



Assessment of RC Tall & Multi Storey Building using Software Mechanism such as Staadpro and CSI-Etabs: A Review

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Abstract

Recently the most versatile used software's in Indian Market are both Staadpro and E-tabs. Many of the researchers who are working in different companies and organization make efficient use of this software's. The proposal and checked procedure of Government body are also willing to check by staadpro and CSI-Etabs software's. With the time frame it is easy to get result through software rather than the manual calculation in the current scenario. The economical design of a building is main aim of a Civil Engineer so a different trial has been made to reach out to extent of design standards using these software's.

The current project deals with the examiner of Tall & Multi storey RCC building frame design on account of dynamic I loads acting in the laterals direction such as earthquake & wind. The software used for the study is Staadpro and csi-Etabs. The main objective is not only to test the accuracy of the software's but also to make buildings with resistant free from the failures & what are output gets by it so that we make the building technical fit & serviceable.

Keywords: Staad.pro, CSI-Etabs, Tall, Multi storey, RCC.

Introduction

The analysis is based on time history analysis of RCC frames or any other structures. In past decades the most of buildings with covering vast area were designed manually by highly qualified and experienced structural designers. The population previously was not that much but with growing increase of people in numbers so that it directly affect the load and revisiting capacity of a building. Under this situation the more focus on the design criteria of buildings. high-rise design criteria the soil and foundation is mostly taken into consideration .Thus at present this design process have been done by means of various load calculation software such as staadpro and E-TABS are both among them.

The manual calculation of the design of structures has taken lot of time with plenty of errors. With the development of these software, it made more comfortable and with ease for a human being by reducing time and human efforts in building design.

This software can be used for different approach of earthquake analysis such as TMA, RS etc. The result parameters are under taken for the calculation of lateral displacement, storey drift etc parameters with already encoded time intervals been provided with the specific arrival time and damping factor. In staadpro and E-TABS software the calculation is done by use of IS codes inbuilt. This software provides very accurate and precise results than manual

calculation that is why also they are very beneficial.

Literature Review

The following literatures are study is carried out which basic in touch with software mechanics of civil engineering structural point of view in staad-pro and csi-etabs. They are as follows:

1) Jajoriya Mansi, Vishwakarma Arvind & et. al. (2020) worked on the different arrangement of the pile group. They examine about the use of pile groups on a weak and expansive soil such as clayey soil which have a weaker bearing capacity. The present study describes about group action of pile group, modeling of four piles were taken for study. In study, spacing between pile groups are taken as 2.5D and 3.5D (D-Diameter of pile).0.8 is the diameter of four pile group. Different pile arrangements are taken such as rectangular, square, staggered; diamond 1 and diamond 2. Analysis for different shapes of pile groups are done by response spectrum method using software approach. Displacement, Shear force and bending moment and three types of stresses are evaluated under the analysis of models. The finally conclude that over than square and rectangular pattern the diamond shape is also adopted for the group but the staggered shape are not predominant resisted the axial force through its arrangements.

2) A. Vishwakarma & S. Maru (2019) the research paper examines a new concept of building behavior, that is, the criteria for human comfort in a high-rise structure by response of wind. The response is recorded in the form of the peak acceleration estimate using the IS code approach of IS 875 (part 3): 2015. Consider four different frame tubes of a high-rise structure with circular cross section from the top view. The storey

taken as G +20, 30, 40 & 50 with different conditions, i.e. normal slab, secondary beam, wafer slab and ribbed slab are taken. A typical round floor with a diameter of 50 m. The ETABS-2013 software is used in it. The parameter are studied is the maximum displacement is estimated by dynamic building wind analysis using the corrosion factor method. Using maximum bias, the Acceleration Peak will be calculated using IS-875 (Part 3); 2015 for various structural conditions of scaffold pipes and construction modes. The peak acceleration obtained in the analysis is compared with the reference data. Result showed that G+20,30,40 are satisfactory result in human response but in G+50 some changes are required to satisfy the human comfort range.

