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# Design & Analysis of Multi Storeyed Building (G+10) Using ETAB

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***Abstract:*** The objectives of this project are assessment between ETAB software and manually designs. The design includes load calculations and analyzing the whole structure by ETAB. The design methods used in ETAB analysis are Limit State Design conforming to Indian Standard Code of Practice. These involve ETAB Modelling, Study the members due to the effect of Wind (WL) & Seismic load (SL) & compare them for a 30 m height Building with Cement Concrete, Rebar & Steel construction. The proposal structure is a G+10 storied building with 3.00 m as the height to each floor. The overall plan dimension of the building is 21.50 m x 14.5m.

***Index Terms*** **- Multi-storeyed building, wind effect, seismic effect, manually calculation, Steel and cement concrete composite structure and ETAB.**

## I. INTRODUCTION

In every feature of human civilization needed structures to live in. Due to fast growth of population the area is declining, so for human needs it is require build multi-storeyed building. Complicated and high-rise structures need very time taking and bulky calculations using manual methods. Here in this project work based on software named ETAB has been used. ETAB provides us a fast, effective, easy to use and accurate platform for analyzing and designing structures. The main Objective of this project is the relative study on design and analysis of multi-storeyed building (G+10) by ETAB software and physically design. In this project we are going to analyses (G+10) building for bending moment, shear forces, deflections, and reinforced details for structure components of buildings such as Columns, Beam and Slabs to develop economic design. Standard problems can also be solved by ETAB. These representative problems have been solved using basic concept of analysis, loading, condition as per Indian Standard code. The problems which we have solved with ETAB. It is the most popular software used now a day. There are four steps using ETAB to achieve the goal.

i. Prepared the input file.
ii. Examine the input file.
iii. Watch the results and confirm them.
iv. Send the analysis result to steel design and concrete design engineers for designing purpose.

## II. METHODOLOGY

### 2.1 Assumptions

2.1.1 Materials:

i. Concrete grade: M30
ii. All steel grade: Fe415 grade
iii. Bearing capacity of soil: 290KN/M²

2.1.2 Density of materials used:

i. Plain concrete: 24 kN/m³
ii. Reinforced: 25 kN/m³
iii. Flooring material (cm): 20 kN/m³
iv. Brick masonry: 19 kN/m³

2.1.3 Live Loads:

i. Live load on slabs = 1.5kN/m²
ii. Live load on passage= 3.0kN/m²
iii. Live load on stairs = 3.0kN/m²

2.1.4 Assumptions in Design:

i. Using partial safety factor (FOS) for loads in according to clause 36.4 of IS-456-2000 as $\Upsilon_t$=1.5

ii. Partial safety factor (FOS) for material in according to clause 36.4.2 of IS-456-2000 is taken as 1.5 for concrete and 1.15 for steel.

iii. Using partial safety factors in accordance with clause 36.4 of IS-456-2000 combination of load

