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Original Article

A Study on Design of G+1 Residential Building

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ABSTRACT
The main objective of this project is A STUDY ON DESIGN OF G+1 RESIDENTIAL BUILDING The process of structural design involves various stages such as consideration of design parameters, computation of loads, member design, reinforcement detailing, and drawings. Any construction project to begin with the Layout of the structure. The layout of the proposed G+1 Residential Building is based on a plot of size 130 m². All drafting was done by using AutoCAD.The conventional method of structural design and analysis leads to lots of complications and tedious calculations, which are time-consuming. Hence, the analysis and design of the entire structure have been completed by ETABS .The foundation has been designed as an isolated sloped footing using safe bearing capacity of soil is 120 KN/m² and column loads are taken from ETABS result. The foundation design values were calculated using excel sheet considering forces coming from all relevant structural member as per IS code for loads.
Keywords: IS 456:2000, Residential Building, Etabs, AutoCAD

INTRODUCTION

The project aims to apply a systematic and structured approach to meet the functional, aesthetic, and structural requirements of the residential building. By utilizing the ETABS software, the analysis and design process will be streamlined, enabling efficient and accurate calculations of internal forces, reactions, displacements, and other relevant parameters. The software offers a user-friendly graphical interface for model generation and analysis, ensuring the precise evaluation of the building's structural elements. Design a G+1 residential building using the analysing software ETABS is considered crucial in civil engineering. In recent years, there has been a growing emphasis on utilizing computer-aided software and tools for structural analysis, which is highly welcomed by engineers as it alleviates them from the often-lengthy calculations and procedures required when analysing large or com-plex structures using classical methods. However, it is not always necessary for engineers to perform such detailed analyses. Nowadays, high-rise buildings and multistorey buildings are commonplace in metropolitan cities, and these structures often contain numerous joints that are free to move. Manual analysis of such structures can prove to be extremely difficult and time-consuming. Therefore, engineers employ computer-based methods, such as utilizing the modern analysing software ETABS, for more efficient analysis. The objective of this project is to planning, analysis and design of G+1 residential building using the software ETABS. The project focuses on a residential building with specific specifications: -

Plot Size = 130 m^2, Total built up Area = 100 m²

METHODOLOGY

The methodology for the project involves the analysis and design of a residential building using the software ETABS. The overall process of structural planning and design is followed, considering the functional, aesthetic, and structural requirements of the building.

3.1 Structural Planning: -The first stage of the design process is structural planning, which involves determining the structures, materials, layout of components, analysis methods, and design philosophy. Key aspects such as column positioning, beam placement, slab spanning, staircase layout, and foundation types are considered during this phase.

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Guidelines and design practices are followed to ensure efficient and effective structural planning.

3.2 Computation of Loads: -Once the structural planning is done, the next step is to compute the loads acting on the building. This includes dead loads (self-weight of the structure), live loads (occupancy loads), wind loads, seismic loads, and any other relevant loads. The loads are determined based on the applicable design codes and standards. Applied loads in structure are: -

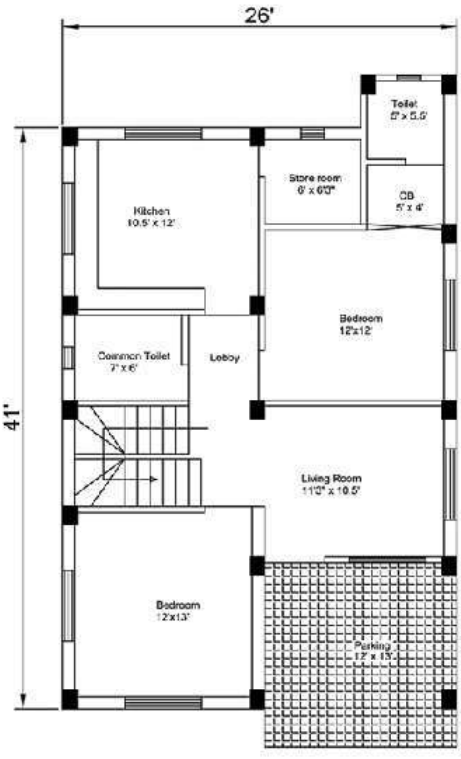
- Live load= 2 kN/m²
- Floor finish =1.5 kN/m²

3.3 Method of Analysis: After computing the loads, the chosen software, ETABS is used for structural analysis. ETABS provides a user-friendly graphical interface for model generation and analysis. The software's analysis engine performs calculations for structural analysis, considering the applied loads, structural elements, and their properties. The results are obtained; which include internal forces, reactions, displacements, and other relevant parameters.

