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Comparative Study of Multi-Story Building with Floating Column Using Software

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***Abstract**: In today's time, many multistory buildings in urban areas are built with floating column due to lack of floor space, growing population and for aesthetic purpose which is very useful for space on the floor. . Such type of construction concepts are developing very fast in India. Floating columns are provided on one or more floors at these buildings. In seismic prone areas these floating columns in buildings are very inconvenient. These are undesirable features in building as per standards irregularity in stiffness, irregularity in load path for the concern of lateral forces such as earthquake load and wind load. The aim of present work is to analyze effect of structure irregularity due to discontinuity of column position overcome to earthquake loads in zone III. In these work analysis is done by with the help of equivalent liner static method of dynamic analysis for the G+ 4, G+ 10 and G+ 20 Rc frame building with and without floating column (FC). The location of floating columns varies on the outer periphery of 1st floor of the building. The entire analysis work is done by with help of fem based ETABS software*
***Keywords**: Floating column (FC), equivalent static analysis, storey displacement, story drift etabs software.*

I. INTRODUCTION

Today, many cities in India inevitably have first floors Feature Mainly used to accommodate, parking and reception rooms at first Floor. As a part of multi-storey urbanization buildings with architectural complexity they are built these complexities are nothing more than soft and floating column, heavy load, stiffness reduction, etc. A floating column structure can be classified as vertically irregular as it causes irregular mass distributions, strength and rigidity along the height of the building. It is defined as a column that ends at its lower level on a beam and does not reach the base level. The floating column provided in a structural system is highly undesirable, especially in higher areas such as III, IV and V. In each building, load transfer takes place from horizontal elements such as beams to vertical like columns and wall elements that transfer the load to the base level of the structure which is foundation level. Therefore, there must be a clear loading path available for the load to reach the base level but in floating column building there is no foundation available at the base of the floating column these floating column is situated on the beam and the load of column is acted such a concentrated point load on the beam. These beams should have sufficient strength to receive the load from floating column. The building with floating column can be analyze by many different structural software such as stad pro, ansys, prokon, midas and etabs. In the present paper work represents the outcome study of structural response quantities of multi story building with and without FC with using fem based etabs software.

II. OBJECTIVE

The main aim undertaken of this study is to analyze the construction of G + 4 of height 15m, G + 10 of height 33m and G + 20 of height 63m floors building with floating columns in zone III and also verify the displacement and story drift of the floor in different cases for floating columns in various positions.

III. MODELING AND ANALYSIS

All The building taken to the analysis a regular G+4 (15m), G+10 (33m), and G+20 (63m) Rc frame rectangular plan area of dimension 50 m x 22.5 m given in fig1 considering buildings are located at seismic prone area of zone III in India as per standard is 1893-2002. The buildings are modeled in etabs software.

Table I Architectural Data

S.N.	I	ii
1.	no. of stories	g+ 4, g+ 10, g+ 20
2.	floor height	3 m
3.	dimension of plan area	50m × 22.5m

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Table II
Structural And Material Data

S.N.	I	II	III	IV			V
1	structure	beam	slab	Column			wall
2	story	-	-	g+ 4	g+ 10	g+ 20	-
3	size	350× 730 (mm^2)	150 (mm)	350 ×350(mm^2)	500× 500 (mm^2)	660× 660 (mm^2)	300 (mm)
4	material	M20	M25	M25	M30	M35	brick

Table III
Seismic Data

S.N.	I	II
1.	seismic zone	iii
2.	importance factor (i)	1
3.	response reduction factor (r)	3
4.	zone factor (z)	0.16

Table IV
Load

S.N.	I	ii
1.	Live load(LL)	3KN/m^2
2.	Wall load(WL)	13KN/m

A. Model

1) *M1:* G+ 4 Rc building
2) *M2:* G+ 10 Rc building
3) *M3:* G+ 20 Rc building

These three models (M1, M2, M3) are analyze for different cases which are given below

B. Case

1) *C1:* Normal Rc building
2) *C2:* Rc building have floating column (FC at outer periphery of frame A at 1st floor).
3) *C3:* Rc building have floating column (FC at outer periphery of frame A and 1 at 1st floor).
4) *C4:* Rc building have floating column (FC at outer periphery of frame A, 1 and K at 1st floor).
5) *C5:* Rc building have floating column (FC at outer periphery at 1st floor).
6) *C6:* Rc building have floating column (FC at outer periphery at 1st floor accept corner columns).

