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Comparative Study of RC Shear wall at Different Location in Multi-Storied Building

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***Abstract** - The structure in high seismic areas may be susceptible to the severe damage. In the seismic design of buildings, reinforced concrete structural walls or shear walls act as major earthquake resisting members. Along with gravity load structure has to withstand lateral load. Now a days, shear wall in R.C. structure are most popular system to resist lateral load due to earthquake, wind, blast etc. Shear wall have high in plane stiffness and strength which can be used to simultaneously resist large horizontal loads and support gravity loads.*

In this present study, main focus is to determine the efficient location of shear wall in multi-storey building. An earthquake load is calculated on a building of fifteen stories located in zone V by seismic coefficient method using IS 1893 (PART – I): 2002. Effectiveness of shear wall has been studied with the help of five different models. Model one is bare frame structural system and other four models are dual type structural system. The computer aided analysis is done by using ETABS 13.1 to find out the effective lateral load system during earthquake in high seismic area. The performance of the building is evaluated using different parameters such as Lateral Displacement, Storey shear and Storey Drift.

***Key Word** - R.C. frame, Shear wall, Lateral displacement, storey shear, storey drift*

I. INTRODUCTION

Reinforced concrete framed buildings are adequate for resisting the vertical load and horizontal load acting on them. Behaviour of RC frame building during earthquake motion depends on distribution of weight, stiffness and strength in both planes of building. Also for a multi storey building, beam and column sizes are quite heavy so there is lot of congestion at joint and it is difficult to place and vibrate concrete at joint which induces heavy forces in member. These difficulties are overcome by introducing shear wall. Shear wall behaves like flexural members and they provide large strength and stiffness to buildings in the direction of their orientation. They have very large in-plane stiffness and therefore resist lateral load and control deflection very efficiently which avoids total collapse of building under seismic forces. When shear wall are situated in advantageous positions in the building they can form an efficient lateral force resisting system. In this present paper one model for bare frame type and four models for dual type structural system are generated with the help of ETAB and effectiveness has been checked.

II. BUILDING MODELING

For the analysis purpose, a 15-story building with 3.5 meters height for each story, regular in plan is modelled. These building structure was designed according to IS 1893 (Part I): 2002 and IS 456 : 2000. The buildings are assumed to be fixed at the base and the floors acts as rigid diaphragms. Storey height of buildings are assumed to be constant including the ground storey.

The buildings are modelled using software ETABS 13.1. Four different models were studied apart from bare frame model with different positioning of shear wall in building. Based on analysis results parameters such as lateral displacement, storey drift and storey shear are compared for each model.

The plan of the building model are given below:
Model 1 – Bare framed without shear wall.

Model 2 – Dual type structural system with shear wall in longitudinal direction (X axis)

Model 3 – Dual type structural system with shear wall in transverse direction (Y axis)

Model 4 – Dual type structural system with shear wall one on each side

Model 5 – Dual type structural system with shear wall in L shape

Table 1: Preliminary Data

Properties	Criteria
Zone	V
No. of stories	15
Structure	Special Moment Resisting Structure
Floor to floor height	3.2 m
Beam size in both direction	300 x 450 mm^2
Column size in both direction	300 x 450 mm^2
Thickness of slab	120 mm
Thickness of shear wall	300 mm
Live Load	3 KN/m^2
Floor Finish	1 KN/m^2
Importance factor	1
Type of Soil	Medium
Grade of Concrete & Steel	M25 Fe 415

