International Journal of Progressive Research in Science and Engineering
Volume-1, Issue-3, June-2020
www.ijprse.com

Analysis of Different Shape of High Rise Building with Alternative RCC Shear Walls Using STAAD Pro

Basant Khare[1], Kavita Golghate[2]

[1]*Student, Sushila Devi Bansal College of Engineering, Indore, India.*

[2]*Assistant Professor, Sushila Devi Bansal College of Engineering, Indore, India.*

Corresponding Author: basantkhare4979@gmail

Abstract A building with irregularity is vulnerable to earthquake damages. So as it's essential to spot the seismic response of the structure even in high seismic zones to cut back the seismic damages in buildings. Objective: The most important objective of this study is to the behavior of the structure in high seismic zone IV and also to evaluate Storey overturning moment, Storey Drift, Lateral Displacement, Design lateral forces. During this purpose a 10 storey-high building on four totally different shapes like Rectangular, C- shape, H-shape, and with shear wall without shear wall are used and also used alternative shear wall with glass frame as a comparison. The complete models were analyzed with the assistance of STAAD.Pro 2015 version. In the present study, Comparative Dynamic Analysis for all four cases have been investigated to evaluate the deformation of the structure. Results & Conclusion: The results indicates that, building with severe irregularity produces more deformation than those with less irregularity particularly in high seismic zones. And conjointly the storey overturning moment varies inversely with height of the storey. The storey base shear for regular building is highest compare to irregular shape buildings. We can say finally shear wall reduce all forces as well as we can adopt C-type of building with alternative shear wall.

Key Words:- ***Rectangular Building, H- Shape of Building, C-Shape of Building, Shear wall, shear wall with Seismic Force, Bending Moment, Lateral Displacement, Story Drift.***

I. INTRODUCTION

Buildings are described as regular or irregular in terms of their size and shape, arrangements of structural elements and mass. Regular building is almost symmetrical (in plan and elevation) about the axis and have uniform distribution of lateral force –resisting structure such that it provides a continuous load path for both gravity and lateral loads. A building that lacks symmetry having discontinuity in geometry, mass or load resisting element is called irregular building. These irregularities may cause interruption of force flow and concentration of stresses. Types of irregularities: a) Vertical irregularities referring to sudden change in strength, stiffness, geometry and mass results in irregular distribution of forces or deformation over the height of the structure. b) Plan/Horizontal irregularities which refer to asymmetrical plan shape (L, T, U, F) or discontinuous in horizontal resisting elements (diaphragms) such as cut-outs, large openings, re-entrant corners etc resulting in torsion, diaphragm deformation and stress concentration. The main aim of this present work is to study the response of horizontally irregular structures under seismic load. For this, three RC building frames; a symmetrical plan configuration of square shape, and unsymmetrical H shaped and hexagonal shaped are chosen, drafted in Auto CAD 2013 software and ETABS 2016.0.3 software is proposed for the analysis. Suitable Load combinations were selected to get comparative results of the parameters like storey drift, storey shear, storey displacement, shear force and bending moment for these models.

At the time of an earthquake, structure starts to fail at the points of weakness. This weakness arises due to discontinuity in mass, stiffness and geometry of the structure. The building structures having this type of discontinuity are termed as Irregular structures. Irregular structures contribute a large portion of urban infrastructure. Vertical irregularities are one of the main reason of failures of building structures during earthquakes. As an example structures with soft storey were the most notable structures which collapsed. So, the effect of vertically irregularities on the seismic evaluation of structures becomes actually important. Height-wise changes in stiffness and mass render the dynamic characteristics of these buildings different from the regular building.

Irregular buildings make up a large portion of the urban infrastructure. The presence of irregularities can be due to architectural, functional, and economical constraints. The main objective of this research is to improve the understanding of the seismic Behaviour of building structures with vertical irregularities. This is done by quantifying the

International Journal of Progressive Research in Science and Engineering
Volume-1, Issue-3, June-2020
www.ijprse.com

effects of vertical irregularities in mass, stiffness, or strength on seismic demands.

Types of Irregularities: The irregularities are of following 2 types-

- Plan Irregularities
- Vertical Irregularities.

Vertical Irregularities are mainly of five types.

