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A REVIEW PAPER ON APPROPRIATE LOCATION OF SHEAR WALL IN HIGHRISE BUILDING TO REDUCE TORSIONAL EFFECT BY USING ETAB SOFTWARE

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Abstract: Shear wall is a vertical element of a system that is designed to resist in-plane lateral forces, typically wind and seismic loads. Shear walls are more effective in terms of seismic performance because they have high strength and stiffness, which can withstand significant lateral stresses as well as gravity loads. Shear walls behave like vertical cantilevers when they are independent planar walls or when they are non-planar connecting walls around elevators and stairwells. When employed inside a building, shear walls can add strength and stiffness. Where the building's exterior walls are unable to give it the necessary strength and stiffness. Knowing the correct location for a shear wall in a building is crucial for it to serve its intended purpose. The objective of the current study is to establish the best position for shear walls and their impact on the seismic performance of buildings. A comparison of the various analytical techniques has also been carried out. This piece of work analyses a high rise structure with various shear wall locations and shapes. [13] For the asymmetric buildings of heights G+9 and G+11, equivalent static analysis, time history analysis, and response spectrum analysis as per IS 1893 (Part 1): 2002 are performed in this paper. Additionally, an effort is made to study the effect of seismic loads on them in order to determine torsional moments, base shear, displacement, and time period. Finally, using ETABS 9.7.4 version, their capacity and demand are evaluated.[12].

***Keywords*:** Torsion, Base shear, Storey displacements, Torsional irregularity, Seismic Zones, Shear wall,ETABS Software.

I. INTRODUCTION

Shear walls are vertical structural components that withstand earthquake forces. They are available at various heights to withstand in-plane loads. Seismic and wind loads are the two principal forces acting on shear walls. In most cases, the diaphragm (the structural element that transverses the lateral load to the vertical resisting parts of a structure) transfers the loads to the walls. They are typically horizontal but occasionally they can be sloping, like a ramp for parking a car.) They may be made of masonry, concrete, or wood. Shear walls are extremely strong and rigid to withstand lateral stresses. Shear walls are crucial in high-rise structures in seismically vulnerable places. These shear walls can reduce lateral movement. They are made to withstand lateral forces as well as the structure's own weight (gravity loads). Natural disasters (earthquakes, wind pressures, etc.) can create a variety of stresses, including shear, tension, and torsion. These stresses can cause the structure to move or even unexpectedly collapse. Shear walls lessen the severity of the structure's lateral movement and reveal structural collapse. The geometric configuration, orientation, and position within the building all affect parameters such as story torsion, base shear, story shear forces, and overturning moments. Because of this, shear wall placement is crucial for a structure with a dual structural system to have high lateral load resistance.

II. LITERATURE REVIEW

- ***Poncet, L. And Tremblay (2004):*** proposed the impact and effect of mass irregularity considering case of an eight-storey concentrically braced steel frame structure with different setback configurations. Methods used in present paper are equivalent static load method and the response spectrum analysis method.

- ***Devesh P. Soni (2006):*** considered several vertical irregular buildings for analysis. Various criteria's and codes have been discussed and reviewed in this paper. Vertical irregular structure performance and response is reviewed and presented. The studies suggested that for combined stiffness and strength irregularity large seismic demands are found.

- ***N. Özhendekci and Z. Polat (2008):*** Undergoing investigation, the "time history method" is used to examine 300 one-story and 300 five-story buildings that simultaneously exhibit eccentricities in two orthogonal direction. According to ASCE 7-05, Q is a ratio of the modified effective modal masses that is used to define buildings' torsional irregularities. Consequently, it is discovered that a structure does not have equal eccentricities in the x and y axes, respectively, ex and ey. Regarding the two orthogonal directions, this building's design would not be uniform. This dispersion is reduced to 59% because the proposed ratio QR, which does not require the evaluation of the eccentricities, is used to represent the buildings' torsional irregularity. The buildings used in the analyses have eccentricities in both orthogonaldirections simultaneously.

- ***P. P. Chandurkar, Dr. P. S. Pajgade 2013*:** The primary goal of this study is to locate the shear wall in a multi-story building. Four distinct models have been used to examine the effectiveness of shear walls. The other three models are dual type structural systems, while model one is a bare frame structural system. An earthquake load is applied to a ten-story building that is situated in zones II, III, IV, and V. Structure with a shear wall in a small span at the corner (model 4) is found to be more cost-effective in a ten storey building than other models. This leads to the conclusion that big shear walls are ineffective inbuildings of 10 floors.

- ***S. Varadharajan et al. (2013):*** It has been noted that shear walls are practical and cost-efficient for high- rise construction. It was also noted that :-

1. The shear wall's position must be correct because shifting it will change the attraction of forces.
2. Shear walls absorb a significant portion of horizontal stresses if their diameters are large.
3. Shear walls in suitable locations significantly lessen earthquake-related displacements.

Reviewed existing works regard-ing plan irregularities and justified the preference of multistory building model over single storey building models.

- ***Aijaj and Rahman (2013):*** tried to analyse the proportional distribution of lateral forces involved in earthquake for individual storey due to changes in stiffness of vertically irregular structure.

- ***Ramesh Konakalla (2014):*** analysed four different 20 story building for effect of vertical irregularity under Dynamic Loads Using Linear Static Analysis. Response of all cases is compared and concluded that in regular structure there is no torsional effect in the frame because of symmetry. The response for vertically irregular buildings is different for the columns which are located in the plane perpendicular to the action of force. This is due to the torsional rotation in the structure.