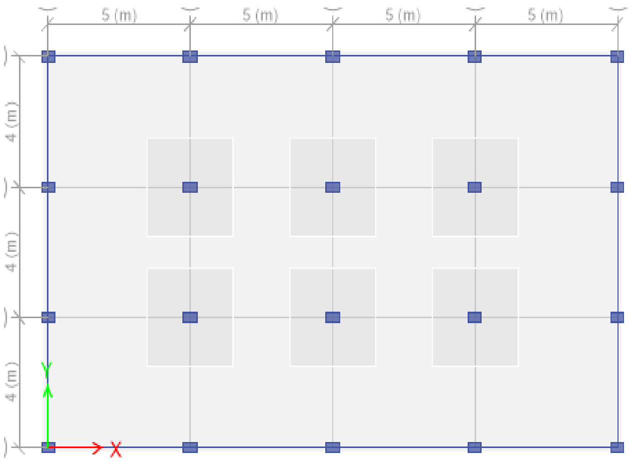

Figure. 1 – Model 1

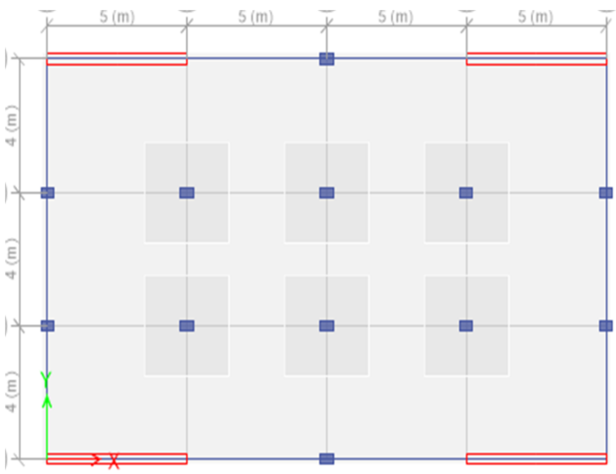

Figure. 2 – Model 2

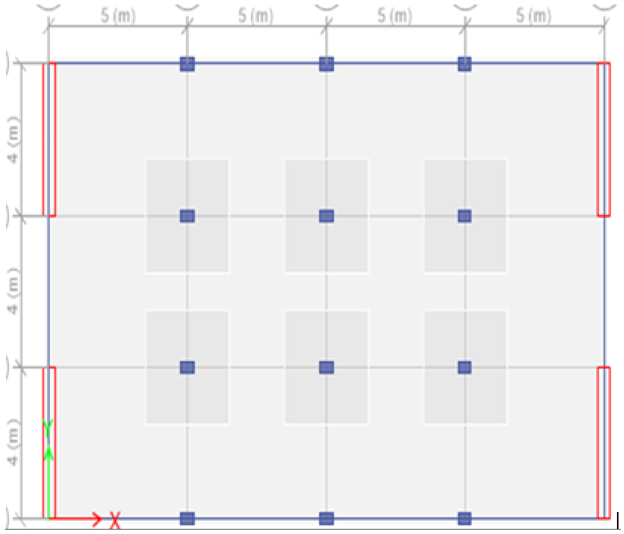

Figure. 3 – Model 3

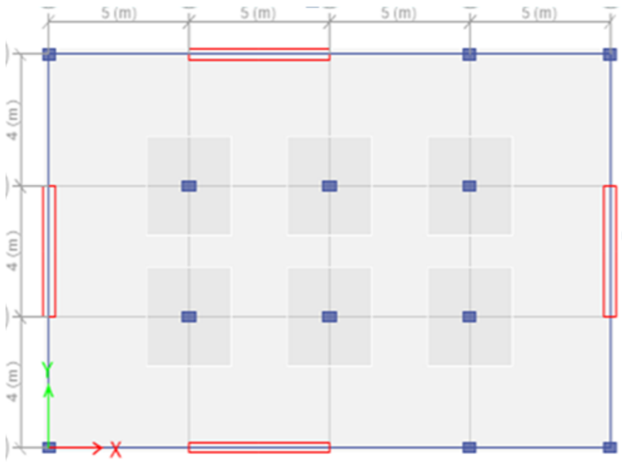

Figure. 4 – Model 4

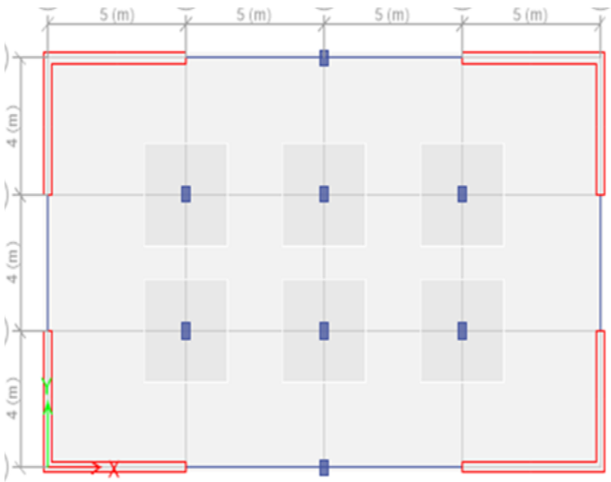

Figure. 5 – Model 5

III. RESULTS AND DISCUSSION

LATERAL DISPLACEMENT

Lateral displacement of models at each floor level is shown in fig.

