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Comparative Study on Multistoried RCC Structure with and without Shear Wall by using SAP2000 v17

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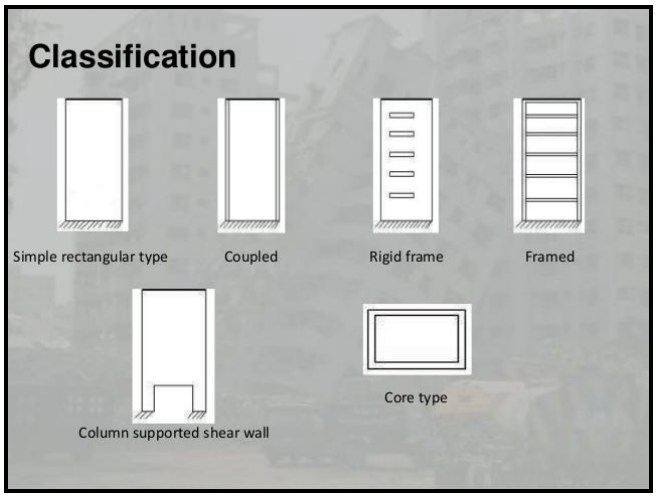
Abstract - ***Now a day tall buildings are provided with shear walls to improve the lateral load resistance. Shear walls are a type of structural system that provides lateral resistance to the building or structure. Shear walls are vertical elements of the structure, the horizontal force resisting system. Shear walls are constructed to counteract and minimize the effect of lateral loads acting on the structure. 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. The effectiveness of RCC shear wall building is studied with help of four different models. The first Model is bare frame system and the other remaining three types are frames having different locations of shear wall. An earthquake load is applied to G+10 storey building located in different zones. The performance of building is evaluated in terms of lateral displacements of each storey. The analysis is done by structural finite element analysis method using SAP2000 software.***

Keywords: *frames, finite element analysis, lateral displacements, SAP2000, seismic forces , shear wall.*

1. INTRODUCTION

1.1 General

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 SAP2000 and effectiveness has been checked.



1.2 Strengthening of RCC building with shear wall

Reinforced concrete (RC) buildings often have vertical plate-like RC walls called Shear Walls in addition to slabs, beams and columns. These walls generally start at foundation level and are continuous throughout the building height. Their thickness can be as low as 200mm, or as high as 400mm in high rise buildings [1]. Shear walls

are usually provided along both length and width of buildings, Shear walls are like vertically-oriented wide beams that carry earthquake loads downwards to the foundation. Properly designed and detailed buildings with shear walls have shown very good performance in past earthquakes [2]. Shear walls in high seismic regions require special detailing. However, in past earthquakes, even buildings with sufficient amount of walls that were not specially detailed for seismic performance (but had enough well-distributed reinforcement) were saved from collapse [3]. Shear wall buildings are a popular choice in many earthquake prone countries, like Chile, New Zealand and USA [2]. Shear walls are easy to construct, because reinforcement detailing of walls is relatively straight-forward and therefore easily implemented at site. Shear walls are efficient, both in terms of construction cost and effectiveness in minimizing earthquake damage in structural and non-structural elements[4][1]. Most RC buildings with shear walls also have columns; these columns primarily carry gravity loads (i.e., those due to self-weight and contents of building). Shear walls provide large strength and stiffness to buildings in the direction of their orientation [5], which significantly reduces lateral sway of the building and thereby reduces damage to structure and its contents. Since shear walls carry large horizontal earthquake forces, the overturning effects on them are large. Thus, design of their foundations requires special attention. Shear walls should be provided along preferably both length and width. However, if they are provided along only one direction, a proper grid of beams and columns in the vertical plane (called a moment-resistant frame) must be provided along the other direction to resist strong earthquake effects[6][5].

