



ANALYSIS AND DESIGN OF A G+4 RESIDENTIAL BUILDING USING SOFTWARES

R.H.S Phanindra¹, T.Girish², N.Pavan Kumar³, M.Atri Sai Manikanta⁴, T.Nithin Kumar⁵, P.SreePavan⁶

Assistant Professor¹, UG Student², UG Student³, UG Student⁴, UG Student⁵, UG Student⁶
Civil Engineering,
NRI Institute Of Technology, Vijayawada, India

Abstract: Structural Analysis is a branch which involves in the determination of behavior of structures in order to predict the responses of different structural components due to effect of loads. Each and every structure will be subjected to either one or the groups of loads, the various kinds of loads normally considered are dead load, live load, earth quake load and wind load. ETABS (Extended Three-Dimensional Analysis of Building System) is a software which is incorporated with all the major analysis engines that is static, dynamic, Linear and non-linear, etc. and especially this Software is used to analyze and design the buildings. Our project "Analysis and Design of R. C. C. building using ETABS software" is an attempt to analyze and design a R. C. C. building using ETABS. A G+4 stored building is considered for this study. Analysis is carried out by static method and design is done as per IS 456:2000 guidelines. Also, an attempt has been made to design the structural elements manually. Drawing and detailing are done using Auto CAD as per SP 34.

Index Terms - Irregular structures, seismic analysis, wind analysis, shear wall, ETABS, STAAD-PRO, stored drift, lateral displacement.

I. INTRODUCTION

The search of man for new methods for constructing his shelter and the invention of cement, led him to the use of multi-story buildings in the form of framed structures. The R.C.C roofs made it easier to build on top of one another. More and more people began opting for multi-storey flats as the land value showed a sharp increase, to exponential increase in the population and limited land supply. Due to scarcity of land and high population density, multistoried buildings are becoming a necessity these days. Recently, there have been a considerable increase in the number of tall buildings both residential and commercial and modern trend is towards taller and taller structures. The advancement in science and technology had made it possible to build high rise structures in areas even susceptible to cyclones and earthquakes. Thus, the effect of lateral loads like wind loads and earthquake forces are gaining importance and almost every designer is faced with problem of providing adequate strength and stability against lateral loads. These lateral forces can produce critical stresses in the structure, set up undesirable vibrations and in addition cause lateral sway of structure, which can reach a stage of discomfort to occupants. In the design of a reinforced concrete structure, the aim is to provide a safe, serviceable, durable, economical and aesthetically pleasing structure.

For the structure to be safe, it must be able to resist the worst loading conditions. Under normal working conditions, the deformation and cracking must not be excessive for the structure to remain serviceable, durable and aesthetically pleasing during the expected design life. Furthermore, the structure should be economical with regard to both construction and maintenance cost. The term building in Civil Engineering is used to mean a structure having various components like foundation, walls, columns, floors, roofs, doors, windows, ventilators, stairs lifts, various types of surface finishes etc. Structural analysis and design are used to produce a structure capable of resisting all applied loads without failure during its intended life. Prior to the analysis and design of any structure, necessary information regarding supporting soil has to be collected by means of geotechnical investigation. A geotechnical site investigation is the process of collecting information and evaluating the conditions of the site for the purpose of designing and constructing the foundation for a structure. Structural engineers are facing the challenges of striving for most efficient and economical design with accuracy in solution while ensuring that the final design of a building and the building must be serviceable for its intended function over its design life time. Now a day's various software packages are available in market for analyzing and designing practically all types of structures viz. RISA, STAADPRO, ETABS, STRUDL, MIDAS, SAP and RAM etc. The term building in Civil Engineering is used to mean a structure having various components like foundation, walls, columns, floors, roofs, doors, windows, ventilators, stairs lifts, various types of surface finishes etc. Structural analysis and design are used to produce a CIVIL ENGINEERING NRIIT 13 structure capable of resisting all applied loads without failure during its intended life. Etabs is a stand-alone structural analysis program with a special purpose features for structural design and analysis of building systems.

II. OBJECTIVES OF THE PAPER

- THE MAIN OBJECTIVE OF THIS STUDY IS TO ANALYZE AND DESIGN A G+4 RESIDENTIAL BUILDING USING ETABS SOFTWARE.
- COMPARISON OF RESULTS OBTAINED FROM ETABS SOFTWARE WITH A MANUAL METHOD
- TO DESIGN STRUCTURAL COMPONENTS LIKE BEAM, SLAB, COLUMN AND FOOTING USING ETABS. COMPARISON OF RESULTS OBTAINED FROM ETABS SOFTWARE WITH IS CODE.

