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Planning, Analysis and Structural Design of G+2 RCC Framed Commercial Building

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Abstract

Planning, analysis and structural design of G+2 Reinforced Cement Concrete (RCC) framed commercial building forms the crux of this project. The planned building shall house shop/ showroom facilities at ground floor level and office facilities at first and second-floor levels. Planning and drawing of buildings' architectural and structures are done through AutoCAD 2026 while Structural Modeling and Analysis will be performed using software known as STAAD. Pro V8i. The consideration for this project is the choice of suitable material property, loading conditions, structural configurations, and relevant codes of Indian Standards for building design. The aim here is developing a safe, functional, and economical commercial building that provides optimal space utilization. The process of design takes into account various types of loads acting on the structure, like dead loads, live loads, etc. Major structural elements such as Slab, Beam, Column, Isolated footings, and Staircases are to be designed according to the results of analysis and relevant design procedures. Selection of appropriate structural elements with proper reinforcements ensures structural stability, strength, and functionality of the building.

Keywords— Auto cad 2024, STAAD Pro v8i, IS Codes.



I. INTRODUCTION

The objective of the given project is to plan, analyse and design a G+2 RCC framed commercial building. The commercial buildings need proper planning and structural design so that various activities can be carried out such as shopping, showrooms, offices. The planned building contains three floors, the ground and two upper floors. The building contains total area of approximately 18000 square feet. The architectural plan is designed to cater various commercial activities, circulation, staircase, lift etc.

Reinforced cement concrete (RCC) is widely used in construction due to its high compressive strength of concrete and high tensile strength of steel. In case of RCC framed structures, slab transfers the load acting on the floor to the beam, beam transfers the load to column and column transfers the load to the foundation and soil. Therefore, proper planning, load analysis and designing is necessary to ensure safety of the building.

AutoCAD 2026 software is used to prepare architectural plans and structural drawings. STAAD.Pro V8i software is used to perform structural modelling and analysis of the building. Dead loads, live loads and other applicable loads are calculated and slab, beams, column, isolated footings, staircase are analysed and designed. Indian standards like IS 456:2000 and provisions of IS 875 are considered for structural design.

The objective of this project is to design a functional, safe and economical commercial building. It also provides hands on experience to prepare engineering drawings. Various load transfer mechanism, analysis results and RCC structural components are understood. Outcome of the project helps to understand the procedures involved in planning, analysing and designing a G+2 RCC framed commercial building.

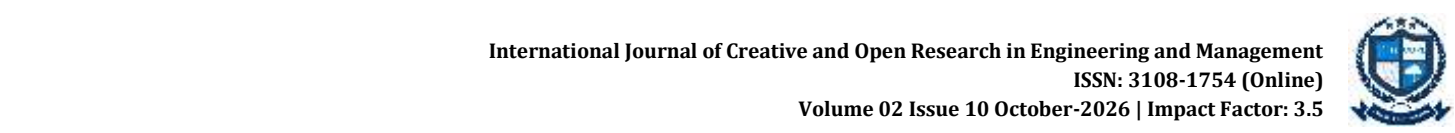
II. LITERATURE REVIEW

Farid Basha, Sharon, Vishnu T., Eswar and Dr. A. Sreenivasulu (2020), In this paper, the analysis and design of a commercial shopping building were carried out using the STAAD.Pro software. This study focused on a Basement + G + 3 commercial building and the effect of dead load, live load, wind load, and earthquake load and their respective load combinations. The analysis of the structural elements was done using STAAD.Pro software, whereas detailing was done using AutoCAD.

Preethi M., Aleena Baby, Alok A. Xavier, Aswathy Madhu and Ayana Stanly (2021),conducted a research on analysis and design of a commercial RCC structure by STAAD.Pro. The study evaluated a G+2 commercial building at Malayatoor. The primary objective of the study was the analysis and design of RCC framed structure by use of structural analysis software. Plan of the building and RCC model were designed using STAAD.Pro. Load calculation and complete analysis of the structure were done as part of the design process. It is noted from the study that structural analysis and design are necessary to ensure safety and integrity of buildings. RCC was preferred for construction of building frames because of strength and stiffness.

