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The Seismic Analysis of Multi Storied Building with Shear Walls of Different Shapes in all Zones

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Abstract: **A shear wall is a wall that used to resist the shear, produce due to lateral forces. Shear walls are added to that Building interior to provide more strength, stiffness to building when the exterior walls cannot provide sufficient strength and stiffness. It is necessary to find out that effective shape of shear wall. These present work deals with a study on improvement of shape of shear walls in symmetrical high rise building. In symmetrical buildings, center of gravity and center of rigidity coincide, so that shear walls are placed symmetrically. In these work a high rise building with different shapes of shear walls is considered for analysis. The multi store building with G+14 storey's are analyzed for storey drift story displacement and base shear using ETABS software. For the analysis of these building for seismic loading with all Zones (Zone-II, III, and IV & V) is considered. The analysis of these building is done by using dynamic method (Response spectrum analysis). The useful of shear walls in the structural planning of multistory buildings has long been recognized. When walls are situated in the advantageous positions in a building, they can be the very efficient in resisting lateral loads originating from wind or earthquakes etc. Reinforced concrete framed buildings are adequate for the resisting both vertical and horizontal loads acting on them of buildings. Extensive research has been done in the design and analysis of shear wall in high-rise buildings. However, significance of shear wall in high-rise irregular or unsymmetrical structures is not much discussed in literature.**

Keywords: Shear wall, ETABS,

I.INTRODUCTION

Adequate stiffness is to ensured in high rise buildings for resistance to lateral loads induced by wind or seismic events. Reinforced concrete shear walls are designed for buildings located in the seismic areas, because of their high bearing capacity, high ductility and rigidity etc. In high rise buildings, beam and column dimensions work out large and heavy reinforcement at the beam-column joins are quite heavy, so that, there is lot of clogging at these joints, it is difficult to place and vibrate concrete at these places which does not contribute to the safety of the buildings. These practical difficulties call for the introduction of shear walls in High rise buildings. Buildings engineered with structural walls are almost always stiffer and then framed structures, reducing the possibility of the excessive deformation and hence damage. RC multi storied buildings are adequate for the resisting both the vertical and horizontal load.

II. DIFFERENT SHAPES OF SHEAR WALLS

The shape and location of the shear wall have significant effect on the structural behavior under lateral loads. Lateral loads are distributed through the structure acting as the horizontal diaphragm, to the shear walls, parallel to the force of the action. The core eccentrically located with respect to the building shapes has to carry out torsion as well as bending and direct shear. These shear wall resist horizontal forces because their high rigidity as deep beams, reacting to shear and flexure against the overturning. The Shear Wall shapes used in this work are,

(a) U – Section
(b) W – Section
(c) H – Section
(d) T – Section

III. MODELLING OF BUILDING

Here the study is carried out for the behavior of G+14 and building with shear walls of four different shapes in all zones. The general software ETABS has been used for the modeling. It is more user friendly and versatile program that offers the wide scope of the features like static and dynamic analysis, non- linear dynamic analysis and non-linear static pushover analysis, etc.

Building Plan And Dimension Details

Table below shows the details of building.

Table 1 Building deatails

Total height of building	45 m and 90 m
No. of stories	15 and 30
Height of each storey	3 m
Grade of concrete	M30
Grade of steel	Fe415
Depth of slab	150 mm
Size of beams	400 X 600 mm
Size of columns	800 X 800 mm
Shear wall thickness	230 mm
Plan area	720 m^2

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IV. OBJECTIVES

- ✓ To analyse the seismic behaviour of the symmetrical multistoried building(G+14) with shear walls of different shapes using dynamic analysis.
- ✓ To find the effective shape of the shear wall and to compare the seismic analysis of the multi storied building with shear wall in two different zone(zone II, zone III, zone IV, and zone V).

V. BUILDING MODELS WITH SHEAR WALLS

a) The Symmetrical Rc Building With H Shaped Shear Wall

The figure below shows the model of an I shaped RC symmetrical building with the H shaped shear wall.

