Analysis of G+10 Residential Building By STAAD Pro

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Abstract- computer aided "design and analysis of G+10 residential building" involves analysis of building frames by using staad pro. conventional method of analysis involves lot of complications and tedious calculations such analysis is a time consuming task. analysis can be made quickly by using softwares Staad pro is the leading design software in the market many design companies use this software for their project design purpose. hence this project mainly deals with the analysis of building by using staad pro Considerably improvement in the earthquake resistant design has been observed in resent past. As a result Indian seismic code IS 1893 has been revised in year 2002,after a gap of 18 years. This project present the seismic load and wind load estimation for residential building as per IS:1893-2002 and IS:875-2015 Part 3 recommendations. For RC framed residential buildings of G+10 are consider and analyzed as per IS:456-2000. The seismic forces computed by IS:1893-2002 are found to be significantly higher when compared with wind forces for analyzed a residential building one has to consider all the possible loadings and see that the structure is safe against all possible loading conditions. There are several methods for analysis of different frames like kani's method, cantilever method, portal method, matrix method. the present project deals with the analysis of a residential building of G+10. The dead load and live loads are applied and the design for beams, column, footings is obtained by staad pro with is new feature surpassed its predecessors, and compotators with its data sharing capabilities with other major software like autocad and ms excel we conclude that staad pro is a very powerful tool which can save much time and is very accurate in designs. Thus it is concluded that staad pro package is suitable for the design of a multistoried building.

Keywords: Analysis, Design, STAAD PRO, Residential building, gravity load, shear force, bending moment and axial force.

I. INTRODUCTION

Structural design is an art and science of designing, with economy and elegance, a safe, serviceable, and a durable structure. The entire process of structural planning and design requires not only imagination and conceptual thinking (which form art of designing) but also sound knowledge of science of structural engineering besides knowledge of practical aspects, such as relevant design codes and bye-laws, backed up by ample experience, institution and judgment. Here comes the role of civil engineering and more precisely the role of analysis of structure. The design consists of G+10 residential building. The building is designed for the 40(numbers) residential flats. Each storey consist of four 2BHK.The floor to floor distance is 3m. There are many classical methods to solve design problem, and with time new software's also coming into play. Here in this project work based on software named "STAAD. Pro" has been used. Few standard problems also have been solved to show how "STAAD. Pro" can be used in different cases. These typical problems have been solved using basic concept of loading, analysis, 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, 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 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 behavior. Few standard problems also have been solved to show how "STAAD. Pro" can be used in different cases. These typical problems have been solved using basic concept of loading, analysis, condition as per IS code. These basic techniques may be found useful for further analysis of problems.

1.1 Stages in structural design:

The process of structural design involves the following stages:

- Structural planning, Computation of loads,
- Method of analysis, Member design and Detailing,
- Drawing and preparation of schedules.

II. LITERATURE REVIEW

- V.Varalakshmi: The design and analysis of multistoried 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 multistoried G+4 building at Salem, tamilnadu, India. The study includes design and analysis of footings, columns, beams and slabs by using two software's named as STAAD.PRO and RCC Design Suit.
- L.G.Kalurkar: The design and analysis of multistoried G+5 building using composite structure at earthquake zone-3. A three dimensional modeling and analysis of the structure are carried out with the help of SAP 2000 software. Equivalent Static Method of Analysis and Response spectrum analysis method are used for the analysis of both Composite and RCC structures. The results are compared and found that composite structure more economical.

III. METHODOLOGY

- **MODELLING (G+10) Residential Building**
- **LOADS**

  Dead load

  Live load

  Floor load

  1.5(Live Load +Dead Load)

- **ANALYSIS:**

  Analysis of RCC framed structure.

  Shear Force and Bending Moment calculations.

- **DESIGN:** Design of Slab, Beam, Column, Footing and Staircase.
- **GEOMETRIC PARAMETRS:**

Beams:

Internal beams	300X400 Sq mm
External beams	230X400 Sq mm

Column:

Internal columns	300X450 Sq mm
External columns	230x400 Sq mm

Slabs:

Thickness=150 mm.

Shear wall:

Surface thickness=300 mm

IV. OBJECTIVES

- Generating structural framing plan
- Creating model in STAAD PRO
- Application of loads on the member
- Analysis of the structure
- Design the structure (manual design).