3) A. Sivaji, N. Madhava Reddy & et. al. (2019) analyzed a multi storey building by taking software staad.pro & csi-etabs. The design of building is based on the code approach followed by IS 456 with manual calculation. The load used in the analysis are dead load (IS875-1987 part1), live load (IS875-1987 part2), wind load (IS875-1987 part3), seismic load (IS1893-1984 part1) and 25 load combinations are considered as per the IS875 (part5)-1987 code book The beams, columns and slabs are designed using software and by manual procedure, reinforcement details are compared. The foundation is designed by using STAAD Foundation software.

4) M. Kalim, A. Rehman & et al. (2019) taken a multi-storey building and code approach of Is 456 and Indian wind codes IS 875part I, II, III. The researcher found many similarities and flexibility in both software are topic based on this study with the help of fourteen storey. The structure consists of dimension of beam and column is same through the cross sections.

The soft ware basic parameters are studied in it which is found approx similar behavior.

5) Balhar L. & Vyas J.N. (2019). The study of this paper is based on the staad pro based analysis using a multistory building is modeled. The three methods are used for the earthquake analysis. The methods are ES,RSA & THA. The prior load acr taken in it is gravity and dynamic loads, analyzed using analysis. It has been observed that lateral displacement, floor displacement and floor drift in the construction of flat slabs are more than conventional slab construction.

6) L. Balhar, J.N. Vyas (2019) examine the behavior of multi-storey buildings with conventional radar plates, flat plates. The studies of the characteristics of buildings are observed under seismic conditions. The obtained result values are based on floor drift, lateral displacement, seismic base shear, floor displacement. The paper concluded that it is important to analyze behavior of buildings under seismic response in order to see what changes will occur for a conventional RC frame building, a flat-plate building and a shear wall, respectively.

7) Charan Raj & Suraj Baraik (2018) examined to show changes of twist alongside the stature of structure on soak slant to research the part of topographic conditions in dispersion example of wind constrain. The investigation of a G+5and G+11 storey RCC expanding on fluctuating slant points i.e., 0°, 15°, 20° is examined and contrasted and the same on the level ground, by using SAP 2000 software v16. In display look into think about parameter such as float based on storey wise and other parameters is displacement, which are basically broke down to assessment on the inclined ground are contrasted and diverse slants and distinctive statures.

8) M. Kalim & B S Tyagi & et.al. (2018) includes load calculations and analysis. The Staadpro and etabs based ansysis is carried out. With the principle involve civil engg. aspect is to design a safe and economical structure. To solve much more complex and large structures. Staadpro features - modern user interface, visualization tools, and powerful analysis and design engines with dynamic analysis capabilities. Staadpro is the professional's choice, from model generation, analysis and design to visualization and validation of results. etabs is also the leading design software currently used by many designers. The analyzed the regular structure using the etabs development software. Etabs gave a smaller steel area compared to the Staad Pro.

9) S .Vijaya Bhaskar Reddy & V.Madhu (2018) The aim of the study is to conduct a detailed analysis of the etabs and staad pro modeling tools that were used to analyze and design a rectangular plan with a vertical regular and rectangular plan with a vertical geometrically irregular multi-storey building. This study focuses on identifying the benefits of using etabs over current practice of staad pro versions. It was noted that etabs is more user-friendly, accurate, compatible for analysis of design results and many other advantages that will be discussed in this study over staadpro.

10) Ramanjaneyulu V., Dharmesh. M & et al. (2018) The article is devoted to a comparative analysis of the results obtained in the design of a conventional and irregular (according to IS 1893) multi-storey building structure when designing using the Staadpro and etabs software separately. The main goal of this project is a comparative study of the design and analysis of a high-rise building (G + 8) using the software Staadpro and etabs. Staadpro is one of the leading

structural design software. In this project, we analyze a G + 8 building to find shear forces, bending moments, deflections, and reinforcement details for building structural elements (such as beams, columns, and slabs). Staadpro software Suitable for G + 8 structures compared to Etabs software. The time period and base shift of the regular and irregular structure in the etabs software is twice that in the staadpro software. After completing the design of the structure in both software products, the design results show 0.4-0.5% more steel in etabs. By comparing the results of the two structures (regular and irregular), the conventional framing element shows the maximum bending moments, shear forces and axial forces for different loading conditions in both programs.

11) Bedi Isha , Sharma Girish & et. al. (2017) The researcher proposed to analyze and conduct a comparative study of rcc framework structures using Staad.Pro, etabs and sap. The proposed research analysis, it is conclude that Staadpro is much more effective. Strong derivatives compared to etabs and sap. The maximum difference between the Staad.Pro, etabs and sap values.

