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Behavioural Study Of Unsymmetical Rcc Buildings With Rectangular Shape And Special Shaped Columns

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ABSTRACT:- The main objective of this study is to determine and assess the seismic performance of the structure under earthquake loads, wind loads and other various loads with rectangular and special shaped columns. Two unsymmetrical shaped RCC buildings with G+12 storeys are taken into consideration for design and analysis. The analysis is done by using the software ETABS 2016. The various shapes of columns taken for design are rectangular columns, T- shaped columns,L shaped columns and cross or Plus shaped columns. The result indicates the comparative analysis and study of regular shaped rectangular columns with the special shaped columns. It is observed or concluded that the seismic performance of the building with special shaped columns are better than the rectangular shaped columns . The special shaped columns are more effective and economical than rectangular shape columns.

Keywords:- Displacements, base shear, story stiffness, L- shaped, T- shaped, Plus shaped and rectangular shaped columns,etc.

I. INTRODUCTION:

The structure is generally constructed with; square, rectangular and circular shape of column and these are commonly and conventionally used. Columns support floors in a structure. Slabs and beams transfer the load as well as stresses to the columns. So, it is important to design strong columns. A column is a very paramount component in a structure. It isthe element of the structure through which the load is transferred from beams and slabs. It is designed to resist axial and lateral forces and transfer them safely to the footings within the ground. Specially shaped columns give more efficient space in the room corners as compared to rectangular or circular columns. . It may undergoes there miscellaneous changes in column buckling, maximum bending moments, shear forces , changes in stiffness and displacement of column beam joints of structures.Experimental analysis is widely carried out to study individual component members and the concrete strength under various loading conditions.For a building to remain safe during earthquake shaking, columns (which receive forces from beams) should be stronger than beams. The frames with special shaped columns are more flexible, efficient and economical as compared to the other conventionally used columns.

II. 2. GEOMETRY AND DESCRIPTION:

In this study two unsymmetrical r.c.c. structures has been taken for analysis and design. Two structures of G+12 storeys were taken into consideration. The height of the each story of each building is taken as 3.5m except the height of the plinth from the base which is taken as 2.1m. The span between the bays is taken as 4m in X and Y directions respectively. The material properties such as Grade of steel is taken as Fe 500 and Grade of concrete is taken as M25 for the yield strength of longitudinal and transverse reinforcement.

Two reinforced concrete buildings were taken into consideration for analyzing and designing. The software used for analyzing and designing is ETABS 2016. IS CODE used for designing these structures is IS 456-2000. To execute the analysis in ETABS static analysis is used.

Model 1: Floor plan of R.C framed structures with rectangular columns.

Model 2: Floor plan of R.C framed structures with special shaped columns.

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2.1 Preliminary Data

Table 1 : Structural Specifications

1.	Types of sections	R.C.C
	Sizes of column sections	
2.	Rectangular column (C1)	300 X 600
3.	Rectangular column (C2)	300 X 530
4.	T- shaped column (CT-1)	230 X 510
	(CT -2)	230 X 460
5.	L- shaped column (CL -1)	230 X 510
	(CL -2)	230 X 460
6.	Cross(+) shaped column (CP -1)	230 X 510
	(CP -2)	230 X 460
	Sizes of beam sections	
7.	Primary beams	230 X 450
8.	Secondary beams	230 X 450

Table 2: Loading Specifications

1.	Floor Load	1.0 KN/m^2
2.	Live Load	3.0 KN/m^2
3.	External Wall Load	12.9 KN/m
4.	Internal Wall Load	12.9 KN/m
5.	Density of concrete	25 KN/m^3
6.	Thickness of Wall	230 mm
7.	Code for RCC	IS 456 (2000)
8.	Code for Earthquake Analysis	IS 1893 (2002)
9.	Code for Wind Load Analysis	IS 875 (1987)
10.	Zone	IV (Severe)
11.	Zone Factor (Z)	0.24

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12.	Importance Factor (I)	1.0
13.	Moment Resisting Frame Type	SMRF
14.	Response Reduction Factor (R)	5.0
15.	Site Soil Type	II (Medium)
16.	Grade of Concrete	M25
17.	Grade of Steel	Fe 500
18.	Floor to floor height	3.5 m
19.	Length of Bay in X-Direction	4 m
20.	Length of Bay in Y-Direction	4 m

