ANALYSIS OF VERTICAL IRREGULARITY BUILDING WITH SHEAR WALL USING ETABS

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ABSTRACT -Construction of High-rise buildings is common in the present days due the availability of limited space, growth of population and high cost of lands. Hence to safeguard the construction, the buildings which are being constructed must be designed in such a way that it should withstand both earthquake and wind loads. For resisting the earthquake loading in high rise buildings, shear walls are used for supporting elements. Walls in high rise structures are connected using beams to increase the ductility of the structure. Many researches are being done on analyzing the behavior of the shear walls using different methods. Analytical method is one of the earliest techniques used to study the behavior of the shear wall. Dynamic loads cause maximum damage to the building during an earthquake. So, the dynamic characteristics of the building must be known to design earthquake resistant buildings. Normally tall structures have different combination of structural forms such as frames, shear walls and structural cores. Lateral forced imposed due to wind, earthquake and uneven settlement loads in addition to the weight of the building and people in it cause displacement in structure. In this study Response Spectrum method is used to study and analyze the structure with shear wall of two different thicknesses. An attempt using ETAB Software is made to analyze and decrease the displacement.

Key Words: ETABS, Shear wall, Thickness of shear wall, Response spectrum method, Residential building.

1. INTRODUCTION

The World, as of late has confronted major hazards like droughts, floods, earthquakes and cyclones. The United Nations has designated the 1990's as the International Decade for Natural Disaster Reduction (IDNDR) to lessen death toll, property harm, and social and financial disturbance brought about by cataclysmic events particularly in non-industrial nations. In many non-industrial nations, catastrophe, ecological corruption and destitution structure an intently sew endless loop. There are even ideas that worldwide danger because of cataclysmic events is expanding because of changing financial examples all throughout the planet and huge expansion in urbanization. Global participation is expected to address the difficulty of these consistently present and complex issues. Misfortunes because of cataclysmic events might be relieved by coordinating new and existing information, and by overseeing hazard through different structural and non-structural strategies.

The earth is comprised of four layers - the internal center, external center, mantle, and outside. The mantle and the hull basically act as an extremely slim layer of shell on our planet's surface. Nonetheless, this shell isn't made out of one single piece; there are a few pieces that exist under the earth, each gradually sliding past each other. These pieces are known as the structural plates. There are indeed seven structural plates that are found under the world's covering. Also, these plates are rarely static, they generally continue to move. Preposterous history, structural plates have converged with different plates to frame significantly bigger plates. Other structural plates have floated into more modest plates and some have been even pushed under different plates (subduction). This is probably the main motivation why we had supercontinents previously, and their possible separation into the seven mainland's that we know today.

At the point when at least two structural plates meet, the region normally turns into a focal point for seismic tremors. The real occasion is caused when these plates begin slipping past each other, making energy as seismic waves. Contingent upon the power of the seismic tremors, the impacts can differ from minor underlying harms to structures to finish breakdown, bringing about death toll and property losses. Here and there, when a quake starts from the center of the sea, it can cause incredibly huge and ruinous waves called tsunamis. Earthquakes can happen at any place on earth not withstanding, it happens in more recurrence where two structural plates meet, particularly along the separation points. The length of separation points shifts between a couple of meters to many kilometers. The majority of the world's seismic tremors happen in pacific ocean. The Belt traces boundaries between numerous tectonic plates, therefore, there is a great deal of development. This subsequently makes it geographically dynamic and is viewed as an extremely "violent" place from a seismological point of view. Various pieces of the world are obligated to a wide scope of likely greatest seismic forces, where shallow quakes of extents of 5.0 or more on the Richter scale, are known to have happened in the chronicled past or have been recorded over the most recent 100 years.

1. 1 SCOPE OF THE PRESENT INVESTIGATION

The primary reasons for construction related mishaps are carelessness of the workers, technical faults of both machinery and manual, inappropriate use of tools, wrong reaction of workers, and most importantly no proper awareness about major sources of accidents. A working site is the place where people come to work together mainly to earn money for supporting their families. A place where many people come together for doing a living must be safe and secure. Nothing justifies an accident. Knowing the sources of potential and predictable accidents means that we can stop them from happening. It is the duly of a construction supervising engineer to know the actual sources of mishaps and to prevent them to the maximum extent.

