



# Analysis and Design OFG+5 Residential Group House using Etabs

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**Abstract:** Rapid urbanization, and lack of land has also contributed to the advancement of multi- storied residential buildings in the contemporary cities to house the ever-increasing population in a limited space. With the ever rising urban population, land management has become a primary concern to the planners and engineers. Multi-storied buildings offer a practical solution as more people can live in a smaller piece of land without compromising on infrastructure and facilities. Never the less, such buildings should be well planned in terms of structure to ensure safety, serviceability, stability and economy .This project is aimed at the analysis and design of a multi- storied group housing building on the structural analysis of ETABS. Due to its accuracy and efficiency, ETABS is commonly used by civil engineers to model, analyze and design complex building structures. The preparation of building plans, load calculations, structural modelling and detailed structural analysis are included in the study. The key structural elements (slabs, beams and columns) were developed using the findings of the software .Different forms of loads acting on the structure are taken into consideration when analysing the structure and they include dead loads, live loads, wind loads and seismic loads. The calculations and application of these loads are based on Indian StandardcodesIS875 and IS1893.Results of the analysis are critically considered, so that the structure will meet all safety and performance requirements. In general, this project illustrates the significance of current structural analysis tools such as ETABS in coming up with safe, stable, and cost effective multi-storied reinforced concrete structures..

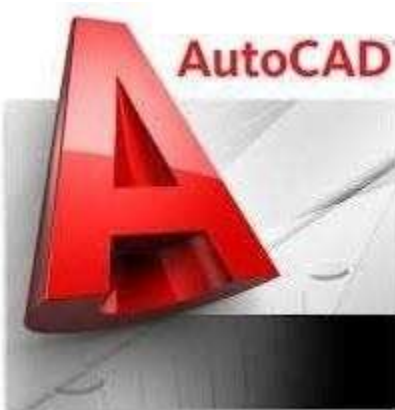


**1. Introduction:** Building construction is the engineering deals with the construction of building such as residential houses. A simple building can be characterized as a confined area, which is closed by walls and a roof, food, cloth and essential human needs. Early in the ancient days humans used to reside in caves, on trees or under trees to save themselves against wild animals, rain, sun etc as times went by as humans began residing in huts that were made of timber branches. The shelters of those old have been developed nowadays into beautiful houses. The wealthy individuals reside in luxurious condition houses. The significant indicator of social progress of the county is buildings. Each human being desires to have comfortable houses, which an average man spends 2/3 of his life period in the houses. The civic sense of responsibility of security. These are the few reasons which are responsible that the person do utmost effort and spend hard earned saving in owning houses. The house building is nowadays an important business of the social development of the county. New methods are being invented daily to construct houses economically, swiftly and satisfying the needs of the community engineers and architects carry out the design work, planning and layout of the buildings etc. The drawing work of building is done by draughts men as is the direction of the engineers and architects. The draughtsman should be familiar with his job and must be capable of executing the direction of the engineer and capable of drawing the necessary drawing of the building, site plans and layout plans etc., as per the requirements. A building frame is made up of the number of bays and storey. Multi-storey multi-panelled frame is a complex structure of intermediate static. A design of R.G+5 storey frame work of C building is taken up. The building in plan (45'\*62') consists of columns built monolithically forming a network. The size of building is 45x62ft. The structure analysis design (E-TABS) is used to create the design by using software. The building subjected to both the vertical loads as well as horizontal loads. Vertical load is made of dead load of the structural elements like beams, columns, slabs etc and live loads. The horizontal load is composed of the wind forces therefore the building is designed as per IS 875 under dead load, live load and wind load. The building is built as a 2 dimensional vertical frame and the maximum and minimum bending moments and shear forces are solved by trial and error procedures 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.

## 2. softwares used:

AUTO CAD , STAAD PRO

AutoCAD is utilized in drawing up plans and layout. ETABS is applied to 3D modeling, analysis and design. Comparative structural analysis is done using STAAD Pro.



## 3. METHODOLOGY:



### 3.1 Building Details

- Type: Residential Building
- Storeys: G +5.
- Floor Height: 3.5 m
- Concrete Grade: M20
- Steel Grade: Fe415
- Bearing Capacity of soil: 300 kN/m<sup>2</sup>.

### 3.2 Loads Considered

- Dead Load (DL): Self-weight of structural elements.
- Live Load (LL): As per IS 875 (Part 2)
- Wind Load (WL): As per IS 875 (Part 3)
- Seismic Load (EL): According to IS 1893.

### 3.3 Load Combinations

- 1.5 (DL + LL)
- 1.2 (DL + LL + WL)
- 1.5 (DL + WL)
- 1.2 (DL + LL + EL)
- 1.5 (DL + EL)

### 3.4 Structural Modeling in ETABS.

- Preparation of plan using AutoCAD
- The DXF file can be imported to ETABS.
- Setting up materials and sections.
- Allocation of loads and supports.
- Conducting Analysis and design.

### 3.5 Design Approach

The building will be constructed according to Limit State Method:

- Limit State of Collapse
- Taper State of Serviceability.

