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# Comparative Study of Multi-Storied RCC Structure under Seismic Effect Having Different Aspect Ratio by Using Etab

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**ABSTRACT:** Construction is a most important part of every developing country. Seismic forces are one of the major natural forces causing huge damage to lives and economy. The aspect ratio of a geometric shape is the ratio of its sizes in different dimensions. For example, the aspect ratio of a rectangle is the ratio of its longer side to its shorter side – the ratio of width to height, when the rectangle is oriented as a "landscape". The aspect ratio of a building is one of the most important determinants of energy efficiency. It defines the building surface area by which heat is transferred between the interior and exterior environment. The present study emphasizes on comparative analysis and design of multi storey building under earthquake with considerations of aspect ratio, by using IS-456, IS-1893, IS-875. To analyze the building for different vertical aspect ratios by using IS 1893 and IS 875 Code. To define the most efficient Vertical Aspect ratio for different story height which can provide seismic force by observing the comparative studies for various soil conditions. The behavior of each model with respect to others is checked for Base Shear ( $V_B$ ), Time Period, Story Drift and Story Displacement ( $\delta$ ) at each and every storey are carried out for seismic forces. To study the effect of shape and size of the building in plan on the behavior of the structure for various soil conditions for different storey height.

**KEYWORDS:** RCC Building, IS-1893, E-tab software Base Shear, Lateral storey drift, Displacement, Model time period.

## I. INTRODUCTION

The responsibilities of structural engineer today have a to understand both of the static and dynamic loading and the structures that should be resist them. The convolution of modern structures will required a enormous knowledge of creativity from the structure engineer in order to ensure that the structure should withstand the loads. An aspect ratio describes the relationship of an object's width to its height. It is commonly used in computing to describe the proportions of a rectangular. The aspect ratio of a geometric shape is the ratio of its sizes in different dimensions. The length divided by width of a building is termed as its Aspect Ratio and the ratio of height to least lateral dimension of a building is termed as its Slenderness Ratio. As building storey increase proportionally the base moment and base shear is goes increase. More slenderness buildings are higher vulnerable than any other buildings when it affect by any seismic forces. Since base moment increases the axial forces in building components so it has become very important parameter to check whether the building is slender or not. Whether the building is slender or not the most important thing is buildings or any other structures should be construct earthquake resistive and stiff against seismic force. The symmetry and regularity are usually recommended for a sound design of earthquake resistant structure.

## II. METHODOLOGY

Research papers on response of buildings (regular or irregular configuration) under seismic loading, Importance of Indian seismic design codes and their introduction in brief. Discussion about Building configuration. Literature based on behavior of structure under Seismic condition. In present research we have used different model of Multi-Storeyed Building frames considering different geometrical plan configurations based on different aspect ratios under earthquake forces. 2. Model the structure in E-TABS 3. Seismic analysis is done as per IS1893-2016. 4. Running the model in E-TABS. 5. Obtaining seismic parameters like model time period, base shear, lateral drift and displacement. 5. Observation and comparison of result. 6. Conclusion

## III. STRUCTURAL MODELLING

In this study, structure will be model for the following cases: 1. 18, 29 and 38 storeyed building 2. To analyze the building for different vertical aspect ratios by using IS 1893 and IS 875 Code. 3. To define the most efficient Vertical Aspect ratio for different story height which can provide seismic force by observing the comparative studies for various soil conditions. 3. The behavior of each model with respect to others is checked for Base Shear ( $V_B$ ), Time Period, Story Drift and Story Displacement ( $\delta$ ) at each and every storey are carried out for seismic forces. 4. To study the effect of shape and size of the building in plan on the behavior of the structure for various soil conditions for different storey height.

## IV. PRELIMINARY DATA

Following are the data assumed for carrying out this study, 1. Length in X direction=17.15m. 2. Length in Y direction=30.36m. 3. Typical storey height=3m. 4. Ground storey height=3.5m. 5. No. of storey=14, 40. 5. Code- IS 1893 and IS 875.

