iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 8 **Issue:** V **Month of publication:** May 2020

DOI: http://doi.org/10.22214/ijraset.2020.5112

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue V May 2020- Available at www.ijraset.com

Comparative Seismic Behaviour Study of Special Shaped Column Framed Reinforced Structure

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Abstract: ***The objective of this study is in order to improve the performance of RCC framed Structure with rectangular columns with Different Shaped (Circular, Rectangle, T-Shape & I-Shape) Column under the Lateral Load Condition. G+9, 30m height of building analysed with different shape of column with equivalent cross section area of different shaped column. Building analysed using Response spectrum method under the Earthquake Zone IV (As per Indian Standard). The maximum story drift, Base shear & other parameter are considered in this paper. Analysis & Calculation done by using STAAD Pro V8i software. The results indicate the comparative Study and analysis of regular shaped and other several shaped column cross sections.***
Keywords: Earthquake, Different Shape Column, Response Spectrum Analysis, Story Drift, Base Shear, Staad Pro.

I. INTRODUCTION

Structural Analysis & Design is Art and Science of understanding the behaviour of structural member subjected to loads and designing them with safety & serviceability. The present work will be dealing with such a study of structural members made of RCC as it is widely used because of its compliance.

Building constructed by various Structural Component like Slab, Beam, Column & Footing. Self-Weight of component as well as dead load & live load of building transferred from slab to beam and beam to column and Column to footing. Column play very important role in buildings because total Gravity load transfer through column. Different Shapes of Column are used in the construction such as Square Column, Rectangular column, Circular Column, T-Shaped Column& I-Shaped Column. Increase in height of building, simultaneously lateral load also increase. While considering later load building, Column behave different under dynamic & Static loading Conditions. The dynamic loading consideration is must require when seismic activity high.

II. GEOMETRY AND DESCRIPTION

Geometry modelling done in Staad Pro software and following Shape of Column, Size of Column & loading parameter assigned to model as below.

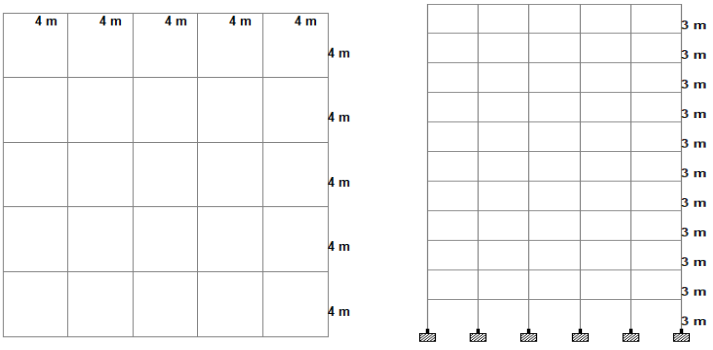


Fig. 1 Plan view & Elevation view of model

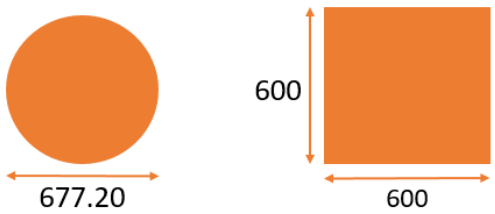


Fig. 2 Circular, Square type Shape & Size of Column[1]

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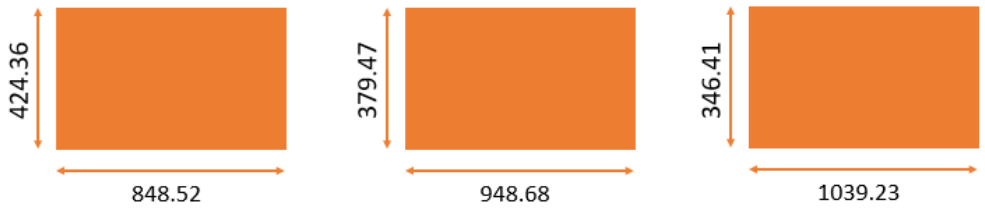


Fig. 3 Rectangle-A, Rectangle-B, rectangle-C type Shape & Size of Column[1]

