Planning,Analysis and Design of Residential Building(G+5) By using STAAD Pro.

[1]Dunnala Lakshmi Anuja, [2]V.S.Nagasai
[1]PG Scholar, [2]Assistant Professor
[1]Srinivasa Institute of Engineering And Technology, Cheyyereu, Amalapuram, A.P, India,
[2]Srinivasa Institute of Engineering And Technology, Cheyyereu, Amalapuram, A.P, India

Abstract - **Structural planning and design is an art and science of designing with economy and elegance, serviceable and durable structure. The entire process of structural planning and designing requires not only imagination and conceptual thinking but also sound knowledge of science of structural engineering besides knowledge of practical aspects, such as relevant design codes and byelaws. Hence in this project, an attempt is made on planning, analysis and design of residential building with four floors and each floor consists of 8 flats each individual flat consists of master bedroom, bedroom, kitchen, toilet, dining hall and veranda. The structural analysis is analysed by using STAAD PRO software for analysing and design of frames. AUTOCAD is also used for draw the plans, columns and beam framing, stair case and etc.In this project the designs of slabs, columns, footing, staircase, sunshades, lintel, septic tank, elevated tank by "Limit State Method" using IS: 456-2000 code book.**

keywords - **Moment analysis by using Moment distribution method, Slope deflection method, STAADpro, for designing purpose, IS 456:2000, SP 34 handbook for detailing etc..**

I. INTRODUCTION

Structural design is an art and science of designing, with economy and elegance, a safe, serviceable and a durable structure. The entire process of structural planning and design requires not only imagination and conceptual thinking but also sound knowledge of science of structural engineering besides knowledge of practical aspects, such as relevant design codes and bye-laws, backed by sample experience, intuitions and judgment. In this project, an attempt is made on planning, Analysis and Design of residential building with G+5 floors.

II. LITERATURE SURVEY

- **MVK. Satish et.al (2017)** he examined and designed a G+3 hospital building and its facility arrangement reaction to seismic load were studied using STAAD.Pro and after were investigated through a 3Dnon linear reaction history examination and corrected with non-linear static working methodology (NSP), this study recommends utilization of modular NSP rather than first mode NSP as it gives better result while comparing building structures.
- **Safwanahmad et.al (2017)** designed a G+2 hospital building using STAAD.Pro by applying suitable loads and sectional details to component within the main aim of this factor was to study the extent of credibility of using STAAD.Pro for analysis Dr. Ashokkumar et.al (2017) designed a G+3 hospital building using substitute frame method in STAAD.Pro the efficiency of analyzing using software over manual method was analyzed and a comparative analysis was carried out.
- **Adiyanto (2008),** analyzed a 3-storey hospital building using STAAD Pro. Seismic loads were applied to the building. The dead loads and live loads were taken from BS6399:1997 and seismic loads intensity is based on equivalent static force procedure in UBC1994. Result showed that the building can withstand any intensity of earthquake. It means that the buildings were suitable to be built in any area located near the epicenter of the earthquake
- **Sankar. J et.al (2016),** designed and developed a G+4 hospital building and analyzed using STAAD.Pro. Effects of seismic load were monitored by calculating base sheer and displacement along the member research findings indicates variation among different zone using a comparative analysis.
- **Tejavat Venkatesh et.al (2017),** designed and analyzed a hospital building for seismic and wind forces. The building was analysed for the reactions toward wind forces by using STAAD.Pro and earthquake loads were analyzed by Equivalent static method with base shear criteria. The G+4 structure was analyzed for structural stability towards considered forces.
- **Alkesh Bhalerao et.al (2016),** studied the effects of wind on different structural orientation of RCC buildings. The study aims at identifying an optimum structural shape of building which could withstand the wind forces under consideration. The building was a G+25 structure analyzed for structural stability using ETABS software. U-shape structure is not preferred as it gives the maximum displacement and maximum drift due to its geometric shape most susceptible for wind load. Bundled tube symmetric RCC structure is need to analysed for special provision and improved cladding surface to attain optimized result.
- **D. Ramya et.al, (2015)** compared thedesign and analysis over a multi-storey G+10 building with STAAD.Pro and ETABS softwares. The basic wind speed for this study was taken as 33.0 m/s and the shear force and bending

moment over each of the component of the building was calculated for different combination of loads. This study shows that STAAD.Pro is more flexible when compared to ETABS software in terms of analysis of structure.

