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Analysis and Design of High Rised RC Framed Building (G+10) using STAAD.PRO

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ABSTRACT

In India, these days there is a large increase in population, which leads to an increase in the usage of land for the upcoming generation so that nowadays several stories in a small area are being constructed. So that less place is consumed to give livelihood for several families. The construction of more buildings in a small area so that place consumption is reduced, which is a very complex process, that takes more time. To reduce the time and complex calculation, a defined path should be adopted. This is where the STAAD.pro helps to complete the project in less time. The main objective of this project is the design and analysis of a multi-storied apartment G+10 using STAAD.pro.

1. INTRODUCTION

STAAD Pro is structural software accepted by much civil engineering. Which can solve typical problems like wind analysis and seismic analysis using various load combinations to confirm various codes like IS456:2000, 1893:2002, IS875:1987, etc. Few standard problems have also been solved to show how "STAAD. Pro" can be used in different cases. These typical problems have been solved using basic concepts of loading, analysis, and condition as per IS code. These basic techniques may be found useful for further analysis of problems. STAAD Pro features a state-of-the-art user interface, visualization tools, and 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, aluminum, and cold-formed steel design of low- and high-rise buildings, culverts, petrochemical plants, tunnels, bridges, piles, and much more. To perform an accurate analysis, a structural engineer must determine information as structural loads, geometry, support conditions, and material 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 behavior. Few standard problems have also been solved to show how "STAAD. Pro" can be used in different cases. These typical problems have been solved using basic concepts of loading, analysis, and condition as per IS code. These basic techniques may be found useful for further analysis of problems.

2. LITERATURE

Anoop(2016): STAAD.Pro graphical input generation facility allows generation of structural models graphically. A powerful geometry generation algorithm facilities generation and viewing of structural models both 2D and 3D situations. All other specifications like section properties, material constants, support load, analysis and design requirements, printing, plotting facilities are available. A versatile "query" facility allows generation of customized reports. Powerful icons-based graphics tools provide extremely user-friendly navigation and manipulation capabilities

V.Varalakshmi: The design and analysis of multi-storeyed G+5 building at Kukatpally, Hyderabad, India. The Study includes design and analysis of columns, beams, footings and slabs by using well known civil engineering software named as STAAD.PRO. Test on safe bearing capacity of soil was obtained.

P.Jayachandran: The design and analysis of multi-storeyed G+4 building at Salem, Tamilnadan, India. The study includes design and analysis of footings, columns, beams and slabs by using two Within the construction industry the last twelve years have seen an increased interest in the study of the environmental impact of building materials on the environment. The research has centred on the determination of embodied energy of particular building materials and the life cycle impacts of materials and systems on the environment.

3. METHODOLOGY

Structural design for framed R.C.C structure can be done by three methods:

1. Working stress method.
2. Ultimate strength method.
3. Limit state method.

1. **Working stress method:** It is earliest modified method of R.C.C structures. In this method structural element is so designed that the stress resulting from the action of services load as computed in linear elastic theory using modular ratio concept do not exceed a pre-designed allowable stress which is kept as some fraction of ultimate stress, to avail a margin of safety. Since this method does not utilize full strength of the material it results in heavy section, the economy aspect cannot be fully utilized in the method.
2. **Ultimate strength method:** This method is primarily based on strength concept. In this method the structural element is proportioned to withstand the ultimate load, which is obtained by enhancing the service load of some factor referred to as load factor for giving desired margin of safety. Since this method is based on actual stress strain behaviour of the material, of the member as of the structure that too right up to failure, the values calculated by this method agree well the experiment results
3. **Limit state method:** During the past several years, extension research works have been carried out on the different aspects of the research in the actual behavior of member and structure has led to the development of design and approach of LIMIT STATE METHOD OF DESIGN. Limit state design, also known as load and resistance factor design, refers to a design method used in structural engineering. A limit state is a condition of a structure beyond which it no longer fulfills the relevant design criteria.

4. RESULTS AND DISCUSSION

Our project involves analysis and design of multi-storeyed [G + 10] using a very popular designing software STAAD Pro. 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,

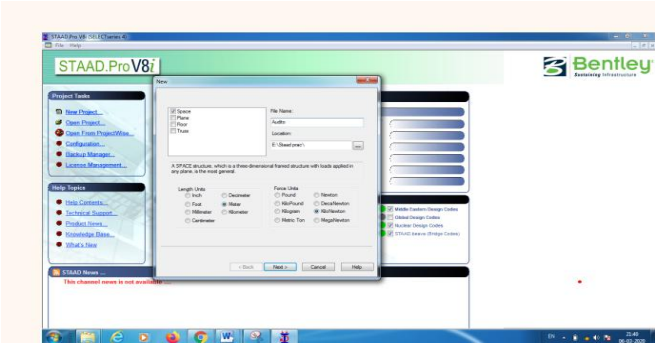
STAAD. pro features is a state-of-the-art user interface, visualization tools, powerful analysis and design engines with advanced finite element and dynamic analysis capabilities. From model generation, analysis and design to visualization and result verification, STAAD. pro is the professional's choice 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.

