

# Comparative Analysis of Multi-Storey RC Frame Building with and without Floating Column using Base-Isolation in Seismic Zone V

Rashi Chaurasia<sup>1</sup>, Ankit Pal<sup>2</sup>

<sup>1</sup>M. Tech Scholar Department of Civil Engineering, Oriental University, Indore, India

Email: rashichaurasia57@gmail.com

<sup>2</sup>Assistant Professor Department of Civil Engineering, Oriental University, Indore, India

Email: ankit.5792@gmail.com

**Abstract**— Earthquakes are the disturbances which occur deep inside the earth's crust they are felt in the form of trembling of earth, jolts, movements and with less or more destructive phase. Although true cause of earthquake is not so easy to determine but most fortunate part is that can be predicted to very much extent. In some cases they are not yet possible to forecast, they usually come without warnings. Which make it a matter of discussion, every year it affects human life with large scale of destruction which brings to the concern of many researchers to minimize its consequences. India is country which has seen devastating effects of earthquakes from pasts. It has many weak zones which are more prominent under its influence. As it is said life never stops many attempts are ongoing to overcome heavy risk which are making it boon to fight such natural activities. We know that development is an ongoing process which is unaware of such activities which greatly affects the infrastructure of a country causing huge economic losses. Tall buildings are standing globally all over the world. What if, if such tall structure with complex designs and irregularities such as irregular plan, asymmetric structure, Floating Columns, balconies, projections etc. hits an earthquake, it will abolish its existence. Therefore, it's very necessary to safeguard human life and property which is a primitive step. From there comes the methods to control. Various ways are there to stop drifts, displacement and minimizing shear values. Variety of static and dynamics method are there to study behavior of structure and conclude most preferable results. One such method is Base-isolation is a very fast-growing technique to isolate a building from ground accelerations and to restrict the structures against objectionable lateral forces.

The study uses a software method of dynamically analyzing a multi-storey modal structure as per Indian standards to know how much effective a base isolation method is when used in high seismic zone V.

**Keywords**— Floating column, Base-isolation, Etabs 2015, Response Spectrum Analysis.

## I. INTRODUCTION

Natural disasters are the most unpredictable things which are mostly faced and are the biggest reasons for the creating huge catastrophe. Earthquake is one such calamity which are responsible for high level of devastating effects if venture unnoticed or give beyond the prediction. They are affecting the human lives and cause damage to property. It directly targets tall structures or buildings which are weak in design. The buildings which have irregularities in horizontal or vertical direction are the one who invites the most lateral forces, which show remarkable effects on them. They certainly affect the structures which are not designed as per the designed criteria. Floating column is an elemental member which are generally in demands or unavoidable due to some requirement criteria. They are also a part of

structure with geometric irregularity which may not be safe for structures especially in seismic zone. They act as a hanging member which start from slab or beam and lie on another beam which supports it. They do not lie on the ground as a normal column do, which differ them from general columns. When structures with floating column are present in seismic region the structure will undergo large shear displacement, story drift or torsional effects. Such structures are venerable to damages to seismic forces. Hence there is need of solution to such problems, one such solution is Base-isolation, they act as a mechanism whose work is to isolate a building from its base. It means between structure and base lies a material which has the flexibility to absorb the seismic frequencies which can harm the structure and can travel through the structure from the bottom to the top story.

## II. LITERATURE SURVEY

Many researches have done with many calculated results, theories and graphical values. Every part is purpose fully done by all, providing variant answers in their analysis and case study. Some has good explanations and justification which have helped a lot to know more about the topic.

**Sukumar Behera (2012)**- He studied a multi-storey framed model by FEM (Finite Element Method), He changed the dimensional parameter to explain the variation in the values obtained for shear and torsion.

**Ms Waykule (2017)**- Software approach is applied for comparative study of the Floating column and brought that base shear in first floor decreases with use of floating column in place of without floating column.

**Snehal Ashok Bhoyar (2017)**- Different locations of Floating column in the structures changes the behaviour of the especially its performance.

**BhavanaBalachandra (2015)**- The Software analysis is done by Etabs 2015 with use of Base isolated with LRB bearing. Base isolation reduces the vibrations moving upwards within the shaft of the building hence limiting the deflection causing parameters.

