ANALYSIS AND DESIGN OF G+17 STOREY BUILDING BY STAAD PRO

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Abstract: STAAD.PRO is a Structure Analysis designing software, it consists of a state-of-the- artwork person interface, visualization gear and global layout codes, and it's far a determination of behavior of systems to analysis the responses of actual systems consisting of buildings, bridges, trusses, etc. The fundamental concept that the earthquakes happened in multi storied buildings suggests that if the systems are properly designed and built with enough power it will now no longer ends in the entire fall apart from the shape. For making sure the protection in opposition to seismic forces of multi saved constructing hence, there is wanting to examine seismic evaluation to layout earthquake resistance shape. The precept objectives of this paper are to ponder the seismic evaluation of creation for static and dynamic research in normal second resisting body and unusual second resisting body. We have taken into consideration the residential constructing G+ 17 storied shape for the seismic evaluation. Finally, we can make a try to the residential constructing G+17 multi saved Structure the use STAAD.PRO software was used to analyses the overall structure.

Keywords: **STAAD PRO, high rise building, Building Analysis, Seismic Zones, Structure, residential building, seismic load.**

I. INTRODUCTION

People are presently coping with problems along with land shortage and excessive land prices. The populace explosion and the appearance of the economic revolution led to an exodus of humans from villages to city areas, implying that the development of multi-tale homes for each residential and business function has grown to be unavoidable[1]. The excessive raised systems aren't well-designed for lateral pressure resistance it may want to cause the fall apart from the systems. Some elements have an impact on the layout of earthquake-resistant systems. Natural frequency of the shape, damping component, form of foundation, significance of the constructing, and ductility of the shape are the elements. Structures designed for ductility must be designed to decrease lateral hundreds because of higher second distribution this component is sorted through reaction discount component R for distinctive form of shape[2]. Under the action of seismic excitation, unsymmetrical buildings necessitate careful analysis and design. Buildings near the edge of a stretch of hills or on sloping ground suffered significant damage in a previous earthquake[3].

II. LITERATURE REVIEW

A significant portion of this research focuses on various structural aspects of structure use and their applications .Many people have published mechanisms .agents of investigation Technical examinations of some of the papers are summarised below.

D.Ramya and A.V.S.Sai kumar:- Design and analysis of G+10 Multistore building . The study incorporates the relative investigation of building utilizing two programming i.e STAAD-Pro and ETABS. In this plan Live, Dead and wind load is taken under consideration[4].

Mukundan H. et al. (2015) , he analysed G+9 storied building structure for zone 4. which have high frequency of earthquake he tracked down that the shear divider course of action for the design. He finished up those shear dividers are more impervious to the equal loads in this construction and for safe plan. Additionally, he concludes that the thickness of shear divider is around 150 to 400 mm[5].

Deshmukh D. R, Yadav.A.K , Supekar S.N , Thakur A.B, Sona disappear H.P and Jain I.M :- Examination and Plan of G+19 Multistoried Building. The study incorporates planning of multistorey structure by notable structural designing programming named as STAAD-PRO and it also incorporates wind and Seismic load. They also look at the consequences of earthquake load applied on structure by STAAD-PRO and manual estimations both by seismic coefficient method[2].

A.K. Yadav et.al This study was focused on to develop, design and analysis model of skyscraper building in STAAD-PRO. In this research the plan depended on IS875-part1 for dead load, IS875-part 2 for live load IS875-part 3 for wind load IS code1893-2002 for earthquake load resistant criteria which stated these pirate analysis criteria based on Zone of area IS456-2000 for concrete design in this work or research the analyst found that the earthquake load take place in x-direction acting on the building, in this study were found that the deflection and height of the building are direct proportion as height grows the deflection also grows[6].

Khan et al. (2016), in this paper he works on impact mass consistency on various floor in Reinforced concrete structure its they are undertaking for works for seismic investigation for reinforced concrete section in this paper he has done work for analyse and design for seismic zone[7].

Akash and Ravi 2017 Studied analysis and design of G+6 building in different Seismic zones in India. This study was focused on analysis of a building in the effect of seismic load in different zones in India. The design of seismic load in different Zones was based on Indian Standard Code (I.S1893). The main objectives of this Paper were to compare the variation of steel percentage, maximum shear force, maximum bending moment and maximum deflection in different seismic zone. From the analysis, it was concluded that the variations are drastically higher from zone II to zone V. The steel rate, maximum shear force, maximum bending moment, maximum diversion is increments from zone II to zone V[8].