2. LITERATURE REVIEW

ETABS is a complex, yet simple to utilize, special purpose analysis and design program developed specifically for building frameworks. ETABS2016 highlights a natural and incredible graphical interface coupled with unmatched demonstrating, logical, plan, and detailing procedures, all integrated using a common database. Albeit snappy and simple for simple structures, ETABS can also deal with the biggest and most complex building models, including a wide scope of nonlinear practices, making it the tool of decision for underlying specialists in the structure industry. The imaginative and progressive new ETABS is that the final integrated software package for the analysis of structure and styling of buildings. Incorporating forty years of continuous analysis and development, this latest ETABS offers unmatched 3D object primarily based modeling and visualization tools, blazingly quick linear and nonlinear analytical power, subtle and comprehensive style capabilities for a wide-range of materials, and perceptive graphic displays, reports, and schematic drawings that enable users to quickly and simply decipher and perceive analysis and style results. From the start of style origination through the gathering of schematic drawings, ETABS incorporates each side of the designing style strategy. Formation of models has never been simpler. Intuitive drawing commands provide the fast generation of floor and elevation framing. CAD drawings are often imported directly into ETABS models or used as templates onto that ETABS objects could also be overlaid.

SHEAR WALL is a primary part normally provided to multistoried or tall structures or structures in territories of high wind speed or seismic action. The motivation behind a shear wall is to oppose the parallel loads that are forced on the design because of wind, tremor or here and there because of hydrostatic or horizontal earth pressure. Such loads will in general act along the course of development of wind or vibrations of the seismic tremor and they act horizontally to the structure along one of the two directions. Such loads induce the following to the shear wall in plane with their direction of action In plane shear flexure. Hence, shear walls are structural elements which resists the effect of two things, they are a) in plane shear and b)in plane bending action due to moment from shear. Also along with these, the shear wall, as a structural functional unit, tends also to resist in plane shear in vertical direction (as a direct consequence to shear in the horizontal direction) and the buckling effect of dead loads coming from top. Accordingly, a shear wall may be failed either in 1 of these three modes namely Flexural shear failure, Horizontal shear failure, and Vertical shear failure or by buckling. Hence, taking the above requirements into consideration, a shear wall usually is designed as a braced moment resisting frame usually made of structural steel or of reinforced concrete wall or it is also be made using plywood or masonry structure.

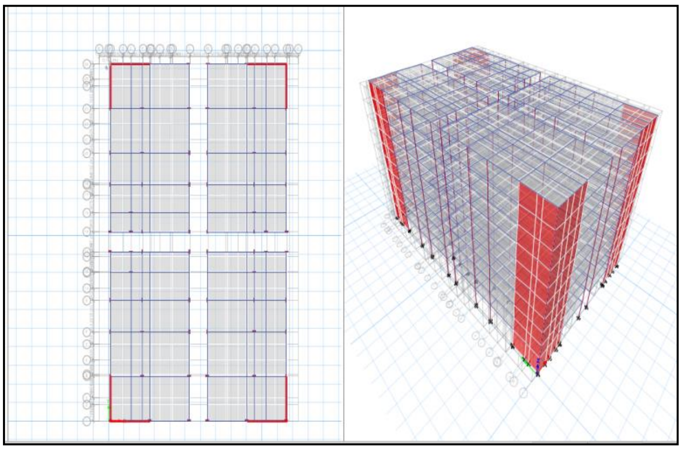
3. DESIGNING OF STRUCTURE

A plot size of 30.93m×48.23m plan is taken into consideration. This chapter mainly deals with process of modeling a structure, defining material properties, primary load assignments, slab dimensions and check model for preliminary analysis.

