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Seismic Behavior of Buildings with Shear Wall

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Abstract- **Its analysis based on software result was being comparison between top stores of building discuss about display displacement top storey .What The effect of shear wall at building and better location of shear wall.**

Key word- RC wall, masonry wall

I. INTRODUCTION

The primary purpose of all kinds of structural systems used in the building type of structures is to support gravity loads. The most common loads resulting from the effect of gravity are dead load, live load and snow load. Besides these vertical loads, buildings are also subjected to earthquake loads. Earthquake loads can develop high stresses, produce sway movement or cause vibration. Therefore, it is very important for the structure to have sufficient strength against vertical loads together with adequate stiffness to resist lateral forces. Therefore, it is very important for the structure to have sufficient strength against vertical loads together with adequate stiffness to resist lateral forces.

A. Shear wall

Shear walls are used in many buildings primarily to resist efficiently the action of lateral loads and to participate as much as possible in carrying gravity loads. They are usually conceived as vertical plates supported at the foundation and are expected to function only under the action of in-plane horizontal and vertical forces. However, depending upon the architectural and structural layout of the building, shear walls may have a more complex shape. Often the walls are of a central core forming boxes, or are cast between two columns leading to I or dumbbell shapes. Shear wall must meet appropriate criteria for strength, stiffness and in earthquake areas, also for ductility. Depending on the moment to shear ratio at each horizontal cross section of the wall, the behavior can be controlled by shear and flexure.

Ductile ‘shear walls’ (more appropriately called flexural walls), which form part of the lateral load resisting system, are vertical members cantilevering vertically from the foundation, designed to resist lateral forces in its own plane, and are subjected to bending moment, shear and axial load. Unlike a beam, a wall is relatively thin and deep, and is subjected to substantial axial forces. The wall must be designed as an axially loaded beam, capable of forming reversible plastic hinges (usually at the base) with sufficient rotation capacity.

Reinforced concrete building structures can be classified as:

1. Structural Frame Systems: The structural system consist of frames. Floor slabs, beams and columns are the basic elements of the structural system. Such frames can carry gravity loads while providing adequate stiffness.
2. Structural Wall Systems: In this type of structures, all the vertical members are made of structural walls, generally called shear walls.
3. Shear Wall–Frame Systems (Dual Systems): The system consists of reinforced concrete frames interacting with reinforced concrete shear walls.

Just we are provided shear wall at different location analysis for better result

B. Object and Scope of the Study

In India, very few buildings are designed properly by structural engineers. Proper analysis and design of building structures that are subjected to static and dynamic loads is very important. Another important factor in the analysis of these systems is obtaining acceptable accuracy in the results.The object of this study is to model and analyze shear wall-frame structures having different thickness and location of wall in the structure and we will also discuss effect of soft storey and opening in shear wall.

C. Classification of Shear Wall

1. Simple rectangular types and flanged walls
2. Coupled shear walls
3. Rigid frame shear wall
4. Framed walls with in filled frames
5. Column supported shear wall

D. Codal Provisions for shear wall in IS: 13920-1993

The code IS 13920 recommends that the thickness of any part of the wall should preferably be not less than 150 mm.

• Flanged walls also have higher bending resistance and ductility.
The code restricts the effective flange width of flanged walls to

(a) Half the distance to an adjacent shear wall web, and
(b) one-tenth of the total wall height.

• The wall should be reinforced with uniformly distributed reinforcement in both vertical and horizontal directions, with a minimum reinforcement ratio of 0.0025 of the gross section in each direction. The bar diameter should not

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exceed one-tenth the wall thickness, and the bar spacing in either direction should not exceed

(a) 1/5 of the horizontal length of wall,
(b) Thrice the wall (web) thickness, and
(c) 450 mm.

