Ravikant Vishwakarma, 2021, 9:3
ISSN (Online): 2348-4098
ISSN (Print): 2395-4752

Parametric Study of Seismic Behaviour of 3D G+10 Building Frame With L, Plus and Rectangular Arrangement of Shear Walls: A Literature Review

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Abstract- According to past earthquake reports, there is a rise in the market for earthquake-resistant buildings. So It is important to build and analyse systems with the seismic impact in mind. The current paper provides an outline of the various research projects that need to be completed in order to analyse multi-story RC frame structures with lateral load resisting systems such as shear walls and diagrid systems. The current research focuses on the seismic analysis of multi-story buildings with shear walls, as well as the analysis of multi-story structures with various shear wall positions and heights, and the correct placement of shear walls in multi-story buildings. The aim of this paper is to provide information on the seismic activity of structures using shear walls.

Keywords:- Lateral Load resisting System, Multi-storey Building, Seismic Effect, Shear wall.

I. INTRODUCTION

The exponential growth of the urban population and the shortage and high cost of available space, taller buildings are now preferred. As the pinnacle of As the size of the system grows, lateral load considerations become more important Significantly significant. The lateral load resisting system, rather than the structural system that resists gravitational loads, becomes more significant as a result.

The load-resisting lateral load Rigid frame, shear wall, diagrid structural system, wall frame, braced tube system, outrigger system, and tubular system are some of the most commonly used structures. Shear wall systems and diagrid structural systems have recently been the most common.

Shear walls have a high in-plane stiffness and strength, allowing them to resist heavy horizontal loads while still supporting them gravity loads, rendering them useful in a variety of situations. Applications in structural engineering Structure with a digrid grid Because of its structural strength, it is used in tall buildings. In addition architectural preparation versatility.

Shear walls are vertical cantilevered lateral-force-resisting elements that act as supports for roof and floor diaphragms, or for the transfer of loads into diaphragms where the wall cannot continue to the foundation. Shear walls can be full-length walls or short wall sections that can occur at any location along a line of lateral force resistance.

II. RESEARCH WORK OF DIFFERENT LITERATURES

Anuj Chandiwala et al (2012) the researcher, had tried to get moment occur at a particular column including the seismic load, by taking different lateral load resisting structural systems, different number of floors, with various positions of shear wall for earthquake zone III in India has been selected. The need for earthquake-resistant buildings can be met by installing shear wall systems in the structures. This research project looked at a 10-story RC residential building in India's seismic zone III that was built on

medium soil, which is a common ground state. Following the contrast of maximum base shear in x and y-direction and the study of the building configuration, it was determined that option-i is better suited for the base shear during earthquake. Best result among different shear wall locations (f-shear wall at end of "I" section). Main reason is "end portion of flange always oscillate more during earthquake". Shear walls specifically prevent this end oscillation, lowering the building's total bending moment.

P. V. Sumanth Chowdary et. al. (2014) Studied the solution for shear wall location and type of shear wall in seismic prone areas. Four different models are used to investigate the efficacy of RCC shear wall construction. The first model is a bare frame system, and the other three models are various shear wall structures. Eight-story buildings in various zones are subjected to an earthquake load. The lateral displacements of each storey are used to assess the building's results.

The structural finite element analysis (SAP2000) programme is used for the analysis. Columns are also present in RC buildings with shear walls; these columns mainly support gravity loads. Bar bell style shear walls, paired shear walls, fixed frame shear walls, framed shear walls with infilled supports, column backed shear walls, and core type shear walls are the different types of reinforced concrete shear walls. Rectangular style shear walls, centre type shear walls, and coupled type shear walls are among the shear walls used for study. Columns and walls in between form a rectangular shape shear wall. Torsion resistance is strong in core form shear walls.In this present paper one model for without shear wall Rcc (G+7) building and three models are different types of shear wall buildings are generated in SAP 2000 software.

K. Lova Raju et. al. (2015) this paper deals with the non-linear analysis of frame for various positions of shear wall in a building frame. The aim of this research is to find the best place for a shear wall in a multi-story structure. The first model is a bare-frame structural structure, while the other three are dual-type structural systems.

According to Code Provision IS1893-2002, an earthquake load is added to an eight-story building located in zones II, III, IV, and V.The analysis has been carried out using ETABS software. For different models, pushover curves have been built and compared. In the case of displacement and base shear, structures with shear walls at suitable locations have been shown to be more important.

N. Janardhana Reddy, et. al. (2015) these researchers in their study have studied the solution for shear wall location and type of shear wall in seismic prone areas. The current research focuses on improving the position of shear walls in symmetrical high-rise buildings. In symmetrical structures, the placement of shear walls must be taken into account.

