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COMPARATIVE STUDY ON DESIGN RESULTS OF RCC FRAME STRUCTURE USING STAAD PRO AND ETABS FOR REGULAR AND IRREGULAR PLAN

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ABSTRACT

ETABS and STAAD. Pro are leading commercial software's worldwide for structural analysis. STAAD. Pro and ETABS are the present day leading design software's in the market. Structural Analysis and design are predominant in finding out significant threats to integrity and stability of a structure. Multi storied structures, when designed, are made to fulfil basic aspects and serviceability. Since Robustness of structure depends on loads imposed, it requires attention. All the challenges faced by structural engineers were taken as opportunities to develop software's such as STAAD. Pro, ETABS & SAFE, SAP etc., with ease of use. The main purpose of this study is to carry out a detailed analysis on simulation tools ETABS and STAAD. Pro, which have been used for analysis and design of rectangular Plan with vertical regular and rectangular Plan with Vertical geometrically irregular multi-story building. The design results using STAAD. Pro and ETABS of rectangular RCC building, for both regular and irregular plan configuration, are obtained and compared. It was observed that STAAD.Pro is more user friendly, accurate, compatible for analyzing design results and many more advantages to be discussed in this study over ETABS.

Key Words: Staadpro, Etabs, Structural Elements, Frame, Load Combinations.

1. INTRODUCTION

1.1.1 STAAD PRO

STAAD is powerful design software licensed by Bentley .STAAD stands for Structural Analysis and Design any object which is stable under a given loading can be considered as structure. So first find the outline of the structure, whereas analysis is the estimation of what are the type of loads that acts on the beam and calculation of shear force and bending moment comes under analysis stage. Design phase is designing the type of materials and its dimensions to resist the load. This we do after the analysis.

To calculate shear force diagram and bending moment diagram of a complex loading beam it takes about an hour. So when it comes into the building with several members it will take a week. STAADPRO is a very powerful tool which does this job in just an hour. Staad is a best alternative for high rise buildings.

1.1.2ETABS

ETABS is the Acronym of EXTENDED 3D ANALYSIS OF BUILDING SYSTEMS, is software developed by Computers and Structures, Inc. (CSI); a Berkeley, California based engineering software company founded in 1975. ETABS is an engineering software product that can be used to analyze and design multi-story buildings using grid-like geometry, various methods of analysis and solution techniques, considering various load combinations.

ETABS can be effectively used in the analysis and design of building structures which might consists of structural members like beams, columns, slabs, shear walls etc., With ETABS you can easily apply various construction materials to your structural members like concrete, structural steel, Reinforced Concrete etc. ETABS automatically generates the self-weights and the resultant gravity and lateral loads.

ETABS is commonly used to analyze Skyscrapers, parking garages, steel & concrete structures, low rise buildings, portal frame structures, and high rise buildings.

1.2 OBJECTIVE OF THE STUDY

1) The main purpose of this study-oriented project is to detailed study of simulation tools for analysis and designing of structures.

2) Comparison of simulation implements STAAD PRO, and ETABS, and analysis of rectangular Plan with vertical regular and rectangular Plan with Vertical geometrically irregular multi-story building using static analysis method.

3) To compare the designed structure on the bases of load capacity.

2. LITERATURE REVIEW

B Suresh et.al in (2012),[30] **"**has concluded that STAAD.Pro software is widely used in analyzing and designing structures – buildings, bridges, towers, transportation, industrial and utility structures. Designs can involve building structures including culverts, tunnels, bridges, and piles and building materials like steel, concrete, timber, aluminum, and cold-formed steel**"**.

Prashant et.al in (2012), [24] **"**presented STAAD.Pro and ETABS are the cutting-edge leading design software's inside the market. Many design group's use these software's for their challenge design purposes. So, this venture especially deals with the comparative analysis of the outcomes obtained from the design of an everyday and a plan abnormal (as in line with IS 1893) multi story building shape when designed the use of STAAD.Pro and ETABS software's one by one. These effects will also be in comparison with guide calculations of a sample beam and column of the equal structure designed as in step with IS 456**"**.