12) T. Subramani, K. Murali (2017) obtained the execution of a multi-storey structural with G+10 storey building. The structure is performed under static and dynamic analysis. The different mode was using ETABS software. High-rise performance analysis for distinctive modes is performed with the aim of identifying the most reliable function of the gadget and truss using side loads. The analysis of the temporal history for statistics of floor movement in the version of the ten-story building is carried out. The floor comes with flow and base shear for static and dynamic loading. Based on the results the effective character of a building with outriggers is

evaluated. Describes the structural diagram of a similar 10-storey building that uses common characteristics based on seismic and wind strategies.

13) Rajeshwari Patil, S. Anoor & et. al. (2017) The research paper deals with the SAP2000 software. It is used to examine the concrete & steel structures, parking garages, skyscrapers, his rise structure in different levels. Under sap a structure is modeled have a G+3 storey framed building. The outputs are in the terms of max. Shear forces, bending moments & maximum displacement of the structure are computed. The IS456 & SP16 provision are adopted for the structural elements are designed.

14) Ms. Monal P Tayade., M. R. Vyawahare (2017) This study is an attempt to investigate and compare the results for building with different stories. A regular plan building with G+5, G+10 and G+15 stories have been considered in this study. It has been observed that buildings with less no of stories when analyzed by STAAD-PRO give conservative results and buildings with high number of stories when analyzed by ETAB produced conservative results.

15) Arindam Sahu, Rohit Bose & et. al. (2016). The purposes of researchers are to analyze and construct the main building G+3 storey building using SAP 2000. Includes planning on how to classify loads and full details of the SAP 2000 layout. research used in SAP 2000 image analysis of stateless state according to Indian Model Law. SAP 2000 demonstrates a person's status including research status, research tools, powerful integration of analysis and the details of its core values. From quantitative analysis, research and structure to results, and visual and validated visualizations, SAP 2000 is the professor's choice. We begin by examining the two-

dimensional tables and confirming the inaccuracies of the program and our results. The accuracy is more in the result gets.

16) D. Zhou, C. Guo & et al. (2016) in this project, in order to fully evaluate the structural behavior of the Shanghai International Design Center (SHIDC) in earthquake conditions, Noscad, Abaqus and execute-3d. It is used to perform analysis of elastoplastic ,temporal history, numerical data results. It also worked on compared this results with vibration table test data , Noscad has a functional module for converting nonlinear analysis model to perform-3d and Abaqus. These models can be used directly in Abaqus or Perform-3d. By the transformation of the model, the seismic characteristics of SHIDC were fully investigated. The analysis gets the maximum drift between floors is within the limits as per Chinese code provisions. The reasonable failure sequence of the structural elements was obtained. This concludes the input energy dissipation is well in earthquake analysis. The structure is intact during frequent earthquake. The structure does not collapse during rare earthquakes. Based on this approach the task of this project has been completed.

17) M. sabeer & D. G. Peera (2015) the paper consist of irregularity of the structures. Plan Analysis with Vertical Geometrically Irregular Multistory Building using the static method of this research-oriented project is to explore in detail the modeling tools for structural analysis and design. Simulation comparison is implemented by STAAD. Comparing STAAD PRO and ETAB software results in different results that are difficult to understand and confusing at the time of boot parameter assignment and design. Based on the results of the calculation of the beams. Based on result it

concluded etabs obtained smaller area of steel requirements compared to staad pro. The required column area in steel is the same for both programs, but in this case it is taken into account as a percentage of 0.3% to 0.5%. Form the results of the calculation of the column; Since the required steel for the column forces is fashionable. The certain obtain problem is less than the minimal limit of the column steel (ie 0.85%). steel obtained through both the software are almost equal.

18) Prashanth. P, Anshuman. S & et. al. (2010)

Deals with irregularity impact on the structure as per codel approach used in IS 1893(PART-I) . The conventional design also taken in to the account. The relative study are based on the both types of software separately. The CSI-ETABS & Staad is used under it. Manual calculation is also done in this project as per codel IS 456. The results shown that ETABS produced less steel area required compared to STAAD PRO. On comparing STAAD results with manual calculations it showed that Staad.pro gives conservative design results. This result is again confirmed in this study by comparing STAAD.Pro, Generate column design results due to the required steel for the column forces in this particular task is less than the minimum limit for the column steel (i.e. 0.8%). The same amount of steel calculated by both programs.

