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Use of Shear Wall System in RC Building with Reinterant Corner

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Abstract: The recent earthquake including the last Nepal earthquake (2015) in which many reinforced concrete structures have been severely damaged or collapsed, have indicated the need for evaluating the seismic adequacy of existing buildings. In multi-storied framed building, damages from earthquake generally initiate at locations of structural weaknesses present in the lateral load resisting frames. This behavior of multi-storied framed buildings during strong earthquake motions depends on the distribution of mass, stiffness, strength in both horizontal and vertical planes of buildings. In few cases, these weaknesses may be created by discontinuities in stiffness, strength or mass along the diaphragm. Many buildings in the present scenario have irregular configurations both in elevation and plan. These in future may be subjected to devastating earthquakes. In this thesis, we have studied various configuration of shear wall in a building with irregular plan (L shape). For the study, we have considered ten test models, out of which one model is not having shear wall. This model is called bare frame. From the bare frame model other nine test models with shear wall is compared in order to define the optimum location of shear wall for L shaped building.
Keywords: Bending Moment, Dynamic load, Displacement, ETABS, Reinforced Concrete, Storey Drift.

I. INTRODUCTION

In multi-storied framed building, damages from earthquake generally initiate at locations of structural weaknesses present in the lateral load resisting frames.

This behavior of multi-story framed buildings during strong earthquake motions depends on the distribution of mass, stiffness, strength in both the horizontal and vertical planes of buildings. In few cases, these weaknesses may be created by discontinuities in stiffness, strength or mass along the diaphragm. Such discontinuities between diaphragms are often associated with sudden variations in the frame geometry along the length of the building. Structural engineers have developed confidence in the design of buildings in which the distributions of mass, stiffness and strength are more or less uniform. There is a less confidence about the design of structures having irregular geometrical configurations and diaphragm discontinuities (J. Sreenath and Dr. H. Sudharsana Rao, 2018).

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These in future may be subjected to devastating earthquakes. It is necessary to identify the performance of the structures to withstand against disaster for both new and existing buildings. Now a day's opening in the floors is common for many reasons like stair cases, lighting architectural etc., these openings in diaphragms cause stresses at discontinuous joints with building elements. Discontinuous diaphragms are designed without stress calculations and are thought about to be adequate ignoring any gap effects. In this paper an attempt is made to try to know the difference between buildings with diaphragm discontinuity and a building without diaphragm discontinuity (J.Sreenath and Dr.H.Sudharsana Rao, 2018).

Fig. 1. Multiple-story collapse in a six-story building due to strong beam-weak column design in the1999 Turkey earthquake.

A. Summary of Literature Studied

From the previous sections in this article, we have seen the importance of shear wall in the multistorey building. The position of shear wall has dominance in defining the lateral stiffness of the building. We have also observed that, the lateral deformation reduces to about 26.7% (ref. K. L. Lovaraju & K.V.G.D Balaji (2015)) only due to the positioning of shear wall. But, majority of studies is done for the buildings which have no irregularities and the input data for comparative analysis is also very less. Irregularities cannot be skipped in practical circumstances. This will give a better approach for construction when practical circumstances are considered. I will determine the optimum location of shear wall in a multistory building with reinterant corner. Looking to the above review of literature, the present topic was identified by me for my dissertation work.

II. PROBLEM FORMULATION

Extended Three Dimensional Analysis of Building systems is engineering software widely used for design and analysis of multistory buildings. It is used to evaluate basic and advanced systems under static or dynamic conditions. For a refined assessment of seismic performance, modal and direct integration time-history analysis, may couple with p-delta and large displacement effects. The modeling of various regular and building is very easy in ETABS. The same is with the application various load patterns. Because of the user friendly interface, this is the choice of various consultancy firms around the globe

