International Journal of Modern Engineering Research (IJMER)
www.ijmer.com Vol. 3, Issue. 3, May - June 2013 pp-1805-1810 ISSN: 2249-6645

Seismic Analysis of RCC Building with and Without Shear Wall

P. P. Chandurkar[1], Dr. P. S. Pajgade[2],

[1]Post graduate student in structural engineering, [2]Department of Civil engineering, Prof. Ram Meghe Institute of Technology and Research Badnera, Sant Gadge Baba Amravati University, Amravati, Maharashtra 444602 India

ABSTRACT: *In the seismic design of buildings, reinforced concrete structural walls, or shear walls, act as major earthquake resisting members. Structural walls provide an efficient bracing system and offer great potential for lateral load resistance. The properties of these seismic shear walls dominate the response of the buildings, and therefore, it is important to evaluate the seismic response of the walls appropriately. In this present study, main focus is to determine the solution for shear wall location in multi-storey building. Effectiveness of shear wall has been studied with the help of four different models. Model one is bare frame structural system and other three models are dual type structural system. An earthquake load is applied to a building of ten stories located in zone II, zone III, zone IV and zone V. Parameters like Lateral displacement, story drift and total cost required for ground floor are calculated in both the cases replacing column with shear wall.*

KEYWORDS: *ETAB v 9.5.0, framed structure, Seismic analysis, Shear wall,*

I. INTRODUCTION

Shear wall are one of the excellent means of providing earthquake resistance to multistoried reinforced concrete building**.** The structure is still damaged due to some or the other reason during earthquakes. Behavior of structure during earthquake motion depends on distribution of weight, stiffness and strength in both horizontal and planes of building. To reduce the effect of earthquake reinforced concrete shear walls are used in the building. These can be used for improving seismic response of buildings. Structural design of buildings for seismic loading is primarily concerned with structural safety during major Earthquakes, in tall buildings, it is very important to ensure adequate lateral stiffness to resist lateral load. The provision of shear wall in building to achieve rigidity has been found effective and economical. When buildings are tall, beam, column sizes are quite 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 quite heavy. Shear walls are usually used in tall building to avoid collapse of buildings. 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 residential building and three models for dual type structural system are generated with the help of ETAB and effectiveness has been checked.

II. BUILDING MODELING

For this study, a 10-story building with a 3-meters height for each story, regular in plan is modeled. These buildings were designed in compliance to the Indian Code of Practice for Seismic Resistant Design of 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 and rectangular and their dimensions are changed for different building. Storey heights of buildings are assumed to be constant including the ground storey. The buildings are modeled using software ETAB Nonlinear v 9.5.0.Four different models were studied with different positioning of shear wall in building. Models are studied in all four zones comparing lateral displacement, story drift, % Ast in column, concrete quantity required, steel and total cost required in all zones for all models.

The plan of the building model are given below
Model 1 – Floor plan of the bare framed structure.
Model 2 – Floor plan of the dual system with shear wall one on each side.
Model 3 - Floor plan of the dual system with shear wall on corner with L = 4.5m
Model 4 – Floor plan of the dual system with shear wall on corner with L = 2m.
All calculations are carried out at ground floor.
All diamensions are in mm.

TABLE 1: Preliminary data

	For ten story
No. of stories	TEN (G+9)
Floor to Floor Height	3.0 m
Beam size longitudinal and transverse direction	230x500 mm^2
Column size	300x600 mm^2
Thickness of slab	150 mm
Thickness External Wall	230 mm
Thickness of Internal wall	115 mm
Grade of Concrete and steel	M20 and Fe415

