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Analysis of Selection of Load Transferring Porch Location Over Hospital Building under Seismic Loading

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Abstract: ***Seismic analysis of any type of structure with different porch location is an significant contemplation while working in high earthquake prone areas. With the assistance of seismic analysis, the structure can be designed and constructed to withstand the high lateral movement of earth's crust during an earthquake. Porch location is very important for any tall structure not because it is good in appearance also good for structural loading point of view. In the innovative phase of tall structure the present job deals with the analysis, design of tall structure subjected to seismic load condition with different porch location. In adding up to the dead load and imposed load, the earthquake loads are applied to the structure and analysis of structure carried out. The design software has been used for design and analysis. In the present situation, a hospital building structure of G+12 and the analysis has been carried out for seismic zone III as per IS 1893-2016 by Response Spectrum Analysis. The assessment of results has been carried out for Displacement, Storey Shear, and Base Shear etc. The results are obtained and represented in the forms of graphs and tables for the seismic zone.***

Keywords: Hospital Building, Load Transferring Porch, Porch Location, Seismic Analysis.

I. INTRODUCTION TO PORCH

It is well familiar that multistorey buildings act as matching significant characters in modern cities. First of all, tall buildings can be outstandingly used to meet the requirements of present-day civilization and resolution the problem of limitation of building site belongings. On the other site, they are the indications of financial properties and civilization. These days' multistorey buildings increase higher and higher, with added and more complex and separate plan and elevation, such as multi-tower structures.

The word "porch" is approximately completely used for a structure that is exterior the major walls of a building, with a lot of dissimilar designs either under the similar roof line or as towers, supported by simple porch posts and arches.

A porch is a word used in technical way to explain a balcony located in frontage of the doorway of a structure forming a near to the ground front, and located in face of the frontage of the structure it instructions. It can be distinct more just as a "projecting building that houses the entry door of a structure or as a entrance hall. There are varieties of styles of porches, many of which depend on the architectural custom of its position, as well as a variety of names used. Porches will permit for enough space for a person to happily pause before entering or after exiting a structure.

II. PROCEDURE AND 3D MODELING OF THE STRUCTURE

Earthquake analysis is carried out using a G+12 Storey building by software approach. The total 7 models are created on the software. The model 1 to 7 were made in the software in which a hospital building structure is considered and in that porch is shifting from left end model to model, hence 7 models were created as per plan. The analysis part consist of the effect on building under the different loads such as dead load, live load and lateral loads (earthquake and wind) etc. into it based on software mechanism. The seismic data is taken as per the IS 1893(PART1):2016. The response spectrum analysis method is adopted for analysis of building.

Table 1: Model Description

Models	Description
Case PA1	Building with no porch exists
Case PB2	Building with Porch exists at 0 m from left end
Case PC3	Building with Porch exists at 4 m from left end
Case PD4	Building with Porch exists at 8 m from left end
Case PE5	Building with Porch exists at 12 m from left end
Case PF6	Building with Porch exists at 16 m from left end
Case PG7	Building with Porch exists at 20 m from left end

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Table 2: Input details of hospital building structures for all cases

Building configuration	G+12
No. of bays in X direction	4m @ 6 bays
No. of bays in Z direction	4m @ 3 bays
Height of building	59.5 m.
Build up area of building	228 sq. m.
Size of beam	0.40m x 0.35m
Size of column	0.50m x 0.40m
Concrete and Steel Grade	M 30 & FE 415
Earthquake parameters	Zone III with RF 4 & 5% damping ratio
Period in X & Z direction	1.0931 sec. & 1.0931 sec. for both direction
Dead load for floor finish	2.2 KN/sq. m.
Live load for floor and roof	2.8KN/ sq. m. & 1 KN/ sq. m.

III.RESEARCH OBJECTIVES

To optimize the better location for porch in building, here we take seven models with different location of porch and study by the help of software approach. This study analyses the different parameters like displacements in longitudinal and transverse direction. After this, storey drift is calculated in both X as well as Z direction. The most efficient porch location will be analyzed after all parameters. There are total 7 cases or location of multistoried building at medium soil condition under seismic forces for earthquake zone III exist.