V. INTRODUCTION OF STAAD PRO

It is one of the effective software which is used for the purpose of analysis and design of structure by the structural engineers. Our project is aimed to complete with the help of Staad.pro STAAD Pro gives more precise and accurate results than manual techniques.

• Analysis and design tool

• GUI based modeling

• Input file/Output file

• Results as per Indian & other standard

• Report generation

ANALYSIS OF BUILDING ELEMENTS IN STAAD PRO:

The modeling analysis is done in the STAAD PRO.

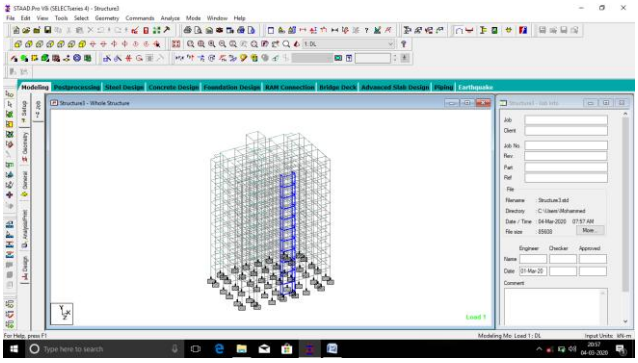


Fig 1: 3d modeling view

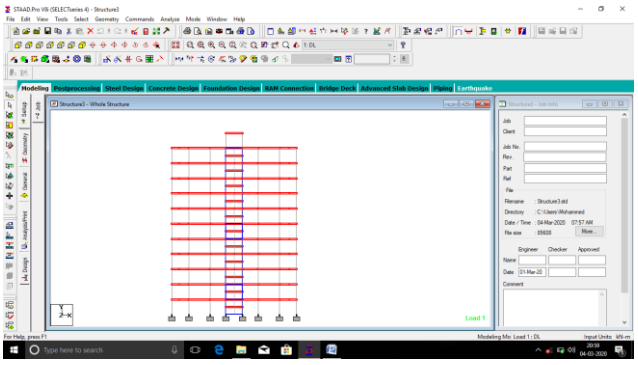


Fig 2. Beams representation

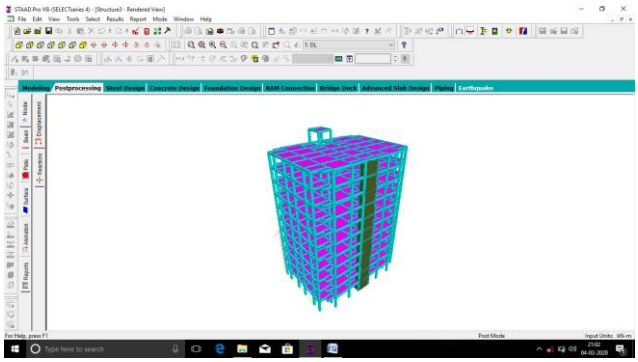


Fig 3. 3D rendering view

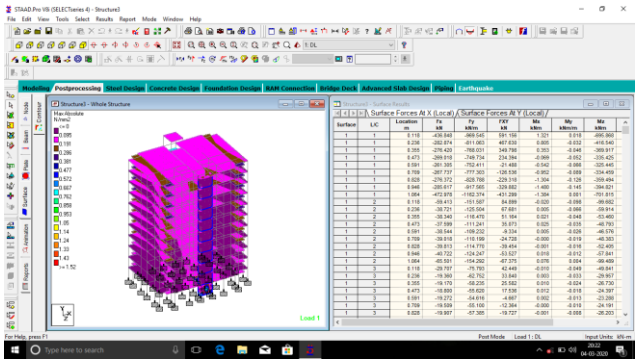


Fig: 07 Plates analysis

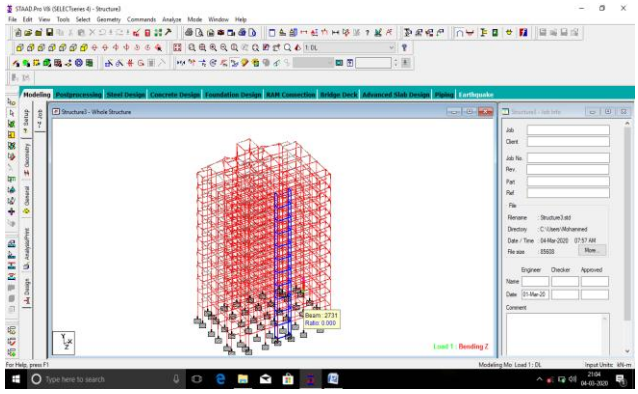


Fig 4. Bending moment diagram

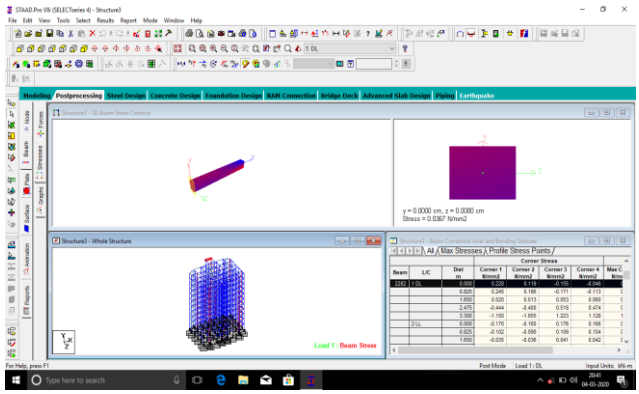


Fig 8: Exterior beam analysis

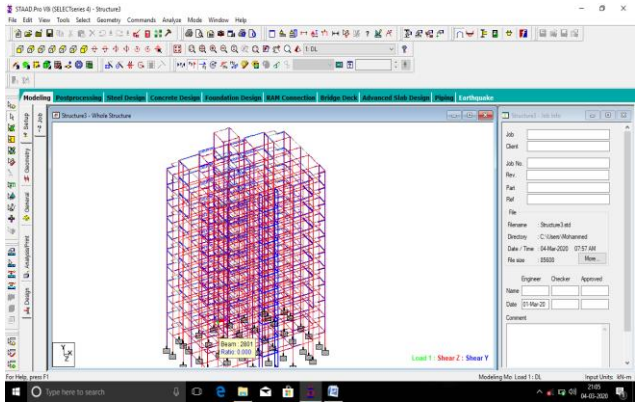


Fig 5. Shear force diagram

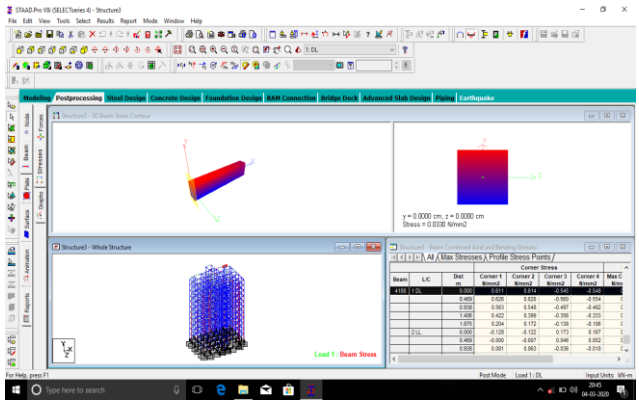


