iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** VI **Month of publication:** June 2022

DOI: https://doi.org/10.22214/ijraset.2022.45136

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Modelling And Analysis of Regular and Irregular RC Frame Structures with and Without Shear Wall

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Abstract: To further develop the quake resistivity of the structure in high seismic zone regions, shear walls can be utilized in supplanting the typical workmanship walls. Shear dividers work on the plan's solidarity and firmness. Shear walls work on the design's solidarity and firmness. In this paper the association of seismic way of behaving of G+20 story RC Framed structures having customary and sporadic plans are displayed by utilizing ETABS v19 programming. The information are broke down and removed utilizing reaction range examination. The outcomes got with and without shear walls with different arrangement designs were analyzed. Both the edge and the corners have shear walls.
Keywords: High- Rise RC Frame, RC Shear Wall, Story displacement, Story drift, Base shear, ETABS v19

I. INTRODUCTION

In most emerging and developed nations throughout the world, cities are expanding with an increase in the number of high-rise structures, and Horizontal city expansion is no longer possible. As the number of high-rise buildings increases, lateral loads have a range of impacts on the structures. Earthquake is one of nature's most unexpected events, and it must be considered while planning the current tall structure.

The wind bearing affects the power and area of the purposeful weight co-productive. It's also worth noting that changes in arrangement measures have a significant impact on the distribution of twist weight throughout the structure's various faces. Regular building structures are symmetric in plan and elevation along their axis, with lateral stresses distributed equally throughout the structure. Regular structures provide a continuous load path for gravity and lateral stresses. Irregular building structures are those that have a dis-assignment in the study of qualities and relations of lines, surfaces, quantities, or groupings of structural parts that withstand loads and asymmetries. A shear wall is a vertical structural feature in high-rise constructions that resists lateral loads like earthquakes and wind.Shear walls are constructed of concrete or masonry wall panels with a reinforcing bar grid.Shear walls are more stable to handle lateral loads than RCC Framed constructions because of their supporting area in relation to the overall plan area of the building.These walls frequently start from the foundation and go all the way to the top of the structure.These are broad beams that are vertically orientated and transfer lateral stresses to the foundation. In high-rise structures, they can be as thin as 40mm and as thick as 500mm.

II. LITERATURE REVIEW

Yogesh Solanki et al., (2022) completed research on [1]Analysis and plan of skyscraper private structure with shear wall by staad.pro and inferred that, it is important to put the shear wall at an optimal area for viable and effective execution of the structure.

You Jiangtao et al., (2021) carried out an investigation on [13] Research on vibration decrease of skyscraper RC outline shear wall structure constrained by magnetorheological dampers.

They discoveries uncover that the three-layered estimation model program of an uncontrolled and a MRD controlled RCF-SW design can precisely imitate the construction's dynamic reaction and dampingimpact. With the exception of specific time spans, the removal reaction of the RCF-SW structure constrained by MRD is not exactly that of the uncontrolled construction simultaneously.

Sayed Mahmoud et al., (2021) carried out experiment on [22] Effect of shear wall plan on execution and cost of RC structures in moderate seismic locales. Concluded the complexity of plan and foundation of malleable shear dividers, responsiveness examination is continued too. It is seen that conventional arrangement fundamentally augments incited seismic responses as well as cost diverged from flexible one.

M. Hasim Kisa et al., (2021) carried out research on [21] Exploratory concentrate on hysteric way of behaving of composite shear walls with steel sheets.
In view of the data, horizontal power versus top relocation bends with envelopes were determined from diagrams, and break proliferation in the component was examined bit by bit. In light of the exploratory discoveries, the disseminated energy, pliability limit, and unbending nature characteristics were checked.
Mr.HardikMandwe et al., (2021) carried out thesis on [20] Seismic Analysis of Multistorey Building with Shear Wall utilizing STAAD Pro. The imperative inflexibility can be accomplished by introducing shear walls at proper areas. The motivation behind this work was to explore the impacts of seismic tensions on a 50-story RCC structure with a shear wall.STAAD Pro software is used to do the analysis.

A. *Summery*

Many creators have done displaying of shear wall in customary and sporadic tall structures in various zones moreover zone I, zone II, zone III and zone IV. Also, made correlation between various zones, static and dynamic investigation is done and few utilized FEA examination. They utilized different programming's moreover sap2000, STAD Pro and ETABS and so forth. From the writing is accessible connected with the seismic way of behaving of shear wall, a tiny work is accounted for on shear wall in elevated structures. Not many gave shear walls at corners of the structure and few gave at fringe.