iv. D.L.+L.L. = 1.5

v. D.L.+L.L.+W.L.=1.2

**2.2 Equations**

2.2.1. Dead Load:

i. Self-Weight of column = 2.5kN/m

ii.Self-weight of beam = 2 kN/m

2.2.2 Wind load:

i. $V_z = V_b \times K_1 \times K_2 \times K_3$

ii. $P_z = 0.6\ V_z^2$

**2.3 Flow chart diagram:**

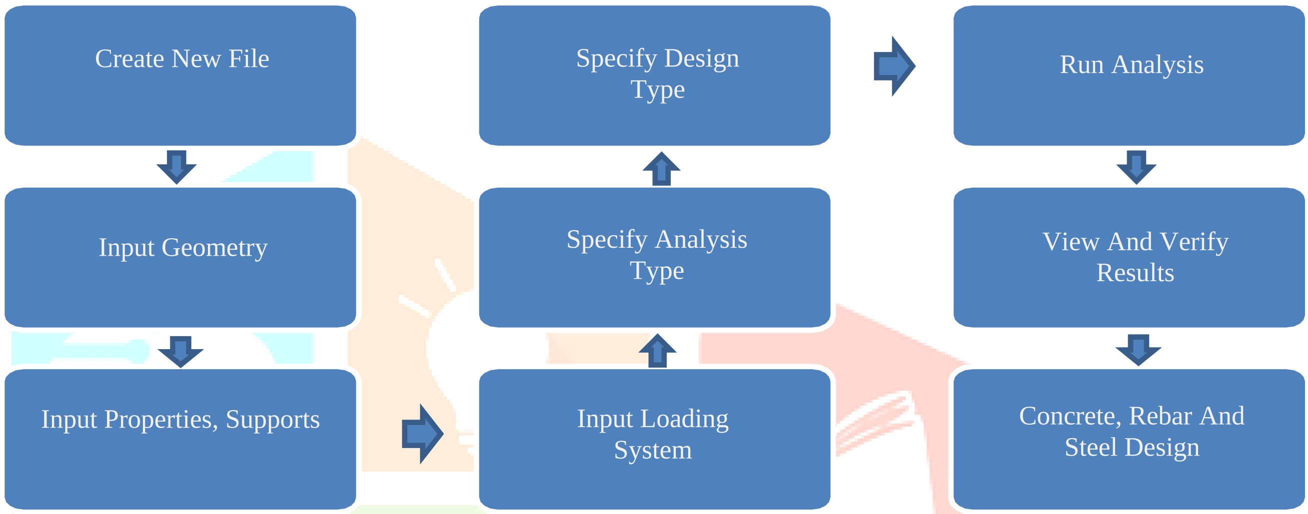


**Fig.1: flow chart diagram**

i.Column Size = 450mm X 450mm

ii.Beam Size = 450mm X 350mm

**III. RESULT OF QUANTITY OF STEEL REQUIRED**

We used some specific material as concrete, rebar and steel (tendons) and find their strength and modulus of elasticity as –

