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# Comparative Study of Multi-Storied RCC Structure under Siesmic Effect Having Different Aspect Ratio by Using Etabs

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**ABSTRACT:** Construction is a most important part of every developing country. Seismic forces are one of the major natural forces causing huge damage to lives and economy. The aspect ratio of a geometric shape is the ratio of its sizes in different dimensions. For example, the aspect ratio of a rectangle is the ratio of its longer side to its shorter side – the ratio of width to height, when the rectangle is oriented as a "landscape". The aspect ratio of a building is one of the most important determinants of energy efficiency. It defines the building surface area by which heat is transferred between the interior and exterior environment. The present study emphasizes on comparative analysis and design of multi storey building under earthquake with considerations of aspect ratio, by using IS-456-2000, IS-1893-2015, IS-875-PART(1,2,3)-1987. To analyze the building for different vertical aspect ratios by using IS 1893 and IS 875 Code. To define the most efficient Vertical Aspect ratio for different storey height which can provide seismic force by observing the comparative studies for various soil conditions. The behavior of each model with respect to others is checked for Base Shear ( $V_B$ ), Time Period, storey Drift and storey Displacement ( $\delta$ ) at each and every storey are carried out for seismic forces. To study the effect of shape and size of the building in plan on the behavior of the structure for various soil conditions for different storey height.

**KEYWORDS:** RCC Building, IS-1893-2015, IS-456-2000, IS875-PART (1,2,3)-1987, ,E-tab software Base Shear, Lateral storey drift, Displacement, Model time period.

## I. INTRODUCTION

The responsibilities of structural engineer today have a to understand both of the static and dynamic loading and the structures that should be resist them. The convolution of modern structures will required a enormous knowledge of creativity from the structure engineer in order to ensure that the structure should withstand the loads. An aspect ratio describes the relationship of an object's width to its height. It is commonly used in computing to describe the proportions of a rectangular. The aspect ratio of a geometric shape is the ratio of its sizes in different dimensions. The length divided by width of a building is termed as its Aspect Ratio and the ratio of height to least lateral dimension of a building is termed as its Slenderness Ratio. As building storey increase proportionally the base moment and base shear is goes increase. More slenderness buildings are higher vulnerable than any other buildings when it affect by any seismic forces. Since base moment increases the axial forces in building components so it has become very important parameter to check whether the building is slender or not. Whether the building is slender or not the most important thing is buildings or any other structures should be construct earthquake resistive and stiff against seismic force. The symmetry and regularity are usually recommended for a sound design of earthquake resistant structure.

## II. LITERATURE REVIEW

The present work is aimed at comparative study of comparative study of multi-storied rcc structure under siesmic effect having different aspect ratio by using etabs. Various studies has been carried out till date for buildings with aspect ratio of a geometric shape is the ratio of its sizes in different dimensions.

**Mr. Mahendra Balasaheb Shelke (2019)** The primary objective of this paper is to study the different cases of aspect ratio of the building and effect of wind and earthquake forces on building. It has been proved that the aspect ratio of building affects the effect of wind and earthquake forces on building. This chapter deals with the concluding remarks drawn from the results of all the analysis and design made for the G+30 storey building with the different type of aspect ratio having same floor area (1000 Sq. m) is considered for analysis. The conclusions are valid under the consideration of different aspect ratio of building and analysis is static. As the aspect ratio increases, the storey displacement also increases. The displacement in x-direction is much more than displacement in y-direction. From the results we can say that the displacement in model 10 is much more than model 1 with respect to EQ loads, RS loads & Wind loads. The axial forces in the columns increase as the aspect ratio increases as well as the bending moment in columns also increases. The base reactions in x-direction are comparatively less than in y-directions. Same effect has been observed for circular column, no major changes have been seen.

**Lekhraj k pandit, swapnil s jadhav (2019)** These thesis study the different cases of aspect ratio of the building and effect of earthquake forces on building. The structural system of high rise buildings are usually sensitive to the effects of earthquake, the earthquake structure interactions and then determines the earthquake loads as equivalent static loads. It has been proved that the aspect ratio of building affects the effect of earthquake forces on building. The concluding Results of all the analysis and design made for the G+9 storey building with the different type of aspect ratio having same floor area (2000 Sq. m) is considered for analysis. The results have been presented in tabular form along with the graphical mode. The conclusions are valid under the consideration of different aspect ratio of building and analysis is static. As the aspect ratio increases, the storey displacement also increases. The displacement in x-direction is much more than displacement in y-direction. From the results we can say that the displacement in model 4 is much more than model 1 with respect to Earthquake loads.

