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G+10 MULTI-STOREYED RESIDENTIAL STRUCTURE SEISMIC ANALYSIS USING STAAD PRO COMPUTER AIDED DESIGN

M.Padmakar Assistant Professor, padmakarmaddala@gmail.com

CH.Ananth, B.Tarun Under-Graduate, ananth452001@gmail.com

Department of Civil Engineering, Vignan's Institute Of Information and Technology,Visakhapatnam-530049

Rojeena Mathew Professor, GITAM University, Visakhapatnam- 530049, rgeorge@gitam.edu

ABSTRACT:

In general, a structure should be built to endure natural disasters and unexpected events. To compete in the ever-increasing global market, a structural engineer must be diligent in his work, accounting for all possible loads that affect a building's behaviour when it is subjected to unanticipated loading.

As a result, the goal of this project is to research and design a G + 10 multi-story building that considers all types of loading, including dead load, live load, wind load, and, most critically, seismic loads.

Traditional approaches such as the moment distribution method, the flexibility matrix approach, and STAAD Pro, a computer-aided software, are used in the analysis. The multi-story structure is designed using the Indian Standard Code IS 456.

The loads are calculated as follows: dead and live loads are calculated according to IS 875 Parts I and II design standards, wind loads are calculated according to IS 875 Part-III, and seismic loads are calculated according to IS 1893:2016.

The structure is modelled and defined using STAAD Pro software, and parameters such as shear force, bending moment, and deflection are obtained as a result.

The structural analysis findings are analysed using both digital and manual calculations, and the design is carried out to produce the best possible results.

INTRODUCTION

As a way of obtaining better economy and efficiency, construction in the twenty-first century is becoming increasingly complex. To address these challenges and save time, engineers use computer-based software tools. STAAD Pro is a computer-based software tool for analysing and designing a variety of buildings. STAAD Pro allows engineers to digitally analyse and design any building.

After learning theoretical knowledge about building analysis and design, we used this programme to analyse and design a G+10 residential building for this assignment. Our proposal includes an analysis for a G+10 residential construction with four flats on each floor, as well as loads.

In this study, we investigate a G+10 residential construction with four flats on each floor, taking into consideration earthquake, wind, dead, and living loads. After the study, the design for columns and beams is done in staad pro.

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The structural system's components are chosen and detailed as part of the design process. The primary purpose of reinforced concrete design is to construct a safe and cost-effective structure.

Slab Design

Beam Design

Column Design

Structural design stages:

The steps of structural design are as follows:

• structural planning, load computations,

• method of analysis, member design and detailing,

• drawing and schedule preparation.

STAAD PRO

STAAD PRO is a world-renowned structural analysis and design software programme. It backs up about 90 international design standards for steel, concrete, wood, and aluminium. It can perform static analysis as well as more contemporary approaches as pdelta analysis, geometric non-linear analysis, Pushover analysis (Static-Non Linear Analysis), and buckling analysis.

It can also perform time history analysis and response spectrum analysis, among other dynamic analytic approaches. The response spectrum analysis capabilities may support both user-defined and international code-specified spectra.

AUTOCAD

AutoCAD is a powerful piece of software that Auto Desk licences. "Auto desk company" and "CAD" (computer-aided design) are phrases that are interchanged. AutoCAD can be used to design numerous layouts, details, plans, elevations, and sections, as well as display various sections.

Civil, mechanical, and electrical engineers will find it quite useful. Every engineer must master this software due to its importance. Auto CAD was used to create the design and elevation of a residential structure.

CONCEPT OF SEISMIC ANALYSIS

Seismic analysis is a subset of structural analysis that involves calculating the response of a structure (whether it is a building or not) to earthquakes.

Seismic analysis is a method for evaluating structural reaction used in the construction of earthquake-resistant structures and/or retrofitting vulnerable existing structures.

The kind of construction is RCC framed.

Structure made of RCC RCC framed structure is the construction type. RCC framed AAC blocks are one method of construction.

Two-bedroom apartment 38.5 x 25.35 metre plot 11 (G+10) Storey No.

1 2

3 m between floors; 150 mm wall thickness; 0.6 mm plinth height; 125 mm slab thickness

G +10 Storey Building Modelling STAAD PRO FOR ANALYSIS AND DESIGN

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Shear wall thickness: 300mm; beam and column sizes: 460mm x 230mm; concrete grade: M30;

Fe415 is a steel grade that can be used in any application.

