Analysis and Design of G+5 Building System at Jalgaon, Maharashtra.

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ABSTRACT

ETABS stands for Extended Three-Dimensional Analysis of Building Systems. ETABS is commonly used to analyze: Skyscrapers, concrete structures, low and high rise buildings, and portal frame structures. Plan of the building is drafted by using AutoCAD which is then transferred for Analysis in ETABS. Modelling of 5-storeys R.C.C. framed building is done on the ETABS software for analysis results ETABS issue, for analysis and design for building systems. ETABS features are contain powerful graphical interface coupled with unmatched modeling, analytical, and design procedures, all integrated using a common database. STAAD and ETABS both of the software are well equipped and very much capable of handling different shape of the structures, static and dynamic loadings and different material properties. ETABS signify Extended three Dimensional Analysis of Building Systems. In the present study, we are mainly determining the results of a lateral loads on moments, shear force, base shear, axial force, maximum displacement and tensile forces on structural system is subjected and also comparing the results of seismic zones 3, 4 and 5. The version of the software used is ETABS 2019, With the help of this software building can be analyzed before the construction, and we can check the failure in the analysis and redesign them, so that failure can be prevented. Once we get the results construction can be done according to design. This project is designed as per INDIAN CODES – IS 1893 part II: 2016, IS 456:2000, IS 875 part I, II, III:2015.

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I. INTRODUCTION

Whenever we think of Design and Analysis of residential building in 21st centaury one thing that comes in our mind is that construction of high rise building has been involved. In Ancient times human lived life as Nomads and accommodated themselves either under trees or in the caves to protect themselves from wild animals, and natural sources like sun rain etc. as the time moved on the people started living either in huts made of timber or mud. Now those houses have been made into beautiful and high floored houses which completely changed the lifestyle of the people. Single storied building generally consists of ground storey only. While multi storied building consist of multiple stories, typically containing vertical structure in form of ramp, stairs, lift etc. With the need of multi storied building requirement all over the world and the buildings touching the sky, safety is the biggest requirement, so people can live happily.

II. LITERATURE REVIEW

1. Sayyed A.Ahad1, Hashmi S Afzal2, Pathan Tabrej3, Shaikh Ammar4, Shaikh Vikhar5, Shivaji Bidve6, Design and Analysis of the residential building which has (G+10) stories has been done. Analysis was done using ETABS software Version 15.2 which proved to be good enough in the design for construction and the structural analysis of all the sections. All the elements of structure like concrete wall, which retains weight of soil are provided. As per soil investigation reports they provided isolated footing. The sectional and design analysis were done using STAAD-PRO and result can be compared.

2. B. M. Saiful Islam (2011) [17] In this study analysis results show that isolation system considerably reduce earthquake induced load on building. Furthermore, method of analysis has been found to have considerable effect on the response of low to medium rise buildings. Time history analysis shows significant less base shear than that from response spectrum analysis. Also, less isolator displacement is obtained from time history analysis than that from response spectrum analysis.

3. S Abhishek1, Manoj S K2, Roopa B D3, Bhagyashree M S4, Guruprasad C H M5, They took into consideration residential buildings (G+1) design and analysis using ETABS, wherein they got very productive results through which they got a great industrial exposure and saved their designing time as well as analysis. They took load consideration for the worst cases for the loading in structures. They designed structural components manually as well as on the software and further compared.

4. Patil A S (2013) [16] This study shows similar variations pattern in Seismic responses such as base shear and Story displacements with intensities V to X.From the study it is recommended that analysis of multi-Storyed RCC building using Time History method becomes necessary to ensure safety against earthquake force.

5. K. Kiran Mai1, Mohd Amer2, MD. Shaibaz Ali3, Mohammed Fazal Ahmed4, Mohammed Omair5, Aftab Tanveer6, This paper mainly deals with the analysis done by comparing the results which we have obtained from the analysis of a multi storied building structure through manual method as well as by using ETABS software. In their construction site they considered a plan under zone –IV. Seismic Intensity came out to be Severe and Zone Factor is 0.24.

6. Abhay Guleria (**2014**): Abhay Guleria presents the analysis of the multi-storeyed building using ETABS reflected that the storey overturning moment varies inversely with storey height. Moreover, L-shape, I-shape type buildings give almost similar response against the overturning moment. Storey drift displacement increased with storey height up to 6th storey reaching to maximum value and then started decreasing. From dynamic analysis, mode shapes are generated and it can be concluded that asymmetrical plans undergo more deformation than symmetrical plans. Asymmetrical plans should beadopted considering into gap.