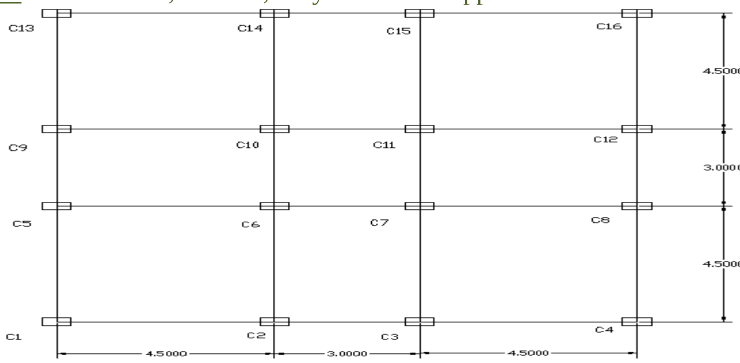

Figure 1: model 1

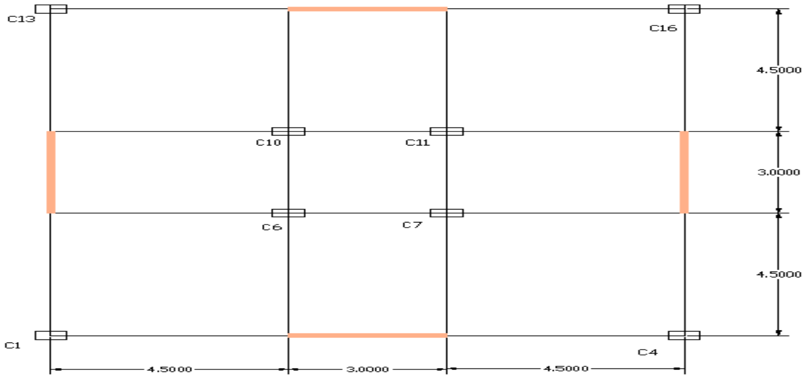

Figure 2: model 2

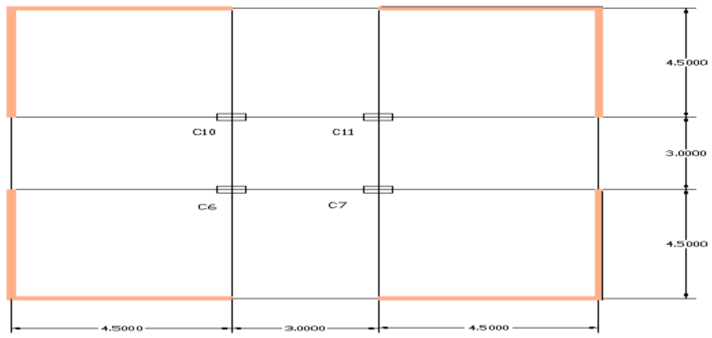

Figure 3: model 3

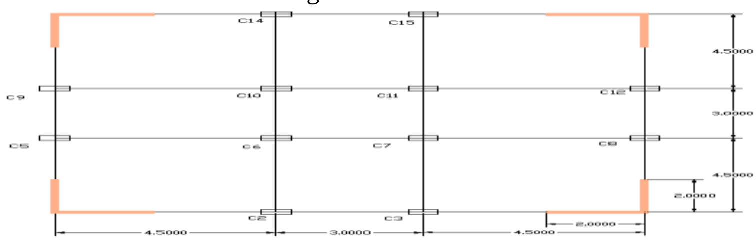

Figure 4: model 4

III. RESULT AND DISCUSSION

III.1 LATERAL DISPLACEMENT

Lateral displacement for all model in all four zones are as shown in fig.

