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Comparative study of shear wall by using displacement and drift parameters

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Abstract-*In the seismic design of buildings, shear wall act as a major earthquake resisting members. It offers great potential for lateral load resistance. The properties of these seismic shear walls give the response of the buildings, and therefore, it is essential to evaluate the seismic response of the walls appropriately. In this present study, the main aim is to determine the solution for shear wall location in multi-storey building. Effect of shear wall has been studied with the help of two different models. We have design it for zone four and Model for with and without shear wall. An earthquake load is applied to a building of G+13 stories. Parameters like Lateral joint displacement and joint drift required for each floor are calculated in both cases of shear wall. The analysis of this parameter is carried out by using ETABS software.*

KEYWORDS: *R.C.C. shear wall, High rise Structure, ETABS, Displacement, and Drift.*

I. INTRODUCTION

Now a days there is very rapid growth of multi-storey buildings, and no any probabilistic assessment procedures have been proposed for seismic risk evaluation of this special building group. Reinforced concrete (RC) buildings often have in addition to slab beam and column vertical plate-like RC wall is termed as Shear Wall. Which are generally start at foundation level and these are continuous throughout the height of the building. The thickness of these walls can be as low as 150mm, or as high as 400mm in case of high rise buildings. Shear walls are mostly provided along both direction i.e. Length and width of buildings. They are like vertically-oriented wide beams that carry earthquake loads downwards to the foundation.

Shear wall are one of the outstanding means of providing earthquake resistance to multi-storied reinforced concrete building. The structure is still spoiled due to some or the other reason during earthquakes. Behaviour of structure during earthquake excitation is depends on distribution of weight, stiffness and strength in both horizontal and vertical planes of building. So as to reduce the influence of earthquake reinforced concrete shear walls are used in the building. Structural design of buildings for seismic loading is primarily concerned with structural safety during major Earthquakes, in high rise buildings, it is very important to ensure adequate horizontal stiffness to resist lateral load. The provision of shear wall in building to achieve inelasticity has been found effective and economical. When buildings are high, beam, column sizes are moderately heavy and steel required is large. So there is lot of congestion at these joint and it is difficult to place and vibrate concrete at these place and displacement is moderately heavy. Shear walls are usually used in high rise building to avoid failure of buildings. In this present paper one model for without shear wall and other with shear wall type residential building system are generated with the help of ETAB and effectiveness has been checked.

II. METHODOLOGY

In this Research Paper we had discussed the most important parameters:

1) Displacement
2) Drift

A. Displacement

Due to dynamic forces like exploration of earthquake, shaking of the ground and due to wind blast in nearby area, there is necessity to find Joint displacement as well as Joint drift. These analyses for the simple structures are carried out manually but for complex structure ETABS can be used to calculate these parameter.

B. Drift

Lateral drift or story drift is nothing but the amount of side sway between any two adjacent stories of a building which is caused by lateral loads i.e. wind and earthquake. Inter-story drift is an important indicator of structural behaviour in performance-based seismic analysis. This paper describes the definition and contents of the inter-story drift. Existing calculation methods for harmful and harmless inter-story drift are revisited first. Their advantages and shortcomings are compared. Finally, the generalized shear deformation of region, which seems to be suitable for structures predominated by flexural-shear deformation, is introduced and evaluated.

C. Building Modelling

For this study, a 14-story building with a 3.1-meters height for each story, regular in plan is model. These buildings were designed in acquiescence to the Indian Code of Practice for Design of Seismic Resistant Buildings .The buildings are assumed to be fixed at the base and the floors acts as rigid diaphragms. The sections of structural elements are square in their dimensions. Storey height of building is assumed to be constant including the ground storey. The buildings are model using ETAB software. Two different models were studied with positioning of shear wall in building at midspan along width of building and without provision of shear wall in building. These Models are compared for lateral displacement, as well as drift calculation.

D. Preliminary data

- G + 13Storey R.C Public building (Hospital building)
- Zone factor, Zone - IV, Z = 0.24
- Building frame system - (SMRF) - Reduction factor, R = 0.5
- Hospital building - Importance factor - I = 1.5
- Floor to floor height = 3.1m
- Roof and floor slab thickness = 200 mm
- Beams dimension = 500 x 500 mm
- Column size = 700 x 700 mm
- Grade of concrete = M20 and steel Fe-415
- Shear wall thickness = 250 mm

The plan of the building model are given below
Model 1 – Floor plan of the structure without shear wall.
Model 2 – Floor plan of the dual system with shear wall on side of the structure.

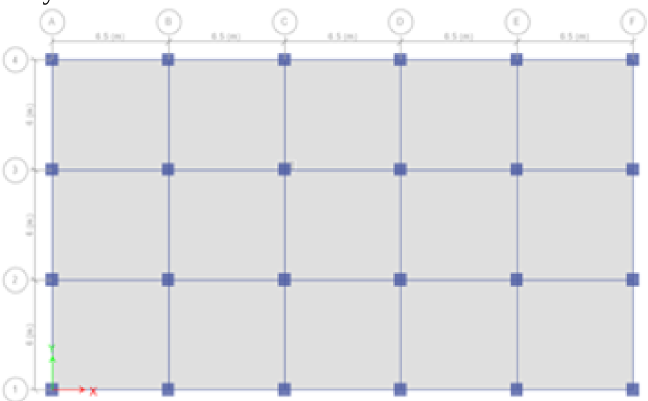

Fig.1 Model 1 – Floor plan of the structure without shear wall.