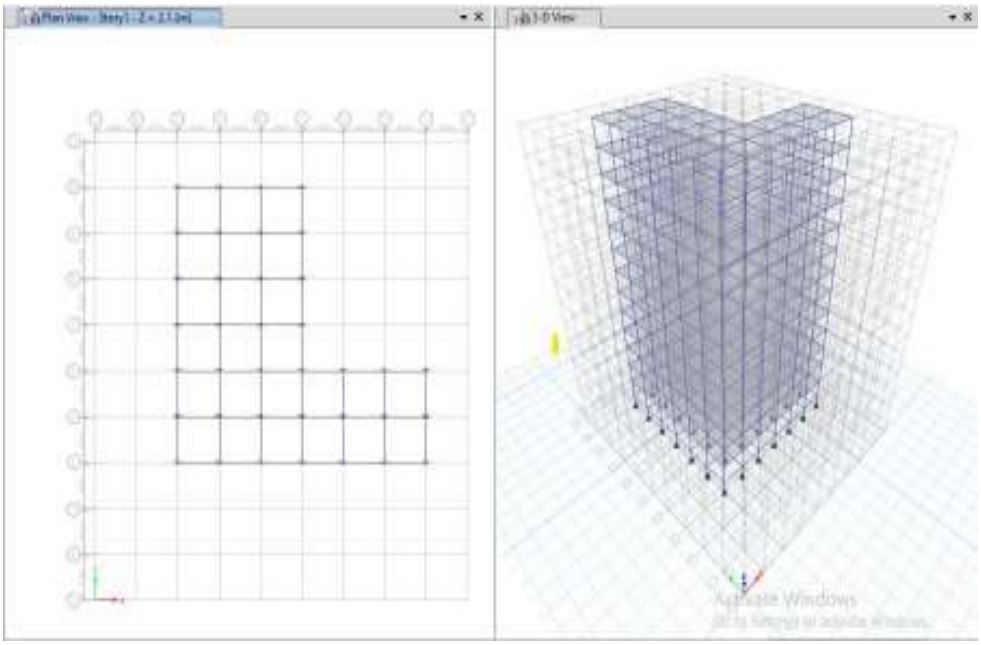

Figure 1: Showing Model of RCC building with rectangular columns

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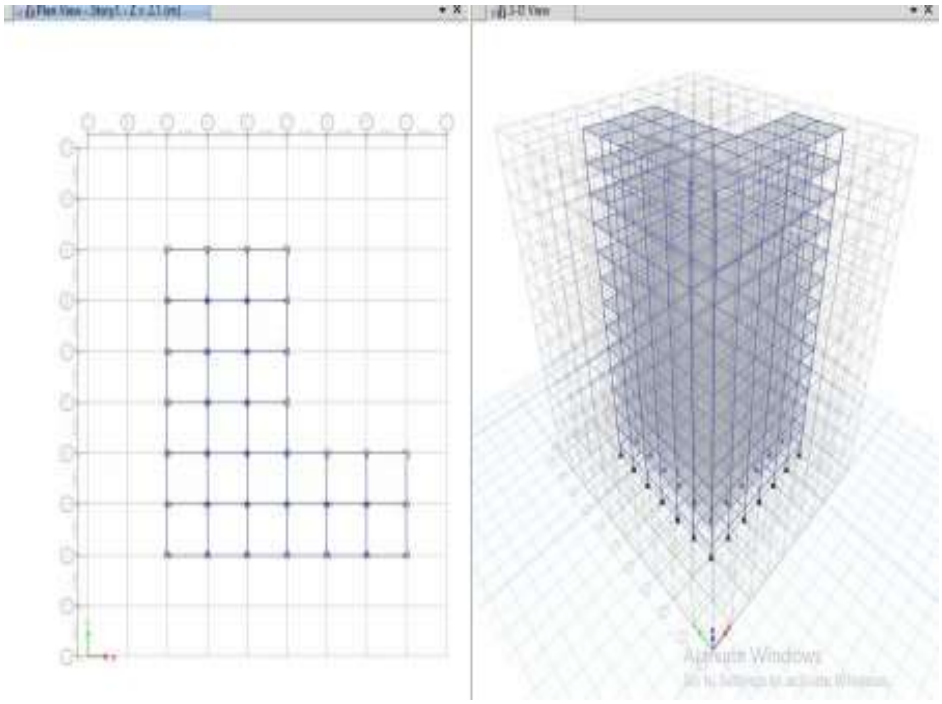

Figure 1: Showing Model of RCC building with special shape columns

III. RESULTS:

The two RCC structures or models of unsymmetrical shape of the buildings and also the different shapes and sizes of columns were taken into considereration for design and analysis. G+12 storey buildings were taken and is applied for the analysis by using ETABS 2016 Software under seismic and other various load combinations.

