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## EARTHQUAKE RESISTANT DESIGN OF SHEAR WALL

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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.*

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### 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:

#### 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.

#### 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. In case of single-story building, Horizontal deflection of a

wall is due to horizontal movement between two supports under wind or earthquake loading. While Vertical deflection of a floor or roof structural member is the amount of sag under gravity loading.

### 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.

### 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.

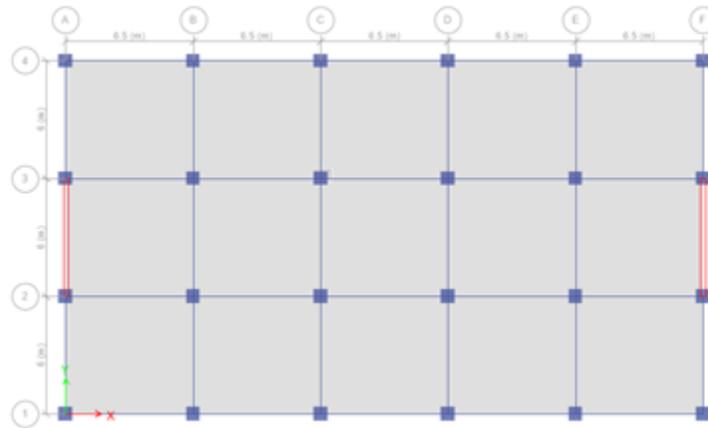


Fig.2 Model 2 – Floor plan of the dual system with shear wall on side of the structure.

