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COMPARATIVE ANALYSIS AND DESIGN OF MULTISTOREY BUILDING USING STAAD AND ETABS

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Abstract:

A structure refers to a system of two or more connected parts use to support a load. It is an assemblage of two or more basic components connected to each other so that they serve the user and carry the loads developing due to the self and super-imposed loads safely without causing any serviceability failure. Once a preliminary design of a structure is fixed, the structure then must be analyzed to make sure that it has its required strength and rigidity. To analyze a structure correctly, certain idealizations are to be made as to how the members are supported and connected together. The loadings are supposed to be taken from respective design codes and local specifications, if any. The forces in the members and the displacements of the joints are found using the theory of structural analysis.

Keywords: Self Imposed, Design tools, Theory.

1. INTRODUCTION

The whole structural system and its loading conditions might be of complex nature so to make the analysis simpler, we use certain simplifying assumptions related to the quality of material, member geometry, nature of applied loads, their distribution, the type of connections at the joints and the support conditions. This shall help making the process of structural analysis simpler to quite an extent. Structural analysis is the backbone of civil engineering. During recent years, there has been a growing emphasis on using computer aided softwares and tools to analyze the structures. There has also been advancement in finite element analysis of structures using Finite Element Analysis methods or matrix analysis. These developments are most welcome, as they relieve the engineer of the often lengthy calculations and procedures required to be followed while large or complicated structures are analyzed using classical methods.

But not all the time such detailed analysis are necessary to be performed i.e. sometimes, just approximate analysis could suffice our requirements as in case of preparing the rough estimates and participating in the bidding process for a tender. It may even happen that sometimes the analysis software or tool is not available at hand? Or the worst case, the computer itself is not available?? Then in such cases, accurate analysis of such large and complicated structures involving so many calculations is almost impossible. Efficiencies are gained through the ability to maintain and streamline current workflows with fluent data collaboration. STAAD.Pro integrates with other Bentley products such as STAAD.foundation and ProSteel and OpenSTAAD is provided for integration with third party programs. Increased client base and therefore business growth can be realized in using STAAD.Pro to serve a broad spectrum of structural

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design projects and a global market.

2. RELATED WORK

The taller and more the slender a structure, the more important the structural factors become and the more necessary it is to choose an appropriate structural form or the lateral loading system for the building. In high rise buildings which are designed for a similar purpose and of the same height and material, the efficiency of the structures can be compared by their weight per unit floor area. The weight of the floor framing is mainly influenced by the floor span and it is virtually independent of the building height, whereas the weight of the columns, considering gravity load only, is approximately proportional to height. Buildings up to 10 stories designed for gravity loading can usually accommodate wind loading also without any increase in member sizes, due to the typically increase in permissible stresses in design codes for the combined loading. The additional material required for wind resistance will increase nonlinearly with respect to height for buildings of more than 10 stories. For the buildings of 50 stories and more the selection of an appropriate lateral loading system may be critical for the economy and viability of the building.

Structural systems for concrete buildings

No.	System	Number of stories 0 10 20 30 40 50 60 70 80 90 100 110	Ultra-tall buildings 120–200 stories
1	Flat slab and columns		
2	Flat slab and shear walls		
3	Flat slab, shear walls and columns		
4	Coupled shear walls and beams		
5	Rigid frame		
6	Widely spaced perimeter tube		
7	Rigid frame with haunch girders		
8	Core supported structures		
9	Shear wall—frame		
10	Shear wall—Haunch girder frame		
11	Closely spaced perimeter tube		
12	Perimeter tube and interior core walls		
13	Exterior diagonal tube		
14	Modular tubes, and spine wall systems with outrigger and belt walls		

Fig.1.Structural System

Modern office buildings are designed for large open spaces that can be subdivided with light weight partitioning to suit the individual tenant's needs. Consequently, the structures main vertical components i.e. columns are arranged as far as possible around the perimeter of the plan and internally around the stair case, service shafts and elevators, thus leaving large column free areas available for office planning. Above the partitioning the services are distributed horizontally in each storey and are usually concealed in a ceiling space. The typical storey height required to accommodate the extra depth required is in the range of 3.5m or more. In the case of residential building or hotel, the services then can be run vertically adjacent to the columns and walls or in a separate shafts to emerge in each storey either very close or The formation of the structure using finite element results in the system of simultaneous algebraic equations

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for the solution. The process of modelling a structure in FEA involves dividing the structure into a equivalent system.

3. PROPOSED STRUCTURE

A load combination results when more than one load type acts on the structure. Building codes usually specify a variety of load combinations together with their respective load factors (weightings) for each load type in order to ensure the safety of the structure under different maximum expected loading scenarios.For example, in designing a staircase, a dead load factor may be 1.2 times the weight of the structure, and a live load factor may be 1.6 times the maximum expected live load. These two "factored loads" are combined (added) to determine the "required strength" of the staircase.