KhushbuJani et.al in (2013), [15] **"**presented the advancement in product generation, materials, structural structures and analytical techniques for evaluation and layout facilitated the increase of excessive upward push buildings. Structural design of excessive rise homes is governed by means of lateral hundreds because of wind

or earthquake. Lateral load resistance of structure is provided by using indoors structural machine or exterior structural system. Analysis and design of 36 store diagrid metal building is presented. A regular ground plan of 36 m × 36 m length is taken into consideration. ETABS software is used for modeling and analysis of structural contributors. All structural participants aredesigned as in step with IS 800:2007 considering all load combinations. Dynamic along wind and across wind are considered for analysis and layout of the shape. Load distribution in diagrid device is also studied for 36 story constructing. Similarly, evaluation and design of 50, 60, 70 and 80 store diagrid systems is performed.**"**

T.T. ISoonget.al in (2014,) [14] "has concluded that structural engineering is mainly a sub-division of civil engineering in which structural engineers are trained to understand, predict, and calculate the stability, strength and rigidity of built structures for buildings and no building structures, to develop designs and integrate their design with that of other designers, and to supervise construction of projects on site. They can also be involved in the design of machinery, medical equipment, and vehicles where structural integrity affects functioning and safety**"**.

D.Ramya, A.V.S.Sai Kumar (2015): A comparative study on design of G+10 building by staadpro and etabs. The paper focuses to conclude the effectiveness of use of a structure software between these two. They found that sometimes staadpro is good for use but many times etabs.

Aman, Manjunath Nalwadgi, Vishal T, Gajendra (2016): aimed an Analysis and design of multistory building by using STAAD Pro for the G+5 commercial building and shows short term deflection, structure is safe in shear and flexure, amount steel provided is economic and so on.

3. METHODOLOGY

A research presents the main features and organization of STAAD Pro and ETABS, a computerPrograms that have been developed for the static and seismic stability evaluations ofdifferent civil engineeringstructures and concrete gravity dams. Our project involves analysis and design of multistoried building using very popular designing software STAAD Pro and ETABs against all possible loading conditions. In this chapter a multistory building has been modeled and analyze with considering all loads like Dead load, Live load, Wind load, Seismic loads as per as IS standard.

Following data has been used in this design as:

- RC moment resisting frame fixed at base.
- Seismic Zone: II
- No of story's :10
- Density of concrete : 25kN/m^2
- Live load on floor level : 3kN/m^2
- Live load on roof level : 1.5kN/m^2
- Plan (regular) : 25m*25m
- Beam dimension : 400mm*400mm
- Column dimension :850mm*850mm
- Slab thickness : 150mm

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- Concrete grade used : M30
- Type of building : RC framed

