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Seismic Analysis and Comparative Study of Brick Wall, Shear Wall and Bare Frame on G+12 High Rise Building

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Abstract: ***Today, larger part of designs around us are built up concrete cement (RCC) outlined constructions. To forestall harm because of quake there is a need to foster powerful procedure to expand the strength and flexibility of elevated structures. Shear wall are steadier and more pliable and thus can bear more even loads. In this paper, we have proposed a relative report between block facade, shear divider and uncovered casing by using ETABS programming. This review is essentially centered around seismic conduct of G+12 building. The outcomes are talked about as far as base shear, sidelong relocation, story float, story solidness and normal period for every one of the three models. We find that shear wall has least parallel uprooting and least time span when contrasted and block facade and uncovered edge. Likewise, we track down that the shear divider model is more adaptable because of lesser float when contrasted and different models. The upsides of removal and float for shear wall is likewise not as much as block facade since the tallness of the structure increments.***
Keywords: shear wall, bare frame, Response spectrum, Earthquake, ETABS

I. INTRODUCTION

Shear Walls are upward plate type built up concrete (RC)components notwithstanding sections, bars and segments in the construction. These walls by and large beginning from the establishment and stretch out as far as possible up to the structure's tallness. They can be just about as dainty as 150mm and as thick as 400mm in tall structure structures. Shear wall are ordinarily developed all through their length and width of a construction.

Shear wall can be considered as sections of enormous width and profundity, which communicate tremor burdens to the establishment. Shear wall enormously increment the strength and solidness of the structure, toward the path they're developed, which thus lessens the sidelong influence and, subsequently, distortion of the structure and harm to its substance is decreased. The cross-segment of shear wall is rectangular, which infers one measurement is a lot bigger than the other. L-and U-plan cross-areas are well known, while rectangular cross-segments are the most common. Structures with flimsy walled RC shafts work as shear wall around the lift center are utilized to forestall seismic impact. The limited brick work structure shows an unbending conduct. The shear obstruction of the jacketed wall was fundamentally further developed when the unreinforced block brick work wall were reinforced. Material supported cement (TRC) fortifications have lower sidelong strength ability than fiber-built up polymer (FRP) fortifications, yet they have considerably higher pliability.

Standard wooden pillars and block stone work implodes rapidly during unexpected seismic tremors, since inversion of stresses happens. When contrasted with the shear divider thought of box-like three-dimensional structures, RCC outlined designs are limited. Not exclusively are the proposed shear divider developments steadier, yet additionally more bendable, in correlation with RC outlined constructions.

As far as wellbeing, it suggests that, they won't fall unexpectedly, and consequently forestall the death toll during serious tremors. They give adequate alerts, like expanding primary crevices, yielding poles, and different pointers, permitting individuals to clear designs, before they breakdown totally.

Outside wall are viewed as shear-opposing wall for substantial support. Powers from the roof and rooftop stomachs is moved to the shear wall, which thus moves it through establishment by means of suitable burden ways.

II. MODELLING

ETABS programming is utilized to reproduce a G+12 story working with each base story tallness of 3m and a common story stature of 3m. The constructions of structures should be attached at the ground. Three unique models were thought of, out of which one is brickwork model, second is shear divider and the third is uncovered frame.12 modes were considered for each model.

