

# Comparison of Analysis of Multi-Storied Building by ETAB & STAAD-Pro: Effect of Number of Stories

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**Abstract** –Planning was done by using AutoCad and load calculations are done by Etab, Staad-Pro and manually also for cross checking and then the structure was analyzed by Staad- pro. A regular planned building with G+5,G+10,G+15 stories has been considered in this study. The dead load, Imposed load and Wind load with load combinations are calculated and applied to the structure. Staad-pro software also gives a detailed value of Shear Force, Bending Moment and Torsion of each element of the structure which is within IS code limits. Overall, the concepts and procedure of designing the essential components of a multistory building are described.

**Key Words:** Staadpro<sup>1</sup>, Etabs<sup>2</sup>, manual calculations Structural Elements<sup>3</sup>, Load Combination<sup>4</sup>, RCC Multi-storied Building<sup>5</sup>.

## 1. INTRODUCTION

Comparison of analysis of multistoried building by using Staad-Pro and Etab. Most of the time due to earthquake many buildings gets collapsed so to reduce collision effect this project is design. In this study plan dimension 25×20m is used. There are three types of models consider for design purpose G+5, G+10, G+15 also varying heights of building. Then I have applied fixed support and also applied loading like dead load, live load, wind load, seismic load. Many elements of building are calculated in theses study. For this thesis I had used seismic zone type 3, Grade of concrete M30 and Grade of steel Fe 500 by using Response Spectrum Method. I had design and analyzed the different parts of structure like Roof Displacement, Base Shear, Story Drift, Bending Moment, Shear Force, Story Shear and Story Displacement by using Staad-Pro and Etab also all data cross checked by manual calculation.

### 1.4 OBJECTIVE OF THE STUDY

1. To calculate the values of bending moment and shear force from multistory building by using STAAD –Pro and ETAB.
2. To calculate the value of Roof Displacement from multistory building by using STAAD – Pro and ETAB.
3. To calculate the value of Story Shear from multistory building by using STAAD Pro and ETAB.

4. To calculate the value of Story Displacement from multistory building by using STAAD- Pro and ETAB.
5. To calculate the value of Story Drift from multistory building by using STAAD Pro and ETAB.
6. To compare manual calculation result with the multi-storied building by using ETAB and STAAD-Pro with effect of number of stories.

## 2. METHODOLOGY

In the present study G+5, G+10, G+15 Storey RC regular plans building with plan dimension 20m x 25m located in zone 3 with medium soil condition is consider. six models are considered out of which three models analysis are carried out using the software called STAAD-pro and another three models analysis are carried out by using the software called ETAB. For all six models analysis are carried using Response spectrum method (IS 1893 2002 Part-I) all the structural members are taken based on design criteria as per IS 456-2000.

### Models Considered for Study:

- Model 1 – G+5 Storey Building with Plan 25X20 M
- Model 2 – G+10 Storey Building with Plan 25X20 M
- Model 3 – G+15 Storey Building with Plan 25X20 M

The various parameters considered or the modeling and analysis of the structure in Staad.pro are given below:

**Table- 1: Geometric Properties**

a. Member Dimension	
Plan dimension	20×25m
No of storey	5,10,15
Height of each storey	3m
Total height	17,32,47
Depth of footing	2m

Size of beam	230×600mm
Size of column	300×600mm
Slab thickness	150mm
<b>b. Seismic data</b>	
Seismic Zone	III
Soil Condition	Medium
Response Reduction Factor	5
Importance Factor	1.5
Zone Factor	0.16
Damping ratio	5%
<b>c. Load details</b>	
Dead Load	1 KN/m <sup>2</sup>
Live Load	2 KN/m <sup>2</sup>
Grade of concrete	M30
Grade of steel	Fe500
Density of brick masonry	20 KN/m <sup>2</sup>
Density of concrete	25KN/m <sup>2</sup>

