*International Journal of Research in Advent Technology (IJRAT) Special Issue "*ICADMMES 2018*"*
E-ISSN: 2321-9637
Available online at www.ijrat.org

Dynamic Analysis of A Multistorey Building With Different Percentage Opening For Shear Wall

Dr. J. Selwyn Babu[1], Dr. J. Rex[2] and Mohd Saif Bhati[3]
[1]*Professor, Department of Civil Engineering, MREC (A), Hyderabad-500100*
[2]*Associate Professor, Department of Civil Engineering, MREC (A), Hyderabad-500100* [3]*M.Tech Student, Department of Civil Engineering, MREC (A), Hyderabad-500100 Email: selwynbabu@gmail.com, rexdindigul@gmail.com and saifbhati321@gmail.com*

Abstract – In recent decades, shear walls and tube structures are the most appropriate structural forms, which have caused the height of concrete buildings to be soared. So, recent RC tall buildings would have more complicated structural behavior than before. Therefore, studying the structural systems and associated behavior of these types of structures would be very interesting. Here in this paper, we will study the structural aspects of the tallest RC buildings, located in Hyderabad seismic zone, with 15 stories. In this Building, shear wall system with irregular openings are utilized under both lateral and gravity loads, and may result some special issues in the behavior of structural elements such as shear walls, coupling beams and etc. Due to functional requirements such as doors, windows, and other openings, a shear wall in building contains many openings. The size and location of openings may vary for architectural and functional point of view. In most of the apartment building, size and location of openings in shear wall are made without considering its effect on structural behavior of the building. Therefore this study is carried out on 15 story frame wall building using Response spectrum analysis by using ETABS V 9.7.4. The models are studied with increase in percentage of shear wall of 15%, 18%, 28% from top to bottom story. From this study the values of drift, shear, and moments are analyzed with the position of opening in shear wall.

1. INTRODUCTION

Many medium-rise apartment buildings are being constructed, in India, using shear walls to provide earthquake resistance to reinforced concrete frames. These shear walls may have openings for the windows, doors and duct spaces for functional reasons. The number, location and size of openings affect the behavior of a structure as well as stress in the shear wall.

Framed structures with shear wall are frequently adopted as the structural system for high-rise building structures. This structural system would also have many openings for the entrance to elevators or staircases etc. Generally, plane stress elements and beam elements are used to model the shear wall and frames respectively in the analysis of this kind of building. A plan stress element should have drilling degrees of freedom to represent the connection of shear wall core and frames. Otherwise, the bending moment at the end of a beam cannot be transferred to the shear wall.

The openings may be of large size that is in the case where it is like function halls, conference halls, and movie theaters. The number, location, size, and shape of opening affects the behavior of structure in the form of deflection, stress in the members.

Shear wall

Shear walls are vertical stiffening elements designed to resist lateral forces exerted by wind or earthquake. The shape and location of shear wall have significant effect on their structural behavior under lateral loads. Lateral loads are distributed through the structure acting as a horizontal diaphragm, to the shear walls, parallel to the force of action. These shear wall resist horizontal forces because their high rigidity as deep beams, reacting to shear and flexure against overturning. A core eccentrically located with respect to the building shapes has to carry tension as well as bending and direct shear. However torsion may also develop in building symmetrical featuring of shear wall arrangements when wind acts on the facades of direct surface textures (i.e, roughness) or when wind does not act through the center of building's mass (schueller, 1977).

Shear walls are much stiffer than horizontal rigid frames. Therefore shear walls are economical up to 35 stories. If, in low to medium rise buildings, shear walls are combined with frames, it is reasonable to assume that the shear walls attract all the lateral loading so that frame may be designed for gravity loads only.
Resistance of a shear wall increases linearly with its thickness. However, the effect of width is much higher.

A coupled shear wall structure is a particular, but very common, form of shear wall structure. It consists of two or more shear walls in the same plane, or almost the same plane, connected at floor levels by means of stiff beams or slabs. These results in a horizontal stiffness very much greater than if the walls acted as a set of separate uncoupled cantilevers.