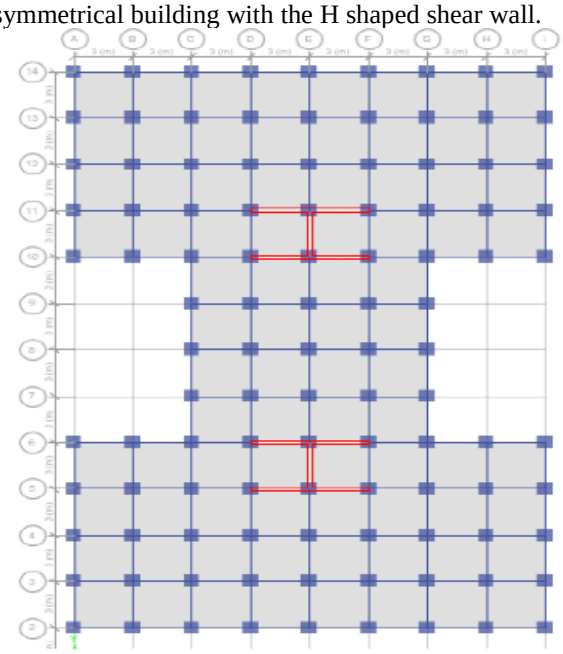

Figure 1: Plan view of building with H shaped shear wall

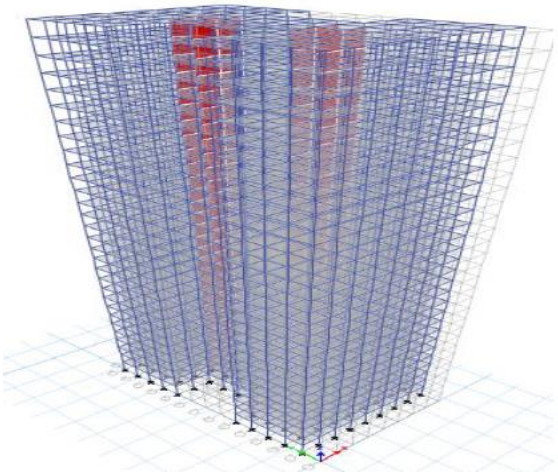

Figure 2: 3D view of building with H shaped shear wall

b) The Symmetrical Rc Building With T Shaped Shear Wall

The figure below shows the model of an I shaped RC symmetrical building with the T shaped shear wall.

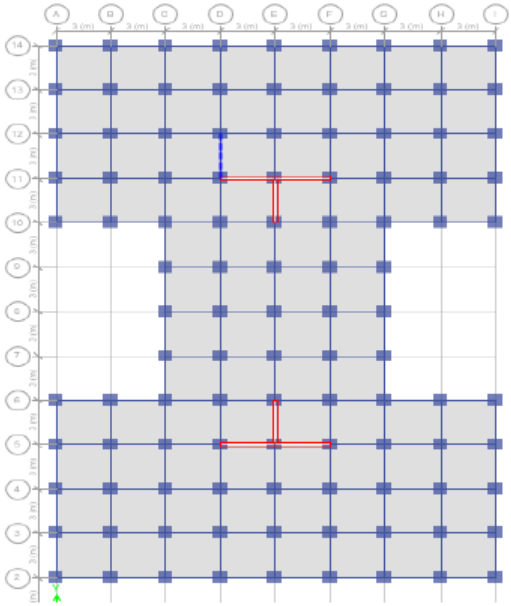

Figure 3: Plan view of building with T shaped shear wall

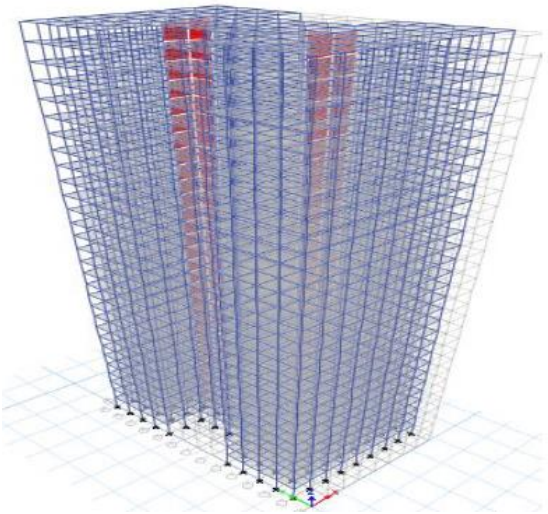

Figure 4: 3D view of building with T shaped shear wall

c) The Symmetrical Rc Building With W Shaped Shear Wall

The figure below shows the model of an I shaped RC symmetrical building with the W shaped shear wall.