III. SILT FLOOR PLAN

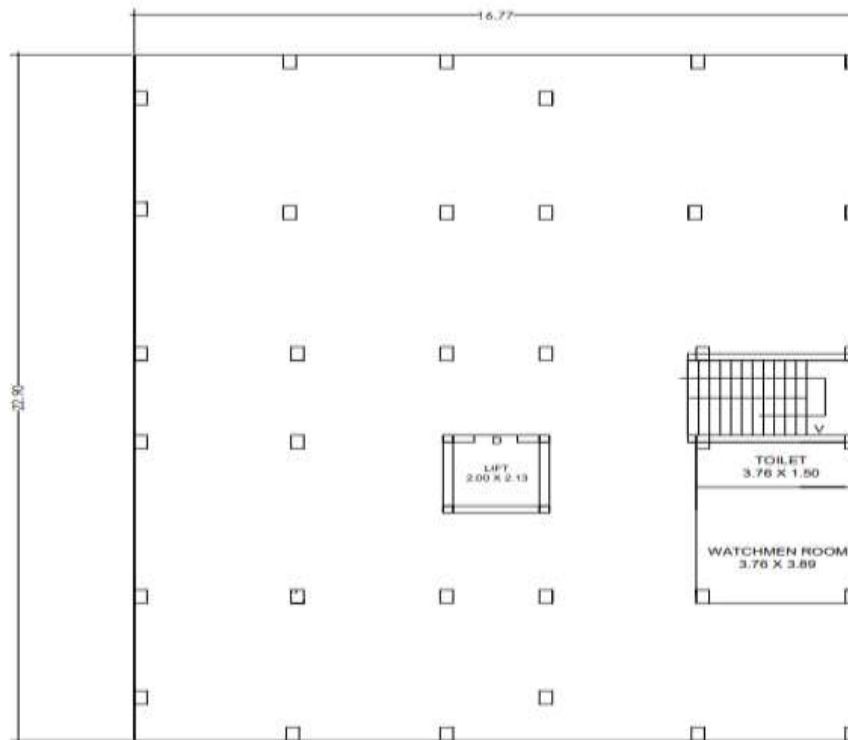


Fig – 1: Stilt Floor Plan

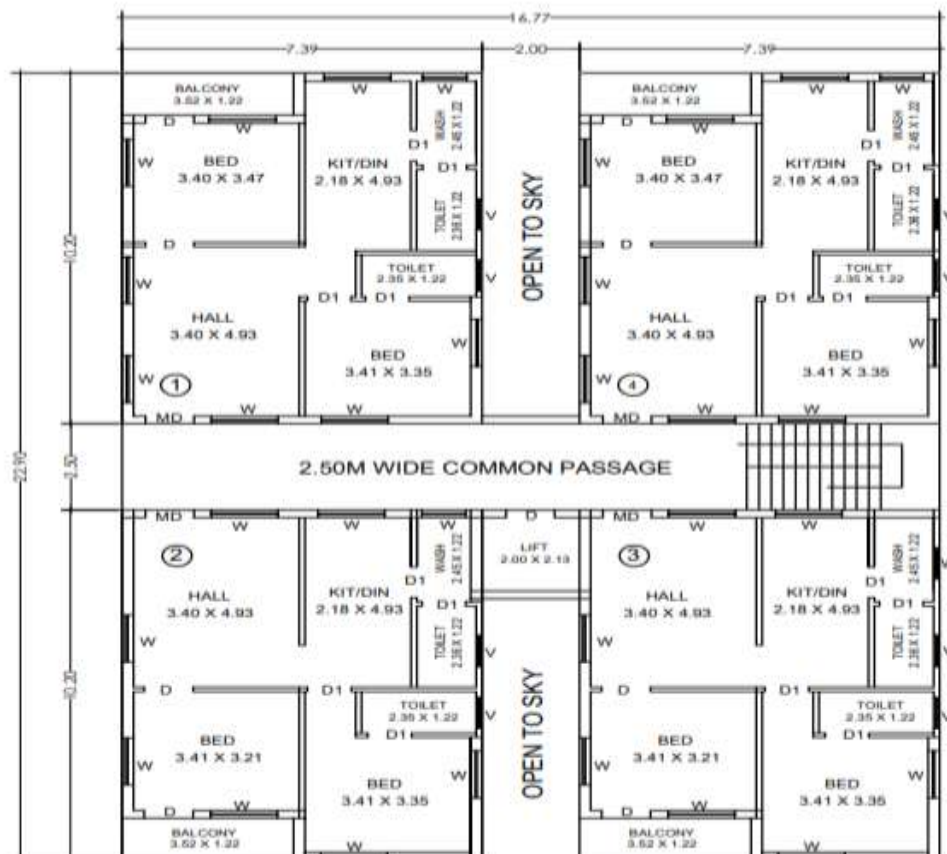


Fig – 2: Typical floor plan

3.1 RESULTS AND DISCUSSIONS

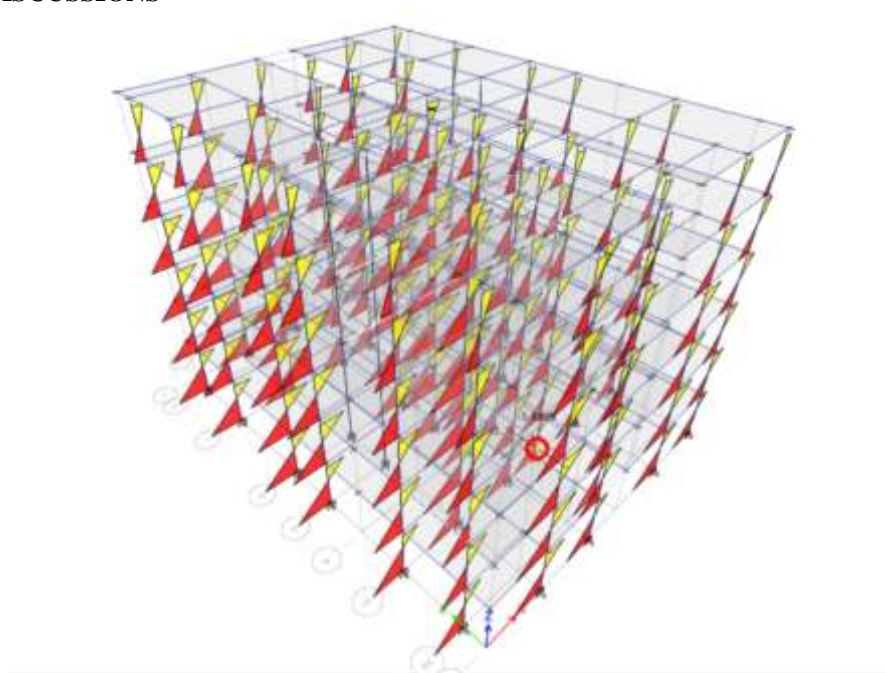


Fig – 3: Bending Moment Diagram Of Building

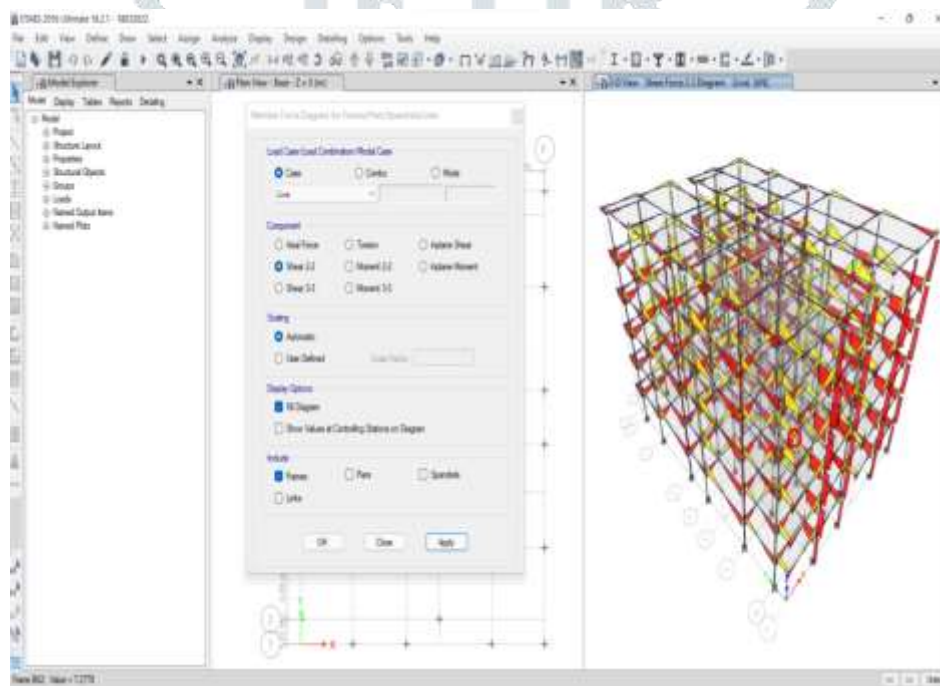


Fig – 4: Shear Force Diagram Of Building

Table-1: Design Moment and Flexural Reinforcement for Moment, M_{u3} & T_u

	Design -Moment kN-m	Design +Moment kN-m	-Moment Rebar mm ²	+Moment Rebar mm ²	Minimum Rebar mm ²	Required Rebar mm ²
Top (+2 Axis)	-3.5197		230	0	23	230
Bottom (-2 Axis)		0	57	0	0	57

Table-2: Shear Force and Reinforcement for Shear, V_{u2} & T_u

Shear V_e kN	Shear V_c kN	Shear V_s kN	Shear V_p kN	Rebar A_{sv} / s mm ² /m
30.6838	31.2686	32.2	20.1181	254.94

