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BEHAVIOR OF MULTI STORIED R.C BUILDING WITH DIFFERENT ELEMENT SIZES AND SHEAR WALL ORIENTATIONS

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ABSTRACT

In recent decades, Structures with shear walls system are the most appropriate structural forms, Improve the structural performance of building subjected to lateral forces due to earthquake excitation. The seismic behavior of buildings is strongly affected by the arrangement of shear walls, Shear walls are normally arranged in such a way that they resist lateral loads most effectively. Therefore, In the present study of this project is to check and compare the seismic response of multi-storied building for different element sizes and location of shear wall, So that it would be very fascinating and useful for designers to choose the best alternative for construction in earthquake-prone area.

Two reinforced concrete building one with normal element sizes and another with the increment of 50% in element sizes, And two reinforced concrete building with different locations of shear walls situated in seismic zone V have been analyzed in this study.

***Keywords*:** R.C building, Sheer wall etc.

I. INTRODUCTION

Looking at the past records of earthquake, There is increase in the demand of earthquake resisting building which can be fulfilled by providing the shear wall systems in the building. Also due to the major earthquakes in the recent past the decision regarding provision of shear wall to resist lateral forces play most important role in choosing the appropriate structural system for given project. Shear wall can be defined as structural vertical members that is able to resist combination of shear, moment and axial load induced by lateral load and gravity load transfer to wall from other structural members. Providing of shear wall represents a structurally efficient solution to stiffen a building structural system because the main function of a shear wall is to increase the rigidity for lateral load resistance.

.Generally structures are subjected to two types of loads i.e static and dynamic. Static loads are constant while dynamic loads are varying with time.

II. OBJECTIVE OF THE STUDY

.The main objective of this project is comparison between the seismic response of multi-storied building with variation in element sizes by subjecting to real earthquake ground motion by varying the position of shear wall.

.To study the seismic behavior of four different r.c building with and without shear wall are modeled in E-TABS 2015 software and the results in terms of storey displacement, storey shear, over turning moment was compared.

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Scope of the work:

.Scope of the work is limited to nonlinear time history analysis and equivalent static method of four symmetrical 5 storey buildings subjected to one real earthquake records namely uttarkashi earthquake data using etabs 2015.In two models shear wall position is varied at centre and extreme corner of the building.

III. BUILDING MODELING

For this study, a 5-storey building with a 3-meters height for each storey, plan is symmetrical about x direction and y direction. These buildings were designed in compliance to the Indian code of practice for seismic resistant design of buildings. The building are fixed at the base and the floors acts as rigid diaphrams. The sections of structural elements are square and rectangular, their dimensions are changed for building model no 2. storey heights of buildings are assumed to be constant including the ground storey, and soil condition was assumed as medium soil. The building are modeled using software etabs 2015 four different models were studied with different positioning of shear wall in building.

IV. MATERIAL PROPERTIES

TABLE 1: Preliminary data for model1, model3, model4.

Grade of concrete	**M20**
Grade of steel	**FE 415**
Density of concrete	**25kN/m^3**
No. of stories	**5**
Plan dimensions	**4m x 4m for each bay**
No. of bays	**5 on both sides**
Floor to floor height	**3 m**
Dimension of Beam	**0.23 m X 0.30 m**
Dimension of Column	**0.30 m X 0.30 m**
Thickness of slab	**0.125 m**
Thickness of shear wall	**0.20 m**
Thickness of wall	**0.23 m**
Soil type	**ii**
Seismic zone	**v**
Live load	**2kN/m^2**
Dead load	**1.5kN/m^2**

Loads on beam	**17kN/m**

TABLE 2: Preliminary data for model2, with 50% increment in element sizes.