The results obtained after analyzing the respective models in terms of displacements, story drifts and base shear, story stiffness are as follows:

Comparison between the rectangular shaped column structure and specially shaped of column structure of RCC structures is shown below with the respective tables:

Table 3: Showing results of RCC Structure of rectangular shaped columns

SR.NO	LOADS	DISPLACEMENTS	STORY STIFFNESS	BASE SHEAR
1.	EQX	37.14mm	214707.38KN/M	1371.04KN
2.	EQY	46.83mm	139820.79KN/M	931.64KN
3.	WLX	37.03mm		1621.14KN
4.	WLY	66.98mm		1621.14KN

Table 4: Showing results of RCC Structure of specially shaped columns

SR.NO	LOADS	DISPLACEMENTS	STORY STIFFNESS	BASE SHEAR
1.	EQX	28.16mm	139865.08KN/M	601.60KN

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2.	EQY	28.26mm	137308.23KN /M	601.60K N
3.	WLX	62.64mm		1621.14 KN
4.	WLY	69.12mm		1621.14 KN

These are the results obtained after the increase in percentage of steel by 0.91% in both the models

Table 3: Showing results of RCC Structure of rectangular shaped columns

SR.NO	LOADS	DISPLACEMENTS	STORY STIFFNESS	BASE SHEAR
1.	EQX	37.58mm	196869.65KN/M	1288.90KN
2.	EQY	47.45mm	127822.95KN/M	870.28KN
3.	WLX	39.81mm		1621.14KN
4.	WLY	37.30mm		1621.14KN

Table 4: Showing results of RCC Structure of specially shaped columns

SR.NO	LOADS	DISPLACEMENTS	STORY STIFFNESS	BASE SHEAR
1.	EQX	48.79mm	128469.27KN/M	909.05KN
2.	EQY	48.18mm	126005.91KN/M	910.49KN
3.	WLX	71.81mm		1621.14KN
4.	WLY	79.20mm		1621.14KN

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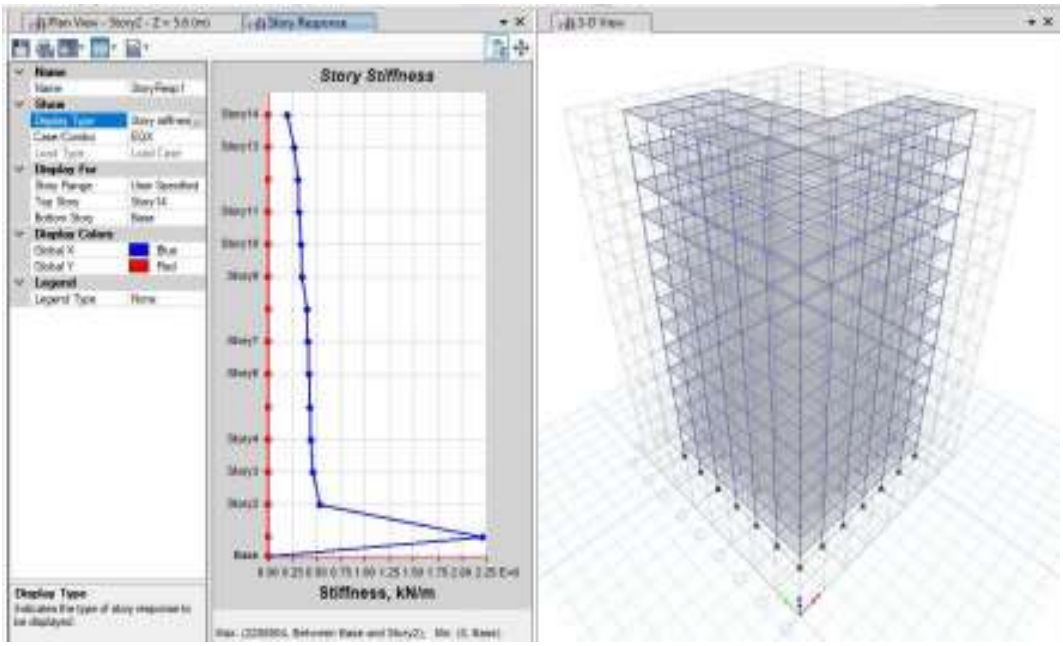