## 4. RESULTS AND DISCUSSION:

### 4.1 Base Reactions

The structure reveals consistent base reactions with varying loading combination, which guarantees equilibrium and effectiveness of loading transfer.



## 4.2 Story Drift

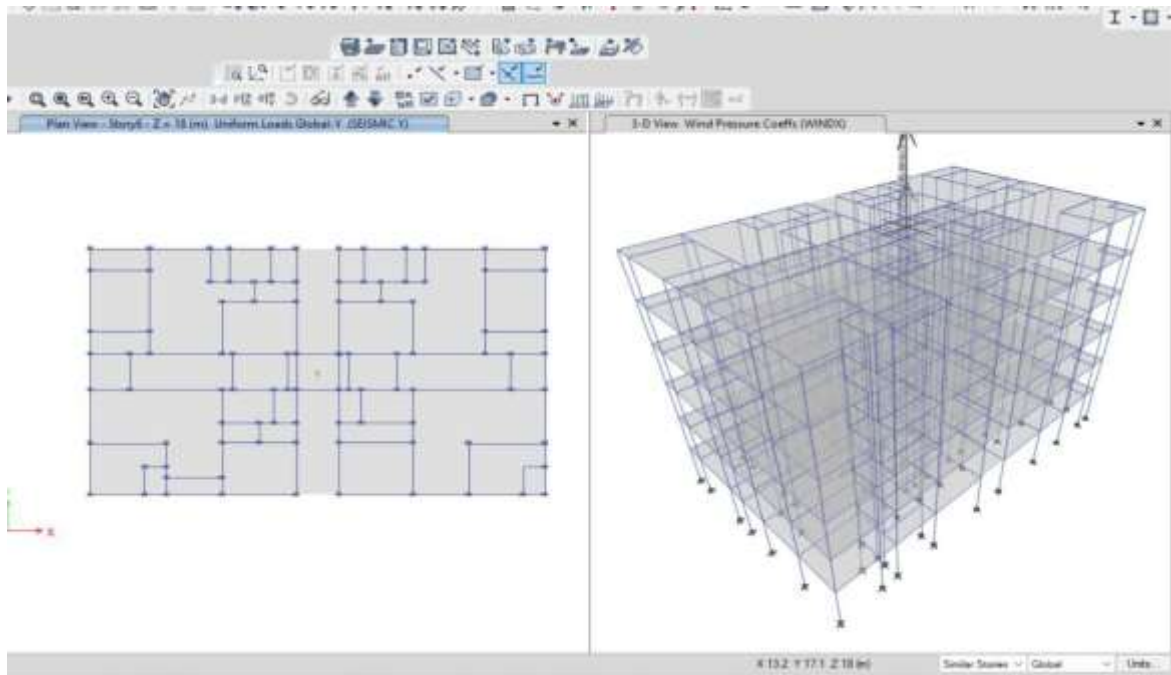
- Peak drift is on upper storeys.
- The values of drift do not exceed permissible levels ( $H/500$ ).
- Shows good lateral stability.

## 4.3 Structural Behavior

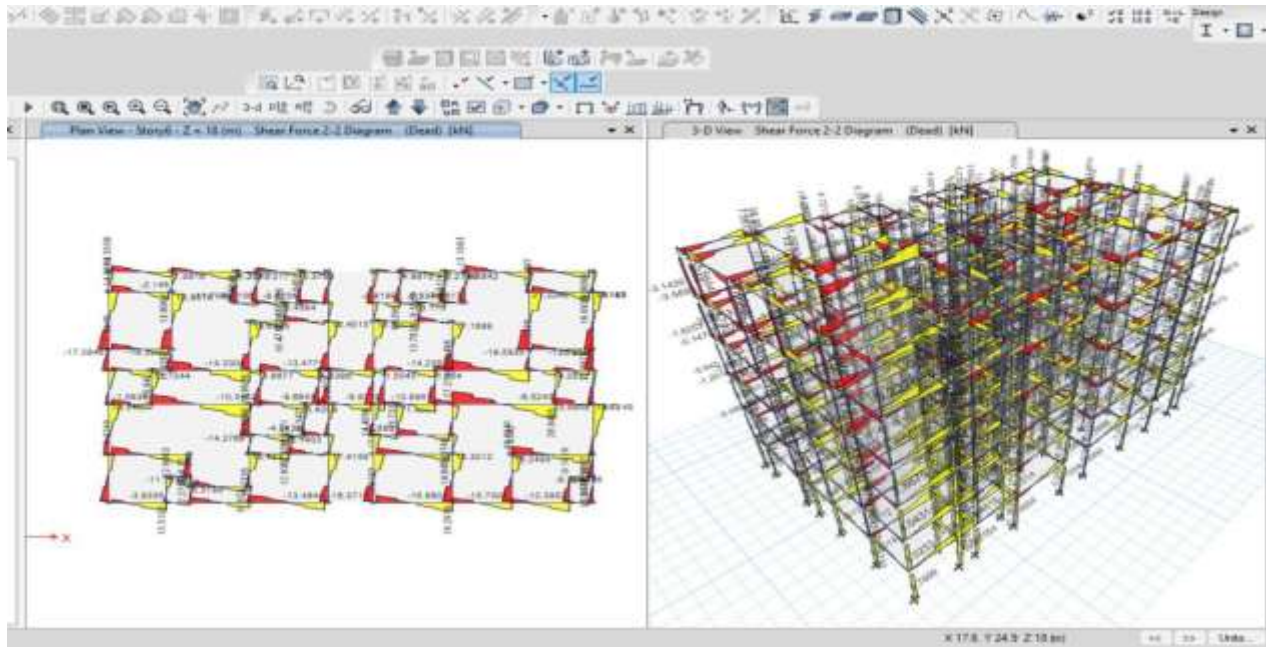
- Bending and shear forces are at safe levels.
- Columns are mainly subjected to bending due to the axial load.
- Beams are used to distribute the loads to the columns.

