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Comparative Study of C & L Shape Shear Wall in RC Flat Slab Structure

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Abstract: ***Flat slab construction possesses major and various advantages over conventional slab-beam-column construction. The flat slab system's structural efficiency is often hindered by occasionally poor performance under earthquake loading due to inherent insufficient lateral resistance. This undesirable behavior is mainly due to the absence of deep beams and/or shear walls in the flat slab system which generally gives rise to excessive lateral deformations. Shear walls are vertical elements of horizontal force resisting system. Shear wall with flat slab gives stability to structure as well as it improves lateral load resistance. This paper studies the effect of C and L shape shear wall in RC flat slab. The effectiveness of C and L shape shear wall in RC flat slab building is studied with the help of three different models such as flat slab building and C and L shape shear wall in RC flat slab building. Response spectrum analysis is carried out for the structure using ETABs software. The parametric study comprises of storey displacement, storey drift and storey shear in three structures. The comparison shows that the L shape shear wall is more effective to resist lateral loads compared to C shape shear wall.***

Keywords: Flat slab, Shear wall, Storey shear, Storey drift

1. Introduction

One of the most common floor systems for the construction practice in many earthquake vulnerable parts of the world is the reinforced concrete flat slab. Flat slab construction possesses major and various advantages over conventional slab-beam-column construction. The flat slab system's structural efficiency is often hindered by occasionally poor performance under earthquake loading due to inherent insufficient lateral resistance. This undesirable behaviour is mainly due to the absence of deep beams and/or shear walls in the flat slab system which generally gives rise to excessive lateral deformations. Shear walls are vertical elements of horizontal force resisting system. When walls are situated in advantageous positions in a building, they can be very efficient in resisting lateral loads originating from wind or earthquakes, large portion of the lateral loads on the buildings and horizontal shear force resulting from the load are often assigned to structural elements they have been called shear wall.

2. Literature Review

R.V.Surve et al (2015) they studied performance of a building with soft storey at different level along with at GL using nonlinear static pushover analysis. From analysis they found that plastic hinges are developed in columns of ground level soft storey which is not acceptable criteria for safe design. They suggested retrofitting with shear wall for safe performance of building. They also found that after retrofitting the base shear carrying capacity is increased by 19.22 % to 34.64%.

Sumit Pahwa et al (2014) studied comparative behavior of flat slab with old traditional two way slab. This parametric study comprised of maximum lateral displacement, storey drift and axial forces generated in the column. In this study models created of two-way slabs and flat slab without shear wall for each plan size of 16x24 m and 15x25 m, using Staad Pro. 2006 for seismic zones III, IV and V with varying height 21m, 27 m , 33 m and 39m.

3. Problem Definition

A ten storey office building with flat slab, flat slab with C shape shear wall and flat slab with L shape shear wall is modeled using ETABS software. Three models of multi-storeyed buildings were created using ETABS software. The inputs required for modeling were taken from standard codes such as IS 456: 2000, IS 1893-(Part 1) 2000, IS 875(part2).

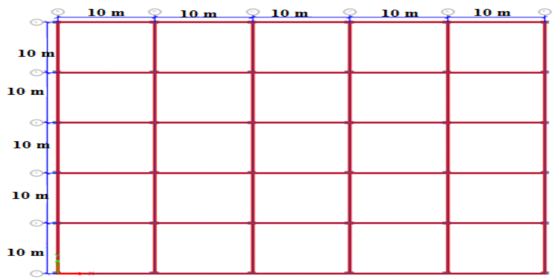

Figure 1: Plan of a flat slab building

4. Modelling

The analysis of framed structures with and without wide beams has been done by using ETABS 2015. Before the analysis, all the required elements of the structure needs to be defined earlier like material properties, loads, load combinations, size of members, response spectrum etc. Once the analysis has been done we can extract the results like storey displacement, storey drift, base shear etc. for comparing the performance of the three models.

