Issue 9 vol 3 ISSN: 2321-8134

IJFEAT

INTERNATIONAL JOURNAL FOR ENGINEERING APPLICATIONS AND TECHNOLOGY

EFFECT OF EARTHQUAKE ON NON SHEAR WALL BUILDING

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Abstract

Earthquake are most changeable and disturbing of all natural disasters. Performance of structures under commonly occurring earth quake ground motions resulting in structural damages as well as failures have continually verified the seismic susceptibility of existing buildings, due to their design based on gravity loads only or insufficient levels of lateral forces. This necessitates the need for design based on seismic responses by suitable methods to ensure strength and stability of structures. Shear wall systems are one of the most commonly used. Shear wall is a structural member position at different place in building from foundation level to top parapet level, used to resist lateral forces i.e parallel to the plane of the wall. Shear wall systems are one of the most commonly used lateral load resisting systems in high rise buildings.. This study aims at comparing various parameters such as storey drift, storey shear, deflection, reinforcement requirement in columns etc of a building under lateral loads based on strategic positioning of shear walls.It is the different types of shear wall i.e R.C.. Shear wall, Steel Plate Shear, wall Plywood Shear wall and R.C. Hollow concrete block Masonry. India there is a need to study the seismic behaviour of such structure with shear wall frame systems. Alternative measure need to be adopted for this specific situation .In this paper review of different researchers on the concept of multi-storied building with and without shear wall paraphrased. In India, most adopted type of earthquake resistant structures with shear wall. These structural walls may differ based on their configuration and utility and their position is any building plays an important role for resisting lateral force.

Keywords: *Earthquake, Shear Wall , Strength, Stiffness*

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1. INTRODUCTION

Earthquake is general had a long history of deadly damage in the place. Earthquake can be measured in terms of energy released i.e. measuring amplitude frequency and location of seismic wave and also by evaluating intensity i.e. considering the destructive effect of shaking ground on people, structure and natural features. mostly the reaction of the structure due to ground motion is an important factor to study and design any earthquake resistant structure.

The loads or forces which a structure subjected to earthquake motions are called upon to resist, the distortions induced by the motion of the ground on which it rests.

The properties of the structure are lateral stiffness, lateral strength and ductility. Lateral stiffness refers to the initial stiffness of the building, even though stiffness of the building reduces with increasing damage. Lateral strength refers to the highest resistance that the structure offers during its whole history of resistance to comparative deformation.

1.1Types of Shear Wall

1.1.1 R.C. Shear Wall

It consist of reinforced concrete wall and reinforced concrete slabs wall thickness varies from 140mm to 500mm depending on the number of stories, building age, and thermal insulation requirement. In general, these walls are continuous through the building height. Here Paragraph content goes here. Paragraph content goes here.

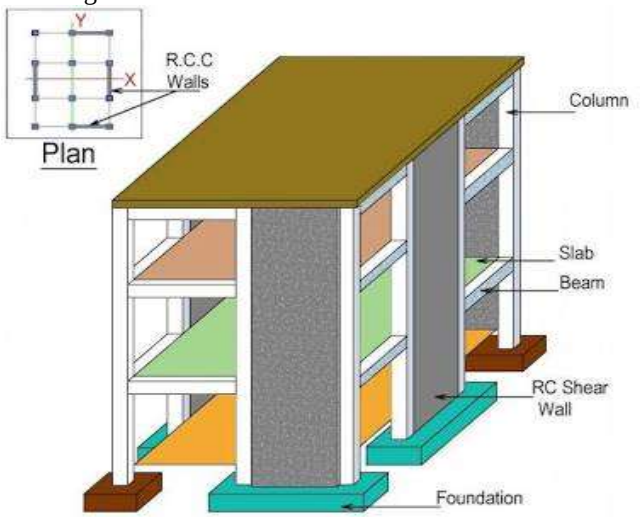

Fig. 1: R.C. Shear Wall

1.1.2 Plywood Shear Wall

Plywood is the traditional material use in the construction of shear walls. The creation of pre-fabricated Shear panels have made it possible to inject strong shear assemblies into small walls that fall at either side of a opening in a shear walls. The plywood shear wall to transfer shear force. and to resist tension/compression generated by the over turning moments.

Fig. 2: Plywood Shear Wall

1.1.3 Steel Plate Shear Wall

The steel plate shear walls system consist of a steel plate wall, boundary columns and horizontal floor beams. Together, the steel plate wall and boundary columns act as a vertical plate girder. The column act as flanges of the vertical plate girder and the steel plate wall acts as it's web.

