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Analysis of Building with and without Shear Wall

Bharat Sharan Shrivastava1[1], Asst. Prof. Rashmi Singh[2]
[1]Student M.Tech Civil Engineering, Amity University Madhya Pradesh
[2]Asst. Prof. Department of Civil Engineering, Amity University Madhya Pradesh

Abstract - In seismic design building there are various methods to ensure stability against lateral forces caused by earthquake. Most commonly used systems is shear wall. The reinforcement concrete shear wall is one of the most reliable systems to make the structure resistant against lateral forces. Shear wall imparts stiffness to the structure which minimizes the damage caused by the earthquake and provides enough strength.. In this paper four models were analyzed in which two models are with shear wall and rest of two models are with shear wall for different heights. In shear wall models, shear wall are placed at corners. All 4 models with and without shear wall were analyzed through STAAD Pro. v8i by using response spectrum method. And calculate the lateral displacement, storey drift and base shear.
Key Words- Shear wall, Lateral Displacement, Storey Drift, Base Shear, Response Spectrum, Staad Pro v8i.

I. INTRODUCTION

Reinforced concrete framed buildings are enough to resist both vertical and horizontal loads. When the buildings are more than 15-story, either beam and column size can be quite heavy work outside the big reinforcement beam column junctions, so there are lots of crowds in these joints and this place, and this is the fact, there is no contribution in these Safety of buildings at places It is difficult to work solid vibration. These practical difficulties in the shear wall of multi-storey buildings for the introduction. A structural element of a shear wall, using the side, horizontal shear, is similar to the plane of the parrot wall parallel to the shear strength. Shear wall resist the lateral or horizontal forces by truss action for short wall where shear deformation is dominant. When the lateral force resistance is provided by the combined contribution of the frame and the structural wall, it is called a dual system or a hybrid structure, the dual system can add the benefits of its constituent elements. Tensile frames, while communicating with the walls, can provide significant amounts of energy, when necessary, especially in the upper stories of a building. On the other hand, as a result of the large rigidity of the walls, good floor control can be achieved during an earthquake, and the evolution of the reservoir mechanism that consists of the pillars (i.e., soft stories) can easily be avoided.

Under the action of the lateral forces, one frame will be mainly distorted in a shear mode, where as a wall will behave like a vertical cantilever with the primary winding distortions, in this story, the story found the walls and frames shear in opposition to the shear forces. But at higher levels, opposing each other, the resistance of the lateral forces between the walls of the dual system and the frames. The way of sharing is also affected by a dynamic reaction characteristics and the development of plastic tissues during a large seismic event and it can be estimated from a different analysis. Use of Shear wall provides an efficient solution to stiffness a structural system of a building as it increases the rigidity against lateral load acting upon the building. Shear wall significantly increases the stiffness and strength of the building in the direction of its orientation. This results in marked reduction in lateral sway of the building. Generally the Shear wall transfers the load to the next element below it in the load path. It helps in reducing the side sway of the above members like roof or floor. It also prevents the floor & roof framing members from moving off their supports when they are stiffened enough and also reduces the non- structural damages.

II. METHODOLOGY

In this chapter a multistory building has been modeled and analysis with considering all loads like Dead load, Live load, Seismic Load as per IS standard and Seismic load as per IS standard.

A. Response Spectrum Method

The main objective of the response spectrum analysis is to achieve the seismic forces of the design, along with its distribution, with the distribution of different levels with the height of the building and the different side load resistance elements. This method is based on the assumption that the dynamic reaction of the structure, by considering the independent response of each natural mode of vibration and then computing the total response together. For analysis, the mass of the structure is assumed to be lumped at the floor levels and only sway displacement is permitted at each storey. Thus for planer systems, only one degree of freedom per floor and for three degree of dimensional analysis three degrees of freedom per floor i.e. two translation and one angle of twist around the vertical axis must be considered.