2. LITERATURE REVIEW

M. D. Kevadkar and P. B. Kodag have done lateral load analysis of R.C.C. Building (G+12) by considering 3 models[7]. Out of this 1st model is without bracing and shear wall, 2nd model with different shear wall system and 3rd Model with Different bracing system the computer aided analysis is done by using E-TABS to find out the effective lateral load system during earthquake in high seismic areas. The performance of the building is evaluated in terms of Lateral Displacement, Storey Shear and Storey Drifts, Base shear and Demand Capacity (Performance point).

Anshuman.S et al. determined the solution for shear wall location in multistory building based on its both elastic and elasto-plastic behaviors[8]. An earthquake load is calculated and applied to a building of fifteen stories located in zone IV. Elastic and elasto-plastic analyses were performed using both STAAD Pro 2004 and SAP (2000) software packages. Shear forces, bending moment and story drift were computed in both cases and location of shear wall was established based upon the results.

Romy Mohan and C Prabha are presented Dynamic Analysis of RCC buildings with Shear Wall[9]. for analysis consider the two multi storey buildings, one of six and other of eleven storey have been modeled using software package SAP 2000 for earthquake zone V in India. Six different types of shear walls with its variation in shape are considered for studying their effectiveness in resisting lateral forces. This paper also deals with the effect of the variation of the building height on the structural response of the shear wall.

3. MODELING

The SAP2000 software is used to develop 3D model and to carry out the analysis. The lateral loads which are applied on the buildings are based on the Indian standards. The study is performed for seismic zone V, IV, III, II as per

- IS 456 (Dead load, Live Load)
- IS 1893:2002 (Earthquake load).

The building consists of reinforced concrete which consists of beam slab structure and shear wall. G+10 storied building analyzed for seismic and gravity forces. The building analyzed with different types Shear walls

A. Preliminary data

Number of stories	G+10
Floor to floor height	3 m
Size of Beam	300mm x 450mm
Size of Column	450mm x 600mm
Thickness of Slab	150 mm
Thickness of Shear wall	250 mm
Number of Bays in X direction	9
Number of Bays in Y direction	5
Length of X bay	6 m
Length of Y bay	6 m
Grade of Concrete	M30
Grade of Steel	Fe415

B. The plan of the building models are given below

- Model 1 - The bare framed structure as shown in Fig. 2.
- Model 2 - The coupled type with openings and core type shear walls at lift wells of frame structure shown in Fig. 3.
- Model 3 - Rectangle type shear walls at four corners of framed structure as shown in Fig. 4.
- Model 4 - The core type shear walls at lift wells and rectangle type shear wall frame structure as shown in Fig..

To find out effectiveness of shear wall to RCC building, there here we study the parameters such as Lateral displacement and storey drift for which there is need to do linear and nonlinear analysis of structure. Four different types of models were studied with different types of shear walls and different positioning of shear wall in building in different earthquake zones.