B. *Objectives*

1) To study the behaviour of regular and irregular RC structures during earthquake load and Wind load with same area and different plan configurations.
2) To measure the efficacy of a shear wall in resisting seismic forces.
3) To model G+19 story high-rise regular and irregular RC Framed buildings using ETABS v 19 software.
4) To perform static response spectrum analysis with the ETABS v19 software.
5) To dissect the consequences of different boundaries, for example, the base shear, time span, story uprooting and story float.
6) To compare regular and irregular RC Framed buildings with different plan configurations in durability aspects.

C. *Aim and Scope of the Project*

The essential objective of this examination is to evaluate the presentation of standard and unpredictable High-Rise RC Framed structures with and without shear walls, as well as fluctuated plan designs, under seismic and wind loads.The presentation of RCC structures under Earthquake and Wind loads is explored and assessed. The effects and importance of many factors in earthquake and wind load calculations are thoroughly investigated. IS 1893(part 1) rules are followed for seismic analysis, while IS 875(Part 3) guidelines are followed for wind analysis. ETABS version 19 is used to perform Dynamic Static Response Spectrum analysis

III. METHODOLOGY

The Knowledge obtained from the ongoing studies is and used to perform the parametric studies of 20 storyed Reinforced concrete building frame structures having square shape, Buildings that are rectangular, T-formed, L-formed, I-formed, H-formed, and C-molded R. C Structures that are outlined. The exploration considers two traditional developments and five unpredictable designs, all of which have a similar region.
The study is carried out for earthquake load for zone V and Basic Wind Speed of 50m/s based on Periodical data at GUWAHATI. The loads and their combinations are valued and an appropriate load factor is used. In the total nine load cases are considered. For the Seismic and Wind load analyses, a large number of factors are taken into account. And parameters of Reinforced Concrete Building R. C Framed structures for Models of various forms are compared to their outcomes.

A. *Response Spectrum Analysis Method*

It is a direct powerful factual scientific methodology for deciding the normal greatest seismic reaction of a fundamentally flexible design by estimating the commitment from every regular method of vibration. The reaction range approach, as characterized by IS code 1893: 2002, might be utilized to perform dynamic examination on normal and unpredictable designs using recently gathered seismic information. In the present work dynamic analysis is performed using response spectrum analysis of the GUWAHATI data and results of the displacements, drift ratio are extracted from the response spectrum analysis.

B. Building Description

General details of the building

For the analysis the different shapes of RC Framed buildings are considered with the same area. The Shapes of buildings are as given below

- Rectangular Shaped RC Frame Building
- I Shaped RC Frame Building
- L Shaped RC Frame Building
- T Shaped RC Frame Building
- C Shaped RC Frame Building**.**

C. Plan Details

- The development is 60 meters in length in the x bearing and 45 meters in length in the y heading. The storey height is kept as 3m.
- The columns are 5 metres apart from one another.
- The model consists of twenty story building, each bay having width of 5m.
- The Beam sizes considered are 0.3mx0.6m and 0.45mx0.60m and grade of concrete is M25
- The Column sizes considered are 0.8mx01.0m and 0.9mx1.0m and grade of concrete is M40
- The Slab thickness is taken as 0.200m& M25 grade concrete
- Shear wall thickness is taken as 0.500m& M25 grade concrete

D. Parameters Considered For The Building Design

Parameter	Type\Value
Structure Type	Regular and Irregular RCC Framed Building Structure
Type of Structure	Rectangular, T, L, I & C
Area of Structure	162000m^2
Live Load	4 kN\m^2
Basic Wind Speed	V_b = 50m/s Guwahati
Importance Factor	1
Terrain Category	2
Class of Structure	B
Zone	V
Response reduction factor, R	5
Floor Finish	1 kN/m^2
Soil type	III
Density of concrete	25 kN/m^3

Model Description

- Model 1: Rectangular Frame exposed Frame in Zone V
- Model 2: I Frame exposed Frame in Zone V
- Model 3: L Frame exposed Frame in Zone V
- Model 4: T Frame exposed Frame in Zone V
- Model 5: C Frame exposed Frame in Zone V
- Model 6: Rectangular Frame Shear wall in Zone V
- Model 7: I Frame with Shear wall in Zone V
- Model 8: L Frame Shear wall in Zone V
- Model 9: T Frame with Shear wall in Zone V
- Model 10: C Frame Shear wall in Zone V