Now the design lateral force at each mode is calculated by the formula, given in CL.7.8.4.5(c), of IS 1893 (part I):2002

$$Q_{ik} = A_k \phi_{ik} P_k W_i \tag{1}$$

B. Staad Pro V8i

All models are analysed with the help of software STAAD-Pro. This comprehensive structural engineering software addresses all aspects of the Structure Engineering - model development, analysis, design, verification and visualization. It is based on the principles of "concurrent engineering", someone can make a model, verify it graphically, analyze and design, review results, sort and search data and create reports in a similar graphics-based environment. For this the main options are available from concurrent graphics environments:

1) STAAD-Pro Analysis and Design
2) STAAD-Pre Graphics Input Generation
3) STAAD-Post Graphical Post-Processing

III. MODELLING AND ANALYSIS IN STAAD PRO V8I

Table 1: Details of G+25 storey building without shear wall

Typical storey height	3 meter
Size of the beam	400mm×500mm
Size of Column	600mm×600mm

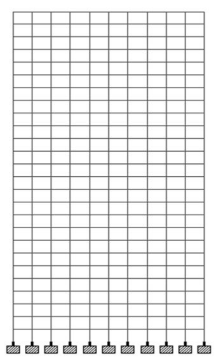

Figure 1: Plan of G+25 building

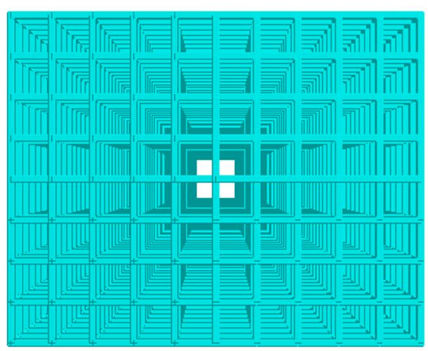

Figure 2: Top view of G+25 storey building without shear wall

Table 2: Details of G+25 storey building with shear wall

Typical storey height	3 meter
Size of the beam	400mm×500mm
Size of Column	600mm×600mm
Thickness of shear wall	300mm

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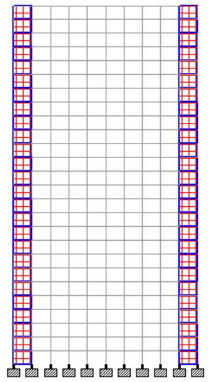


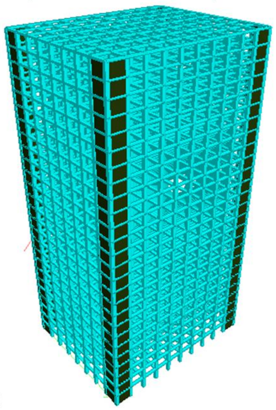


Figure 3: Plan of G+25 building

Figure 4: G+25 Building with shear wall

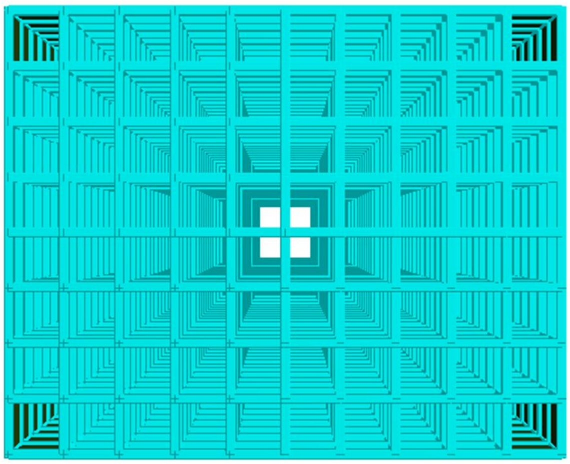
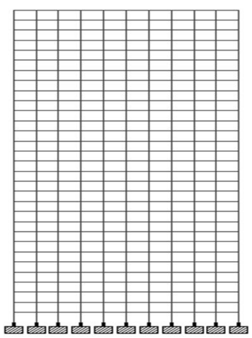


Figure.5: Top view of G+25 storey building with shear wall

Table 3: Details of G+30 storey building without shear wall

Typical storey height	3 meter
Size of the beam	500mm×600mm
Size of Column	700mm×700mm



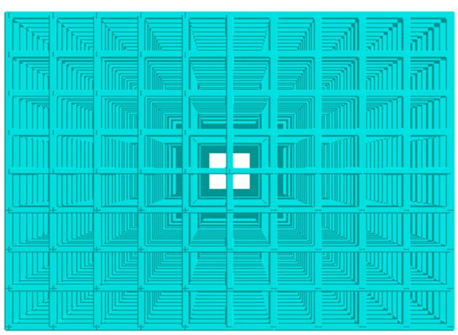


Figure 6: Plan of G+30 building

Figure 7: 3D view of G+30 building

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Table 4: Details of G+30 building with shear wall