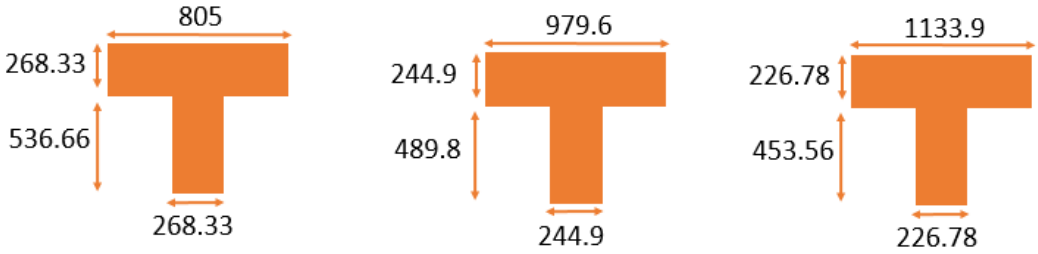


Fig. 4 "T" Shape-A, "T" Shape-B, "T" Shape-C type Shape & Size of Column[1]

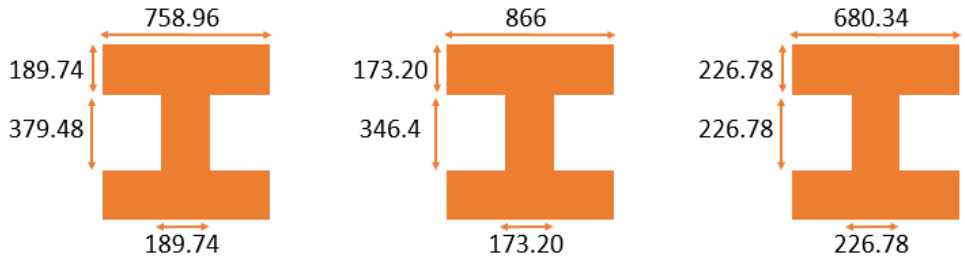


Fig. 5 "I" Shape-A, "I" Shape-B, "I" Shape-C type Shape & Size of Column[1]

TABLE I
Geometry and Description

Sr. No	Description & Parameter	Value	Unit
1	Total height of Building	33	Meters
2	Height of each story	3	Meters
3	Type of Structure	RC Framed	
4	Number of bay in X & Z-Direction	5	Nos.
5	Beam Size	300 x 600	mm
6	Wall load on Beam	14.5	kN / m
7	Parapet load on Beam	5	kN / m
8	Slab Dead Load	4.75	kN / m
9	Slab Live Load	3	kN / m
10	Seismic Zone	IV	
11	Period in X & Z Direction	0.604	Seconds
12	Support as base	Fix	
13	Reinforcement Grade	Fe500	
14	Concrete Grade	M25	
15	Analysis Standard	Indian Standards	

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III.RESULT OF STRUCTURAL RESPONSE OF R.C. FRAME BUILDING

A. Story Drift

Maximum Story Drift of the frame structure with specially shaped column under response spectrum analysis are shown.