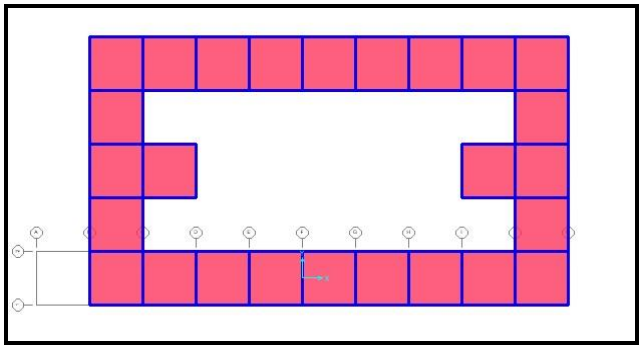


Figure 1 : Floor plan of the building

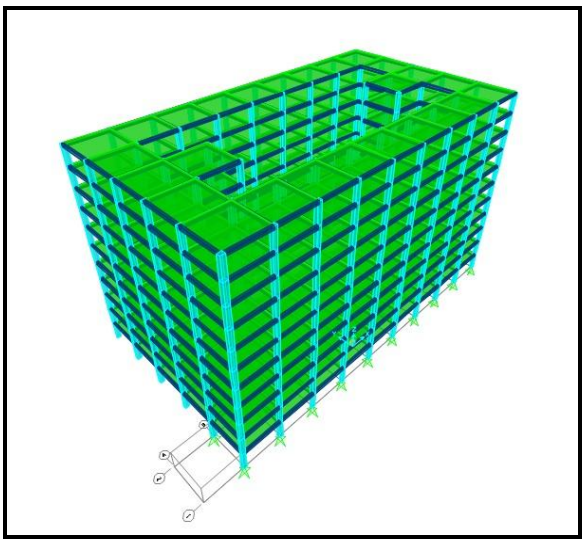


Figure 2 : 3D Model No. 1

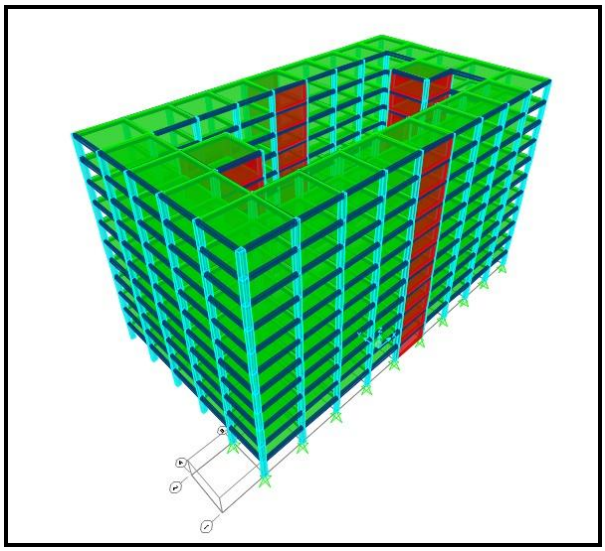


Figure 3: 3D Model No. 2

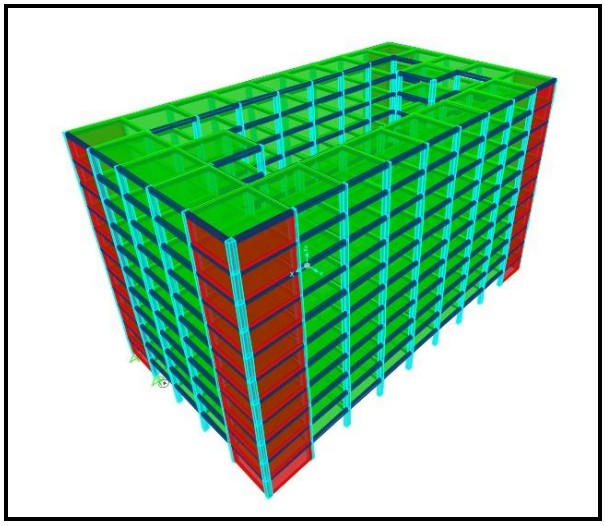


Figure 4: 3D Model no. 3

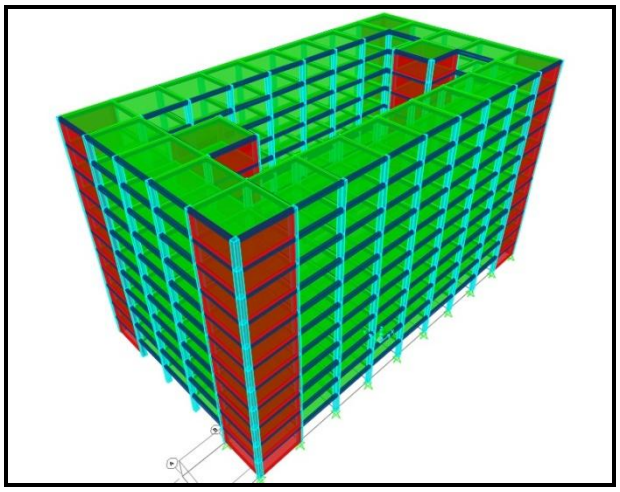


Figure 5: Model No. 4

3. RESULTS

3.1 LATERAL DISPLACEMENT

Analysis of G+10 storied bare frame model and different types shear wall models is done using sap 2000 software, from the response spectrum analysis results obtained, four model results are compared.