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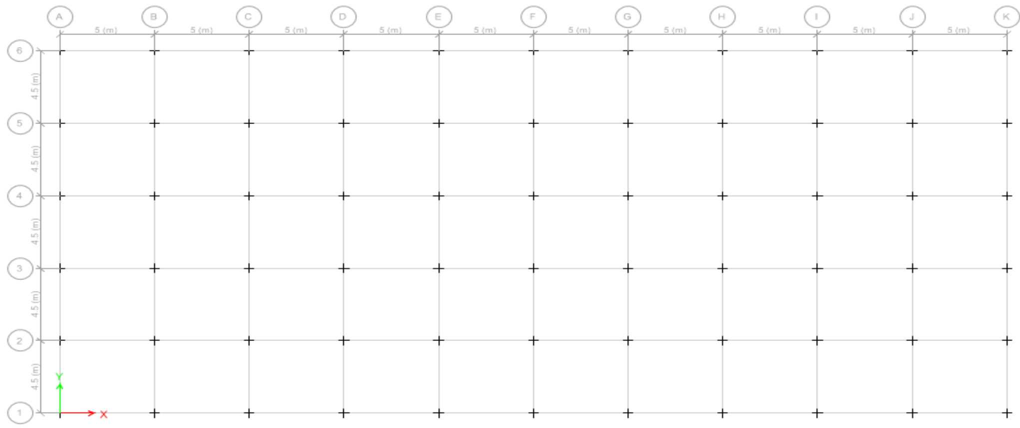

Fig. 1 Plan of Rc building of 50 m x 22.5 m

There many different standard codes are used for different locations of country. For the seismic design of building IS 1893 2002 standard code is used.

IV. RESULTS

As the outcomes of these work of the appliance of loads in the lateral direction X building is analyzed for different load combinations which is given in clause6.3.1.2 of IS 1893 – 2002. For specified combinations of loads maximum story displacement and story drift at each floor is calculated in the x direction by equivalent liner static analysis. Fig 2,3 and 4 shows max story displacement for G+ 4, G+ 10 and G+ 20 story building and fig 5, 6 and 7 shows max story drift in X direction for G+ 4, G+ 10 and G+ 20 story building. Fig 8 and 9 shows maximum story displacement and maximum story drift for all three models. Second and Following Pages.

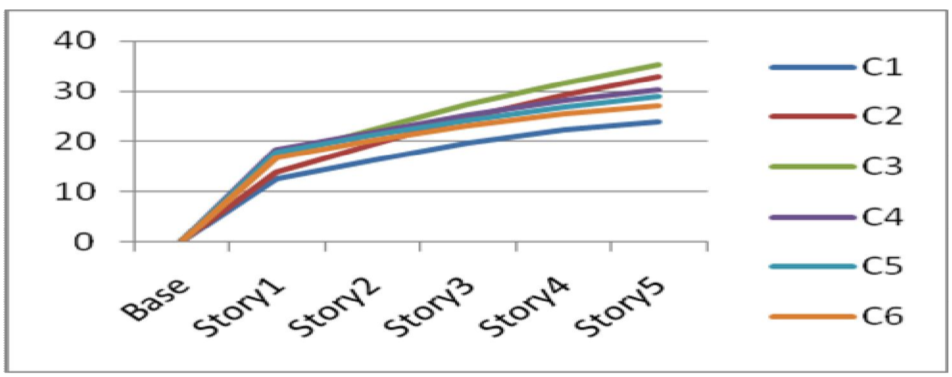

Fig. 2 Displacement in mm for G+ 4 RC building

TABLE V
Displacement (mm) for g+ 4 rc building

STORY	C1	C2	C3	C4	C5	C6
base	0	0	0	0	0	0
story1	12.4	13.9	17.1	18.3	17.8	16.8
story2	16.2	19.5	22.4	21.8	21.1	20.1
story3	19.5	24.7	27.4	25.2	24.2	23
story4	22.2	29.2	31.8	28.1	26.9	25.5
story5	23.8	32.9	35.4	30.2	28.9	27.1