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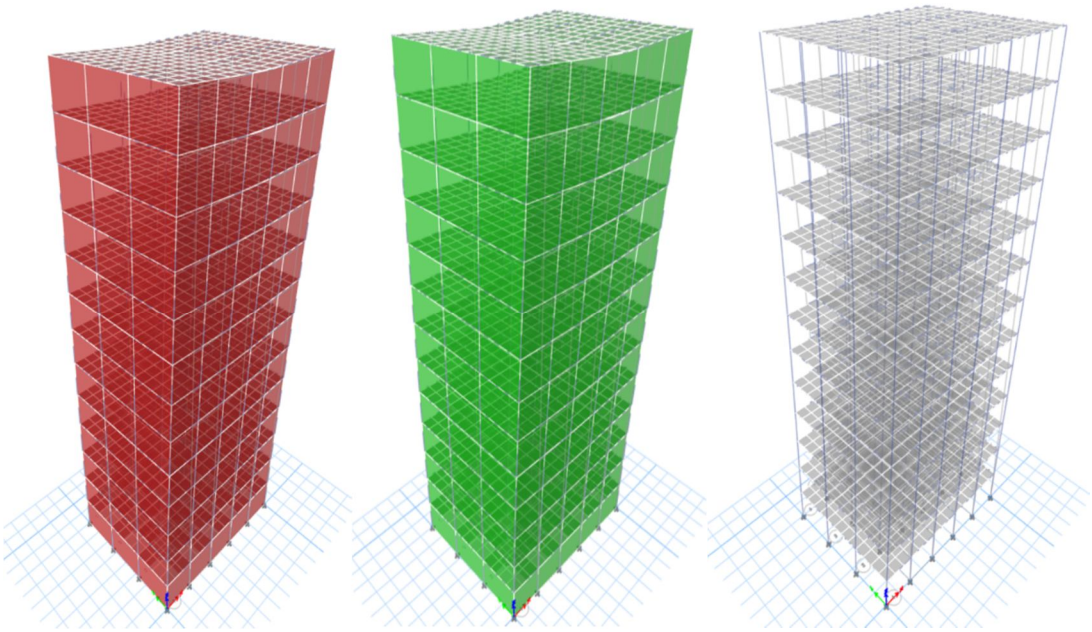

Fig. 1(a) Fig. 1(b) Fig. 1(c)

Fig.1. Deformed shape of (a) Brick wall (b) shear wall and (c) bare frame of G+12 multi-storey building

Plan Size	**15m X 12m**
No. Of Storeys	13
Bottom Storey Height	3m
Typical storey height	3m
Thickness Of Slab	0.15m
Wall Thickness	0.23m
Column Size	0.5m X 0.5m
Beam Size	0.3m X 0.5m
Grade of steel	Fe500
Grade of concrete for beam	M25
Grade of concrete for column	M25
Floor finish	$1kN/m^2$
Live load on floor	$4kN/m^2$
Live load on roof	$1kN/m^2$
Zone Factor	0.16

Table 1. Geometric details of G+12 structure building

Response Reduction Factor	5
Importance Factor	1
Soil Condition	Medium
Type	II
Zone	III

Table 2. Seismic details of building

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III. METHODOLOGY

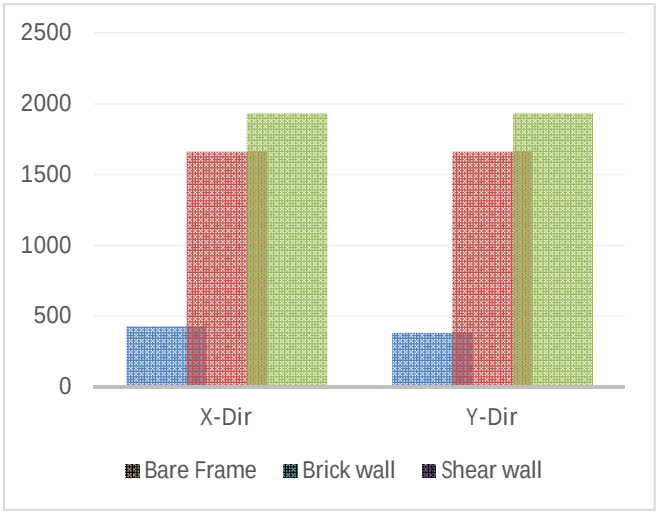
A. For this study, ETABS software is used to simulate a G+12 storey building with each bottom storey height of 3m and a typical storey height of 3m.

B. The structures are supposed to be permanently affixed to the ground. Three different models were considered: the brickwork model, the shear wall model, and the bare frame model.