The results of the displacement in Y direction of each floor of different models situated in different earthquake zones are presented in the below graphs.

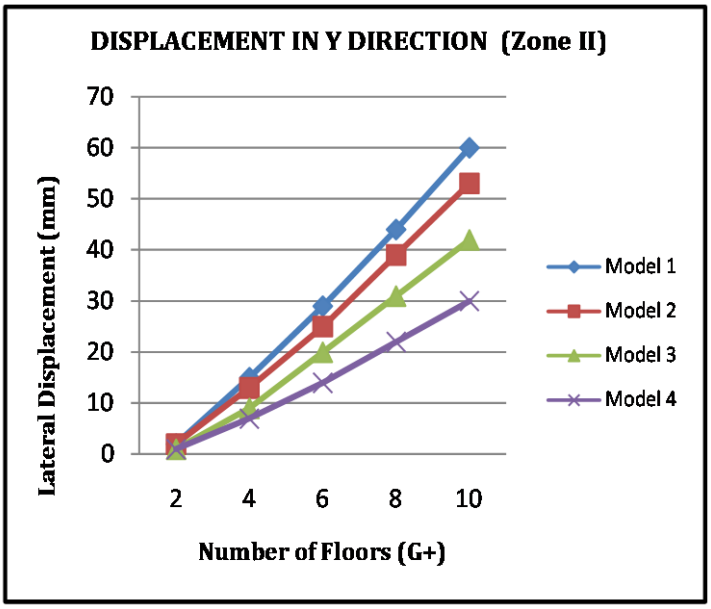


Figure 6: Model Displacements in zone II

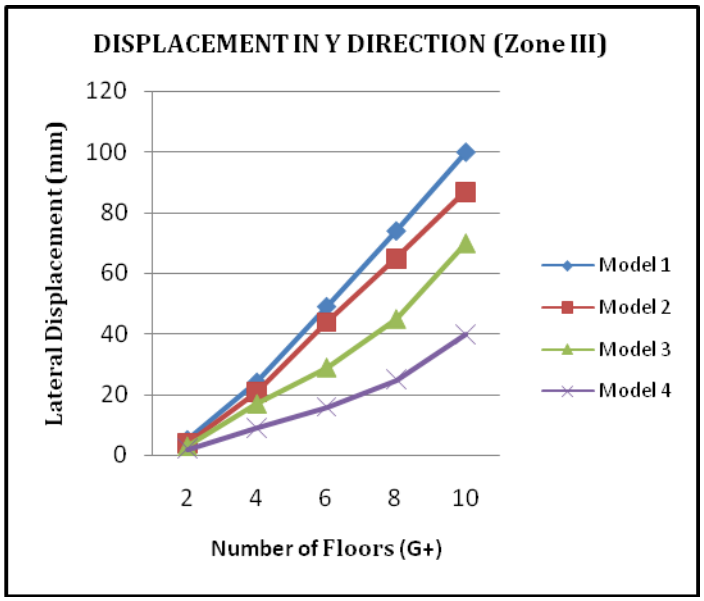


Figure 7: Model Displacements in zone III

