need of advanced programming tools is in a great demand. An economical structure cannot be achieved by manual calculation hence, a programming tool such as Staad.Pro is needed which provides economical and faster approach to structural design and analysis with chances of minimum errors. There are various types of loads like live load, dead load, wind load and seismic load. Generally due to weakness of structure and geometry the failure of building structure occurs. Earthquake is occurring

due to earth shaking, when it occurs then many people kill and losses of highly economic [2,3,4,5,6]. Therefore, structural engineers are responsible for the preparation of the design of the structure, planning and layout, etc. of the buildings using Staad.pro which is the foremost computer code for 3D model generation and multi material design and it's the world's leading software for the analysing and designing the high-rise complicated buildings in very less time with high accuracy [2].

II. RESEARCH MOTIVATION

Building construction is the engineering deals with the construction of building such as residential houses. In a simple building can be define as an enclosed space by walls with roof, food, cloth and the basic needs of human beings. In the early 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. Every human has desire to own comfortable homes on an average generally one spends his two-third life times in the houses [3]. The security of civic sense is the responsibility. These are the few reasons which are 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 is 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 storey. A multi-storey, multi panelled frame is a complicated statically intermediate structure. A design of R.C building of G+11 storey frame work is taken up. The building in plan consists of columns built monolithically forming a network. The size of building is 39X25m. The numbers of columns are 55. 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 frames and analyzed for the maximum and minimum bending moments and shear forces by trial and error methods as per IS456-2000. The help is taken by software available in institute and the computations of loads, moments and shear forces and obtained from this software [4].

Infrastructure is the basic way to represent the level of development of a country, among which the major share is shared by the high rise buildings which are not possible without a structural designer. As the world is transforming the high rise buildings are in a great demand which is to be fulfilled without sacrificing any of the three factors, cost, time and safety. Achieving this is not possible with manual calculation hence to counter this we need highly advanced ways of computation, which can allow you to calculate and analyse the structural variables like shear force, nodal displacement, bending moment etc. The answer to such problems is Stadd. Pro which provides a much faster approach to structural analysis and designing with chances of minimum errors. There has been several research conducted comparing the results from Stadd. Pro to the manually calculated results, which all support the use of Stadd. Pro over manual the one. Stadd. Pro is a much better way to analyse the complicated load combinations and is quite versatile [5-10].

III. LITERATURE REVIEW

A. Sivaji, N. Madhava Reddy, T. Yeswanth Kumar: Analysis & Design of Multi story Building using Staad Pro and E-Tabs. This paper represents the 5-storey building using STAAD Pro and ETABS. The beams, columns and slabs are designed using software and by manual procedure and also reinforcement

details also compared. The foundation is designed by using STAAD Foundation software. The load used in the analysis are dead load (IS 875-1987 part 3), seismic load (IS 1893-1984 part 1) and 25 load combination are considered as per 1987 code book.

A. D. Bhosale, Archit Pradip Hatkhambhar : Analysis and Design of multi-storey Building by using STAAD Pro-V8i. In this paper G+11 structure is consider and dead , live , combination , wind are applied. Then result are studied and compared by manual calculations. In the STAAD Pro the designing is done by better technique for creating geometry, defining the cross sections for columns and beams etc. After that the model is analyzed for 'run analysis'.

S.K. Saleen, B. Ravi Kumar : Analysis and Design multi-storeyed building by using STAAD Pro. In this paper the design involves load calculations manually and analysing the structure by STAAD Pro. The design methods used in STAAD Pro analysis are limit state design conforming to Indian standard code of practice. The final work was the proper analysis and design of a G+11 3D RCC frame under various load combinations. STAAD Pro feature the state-of-the-art user interface, visualization tools, powerful analysis and design engines with advanced finite elements and dynamic analysis capabilities.

B. Pradeep Kumar, Sk. Yusuf Basha: Planning Analysis and Design of residential building, quantity survey. The primary objective of this project is to gain sufficient knowledge in planning, analysis and design of building and quantity surveying. It is reinforced concrete framed structure consist of G+6 using IS 456-200. The planning will be recognized by NBC. The ceiling height is provided as 3.2 m.