Grade of concrete	**M20**
Grade of steel	**FE 415**
Density of concrete	**25kN/m^3**
No. of stories	**5**
Plan dimensions	**4m x 4m for each bay**
No. of bays	**5 on both sides**
Floor to floor height	**3 m**
Dimension of Beam	**0.35 m X 0.45 m**
Dimension of Column	**0.45 m X 0.45 m**
Thickness of slab	**0.190 m**
Thickness of shear wall	**0.20 m**
Thickness of wall	**0.23 m**
Soil type	**ii**
Seismic zone	**v**
Live load	**2kN/m^2**
Dead load	**1.5kN/m^2**
Loads on beam	**17kN/m**

V. ANALYSIS

EQUIVALENT AND STATIC ANALYSIS:

.Equivalent static analysis can, therefore, work well for low- to medium-rise buildings without significant coupled lateral–torsional modes, in which only the first mode in each direction is of significance. Tall buildings (over, say, 75 m), where second and higher modes can be important, or buildings with torsional effects, are much less suitable for the method.

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TIME HISTORY ANALYSIS :

.The uttarkashi October 20, 1991 earthquake data file loading is used in global - X direction with 8 points per line at a time interval 0.02 seconds.

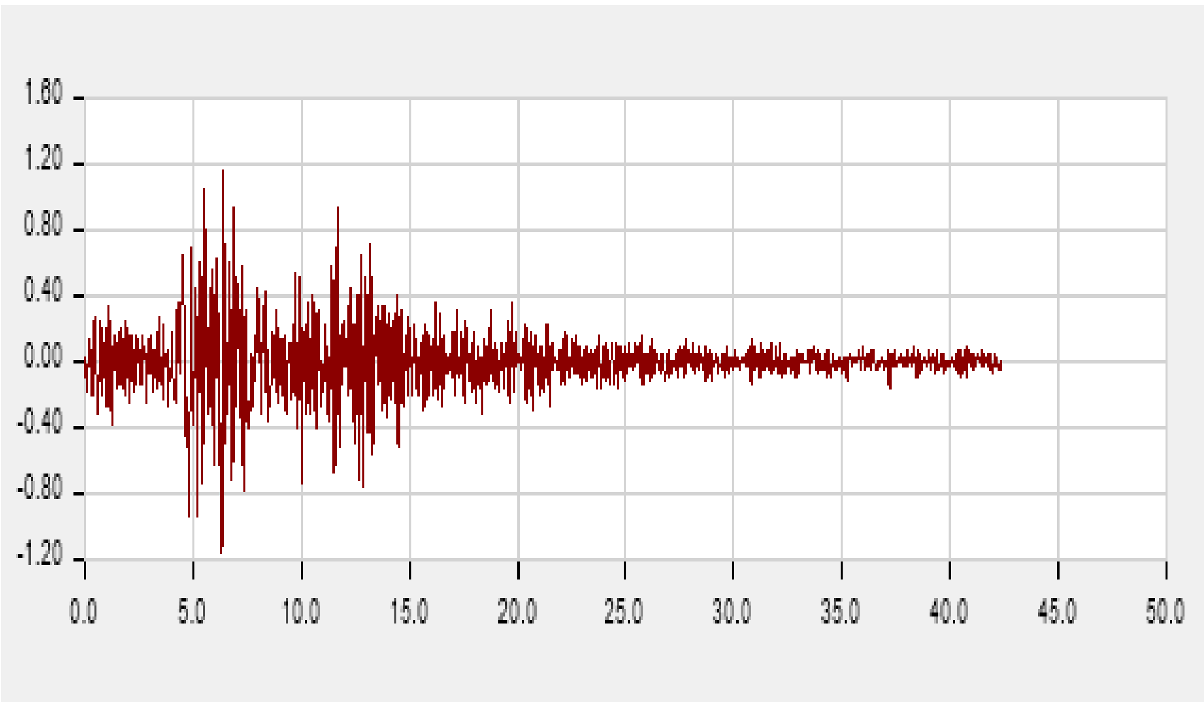

FIGURE 1 Acceleration vs. Time (uttarkashi)

DETAILS OF THE BUILDING MODEL ARE GIVEN BELOW

MODEL 1 - building with normal element sizes.

