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A REVIEW ON HIGH RISE STRUCTURE HAVING SHEAR WALLS SUBJECTED TO LATERAL LOADS

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***Abstract* -** Civil engineering is concerned with the construction of various types of structures while ensuring their safety, durability, and serviceability. "Earthquake" is now a phenomenon that affects the safety and serviceability of structures. The amount of damage caused by an earthquake to structures is determined by the type of building, the type of soil, the technology used for earthquake resistance, and, finally, the location of the building with shear wall. The effects of an earthquake are heavily dependent on the type of soil in which the foundation of a building is built, because an earthquake changes the motion of the ground, resulting in foundation failure. As a result, it is critical to investigate the behavior of various soils during the construction of structures having shear walls. The past work proofs that Shear walls can withstand earthquakes. It improves the structural performance of building subjected to lateral forces due to earthquake excitation. This study focuses on behavior of different types of shear wall impact on structures.

Keywords: Earthquake, Shear wall, Lateral forces, Behaviour

1. Introduction –

A shear wall is a structural component used in multistory or tall buildings, as well as ordinary buildings, in high wind areas. These walls typically begin at the foundation level and run the length and width of the building. In tall buildings, their thickness can be above 150 mm or below 400 mm, and they act as vertically oriented wide beams that carry the earthquake load towards the foundation. Reinforced concrete walls and reinforced concrete slabs make up an RC wall. Their wall thicknesses range from 140 mm to 500 mm, depending on the age of the building and the amount of thermal insulation required. Typically, these walls remain at the entire building's height; however, some walls are closed to the road front or basement level to allow for industrial or parking areas. Plywood is the most common material used in the construction of shear walls. Because of the advancement of prefabricated shear panels, these walls now reinforce small shear assemblies that fall on both sides of the opening. MIDPLY shear walls are improved wood shear walls designed to redesign sheathing and framing member joints. Normal wall testing modes of failure cause lateral load levels to trigger failures in normal walls. A ply of shielding materials is positioned within the center of the walls between a series of pairs of studs oriented in a 90° rotated position relative to standard shear walls in the MIDPLY shear wall design. Steel plate shear walls systems are typically made up of steel plate walls, a boundary column, and a horizontal backside beam, with the steel plate walls and boundary column acting as a vertical plate girder. The columns serve as the vertical plate girder's flanges, and the steel plate wall serves as its web [1].

2. Literature Review

Romy Mohan (2011) [2] investigated two multi-story buildings, one of six stories and the other of eleven stories, which were modelled using the software package SAP 2000 for earthquake zone V in India. Six different types of shear walls with varying shapes are studied for their effectiveness in resisting lateral forces. The paper also discusses the effect of building height variation on the structural response of the shear wall. Dynamic responses to a significant earthquake, El-Centro, have been studied. This paper compares the accuracy and precision of Time History analysis to the most used Response Spectrum Analysis and Equivalent Static Analysis.

Abhishek Kumar Ranjan (2021)[3] observes many developments and changes in the construction sector, and new commercial and residential building projects are initiated on a daily basis. As a result, proper planning is required before beginning construction so that the work can be completed in a cost-effective manner while also meeting the needs of the users. The ETABS is a piece of engineering software that aids in the modelling, design, and calculation of loads when building a structure. It is a very useful software in the civil engineer structure is analyzed in terms of static and dynamic loads. Today, there is a large scope in this field, which allows many people to work in the respective engineering field and provides a wide range of methods to help engineers with their work. It analysis the structure in terms of static and dynamic loads. Today there is a huge scope in this field and it also gives the opportunity to many people to work it the respective field.

Vinay Kumar Sahu (2022) [4] investigated the paper's study of load bearing wall structure models. This Masonry load bearing wall may collapse due to instability if subjected to vertical concentric and eccentric loading. The failure pattern of masonry load bearing walls of various sizes was investigated in this paper using shaking table tests and compressive strength. The results show that the bearing wall cannot withstand heavy loads, but increasing thickness increases the possibility of structural damage.

Kashyap Shukla (2022) [5] study the seismic and wind loads considered for various high-rise rectangular building models with and without shear walls using finite element based ETABS software. Seismic loads were calculated using the equivalent static method specified in IS Code 1893 (Part-1): 2016[6], and imposed loads were calculated using IS Code 875 (Part-3): 2015 [7] . The results of storey displacements and drifts were extracted using four load combinations from the Indian Standard Code. It has been discovered that shear walls located in the center, in the form of a core, perform well against lateral loads.

Rohit Sahu (2022) [8] studied that in India the seismic activity threatens 50-60% of the total land area. Earthquakes are the vibrations or movement of the ground caused by the release of energy. The vibrations or ground motion are important factors to consider when analyzing and designing an earthquake-resistant structure. As a result, various efforts have been made in this field to reduce the impact of earthquakes. Basically, earthquakes exert both lateral and vertical forces, so earthquake resistant structures have been designed to dissipate those forces and vibrations in the system. The design of earthquake-resistant structures is based on providing stiffness, strength, and inelastic deformation to withstand seismic forces. As the structure's height increases, the lateral loads acting on it increase and the stiffness decreases, so different damping devices have been used to counteract those shear walls.