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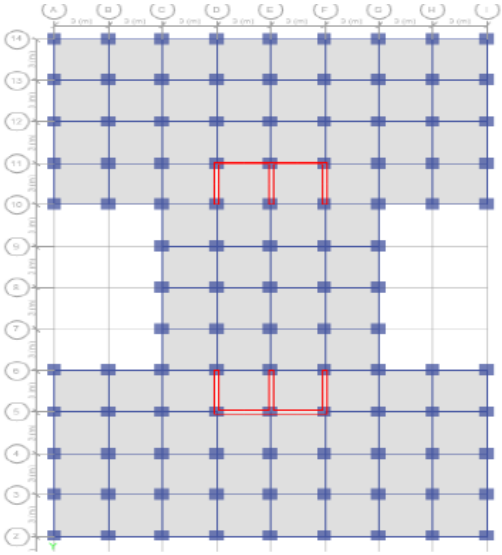

Figure 5: Plan view of building with W shaped shear wall

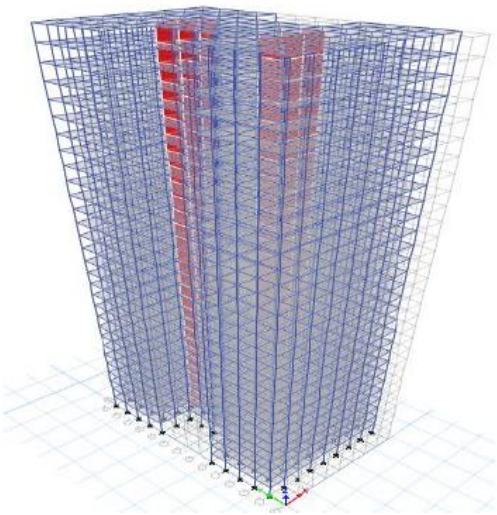

Figure 6: 3D view of building with W shaped shear wall

d) The Symmetrical Rc Building With U Shaped Shear Wall

The figure below shows the model of an I shaped RC symmetrical building with the U shaped shear wall.

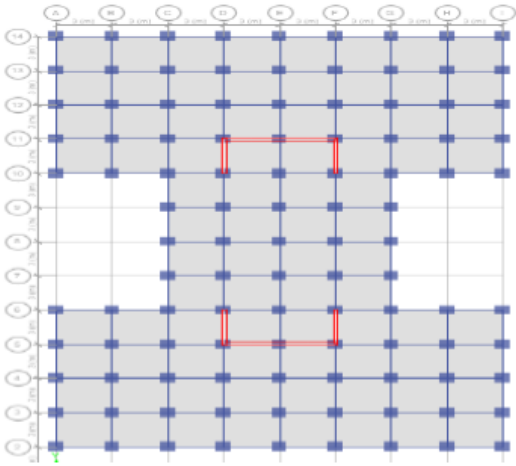

Figure 7: Plan view of building with U shaped shear wall

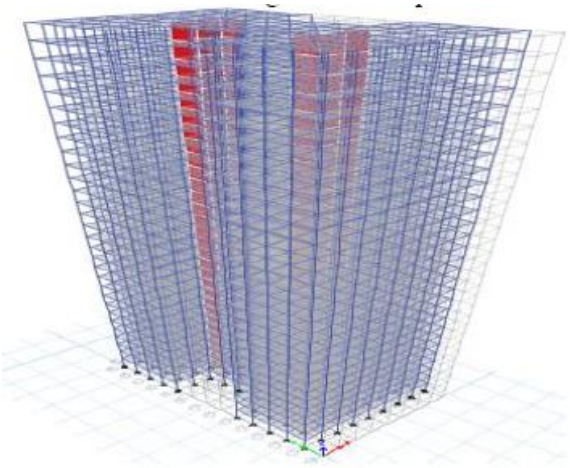

Figure 8: 3D view of building with U shaped shear wall

e) LOAD FORMULATION

In the present project works following loads are considered for the analysis. Dead Loads (IS- 875 PART 1) and Live Loads (IS 875 PART 2).

