

# **ANALYSIS AND DESIGN OF MULTISTOREY BUILDING BY USING E TAB SOFTWARE**

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## **Abstract**

Structural Analysis is a branch which includes in the determination of conduct of constructions to anticipate the reactions of various underlying segments because of the impact of loads. Every single construction will be exposed to possibly one or the gatherings of loads, the different sorts of loads typically considered are dead loads, live loads, wind load IS:875-1987 Part1, 2, 3, seismic load(IS:1893-2016). ETABS (Extended Three Dimensional Analysis of Building System) is a product which is joined with all the significant forces that are static, dynamic, Linear and non-direct, and so on. This Computer programming's are additionally being utilized for the computation of forces, bending moment, stress, strain & deformation or diversion for a complex underlying framework and this software is utilized to design and plan the structures. The study of this project is to analyze & design of Reinforced Concrete building using Etabs. By this project, it has been checked that the displacement of the building seems to be within permissible limit'. The Structure has been designed as per Indian Codes & by laws provided by that area.

## **INTRODUCTION**

The imaginative and progressive new ETABS is a definitive incorporated programming bundle for the underlying investigation and plan of structures .ETABS offers unrivaled 3D article based demonstrating and perception apparatuses , blazingly quick straight and nonlinear logical force , refined and complete plan capacities for a wide-scope of materials and keen realistic presentations , reports and schematic drawings that permit clients to rapidly and effectively

interpret and get examination and configuration results. ETABS is designing programming which is utilized to examination and plan multi-story building. ETABS represents Extended Three-Dimensional (3D) Analysis of Building Systems. Computer aided design drawings can be changed over straightforwardly into ETABS models or utilized as layouts in which ETABS articles might be overlaid.

A significant number of the floor levels in structures are comparable which decrease demonstrating and configuration time. Quick model age utilizing the idea of comparable stories. Various materials can be allotted to the primary components inside a similar model like steel, RCC, composite or some other client characterized material. Computer aided design drawings can be changed over straightforwardly into ETABS models or utilized as formats in which ETABS items might be overlaid. Report is produced straightforwardly in the product with complete support subtleties. Large numbers of the floor levels in structures are comparative which lessen demonstrating and configuration time. Quick model age utilizing the idea of comparative stories. Various materials can be appointed to the primary components inside a similar model like steel, RCC, composite or some other client characterized material.

**Properties of materials – following table shows the assumed values of steel bar and concrete taken as per IS 456:2000.**

**Table 1:- Properties of steel bar and concrete as per IS 456**

Steel Bar Properties		Concrete section Properties	
Unit Weight ( $\gamma_s$ )	76.9729 KN/m <sup>2</sup>	Unit Weight ( $\gamma_c$ )	24.9926 KN/m <sup>3</sup>
Modulus of elasticity	21000 Mpa	Modulus of elasticity	27386.13 Mpa
Poisson ratio ( $\nu_s$ )	0.3	Poisson ratio ( $\nu_c$ )	0.2
Thermal coefficient ( $\alpha_s$ )	0.0000117 Mpa	Thermal coefficient ( $\alpha_c$ )	0.0000055
Shear modulus ( $\zeta_s$ )	80769.23 Mpa	Shear modulus ( $\zeta_c$ )	11410.89 Mpa
Yield strength	379.5 Mpa	Damping ratio ( $\zeta_c$ )	5%
Compressive strength ( $F_s$ )	495 Mpa	Compressive strength ( $F_c$ )	30