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue VI June 2022- Available at www.ijraset.com

E. ETABS Models

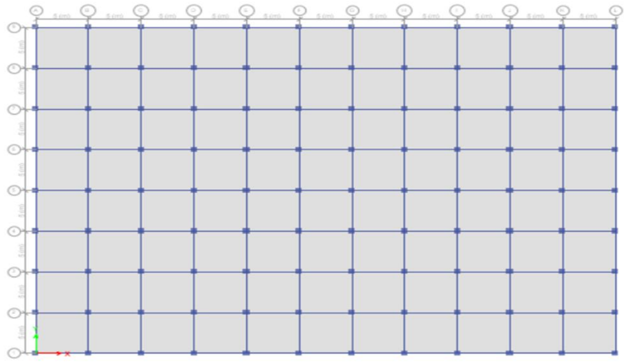

Fig 1. Plan of Modal-1

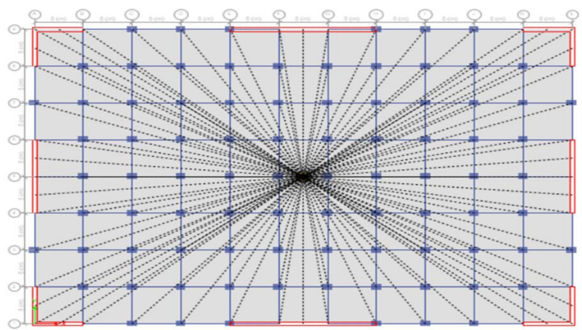

Fig 2. Plan view of M- 6

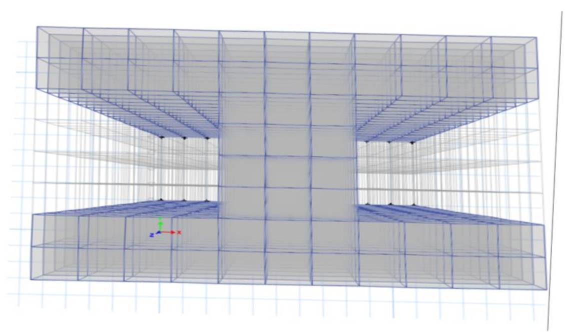

Fig 3. Plan view of M- 2

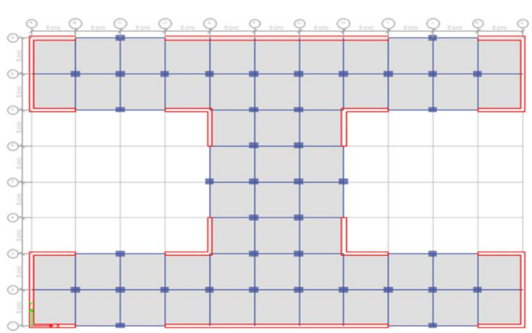

Fig 4. Plan view of M- 7

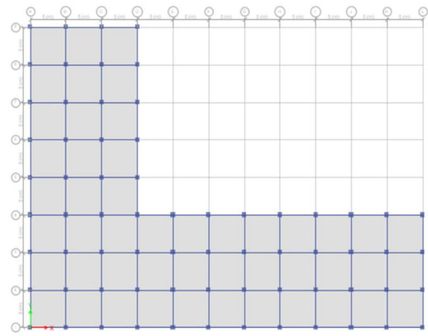

Fig 5. Plan view of M- 3

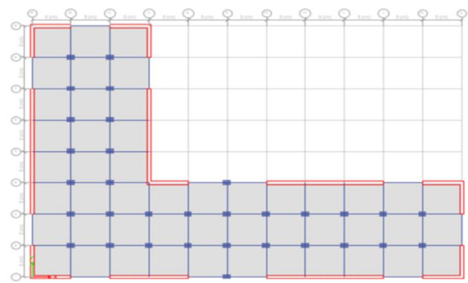

Fig 6. Plan view of M-8

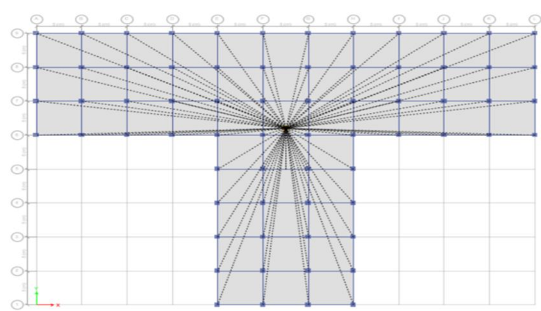

Fig 7. Plan view of M- 4

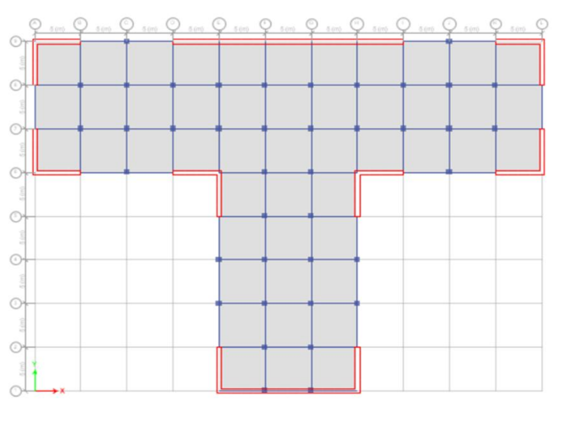

Fig 8. Plan view of M- 9

