

# DESIGN AND ANALYSIS OF MULTISTOREY BUILDING BY USING E-TABS

<sup>1</sup>MOHAMMED AMAAN, <sup>2</sup>MOHAMMED ANNAS SIDDIQ, <sup>3</sup>MOHAMMED NIZAM UDDIN ALI, <sup>4</sup>MOHAMMED ARFATH MUNEEB, <sup>5</sup>MOHD AMEER ULLAH KHAN

<sup>1,2,3,4</sup>BE Student, Dept.of Civil Engineering, Lords institute of Engineering and Technology, Hyderabad

[amaansodia1@gmail.com](mailto:amaansodia1@gmail.com), [mdannassiddiq@gmail.com](mailto:mdannassiddiq@gmail.com), [aliatheeq1@gmail.com](mailto:aliatheeq1@gmail.com),  
[arfathmuneeb@gmail.com](mailto:arfathmuneeb@gmail.com)

<sup>5</sup>Assistant Professor, Dept.of Civil Engineering, Lords institute of Engineering and Technology, Hyderabad, [mdameerullahkhan2014@gmail.com](mailto:mdameerullahkhan2014@gmail.com)

**Abstract:** Shelter is one of the three basic and most important needs of mankind and deserves much importance. Since the early age man in his quest for shelter-built structures mainly of stone and brick masonry. Today “LIMIT STATE METHOD” has evolved as the Most efficient design philosophy, after embedding Merits of “WORKING STRESS METHOD” & “ULTIMATE LOAD METHOD” and shunning their demerits. In this Project of “ANALYSIS & DESIGN OF MULTI STOREYED BUILDINGS” We have Adopted “LIMIT STATE METHOD” for design purpose. The design is in confirmation with IS456:2000. The analysis of frames has been performed by “ETABS” i.e., “stiffness matrix method”. The Advantage of “MS EXCEL” has been effectively used for writing the Beam & slab Summary. In this attempt we use to apply our knowledge acquired in the last four years of study we are happy that we could complete this work successfully and, in the process, acquired more knowledge. This work posed to us many important problems, thus forcing us to have a detailed study in to the subject.

**Keywords:** E-tabs, limit state method, working stress method, ultimate load method, multi storeyed building, ms-excel.

## I. INTRODUCTION

Building construction is the engineering deals with the construction of building such as residential houses. In a simple building can be define as an enclose space

by walls with roof, food, cloth and the basic needs of human beings. In the early ancient times humans lived in caves, over trees or under trees, to protect themselves from wild animals, rain, sun, etc. as the times passed as humans being started

living in huts made of timber branches. The shelters of those old have been developed nowadays into beautiful houses. Rich people live in sophisticated condition houses. Buildings are the important indicator of social progress of the county. Every human has desire to own comfortable homes on an average generally one spends his two third life times in the houses. These are the few reasons which are responsible that the person does utmost effort and spend hard earned saving in owning houses. Nowadays the house building is major work of the social progress of the county. Daily new techniques are being developed for the construction of houses economically, quickly and fulfilling the requirements of the community engineers and architects do the design work, planning and layout, etc. of the buildings. Draughtsmen are responsible for doing the drawing works of building as for the direction of engineers and architects. The draughtsman must know his job and should be able to follow the instruction of the engineer and should be able to draw the required drawing of the building, site plans and layout plans etc, as for the requirements.

#### **ETABS:**

The building subjected to both the vertical loads as well as horizontal loads. The

vertical load consists of dead load of structural components such as beams, columns, slabs etc and live loads. The horizontal load consists of the wind forces thus building is designed for dead load, live load and wind load as per IS 875. The building is designed as two-dimensional vertical frame and analysed for the maximum and minimum bending moments and shear forces by trial-and-error methods as per IS 456-2000. The help is taken by software available in Institute and the computations of loads, moments and shear forces and obtained from this software.

