

Research Article

Use of Shear Wall with Opening in Multistoried Building: A Factual Review

Gagan Yadav and Sagar Jamle*

Department of Civil Engineering, Oriental University, Indore (M. P.), India

Received 27 Jan 2020, Accepted 28 March 2020, Available online 30 March 2020, Vol.10, No.2 (March/April 2020)

Abstract

Normally it has been seen that shear walls are used for stiffening the entire structure, to overcome the effects seismic activities. Since the shear wall is made up of reinforced concrete and make the entire building very costly. One of the solutions adopted as per analysis is that there should be opening criteria of shear wall within the limit. This will be a most effective solution of cost reduction of the building along with the seismic resistant structure. In this work, firstly literature survey has performed and it has been seen that most of the researchers done a very good job to make the seismic resistant building. On other hand, none of them have done the opening area effect of the shear wall to make it cost effective. The following work started with the introductory part with types of core type shear wall then types of wall opening. After then review of literature have been performed then at the end of the work, conclusions and outline of the proposed work have made.

Keywords: Base Shear, Core Type Shear Wall, Importance Factor, Lateral load, Optimum Case, Shear Wall Opening.

1. Introduction

The earthquake disasters are spreading day by day due to various global changes. Various places were hit by it and the same will stop the functionality of the stroked areas. It is always necessary to lessen the effect of the seismic activities on the multistoried structures since it has the number of capacity of lives living, working and enjoying the resources. A part of the structural engineering suggested that it is very essential to make structure stiff well enough to resist these before and after effects.

Shear wall is the oldest one of the remedies in the field of earthquake engineering. It is additional structural component members stands its own place and resist the lateral forces. It starts from the foundation base and ends up to the top building height.

2. Types of Core Type Shear Wall

It has been seen that there is a requirement of lift in multistoried structure. Some of them are as follows:-

- 1) Structure with Single Core Shear Wall
- 2) Structure with Dual Core Shear Wall

The core shear wall depends on frequency of the live load moving from floor to floor. The figure below

shows clear view of different types of shear wall openings.

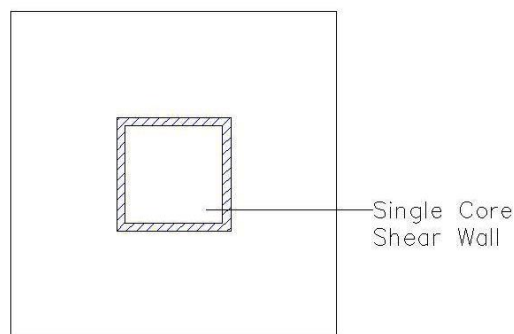


Fig. 1: Structure with Single Core Shear Wall

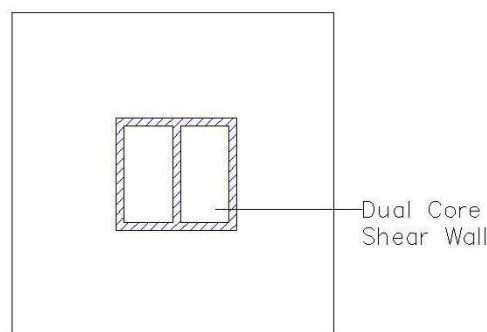


Fig. 2: Structure with Dual Core Shear Wall

*Corresponding author **Sagar Jamle** (ORCID ID: 0000-0002-6890-6971) is working as Assistant Professor; **Gagan Yadav** is a M.Tech Scholar, DOI: <https://doi.org/10.14741/ijcet/v.10.2.9>

3. Types of Shear Wall Opening

Generally there are total three types of shear wall openings, they are as follows:-

- 1) Structure with Very Large Opening Shear Wall
- 2) Structure with Medium Opening Shear Wall
- 3) Structure with Very Small Opening Shear Wall

The opening in shear wall depends on the stiffness of the structure that how it will stand in front of seismic activities. The figure below shows the clear view of different types of shear wall openings.