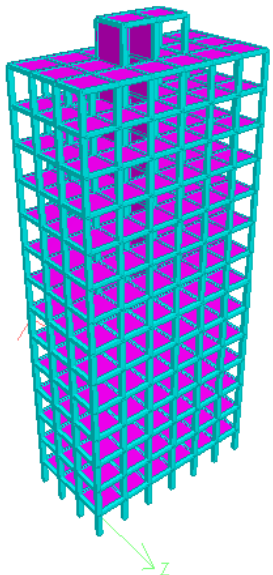

Fig. 1: 3D model with no Porch exist - Case PA1

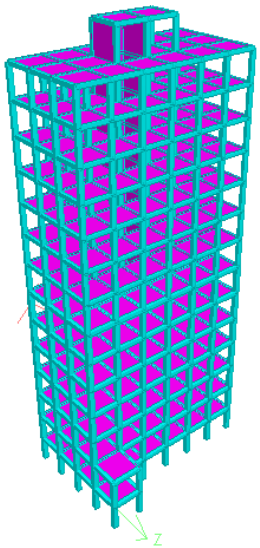

Fig. 2: 3D model with Porch exists at 0 m from left end - Case PB2

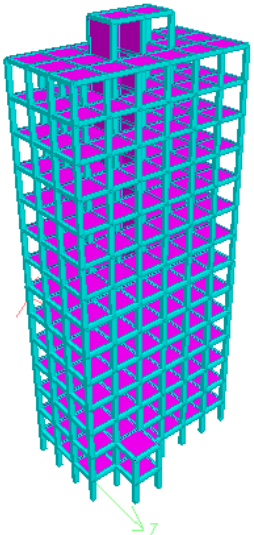

Fig. 3: 3D model with Porch exists at 4 m from left end - Case PC3

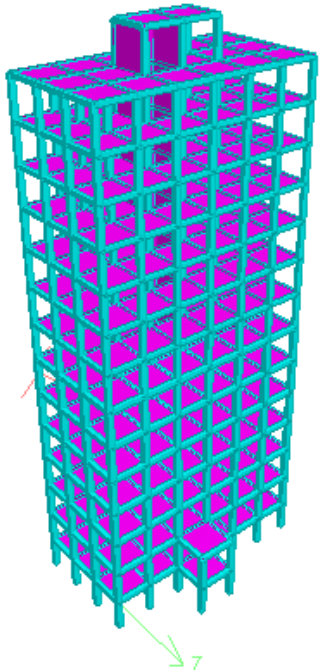

Fig. 4: 3D model with Porch exists at 8 m from left end - Case PD4

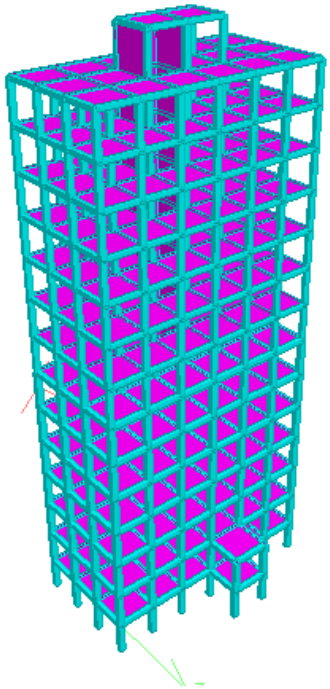

Fig. 5: 3D model with Porch exists at 12 m from left end - Case PE5

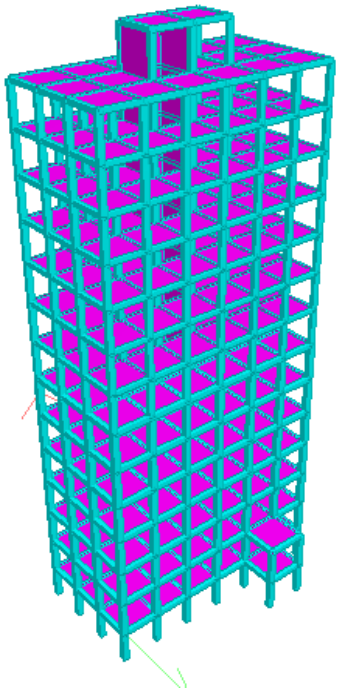

Fig. 6: 3D model with Porch exists at 16 m from left end - Case PF6