Figure 3: Graph showing story stiffness of rectangular column for EQX

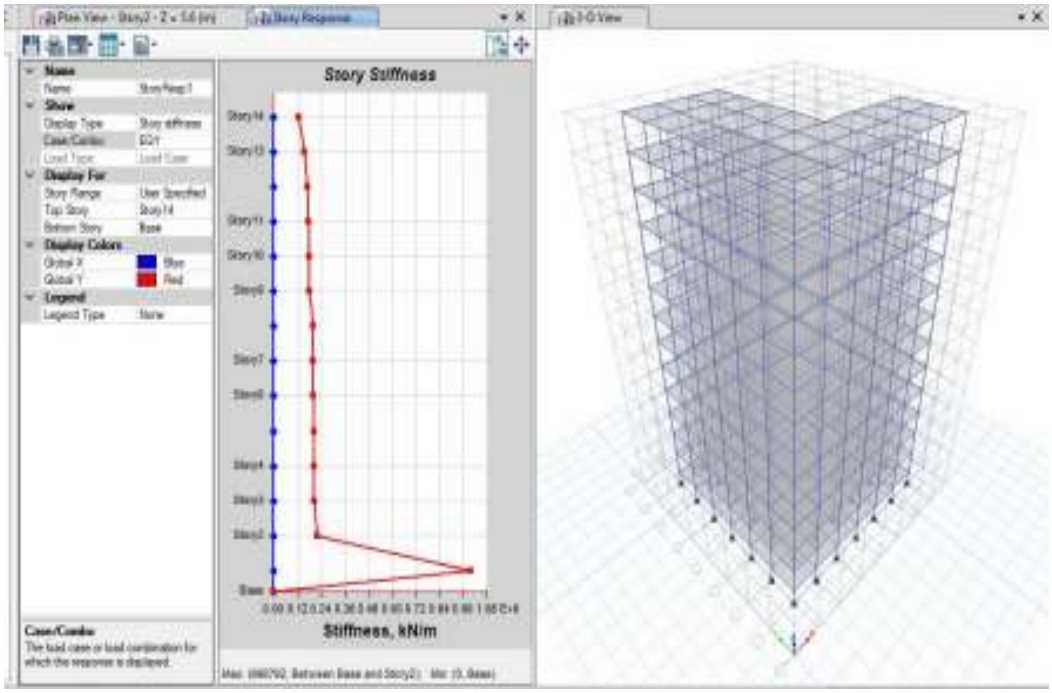

Figure 4: Graph showing story stiffness of rectangular column for EQY

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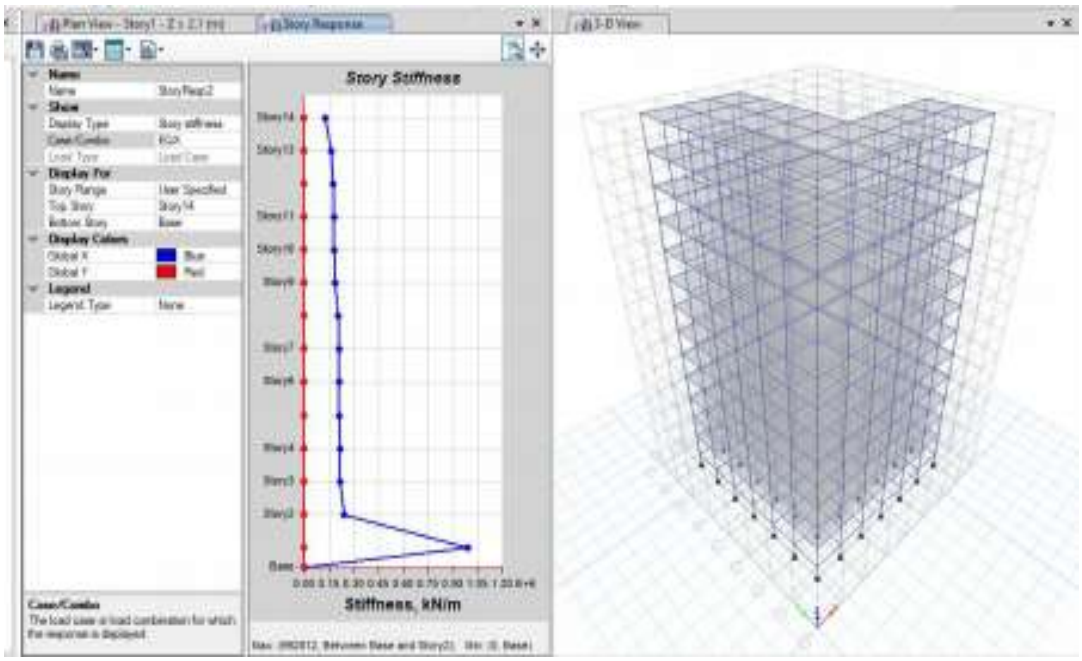

