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Study the Behavior of Special Columns on Multi Storey Building for Seismic Ground Motions

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ABSTRACT: Columns are RC building structural elements that are primarily subjected to axial load and moments as they transport them from the superstructure to the substructure. Columns of various shapes and sizes are used. Popular column shapes include square, rectangular, and circular columns, as well as L-shaped, T-shaped, and (+) shaped columns, which are uncommon but provide more interior space than commonly used column shapes. This study aims to examine the seismic performance of multistorey G+10 buildings with Rectangular columns and building with specially shaped columns. According to IS Code 1893(part 1):2016, the proposed buildings are analyzed using equivalent static analysis for zone IV. ETABs are used to analyze the models. After analysis, we conclude that buildings having special columns are safer and have more space as compared to the regular shaped column buildings
Keywords: Special shape column, Multistorey buildings, ETABs, IS-CODE 1893(part1):2016, Seismic analysis.

I. INTRODUCTION

Structural design is a blend of art and science, and structure behavior is the unspoken emotion of an Engineer with knowledge acumen. It may involve statistical principles, dynamics, material mechanics, and structural analysis to create a safe economic structure that is lasting and serves the desired goal.

A structural engineer's primary responsibility is to ensure the safety of building occupants by replacing traditional construction practices with modified techniques that allow a large population to be accommodated in a given area and large commercial space to be created in a confined area to improve the living environment. It is critical to replace traditional building approaches with modified ones.

Buildings, which are often intended for office, institutional, or commercial use, are among the most notable space definitions in the twentieth-century architectural historey of urbanization. They are essentially a response to the fast increase of the urban population and the need for economic operations to be as close to one another as feasible.

As per previous work byPreetha Vetc.all. (2020) where they study about the y G+10 multi-storied building composed of RCC columns and two different composite columns viz. Encased column and Infill rectangular tubes are analyzed by using ETABS software.

Where they conclude that Storey shear and drift reduces to composite columns as compare to RCC column. And the study by Shu Sua ,Xiaodong Lia etc.all; (2018) on A comparative study of environmental performance between CFST and RC columns under combinations of compression and bending where they assessed and compared the EI of columns constructed with two concrete types (CFST and RC) and three cross-sections (circular, rectangular and square) under different combinations of compression and bending.

And the study by Vidhya Purushothamanetc.all (2017) where they evaluate the comparison of composite columns with concrete filled steel tube and composite encased I section column. This paper mainly emphasizes on structural behavior of multi-storey building for different plan configurations like Rectangular, C, L and H shape with two different column property and they concluded that building with composite column is more effective against lateral loads.

II. OBJECTIVES

1) To compare the Rectangular columns with special columns in G+10 storey structure
2) To study he behavior of cross (+) Shaped, T shaped, and L shaped column under Seismic forces in zone force
3) To perform static linear analysis on G+10 storey building.
4) To evaluate seismic parameters like storey displacement, storey drift, storey shears and storey stiffness for proposed structural models.

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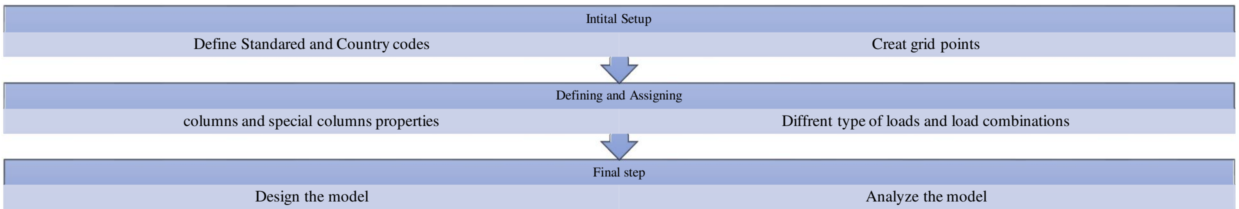
III. METHODOLOGY

For the present thesis work, modeling and analysis are carried out for rectangular-shaped buildings. Where we modeled two buildings one is with a regular rectangular RC column whereas the other one had special columns i.e. L-Shaped columns at a corner Crossed (+) Shaped columns at the center of the building and T-Shaped columns at the boundary of the model as shown in the fig. 2. For achieving the goals, we use ETABs as software and in ETABs we used the following steps as mentioned below.