C. In zone III, all models are compared for lateral displacement, storey drift, storey stiffness, base shear, and natural period

IV. RESULT AND DISCUSSION

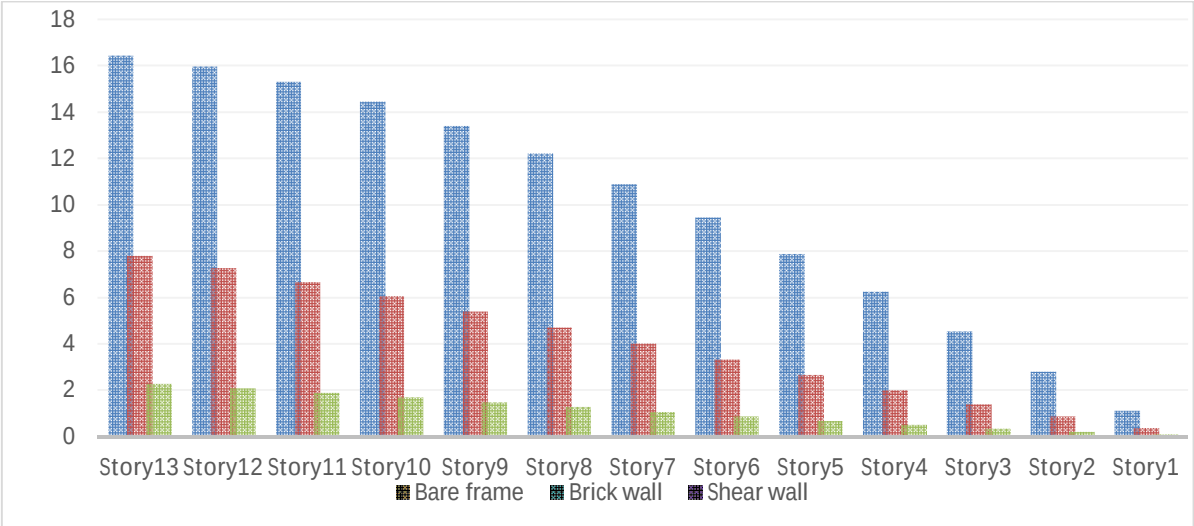
A. Base Shear



Comparison of base shear of bare frame, brick wall and shear wall

	X-DIR KN	Y-DIR KN
BARE FRAME	424.9284	382.4537
BRICK WALL	1661.3748	1661.3748
SHEAR WALL	1934.2787	1934.2787

B. Storey Displacement



Comparison of storey displacement of Bare frame, Brick wall and Shear wall

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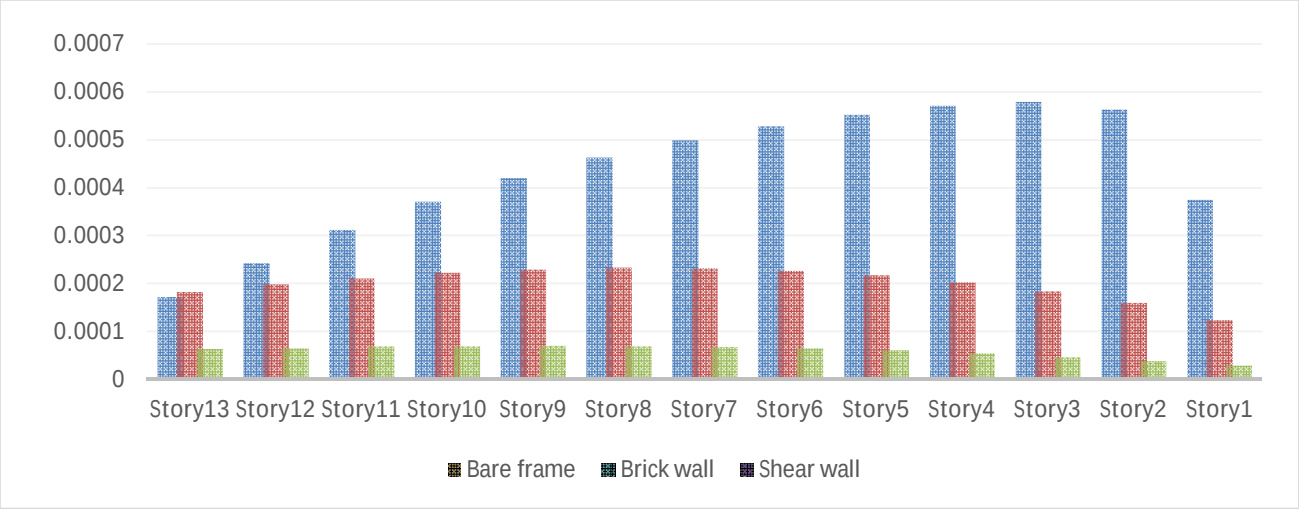
Story	BARE FRAME mm	BRICK WALL mm	SHEAR WALL mm
Story13	16.45	7.803	2.267
Story12	15.971	7.259	2.08
Story11	15.301	6.671	1.885
Story10	14.441	6.043	1.684
Story9	13.407	5.384	1.478
Story8	12.217	4.703	1.27
Story7	10.89	4.013	1.064
Story6	9.442	3.324	0.864
Story5	7.89	2.65	0.673
Story4	6.252	2.003	0.495
Story3	4.549	1.399	0.335
Story2	2.81	0.851	0.197
Story1	1.125	0.373	0.085