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
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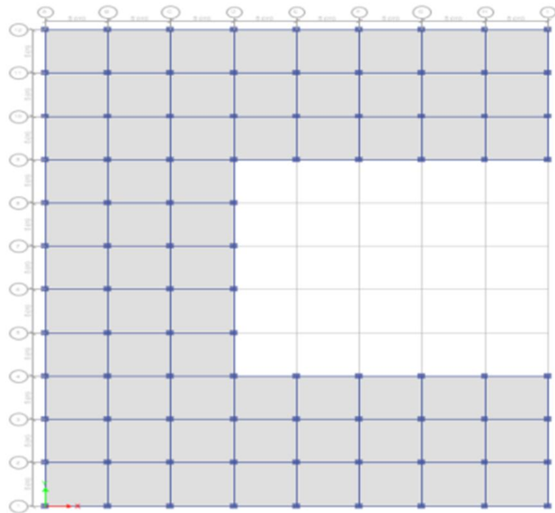

Fig 9. Plan view of M- 5

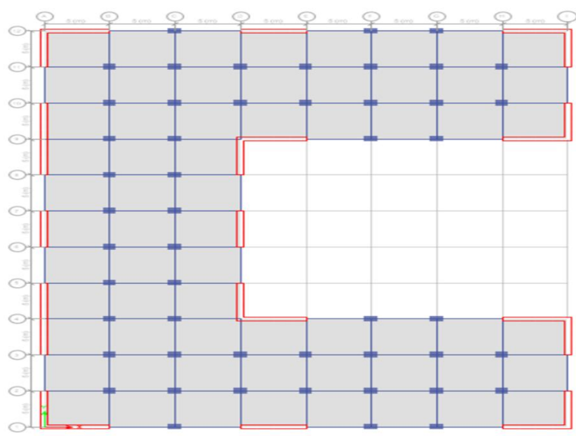

Fig 10. Plan view of M- 10

IV. RESULTS AND DISCUSSIONS

A. *Story Displacements*

Table 4.1. Displacements

MODELS	STORY DISPLACEMENTS
1	3050.016
2	829.669
3	829.669
4	348.602
5	543.385
6	235.702
7	133.275
8	177.353
9	71.696
10	175.517

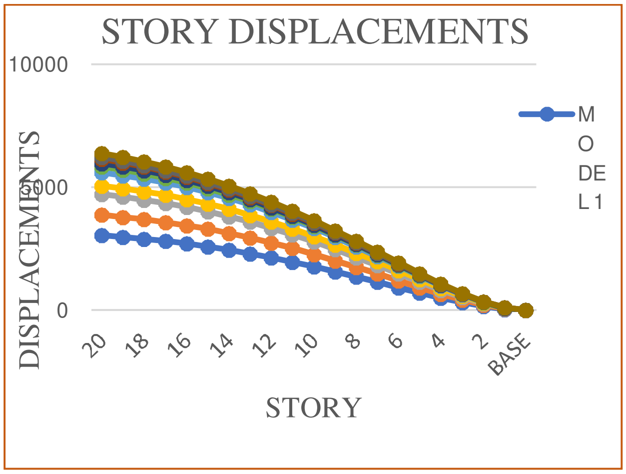

Fig.4.1 Displacements v/s story

B. *Story Drift*

Table 4.2 Drifts

MODELS	DRIFTS
1	0.025398
2	0.007009
3	0.008079
4	0.002446
5	0.004511
6	0.00501
7	0.002629
8	0.003598
9	0.001397
10	0.003348

