COMPARATIVE STUDY OF FRAMED STRUCTURE WITH AND WITHOUT SHEAR WALL USING ETABS

RISHABH SISODIA[1]

Student, Department of Civil Engineering, Vellore Institute of Technology, Tamil Nadu, India

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Abstract - *Framed structural system are the most preferable configuration for a high-rise structure situated in seismic zone. In this paper, 15 stories RCC residential building is considered for the seismic investigation which is situated in zone V. Two models, one with exposed edge display and staying, another with the shear wall at different positions is considered. The demonstrating and examination are finished utilizing ETABS -2016 programming module. An endeavor is made to study and analyse the parameters, for example, storey displacement, storey drift, storey shear, natural period and base shear.*

***Key Words**: shear wall, lateral loads resisting system, seismic load.*

1. INTRODUCTION

The rapid growth of urbanization and advent of new advancement in high rise construction has become a common scenario. Ever increasing height of building brought a fundamental change in design philosophy. These fundamental changes focus mainly on the effects of dynamic loads such as the earthquake and wind loads. Thus, in a way, seismic design revolves around the concept to reduce the displacement of structure under the impact of seismic loading. This can be done by incorporating lateral load resisting system such as shear wall, mass tuned damper, and liquid tuned damper and bracing system.

Our present study pivots around the use of shear wall as our lateral load resisting system. The shear wall dissipates the energy by undergoing large non-linear deformation. The modelling is done to examine the effect of seismic loads.

Multi-storey concrete structure experiences large lateral displacement. Shear wall as a structural element reduces lateral forces which also anticipated the spike in dynamic loads during earthquake. According to *Indian standard 1893:2016 criteria for earthquake resistant design of structure* suggest the maximum allowable lateral displacement should not exceed 0.004 times the height of the building. These lateral forces resisting system, in our case is reinforced concrete shear wall. These structural elements possess high in-plane stiffness and it is due to this property that a shear wall can counter lateral load and deflection more efficiently. Shear wall is ductile in orthogonal plane and can easily distribute the lateral load in their own plane by developing counter resistive moment and shear. Position and placement of shear wall in and around the structure play significant role. They should be place in manner that it does not cause any secondary effects such as torsion i.e. the center of stiffness and center of gravity should lie in the same plane and at same location in a structure.

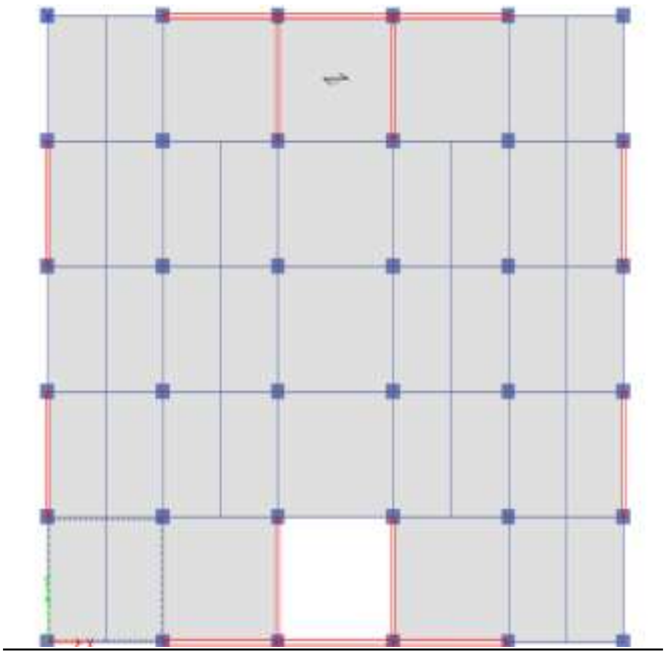
2. METHODOLOGY

The software ETABS is used in order to analyse the given G+15 structure for structural parameters like shear force, displacement, bending moment using response spectrum method.

Response spectrum method:

Response spectrum method mainly deals with maximum response of single degree of freedom system subjected to earthquake forces. For lateral earthquake forces developed in structure, response spectra give a curve between maximum response of SDOF and period.