The centre of gravity and rigidity correlate in symmetrical buildings, allowing shear walls to be positioned symmetrically over the outer or inner edges (like box shape). To mitigate the torsion effect, it is critical to find the most effective and optimal position of shear walls in symmetrical buildings.

For the purposes of this study, a high-rise building with various shear wall locations is considered.The multi storey building with 14 storeys is analyzed for its displacement, strength and stability using ETABS-2013 software. For the analysis of the building for seismic loading with two different Zones (Zone-II & Zone-V) is considered with a soil I & soil III types. The analysis of the building is done by using equivalent static method and dynamic method.

Shaikh Faraz et. al. (2015) in which the researchers study, Shear-walls are oriented in three different positions for circular and rectangular types of shear walls. The structure is considered as OMRF (ordinary moment resisting frame) structure.

Joint displacement, axial stress, bending moment, and base shear are the four parameters used to compare the structures. In comparison to circular and rectangular shear walls, the response of bare frame structures (structures without shear walls) in the study of joint displacement, axial force, bending moment, and base shear is also considered. Seven different models were used to investigate the effectiveness of shear walls. The configuration of Ground+10-storeys in zone-III is subjected to seismic forces.

STAAD Pro V8i software is used for the analysis of structures. The structure is considered as public building. The load conditions are taken from IS

1893:2002 (Part 1). From the analysis and results of various parameters.

Deepak Kumar Bandewar et. al. (2016) The shear wall was examined to see if it was suitable and how it would react to seismic loads. The forms of shear wall openings on the ground floor of a G+5 R.C. multistory building frame was studied in this analysis. The research and modelling platform Bentley STAAD PRO. (V8i) SERIES 4 was used to complete this project.Is 1893 (part-1)-2002 code has been used in this work to calculate the seismic forces. Hard rock type is used & the work has been done for seismic zone-II.

Kiran Tidke et. al. (2016) focuses on They are mostly flexural members that are often used in buildings to prevent complete collapse due to seismic forces. Since the seismic response of these seismic shear walls dominates the response of the structures, it is critical to assess the seismic response of the walls accordingly.

The aim of this project is to investigate the impact of seismic loading on the placement of shear walls in buildings in various locations. Five different models were used to investigate the effectiveness of shear walls. The first model is a bare frame structural system, while the other four versions have separate shear wall configurations. Response spectrum and time history method are used for analysis in SAP2000 software and structure was assumed to be situated in zone II.

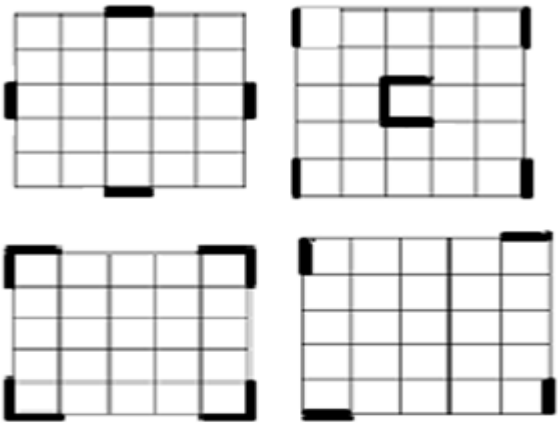

Fig 1. Shows different location of shear wall in Model.

V. Abhinav et. al. (2016) studied an RCC building of 11 floors placed exposed to earthquake loading in Zone -V is considered in this case. An earthquake load is calculated by seismic coefficient method using IS 1893(PART-I):2002. After, the three separate shear wall installation instalments for an 11-story building will be investigated. The results of the preceding four analyses will be compared, and the shear wall frame structure will be proposed for the building under consideration for that review.

This analysis can help in achieving safety against earthquakes in addition to maintaining your versatility from the frame structure intact.

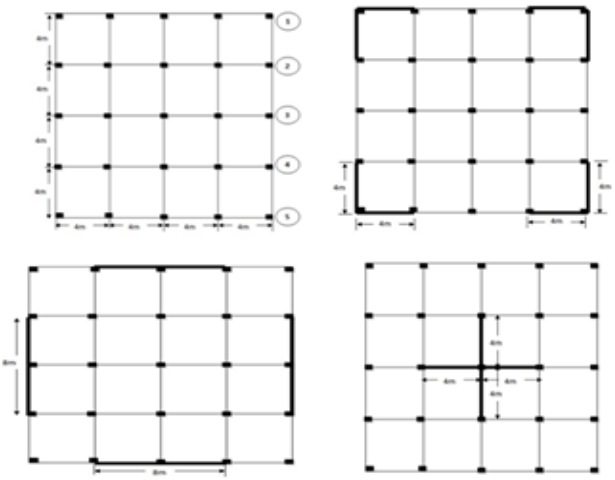

Fig 2. Shows different location of shear wall in model.