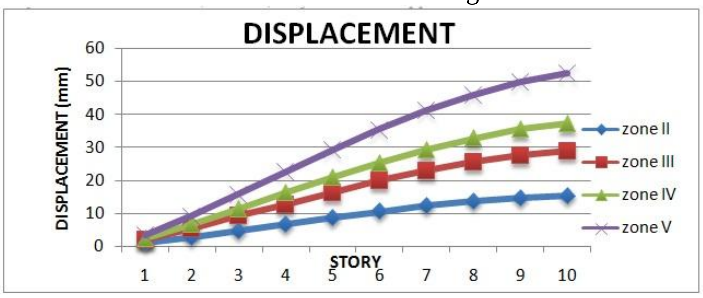

Figure 5: displacement of model 1

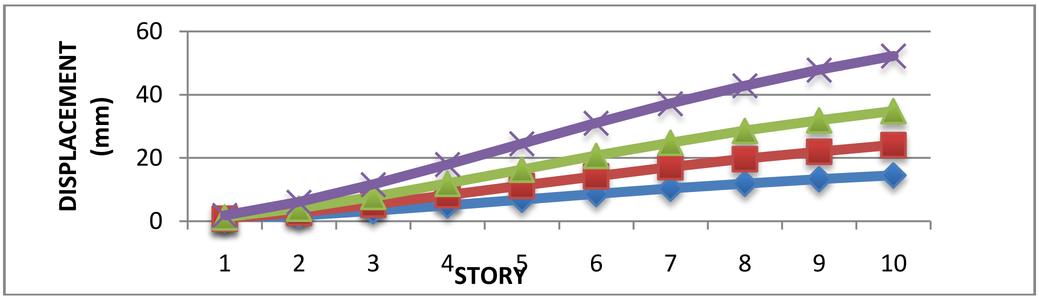

Figure 6: displacement of model 2

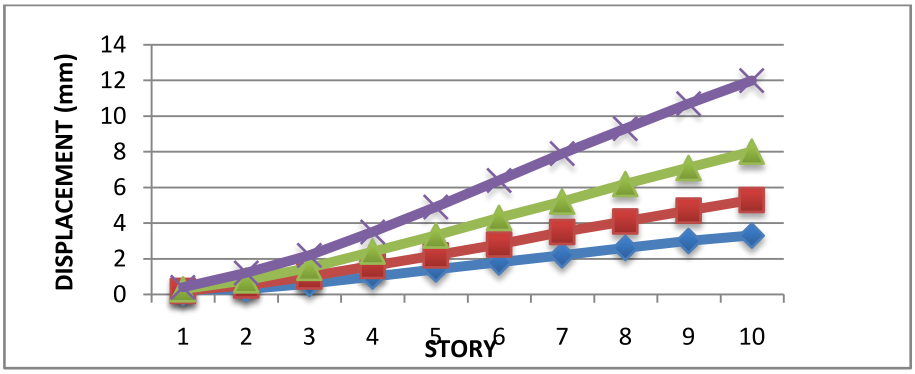

Figure 7: displacement of model 3

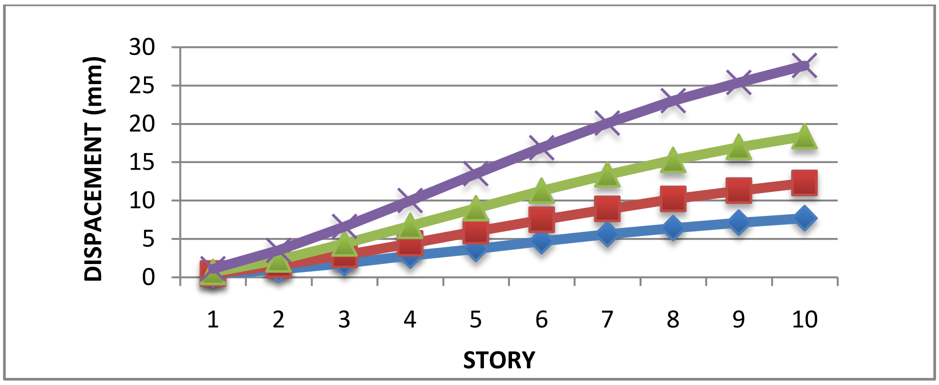

Figure 8: displacement of model 4

From results it is observed that the displacement of all models in zone II, III, IV is reduced upto 40% as compared with zone V.