II. ANALYSIS

For this study, a 5-story building with a 3.5-meters height for each story, regular in plan was modeled. These buildings were designed in compliance to the Indian Code of Practice for Seismic Resistant Design of Buildings .The buildings were assumed to be fixed at the base. The buildings were modeled using software ETAB. Models were studied in V zone comparing lateral displacement, base shear and storey acceleration in X and Y direction for all structural models under consideration. We are taking two cases

Table 1 List of model

Building 1	The Building without shear wall. (Figure 1)
Building 2	The building with shear walls one on each side at centre. (Figure 2)
Building 3	The building with shear walls alternatively on each side. (Figure 3)
Building 4	The building with shear walls at corners on each side. (Figure 4)
Building 5	The building with shear walls one on each side at centre on inner side (Figure 5)

Table 2 The Material and element properties considered for the modelling in ETAB is given below

Column Size	450mm x 450mm
Beam Size	300mm X 300mm
Slab Thickness	200 mm
Wall Thickness	115 mm
Shear Wall Thickness	150mm / 200mm
Floor Height	3.5 m
Unit Weight	
Masonry	20 kN/m3
Concrete	25 kN/m3
Concrete Grade	M25
Steel Grade	Fe500
Loading	
Dead Load	
Wall Load	8.05 kN/m
Parapet Wall Load	4.6 kN/m
Floor Load	0.6 kN/m2
Live Load	3 kN/m2
Seismic Parameter	
Seismic Zone	V (Very Severe)
Seismic Intensity (Z)	0.36
Soil Type	Medium Soil
Importance Factor	1

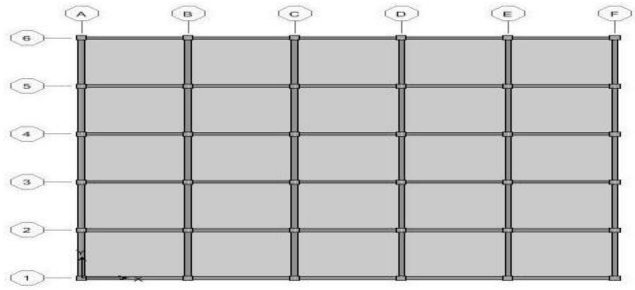

Fig. 1. The Building without shear wall

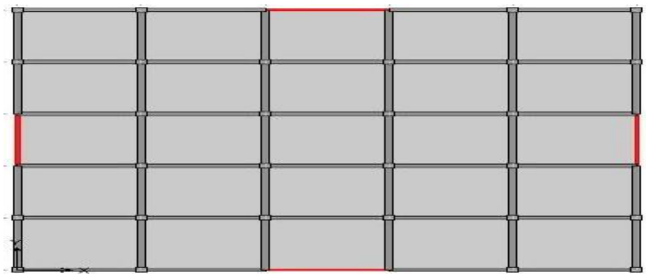

Fig. 2. The building with shear walls one on each side at centre

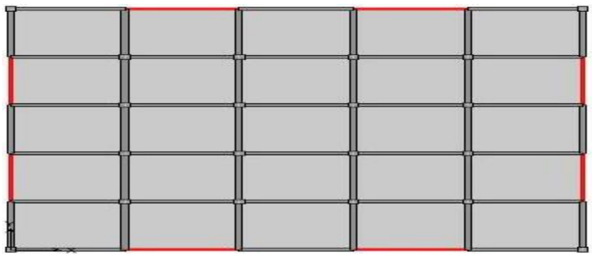

Fig. 3. The building with shear walls alternatively on each side

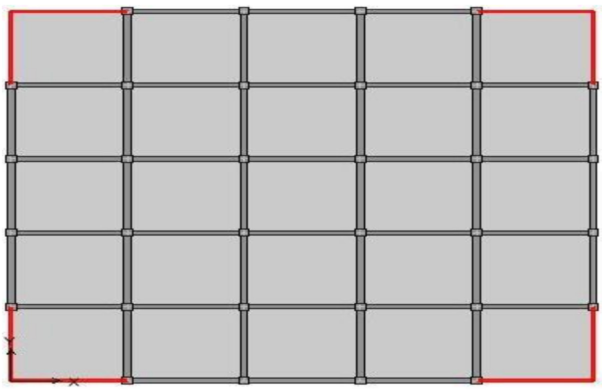

Fig. 4. The building with shear walls at corners on each side

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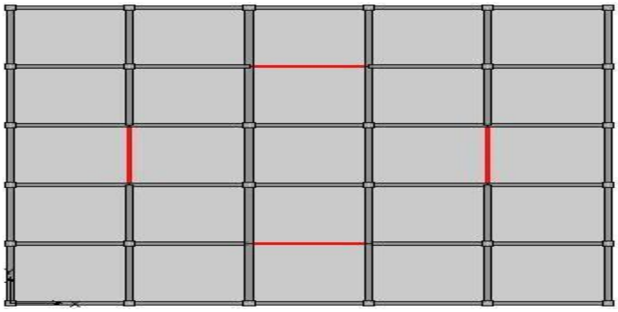