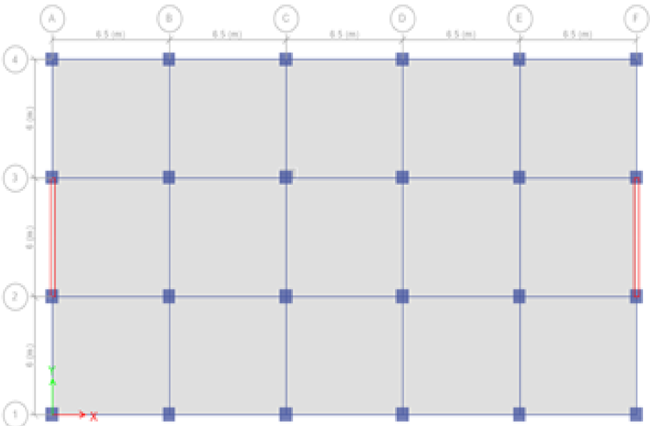

Fig.2 Model 2 – Floor plan of the dual system with shear wall on side of the structure.

Table 1 Displacement with and without Shear wall

Sr. no	Storey no	Displacement without SW	Displacement with SW
1	Terrace	87.021	45.06
2	Slab 13	83.8119742	42.83
3	Slab 12	81.3292116	41.45
4	Slab 11	77.6385969	39.36
5	Slab 10	73.157	36.8
6	Slab 09	68.008	33.86
7	Slab 08	62.313	30.59
8	Slab 07	56.1912726	27.089
9	Slab 06	49.7533078	23.395
10	Slab 05	43.0885868	19.568
11	Slab 04	36.2692316	15.662
12	Slab 03	29.3613214	11.726
13	Slab 02	22.37557717	7.829
14	Slab 01	15.2479902	4.128
15	G.L	7.2820937	0.999

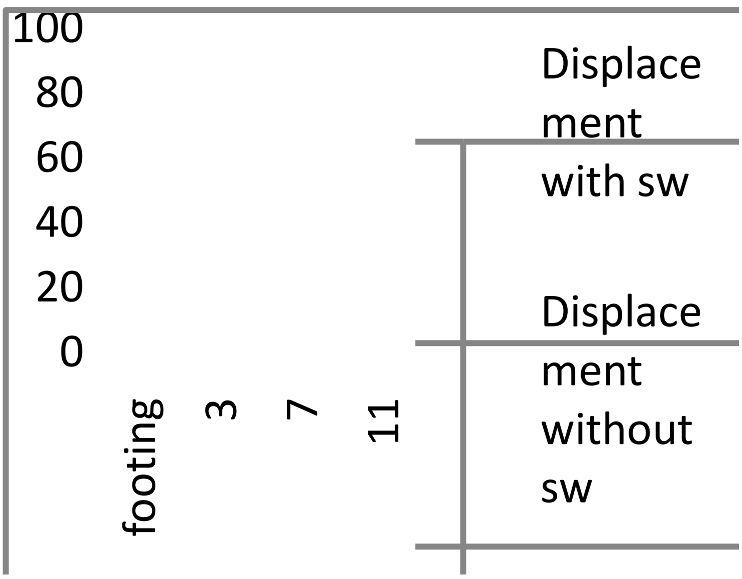

Fig.3 Joint Displacement for model 1 & 2

Table 2 Drift with and without Shear wall

Sr. no	Storey no	Drift without SW	Drift with SW
1	Terrace	0.0059	0.0034
2	Slab 13	0.0083	0.0047
3	Slab 12	0.011	0.0063
4	Slab 11	0.0135	0.0077
5	Slab 10	0.0155	0.0089
6	Slab 09	0.0172	0.0098
7	Slab 08	0.0185	0.0204
8	Slab 07	0.0194	0.011
9	Slab 06	0.020	0.0115
10	Slab 05	0.0206	0.0604
11	Slab 04	0.0209	0.0119
12	Slab 03	0.0211	0.0118
13	Slab 02	0.0216	0.0112
14	Slab 01	0.0234	0.0093
15	G.L	0.0284	0.0042

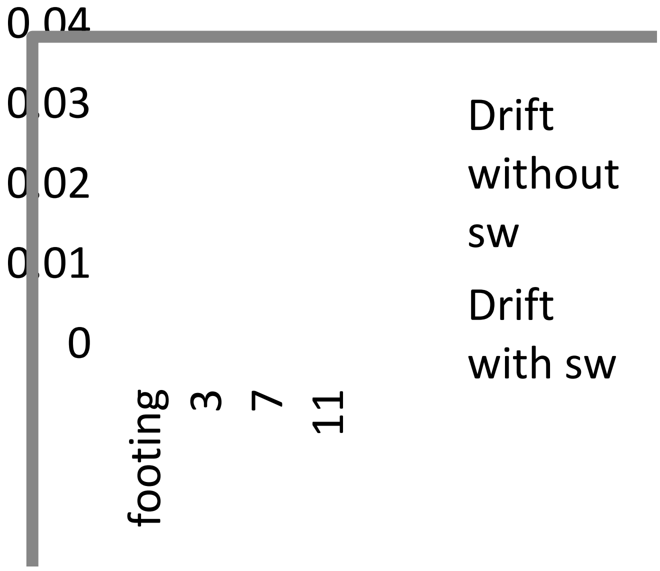

Fig.4 Joint Drift for model 1& 2

III. CONCLUSION

From all the above analysis, it is observed that in 14 story building, constructing with shear wall along short span at middle (model 2) is effective in resisting seismic forces as compare to building without shear wall. It is also observed that joint displacement & joint drift of the structure is reduced by providing shear wall.

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