In addition to the above mentioned loads and dynamic loads in form of the Response Spectrum method are also be assigned.

- ✓ **Dead load**

Dead load intensity is = 1.5 kN/m2

- ✓ **Live load**

Live Load Intensity is = 4kN/m2

- ✓ **Wall weight**

Wall weight is = 13.8 kN/m

f) ANALYSIS

The three dimensional reinforced concrete structures were analyzed by the Response Spectrum Analysis using ETABS software. It is a linear dynamic statistical analysis method to indicate the likely maximum seismic response of the elastic structure. The plot of the peak acceleration for the mixed vertical oscillators. A response spectrum is simply a plot of the peak and steady-state response (displacement, velocity or acceleration) of a series of oscillators of varying natural frequency that are forced into motion by the same base vibration or shock.The analysis results will show in the performance levels, behaviour of the structures.

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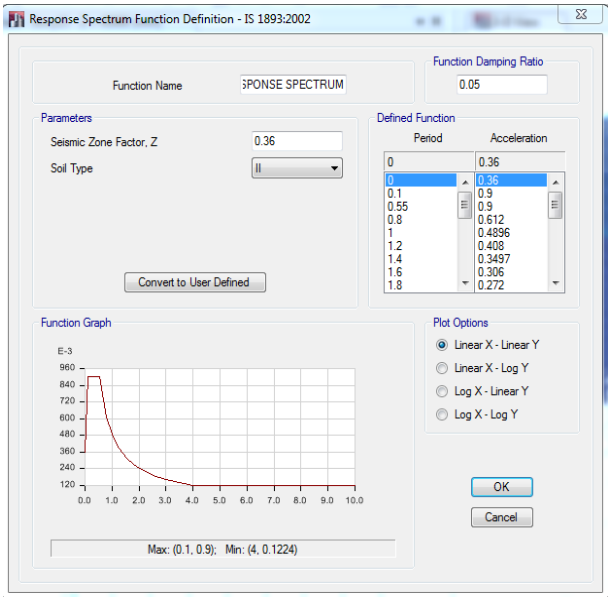

Figure 9: Response sprectrum analysis using E-Tabs

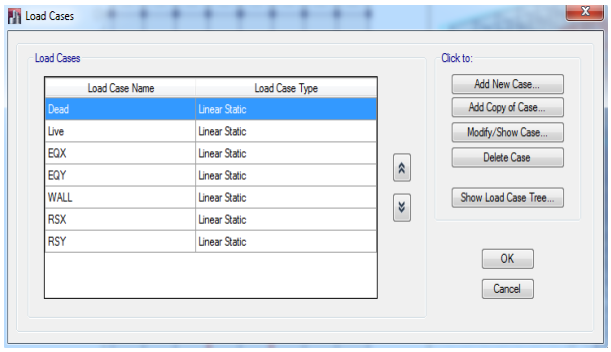

Figure 10: Load cases

VI. COMPARISON OF RESULTS

ZONES		RSX	RSY
II	Displacement	14.421	15.548
	Drift	0.000048	0.000103
	Shear	5904	5123
III	Displacement	15.564	17.725
	Drift	0.000078	0.000125
	Shear	12545	12538
IV	Displacement	16.364	17.798
	Drift	0.000185	0.000245
	Shear	24325	24396
V	Displacement	17.065	18.965
	Drift	0.000236	0.000258
	Shear	26432	26456

Table 1: H-Shaped shear wall Response Spectrum Values

ZONES		RSX	RSY
II	Displacement	7.715	8.740
	Drift	0.000043	0.000116
	Shear	7345	6326
III	Displacement	9.324	9.960
	Drift	0.000145	0.000186
	Shear	12325	9548
IV	Displacement	27.774	31.466
	Drift	0.000236	0.000325
	Shear	12651	10614
V	Displacement	28.765	33.456
	Drift	0.000345	0.000425
	Shear	26315	20358