Building Parameters

Area of building	$15*20\ m^2$			
Height of building	30 m			
Shape of building	Rectangular			
Seismic zone	IV			
Zone factor	0.240			
Soil type	II			
Importance Factor, I	1.5			
R	5			
IS Codes adopt for research	IS 1893:2016 (part1)			
Member	Dimensions			Grade
Slab	170mm			M30
Column	Rectangular	550*750 mm		M30
	T Shape	Total Depth	550mm	
		Total Width	550mm	
		Flange Thickness	150mm	
		Web Thickness at flange	150mm	
		Web Thickness at tip	150mm	
	+ Shape	Total Depth	550mm	
		Total Width	550mm	
		Flange Thickness	150mm	
		Web Thickness	150mm	
	L shape	Total Depth	550mm	
		Total Width	550mm	
		Flange Thickness	150mm	
		Web Thickness	150mm	
Beam	350*450			M30

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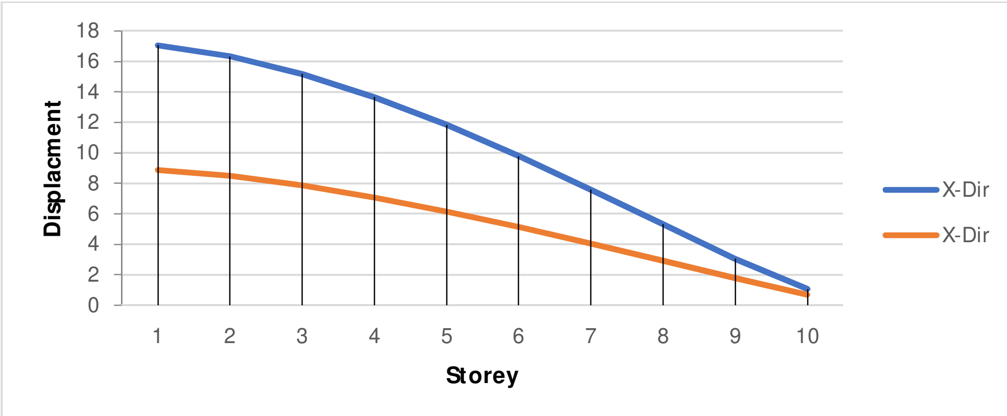
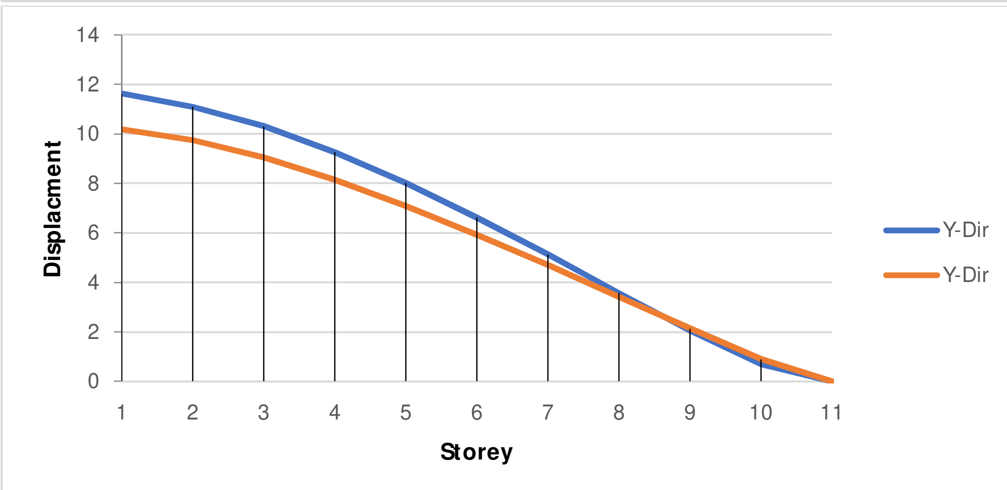
IV. RESULTS