**Swathirani K., Murlidhara G. (2015)**- He compared various isolators with a fixed base building. HDRB is very much efficient then LRB as a bearing system in isolation technique. High values of damping ratio may reduce displacement in the buildings. Base isolation has come forward to the solution of many problems in zones of seismic intervention.

**Gaurish Kumar Som (2017)**- Modelled a G+5 building for case study to design LRB suitable for the building. He studied the response of the structure to various frequencies. By increasing damping percentage, it low down the values of time period.

**Sharma R.K. (2016)**- Analyzing an RCC framed structure using SAP 2000 having Floating column as a member. Floating column make load pattern distribution unbalance generate torsional effect causing building to twist and turn. It obtains more stiffness in each levels of the structure.

**Rupali Goud (2017)**- The result has much higher displacement values with floating member. Time history analysis give more lateral displacement than other methods of the dynamic analysis. Building experience more storey drift at each floor levels.

**R.B. Ghodke (2015)**- LRB isolator has been used as an isolation system in moment resisting frame using SAP 2000. Isolation act as aa absorbing material to absorb the energy coming from ground due to tectonic activities following with ground accelerations. It is a flexible

member to be good for tall structures but has strength to bear the weight of the structure without any failure. As height increases the displacement values increases with is lessened by isolating system as compared when isolating system not in use.

## III. EXPECTED OUTCOMES AND NEED OF THE STUDY

One just can't bear the effect caused from the disasters, the humans are capable enough to find effective measures to minimize the risk of damage or injury caused. The technologies, new approaches and advancement in the field of science and instrumentation has helped a lot. It has served as a source to rescue for better sustainable living.

Problems are never ending and finding solutions is a continuous process. Need of study is not just limited to finding appropriate method to fight the existing problem but also it a method to make modifications to existing solutions more worthy. Finding cost effective ways as they may not prove to be pocket friendly when implemented on a large scale. Study also means predicting new problems which can arrive in front of us in future and ways to cope with it. Making the study easier with use of better tactics, knowledge, proper initial investment, experiences and merging various subjects and stream on an advance level.

Today also research is going on to timely determine the happenings or occurrences of earthquake but yet there is no such method to determine it. Building are yet standing tall although very much known to the effects it can cause to them. It is really a matter to study more about it and gathering as much knowledge to keep check on the misleading which it can cause.

The need here is to evaluate the behavior of structure and examine the forces coming over it. The nature or response a building shows to those developed forces. The pattern of modes it gives for various frequencies it shows at various time period. The resistibility of the structure to various load combinations.

## IV. PROBLEM FORMULATION AND OBJECTIVE

The purpose of the study is to know how much difference a structure with floating column show as compared to structure without floating column. Determining the feasibility of the structure with floating column in severe seismic zone. How a soft story can be reason behind over all structure frame instability. Studying the shear force and bending moment values. Dynamic analysis is done to see inelastic deformations in the member. The aim here is

to determine base shear values, story displacement and check the torsion in structure. Studying cases of structure with floating and non-floating members. To know effectiveness of base-isolation system to bypass the vibrations reaching the structure's body. Comparative study of floating column member structure with no base-isolation and the structure with floating columns and base-isolation system together present in the same structure.

The software analysis for the dynamic analysis of the multi-storey RC Frame structure to determine the time period and frequencies of various mode shapes to the ground accelerations. Calculating maximum mass participation of the structure in which mode by the response spectrum using civil software.

## V. CONCLUSION

The work done earlier gives very useful information obtained from the various methods of analysis performed on various types of structures both manually and software approach. These studies have helped a lot in making clarity to understand the subject. The study also promotes to widen the scope to the untouched parameters and topic on a broader scale. One can bring his results to the existing work done in the field, to development tremendous outcomes bringing more clarity to the concept.

1. The study so far says that floating columns are not a best choice to be incorporated in the multi-storey structure and when they are constructed in seismic zone it may prove to be poorer as they are the member making a building irregular. They can make building soft storey to bring more undesirable results.
2. More dimensional area is required for floating column and they require more ductile detailing for better distribution of loads. The position of floating column also matters a lot.
3. Storey drift and displacement increases due to vertical irregularity.
4. Base-isolation are the control method which confine a building against lateral forces which does not allow a building to undergo through vibration effects as the base isolation minimize them.
5. Use of base isolation to reduce the base shear values at the bottom of the structure.

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