Fig 9: Interior beam analysis

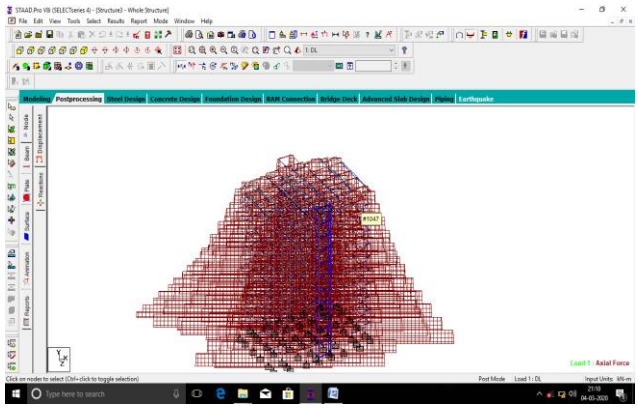


Fig 6. Axial force diagram

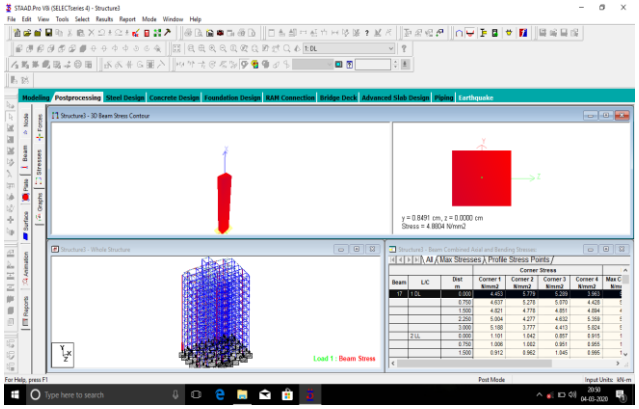


Fig 10: Exterior column analysis

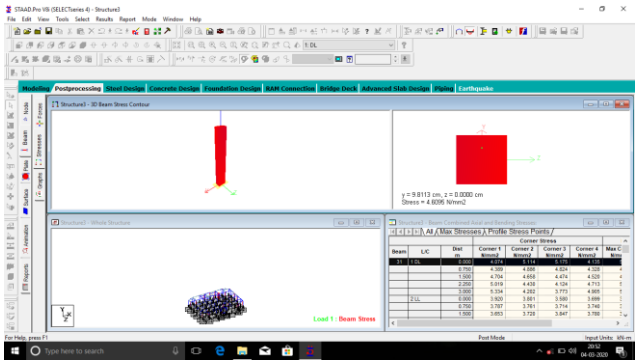


Fig 11:Interior column analysis

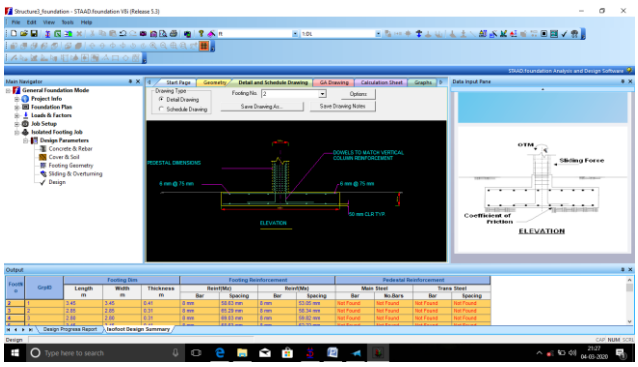


Fig 12:Footing analysis

5.2 Design of RCC elements

The RCC are slab, beam, column, footing and

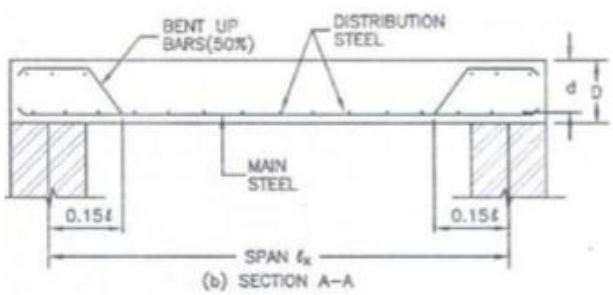
stair case etc...

5.2.1 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. On the basis of spanning direction: It is two type one way slabs and two way slab.

5.2.1.1 One way slab: When the slab is supported on two opposite side parallel edges, it spans only in the directions perpendicular to the supporting edges. It bends in one directions and main steel is provided in the directions of the span. Such a slab is known as one-way slab.

5.2.1.2 Two way slab: When the is supported on four edges and the load distribution is also on four edges of the panel. The reinforcement is provided on both the sides. Such slab is known as two way slab.