## 4.4 Seismic Performance

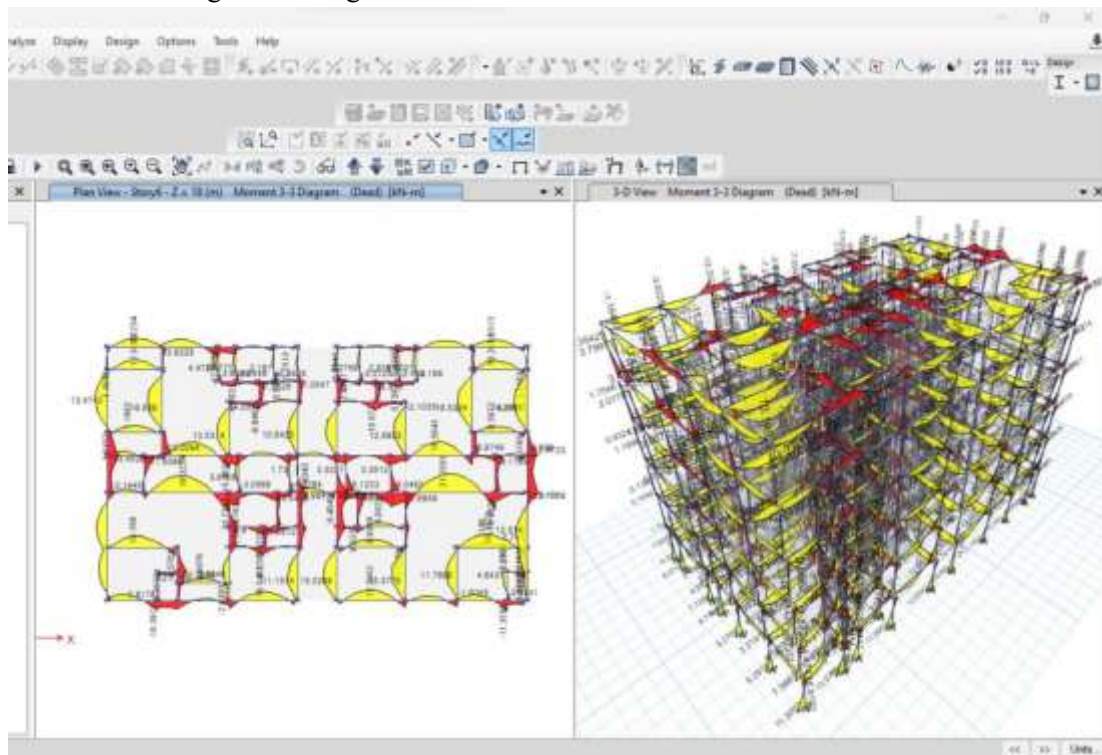
- Structure is a good structural material in seismic loads.
- Appropriate allocation of stiffness decreases deformation.



Seismic effect on building in 3D view



Shear force acting on building



Bending moment acting on building



## 5. CONCLUSION:

- The current project is concerned with structural analysis and design of a multi-storey reinforced concrete G+5 residential building with the help of ETABS software. The structure was designed and calculated based on the different loads including dead load, live load, wind load and seismic load in line with the applicable Indian Standard codes.
- The structural elements such as slabs, beams, columns, and foundations were developed based on the Limit State Method to guarantee sufficient strength, safety, and serviceability of the building during the period of its existence. The modelling and analysis performed in ETABS helped in accurately determining important structural parameters such as bending moments, shear forces, axial forces, and displacements.
- The obtained results of the analysis prove that the structure is stable and safe in the given load combinations. ETABS greatly simplified the intricate computations that are used in the design of multi-storey buildings and enhanced the efficiency and precision of the structural analysis.
- Moreover, the project assisted in knowing how structural design concepts, load calculations, modelling processes, and Indian Standard design code application can be put into practice in real-world construction projects.
- Comprehensively, the research indicates that ETABS is a useful tool to analyze and design multi-storey RCC buildings to ensure structural safety, economy, and reliability. The developed G+5 residential building meets all needed structural requirements and can be deemed safe to be constructed under the mentioned loading conditions and design parameters.

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