**Sanjay Kumar Sadh , Dr. Umesh Pendharkar (2016)** This paper focuses on the effect of both Vertical Aspect Ratio (H/B ratio i.e. Slenderness Ratio) and Horizontal or Plan Aspect Ratio (L/B ratio), where H is the total Height of the building frame, B is the Base width and L is the Length of the building frame with different Plan Configurations on the Seismic Analysis of Multi-storeyed Regular R.C.C. Buildings. The test structures are kept regular in elevation and in plan Here, height and the base dimension of the buildings are varied according to the Aspect Ratios. The values of Aspect Ratios are so assigned that it provides different configurations for Low, Medium and High-rise building models. In the present study, four building models having different Horizontal Aspect ratios viz. 1, 4, 6 & 8 ranging from 12m. to 96m. length of different Vertical Aspect ratios (slenderness ratios) viz. 1, 4, 6 & 8 of varying 4, 16, 24 & 32 storeys have been considered and their influence on the behaviour of the RCC Multi-storeyed buildings is demonstrated, using the parameters for the design as per the IS-1893-2002-Part-1 for the seismic zone-3. In this way total 16 building models are analyzed for different load combinations by Linear Elastic Dynamic Analysis (Response Spectrum analysis) with the help of ETABS-2015 software and the results obtained on seismic response of buildings have been summarized.

**Md. Mohiuddin Ahmed (2019)**, there are several types of aspect ratios depending mainly on geometry and height of the building. The behaviour of a building during earthquakes depends on its overall shape, size, height and geometry. To make a building earthquake resistant, the building should have enough strength, stiffness and inelastic deformation capacity. This can be achieved through the selection of an appropriate building configuration and the careful detailing of structural members. Vertical aspect ratio (H/L or H/B) and horizontal aspect ratio (L<sub>max</sub>/L<sub>min</sub>) affect the efficiency of structure for resisting lateral loadings. In the present study, six building models having G+10 storeys intermediate moments resisting frame building but different horizontal aspect ratios such as 1, 2, 4, 6, 8 and 10 have been considered and their influence on the behaviour of the RCC buildings is demonstrated, using the parameters for the design as per the BNBC-1993 for the seismic zone-2. With the help of software the results obtained on seismic response of buildings have been summarized by graphs and tables. The analysis outputs have been investigated to select the appropriate horizontal aspect ratio for the building subjected to earthquake loadings. It can be concluded that all the seismic parameters such as base shear, storey shear and storey overturning moment increase with the number of spans but storey drift and storey displacement along x-direction decrease with the number of spans on the other hand when we increase the number of spans the values of all these parameters increase excessively and tremendously along y-direction. In comparison of square and rectangular configurations (aspect ratio 2, 4, 6, 8 and 10), the square configurations (aspect ratio 1) perform better since they have low values of base shear, storey shear and storey overturning moment. Therefore, configurations which have narrow diaphragms should be avoided. In comparison as a whole, the present study demonstrates that the building frames whose horizontal aspect ratios are 2, 4, 6, 8 and 10 do not perform seismically better in respect of the building frames whose horizontal aspect ratio is 1.



### III. METHODOLOGY

Research papers on response of buildings (regular or irregular configuration) under seismic loading, Importance of Indian seismic design codes and their introduction in brief. Discussion about Building configuration. Literature based on behavior of structure under Seismic condition. In present research we have used different model of Multi-Storeyed Building frames considering different geometrical plan configurations based on different aspect ratios under earthquake forces. 2. Model the structure in E-TABS 3. Seismic analysis is done as per IS1893-2016. 4. Running the model in E-TABS. 5. Obtaining seismic parameters like model time period, base shear, lateral drift and displacement. 5. Observation and comparison of result. 6. Conclusion

### IV. STRUCTURAL MODELLING

In this study, structure will be model for the following cases: 1. 18, 29 and 38 storey building 2. To analyze the building for different vertical aspect ratios by using IS 1893 and IS 875 Code. 3. To define the most efficient Vertical Aspect ratio for different storey height which can provide seismic force by observing the comparative studies for various soil conditions. 3. The behavior of each model with respect to others is checked for Base Shear ( $V_B$ ), Time Period, storey Drift and storey Displacement ( $\delta$ ) at each and every storey are carried out for seismic forces. 4. To study the effect of shape and size of the building in plan on the behavior of the structure for various soil conditions for different storey height.

### V. PRELIMINARY DATA

Following are the data assumed for carrying out this study, 1. Length in X direction = 17.15m. 2. Length in Y direction = 30.36m. 3. Typical storey height = 3m. 4. Ground storey height = 3.5m. 5. No. of storey = 18, 29, 38. 5. Code- IS 1893 and IS 875 and IS-1893

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