5.2.2 Design of beam

There are three types of reinforced concrete beams

1 Single reinforced beams

2 Double reinforced beams

5.2.2.1 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.

5.2.2.2 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.

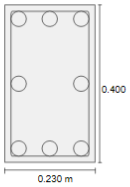
Design of beam :

Interior beam detailing :

STAAD.Pro Query Concrete Design

Beam no. 3996

Design Code: IS-456



Design Load

Load	2
Location	Long Col
Pu(Kns)	5.810000
Mz(Kns-Mt)	10.720000
My(Kns-Mt)	0.050000

Design Results

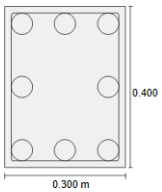
Fy(Mpa)	415
Fc(Mpa)	25
As Reqd(mm²)	157.000000
As (%)	0.983000
Bar Size	12
Bar No	8

Exterior beam design:

STAAD.Pro Query Concrete Design

Beam no. 2282

Design Code: IS-456



Design Load

Load	1
Location	End 2
Pu(Kns)	4.400000
Mz(Kns-Mt)	9.110000
My(Kns-Mt)	0.290000

Design Results

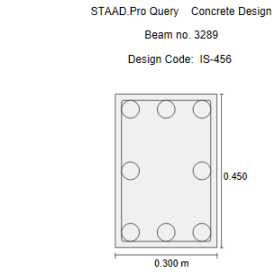
Fy(Mpa)	415
Fc(Mpa)	25
As Reqd(mm²)	139.000000
As (%)	0.754000
Bar Size	12
Bar No	8

5.2.3 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 ends.