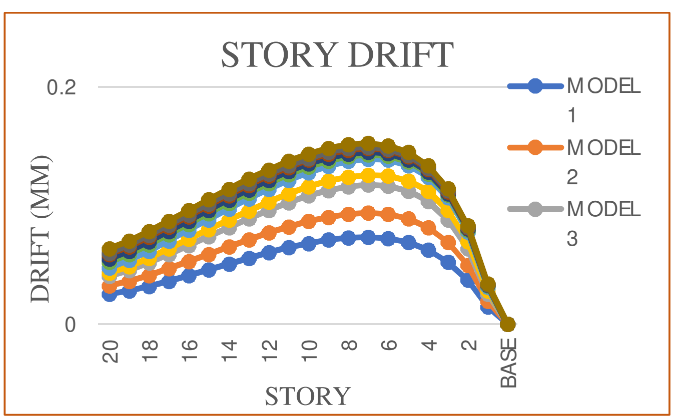

Fig 4.2 Drift v/s Story

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C. Base Shear

Table 4.3 Base shear

MODELS	BASE SHEAR
1	136093.6654
2	68153.0108
3	62321.2132
4	38559.9961
5	49629.9937
6	103776.6566
7	98862.5713
8	56112.9961
9	36536.0118
10	37063.0448

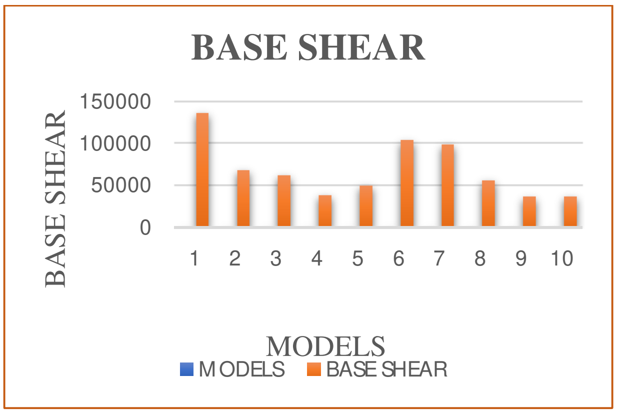

Fig. 4.3 Base shear for all the models

D. Time Period

Table 4.4 Time period

MODELS	TIME PERIOD
1	9.277
2	4.783
3	5.038
4	3.439
5	4.954
6	4.257
7	1.746
8	2.322
9	1.716
10	3.039

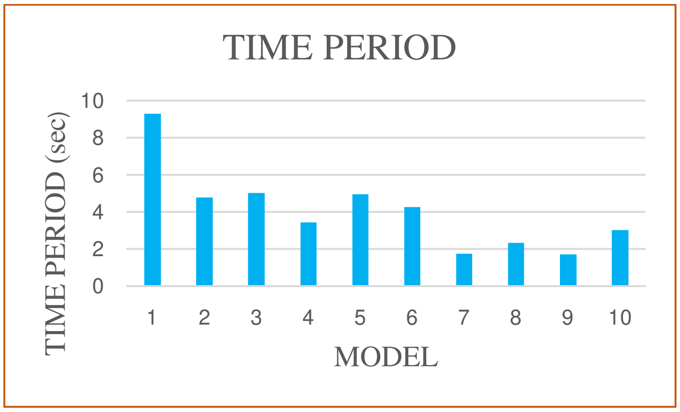

Fig 4.4 Time period v/s Models

V. CONCLUSION

To investigate the impact of shear wall on the reaction of multi-story for both normal and unpredictable RC outlined building the reaction range examination did, in view of the outcomes following focuses are closed:
From the outcomes acquired, it is reasoned that the RC outlined working with shear wall has more protection from tremor too as wind and can support the vibrations because of quake.

A. Story Displacements

It is observed that regular building Model-6 with shear wall has reduced up-to 90% displacements compare to regular building Model-1 without shear wall. The irregular building model-7 with shear wall has reduced story displacements up-to 83% compare to model-2 without shear wall. The irregular building model-8 with shear wall has obtained 85% story displacement reduction compare to irregular building model-3.The model-9 with shear wall have less story displacements compare to model-4 i.e., 79%.The model-10 with shear wall has reduced story displacements compare to model-5 i.e., 67.69%.