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Model 1- Flat Slab Building
Model 2 - C Shape Shear Wall In Flat Slab Building
Model 3 – L Shape Shear Wall In Flat Slab Building

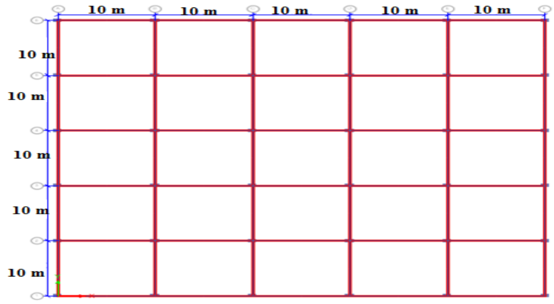

Figure 2: Plan of model 1

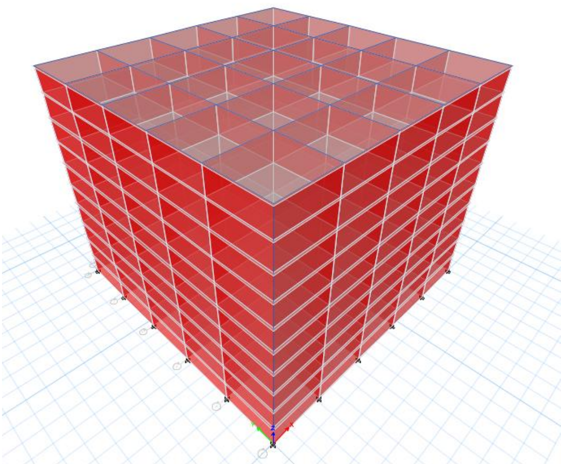

Figure 3:3D view of model 1

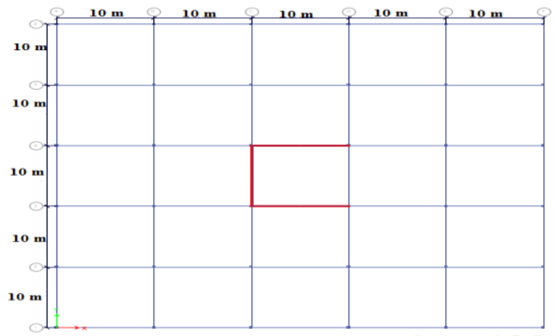

Figure 4 : Plan of model 2

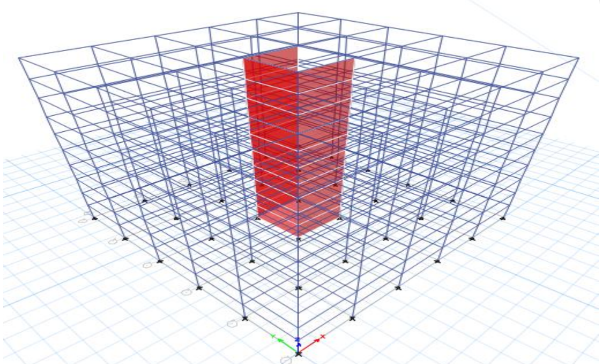

Figure 5 :3D view of model 2

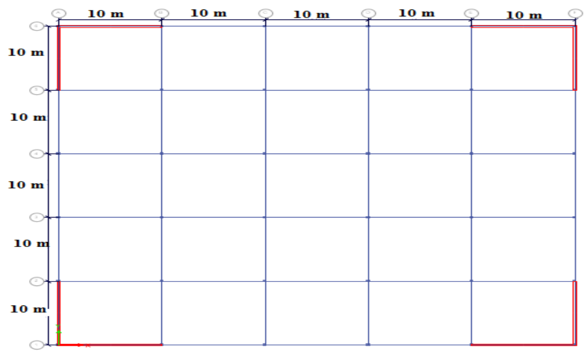

Figure 6: Plan of model 3

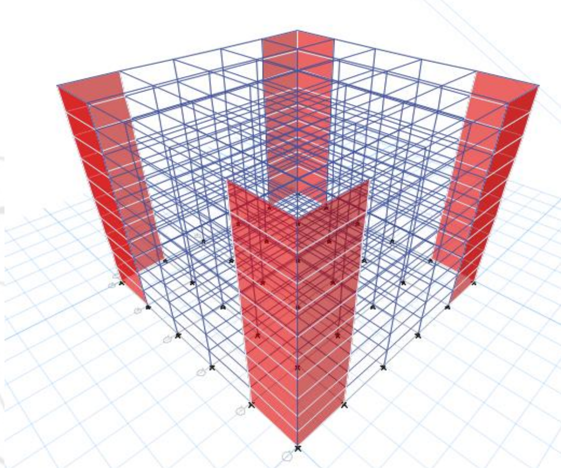

Figure 7:3D view of model 3

5. Result and Discussion

Three building models, one with flat slab, second with C shape shear wall and other with L shape shear wall were modeled and various parameters such as storey displacement, storey drift and storey shear were obtained by analyzing the models.

5.1 Storey Displacement

Storey displacement is the lateral displacement of the storey relative to the base. Displacement is an important criterion to describe the dynamic behavior of buildings. The displacement is maximum at top storey and minimum at base level. The variation in displacement values at different storey levels plotted in figure 5.1.

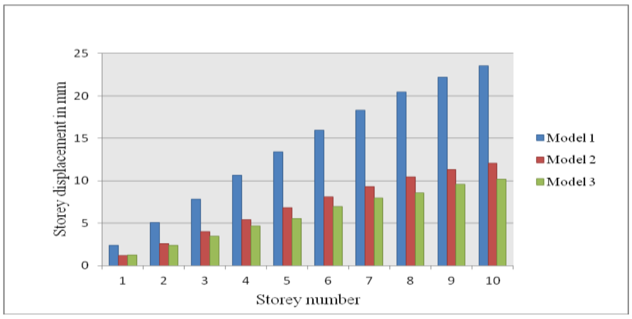

Figure 8: Variation of displacement in each storey

5.2 Storey Drift

Storey drift is defined as the difference in lateral deflection between two adjacent stories. During an earthquake, large lateral forces can be imposed on structures. Lateral deflection and drift have three primary effects on its structure, the movement can affect the structural elements. The sudden decrease in drift value is plotted graphically as shown in Figure 6.4.

