**ANALYSIS AND DESIGN OF G+5 RESIDENTIAL BUILDINGS BY USING ETABS**

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**Abstract –** Due to growing population and less available land, multi – storied building is constructed to provide accommodation for many families in limited area. In this project, we have drafted G+5 building plan in AutoCAD and Analysis and Design of structure is done by using Etabs and then Scheduling and controlling is done by using Primavera software. Management of a construction project mission entails the multi directional interaction of dynamic forces represented by its scope, time, resources, costs, and quality. There is a dynamic link on how to manage scope, resources, product quality and how to stay within time and budget limits. Here we are use primavera p6 to defined in terms of quality specifications, completion time, budgeted costs.

**Key Words:** AUTOCAD, ETABS, Analysis and design

## INTRODUCTION

## Now a days, the people from village are coming to towns for employment and educational facilities hence with the limited land available so as to proposed the apartment building and individual houses are feasible with each other. The main objective of this project is to analysis and to construction scheduling of an apartment building (G+5) using Etabs and Primavera P6 software. First of all, the planning is done using AutoCAD and code refers for this project is IS 456-2000. The first and foremost thing which we can get by effectively planning in primavera is start date and finishing date of the project. Primavera P6 helps in effectively scheduling the project by assigning two relationships at a time to each activity and considerably reduces the float. All the important steps like creating an EPS, creating a WBS, linking of activities according to their interdependence and availability of resources and determination of critical path are clearly exhibited in this report.

## LITERATURE REVIEW

Following are the research works conducted on analysis and design of structures by using different softwares.

**Sarah (2016)** – ETABS demonstrated proficiency in modeling nonlinear behavior, providing accurate predictions of structural performance under extreme conditions.

**David** **(2017)** – Parametric studies revealed significant variations in structural behavior, emphasizing the importance of parameter selection in design.

**Chen (2017)** – High user satisfaction with features – Requests for enhanced customization options – Performance issues with large datasets.

**Jhonson et al. (2018) –** Resistance to change among stakeholders – Lack of IT infrastructure in some agencies – Positive impact on project transparency.

**Smith** **et al. (2018)** -Improved project scheduling – Enhanced communication among teams – Challenges in initial setup and training.

**Rachel (2018)** – ETABS offered comprehensive tools for concrete design, facilitating efficient and accurate structural analysis and detailing.

**John et al. (2018)** – ETABS showed faster analysis and design iterations compared to SAP2000, while both yielded similar results in structural analysis.

**Williams et al. (2019)** – Limited support for Agile methodologies in Primavera – Workarounds to adapt Agile practices – Potential for future software updates to address Agile needs.

**Pate et al. (2019) –** Significant reduction in project delays – better resource allocation – Complex learning curve for users.

**Mark et al. (2019)** – ETABS accurately predicted wind-induced structural responses, aiding in the design of resilient structures against wind loads.

**Jane (2019)** – ETABS demonstrated high accuracy in predicting structural behavior under different loading conditions, with minimal computational time.

**Garcia et al. (2020)** – Improved resource allocation efficiency – Challenges in tracking resource utilization accurately – Need for more robust reporting capabilities.

**Michael** **(2020)** – ETABS provided robust seismic analysis capabilities, accurately predicting structural responses to seismic forces.

**Brown et al. (2020)** – Improved cost estimation accuracy – Better tracking of project expenses – Integration challenges with other software.

**Nguyen et al. (2021)** – Streamlined data exchange between BIM and Primavera – Improved project visualization and coordination – Technical challenges in software integration.

**Emily (2021)** – ETABS integration with BIM streamlined the design process, facilitating seamless data exchange and collaboration among stakeholders.

1. **OBJECTIVES**

* To understand basic principles of the structure using IS codes.
* To analysis the structural details of the structure.
* To understand the design parameter of the beams, slab, column and other structural entities.
* To prepare the 3D model of the structure by use of the software for detailed design and analysis.
* To design G +5 residential building using ETABS software in order to design and analyse the building.