Mahdi Hosseini et. al. (2017) The utility of shear walls in the structural planning of multistory buildings has long been accepted. This research is done on RC framed multistory building with RC shear walls with defined support conditions. When walls are placed in strategic locations within a structure, they can be very effective in resisting lateral loads caused by wind or earthquakes. Incorporation of shear wall has become inevitable in multistory building to resist lateral forces. In present work, In India, forty-story buildings (120m) are needed for earthquake zone V.

This paper aims to investigate the action of reinforced concrete buildings by dynamic analysis of the best shear wall positions and locations. The structural reaction is estimated, including storey displacements, base shear, storey drift, and Stress Distribution. Dynamic responses under zone V earthquake as per IS 1893 (part 1): 2002 have been carried out. The Response Spectrum approach is used in dynamic analysis. The protocols set out in IS codes were used to study reinforced concrete shear wall buildings in this article. The building model's seismic strength is assessed.

Poornima D et. al. (2017) Observed The main goal of this paper is to justify the shear wall location for a G+9 Residential building by considering the heap case such as quake and twist using the Response continuum approach for various types of buildings, such as symmetric and asymmetric buildings.

Find the shear walls of irregular buildings and structures surrounded by RC through considering parameters like Maximum Story Displacements and Maximum Story Drifts examining both by the static and element analysis schemes by the procurement of programming bundle ETABS-2013 at distinct locations, for example, Shear wall at the internal core of the model, Shear wall at the fringe side edges, and Shear wall at the corner edges for all the structures.

According to this study, the drop in storey displacement is attributed to an increase in structure stiffness as well as a decrease in structure velocity and acceleration. Furthermore, the graph reveals that the volume of displacement of stories has increased steadily over time.

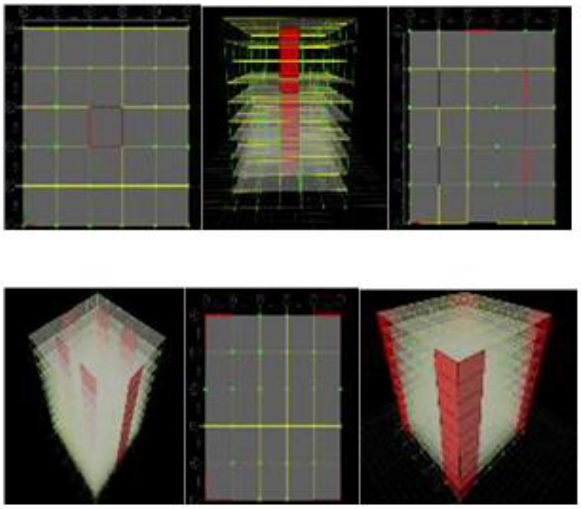

Fig 3. Plan of Symmetric Building.

S. P. Sharma et. al. (2017) the researcher gives an overview of different research works to be done regarding the study of multi-storey RC frame structure with lateral load resisting systems such as shear wall and diagrid system. The current research focuses on a quantitative study of seismic analysis in multi-story buildings with shear walls and bracing, analysis of multi-story structures with various shear wall positions and heights, and correct shear wall placement in multi-story buildings, among other things.

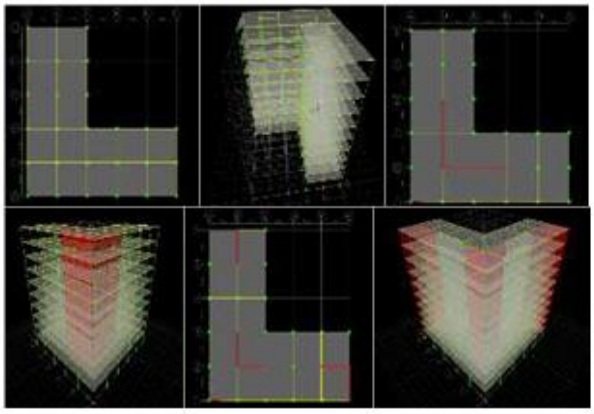

Fig 4. Plan of Irregularity Building.

The current paper provides information on seismic activity of structures using shear walls and diagrids, as well as comparisons between them. This paper describes the progress of studies into the seismic activity of structures using shear walls or diagrids.