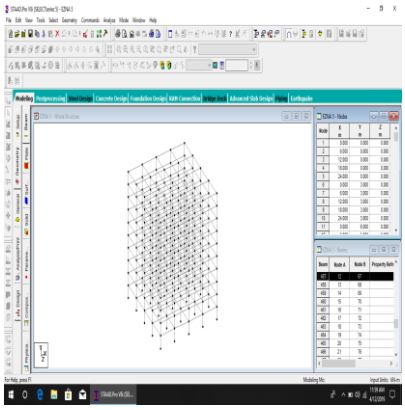

Fig 1: Nodes and Beams for RCC Structure

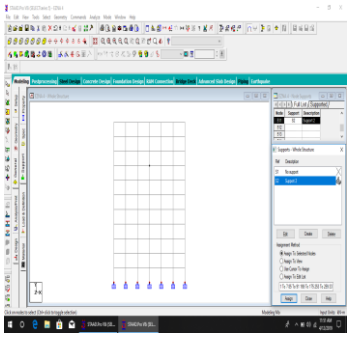

Fig 2: Supports of RCC Structure

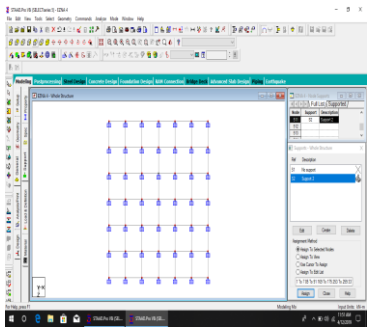

Fig 3: Plan of RCC Frame Structure

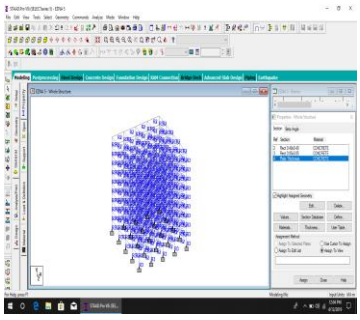

Fig 4: Properties of RCC Structure

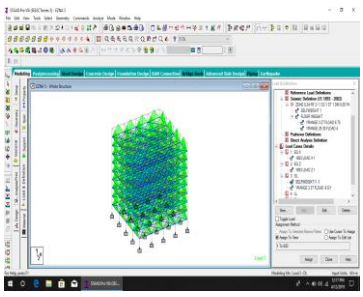

Fig 5: Load Definition of RCC Structure

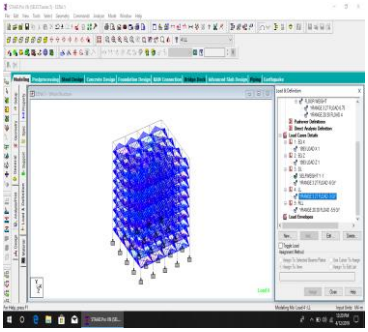

Fig 6: Structure under Live Load

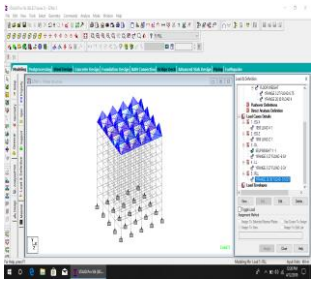

Fig 7: Structure under Roof Live Load

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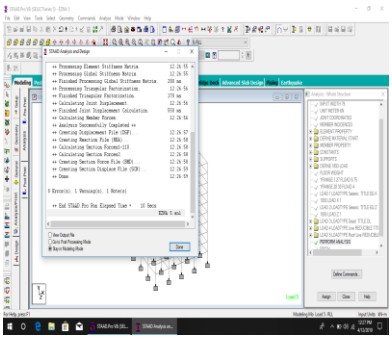


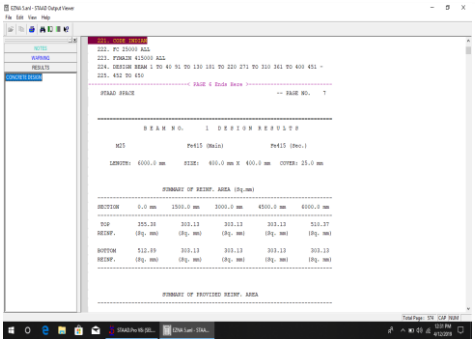
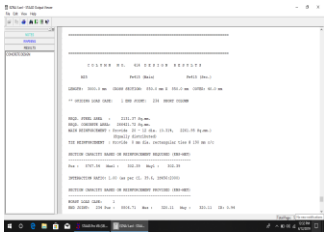


Fig 8: Analysis of Loads on RCC Structure **Fig 9: Beam Design Results**



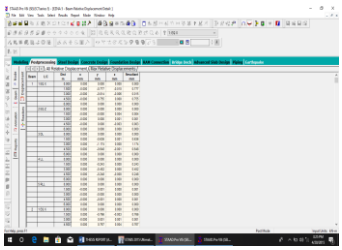
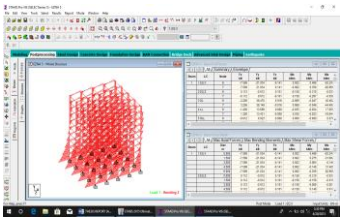


Fig 10: Column Design Results **Fig 11: Displacement of the Structure of Beam Relative Values**



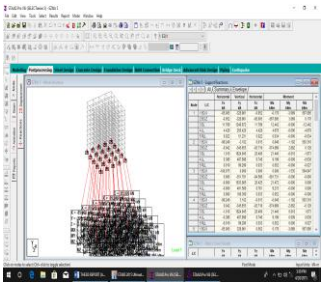


Fig 12: Beam End Forces of RCC Frame Structure **Fig 13: Values of Support Reactions**

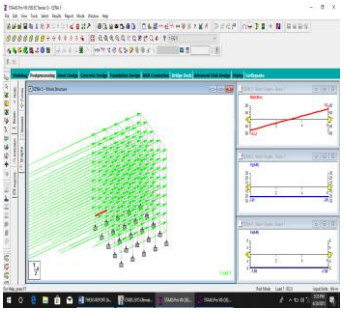


Fig 14: Graphical Representation of Forces and Moments.

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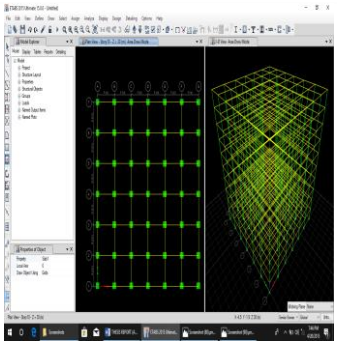

Fig 15: RCC Frame Structure Imported and analyzed using ETABS.