Typical storey height	3 meter
Size of the beam	500mm×600mm
Size of Column	700mm×700mm
Thickness of shear wall	300mm

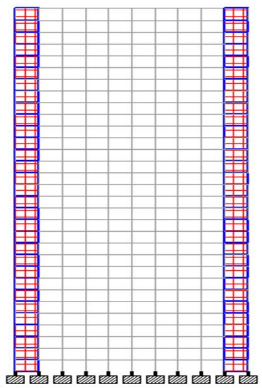

Figure 8: Plan of G+30 building

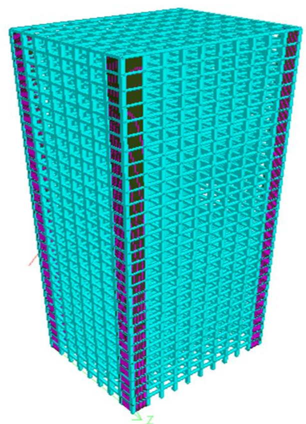

Figure 9: G+30 Building with shear wall

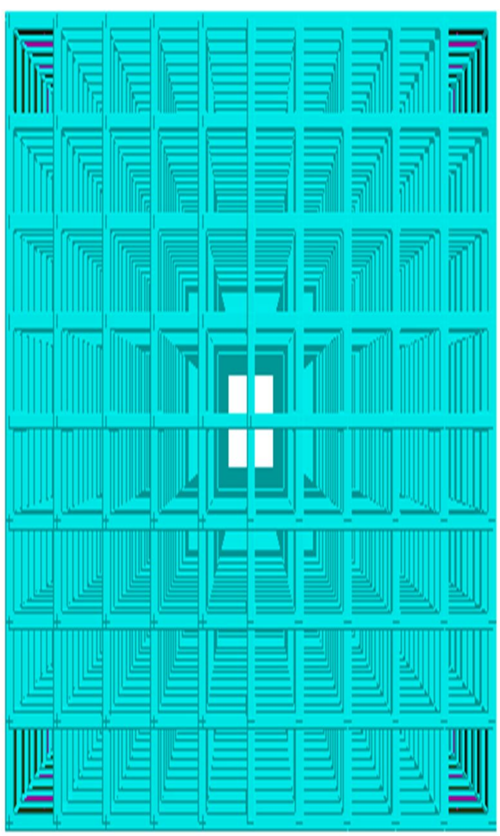

Figure 10: Top view of G+30 storey building with shear wall

IV. RESULTS AND DISCUSSION

A. *Lateral Displacement*

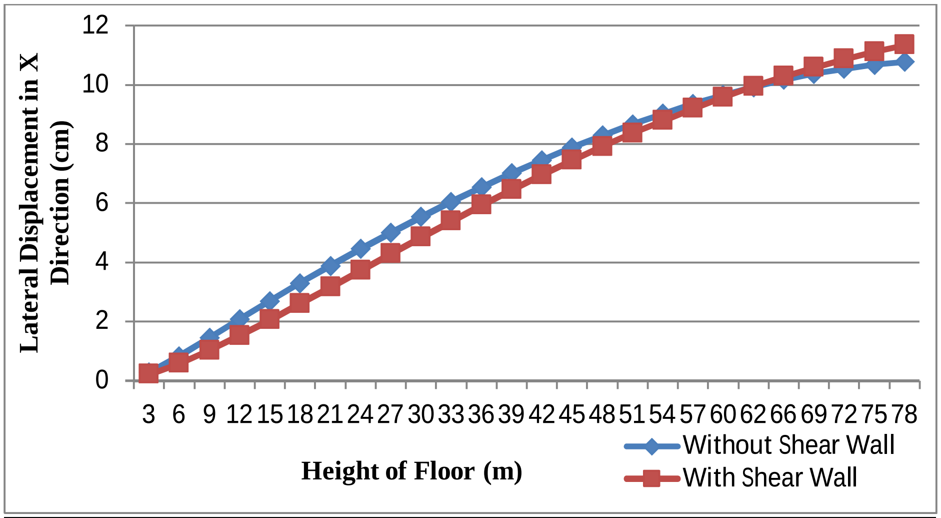