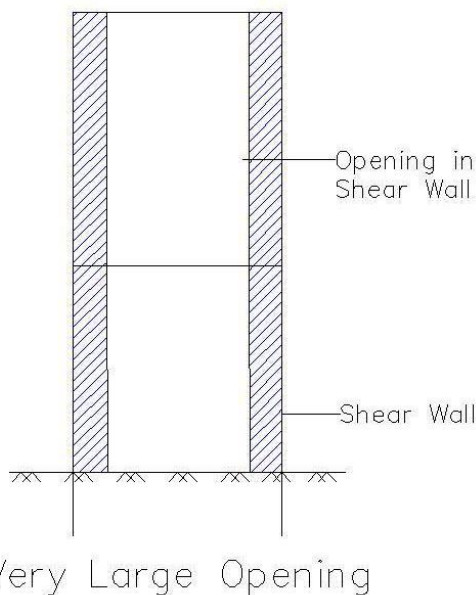


Fig. 3: Structure with Very Large Opening Shear Wall

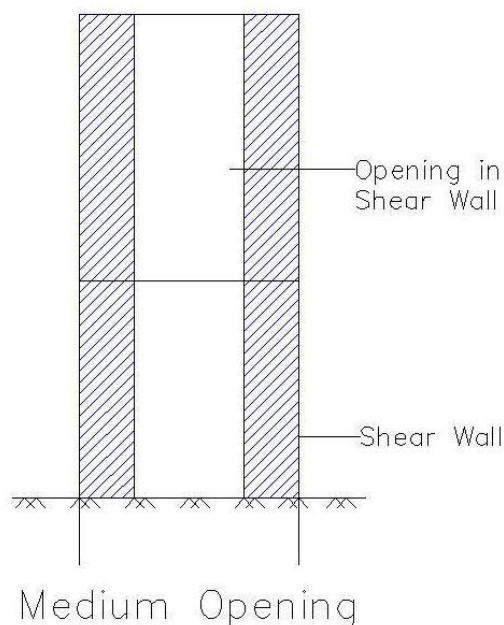


Fig. 4: Structure with Medium Opening Shear Wall

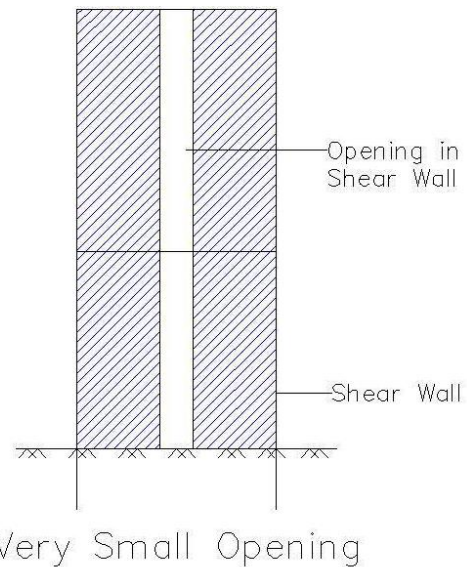


Fig. 5: Structure with Very Small Opening Shear Wall

4. Review of Literature

The work has been gone through with the theme of the structural engineering that always suggest the lateral load handling capacity of the multistoried building. Both the authors have done a review work by done a survey on various research papers. They have gone through various research approaches and after then conclusions have drawn that numerous research works were done to reduce the lateral effects of the multistoried structures. It has seen that the shear wall belt can reduce the movement in the building. The belt has the ability to tighten the entire structure from a particular height and will conduct a stability enhancement against the lateral effects (Neeraj Patel *et. al.*).