3.2 STORY DRIFT RATIO

Story drift is the displacement of one level relative to the other level above or below. Story drift ratio according to the zones of each model is shown in fig. In Software value of story drift is given in ratio.

$$\text{Story drift ratio } = \frac{\text{difference between displacement of two stories}}{\text{height of one story}}$$

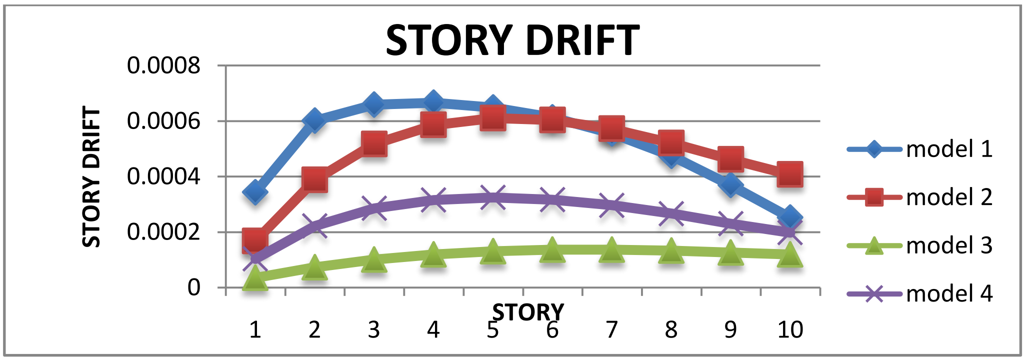

Figure 9: story drift for zone II

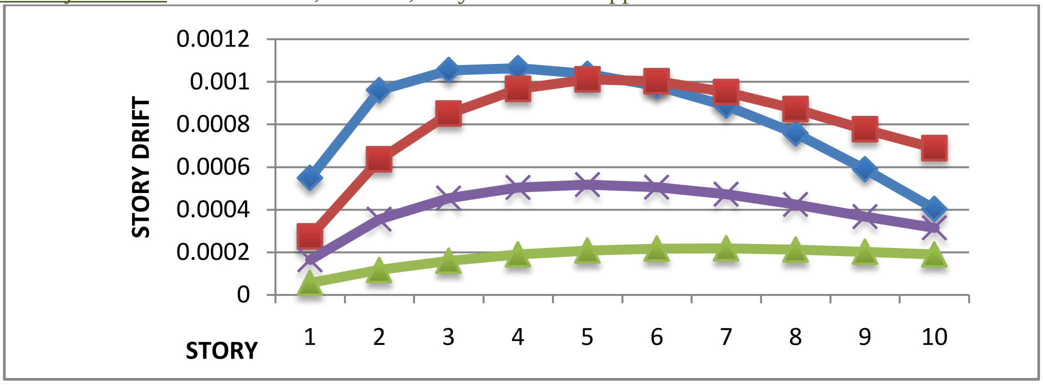

Figure 10: story drift for zone III

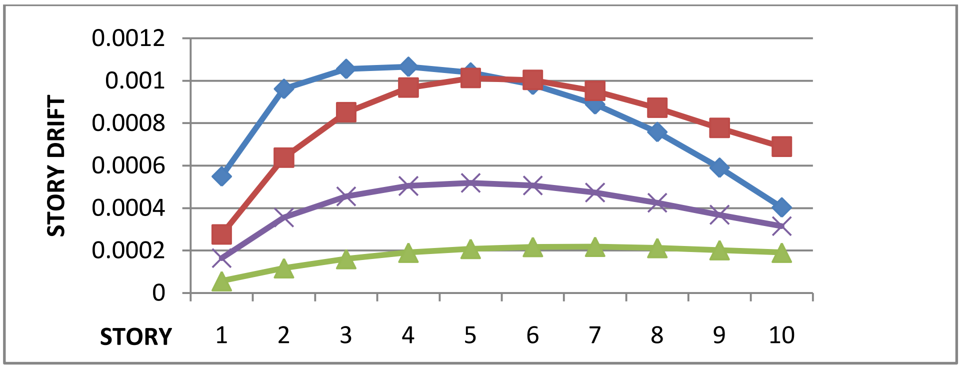

Figure 11: story drift for zone IV

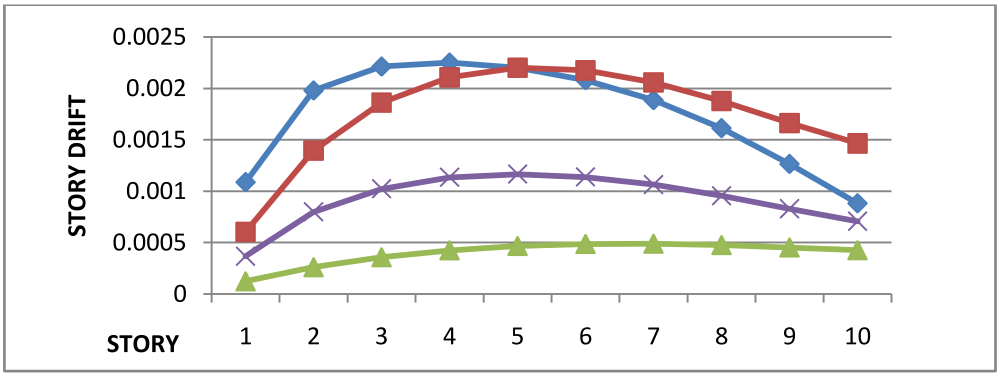

