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Advanced Design Analysis of G+30 building using STAAD PRO

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ABSTRACT

Structural engineer is responsible to design the structures for a safe technology in the computing field, the structural engineer can dare to tackle much larger and complex structure subjected to various type of loading condition. To save time of structural engineer an attempt is made to analyse and design a Multi-storied building by using a software package STAAD Pro. For analysing a multi-storied building one has to consider all the possible loadings and see that the structure is safe against all possible loading conditions. The aim of the project is to define proper technique for creating geometry, cross sections for column and beam etc., developing specification and supports conditions, types of Loads and load combinations. In this 30- storey high rise structure is analysed for seismic and wind load combination using STAAD PRO.

Keywords : Design, Analysis, Loads, Support, Residential Building.

I. INTRODUCTION

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. This in turn leads to the responsibility of civil engineer to great extent. 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 STAAD 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 STAAD Pro to the manually calculated results, which all support the use of STAAD Pro over manual one. Hence STAAD Pro is much better way to analyse the complicated load combinations and is quite versatile.

II. LITERATURE REVIEW

1. Ibrahim, et.al (April 2019): Design and Analysis of residential building (G+4):

After analysing the G+4 storey residential building structure, conducted that the structure is rate in loading like dead load, live load, wind load and seismic load. Member dimensions (beams, column, slab) are assigned by calculating the load type and its quantity applied on it. AutoCAD gives detailed information at the structure member i.e. length, height, depth, size, numbers etc. STAAD Pro has the capability to calculate the program and contains number of parameters which are designed as per IS 456-2000. Beams are designed for flexure, shear and tension and it gives the detail about the number, position and spacing.

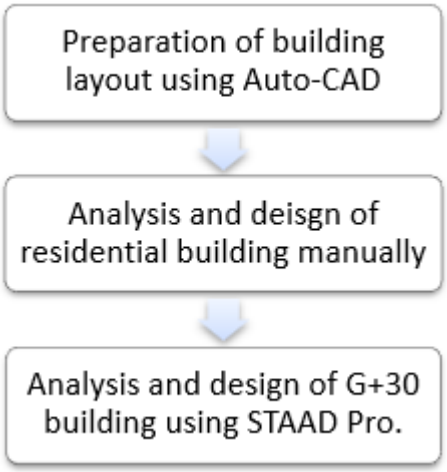
2. **Dunnala Lakshmi Anuja, et.al (2019): Planning, Analysis and Design of residential building (G+5) by using STAAD Pro:**

Frame analysis was done by STAAD Pro. Slabs, beams, footing and staircase were design as per IS Code 456-2000 by LSM. The properties such as shear, deflection, torsion, development length is with IS code provision. Design of column and footing were done as per IS 456-2000 along with SP-16 design charts. The check for one way or two-way shear within IS code provision.

3. **R. D. Deshpande, et.al (June, 2017): analysis, design and estimation of basement+G+2 residential building**

They found that check for deflection was safe. They carried design and analysis of G+2 residential building by using E-tabs software with the estimation of building by method of center line. They safely designed column using SP-16.

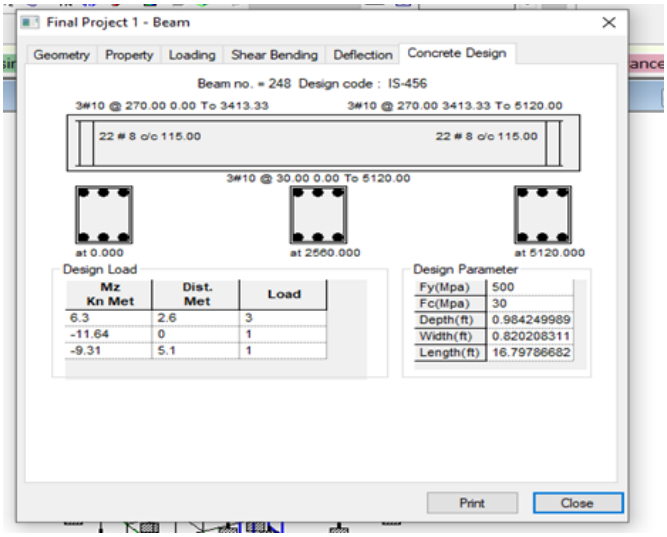
III. METHODOLOGY



Parameters

Geometric details	Material detail
Ground floor height=3m	Concrete grade- M30
Floor height=3m	Steel grade- Fe500
Total height=93m	Location- Vadodara Type-Residential building