The researchers have gone through with various possible cases of the stability of multistoried building by providing core type shear wall around the lift and this core stabilizes the entire building lateral loads along with the vertical loads too. The analytical approach was performed on the G+12 residential building with and without tower over it. The tower was selected and was equipped with all the communication gears on it. The entire load was on the roof in their study. Total 5 cases was selected and abbreviated from CASE A to CASE E from position P1 to P5. The results are same for each mirror locations was a good and mindful effort. Outcomes consists base shear, nodal displacements, axial forces, shear forces, storey drift and bending moment were the parametric approach. Comparative analysis results shows the Optimum Case A and Case D should be preferred for tower placing only on these particular positions (Suyash Malviya *et. al.*).

The provision of openings in shear walls was a great effort done by the researchers. They introduced high local vertical stress along with concentration of shear stress around the corners of the openings. A 30 storied multistoried building with shear wall with

different size of openings analysis was conducted. The volume of the wall have reduced just because of opening was introduced. Using response spectrum method and time history analysis the walls provided on the boundary have analyzed. Displacement and drift have increased since there was increment of shear wall opening area. Storey drift increased in their work was 1.04 percent to 23.63 percent (Ruchi sharma *et. al.*).

The previous work done and the recent trend in the field of stability have described by the authors in their work. By introducing the seismic effects on a building and using the outrigger systems, wall belt systems and truss belt system, the researchers keep on reforming Taranath method of optimum outrigger height. Total seven cases have prepared in their work that were abbreviated as S1 to S7. One simple building was compared with other six cases and the result shows that for a multistoried high rise structures, for heavy weight, shear wall belt system has proved to be more effective as compared to different types of truss belt systems. The main recommendation of their work was "If column design is the main criteria, building axial forces shows a least value when only Shear Core system will be used". Also; "Member torsion values have seen effective and efficient case for building with shear core and wall outriggers" (Archit Dangi *et. al.*).

As per the objectives, the authors have done a lot of efforts to Increase Lateral Load Handling Capacity in Multistory Building by the use of shear wall belt at optimum height. This is once again the Taranath approach of efficient location height of such system. Plinth area of 825 square meters was selected in their work with analytical approach conducted on 25 storied high rise residential building. Great efforts of cases created viz. Case A, Case B, Case B1...Case B14 and comparison were done by applying shear belt at different floors. Seismic analysis with SRSS combinations was done and output parameters viz. displacement, drift, base shear. None of the researchers but them has performed a deep analysis of load cases that creates maximum drift with shear belt at different floors. Optimum shear wall strip found out to be at 12th floor (Neeraj Patel *et. al.*).

To lessen the effect of the seismic activities and to decrease the overall cost of the structure without losing its stiffness, the researchers have analyzed and suggested opening area effect of shear wall in multistorey building. The researchers first explained what shear wall was and then have informed the classification of shear wall. After the same, they have suggested the concept of shear wall opening. Three types of opening have discussed viz. very small opening, medium opening and very large opening. They discussed the objectives of their research theme. After then total 5 building models have prepared with percentage deduction in wall area and then they performed analysis. Results of their study proves that, beyond the 20% opening limit, the stiffness keeps on decreasing and this limit was the threshold limit. Building with 80% coverage shear wall performs best of all (Prafoolla Thakre *et. al.*).

Conclusions and Outline of Proposed Work

So far by reviewing, analyzing and learning the above research papers it has been found that numerous work has been going on to make the multistoried structure free from seismic activities. Various possible ways are now available in the field of structural engineering that made a drastic revolutionary change. There has to be other ways to make the structure firm on its foundation and make itself earthquake free.

The conclusive outcomes drawn from the study is suggested by outline of the proposed work below:

The proposed work will going to be an analysis of the single core structures in which percentage shear wall area of core type will be provided. After then comparative analytical approach will be done to show the percentage criteria usage in single core type shear wall. The following proposed work will also going to show the analysis of the dual core structures in which percentage shear wall area of dual core type will be provided. After then comparative analytical approach will be done to show the percentage criteria usage in dual core type shear wall. The optimum percentage case will be calculated and that will be the major analytical part of the study of single core and dual core shear wall structures.

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