

# Comparison of Analysis & Design Results of A Structural Elements using STAAD-Pro, STRUDS and ETABS Software

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**Abstract** - STAAD-Pro-V8i, STRUDS-2009 and ETABS-2015 are the most needed analysis and design softwares in the structural engineering field. Most of the structural consultancies are using these softwares for the analysis and designing of multistoried buildings. Here, the research work mainly deals with the comparative analysis of the results obtained from the design of a regular multi storey building when designed using STAAD-Pro, STRUDS and ETABS softwares separately. These results will also be compared with manual calculations of a sample beam and column of the same structure designed as per IS 456-2000.

**Keywords:** Structure Analysis & Design, STAAD-Pro-V8i , STRUDS-2009 and ETABS-2015.

## I. INTRODUCTION

Structure Softwares are most promising tool for accurate and precise analysis and design of multi-storied buildings. Earlier, analysis of high rise structure was very difficult and cumbersome task. There was very high chances of error in mathematical calculations. But, Nowadays presence of structure softwares minimize the mistakes. Some of the structure softwares are STAAD-Pro, MIDAS, ETABS, SAP, STRUDS, ANSYS etc. Here, we are discussing the comparative analysis of the results coming through some of these softwares.

STAADPro-V8i, STRUDS-2009 and ETABS-2015 are the most demanding structure softwares in the present working market. Most of the designing companies are using these softwares for the analysis and designing of multi-storied buildings. Here, the project mainly deals with the comparison of the analysis and design results of a regular, as per IS456, multi- storey structure when designed using STAAD-Pro, STRUDS and ETABS softwares separately. For a particular case, a 30mx30m 5 storey building is modeled using STAAD-Pro , STRUDS and ETABS softwares. Each storey is having 3mts height and which makes the total height of the structure 12 mts. Thereafter , analysis and design of the structure is done and then the

related results generated by these softwares are compared and a conclusion is drawn from them. In addition, future aspect for this research will be discussed.

## II. SYSTEM MODEL

A 30 mt x 30mt 5 storey regular structure is considered for the study. Modeling, analysis and design of the structure is done separately on STAAD-Pro , STRUDS and ETABS software. The building plan considered is shown in Figure 1.

## III. PREVIOUS WORK

Previously, some of the authors have done excellent job in this field . Prashant , Anshuman , RK Pandey and Arpan have done comparative study of STAAD-Pro and ETABS softwares while designing structure through it. They have considered 11 storied structure , both regular and irregular in geometry, for comparison purpose. In the analysis and designing , authors took different types of load such as Dead Load, Live Load and Earthquake Load . After that , the results ,got for regular and irregular structure, were discussed. Later on , a conclusion was made for the said research work.

## IV. PROPOSED METHODOLOGY

The regular 5 story building is having 6 bays of width 5m. The structure is made up of Reinforced Cement Concrete. The important structural parameters are given in Table-1.

TABLE 1. PRELIMINARY DATA

Length x Width	30m x 30m
No. of storeys	5
Storey height	3m
Beam	380 mm x 380mm
Column 1-5 storeys	400mm x 400mm
Slab thickness	130mm
Support conditions	Fixed
Beam Releases	Axial force

The loads acting on the structure are Dead Load and Live Load.

Dead Load (DL) includes self - weight of the building, floor Finishes and Wall Loads.

Wall Thickness – 115 mm

Live Load - 2 kN/m<sup>2</sup>

Floor Finish - 1 kN/m<sup>2</sup>

Wall Load - 6.026 kN/m<sup>2</sup>(As per the calculation)

Soil Type – II

Plastering is not considered Grade of Concrete - M25

Grade of Steel - Fe500

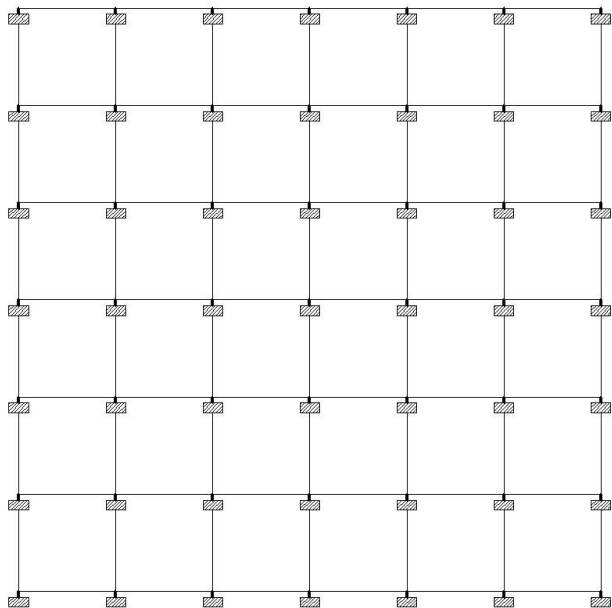


Fig.1 Plan of the regular structure considered

**V. SIMULATION/EXPERIMENTAL RESULTS**

Results of base reactions of a structure for different loads have been given in Table-2.

TABLE 2. BASE REACTIONS

Loading	STAAD Pro	STRUDS	ETABS
DL	35339.35 kN	35944.67 kN	35387.11 kN
LL	7200 kN	7200 kN	7200 kN

Similarly, Bending Moment and Shear Force of a sample column is given in Table-3.

TABLE 3 : BENDING MOMENT AND SHEAR FORCE OF A SAMPLE COLUMN

Loading	Forces	STAAD Pro	STRUDS	ETABS
DL	Fx	360.44	374.74	362.43
	Fy	3.46	3.54	3.45
	Fz	3.46	3.54	3.45
	Mx	0	0	0
	My	3.61	3.71	3.63
	Mz	3.61	3.71	3.63
LL	Fx	50.15	50.17	47.94
	Fy	0.12	0.12	0.16
	Fz	0.12	0.12	0.16
	Mx	0	0	0
	My	0.05	0.056	0.085
	Mz	0.05	0.056	0.085

Design results of a sample beam and column by STAAD-Pro, STRUDS, ETABS and Manual Calculation are given in Table 4.

TABLE 4 : DESIGN RESULTS OF A SAMPLE BEAM AND COLUMN

Section	Total Reinforcement (sq.mm)			
	STAADPro	STRUDS	ETABS	Manual Calculation
Beam	451	465	443	435
Column	1280	1357	1280	1280

**VI. CONCLUSION**

By the analysis results, we can find that the base reactions for the dead load of whole structure is coming little bit different from all the softwares. Besides this, we can find base reactions for the live load of the building are equal through all the softwares. Furthermore, the bending moment and shear force are also coming nearly same for the considered sample column by all the structural softwares.

From the design results of beam, we can conclude that ETABS gave lesser area of steel as compared to STAAD Pro and STRUDS. It is found that the ETABS give more precise and accurate results as compared to the STAAD-Pro and STRUDS. Even the manual calculations for design go in favour of ETABS.

Through the design results of column; we can jump to conclude that the area of steel is same for ETABS and STAAD-Pro. But, we can find area of steel is coming little

higher from STRUDS software than in comparison to the other two softwares.

## VII. FUTURE SCOPES

This research is quite helpful in future in choosing the software that provides minimum reinforcement in structural elements. This research will help in maximizing the profit in real estate business.

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