Seismic Analysis of rcc building with shear walls using staad pro

Vivek Pal[1], Gaikwad Yogesh[2], Pawar Chetan[3], Vishwajeet Kadlag[4].
***Nikhil Maske*[5]**

[1] *Student, Department of Civil Engineering, Dr D Y Patil SOET, Pune, India*
vivekpalvivekpal1912@gmail.com
[2] *Student, Department of Civil Engineering, Dr D Y Patil SOET, Pune, India*
ysgaikwad1990@gmail.com
[3] *Student, Department of Civil Engineering, Dr D Y Patil SOET, Pune, India*
chetanpawar9797@gmail.com
[4] *Prof, Department of Civil Engineering, Dr D Y Patil SOET, Pune, India*
vishwajeet.kadlag@dypic.in
[5] *Prof, Department of Civil Engineering, Dr D Y Patil SOET, Pune, India*
nikhil.maske@dypic.in

Abstract:

In recent years, Shear walls are specially designed structural walls which are incorporated in buildings to resist lateral forces that are produced in the plane of wall due to earthquake, wind and flexural members. Shear walls are structural members used to elongate the strength of R.C.C. structures. These shear walls will be construct in each level of the structure, to form an effective box structure. Equal length shear walls are placed symmetrically on opposite sides of outer walls of the building. Shear walls are added to the building interior to provide more strength and stiffness to the building when the exterior walls cannot provide sufficient strength and stiffness. It is necessary to provide these shear walls when the tolerable span-width ratio for the floor or roof diaphragm is exceeded. The present work deals with a study on the improvement location of shear walls in symmetrical high rise building. Position of shear walls in symmetrical buildings has due considerations. In symmetrical buildings, the center of gravity and center of rigidity coincide, so that the shear walls are placed symmetrically over the outer edges or inner edges. So, it is very necessary to find the efficient and ideal location of shear walls in symmetrical buildings to minimize the torsion effect.

Keywords: *Shear wall, different shape & locations, Analysis and comparison, STAAD.pro.*

---

1. INTRODUCTION:

Shear wall are one of the excellent means of providing earthquake resistance to multistoried reinforced concrete building**.** The structure is still damaged due to some or the other reason during earthquakes. Behavior of structure during earthquake motion depends on distribution of weight, stiffness and strength in both horizontal and planes of building. To reduce the effect of earthquake reinforced concrete shear walls are used in the building. These can be used for improving seismic response of buildings.

Structural design of buildings for seismic loading is primarily concerned with structural safety during major Earthquakes, in tall buildings, it is very important to ensure adequate lateral stiffness to resist lateral load. The provision of shear wall in building to achieve rigidity has been found effective and economical. When buildings are tall, beam, column sizes are quite heavy and steel required is large. So there is lot of congestion at these joint and it is difficult to place and vibrate concrete at these place and displacement is quite heavy. Shear walls are usually used in tall building to avoid collapse of buildings. When shear wall are situated in advantageous positions in the building, they can form an efficient lateral force resisting system.

Reinforced concrete (RC) buildings often have *vertical plate-like* RC walls called *Shear Walls*in addition to slabs, beams and columns. These walls generally start at foundation level and are continuousthroughout the building height. Their thickness can be as low as 150mm, or as high as 400mm in high risebuildings.

2. OBJECTIVE BEHIND THIS PROJECT

Following specific objectives has been made for the present study-

1.To develop, design and analysis model of the High rise structure in STAAD-Pro.

2.Study of seismic and wind load applied to the structure as per IS 875 and IS 1893.

3.Comparison of results of earthquake load applied on the structure by STAAD-Pro and manual calculations both by seismic coefficient method.

4.To verify deflection obtained by STAAD-Pro with IS codal Limit..

3. METHODOLOGY

A Model of G+15 storeyed is developed, analysis and design using STAAD-Pro software. Building plan size is 24m × 24m. The building is situated in Pune in earthquake zone Ⅲ.seismic zone coefficient is taken as 0.16 as per IS code. Following specifications are given to the structure:

Sr.No	Parameters	Dimensions/Type
1	Plan dimension	24m x 24m
2	Number of stories	G+15
3	Total height of building	48m
4	Height of each storey	3m
5	Column size	230 X 450 mm
6	Beam size	230 x 400 mm
7	Grade of concrete	M25
8	Frame type	OMRF
9	Soil type	Medium soil
10	Live load	3 KN/sq.m
11	Floor finish	1 KN/sq.m
12	Inner wall	230 mm
13	Outer wall	230 mm
14	Slab thickness	130mm
15	Unit weights of Concrete	25 KN/Cum
16	Unit weights of brick work	19 KN/Cum
17	Shear wall thickness	200mm
18	Section for steel bracing	ISA 110 X 110 X 10mm

3. METHODS OF SEISMIC ANALYSIS
3.1 Introduction

Methods of seismic analysis are
- Equivalent static analysis
- Response spectrum analysis
- Linear dynamic analysis
- Nonlinear static analysis
- Nonlinear dynamic analysis

Loads Considered
1. Dead Loads
2. Imposed Loads
3. Wind Load

4. Seismic Load: Design Lateral Force: The design lateral force shall first be computed for the building as a whole. This design lateral force shall then be distributed to the various floor levels.