4.1 Typical building plain

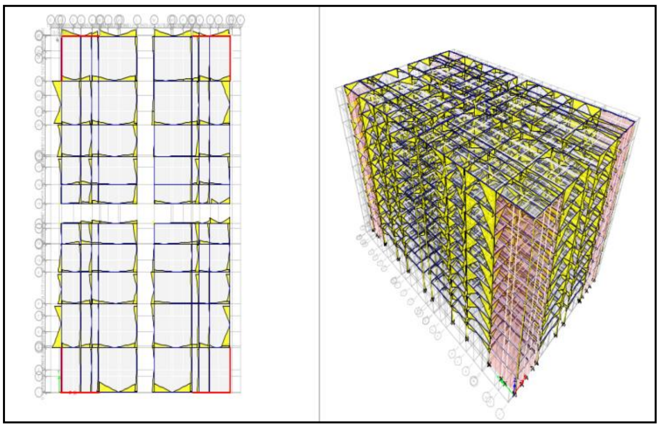
3.1 MODELLING PROCEDURE

Analysis is done in ETABS software. Two models have been analyzed. For both the models thickness only will be varying. For the first model thickness has been taken as 150mm and for the second model thickness has been taken as 200 mm. columns size for both the models has been taken as 230 x 600mm and beam size as 350 x 400 mm. Diaphragms is added to each storey. Wall of two different thickness 150mm and 200mm thickness is considered and design for shear wall design. Loads has been assigned for both the models according to the Indian codes. For the design purpose code of concrete IS 456-2000 and steel IS 800-2007 and material properties. In this design the M30 Grade concrete and steel of HYSD 550 is considered.



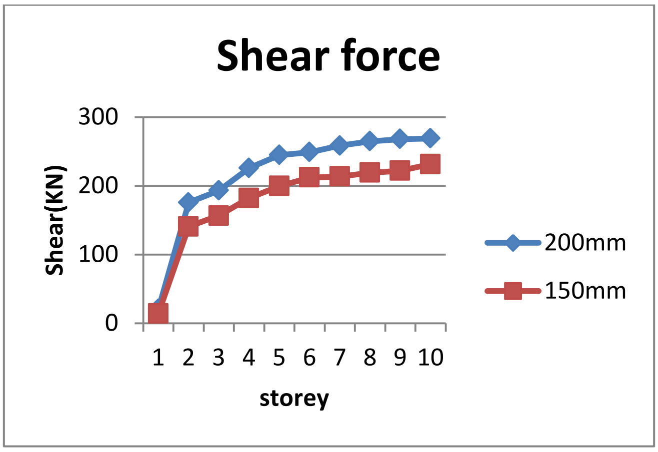
4. RUN ANALYSIS

Go to analyze and select run analysis, then the deflections, shear force and bending moment are shown.

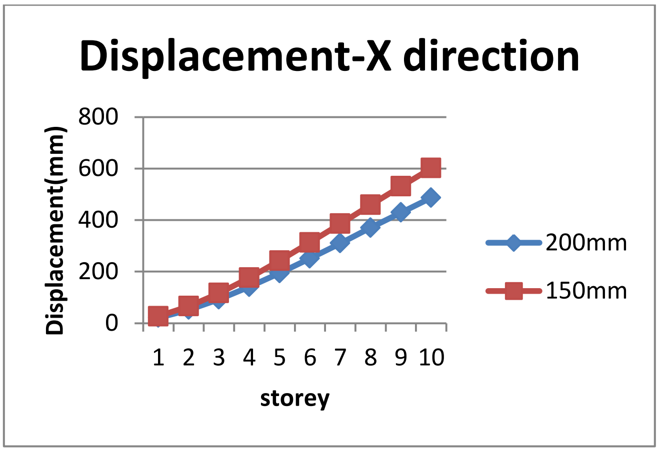


5. RESULTS AND DISCUSSIONS

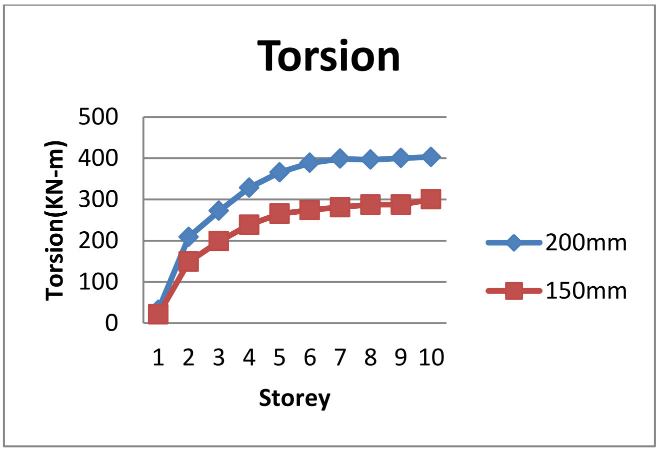
The bending moment, torsion, shear force and displacement results for the 10 storey building are obtained for two different thickness of shear wall 150mm and 200mm for earthquake loads in x direction are presented in this study. Relative values of shear force, torsion and bending moment are compared between shear walls of 150mm and 200mm thickness.