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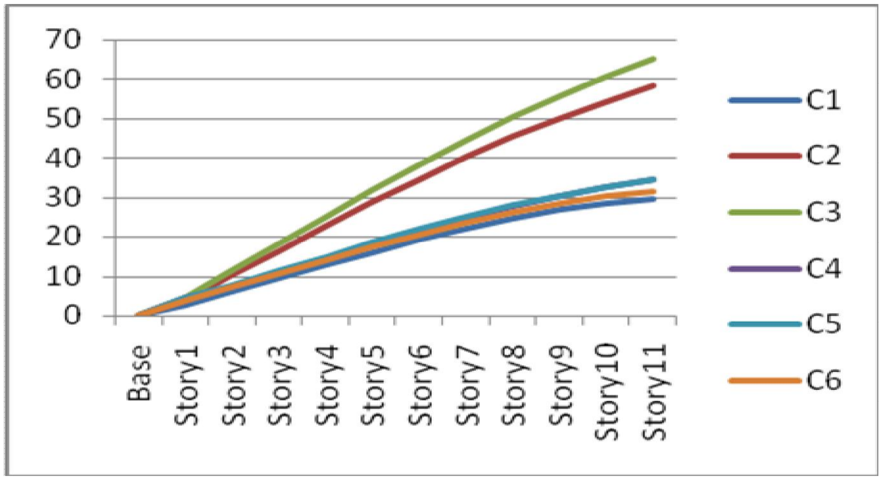

Fig. 3 Displacement in mm for G+ 10 RC building

TABLE VI
Displacement (mm) for G+ 10 RC building

STORY	C1	C2	C3	C4	C5	C6
base	0	0	0	0	0	0
story1	2.5	3.7	4.4	4.4	4.5	3.8
story2	5.9	10.1	11.2	7.3	7.6	7.1
story3	9.3	16.4	18.2	10.9	11.3	10.6
story4	12.7	22.7	25.1	14.5	14.9	14
story5	16	28.7	31.8	18.1	18.5	17.3
story6	19.1	34.5	38.3	21.6	21.9	20.5
story7	22	40.1	44.5	24.8	25.1	23.5
story8	24.6	45.3	50.3	27.8	28	26.1
story9	26.7	50	55.7	30.4	30.5	28.3
story10	28.3	54.2	60.6	32.5	32.6	30
story11	29.4	58.2	65.2	34.5	34.6	31.3

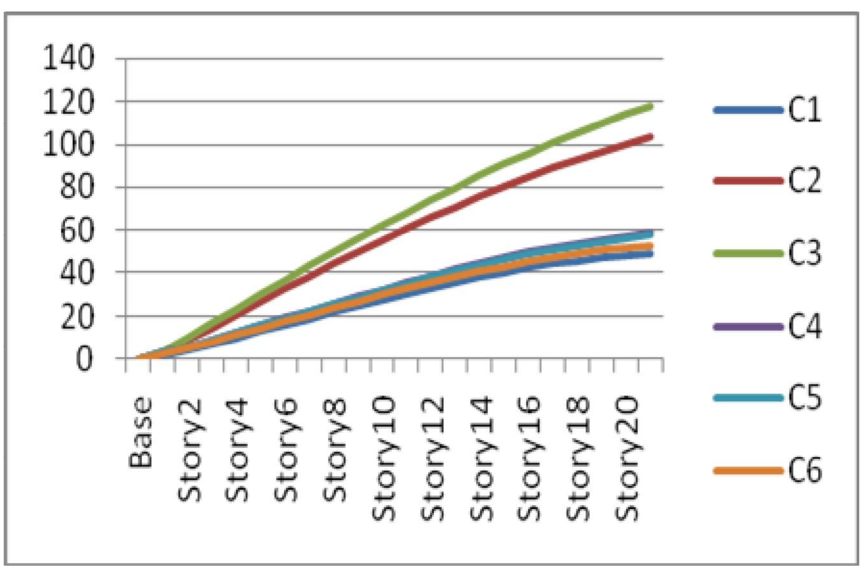

Fig. 4 Displacement in mm for G+ 20 RC building

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TABLE VII
Displacement (mm) for G+ 20 RC building