II. Problem Formulation And Analysis

To study the Behavior, the response parameters selected are lateral displacement and storey drift. Building is assumed to be located in seismic zone IV. All the building models are analyzed with, without shear wall and with alternative shear wall

For this purpose, 3 models of 10 storeys for zone IV, considered:

- Rectangular building
- H-types shape of building
- C-types of building

Where is shear wall thickness same in all types of building

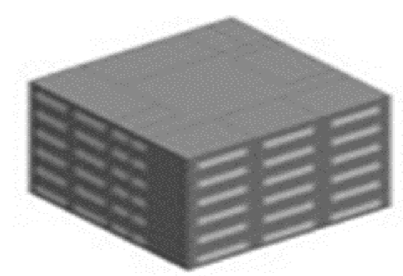
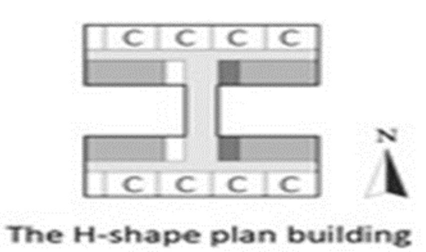


Fig.1. Rectangular Building



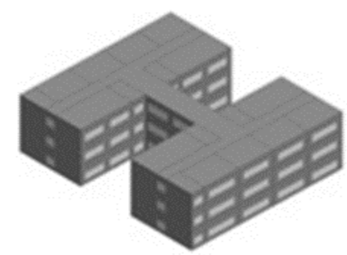


Fig.2. H- types of Building

Loadings Considered:

- Dead Load- floor load, wall load, Parapet Load as per to IS 875 (part1).
- Live Load- 2 KN/m^2 on all the floors.
- Earthquake Load- As per IS 1893 (Part-I):2002.
- Concrete Grade as Per IS 456 (Part-1): 2002
- Steel Grade as Per Is Code 800 (Part-1): 2002

Load Combinations:

Load combinations considered are as follows:

- 1.5(DL + LL)
- 1.5(DL + EQX)
- 1.5(DL - EQX)
- 1.5(DL + EQZ)
- 1.5(DL - EQZ)
- 1.2(DL +LL + EQX)
- 1.2(DL +LL - EQX)
- 1.2(DL +LL + EQZ)
- 1.2(DL +LL - EQZ)

III. Result Analysis, Discussion and Comparison

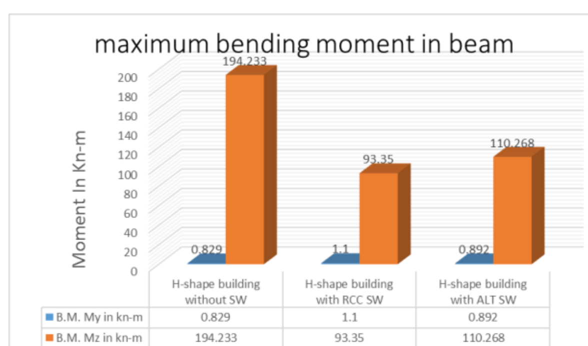


Fig.3. Comparison between in H-shape of building of maximum bending moment in beam

IJPRSE
Progressive Research
International Journal of Progressive Research in Science and Engineering
Volume-1, Issue-3, June-2020
www.ijprse.com

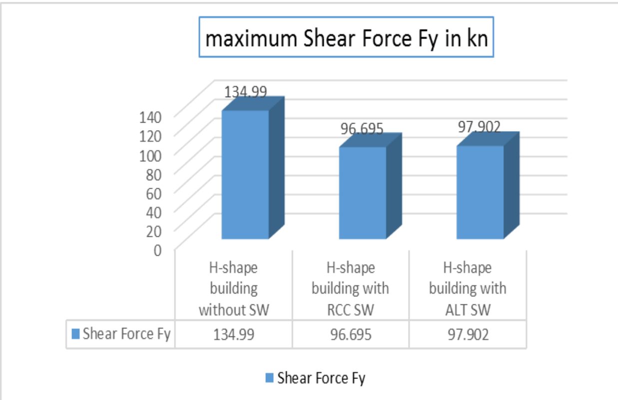


Fig.4.Comparison between in H-shape of building of maximum shear force $F_y$in beam

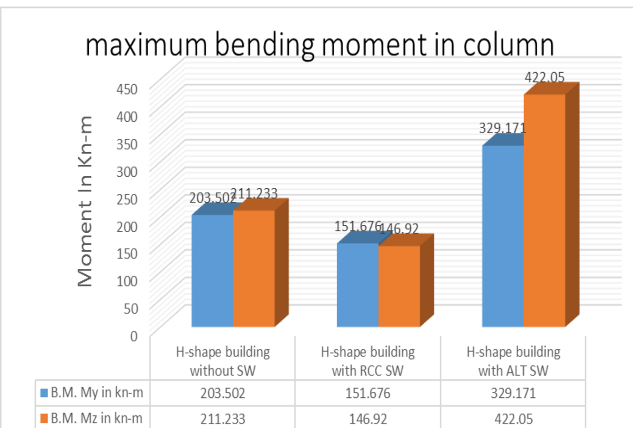


Fig.5.Comparison between in H-shape of building of maximum bending moment in column