Table1 Comparisons Staadpro and CSI- Etabs

S.No.	Properties/ description	Staad.Pro	CSI- Etabs
1	Latest version	StaadproV8i	ETABS 2020
2	Developed by	Development Research Engineers International in 1997. Research Engineers International was bought by Bentley Systems IN Yorba Linda, CA in 2005. .	Developed by Computers and Structures, Inc. (CSI) America.
3	Flexibility	As per discussion and use of different users staad.pro is quite less flexible as compare to csi-etabs	As per discussion and use of different users staadpro is more flexible as compare to csi-etabs
4	Output gets	Displacements, story shear, story drift , stress, moments etc	Displacements, story shear, , stress, moments etc But drift are shown with unit less parameters in it, latter it is converted into unit quantity with the help of factors.
5	Stresses	Absolute, tresa, monmesko types stress shown directly on it	Absolute and maximum stress developed mainly and other stress given some unique code forms.
6	Result display	Tabulated but less interface clearifcance as compare to etabs, import to excel also.	Tabulated and easy grip the result and import in pdf.
7	Orientation of task bar	Oriental is good and all task bar is display on the top as well left side of screen	Oriental is more better and all task bar is display on the top as well left side of screen,
8	Uses in Govt. approval project	As per MP govt. project survey max. Department are use Staad.pro design as approval.	Some govt. are aware about the etabs and need to aware more
9	Load combination	Load combination is assigned by user	Load combination is assigned by user as well as it is by default is there in the software also.
10	User friendly	Both are nice and easy way to operated	Both are nice and easy way to operated but overall etabs prefer more versatile
11	Foundation modeling	An extra software is there ie. Staad foundation but we can modeled to staad.pro also	An extra software is there ie. SAFE but we can modeled to Etabs also for simple foundation
12	Import file	Autocad file import in it	Autocad file import in it

Gap of Study

With multiple reviews & study of most of the papers it has been analyzed that there have been following gape of study:

- 1). Comparison of the modeling of both the software's namely E-tabs & Staadprois not done by using Time history Analysis.
- 2). The use of shear wall & without shear wall effect is also not taken into consideration during of analysis.
- 3).The use of Comparison of different RCC & composite frames modeling in software's has also not been analyzed.
- 4).The criteria of taking different soil Earthquake Zones are not being analyzed in both softwares.
- 5). Comparison of Flat slabs & Conventional slabs using both the software have also found in the gape of study.

Conclusions

On the basis of compared the software of Staadpro and CSI-Etabs

- 1) Both software and equally predominating in their respective platforms.
- 2) Staadprois run by Bentley and CSI-Etabs is run by CSI- America.
- 3) The output scenario both are gives immense results but somehow better result platform is obtained by CSI-etabs.
- 4) The outputs are plotted and tabulated in terms of displacement, drift, shear and moments of the storey. But in case of Bentley staadpro the stresses are obtained in the form of different types such as absolute, von Masco, and tresca top and in etabs absolute and maximum stress are major concern by the different researchers.
- 5) The graphical results easily obtained in the csi-etabs software as compare to staad.pro.

- 6) Different structural form such as bracing, outrigger, shear wall, hull core, tube etc are easy way to construct in etabs as compare to staad.
- 7) Both software earthquake approach are anyslded somehow by default in csi-etabs the alcentro earthquake is there for the time history analysis. For user friendly maximum researchers are used pushover and response spectrum method there project analysis.