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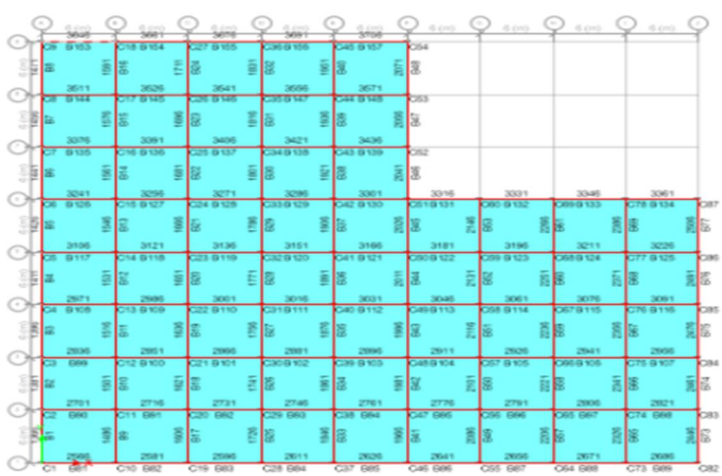

Fig. 2. General View of Structure.

III. METHODOLOGY

The building considered in the study is to be located in seismic Zone V, and intended for Commercial use (Hotel). Building is founded medium strength soil. The columns at base are assumed to be provided with Mat footing. Response reduction factor for the ordinary moment resting frame has taken as 1. The cases has been considered for the analysis of work. Modeling has been carried out using ETAB 16.2.1. Following sequence has been followed to analyse the structure by using ETABS:

1) *Step 1:* Starting the ETABS and defining the type of structures and unit.
2) *Step 2:* Preparing the model of the building.
3) *Step 3:* Defining support conditions.
4) *Step 4:* Defining material properties.
5) *Step 5:* Defining various loading conditions of dead load , live load and temperature load.
6) *Step 6:* Creating slabs and imposing loads on it
7) *Step 7:* Structural analysis for various cases
8) *Step 8:* Critical study of results

