

COMPARISON DESIGN RESULT OF RCC BUILDING USING STAAD AND ETABS SOFTWARE

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Abstract— *STAAD and ETAB are the present day leading design software's in the market. Many design Companies using this ultimate encoded software. Consequently, this venture development of the project mainly deals with the virtual analysis of the results obtained commencing the design of concrete frame multi-story structure when designed using STAAD and ETAB software separately. In these modern days the Buildings are made to fulfil our basic aspects and better Serviceability. It is not a topic to build a configuration at all how its, significant to assemble an efficient building which will serve for many years without showing any failure.*

Keywords— *Comparison, Static analysis, Regular, Irregular, STAAD PRO and ETABS*

I. INTRODUCTION

In 21st century, owing headed for massive inhabitants the numbers of areas in units are diminishing gradually. Few years sponsor the populations were not so vast as a result they used to stay in Horizontal co-ordination system (due to large area available per person). however at the present a day's people preferring Vertical co-ordination System (high-rise building due to deficiency of area). In high-rise buildings, we should concern about all the forces that take action on a building. It's have weight, as well as the soil demeanour or compartment capacity. For external forces that perform on the edifice beam, column, and reinforcement supposed to be good enough to counteract these forces lucratively.

The soil ought to be superior enough to distributing the load effectively to the establishment. For loose soil, we preferred deep foundation (pile). Calculation for a high rise construction manually then it will take extra time in addition to human individual errors possibly will be occurred. Consequently, the use of STAAD and ETAB will make it easy.

Solve typical problem in Static analysis, Seismic can analysis and Natural frequency of time period and zone factor. This type of problem solved by STAAD-PRO and ETAB along with referring IS codebook. Moreover has a greater benefit than the instruction manual technique as it gives more truthful and precise result than the manual technique. STAAD-PRO and ETAB was born giant. It is the most popular software used now days. It is performing design works.

A. Objectives of the study

The main purpose of this study-oriented project is to detailed study of simulation tools for analysis and designing of structures Comparison of simulation implements STAAD PRO, and ETABS, and analysis of rectangular Plan with vertical regular and rectangular Plan with Vertical geometrically irregular multi-story building using static analysis method.

II. PROBLEM FORMULATION

A. TYPES OF LOAD USED

1. **DEAD LOAD (DL):** Dead load defined as the load on a structure owing to it is possess weight (self-weight). It also added other loads if some permanent structure added to that structure.
2. **LIVE LOAD (LL):** Live load or impose load is distinct load on the structure due to distressing weight. The live load varies according to the type of structure. For example, usually for a Residential Building the live load taken as 2 to 3 Kn/m²
3. **WIND LOAD (WL):** Wind load distinct on a structure due to wind intensities. In broad-spectrum, wind intensities diverge from time to time. Therefore, it recommended taking maximum probable wind intensities calculation should be avoided tremendous effect of human life and structure life.
4. **SEISMIC LOAD Or EARTHQUAKE LOAD (EQ):** Seismic load calculated captivating the observation of acceleration response of the position to the burnt brick masonry structure to a difficulty of earthquake intensity divided into 4 zones.
 - Zone factor zone and I factor II a recombined as zone factor II.
 - Zone factor III.
 - Zone factor IV.
 - Zone factor V.

B. CALCULATION OF LOADS

1. **MAIN WALL LOAD:** (Commencing above plinth area to below the Roof) should be the area of the cross sectional wall multiplied by unit weight of the brick. (Unit weight of brick taken as 12KN/m^3). Usually understanding concept of the plinth load to the IS-code be supposed to be partially of the main wall load. Internal plinth load should be half of the plinth load.
2. **SLAB LOAD:** Arrangement of slab load+ floor finishes of slab. Slab load be able to be deliberate by breadth and width of slab multiplied by unit weight of material (according to IS-code unit weight of concrete is taken as 2.5 Kn/m^3).
3. **FLOOR FINISH LOAD:** Floor load is a live load acting on the floor in a building, which taken as 1.5 KN/m^3 .
4. **LIVE LOAD:** Live load is functional all over the burnt brick masonry structure with the exception of plinth .usually Live load varies according to the types of structure. For inhabited, building live load is taken as -2 KN/m^2 on each floor and -1.5 KN/m^2 on roof. Negatives sign indicates its acting on downward direction.
5. **WIND LOAD:** Wind is atmosphere in movement comparative to the surface of the earth. The primary cause of wind traced to earth's rotary motion and differences in terrestrial emission. The emission special possessions are primarily accountable for convection either upwards or downwards. The wind commonly blows parallel to the ground at high wind speeds. Since vertical components full of atmosphere motion are comparatively diminutive, the term 'wind' denotes almost exclusively the horizontal wind, vertical winds always identified as such. The wind speed assessed with the give support to of anemometers or anemographs.

C. LOAD COMBINATION

For seismic analysis of a building, refer the code following load combination.