1. **METHODOLOGY**

The seminar topic “Design of an RCC structure using ETABS”, starts with drafting a plan of building in AUTO CADD software. After completion of the drafting process, the designing of the slab, beam, and column is to be done. The design of the columns, beams, slabs (Two-way and one-way slab) have been done according to IS 456 norms. The procedure as follows, starting with the data collection for the designing of the particular building. In which the information like type of the building, building plan, floor to floor height, plinth height, depth of foundation, BCS of soil, wall thickness, and assumed loading factors including floor finish, roof finish, live load and dead load. The material to be used in the structure is to be defined too. Additionally, structural planning of the purposed project for deciding the position of columns, followed by positioning of beams and spanning of slabs. The numbering and nomenclature for members are then done in order to facilitate the easy in the practice of designing of the member. Sizing of beams and column is to be done according to the specific need of the building. Ultimate load which is also called as factored load for the given member. These comprise of a load of the roof, floor, and bath –WC, loft and balconies. Then comes on of the very important designing procedure, design of the beam. In which the designing of roof beam, floor beams, and plinth beams are done. After the designing of the beams, designing of the column section is done, which comprises of columns in top storey, in an intermediate storey and in the first storey. This all comprises of end columns, intermediate columns and a number of columns on each floor. The design of footing is then done. All the footings are to be designed according to the bearing capacity of the soil below the foundation level of the soil, for example, the bearing capacity of the soil is reasonably low then all the footings are to be designed for axial loads. Finally, the designing of the slabs is carried out using the IS 456, depending upon the type of the slab.

* 1. **PLAN DETAILS**
* Super Built-up area – 3880Sq.ft
* Build up area {4 plots} – 3066Sq.ft
* Single plot area – 766.500 Sq. ft
* Outer wall to compound wall distance {Setbacks} – 6ft
* Each story height: 12ft or 3m.

**4.2 PLAN OF G+5 RESIDENTIAL BUILDING**

**A blueprint of a house

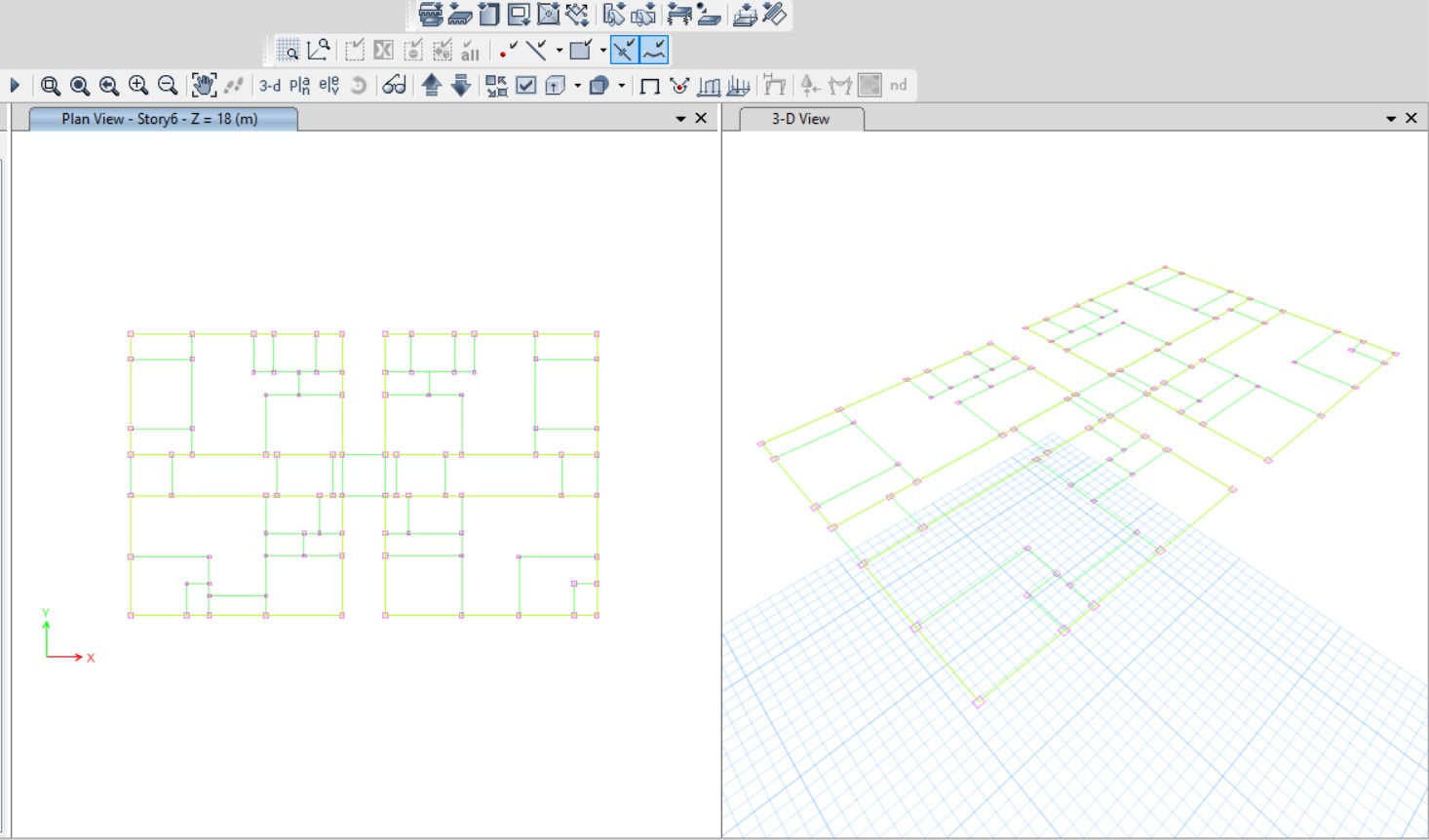
Description automatically generatedFigure 1 Plan of a floor**

