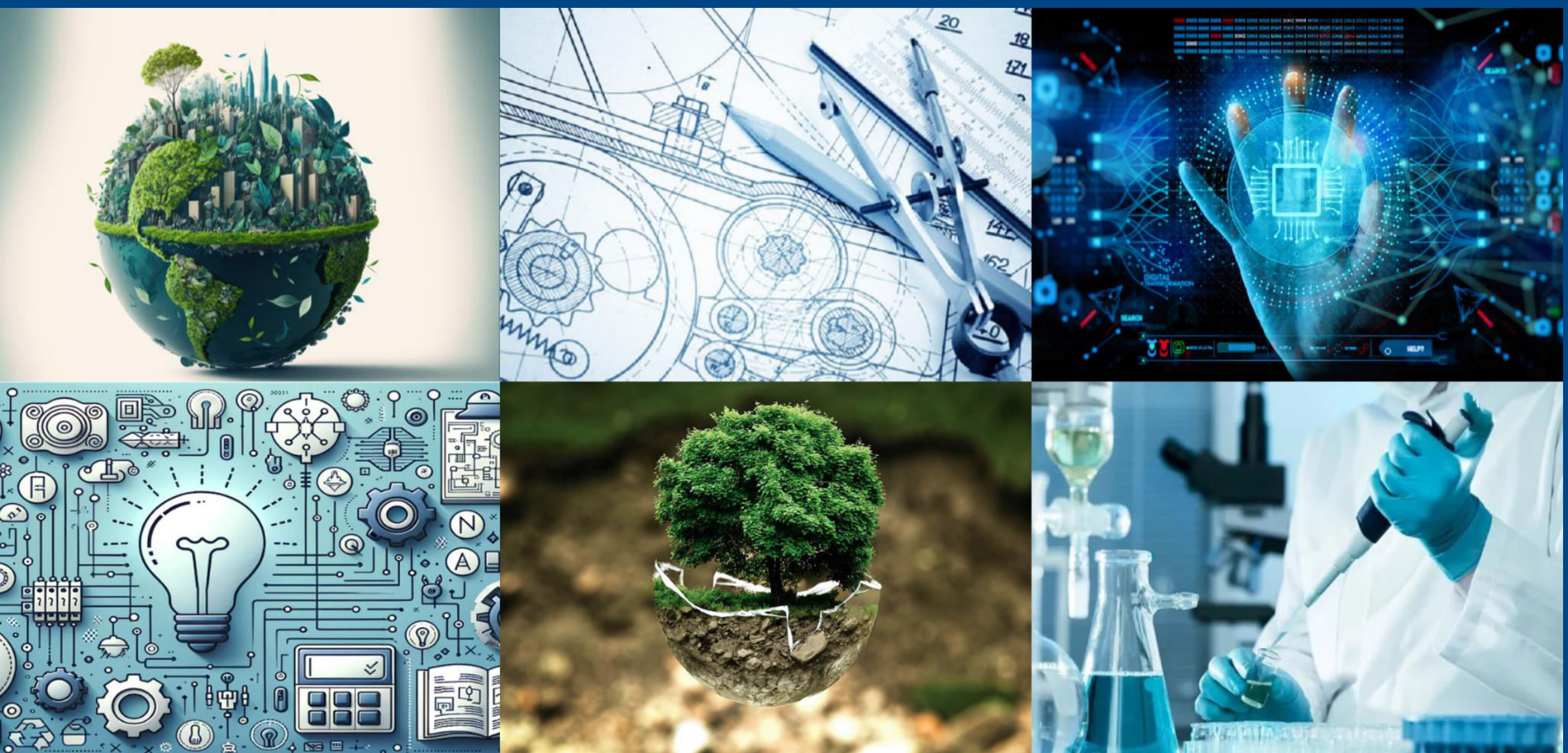
ISSN: 2582-7219

International Journal of Multidisciplinary Research in Science, Engineering and Technology

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 8.206

Volume 8, Issue 6, June 2025

www.ijmrset.com ijmrset@gmail.com +91 6381 907 438 +91 63819 07438

© 2025 IJMRSET | Volume 8, Issue 6, June 2025| DOI:10.15680/IJMRSET.2025.0806227

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 8.206| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Research Paper on Analysis of Lateral Load on Different Orientation of Shear Wall