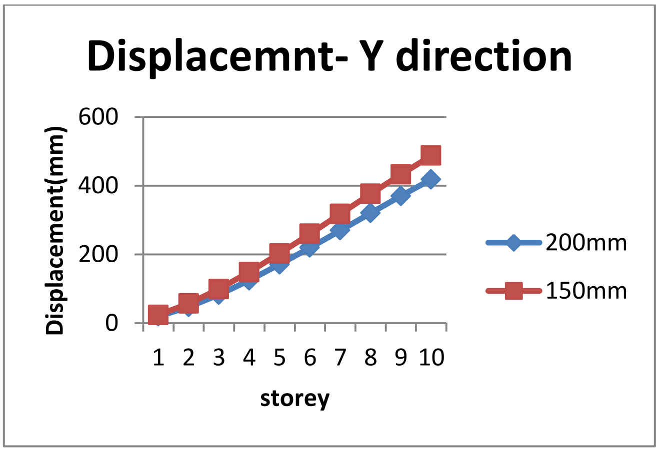
Graph5.1: Comparison of Shear force forEQ(loading) of 150mm and 200mm wall thickness



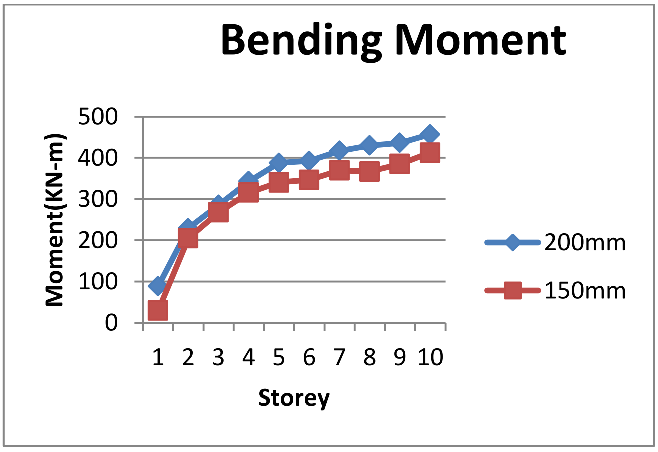
Graph5.4: Comparison of Displacements for (EQ Loading) of 150mm and 200mm wall thickness



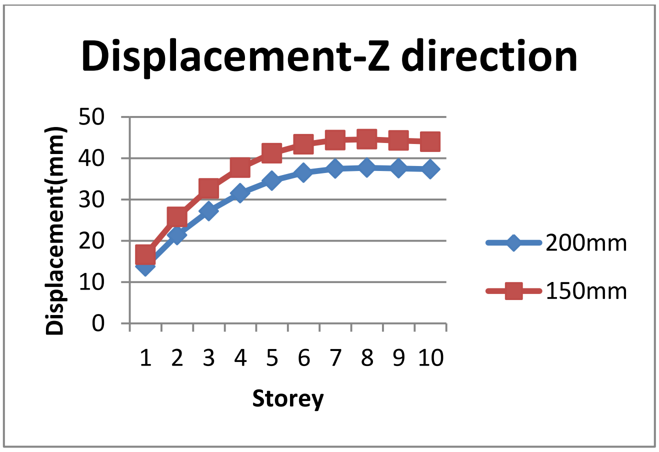
Graph5.2: Comparison of Torsion for EQ (loading)of 150mm and 200mm wall thickness



Graph5.5: Comparison of Displacements for (EQ Loading) of 150mm and 200mm wall thickness



Graph5.3: Comparison of Bending Moments for (EQ Loading) of 150mm and 200mm wall thickness



Graph5.6: Comparison of Displacements for (EQ Loading) of 150mm and 200mm wall thickness

6. CONCLUSIONS

Two different thickness of shear wall i.e., 150mm and 200mm positioned for 10 storey building using ETABS 2016 subjected Wind and Earthquake loads. Based on the analysis following conclusion Drawn:

- The Torsion, Shear force, Bending Moment and Displacements has been calculated and compared for both the models. It is observed that Model 2 performs better than Model 1
- In Economical considerations Model 1 is less When compared to Model 2
- Wind load and Earthquake loads has been followed according to Indian standard codes IS 875-PART3 and 1893-2002

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