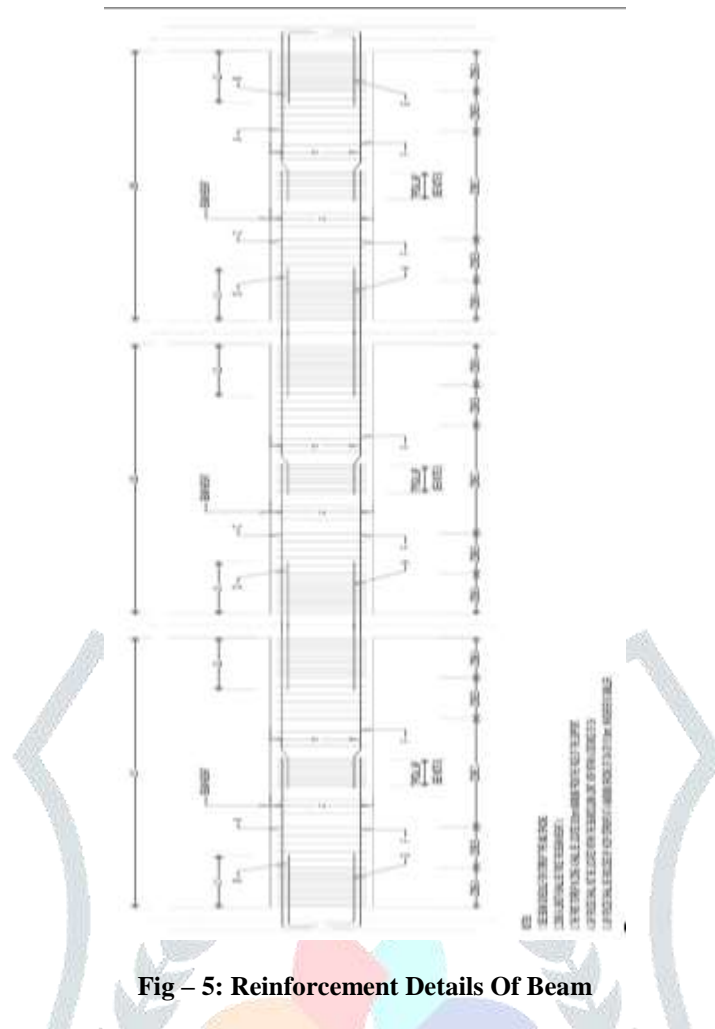


Fig – 5: Reinforcement Details Of Beam

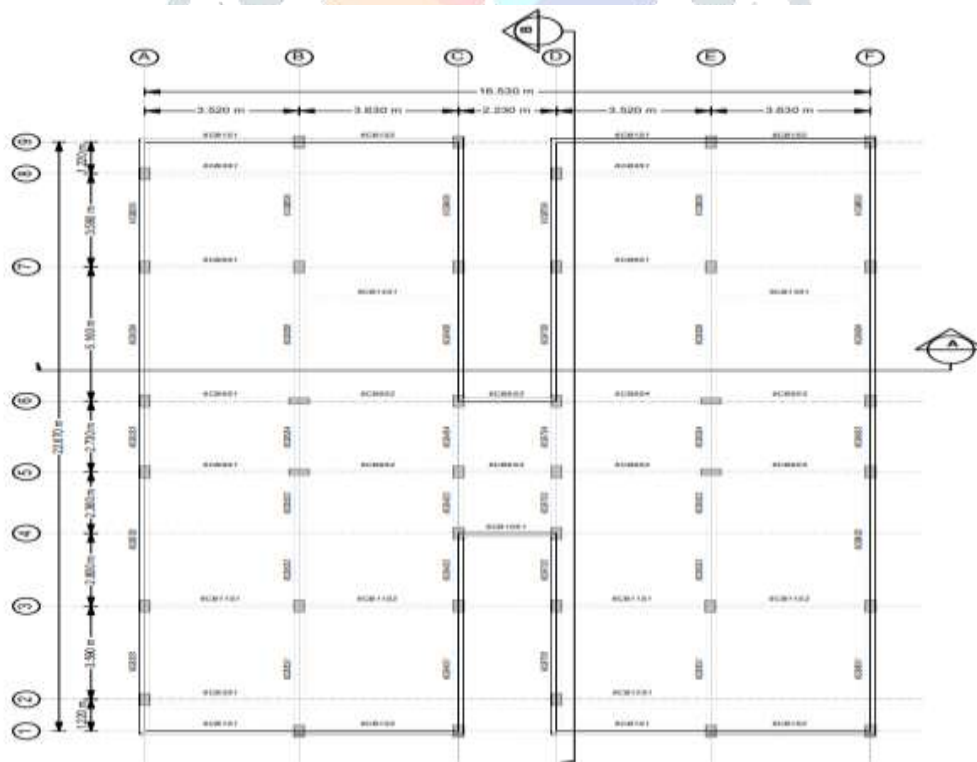


Fig – 6: Reinforcement Details Of Slab

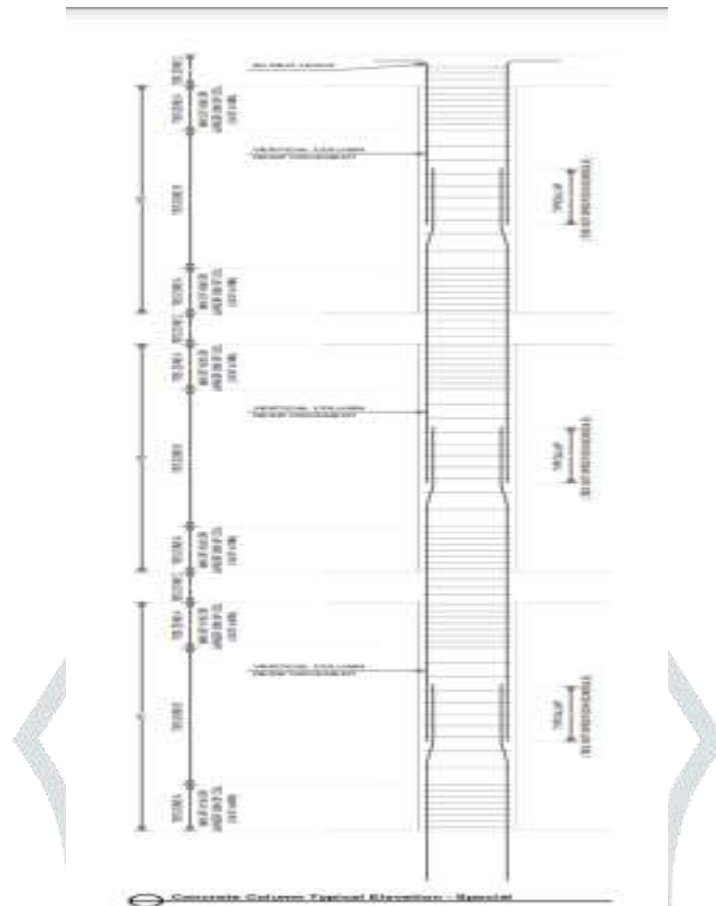


Fig – 7: Reinforcement Details Of Column

Conclusions:

- The plan of G+4 residential building was drafted using custom grid spacing in E-TABS 2016 software.
- The analysis of G+4 residential building is done using E-TABS as it takes less time to analysis the structure.
- Usage of ETABS software minimizes the time required for analysis and design.
- As the 5-storey building has similar floors ETABS is the perfect software which can be adopted for analysis and design.

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