C. Storey Drift



Comparison of storey drift between brick wall, shear wall and bare frame

Story	BARE FRAME	BRICK WALL	SHEAR WALL
Story13	0.000171	0.000182	0.000063
Story12	0.000243	0.000198	0.000065
Story11	0.000312	0.000211	0.000068
Story10	0.000371	0.000222	0.000069
Story9	0.000421	0.000229	0.00007
Story8	0.000463	0.000233	0.000069
Story7	0.000499	0.000232	0.000067
Story6	0.000529	0.000227	0.000064
Story5	0.000553	0.000217	0.00006
Story4	0.000571	0.000202	0.000054
Story3	0.00058	0.000183	0.000046
Story2	0.000563	0.000159	0.000038
Story1	0.000375	0.000124	0.000028

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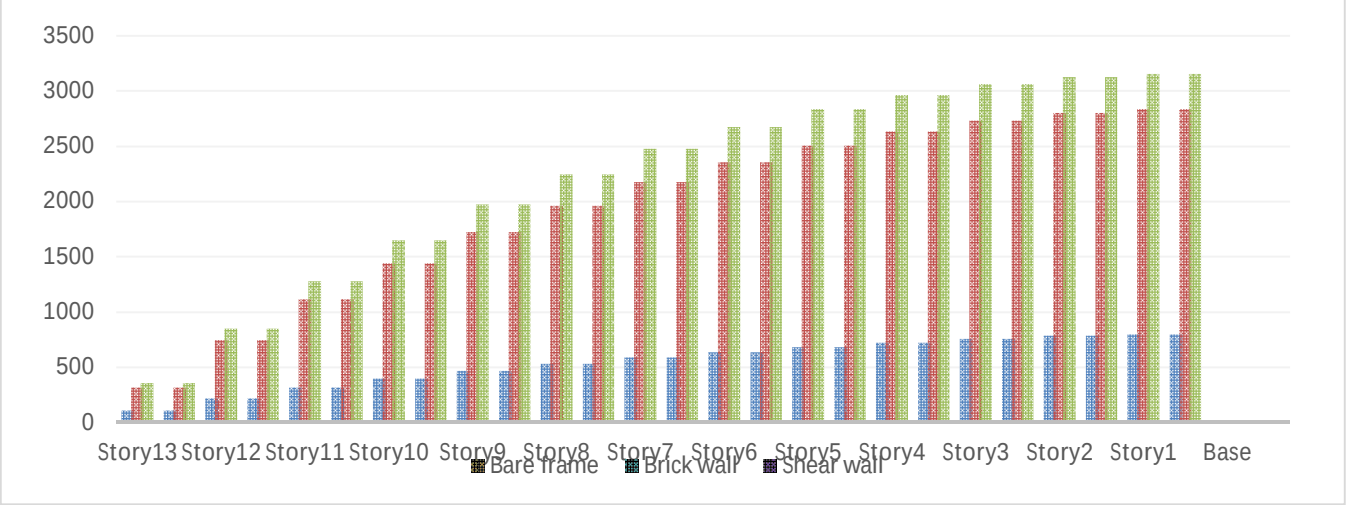
D. Storey Shear