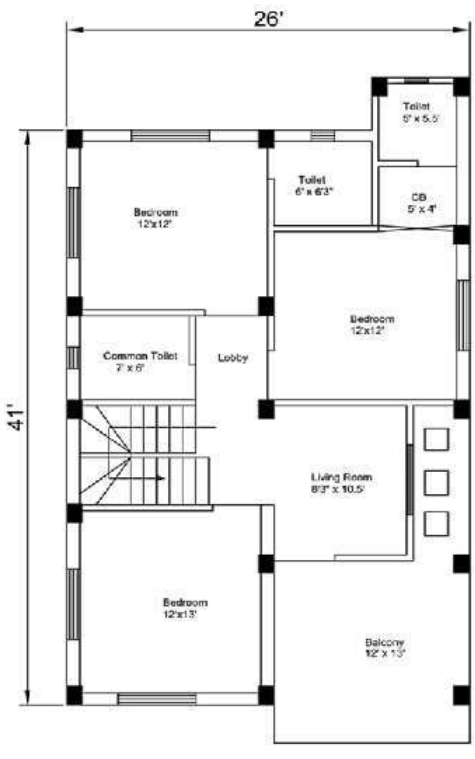
3.4 Member Design and Detailing: -Once the structural analysis is completed, member design and detailing are carried out. This involves determining the sizes and reinforcement requirements for structural members such as beams, columns, slabs, and foundations. The design is performed in accordance with the applicable design codes and standards to ensure the safety, serviceability, and durability of the structure.

3.5 Drawing and Preparation of Schedules: -After the member design and detailing, the final drawings and schedules are pre-pared. These include detailed drawings of the structural elements, reinforcement details, and construction specifications. The drawings and schedules provide the necessary information for the construction and implementation of the designed structure. Throughout the entire methodology, the project team consults relevant design codes, standards, and guidelines to ensure compliance and accuracy. Qualified structural engineers or architects may be involved in the process to provide their expertise and ensure the effective planning and design of the building's structural elements. By following this methodology and considering the specific project requirements, the aim is to achieve a well-designed residential building that meets the necessary functional, aesthetic.

