A REVIEW PAPER ON EARTHQUAKE RESISTING SHEAR WALL USING ETABS

FASIL BHAT[#1], PRATIBHA DANGARANE *[2], RHUSHIKESH DHAKANE*[3], ADESH NIMBALKER[*4]

DEPARTMENT OF CIVIL ENGINEERING

SAVITRIBAI PHULE PUNE UNIVERSITY

ALARD COLLEGE OF ENGINEERING AND MANAGEMENT
MARUNJI, PUNE ,INDIA

Abstract

In contrast with the past, structures are becoming more and more slender and capable to sway and gives the best performance to reduce the problems of earthquake like displacement and story-drift. In the past Researchers and engineers have worked out to make the structures as earthquake resistant. Many practical studies has shown that use of lateral load resisting systems in the building configuration has tremendously improved the performance of the structure in earthquake. In seismic design of multistoried building, First we will generate a plan in Auto cad and modelled by manual and in ETABS. Analyse this model for axial and lateral loads will be studied. After studying Optimization of shear wall ,location shear wall is placed in three different locations and Then results are observed by comparing the displacement and story-drift.

1. INTRODUCTION

Shear walls are vertical elements of the horizontal force resisting system. Shear walls are constructed to counter the effects of lateral load acting on a structure. In residential construction, shear walls are straight external walls that typically form a box which provides all of the lateral support for the building. Lateral forces caused by wind, earthquake, and uneven settlement loads, in addition to the weight of structure and occupants; create powerful twisting (torsion) forces. These forces can literally tear (shear) a building apart. Reinforcing a frame by attaching or placing a rigid wall inside it maintains the shape of the frame and prevents rotation at the joints. Shear walls are especially important in high-rise buildings subjected to lateral wind and seismic forces.

Shear wall buildings are usually regular in plan and in elevation. However, in some buildings, lower floors are used for commercial purposes and the buildings are characterized with larger plan dimensions at those floors. In other cases, there are setbacks at higher floor levels. Shear wall buildings are commonly used for residential purposes and can house from 100 to 500 inhabitants per building.

2. LITERATURE REVIEW

1) K Venkatesh, T. Venkatdas (2017) In this paper the analytical study on the lateral behavior of the structure is mainly concentrated and how it is varying in the different zones of zone II and zone III wit heights of a 6storey, 11storey, and 16storey shear wall. Method in this study the behavior of lateral displacements induced on or after earthquakes. Concrete shear walls are used to vibrations. Shear walls can be placed around the building as periphery walls, around the lift and beside the staircase. Filing the buildings are modelled with floor area of 32mx28m. with 8 bays along 32m span and 7 bays along 28m and apiece bay width of 4m the lateral displacement of the structure is compared in OMRF to another floor level should reach storey drift, the analysis is done in s lateral displacements of the struc displacement is less in SMRF compare with OMRF.

2) J Tarigan (2018) Based on this study, it has been observed that the utilization of shear wall can contribute in increasing stiffness of structure. It reduces the natural period of structure, lateral displacement and story-drift significantly. Position of shear wall need to be considered carefully because it gives difference performance to resisting earthquake load. The results are observed by comparing the displacement and story-drift. Based on the

analysis, the placement of shear wall at the core of structure symmetrically gives the best performance to reduce the displacement and story-drift. presented a study of the effect of shear wall placement in the 10-story RC structure at 6 alternative placement. The structure located in India at earthquake zone V. Analysis of earthquake using static equivalent method by ETABS 2015. It is found that the story displacement of the structure without shear wall shows maximum displacement compared to the other Model having shear wall. Placing shear wall near the core of the building was the best location to reduce the story displacement. It also found that by providing shear wall to the high rise building, structural behavior will be affected to a great extent and also the stiffness and the strength of the building will be increased.

3) O. Esmaili S. et al (2012) The researcher on the structural aspects of one of the tallest RC buildings, located in the high seismic zone, with 56 stories. In this Tower, shear wall system with irregular openings are utilized under both lateral and gravity loads, and may result some especial issues in the behavior of structural elements such as shear walls, coupling beams and etc. To have a seismic evaluation of the Tower, a lot of non-linear analyses were performed to verify its behavior with the most prevalent retrofitting guidelines like FEMA 356. In this paper; some especial aspects of the tower and the assessment of its seismic load bearing system with considering some important factors will be discussed. After a general study of ductility levels in shear walls he conclude the optimality and conceptuality of the tower design. Finally, some technical information about the structural behavior of the case would be very fascinating and useful for designers.

