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# DESIGN AND ANALYSIS OF MULTISTORIED COMMERCIAL BUILDING (G+4) USING STAAD PRO & MANUAL DESIGNING

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***Abstract:*** The basic needs of a human being are food, clothing and shelter. There have different kinds of housing, but multi storeyed RCC buildings from the core and it has become the need of the day. The main reason shifted from independent bungalows to RCC multi storeyed sky scrapers is the shortage of space metropolitan cities. Shortage of space in cities has pushed up the land cost necessitating the construction of multi storeyed structures. The planning and designing of multi storey structures involves a number of steps.The plan based on the functional requirements and the utility considerations. The loads coming on to the structures are taken as per IS:875. The loads are calculated as per provisional of IS:456-2000.This project is reflected in the recent revision of the code of practice of plain and reinforced cement concrete IS-456-2000 and design aids for reinforced concrete to IS: 456-1978(SP:16-1980) interaction diagrams. These codes place more emphasis on providing sufficient strength and ductility besides satisfactory Serviceability requirements of cracking and deflection in concrete structures. Both theses codes are based on the principles of limit state design rather than working stress design. A complete structural analysis of a multi storeyed building is done in this project

## INTRODUCTION:

The objective of structural design is to plan a structure which meets the basic requirements of structural science and those of the user. The basic requirements of structural design are safety service abilty, durability and economy. In this project work it is proposed to design a multi-storeyed residential building consisting of 4 floors. Each floor consists of 4 flats. The building is served by one stair case and one lift.

## IMPORTANCE OF MULTISTORIED BUILDINGS:

The rapid increase in population and Industrial growth and of shelter there is considerable rise in the price of shelter there is considerable rise in the price of city land and as the space is limited horizontal expansion is difficult. Hence vertical expansion has become compulsory. This has led to the conception of apartments or flats. An apartment consists of 3 to 7 storeys and each storey may accommodate 2 to 4 tenentments. The land and other amenities of apartments are shared by all the occupants.

As our country is in developing stage. The economy of people may permit to acquire costly flats. Hence for low income group LIG flats are within reach and are most preferred.

**Multi storeyed building has been broadly classified into five types**

- Load bearing constructions.
- Composite Constructions.
- Framed Construction.
- Reinforced Concrete framed Construction.
- Steel framed Construction**.**

The first method has got the limitation that it will be economical only up to 2-3 storey. By means of composite constructions technique the economy is achieved number is in between 3 to 5. Any building having more

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than 6 storeys has to be dealt by means of framed constructions.

## ADVANTAGES OF FRAMED CONSTRUCTION OVER OTHER TYPES:

1. Foundation cost will be due to reduction wall thickness.

2. Considerable speed is achieved in the reaction of building.

3. Floor area will be more due to reduction in thickness of wall.

4. Greater glazing area can be obtained.

5. This type of construction permits removal or change of partition walls to suit varying requirements.

## STRUCTURAL DESCRIPTIONS:

The building has to be four storied with plinth area of and served by one lift and staircase.

The Various loads considered in the design of this building are dead load, live load. As the height of building is not more than 1.5 times the least lateral dimension, wind load is not taken into consideration in the design of this building. Earthquake loads are not considered in the design of this building.

## DESCRIPTION OF STRUCTURAL ANALYSIS:

Structural analysis is branch of physical sciences which deals with the behavior of structures in given design conditions. Structures are defined as the systems that carry loads and the word behaviour is understood to be their tendency to deform, vibrate, buckle or yield, depending upon the conditions confronting them. The results of analysis used to determine the deformed shape of structures and to verify their adequacies is to carry the loads for which they are being designed.

Considering that the deformation is the summation of strains and yielding is the excess and further considering that stress and strains are related to each other by the modulus of elasticity E' the analysis of structures thereby reduces itself to the determination of the state of strain and stress throughout the structures. Since the stresses on the other hand are the limiting values of internal forces what actually remains to be done is the evaluation of internal force in the system.

Structural analysis along with stress analysis and design are the three basic topics with which structural engineering is primarily concerned. All inspite of being so inter-related are so distinct that they are often studied independently.

When the static equilibrium equations alone are not sufficient to analyse a structure the use of displacement compatibility which rely on the physical properties of the structure become imperative. Whether the equilibrium equations alone are sufficient or not the results of analysis must always satisfy the following three conditions.