Figure 5: Graph showing story stiffness of special shaped columns for EQX

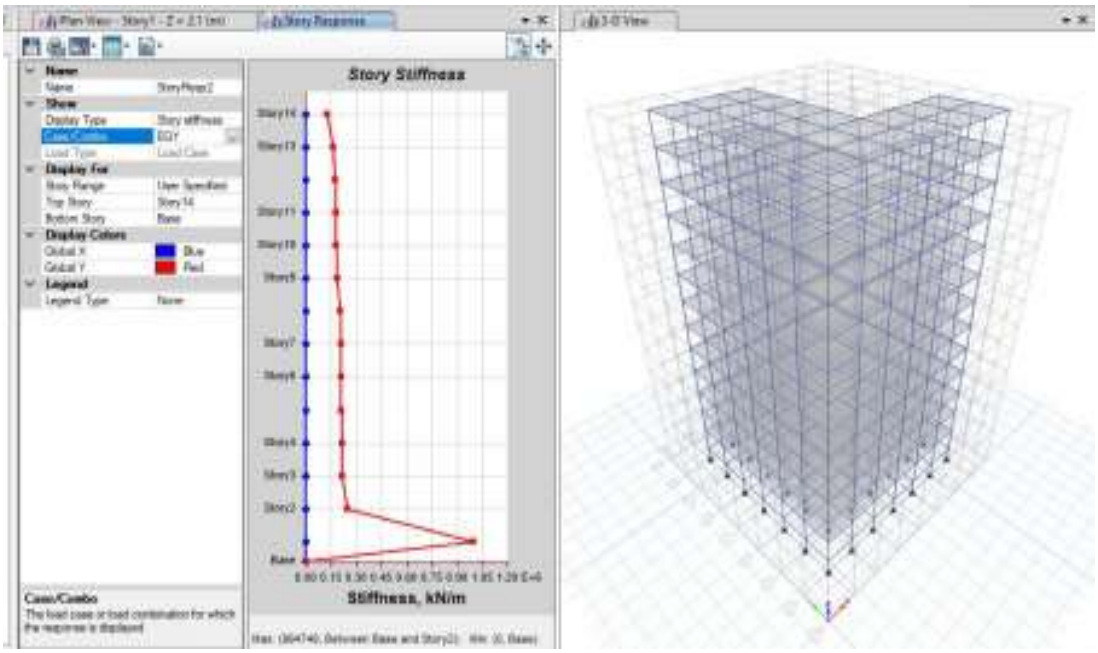

Figure 6: Graph showing story stiffness of special shaped column for EQY

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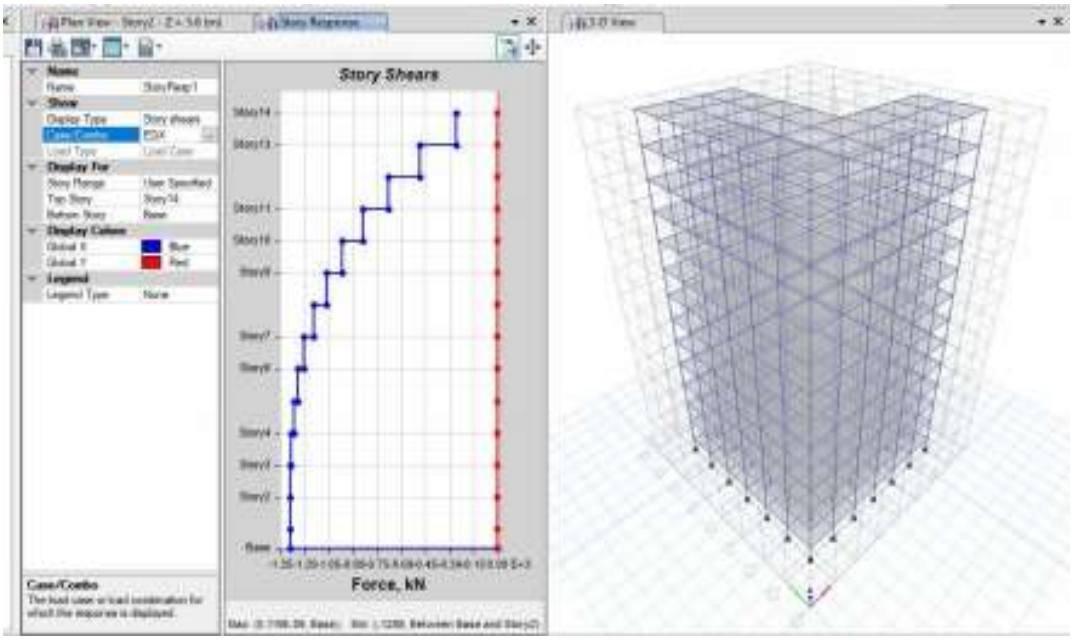