B. Story Drift

Greatest decrease of story float was seen in model - 6 by 48.92% for standard building.In unpredictable structure being model-9 by 89.1% along X-Direction is noticed.

C. Base Shear

Base shear values for normal and sporadic structure is seen to be diminished in the wake of giving shear wall in both outskirts and corner. Base shear an incentive for customary structure with shear wall is seen to be diminished by 23.758% for model-6.For model-9 unpredictable structure with shear wall is seen to be decreased by 6%.

D. Time Period

For regular building model-6 with shear wall is reduced up-to 54.112% of time period.For irregular building model-7 with shear wall has reduced up-to 63.49%of time period.

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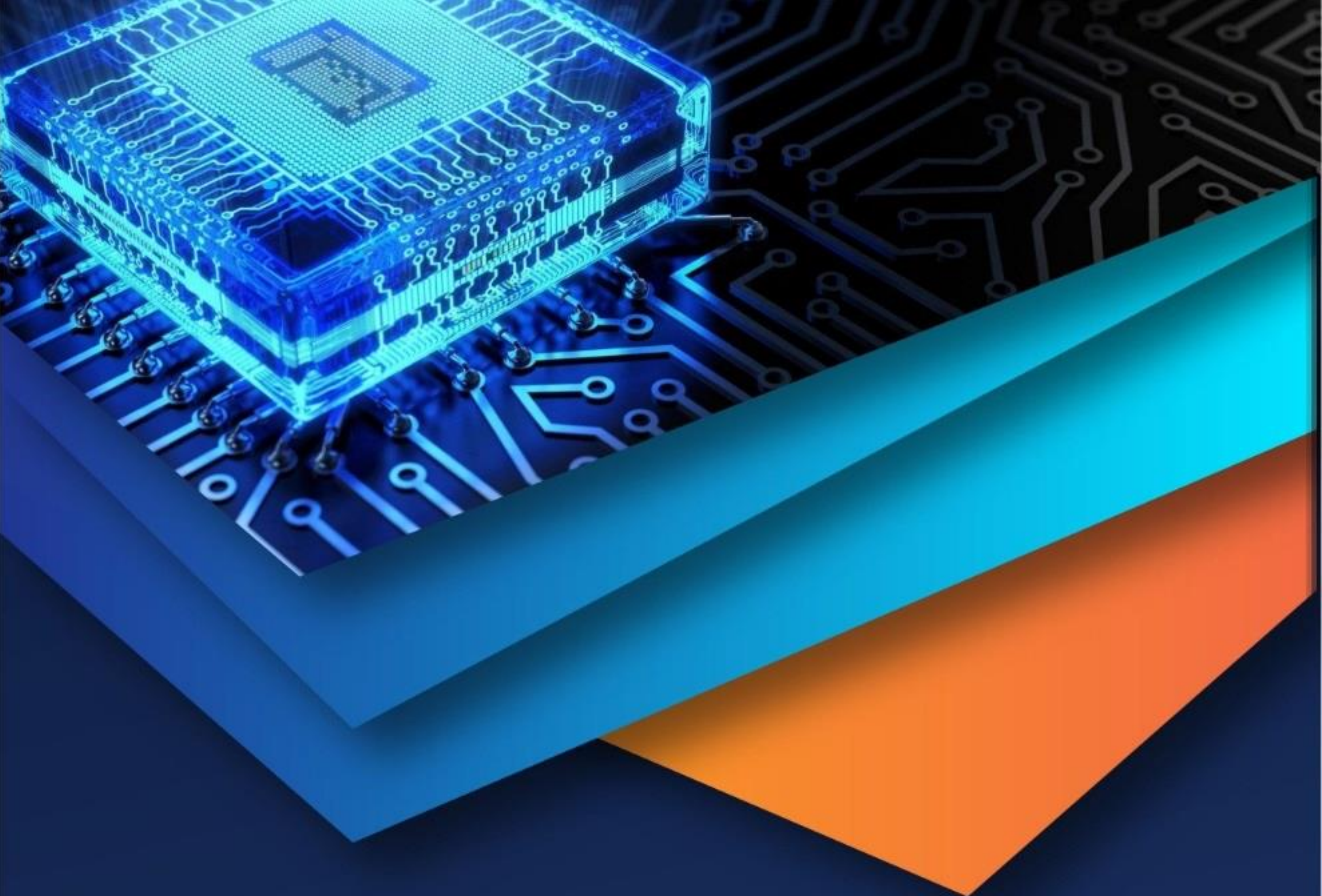

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