Table 2: T-Shaped shear wall Response Spectrum Values

ZONES		RSX	RSY
II	Displacement	6.546	8.808
	Drift	0.000036	0.000101
	Shear	4223	3463
III	Displacement	7.562	8.945
	Drift	0.000052	0.000156
	Shear	12555	11348
IV	Displacement	21.456	25.325
	Drift	0.000105	0.000232
	Shear	13656	12896
V	Displacement	22.564	30.562
	Drift	0.000125	0.000356
	Shear	24536	24138

Table 3: W-Shaped shear wall Response Spectrum Values

ZONES		RSX	RSY
II	Displacement	6.509	8.321
	Drift	0.000036	0.000116
	Shear	4387	2349
III	Displacement	7.456	9.365
	Drift	0.000052	0.000165
	Shear	12632	10432
IV	Displacement	22.345	29.995
	Drift	0.000078	0.000196
	Shear	14106	12056
V	Displacement	23.564	30.567
	Drift	0.000125	0.000356
	Shear	26325	23548

Table 4: U-Shaped shear wall Response Spectrum Values

A. STOREY DISPLACEMENT

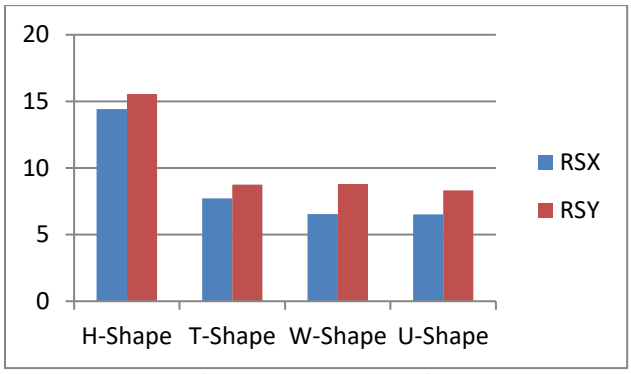

Figure 9: Variation of the storey displacement for G+14 building with different shape of shear wall in (zone II).

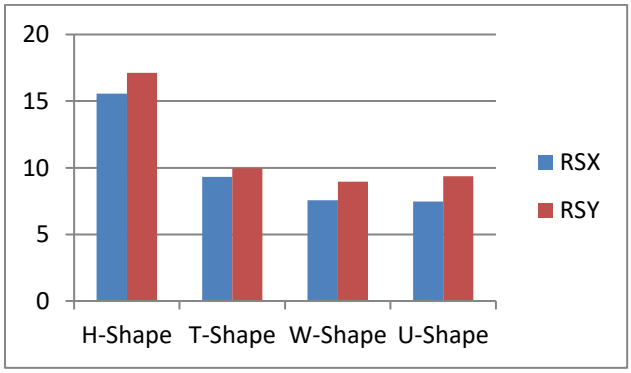

Figure 10: Variation of the storey displacement for G+14 building with different shape of shear wall in (zone III).

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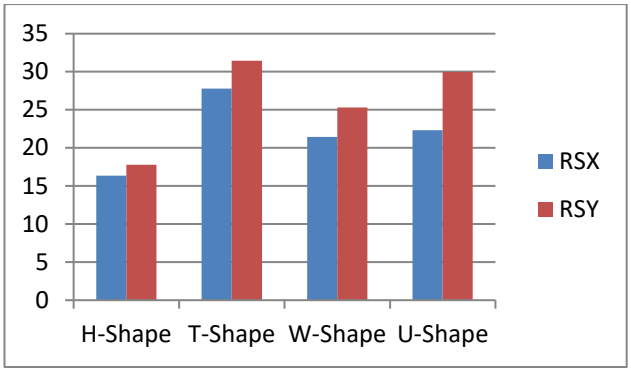

Figure 11: Variation of the storey displacement for G+14 building with different shape of shear wall in (zone IV).