**A diagram with red lines on a black background

Description automatically generated**

**Figure 2 Line diagram of a floor**

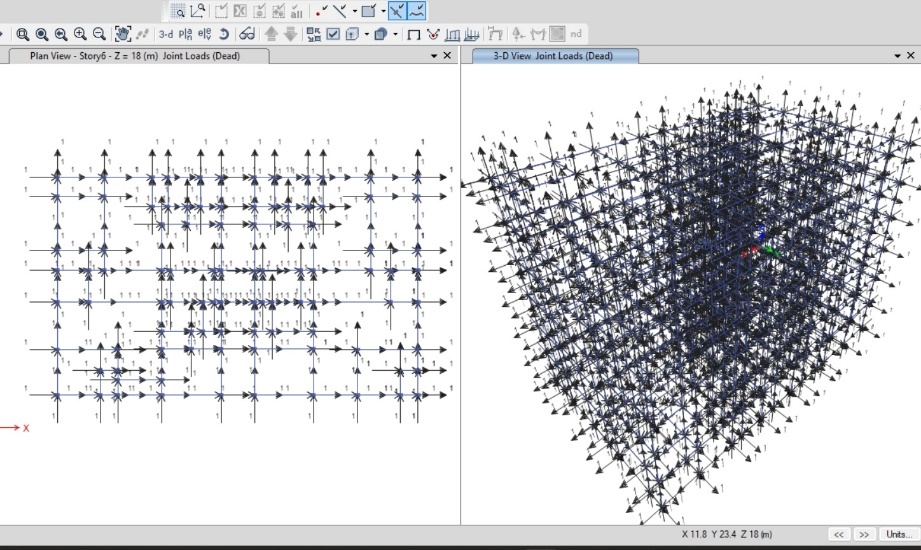
**4.3 IMPORTED PLAN FROM AUTOCAD TO ETABS**