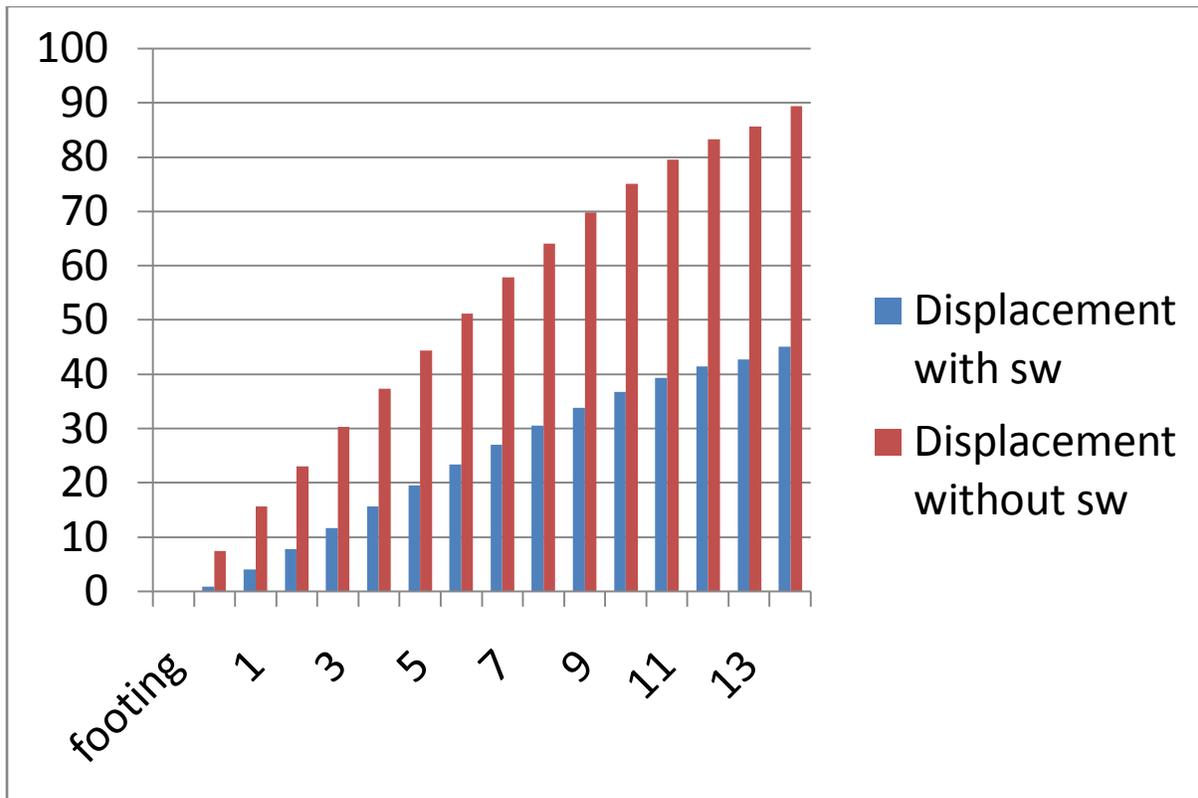


Fig.3 Joint Displacement for model 1 & 2

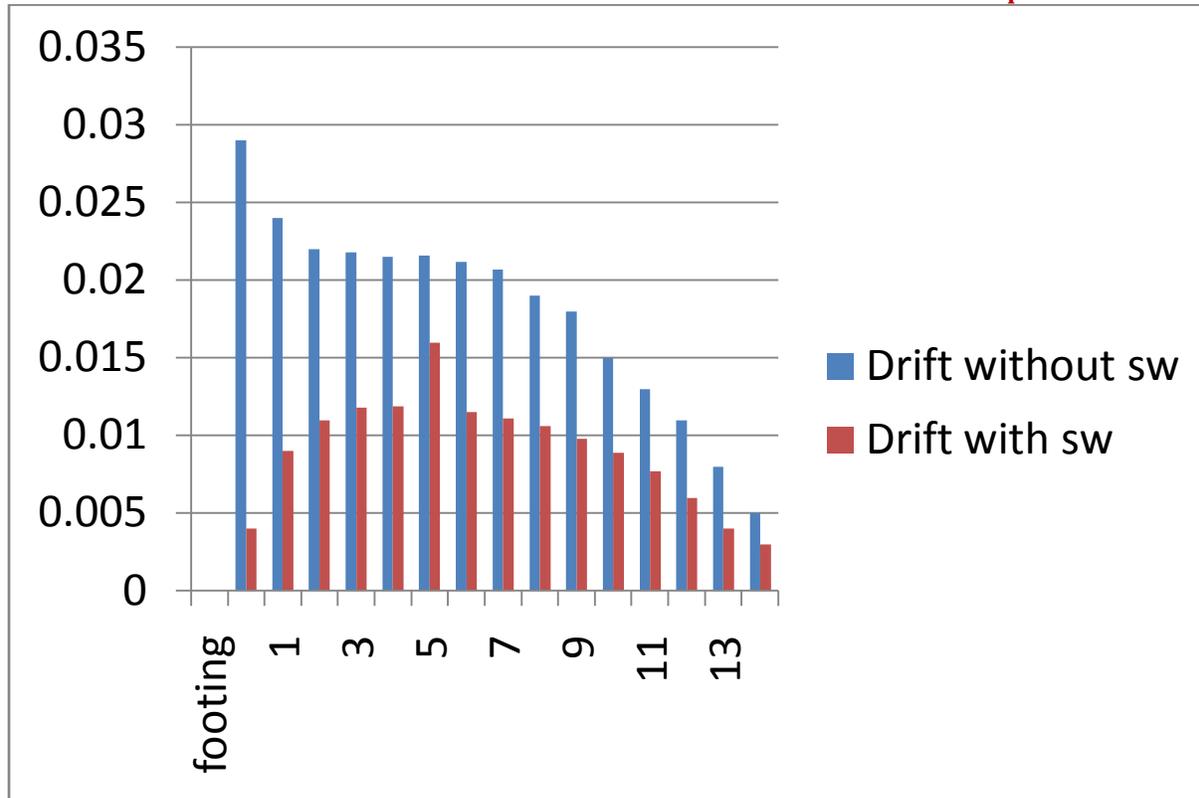


Fig.4 Joint Drift for model 1&amp; 2

### 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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### REFERENCES

1. P. P. Chandurkar, Dr. P. S. Pajgade, Vol. (3), Issue. (3), May - June (2013),ISSN: 2249-6645,Seismic Analysis of RCC Building with and Without Shear Wall,International Journal of Modern Engineering Research.
2. Ghalimath A.G, Waghmare Y.M, Zadbuke A.A , ChaudhariA.R,Vol. (02) Issue ( 05) Aug-2015, ISSN: 2395 -0056,Seismic Comparative Study of Multistoried R.C.C Building with Shear Wall in Bare Frame and Masonry Infill Frame For Various Types of Soil and Seismic Zones, International Research Journal of Engineering and Technology .
3. AnujChandiwala, Vol.( 2), Issue (12), December 2012, ISSN 2250-2459, earthquake analysis and configuration of building with different position of shear wall,International Journal of Emerging

*Technology and Advanced Engineering.*

4. C.V.Alkunte, M.V.Dhimate, M.B.Mahajan, S.Y.Shevale, S.K.Shinde & A.A.Raskar, Vol.(2), Issue.(6), 2016, ISSN: 2454-1362, *Seismic Analysis of Multi-storeys Building having Infill Wall, Shear Wall and Bracing. Imperial Journal of Interdisciplinary Research.*
5. Tae-Hyung Lee and Khalid M. Mosalam, July 6- 2003, (ICASP 9), *Sensitivity of Seismic Demand of a Reinforced Concrete Shear-Wall Building, Ninth International Conference on Application of Statistics and Probability in Civil Engineering.*
6. Varsha R. Harné, Vol.(5), Issue (2014), ISSN 2278-3652, *Comparative Study of Strength of RC Shear Wall at Different Location on Multi-storied Residential Building, International Journal of Civil Engineering Research.*
7. Dipali Patel a, J. A. Amin b, vol.(2), Issue 14 July (2015), *Evaluation of Shear Wall-RC Frame Interaction of High-rise Buildings using 2-D Model Approach, journal of materials and engineering structures.*
8. K. G. Patwari, L. G. Kalurkar Vol.(5), Issue(2016), ISSN:2319-6890, *Comparative study of RC Flat Slab & Shear wall with Conventional Framed Structure in High Rise Building, International Journal of Engineering Research.*
9. G.S Hiremath, Md Saddam Hussain, Vol.(3), Issue 10, October (2014), *Effect of Change in Shear Wall Location with Uniform and Varying Thickness in High Rise Building, International Journal of Science and Research*