2.1 Building dimensions and Design Plan:



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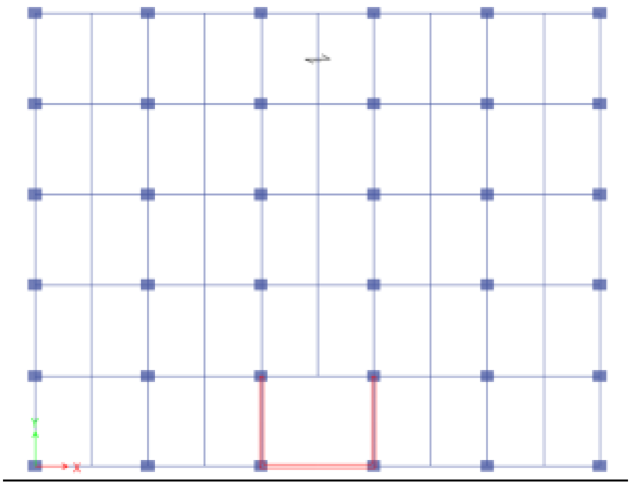

Figure. 1 Plan of a building with and without shear wall

Table 1: Plan specifications

Height of building	64.45 m
Floor to floor height	3.3 m
Number of Storeys	15
Slab thickness	250mm
Thickness of shear wall	250 mm
Column size	750mm x 950mm
Primary beam size	500mm x 700mm
Secondary beam size	350mm x 550mm
Seismic zone (Z)	V
Type of soil	Class 3
Importance factor (I)	1
Response reduction factor (R)	1.2
Diameter of bars in column	20 mm
Diameter of bars in beam	16 mm

Load and load combinations:

Assignment of Load:

1. Dead load (DL): 17.25 kN/m
2. Live load (LL): 7 kN/m
3. Floor finish (FF): 1 kN/m
4. Masonry load (ML): 14 kN/m

Load combinations:

1. 1.5 (DL) +1.5(LL) +1.5 (FF)+ 1.5(ML)
2. 1.2 (DL) +1.2(LL) +1.2 (FF) +1.2(EQ X)
3. 1.2 (DL) +1.2(LL) +1.2 (FF) + 1.2 (ML) +1.2(EQ X)
4. 1.2 (DL) +1.2(LL) +1.2 (FF) + 1.2 (ML) -1.2(EQ X)
5. 1.2 (DL) +1.2(LL) +1.2 (FF) + 1.2 (ML) +1.2(EQ Y)
6. 1.2 (DL) +1.2(LL) +1.2 (FF) + 1.2 (ML) -1.2(EQ Y)