V. Bhargavi and G. Santosh (2019) [9] studied that the shear walls are the most commonly used to resist lateral forces such as wind and seismic loads, among others. Shear walls have a high stiffness and strength, which contribute to the structure's stability. The purpose of this work is to investigate different stories of buildings with and without shear walls, taking into account different wind loads at various heights and the lateral moment of the structure with and without shear wall. Wind loads will be applied to the building for G+10 in various shear wall position cases. STAAD Pro software will be used for analysis and design. Shear walls are commonly used in areas with high wind loads because they are highly efficient at bearing the loads. Not only do these shear walls resist wind loads, but they also resist earthquake loads, which can be quite high in some areas. Shear walls have a high strength and can withstand wind loads and seismic loads. They can also be built on weak soil bases using various ground improvement techniques. Not only is the strength and effectiveness of bare horizontal loads very high, but it also increases the speed of the construction process.

The main goal of **TAGORE SRILEKHA (2022)** [10] is to find a solution for shear wall placement in multi-story buildings. A G+ 10 storied reinforced concrete (RC) building with varying ground slopes of 0, 5, 10, 15, and 20 degrees without shear walls and incorporating shear walls symmetrically in plan and at peripheral corners was considered for analysis in this study. Buildings are designed in accordance with IS 456:2000 [11] and then subjected to earthquake loads. Linear Static, Linear Dynamic analysis (Response Spectrum, and Linear Time History analysis) were used to model and analyze the building using the structure analysis tool SAP 2000.

Rachakonda Divya, K.Murali (2022) [12] presents a study of structures with horizontal irregularity, vertical irregularity, stiffness irregularity, and mass irregularity with and without shear wall, and compares the responses of the buildings. The ETABS software is used to model these four types of models with and without shear walls for G + 15 storey. The study's goal is to compare model results such as stiffness, displacement, shear, and drift values to determine which model performs better. Vertical geometrical irregular building with shear wall performed significantly better than other irregular buildings.

The study by Kavya **Kodali and C.Ravi Kumar Reddy (2021)**[13] focuses on determining the optimum diagonal angle of the steel diagrid structure for greater lateral load resistance depending on the aspect ratio of the buildings. The results showed that diagrid structures with uniform diagonal angles ranging from 50° to 70° were the most efficient in resisting lateral and gravity loads for aspect ratios of building models ranging from 1.6-0.55, and diagrid structures outperformed regular conventional type buildings in all zones in India. Finally, the study concludes with the optimal angle of complete module diagrid structures with uniform diagonal angles of various aspect ratios.

Naresh and Mood (2019) [14] investigated the seismic performance of a multi-story R.C. framed structure with a shear wall. The seismic performance of R.C. framed buildings of 6, 12, 24, and 36 stories was evaluated using the ETAB program's elastic and inelastic analyses. Eight models with a plan area of 30 m X 20 m and a height of 3 m were created for each type of storey.

The programme was used by **Bhat and Akeel Firdos (1999)** [15] to conduct research on the seismic analysis of RCC buildings with and without shear walls. They investigated factors such as lateral displacement, narrative drift, and the cost required for a shear wall to be cost-effective and efficient. The program was used to research a ten-story building with three meters between each floor. The structures were thought to be fastened at the bottom. Model 1 was a bare-framed structure, Model 2 was a dual system with shear walls on both sides, Model 3 had a shear wall on a corner with a L=4.5 m, and Model 4 had a shear wall on a corner with a L=2 m.

Patel and Maulin (2022)[16] investigated the load-bearing walls of precast reinforced concrete in the G+11-story residential building. This study examined a load-bearing wall and a one-way slab for gravity and lateral load using ETABS software. Different wall forces, displacements, and moments calculated for different load combinations were analyzed. A G+11 storey shear wall building was considered for a one-acre plot with 350 apartments.

M.Pavani (2015) [17] study considers a 45-story high-rise building with a podium up to the fourth floor level. There is no abrupt change in plan after the podium level (4th floor level), because any abrupt change may result in stiffness/torsional irregularities of the building if a small seismic force or other less magnitude horizontal force strikes the structure. The Indian seismic code i.e. IS 1893:2002 [18] is been sued for he study. The optimization techniques used in this project first consider the size of the shear wall is the same throughout the building and then analysis is done from the result the failed shear wall dimensions are increased to resist the whole structure, in this way the optimization was done for a number of times until the whole structure comes to stable to resist the whole structure.

Ashok Kankuntla (2016) [19] used finite element modelling to investigate the behaviour of a shear wall with an opening under seismic load action on member forces. As a result, the current study compares the seismic performance of a 15-story building with openings in the shear wall in earthquake zone V. For seismic analysis, the seismic coefficient method and the response spectrum method are used. The SAP software is used, and the outcomes are compared. The position of the shear wall is determined for all building models by changing the sizes and shapes of the openings in the shear wall.

Maikesh Chouhan (2016) [20] put his classroom knowledge to use by designing a multi-story residential building. In multi-story buildings, shear walls are more effective at resisting lateral loads. Steel and reinforced concrete shear walls are kept in major positions of multi-story buildings that are designed to withstand seismic and wind forces. Shear walls are very powerful structural elements that, when used properly, can significantly reduce deflections and stresses.

3. Conclusions

The analysis of shear wall in RCC frame building have already been worked by many authors. Some of the significant points are noted from the study such as When soil structure interaction is considered on a base isolated structure, the natural time period of the structure increases. The effect of soil structure interaction is strongest in soils with soft or medium strata. The base shear and displacement increase as the number of storey in the building increases. It is possible to conclude that shear wall placement at appropriate locations is more important in cases of base shear and displacement. The attraction of forces is affected by changing the position of the shear wall, so the wall must be in the proper position. Shear walls absorb a significant number of horizontal forces if their dimensions are large.

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