III. METHODOLOGY

A Model of G+17 Storey is developed, analysis and design using STAAD-Pro software. Building plan size is 30m × 40m. The structure is arranged in Pune in tremor zone III. seismic zone coefficient is taken as 0.06 according to IS code. Following specifications are given to the structure:

Detail	value
Column	0.6 m × 0.5 m
Beam 1	0.5 m × 0.4 m
Beam 2	0.45 × 0.3 m
Slabs	0.13m thick
Parapet Wall	0.1 m
Live load	2kN/m2
Floor Finish	1.5kN/m2
Grade of concrete	M25
Grade of steel	Fe 500
Height floor to floor	3.2 m

Calculation loads as per Indian standard.

There are various types of loads acting on the structure.

Dead load (DL): The dead load, also known as permanent or static loads, consists of all the weight of the walls, floors, partitions, false ceiling, false floor, and other permanent construction in the building. The DL is calculated using the member size and estimated material density, as well as the unit weights of plain and reinforced concrete made with sand and gravel or crushed stone aggregates[9].

Live load (LL): The weight of mobile segments, circulated and concentrated loads, load due to effect and vibration, and dust loads are delivered by the planned use or occupancy of a structure. Wind, seismic action, snow, and loads forced by temperature changes to which the construction will be exposed, creep and shrinkage of the design, and differential settlements to which the design may be subjected are examples of forced burdens[10].

Wind load (WL): Wind load is the movement of air relative to the earth's surface. The primary cause of wind can be traced back to the earth's rotation and differences in earth radiation. Radiation impacts are primarily responsible for either upward or downward convection. At high wind speeds, the breeze generally blows from the horizontal to the ground. Because vertical parts of air movement are generally small, the term "wind" only refers to the even wind, and vertical breezes are frequently recognised in that capacity. Wind speeds are to be measured using anemometers or anemographs, which are installed at meteorological observatories at heights ranging from 10 to 30 meters above the ground[11].

Self-weight: STAAD can calculate the structure's self-weight. Use the self-weight command in the load case column to help itself.

Supports: The structure's base support is designated as fixed.

Combination of loads

Load combination for Static analysis:

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

Load combination for dynamic analysis:

- DL +LL
- DL+WL
- DL+0.8LL+0.8WL

Building Data for Analysis

G + 17 is the proposed building for the project. The building data that has been considered is provided below.:

Building Specifications: -

Number of stores: G +17 Storey Residential building.

Length of the building in Y direction: 57.6

Length of the building in X direction: 40 m

Length of the building in Z direction: 30m

Inter Storey height of the building: 3.2m (height floor to floor)

Foundation deep is: 1.5m

DESIGN OF G + 17 Residential BUILDING USING STAAD. PRO

Step - 1: Importing a center-line plan in.dxf format from AutoCAD.

Step - 2: Nodal point formation. We entered the node points into the STAAD file based on the column positioning of the plan.

Step - 3: Beams and columns are represented. We had drawn the beams and columns between the corresponding node points using the add beam command.

Step - 4: A 3D view of the structure. To obtain a 3D view of the structure, we used the Transitional repeat command in the Y direction.

Step - 5: Assigning properties and providing support Following the creation of the structure, the supports at the structure's base are specified as fixed. Materials were also specified, and the cross section of beams and column members was assigned.

Step - 6: View of 3D rendering. The 3D rendering view of the structure can be displayed after assigning the property.

Step - 7: The assignment of dead loads. Dead loads for external walls, internal walls, and parapet walls are calculated in accordance with IS 875 PART 1 and include the structure's self-weight.

Step - 8: The assignment of live loads. Based on IS 875 PART 2, live loads of 2 kN/m2 are assigned to each floor.

Step - 9: Load combinations can be added. Following the assignment of all loads, the load combinations are given with an appropriate factor of safety in accordance with IS 875 PART 5.
Step - 10: After completing all the preceding steps, we performed the analysis and checked for errors.
Step - 11: Create. Finally, concrete design is carried out in accordance with IS 456: 2000 by defining appropriate design commands for various structural components. Following the reassignment of commands, we checked for any errors.