III. STAGES IN STRUCTURAL DESIGN

The process of structural design involve the following stages

I. Structural Planning
II. Estimation of Loads
III. Analysis of Structures
IV. Member Design
V. Drawing, Detailing and Preparation of Schedules

Structural Planning, This involves determination of the structure, the material for the same, the structural system and the layout of the components, the method of analysis and the philosophy of structural design.

Estimation of Loads, Dead loads are permanent or stationary loads which are transferred to the structure throughout their life span. The unit weight of commonly used building materials are given below in table-1 with reference to IS: 875(part-1)-1987.

Table-1 UNIT WEIGHT OF COMMON BUILDING MATERIALS

SL NO	MATERIALS	UNIT WEIGHT kN/m³
`1	Pain Concrete	24
2	Reinforced Concrete	25
3	Brick masonry, Cement plaster	20
4	Stone masonry	24
5	Wood	8
6	Steel	78.5
7	Floor finish	0.6-1.2

Live loads or imposed loads include loads due to the people occupying the floor, weight of the movable partitions, weight of furniture and materials. The live loads to be taken in design of building have been given in IS: 875(part-2)-1987 are as follow:

SL No	**TYPE OF FLOORS**	**MINIMUM LIVELOAD kN/m²**
1	Floors in dwelling houses, tenements, hospital wards, hostels and dormitories	2.0
2	Office floors other than entrance hall, floors of light	2.5-4.0
3	Floors of banking halls, office entrance halls and reading rooms	3.0
4	Shops, educational buildings, assembly buildings, restaurants	4.0
5	Office floors for storage, assembly floor space without fixed seating. Public rooms in hotels, dance halls and waiting halls	5.0
6	Ware houses, workshops and factories a) Light weight loads b) Medium weight loads c) Heavy weight loads	 5.0 7.5 10.0
7	Garages(light handing vehicles of weight <25KN) Garages(Heavy vehicles of weight>25KN)	4.0 7.5
8	Stairs, landings, balconies and corridors for floor mentioned in 1, not liable to overcrowding and for all others	3.0 5.0

Analysis of Structures, Method of analysis of statistically indeterminate portal frames used methods were:

a) Slope deflection method
b) Moment distribution method

Member Design, The aim of design is to decide the size of the member not amount of reinforcement required, so that the structure will perform satisfactory during its life period with minimum cost. The following three methods have been developed for the design of reinforced concrete structures.

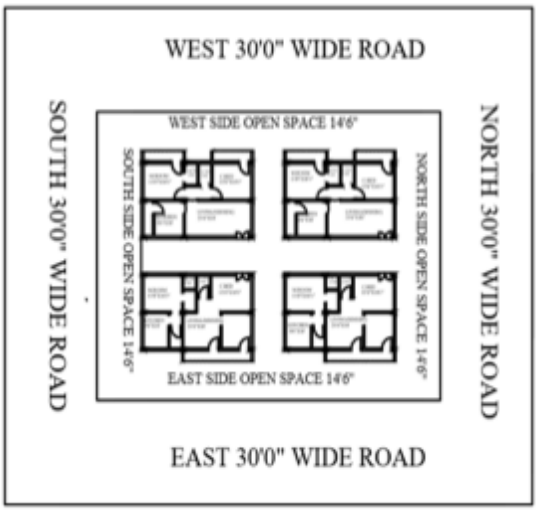
Working stress method, Working stress method is based on elastic theory assuming reinforced concrete as elastic material. The stress strain curve of concrete is assumed as linear from zero at the neutral axis to a maximum value at the extreme fiber.