Figure 7: Graph showing story base shear of rectangular column for EQX

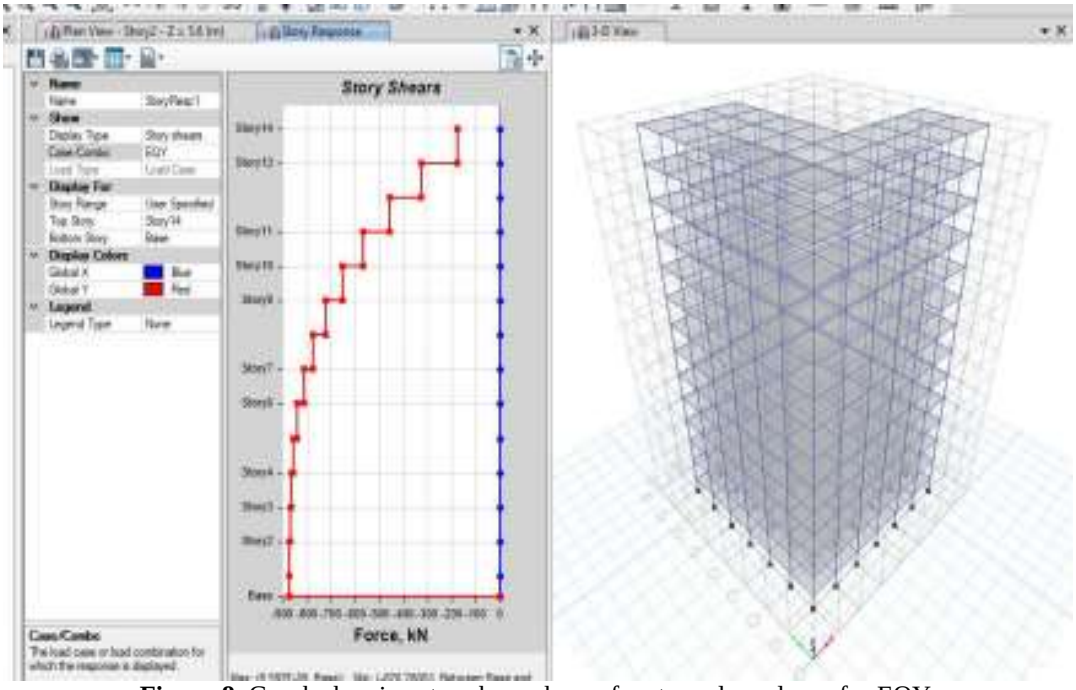

Figure 8: Graph showing story base shear of rectangular column for EQY

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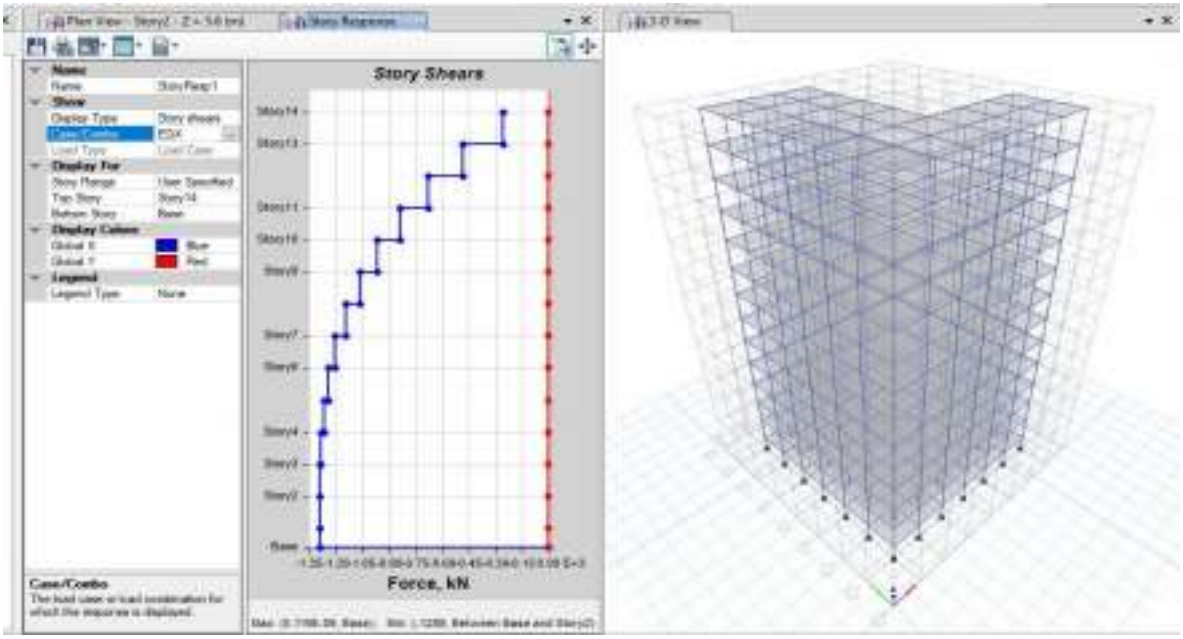