Ayesha Siddiqui and Dr. Madhuri Kumari (2022), conducted a comparative analysis study for analyzing a G+8 commercial building using STAAD.Pro and ETABS. The study is focused on the structural behavior of the commercial building through structural analysis using two widely used structural analysis software programs.

Mohammad Badroddin and P. SriVidya (2024), This research dealt with the planning, analysis and structural design of a G+20 multi-level commercial building through the use of STAAD.Pro. The plans and structural designs were drawn STAAD.Pro offers a through AutoCAD. After that, the building was analyzed and designed using STAAD.Pro. Forces on structural elements and foundation design were among the important aspects included in this research. The use of materials and cost estimates were also discussed, thereby highlighting the use of computer-aided design for structural design and material planning.



III. METHODOLOGY



The methodology followed for planning, analysis and structural design of the G+2 RCC framed commercial building includes systematic procedures beginning from data gathering and ending up in completion of the project. At the very first step, all the data related to the building size, functionality, material characteristics and structural requirements are gathered. Based upon the above data, the building is planned to contain shops and showrooms at the ground floor level whereas office spaces will be available at the upper floors.

Architectural and structural drawings that include floor plan, column layout, elevation and sectional view drawings are prepared through the help of AutoCAD 2026. Three dimensional structural model is prepared by using STAAD.Pro V8i in order to perform load analysis on the building. All types of loads including dead loads and live loads will be included in the analysis.

At the last stage, slabs, beams, columns, isolated footings and staircases are designed by using structural analysis data as well as Indian Standard codes.

IV. RESULTS AND DISCUSSION

1. Ground Floor Plan



Figure 1: Ground Floor Plan

The ground floor plan is the layout of the proposed G+2 RCC framed commercial building that will be used for commercial purposes such as shops and showrooms. This building layout is supposed to facilitate easy access, efficient use of space and adequate circulation of people in the building.

The ground floor is made up of commercial spaces that have been arranged in accordance with the building needs. Sufficient space has been provided for entrance, circulation and access to the upper floors. There are staircases, lifts, toilet facilities and other services in the building. The overall size of the building is 100 ft × 60 ft, giving a total floor area of about 6,000 sq. ft.

2. First Floor Plan

The ground floor plan shows the layout of the proposed G+2 RCC framed commercial building that will be used for the purpose of having shops and showrooms for commercial use.

The ground floor has the commercial spaces designed based on the requirement of the building. Suitable space has been allowed for entrances and access to the upper floors. Staircase and lift provision, as well as toilet provisions, have been made in the layout. The building has dimensions of 100 ft × 60 ft, having a floor area of approximately 6,000 sq. ft..