2.2 Modelling In E-Tabs:

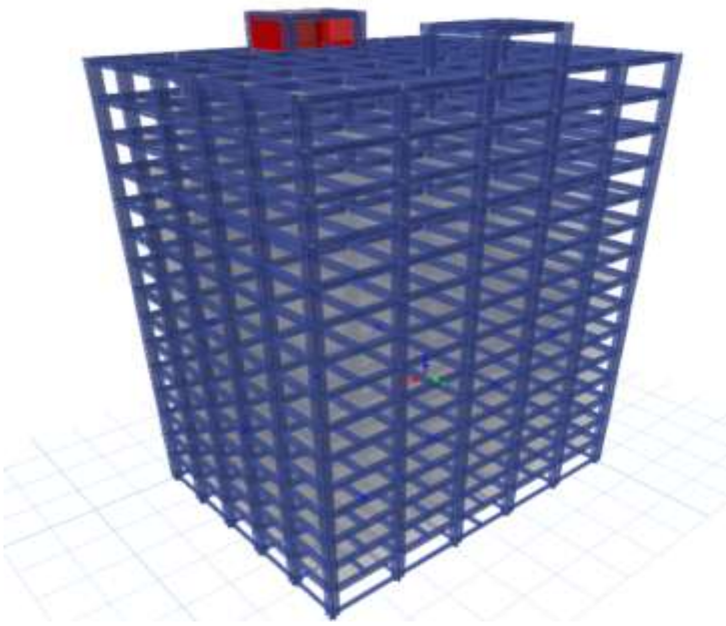

Figure 2: 3D model without shear wall

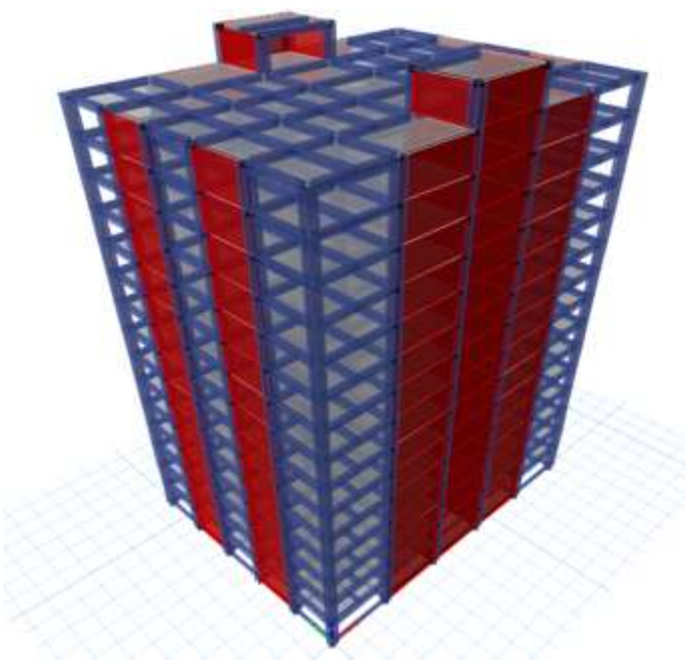

Figure 3: 3D model with shear wall

3. RESULTS AND INFERENCE

Table no .02 Storey displacement with and without shear wall

Storey	Displacement			
	With shear wall		Without shear wall	
	X (mm)	y (mm)	x (mm)	y (mm)
15	0.05	-0.033	-215.71	190.74
14	0.025	-0.018	-210.601	179.479
13	0.012	0.009	-203.173	165.882
12	0.009	-0.008	-193.772	151.552
11	0.007	-0.007	-182.439	138.992
10	0.006	-0.006	-169.58	121.92
9	0.005	-0.005	-155.391	106.582
8	0.004	-0.004	140.165	91.174
7	0.003	-0.004	124.087	75.95
6	0.003	-0.003	107.382	61.18
5	0.002	-0.003	90.296	49.827
4	0.001	-0.003	73.085	40.751
3	0.001	-0.002	56.016	31.631
2	0.004	-0.003	39.238	22.501
1	0.027	-0.001	22.118	13.024
Plinth	0.035	-0.013	-2.369	1.414

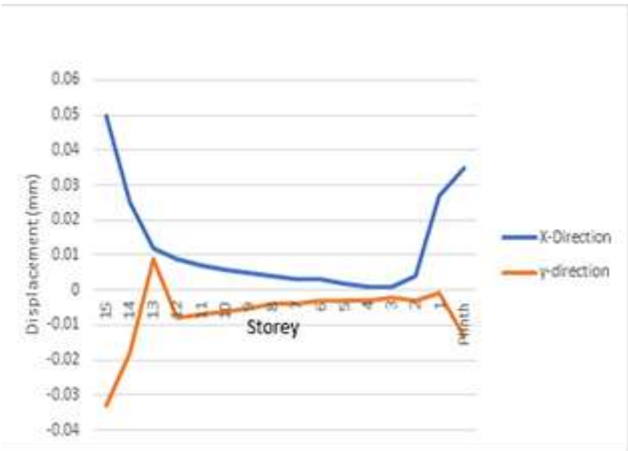

Figure 4: Displacement for storey without shear wall

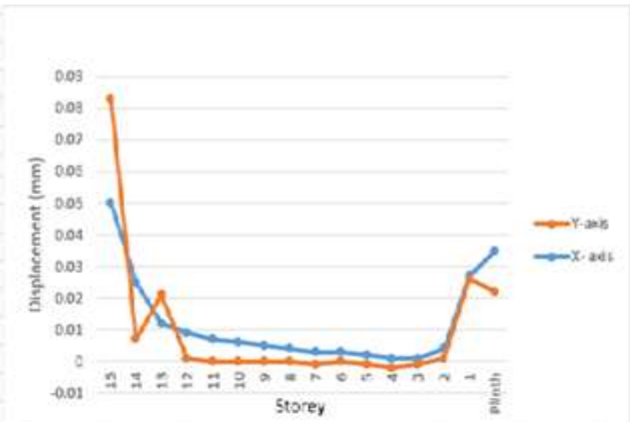

Figure 5: Displacement for storey with shear wall

From the analysis results, we can infer that the storey displacement got significantly reduced due to the inclusion of shear wall. Thus, it can be concluded that shear wall was able to absorb the dynamic lateral load imparted by the earthquake.

The model without shear wall had maximum displacement of about 215.71 mm in positive X direction, while a value of 190.74 mm was obtained in the other direction.