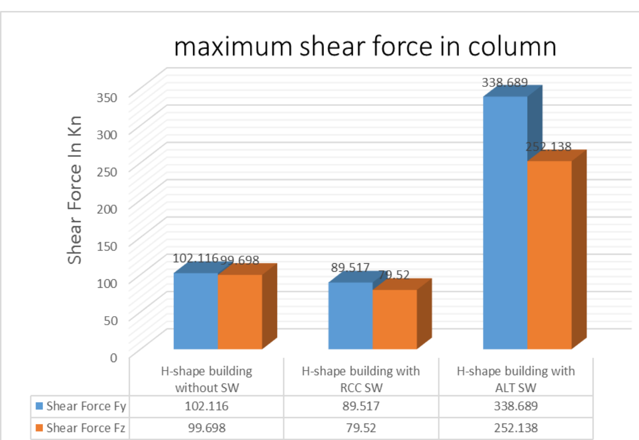


Fig.6.Comparison between in H-shape of building of maximum Shear force moment in column

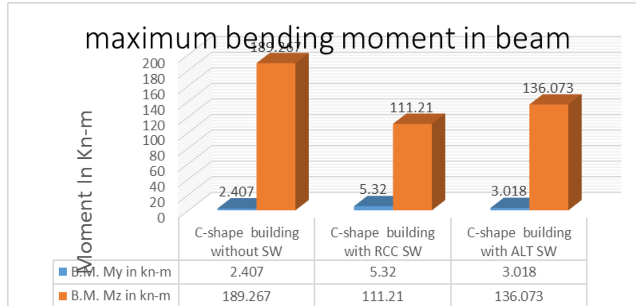


Fig.7. Comparison between in C-shape of building of maximum bending moment in beam.

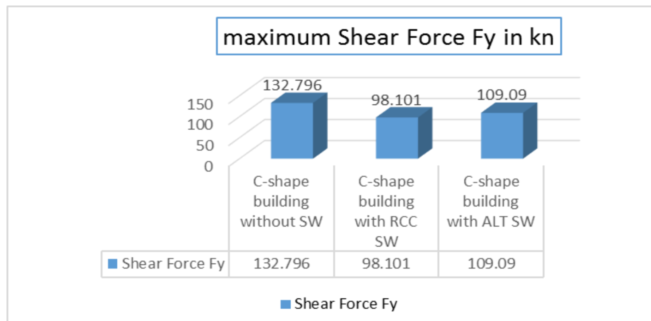


Fig.8.Comparison between in C-shapeof building of maximum shear force $F_y$in beam

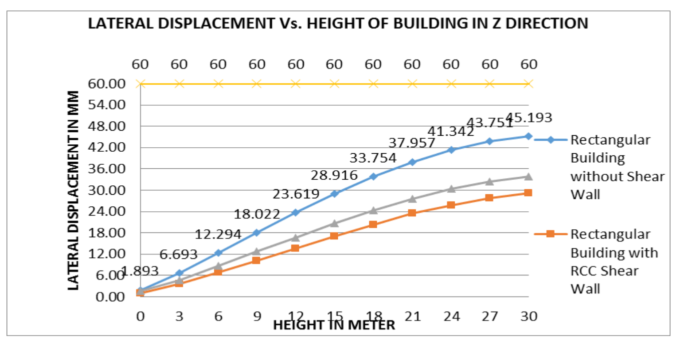


Fig.9.Displacement vs. Height of Building Comparison between rectangular buildings in Z direction

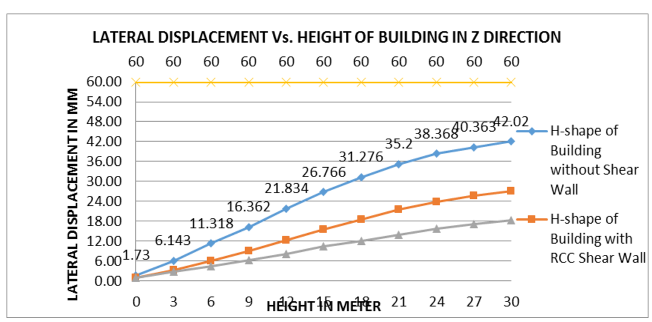


Fig.10. Displacement vs. Height of Building Comparison between H-shape of buildings in Z direction