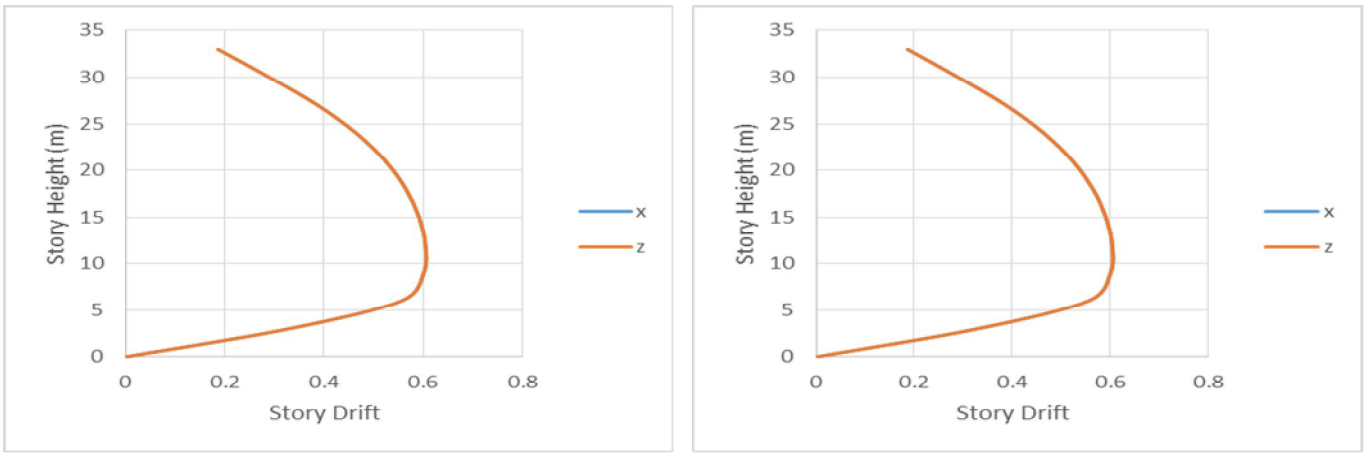


Fig. 6 Circular & Square Column Story Drift in X-Direction & Z-Direction

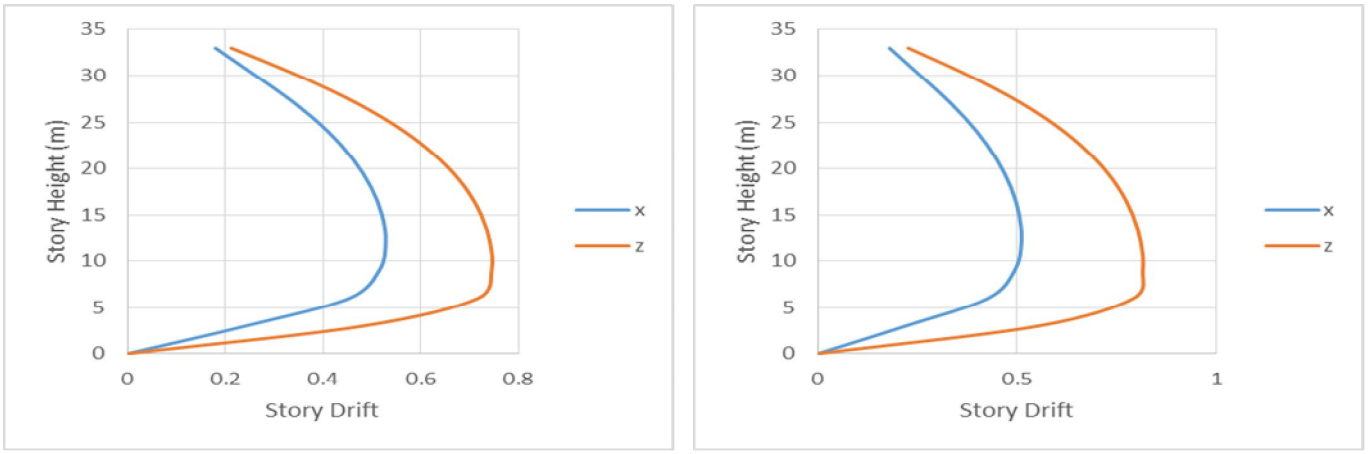


Fig. 7 Rectangle-A & Rectangle-B Column Story Drift in X-Direction & Z-Direction