**Figure 3 Plan imported from Autocad to Etabs**

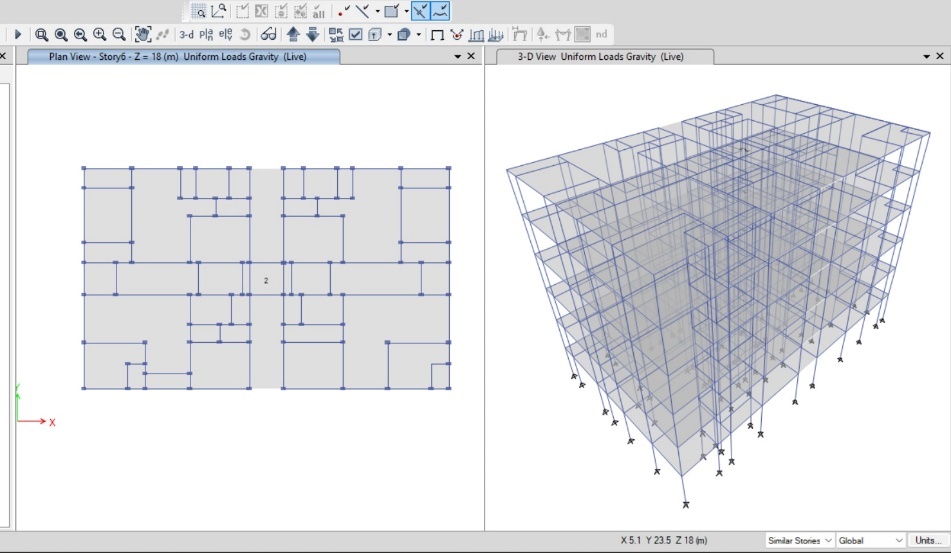
**4.4 LOADS & LOAD COMBINATIONS**

* Dead Load (IS 875-Part-1:1987) Unit Weight of Building Materials.
* Live Load (IS 875- Part-2:1987)
* Wind Load (IS 875-Part-3:1987)
* Seismic Load (IS 1893-Part-1:2002
  1. **LOAD COMBINATIONS**
* 1.5(Dead Load + Live Load)
* 1.2 (Dead Load + Live Load + Wind X)
* 1.2 (Dead Load + Live Load + Wind Y)
* 1.2 (Dead Load + Live Load + Seismic X)
* 1.2 (Dead Load + Live Load + Seismic Y)
  1. **DEAD LOAD**



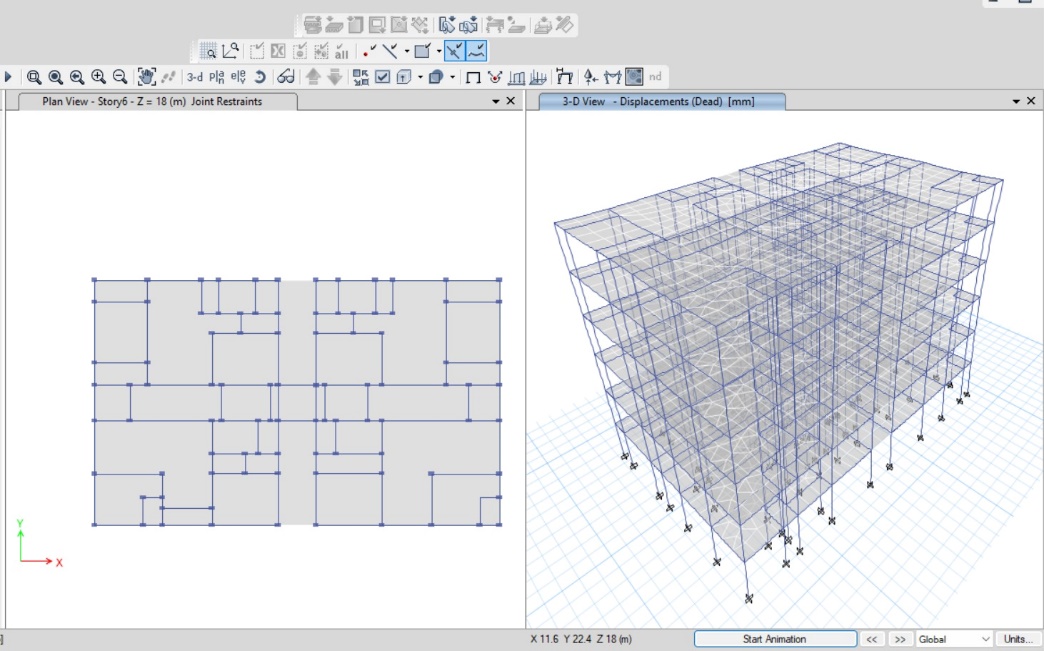
**Figure 4 Dead load on structure**

**4.7 LIVE LOAD**

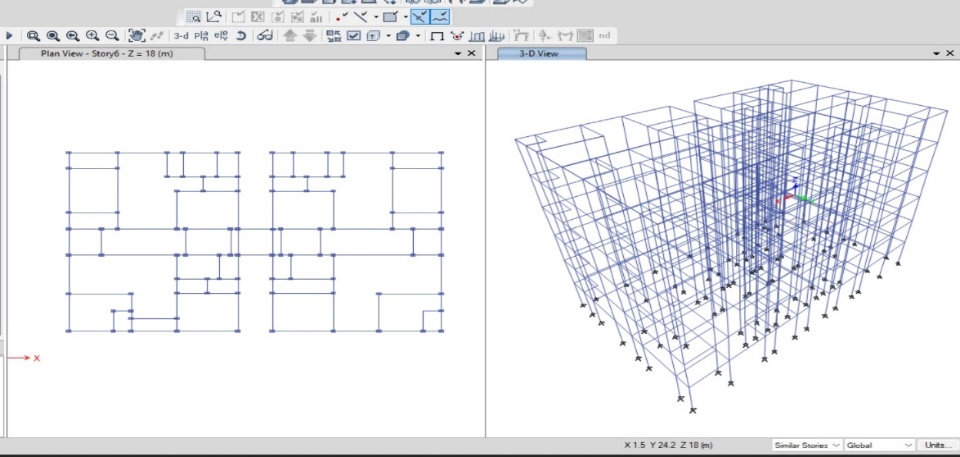
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**Figure 5 Live load on structure**