Loads and Load Combinations Loads considered



Dead load: The load due to its self-weight
Live load: For residential building live load is taken as kN/m2
Wind load: The load due to wind intensities.
Seismic load: The load due to acceleration response of the ground to the super structure

CALCULATION OF LOADS

According to IS code:
FOR DEAD LOAD CALCULATIONS,
Unit weight of brick masonry= 19.2 kN/m3.
Unit weight of RCC= 25 kN/m3
FLOOR FINISHES =2kN/m2 on each floor and (-1.5kN/m2) on roof. (negative sign indicates its acting on downward direction.)
WIND LOAD CALCULATION: AS PER IS CODE 875 2015 PART-3
SEISMIC LOAD CALCULATION: AS PER IS-CODE 1893(part 1)

VII. Load combination for Static analysis:

- 1.5(DL + IL)
- 1.2(DL + IL ± EL)
- 1.5(DL ± EL)
- 0.9 DL ± 1.5 EL

Design and loading

1. Design of slab

Slabs are most widely used structural elements forming floor and roof of building. Slab support mainly transverse load and transfer them to supports by bending actions more or one directions. The thickness of the slab taken was 200mm.

2. Design of beam

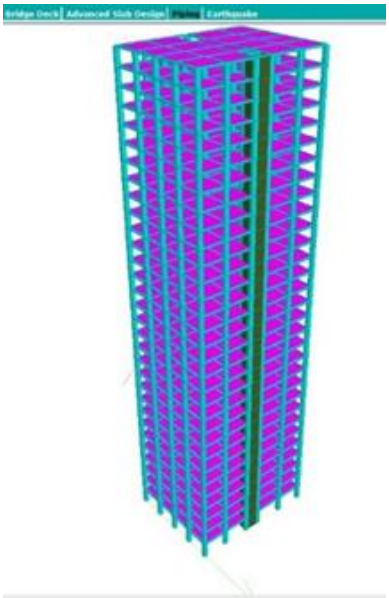
Single reinforced beams: In singly reinforced simply supported beams steel bars are placed near the bottom of the beam where they are effective in resisting in the tensile bending stress.

Double reinforced beams: It is reinforced under compression tension regions. The necessities of steel of compression region arise due to two reasons. When depth of beam is restricted. The strength availability. singly reinforced beam is in adequate.

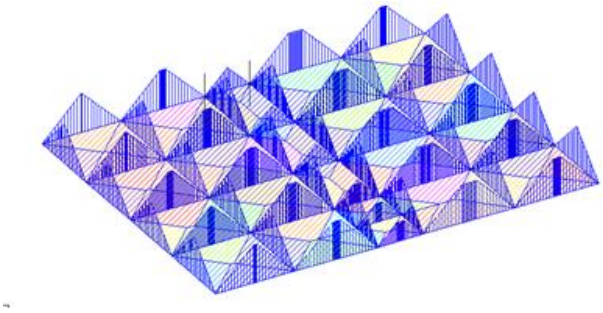
3. Design of column

A column may be defined as an element used primary to support axial compressive loads and with a height of a least three times its lateral dimension. The strength of column depends upon the strength of materials, shape and size of cross section, length and degree of proportional and dedicational restrains at its end.

Details of the structure



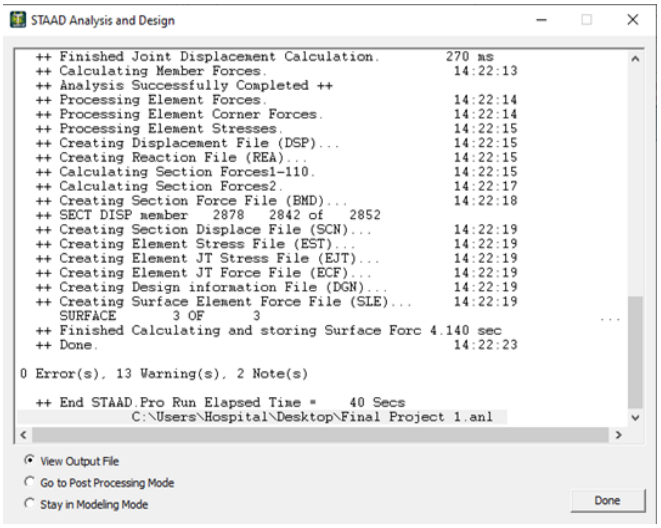
3D Rendered View



IV. Results and conclusion

We encountered some warnings while analyzing the building such as: some beams were supposed to be merged but they weren't. so we merged the beams wherever necessary and decreased the number of warnings.

We have calculated the wind load manually and compared with the result of the software and they were almost the same.



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