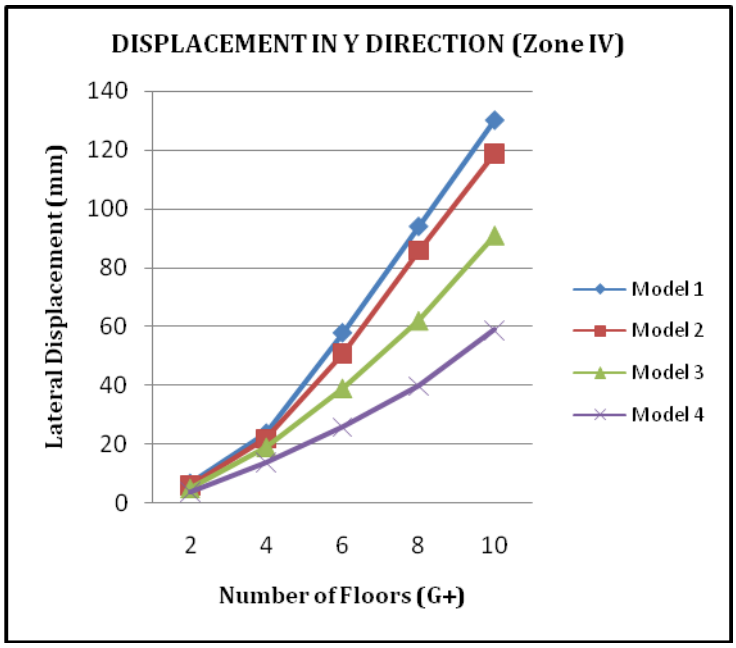


Figure 8: Model Displacements in zone IV

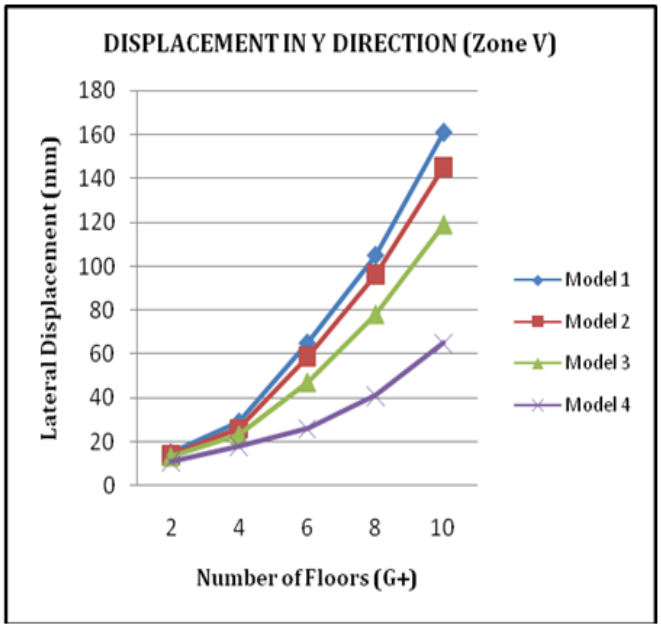


Figure 9: Model Displacements in zone V

3.2 STOREY DRIFT

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. Story drift ratio is the difference between displacement of two stories by height of one story