According to some experts, the shear wall, diagrid, and hexagrid systems have little effect on the vertical load resisting system of an RC structure, but they do affect the lateral load resisting system due to stiffness and density. While the storey shear varies linearly from one to the other, the steel bracing frame system outperforms the shear wall system. It is observed that the deflection at the different level in multi-storey building with shear wall is comparatively lesser as compare to RC building without shear wall.

Sanisha Santhosh et. al. (2017) was studied the improvement of the form of shear walls in symmetrical high-rise buildings. The centre of gravity and rigidity correlate in symmetrical buildings, allowing the shear walls to be positioned symmetrically. For the purposes of this study, a high-rise building with various shear wall forms is considered.

The multi storey with G+14 and G+29 storey's are analyzed for its storey drift and base shear using ETABS software. For the analysis of the building for seismic loading with two different Zones (Zone- III & Zone-V) is considered. The building's research is carried out using a complex approach (Response spectrum analysis). Shear walls' form and position have a direct impact on their structural activity when subjected to lateral loads. Lateral loads are transmitted parallel to the force of motion across the structure acting as a lateral diaphragm to the shear walls.

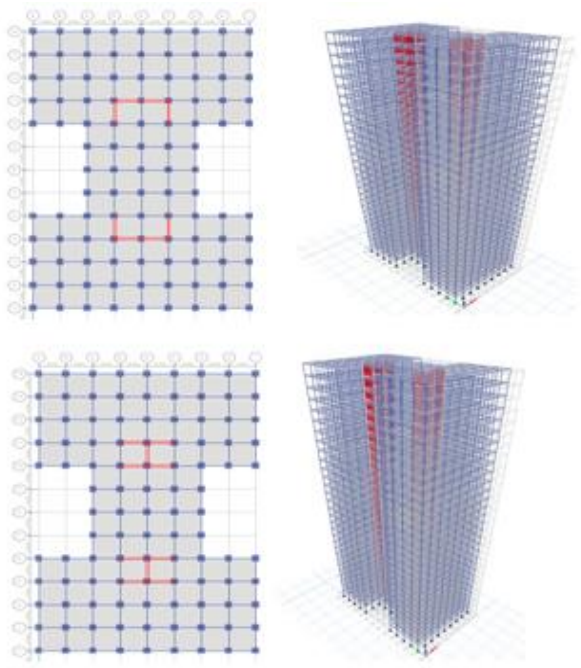

Fig 5. Plan view of building with U and H shaped shear wall.

Brajesh Kumar Tondon et. al. (2018) about the response of building when it is subjected to seismic load , this response can be shown by story drift and base shear .seismic analysis has been performed on (G+8) building which is located in zone 2 & 4 using STAAD Pro software. Analysis has been performed according to IS 1893 PART 1 (2002). In this article, the seismic analysis of a G+8 BUILDING in zones 2 and 4 is defined, and the building's response is seen in the form of storey drift and base shear. The seismic parameter analysis was carried out using STAAD Pro in accordance with IS 1893 CODE, and the modelling was carried out using AutoCAD.

B. Jaswant et. al. (2018) studied on the improvement location of shear walls in symmetrical high rise buildingIn symmetrical structures, the placement of shear walls must be taken into account. The centre of gravity and rigidity correlate in symmetrical buildings, allowing shear walls to be positioned symmetrically over the outer or inner edges (like box shape). To mitigate the torsion effect, it is critical to find the most effective and optimal position of shear walls in symmetrical buildings.In this work a high rise building with different places of shear walls is considered for analysis. The multi storey building with 8 story's is analyzed for its displacement, strength and stability using ETABS-2015 software. The soil III is considered for the seismic loading study of the building with Zone-III. The building's research is carried out using both equivalent static and dynamic methods. The two big lateral forces that impact the buildings are earthquake and wind forces.

Vijit Sahu et. al. (2018) explained the main focus is to determine the solution for shear wall location in multistory building. A RCC building of five storey subjected to earthquake loading in zone-IV is considered. An earthquake load is calculated by static method or equivalent lateral force method using IS 1893 (PART–I):2002. These analyses were performed using STAAD Pro.

A research was conducted to assess the reliability of a multistory building's RC shear wall in various configurations, including with and without a central cross shear wall. Six separate shear wall positions for a five-story building were investigated. The aim of this project is to evaluate the structure's response using a static approach or equivalent.And base shear, storey drift, model displacement, and Maximum reactions of the building is observed and compared for both the cases with and without central cross shear walls.

A study has been carried out to determine the strength of RC shear wall of a multistoried building by changing shear wall location.