Earthquake parameters considered:-

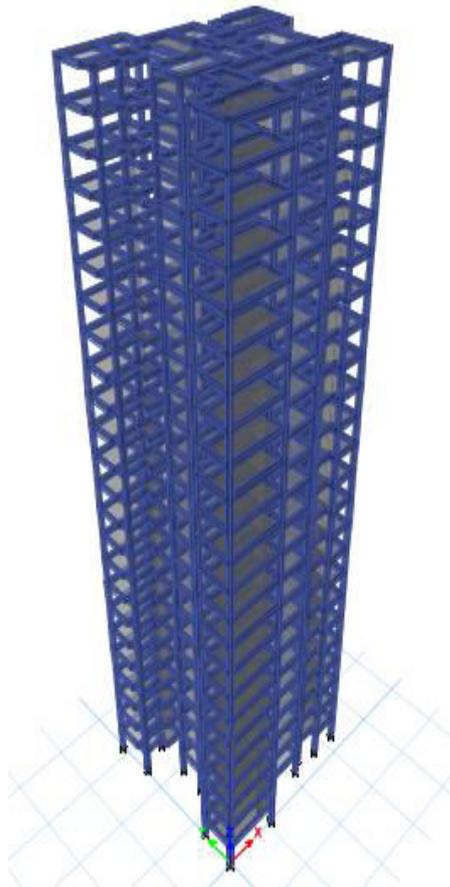
- |                      |               |
|----------------------|---------------|
| 1. Zone              | : III, IV & V |
| 2. Soil type         | : Medium soil |
| 3. Importance factor | : 1.5         |
| 4. Frame type        | : SRMF        |

The basic parameters considered for the Analysis and design:-

1. Slab depth: 120 mm thick : Assumed
2. Live load in floor area : 2 kN/sq m : As per IS 875 Part 2 (1987)
3. Live load in Balcony area: 2 kN/sq m : As per IS 875 Part 2 (1987)
4. Live load in passage area : 2 kN/sq m : As per IS 875 Part 2 (1987)
5. Live load in urinals : 2 kN/sq m : As per IS 875 Part 2 (1987)
6. Floor finish load : 1.5 kN/ sq m : As per IS 875 Part 1 (1987)

Codes used for analysis of the structure:-

- |                       |                       |
|-----------------------|-----------------------|
| 1. R.C.C. design      | : IS 456: 2000        |
| 2. Earthquake design  | : IS 1893: 2016       |
| 3. Code for Dead load | : IS 875: Part 1-1987 |
| 4. Code for Live load | : IS 875: Part 2-1987 |
| 5. Code for wind      | : IS 875: part 3-2015 |



3D Generated Model G+14



3D Generated Model G+40

## V.RESULTS AND DISCUSSION

### Results & Discussions

#### A) Model time periods

Table 01 Model time periods Details

Case Mode	G+14 (Low rise)		G+24 (Mid rise)		G40+(High rise)	
	Zone-III	Zone-V	Zone-III	Zone-V	Zone-III	Zone-V
1	2.375	2.375	3.208	3.208	9.3	9.3
2	2.18	2.18	2.868	2.868	8.245	8.245
3	2.169	2.169	2.753	2.753	7.744	7.744
4	0.799	0.799	1.02	1.02	2.953	2.953
5	0.751	0.751	0.946	0.946	2.695	2.695
6	0.745	0.745	0.919	0.919	2.628	2.628

