Analysis and Design of Multi Storey (G+6) Residential Building using Staad Pro

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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 Multi-storeyed 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+6 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. Thus it is concluded that staad pro package is suitable for the design of a multi-storeyed building.

I. 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 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 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. The security civic sense of 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+6 storey frame work is taken up. The building in plan (40*28) consists of columns built monolithically forming a network. The size of building is 40x28m. The number of columns is 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 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.

II. DESIGN LOADS FOR RESIDENTIAL BUILDING

Loads are a primary consideration in any building design because they define the nature and magnitude of hazards are external forces that a building must resist to provide a reasonable performance(i.e., safety and serviceability) throughout the structure's useful life. The anticipated loads are influenced by a building's intended use (occupancy and function), configuration (size and shape)and location(climate and site conditions).Ultimately, the type and magnitude of design loads affect critical decisions such as material collection, construction details and architectural on figuration. Thus, to optimize the value (i.e., performance versus economy) of the finished product, it is essential to apply design loads realistically. While the buildings considered in this guide are primarily single-family detached and attached dwellings, the principles and concepts related to building loads also apply to other similar types of construction, such as low-rise apartment buildings. In general, the design loads recommended in this guide are based on applicable provisions

of the ASCE 7 standard-Minimum Design ;loads for buildings and other structures(ASCE,1999).the ASCE 7 standard represents an acceptable practice for building loads in the United states and is recognized in virtually all U.S. building codes. For this reason, the reader is encouraged to become familiar with the provisions, commentary, and technical references contained in the ASCE 7 standard. In general structural design of housing has not been treated as a unique engineering discipline or subjected to a special effort to develop better, more efficient design practices. Therefore, this part of the guide focuses on those aspects of ASCE 7and other technical resources that are particularly relevant to the determination of design loads for residential structures. The guide provides supplemental design assistance to address aspects of residential construction where current practice is either silent or in need of improvement. Residential buildings methods for determining design loads are complete yet tailored to typical residential conditions. as with any design function, the designer must ultimately understand and approve the loads for a given project as well as the overall design methodology, including all its inherent strengths and weakness. Since building codes tend to vary in their treatment of design loads the designer should, as a matter of due diligence, identify variances from both local accepted practice and the applicable code relative to design loads as presented in this guide, even though the variances maybe considered technically sound. Complete design of a home typically requires the evaluation of several different types of materials. Some material specifications use the allowable stress design (ASD) approach while others use load and resistance factor design (LRFD).

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 In staad pro assignment of dead load is automatically done by giving the property of the member In load case we have option called self weight which automatically calculates weights using the properties of material i.e., density and after assignment of dead load the skeletal structure looks red in color as shown in the figure
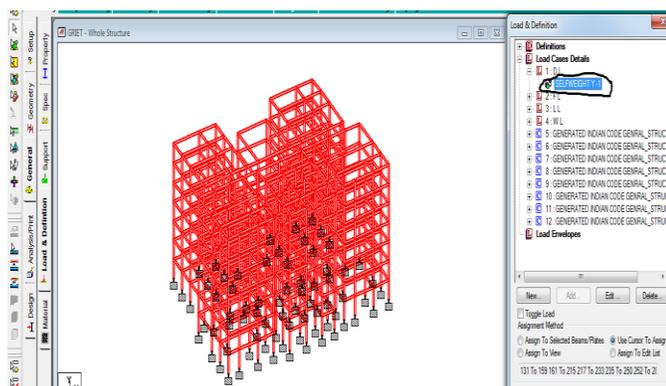
Example for calculation of dead load

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 n a structura evaluation. Concentrated loads should be applied to a small area or surface consistent with the application and should b e 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 center of the stair tread between supports 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

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 becom too analytically intensive for precise consideration in design. Therefore, wind load specifications attempt to amplify the design problem by considering basic static pressure zones on a building representative of peak loads that are likely to be experienced. The peak pressures in one zone for a given wind direction may not, However, occur simultaneously in other zones. For some pressure zones, The peak pressure depends on an arrow range of wind direction. Therefore, the wind directionality effect must also be factored into determining risk consistent wind loads on buildings.

III.   Load combinations:
All the load cases are tested by taking load factors 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 **IS456-2000** When the building is designed for both wind and seismic loads maximum of both is taken. Because wind and seismic do not come at same time as per code. Structure is analyzed by taking all the above combinations

VI.CONCLUSION
In the present study G+6 building at Nayapally, Bhubaneswar, India is designed (Slabs, Beams, Columns and Footings) using staad pro software. The loads are calculated namely the dead loads which depend on the unit weight of the materials used (concrete, brick) and the live loads using the code IS:456-2000 and HYSD BARS FE415 as per IS:1786-1985.The safety of G+6 reinforced concrete building will depend upon the initial architectural and structural configuration of the total building, the quality of the structural analysis, design and reinforcement detailing of the building frame to achieve stability of elements and their ductile performance. Proper quality of

construction and stability of the infill walls and partitions   are additional safety requirements of the structure as a whole

VII. REFERENCES

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[4] Fundamentals of Reinforced concrete structure by N. C. Sinha

[5] IS 456-2000 code book for design of beams, columns and slabs

[6] SP-16 for design of columns.