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SEISMIC PERFORMANCE OF RCC HIGH RISE STRUCTURE FOR DIFFERENT ASPECT RATIO

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Abstract: The earthquakes in the Indian subcontinent have led to an increase in the seismic zoning factor over many parts of the country. Under this circumstance, seismic qualification of building has become extremely important. 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. There are several types of aspect ratios depending mainly on geometry and height of the building. The behavior of a building during earthquakes depends on its overall shape, size, height and geometry. Therefore, structural engineering profession has been using the nonlinear static procedure (NSP) or pushover analysis. Nonlinear static analysis, has been developed over the past twenty years and has become the preferred analysis procedure for design and seismic performance evaluation purposes. This paper aims to evaluate the reinforced concrete building to conduct the Pushover Analysis. The pushover analysis shows the pushover curves, capacity spectrum, plastic hinges and performance level of the building. The non-linear static analysis gives better understanding and more accurate seismic performance of building's damage or failure element.

Keywords: High rise building, RCC structure, ductility, seismic design.

INTRODUCTION

RCC structures are preferred in most of the construction as they possess higher stiffness and accompanied with low cost. RCC structural systems provide a very good shear and lateral stiffness.
Tall buildings throughout the world are becoming popular day by day. With the advent of modern day construction technology and computers, the basic aim has been to construct safer buildings keeping in view the overall economics of the project. They may be referred to as "Multi Dwelling Unit" or "Vertical cities". The Benefits include, they act as landmarks; create unique skyline and efficient land use.
On structural point of view, these high rise structures height will be affected by lateral forces produced from wind loads and earthquake loads to the extent that these forces play important role in design process. So the behavior of a multi-storey framed building during strong earthquake motions depends on the distribution of mass, stiffness, and strength in both the horizontal and vertical planes of the building. In multi-storied framed buildings, damage from earthquake ground motion generally initiates at locations of structural weaknesses present in the lateral load resisting frames. The existing building can become seismically deficient since seismic design code requirements are constantly upgraded. Therefore, proper account of actions, material properties, structural systems and method of analysis should be considered while designing the high-rise buildings.
The present decade, high rise multi-story buildings are subjected to many external effects such as earthquake, wind loads, tidal loads, etc., in most cases high rise buildings have more vulnerable to earthquake and wind loads. Most of the reinforced concrete multi-storeyed frame buildings were heavily damaged and many of them completely collapsed during due earthquakes. RC frame buildings were severely damaged due to various deficiencies when proper codal provisions are not designed. A study is need to study the behaviour of the RC framed structure under earthquake load to reduce the damage caused by earthquake forces.

OBJECTIVES

- To perform a comparative study of the various seismic parameters of reinforced concrete frames with varying number of bays in horizontal configurations and number of stories in vertical configurations to investigate the effect of aspect ratios.
- To study the change in different seismic response parameters along the increasing height and increasing bays.

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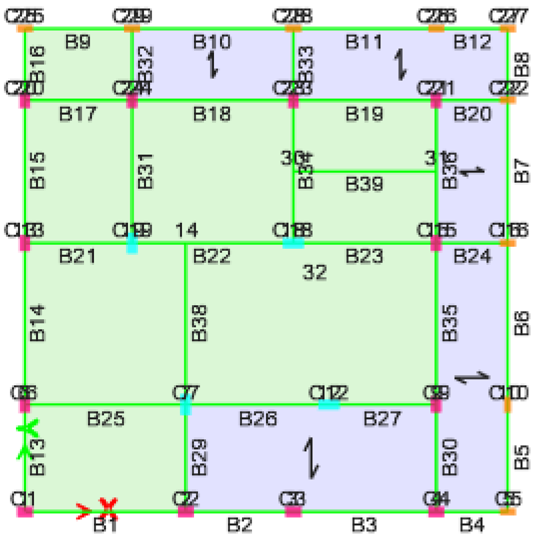
- To evaluate-base shear, storey overturning moment, storey drift, storey displacements.