1. Equilibrium
2. Compatibility
3. Boundary

Normally there are two kinds of

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equilibrium static and dynamic equilibrium When the loads are applied on the structure in a quasi linear fashion (starting from 200 and reaching their final stage gradually) the structure will deform under these loads and will rest in its final shape. From here on the structure might change neither its position nor its deformed shape. This called the static equilibrium position of the structure. To the contrary if loads are applied suddenly the structure will undergo different deformation at different times. At any particular time any particle or any portion of structures is in equilibrium under external loads. gravity forces, spring forces and inertia forces act on that portion of the structure. This is called dynamic equilibrium.

The compatibility principle assumes that deformation consequently displacement of any particular point of the structure is continuous and single valued.

The last condition specifies the way a structure is supported and is specified either in terms of forces (nodal forces or member forces) or in terms of displacements.

## STRUCTURAL DESIGN:

Structural design is an art and science of designing serviceable and durable structures with economy and elegance. The entire process of structural planning and design requires not only imagination and conceptual thinking but also sound knowledge of science and structural engineering, knowledge of practical aspects such as relevant design codes and bye-laws backed up by ample experience in tuition and judgement.

Construction is an ultimate objective. An engineer is key person for successful completion of any kind of project undertaken. Hence he should adopt all means to reduce cost of project to minimum without unduly reducing the serviceability aspect of the project.

An engineering structure is an assembly of members for elements transferring the load and providing a form, space, enclosure and or a cover to serve the desired function.The objective of structural design is to plan a structure which meets the basic requirements such as serviceability, safety, durability, economy, aesthetic beauty. feasibility, practicability and acceptability.

## PURPOSE OF STRUCTURAL DESIGN:

The purpose of structural design is, providing a safe structure with user's requirements. The design should evolve a structural solution for safety and serviceability throughout the

design life, which gives the greatest overall economy for the first cost and for maintenance cost. Satisfactory design must ensure the achievement an acceptable probability that the specified life of a structure is not curtailed permanently due to attainment of an unsatisfactory serviceability condition called "LIMIT STATE". The acceptable probability should be chosen in such a way that a satisfactory balance is achieved between the cost of a possible structure and serviceability failure.

## ADVANTAGES OF LIMIT STATE METHOD:

It is a concept including some constants which are arrived at after a

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series of experimentation and also out of experience of many senior engineers, architects etc. Limit states are concerned with structural safety and serviceability and covers all forms of failure, A structure could be rendered unit in many ways and these factors are conveniently grouped into main categories.

**a) ULTIMATE LIMIT STATE:** Collapse of the structure due to normal or severe loading on the occurrence of catastrophic events like earthquakes etc.

**b) SERVICEABILITY LIMIT STATE:** Deflection, cracking and vibration.

**c) OTHER LIMIT STATES:** Fatigue, durability, fire resistance, lighting etc. It is often possible that a given structure is required to satisfy one or more limit states simultaneously. The usual approach then is to design on the basis of the most critical limit states and check for the other limit states. Many times satisfying one of one limit state would satisfy other limit states. For e.g. a structure is designed to keep the limit states for cracking within acceptable value, the limit for durability is also simultaneously satisfied.

The concept of limit state provides a rational approach taking into account, variations in material strength and loads. This is in fact a rationalization of the ultimate load.

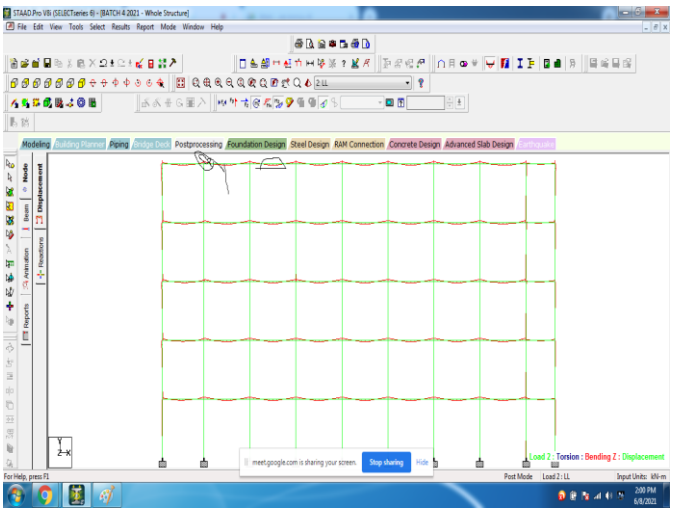
Four reasons to justify the design of structures by limit state method are:

I. Concept of separate partial safety factors of loads of different combinations in the two limits state methods.

II. Concept of separate partial safety factors of materials depending on their quality control during preparation. Thus, y for concrete is 1.5 and the same for steel is 1.15. This is more logical than one arbitrary value in the name of safety factor.