The main objectives of the project management are:

- To check& design of the seismic response of multi-storied building using Etabs.
- To make the building earthquake resistant against seismic effect
- To analysis story drift, displacement, shear, story stiffness model period

#### **II. LITERATURE SURVEY**

- N.M. Mary Shuinu studied on Structural analysis and design of a multistoried RCC building to prevent disproportionate collapse. Civil engineering structural systems are susceptible to disproportionate collapse when prone to aberrant loads

beyond the ultimate capacity of critical structural components. Sudden loss of critical structural components may result in the complete collapse of the structure. Presently, researchers follow different modelling ideas to simulate the loss of critical load supporting member for disproportionate collapse assessment. This paper is intended to study about the practices that we should follow to reduce the potential of disproportionate collapse in building.

- P Neeraja and K Anish Investigated on progressive collapse failure in a multistorey irregular structure Progressive collapse occurs due to failure of Primary load carrying members when subjected to abnormal loads or during the occurrence of earthquakes. This leads to overloading in nearby structural elements. Therefore, the load pattern of the overloaded elements changes which ultimately leads to failure of the elements. Designing the structure should be done properly to with stand the loads on it.
- Abdoul Hakim Souhaib studied on Design considerations for formwork in multistorey concrete buildings in a multistorey reinforced concrete (RCC) building construction, the formwork system and the partially completed structure support all construction loads occurring during the construction process.

Field investigations and recent analytical studies have shown that construction loads on a supporting system including slabs, shores and reshores may appreciably exceed their load-carrying capacity and contribute to a significant portion of the disasters of RC buildings during construction. This paper will examine many factors relating to the analysis of multistorey reinforced concrete buildings during construction.

- Neha Tirkey,G.B. Ramesh Kumar (2018), They took into thought of the residential buildings (G+5) style and did the analysis using ETABS, whereby they got productive results through that they got a great industrial exposure and saved their coming up with time in addition as analysis. They took load thought for the worst scenarios for the loading in their structures. They designed structural components on the software as well as manually and after they did comparison.

K. Naga Sai Gopal (2017), He took into thought of the designing of (G+5) residential buildings using ETABS, his structure was based on theory of LIMIT STATE METHOD which provide adequate strength, serviceability and durability besides economy. He took the necessary steps in the modelling process after correctly defining material in ETABS. He prepared the 3D model of the structure

using ETABS software for detailed analysis and design.

- Sayyed A. Ahad, Hashmi S Afzal, Pathan Tabrej, Shaikh Ammar, Shaikh Vikhar, Shivaji Bidve (2017), This paper deals with the analysis and design of (G+5) residential buildings. Analysis was done with the help ETABS software Version 17. It proved to be good enough in the design for construction including the analysis of all the sections. All the elements of structure like concrete wall, are provided. They provided isolated footing as per soil investigation reports. The sectional and design analysis were done with the help of ETABS and result was compared.

- V.L.S Banu, Shaik Mohd Sadeq(2021), They took into thought of the analysis and designing of the residential building (G+5) using ETABS. Their scope of the study was to produce good and strong structural work for analysis and designing of the building. They took the load consideration as per theory of LIMIT STATE METHOD. They assigned the wind loads, seismic loads, and live loads to the model. They showed the displacement, shear force, bending moment variation.

- K. KIRAN MAI, Mohammed, OMAIR, AFTAB TANVEER, this paper mainly deals with the analysis done by the members by comparison of the results

which they have obtained from the analysis of a multi storied building structure through manual method as well as by using ETABS software. They considered a plan under zone-IV and Zone Factor is 0.24

Sayyed Feroz Sikandar, Gudie (2019), This paper deals with the analysis and design of multistory building using E-tabs software. They took into consideration of dead loads, live loads, wall loads, earthquake forced, earthquake loading etc. They took the load consideration as per IS 456:2000, IS 875:1987 (Part-V) and IS 1893(part-I):2002. They checked for one way shear, two-way shear, development length, bearing stress. According to soil investigation report they provided an isolated footing. They also provided structural elements like RCC frame, shear walls and retaining walls.