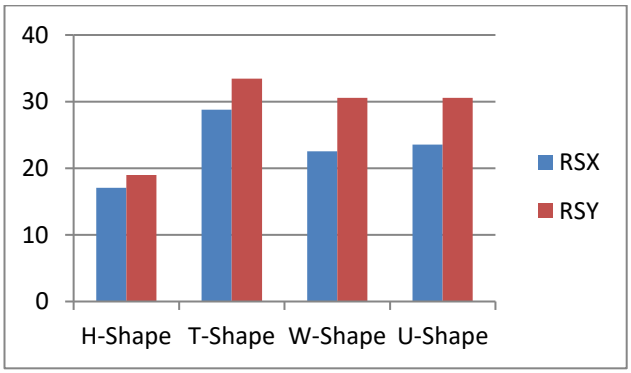

Figure 12: Variation of the storey displacement for G+14 building with different shape of shear wall in (zone V).

B. STOREY DRIFT

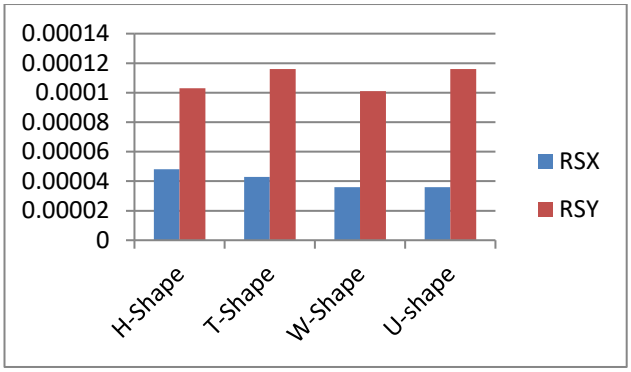

Figure 13: Variation of the storey drift for G+14 building with different shape of shear wall in (zone II).

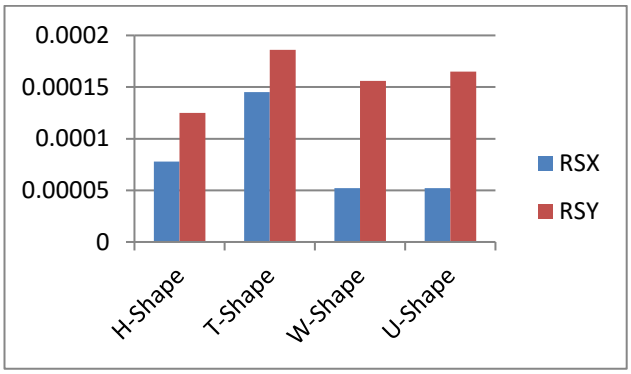

Figure 14: Variation of the storey drift for G+14 building with different shape of shear wall in (zone III).

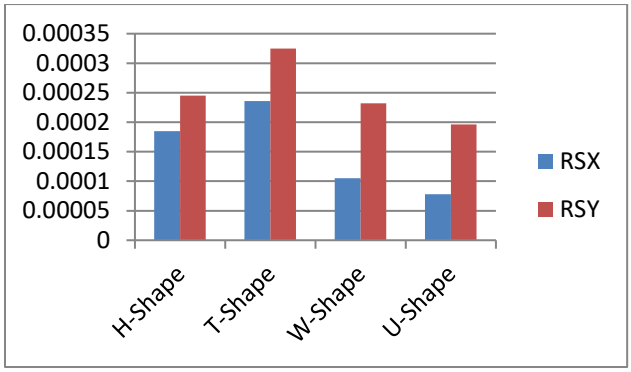

Figure 15: Variation of the storey drift for G+14 building with different shape of shear wall in (zone IV).

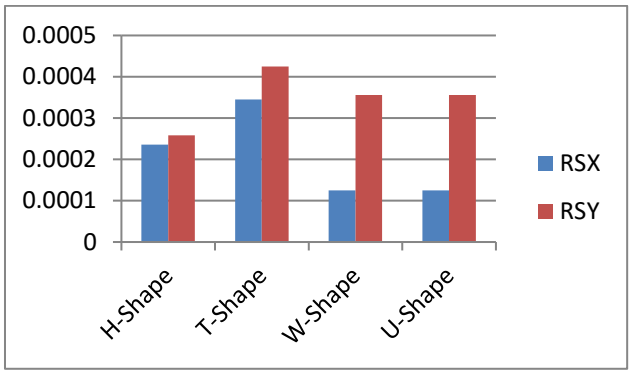

Figure 16: Variation of the storey drift for G+14 building with different shape of shear wall in (zone V).