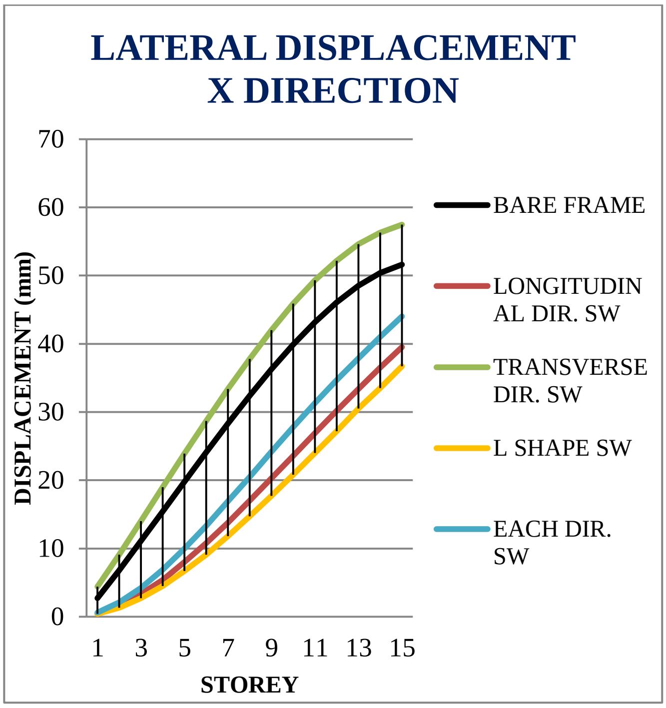

Figure. 6 Lateral Displacement in X Direction

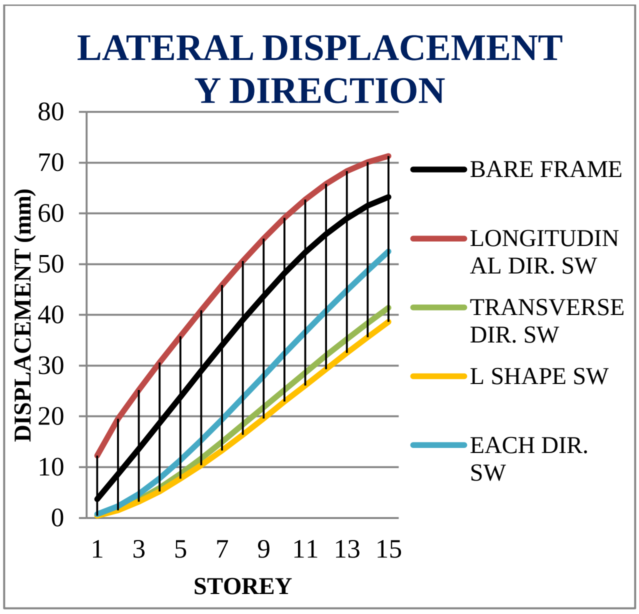

Figure. 7 Lateral Displacement in Y Direction

- Lateral displacement of shear wall in longitudinal direction (X axis) is reduced by 25% compare to bare frame.
- Lateral displacement of shear wall in transverse direction (Y axis) is reduced by 35% compare to bare frame.
- Lateral displacement of shear wall in L shape is reduced by 30% compare to bare frame.
- Lateral displacement of shear wall one on each side is reduced by 15% compare to bare frame.
- Lateral displacement of L shape shear wall is reduced by 10%, 40% and 20% compare to longitudinal, transverse and one on each direction shear wall respectively.

STORY DRIFT

Story Drift of models at each floor level is shown in fig.