### Structural Elements

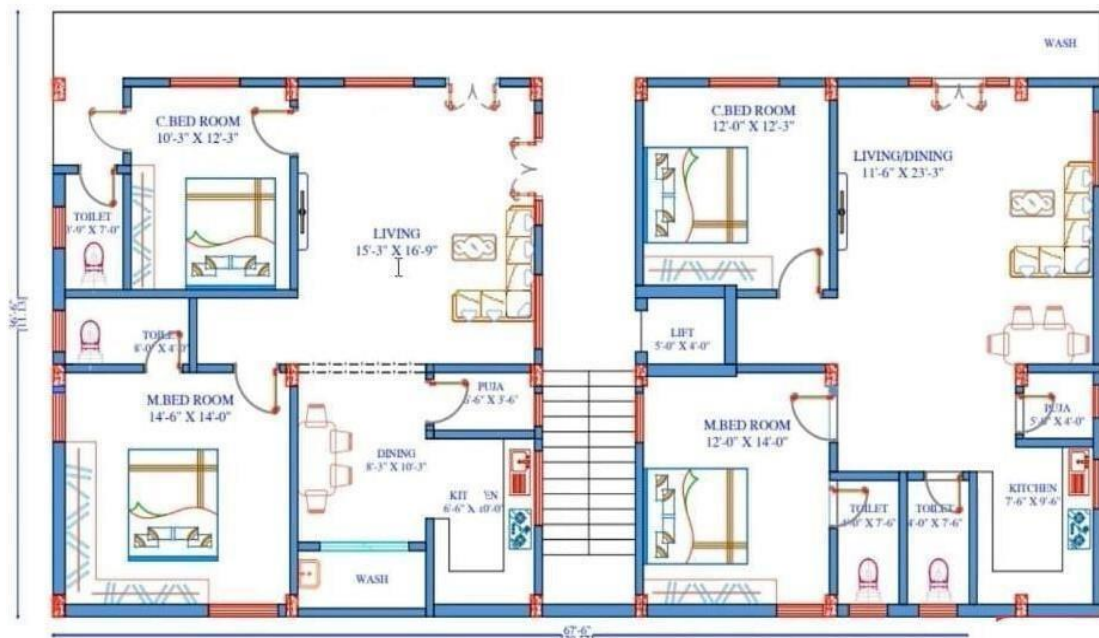
A four story symmetrical reinforced concrete residential building was analyzed for seismic loadings in ETABS software. For doing the comparative study, dimensions of beam and columns are taken as 350mm x 350mm and 450mm x 450mm respectively. Story height is taken as 3m for each stories and beam length is taken as 4m, 2m, 3m in longitudinal direction and 4m and 3m in transverse direction. These dimensions and cross sections are shown in below table.

**Table 2: Beam and column length and their Cross Section.**

Structural Elements	Cross section (mm x mm)	Length (m)
Beam in longitudinal Direction (x)	350 x 350	4m (three numbers ) 2m 3m
Beam in Transverse Direction(z)	350 x 350	4m 3m
Columns	450 x 450	4m

### Methodology

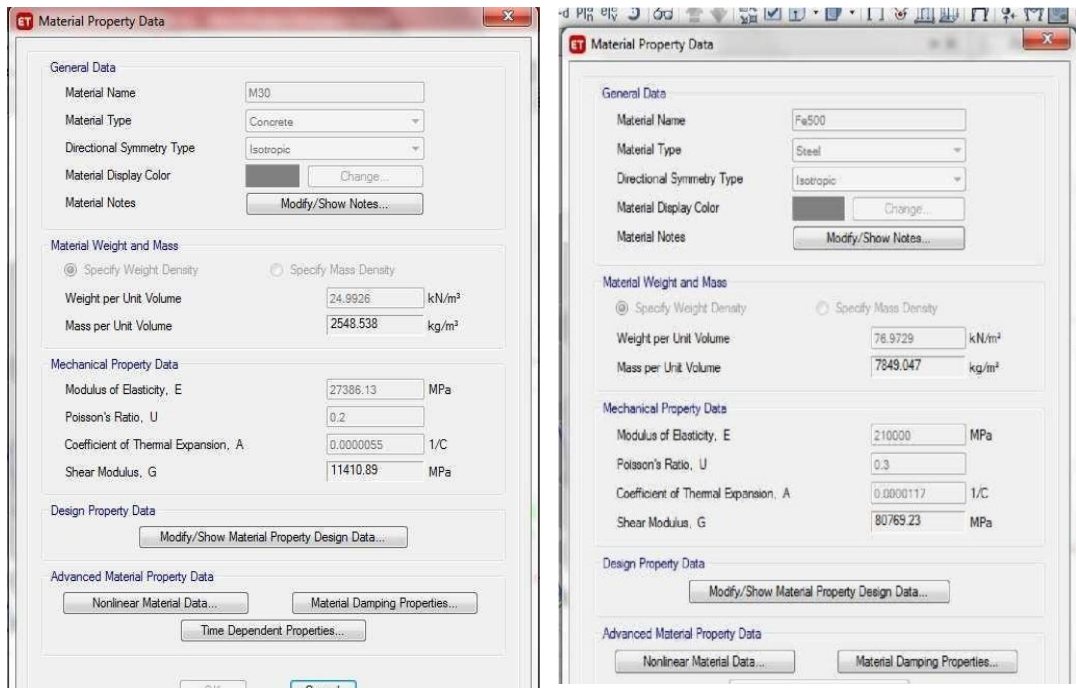
Importing floor plan using AutoCAD:



Figure(9) Plan in AutoCAD

Analysis in ETABS

Material properties: Summary



Figure(10) Summary of Material Properties Frame Sections Summary

## APPLICATIONS OF ETABS SOFTWARE

Just structural engineer and architects utilize this software expertly. It's a three-dimensional analysis and plan programming software.

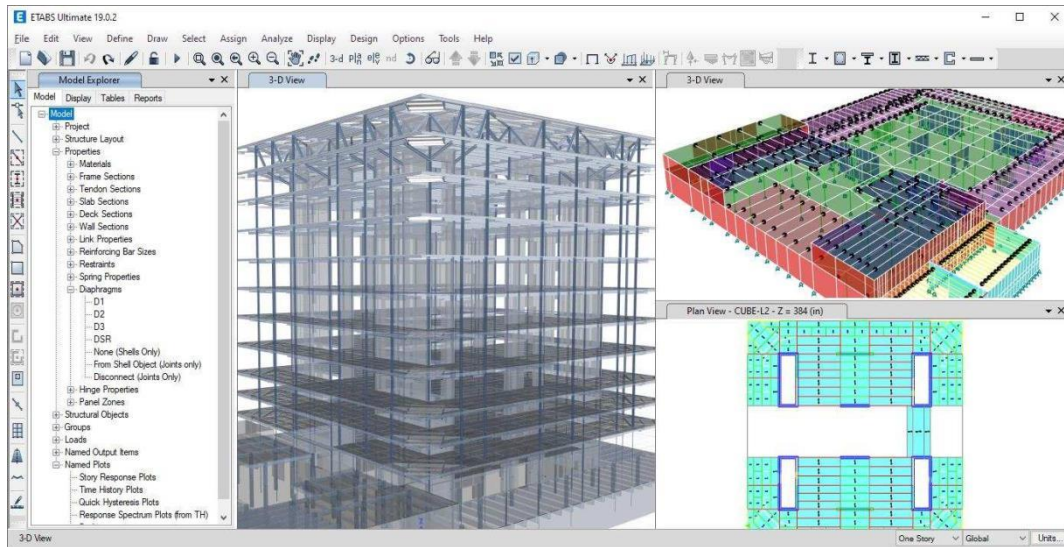
For almost thirty years, ETABS has been recognized as the business standard for Building Analysis and Design Software. Today, proceeding with the comparable practice, ETABS has arisen into a strategically evolved structure analysis and design program.

The framework worked around an aesthetical article based graphical user interface. The plan is controlled by desired, new unique yearning calculations for plan investigation and analysis. With facilities for drafting just as delivering output, is reproducing standards of integration, inventiveness, and specialized advancement.