Gourav Melekar, Ishant Dahat

PG Scholar, Department of Civil Engineering, G.H. Raisoni University, Amravati, India

Professor, Department of Civil Engineering, G.H. Raisoni University, Amravati, India

ABSTRACT: This study describes mathematical study and relation between wind and earthquake and its effects on building as a whole with respect of Lateral force and Storey shear for different orientation of shear wall. The Effect of Storey drift and storey displacement is also estimated in study. Earthquake Lateral force, Storey Shear, Storey Drift and Storey Displacement are analyzed for Seismic zone factor

KEYWORDS: Shearwall; E-TAB; Siesmic; Wind load; lateral loading, equivalent static load, gust Factor**.**

I. INTRODUCTION

Now a days there has been a considerable increase in the number of high rise buildings, both residential and commercial, and the modern trend is towards more taller and slender structures because of scarcity and value of land. Thus the effects of lateral loads like winds loads, earthquake forces are acquiring increasing importance and almost every structural designer is faced with the problem of providing adequate strength and stability against lateral loads. It is very essential to consider the effects of lateral loads induced from earthquake and wind in the design of reinforced concrete structures, especially for high-rise buildings.

The importance of wind engineering is emerging in India ever since the need for taller and slender buildings. Considering the ever increasing population as well as limited space, horizontal expansion is no more a viable solution especially in metropolitan cities. There is enough technology to build super-tall buildings today, but in India we are yet to catch up with the technology which is already established in other parts of the world

SCOPE OF WORK:

The scope of the present work includes the study of the Wind load and Earthquake load estimation on Tall buildings for the structural design purpose with the analytical approach as per IS 875: part 3-1987 and IS1893-2002 respectively. Maximum forces are determine for five different orientation shear wall model as analyzed and obtained the maximum values for lateral loads, story displacement, story drift and story shear. Analysis is carried out with different zones of earthquake defined by code for lateral loads, shear, drift and displacement. Present work also includes analysis of G+15 story bare frame building with normal beam, slab & column structure.

OBJECTIVES:

Following are the main objectives of the work.

1. To find out better location of shear wall provision in building.
2. To analysis the Bare frame Building with Different Orientation of Shear wall i.e. Inner core, L-Shape, T- Shape & L- Shape outside under Static Dynamic analysis.
3. To analyzed Displacement and Drift for Stability of Structure for Inner core, L-Shape, T- Shape & L- Shape outside.
4. To analyze the models under seismic zone II & V.

II. LITERATURE REVIEW

Lakshmi K.O Jayasree Ramanujan (2016). They have made a analytical study of various parameters such as story drift, story shear, deflection, reinforcement requirement in columns etc of a building under lateral loads based on strategic positioning of shear walls., in accordance with IS 875 (part 3) – 1987 and the various analytical approaches (linear static and dynamic analysis) were performed on the building to identify the base shear, story displacement, story drift, push over analysis and found that in medium high rise buildings (ie greater than 10 storys) provision of shear walls is found to be effective in enhancing the overall seismic capacity characteristics of the structure. From the comparison of story drift values it can be observed that maximum reduction in drift values is obtained when shear walls are provided at corners of the building . Lateral displacement values obtained from static method of analysis indicate that shear wall provision along longitudinal and transverse directions are effective in reducing the displacement values in the same directions.

Shahzad Jamil Sardar and Umesh. N. Karadi 2013 In this study, study of 25 storys building in zone V is presented with some investigation which is analyzed by changing various location of shear wall for determining parameters like story drift, story shear and displacement is done by using standard package software pakage ETAB. Creation of 3D building model for both linear static and linear dynamic method of analysis and influence of concrete core wall provided at the center of the building.The seismic analysis of reinforced concrete frame structure is done by both static and dynamic analysis to determine and compare the base shear; it has been found that maximum base shear in model-5 along longitudinal and transverse direction as compared to the other models. The presence of shear wall can affect the seismic behavior of frame structure to large extent, and the shear wall increases the strength and stiffness of the structure