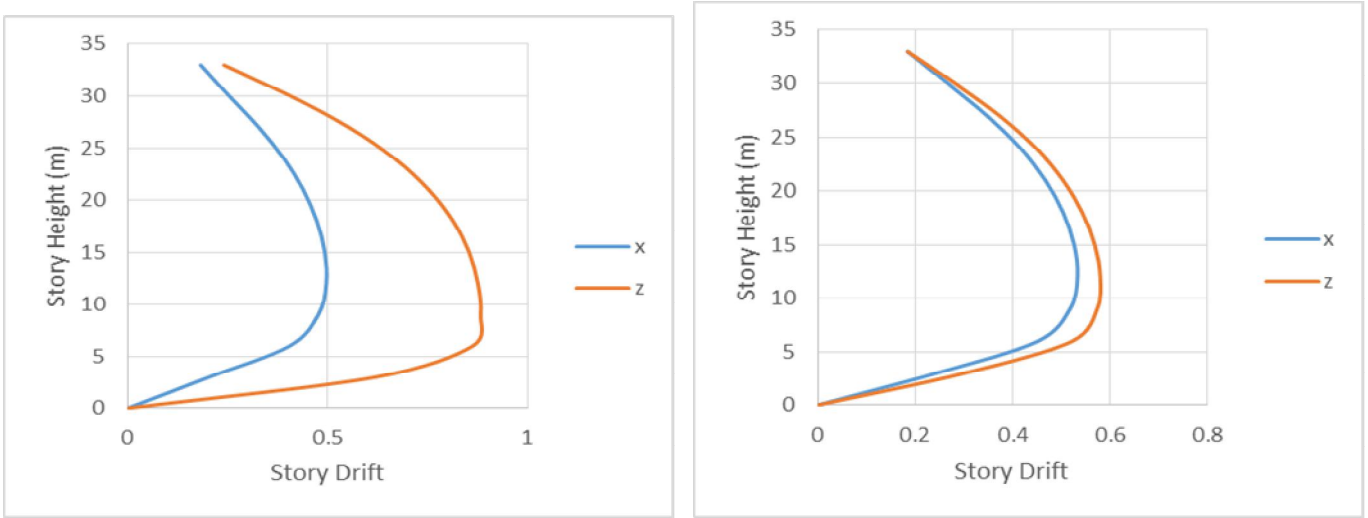


Fig. 8 Rectangle-C & "I-Shape"-A Column Story Drift in X-Direction & Z-Direction

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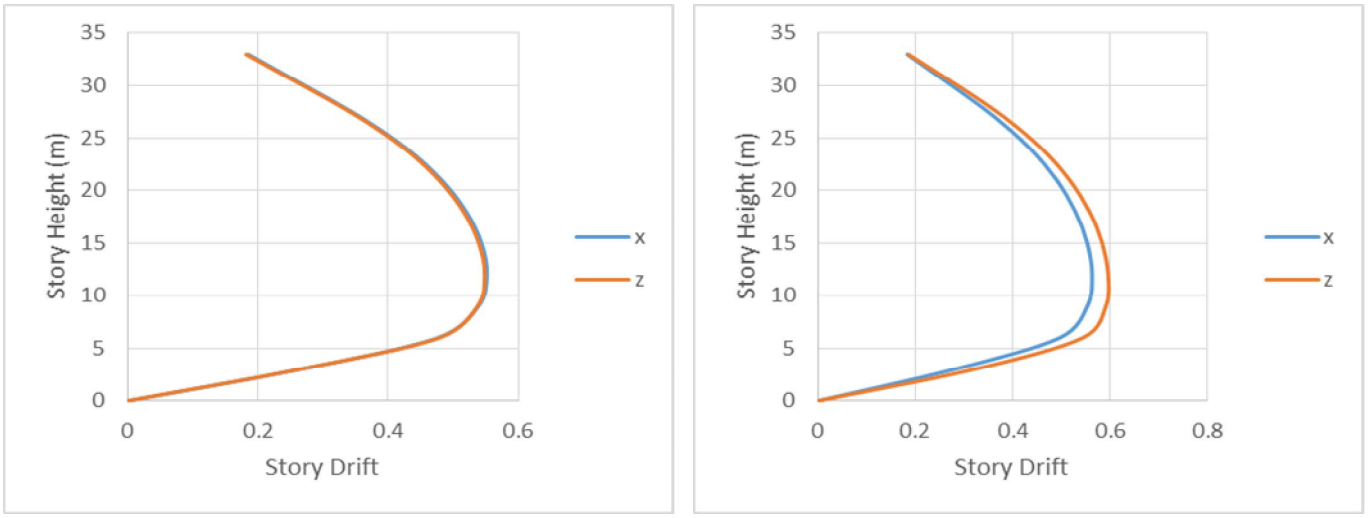