Loads of things you can do utilizing ETABS programming including moment-resisting frames and braced frames. It can likewise analyses any kind of support rooftop framework, structure with beam size reduction or side plates. You can likewise plan inflexible floor framework or adaptable floors, messy material design, incline section/slope just as parking framework structure.

Aside from those the program can do intermediate level floor framework and several tower structures, and various level diaphragm technique along with basic concrete structures. The highlevel composite floor framework or steel joist floor outlining strategy is simpler to examine with this program.

ETABS offers a solitary user interface to perform modelling, analysis, design and reporting. There is no restriction to the quantity of model windows, model control perspectives and information view.



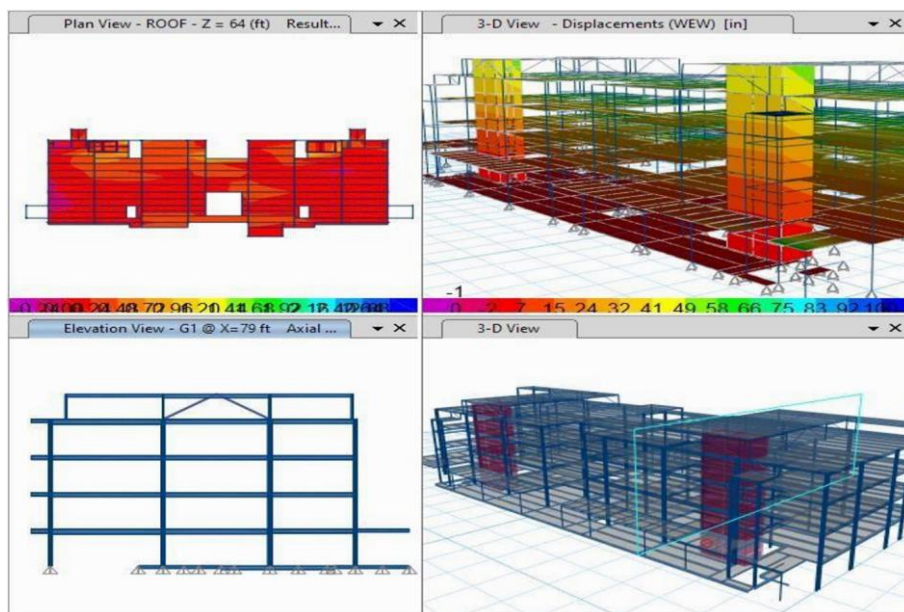
**Figure (22) DirectX Graphics in ETABS**

### Enhanced DirectX Graphics

DirectX illustrations with equipped speed up designs take into considerate navigation of models with fly-throughs and quick revolutions/rotations.

### Multiple Views

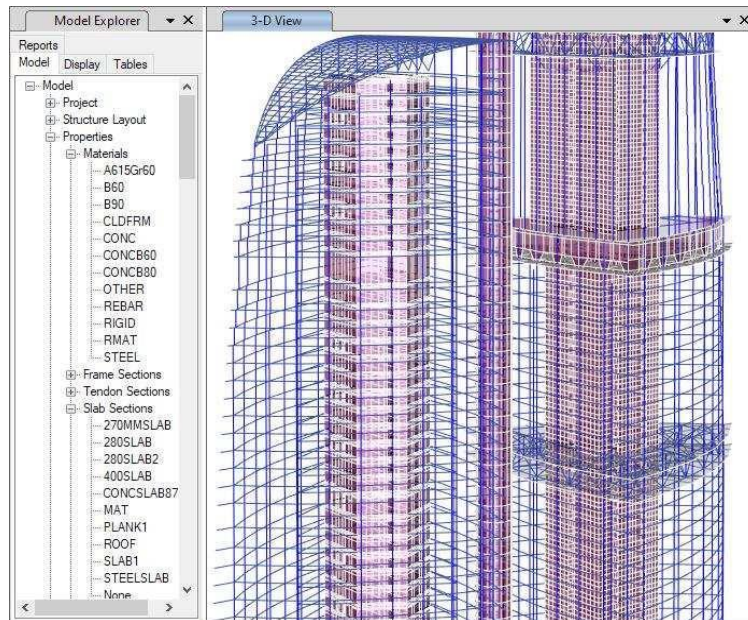
Users can see moment diagrams, load task, deflected shapes, plan output and reports all in a solitary screen.