Design of exterior column:



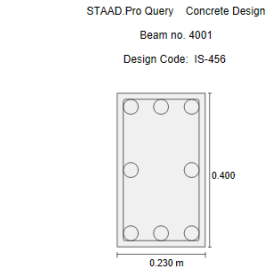
Design Load

Load	1
Location	End 1
Pu(Kns)	281.190002
Mz(Kns-Mt)	9.830000
My(Kns-Mt)	12.320000

Design Results

Fy(Mpa)	415
Fc(Mpa)	25
As Reqd(mm²)	202.000000
As (%)	0.670000
Bar Size	12
Bar No	8

Interior column:



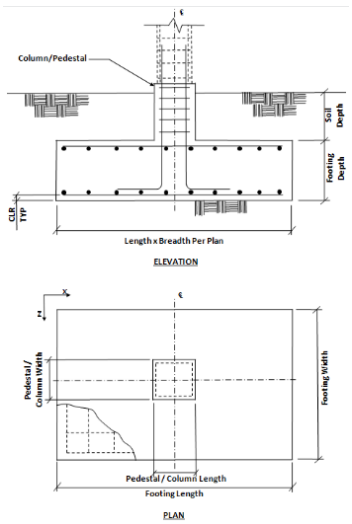
Design Load

Load	2
Location	Long Col
Pu(Kns)	23.049999
Mz(Kns-Mt)	10.180000
My(Kns-Mt)	2.780000

Design Results

Fy(Mpa)	415
Fc(Mpa)	25
As Reqd(mm²)	306.000000
As (%)	0.983000
Bar Size	12
Bar No	8

5.2.4 FOOTING: Foundations are structural elements that transfer loads from the building or individual column to the earth .If these loads are to be properly transmitted, foundations must be designed to prevent excessive settlement or rotation, to minimize differential settlement and to provide adequate safety against sliding and overturning



- **Column dimensions:**

Exterior column	Interior column
Length inX-direction = 0.450m	Length in X-direction = 0.400m
Width in Z-direction = 0.300m	Width in Y-direction = 0.230m

- **Soil properties:**

Soil type	Drained
Unit weight	22 Kn/m^2
Soil bearing capacity	100 Kn/m^3

- **Design parameters:**

Unit weight of concrete	25 Kn/m^3
Strength of concrete	25 N/mm^2
Yield strength of steel	415 N/mm^2
Min bar size	6 mm
Max bar size	32 mm
Min bar spacing	50 mm
Max bar spacing	500 mm
Pedestal clear cover	50 mm
Footing clear cover	50 mm

VI. CONCLUSIONS

1. Short term deflection of all horizontal members is within 20mm.

2. The structural components of the building are safe in shear and flexure.

3. Amount of steel provided for the structure is economic.

4. There is no such large difference in analysis results of STAAD Pro and Kanis method.

5. Proposed sizes of the elements can be used in the structure.

REFERENCES

[1] V.Varalakshmi, G. Shiva Kumar and R. Sunil Sarma, Analysis and Design of G+5 residential building, mini project report, Marri Laxman Reddy Institute of Technology and Management, Dundigal, Hyderabad, India-2014.

[2] P. Jayachandran and S. Rajasekaran, Structural Design of Multi-story Residential Building for in Salem, India, mini project report, PSG College of Technology, Coimbatore, Tamil Nadu, India-2006.

[3] Mahesh Suresh Kumawat and L.G. Kalurkar, Analysis and Design of multistory building using composite structure-2014.

[4] Divya kmath, K.Vandana Reddy, Analysis and Design of reinforced concrete structures-A G+5 building model, mini project report, Gokaraju Rangaraju Institute of Engineering and Technology, Hyderabad, India- 2012.

IS CODES :

IS 456-2000 (Design of RCCstructural elements)

IS 875-Part 1 (Dead Load)

IS 875-Part 2 (Live Load)

SP-16 (Depth and Percentage of Reinforcement)

SP-34 (Detailing).