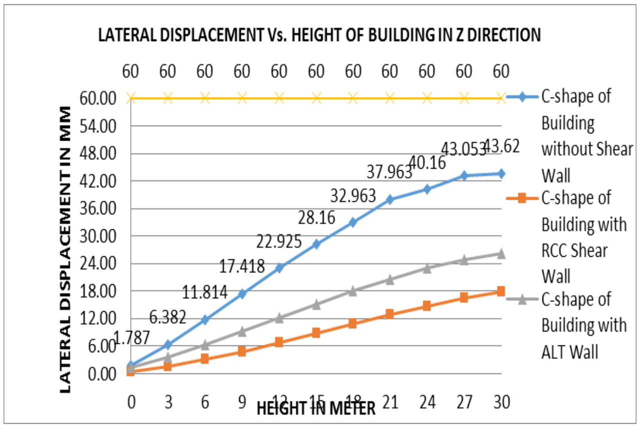


Fig.11.Displacement vs. Height of Building Comparison between C-shape of buildings in Z direction

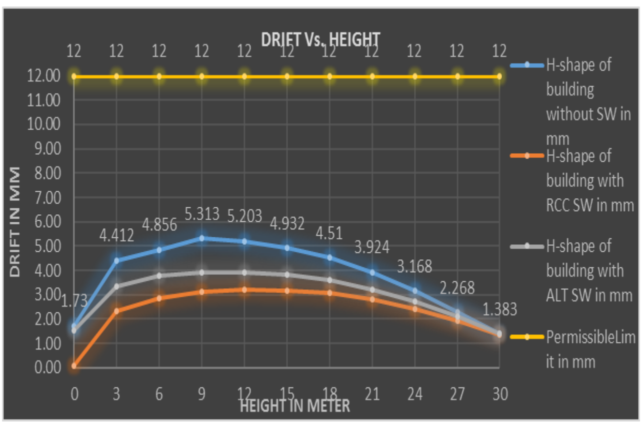


Fig.12. Drift vs. Height of Building with comparison between H-shape of buildings in Z direction

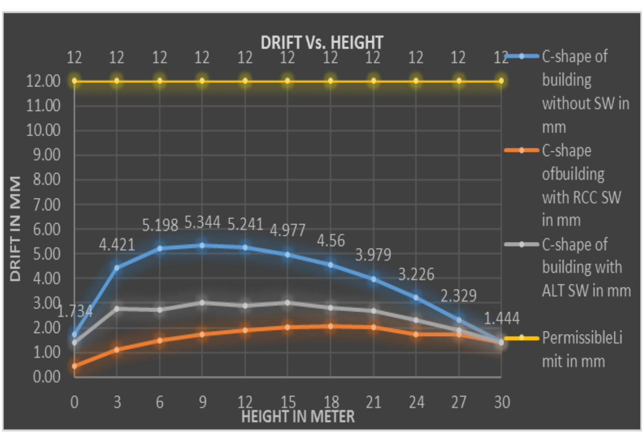


Fig.13. Drift vs. Height of Building with comparison between C-shape of buildings in Z direction

IV. CONCLUSION

- This study reveals that the lateral displacement and the storey drift of the structure are affected by its plan shape it's also affected by the alternative shear wall with glass aluminum.
- Maximum lateral displacement is obtained in Rectangular shape & H- shape Building is more as compared to the lateral displacement in C shape building X and Z Direction. due to alternative shape we can say that we used this system in future work
- Displacement in rectangular building with all types of building and condition where displacement in rectangular building without shear wall 45.193mm and minimum 29.33mm. We can say that alternative SW and shear wall reduce load effect on building similar when we go to different shape of building H and C gives same result over all types of building under permissible limit of building 60mm
- It is observed that lateral displacement is more for rectangular and H- shape building as compared to C Shape Due to load in X direction.
- Results have been proved that C -shape building is more vulnerable compare to all other different shapes.
- Maximum Bending Moment in beam Mz and My Direction. Mz is maximum in rectangular building 178 kn-m and column maximum bending moment in rectangular building is 440 kn-m in case of with SW where effect of shape of building
- Maximum Bending Moment in beam Mz and My Direction. Mz is maximum in H-shape, C-shape of building is 110.263kn-m, 136.073kn-m and column maximum bending moment in H-shape, C-shape of building is 442.05 kn-m,407.969 it's effect of unsymmetrical of building. Also in case of with SW where effect of shape of building
- But as well as we provide SW we find out all type of system of force will decreases for example maximum bending moment in alternative shear wall c-shape of building
- we also found that where we get less moment in beam other than column get high moment 444.230 kn-m

REFERENCES

[1]. Amin Alavi, P. Srinivasa Rao., Effect of Plan Irregular RC Buildings in High Seismic Zone. Aust. J. Basic &Appl.Sci., 7(13): 1-6, 2013.