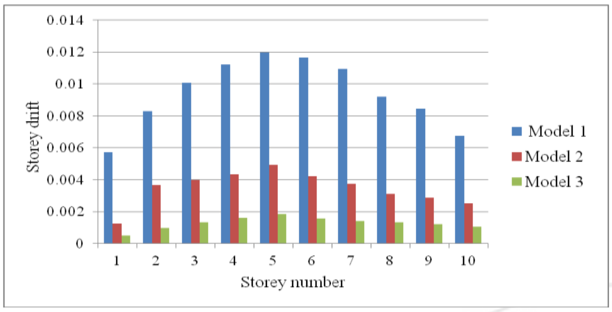

Figure 9: Variation of drift in each storey

5.3 Storey Shear

It can be observed that the storey shear is maximum at plinth level and minimum at terrace level for all types of buildings. After the plinth level the storey shear decreases as the storey level increases. As the total number of stories increases storey shear at plinth level increases. From the above table, it can be observed that the storey shear is maximum at plinth level and minimum at terrace level. Storey shear becomes lesser when L shape shear wall in RC flat slab is provided.

6. Conclusion

Storey displacement is uniformly increasing and it is maximum at top floor of the structures. Displacement of RC flat slab building is more than the flat slab building with C and L shape shear wall because of stiffness participation factor is more in shear wall building compared with that of flat slab. The storey drift values followed a parabolic path along storey height with maximum value lying somewhere near the middle storey, it was reduced more than 20 % and 45% when C and L shape shear were provided. Thus extra stiffness of columns is required at middle stories compared to other stories.

Flat slab building have maximum storey shear and L shape shear wall in flat slab building have minimum storey shear.
The paper concludes that building with L shape shear wall is more effective to resist lateral loads compared to C shape shear wall.

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