

# Parametric Study on Location of Shear Wall with Opening in Irregular Structure with Respect to Seismic & Blast Load – A Review

Arvind Patel, Dr. K.B. Parikh

**Abstract**— Shear walls are structural systems which provide stability to structures from lateral loads like wind, seismic loads. These structural systems are constructed by reinforced concrete, plywood/timber unreinforced masonry, reinforced masonry at which these systems are sub divided into coupled shear walls, shear wall frames, shear panels and staggered walls. As the functional requirement opening is provide in the shear wall in term of door and window and other duct. So the present paper work was made in the interest of studying various research works involved in enhancement of shear walls with opening and their behaviour towards lateral loads and accidental load like blast load

**Index Terms**— analysis software, blast load, seismic load, Shear wall with opening

## I. INTRODUCTION

An earthquake produced the waves which cause vibrations under the earth, disturb the earth's surface. Shear walls to resist the lateral forces produced during earthquake. Shear walls behavior depends upon the material used, wall thickness, wall length, wall positioning in building frame and opening size and their opening location. Walls have to resist the shear forces that try to push the walls over.

In the past year and now days many terrorist attack occur on the building and many other structure. Due to blast, pressure wave produced surrounding the building structure by this building is damage and completely collapse hence the behavior of structural components Subjected to blast loading has been the subject of considerable research effort in recent year to prevent the building component to completely collapse.

## II. LITERATURE REVIEW

Shear walls are more efficient in resisting lateral loads in multi storied buildings. Shear walls are made with steel, reinforced concrete are kept in major positions of multi storied buildings which are made in consideration of earthquake forces, wind forces. A significant amount of research work was done in various aspects of shear walls such as

### Part I- Shear Wall Subjected To Blast Load

Manuscript received Feb 18, 2014

Arvind Pate, PG Student, GEC, Dahod India

Dr. K.B. Parikh Assist. Prof & HOD,, GEC, Dahod, India

C. J. Naito, and K. P Wheaton Studied combines basic section analyses, equivalent single degree of freedom \_SDOF\_ modeling and a static finite element pushover analysis to calculate the blast resistance of an existing shear wall subject to an external explosion. With prototypical building of three stories high. It is conclude that corner shear wall showing that the wall is more vulnerable to structural damage in the second and third floor levels than the first floor.

Hrvoje Draganić, Vladimir Sigmund. Author describes the process of determining the blast load on structures and provides a numerical example of a structure exposed to this load. The blast load was analytically determined by pressure-time history and numerical model of the structure was created in SAP2000.. result obtain fromt his, In elements exposed to distant explosions, conventional reinforcement provides sufficient ductility, while for close explosions additional reinforcement is needed.

Xiaoshan Lin, Y.X. Zhang ,Paul J. conducted study of model validation by comparing the computed results with experimental data from the literature. In addition, a parametric study is carried out to investigate the effects of charge weight, standoff distance, panel thickness and reinforcement ratio on the blast resistance of reinforced concrete panels. it is shown that the deflection of reinforced concrete panel can also be reduced by increasing the panel thickness and the ratio of reinforcement.

### Part II -Shear Wall Subjected To Seismic Load

Hyun-Su Kima, Dong-GuenLeea, Chee KyeongKimb, conducted study using Thusan efficient method for the analysis of a high-rise building structure with shear walls regardless of the number, size and location of openings in the wall using ETABS, MIDAS software. The proposed method uses super elements, substructures and fictitious beams. Static and dynamic analyses of example structures with various types of opening were performed to verify the efficiency and accuracy of the proposed method. And the result observed is that refined mesh model may not be feasible for practical engineering purpose C. Alarcon, M.A. Hube, J.C. de la Llera, evaluate the influence of axial loads in the seismic behavior of RC walls with unconfined boundaries using 3 wall section and tested after 260 days. These wall specimens were tested under equal lateral displacement cycles and subjected to different axial load ratios. The flexural-compressive failure mode exhibited by damaged walls during the earthquake was reproducing in these tests. Result shows that wall sudden fail after spalling of concrete cover.