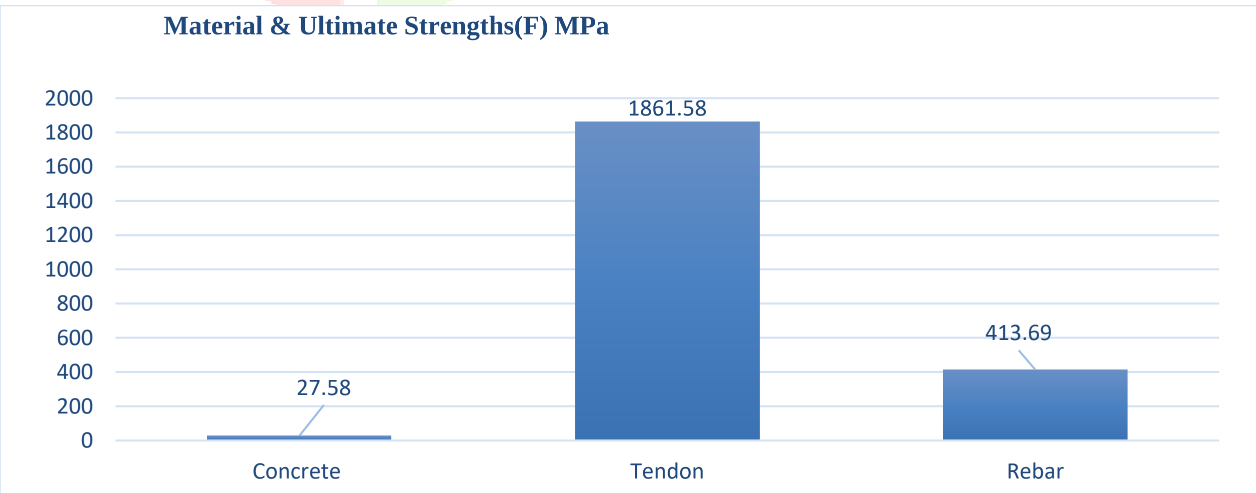


**Fig-1 Material & its Ultimate strength**

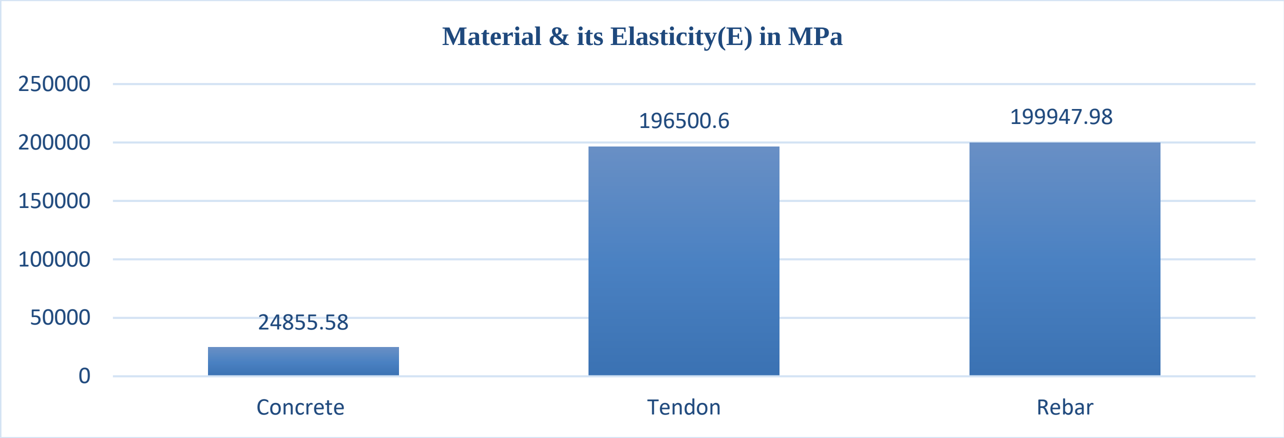


**Fig-2 Material & its Modulus of Elasticity**

**Table-1 Concrete Slab - IS 456:2000**

| Item | Value |
|---|---|
| Gamma Steel | 1.15 |
| Gamma Conc | 1.5 |
| Cover Top mm | 15 |
| Cover Bot mm | 15 |
| Bar Size | 18 |
| Inner Layer | B |
| PTCGS Top mm | 25 |
| PTCGS Bot Ext mm | 40 |
| PTCGS Bot Int mm | 25 |
| Slab Type | Two Way |

**Table-2 Total Steel quantity**

| Diameter of bar (mm) | Steel (newton) |
|---|---|
| 8 | 13677 |
| 10 | 7892 |
| 12 | 19689 |
| 16 | 23671 |
| 20 | 1181 |
| **Total** | **66110** |