B. Dean Kumar and B.L.P. Swami the study of nature and variation of gust pressures. For this study, multistory frames ranging from 20 to 100 storys were considered. By considering single bay and two bay frames in all the cases. multistory frames of 20, 40, 60 and 100 storys with one bay and two bays are considered. The typical size of column is 0.3 m X 0.49 m. The size of beam is 0.3 m X 0.4 m. The height of each story is 3.5 m.By comparing the values of wind pressures computed by static method and the Gust Effectiveness Factor Method, the gust pressures are more than the static pressures

Dr. K. R. C. Reddy, Sandip A.Tupat 2014 presents a comparative study of wind and earthquake loads to decide the design loads of a multistoried building. The significant of this work is to estimate the design loads of a structure which is subjected to wind and earthquake loads in a particular region. It is well known fact that the earthquake loads may be estimated in particular zone with a specified zone factor. Then the wind load of that zone can also be estimated based on the basic wind speed and other factors of that particular region. However, the wind velocity is stochastic and time dependent. In the present study a multi-storyed building was analyzed for earthquake loads in various zones based on IS 1893 and for wind loads IS 875 code is used. The wind loads are estimated based on the design wind speed of that zone with a variation of 20%. The wind loads so obtained on the building have been compared with that of earthquake load. The wind loads and earthquake loads are estimated for a twelve storied RC framed structure. Based on the results obtained the following conclusions are made. The wind and earthquake loads increases with height of structure. Wind loads are more critical for tall structures than the earthquake loads. Structures should be designed for loads obtained in both directions independently for critical forces of wind or earthquake .Finally it is found the wind loads are more critical than the earthquake loads in most of the cases.

III. METHODOLOGY

In this chapter, analysis of multi story building for wind and earthquake forces is carried out as per IS Codes. If we do so much calculation for a high rise building manually then it will take more time as well as human errors can be occurred. So the use of E TABS will make it easy. E TAB can solve typical problem like static analysis and dynamic analysis for earthquake and wind. Moreover E TAB has a greater advantage than the manual technique as it gives more accurate and precise result than the manual technique. It is the most popular software used now days. Basically it is performing analysis and design works. The present study deals with analysis of lateral forces and its comparison for G+11, G+15, G+21, G+31 building. Application example for building with different heights, floor weights for both winds & Earthquakes such as intensity of wind pressure, gust factor (G), seismic zone coefficient (Z), the importance factor (I), Response reduction factor (R) and Structural response factor (Sa/g) are analysed and discussed for the purpose of comparison by using IS 456:2000, IS 1893:2002 & IS 875:1987 (part3).

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 8.206| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Building Parameters:

1. Dimensions of Building : 23.6 m x19 m.
2. Height of Building : All building models (3.0 m of each floor)
3. Wall Thickness : 0.23m
4. Slab Thickness : 0.15M

Structural Elements

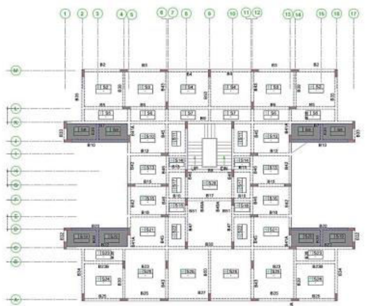
MODEL NO.	MODEL	STORY HEIGHT	COLUMN SIZE	SHEAR WALL	BEAM SIZE
1	G+11	33000	300 X 600	250MM	230 X 500
2	G+15	45000	300 X 600	250MM	230 X 500
3	G+21	63000	300 X 1000	350MM	230 X 500
4	G+31	93000	300 X 1200	400MM	230 X 500

.

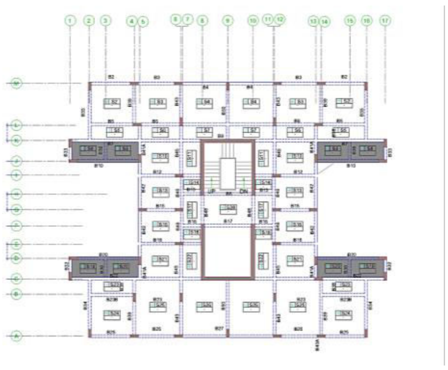
Location of shear wall from centre of mass of building

SR. NO.	TYPE OF SHEAR WALL	PERIMETER	CENTROID OF GRAVITY	
			CX	CY
1	INNER CORE	12.54	0	3.19
2	L SHAPE	6.6	8.7	7.96
3	T SHAPE	8.3	0	7.34
4	L OUTSIDE	2.7	9.2	3.9