Marius Mosoarca presents the results of the theoretical and experimental tests on failure modes of three types of reinforced concrete shear walls with staggered openings which are compared to those obtained from walls with vertical

ordered openings as far as the seismic response is displacement, storey drift and acceleration is done by using standard FEM software ETAB in which beams and columns were replaced by the shear wall. Result produced from that combined internal shear wall has less displacement, storey drift than any other position of shear wall.

VenkataSairamKumar.N, SurendraBabu.R, UshaKranti.J conducted study in the interest of studying various research works involved of shear walls and their behavior towards lateral loads. As shear walls resists major portions of lateral loads in the lower portion of the buildings and the frame supports the lateral loads in the upper portions of building which is suited for soft storey high rise building.

Divyashree M, Bhavyashree B N, GopiSiddappa, In this paper, an eight storey buildings are modeled and analyzed by response spectrum and pushover analysis methods using ETABS software. In the present study, an attempt is made to study the improvements in seismic performance of the buildings with re-entrant corners by the introduction of bracing and shear wall and to compare their relative efficiency. Regular buildings are found possess higher base shear capacity and experience much lower storey drifts compared to buildings with re-entrant corners. Increase in the stiffness of shear walls and bracings decreases the storey drifts and their by improves the seismic performance of the structure.

RavikanthChittiprolu, Ramancharla Pradeep Kumar. Conducted study of an irregular high rise building with shear wall and without shear wall was studied to understand the lateral loads, storey drifts and torsion effects. For this A residential building of G+15 irregular structure having the base dimension of plan 24.38m x 25.98m with a stilt floor of height 4m and typical floor of height 3m is considered for the analysis in ETABS.. Result present from this study is that the forces are reducing when the shear walls are added at the appropriate locations of frames having minimum lateral forces. Therefore, it is inferred that shear walls are more resistant to lateral loads in an irregular structure. Also they can be used to reduce the effects of torsion.

P. V. SumanthChowdary, SenthilPandian. M. made Study on the effectiveness of RCC shear wall building is studied with help of four different models. Model one is bare frame system and remaining three types are different shear wall buildings. An earthquake load is applied to 8 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 using structural finite concerned. The results theoretically obtained with the help of the calculus programs have been confirmed experimentally Andfrom analysis is find out that The walls with staggered openings are more rigid and have a higher bearing capacity in comparison with the walls with ordered openings, with the same amount of reinforcement.

V. Sunil Ganesh,Mallikarjun S. Bhandiwad,. study a 20 storey irregular building in zone V having same shear wall with same cross section area is analyzed by changing the various location to find the optimum position of shear wall for determining the parameters like storey shear element analysis (SAP2000) software from the response spectrum analysis it is observed that the corner type shear wall (model 2) is less deflection and compared to all other models. 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 in X and Y direction. Corner core type shear wall reduce shear force and bending moment of building. .

Sharmin Reza Chowdhury. Conducted study on 6- storey frame-shear wall buildings, using linear elastic analysis with the help of finite element software, ETABS under earthquake loads in equivalent static analysis is clearly understood that opening in shear wall placed in plane of loading is more critical than that of opening in shear wall placed out of plane of loading since there is a significant change in displacement noticed after having opening in shear wall placed in plane of loading. Shear wall with different opening sizes and locations considering coupling beam actions may be considered for future research.

Han-Seon Lee, Dong-Woo K.written a paper in which Three 1:12 scale 17-storey RC wall building models having different types of irregularity at the bottom two stories were subjected to the same series of simulated earthquake excitation to observe their seismic response characteristics. The first model has a symmetrical moment-resisting frame (Model 1), the second has an in filled shear wall in the central frame (Model 2), and the third has an in filled shear wall in only one of the exterior frames (Model 3) at the bottom two stories. The largest energy absorption is due to overturning, followed by that due to shear deformation. Horizontal cracks occurred at the construction joint in the shear wall, which is made for installation of the load cell in the first storey. Very high compressive forces in the exterior columns cause the spalling of concrete and buckling of the longitudinal bars just beneath the load cell in each model.