Comparison of storey shear for Brick wall, Shear wall and Bare frame

		BARE FRAME	BRICK WALL	SHEAR WALL
		kN	kN	kN
Story13	Top	107.6414	317.6548	356.1047
	Bottom	107.6414	317.6548	356.1047
Story12	Top	219.8743	744.3388	848.8906
	Bottom	219.8743	744.3388	848.8906
Story11	Top	315.5285	1118.0874	1279.7137
	Bottom	315.5285	1118.0874	1279.7137
Story10	Top	397.3073	1442.0232	1652.3149
	Bottom	397.3073	1442.0232	1652.3149
Story9	Top	468.5626	1722.2068	1972.634
	Bottom	468.5626	1722.2068	1972.634
Story8	Top	530.9933	1964.4126	2246.5059
	Bottom	530.9933	1964.4126	2246.5059
Story7	Top	586.5147	2173.7585	2479.3282
	Bottom	586.5147	2173.7585	2479.3282
Story6	Top	637.216	2354.3435	2675.5691
	Bottom	637.216	2354.3435	2675.5691
Story5	Top	683.4343	2508.1459	2837.8122
	Bottom	683.4343	2508.1459	2837.8122
Story4	Top	724.3491	2635.1116	2966.9274
	Bottom	724.3491	2635.1116	2966.9274
Story3	Top	759.0642	2733.9502	3063.0148
	Bottom	759.0642	2733.9502	3063.0148
Story2	Top	784.7432	2801.8886	3125.6982
	Bottom	784.7432	2801.8886	3125.6982
Story1	Top	796.5422	2835.1476	3154.8989
	Bottom	796.5422	2835.1476	3154.8989
Base	Top	0	0	0
	Bottom	0	0	0

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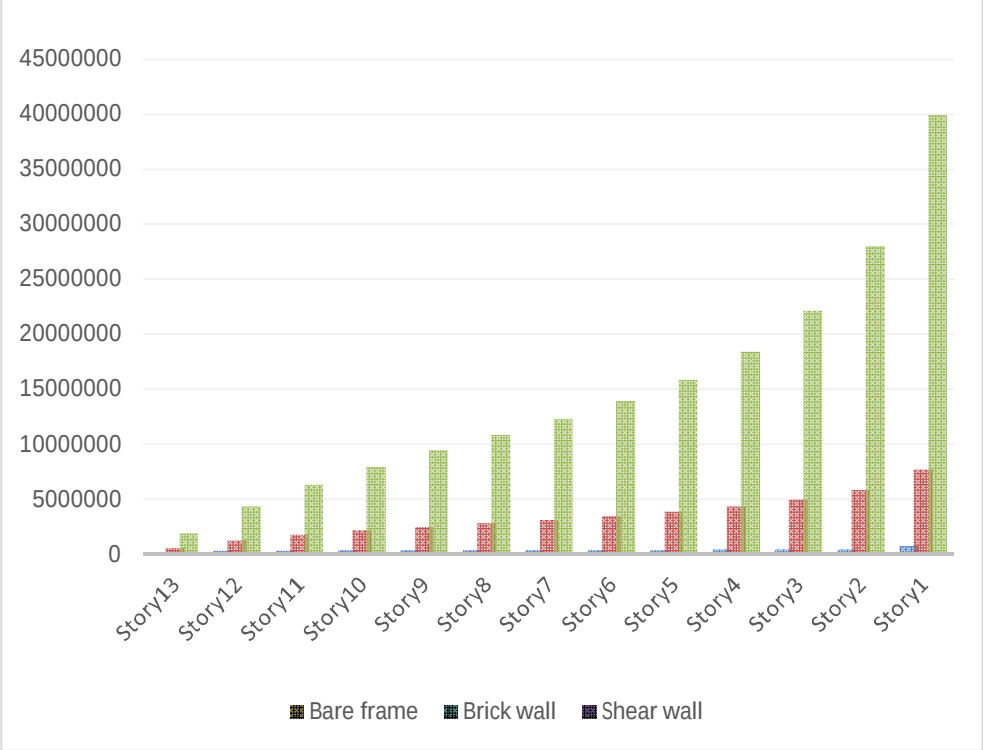
E. Storey Stiffness