Figure 12: story drift for zone V

From the result observed that the story drift is maximum for model 1 i.e. bare frame without shear wall as compared with other model in all zones. While compared with zone story drift is maximum in zone V and minimum in zone II. Model 3 has the minimum value of story drift in all zones as compared with other models.

3.3 Concrete quantity in mm^3

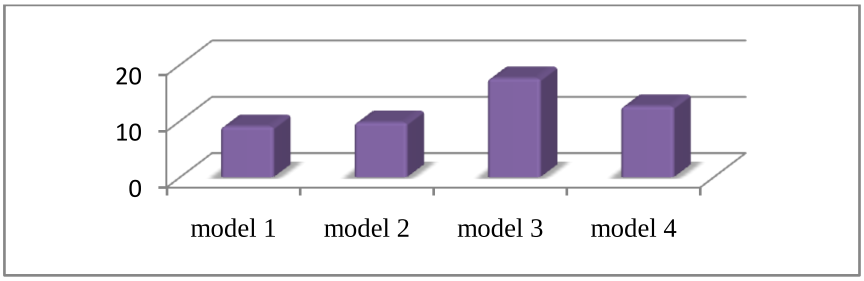

Figure 13: chart of concrete quantity in mm^3models

As the shear wall in model 3 are large (4500x3000 mm), the quantity of concrete require for that model is more as compared with other models.