Ultimate load method, In ultimate load method, structural elements are designed for ultimate load which are obtained by multiplying the working loads with factor known as load factor. Hence, the designer can able to predict the excess load the structure can carry beyond the working loads without collapse.

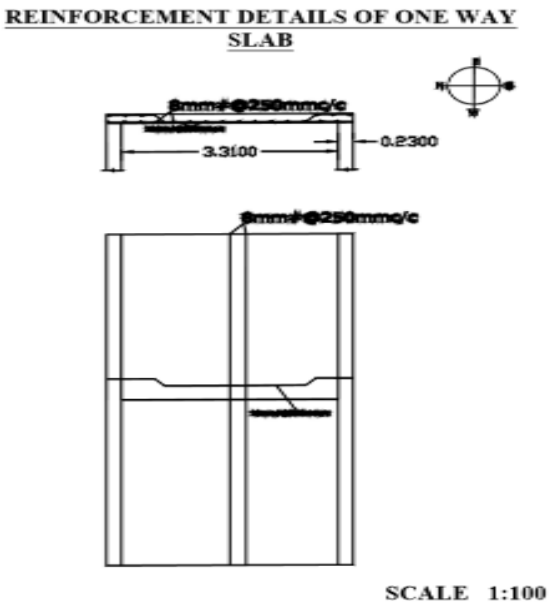
Limit state method, In the limit state method, the structural elements are designed for ultimate loads and checked for serviceability (deflection, cracking etc.) at working loads so that the structure is fit for used for throughout its life period.

IV. DRAWING AND DETAILING OF PROJECT

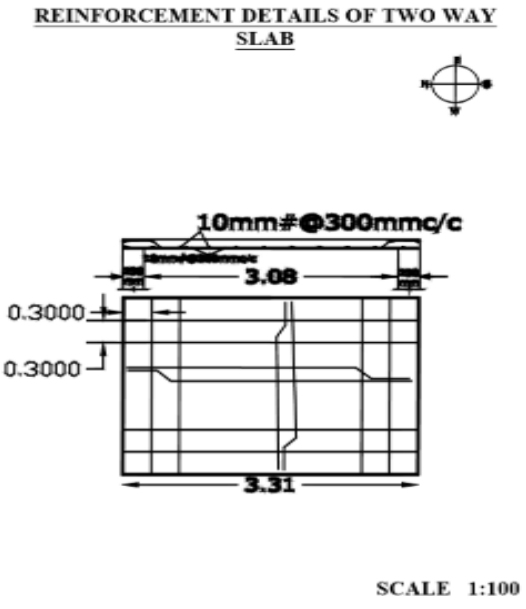
Proposed Site layout
Plot Area: 9272.81 Sq.ft
Plinth Area: 4476.16 Sq.ft