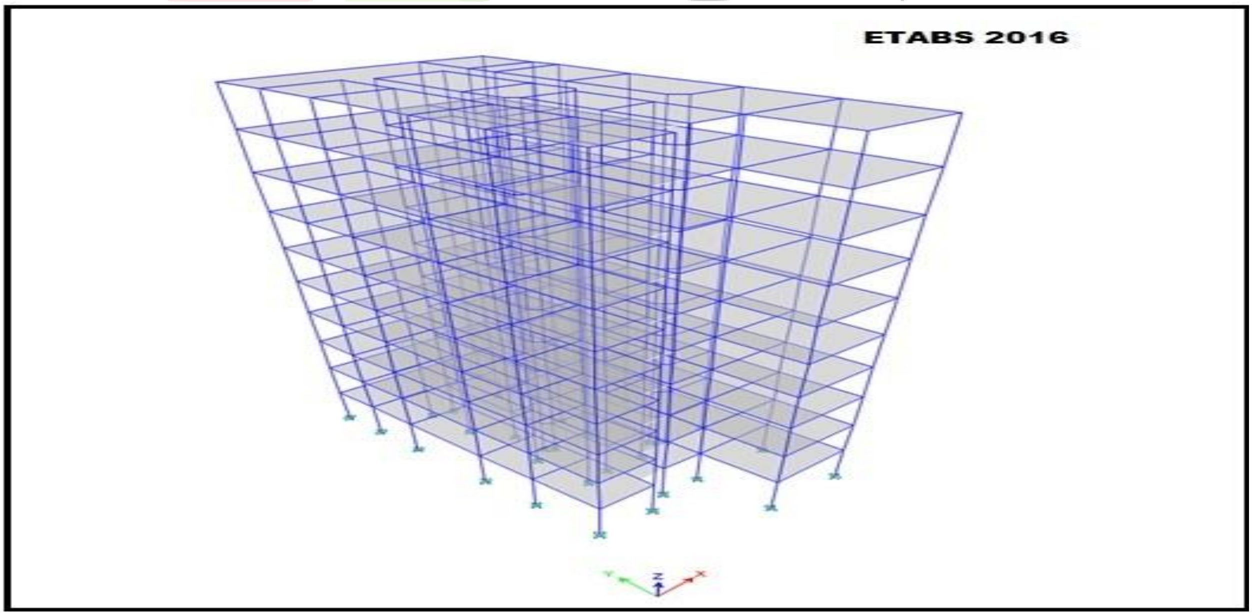


**Fig- 3 Frame structure of G+10**

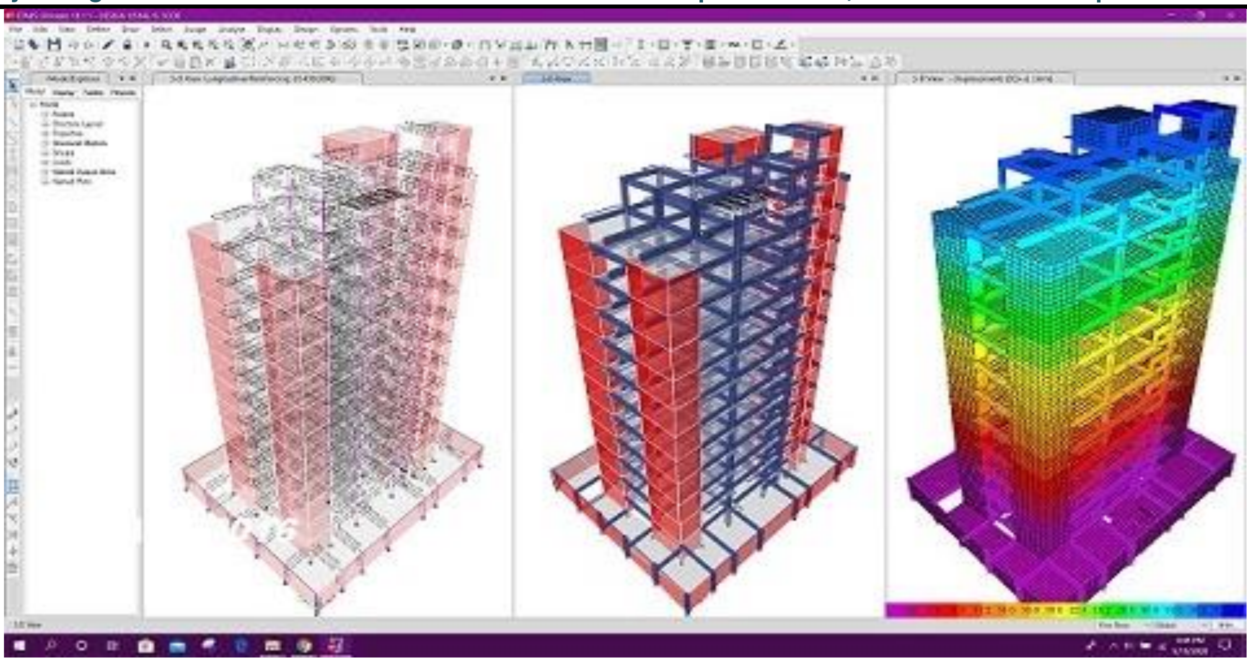

**Fig-4 3D modelling on ETABs 2016**

The steel quantity represents reinforcing steel in beams and columns in our designed. Reinforcing steel in plates is not considered in the reported quantity. Total volume of concrete = 52.8 cu. Meter.

## IV. CONCLUSIONS

In this section an analysis and design of G+10 storied composite R.C.C. and steel Building is given. The Results shows that:

1. All details of each and all members are gained by using ETAB software.
2. It is found that the wind load combination are much more than Earthquake load (EL) combinations in Bending moment and shear force.
3. Area of steel in column is a little greater in wind load combinations as compare to an earthquake load combination.
4. The deflection of all members is less than 25 mm. Hence it is safe.
5. The structural component of building is safe.
6. In structural members it is required to reordering of reinforcement for practical.
7. It is not easy to show each and every member with details of that reinforcement, so it is required to create a grouping of members and offer reinforcement details.

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