### III. METHODOLOGY

Planning The basic objective of planning of buildings is to arrange all the units of a building on all floors and at level according to their functional requirements making best use of the space available for a building. The shape of such a plan is governed by several factors such as climatic conditions, site location, accommodation requirements, local by-laws, surrounding environment, etc. in

spite of the certain principles or factors, which govern the theory of planning, are common to all buildings of all classes intended to be used for residential purposes. These principles, enunciated below are right and the factors to be considered in planning are: (01) Aspect (02) Prospect (03) Privacy (04) Grouping (05) Roominess (06) Furniture Requirement (07) Sanitation (08) Flexibility (09) Circulation (10) Elegance (11) Economy (12) Practical Consideration

### **Building Bye-Laws**

Every locality has its own peculiarities in respect of weather conditions, availability of material and labour and thus adopts its own method of construction. In addition, every locality has certain rules and regulations which help in controlling the development of locality. The rules and regulations covering the requirements and ensure the safety of the public, minimum use of rooms, area limitations are known as “Building bye-laws.” Building bye-laws are necessary to achieve the following objects:

- Gives guidelines to the architects/engineer and thus help in preplanning the building activities.
- Allow to prevent haphazard development.
- Afford safety against fire, noise pollution, structural failures etc. While framing building bye-laws assistance of experts on various subjects such as town planning,

law, health, civil engineering, traffic, general administrations etc. should be sought due its weightage. Indian Standard Institution, an organization of Govt. of India has published IS 1256 “code of building laws” covering all the salient aspects of building activities. National Building Code (NBC) was published by the Govt. of India for smooth running of building activities by realizing the importance of building bye-laws.

National Building Code of India National Building Code of India was first published in 1970 and was revised in 1983. The Code contains regulations which can be immediately adopted or enacted for use by various departments, municipal administrations and public bodies. It lays down a set of minimum provisions designed to protect the safety of the public with regard to structural sufficiency, fire hazards and health aspects of buildings; so long as these basic requirements are met, the choice of materials and methods of design and construction is left to the ingenuity of the building professionals. The latest revision was made in 2005.

### **Orientation of the Building**

The orientation of the building is the relationship of the buildings to its environment. Orientation of the building is fixed by studying the sun diagram

indicating the path of sun at a particular place during the day and the year. The building orientation can have an impact on heating, lighting and cooling costs. By maximizing southern exposure, for example, one can take optimal advantage of the sun for daylight and passive solar heating. This will result in lower cooling costs by minimizing western exposures, where it's most difficult to provide shade from the sun. Important points to be remembered regarding the orientation of a building are as follows:

- Long walls of the building should face north and south; short walls should face east and west.
- A verandah or balcony can be provided towards east and west to keep the room cool.
- To protect a building from sun and rain, chajjas are required for window facing the east, west and south

#### **IV. SOFTWARE USED**

**SOFTWARE USED** AutoCAD 2017: AutoCAD is a CAD (Computer Aided Design or Computer Aided Drafting) software application for 2D and 3D design and drafting, developed and sold by Autodesk. It is a vector graphics drawing programme. It uses primitive entities-such as lines, poly-lines, circles, rectangles, arcs

and text-as the foundation for the complex objects. AutoCAD's native file format is DWG, and a lesser extent, its interchange file format, DXF has become the standards for interchange of CAD data. The plan of Multi-Story Building is done using AutoCAD software in 2D wireframe and the Centre line Diagram of the columns in the building is done in AutoCAD 2018 according to the data collected, the column positions are shown in the building plan which is made in AutoCAD. First floor plan is made in AutoCAD which is same for all the stories of the building, lift position and stairs are also shown in the AutoCAD drawing. ETABS 2017: The innovative and revolutionary new ETABS (Extended 3D Analysis of Building System) is the ultimate integrated software package for the structure analysis and design of buildings. Incorporating 40 years of continuous research and development, this latest ETABS offers unmatched 3D object-based modeling and visualization tools, blazingly fast linear and nonlinear analytical power, sophisticated and comprehensive design capabilities for a wide range of materials, and insightful graphic displays, reports, and schematic drawings that allow users to quickly and easily understand analysis and design results



**E-TABS**

Fig.1 ETABS

ETABS is a 3D modeling software for any kind of structural analysis and design. Using this program, you can perform both steel structure and RC Structure. Here are some important advantages of ETABS software for 3D modeling.