1. Floor Plan of Bare Frame Building for G+11, G+15, G+21 & G+31



2. Floor Plan of Inner Core Shearwall Building for G+11, G+15,G+21 & G+31

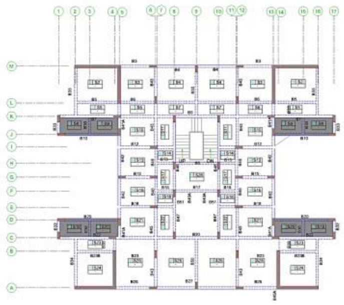


ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 8.206| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

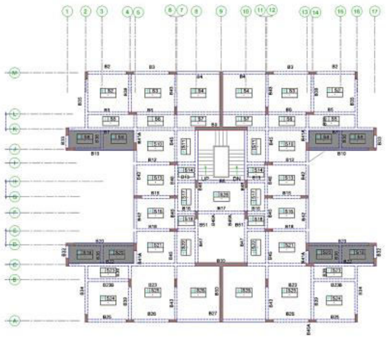
(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

3. Floor Plan of L-Shape Shearwall Building for G+11,G+15,G+21 & G+3

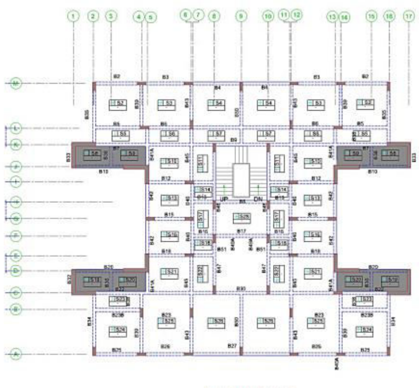


1

4. Floor Plan of T-Shape Shearwall Building for G+11,G+15,G+21 & G+31



5. Floor Plan of L-Shape outside Shearwall Building for G+11,G+15,G+21& G+31



Calculations ofWind Design Parameters:

Wind Data:

Basic Wind Speed V_b = 39 m/s

Terrain Category: Category 2

Design Factors

k_1 = 1N k_2 = varies with height k_3 = 1

Design Wind Speed (V_z) = Vb x k_1 x k_2 x k_3

Design Wind Pressure $P_z = 0.6\ V_z^2$

Wind Load Calculation

F = A_e x P_z x C_f

© 2025 IJMRSET | Volume 8, Issue 6, June 2025| DOI:10.15680/IJMRSET.2025.0806227

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 8.206| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Effective Area A_e:
In X direction: 23.6 x 3 = 70.8 sq.m
In Y direction: 19 x 3 = 57 sq.m
Along X direction,
$\frac{a}{b} = \frac{23.6}{19} = 1.24$
$\frac{h}{b} = \frac{45}{19} = 2.37$
Along Y direction,
$\frac{b}{a} = \frac{19}{23.6} = 0.805$
$\frac{h}{b} = \frac{45}{23.6} = 1.906$
C_f for these values from fig 4 = 1.3
Wind Lateral force for G+15

H	k_2	V_z (m/s)	P_z (kN/m²)	C_fx	C_fy	$A_e.x$ (m²)	$A_e.y$ (m²)	F_x (kN)	F_y (kN)
3	0.98	38.22	0.876	1.15	1.15	70.8	57	71.36	57.45
6	0.98	38.22	0.876	1.15	1.15	70.8	57	71.36	57.45
9	0.98	38.22	0.876	1.15	1.15	70.8	57	71.36	57.45
12	0.996	38.84	0.905	1.15	1.15	70.8	57	73.71	59.34
15	1.02	39.78	0.949	1.15	1.15	70.8	57	77.30	62.24
18	1.038	40.48	0.983	1.18	1.18	70.8	57	82.14	66.135
21	1.055	41.15	1.016	1.2	1.2	70.8	57	86.29	69.48
24	1.07	41.73	1.045	1.22	1.22	70.8	57	90.25	72.66
27	1.085	42.32	1.074	1.23	1.23	70.8	57	93.56	75.32
30	1.1	42.9	1.104	1.23	1.23	70.8	57	96.16	77.42
33	1.108	43.212	1.120	1.24	1.24	70.8	57	98.36	79.18
36	1.115	43.485	1.135	1.26	1.26	70.8	57	101.21	81.48
39	1.123	43.797	1.151	1.28	1.28	70.8	57	104.30	83.97
42	1.13	44.07	1.165	1.3	1.3	70.8	57	107.25	86.35
45	1.138	44.382	1.182	1.3	1.3	70.8	57	108.78	87.58