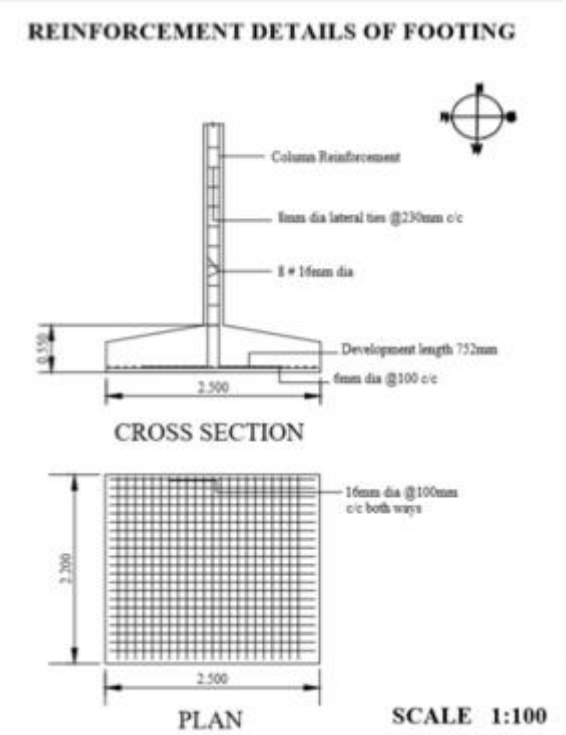
Proposed plan for 1st floor



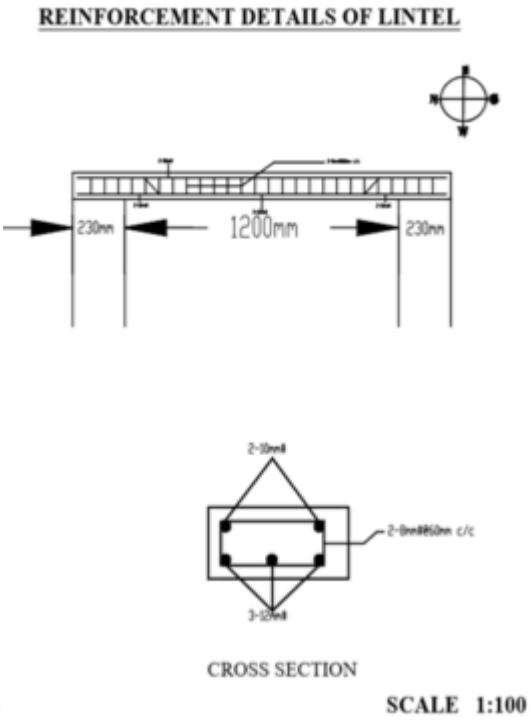
One way Slab



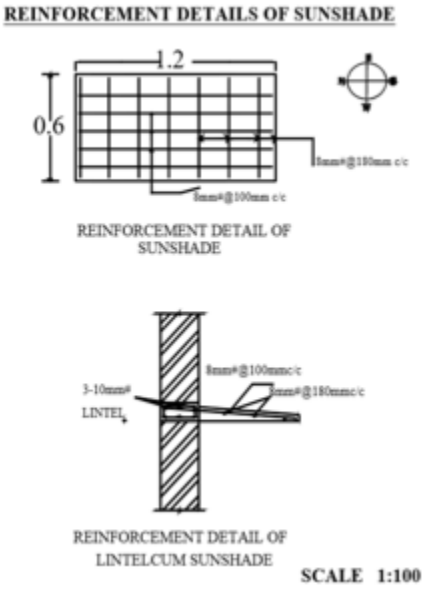
Two Way Slab



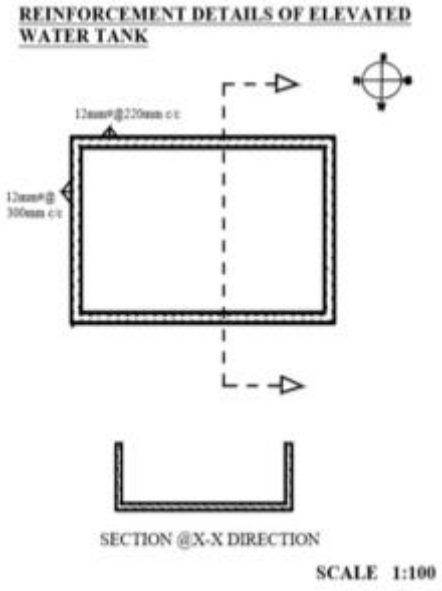
Footing



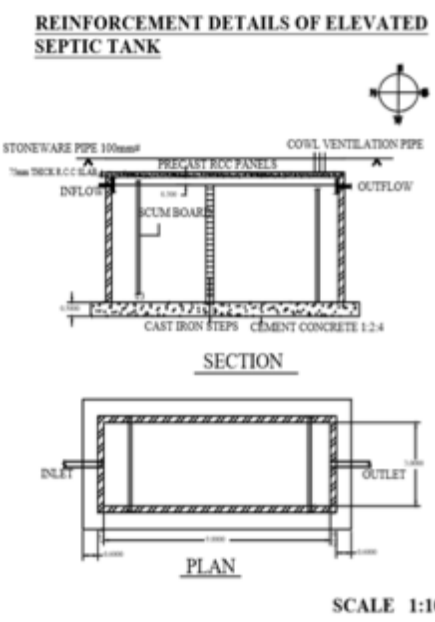
Beam



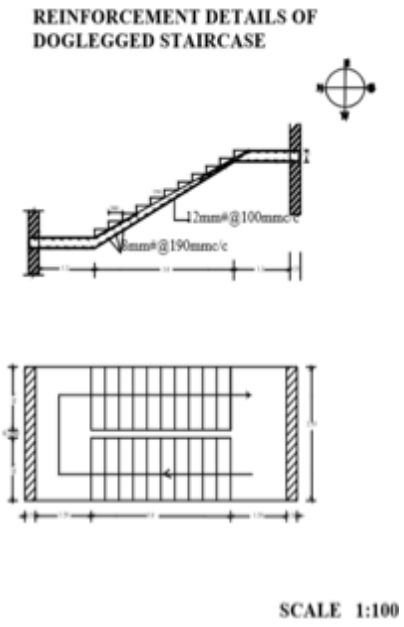
Sunshade



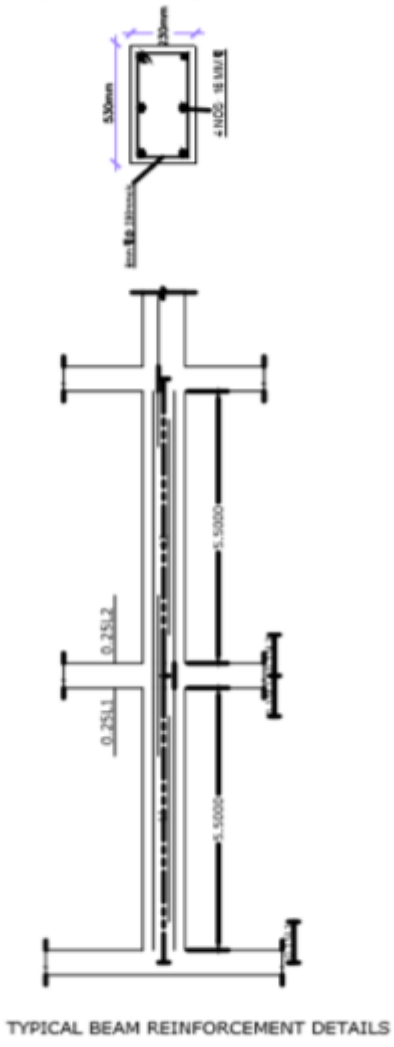
Water Tank



Septic Tank



Stair Case



T- Beam

V. CONCLUSION:

- Frame analysis was done by STAAD.pro. Slab and beams were designed as per IS code 456-2000. The properties such as shear, deflection, development, torsions are with the IS code provisions.
- Design of columns has been as per IS 456-2000 along with SP-16 design charts. The shear load carrying capacity etc., are within the IS 456-2000.

- Design of footing is also done as per IS 456-2000. The checks like one way shear, two way shear are within the IS code limits. Frame analysis, columns and beams were designed by using STAAD.Pro, Computer software.
- The design of slab, beam, column, rectangular footing and staircase are done in limit state method which is safe at control of deflection and in all aspects.
- Using staad.pro software, the design consideration has been taken as per the codes. The design is safe in all conditions.
- On comparison with drawing, manual design and the geometrical model using staad.pro the area of AST required for the beam, column, footing and slab are comparatively similar to that of the requirement.

VI. FUTURE SCOPE:

- Further, this project can be enhanced by 1 or 2 floors with the interest of the client, at present the project had been analyzed for 7 floors but designed for 5 floors. If any violation occurs during enhancement, design criteria has to be changed accordingly to the results obtained from STAAD pro..

VII. REFERENCES

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