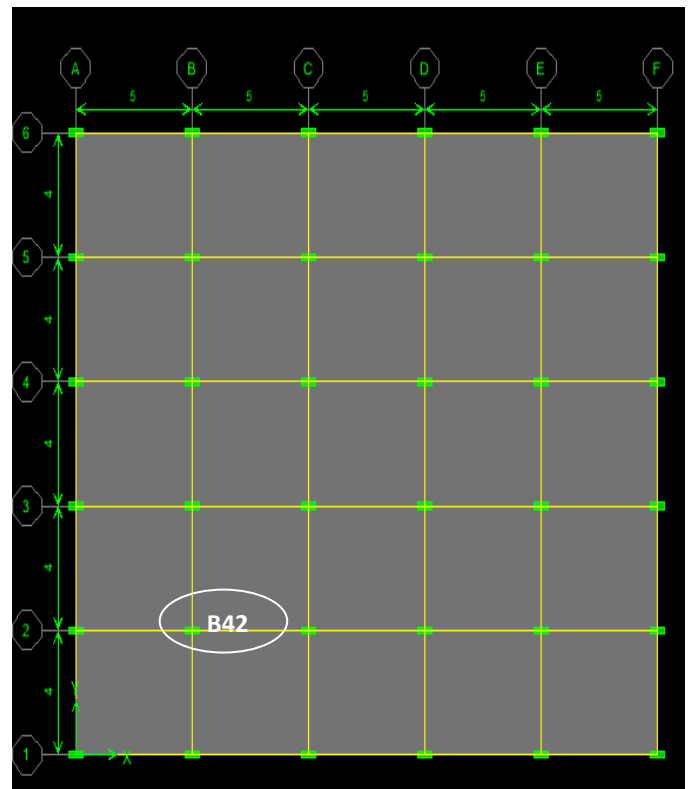


Fig-2.2 Plan Of Model Using Etabs

As per the parameter considered all the models are prepared in Staadpro software. Plan and elevation View of all the models is shown below:

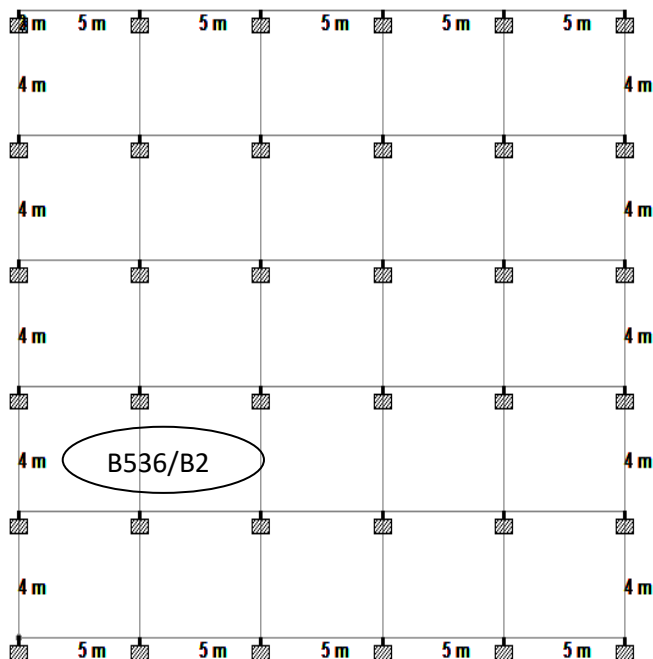


Fig-2.1 Plan of Model Using Staadpro

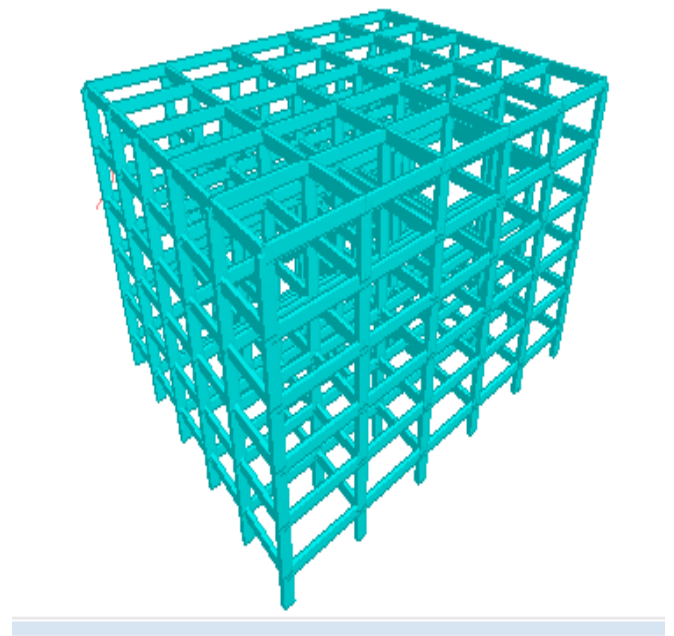


Fig-2.3 3D View of Model Using Staad pro

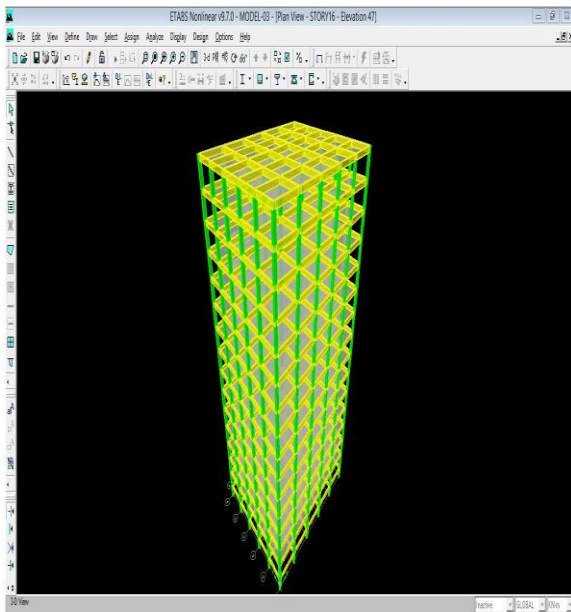


Fig - 2.4 3D View for Model Using Etab

Each model of the building is subjected to Self Weight, Dead load, Live load, wind load, seismic load. After applying these loads, each model of the building is analysed for the response spectrum method for the load combinations. After analyzing each model, result are obtained in terms of Bending Moment, Roof Displacement, Storey shear, Storey Displacement, Storey Drift.

### 3. RESULT AND DISCUSSIONS

By comparing the results we came to the conclusion that one can easily observe the analysis of multistoried building by using Staad pro and Etab.

Detailed study of each graph is shown below:

#### 3.1: Roof Displacement

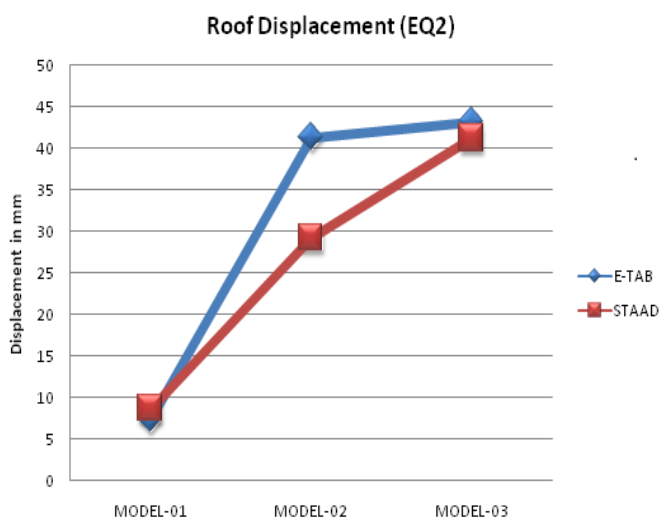


Fig- 3.1 Roof Displacement (mm)

As shown in above graph it has been observed that the results of roof displacement are more conservative in STAAD-Pro analysis along EQ1 and along EQ2 the results are conservative in ETAB analysis.

#### 3.2: Base Shear

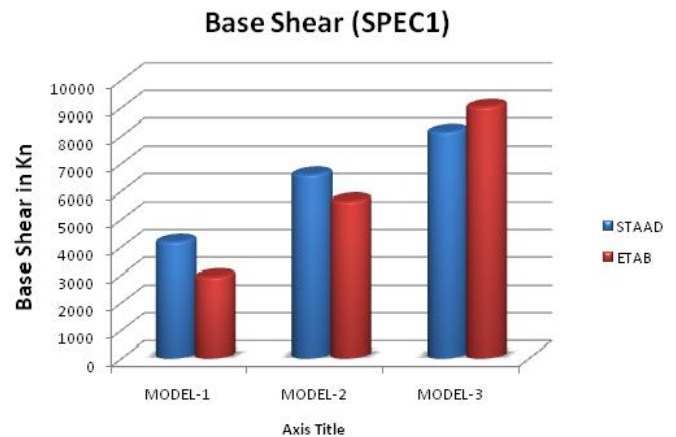


Fig- 3.2 Base Shear (KN)

As shown in above graph it has been observed that the results of base shear along spect 1 for model 1 and 2 are conservative in STAAD-pro analysis. But the results of base shear for model 3 is conservative in ETAB analysis.

#### 3.3: Storey Shear

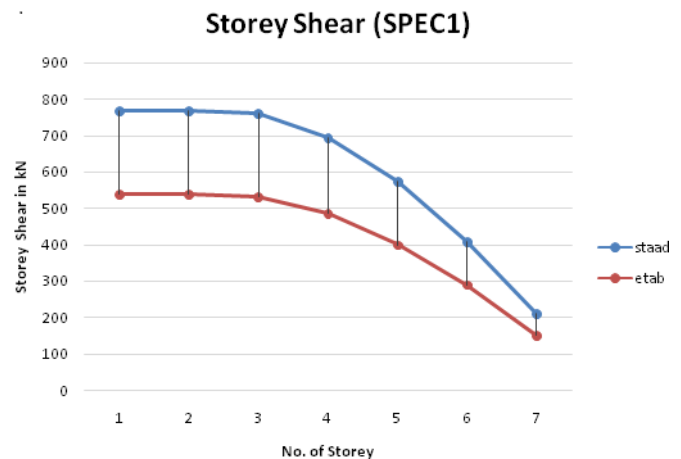


Fig- 3.3 Storey shear (KN)

As shown in above graph it has been observed that the results of storey shear along spect 1 and spect 2 are conservative in STAAD-Pro analysis.