Design Seismic Base Shear: The total design lateral force or design seismic base shear (Vb)

$$Vb = Ah\ W \quad \ldots..(1)$$

Where,

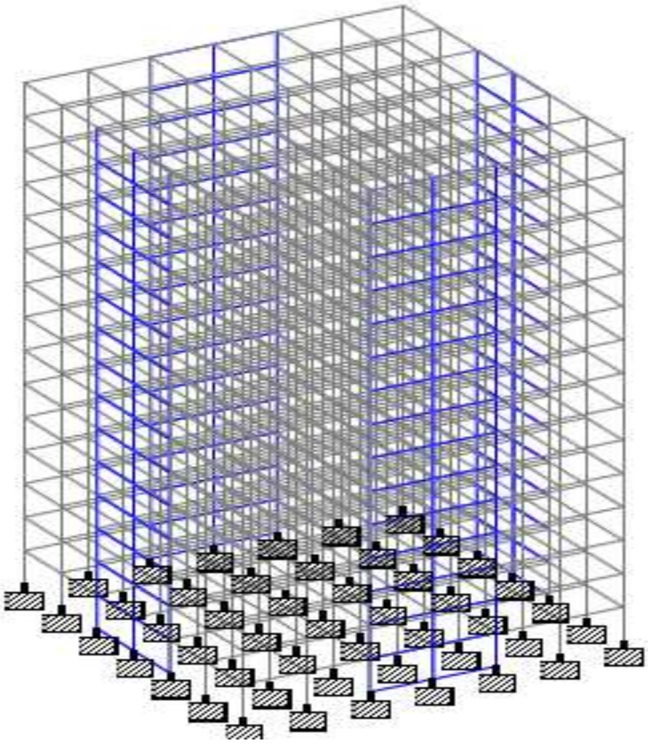
Ah = horizontal acceleration spectrum

W = seismic weight of all the floors

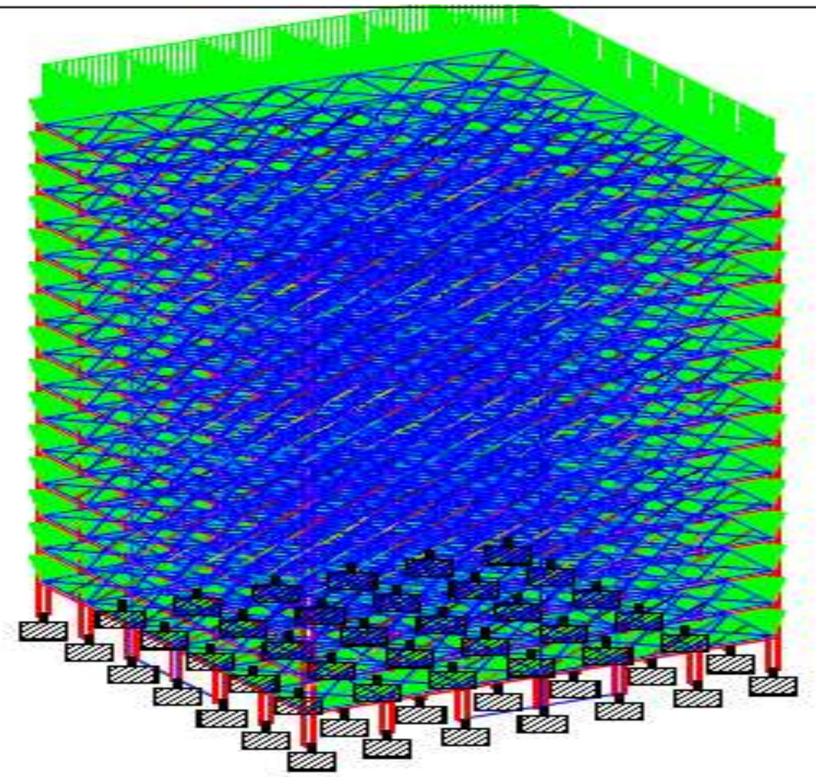
Distribution of Design Force: Vertical Distribution of Base Shear to Different Floor Level The design base shear (V) shall be distributed along the height of the building as per the following expression:

$$Q_i = V_B \frac{W_i h_i^2}{\sum_{j=1}^{n} W_j h_j^2}$$

4. STAAD PRO OUTPUT:-



Whole structure



Dead load using staadpro

Section Properties

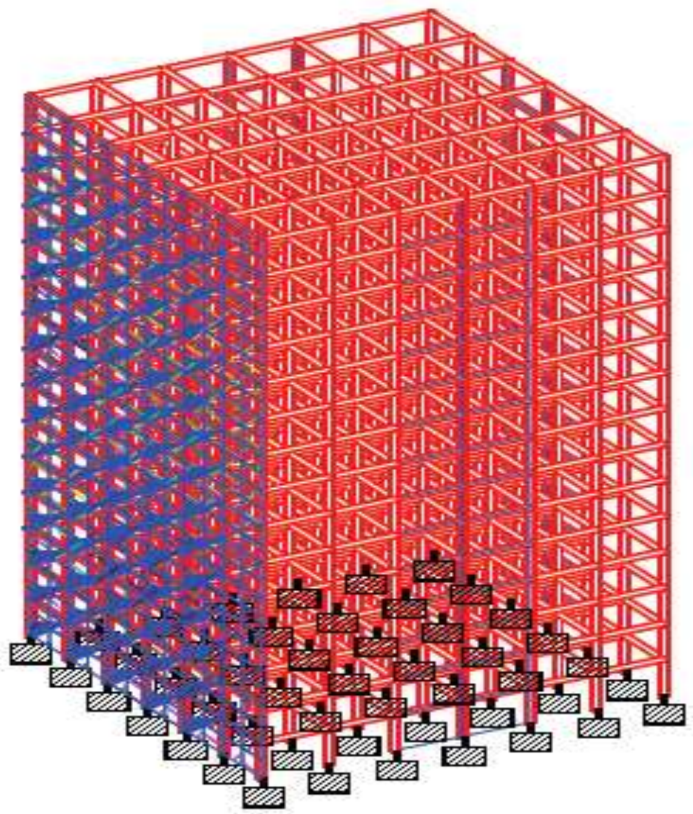
Prop	Section	Area (cm^2)	I_{yy} (cm^4)	I_{zz} (cm^4)	J (cm^4)	Material
1	Rect 0.40x0.23	920.000	40.6E+3	123E+3	104E+3	CONCRETE
2	Rect 0.45x0.23	1.04E+3	45.6E+3	175E+3	124E+3	CONCRETE
3	Surface Thickness	0.000	0.000	0.000	0.000	CONCRETE

Table -(1)

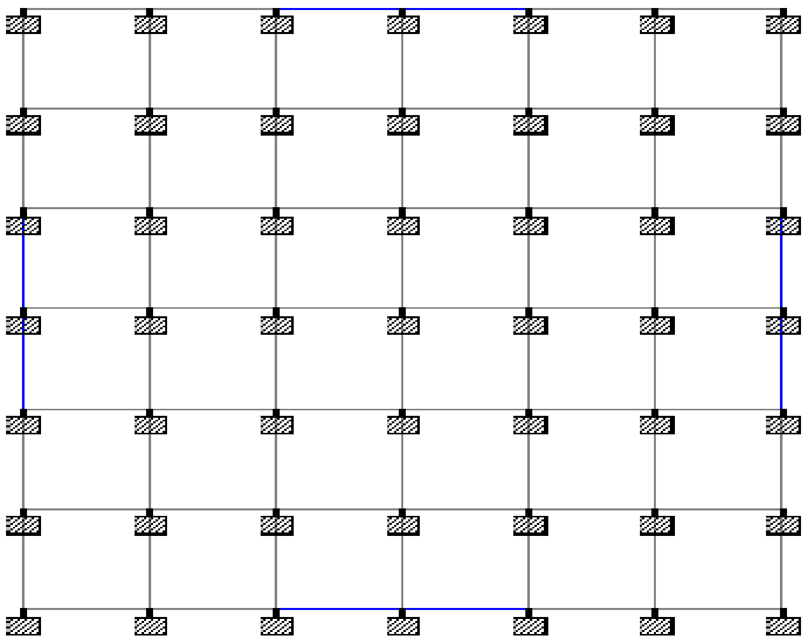
Materials

Mat	Name	E (kN/mm^2)	ν	Density (kg/m^3)	α (/°C)
1	STEEL	205.000	0.300	7.83E+3	12E -6
2	STAINLESSSTEEL	197.930	0.300	7.83E+3	18E -6
3	ALUMINUM	68.948	0.330	2.71E+3	23E -6
4	CONCRETE	21.718	0.170	2.4E+3	10E -6