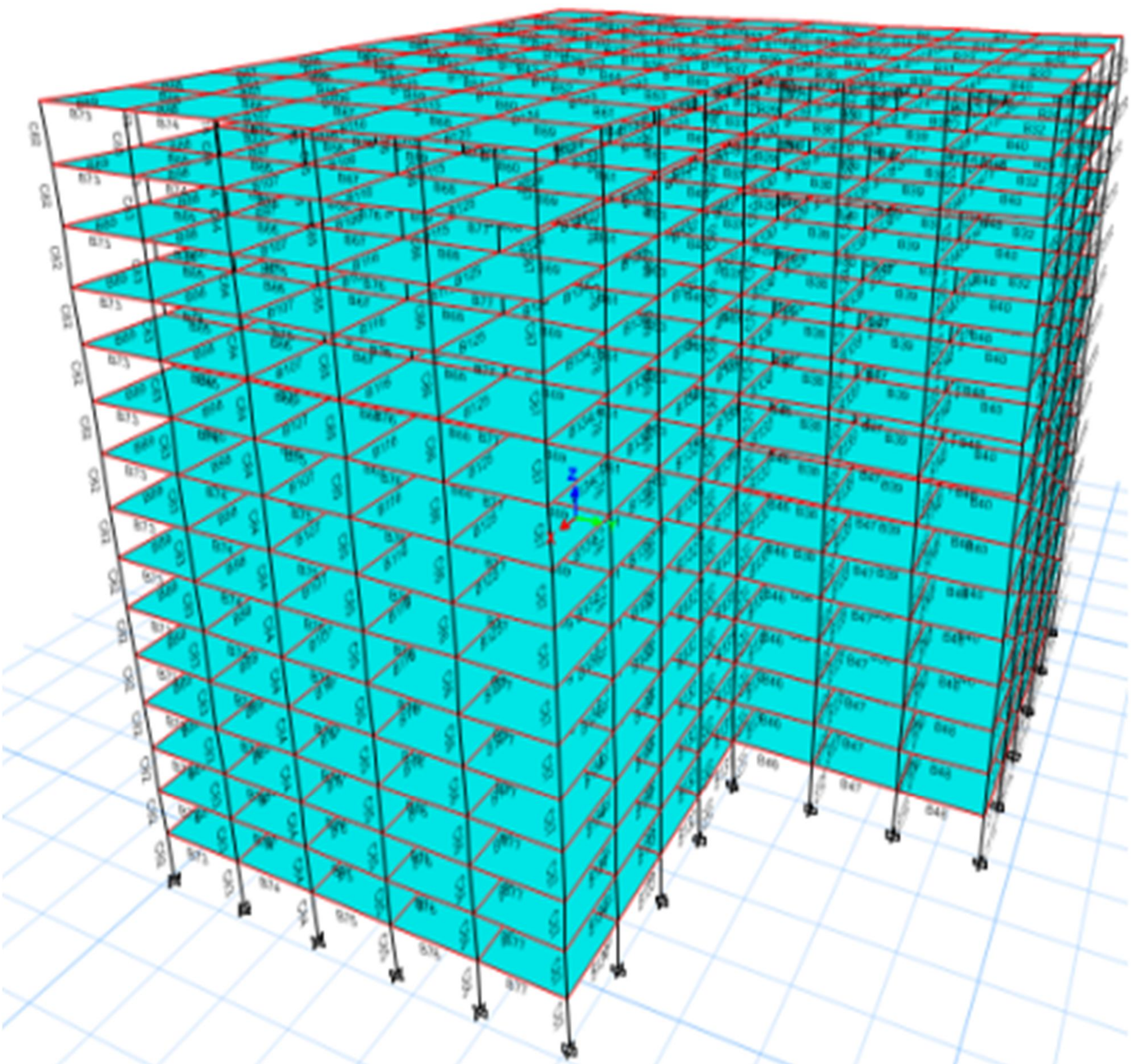

Fig. 3. Modelling of Structure in ETABS.

IV. RESULTS

Results are to be discussed in the following parameters.