Figure 11: G+25 storey lateral displacement in X direction

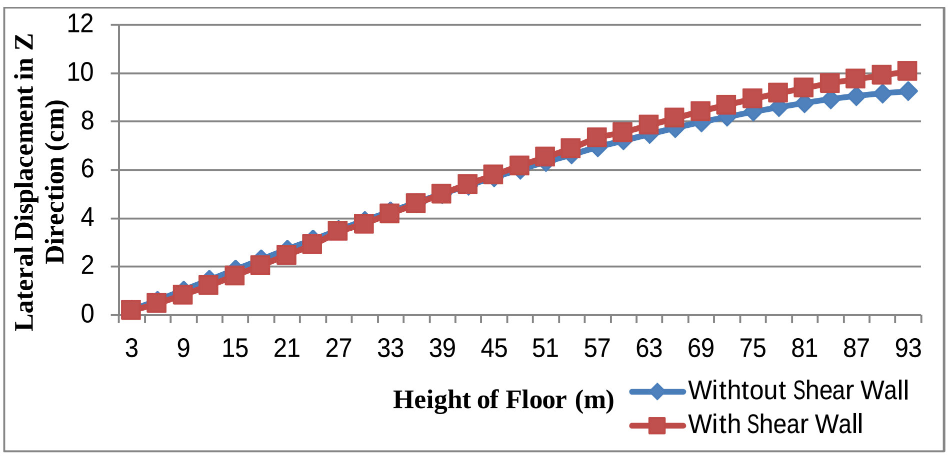

Figure 12: G+30 storey lateral displacement in X direction

B. *Storey Drift*

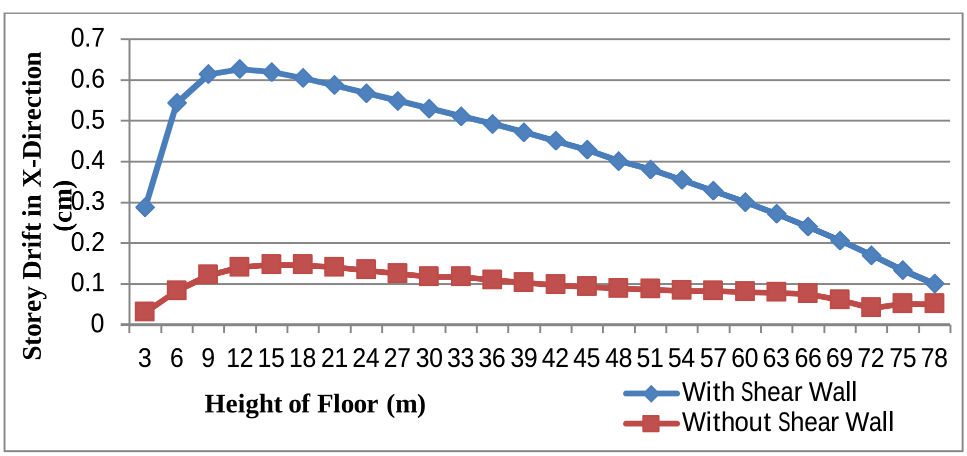

Figure 13: G+25 storey drift in X direction

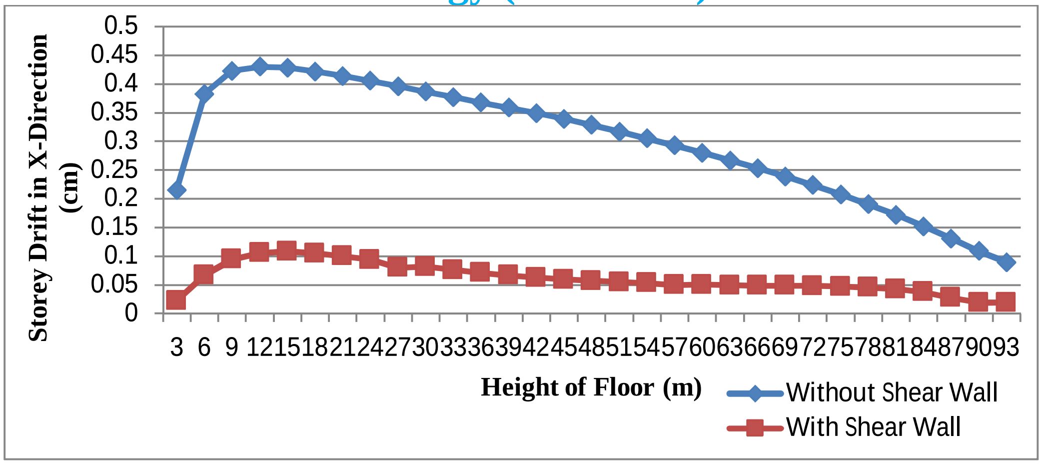

Figure 14**:** G+20 storey drift in X direction

C. Base Shear

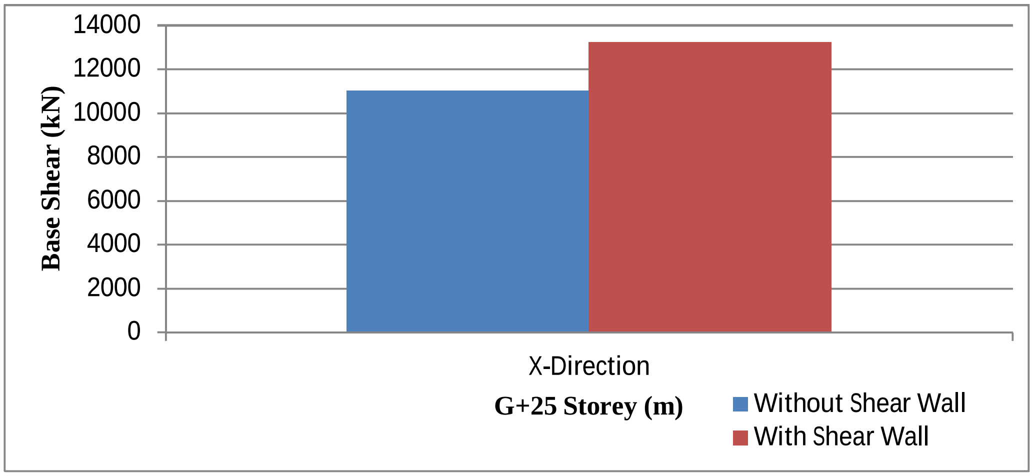

Figure 15: Base shear of G+25 storey building in X direction