Table –(2)



Wind load on one side



Foundation 24m x 24m (6 x 6 bays)

Node Displacement Summary

	Node	L/C	X (mm)	Y (mm)	Z (mm)	Resultant (mm)	rX (rad)	rY (rad)	rZ (rad)
Max X	218	10:Generated I	**3.267**	-20.065	-0.019	20.329	-0.003	-0.000	-0.002
Min X	224	11:Generated I	**-3.267**	-20.065	-0.019	20.329	-0.003	0.000	0.002
Max Y	672	2:EQ-X	-2.395	**0.067**	-0.003	2.396	-0.000	-0.000	0.000
Min Y	445	9:Generated In	0.002	**-41.896**	0.000	41.896	0.000	-0.000	0.000
Max Z	107	12:Generated I	-0.070	-18.784	**3.317**	19.074	0.003	0.000	0.002
Min Z	779	13:Generated I	-0.070	-18.784	**-3.317**	19.074	-0.003	-0.000	0.002
Max rX	221	12:Generated I	-0.000	-29.536	0.136	29.536	**0.006**	-0.000	0.000
Min rX	669	13:Generated I	-0.000	-29.536	-0.136	29.536	**-0.006**	0.000	0.000
Max rY	784	12:Generated I	0.039	-19.329	0.032	19.329	-0.002	**0.001**	0.001
Min rY	112	13:Generated I	0.039	-19.329	-0.032	19.329	0.002	**-0.001**	0.001
Max rZ	447	11:Generated I	-0.225	-29.367	-0.000	29.368	0.000	-0.000	**0.003**
Min rZ	443	10:Generated I	0.225	-29.367	-0.000	29.368	0.000	0.000	**-0.003**
Max Rst	445	10:Generated I	0.086	-41.896	0.000	**41.896**	0.000	0.000	-0.000

Minimum Resultant without failure

5. CONCLUSION:

1. Shear wall elements are very much efficient in reducing Earthquake displacement of frame and horizontal deflection when shear wall are placed in opposite sides of opposite sides in High rise building.

2. The location of shear-wall in opposite sides has significant effect on the seismic response than shear wall placed on any other location of building.

3.Shear wall construction will provide large stiffness to the building by reducing the damage to the structure.

4. STAAD PRO has the capability to calculate the reinforcement needed for any concrete section. The program contains a number of parameters which are designed as per IS: 456(2000). Beams are designed for flexure, shear and torsion.

5. Axial forces and bending moment in column are reduced more for shear wall in opposite sides as compare to without shear wall at corner , adjacent and centre of building.

6. The seismic response of regular structure gives better in comparison with that of irregular structure, because of the discontinuities along the height of the building.

7. It is thus concluded that seismic response of a building is influenced greatly by brick infill wall and shear walls, soil supporting the base. Ignoring any one of them, can significantly affect the performance of the structure during earthquake and lead to devastating effects.

8.. The results in Table-3 shows that the values are safe for building in earthquake. As there is minimum horizontal forces and dispalcements acting on building.

6 .REFERENCES:

1. E. Pavan Kumar et al Int. Journal of Engineering Research and Applications ISSN : 2248-9622, Vol. 4, Issue 11(Version 1), November 2014, pp.59-64. Website:-www.ijera.com

2. International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064 Index Copernicus Value (2013): 6.14 | Impact Factor (2014): 5.611.

3. Anna Birely and Dawn Lehman (2008). “Investigation of the seismic behavior and analysis of reinforced concrete structural walls”. The 14th World Conference on Earthquake Engineering, Beijing, China.

4. Lepage, A (1994). “Seismic Drift Estimates for RC 4. Structures”. Eleventh World Conference on Earthquake Engineering, Acapulco, Mexico

7. BIOGRAPHIES.

“[1]Student,Civil Engg,Dr.D.Y.Patil School of Engineering & Technology,Lohegaon,Pune-412105,India.”

“[2]Student,Civil Engg,Dr.D.Y.Patil School of Engineering & Technology,Lohegaon,Pune-412105,India.”

“[3]Student,Civil Engg,Dr.D.Y.Patil School of Engineering & Technology,Lohegaon,Pune-412105,India.”

“[4] Professor,Civil Engg, Dr. D. Y. Patil School of Engineering & Technology, Lohegaon, Pune-412105,India.”

“[4] Professor,Civil Engg, Dr. D. Y. Patil School of Engineering & Technology, Lohegaon, Pune-412105,India.”