**4.8** SEISMIC LOAD

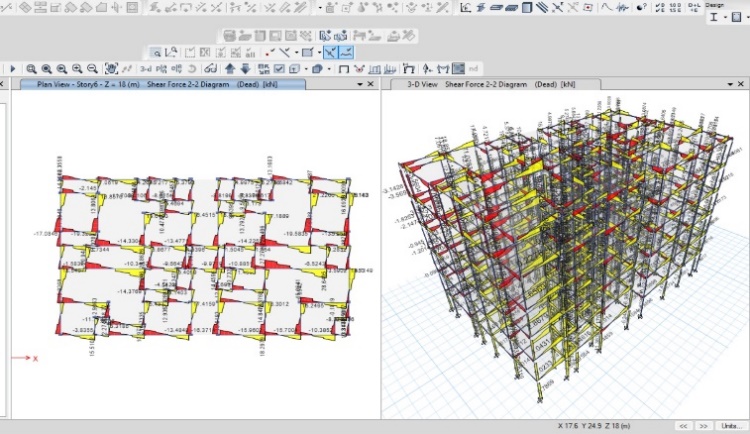
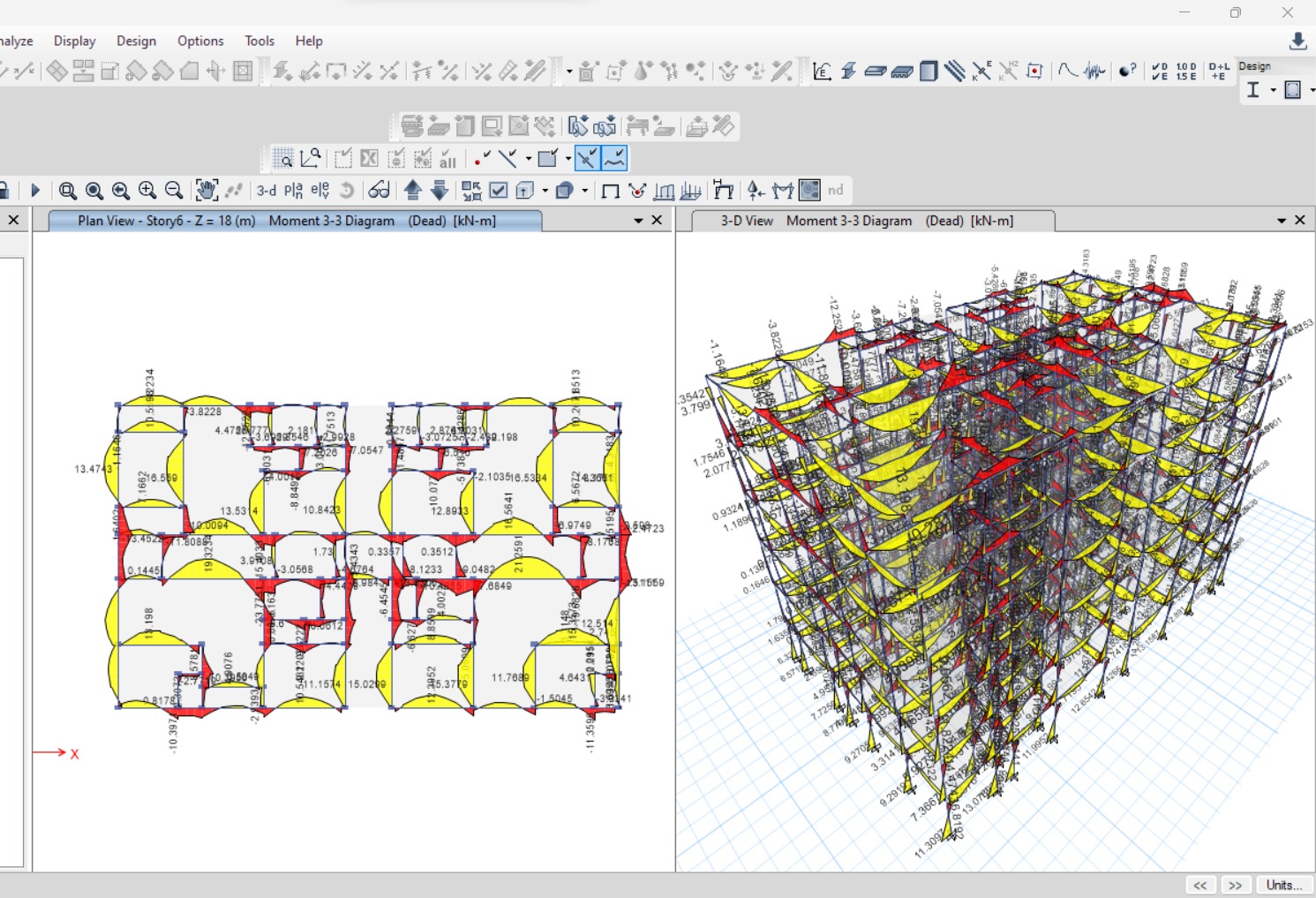
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1. **BEAMS AND COLUMNS**