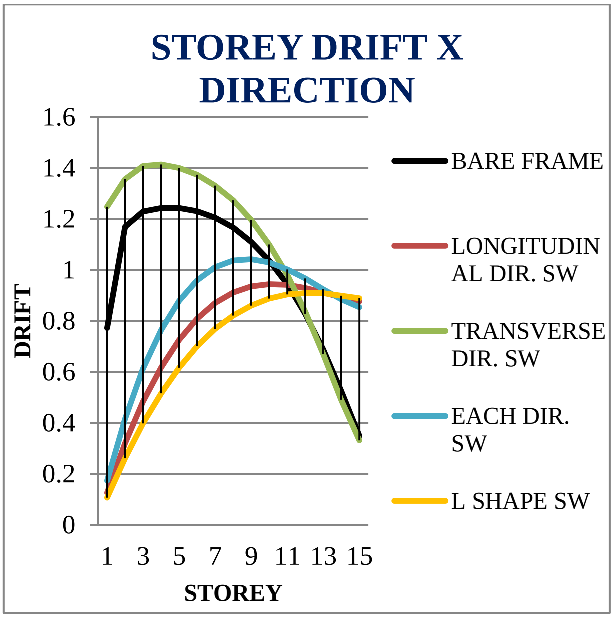

Figure. 8 Storey Drift in X Direction

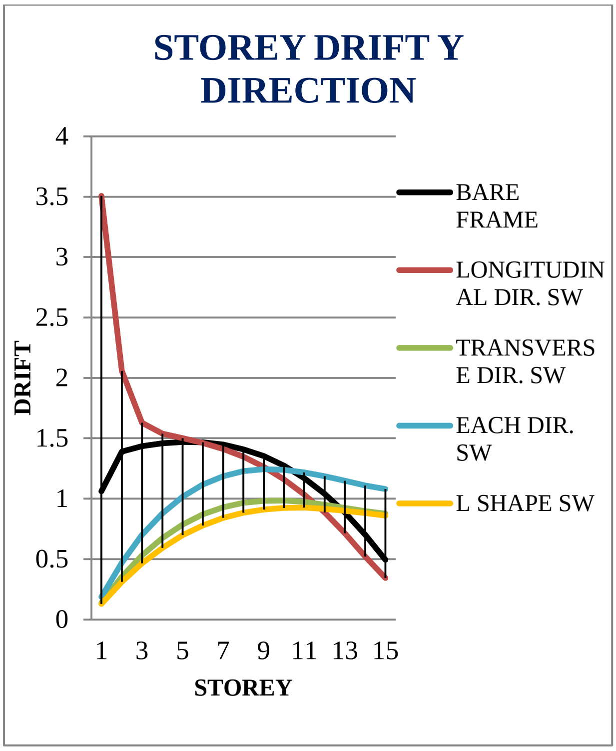

Figure. 9 Storey Drift in Y Direction

- Storey drift in X as well as Y direction increase at 15 storey but after 11 storey it is significantly decrease in four modals compare to bare frame modal.
- Storey drift of L shape shear wall is reduced by 15%, 90% and 40% compare to longitudinal, transverse and one on each side shear wall respectively.

STORY SHEAR

Story Shear of models at each floor level is shown in fig.

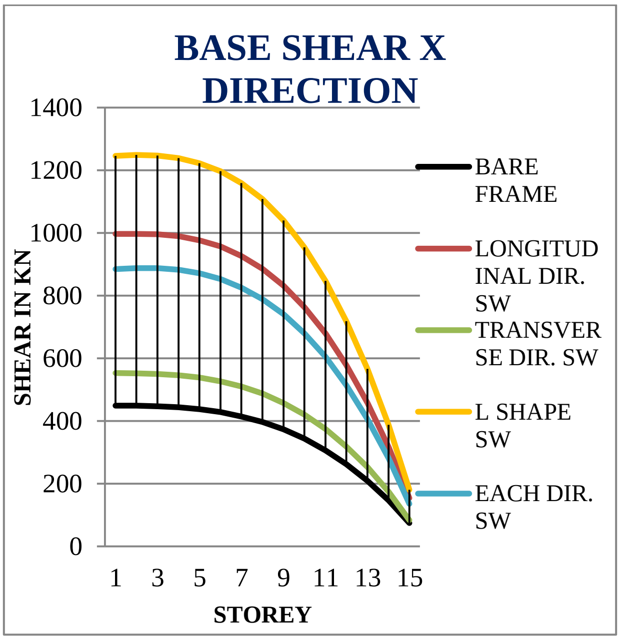

Figure. 10 Base Shear in X Direction

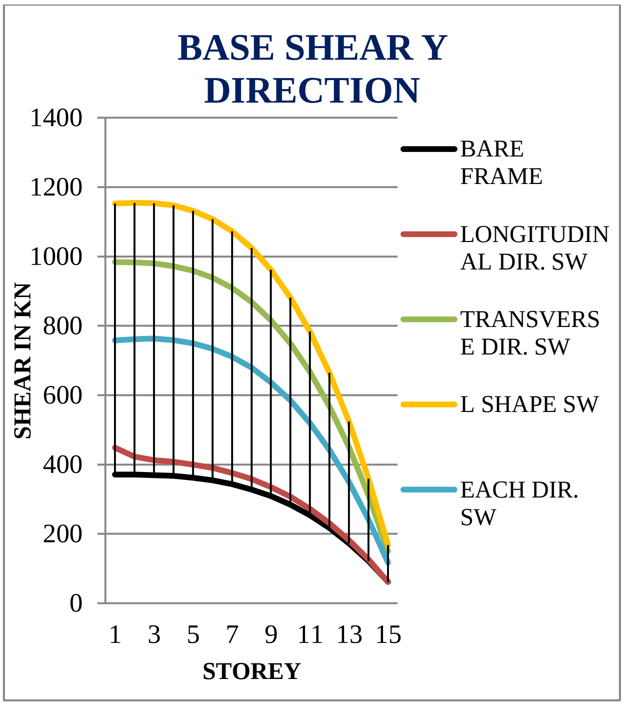

Figure. 11 Base Shear in Y Direction

- Storey shear in X as well as Y direction increases in four modal compare to bare frame modal.

IV. CONCLUSION

From above results it is clear that shear wall frame interaction systems are very effective in resisting lateral forces induced by earthquake. The study indicates the significant effect on lateral displacement; storey drift and storey shear by applying an "L shape" shear wall in model.

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