Storey stiffness [kN/m] for shear wall, brick wall and bare fr

Story	BARE FRAME	BRICK WALL	SHEAR WALL
Story13	211139.25	582272.385	1908837.401
Story12	302105.488	1256480.02	4346256.551
Story11	337599.296	1763412.183	6318142.555
Story10	357207.516	2163906.358	7970325.979
Story9	370939.516	2503417.899	9438041.936
Story8	381953.355	2815870.647	10839312.678
Story7	391860.868	3128556.115	12288072.227
Story6	401728.003	3467107.193	13911932.089
Story5	411892.798	3859137.889	15876667.971
Story4	422641.449	4341832.754	18443070.628
Story3	435891.519	4977396.904	22116302.899
Story2	465094.857	5876694.845	27997576.711
Story1	709202.442	7708986.112	39968844.993

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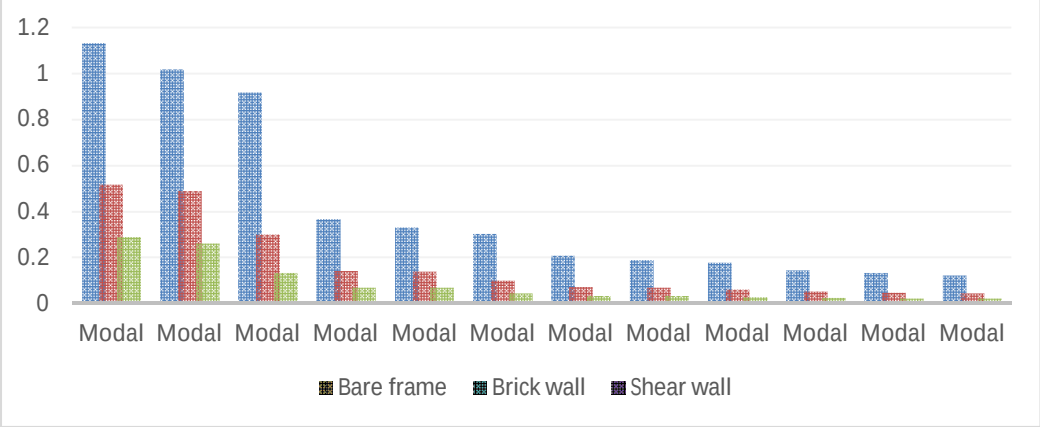
F. Time Period



Time period of brick wall, shear wall and bare frame

Case	Mode	BARE FRAME	BRICK WALL	SHEAR WALL
Modal	1	1.132	0.518	0.29
Modal	2	1.019	0.489	0.26
Modal	3	0.919	0.299	0.132
Modal	4	0.368	0.141	0.068
Modal	5	0.332	0.139	0.068
Modal	6	0.303	0.1	0.044
Modal	7	0.208	0.073	0.034
Modal	8	0.189	0.07	0.033
Modal	9	0.178	0.06	0.027
Modal	10	0.144	0.051	0.024
Modal	11	0.132	0.048	0.023
Modal	12	0.123	0.043	0.022

V. CONCLUSION

The following conclusion may be reached from the research work's examination of three models of bare frame, brick wall, and shear wall, taking into account various characteristics such as time period of oscillation, lateral displacement, stiffness, storey shear, and storey drift.

1) The model with Shear wall has the least time period than other models and model of bare frame has maximum time period. Hence, if we consider time period as the only factor then the model with shear wall will be the best choice.

2) The model with bare frame has more lateral displacement under the application of lateral force than brick wall, and shear wall has the least displacement, so we can say that if the structure has to be made greater seismic resistance, then shear wall would be the best choice.

3) The model of bare frame has the least stiffness while the model of shear wall has maximum stiffness, so when we consider the stiffness criteria, we tend to choose the model having the least stiffness in order to provide flexibility to the building model so that the building does not develop cracks in the event of an Earthquake.

