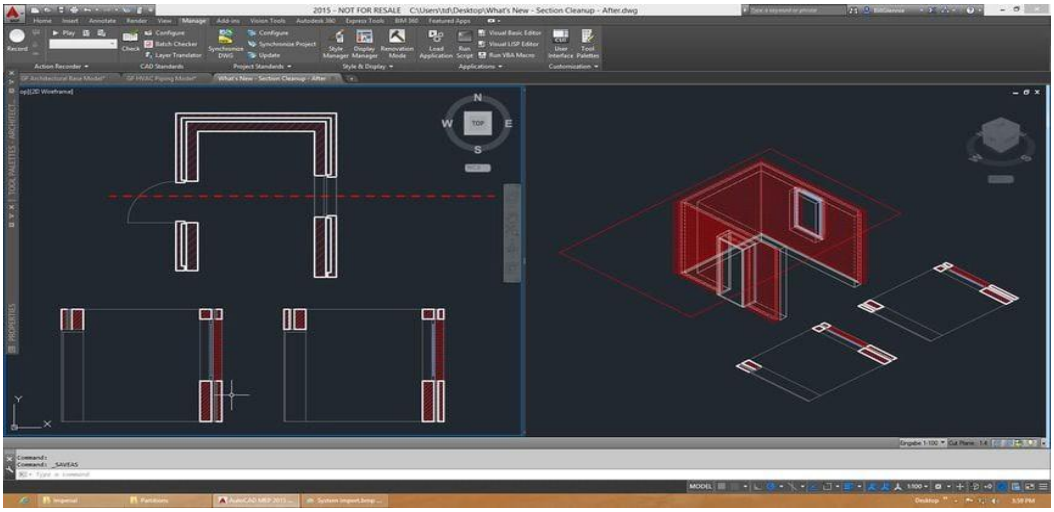


Fig .1 Auto CAD Interface

AutoCAD facilitates efficient drafting and visualization of 2D/3D models, offering features like powerful drafting tools, object analysis, and extensive plug-in support. It enables integration with various utilities and benefits from widespread training resources.

4.1 SOFT WARE USED:

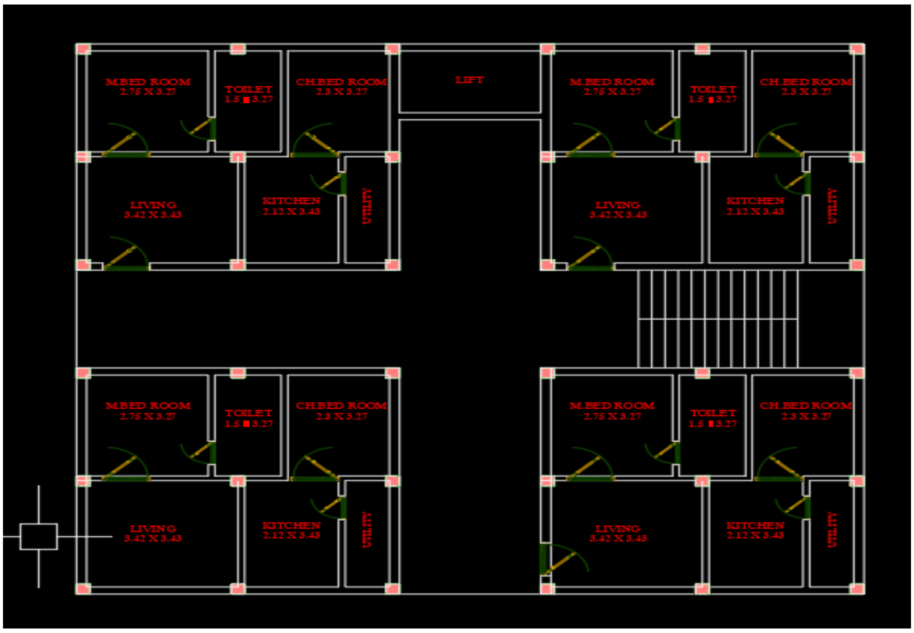
Developed by Autodesk, AutoCAD is a popular computer-aided design (CAD) program used for 2D and 3D design creation and editing. It has been a vital tool for many industries, including engineering, construction, and architecture, since its introduction in 1982. It makes it easier to create accurate models and blueprints. By enabling users to effortlessly edit and share designs across several platforms, AutoCAD's automation, customization, and collaboration tools boost productivity.