A. Storey Displacement

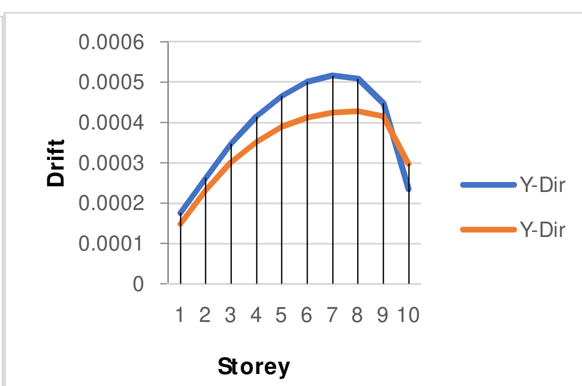
The lateral displacement of the tale relative to the base is referred to as storey displacement. The lateral force-resisting system can reduce the building's excessive lateral displacement. We calculate displacement with square shape column and special shape columns in building and here observed that building with special shape coulomb had minimum displacement than the Square column in both X and Y direction





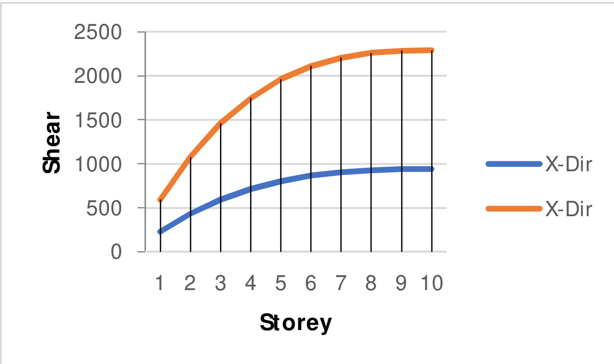
B. Storey Drift

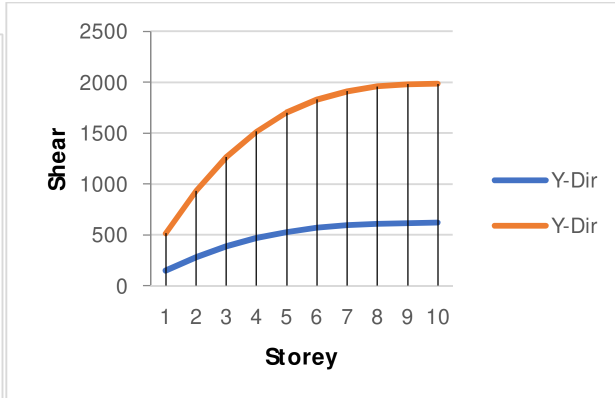
The plot of the resultant drifts per level, on the other hand, is known as storey drift. Drift is a unit less number obtained by dividing the relative lateral displacement by the storey height, and it indicates how far a storey is moved by a given weight. Here we observe that Drift in the Special column is minimum in comparison with the Regular column and it is observed that for the 8th storey it is maximum as compared to other storey.



C. Storey Shear

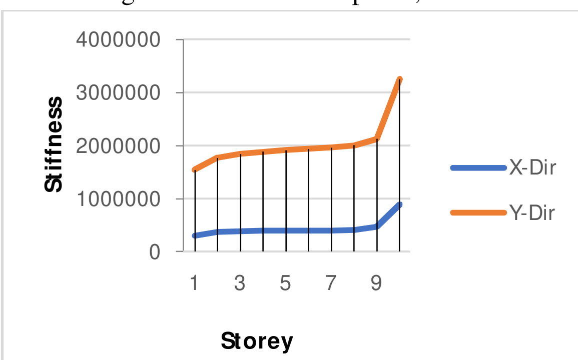
It is the lateral force acting on a storey due to the forces such as seismic and wind force. It is calculated for each storey, changes from minimum at the top to maximum at the bottom of the building.The graph of storey shear shows how much lateral load, i.e. seismic, is acting per storey.

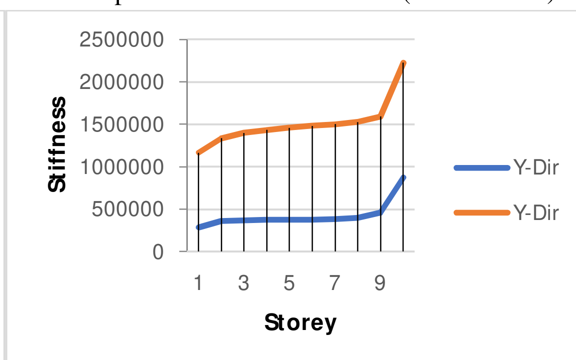




D. Storey Stiffness

As long as we're talking about the elastic response, narrative stiffness is independent of the sort of load (Linear Static)





V. CONCLUSION

1) Observed that building with special columns shows minimum deflections, drift, shear forces as compare to regular column building.
2) Also, it seen that building had special columns shows maximum stiffness then regular column building
3) After analysis it is observed that building with special column is safer than building with regular Columns.
4) Carpet Area is also increased in building having special columns.