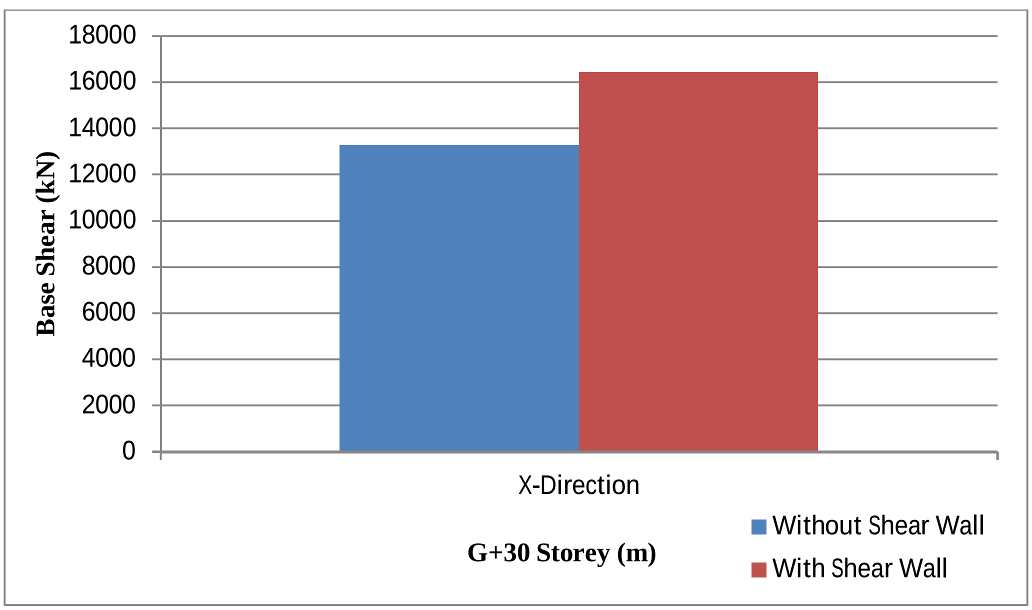

Figure 16: Base shear of G+30 storey building in X direction

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V. CONCLUSION

A. Lateral displacement in X direction for G+25 building with the provision of shear wall is increased by 4.9% with respect to building without shear wall.

B. Lateral displacement in X direction for G+30 building with the provision of shear wall is increased by 8.1% with respect to building without shear wall.