Fig. 9 “I-Shape”-B & “I-Shape”-C Column Story Drift in X-Direction & Z-Direction

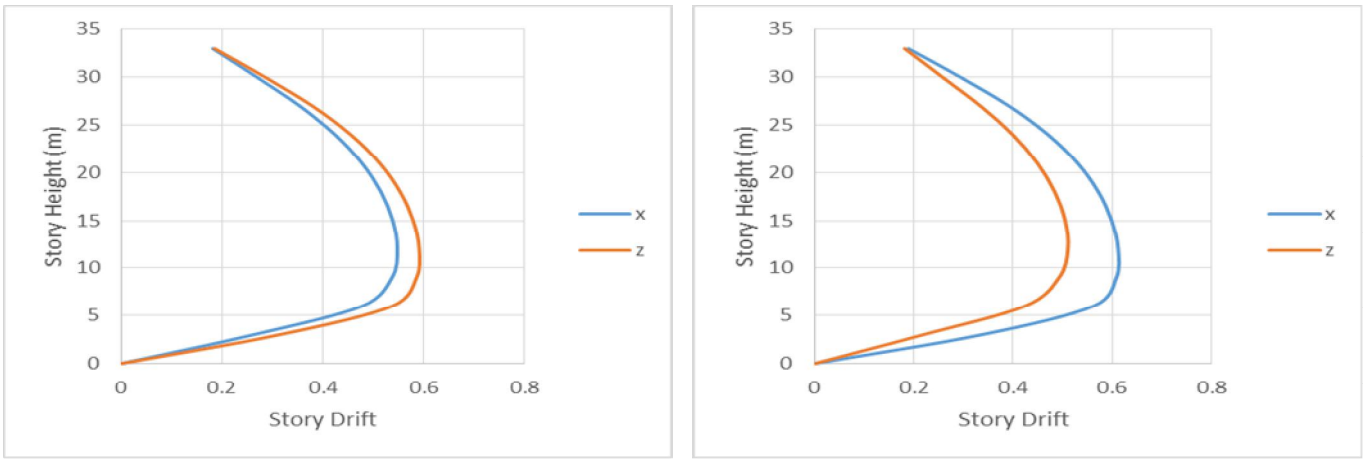


Fig. 10 “T-Shape”-A & “T-Shape”-B Column Story Drift in X-Direction & Z-Direction