© 2025 IJMRSET | Volume 8, Issue 6, June 2025| DOI:10.15680/IJMRSET.2025.0806227

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 8.206| ESTD Year: 2018|

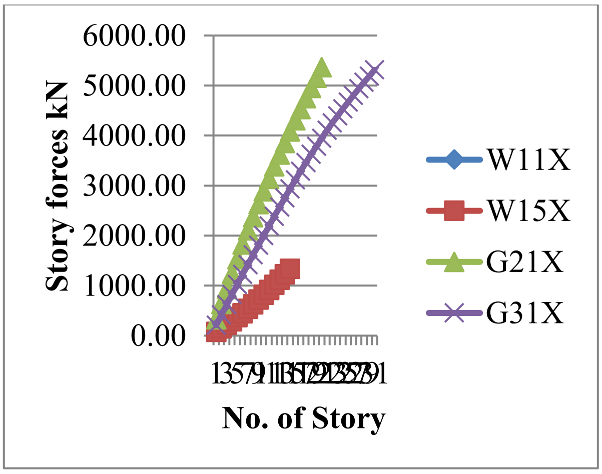
International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Wind Story forces with varying height in X Direction

For Bare Frame Structure

Story	W11-X (kN)	W15-X (kN)	G21-X (kN)	G31-X (kN)
1	57.45	57.45	269.385	207.98
2	114.90	114.90	516.043	414.56
3	172.35	172.356	759.511	619.39
4	231.69	231.69	999.71	822.48
5	293.93	293.93	1235.80	1023.48
6	360.07	360.07	1467.95	1222.77
7	429.54	429.54	1695.36	1420.49
8	502.20	502.20	1919.74	1616.52
9	577.52	577.52	2139.08	1810.54
10	654.94	654.94	2341.77	2002.53
11	733.70	734.13	2541.54	2192.85
12		815.62	2738.39	2381.66
13		899.59	2924.86	2568.03
14		985.93	3108.45	2751.90
15		1073.51	3288.81	2932.62
16			3465.94	3110.32
17			3641.68	3284.40
18			3814.93	3456.16
19			3980.63	3624.05
20			4146.32	3787.45
21			4312.01	3947.10
22				4103.07
23				4249.55
24				4392.53
25				4531.78
26				4667.37
27				4801.90
28				4934.51
29				5061.35
30				5188.18
31				5315.01



ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 8.206| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Wind Story forces with varying height in Y Direction

For Bare Frame Structure

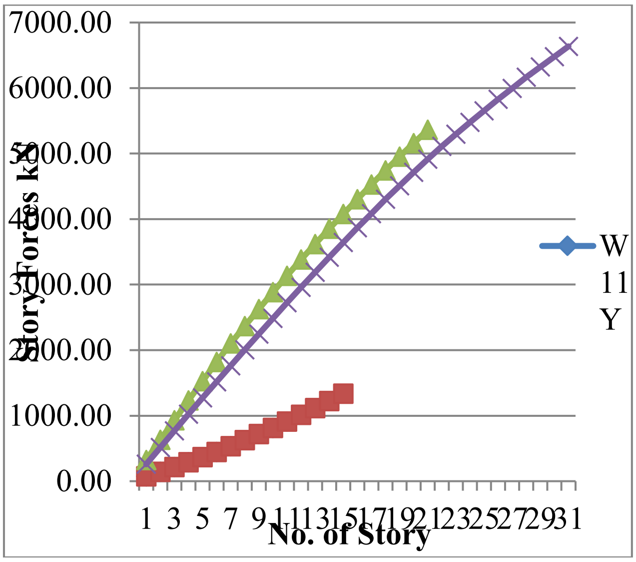
Story	W11-Y (kN)	W15-Y (kN)	G21-Y (kN)	G31-Y (kN)
1	71.36	71.36	322.31	257.80
2	142.72	142.72	628.78	514.07
3	214.08	214.08	931.29	768.17
4	287.79	287.79	1230.95	1020.11
5	365.10	365.10	1526.71	1269.46
6	447.24	447.24	1817.52	1516.87
7	533.55	533.54	2102.41	1762.16
8	623.79	623.79	2366.17	2005.33
9	717.35	717.35	2626.20	2246.39
10	813.51	813.54	2882.51	2485.14
11	911.34	911.87	3135.09	2721.99
12		1013.08	3383.97	2956.59
13		1117.38	3619.70	3188.15
14		1224.63	3851.78	3417.53
15		1333.41	4079.75	3643.92
16			4303.63	3866.54
17			4525.73	4084.61
18			4744.64	4300.68
19			4950.51	4509.28
20			5156.39	4714.01
21			5362.26	4914.56
22				5110.97
23				5295.91
24				5476.90
25				5653.64
26				5826.46
27				5996.47
28				6164.04
29				6321.63
30				6479.22
31				6636.81