3. DESCRIPTION OF MODEL STUDY

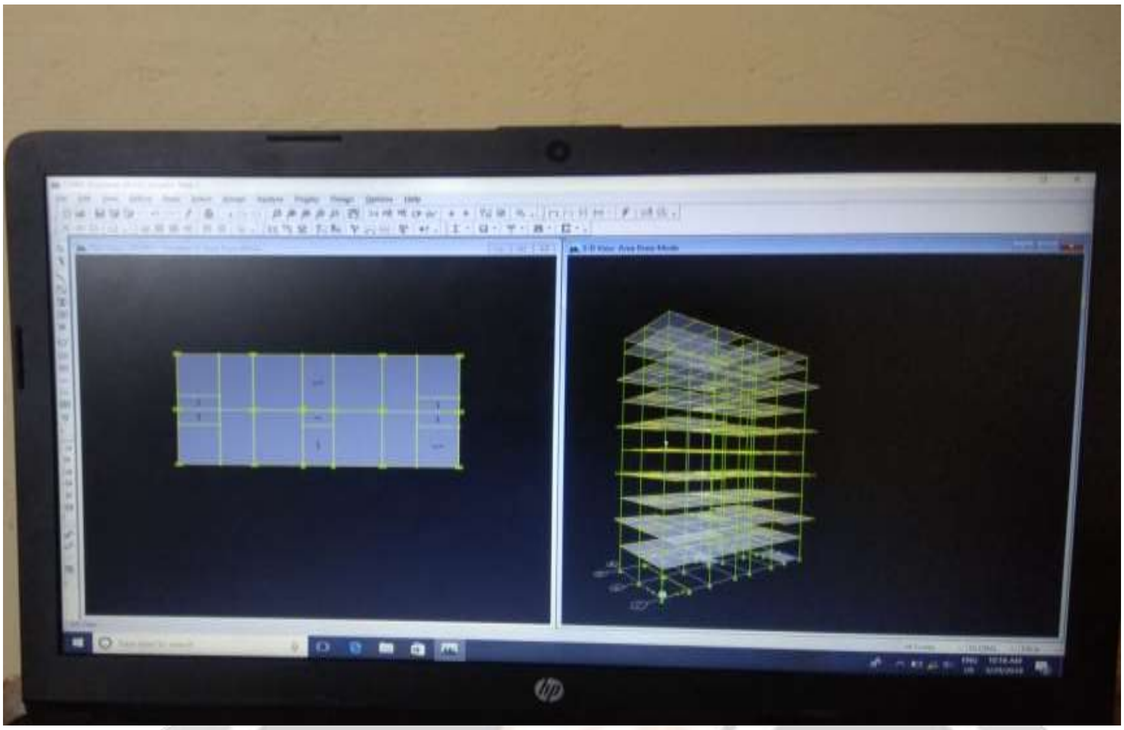
3.1 PROBLEM STATEMENT

Height of storey 3m, area of the building 440m2, Height of the building 30m ,Number of stories 10 Floor Slab Thickness 150mm Grade of the concrete M25, Thickness of shear wall 230mm, Grade of the steel Fe-415 ,Column size 900X600mm Beam size 400x600mm, Seismic zone(Z) III ,Type of soil II, Importance factor (I), Response reduction factor (R) 5, Diameter of Bar in Column 16mm ,Diameter of Bar in Beam 16mm.