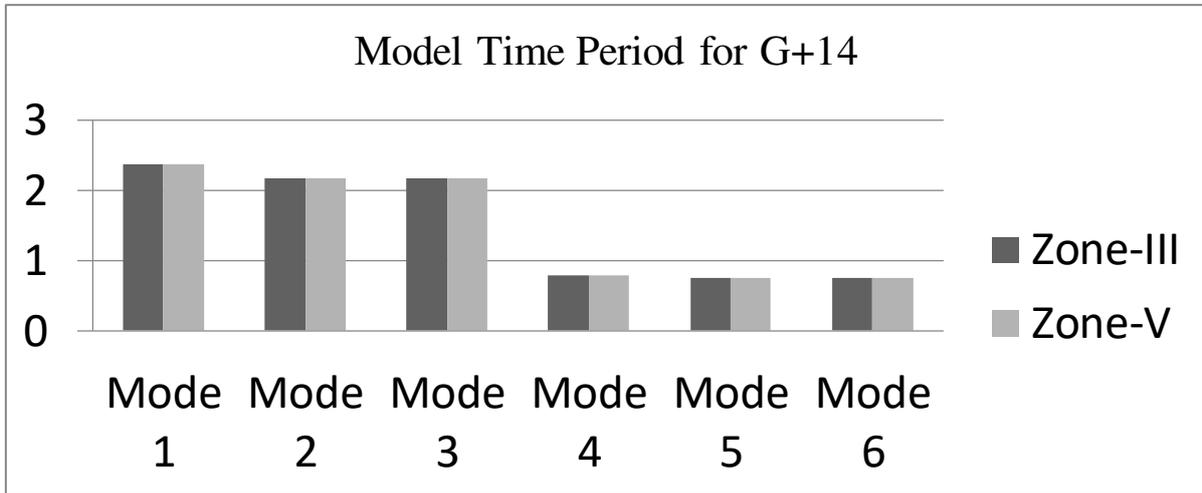


Fig 01 Model time periods Details for G+14 storey

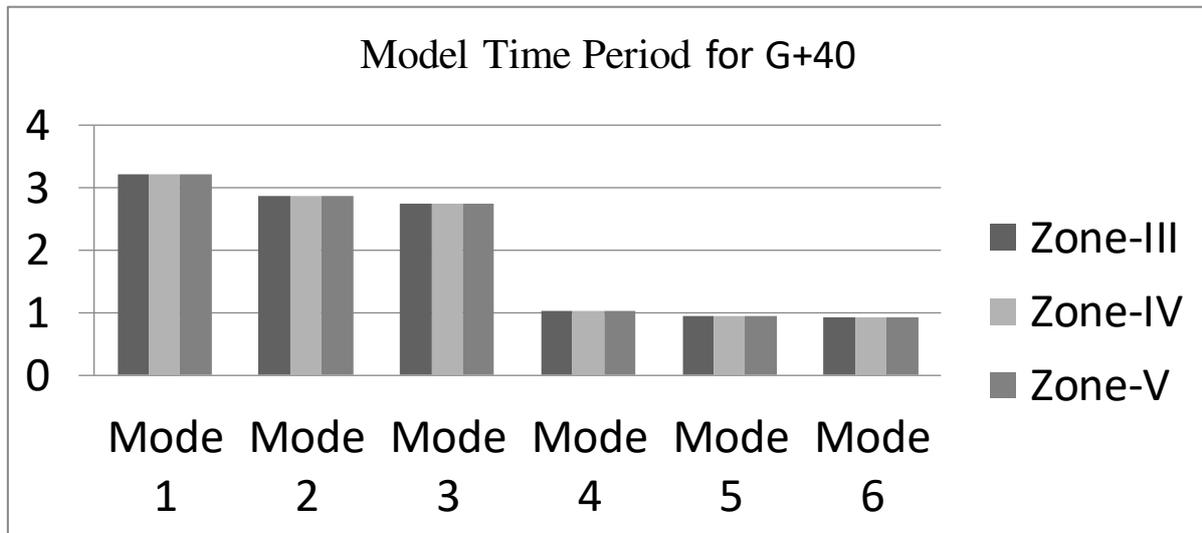


Fig 02 Model time periods Details for G+40 storey

**B] Base shears Details:**

**Table 02** – Base Shear Details for Static Condition in X and Y Direction

	G+14 (Low rise)		G+24 (Mid rise)		G40+(High rise)	
	Zone-III	Zone-V	Zone-III	Zone-V	Zone-III	Zone-V
Ex	846.57	1904.79	726.30	1634.18	2453.11	5519.52
Ey	823.83	1853.62	706.79	1590.27	2387.21	5371.23
Dx	816.14	816.145	540.85	540.854	1515.68	1515.68
Dy	767.08	767.082	477.24	477.245	1370.77	1370.77