A sort of load is seismic.

Zone V, or Zone factor 0.36; Response reduction factor: 5; Importance factor: 1; Seismic zone: Zone V, or Zone factor 0.36; Response reduction factor: 5; Importance factor: 1; Seismic zone: Zone V, or Zone

0.36 zone factor; 5 response reduction factor

1; importance factor

Zone V, is a seismic zone.

Soil type: medium

The damping ratio is 5%.

Wind gusts: 50m/sec basic wind speed

Terrain classification: III 0.587 sec Px (period in x direction) 0.836 sec Pz (period in z direction)

0.8 exposure factor for dead loads

The self-weight of the structure

4.025 KN/m (Main wall) Sidewalls: 0.992 KN/m (Parapet wall)

16.39 KN/m (along length) Slab load for staircase: 8.81 KN/m (along width)

Floor load of 4.7 KN/m3 plus slab load

Shear wall load of 7.5 KN/m2

Live loads on the stairwell, 6.975 KN/m is a force per metre unit (along length) ,3.75 kilogrammes per metre (along width)For a residential building, 2 KN/m3

OBJECTIVES:

The purpose of this study is to develop a structural framework plan.

I'm working on a model in STAAD PRO.

1.To analyse the entire analysis and design of a building using software.

2.The goal of this project is to look at how earthquake loads affect the structure.

3.The member is subjected to loads.

4.A structural investigation.

5.Design of the structure (manual design)

SCOPE OF THIS STUDY:

The goal of this research is to learn the basic concepts of structure utilising IS codes. To examine the structure's structural details.

i. To comprehend the beams, slab, column, staircase, and other structural entities' design parameters.

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ii. Using tools for extensive design and analysis, create a 3D model of the structure.

iii. To use STAAD pro software to design and analyse a G + 10 residential structure with the highest level of accuracy and economic value.

iv. The main goal is to use these two applications to analyse and design a multi-storey structure.

METHODOLOGY:

Civil engineering is primarily concerned with structural design.

The design of the basic components and parts of a building,

such as slab, beams, columns, and footings, is the most fundamental in structural engineering.

The steps in the structure design process are as follows:

Structural Design,

Load Calculation,

Structure Analysis,

Member Design,

Drawing,

Detailing.

RESULTS & TABLE :

1. Values of shear force and bending moment for various floors

Height (m)	Shear Y(KN)	Bending Z(N-m)
3.5	2845.326	1398.226
7	2308.316	1277.217
10.5	1931.583	1139.601
14	1601.843	999.554
17.5	1273.615	858.311
21	950.108	721.468
24.5	778.506	580.144

2. Beam reinforcement details

FLOOR	Mu in (kNm)	Ast (in m^2)	Reinforcement
FLOOR - 1	1398.22	4157.95	6 no's - 20 dia
FLOOR - 2	1277.21	4157.85	6 no's - 20 dia