**V. PLANS AND LAYOUTS**

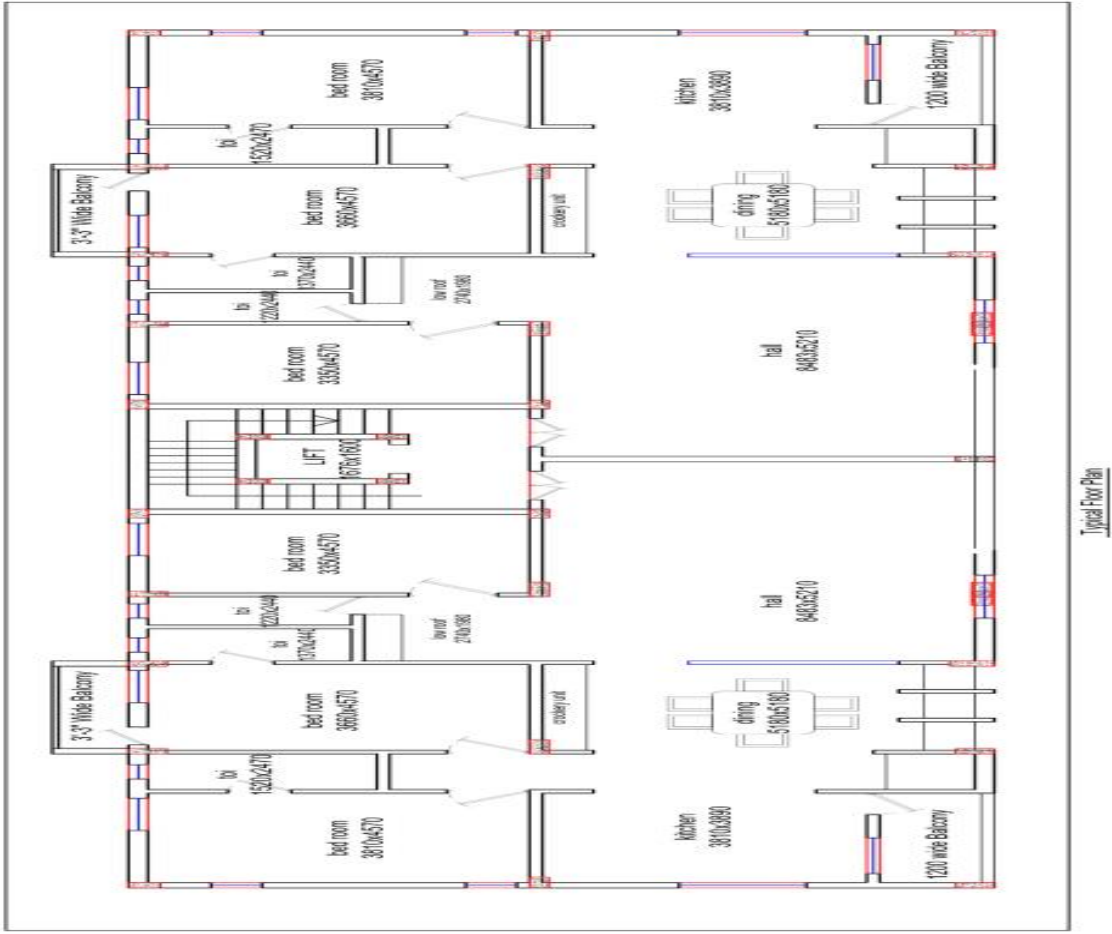


Fig.2 TYPICAL FLOOR PLAN

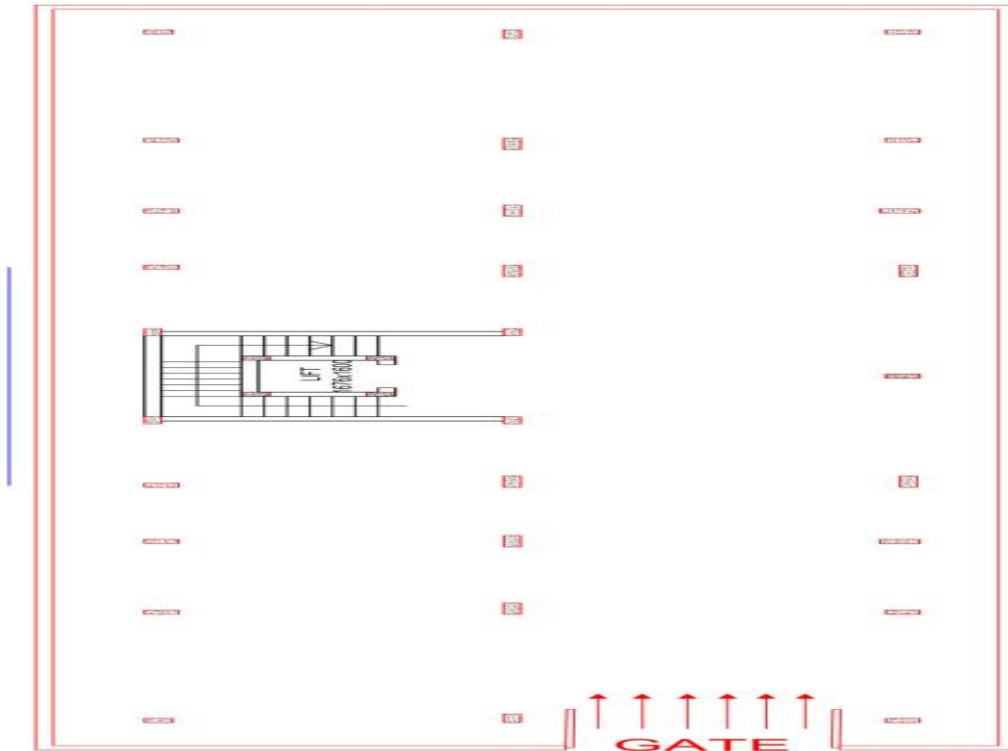