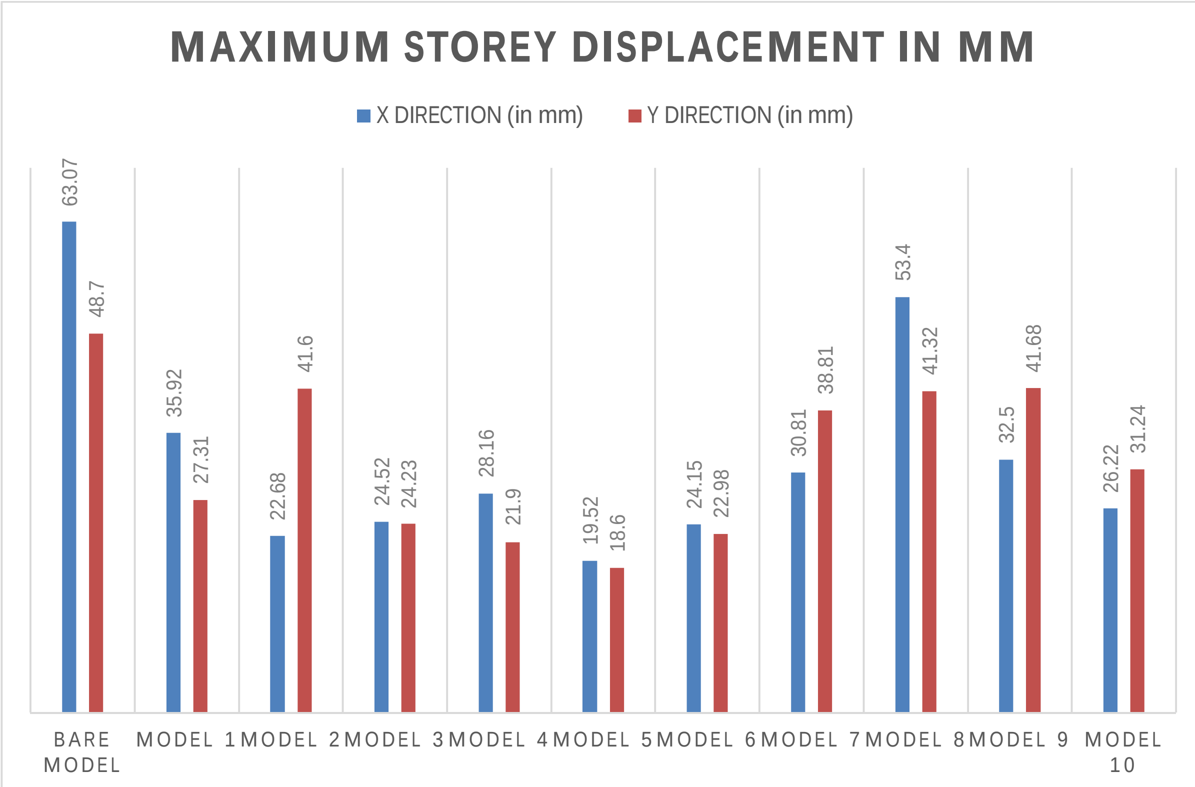

Fig. 4. Comparison of displacement (in mm)