**Figure (23) Multiple Views of the Plan**

## Quick Navigation and Data Management

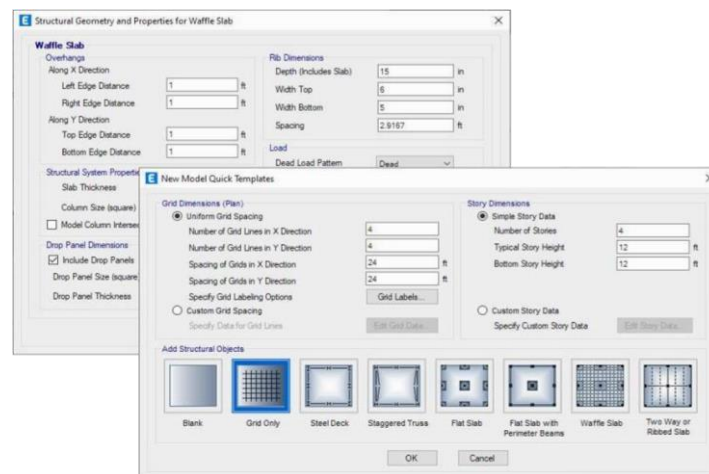
The ETABS model explorer improves our capacity to oversee information in your model. One can characterize, copy and alter properties in groups and drag-and-drop properties directly on to the models for task. User characterized presentations can be set up effectively in the model explorer for fast navigation.



## Modeling

**Figure (24) Navigation of a High-Rise Building**

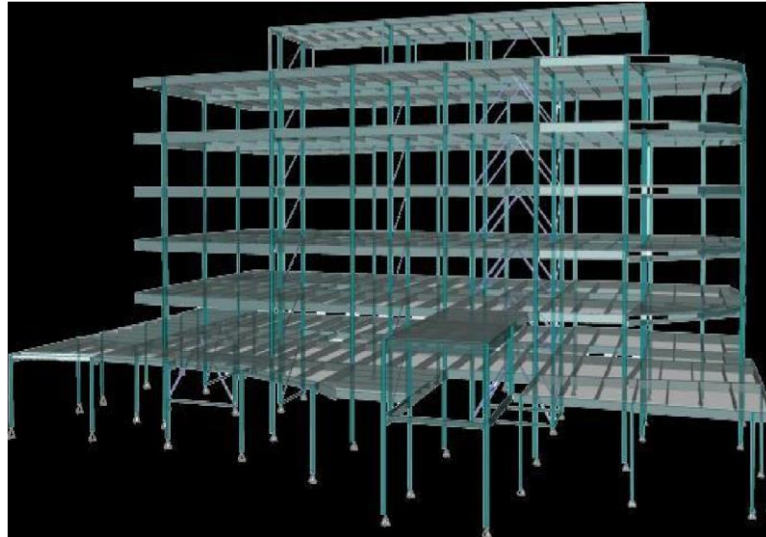
ETABS has a wide determination of formats for beginning another model rapidly. At this model format stage, one can characterize matrix/grid and grid spacing, the quantity of stories, the default structural framework sections, default slab and drop plan sections and uniform loads (specifically dead and live loads).