Fig.3 STILT FLOOR PLAN

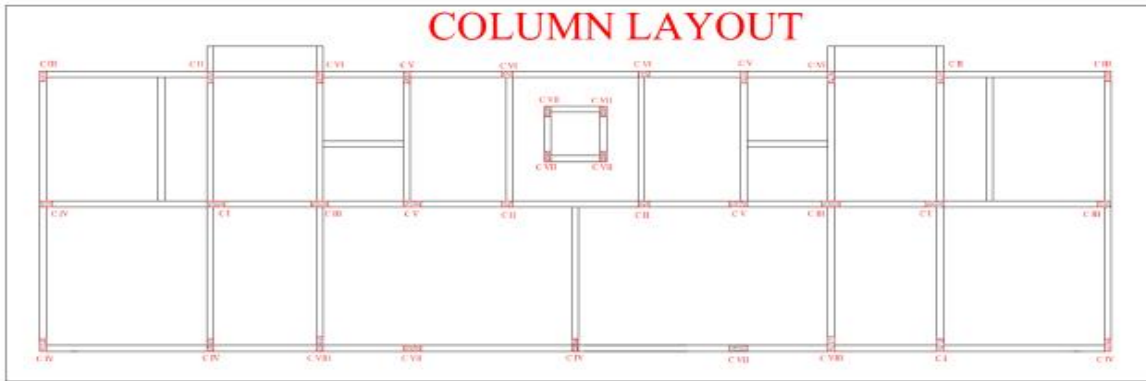


Fig.4 COLUMN LAYOUT

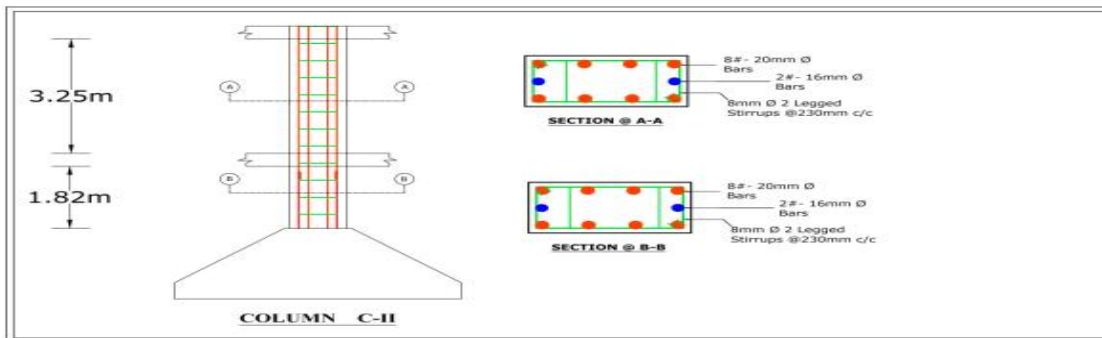