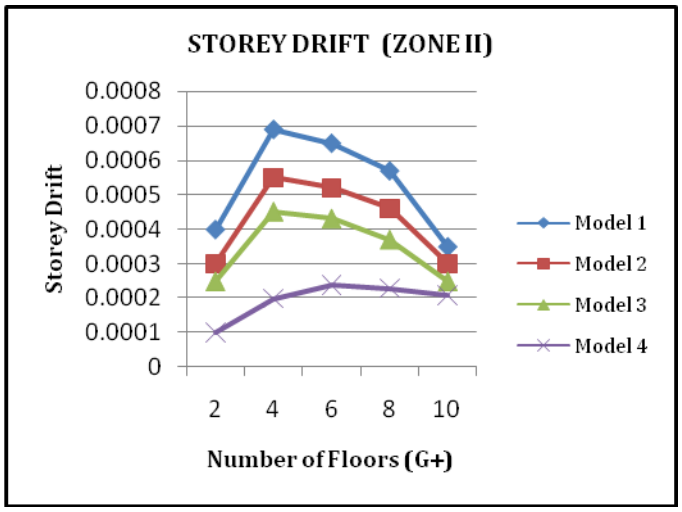


Figure 10: Storey Drift in Zone II

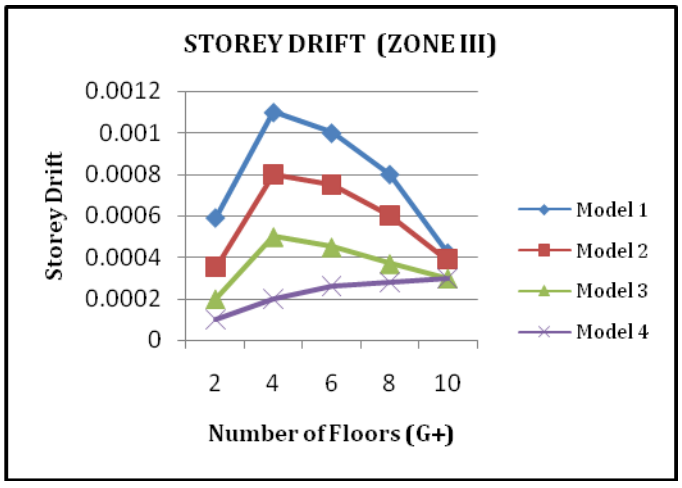


Figure 11: Storey Drift in Zone III

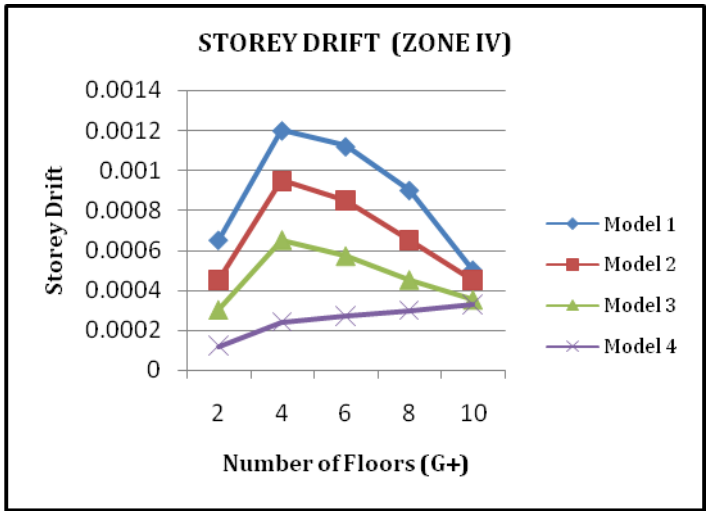


Figure 12: Storey Drift in Zone IV

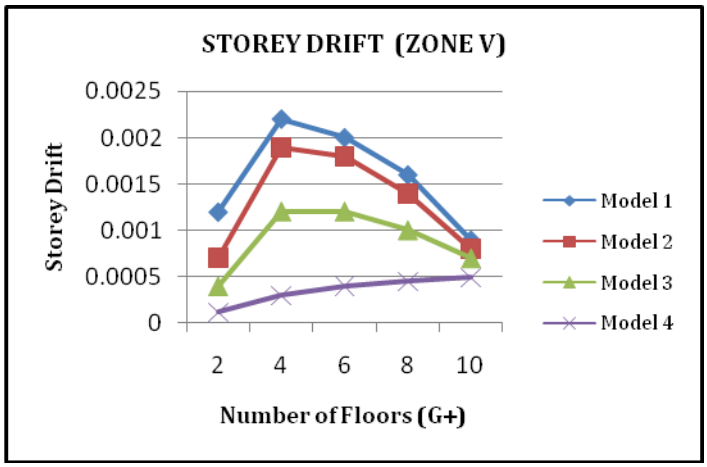


Figure 13: Storey Drift in Zone V

4. CONCLUSIONS

- From the above response spectrum analysis it is observed that the corner type shear wall (model 4) has least deflection as compared to all other models.
- If the dimensions of shear wall are large then major amount of horizontal forces are taken by shear wall.
- Providing shear walls at adequate locations substantially reduces the displacements due to earthquake
- In zone V and IV like high earthquake intensity areas, provide shear walls on all four corners and Centroid of the building to reduce deflection.

