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## Design and analysis of G+2 Hostel Building

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**ABSTRACT:** Structural analysis is a branch which involves determination of behaviour of structures in order to predict the responses of real structures such as buildings, bridges, trusses etc, with economy, elegance, serviceability and durability of structure. Analysis, designing and estimation of multi-storied building has been taken up for Basement+G+2 Building, thereby depending on the suitability of plan, layout of beams and positions of columns are fixed. For the design of columns and beams frame analysis is done by limit state method. All loads are calculated by IS codes.

**KEYWORDS:** Multi-storied Building, Beam, column, Analysis

### I. INTRODUCTION

The aim of the structural design is that structure should be safe, durable, serviceable and economical with respect to initial cost and maintenance cost. Structural Analysis is a branch which involves in the determination of behaviour 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. For the design of the structure, the dead load, live loads, seismic and wind load are considered. The analysis and design for the structure done by using a software package STAAD PRO. In this project Multi-storey construction, we have adopted limit state method for analysis and design of the structure. The design is in confirmation with IS456:2000. The analysis of one frame is worked out manually and simultaneously it has been checked using STAAD PRO.

It is an educational institution requires a hostel building to accommodate minimum 200 students. The building shall be RCC multi-storied, with each room accommodating two students. Common toilets of required number may be provided in the building. The building is limited to G+2, however a truss roof shall be provided above the RCC roof, to utilise that area. The building is located in earthquake zone 5, and the wind velocity at the location may be taken as 44m/s. The geo-technical report recommends shallow footing with net safe bearing capacity not less than 200kN/sqm at a depth of 1.5m

Paper is organized as follows. Section II describes methodology used for the design and analysis of a G+2 structure. The flow diagram represents the step of methodology. After that the building details are given in Section III. Section IV presents the design results of elements tested. Finally, Section V presents conclusion.

### II. METHODOLOGY

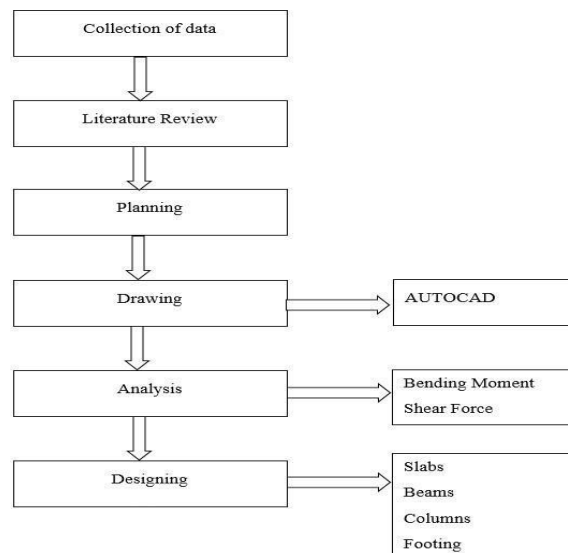
The figure shows the methodology used for the design and analysis of building. For designing various activities are carried out. The fig 1 (a) shows the flowchart of various methods used in the proposed designing and analysis.

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(a)

To achieve the objectives of the study that is to plan, analyse and design the hostel building, which meets the basic requirements it has been proposed to follow the methodology.

## General Principles of Design

The design of a structure must satisfy three basic requirements.

- Stability – To prevent overturning, sliding or buckling of the structure or part of it under the action of loads
- Strength – To resist safely the stresses induced by the loads in the various structural members.
- Serviceability – To ensure satisfactory performance under service load condition which implies providing adequate stiffness and reinforcement to contain deflection, crack widths and vibrations within acceptable limits, and also providing impermeability and durability.

Dead load and Live Load are assigned to this structure. The first vertical load that is considered is dead load. Dead loads are permanent or stationary loads which are transferred to the structure throughout the life span of the structures. Live load is either movable or moving loads. Analysis of the structure is done to know the deflection details of the structure or also by the analysis of the structure Shear force diagram and Bending moment diagram can be obtained. And the structure is designed to obtain the value of total amount of steel and concrete required for the construction.

The procedure of structural analysis is simple in concept but complex. In detail. It involves the analysis of a proposed structure to show that its resistance or strength will meet or exceed a reasonable expectation. The building consists of three storeys. In this project the hostel building for according 200 students is drawn using autocad software. It is a g+2 proposed building, The plan shows the details of dimensions of each and every room and the type of room and orientation of the different rooms like bed room, bathroom, hall etc.

All the three apartments have similar room arrangement. The entire plan area is about 1156.44 sq.m. There is some space left around the building for parking of cars. The plan also gives the details of location of stair cases in different blocks. we have 6 stair cases for each block.

## III. BUILDING DETAILS

The building consists of three storeys. All the three apartments have similar room arrangement. The entire plan area is about 1156.44 sq.m. The plan also gives the details of location of stair cases in different blocks. we have 6 stair cases for each block. Area of Ground Floor is 1196.23 sq. m. 30 rooms are provided on the ground floor with size of 3.5 x 3m. Mess hall is provided for the sufficient members. Car porch and staircase are provided. In case of emergency occur the