Fig. 5. The building with shear walls one on each side at centre on inner side

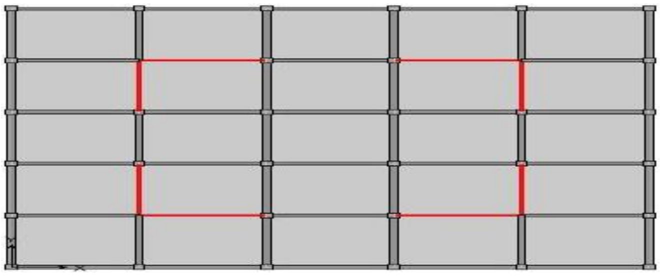

Fig. 6. The building with shear walls at corners on each side on inner side

III. EFFECT OF LOCATION OF SHEAR WALL

Proper positioning of shear wall results in effective and efficient performance of building during earthquakes. In this study of 5 storeys building in zone V is presented with some investigation which is analyzed by changing various location of shear wall for determining parameters like storey displacement, storey acceleration and base shear. In this section, a comparison of seismic analysis using response spectrum method for six building models:

Building 1: The Building without shear wall

Building 2: The building with shear walls one on each side at centre

Building 3: The building with shear walls alternatively on each side

Building 4: The building with shear walls at corners on each side

Building 5: The building with shear walls one on each side at centre on inner side

This section presents the results of the comparisons of top floor displacements, base shear and top floor acceleration obtained by using response spectrum analyses performed in the x and y directions. Due to the symmetry, the dynamic loading in the x direction and y direction causes pure translations on the building structures.

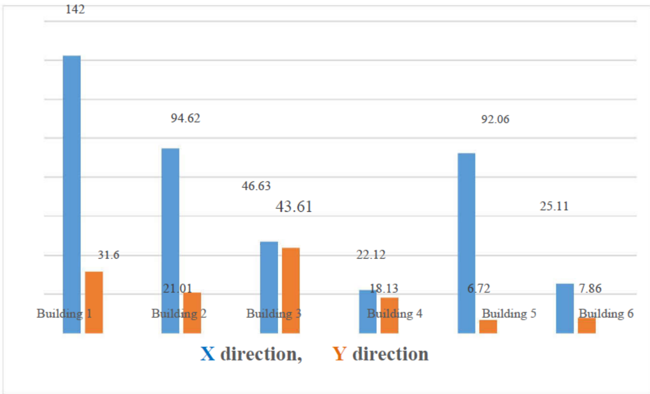

Fig.7. Curve between displacements in building at different location

Building 4 has minimum displacement. It can also be seen that when shear wall placed at inner walls (building 5) of the building, displacement reduced by 2.56 mm.

The base shear is quite important in earthquake analysis and the design of building structures. Especially in dynamic analysis, the total effect of lateral inertia forces acting on the structure can be determined by base shear forces.

IV. CONCLUSION

In this study, various concrete frame models with and without shear, opening in shear wall and discontinuity of shear wall have been studied. The carried out study has shown that shear walls are able to decrease lateral top displacement of each modeled building and the harmful impacts during earthquakes.

1) From the above result it is seen that top displacement of building 4 is minimum compared to other models. Top storey displacement of building 4 is 84.42% less compared to building 1 but base shear and storey acceleration is 30.72% and 32.20% is more compared to building 1 respectively. Because of stiffness of building 4 is more than building 1, the building 4 is less vulnerable than bare frame.
2) Top displacement in building 9 (25% opening) is 23.84% less than building 7 which has 100% opening but base shear in building 9 is 8.85% more than building 7 and storey acceleration in building 9 is
5.97% more than building 7. Area of shear wall directly affect the stiffness. Building 9 which has less opening than building 7 and 8 is stiffer. So, Building 9 shows less displacement than other buildings.
3) It is also observed that top displacement in building 10 is 54.45% less than building 11 and base shear and top storey acceleration is 27% and

31.45% respectively also less than building 11. This is similar to above case.

4) According to analysis best location of shear wall is figure 6 there is low displacement in x and y direction of wall.

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