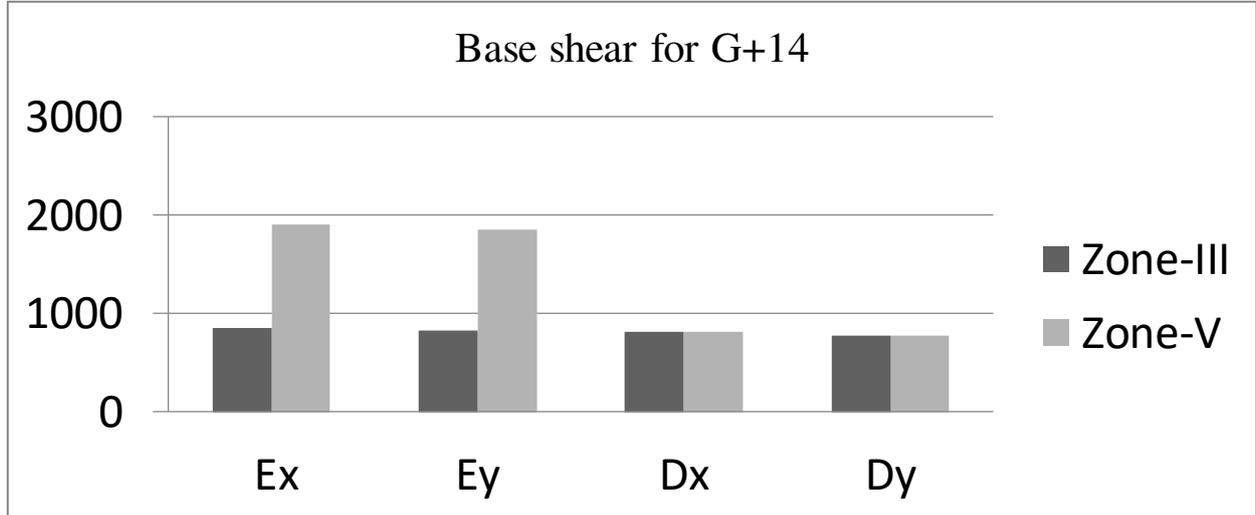


Fig 03 Base shear Details for G+ 14 storey

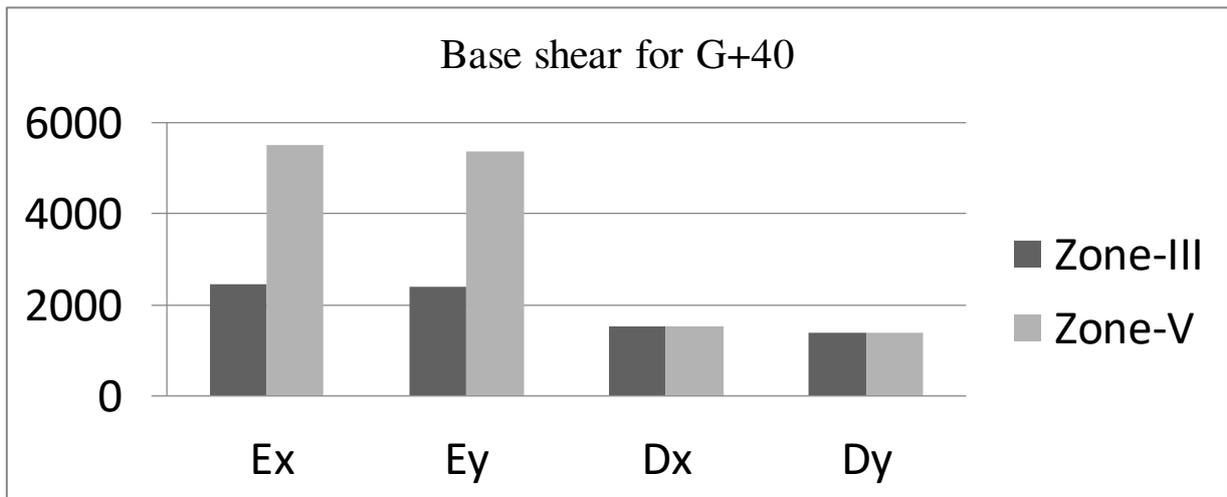


Fig 04 Base shear Details for G+ 40 storey

**C] Displacement Details**

Table 03 Displacement Details in X and Y Direction for Seismic Condition

Case	G+14 (Low rise)		G+24 (Mid rise)		G40+(High rise)	
	Zone-III	Zone-V	Zone-III	Zone-V	Zone-III	Zone-V
DL	0.012	0.012	0.014	0.014	0.097	0.097
LL	0.0026	0.00026	0.006	0.0069	0.014	0.014
Ex	0.846	0.100	0.0682	0.176	0.225	0.574
Ey	0.823	0.109	0.0831	0.211	0.282	0.709
Dx	0.816	0.028	0.036	0.036	0.226	0.226
Dy	0.767	0.030	0.047	0.047	0.341	0.341