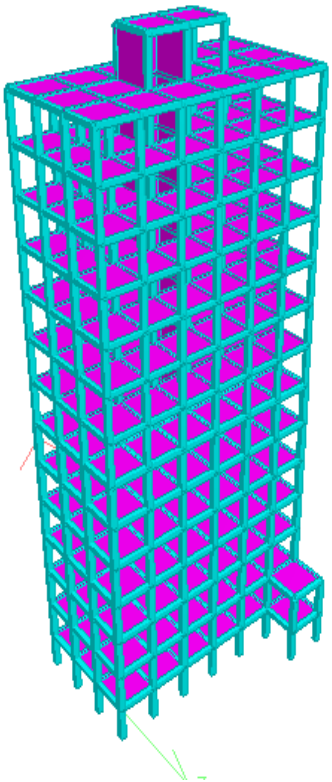

Fig. 7: 3D model with Porch exists at 20 m from left end - Case PG7

IV. RESULTS ANALYSIS

The result parameters obtained by the application of loads and their combinations on various cases of the multistorey hospital building as per Indian Standard 1893: 2016 code of practice.

Result of each parameter has discussed with its representation in graphical form below:-

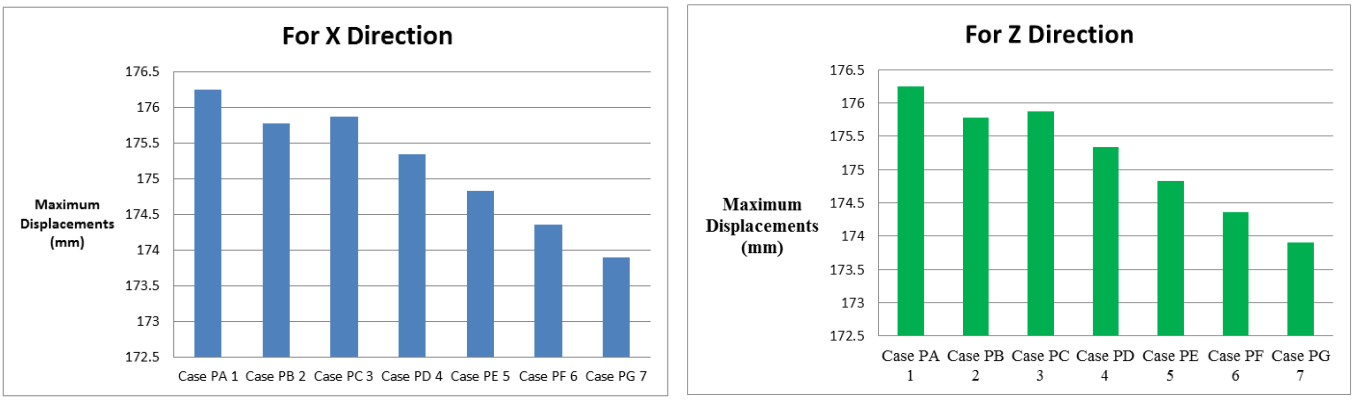

Fig. 8: Graphical Representation of Maximum Displacement in both X and Z direction with Porch exists for all Cases in Zone III