7. Pushkar Rathod and Rahul Chandrashekar (2017): With the help of seismic analysis, the structure can be designed and constructed to withstand the high lateral movement of earth's crust during an earthquake. Any type of basic or a highly advanced structure which maybe under static or dynamic conditions can be evaluated by using ETABS. ETABS a coordinated and productive tool for analysis and designs, which range from a simple 2D frames tomodern high-rises which makes it one of the best structural software for building systems.

8. Ali Kadhim Sallal (2018): His main purpose of this software is to design and analysis multi-Storeyed building in a systematic process. This paper present a building where designed and analyzed under effect of earthquake and wind pressure by using ETABS software. In this case, (18m x 18m) and eight stories structure are modelled using ETABS software. Ten Storey is taken as (3m) height and making the total height of the structure (31m).

III. METHODOLOGY

Step 1: Initial setup of Standard Codes and Country codes

Step 2: Creation of Grid points & Generation of structure After getting opened with ETABS we select a new model and a window appears where we had entered the grid dimensions and story dimensions of our building.

Step 3: Defining of property Here we had first defined the material property by selecting define menu material properties. We add new material for our structural components (beams, columns, slabs) by giving the specified details in defining. After that we define section size by selecting frame sections as shown below & added the required section for beams, columns etc.

Step 4: Assigning of Property After defining the property we draw the structural components using command menu. Draw line for beam for beams and create columns in region for columns by which property assigning is completed for beams and columns.

Step 5: Assigning of Supports By keeping the selection at the base of the structure and selecting all the columns we assigned supports by going to assign menu joint\frame Restraints (supports) fixed.

Step 6: Defining of loads In ETABS all the load considerations are first defined and then assigned. The loads in ETABS are defined as using static load cases command in define menu.

Step 7: Assigning of Dead loads After defining all the loads. Dead loads are assigned for external walls, internal walls in staad but in E-TABS automatically taken care by the software i.e., inbuilt.

Step 8: Assigning of Live loads Live loads are assigned for the entire structure including floor finishing.

Step 9: Assigning of wind loads Wind loads are defined and assigned as per IS 875:2015 PART 3 by giving wind speed and wind angle.

Step 10: Assigning of Seismic loads Seismic loads are defined and assigned as per IS 1893: 2016 by giving zone, soil type, and response reduction factor in X and Y directions.

Step 11: Assigning of load combinations Using load combinations command in define menu 1.5 times of dead load and live load will be taken as mentioned in above.

Step 12: Analysis After the completion of all the above steps we have performed the analysis and checked for errors.

Step 13: Design After the completion of analysis we had performed concrete design on the structure as per IS 456:2000. ETABS performs the design for every structural element.

3.1 Architectural plan:



1. Material Property

Grade of concrete (for all structural elements): M20, Unit weight of concrete: 25kN/m3, Unit weight of cement mortar: 24kN/m3, Unit weight of water: 10kN/m3, Unit weight of Brick: 20kN/m3, Grade of concrete: M20, Grade of steel: Fe 415, Beam Size: 230X300 mm, 230X380 mm, 230X450 mm, 230X530 mm, 230X600 mm, Column Size: 230X600 mm, 300X450 mm300X600 mm

2. Description of Loads

Live load (on floors): 1.5kN/m2, (IS 875:2015 – Part -2) Live load (on roof): 0.75kN/m2, (IS 875:2015 – Part -2) Floor Finishes (on floors): 1.5kN/m2



IV. RESULTS OF ANALYSIS:



Fig.4.2. Moment Diagram



on any Line for detailed diagram

Fig.4.4. Axial Force Diagram

< >> Units...

V. RESULTS OF DESIGN:



Fig.4.5. 3D View



Fig.4.6. Plan View

VI. CONCLUSION

1. A building of (G+5) floors subjected to seismic, wind and live loads were analyzed using ETABS 2019 software. **2.** All members were designed using ETABS. **3.** The members which aren't appropriate will be obtained and suitable sections are recommended by the software. **4.** Better accuracy of the analysis can be obtained by using ETABS software. **5.** Usage of ETABS software saves the working time and helps us in the Designing the structure accurately. **6.** The structure is design based on the theory of LIMIT STATE METHOD which provide adequate strength, serviceability, and durability besides economy. The displacement, shear force, bending moment variation has been shown. If any beam fails, the dimensions of beam and column should be changed and reinforcement detailing can be produced.

REFERENCE

- [1]. Sayyed A.Ahad1, Hashmi S Afzal2, Pathan Tabrej3, Shaikh Ammar4, Shaikh Vikhar5, Shivaji Bidve6, Design and Analysis of the residential building which has (G+10) stories has been done.
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