1. COMBINATION OF LOAD.

- $1.5(\text{DL} + \text{IL})$
 - $1.2(\text{DL} + \text{IL} \pm \text{EL})$
 - $1.5(\text{DL} \pm \text{EL})$
 - $0.9\text{ DL} \pm 1.5\text{ EL}$
- #### 2. SERVICE LOAD
- $1\text{DL}+1\text{LL}$

For wind load analysis of a structure, the system of arrangement or classification refers following load combination.

- $\text{DL} + \text{LL}$
- $\text{DL} + \text{WL}$
- $\text{DL} + 0.8\text{LL} + 0.8\text{WL}$

Both wind load and earthquake load are applied X in along the length and Z in along the width direction. These loads again applied further in negative X and Z direction. Therefore, for Seismic analysis, Wind load analysis, there are number of load combinations it is depend upon leading the contribution load prototype are assign in the concrete frame structure.

III. PLAN DETAILS

A. Rectangular plan with vertical Regular section

A 25m in X direction and 25m in Y direction and an 11 story building is modelled using both STAAD and ETAB Software's. The height of each story is kept as 3 m in the structure with the total height of the structure as 33 m. Analysis and design of the structure is done and then the results generated by these software's are compared and a conclusion is drawn from them.

1. Materials properties:

Steel:

- Modulus of elasticity of steel, $E = 200\text{ Gpa}$
- Poisson's ratio, $\mu = 0.3$
- Steel density = 77 Kn/m^3 (7.850 Kg/m^3)
- Yield strength of steel, $F_y = 450\text{ Mpa}$
- Ultimate yield strength of steel, $F_u = 450\text{ Mpa}$

Concrete:

- Characteristic strength of concrete, $F_{ck} = 25\text{ Mpa}$
- Density of concrete, $\rho = 25\text{ Kn/m}^3$

Building Parameters:

- Length and width =25mx25m
- No of story =11
- Story height=3m
- Main Beam=400mmx400mm
- Column 1-6=850mmx850mm
- Column 6-11=650mmx650mm
- Slab thick =120mm
- Support condition =fixed
- Beam release =axial force

Loading Conditions:

Dead Load:

- Dead Load =1Kn/m²
- Main wall load =12Kn/m²

Live Load:

- live load = 2Kn/m²
- Floor load=1.5Kn/m²
- Floor load pressure=4.625Kn/m²

Seismic weight:

- Dead load = 1 Kn/m²
- Live Load = 0.25Kn/m²

Seismic parameters:

- Code -IS 1893-2002 - Seismic analysis in X1 and X3 directions.

Load combo:

- Self-weight =1.5Kn/m²
- Wall load =1.5Kn/m²
- Floor load =1.5Kn/m²
- Live load =1.5Kn/m²

Method of combining approach shapes – Whole quadratic combination with:

- Damping ratio= 0.05 (5%)
- Zone = I (0.1)
- Soil type =Medium II
- Importance factor =1
- Response Reduction factor = 5
- Time period (Ta) = 0.54 sec (calculate as per 1893:2002)
- Wind intensity =36m for 1.617Kn/m

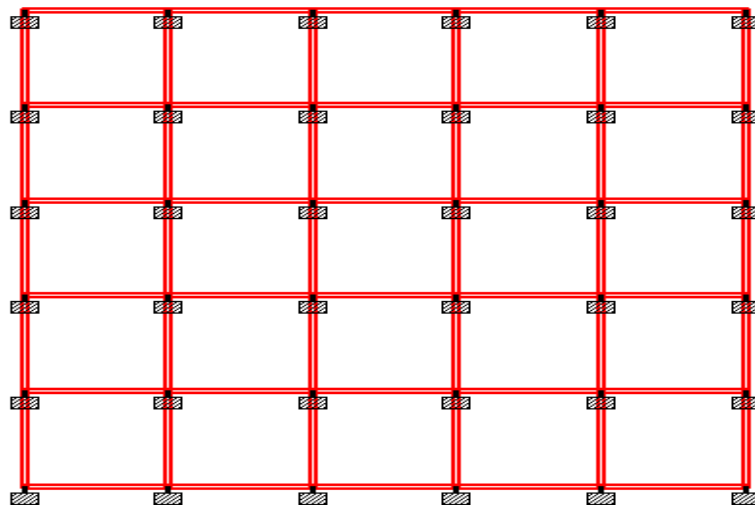


Fig. 1.Rectangular plan with vertical Regular section.

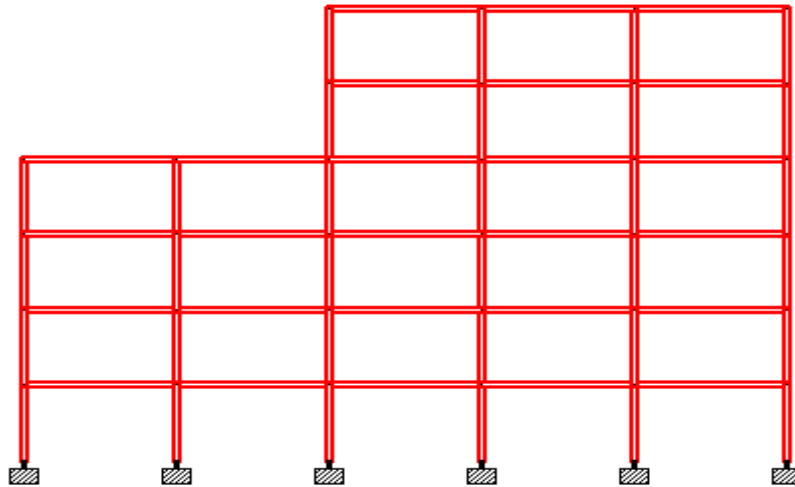


Fig. 2. Rectangular plan with vertical Irregular section

IV. RESULTS AND DISCUSSION

Result of vertical reaction of a sample node for different loads have been tabulated in table I