- Corner core type shear wall reduce shear force and bending moment of building.
- Rectangle type shear wall (model 3) is suitable for zone III. The deflection of this model is allowable range
- Coupled type shear wall with openings (model 4) is allowable deflection in zone II.

REFERENCES

[1] AshishS.Agrawal, S.D.Charkha,‘ Effect of change in shear wall location on story drift of multistory building subjected to lateral loads‘ International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com Vol. 2, Issue 3, May-Jun 2012, pp.1786-1793

[2] Prof. Mark fintel—Shear wall – an answer for the seismic resistant? —Proc Concrete International, July 1992

[3] RS Malik, SK Madan, VK Sehgal, Effect of Height on Seismic Response of Reinforced Cement Concrete Framed Buildings with Curtailed Shear Wall

[4] A. M. Pande, Displacement Control of High Rise Structures with the Provision of Shear Wall,‘ International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 Vol. 1, Issue 4, pp. 1515-1521

[5] P. S. Kumbhare, A. C. Saoji ,Effectiveness of Changing Reinforced Concrete Shear Wall Location on Multi-storeyed Building, International Journal of Engineering Research and Applications (IJERA)ISSN: 2248-9622 www.ijera.com Vol. 2, Issue 3, May-Jun 2012, pp.1786-1793

[6] Rahul RANA, Limin JIN and AtilaZEKIOGLU, Pushover analysis of 19 story concrete shear wall building‘13th World Conference on Earthquake Engineering Vancouver, B.C., Canada August 1-6, 2004 Paper No. 133

[7] M. D. Kevadkar and P. B. Kodag, “Lateral Load Analysis of R. C. C. Building”, IJMER International Journal of Modern Engineering Research, Vol.3, Issue.3,May-June 2013.

[8] Anshuman. S, Dipendu Bhunia and Bhavin Ramjiyani, “Solution of Shear Wall Location in Multi Storey Building” ,International Journal of Civil and Structural Engineering,Vol.2,September 2011

[9] Romy Mohan and C Prabha, “Dynamic Analysis of RCC Buildings with shear wall”, International Journal of Earth Science and Engineering,Vol.04,No.06, October 2011

[10] P. V. Sumanth Chowdary, Senthil Pandian, "M2A Comparative Study on RCC Structure with and without Shear Wall", IJSRD - International Journal for Scientific Research & Development| Vol. 2, Issue 02, 2014 | ISSN (online): 2321-0613

[11] P. P. Chandurkar, Dr. P. S. Pajgade, "Seismic Analysis of RCC Building with and Without Shear Wall", International Journal of Modern Engineering Research (IJMER) Vol. 3, Issue. 3, May - June 2013 pp-1805-1810

[12] Ashok Thakur, Arvinder Singh, " Comparative Analysis of a Multistoried Residential Building with and Without Shear Wall using STADD Pro", al. International Journal of Recent Research Aspects ISSN: 2349-7688, Vol. 1, Issue 1, June 2014, pp. 54-57

[13] P. P. Chandurkar, Dr. P. S. Pajgade,""Seismic Analysis of RCC Building with and Without Shear Wall", International Journal of Modern Engineering Research (IJMER), Vol. 3, Issue. 3, May - June 2013 pp-1805-1810

[14] https://www.google.co.in/search?q=type+of+shear+walls&es_sm=122&source=lnms&tbm=isch&sa=X&ved=0CAcQ_AUoAWoVChMIsNi2lPLpyAIVpRamCh0dGwSZ#imgrc=yp3trBEVIXQWUM%3A