Objectives of the study

The following are the main objectives of the project

1. To study the seismic behavior of multi story building by using IS 1893:2002
2. To compare the multi story buildings with 0% shear wall, 15% shear wall,28% shear wall, 38% shear wall .
3. To compare the results of Story Drift, Shear force, Bending moment, Building torsion of buildings with 0% shear wall, 15% shear wall,28% shear wall, 38% shear wall .
4. To study the buildings in ETABS V9.7.4 in Response spectrum analysis.

2. LITERATURE REVIEW

Najma Nainan., et al[3] (2012)

Structures on the earth are generally subjected to two types of load: static and dynamic. Static loads are constant with time while dynamic loads are time-varying. In general, the majority of civil engineering structures are designed with the assumption that all applied loads are static., this study include: the effect of height of shear wall in the dynamic response of building frame. From this study it was concluded that the analytical study on the dynamic response of seismo resistant building frames was done.

Syed Khasim Mutwalli, Dr. Shaik Kamal Mohammed Azam, et al[6].,(2014)

This study presents the procedure for seismic performance estimation of high-rise buildings based on a concept of the capacity spectrum method. In 3D analytical model of thirty storied buildings have been generated for symmetric buildings Models and analyzed using structural analysis tool ETABS. The analytical model of the building includes all important components that influence the mass, strength, stiffness and deformability of the structure. To study the effect of concrete core wall & shear wall at different positions during earthquake, seismic analysis using both linear static, linear dynamic and non-linear static procedure has been performed.

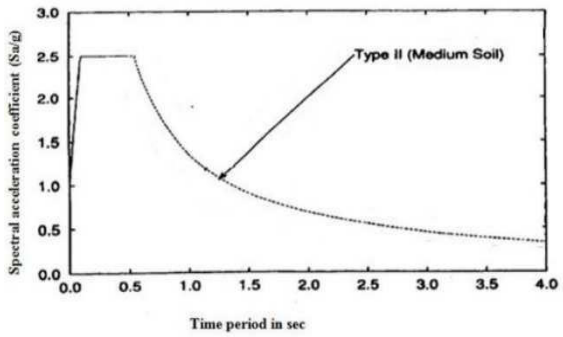
3. METHODOLOGY AND MODELLING OF BUILDING

Response spectrum method

This examination is completed by the code IS 1893-2002 (part1). Here kind of soil, seismic zone factor ought to be entered from IS 1893-2002 (part1). The standard reaction spectra for sort of soil considered is connected to working for the investigation in ETABS 2013 programming. Following chart demonstrates the standard reaction range for medium soil compose and that can be given as day and age versus ghastly speeding up coefficient (Sa/g).

Response spectrum for medium soil type for 5% damping

In this we need to figure the size of powers every which way i.e. X, Y and Z and after that see the consequences for the building. Mix techniques incorporate the accompanying:



- absolute - crest esteems are included
- square base of the total of the squares (SRSS)
- complete quadratic mix (CQC) - a strategy that is a change on SRSS for firmly dispersed modes

Different types of loads acting on the structure

The types of loads following up on structures for structures and different structures can be comprehensively named vertical loads, flat loads and longitudinal loads. The vertical burdens comprise of dead loads, live load. The even loads contains wind load and quake load.

Types of loads acting on the structure are

- Dead loads
- Imposed loads
- Wind loads
- Snow loads
- Earthquake loads
- Special loads

Problem statement

Basic parameters considered for the analysis are

1. Utility of building : Residential building
2. Number of stories : G+14
3. Shape of building : Rectangular
4. Shear wall opening : 0%, 15%, 28%, 38%
5. Geometric details
   i. Ground floor: 3m
   ii. floor to floor height: 3m
6. Material details
   i. Concrete Grade : M40 (Columns and Beams)
   ii. All Steel Grades : HYSD reinforcement of Grade Fe415
   iii. Bearing Capacity of Soil : 200 KN/m^2
7. Type Of Construction : R.C.C Framed structure