### 3.4: Storey Displacement

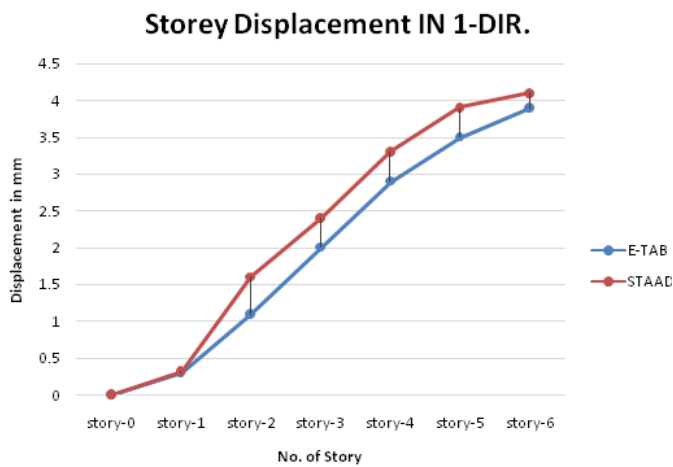


Fig- 3.4 Storey Displacement (mm)

As shown in above graph it has been observed that the results of storey displacement for load case EQ1 in 1direction for all models are conservative in ETAB analysis.

### 3.5: Storey Drift

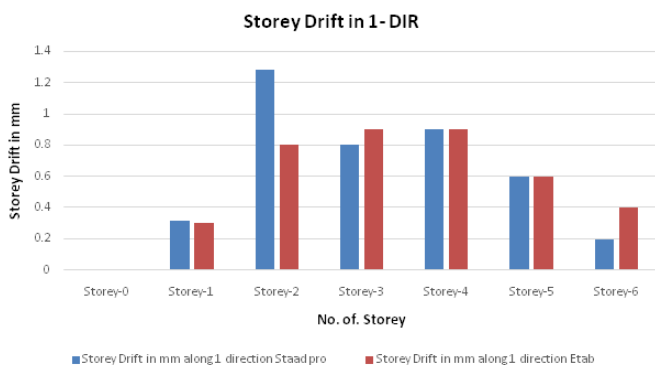


Fig- 3.5 Storey Drift (mm)

As shown in above graph it has been observed that the result of storey drift for load case EQ1 in 1 direction for all models is conservation in analysis.

## 4. CONCLUSIONS

### 4.1 Bending Moment and Shear Force

The values of shear force and bending moment obtained by STAAD-Pro analysis are more as compare to ETAB analysis and difference is not so much. As the storey level increases ETAB analysis gives conservative results.

### 4.2 Roof Displacement

The values of roof displacement increased with increase in no. of storeys. The values of roof displacement obtained by ETAB analysis are more compared to STAAD.Pro analysis but the difference is not so much.

### 4.3 Storey Shear

The values of storey shear obtained by STAAD-Pro analysis are more for fewer storeys than ETAB analysis. As the storey level increases ETAB analysis gives conservative results. Storey shear decreases with increase in no. of storeys.

### 4.4 Storey Displacement

The values of storey displacement obtained by STAAD-Pro analysis are more than ETAB analysis and the difference is not so much. As the shear force and bending moment are basic criteria for design of structure and also the values of shear force and bending moment obtained by STAAD-Pro analysis are more. STAAD-Pro analysis software is more preferable.

### 4.5 Storey Drift

The values of storey drift obtained by STAAD-Pro analysis are more than ETAB analysis and the difference is not so much.

### 4.6 Manual Calculation

The values of seismic load, seismic weight and base shear obtained from Staad-pro and Etab are cross checked with manual calculations and they are absolutely near about similar and also these calculations are safe.

## 5. SCOPE FOR FUTURE WORK

- It can be determined for different types of multistoried buildings at different places that, since soil condition varies from place to place we can change capacity of our foundation to cope up the situation.
- Since I have cross checked the values manually, I reached to the conclusion that ETAB is more preferable software than Staad pro for calculations.
- Comparison of G+5, G+10, and G+ 15 will be done in ETAB, Staad Pro and also crossed checked manually.
- Seismic analysis is done by Response Spectrum Analysis Method.
- Seismic analysis also can be done by distinct methods surpassing Response Spectrum Analysis method.
- According to different seismic zone – Seismic intensity and zone factor changes.

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