In seismic design, the proportions of a building may be more important than its absolute size. For tall buildings the aspect ratio of a building is one of the important considerations than just the height alone. The more slender the building is worse are the overturning effects of an earthquake and greater are the earthquake stresses in the outer columns, particularly the overturning compressive forces, which can be very difficult to deal with. Increasing the height of a building may be similar to increasing the span of a cantilever beam. As the building grows taller there is a change in the level of response to the seismic forces. Therefore, proportions of buildings length-wise width-wise and height-wise need to be considered carefully.
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. Increase in length of a building increases the stresses in a floor working as a horizontal distribution diaphragm in a transverse direction. The rigidity of the floor may be insufficient to redistribute the horizontal load caused by an earthquake.

METHODOLOGY

This segment furnishes an overview of the techniques of modeling and analysis which are being adopted in the present investigation.

The following methodology is employed in the present study.
- RCC 10 Storey building is modelled for different aspect ratio
- Plan aspect ratio varied from 1:1 to 1:6 according to IS 16700:2017 to examine the functioning of the building during seismic action.
- ETABS software is validated by choosing a simple 2-storey RC frame.
- 6 models of RCC with varying plan aspect ratio are developed using ETABS 18 software.
- All the models are subjected to pushover analysis by response spectrum method.
- Results from the analysis are compared by plotting the graphs using various parameters such as ductility ratio, base shear, displacement and storey drift.



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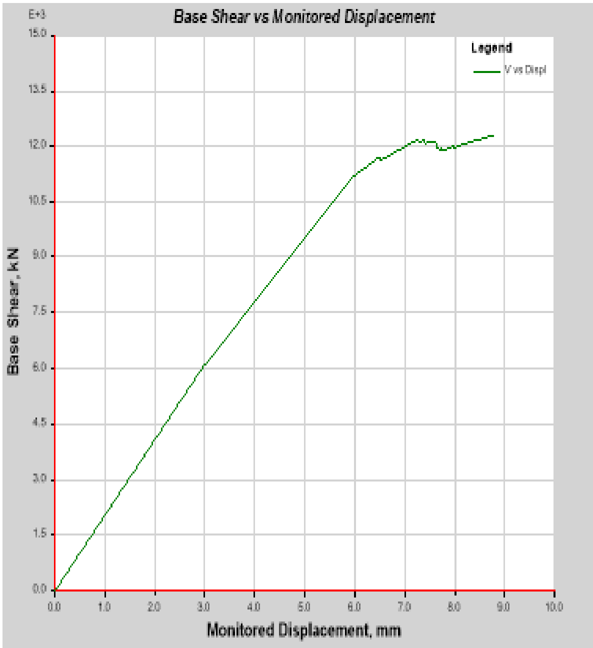
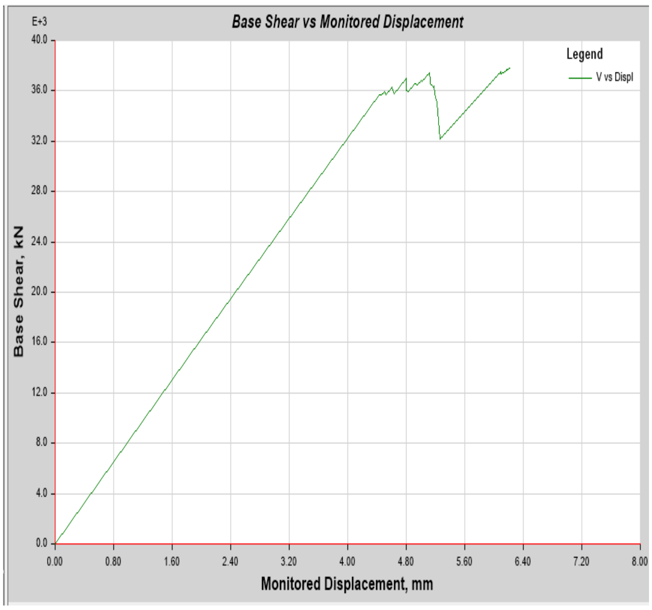
PLAN OF BUILDING OF ASPECT RATIO 1:1 AND 1:6