References

- [1]M. sabeer,D & Gouse Peera (2015) "Comparison Design Result Of Rcc Building Using Staad And Etabs Software" International Journal of Innovative Research in Advanced Engineering (IJIRAE) Issue 8, Volume2.
- [2]A. Sivaji & N. Madhava Reddy (2019)"Analysis & Design Of Multi-Story Building Using Staad Pro And E-Tab" International Journal of Management, Technology And Engineering (IJMTE) Issue 1 ,Vol 9.
- [3]Isha Bedi, Girish Sharma & et, al.(2017) "Comparative Study Of Rcc Frame Structures Using Staad.Pro, Etabs, And Sap" International journal of advance research in science & Engineering . Issue 9,Vol 6.
- [4]M. P Tayade. & M. R. Vyawahare(2017) "A Comparative Study Of Stress Parameters Obtained By Staad-Pro And Etab" International journal of research in applied science & Engineering Tcehnology (IJRASET) . Issue 2, Vol 5.
- [5] Sv. Bhaskar Reddy and V.Madhu(2018) "Comparative Study On Design Results Of A Multi-Storied Building Using Staad Pro And Etabs For Regular And Irregular Plan Configuration" International Journal of appllied Engineering research Issue 15,Vol 13.

- [6]Mohammad Kalim, Abdul Rehman, B S Tyagi(2018) “Comparative Study on Analysis and Design of Regular Configuration of Building by Staadproand Etabs” International Research Journal of Engineering and Technology (IRJET) Issue 03,Vol 5.
- [7]Lalit Balhar, Dr. J.N. Vyas(2019) “Comparative Analysis Of Flat Slabs & Conventional Rc Slabs With And Without Shear Wall”, International Research Journal of Engineering and Technology (IRJET) Issue 01,Vol 6.
- [8]Lalit Balhar, Dr. J.N. Vyas, “review paper on comparative analysis of flat slabs & conventional rc slabs with and without shear wall”, International Research Journal of Engineering and Technology (IRJET) Issue 02, Vol 6 (February 2019).
- [9]Arindam Sahu, Rohit Bose & et. al.(2016) “design & analysis of multi-storied building using sap 2000” Journal of Basic and Applied Engineering Research Issue 11,Vol 3.
- [10]Deyuan Zhou, Changtuan Guo & et. al. (2016) “seismic evaluation of a multitower connected building by using three software programs with experimental verification” Hindavi Publishing cooperation shock & vibration (2016).
- [11]Sumukam Sai Charan Raj, Suraj Baraik, Dr. G Venkata Ramana, “WIND ANALYSIS OF HIGH-RISE BUILDINGS USING SAP2000” , International Journal of Civil Engineering and Technology (IJCIET) ,Issue 8, Vol 9 (AUGUST 2018).
- [12]T.Subramani, K.Murali , “Analytical Study of Tall Building with Outtrigger System with Respect to Seismic and Wind Analysis Using ETABS” , International Journal of Engineering & Technology (2018).
- [13]Rajeshwari Patil, Shweta Anoor, Shweta Desai “Analysis and Design of Residential Building by Using SAP-2000, International Research Journal of Engineering and Technology (IRJET) Issue 05, Vol 4 (May 2017).
- [14]Arvind Vishwakarma, Savita Maru Assessment on Human Comfort Criteria of Tall Building under Dynamic Wind Loading International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-9, Issue-2, December 2019
- [15]Arvind Vishwakarma, Savita Maru(2019) Assessment on Human Comfort Criteria of Tall Building under Dynamic Wind Loading, International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-9, Issue-2, December 2019, pp – 2265-2273. Retrieval Number: B6688129219/2019©BEIESP DOI: [10.35940/ijitee.B6688.129219](https://doi.org/10.35940/ijitee.B6688.129219)
- [16]V.Ramanjaneyulu, Dharmesh.M, V.Chiranjeevi (2018) Comparative Study On Design Results Of A Multi-Storied Building Using Staad Pro And Etabs For Regular And Irregular Plan Configuration International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 05 Issue: 01 | Jan-2018 www.irjet.net p-ISSN: 2395-0072, pp 676-681.
- [17]Mohammad Kalim1, Abdul Rehman2, B S Tyagi(2018) Comparative Study on Analysis and Design of Regular Configuration of Building by Staadproand Etabs International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 05 Issue: 03 | Mar-2018 www.irjet.net p-ISSN: 2395-0072, pp 1794-1797.
- [18]Prashanth.P1, Anshuman.S2, Pandey.R.K3, Arpan Herbert 4(2010) Comparison of design results of a Structure designed using STAAD and ETABS Software International Journal of Civil and Structural Engineering Volume 2, No 3, 2012 ISSN 0976 – 4399, pp 869-875.