STORY	C1	C2	C3	C4	C5	C6
base	0	0	0	0	0	0
story1	1.6	2.9	3.3	3.3	3.3	2.5
story2	4.3	8.8	9.9	5.5	5.8	5.3
story3	7.3	14.7	16.6	8.8	9.1	8.3
story4	10.2	20.8	23.4	12.2	12.5	11.4
story5	13.2	26.8	30.2	15.6	15.8	14.5
story6	16.3	32.7	36.8	19.1	19.2	17.7
story7	19.2	38.5	43.3	22.4	22.5	20.7
story8	22.2	44.2	49.7	25.8	25.8	23.8
story9	25.1	49.8	56	29.1	29.1	26.8
story10	28	55.3	62.1	32.3	32.2	29.8
story11	30.7	60.6	68.2	35.4	35.3	32.7
story12	33.4	65.8	74	38.5	38.3	35.4
story13	36	70.9	79.8	41.4	41.2	38.1
story14	38.4	75.7	85.3	44.2	44	40.6
story15	40.6	80.4	90.6	46.8	46.6	43
story16	42.7	84.8	95.8	49.3	49	45.1
story17	44.5	89	100.6	51.5	51.2	47.1
story18	46	93	105.3	53.5	53.2	48.8
story19	47.3	96.6	109.6	55.3	55	50.2
story20	48.2	100	113.7	56.7	56.4	51.4
story21	49.2	103.5	117.7	58.5	58.2	52.4