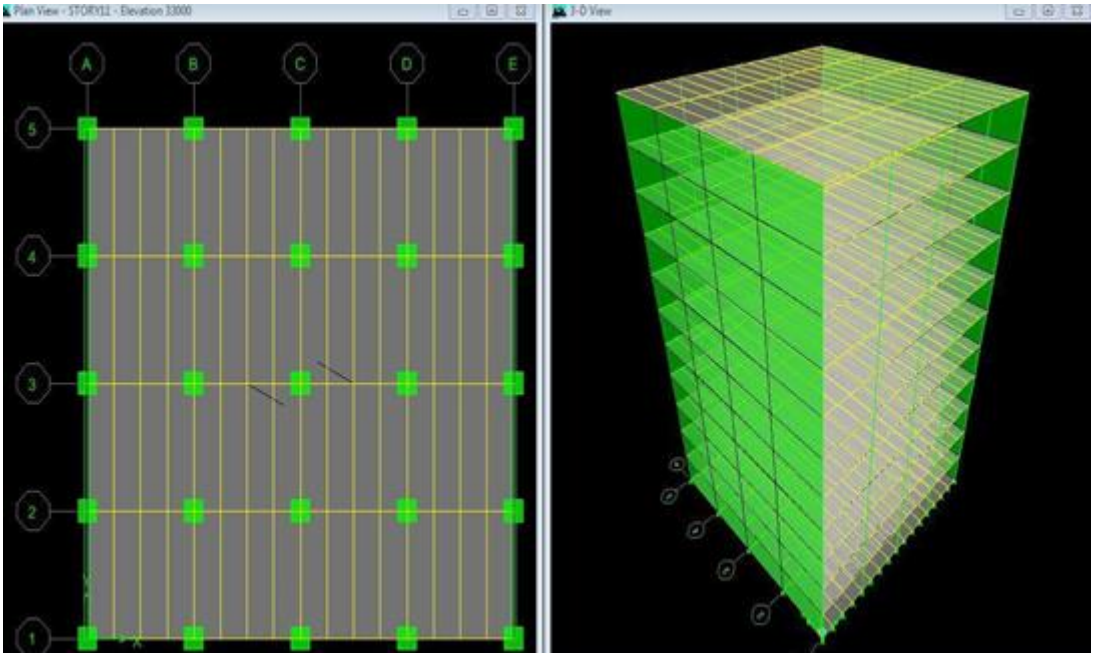

Fig.2.Support Model

4. ANALYSIS

The reason for the disparity between factors for dead load and live load, and thus the reason the loads are initially categorized as dead or live loads are because while it is not unreasonable to expect a large number of people ascending the staircase at once, it is less likely that the structure will experience much change in its permanent load. The design loading combinations are the various combinations of the pre-scribed response cases for which the structure is to be checked/designed. The program creates a number of default design load combinations for a concrete frame design. Users can add their own design load combinations as well as modify or delete the program default design load combinations. An unlimited number of design load combinations can be specified.To define a design load combination, simply specify one or more response cases, each with its own scale factor. The scale factors are applied to the forces and moments from the analysis cases to form the factored design forces and moments for each design load combination. There is one exception to the pre- ceding. For spectral analysis model combinations, any correspondence between the signs of the moments and axial loads is lost. The program uses eight design

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load combinations for each such loading combination specified, reversing the sign of axial loads and moments in major and minor directions.

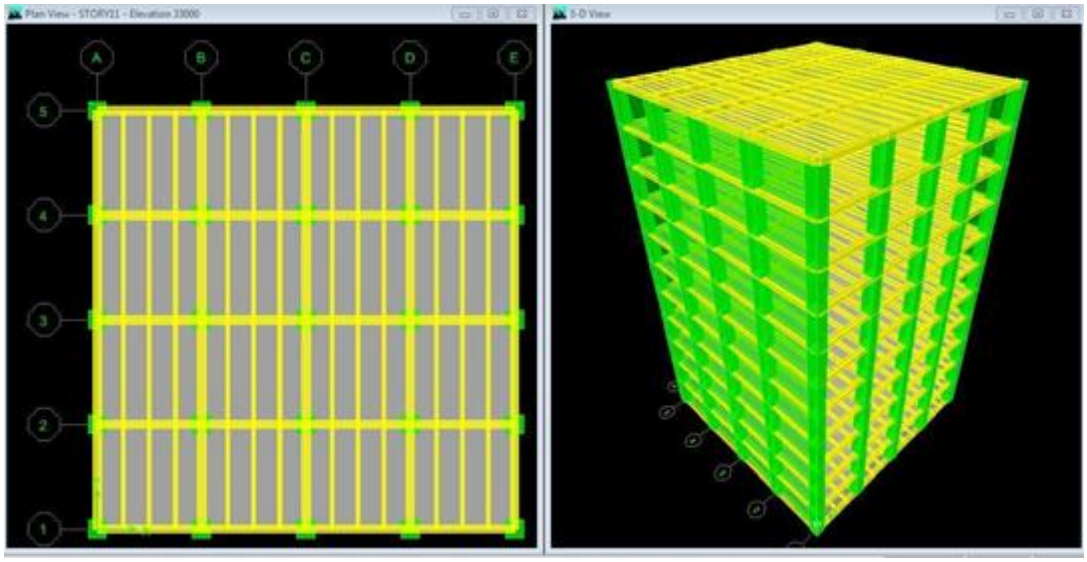

Fig.3.Model Analysis

Rigid frame structures consist of girders and columns joined by moment resisting connections. For a rigid frame bent the lateral stiffness depends on the bending stiffness of the columns, girders, and connections in the plane of the bent. The main advantage of the rigid fame structure is its open rectangular arrangement, which allows the choice of planning and simple fitting of doors and windows. often limited by the floor-to-floor height. However, frames located at the building exterior do not inevitably have these limitations. An efficient frame action can thus be developed by providing closely spaced columns and deep spandrels at the building exterior. Above 25 stories the quite high lateral flexibility of the frame calls for inefficiently large members in order to control the drifts. If the rigid frame is used as the only structure to resist the lateral loads in its typical 6m to 9m by size, it is economical only for buildings up to about 25 stories.

CONCLUSION

In this study, the design and analysis of different shaped building with different specifications are explained in detail including the calculations of loads. The formulation for calculating the loads and deflection of the structure are carried out according to the Indian Standards.This project is an attempt to bring the general procedure for calculating, designing and analyzing the structure using two different softwares. Staad pro is the generally used software where as Etabs doesn't have that much usage as compared to staad. The calculation of loads has been given for one building out of three for the purpose of understanding.

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