Fig. 3: Steel Plate Shear Wall

1.1.4 R.C. Hollow Concrete Block Masonry Wall

This wall are constructed by reinforcing the hollow Concrete Block Masonry. by taking advantages of hollow space and shape of the hollow block. It requires continuous steel rods (RF) both in the vertical and horizontal direction.

Fig. 4: R.C. Hollow Concrete Block Masonry Wall

1.2 Needs and Necessity

Since stilt type framed structures are widely adopted India there is a need to study the seismic behaviour of such structure with shear wall frame systems. Alternative measure need to be adopted for this specific situation. The under-lying principle to this problem is

a) Increasing the stiffness of the first storey such that the first storey is at least 50% stiff as that second storey, and
b) Providing adequate strength in the first storey.

The possible schemes to achieve the above are

1) Provision of stiffer columns in the first storey, and
2) Provision of a concrete core wall (shear wall) in the building.

2. LITERATURE REVIEW

2.1Venkata Sairam Kumar et.al. reviewed different papers on shear walls and stated that shear walls are structural systems which supply stability to structures from lateral loads like wind, seismic loads. These structural systems are constructed by reinforced concrete, plywood/timber unreinforced brickwork, reinforced brickwork at which these systems are sub divided into joined shear walls, shear wall frames, shear panels and staggered walls. The paper was made in the interest of studying various research works concerned in enhancement of shear walls and their behaviour in the way of lateral loads. As shear walls resists major portions of lateral loads in the lower part of the building and the frame supports the lateral loads in the upper part of building which is appropriate for soft storey high rise building. Researchers studied different parameters like development of stiffness, drift, development forces in buildings and also to study perfect position of shear wall position in building frame for construction.

2.2 P. P. Chandurkar et.al. investigate about a structure with Shear wall and without Shear wall were measured and compared. As per their research work Structural walls provide an efficient bracing system and offer large potential for lateral load resistance. The properties of these seismic shear walls control the reply of the buildings, and therefore, it is essential to calculate the seismic response of the walls correctly. According to their study, main focus was to decide the result of shear wall location in multi-storey building. Effectiveness of shear wall had been studied with the help of four dissimilar models. One model was bare frame structural system and other three models were dual type structural system. When earthquake load were applied to the structure of ten stories located in zone II, zone III, zone IV and zone V, parameters like Lateral displacement, story drift and whole cost required for ground floor were calculated in equal cases replacing column with shear wall. E- Tabs software was adopted for testing.

2.3 Shaik Kamal Mohammed Azam,2013 presented a study on seismic performance evaluation of multi-storeyed R.C framed buildings with shear wall. A comparison of structural performance in terms of strength, stiffness and damping quality is done. The provision of shear wall has important influence on lateral strength in taller buildings while

it has less influence on lateral stiffness in taller buildings. The provision of shear wall has important influence on lateral stiffness in the structure of shorter height while it has less influence on lateral strength. The influence of shear walls is significant in terms of the damping characteristics and time at the performance point for tall buildings. Provision of shear walls symmetrically in the outermost moment-resisting frames and if possible interconnected in equally perpendicular direction forming the centre will have better seismic performance in terms of strength and stiffness.

2.4 Misam Abidi,Mangulkar Madhuri. N;2012 presented an assessment to understand the behaviour of Reinforced Concrete framed structures by pushover analysis and the Comparative study was done for different models in terms of base shear, displacement, performance point. The inelastic performance of the example structures are examined by carrying out displacement controlled pushover testing

3.EFFECT OF EARTHQUAKE ON NON SHEAR WALL BUILDING

1) Most earthquake induced building damaged, however is a result of shaking.
2) More damage in the after shocks when they are already weakened meaning that there is a higher risk of death.
3) When the ground shakes at a building site, the building foundations vibrate in a manner that similar to the surrounding ground.
4) Brittle elements tends to break and lose strength of the building .ex :- It includes unreinforced masonry walls that cracks when overstressed in shear and crush the concrete elements in compressive overloads.
5) Ductile elements are able to deform beyond their elastic strength limit and continue to carry load. Ex :- It includes tension braces beams in moment frame.
6) The column undergo relative moment between their ends.

4. FUNCTIONS AND LOCATION

4.1 Function of shear wall

They are two functions of Shear wall Strength and Stiffness.

1) **Strength**

Shear wall most provide the necessary lateral strength to resist horizontal earthquake forces.

When Shear walls are strong sufficient they will move these horizontal forces to the next elements in the load pathway under them such as other shear walls floors, foundation walls, slabs or footing.

2) **Stiffness**

Shear wall also provide lateral stiffness to prevent the roof or floor above from excessive sides way.