8. Column : 0.4m X 0.6m
9. Beams : 0.6m X 0.6m
10. Slab : 0.150m
11. Thickness of Shear wall : 120mm

Building models in ETABS

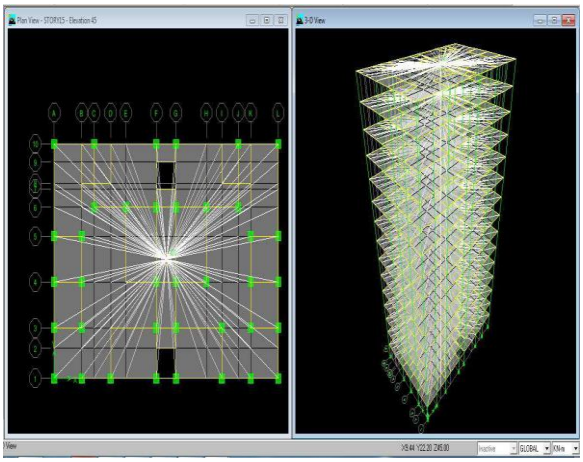


Figure 1. Building with 0% Shear wall

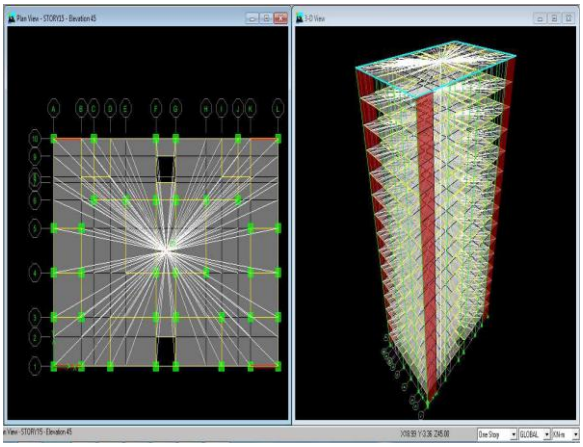


Figure 2. Building with 15% Shear wall

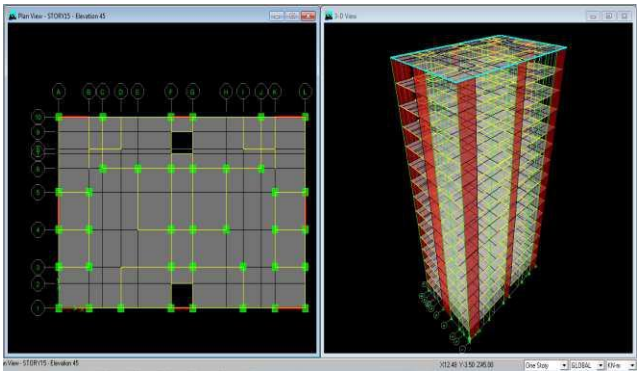


Figure 3. Building with 28% Shear wall

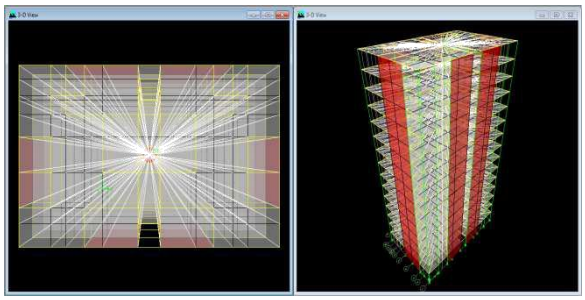


Figure 4. Building with 38% Shear wall

4. RESULTS AND ANALYSIS

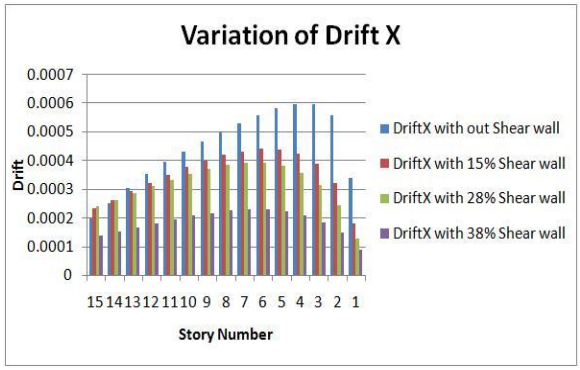


Figure 5. Variation of Drift X

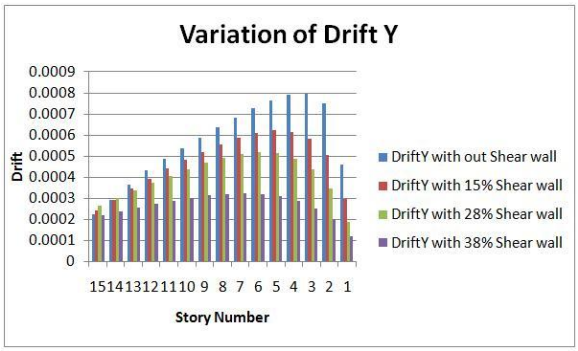


Figure 6. Variation of Drift Y

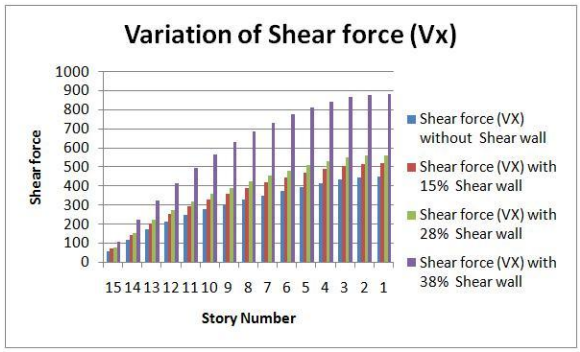


Figure 7. Variation of Shear force Vx

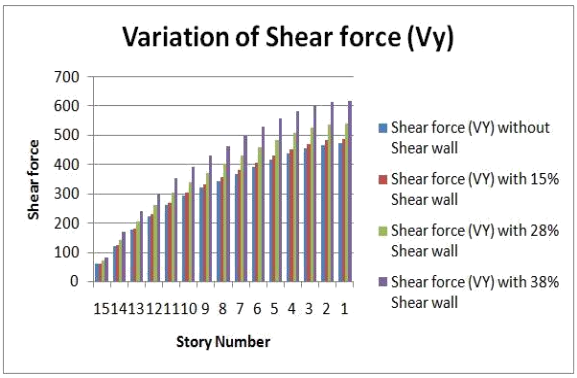


Figure 8. Variation of Shear force Vy

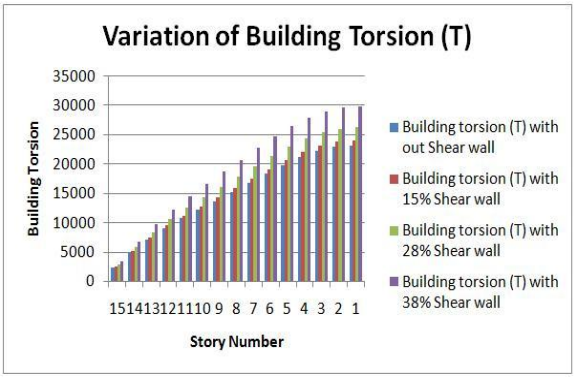


Figure 9. Variation of Building Torsion

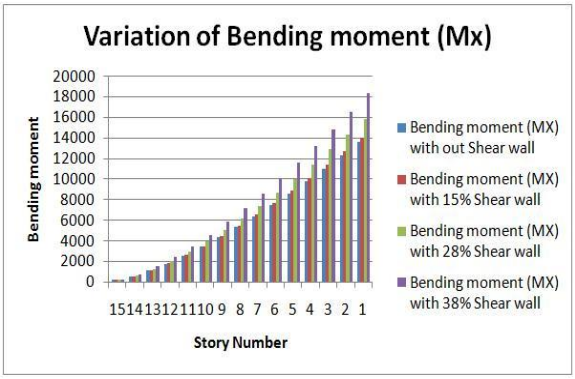


Figure 10. Variation of Bending moment Mx

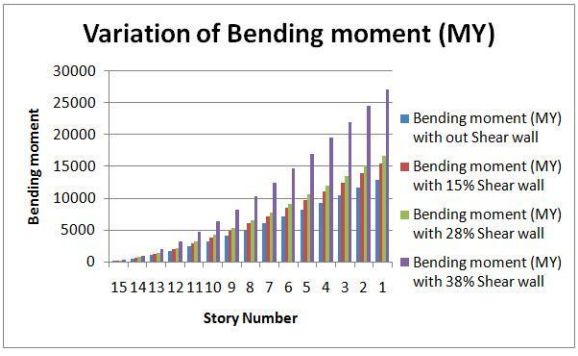


Figure 11. Variation of Bending moment My

5. CONCLUSIONS

From the above study the following conclusions were made

1. The values of Drift in both X and Y-Direction are found higher value for building without using shear wall than the building with shear wall. from this it was conformed that increasing the percentage of shear wall will results in decrease in the Drift