Fig.5 COLUMN REINFORCEMENT DETAILS

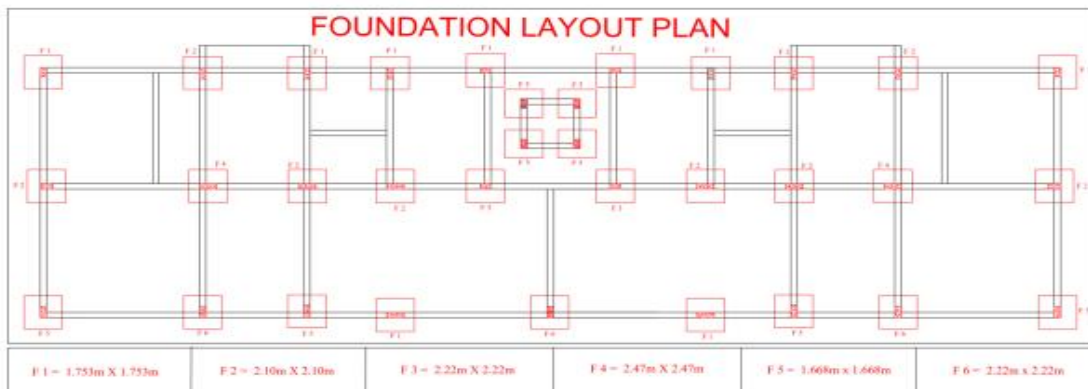
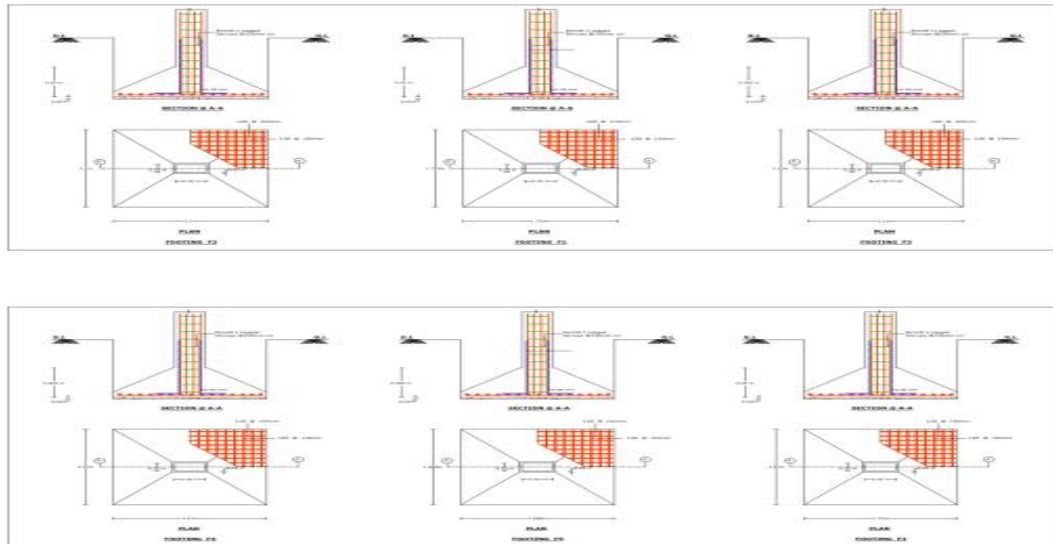
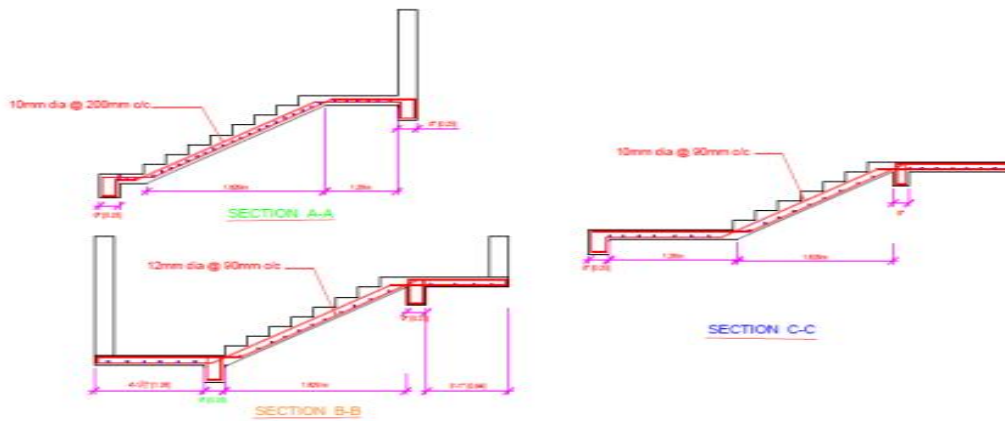