Figure 7: Graph showing story base shear of rectangular column for EQX

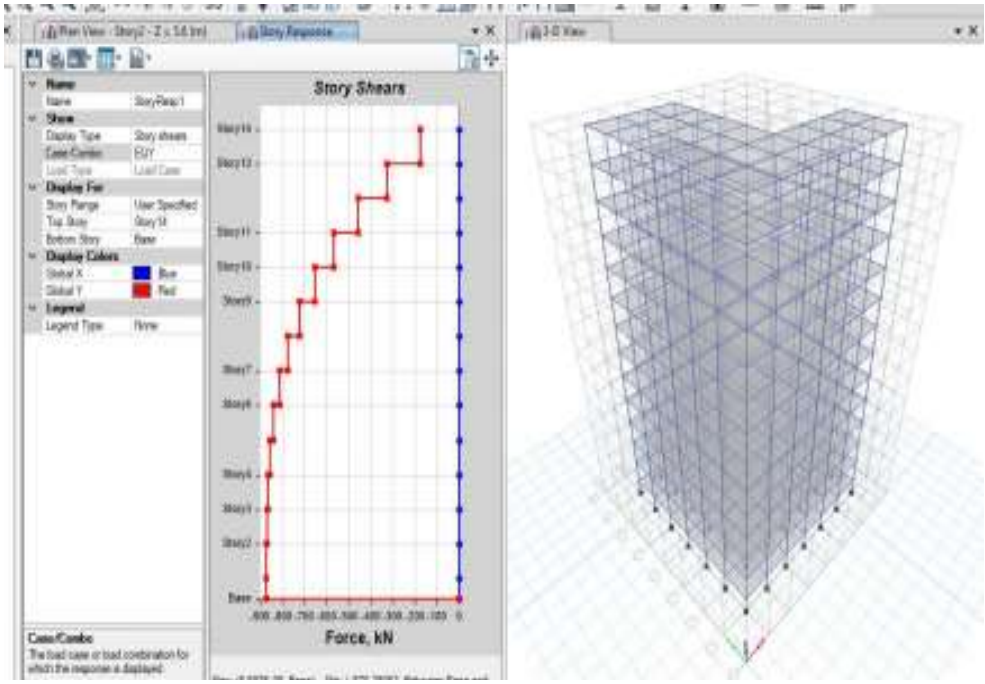

Figure 8: Graph showing story base shear of rectangular column for EQY

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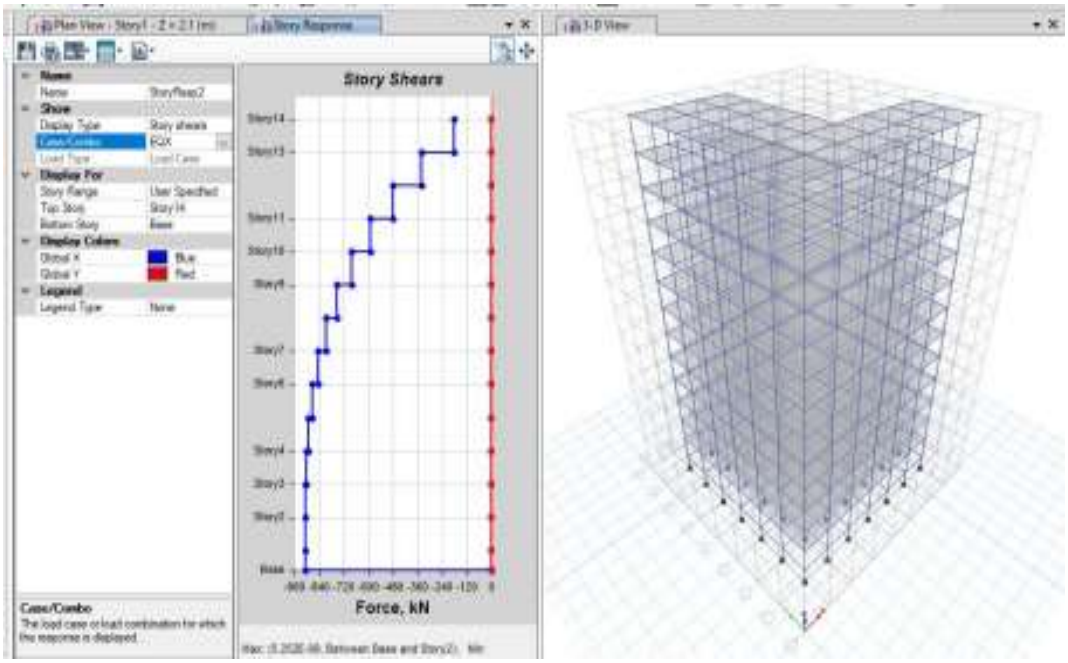