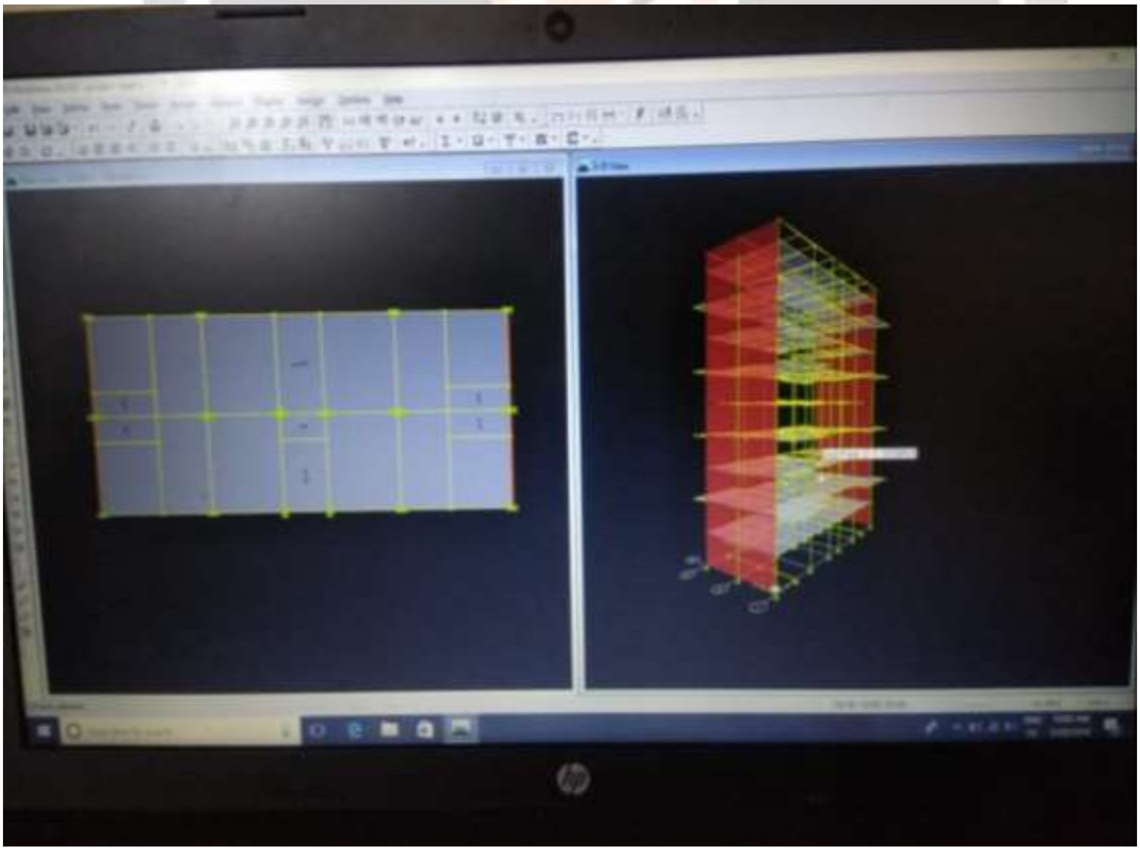
Building Dimension and Plan Details

Height of storey	3m
area of the building	440m^2
Height of the building	30m
Number of stories	10 floor
Slab Thickness	150mm
Grade of the concrete	M25
Thickness of shear wall	230mm
Grade of the steel	Fe 415
Column size	900X600mm
Beam size	400X600mm
Seismic zone(Z)	III(moderate -0.16)
Type of soil	II(medium)
Importance factor(I)	1(All other buildings)
Response reduction factor (R)	5(SMRF)
Diameter of Bar in Column	16mm
Diameter of Bar in Beam	16mm