2. The values of Shear force in both X and Y-Direction are found higher value for building with 38% shear wall than other buildings. From this it was conformed that increasing the percentage of shear wall will results in increase in the Shear force.
3. The values of Building Torsion (T) found higher value for building with 38% shear wall than other buildings. From this it was conformed that increasing the percentage of Building Torsion will results in increase in the Shear force.
4. The values of Bending moment (M) found higher value for building with 38% shear wall than other buildings. From this it was conformed that increasing the percentage of Bending moment will results in increase in the Shear force.
5. Opening in the shear walls lead to a significant increase in the bending moment and shear force in the columns connected to that shear wall and when opening is to top the percentage of the increase percentage increase it is less for the opening percent.
6. It was observed for a particular opening in wall when the opening position is shifted from one position to other position.
7. From this study it was concluded that increase in the percentage of Shear wall results in decrease in the drift and increases the Shear force, Bending moment, Building Torsion.

REFERENCES

[1] Ehsan Salimi Firoozabad, Dr. K. Rama Mohan Rao, Bahador Bagheri, Effect of Shear Wall Configuration on Seismic Performance of Building, Proc. of Int. Conf. on Advances in Civil Engineering 2012

[2] Shahzad Jamil Sardar and Umesh. N. Karadi, International Journal of Innovative Research in Science,Engineering and Technology, Vol. 2, Issue 9, September 2013.

