# SOFTWARE VERIFICATION USING STAAD PRO AND ETABS

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**Abstract—** *The objective of this project is to verifying the software i.e. ETABS And STAAD PRO as per IS Standards. As in actual design ,we have encountered with different type of members and more numbers of member ,for this software should be accurate and give the result as per codal provisions. Single member were check manually as per code and also in software and find out that some software show accurate result and some is not. Also ,we see the user friendly interface of both software and compare it, which one is best suited for work. Not every result is accurate in both the software ,Therefore we are taking accurate and feasible results.*

***Keywords—****STAAD PRO V8i,ETABS.*

## 1. INTRODUCTION

In each facet of human civilization we would have liked structures to measure in or to induce what we want. However it's not solely building structures however to make economical structures in order that it will fulfill the most purpose for what it had been created for. Here comes the role of technology and a lot of exactly the role of study of structure. There are several classical strategies to resolve style drawback, and with time new software's additionally returning into play. Here during this professional work supported software package named Staad pro has been used. Few customary issues even have been solved to indicate however Staad professional is utilized in totally different cases. These typical issues are solved using basic conception of loading, analysis, condition as per IS code. These basic techniques could also be found helpful for additional analysis of issues.

Following points will be covered in project work:

- Study of design of various elements of building
- planning of various components of a building with column positioning
- Introduction of STAAD.Pro
- Introduction of ETABS
- Modeling of the building in the STAAD.Pro giving all boundary conditions (supports, loading etc…)
- Analysis and Design of various structural components of the modal building
- Study of analysis Data of the software
- Detailing of beams, columns, slab with section proportioning and reinforcement.
- Reliability check of software

## 2. LITRATURE REVIEW

**2.1 Papa Rao and Kiran Kumar (2013):** The author's researches on the changes in the percentage of steel and volume of concrete for the RCC framed structure for various seismic zones of India. They have designed the structure for gravity load and seismic forces, which might be effect on building. According to their research, they concluded that the variation in support reactions for exterior columns increased from 11.59% to 41.71% and in case of edge columns, it is 17.72% to 63.7% from Zone II to Zone V and as in the case of interior columns, it is very less. In case of concrete quantities, volume of concrete has been increased for exterior and edge columns from Zone III to Zone V because of increase in support reactions with the effect of lateral forces and variation is very small in interior columns. Percentage variations of steel in external beams are 0.54% to 1.23% and in internal beams, it is noted 0.78% to 1.4%. The bottom reinforcement is not changed for seismic and non-seismic design.

**2.2 Perla Karunakar (2014):** The author put his efforts to find out the performance and variation in steel percentage and concrete quantities in various seismic zones and impact on overall cost of construction. According to his research, the concrete quantities are increased in exterior and edge columns due to increase in support reactions however; variation is very small in interior column footings. Reinforcement variation for whole structure between gravity and seismic loads are 12.96, 18.35, 41.39, 89.05%.the cost variation for ductile vs. non-ductile detailing are 4.06%.

**2.3 Salahuddin Shakeeb S M, Prof Brij Bhushan S, Prof Maneeth P D, Prof Shaik Abdulla (2015):** In the work, attempt is made to find the percentages required for various seismic zones by considering the effects of infill and without infill. For the study a symmetrical building plan is used with 13 storey's and analyzed and designed by using structure analysis software tool ETABS-2013. The study also includes the determination of base shear, displacement, moment and shear and the results are compared between gravity loads and various seismic zones. These parameters have also considers the effect of masonry infill's. In the research he concluded that the total variation in percentage steel in columns for infill case with maximum loading from seismic zone-2 to zone-5 are 1.935% to 51.612% compared to gravity loads. and the total variation in percentage steel in columns for without infill case with maximum loading from seismic zone-2 to zone-5 are 1.24% to 9.12% compared to gravity loads. The amount of variation of percentage steel in beams for infill case with maximum loading from zone-2 to zone-5 are 2.7% to 16.21% compared to gravity load and the variation in percentage steel in beams for non infill case with maximum loading from seismic zone-2 to zone-5 are 16.66% to 68.75% compared to gravity loads.