- ***Bansal, and Gagandeep (2014):*** Studied ductility based design is carried considering vertical irregular building and methods used are RSA and THA. Three types of irregularities namely mass irregularity, stiffness irregularity and vertical geometry irregularity were considered.

- ***Himanshu Bansal (2014):*** Analyzed vertical irregular building with Response spectrum analysis and Time history Analysis. Irregularities considered are mass irregularity, stiffness irregularity and vertical geometry irregularity. The storey shear force was found maximum for the first storey and it decreases to minimum inthe top storey in all cases.

- ***Sagar et al. (2015):*** Analyzed the performance on various type of irregularity Considered i.e. (a) Horizontal Irregularity-plan irregularity (b) Vertical Irregularity -Mass Irregularity. To achieve objective of the project Time history Analysis & Response spectrum analysis method were carried out.

- ***Reddy and Fernandes (2015):*** conducted an analytical study to compare the responses of regular and irregular buildings in seismic zone V. ETABS software is used to model and simulate the reaction of a 15- story building. Both static and dynamic approaches of analysis are analyzed. The paper came to the conclusion that irregular structures behave differently than regular structures.

- ***Khan & Dhamge (2016):*** Response Spectrum analysis performed with STAAD-Pro V8i software demonstrated the impact of mass irregularity on various floors in RCC buildings.

- ***Salunkhe and Kanase (2017):*** Investigated that response of mass irregular structure need to be studied for the earthquake scenario. In this paper researcher deal with RCC framed structure in both regular and mass irregular manner with different analysis methods.

- ***Oman Sayyed (2017):*** Focused his study on the effect of infill and mass irregularity on different floor in RC buildings. The results were concluded that the brick infill enhances the seismic performance of the RC buildings and poor seismic responses were shown by the mass irregular building, therefore it should be avoided in the seismic vulnerable regions.

- ***Muhammad Mostafijur Rahman, Sagar M. Jadhav,Bahram M.Shahraooz* (2018):*** A comparative study between seismic design provisions in Bangladesh (BNBC-1993), India (IS-1893), and the U.S. (ASCE 7- 10) is done in relation to analysis, design, and seismic performance of RC buildings and it is concluded that When subjected to the ground motion intended to represent the Indian design response spectrum the structure constructed in accordance with the Indian code performed better in terms of base shear and story- level hinging. Even though the drift limits were met, the IS building's stiffness would have been comparable to that of the ASCE building if its members had been slightly larger, while BNBC buildings were found to have lowest stiffness. The IS building had the smallest energy dissipation.

- ***Theertha Ajay.N. Parthasarathi ,M. Prakash ,K.S.Stayanarayanan (2020):*** The analytical behavior of buildings with increasing irregularities under Linear Dynamic (Response Spectrum) Analysis at various Excitation angles is the subject of study. IS Code 1893:2002 (part 1) and MIDAS Gen 2019 (V2.1) is used to model and analyze regular buildings with 13 storeys and a 3 m height using the "T," "L," and "Fan" shapes. It is concluded that increase in irregularity makes the critical angle more unpredictable and can be calculated via incremental method. The primary mode shapes dominate modal participation in regular buildings, while higher mode shapes also play a significant role as irregularity rises. Despite not being taller than 40 meters, the sum of mass participation indicates the need for non-linear analysis.

- ***Bhavana Veldurthi (2021)*:** For the asymmetric buildings of heights G+9 and G+11, equivalent static analysis, time history analysis, and response spectrum analysis as per IS 1893 (Part 1): 2002 are performed in this paper. Additionally, an effort is made to study the effect of seismic loads on them in order to determine torsional moments, base shear, displacement, and time period. Finally, using ETABS 9.7.4version, their capacity and demand are evaluated.

  This work highlights how a variety of factors might affect a structure's torsional response when it is subjected to an earthquake. Some of these impacts are ductility and ultimate top displacement. In terms of capacity the asymmetrical structure's lateral yielding strength is greater than the symmetrical structure's in both directions. Calculating time and base shear using the analogous static approach is almost equivalent to using the response spectrum method in ETABS. More torsion irregularity is experienced by the building as its height rises. As a building's height rises, the drift values rise as well, leading to increasing torsional irregularity. The topmost floor typically experiences the greatest displacement.

- ***Wesam Al Agha ,Nambiappan Umamaheswari (2021):*** Utilizing the Equivalent Static and Response Spectrum Method, an analytical study of an irregular RC building with a shear wall and dual Framed-Shear wall system shows that in the case of comparing two methods, the values for the time period remain constant while according to ratio values with both directions (X, Y) of all models, the base shear as well as bending moment values increased in Response Spectrum Method over Equivalent Static Method. And the values of displacement in Response Spectrum Case, demonstrate the actual performance of irregular building, particularly in the Y direction; otherwise, they are greater than Equivalent Static one.

III. CONCLUSION

In order to better understand the elements influencing design and analysis in the current study, this review paper contains information on a variety of aspects. G+9 and G+11 buildings have been built with seismic loading utilizing an equivalent static method. Etabs software has been used to analyse the building. Using IS 875(Part 1Part 2Part 3): 1987 and IS 1893:2002, the dead load, live load, and wind loads are computed. By studying all the papers till now, different types of irregularity have been told and by applying different types of load on the building, analysis of the building has been done by using different methods like response spectrum method and time history analysis. by Etabs software. During Earthquake parameters have been studied using IS code in zone V.

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