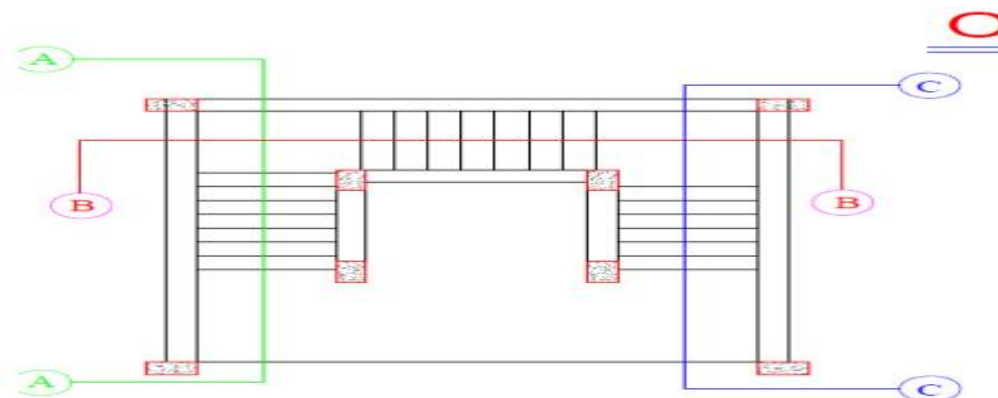
Fig.6 FOUNDATION LAYOUT



**Fig.7 FOOTING REINFORCEMENT DETAILS**



**Fig.8 Section CC**



**VI. CONCLUSION**

1) The structure is a design based on the E-Tabs, which provides adequate serviceability, strength and also the work is economical. 2) With the usage of ETABS software working time is saved and it also helps us in the designing of structure accurately. 3) The structural components were designed manually in as well as with the help of software. 4) There is not much land available in urban areas so buildings are constructed in storey to utilize the vertical space. 5) Rather than destroying forests and swamps to build houses, shopping centers, and factories, they can be placed in a vertical tower, serving to preserve the environment

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