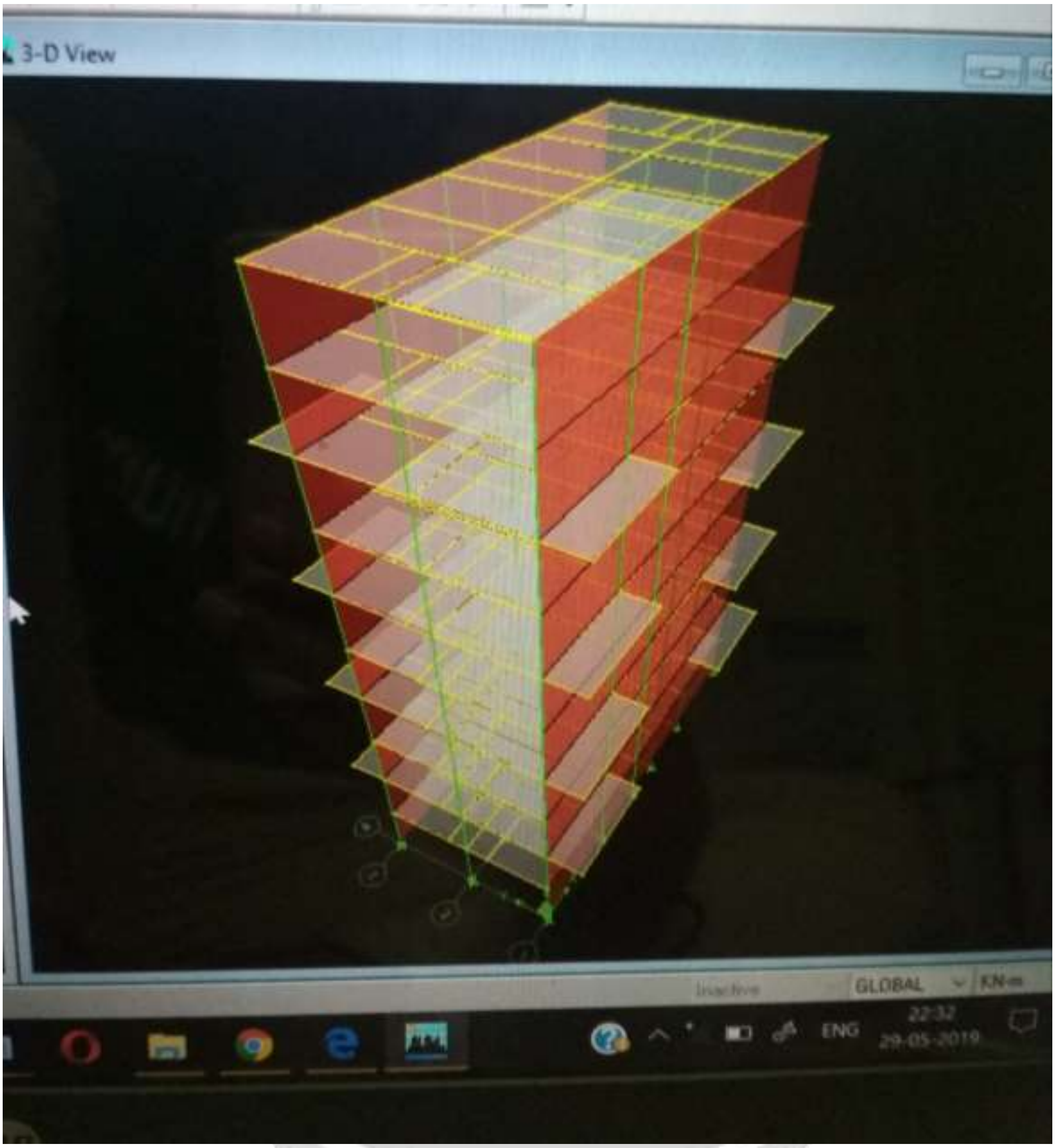
Building Dimensions



Elevation and 3d view of frame structure OF BUILDING WITHOUT SHEAR WALL



Elevation and 3d view of frame structure Of Building With Shear Wall at short side



Elevation and 3D view of RC frame structure Model Of Building With Shear Wall at long side

3.2 METHODOLOGY

Following factors were taken into consideration for Analysis of G+9 structure

- Design horizontal seismic coefficient (A_h)

$$A_h = \frac{SaZI}{g\,2\,R}$$

Provided that at not be less than Z/2 for T ≤ 0.1S,

- Fundamental natural period (T)

$$T = \frac{0.09h}{\sqrt{d}}$$

- Design seismic base shear

$$Vb = A_h W$$

- Distribution of design force

$$Qi = Vb \frac{Wi\, hi^2}{\sum_{i=1}^{n} Wihi^2}$$

- Zone factor (Z)
- Importance factor (I)

R = Response reduction factors: R=3 for OMRF [ordinary RC moment-resisting frame] and R=5 for SMRF [special RC moment-resisting frame] are taken from code.

LOAD COMBINATIONS

The load factors for the design of the reinforced concrete structures as recommended by the code are:

i) 1.5(DL+IL)
ii) DL+IL+EL
iii) DL+EL
iv) 0.9DL+1.5EL

4. RESULTS AND DISCUSSION

4.1 Lateral displacement

The lateral displacement for building shown in tabulated Table :

Story Maximum and Average lateral displacement building without Shear wall along x diection

Storey	Load	Direction	Maximum lateral displacement	Average	Ratio
Storey 9	EQX	X	12.5178	11.7941	1.061
Storey 8	EQX	X	11.7834	11.0990	1.062
Storey 7	EQX	X	10.6218	10.0363	1.058
Storey 6	EQX	X	9.2822	8.7915	0.56
Storey 5	EQX	X	7.7585	7.3491	0.56
Storey 4	EQX	X	6.1608	5.8320	0.56
Storey 3	EQX	X	4.6025	4.3529	1.057
Storey 2	EQX	X	3.0537	2.8827	1.059
Storey 1	EQX	X	1.4143	1.3324	1.061