© 2025 IJMRSET | Volume 8, Issue 6, June 2025| DOI:10.15680/IJMRSET.2025.0806227

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 8.206| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



IV. CONCLUSION

1. Providing shear walls at adequate locations substantially reduces the displacements due to earthquake, percentage of lateral drift and displacement also depends on the location of shear wall and its thickness.
2. Model with shear wall at center i.e. Inner core shear wall having varying thickness achieves highest reduction in displacement with base shear in elastic region, so that the building acts well within the elastic region.
3. Centre of gravity, perimeter and thickness of shear wall with respect to its center of mass of building plays vital role because when location nearer of shear wall is nearer to center of mass it not only restrains displacement but also gives stiffener to structure such observation was found in Inner core, T- shape & L- outside when provided for G+31 in Zone-V, but overall performance provided by Inner core was satisfied in X & Y direction.
4. Story drift is moderate at base, more at mid height and less at top. From analysis, it is observed that story drift in any story of example building, is not exceeds 0.004 times the store height. From the comparison of story drift values it can be observed that maximum reduction in drift values is obtained when shear walls are provided at inner core of the building.
5. It is found that story displacement of G+31 shear wall building is not exceeding 'h/250' for earthquake and 'h/500' for wind analysis but Displacement in bare frame structure found considerably large as compare to other structure in zone V reaches to its maximum limit to avoid such displacement provision of shear wall is must in Centre of building i.e. Inner core shear wall. After taking trail of placing of shear wall concluded that inner core shear wall proved best for reducing displacement.
6. As the height of building increases time period (T) get increases and this leads to decrease in structural response factor (Sa/g). That means structural response factor is inversely proportional to time period.

REFERENCES

1. Lakshmi K.O., Ramanujan J. , Bindu S., Dr. Laju K., Poweth M. J. *"Effect of shear wall location in buildings subjected to seismic loads"* ISOI Journal of Engineering and Computer science Volume 1 Issue 1; Page No. 07-17 Dec. 2014.
2. Shahzad J.S. and Karadi.U.N. *"effects of change in shear wall location on story drift of 20 stored multi story building subjected to lateral loads"* (IJIRSET-2013).
3. Syed.E.A., MohdMinhaj.U.*"Study of Strength of RC Shear Wall at Different Location on Multi-Storied Residential Building"* Int. Journal of Engineering Research and Applications 2015.
4. Rahman Md. A.,Farzana S. Z. ,Alam Md J. B. , *"A Study on Drift Analysis for Lateral Stability of High Rise Building in Sylhet City Corporation Area"* International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181 Vol. 3 Issue 6, June – 2014.
5. Pasto.S.*"Equivalent static wind loads on tall buildings,"* BBAA VI International Colloquium on: Bluff Bodies Aerodynamics & Applications, Milano, Italy, July, 20–24, 2008.

INNO SPACE
SJIF Scientific Journal Impact Factor

INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

निस्केयर
NISCAIR

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH IN SCIENCE, ENGINEERING AND TECHNOLOGY

| Mobile No: +91-6381907438 | Whatsapp: +91-6381907438 | ijmrset@gmail.com |

www.ijmrset.com