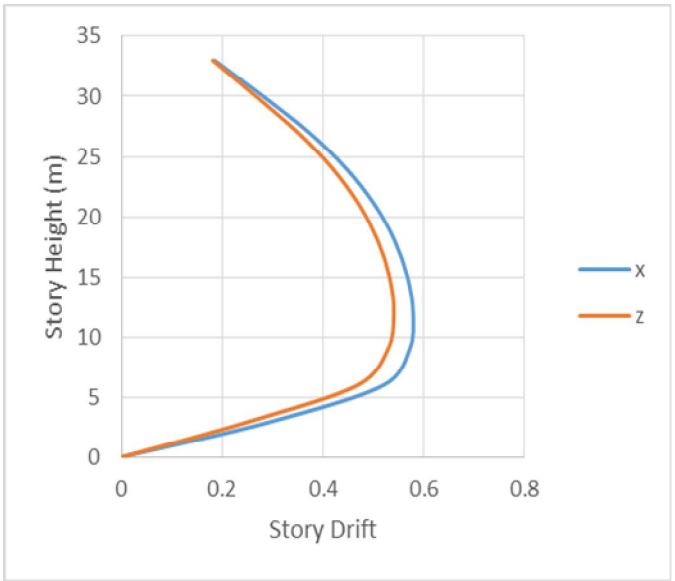


Fig. 11 “T-Shape”-C Column Story Drift in X-Direction & Z-Direction

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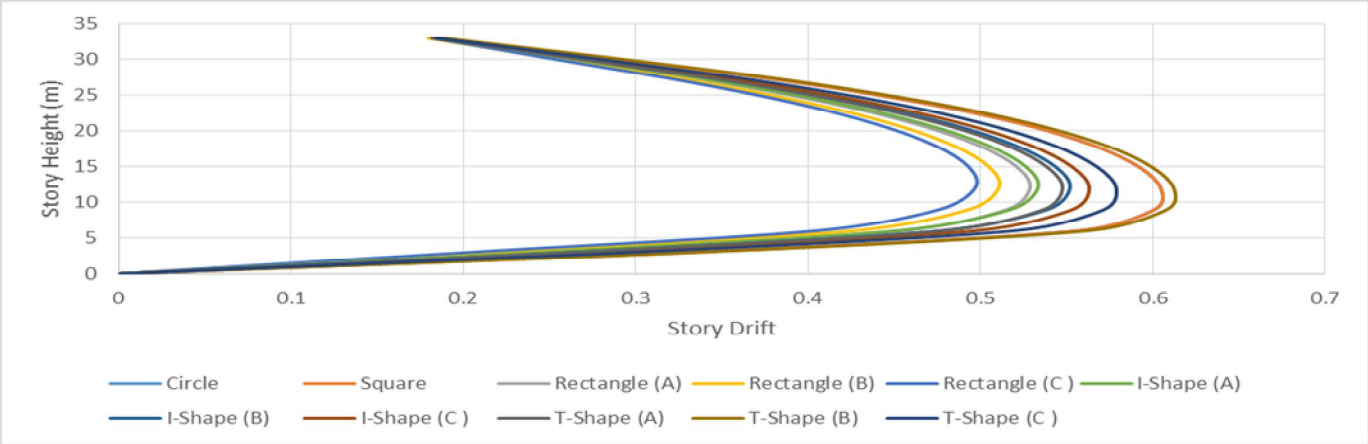


Fig. 12 Story Drift of Different shaped column in X-Direction

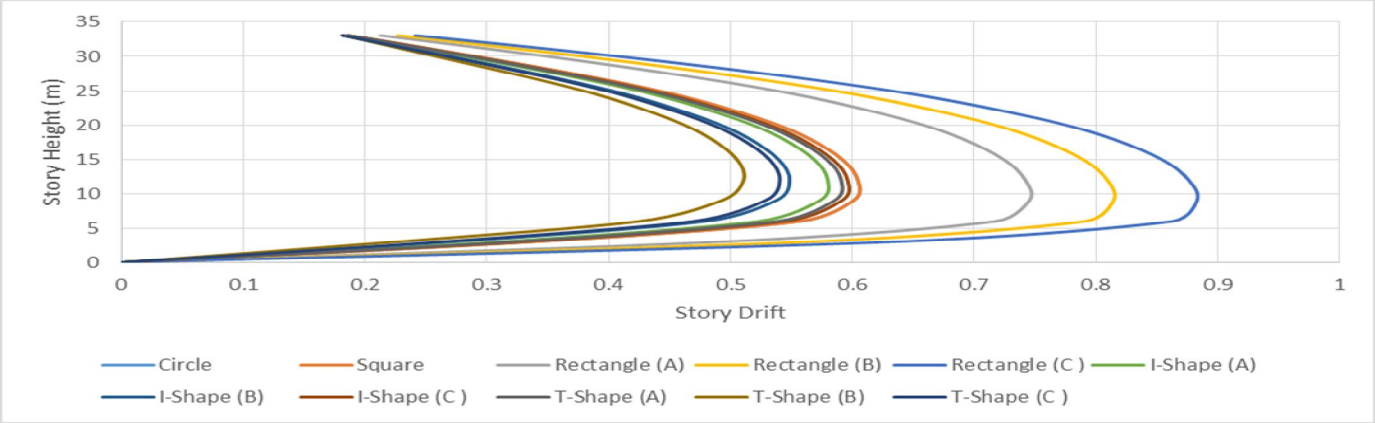


Fig. 13 Story Drift of Different shaped column in Z-Direction

Following as above graph representing the different shape of column story drift in X-Direction & Z-Direction.

B. Base Shear Reaction

It is the total Design Lateral force at the base of structure. Variation of base shear in X-Direction & Y-Direction has been carried out in this research work as beloved base shear mention value.