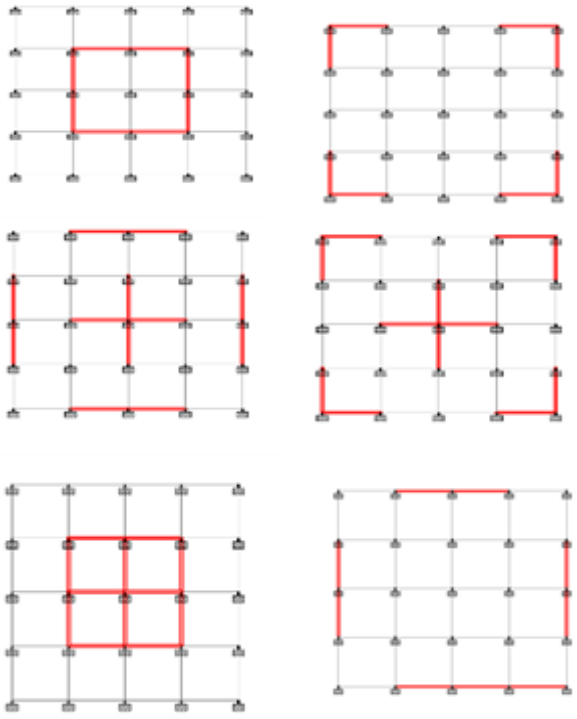

Fig 6. Structure with All type shear wall.

Ameer Qasim et. al. (2019) The aim of this project is to figure out where the shear wall can go in a multi-story structure. For this reason, four different models of four different storied buildings, each with one model without shear wall, have been considered. In a high seismic zone, models are investigated to compare lateral displacement and load transfer to various structural elements of varying positioning of shear wall.(i.e., the shear wall was placed at corner, corner and lift, alternative positions was compared with ordinary building (without shear walls) Earthquake load is calculated as per IS: 1893-2002 (Part-1). Various parameters like response reduction factor, importance factor, zone factor etc. are taken from IS: 1893-2002 (Part-1) and are applied to a building located in Zone V.

Mindala Rohini et. al. (2019) Observed An earthquake is caused by the rapid release of energy in the form of seismic waves, which causes ground shaking. Generally, buildings are exposed to a variety of influences over the course of their lives. Static forces from dead and live loads, as well as dynamic forces from earthquakes, can be present. In this study, the analysis is carried out for seismic response of (G+15) residential building for zone-III and Zone-V regions through response spectrum method and time history method in ETABS. For specific areas, parameters such as storey displacement, storey drift, and storey shear are measured.in this paper is to study the seismic analysis of residential building for Zone-III and Zone-V regions using ETABS.

Donthireddy et. al. (2019) explained on improving the form of shear walls in symmetrical high rise buildings was clarified. Shear walls are positioned symmetrically in symmetrical buildings so the centre of gravity and rigidity correlate. In this study, a high-rise building with various shear wall forms is considered for review.The multi store building with G+14 storey's are analyzed for storey drift story displacement and base shear using ETABS software. For the analysis of these building for seismic loading with all Zones (Zone-II, III, and IV & V) is considered. The analysis of these building is done by using dynamic method (Response spectrum analysis).

Ashish Raghuwanshi et. al. (2020) was At an outer portion of the building with R.C.C beam and slab, a coupled shear wall in combination with steel x bracing provided in bare frame was tested, and this frame was evaluated and compared to bare frame. The cross bracing diagonal member efficiently absorbs compression and strain strains, while the combined shear wall decreases bending moment and shear power.

As compared to stresses formed in columns and beams in a traditional building system, the structure transferred lateral loads through axial motion, which reduced stresses over the column and beams. For present research analysis a regular 13 storey RCC frame having square plan of size 25 m × 25 m which is located in seismic zone V is considered.

For the analysis of structure STAAD. Pro software is used and the Seismic zone consideration is as per IS 1893(Part 1): 2002.

III. CONCLUSION

This paper reports on research de0velopment on seismic behavior of structure by using shear wall . According to some experts, the shear wall, diagrid, and hexagrid systems have little effect on the vertical load resisting system of an RC structure, but they do affect the lateral load resisting system due to stiffness and density.

While the storey shear varies linearly from one to the other, the steel bracing frame system outperforms the shear wall system. The deflection at different stages in multi-story buildings with shear walls is comparatively less than in RC buildings without shear walls.

Some scholars also argued that adding a shear wall to a high-rise building would improve seismic activity while also increasing the stiffness and strength of the structure. It is also observed that due to diagonal columns in periphery of the structure the diagrid structure is more effective in lateral load resisting system.

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