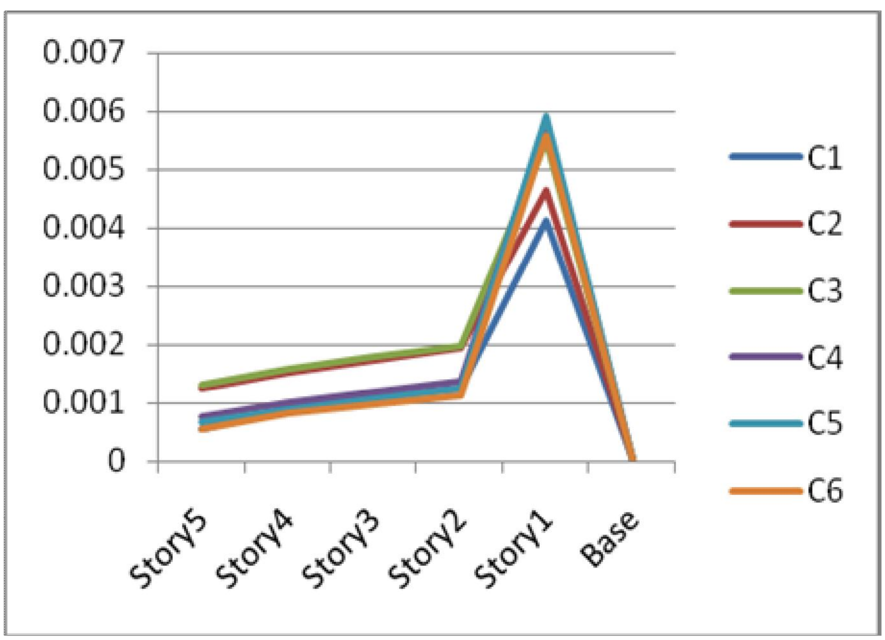

Fig. 5 Story Drift of G+ 4 Rc building

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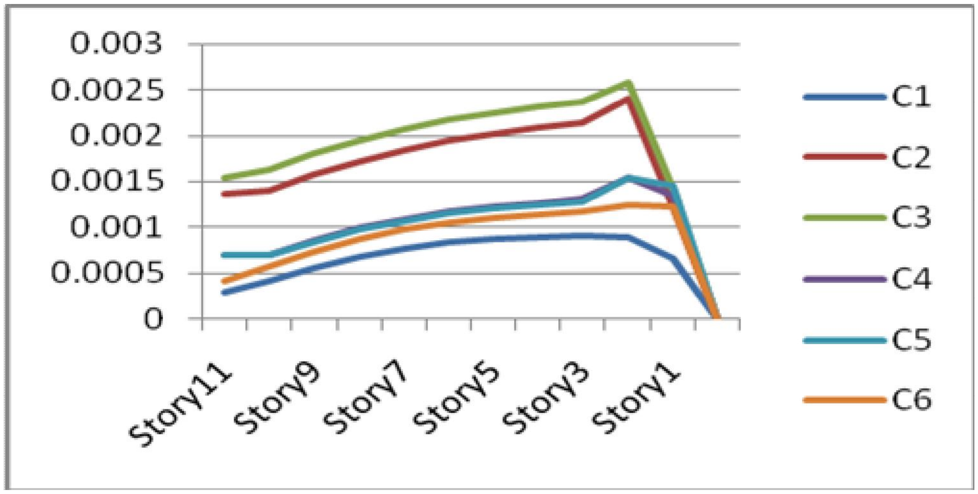