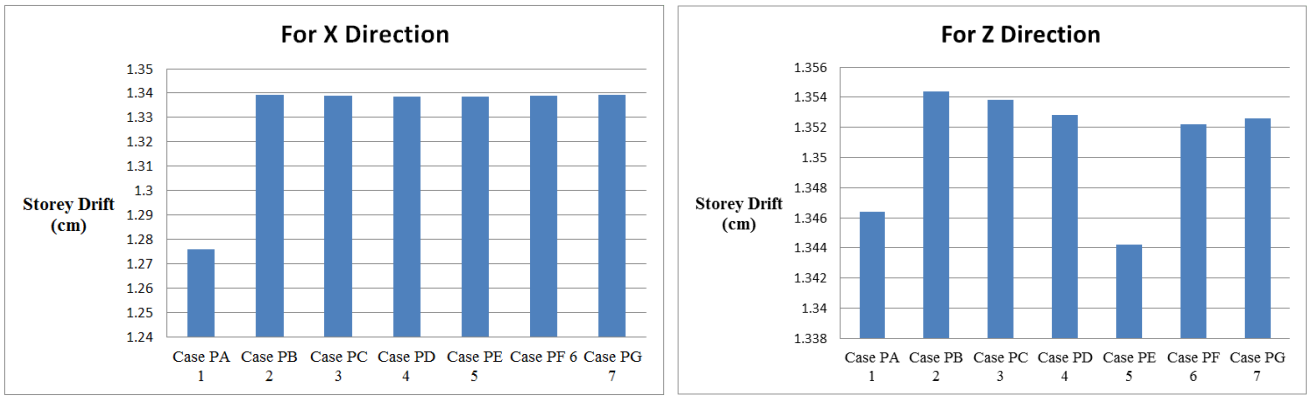

Fig. 9: Graphical Representation of Storey Drift in both X and Z direction with Porch exists for all Cases in Zone III

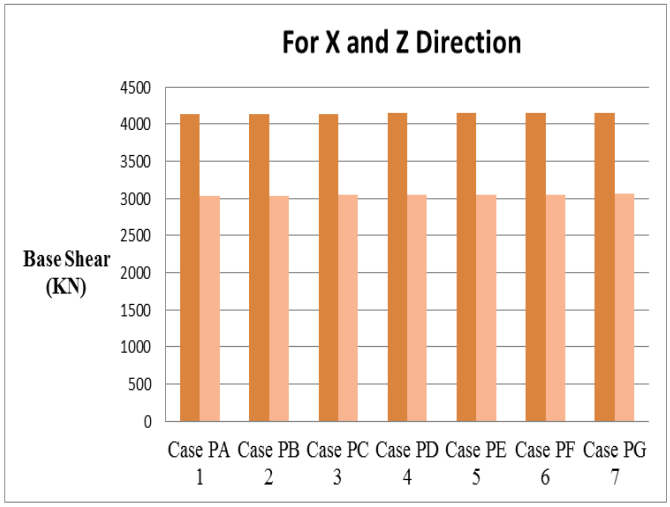

Fig. 10: Graphical Representation of Base Shear in X and Z direction with Porch exists for all Cases in Zone III

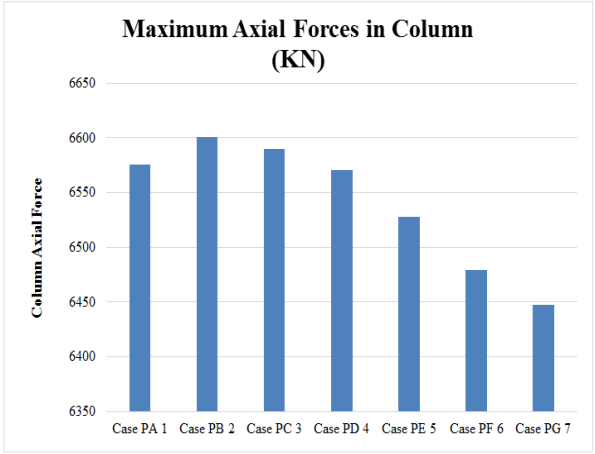

Fig. 11: Graphical Representation of Maximum Axial Forces in Column with Porch exists for all Cases in Zone III

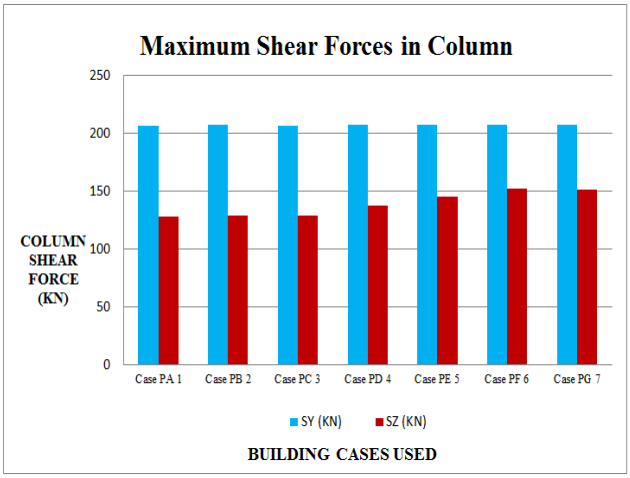

Fig. 12: Graphical Representation of Maximum Shear Forces in Columns with Porch exists for all Cases in Zone III