RESULT AND DISCUSSION



Ground Floor



First Floor

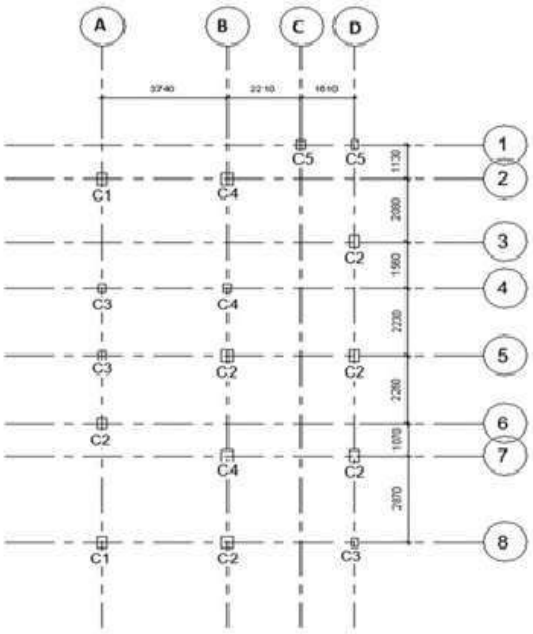


FIG- COLUMN LAYOUT

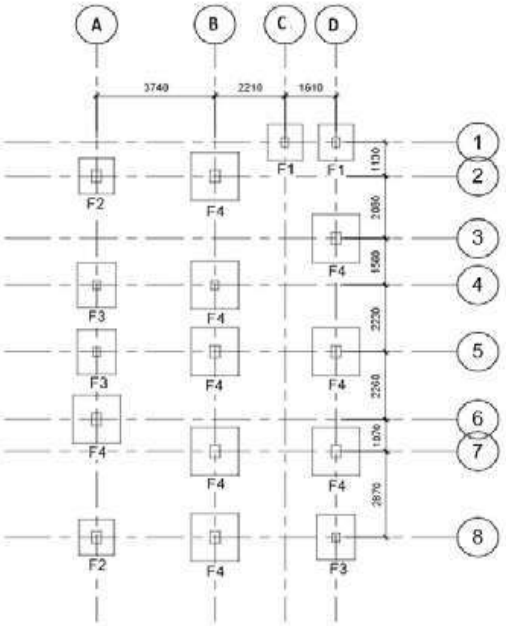


FIG- FOOTING LAYOUT

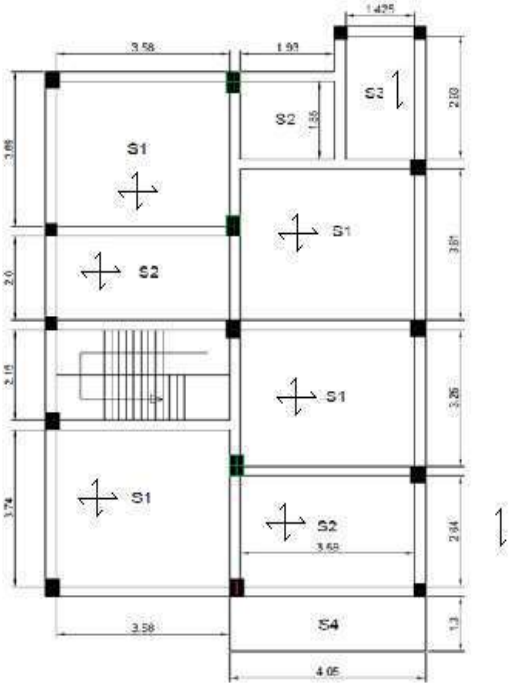


FIG- SLAB LAYOUT

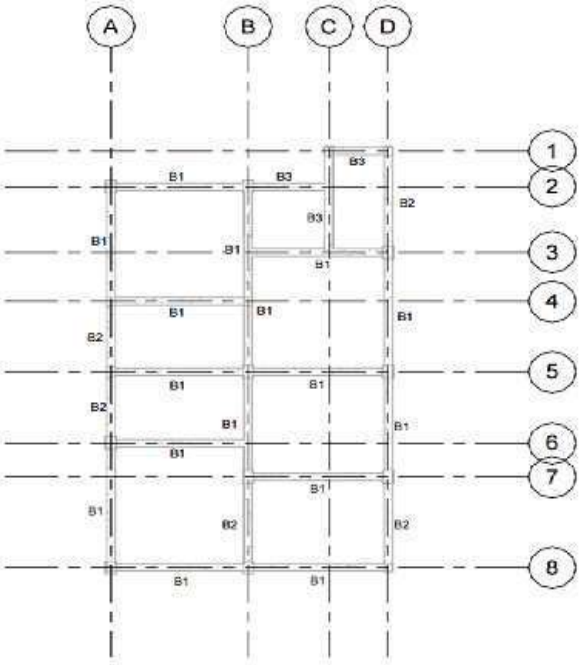


FIG- BEAM LAYOUT

s.n.	column	column size (mm)	percentage of steel	Acting load (KN)	Dia and number of bar
1	C1	300X400	1.17	313.97KN	16mm-8bars
2	C2	300X400	0.9	548.78KN	16mm-4bar &12mm-2bar
3	C3	230X300	1.39	355.02KN	12mm-8bar
4	C4	300X500	1.42	613.01	16mm-10bar
5	C5	230X300	0.8	98.25	12mm-06bar

TABLE- DETAILING OF COLUMN

S.n.	Footing	Design load	Footing size	Dia of bar	Depth
1	F1	100KN	1.00mX1.00m	10mm@150mmc/c	200mm
2	F2	325KN	1.20mX1.10m	10mm@150mmc/c	400mm
3	F3	450KN	1.50mX1.20m	10mm@150mmc/c	400mm
4	F4	615KN	1.60mX1.50m	10mm@150mmc/c	400mm

TABLE- DETAILING OF FOOTING

S.n	Slab	type of slab		Reinforcement	
			Depth	along shorter span	along longer span
1	S1	Two way	150mm	10mm@150mm c/c	8mm@150mm c/c
2	S2	Two way	150mm	8mm@150mm c/c	8mm@150mm c/c
3	S3	One way	120mm	8mm@150mm c/c	8mm@150mm c/c
4	S4	cantilever	150mm	10mm@150mm c/c	8mm@150mm c/c

TABLE-DETAILING OF SLAB

S.n.	Beam	Size	Bottom reinforcement			Top reinforcement			Shear stirrups		
			Left	Mid span	Right	Left	Mid span	Right	Left	Mid span	Right
1	B1	300X300	2T-12	2T-12,2T-10	2T-12	2T-12	2T-12	2T-12	2L-T10@150mmc/c	2L-T10@150mmc/c	2L-T10@150mmc/c
2	B2	230X300	2T-10	2T-10,2T-8	2T-10	2T-10	2T-10	2T-10	2L-T10@150mmc/c	2l-T8@150mm c/c	2L-T8@150mmc/c
3	B3	200X300	2T-10	2T-10,2T-8	2T-10	2T-10	2T-10	2T-10	2L-T10@150mmc/c	2l-T8@150mm c/c	2L-T8@150mmc/c

TABLE-DETAILING OF BEAM

CONCLUSION

The main objective of this project was to plan and design G+1 residential building. The project utilized the software ETABS for the analysis and design process, considering design parameters, computation of loads, member design, reinforcement detailing, and drawings. The structural planning phase involved determining the structures, materials, layout of components, analysis methods, and design philosophy. This included column positioning, beam placement, slab spanning, and selection of foundation types.

1. Throughout the project, the software ETABS was chosen for its user-friendly interface, conformance with Indian Standard Codes, versatility, and accuracy. Structural design was approached as both an art and science, emphasizing the creation of a safe, serviceable, and durable structure with economy and elegance.

2. The methodology encompassed various stages, including structural planning, computation of loads, method of analysis, member design and detailing, and the preparation of drawings and schedules. The project team followed design codes, standards, textbooks, and consulting with guide.

3. The planning phase specifically focused on the positioning of columns, beams, and slabs, as well as the selection of foundation types. These aspects were considered in accordance with design principles and recommendations to ensure efficient and effective structural planning.

4. By following the methodology and considering specific project requirements, our aim was to achieve a well-designed residential building that met the necessary functional, aesthetic and structural criteria.

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