Fig. 6 Story Drift of G+ 10 Rc building

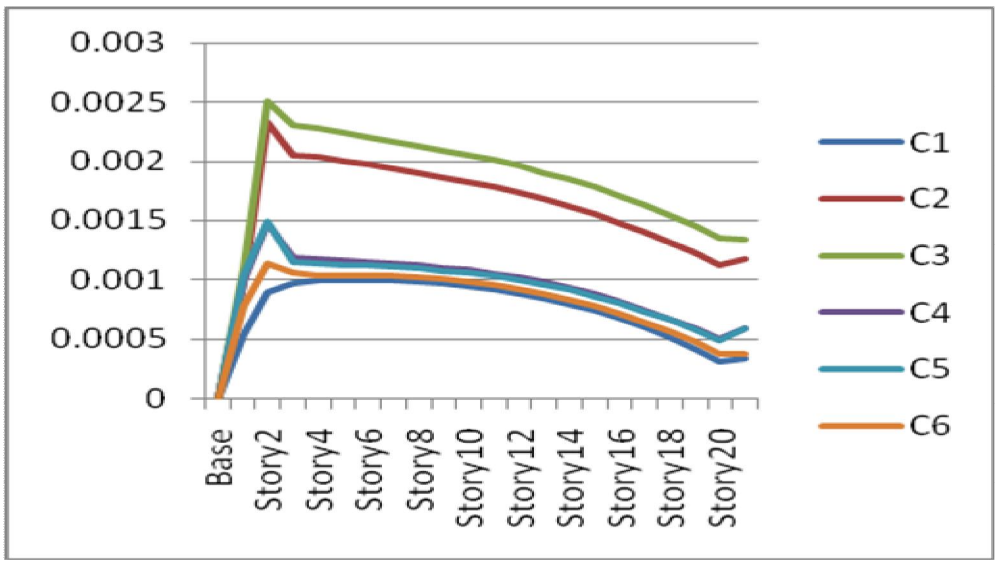

Fig. 7 Story Drift of G+ 20 Rc building

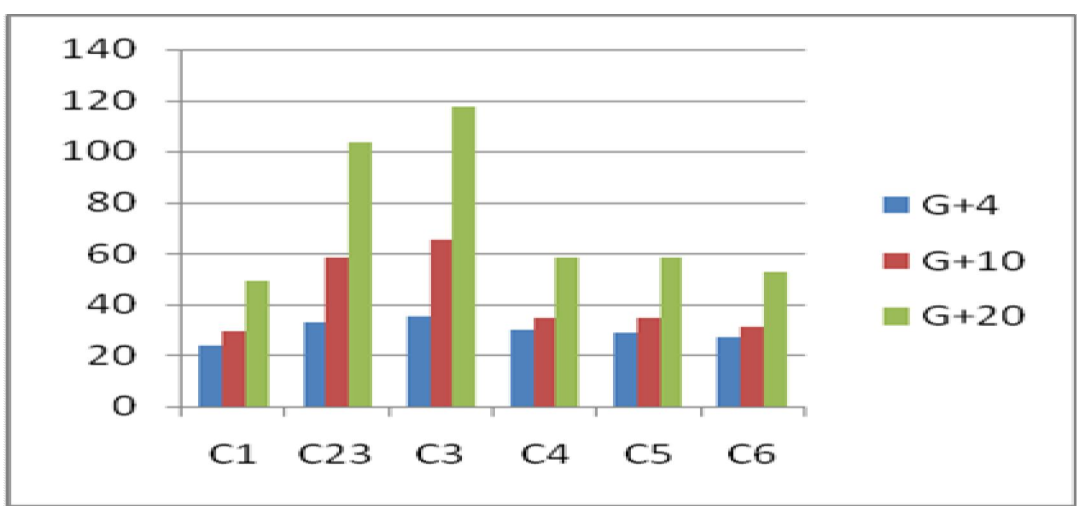

Fig. 8 maximum Displacement of G+ 4, G+ 10 and G+ 20 building

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TABLE VIII
Maximum displacement of G+ 4,G+ 10 and G+ 20 building

MODEL	C1	C23	C3	C4	C5	C6
g+4	23.8	32.9	35.4	30.2	28.9	27.1
g+10	29.4	58.2	65.2	34.5	34.6	31.3
g+20	49.2	103.5	117.7	58.5	58.2	52.4

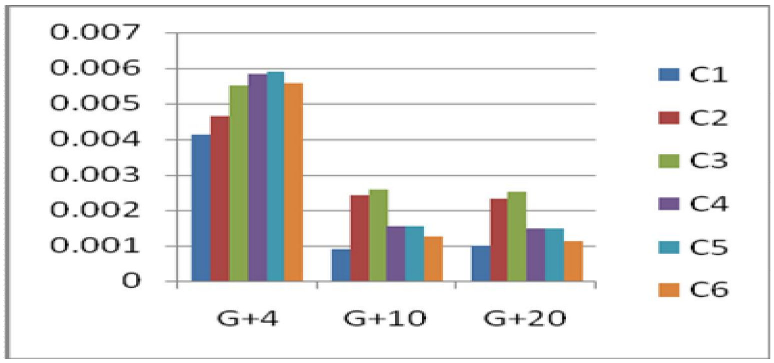

Fig. 9 Maximum drift of G+ 4, G+ 10 and G+ 20 building

Table IX
Maximum story drift of G+ 4,G+ 10,G+ 20 Rc building

MODEL	C1	C2	C3	C4	C5	C6
G+4	0.004134	0.004642	0.005503	0.005827	0.005919	0.005593
G+10	0.000916	0.002406	0.002579	0.001542	0.001534	0.001246
G+20	0.001002	0.002332	0.00251	0.001473	0.001497	0.00114

V. CONCLUSIONS

It was observed that buildings which have constructed with FC for different cases has more displacement and more story drift compare to normal building which have no FC case1.

A. Maximum story displacement of G+ 4 Rc building for the case- C2, C3, C4, C5, C6 are 38.23, 48.74, 26.89, 21.43 and 13.87 percentage more compare to case-C1.
B. Maximum story displacement of G+ 10 Rc building for the case- C2, C3, C4, C5, C6 are 97.96, 121.77, 17.34, 17.68, and 6.46 percentage more compare to case-C1.
C. Maximum story displacement of G+ 20 Rc building for the case- C2, C3, C4, C5, C6 are 110.36, 139.23, 18.9, 18.29, and 6.5 percentage more compare to case-C1.
D. Maximum story drift of G+ 4 Rc building for Case- C2, C3, C4, C5, C6 are12.28, 33.11, 40.95, 43.18 and 35.29 percentage more compare to case- C1.
E. Maximum story drift of G+ 10 Rc building for Case- C2, C3, C4, C5, C6 are 162.7, 181.5, 68.34, 67.46 and 36.03 percentage more compare to case- C1.
F. Maximum story drift of G+ 20 Rc building for Case- C2, C3, C4, C5, C6 are 132.7, 150.5, 47, 49.4 and 13.77 percentage more compare to case- C1.
G. As from maximum story Displacement and maximum story drift of our result on floating if it is necessary to provide floating column at outer periphery of 1st floor then case- C5 and C6 should be preferred. The max story displacement and story drift also high so in categorize to improve its performance during earthquake it is essential for certain remedial measuring like Shear Wall, bracings etc.