III. A structure designed by employing limit state method of collapse and checked for other limit states will ensure the strength and stability requirements at the collapse under the design loads and also deflection and cracking at the limit state of serviceability. This will help to achieve the structure with acceptable probability that the structure will not become unfit for the use for which it is intended.

The stress block represents in a more realistic manner when the structure is at the collapsing stage (limit state of collapse) subjected to design loads.



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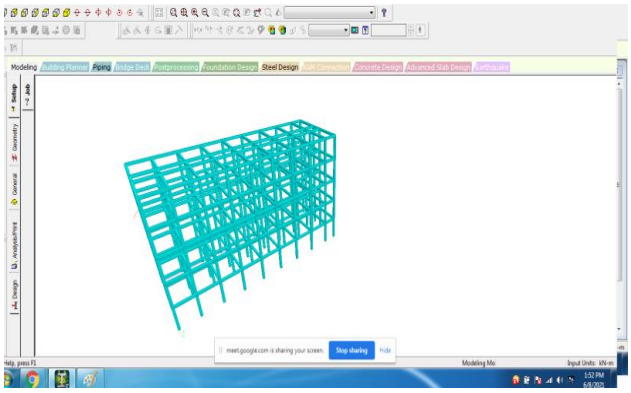

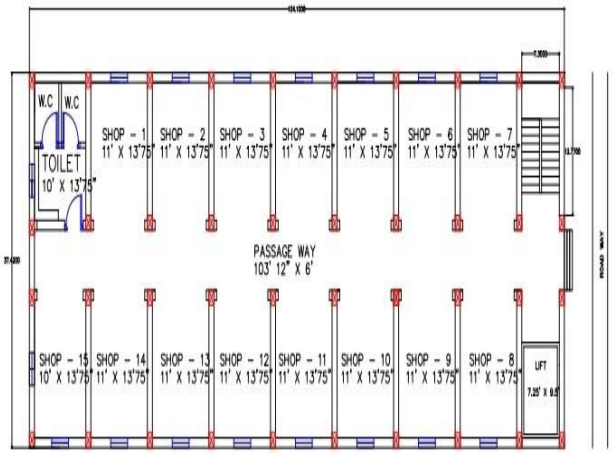


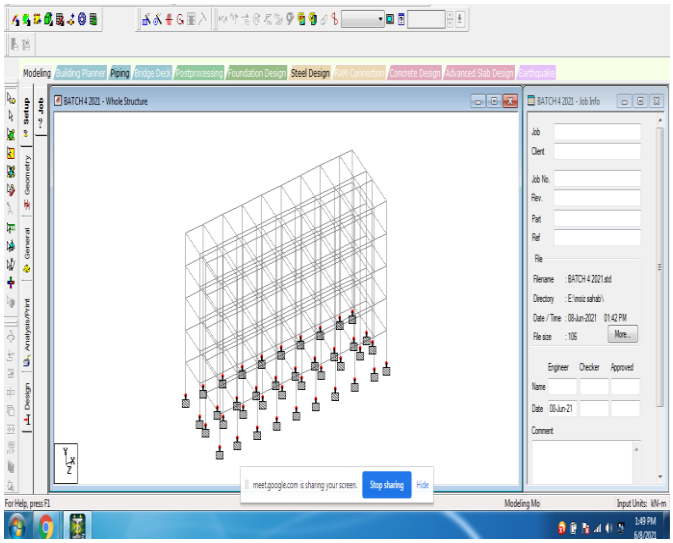

## CONCLUSION

1) This project is mainly concentrated with the Design and Analysis of multi-storied residential building with all possible cases of the load combinations as per IS Code using Analysis Softwares tool meeting the design challenges are described in conceptual way.

2) To understand the Basic principles of structures by Understanding the standard Indian code. The scope of the study is to Produce good Structural work for performing Analysis and Design for residential/Commercial Structures.

3) This facilities for the implementations of more effective & professional engineering software

4) Further in case of rectification it is simple to change the values at the place where error occurred and the obtained results are generated in the output.

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