ETABS is a powerful 3D modelling software used for the analysis and design of multi-story buildings. It allows for efficient structural modelling, including beams, columns, slabs, and shear walls, using graphical inputs. ETABS supports seismic, wind, and load analysis, incorporating standards such as IS codes. The software simplifies complex calculations, facilitates quick design modifications, and enhances productivity through tools like template libraries, automated reinforcement calculations, and similar story concepts. ETABS is widely used in iconic projects, offering accurate modelling, load analysis, and advanced design features for both steel and RC structures.

Model Data:

4.2 DETAILS OF THE BUILDING

Building Type:	R.C. Frame building
Number of Floors:	G+30
Location:	Hyderabad
Total Height:	96 m from ground level
Number of Columns:	36
Foundation Depth:	3 m below ground level
Footing Type:	Isolated footing & Combined footings
Plinth Level:	0.5 m above ground level
Beam Size:	0.3 m x 0.45 m
Column Size:	0.5 m x 0.5 m
Slab Thickness:	150 mm
Wall Type:	Ordinary clay brick walls
Wall Thickness:	6” for outer walls, 4.5” for inner walls
Staircase Type:	Dog legged staircase
Concrete Grade:	M30
Steel Grade:	Fe 500



4.3 FUNCTIONAL DESIGN OF BUILDING

The principles of building planning are essential for ensuring functionality, comfort, and efficiency. Key principles include aspect, which refers to optimizing the placement of doors and windows for natural light and ventilation; prospect, focusing on creating a pleasing external view and concealing undesirable ones; privacy, ensuring both internal and external privacy; and grouping, which arranges rooms for convenience and comfort, minimizing circulation. Roominess emphasizes maximizing space through room proportions, while furniture requirements ensure adequate space for essential furniture. Circulation involves easy access between rooms, with horizontal and vertical movement well-planned. Sanitation ensures proper ventilation, lighting, and cleanliness to maintain hygiene. Flexibility in design allows for future adaptations, and elegance enhances the building's aesthetic appeal. Finally, economy ensures cost-effectiveness by maximizing space utility and minimizing unnecessary elements. Effective planning optimizes space and ensures the building meets both functional and aesthetic needs.

4.4 Load Combinations

For Gravity Analysis, the applied load combination is 1.5(DL + LL) [12]. In Equivalent Static Analysis, the combinations include 1.5(DL ± EQX), 1.5(DL ± EQY), 1.2(DL + LL ± EQX), 1.2(DL + LL ± EQY), and 0.9DL ± 1.5EQX/EQY [13]. For Wind Load

Patterns, the combinations are 1.5(DL ± WLX), 1.5(DL ± WLY), 1.2(DL + LL ± WLX), and 1.2(DL + LL ± WLY) [14].