When shear wall are stiff sufficient they will prevent floor and roof framing members from moving of their support.

Also building that are sufficiently stiff will usually suffers less non structural damage.

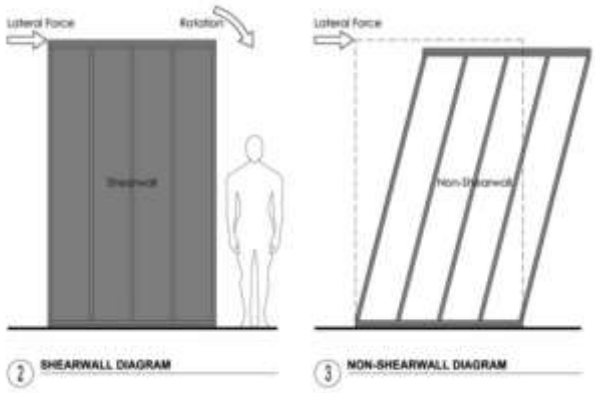

Fig. 5: Shear and Non Shear Wall Diagram

4.2 Location of Shear Wall building

Shear walls are usually provided between column line in stair wells lift well and in shaft. When design for wind loading of the shear wall with in the building plane does not play an important role. In case of seismic loading, however wall location are a critical factor. Under wind loading a fully elastic response is expected, while during strong earthquake significant in elastic determination are anticipated.

A wall configuration which has very little eccentricity between the centre of building mass and stiffness and results in a reasonably uniform distribution of inelastic determination under seismic loading.

The effective shear wall should be equal length and placed symmetrically on all four exterior wall of the building.

Shear wall should be added to the building interior, when exterior wall can not provide sufficient strength and stiffness.

For the best torsional resistance or many of the walls as possible should be located at the border of the building.

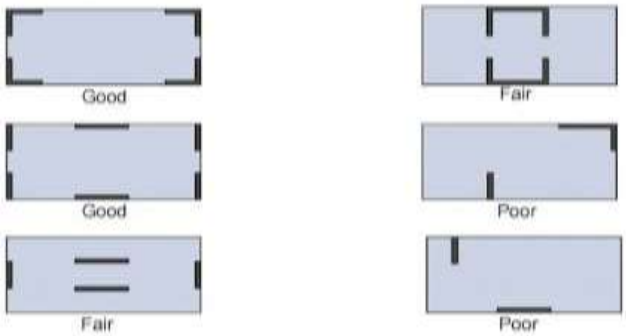

Fig. 6: Placement of Shear Wall

5. METHODOLOGY

3-D model staad pro has been studied to analyze the behaviour of reinforced concrete tall building and steel structure building under earthquake load. This paper explain briefly also the effect of earthquake load on the structure, earthquake effect on RCC framed building and steal framed building. Important factor of building and finally soil factor were taking into consideration and there effect on the performance of tall building were discussed. Our purpose is to analyse and design both structure and study the effect on foundation and as well as effect on costing of material for construction purpose. The model has been design for 10 storied building and this will guide us in choosing the type of structure for a 35m height building.

Fig. 7: 3-D Model Steel Framed Structure

6.ADVANTAGES OF SHEAR WALL BUILDING

1) Shear Wall especially important in high rise building.
2) Shear wall resist horizontal lateral forces and provide earthquake resistance.
3) It possess very large in plane stiffness which resist lateral load.
4) Shear walls are helpful in controlling deflection.
5) R.C.C Shear Walls are easy to construct reinforcement detailing.
6) It Minimize earthquake damage to structural damage and non structural damages.
7) Well designed shear wall not only provide adequate safety but also provide great measure of protection against costly non- structural damage during moderate seismic damages.
8) Shear wall have to resist the uplift forces caused by the pull of the wind.
9) The shear walls are more important in seismically active zone because during earthquake shear forces on the structure increases.
10) Shear wall should have more strength and stiffness.
11) Shear wall provide adequate strength and stiffness to control lateral displacement.
12) Shear wall perform dual action that is they as lateral as well as gravity load bearing elements.

7. CONCLUSION

1. From the above study it can be concluded that, different researchers had studied different type of problems related to earthquake and addressed that shear wall are more prominent to resist lateral force due to earthquakes.
2. Thus shear wall are one of the most effective building element in resisting lateral forces during earthquake.
3. By constructing shear wall damage due to effect of lateral forces due to earthquake and high wind can be minimize.
4. Shear wall construction will provide large stiffness to the building there by reducing the damage to structure and its contents.
5. Shear wall is more efficient with increased ductility.
6. Effect of lateral forces due to earthquake and high wind can be minimize.

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