[2]. Bureau of Indian Standards: IS-1893, part 1 (2002), Criteria for Earthquake Resistant Design of Structures: Part 1General provisions and Buildings, New Delhi, India.

[3]. Bureau of Indian Standards: IS-875, part 1 (1987), Dead Loads on Buildings and Structures, New Delhi, India.

[4]. Giordano, A., M. Guadagnuolo and G. Faella, 2008. “Pushover Analysis of Plan Irregular Masonry Buildings”. Inthe 14th world conference on earthquake engineering. Beijing, China, 12-17.

[5]. Guleria, Abhay. "Structural Analysis of a Multi-Storeyed Building Using ETABS for Different Plan Configurations." Vol.3. Issue 5 (2014): 1481-484. International Journal of Engineering Research & Technology (IJERT). Web. 1 May 2014.

[6]. Herrera, Raul Gonzalez and Consuelo Gomez Soberon, 2008. Influence of Plan Irregularity of Buildings." In the14th world conference on earthquake engineering. Beijing, China, 12-17.

[7]. M.R.Wakchaure, AnantwadShirish, RohitNikam, “Study of Plan Irregularity on High-Rise Structures”, International Journal of Innovative Research &Development, Vol 1 Issue 8 October 2012.

[8]. Poonam, Anil Kumar and A. K. Gupta, “Study of Response of Structural Irregular Building Frames to SeismicExcitations,” International Journal of Civil, Structural, Environmental and Infrastructure Engineering Research and.

[9]. AnupamRajmani, Prof PriyabrataGuha (2015), “Analysis of Wind & Earthquake Load For Different Shapes of High Rise Building”, International Journal of Civil Engineering and Technology (IJCIET), vol. 2, pp.38-45

[10]. BhumikaPashine, V. D. Vaidya, Dr. D. P. Singh (2016), “Wind analysis of multistoried structure with T shape and L Shape geometry”, International Journal of Engineering Development and Research, vol.3, pp.2321-9939

[11]. Dr. K. R. C. Reddy1, Sandip A Tupat (2014), “The effect of zone factors on wind and earthquake loads of high-rise structures”, IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE), pp.53-58

[12]. LodhiSaad, S. S. Jamkar (2015), “Comparative study of Wind Load Analysis of buildings of various shapes and sizes as per IS 875: (part 3) and ASCE 7-02”, International Journal of Emerging Technology and Advanced Engineering, vol.5

[13]. M. R. Wakchaure, SayaliGawali (2015), “Effects of Shape on the Wind-Instigate Response of High Rise Building”, International Journal of Research in Engineering and Technology, vol.09.

[14]. IS 875: Part 1- 1987, Indian Standard Code of Practice for Design Loads (Other Than Earthquake) For Buildings and Structures, Part-1 Dead Loads - Unit Weights of Building Materials and Stored Materials.

[15]. IS 875: Part 2- 1987, Indian Standard Code of Practice for Design loads (Other than earthquake) For Buildings and Structures, Part 2- Imposed Loads.

[16]. IS 875: Part 3- 1987, Indian Standard Code of practice for design loads (Other than earthquake) For buildings and structures, Part 3.

[17]. M. Santhosh, S. Pradeep“Seismic Analysis and Design of MultiStorey Building with Non Parallel Shear Wall System” Volume-4, Issue-2, April-2014, ISSN No.: 2250-0758 International Journal of Engineering and Management Research.

[18]. Prof. Vishwanath.B.Patil, Sunil Kumar Kalyani“Effect of Shear Wall Sections on Multi-storey Building with Satellite Bus Stop Having Floating Columns With Top Soft Storey IJIRST –International Journal for Innovative Research in Science &Technology| Volume 2 | Issue 02 |July 2015 ISSN (online): 2349- 6010

[19]. Dr. E Arunakanthi, aMurali Krishna “Optimum Location of Different Shapes of Shear Walls in Unsymmetrical High Rise Buildings”. International Journal of Engineering Research &Technology (IJERT) ISSN: 2278-0181.