MODEL 2 - building with increment of 50% in element sizes.

MODEL 3 - building with shear wall on core.

MODEL 4 - building with shear wall on corner

MODEL-1 MODEL-2

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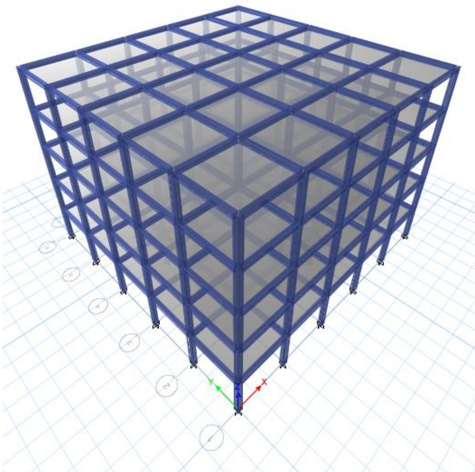


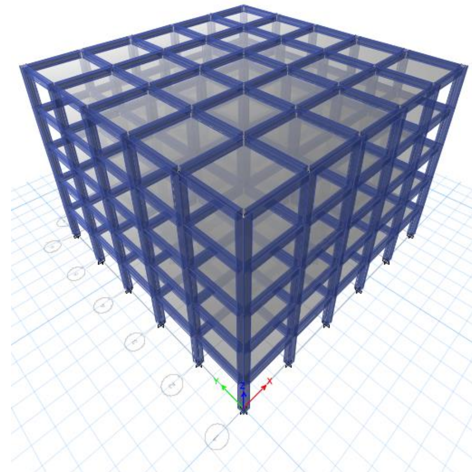
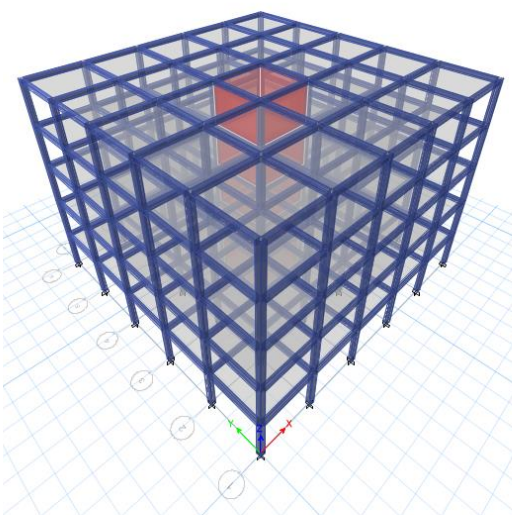


FIGURE 2 3-D VEIW OF THE 5 STORIED NORMAL BUILDING

FIGURE 3 3-D VEIW OF THE 5 STORIED BUILDING WITH 50% MORE IN ELEMENT SIZES

MODEL-3

MODEL-4



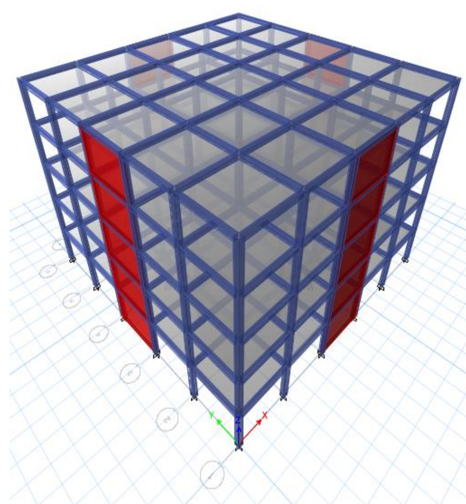


FIGURE 4 3-D VEIW OF THE 5 STORIED

FIGURE 5 3-D VEIW OF THE 5 STORIED

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BUILDING WITH SHEAR WALL AT CENTER BUILDING WITH SHEAR WALL AT CORNER

VI. RESULTS & DISCUSSION

The seismic responses of all these models have been determined using time history analysis and equivalent static method. The equivalent static and time history records are shown in the figure below i.e. figure 6 to 8 , and the obtained results are summarized as follows.