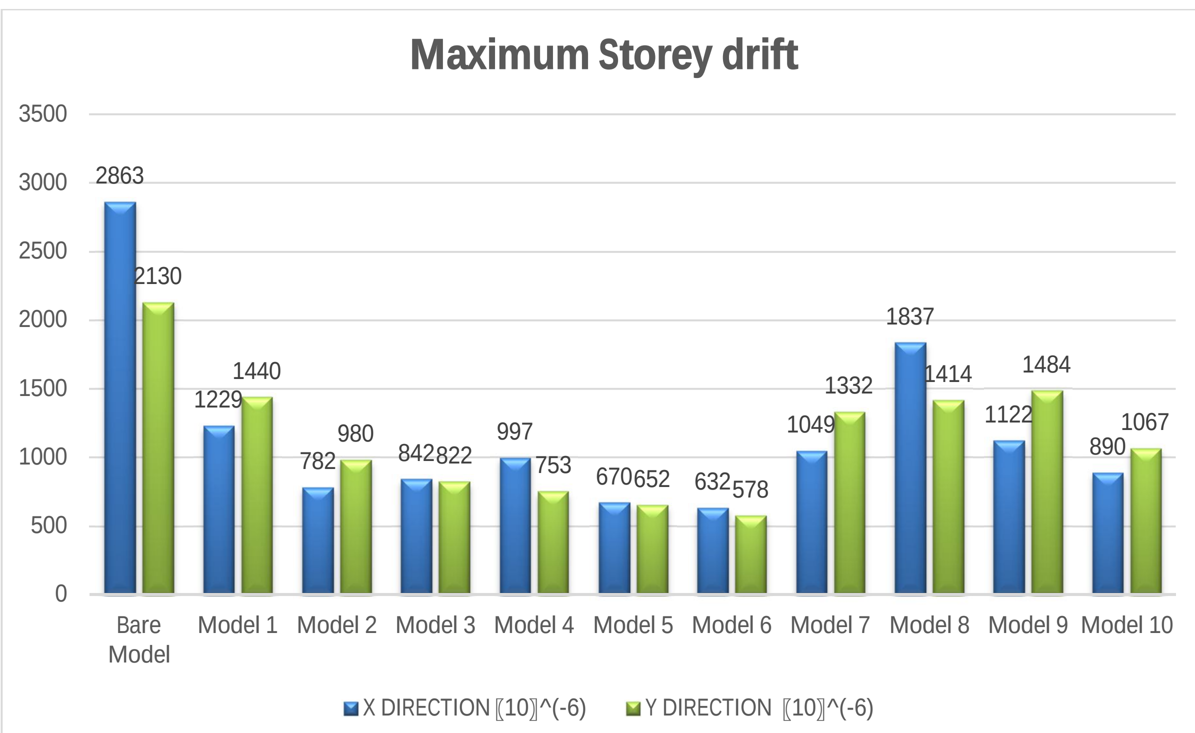

Fig. 5. Comparison of storey drift

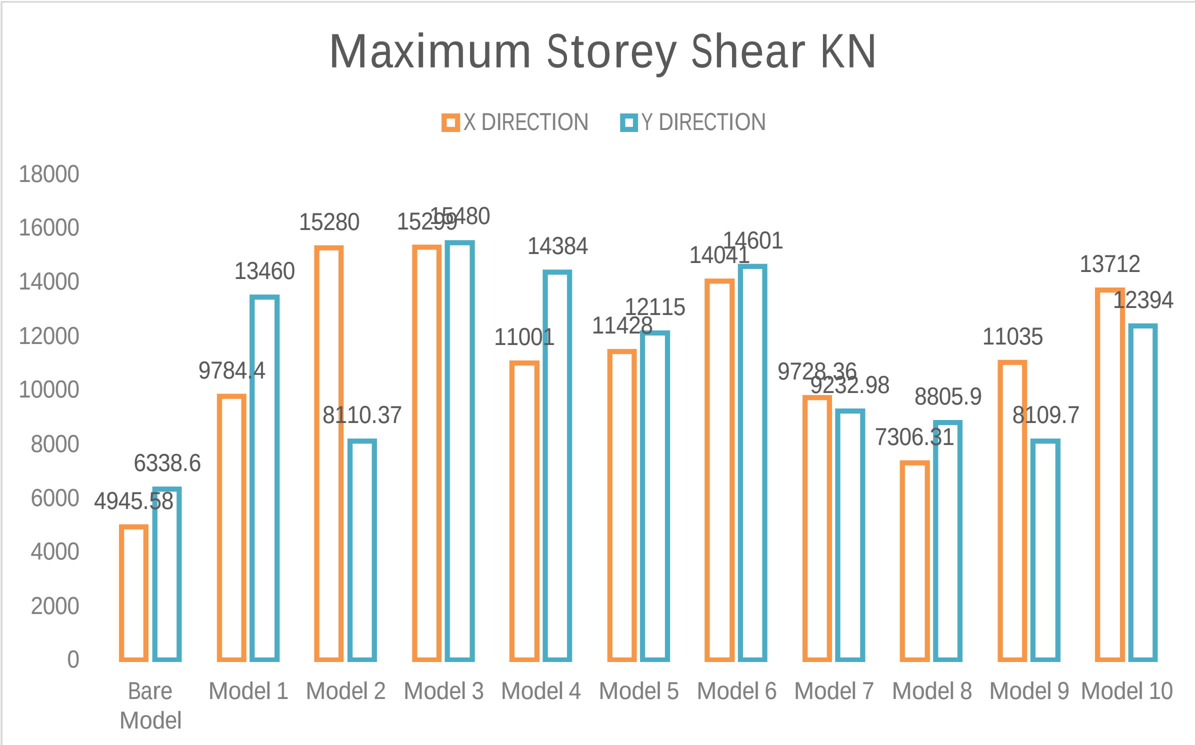

Fig. 6. Comparison of storey shear (in kN)

V. CONCLUSION

After comparing the values of different parameters with acceptance criteria it can be concluded that Under the defined loading conditions, The shear wall configuration should effectively reduce the lateral displacement. The lateral displacement should be reduced on the basis of the fact that, minimum eccentricity should be generated between centre of mass and centre of stiffness. This will result in minimal amount of torsion. In irregular structures, the configuration should not promote any kind of additional forces in the structure; rather it should tackle the unwanted elements. Like the 'L' shaped models were having inborn eccentricity, but the optimum location of shear wall reduced the inborn eccentricity in the structure.