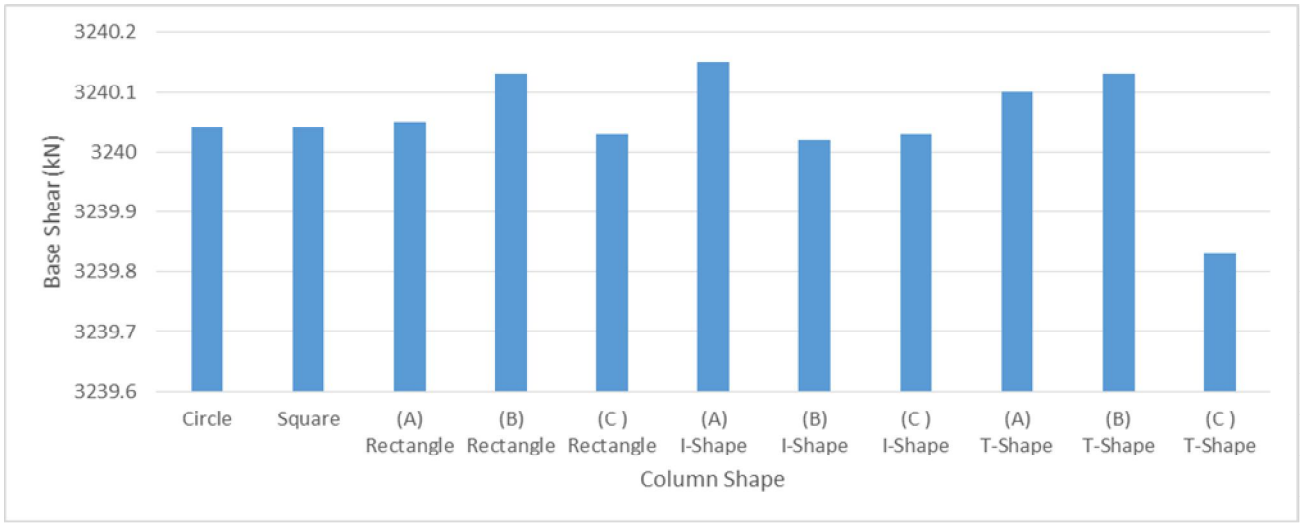


Fig. 14 Base Shear (kN) in X-Direction

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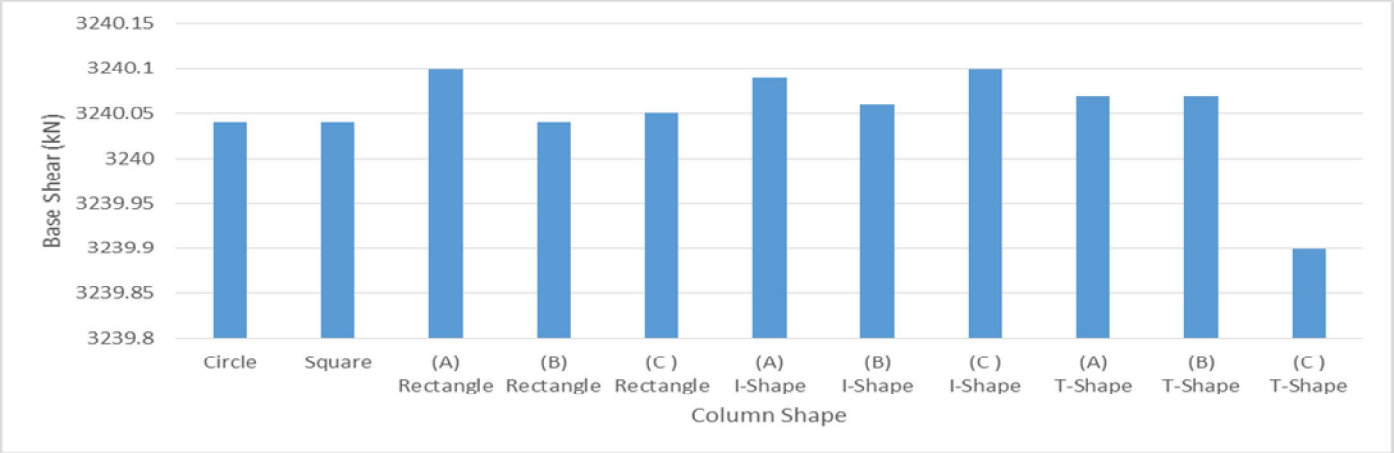


Fig. 15 Base Shear (kN) in Z-Direction

IV. CONCLUSION

In the present study analysis of G+9, 33 meters height framed structure is carried out with various shape of column. Based on analysis and result for all models considered, following conclusion are drawn.

A. Base Shear remain same for all type of column but Circular column have least base shear among all type of Column in both X-Direction & Z-Direction.