.The critical response depends on the earthquake characteristics and particularly frequency content of earthquake records.

.It is observed that the displacements for models with shear wall are less than the models without shear wall.

.Provision in increment of 50% element sizes increases the value of base shear than normal sizes element building.

.Considering shear wall location at middle(core) is most efficient then the shear wall located at outer periphery in terms of base shear, displacements.

.The overturning moment of a building is the moment of energy capable of upsetting the object, possibly resulting in damage and unwanted change in structures.

.Base shear and displacements are directly proportional to the height of the structure.

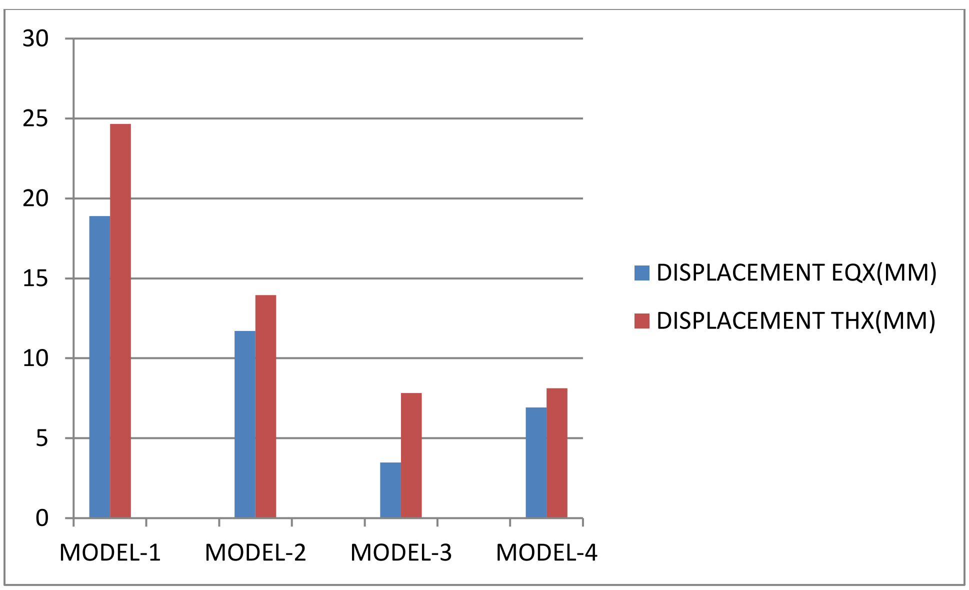

FIGURE6:MAX LATERAL DISPLACEMENT FOR DIFFERENT MODELS

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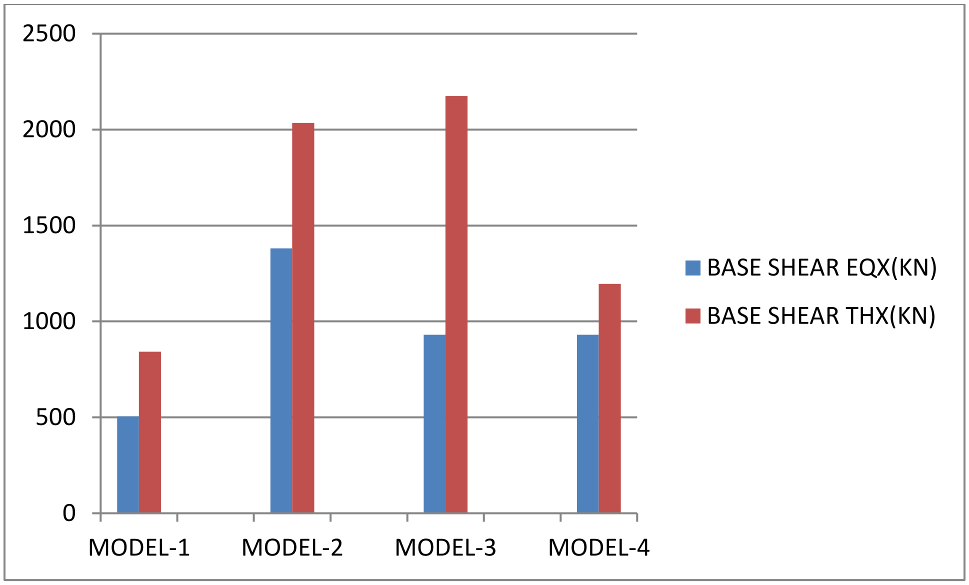

FIGURE7: MAX BASE SHEAR FOR DIFFERENT MODELS

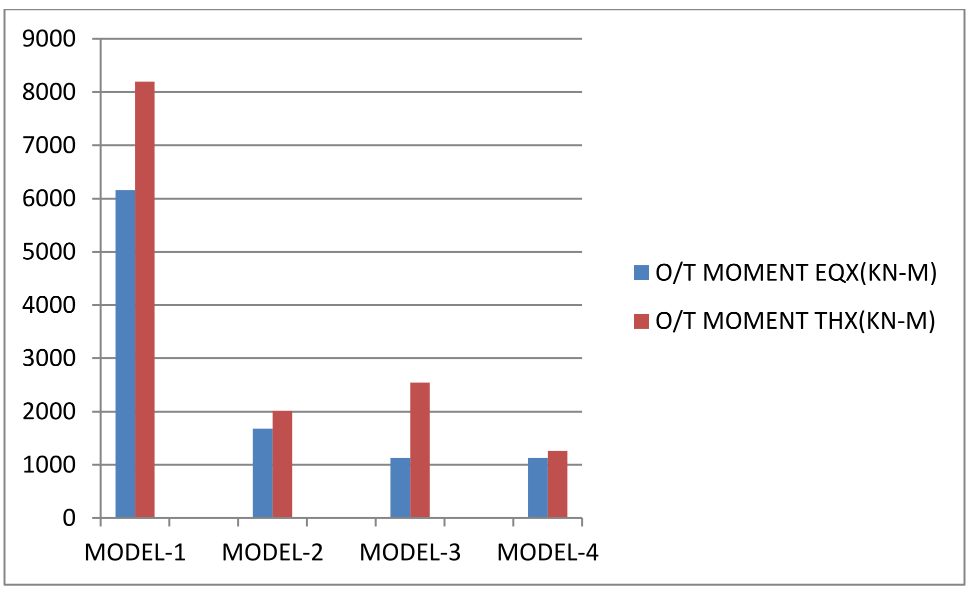

FIGURE8: MAX OVER TURNING MOMENT FOR DIFFERENT MODELS

VII. CONCLUSION

From all the above analysis, it is observed that this paper represents the summary of the study, for normal R.C. structure and structure with increment in sizes of element by 50% along with different location of shear wall, on the basis of results following conclusion have been drawn.

.Changing the position of shear wall will effect the attraction of forces, so that wall must be in proper position.

.Providing shear wall at centre substantially reduces the displacements due to earthquake.

.Increasing the element sizes by 50% base shear increases and displacements decreases.

.Over turning moments are observed max on the 1st model and low on others as shown in figure above.

.The change in shear wall location also has impact on all the observed analytical data.

VIII. ACKNOWLEDGEMENT

. I wish to express my sincere appreciation to my project guide, MR. MOHD ABDUL HAFEEZ, for encouragement, guidance and constructive criticisms, which led me for completion the work undertaken.

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