**2.4 Inchara K P, Ashwini G (2016):** The main objectives of this study were to study the performance and variation in steel percentage and quantities concrete in R.C framed irregular building in gravity load and different seismic zones.And to know the comparison of steel reinforcement percentage and quantities of concrete when the building is designed as per IS 456:2000 for gravity loads and when the building is designed as per IS 1893(Part 1):2002for earthquake forces in different seismic zones. In this study five (G+4) models were considered. All the four models were modelled and analysed for gravity loads and earthquake forces in different seismic zones. ETABS software was used for the analysis of the models. According to their research, it can be inferred that support reactions tended to increase as the zone varied from II to V, which in turn increased volume of concrete and weight of steel reinforcement in footings and in case of beams, percentage of steel reinforcement increased through zones II to V.

### 2.5 Software Verification Overview

*1. STAAD PRO V8i :*

STAAD or (STAAD.Pro) is a structural analysis and design software application originally developed by Research Engineers International in 1997. In late 2005, Research Engineers International was bought by Bentley Systems

In this project, the STAAD Pro design result is checked manually to get reliability of software according to IS:456:2000.

2. ETABS: ETABS is a highly efficient analysis and design program developed especially for building systems. It is loaded with an integrated system with an ability to handle the largest and most complex building models and configurations.

In this project, the ETABS design result is checked manually to get reliability of software according to IS:456:2000.

3. Side Wall -Where the side walls are non-parallel as in the case of a fan-shaped hall, the walls may remain reflective and may be architecturally finished in any manner required, if sound absorbing material is not required from other considerations. Where the side walls are parallel they may be left untreated to a length of about 7.5 m from the proscenium end. In addition, any of the surfaces, likely to cause a delayed echo or flutter echo should be appropriately treated with a sound absorbing material. Difference between the direct path and the path reflected from side walls shall not exceed 15 m.

## 3. ANALYSIS

3.1 Given data

| | |
|---|---|
| Live load : | 4.0 kN/m2 at typical floor |
| | : 1.5 kN/m2 on terrace |
| Floor finish : | 1.0 kN/m2 |
| Water proofing : | 2.0 kN/m2 |
| Terrace finish : 1.0 kN/m2 | 1.0 kN/m2 |

| | |
|---|---|
| Location : | Vadodara city |
| Wind load : | As per IS: 875-Not designed for wind |
| | load, since earthquake loads exceed the |
| | wind loads. |
| Earthquake load : | As per IS-1893 (Part 1) - 2002 |
| Depth of foundation below ground : | 2.5 m |
| Type of soil : | Type II, Medium as per IS:1893 |
| Allowable bearing pressure : | 200 kN/m2 |
| Average thickness of footing : | 0.9 m, assume isolated footings |
| Storey height : Typical floor: | 5 m, GF: 3.4 m |
| Floors : | G.F. + 5 upper floors. |
| Ground beams : | To be provided at 100 mm below G.L. |
| Plinth level : | 0.6 m |
| Walls : | 230 mm thick brick masonry walls |
| | only at periphery. |

### Material Properties

***Concrete***

All components unless specified in design: M25 grade all

$Ec = 5\,000\, fck$ N/mm2

$= 5\,000\, fck$ MN/m2

= 25 000 N/mm2 = 25 000 MN/m2 .

For central columns up to plinth, ground floor and first floor: M30

grade

$Ec = 5\,000\, fck$ N/mm2

$= 5\,000\, fck$ MN/m2

= 27 386 N/mm2 = 27 386 MN/m2 .

***Steel***

HYSD reinforcement of grade Fe 415 confirming to IS: 1786 is used throughout

### 3.2. SIZE OF COLUMN AND BEAM

- Columns (500 x 500)
- Columns (600 x 600) Upto PL
- Ground beam (300 x 600)
- Secondary beams rib (200 x 500)
- Main beams (300 x 600)
- Slab (100 mm thick)
- Brick wall (230 mm thick)

Floor wall (height 4.4 m)

4.4 x 4.9 = 21.6 kN/m

Ground floor wall (height 3.5 m)

3.5 x 4.9 = 17.2 kN/m

Ground floor wall (height 0.7 m)

0.7 x 4.9 = 3.5 kN/m

Terrace parapet (height 1.0 m)