C. STOREY SHEAR

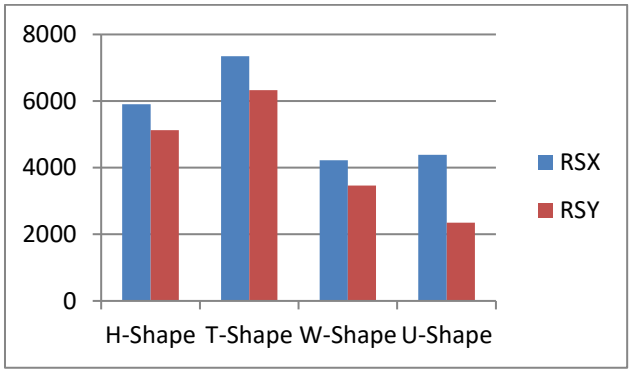

Figure 17: Variation of the storey Shear for G+14 building with different shape of shear wall in (zone II).

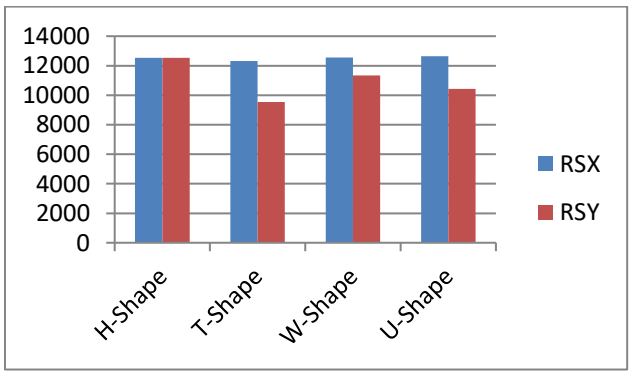

Figure 18: Variation of the storey Shear for G+14 building with different shape of shear wall in (zone III).

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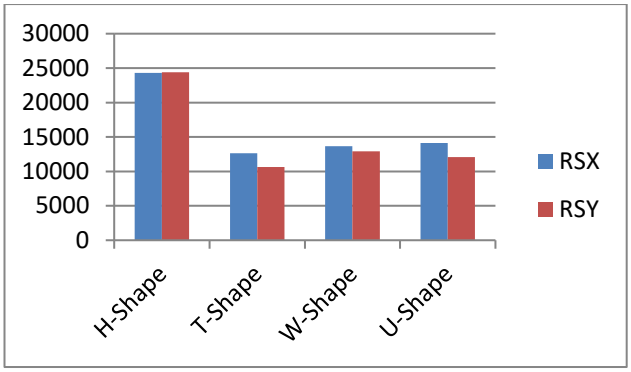

Figure 19: Variation of the storey Shear for G+14 building with different shape of shear wall in (zone IV).

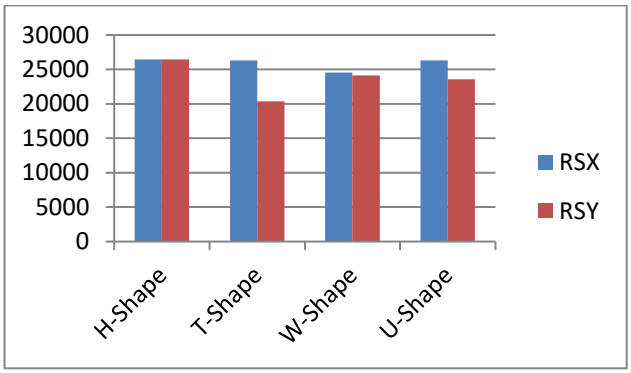

Figure 20: Variation of the storey Shear for G+14 building with different shape of shear wall in (zone V).

VII. CONCLUSION

In the present study, an attempt is made to the study of seismic behavior of the building with shear walls of four different Shapes in all zones comparing. First part of the study included the dynamic analysis of Building. The storey drift, story displacement and base shear will be obtained and comparative table of these results for all the shapes of shear wall will be presented and also comparison of shapes of shear walls in different zones like zone-II, III, IV, V needs to be executed.