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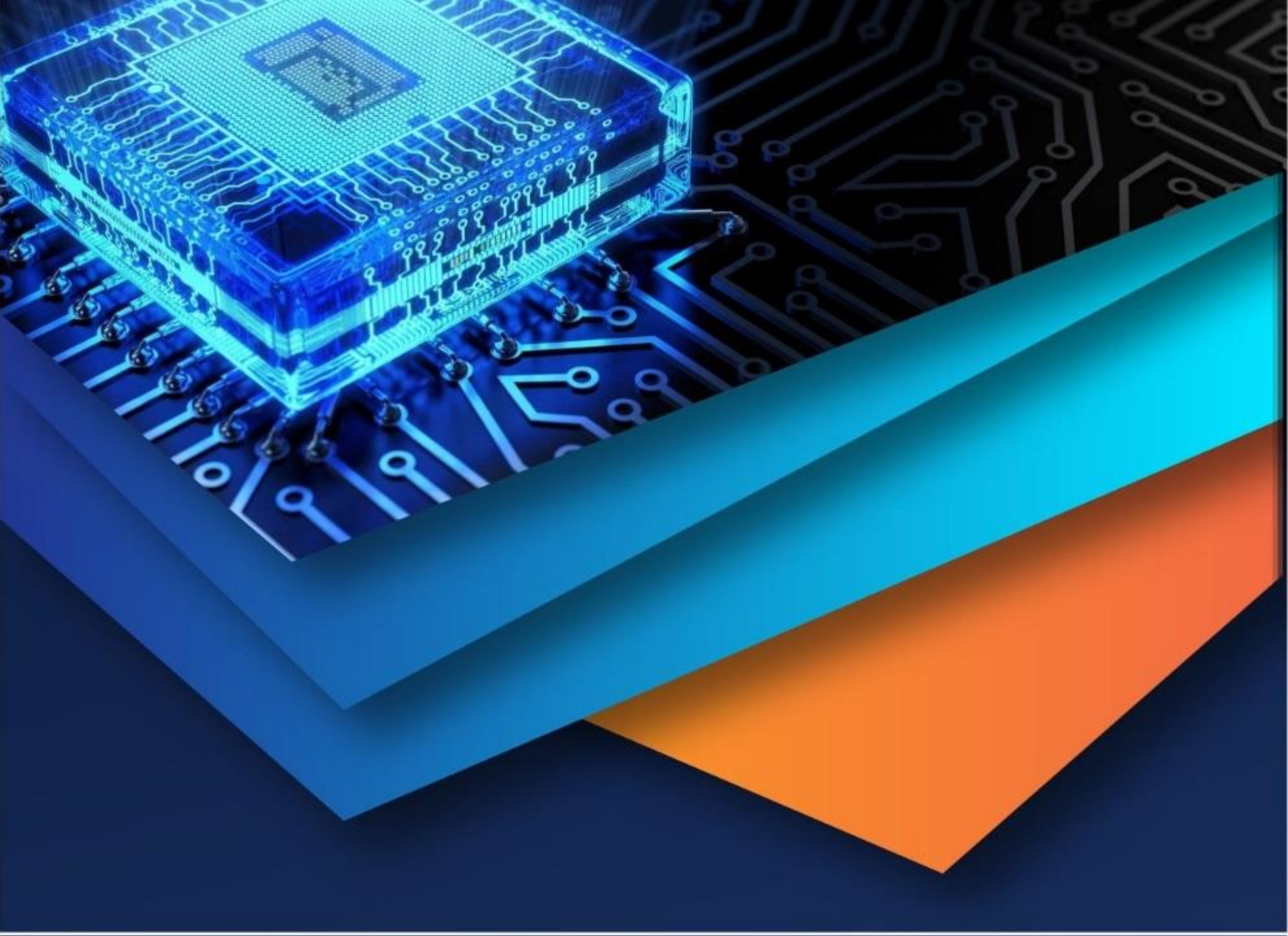

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