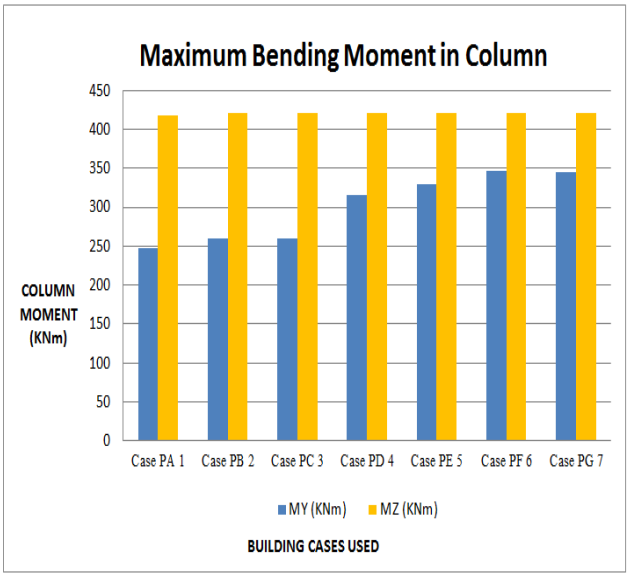

Fig. 13: Graphical Representation of Maximum Bending Moment in Columns with Porch exists for all Cases in Zone III

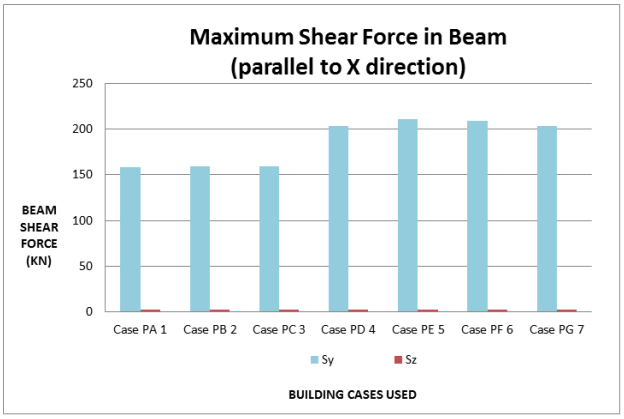

Fig. 14: Graphical Representation of Maximum Shear Forces in beams parallel to X direction with Porch exists for all Cases in Zone III

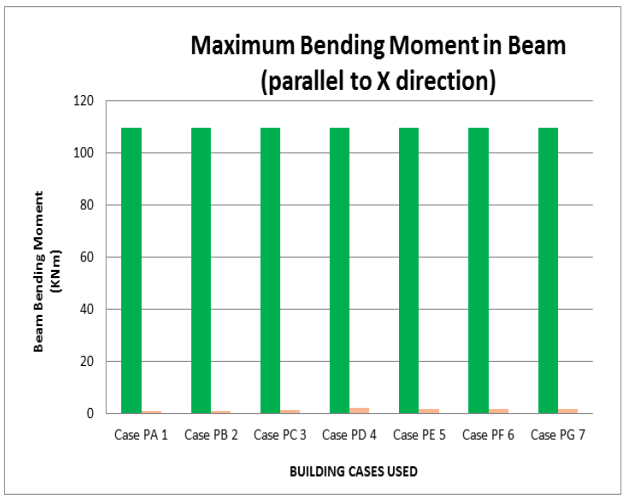

Fig. 15: Graphical Representation of Maximum Bending Moment in beams parallel to Z direction with Porch exists for all Cases in Zone III