Graphical representation of the storey drift, storey displacement and base shear values are shown in figure. The results indicated that W and U shaped shear wall shows better performance than others based on the storey drift and base shear values. In Y direction H shape is better according to the storey drift and T shape is better according to base shear value. Graphical representation of storey drift, storey displacement and base shear values are shown in the figure. The results indicated that W and U shaped shear wall shows better performance than others based on the storey drift and base shear values. In Y direction H shape is better according to storey drift and T shape is better according to base shear value. Graphical representation of the storey drift, storey displacement and base shear values are shown in figure below. The results indicated that, in terms of storey drift W and H shaped shear wall is good in X and Y direction. According to base shear values T shaped shear wall is good in both the X and Y direction. Graphical representation of storey drift, storey displacement and base shear values are shown in the figure below. The results indicated that, in terms of storey drift W and H shaped shear wall is good in the X and Y direction. According to base shear values T shaped shear wall is good in the both X and Y direction.

- ✓ On the basis of the storey drift, storey displacement and base shear value G+14 building with W and U shaped shear wall shows better performance (X - direction) in both zone V and III.
- ✓ G+14 building with H shaped shear wall is good in terms of the storey drift (Y – direction) in zone V and III.
- ✓ G+14 building with T shaped shear wall is good in terms of the base shear (Y – direction) in zone and III.
- ✓ In overall H-shape and W-shape shear walls are shows better performance in drift, displacement and shear.
- ✓ There is no change in better shape of shear wall in both zones.

VIII. FUTURE SCOPE

- ✓ Further study can be carried out by the changing the position of shear wall.
- ✓ This work can be extended to do the analysis for un-symmetrical buildings.
- ✓ This work also extended to do the push over analysis structures.This work also extended to do the analysis for changing of size, thickness.

REFERENCES

[1] Dr. E Arunakanth(2014), "Optimum Location of Different Shapes of Shear Walls in Unsymmetrical High Rise Buildings". *International Journal of Engineering Research & Technology (IJERT)*, Vol. 3 Issue 9, September- 2014.

[2] Dr. Laju Kottalil et al (2014) "Effect of shear wall location in buildings subjected to seismic loads". *IOSI Journal of engineering and computer science*, Volume 1 Issue 1.

[3] T. Anil Kumar Reddy et (2014), "Seismic Analysis of Multi-Storied Building with Shear Walls Using ETABS-2013". *International Journal of Science and Research (IJSR)*,volume 1,2013.

[4] Dr. P. S. Pajgade et (2013), "Seismic Analysis of RCC Building with and Without Shear Wall". *International Journal of Modern Engineering Research (IJMER)* Vol. 3, Issue. 3, May - June 2013.

[5] P.Kalpana et (2016)," Analysis Of Building With And With Out Shear Wall At Various Heights And Variation Of Zone III And Zone V". *Int. Journal of Engineering Research and Application ISSN* : 2248-9622, Vol. 6, Issue 12, (Part -2) December 2016, pp.05-11

[6] Abhay Guleria et (2014)," Structural Analysis of a Multi-Storeyed Building using ETABS for different Plan Configurations". *International Journal of Engineering Research & Technology (IJERT)ISSN*: 2278-0181,Vol. 3 Issue 5, May – 2014

[7] M.Pavani, G.Nagesh Kumar et (2015)," Shear Wall Analysis and Design Optimization In Case of High Rise Buildings Using Etabs". *International Journal of Scientific & Engineering research*, volume 6, issue 1, january-2015

[8] Anshuman. S, Dipendu Bhuia, Bhavin Ramjiyani,"Solution of shear wall location in multistory building", International journal of civil and structural engineering, 2011.

[9] Alfa Rasikan, M G Rajendrann,"Wind behavior of buildings with and without shear wall", International Journal of Engineering Research and Applications. Vol. 3, Issue 2, pp. 480-485, 2013.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 07, July-2019

[10] Himalee Rahangdale, S.R.Satonee,"Design and analysis of multi-storied building with effect of shear wall", International journal of engineering research and application", Vol. 3, Issue 3, pp. 223-232, 2013.

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