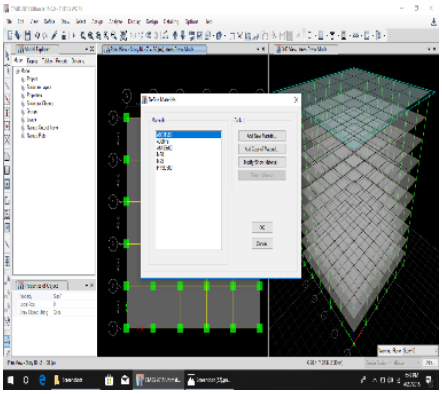

Fig 16: Defining Materials of RCC Frame Structures

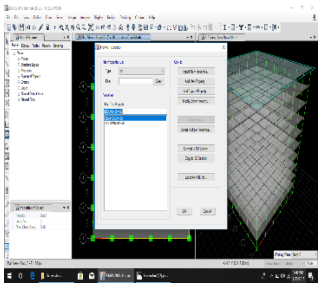

Fig 17: Frame Properties of RCC Frame Structures

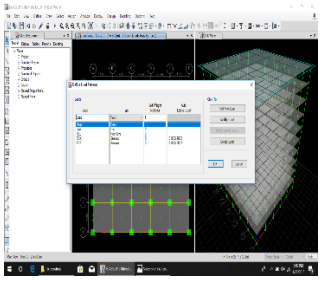

Fig 18: Defining Load Patterns on RCC Frame Structures

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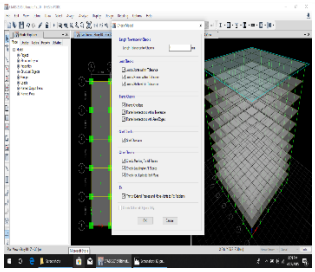

Fig 19: Representation of Check Model

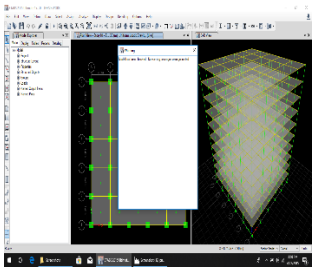

Fig 20: Analysis of Loads on RCC Frame Definition of Structure

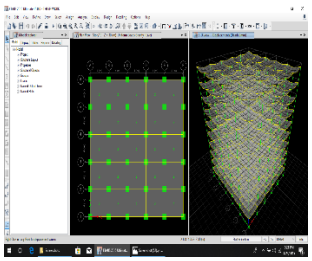

Fig 21: Representation of Displacements of RCC Frame Structures

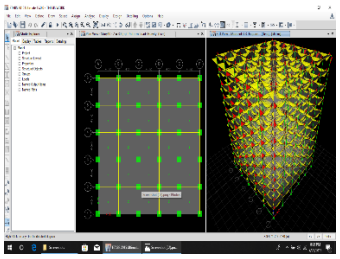

Fig 22: Representation of Moment Diagram

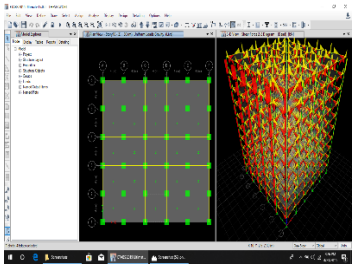

Fig 23: Representation of Shear Diagram

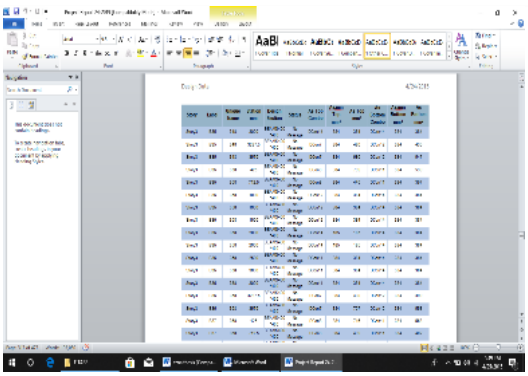

Fig 24: Design Data of RCC Frame Structure.

4. CONCLUSIONS From the design results of beams, we may conclude that ETABS gave lesser area of required steel as compared to STAAD PRO.

- From dynamic analysis mode shapes are generated and it can be concluded that asymmetrical plans undergoes more deflection that or deformation then symmetrical plans.
- By comparing the results of two structures regular and irregular, the frame elements of regular has shown maximum bending moments shear forces and axial forces for different loading condition in both software's.
- The values of force derivative of STAAD PRO are low as Compared to ETABS
- ETABS provide detailing of structure while as STAAD PRO does not provide detailing of structure.
- By the intensive study of "Comparative study on Analysis and Design of multi-storied building by both STAAD and ETABS software's" the "economical sections" was developed by ETABS software.

5. FUTURE SCOPE

- Any structural designer will use this project as a reference for analysis of RCC Framed Structure.
- In Future the analysis can be made with a scope of extension in the design in the building due to increased need in space and availability if possible.
- This project work helps the structure designers to decide which software is better for designing RCC Framed Structure.
- STAAD PRO software is more flexible to work as compared to the ETABS software.

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