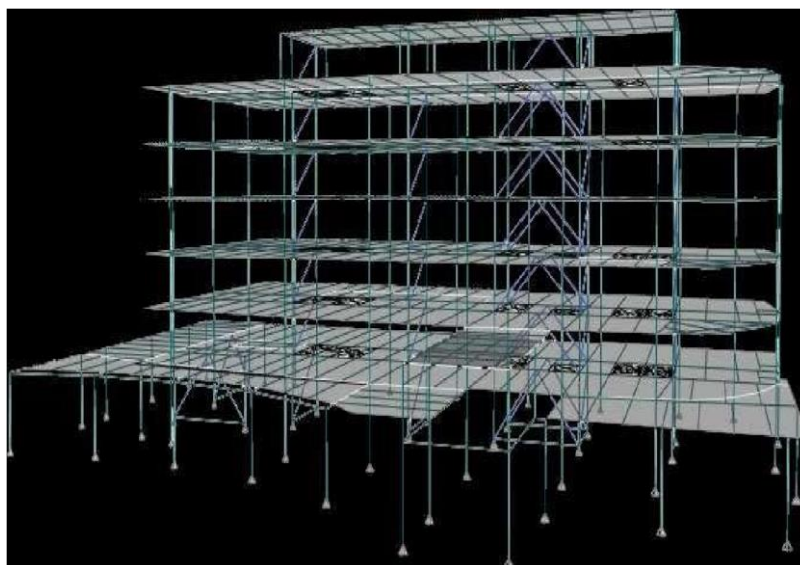
## Physical Model

**Figure (25) Data Input Windows**

The physical model is comprised of objects that address the physical structural members. Physical model perspectives precisely show insertion forces, member orientations, object convergences, and other mathematical details caught by the object model.

**Analytical Model****Figure (26) Physical Model**

Analytical model perspectives show the limited component model of the design which is comprised of the connectivity of the joints, frames, and shells and characterized meshing. At the point when the analysis is run, the analytical model is auto-produced from the model and its tasks and settings.

**Figure (27) Analytical Model**

ETABS software has the following implications in the construction, designing, and modelling industry:

1. It is a product utilized in developing structure. It examines and surveys seismic execution and checks the load bearing limit of building structures.
2. Using this software, one can view and control the analytical model with incredible precision. Plans and elevation views are auto-produced at each grid line.
3. ETABS programming is utilized for the analysis of concrete shear walls and concrete moment frames. It is profoundly acclaimed for static and dynamic analysis of multi-story frame and shear wall structures.
4. It is the most popular civil designing devices utilized in the structural industry and builds the efficiency of underlying structural engineering specialists. It likewise forestalls the speculation of unnecessary time and cash in broadly useful projects.
5. The input, output and numerical solution techniques of ETABS are especially intended to take an advantage of the extraordinary physical and mathematical quantities related with building type structures. Thus, this analysis and design tool speeds up data readiness, output interpretation, and complete execution.

## CONCLUSION

[ ETABS is a crucial programming device that takes into account multi-story building analysis and plan designing. ETABS is a 3D displaying programming for any sort of structural analysis and plan designing. Utilizing this Program one can perform both steel structure and RC Structure.

[ ETABS gives users to Graphic information and change for smooth and fast model creation for a construction which is very helpful for the engineers to directly get the knowledge of the building whether the materials taken are proper or not. As the software gives the total interpretation of the structure, the new advancement occurring in the software will be more beneficial for the engineers, as it will save their time and energy used for the paper work of the same.

[ Creation of a 3D model including the use of plan perspectives and elevations, 3D model of any sort of confounded design can be made effectively. Tower's and skyscraper's structure will be designed thoroughly in this software which saves a lot of paper work which used to done before this software was invented. There is also need to develop more custom software's like ETABS and models to test the structural adequacy of various complex design with more accuracy.

[ This software will lead the civil engineers to next dimensions of seeing through the object much before it is constructed practically. It will give the idea of how the structure will perform for various types of loadings and burdens applied/given on a particular part of the whole structure. It will save engineers time and cost required to get a paper-based



knowledge/calculation which has lots of error, rather software like ETABS will do the calculations effortlessly and efficiently.

□ Future structural engineers need to learn software's like ETABS in their initial stage of learning about civil engineering to get expertise and professional in the structural field which will help them to be a better engineer and will be advantageous for the betterment of the engineers.

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