3.4 Concrete Cost in Rs

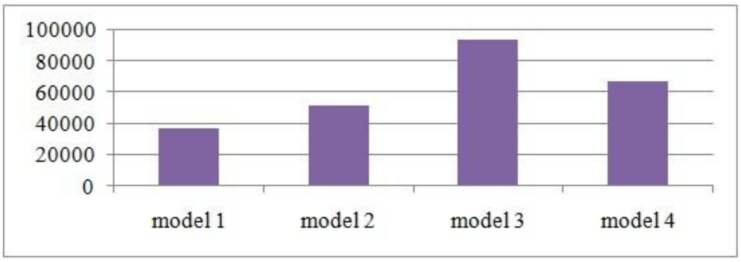

Figure 14: chart for concrete cost in rs

3.5 STEEL COMPARISION

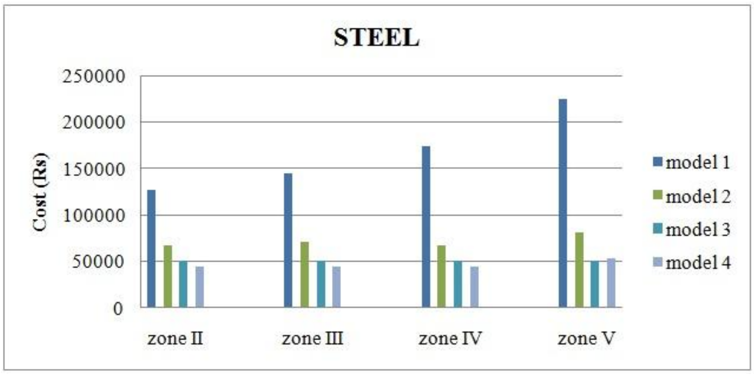

Figure 15: chart of required steel in all zones

From the above graph, it is observed that model 1 require more steel in all zone as compared with other zones. In zone V, steel required is much higher in all models except that in model 3.

3.6 TOTAL COST

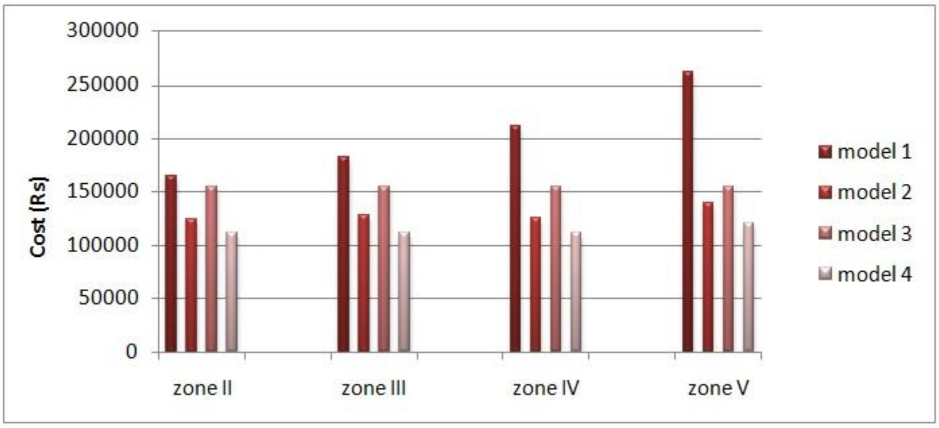

Figure 16: chart showing total cost

Comparing the total cost i.e. concrete and steel cost of structure, model 1 required more cost in all zones while model 3 require same cost in all zones. The corner shear wall in 2m length (model 4) is economical to provide as it require less cost comparing with other models.