Figure 9: Graph showing base shear of special shape columns for EQX

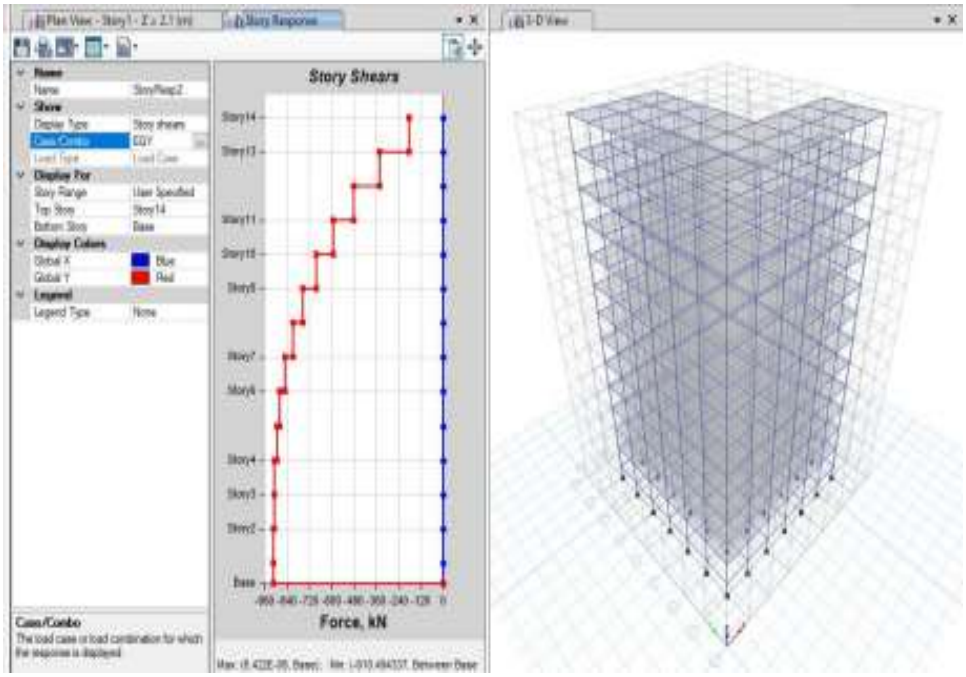

Figure 10: Graph showing base shear of special shape columns for EQY

IV. CONCLUSION

From above analysis, it is observed that in G+12 buildings, Specially shaped columns in R.C. structure give minimum displacement and minimum drift than Rectangular columns in R.C. structure.

1] As per analysis, it is concluded that displacement at every story in Special shaped column structures is less than Rectangular column structures.

2]As per analysis, it is concluded that stiffness at every story in Special shaped column structures is less than Rectangular column structures.

3] More carpet area will be available to use in Specially shaped columns in R.C. structure than Rectangular columns in R.C. structure.

4] Specially shaped columns give more usable floor area at the corners in rooms as compared to

rectangular columns in R.C. structure.

5] No obstruction will be created by the offset of columns in case of Specially shaped column structures.

Changes are observed after increasing percentage of steel by 0.91%

6] Increase in percentage of steel exceptionally controlled the displacements in rectangular columns as well as special shaped columns.

7] Base shear and stiffness reduces due to increase in percentage of steel.

It is concluded that building with Specially shaped columns is constructed in lower cost as compare to building with Rectangular columns. Also increase in % of steel affects the behaviour of the structure under seismic loads and other various loads, but the cost of construction increases due to increase in percentage of steel and proves to be uneconomical.

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