Seyed M. Khatami Study about a ten-storey building was modeled with three different types of lateral resisting systems: complete shear walls, shear walls with square opening in the centre and shear wall with opening at right end side. Studied models were analyzed with nonlinear software under the two mentioned records. The results evaluated were time history of displacements and basal shears of the investigated models. In the first study, the complete shear wall of the 3D building was able to absorb more energy than other investigated models of shear wall with openings. the second study also indicated a deformation delay – of the panel with opening as compared with the complete panel – occurring at the yielding load level.

KasliwalSagar K., Prof. M.R.Wakchaure, AnantwadShirish. deals with the Dynamic linear Response spectra method and static non-linear pushover method on multi-storey shear wall building with variation in number and position of shear Same model i.e.M2 use for Pushover analysis and name it as model M3.Use ETABS for model M1 and M2 and SAP2000 for Pushover analysis on M3 model . From the analysis it is observed that maximum deflection in Model M1 is reduced by 13% in the Model M2. Modal mass participation ratios for Model M1 and Model M2 are 92% and 95% which are above 90% satisfying the clause 7.8.4.2 of IS 1892(Part 1) : 2002.

## CONCLUSION

From the above literature it is conclude that in blast load shear wall damage depends on the thickness of wall. Regular opening in shear wall show more deflection rather staggered opening. Hence regular opening is restricted to 10% of wall area. And as the percentage of opening is increase the displacement is increase. Also In irregular building shear wall

reduce the effect of torsion. In high intensity earthquake zone both external and internal shear wall combined reduced the lateral loads.

#### REFERENCES

- [1] Hyun-sukima, Dong-guenleea ,Cheekyeongkimb “Efficient three-dimensional seismic analysis of a high-rise building structure with shear wall”, Elsevier journal, 2005.
- [2] C. J. naito, m.ascel; and K. P. wheaton. “Blast assessment of load-bearing reinforced concrete shear walls”, by ASCE library, 2006
- [3] Han-seon lee, Dong-woo k. “Seismic response characteristics of high-rise rc wall building have different irregularities in lower stories” by Elsevier, science direct, 2007.
- [4] Hrvojedraganić, Vladimirsigmund. “Blast loading on structures”, by Technical gazette 19, 3(2012).
- [5] Sharminreza chowdhury. “Effects of openings in shear wall on seismic response of structures” by International journal of computer applications, 2012.
- [6] Seyed m. khatamia. “Comparing effects of openings in concrete shear walls under near-fault ground motions” by wcee 2012
- [7] Kasliwalsagar k., prof. M.R. wakchaure, Anantwa dshirish “Effects of numbers and positions of shear walls on seismic behavior of multistory structure”, by. Ijair, 2013.
- [8] Xiaoshanlin, Y.X. zhang ,Paulj “Modeling the response of reinforced concrete panels under blast loading” by .materials and design,2013
- [9] C alarcon, m.a.hube, J.C.. delallera “Effect of axial loads in the seismic behavior of reinforced concrete walls with unconfined wall boundaries” by ,elsevier journal, science direct,2014.
- [10] Mariusmosoarca, “Failure analysis of rc shears walls with staggered openings under seismic loads”, by science direct, 2014.
- [11] j. v. sunilganesh, mallikarjun s. bhandiwad “Seismic analysis of irregular multistoried structure with shear wall”,bythe international journal of science & technology,2014.
- [12] Venkatasairamkumar. n, Surendrababu.r, Ushakranti.j “Shear walls –a review”, by., international journal of innovative research in science, engineering and technology,2014.
- [13] Divyashree m, Bhavyashree b n, Gopisiddappa “Comparison ofbracings and shear walls as seismic strengthening method to building with plan irregularities”, by International journal of innovative research in science, engineering and technology., 2014.
- [14] Ravikanth chittiprolu, Ramancharlapra deep kumar “Significance of shear wall in high rise irregular buildings”, by. International journal of education and applied research, 2014.
- [15] P. V. sumanth chowdary, Senthilpandian. m “A comparative study on RCC structure with and without shear wall” by. international journal for scientific research & development,2014