4) The model with Shear wall has minimum drift and hence it is more efficient and more flexible when compared with other models.

5) Shear wall is more effective in reducing displacements and drifts, than brick wall

6) As height of the building increase, displacement and drift also increase, but for shear wall models displacement and drifts value is significantly lower than of brick walls.

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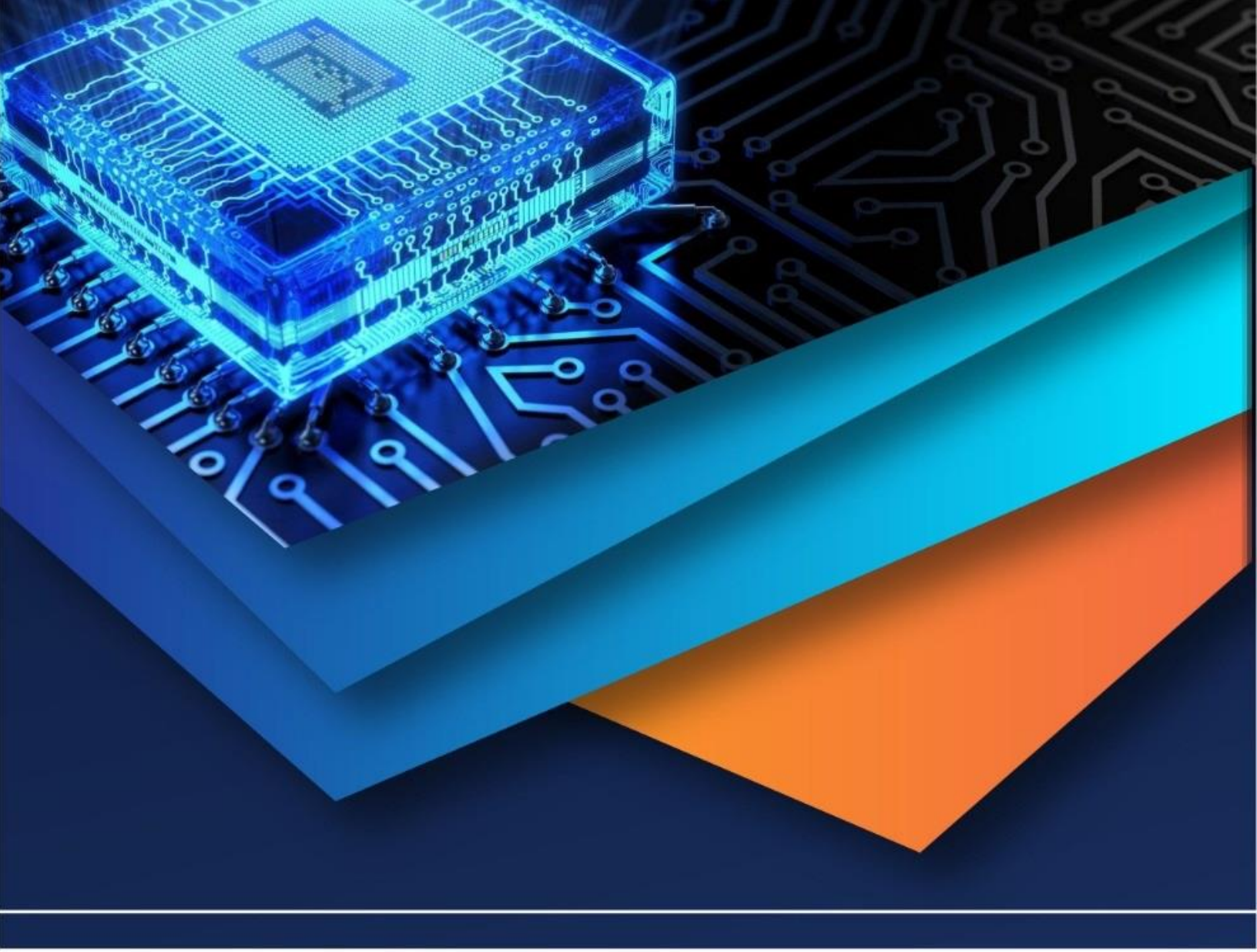

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