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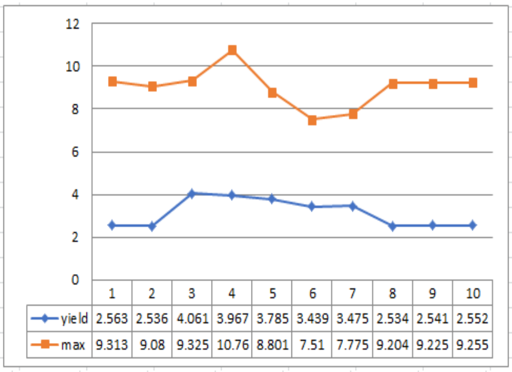
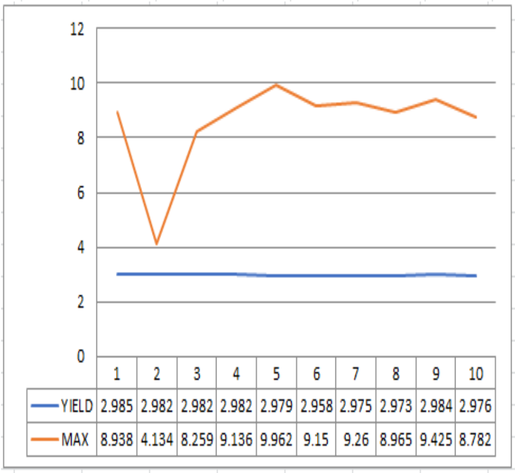
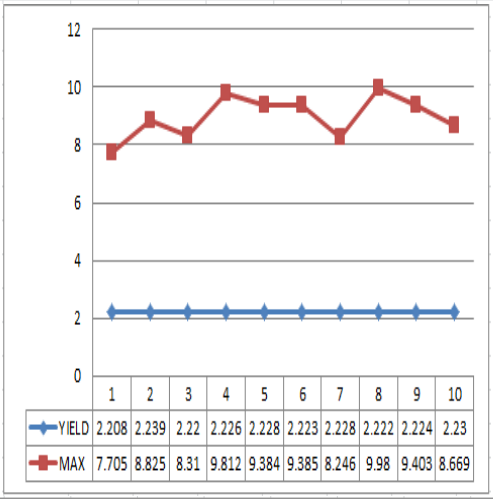
PLOT OF BASE SHEAR V/S DISPLACEMENT OF 1:1 AND 1:6 ASPECT RATIO



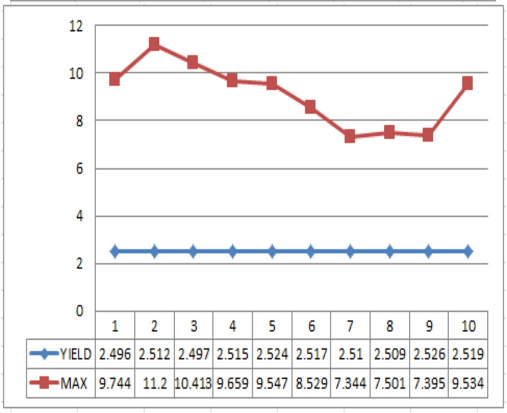
	1	2	3	4	5	6	7	8	9	10
yield	2.563	2.536	4.061	3.967	3.785	3.439	3.475	2.534	2.541	2.552
max	9.313	9.08	9.325	10.76	8.801	7.51	7.775	9.204	9.225	9.255



	1	2	3	4	5	6	7	8	9	10
YIELD	2.985	2.982	2.982	2.982	2.979	2.958	2.975	2.973	2.984	2.976
MAX	8.938	4.134	8.259	9.136	9.962	9.15	9.26	8.965	9.425	8.782



	1	2	3	4	5	6	7	8	9	10
YIELD	2.208	2.239	2.22	2.226	2.228	2.223	2.228	2.222	2.224	2.23
MAX	7.705	8.825	8.31	9.812	9.384	9.385	8.246	9.98	9.403	8.669



	1	2	3	4	5	6	7	8	9	10
YIELD	2.496	2.512	2.497	2.515	2.524	2.517	2.51	2.509	2.526	2.519
MAX	9.744	11.2	10.413	9.659	9.547	8.529	7.344	7.501	7.395	9.534