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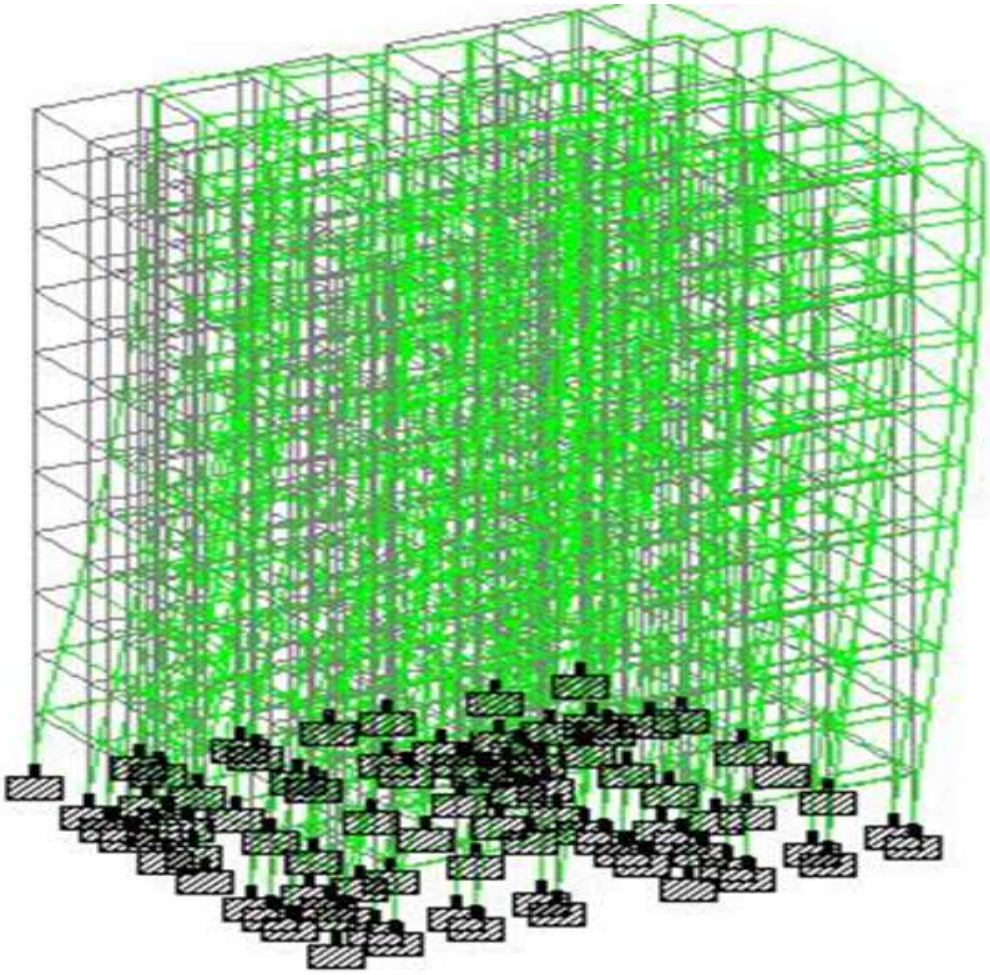
FLOOR - 3	1139.6	4157.65	6 no's - 20 dia
FLOOR - 4	999.55	4157.63	6 no's - 20 dia
FLOOR - 5	858.31	4156.81	6 no's - 20 dia
FLOOR - 6	721.46	4156.8	6 no's - 20 dia
FLOOR - 7	580.14	4156.73	6 no's - 20 dia
FLOOR - 8	433.23	4156.7	6 no's - 20 dia
FLOOR - 9	304.49	4156.64	6 no's - 20 dia
FLOOR - 10	227.18	4156.57	6 no's - 20 dia

3. When a wind load is applied in the X direction, the entire structure deflects.



4. Seismic load

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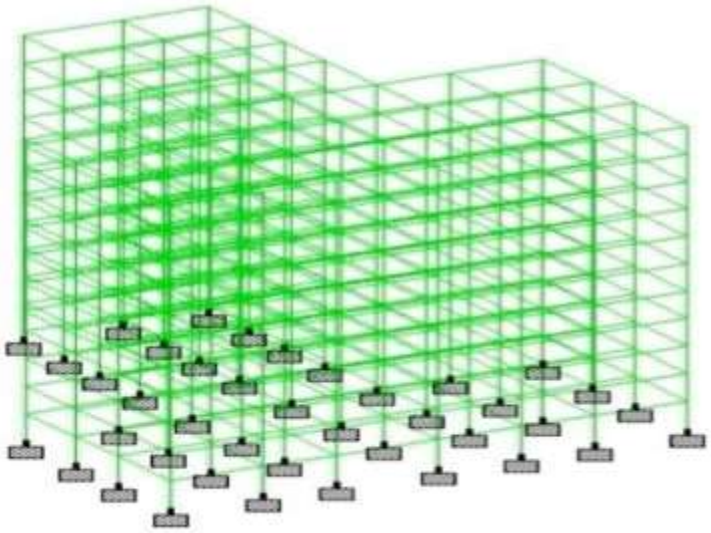

CONCLUSIOIN:

When manual methods and STAAD Pro findings are compared, STAAD Pro produces higher shear force, bending moment, and deflection values.

As a result, the structure is constructed to reflect those values.

The findings are as follows:

The shear force on the beam is -0.84KN.

The bending moment in the beam is 1.96 KN-m.

The deflection of the beam is -0.45m.

0.79KN is the column shear force.

The bending moment in a column is -0.75KN-m.

The deflection of the column is -0.605m.\

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