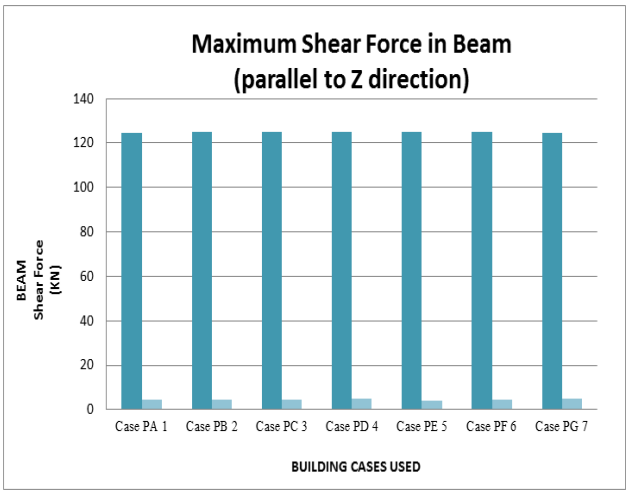

Fig. 16: Graphical Representation of Maximum Shear Forces in beams parallel to Z direction with Porch exists for all Cases in Zone III

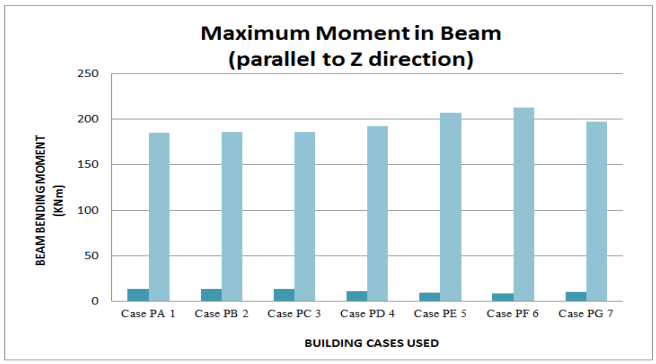

Fig. 17: Graphical Representation of Maximum Bending Moment in beams parallel to X direction with Porch exists for all Cases in Zone III

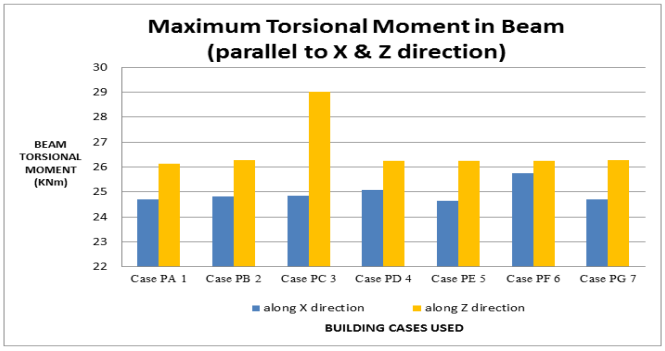

Fig. 18: Graphical Representation of Maximum Torsional Moment in beams parallel to X &Z direction with Porch exists for all Cases in Zone III

V. CONCLUSIONS

After comparison of the various parameters over the building with and without porch subjected to seismic effects with seven different locations, the following conclusions have been drawn:-

A. After analyzing and comparing the maximum displacement, the minimum value has been obtained in Case PG7 for both X and Z direction.
B. Maximum base shear is almost similar for all cases, hence this parameter is not taken into consideration.
C. Comparing the maximum Story Drift, the minimum value after comparison is obtained in Case PA1 and Case PE5 in X and Z direction respectively.
D. The minimum value after comparing the Maximum Axial Force in column is porch location Case PG7 and proved to be an efficient case.
E. When comparing the maximum Shear Forces and Moments in Column, Case PA1, PB2 and PC3 have been obtained as most efficient case respectively.
F. Again comparing the Shear in Beams parallel to X direction, porch Case PA1, PB2 and PC3 have been obtained as most efficient case for the current parameter only.
G. Shear Forces in Beam parallel to Z direction and Moment in Beam parallel to X direction, no results has been considered for comparison, since there has been a minute changes.
H. Beam Moment parallel to Z direction, porch location Case PA1, PB2 and PC3 have been obtained as most efficient case. The last parameter compared was Torsional Moments in Beam, porch location Case PA1, PE5 and PG7 have been obtained as most efficient case.