1.0 x 4.9 = 4.9 kN/m

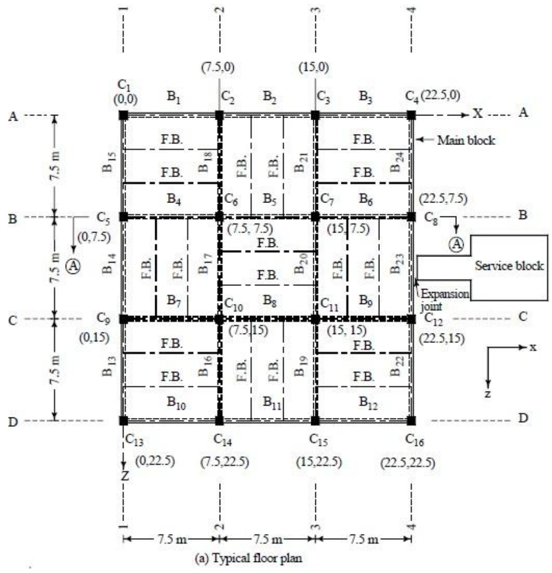


Fig-1.(a) Floor Plan

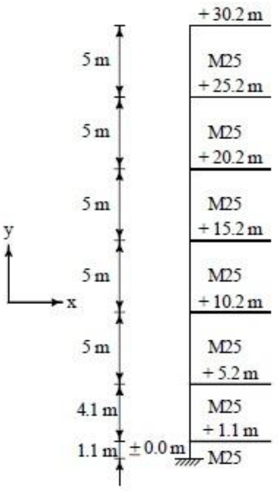


Fig- 1.(b) Frame Section View

### 3.3 MANUAL CALCULATION

### 3.3.1 Manual Inputs

### Dead Loads

Main beams B1–B2–B3 and B10–B11–B12

| Component | B1-B3 | B2 |
|---|---|---|
| From Slab | | |
| 0.5 x 2.5 (5.5 +1.5) | 6.9 + 1.9 | 0 + 0 |
| Parapet | 4.9 + 0 | 4.9 + 0 |
| Total | 11.8 + 1.9 kN/m | 4.9 + 0 kN/m |

Main beams B13–B14–B15 and B22–B23–B24

| Component | B13 – B15 B22 – B24 | B14 B23 |
|---|---|---|
| From Slab 0.5 x 2.5 (5.5 +1.5) | ---- | 6.9 + 1.9 |
| Parapet | 4.9 + 0 | 4.9 + 0 |
| Total | 4.9 + 0 kN/m | 11.8 + 1.9 kN/m |

### Live load On Floor

| Component | Terrace (DL + LL) | Typical (DL + LL) |
|---|---|---|
| Self (100 mm thick) | 2.5 + 0.0 | 2.5 + 0.0 |
| Water proofing | 2.0 + 0.0 | 0.0 + 0.0 |
| Floor finish | 1.0 + 0.0 | 1.0 + 0.0 |
| Live load | 0.0 + 1.5 | 0.0 + 4.0 |
| Total | 5.5 + 1.5 kN/m$^2$ | 3.5 + 4.0 kN/m$^2$ |