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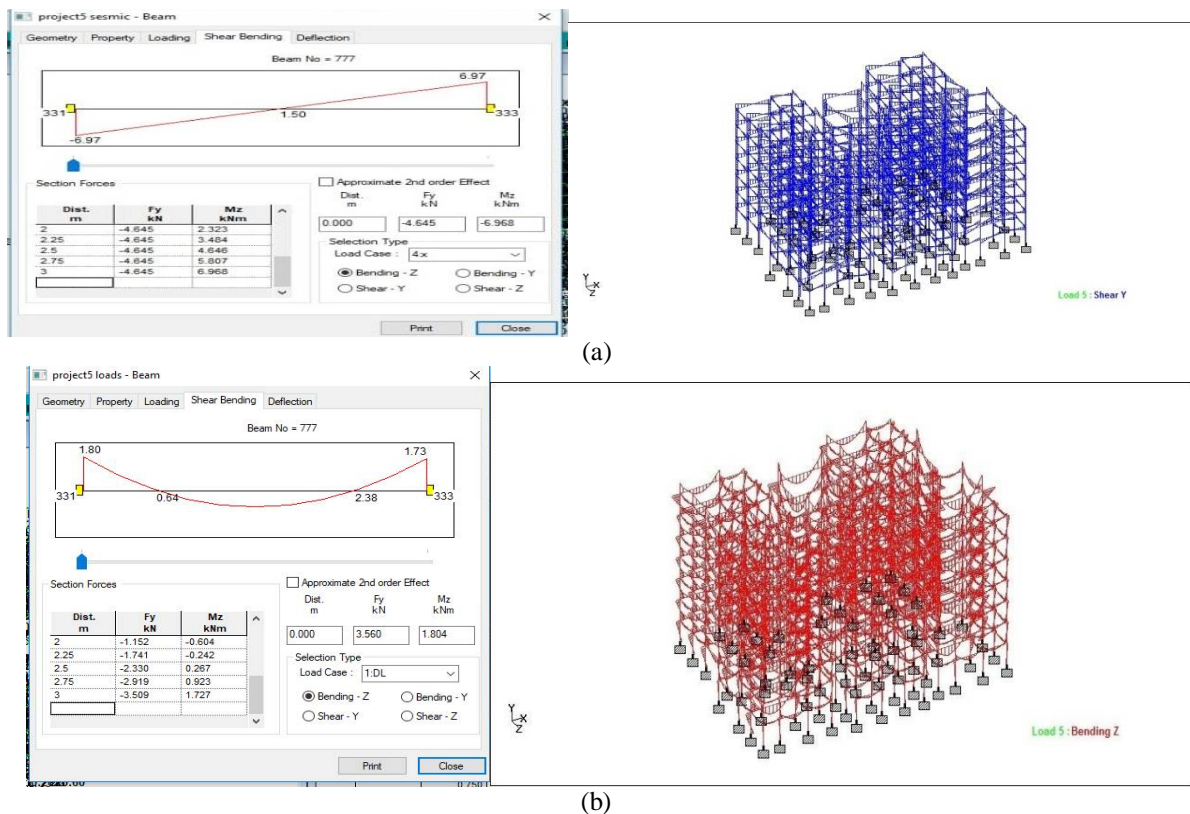
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sufficient requirements are provided. The building is actually constructed and all the analysis and design work is completed before the beginning of the project. The building is not designed for increasing the number of floors in future. so the number of floors is fixed for future also for this building due to unavailability of the permissions of respective authorities. Also special materials like fly ash and self-compacted concrete were also used in order to reduce the dead load and increase life of the structure and also improve economy. But these materials were not considered while designing in STAAD to reduce the complexity and necessary corrections are made for considering the economy and safety of the structure. This is regarding the plan and details of the site and next section deals with the design part of the building under various loads for which the building is designed.

## IV. DESIGN RESULTS

### • Design of beam

A beam is a structural member subjected to a system of external forces at right angles to the axis. Beams are usually provided for supporting slabs and walls or secondary beams. The beam in which steel reinforcement is provided in the tensile zone only is known as singly reinforced beam. Beam is designed for vertical bending and shear. We designed a singly reinforced beam. After the analysis using STAAD, it is compared with manual designing. Figures shows the results obtained in designing beam using STAAD software. The figs 2 (a) and (b) shows the shear force diagram and bending moment diagram of beams. Selected beam is the one in which carries the max. bending moment.



### • Design of column

A column is an important component of RC structure. A column, in general may be defined as A member carrying direct axial load which causes compressive stresses of such magnitude. Columns are of two types. A column may be

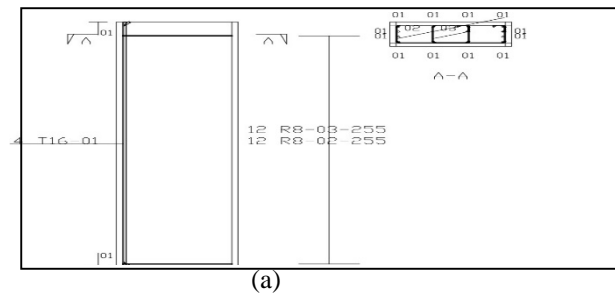
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considered as short when the slenderness ratios  $l_e/d$  or  $l_e/b$  are less than 12, otherwise it is a long column. We designed for short column. By checking for slenderness ratio, moment resistance, axial & biaxial resistance, result is obtained. Figure shows the column reinforcement obtained from the analysis. Fig 3 (a) shows the reinforcement of column which carry maximum axial load. By checking for slenderness ratio, moment resistance, axial & biaxial resistance, result is obtained.



### V. CONCLUSION

Our project mainly consist of two objective, first objective was to study and analyse the various component of building and their importance and second was to design the super structure of G+2 Hostel building. The plan of the project is drawn by AUTOCAD and the analysis is done by using STAAD ProVi8. The given proposed project is an educational institution at Nagaland which requires a G+2 hostel building. The plan consists of 100 rooms which are distributed among three storeys. The total area of the plan is 3509.11sq.m. After the analysis of the entire structure was done by STAAD Pro, the structure was found to be safe. The design of structure was done manually. The structure was designed in such a way so as to satisfy the criterion of ultimate strength and serviceability. It should also satisfy the stability against overturning, sliding and buckling. Designing using Software's like Staad reduces lot of time in design work.

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