Nasreen M. Khan: Analysis and Design of Apartment Building. Practical knowledge is an important and essential skill required by every engineer. For obtaining this skill, an apartment building is analysed and designed, located at thrissure with B+G+11 storeys having a car parking facility provided at basement and ground floor. The building have a shear wall around the lift pit. The modelling and analysis of structure is done by using STAAD Pro 2007 and detailing is done using AutoCAD 2016 and designing was done manually.

IV. TYPES OF LOADS

1. Lateral Loads

The primary loads that produce lateral forces on buildings are attributable to forces associated with wind, seismic ground motion, floods, and soil. Wind and seismic lateral loads apply to the entire building. Lateral forces from wind are generated by positive wind pressures on the windward face of the building and by negative pressures on the leeward face of the building, creating a combined push and-pull effect. Seismic lateral forces

are generated by a structure's dynamic inertial response to cyclic ground movement.

2. Structural Systems

As far back as 1948, it was determined that "conventions in general use for wood, steel and concrete structures are not very helpful for designing houses because few are applicable"(NBS,1948).More specifically, the NBS document encourages the use of more advanced methods of structural analysis for homes. Unfortunately, the study in question and all subsequent studies addressing the topic of system performance in housing have not led to the development or application of any significant improvement in the codified design practice as applied to housing systems.

3. Dead Loads

Dead loads consist of the permanent construction material loads compressing the roof, floor, wall, and foundation systems, including claddings, finishes and fixed equipment. Dead load is the total load of all of the components of the components of the building that generally do not change over time, such as the steel columns, concrete floors, bricks, roofing material etc.

4. 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. For example. The stair load of 300 pounds should be applied to the centre of the stair tread between supports.

5. Wind loads

In the list of loads we can see wind load is present both in vertical and horizontal loads. This is because wind load causes uplift of the roof by creating a negative (suction) pressure on the top of the roof Wind produces non static loads on a structure at highly variable magnitudes. The variation in pressures at different locations on a building is complex to the point that pressures may become too analytically intensive for precise consideration in design.

V. ADVANTAGES OF STAAD.PRO

STAAD.PRO is user friendly software which is used for analysing and designing of structures by structural engineers. STAAD.PRO provides a lot of precise and correct results than

manual techniques.STAAD.PRO software is used for both static and dynamic analysis for structures such as bridges, low rise or high-rise buildings, stadiums, steel structures etc. First step in STAAD.PRO is to specify the geometry of the structures and then the properties of the members are mentioned, then the supports are generated and loadings are specified on the structure. Finally, the structure is analysed

- Covers all aspects of structural engineering
- It has a prebuilt collection of most used structures, such as trusses, buildings, and many more and can be altered as per the requirement
- It includes the design of concrete and steel together and also includes the features for bridge and pipe designing
- It provides fast and reliable method of designing durable structures
- Eliminates the need for any manual collection
- Stadd. Pro gives hardly any variation in results compared to the results computed manually
- Stadd. Pro allows you to follow the criteria of several design codes for eg. The Indian standards relating to loads, designs, analysis etc.
- Stadd. Pro is a much easier and faster way of analysing and designing a structure when compared to manual computation.
- Stadd. Pro is a user-friendly way to analyse the structure as its GUI is very easy to work with and the software is quite versatile.

VI. CONCLUSION

Many investigational, analytical, performance and relative works have been done by many researchers related to the design of high-rise buildings. For the planning of the structure, the self-weight, imposed load, load due to wind and seismic load are considered with load combination. The analysis of building is figured by manual also simultaneously it has been checked through STAAD Pro.

- Stadd. Pro gives hardly any variation in results compared to the results computed manually.
- Stadd. Pro allows you to follow the criteria of several design codes for eg. The Indian standards relating to loads, designs, analysis etc.
- Stadd. Pro is a much easier and faster way of analysing and designing a structure when compared to manual computation.
- The variation of seismic load, wind load, shear force and bending moment with the height is showing a direct relationship.
- Stadd. Pro is a user-friendly way to analyse the structure as its GUI is very easy to work with and the software is quite versatile.

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