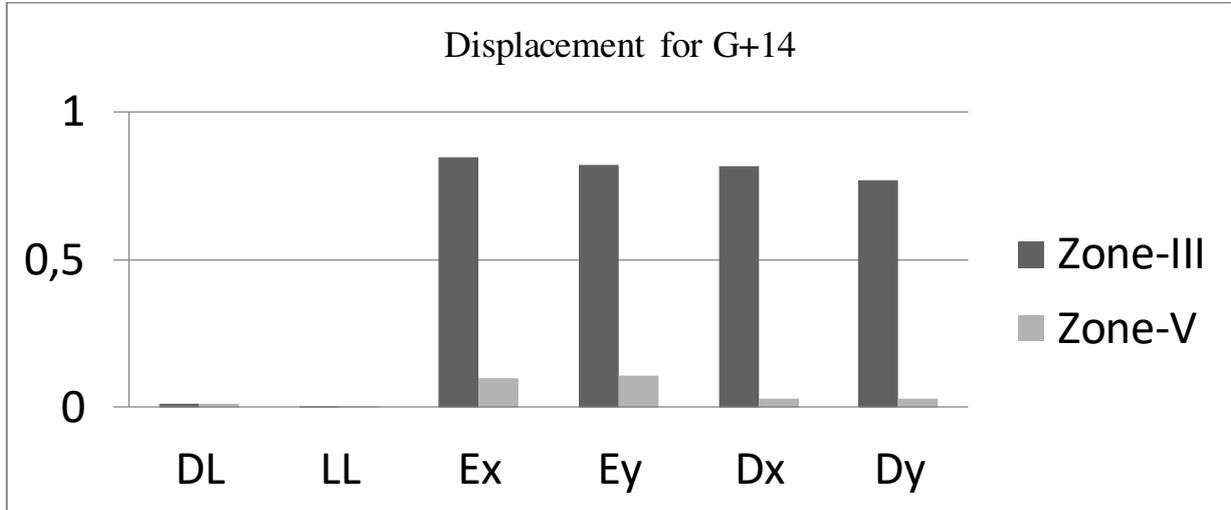


Fig 05 Displacement Details for G+ 14 storey

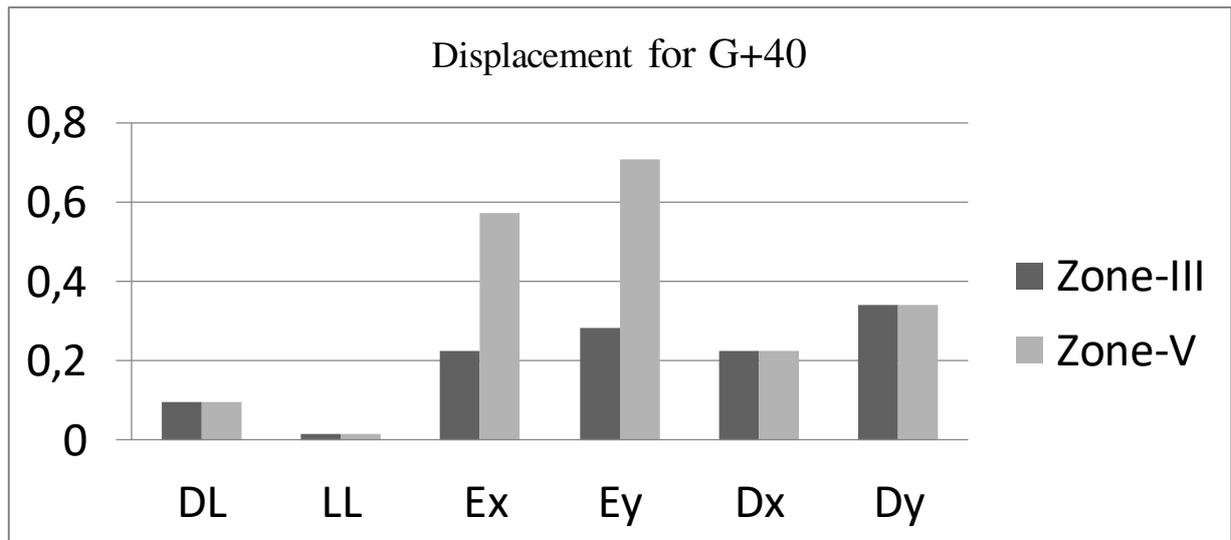


Fig 06 Displacement Details for G+ 40 storey

D] Drift Details

Table 04 - Drift Details in X and Y Direction for Seismic Condition-

	G+14 (Low rise)		G+24 (Mid rise)		G40+(High rise)	
	Zone-III	Zone-V	Zone-III	Zone-V	Zone-III	Zone-V
DL	0.000534	0.000534	0.000351	0.000351	0.00136	0.00013
LL	0.000125	0.000125	0.000179	0.000179	0.00023	0.00023
Ex	0.001138	0.002942	0.001204	0.00310	0.00349	0.00898
Ey	0.00128	0.003283	0.001479	0.00375	0.00413	0.01050
Dx	0.000897	0.000897	0.000696	0.000696	0.00260	0.00260
Dy	0.00095	0.000955	0.000894	0.000894	0.00390	0.00390