C. Storey drift in X direction for G+25 building with the provision of shear wall is reduced by 50.3% with respect to building without shear wall.

D. Storey drift in X direction for G+30 building with the provision of shear wall is reduced by 78.3% with respect to building without shear wall.

E. Base shear in X direction for G+25 building with the provision the shear wall is increased by 16.6% with respect to building without shear wall.

F. Base shear in X direction for G+30 building with the provision the shear wall is increased by 19.2% with respect to building without shear wall.

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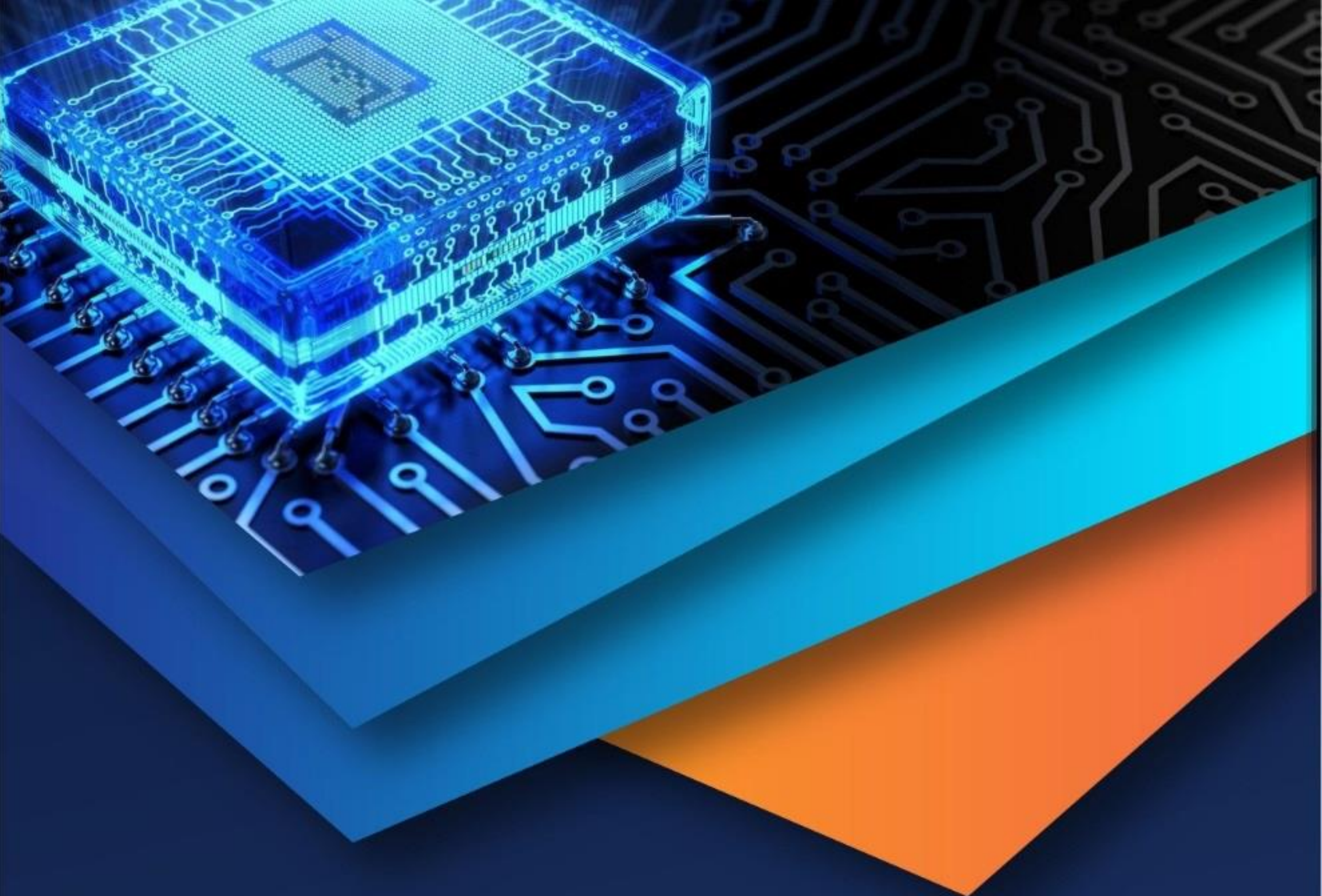

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