IV. RESULTS & DISCUSSION

The seismic load values were calculated in accordance with IS 1893-2002. STAAD is an abbreviation for "Standard According to the IS code, Pro has a seismic load generator.

$$A_h = \frac{z}{2} \times \frac{I}{R} \times \frac{S_a}{g}$$

$$T = \frac{0.09H}{\sqrt{d}}$$

Where S_a/g depends upon Natural period(T)

$$V_b = W \times A_h$$

$$Q = \frac{WH^2}{\Sigma WH^2} \times V_b$$

Where, Z= zone factor
I= Importance factor
R= Response reduction factor
S_a/g =Average response acceleration coefficient
W= Total dead load plus approximate imposed load
A_h= Design horizontal acceleration coefficient
V_b =Design seismic Base shear
Q= Design Lateral force
T= Natural period
d= Base dimensions

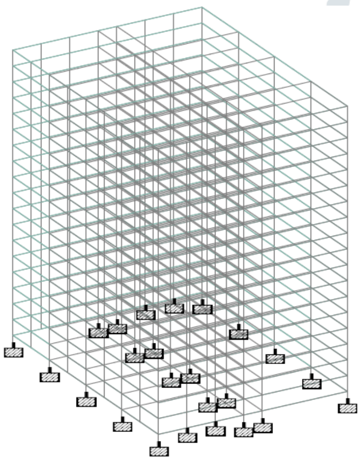

fig 1: whole building in staad-pro

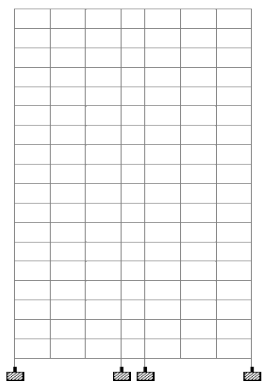

fig 2: elevation of the building

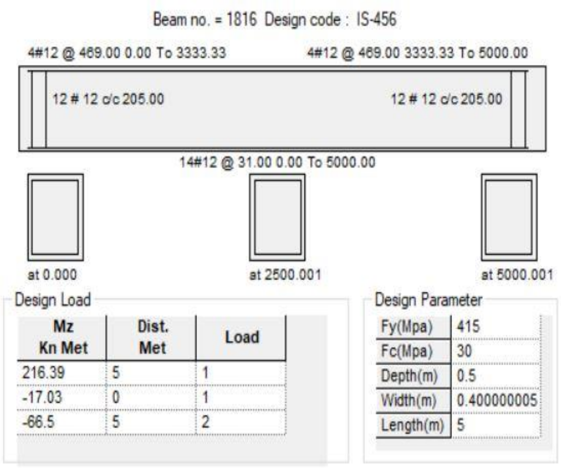

fig 3: concrete design of beam 1816.

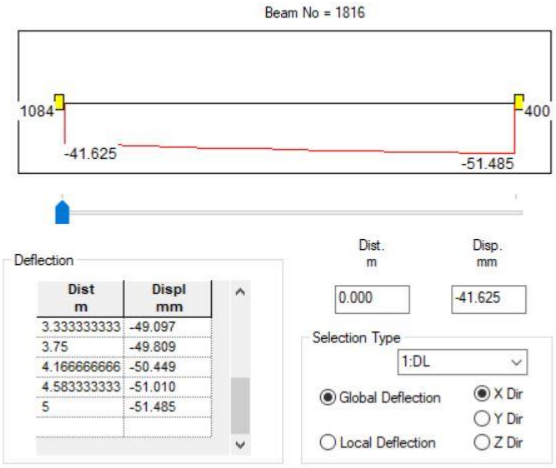

fig 4: deflection in beam 1816.