To perform an accurate analysis a structural engineer must determine such information as structural loads, geometry, support conditions, and materials properties.

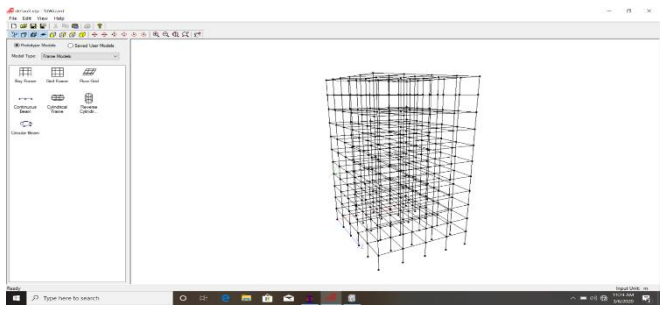
The results of such an analysis typically include support reactions, stresses and displacements. This information is then compared to criteria that indicate the conditions of failure. Advanced structural analysis may examine dynamic response, stability and non-linear behaviour.

5. PROCEDURE

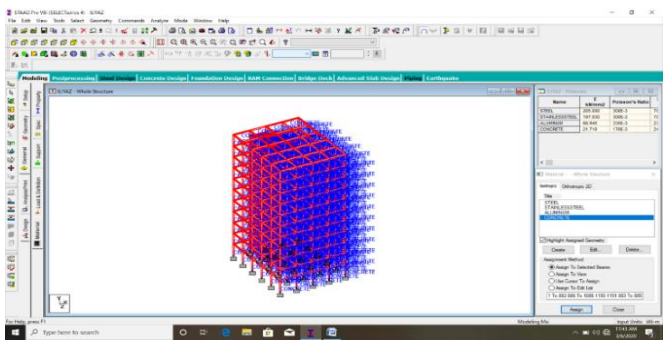
- Open STAAD.PRO v8i software.
- Click on new project.
- Click on space.
- Give file name- 3d frame and location.
- Then select add beam-finish.



- Click on geometry-open run structure wizard-select shape-model type-frame model-select bay frame-click on apply.
- Select transfer model to work space---yes---ok.

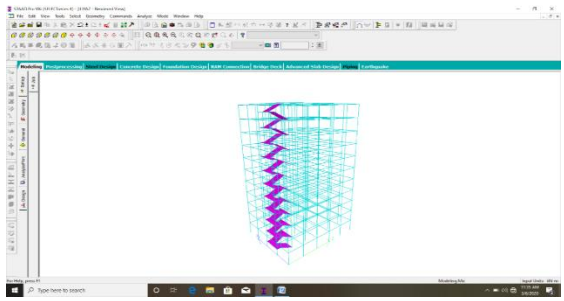


- Select general-select material as concrete --- assign it to assign to view.

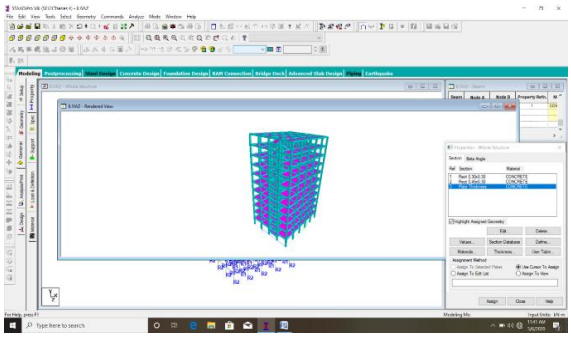


- **Using cu**t section cut single bay to draw stair case – Draw stair case using insert nodes by selecting beams on the simgle bay and add beam , adding 4 noded plate to the stair case added beams.
- Using plate and beam cursor select the respective beams and plates drawn for single bay – copy to all

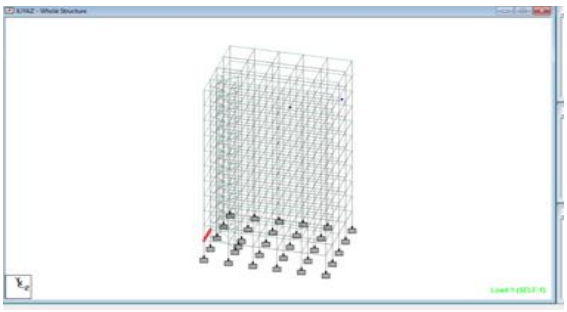
floors using translation repeat – y direction – number of stories – link steps – ok.