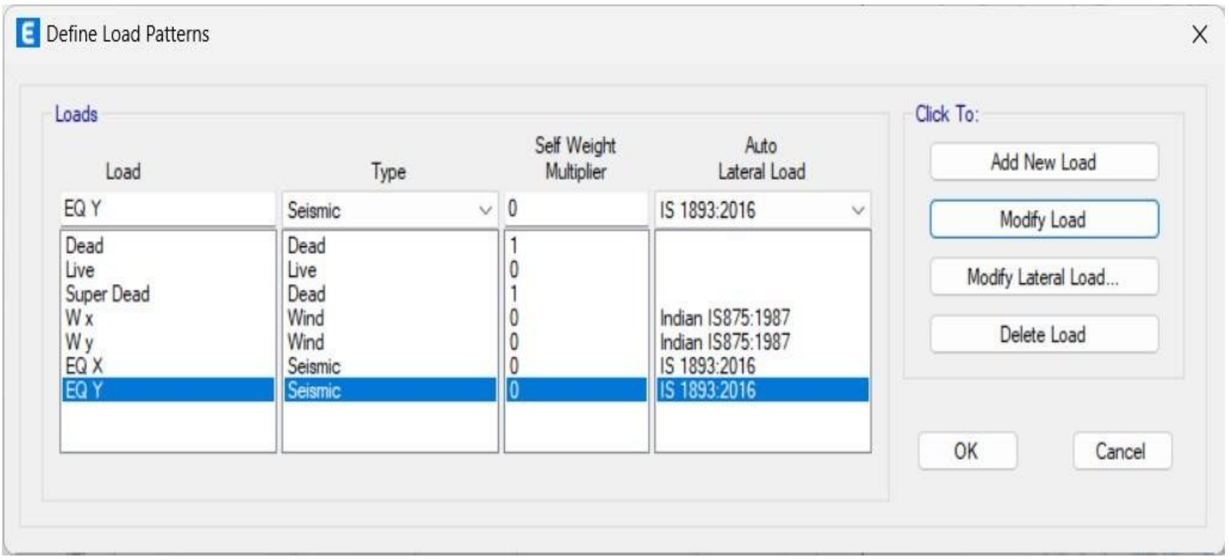


Fig-3: load combination

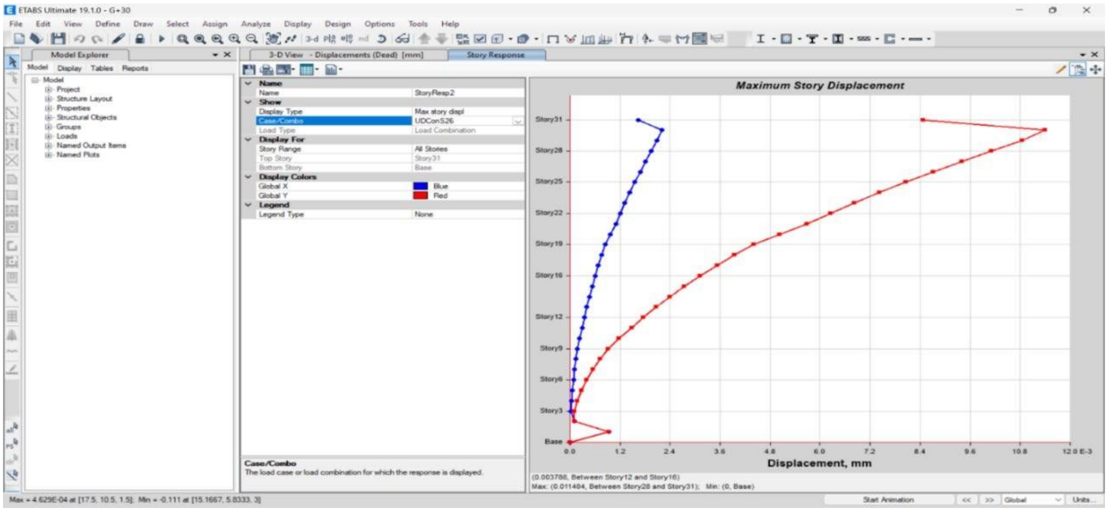


Fig.4 Displacement (Dead) Story Response

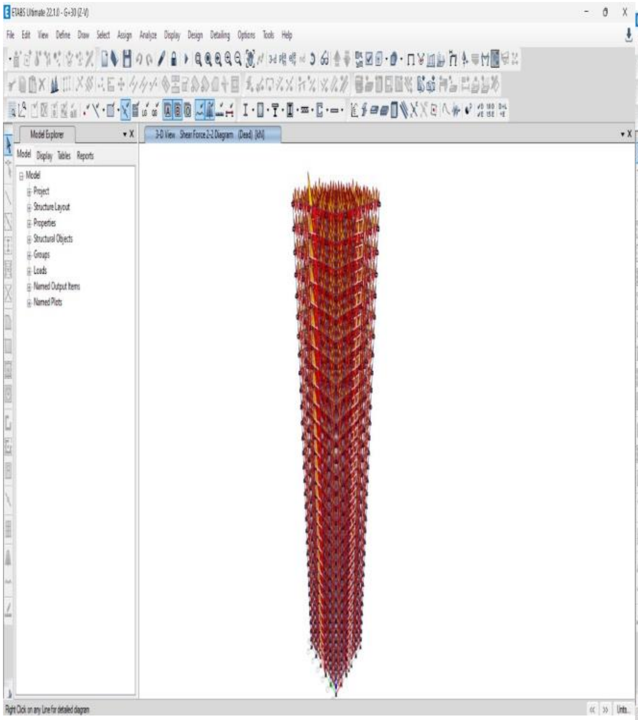


Fig.5 Shear force

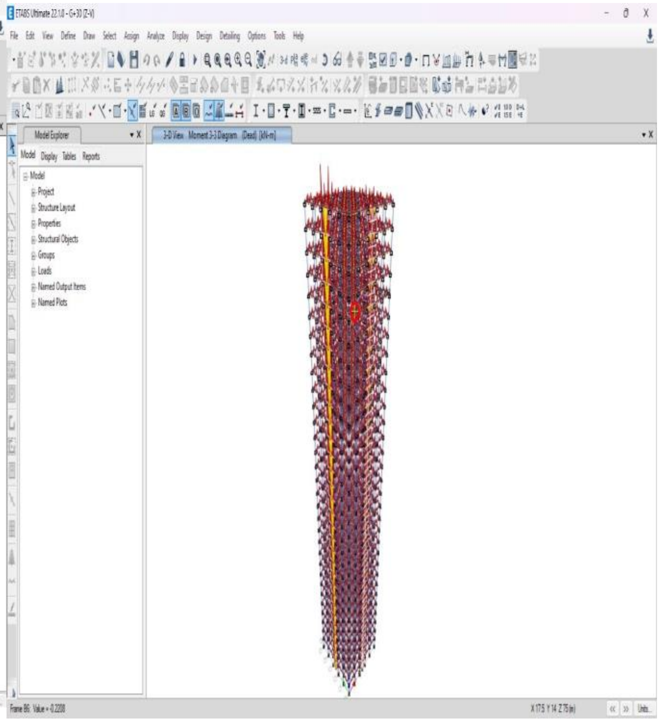
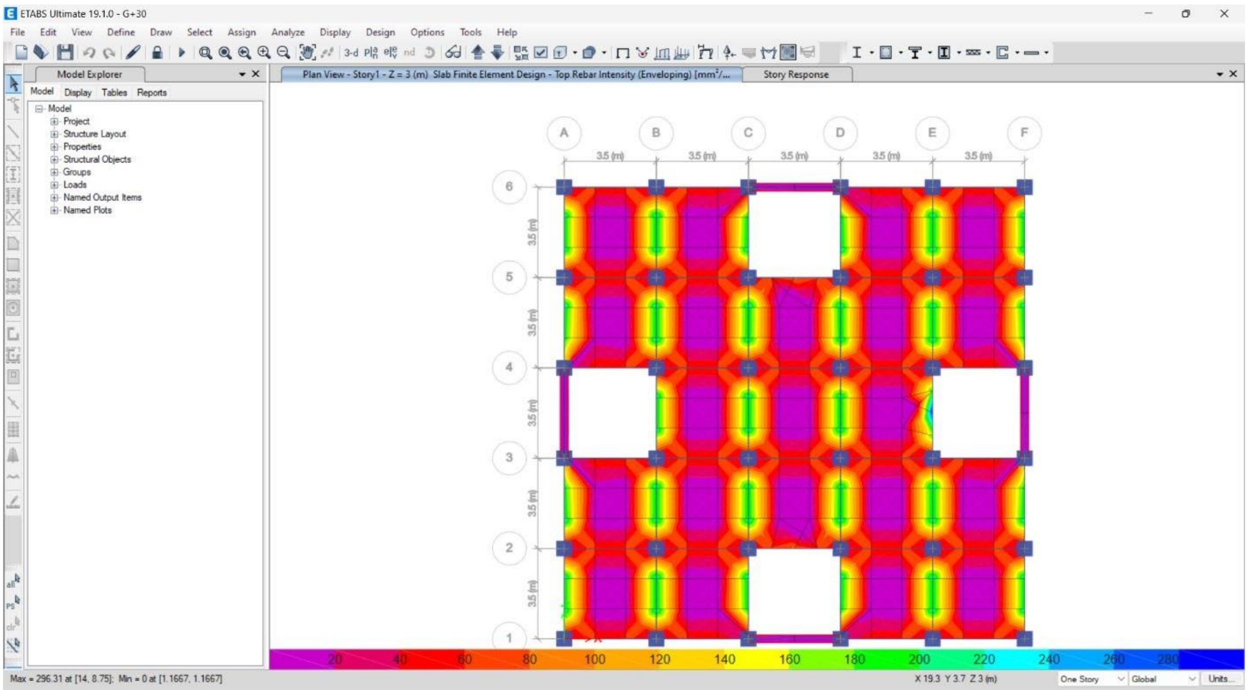


Fig.6 moments

Fig .7 Slab Finite Element Design



5. RESULTS AND DISCUSSIONS

In the analysis of Zone 5 and Zone 4, the results show notable similarities and differences in the reaction forces and moments under various load cases. For Dead Load and Live Load, both zones experience identical results. The forces in the z-direction (Fz) are the same: 113,873.45 kN for Dead Load and 44,100 kN for Live Load. The moments in the x and y directions (Mx and My) also remain consistent between the two zones [14][15].