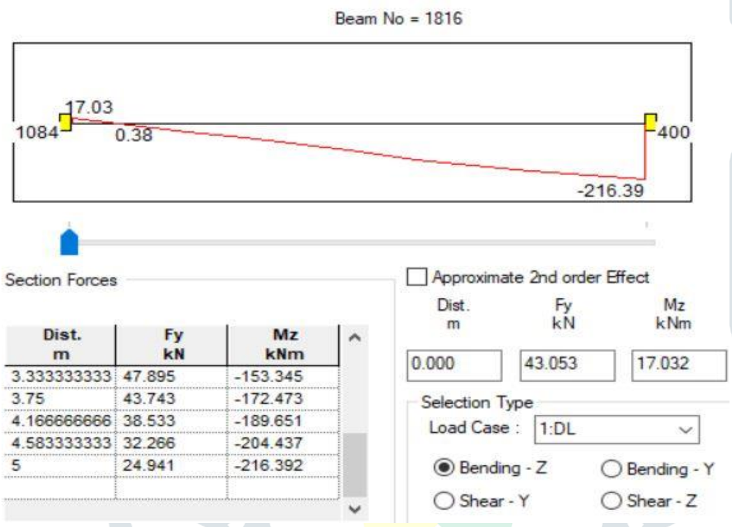

fig 5: shear bending of beam 1816.

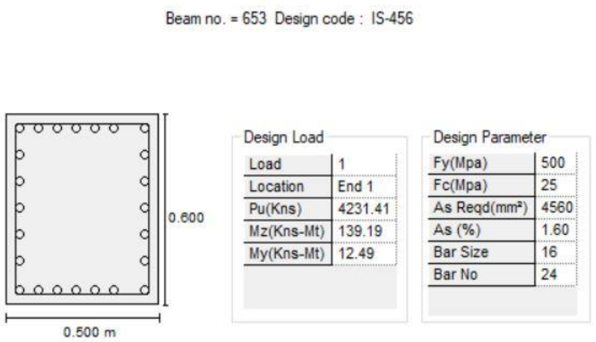

fig 6: concrete design of column 653.

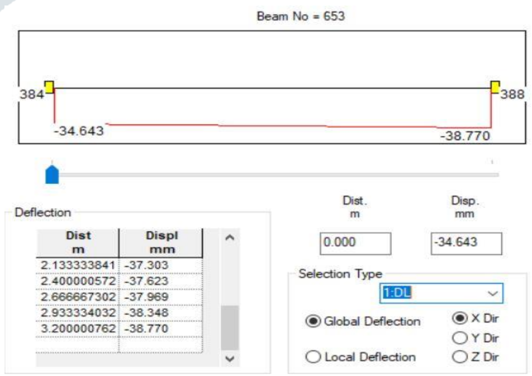

Fig 7: Deflection in Column 653.

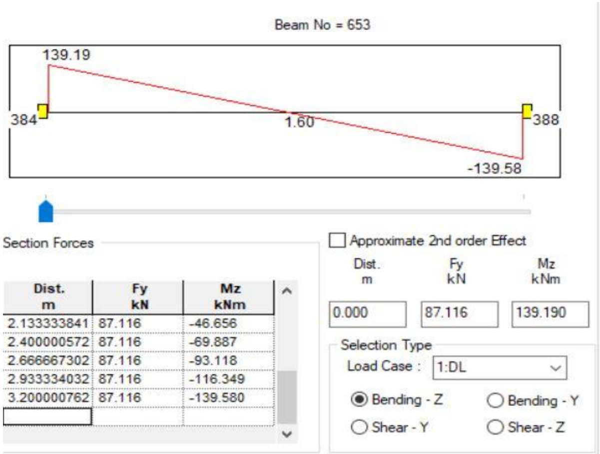

Fig 8: Shear Bending in columns 653.

IV. CONCLUSION

STAAD PRO is a versatile software that can calculate the reinforcement required for any concrete section as well as determine lateral deflection due to earthquake load. It saves more time. Because we have entered the data into software and obtained the results of the analysis as an output, the program includes several parameters that are designed in accordance with IS: 456(2000) and IS 1893:2002. The behavior of the structure varies depending on the shape of the structure. As a result, the structure should be analyzed for each angle and designed to have the greatest shear force and moments. Various structural actions on members, such as axial, flexure, torsion, and so on, are considered based on their response. Excessive deflection occurs in high-rise structures. The analysis has been completed for the G+17 building. IS Coda limits the serviceability of the Deflection obtained by STAAD pro. And base shear is very important. It provides the foundation shear for entire structures.

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