Story Maximum and Average lateral displacement building without Shear wall along Y diection

Storey	load	Direction	Maximum lateral displacement	Average	Ratio
Storey 9	EQY	Y	19.2363	18.5952	1.034
Storey 8	EQY	Y	18.0849	17.4550	1.036
Storey 7	EQY	Y	16.3820	15.8043	1.037
Storey 6	EQY	Y	14.3674	13.8591	1.037
Storey 5	EQY	Y	12.0708	11.6295	1.038
Storey 4	EQY	Y	9.6389	9.2677	1.040
Storey 3	EQY	Y	7.1493	6.8919	1.037
Storey 2	EQY	Y	4.6626	4.5230	1.031
Storey 1	EQY	Y	2.1961	2.1405	1.026

Story Maximum and Average lateral displacement for long span of building along x diection

Storey	load	Direction	Maximum lateral displacement	Average	Ratio
Storey 10	EQX	X	0.7125	0.7110	1.002
Storey 9	EQX	X	0.6341	0.6327	1.002
Storey 8	EQX	X	0.5511	0.5499	1.002
Storey 7	EQX	X	0.4649	0.4638	1.002
Storey 6	EQX	X	0.3784	0.3775	1.002
Storey 5	EQX	X	0-2938	0.2931	1.002
Storey 4	EQX	X	0.2142	0.2137	1.002
Storey 3	EQX	X	0.1421	0.1418	1.002
Storey 2	EQX	X	0.0806	0.0804	1.002
Storey 1	EQX	X	0.319	0.0318	1.002

Story Maximum and Average lateral displacement for long span of building along y diection

Storey	load	Direction	Maximum lateral displacement	Average	Ratio
Storey 10	EQY	Y	8.6430	8.6422	1.000
Storey 9	EQY	Y	8.3356	8.3349	1.000
Storey 8	EQY	Y	7.8079	7.8073	1.000
Storey 7	EQY	Y	7.0813	7.0808	1.000
Storey 6	EQY	Y	6.2155	6.2151	1.000
Storey 5	EQY	Y	5.2400	5.2398	1.000
Storey 4	EQY	Y	4.1085	4.1903	1.000
Storey 3	EQY	Y	3.1160	3.1159	1.000
Storey 2	EQY	Y	2.0220	2.0220	1.000
Storey 1	EQY	Y	0.9397	0.9397	1.000

Story Maximum and Average lateral displacement for Short Span of building along x diection

Storey	load	Direction	Maximum lateral displacement	Average
Storey 10	EQX	Y	0.0000	0.0000
Storey 9	EQX	Y	0.0000	0.0000
Storey 8	EQX	Y	0.0000	0.0000
Storey 7	EQX	Y	0.0000	0.0000
Storey 6	EQX	Y	0.0000	0.0000
Storey 5	EQX	Y	0.0000	0.0000
Storey 4	EQX	Y	0.0000	0.0000
Storey 3	EQX	Y	0.0000	0.0000
Storey 2	EQX	Y	0.0000	0.0000
Storey 1	EQX	Y	0.0000	0.0000

: Story Maximum and Average lateral displacement for short span of building along y diection

Storey	load	Direction	Maximum lateral displacement	Average	Ratio
Storey 10	EQY	y	0.0000	0.0000	0.0000
Storey 9	EQY	y	0.0000	0.0000	0.0000
Storey 8	EQY	y	0.0000	0.0000	0.0000
Storey 7	EQY	y	0.0000	0.0000	0.0000
Storey 6	EQY	y	0.0000	0.0000	0.0000
Storey 5	EQY	y	0.0000	0.0000	0.0000
Storey 4	EQY	y	0.0000	0.0000	0.0000
Storey 3	EQY	y	0.0000	0.0000	0.0000
Storey 2	EQY	y	0.0000	0.0000	0.0000
Storey 1	EQY	y	0.0000	0.0000	0.0000

C0NCLUSION

- It can be concluded that shear wall placing at adequate locations is moresignificant in case of base shear and displacement.
- From all the above analysis, it can be concluded that small dimension ofshear wall is not more effective then large dimension of shear wall to control the lateral displacement in 8 stories or below 8 stories buildings**.**
- Changing the position of shear wall will affect the attraction of forces, so that wall must be in proper position.
- If the dimensions of shear wall are large then major amount of horizontal forces are taken by shear wall
- Providing shear walls at adequate locations substantially reduces the displacements due to earthquake.

5. REFRENCES

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