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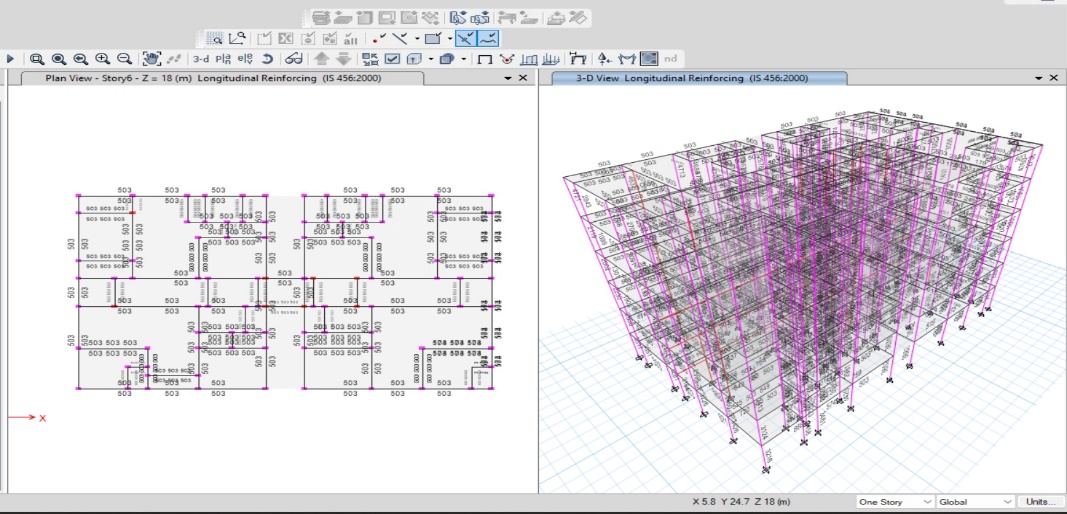
**Figure 6 Applying properties to beams and columns**

1. **SHEAR FORCE AND BENDING MOMENT DIAGRAMS**

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**Figure 7 Shear force and Bending moment of the structure**

1. **TOP AND BOTTOM REINFORCEMENT OF THE BEAMS AND COLUMNS**

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**Figure 8 Top and Bottom reinforcement of beams and columns with value**s

|  |  |  |  |
| --- | --- | --- | --- |
| **TYPE OF COLUMN** | **DIMENSIONS (b.h)**  **mm** | **REINFORCEMENT**  **mm2** | **NO. OF BARS** |
| Column 1 | 230 x 350 | 3481 | 12 bars with 14mm dia |
| Column 2 | 450 x 450 | 3162 | 12 bars with 12mm dia |
| Column 3 | 500 x 500 | 3674 | 12 bars with 14mm dia |

**8 COLUMN DETAIL**

|  |  |  |  |
| --- | --- | --- | --- |
| **TYPE OF BEAM** | **DIMENSIONS (b.h)**  **mm** | **REINFORCEMENT mm2/m** | **NO. OF BARS** |
| Beam 1 | 230 x 350 | 548.55 | 10 bars with 14mm dia |
| Beam 2 | 300 x 450 | 340.66 | 8 bars with 12mm dia |
| Beam 3 | 300 x 600 | 608.28 | 12 bars with 14mm dia |

**9 BEAM DETAIL**

|  |  |  |  |
| --- | --- | --- | --- |
| **TYPE OF BEAM** | **DIMENSIONS (b.h)**  **mm** | **REINFORCEMENT mm2/m** | **NO. OF BARS** |
| Slab 1 |  |  |  |
| Slab 2 |  |  |  |
| Slab 3 |  |  |  |
| Slab 4 |  |  |  |
| Slab 5 |  |  |  |

1. **SLAB DETAIL**
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