However, there are significant differences in the Seismic Loads. Zone 5 experiences higher seismic forces, with a force of - 1,326.4762 kN in the x or y direction, compared to Zone 4's -884.3175 kN. The moments in Zone 5 are notably larger in all directions. For example, the moment in the x-direction (Mx) for Zone 5 is 90,389.3333 kNm, significantly higher than Zone 4's 60,259.5555 kNm. Similarly, the moments in the y and z directions are also higher in Zone 5. This indicates that Zone 5 is subjected to a higher seismic response due to its increased seismic forces and moments [16][17].

For the Combined Load Case (Comb1), both zones show identical results. The force in the z-direction (Fz) is 157,973.45 kN, and the moments in the x and y directions (Mx and My) are 1,895,681 kNm and -2,369,602 kNm, respectively, with no moment in the z-direction (Mz). This consistency in results suggests that under combined load conditions, the structural reactions are similar for both zones [18].

In summary, while Zone 5 and Zone 4 exhibit the same reactions for Dead Load, Live Load, and Combined Load Case, Zone 5 experiences significantly higher seismic forces and moments, indicating a more substantial seismic impact compared to Zone 4.

6.CONCLUSION

- In seismic Zones IV and V, the study and design of a G+30 residential structure utilizing ETABS is a crucial undertaking to guarantee structural integrity and safety in areas that are prone to earthquakes. The performance of various frame sections under seismic stresses as specified by Indian norms has been investigated in this study. The results highlight the significance of choosing suitable structural configurations and materials to improve resilience against probable seismic events, given the high seismic risk associated with these zones.
- The Functional Designing i.e., the Planning of the Building has been completed as per the Building Bye-laws, Regulations and Principles of planning.
- The Modelling, Analysis and Design of the Building frame has been completed using ETABS software.
- The Reinforcement scheduling of Slab, Staircase and Columns has been done as per Standards.
- Zone 5 demonstrates a higher seismic response compared to Zone 4. The forces in the x and y directions are largerin Zone 5, and the moments in all directions are significantly greater than in Zone 4. This indicates that Zone 5 experiences a more intense seismic impact, making it more susceptible to larger deformations or movements during an earthquake.
- From a structural performance perspective, Zone 4 is better in terms of seismic load resistance. It experiences lower forces and moments, which could indicate that buildings in Zone 4 are less likely to suffer from severe seismic damage compared to Zone 5. Zone 4's lower forces and moments suggest a more stable reaction under seismic conditions, making it preferable for minimizing structural stress during an earthquake.
- Thus, Zone 4 is better suited for resisting seismic forces due to its lower load reactions, while Zone 5 faces higher seismic impacts that demand stronger reinforcements or seismic design considerations.

6.1 FUTURE OF THE STUDY

- Future research and development opportunities abound in the analysis and design of G+30 residential buildings in seismic Zones IV and V utilizing ETABS. This section lists possible directions for future research that could improve knowledge and use of earthquake-resistant design concepts.
- **Advanced Structural Analysis Techniques:** Nonlinear dynamic analysis and performance-based design approaches are two examples of more sophisticated analysis techniques that may be used in future research. Beyond the linear assumptions usually employed in traditional analysis, this would enable a more thorough knowledge of how structures behave under high earthquake circumstances.
- **Material Innovations:** It is crucial to conduct research on novel building materials and methods that enhance seismic performance. The application of fiber-reinforced polymers, high-performance concrete, or creative damping techniques to improve the resilience of buildings in high seismic zones may be the subject of future

research.

- Integration of Smart technology: One important area for future research may be the integration of smart technology into building design, such as real-time structural health monitoring systems. During seismic events, these devices can offer useful data that improves safety and allows for improved reaction plans.

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