### 3.3.1 Staad Inputs

### Dead load


Fig-2 Dead Load Detail

### Live load on Floors

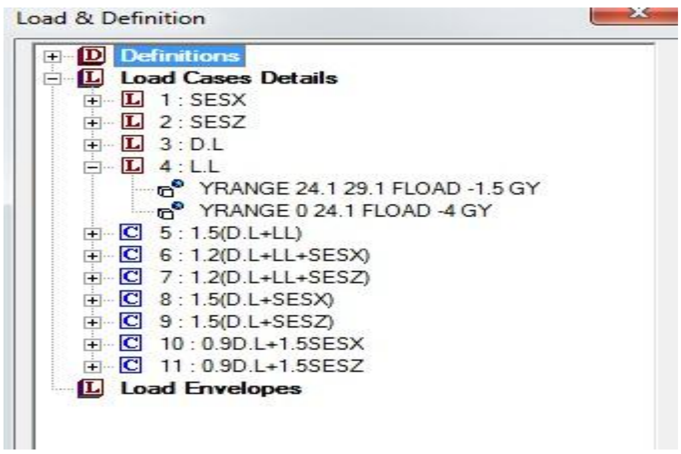


Fig-3 Live load Detail

### 3.4 Geometry

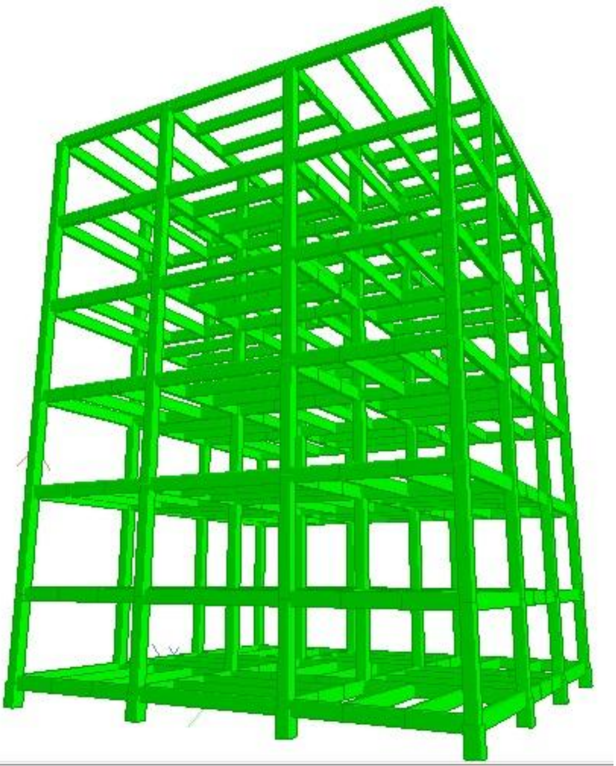

Fig 4-Staad Pro Geometry

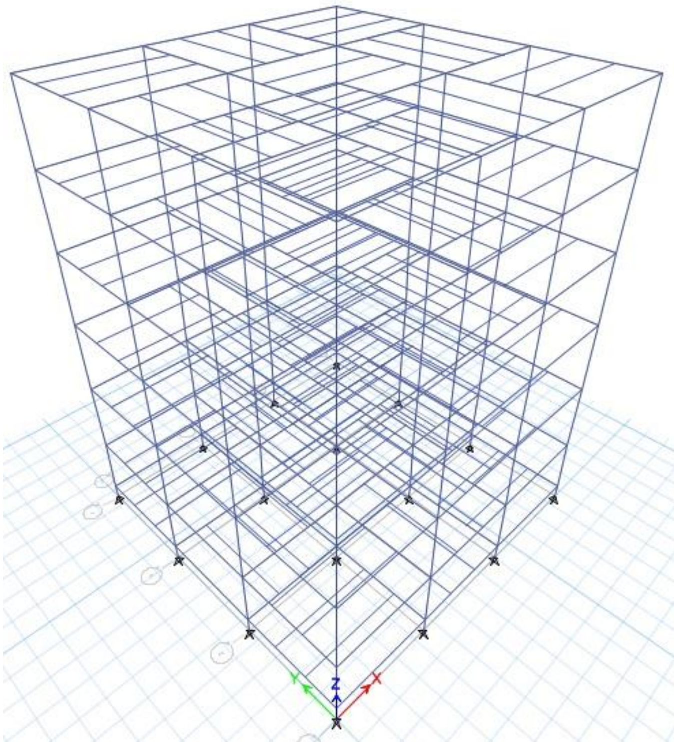

Fig 5- Etabs Geometry

## 4. RESULTS

| In KNm | | MANUAL | | STAAD PRO V8I | | ETABS | |
|---|---|---|---|---|---|---|---|
| S.NO. | Load Case | | | | | | |
| | | Left | Right | Left | Right | Left | Right |
| 1 | (DL) | 117.95 | -157.95 | 122.27 | 151.84 | -111.86 | -136.33 |
| 2 | (IL/LL) | 18.18 | -29.85 | 17.32 | 25.95 | -20.74 | -26.25 |
| 3 | (EXTP) | -239.75 | -215.88 | -220.91 | 206.35 | 161.18 | -150.55 |
| 5 | (EZTP) | -18.28 | -17.25 | 0.42 | -1.22 | 0.6752 | -2.95 |

The Above table shows the value differences in a particular Beam.

## 5. CONCLUSIONS

1. From the above analysis we found the moment in z-direction in different softwares.

2. Manual calculation are present as a reference which is used for finding accuracy of software.

3. The Dead load and Live load approximately matched with manual calculation but accuracy is not up to mark.

4. It shows too much differences when taking the Earthquake loads in x and z direction.

5. In x and z direction, the moment also carry different sign.

## 6. REFERENCES

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