The conclusion after comparing all the parameters, porch location Case PA1 is very efficient case for porch in the selected hospital building and should be recommended when this type of construction taken into consideration at seismic zone III.

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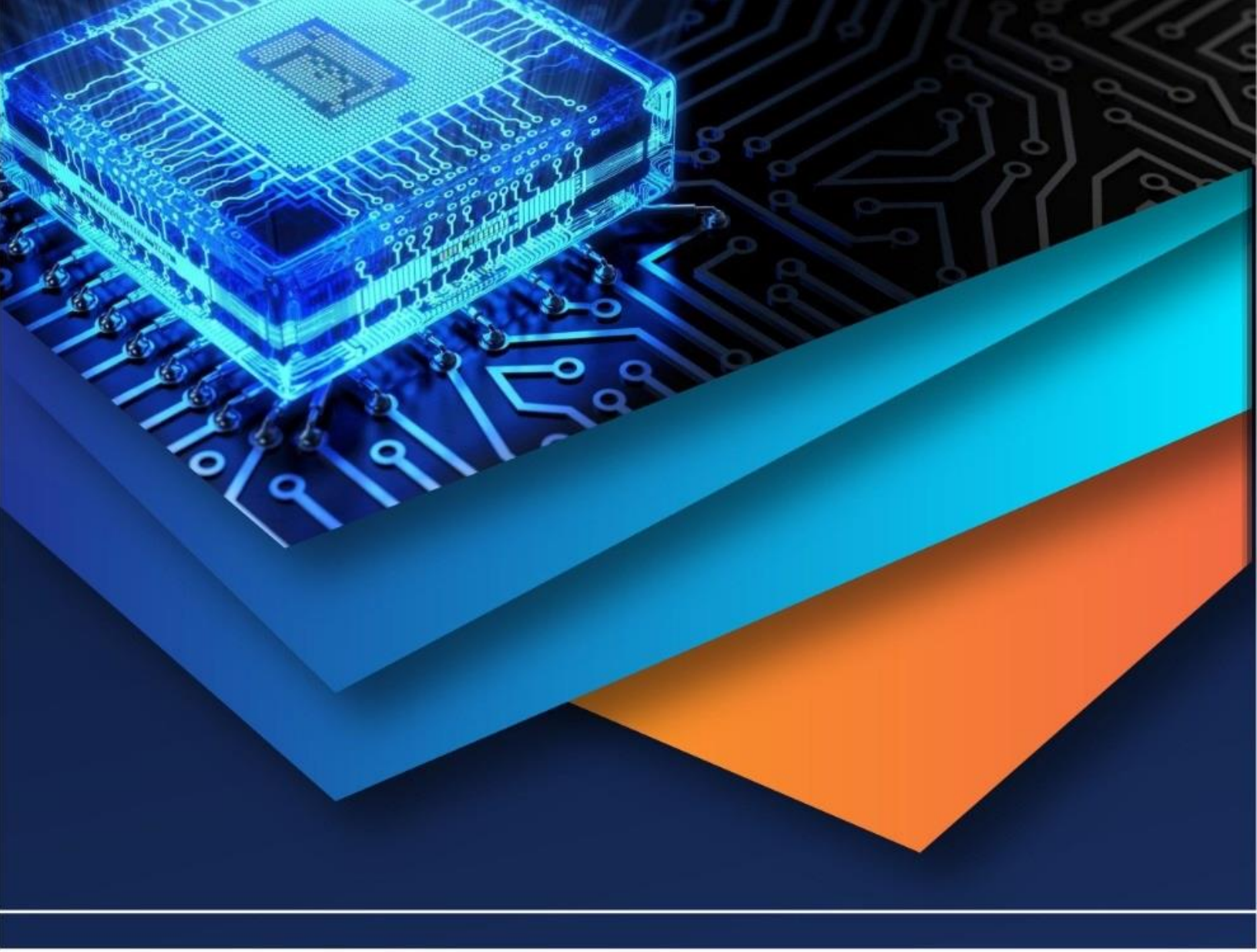

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