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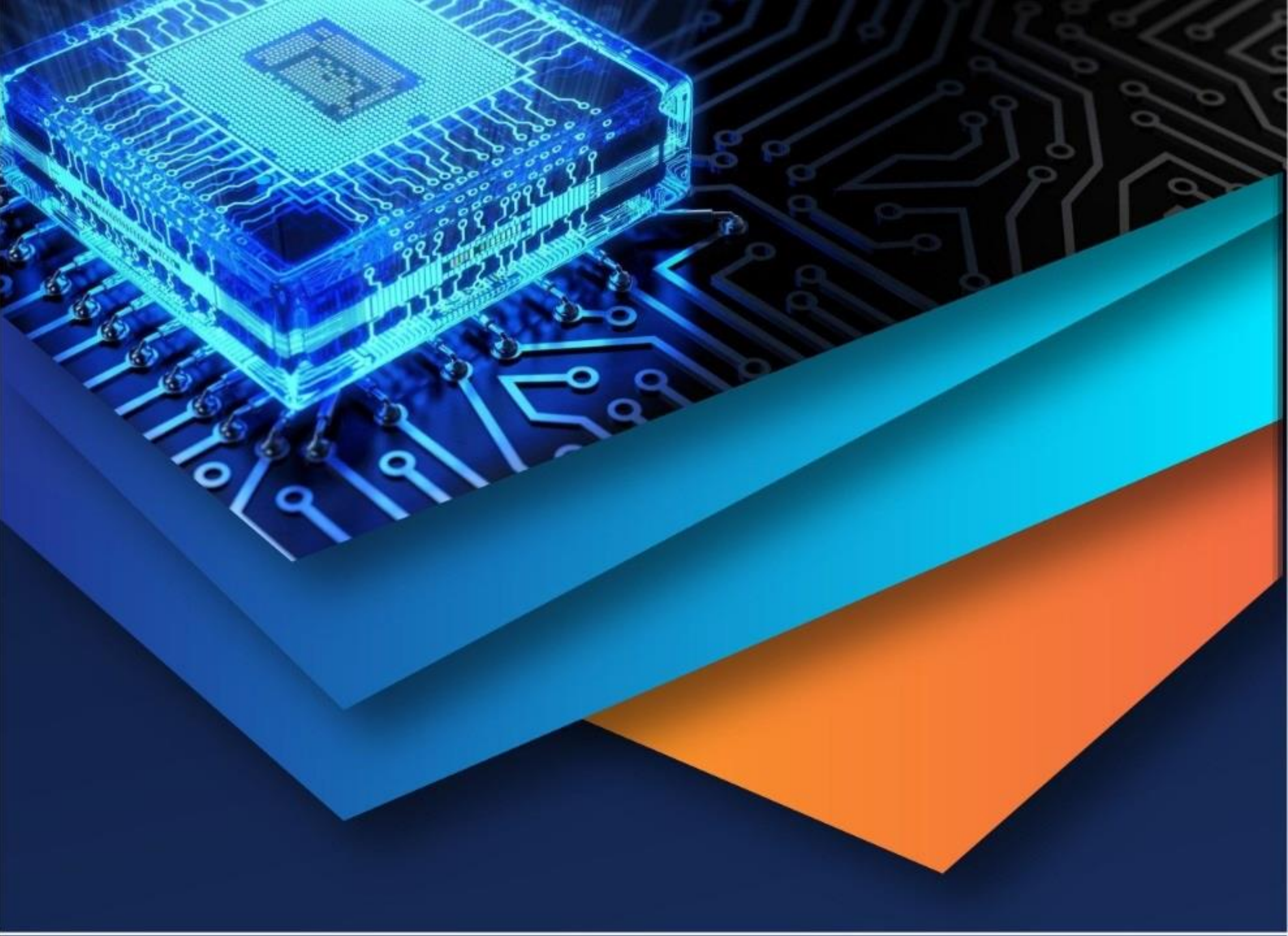

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