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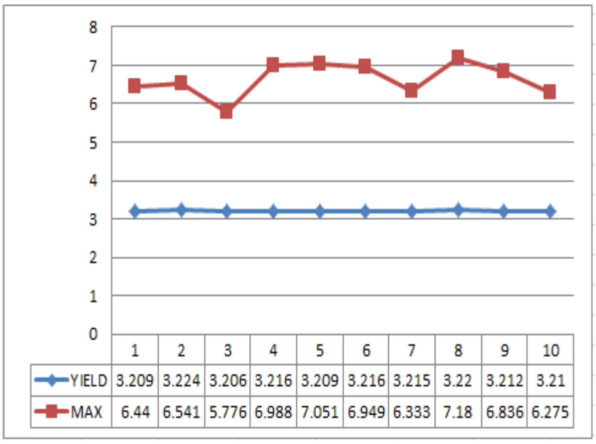

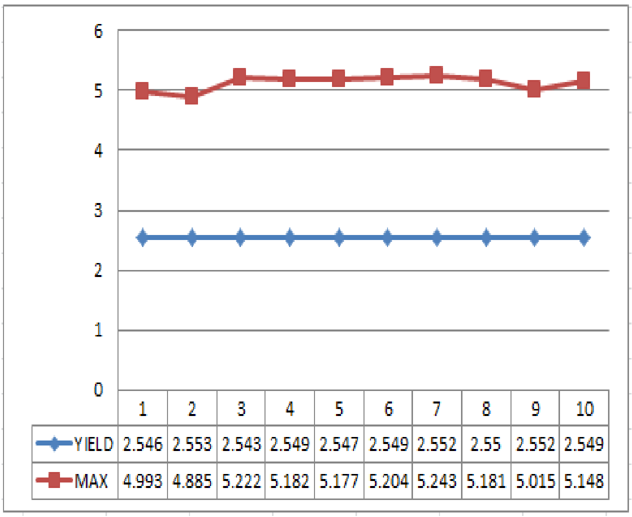

PLOTS OF YIELD V/S MAXIMUM YIELD GRAPHS

No. of stories	10,20,30
Height of each storey (m)	3
Grade of Concrete	M25,M30 and M35
Column dimension (mm^2)	200*500, 300*500, 300*600 and 400*600
Beam dimension (mm^2)	200*450, 300*450 and 350*450
Slab thickness (mm)	150
Wall thickness (mm)	210

CONCLUSION

The ductility demand of the critical story in most cases occurs in the upper stories of the structure and the amount is significantly high in tall structures especially under severe earthquakes.
It is observed that, the story stiffness is gradually increasing with respect to the aspect ratio.
The time period of the critical story in most cases occurs in the lower stories of the structure (first story).
From the calculations, it is observed that the base shear increases with increase in plan aspect ratio and the values of base shear from ETABS and calculations are nearly same.

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REFERENCES

1. Pushover analysis of RC building Dona Mary Daniel, Shemin T. John International Journal of Scientific & Engineering Research, Issue 10,October-2016 ISSN 2229-5518.
2. Pushover Analysis Of RCC Building With Soft Storey At Different Levels, Achyut S. Naphade, Prof. G. R. Patil IOSR Journal of
3. Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN : 2278-1684, ISSN : 2320–334.
4. Pushover analysis of an existing R.C.C. building with use of software e-tabs Patel Sumant B.Lecturer, Head of Department,B.B.I.T.,Associate Professor 2016 IJEDR ISSN: 2321-9939.
5. Behaviour of R.C.C.Tall Buildings Having Different Shapes Subjected to Wind Load Prof. Sarita Singla , Taranjeet Kaur , Megha Kalra and Sanket Sharma 2012 ACEE.
6. Pushover Analysis of 4 Storey's Reinforced Concrete Building Kavita Golghate Student, Department of Civil Engineering IES, IPS Academy International Journal of Latest Trends in Engineering and Technology.
7. Pushover analysis of RCC building. A survey of methodologies for seismic evaluation of building Canadian journal on environmental, construction and civil engineering.
8. Non-linear pushover analysis of rcc building with base isolation system Asst Prof. Noor Mohammed, Mohammed Huzaifa Yaman, Shaik Mohammed Siddiq, international journal of engineering sciences & research technology ISSN: 2277-9655.
9. Influence of Aspect Ratio on Performance in R.C.C Buildings International Conference on Quality Up-gradation in Engineering, Science&Technology-2017
10. Progressive Collapse Analysis of a Multistorey RCC building using Pushover Analysis. International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-0181.
11. Analysis and Design of RCC Tall-Building with different structural systems International Journal of Innovative and Emerging Research in Engineering -2017.