3.7 % Ast IN COLUMN

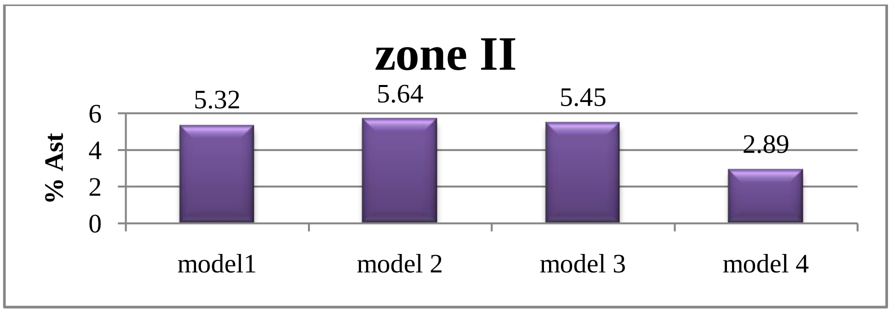

Figure 17: % ast in column c6

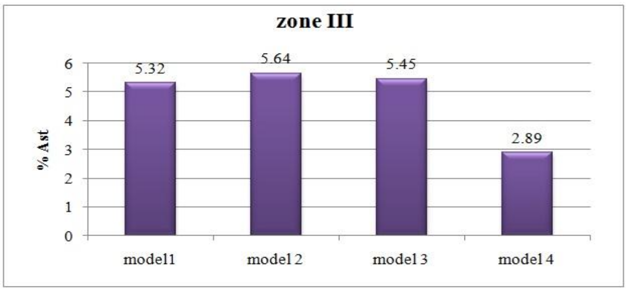

Figure 18: % ast in column c6

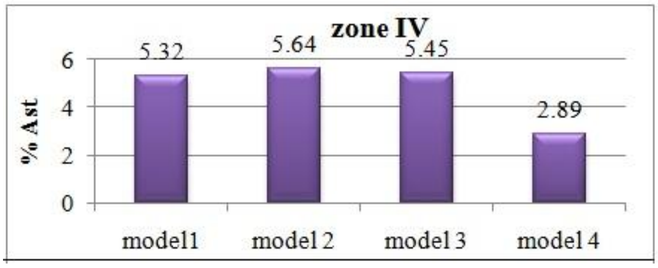

Figure 19: % ast in column c6

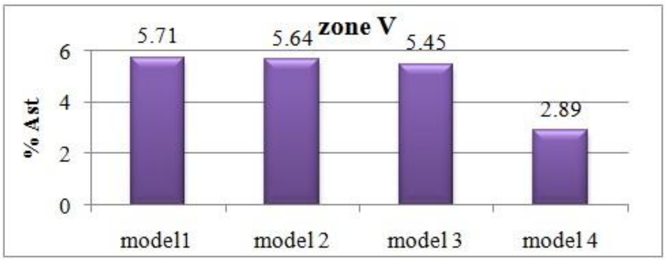

Figure 17: % ast in column c6

From the above result it is seen that, there is no increase in % Ast of central column in dual system where as %Ast of same column in frame structure increases and maximum in zone V.

IV. CONCLUSION

From all the above analysis, it is observed that in 10 story building, constructing building with shear wall in short span at corner (model 4) is economical as compared with other models. From this it can be concluded that large dimension of shear wall is not effective in 10 stories or below 10 stories buildings. It is observed that the shear wall is economical and effective in high rise building.

Also observed that

1. Changing the position of shear wall will affect the attraction of forces, so that wall must be in proper position.
2. If the dimensions of shear wall are large then major amount of horizontal forces are taken by shear wall.
3. Providing shear walls at adequate locations substantially reduces the displacements due to earthquake.

REFERANCES

[1]. Anshumn. S, Dipendu Bhunia, Bhavin Rmjiyani (2011), "Solution of shear wall location in Multi-storey building." International Journal of Civil Engineering Vol. 9, No.2Pages 493-506.
[2]. M. Asharaf, Z. A. Siddiqi, M. A. Javed, "Configuration of Multi-storey building subjected to lateral forces". Asian Journal of Civil Engineering (Building & Housing), Vol. 9, No. 5 Pages 525-537.
[3]. H.-S. Kim, D.-G. Lee"Analysis of shear wall with openings using super elements" Engineering Structures 25 (2003) 981–991
[4]. M. Shariq, H. Abbas, H. Irtaza, M. Qamaruddin "Influence of openings on seismic performance of masonry building walls" Building and Environment 43 (2008) 1232–1240
[5]. Sid Ahmed Meftah, Abdelouahed Tounsi, Adda Bedia El Abbas "A simplified approach for seismic calculation of a tall building braced by shear walls and thin-walled open section structures" Engineering Structures 29 (2007) 2576–2585
[6]. Quanfeng Wang , Lingyun Wang, Qiangsheng Liu "Effect of shear wall height on earthquake response" Engineering Structures 23 (2001) 376–384P.A. Hidalgo, R.M. Jordan, M.P.
[7]. Martinez "An analytical model to predict the inelastic seismic behavior of Shear-wall, reinforced concrete structures" Engineering Structures 24 (2002) 85–98Duggal S. K.(2010), " Earthquake Resistant Design Structues". Oxfored University press YMCA library building, Jai Singh road, New Delhi. Bureau of India Standard, Is-1893, Part 1 (2002), "Criteria for earthquake resistant design of structures." Part 1
[8]. General Provision and building, New Delhi, India.
[9]. Bureau of Indian Standard, IS-456(2000), "Plain and Reinforced Concrete Code of Practice".