TABLE I
 VERTICAL REACTION OF DIFFERENT LOADS

Loading	STAADPro	ETABS
Dead load	1700.285	1700.176
Live load	213.32	212.91
Earthquake load Along the length	186.626	183.66
Earthquake load Along the width	185.626	182.63

TABLE II
 Bending Moment, axial force and Shear Force of a SAMPLE column

LOADING	FORCES	STAAD PRO	ETABS
Dead load	Axial force Fx	241.21	235.82
	Shear force Fy	19.879	16.31
	Shear force Fz	18.879	19.31
	Bending moment Mx	0	0
	Bending moment My	28.282	28.425
	Bending moment Mz	28.282	28.425
Live load	Axial force Fx	31.597	31.48
	Shear force Fy	3.899	4.05
	Shear force Fz	3.899	4.05
	Bending moment Mx	0	0
	Bending moment My	5.982	6.014
	Bending moment Mz	5.982	6.014
Combo load 1.5DL+1.5LL at the Support reaction	Axial force Fx	21.580	22.890
	Shear force Fy	3680.869	3702.563
	Shear force Fz	21.580	22.890
	Bending moment Mx	22.938	23.988
	Bending moment My	0	0
	Bending moment Mz	22.938	23.988

TABLE III
BENDING MOMENT AND SHEAR FORCE OF A SAMPLE BEAM

LOADING	FORCES	STAAD PRO	ETABS
Dead load	Axial force Fx	2292.209	2305.229
	Shear force Fy	12.637	13.058
	Shear force Fz	12.637	13.058
	Bending moment Mx	0	0
	Bending moment My	24.492	22.532
	Bending moment Mz	13.421	11.421
Live load	Axial force Fx	161.704	163.23
	Shear force Fy	1.749	1.63
	Shear force Fz	1.749	1.63
	Bending moment Mx	0	0
	Bending moment My	3.371	1.770
	Bending moment Mz	1.871	1.770
Combo load 1.5DL+1.5LL at the Support reaction	Axial force Fx	3680.869	3638.690
	Shear force Fy	21.587	20.981
	Shear force Fz	21.587	20.981
	Bending moment Mx	0	0
	Bending moment My	22.938	21.903
	Bending moment Mz	41.082	42.85

TABLE IV
BENDING MOMENT AND SHEAR FORCE OF EARTHQUAKE ALONG THE LENGTH AND WIDTH

LOADING	FORCES	STAAD PRO	ETABS
Earthquake along the length	Axial force Fx	13.562	14.89
	Shear force Fy	8.982	9.13
	Shear force Fz	0	0
	Bending moment Mx	0	0
	Bending moment My	0	0
	Bending moment Mz	9.54	9.205
Earth quake along the width	Axial force Fx	13.567	14.76
	Shear force Fy	8.982	9.13
	Shear force Fz	0	0
	Bending moment Mx	0	0
	Bending moment My	0	0
	Bending moment Mz	9.54	9.205

TABLE V
TOTAL REINFORCEMENT OF A SAMPLE BEAM AND COLUMN.

SECTION	TOTAL REINFORCEMENT	
	STAAD PRO	ETABS
Beam	1131	1048
Column	3380	3385

V. CONCLUSION

- Comparison of STAAD PRO and ETAB software is getting the result different manner difficult to understanding and lot of confusing during the assign the loading parameter and design.
- From the design results of beams, we may conclude that ETABS gave lesser area of required steel as compared to STAAD PRO. Similarly the column section required area of the steel similar both software's but in these case are considered in percentage 0.3% TO 0.5%
- Form the design results of column; since the required steel for the column forces trendy this certain problem is less than the minimum steel limit of column (i.e., 0.85%), the amount of steel calculated by both the software's is equal. Therefore, comparison of results for this case is not possible.



REFERENCES

- [1].Government of Bureau of Indian Standards: IS-1893, part 1 (2002), Criteria for Earthquake Resistant Design of concrete frame Structures: Part 1 General requirements of Buildings, New Delhi, India.
- [2].Government of Bureau of Indian Standards: IS-875, part 1 (1987), Dead Loads on Buildings and Structures, New Delhi, India.
- [3].Government of Bureau of Indian Standards: IS-875, part 2 (1987), Live Loads on Buildings and Structures, New Delhi, India.
- [4].Hammad Salahuddin, Saqib Habib, Talha Rehman (2010), Comparison design result of a building using ETABS V 9.7.1 & STAAD PRO v8 and 2005, university of Engineering and Technology, Taxila, Pakistan