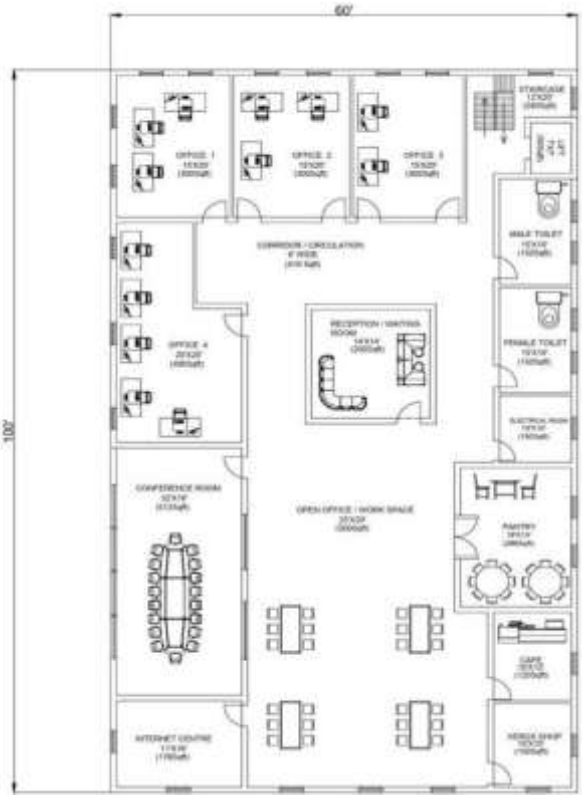


Figure 2 First Floor Plan

3. Second Floor Plan

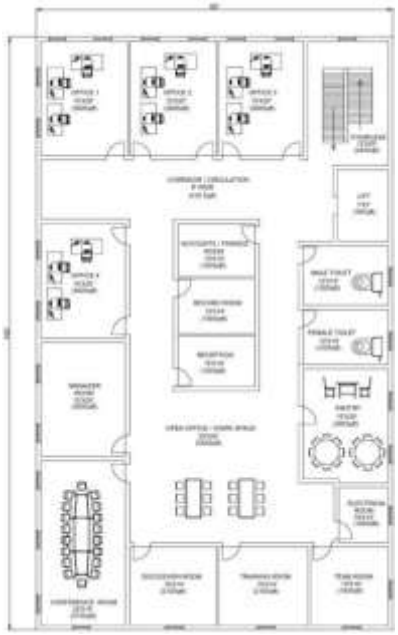


Figure 3 Second Floor Plan

The second floor plan aims at adding extra commercial areas for achieving the necessary functions of the building. A number of office rooms have been provided for various functions with adequate circulation space.

A number of other facilities like stairs, lifts, toilets, and corridors have been provided. The planning is done in order to maintain continuity with the other floors as well as coordinate with the column layout**.**

4. ELEVATION



Designing the front elevation of the proposed G+2 RCC framed commercial building makes sure that it looks modern and functional. The elevation will serve as the external look of the building with the arrangement of its floors, doors, windows and other components.

The ground floor will be used for shops and show rooms whereas the first and second floor will be for offices and commercial uses. There will be adequate arrangements of windows to ensure natural lighting and ventilation. Arrangement of the entrance will facilitate easy access to the building. Flat roof and horizontal projection will give neat look to the building.

The elevation has been designed keeping in view the overall size of the building which is 100ft × 60ft and height of the typical floor being 10ft. External appearance has been coordinated with the floor plan and structural design.



5. PLAN AND DETAILS

i.	Breadth & Length of building	= 100 ft x 60 ft
ii.	Area of Building Per floor	= 6000 Sq.ft
iii.	Total Built-Up area (G+2)	= 18,000 Sq.ft
iv.	External Wall Thickness	= 9 inches
v.	Internal Wall Thickness	= 4½ inches
vi.	Main Entrance Door	= 6 ft x 7 ft
vii.	Internal Door size	= 3 ft x 7 ft
viii.	Office Door Size	= 3 ft x 7 ft
ix.	Toilet Door Size	= 2 ½ ft x 7 ft
x.	Window Size	= 5 ft x 4 ft
xi.	Ventilator size	= 2 ft x 2 ft
xii.	Staircase width	= 5 ft
xiii.	Lift size	= 7 ft x 7 ft
xiv.	Typical floor - to – floor height	= 10 ft

6. Rendering View

The 3D rendering view below is the structure model of the G+2 RCC framed structure building that includes columns, beams and floor slabs which are arranged in accordance with the building plan. This model helps to understand the overall structure arrangement and the placement of structural elements on the three floors. It also gives an insight into the structure geometry and load transfer process. This model is prepared in STAAD.Pro V8i for Structural Modelling and Analysis.



Figure 4 Rendering View

V. CONCLUSION

Proposed G+2 RCC Framed Commercial Building The intended uses of the proposed building will be commercial purposes. The ground floor will have shops/showrooms while the offices will be in the first and second floors. Architectural planning and drawing is done by using AutoCAD 2026. Structural modelling and analysis are done by using STAAD.Pro V8i in order to analyse the behaviour of the structure under the loads considered.

Design of slabs, beams, columns, isolated footing and staircase is done through structural analysis results and respective Indian Standard codes. This project shows the significance of proper structural planning, load calculation and reinforcement of structures. Engineering software makes it possible to model and analyses with high level of accuracy and understanding of structural behaviour.

In general, this project has provided practical knowledge in building planning, structural analysis and designing of G+2 RCC framed commercial building.

ACKNOWLEDGMENT

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