The model without shear wall shows a significant reduction in storey displacement in both X as well in Y direction respectively and obtained a value of maximum value of .033 mm which is within the prescribed limits as mentioned in IS CODE

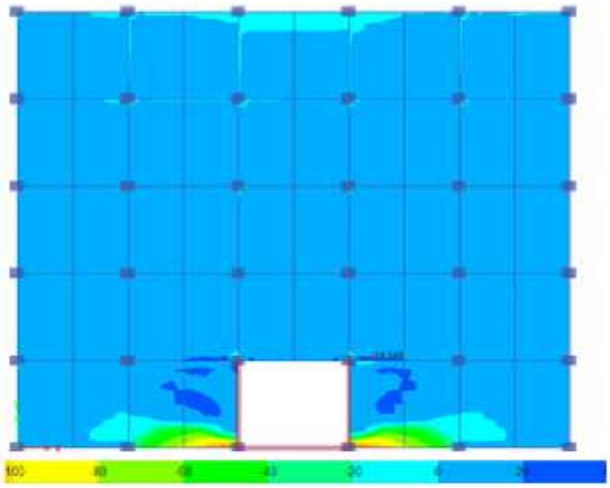

Figure 6a: Resultant force contour at 10th storey of the building without shear wall

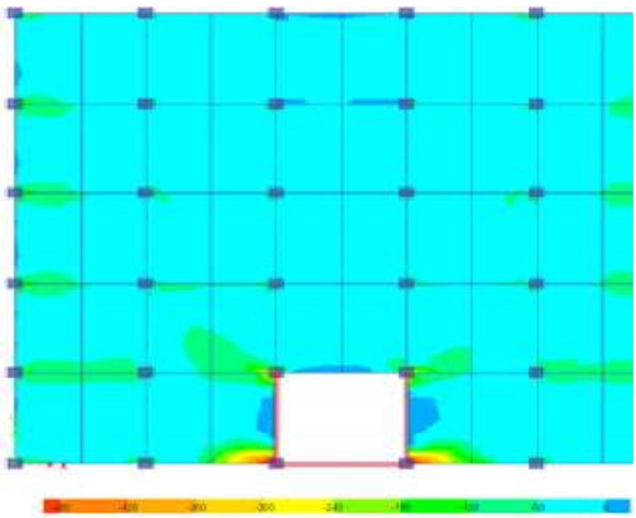

Figure 6b: Resultant force contour at 15th storey of the building without shear wall

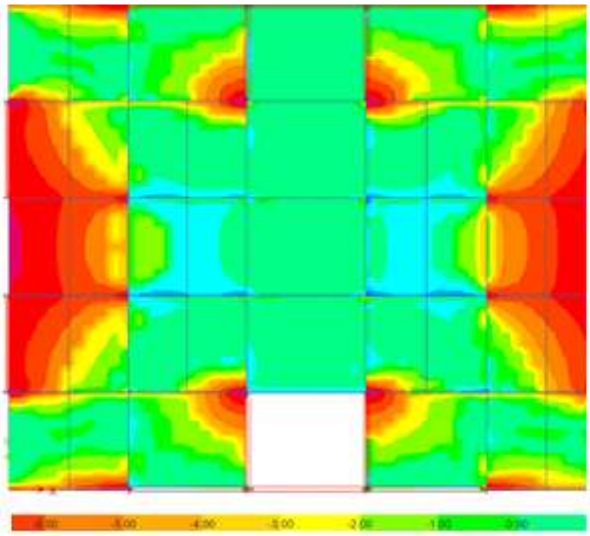

Figure 7a: Resultant force contour at 10th storey of the building with shear wall

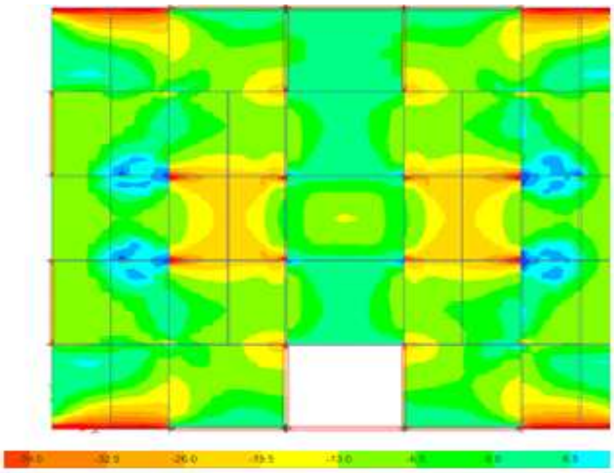

Figure 7b: Resultant force contour at 15th storey of the building with shear wall

Comparing the force contour obtained from the analysis we find that the building consisting of shear wall as means of lateral load resisting system had less stress concentration at the different location in structure. Which yield the conclusion that shear wall in a way reduce the accumulation of force and helping the structure to remain stable throughout its service life under cyclic loading requiring only some minor changes.

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