[3] Najma Nainan, Alice T V, Dynamic Response Of Seismo resistant BuildingFrames,International Journal of Engineering Science and Technology (IJEST) ISSN : 0975-5462 Vol. 4 No.05 ,May 2012.

[4] Mr.K.LovaRaju, Dr.K.V.G.D.Balaji, Effective location of shear wall on performance of building

frame subjected to earthquake load, International Advanced Research Journal in Science, Engineering and Technology, ISSN 2394-1588 Vol. 2, Issue 1, January 2015.

[5] Varsha R. Harne, Comparative Study of Strength of RC Shear Wall at Different Location on Multi-storied Residential Building, International Journal of Civil Engineering Research.ISSN 2278-3652 Volume 5, Number 4 (2014), pp. 391- 400

[6] Syed Khasim Mutwalli, Dr. Shaik Kamal Mohammed Azam, "Dynamic Response of High Rise Structures Under The Influence of Shear Walls", Int. Journal of Engineering Research and Applications, ISSN : 2248-9622, Vol. 4, Issue 9(Version 6), September 2014, pp.87-96.

[7] R. S. Mishra, V. Kushwaha and S. Kumar, "A Comparative Study of Different Configuration of Shear Wall Location in Soft Story Building Subjected to Seismic Load.", International Research Journal of Engineering and Technology (IRJET), Volume: 02 Issue: 07 | Oct-2015.

[8] Zeeshan Baseer and Syed Farrukh Anwar," Effect of Perforation of Shear Wall on Various Design Parameters of A High Rise Building", Global Journal of engineering Science And Researches.