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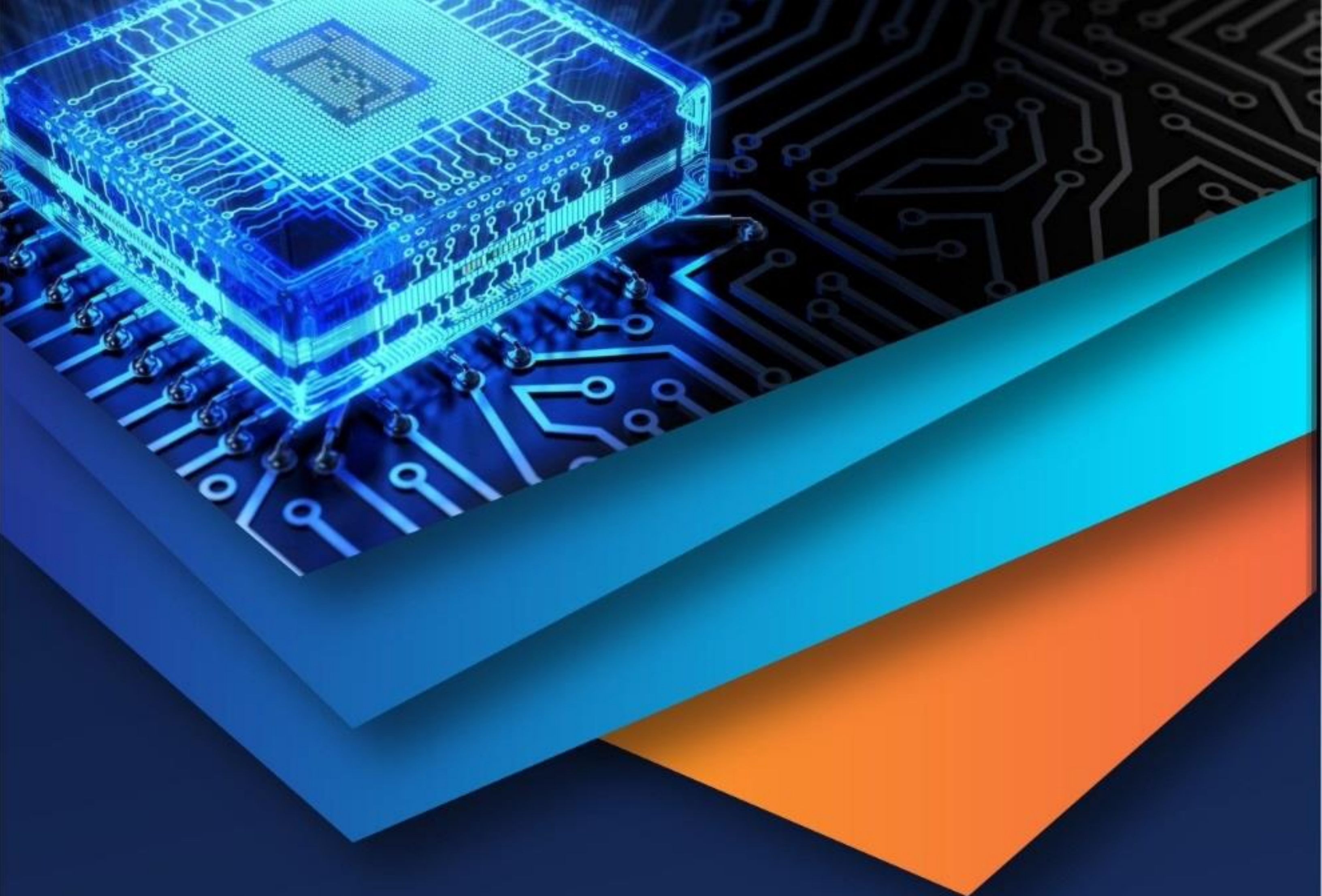

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