B. T Shape-B type column have maximum Story drift in X-Direction but in Z-direction maximum Storey drift shown in Rectangle-C type column.

C. Rectangle-C type column have minimum Story drift in X-Direction up to 30 meters. But in Z-direction minimum Storey drift shown in T Shape-B type column up to 30 meters.

D. Obstruction will be made by the offset of columns in case of specially shaped column buildings.

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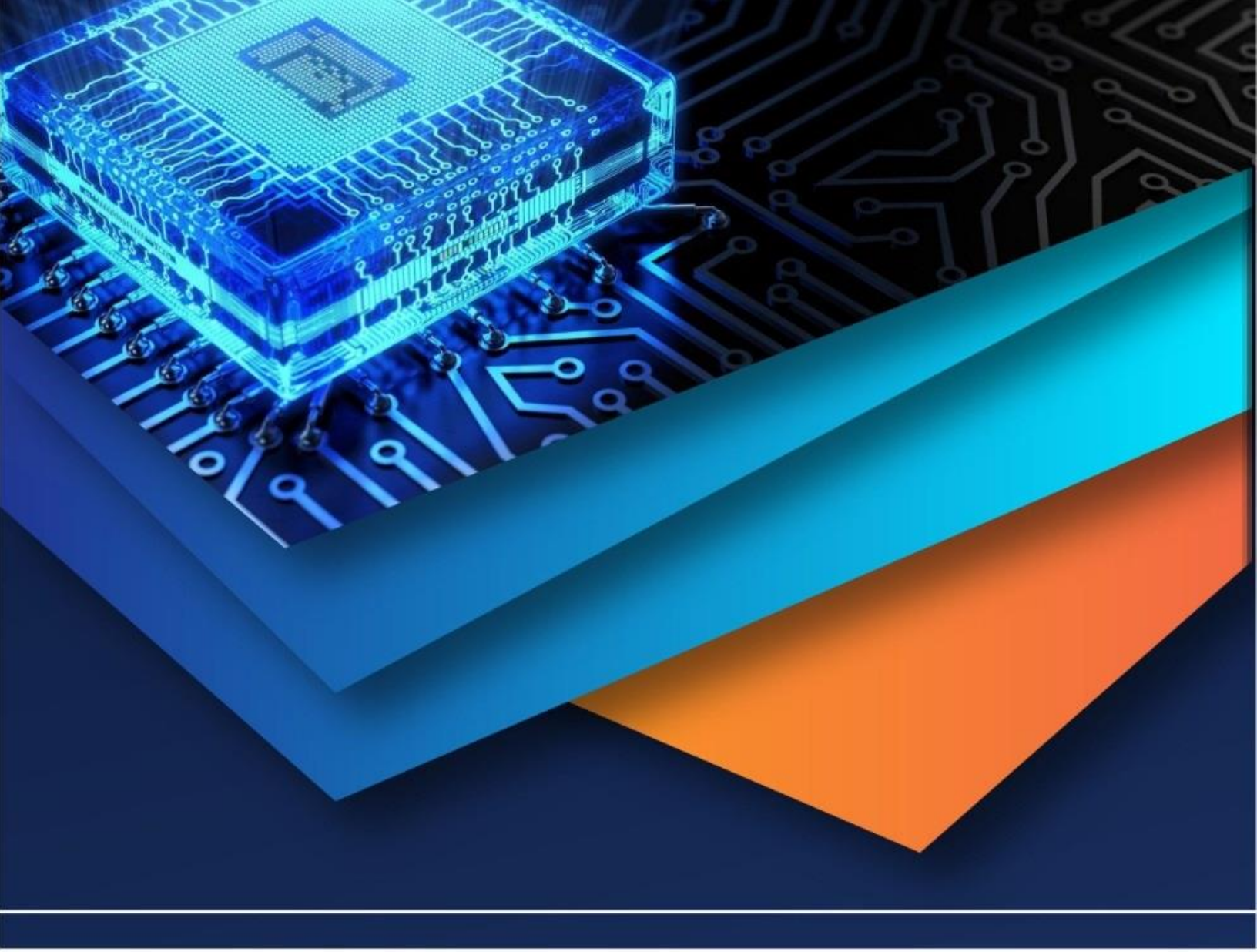
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