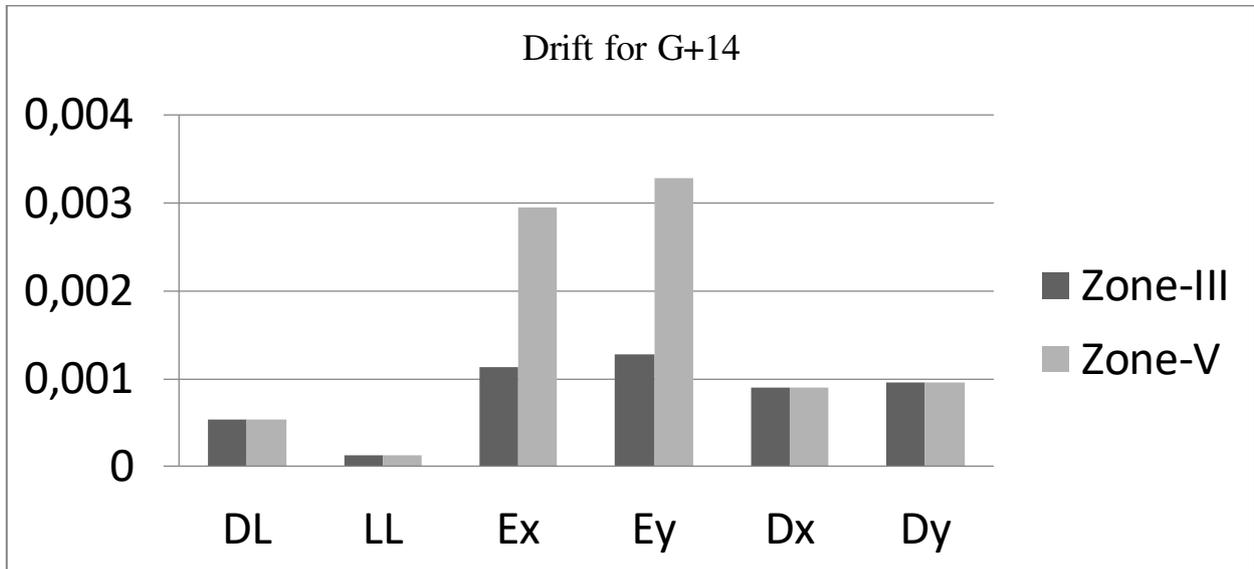


Fig 07 Drift Details for G+ 14 storey

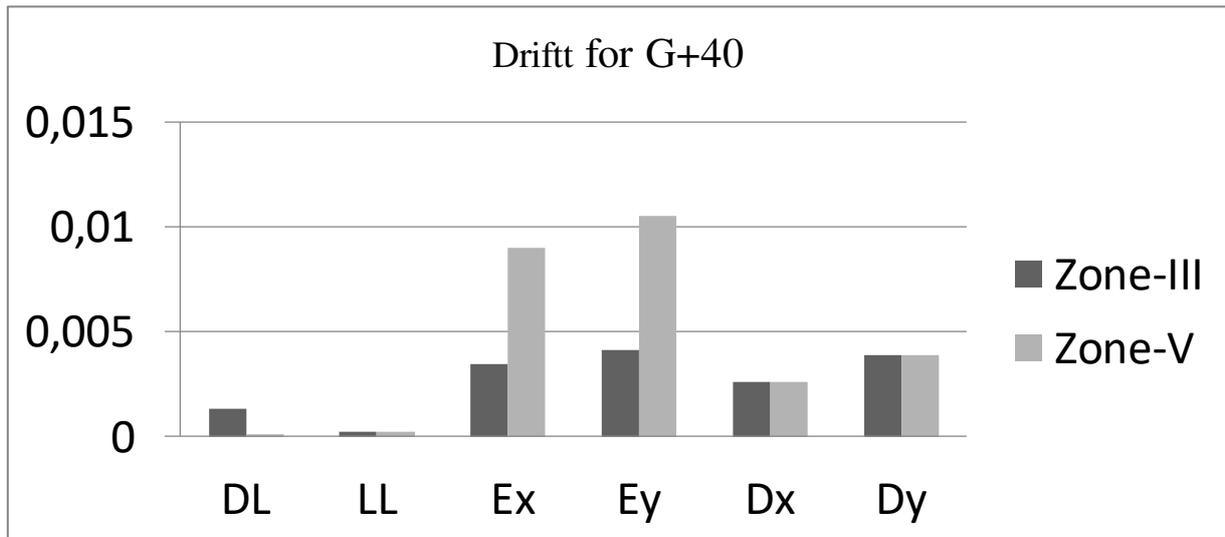


Fig 08 Drift Details for G+ 40 storey

## VI. CONCLUSUION

### Conclusions:

1. Time period  
As the height of the building is increasing from G+14 to G+40 the time period are increasing respectively. And in case of zone changing from III to V the time period values are not changing as shown in the table.
2. Base shear  
The base shear values are higher in G+40 storey building due to its mass , as the base shear is depends on mass and stiffness of the building there for base shear in high rise building is more .also the base shear values are increasing as we increase the zone from III to V.
3. Displacement

The Displacement values are higher as 0.341 m in G+40 storey building for Dynamic load case and similarly increasing the displacement for highrise building as compared with low and mid rise as shown in table.

4. Drift

Drift is more in case of low rise building when compared with other buildings. Also the drift values are not much changing while the zones are changing from III to V.

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