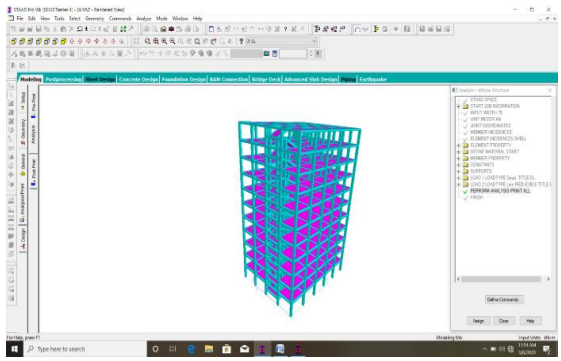
- Select property-click on define-select property type-rectangular beam size 0.3*0.3m-rectangular column size 0.45*0.3m-click ok.
- Click on thickness-select plate element thickness-0.15 m-click on material type- concrete.
- Assign the beam property to the respective beams in x and z directions by selecting in select command.
- Assign column property to the resspective column in y direction by selecting columns in select command – assign to selected columns – ok.
- Similarly assign plate i.e slab thickness to assign to view.
- We can verify weather the properties are assigned or not in 3d rendering view.



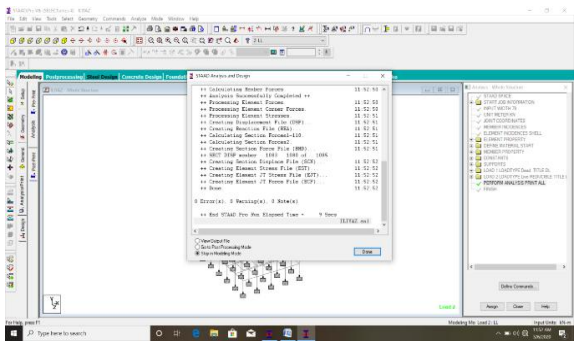
- Click on supports-click on create-then support type –fixed-click on close.select support type-keep the structure in front view-And give the selected support.



- Click on load and deflection and add all required loads and define them as per IS code provisions.
- Click on 3d render view.



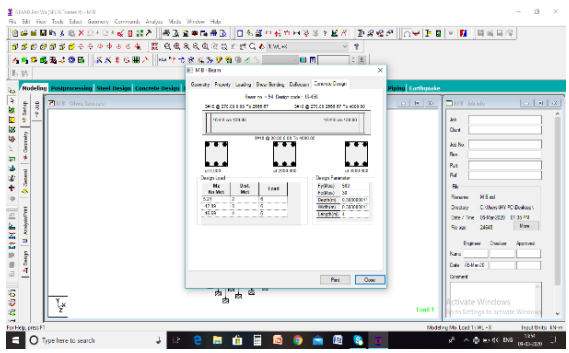
- After completion of adding all loads and meterial to the structure analyze the structure using run analysis.



- Check for Zero errors and note results.

6. BEAN DESIGN

Beams are designed for flexure, shear and torsion. If required the effect of the axial force may be taken into consideration. For all these forces, all active beam loadings are pre-scanned to identify the critical load cases at different sections of the beams. For design to be performed as per IS: 13920 the width of the member shall not be less than 200mm. Also the member shall preferably have a width-to depth ratio of more than 0.3.



7. COLUMN DESIGN

A column or strut is a compression member, which is used primarily to support axial compressive loads and with a height of at least three times it's least lateral dimension. A reinforced concrete column is said to be subjected to axially loaded when the line of the resultant thrust of loads supported by the column

is coincides with the line of C.G. of the column in the longitudinal direction. Depending upon the architectural requirements and the loads to be supported, R.C.C. column may be cast in various shapes i.e. square, rectangular, hexagonal, octagonal or circular. Column of ell-shaped or tee-shaped are also sometimes used in column help to bear the load in combination with the concrete. The longitudinal bars are held in position by transverse reinforcement, or lateral binders. The binders prevent displacement of the longitudinal bars during concreting operation and also check the tendency of their buckling out wards under loads.

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